



					6 551mz 5 550mz 4 550mz 3 551mz 2 568mz
Prepared by	DRAWN	DATE 4 August 2015	$\frown$		DRAWING NO.
Kirsten Hay	КМН	scale 1:1000@A3	(-+)	site Plan stage I	112
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Narara Ecovillage Co-operative Ltd					\



# Narara Ecovillage Stage 2 Concept Masterplan

The masterplan utilises a perimeter road to provide circulation and access to the proposed lots. A Green Heart central space in the geographic centre of Stage 2 forms both the physical and a social focal point.

The terracing of the Green Heart will allow the formation of one of the few level areas within the Ecovillage. This will act as a gathering and celebration space symbolically in the centre of the ecovillage.

The lot sizes are varied with 8 lots over 800m2. There is a mixed orientation with some north-south lots. The proposed setbacks to be controlled through the Narara Building Standards will ensure great solar access is possible for all developments. North-south lots have minimum widths of 15 metres easily permitting good passive solar design.

LOT SIZE	NUMBER OF LOTS
550-799M2	35
800M2+	8
TOTAL LOTS	43





DATE: 2019-09-19 REV: 1

WWW.ENVIROTECTURE.COM.AU NOMINATED ARCHITECT: ANDY MARLOW ARB #9597





























### GENERAL NOTES:

- 1. ALL WORK TO BE CARRIED OUT IN ACCORDANCE WITH THESE TECHNICAL SPECIFICATION OF THE PROJECT. CONTRACTOR TO OBTAIN AND RETAIN A COPY ON SITE DURING THE COURSE OF THE WORKS.
- 2. ALL NEW WORKS ARE TO MAKE A SMOOTH JUNCTION WITH EXISTING CONDITIONS, AND MARRY IN A 'WORKMANLIKE' MANNER.
- 3. THE CONTRACTOR IS TO VERIFY THE LOCATION OF ALL SERVICES WITH EACH RELEVANT AUTHORITY. ANY DAMAGE TO SERVICES SHALL BE RECTIFIED BY THE CONTRACTOR OR THE RELEVANT AUTHORITY AT THE CONTRACTOR'S EXPENSE. SERVICES SHOWN ON THESE PLANS ARE ONLY THOSE EVIDENT AT THE TIME OF SURVEY OR AS DETERMINED FROM SERVICE DIAGRAMS. HENRY AND HYMAS CANNOT GUARANTEE THE INFORMATION SHOWN NOR ACCEPT ANY RESPONSIBILITY FOR INACCURACIES OR INCOMPLETE DATA.
- 4. SERVICES & ACCESSES TO THE EXISTING PROPERTIES ARE TO BE MAINTAINED IN WORKING ORDER AT ALL TIMES DURING CONSTRUCTION.
- ADJUST EXISTING SERVICE COVERS TO SUIT NEW FINISHED LEVELS TO RELEVANT AUTHORITY REQUIREMENTS WHERE NECESSARY.
- ALL DAMAGED LANDSCAPED AREAS TO BE MADE GOOD TO MATCH EXISTING.
- ALL TEMPORARY SEDIMENT AND EROSION CONTROL DEVICES ARE TO BE CONSTRUCTED, PLACED AND MAINTAINED IN ACCORDANCE WITH THESE TECHNICAL SPECIFICATIONS, EROSION AND SEDIMENTATION CONTROL PLAN AND SWMP REQUIREMENTS WHERE APPLICABLE.
- PROPERTIES AFFECTED BY THE WORKS ARE TO BE NOTIFIED IN ADVANCE WHERE DISRUPTION TO EXISTING ACCESS IS LIKELY.
- CONSTRUCTION FROM THESE DRAWINGS SHALL NOT COMMENCE UNTIL THEY ARE APPROVED BY THE SUPERINTENDENT.
- ALL WORKMANSHIP AND MATERIALS SHALL BE IN ACCORDANCE WITH THE RELEVANT AUSTRALIAN STANDARDS, THE BUILDING CODE OF AUSTRALIA, AND THE REQUIREMENTS OF THE RELEVANT STATUTORY AUTHORITIES. ALL WORKMANSHIP SHALL BE CONSISTENT WITH GOOD TRADE PRACTICE.
- 11. AUSTRALIAN STANDARDS REFERRED TO ON THESE DRAWINGS SHALL BE THE LATEST REVISIONS OF THE NOMINATED STANDARD.
- 12. THE BUILDER MUST HAVE A QUALITY MANAGEMENT PLAN IN PLACE TO CARRY OUT THE WORK IN ACCORDANCE WITH THE PROJECT DOCUMENTS INSPECTION TEST PLAN (ITP'S) AN JOB SAFETY & ENVIRONMENT ANALYSIS (JSEA) SHALL BE DEVELOPED TO THE SATISFACTION OF THE CLIENT.

### SITEWORKS NOTES

- 1. DATUM A.H.D.
- ORIGIN OF LEVELS. REFER TO BENCH OR STATE SURVEY MARKS WHERE SHOWN ON PLAN.
- CONTRACTOR MUST VERIFY ALL DIMENSIONS AND EXISTING LEVELS ON SITE PRIOR TO COMMENCEMENT OF WORK.
- 4. ALL WORKS TO BE UNDERTAKEN IN ACCORDANCE WITH THE DETAILS SHOWN ON THE DRAWINGS & THE DIRECTIONS OF THE NEV SUPERINTENDENT.
- 5. EXISTING SERVICES UNLESS SHOWN ON SURVEY PLAN HAVE BEEN PLOTTED FROM SERVICES SEARCH PLANS AND AS SUCH THEIR ACCURACY CANNOT BE GUARANTEED. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO ESTABLISH THE LOCATION AND LEVEL OF ALL EXISTING SERVICES PRIOR TO THE COMMENCEMENT OF ANY WORK. ANY DISCREPANCIES SHALL BE REPORTED TO THE SUPERINTENDENT. CLEARANCES SHALL BE OBTAINED FROM THE RELEVANT SERVICE AUTHORITY.
- 6. WHERE NEW WORKS ABUT EXISTING THE CONTRACTOR SHALL ENSURE THAT A SMOOTH EVEN PROFILE, FREE FROM ABRUPT CHANGES IS ACHIEVED.
- 7. THE CONTRACTOR SHALL ARRANGE ALL SURVEY SETOUT TO BE CARRIED OUT BY A REGISTERED SURVEYOR.
- 8. CARE IS TO BE TAKEN WHEN EXCAVATING NEAR EXISTING SERVICES. NO MECHANICAL EXCAVATION IS TO BE UNDERTAKEN OVER TELSTRA OR ELECTRICAL SERVICES. HAND EXCAVATE IN THESE AREAS.
- 9. CONTRACTOR TO OBTAIN AUTHORITY APPROVALS WHERE APPLICABLE.
- 10. MAKE SMOOTH TRANSITION TO EXISTING SURFACES AND MAKE GOOD TO SUPERINTENDENT SATISFACTION.
- 11. THESE DRAWINGS AND NOTES SHALL BE READ IN CONJUNCTION WITH ALL ARCHITECTURAL AND OTHER CONSULTANT'S DRAWINGS. REPORTS, SPECIFICATIONS AND ANY OTHER WRITTEN INSTRUCTIONS AS MAY BE ISSUED DURING THE COURSE OF CONSTRUCTION. ALL DISCREPANCIES SHALL BE REFERRED TO THE ENGINEER FOR CLARIFICATION OR DECISION BEFORE PROCEEDING WITH THE WORK.
- 12. GRADES TO PAVEMENTS TO BE AS IMPLIED BY RL'S ON PLAN . GRADE EVENLY BETWEEN NOMINATED RL'S. AREAS EXHIBITING PONDING GREATER THAN 5mm DEPTH WILL NOT BE ACCEPTED/ UNLESS IN A DESIGNATED SAG POINT.
- 13. ALL COVERS AND GRATES ETC TO EXISTING SERVICE UTILITIES ARE TO BE ADJUSTED TO SUIT NEW FINISHED SURFACE LEVELS WHERE APPLICABLE.
- 14. APPROVAL OF A SUBSTITUTION OR ALTERNATIVE FROM THE ENGINEER IS NOT, IN ITSELF AUTHORIZATION FOR A VARIATION.

### FORMWORK

- FORMWORK SHALL BE DESIGNED, CONSTRUCTED AND STRIPPED IN ACCORDANCE WITH AS 3610.
- 2. THE DESIGN, CONSTRUCTION, CERTIFICATION AND PERFORMANCE OF FORMWORK, FALSEWORK, AND ITS SUPPORT, IS THE RESPONSIBILITY OF THE CONTRACTOR.
- DESIGN INFORMATION CONCERNING THE GROUND SUPPORT OF FORMWORK SHALL BE DETERMINED FROM THE CONDITIONS EXISTING ON SITE AT THE TIME OF CONSTRUCTION.
- THE FORMWORK SHALL BE DESIGNED TO RELY ON NO RESTRAINT OR STABILITY FROM THE PERMANENT STRUCTURE WITHOUT PRIOR APPROVAL FROM THE ENGINEER.
- WHERE APPLICABLE, THE FORMWORK SHALL BE DESIGNED TO ACCOMMODATE MOVEMENT AND LOAD REDISTRIBUTION DUE TO POST-TENSIONING. THE FORMWORK DESIGNER MAY NEED TO CONSULT THE POST-TENSIONING SUBCONTRACTOR TO ACHIEVE THIS.
- 6. SIZES OF CONCRETE ELEMENTS DO NOT INCLUDE APPLIED FINISHES. BEAM DEPTHS ARE WRITTEN FIRST AND INCLUDE THE SLAB THICKNESS. FOR CHAMFERS, DRIP GROOVES, REGLETS etc. REFER TO THE ARCHITECT'S DRAWINGS AND/OR SPECIFICATION.
- PROVIDE UPWARD CAMBER OF FORMWORK TO SLABS AND BEAMS WHERE NOTED ON THESE DRAWINGS. ALSO APPLY AN UPWARD PRE-SET OF L/120 TO CANTILEVERS WHERE L IS THE SHORTEST PROJECTION FROM THE COLUMN OR WALL FACE. THE FORMWORKER SHALL MAKE THE BUILDER AND CONCRETOR FULLY AWARE OF WHERE FORMWORK IS CAMBERED OR PRE-SET IN ORDER THAT THE FULL DEPTH OF THE MEMBERS IS ACHIEVED DURING CONCRETING.
- FOR HORIZONTAL REINFORCED CONCRETE ELEMENTS, FORMWORK MAY BE STRIPPED WHEN THE CONCRETE HAS REACHED 80% OF ITS SPECIFIED 28 DAY STRENGTH UNLESS STRIPPING TIMES ARE OTHERWISE NOTED ON THE DRAWINGS. ALTERNATIVELY, FORMWORK MAY BE STRIPPED AND PROGRESSIVELY BACK PROPPED AFTER 5 DAYS. THE PROPS SHALL REMAIN IN PLACE UNTIL THE CONCRETE HAS REACHED 80% OF ITS SPECIFIED 28 DAY STRENGTH.
- VERTICAL FORMS TO BEAM SIDES, COLUMNS AND WALLS (UNLOADED) MAY BE STRIPPED AFTER 3 DAYS AND WHEN THE FORMWORKER IS SATISFIED STRIPPING WILL NOT DAMAGE THE GREEN CONCRETE.
- 10. STRIPPING AND BACK PROPPING TO POST-TENSIONED SLABS SHALL BE AS DIRECTED BY THE STRESSING DESIGNER.
- 11. CONSTRUCTION AND SUPPORT PROPPING SHALL BE ADDED, OR LEFT IN PLACE, TO AVOID OVERSTRESSING THE STRUCTURE DUE TO CONSTRUCTION LOADING.
- 12. THE FORMWORKER SHALL PROVIDE CLEANOUTS TO ALL COLUMNS LEAVE OPEN FOR ENGINEERS INSPECTION. THEN CLOSE OFF IMMEDIATELY PRIOR TO POURING.

## SUBGRADE PREPARATION - SITEWORK

- THE EXISTING SURFACE IS TO BE STRIPPED OF ANY PAVEMENTS, TOPSOIL OR **OBVIOUS UNSUITABLE MATERIAL**
- EXCAVATE TO ACHIEVE SUBGRADE LEVELS WHERE NECESSARY.
- THE EXPOSED SUBGRADE AFTER STRIPPING AND/OR EXCAVATION TO BE PROOF ROLLED USING NOT FEWER THAN 5 PASSES OF A MINIMUM 8 TONNE DEAD WEIGHT STEEL SMOOTH-DRUM ROLLER UNDER THE SUPERVISION OF AN EXPERIENCED GEOTECHNICAL ENGINEER OR AN EXPERIENCED CIVIL ENGINEER. ANY AREAS ON THE SUBGRADE EXHIBITING EXCESSIVE DEFLECTION / MOVEMENT UNDER ROLLER TO BE EXCAVATED TO A MIN. DEPTH OF 0.5m AND REPLACED WITH APPROVED GRANULAR MATERIAL COMPACTED IN 250mm LOOSE LAYERS OR AS DIRECTED BY THE GEOTECHNICAL ENGINEER.
- ENGINEERED FILL FOR REPLACEMENT OF SOFT OR HEAVING AREAS OR FOR BULK 4 FILLING TO COMPRISE ESSENTIALLY OF GRANULAR MATERIALS (EG EXCAVATED SHALE), WITH A PARTICLE SIZE NOT GREATER THAN 75mm DIAMETER. ENGINEERED FILL TO BE PLACED IN LAYERS NOT EXCEEDING 250mm LOOSE THICKNESS AND COMPACTED TO BETWEEN 98% AND 102% OF STANDARD MAXIMUM DRY DENSITY (SMDD) WITHIN 2% OF OPTIMUM MOISTURE CONTENT (OMC).
- IN RELATION TO ANY IMPORTED FILL MATERIAL, ALL FILL MATERIAL MUST COMPLY 5 WITH THE REQUIREMENTS UNDER THE NSW WASTE REGULATIONS AND OTHER RELEVANT LEGISLATION.
- ALL FILL MATERIAL SHALL BE FROM A SOURCE APPROVED BY THE SUPERINTENDENT AND SHALL COMPLY WITH THE FOLLOWING. FREE FORM ORGANIC AND PERISHABLE MATTER MAXIMUM PARTICLE SIZE = 75mm MAXIMUM PLASTICITY INDEX = 15%

#### SURVEY NOTES:

- 1. THE EXISTING SITE CONDITIONS SHOWN ON THE FOLLOWING DRAWINGS HAVE BEEN SURVEYED BY CBH SURVEYING AND ENGINEERING.
- 2. THE INFORMATION IS SHOWN TO PROVIDE A BASIS FOR DESIGN. HENRY AND HYMAS. DOES NOT GUARANTEE THE ACCURACY OR COMPLETENESS OF THE SURVEY BASE OR ITS SUITABILITY AS A BASIS FOR CONSTRUCTION DRAWINGS. SHOULD DISCREPANCIES BE ENCOUNTERED DURING CONSTRUCTION BETWEEN THE SURVEY DATA AND ACTUAL FIELD DATA, CONTACT THE SUPERINTENDENT .

SURVEY							
SURVEYED BY CBH							
DATUM: AHD	02	ISSUED FOR CO-ORDINATION	D.Tran	L.Faghihi	Sept 2019		
ORIGIN OF LEVELS: SSM 68340, RL 24.324 (AHD)	01	ISSUED FOR INFORMATION	D.Tran	L.Faghihi	Sept 2019		
	REVISION	AMENDMENT	DRAWN	DESIGNED	DATE	REVISION	AMENDMENT

# **POTABLE & RECYCLED WATER RETICULATION** NARARA ECO VILLAGE STAGE 2 NARARA NSW



LOCALITY PLAN SITE LOCATION

# **EXISTING SERVICES & FEATURES:**

1. THE CONTRACTOR SHALL ALLOW FOR THE CAPPING OFF, EXCAVATION AND REMOVAL (IF REQUIRED) OF ALL EXISTING SERVICES IN AREAS AFFECTED BY WORKS WITHIN THE CONTRACT AREA OR AS SHOWN ON THE DRAWINGS UNLESS DIRECTED OTHERWISE BY THE SUPERINTENDENT.

2. THE CONTRACTOR SHALL ENSURE THAT AT ALL TIMES SERVICES TO ALL BUILDINGS NOT AFFECTED BY THE WORKS ARE NOT DISRUPTED.

PRIOR TO COMMENCEMENT OF ANY WORKS THE CONTRACTOR SHALL GAIN APPROVAL OF HIS PROGRAM FOR THE RELOCATION/ CONSTRUCTION OF TEMPORARY SERVICES.

CONTRACTOR SHALL CONSTRUCT TEMPORARY SERVICES TO MAINTAIN SUPPLY TO EXISTING BUILDINGS REMAINING IN OPERATION DURING WORKS TO THE SATISFACTION AND APPROVAL OF THE SUPERINTENDENT. ONCE DIVERSION IS COMPLETE AND COMMISSIONED. THE CONTRACTOR SHALL REMOVE ALL SUCH TEMPORARY SERVICES AND MAKE GOOD TO THE SATISFACTION OF THE SUPERINTENDENT.

INTERRUPTION TO SUPPLY OF EXISTING SERVICES SHALL BE DONE SO AS NOT TO CAUSE ANY INCONVENIENCE TO THE PRINCIPAL. CONTRACTOR TO GAIN APPROVAL FROM THE SUPERINTENDENT FOR TIME OF INTERRUPTION.

6. EXISTING SERVICES, BUILDINGS, EXTERNAL STRUCTURES AND TREES SHOWN ON THESE DRAWINGS ARE EXISTING FEATURES PRIOR TO ANY DEMOLITION WORKS.

7. EXISTING SERVICES UNLESS SHOWN ON SURVEY PLAN HAVE BEEN PLOTTED FROM SERVICES SEARCH PLANS AND AS SUCH THEIR ACCURACY CANNOT BE GUARANTEED. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO COMPLETE A 'DIAL BEFORE YOU DIG' SEARCH. SERVICE SCANNING AND TO ESTABLISH THE LOCATION AND LEVEL OF ALL EXISTING SERVICES PRIOR TO THE COMMENCEMENT OF ANY WORK. ANY DISCREPANCIES SHALL BE REPORTED TO THE SUPERINTENDENT. CLEARANCES SHALL BE OBTAINED FROM THE RELEVANT SERVICE AUTHORITY

### TELSTRA - DUTY OF CARE NOTE:

1. TELSTRA'S PLANS SHOW ONLY THE PRESENCE OF CABLES AND PLANT, THEY ONLY SHOW THEIR POSITION RELATIVE TO ROAD BOUNDARIES. PROPERTY FENCES ETC. AT THE TIME OF INSTALLATION AND TELSTRA DOES NOT WARRANT OR UPHOLD THAT SUCH PLANS ARE ACCURATE THEREAFTER DUE TO CHANGES THAT MAY OCCUR OVER TIME.

DO NOT ASSUME DEPTH OR ALIGNMENT OF CABLES OR PLANT AS THESE VARY SIGNIFICANTLY. THE CONTRACTOR HAS A DUTY OF CARE WHEN EXCAVATING NEAR TELSTRA CABLES AND PLANT. BEFORE USING MACHINE EXCAVATORS TELSTRA PLANT MUST FIRST BE PHYSICALLY EXPOSED BY SOFT DIG POTHOLING TO IDENTIFY IT'S LOCATION. TELSTRA WILL SEEK COMPENSATION FOR DAMAGES CAUSED TO IT'S PROPERTY AND LOSSES CAUSED TO TELSTRA AND IT'S CUSTOMERS.

### REINFORCEMENT

- REFER TO THE CONCRETE NOTES FOR THE SPECIFIED COVERS TO REINFORCEMENT. COVER MUST BE MAINTAINED AT ALL CHAMFERS, DRIP GROOVES AND REGLETS etc. UNLESS NOTED OTHERWISE ON THE DRAWINGS.
- REINFORCEMENT IS SHOWN DIAGRAMMATICALLY. IT IS NOT NECESSARILY SHOWN IN TRUE PROJECTION
- REINFORCEMENT SHALL NOT BE CUT OR WELDED ON SITE WITHOUT APPROVAL BY THE ENGINEER. AT SMALL HOLES LESS THAN 300mm DIAMETER, eg PLUMBING PENETRATIONS, BARS SHALL BE DISPLACED TO EITHER SIDE.
- SITE BENDING OF REINFORCEMENT SHALL BE AVOIDED IF POSSIBLE. WHERE SITE BENDING IS SPECIFIED, OR UNAVOIDABLE, IT SHALL BE CARRIED OUT COLD, WITHOUT THE APPLICATION OF HEAT, AND IN ACCORDANCE WITH THE PRACTICE NOTE RPN1 OF THE STEEL REINFORCEMENT INSTITUTE OF AUSTRALIA.
- SPLICES IN REINFORCEMENT SHALL BE MADE ONLY IN THE POSITIONS SHOWN. THE WRITTEN APPROVAL OF THE ENGINEER SHALL BE OBTAINED FOR ANY OTHER SPLICES. WHERE LAP LENGTHS ARE NOT SHOWN THEY SHALL BE AS INDICATED **BELOW**

BAR SIZE	MINIMUM LAP LENGTH					
N10	300	(300)				
N12	400	(500)				
N16	600	(800)				
N20	800	(1000)				
N24	1000	(1300)				
N28	1200	(1600)				
N32	1500	(1900)				
N36	1700	(2200)				

\* LENGTHS SHOWN IN BRACKETS APPLY TO HORIZONTAL BARS WITH MORE THAN 300mm OF CONCRETE CAST BELOW THE BAR

THE ABOVE DEVELOPMENT LENGTHS ARE FOR MAIN REINFORCEMENT IN fc=32 MPa CONCRETE WITH 30mm CLEAR COVER FOR WALLS AND SLABS AND 30mm CLEAR COVER TO MIN. R10 FITMENTS FOR COLUMNS AND BEAMS.

REINFORCEMENT SYMBOLS:

N - DENOTES D500N DEFORMED BAR TO AS 4671 R - DENOTES 250R HOT ROLLED PLAIN BAR TO AS 4671 SL/RL - DENOTES HARD DRAWN WIRE REINFORCEMENT FABRIC TO AS 4671 W - DENOTES R500L HARD DRAWN PLAIN WIRE TO AS 4671

- FABRIC REINFORCEMENT SHALL BE LAPPED TWO TRANSVERSE WIRES PLUS 50mm 7
- 8. JOGGLES TO BARS SHALL COMPRISE A LENGTH OF 12 BAR DIAMETERS BETWEEN BEGINNING AND END OF AN OFFSET OF ONE BAR DIAMETER.
- ALL REINFORCEMENT SHALL BE CHAIRED AT MAXIMUM CENTERS AS FOLLOWS:-BARS - 800 CENTERS EACH WAY FABRIC - 600 CENTERS EACH WAY

EXTRA CHAIRS MAY BE REQUIRED ADJACENT TO SLAB EDGES AND JOINTS TO PREVENT THE UPWARD DEFLECTION OF THE FABRIC WHEN STOOD ON.

- 10. ALL STEEL CHAIRS SHALL BE PLASTIC TIPPED. STEEL CHAIRS SHALL ONLY BE USED FOR EXPOSURE CONDITIONS A1 AND A2. FULLY PLASTIC CHAIRS ONLY SHALL BE USED ON ELEMENT FACES HAVING EXTERNAL EXPOSURE IN THE COMPLETED STRUCTURE. WHERE REINFORCEMENT IS GROUND SUPPORTED PROVIDE PLATES UNDER ALL BAR CHAIRS.
- AT THE END SUPPORT OF A SLAB ON A MASONRY WALL. ALL BOTTOM 11. REINFORCEMENT SHALL EXTEND OVER THE MASONRY WALL BY 75mm FOR N12 BARS OR 95mm FOR N16 BARS. IF COVER REQUIREMENTS PROHIBIT THIS THE BARS SHALL BE COGGED.

DRA	WING SCHEDULE
19067_SK_P100	COVER PAGE AND NOTES - POT/ WATER WORKS
19067_SK_P100	GENERAL ARRANGEMENT - POT
19067_SK_P101	CONNECTION POINT PLAN FOR V
19067_SK_R100	GENERAL ARRANGEMENT - REC
19067_SK_P200	CONNECTION DETAILS
WAT-1102-V	TYPICAL MAIN CONSTRUCTION / ARRANGEMENTS
WAT-1104-V	TYPICAL MAIN CONSTRUCTION / ARRANGEMENT
WAT-1201	EMBEDMENT & TRENCH FILL / TY
WAT-1202-V	STANDARD EMBEDMENT / ALL PI
WAT-1301-V	TYPICAL VALVE & HYDRANT INS PIPES & FITTINGS ASSEMBLY
WAT-1854-S	SINGLE PROPERTY SERVICES / F
WAT-1856-S	SINGLE OR SPLIT PROPERTY SE

			NARARA ECO VILLAGE CO-OPERATIVE LTD	Level 5, 79 Victoria Avenue Chatswood NSW 2067	Telephone +61 2 9417 8400 Facsimile	
			Surveyor CBH SURVEYING AND ENGINEERING	Anna Sement	+61 2 9417 8337 Email email@hhconsult.com.au Web	
DRAWN	DESIGNED	DATE	This drawing and design remains the property of Henry & Hymas and may not be copied in whole or in part without the prior written approval of Henry & Hymas.	Global-Mark.com.au®	www.nenryananymas.com.a	henryshymc

### CONCRETE

- ABLE & RECYCLED FABLE WATER WORKS WATER & SEWER CYCLED WATER WORKS **RETICULATION MAIN** / D63 PE CUL-DE-SAC YPICAL ARRANGEMENT
- PIPE TYPES
- TALLATION / SHROUD
- PRE-LAID IN FOOTWAYS ERVICES / PRE-LAID IN

- ALL WORKMANSHIP AND MATERIALS SHALL BE IN ACCORDANCE WITH AS 3600 AND AS 3735 AND ANY OTHER RELEVANT AUSTRALIAN STANDARDS UNLESS VARIED BY THE ENGINEER.
- HOLES, PENETRATIONS, CHASES AND CONSTRUCTION JOINTS, OTHER THAN THOSE SHOWN ON THE STRUCTURAL DRAWINGS SHALL NOT BE MADE IN CONCRETE MEMBERS WITHOUT THE PRIOR APPROVAL OF THE ENGINEER.
- CONSTRUCTION JOINTS SHALL BE PROPERLY FORMED WHERE VERTICAL. THE FIRST POUR SHALL BE THOROUGHLY SCABBLED AND CLEANED OF ALL POORLY COMPACTED MATERIAL AND LAITANCE, THOROUGHLY SOAKED AND PAINTED WITH A 2:1 SAND CEMENT SLURRY IMMEDIATELY BEFORE PLACING THE SECOND POUR. THOROUGHLY COMPACT THE SECOND POUR AGAINST THE FIRST POUR.
- CONDUITS, PIPES AND THE LIKE SHALL BE PLACED WITHIN THE MIDDLE THIRD OF THE SLAB DEPTH AND AT A MINIMUM SPACING OF NOT LESS THAN 3 DIAMETERS. CONDUITS AND PIPES SHALL NOT BE PLACED WITHIN THE CONCRETE COVER OUTLINED BELOW.
- THE FINISHED CONCRETE SHALL BE FULLY MECHANICALLY VIBRATED TO ACHIEVE FULL COMPACTION, COMPLETELY FILLING FORMWORK, THOROUGHLY EMBEDDING THE REINFORCEMENT AND FREE OF STONE POCKETS. ALL CONCRETE, INCLUDING SLABS ON GROUND AND FOOTINGS, SHALL BE FULLY VIBRATED USING A HIGH FREQUENCY MECHANICAL VIBRATOR.
- ALL CONCRETE SHALL BE PROPERLY CURED. CURING SHALL COMMENCE WITHIN 2 HOURS OF POURING AND SHALL CONTINUE FOR A MINIMUM OF 7 DAYS. FOLLOWED BY A GRADUAL DRYING OUT. CURING SHALL BE BY CONTINUOUS SATURATION WITH POTABLE WATER OR BY USE OF AN APPROVED PROPRIETARY CURING COMPOUND COMPLYING WITH AS 3799, APPLIED UNIFORMLY IN ACCORDANCE WITH THE MANUFACTURERS INSTRUCTIONS. THE COMPATIBILITY OF CURING COMPOUNDS WITH PROPOSED APPLIED FINISHES SHALL BE VERIFIED PRIOR TO APPLICATION. FORMED SURFACES EXPOSED WITHIN 14 DAYS OF CASTING SHALL BE SPRAYED WITH AN APPROPRIATE CURING AGENT IMMEDIATELY UPON EXPOSURE.
- SPECIFICATION OF CONCRETE

Element	Slump	Max. Agg.	Cement Type	Admix.	Concrete Grade	Exposure Clasif'n	Fire Resistance Rating	Cover U.N.O.
Footings/piers Reinforced	80	20	GP	NIL	32 MPa	B1	-	50
Walls	80	20	SL	NIL	40 MPa	B1	-	40
Core Filling Grout	230±30	10	GP	NIL	20 MPa	B1	-	-
External Slab on Ground	80	20	SL	NIL	32 MPa	B1	-	40 UNO

ALL CONCRETE WITH SHRINKAGE LIMITED (SL) CEMENT SHALL HAVE A MAXIMUM SHRINKAGE STRAIN OF 600 MICROSTRAINS AS DETERMINED BY TEST IN ACCORDANCE WITH AS 1012.13 AFTER 8 WEEKS OF DRYING WATER CEMENT RATIO OF CONCRETE SHALL NOT EXCEED 0.55 (EXCEPT FOR CORE FILLING GROUT I BLOCK WALLS

- WHERE A VAPOUR BARRIER IS SPECIFIED BENEATH SLABS ON GROUND PROVIDE A 0.2mm BRANDED POLYTHENE MEMBRANE THROUGHOUT. LAP SHEETS 300mm AND SEAL WITH A 50mm WIDE PRESSURE SENSITIVE WATERPROOF TAPE.
- WHERE CONCRETE SLABS BEAR ON MASONRY, INCLUDING CORED BRICKS, THE BEARING SURFACE OF THE MASONRY SHALL BE RENDERED WITH 1:3 CEMENT SAND MORTAR TO GIVE A LEVEL SURFACE AND A METAL SLIP JOINT LAID PROTECTED BY 0.2mm POLYTHENE SHEET TAPED TO FORMWORK BEFORE PLACING CONCRETE. SPECIAL DETAILS SHALL APPLY FOR ROOF SLABS OR SIMILARLY EXPOSED SLABS.
- 10. NON LOAD BEARING MASONRY SHALL BE SEPARATED FROM THE SOFFIT OF SLABS AND BEAMS BY 12mm CANITE OR OTHER MEANS APPROVED BY THE ENGINEER.
- 11. BEFORE THE COMMENCEMENT OF CONCRETING THE BUILDER SHALL ENSURE THE CONCRETOR IS FULLY AWARE OF ANY AREAS OF FORMWORK THAT HAVE BEEN PRE-CAMBERED OR PRE-SET. EXTREME CARE MUST BE TAKEN TO ENSURE THE SPECIFIED DEPTHS OF BEAMS AND SLABS ARE ACHIEVED IN AREAS OF PRE-SET OR PRE-CAMBERED FORMWORK. THIS CANNOT BE ACHIEVED BY LEVELLING THE CONCRETE SURFACE INTO THE NOMINAL FINISHED CONCRETE LEVEL.
- 12. CONSTRUCTION AND SUPPORT PROPPING SHALL BE ADDED, OR LEFT IN PLACE, TO AVOID OVERSTRESSING THE STRUCTURE DUE TO CONSTRUCTION LOADS.
- 13. NO MASONRY OR PARTITION WALLS SHALL BE CONSTRUCTED ON SUSPENDED LEVELS UNTIL 7 DAYS AFTER PROPPING HAS BEEN REMOVED AND THE SLAB PRE-LOADED WITH THE BRICKS OR MATERIALS TO BE USED IN THE WALL.

	ISSUED	FOR	C0-0	)RDI	NA	TIC	DN
Project NARARA ECOVILLAC DETAILED DESIGN	GE STAGE 2	-	Drawn D.Tran <sup>Checked</sup> H.Williamson	Designed L.Faghihi Approved L.Herngren		Date Mar 2019 Scale NTS	
COVER PAGE AND N POTABLE & RECYCL	NOTES LED WATER WOF	RKS	Drawing number 19067_	_SK_	P0	00	Revision







SURVEY				
INFORMATION				
SURVEYED BY CBH				
DATUM: AHD				
ORIGIN OF LEVELS: SSM 68340, RL 24.324 (AHD)				

D.Tran L.Faghihi Sept 2019 03 ISSUED FOR CO-ORDINATION ISSUED FOR INFORMATION L.Faghihi Sept 2019 02 D.Tran 01 ISSUED FOR CONCEPT D.Tran L.Faghihi July 2019 REVISION AMENDMENT DRAWN DESIGNED DATE REVISION AMENDMENT



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OVILLAGE STAGE	2	Drawn D.Tran	Designed L.Faghihi	Date Mar 2019
DESIGN		H.Williamson Drawing number	L.Herngren	1:100 Revision
)N POINT PLAN		10067	SK D	101 02





HERN         EASTERN         WESTERN           7.83         7.29         7.37           7.29         7.31         7.31           7.29         7.31         7.31           7.29         7.31         7.31           7.29         7.31         7.31           7.29         7.31         7.31           7.31         7.29         7.31           7.31         7.29         7.31           7.31         7.31         7.31           7.31         7.31         7.31           7.31         7.31         7.31           7.31         7.31         7.31           7.31         7.31         7.31           7.31         7.31         7.31           7.31         7.31         7.31           7.31         7.31         7.31           7.31         7.31         7.31           7.31         7.31         7.31           7.31         7.31         7.31           7.30         7.30         7.30           7.31         7.30         7.31           7.31         7.31         7.31           7.31         7.31         7.31 <th>ertv Con</th> <th>nection Approx 1</th> <th>.50m</th>	ertv Con	nection Approx 1	.50m
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### GENERAL NOTES:

- 1. ALL WORK TO BE CARRIED OUT IN ACCORDANCE WITH THESE TECHNICAL SPECIFICATION OF THE PROJECT. CONTRACTOR TO OBTAIN AND RETAIN A COPY ON SITE DURING THE COURSE OF THE WORKS.
- 2. ALL NEW WORKS ARE TO MAKE A SMOOTH JUNCTION WITH EXISTING CONDITIONS, AND MARRY IN A 'WORKMANLIKE' MANNER.
- 3. THE CONTRACTOR IS TO VERIFY THE LOCATION OF ALL SERVICES WITH EACH RELEVANT AUTHORITY. ANY DAMAGE TO SERVICES SHALL BE RECTIFIED BY THE CONTRACTOR OR THE RELEVANT AUTHORITY AT THE CONTRACTOR'S EXPENSE. SERVICES SHOWN ON THESE PLANS ARE ONLY THOSE EVIDENT AT THE TIME OF SURVEY OR AS DETERMINED FROM SERVICE DIAGRAMS. HENRY AND HYMAS CANNOT GUARANTEE THE INFORMATION SHOWN NOR ACCEPT ANY RESPONSIBILITY FOR INACCURACIES OR INCOMPLETE DATA.
- 4. SERVICES & ACCESSES TO THE EXISTING PROPERTIES ARE TO BE MAINTAINED IN WORKING ORDER AT ALL TIMES DURING CONSTRUCTION.
- ADJUST EXISTING SERVICE COVERS TO SUIT NEW FINISHED LEVELS TO RELEVANT AUTHORITY REQUIREMENTS WHERE NECESSARY.
- ALL DAMAGED LANDSCAPED AREAS TO BE MADE GOOD TO MATCH EXISTING.
- ALL TEMPORARY SEDIMENT AND EROSION CONTROL DEVICES ARE TO BE CONSTRUCTED, PLACED AND MAINTAINED IN ACCORDANCE WITH THESE TECHNICAL SPECIFICATIONS, EROSION AND SEDIMENTATION CONTROL PLAN AND SWMP REQUIREMENTS WHERE APPLICABLE.
- PROPERTIES AFFECTED BY THE WORKS ARE TO BE NOTIFIED IN ADVANCE WHERE DISRUPTION TO EXISTING ACCESS IS LIKELY.
- CONSTRUCTION FROM THESE DRAWINGS SHALL NOT COMMENCE UNTIL THEY ARE APPROVED BY THE SUPERINTENDENT.
- ALL WORKMANSHIP AND MATERIALS SHALL BE IN ACCORDANCE WITH THE RELEVANT AUSTRALIAN STANDARDS, THE BUILDING CODE OF AUSTRALIA, AND THE REQUIREMENTS OF THE RELEVANT STATUTORY AUTHORITIES. ALL WORKMANSHIP SHALL BE CONSISTENT WITH GOOD TRADE PRACTICE.
- 11. AUSTRALIAN STANDARDS REFERRED TO ON THESE DRAWINGS SHALL BE THE LATEST REVISIONS OF THE NOMINATED STANDARD.
- 12. THE BUILDER MUST HAVE A QUALITY MANAGEMENT PLAN IN PLACE TO CARRY OUT THE WORK IN ACCORDANCE WITH THE PROJECT DOCUMENTS INSPECTION TEST PLAN (ITP'S) AN JOB SAFETY & ENVIRONMENT ANALYSIS (JSEA) SHALL BE DEVELOPED TO THE SATISFACTION OF THE CLIENT.

### SITEWORKS NOTES

- 1. DATUM A.H.D.
- ORIGIN OF LEVELS. REFER TO BENCH OR STATE SURVEY MARKS WHERE SHOWN ON PLAN.
- CONTRACTOR MUST VERIFY ALL DIMENSIONS AND EXISTING LEVELS ON SITE PRIOR TO COMMENCEMENT OF WORK.
- 4. ALL WORKS TO BE UNDERTAKEN IN ACCORDANCE WITH THE DETAILS SHOWN ON THE DRAWINGS & THE DIRECTIONS OF THE NEV SUPERINTENDENT.
- 5. EXISTING SERVICES UNLESS SHOWN ON SURVEY PLAN HAVE BEEN PLOTTED FROM SERVICES SEARCH PLANS AND AS SUCH THEIR ACCURACY CANNOT BE GUARANTEED. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO ESTABLISH THE LOCATION AND LEVEL OF ALL EXISTING SERVICES PRIOR TO THE COMMENCEMENT OF ANY WORK. ANY DISCREPANCIES SHALL BE REPORTED TO THE SUPERINTENDENT. CLEARANCES SHALL BE OBTAINED FROM THE RELEVANT SERVICE AUTHORITY.
- 6. WHERE NEW WORKS ABUT EXISTING THE CONTRACTOR SHALL ENSURE THAT A SMOOTH EVEN PROFILE, FREE FROM ABRUPT CHANGES IS ACHIEVED.
- 7. THE CONTRACTOR SHALL ARRANGE ALL SURVEY SETOUT TO BE CARRIED OUT BY A REGISTERED SURVEYOR.
- 8. CARE IS TO BE TAKEN WHEN EXCAVATING NEAR EXISTING SERVICES. NO MECHANICAL EXCAVATION IS TO BE UNDERTAKEN OVER TELSTRA OR ELECTRICAL SERVICES. HAND EXCAVATE IN THESE AREAS.
- 9. CONTRACTOR TO OBTAIN AUTHORITY APPROVALS WHERE APPLICABLE.
- 10. MAKE SMOOTH TRANSITION TO EXISTING SURFACES AND MAKE GOOD TO SUPERINTENDENT SATISFACTION.
- 11. THESE DRAWINGS AND NOTES SHALL BE READ IN CONJUNCTION WITH ALL ARCHITECTURAL AND OTHER CONSULTANT'S DRAWINGS. REPORTS, SPECIFICATIONS AND ANY OTHER WRITTEN INSTRUCTIONS AS MAY BE ISSUED DURING THE COURSE OF CONSTRUCTION. ALL DISCREPANCIES SHALL BE REFERRED TO THE ENGINEER FOR CLARIFICATION OR DECISION BEFORE PROCEEDING WITH THE WORK.
- 12. GRADES TO PAVEMENTS TO BE AS IMPLIED BY RL'S ON PLAN . GRADE EVENLY BETWEEN NOMINATED RL'S. AREAS EXHIBITING PONDING GREATER THAN 5mm DEPTH WILL NOT BE ACCEPTED/ UNLESS IN A DESIGNATED SAG POINT.
- 13. ALL COVERS AND GRATES ETC TO EXISTING SERVICE UTILITIES ARE TO BE ADJUSTED TO SUIT NEW FINISHED SURFACE LEVELS WHERE APPLICABLE.
- 14. APPROVAL OF A SUBSTITUTION OR ALTERNATIVE FROM THE ENGINEER IS NOT, IN ITSELF AUTHORIZATION FOR A VARIATION.

### FORMWORK

- FORMWORK SHALL BE DESIGNED. CONSTRUCTED AND STRIPPED IN ACCORDANCE WITH AS 3610.
- 2. THE DESIGN, CONSTRUCTION, CERTIFICATION AND PERFORMANCE OF FORMWORK, FALSEWORK, AND ITS SUPPORT, IS THE RESPONSIBILITY OF THE CONTRACTOR.
- DESIGN INFORMATION CONCERNING THE GROUND SUPPORT OF FORMWORK SHALL BE DETERMINED FROM THE CONDITIONS EXISTING ON SITE AT THE TIME OF CONSTRUCTION.
- THE FORMWORK SHALL BE DESIGNED TO RELY ON NO RESTRAINT OR STABILITY FROM THE PERMANENT STRUCTURE WITHOUT PRIOR APPROVAL FROM THE ENGINEER.
- WHERE APPLICABLE, THE FORMWORK SHALL BE DESIGNED TO ACCOMMODATE MOVEMENT AND LOAD REDISTRIBUTION DUE TO POST-TENSIONING. THE FORMWORK DESIGNER MAY NEED TO CONSULT THE POST-TENSIONING SUBCONTRACTOR TO ACHIEVE THIS.
- 6. SIZES OF CONCRETE ELEMENTS DO NOT INCLUDE APPLIED FINISHES. BEAM DEPTHS ARE WRITTEN FIRST AND INCLUDE THE SLAB THICKNESS. FOR CHAMFERS, DRIP GROOVES, REGLETS etc. REFER TO THE ARCHITECT'S DRAWINGS AND/OR SPECIFICATION.
- PROVIDE UPWARD CAMBER OF FORMWORK TO SLABS AND BEAMS WHERE NOTED ON THESE DRAWINGS. ALSO APPLY AN UPWARD PRE-SET OF L/120 TO CANTILEVERS WHERE L IS THE SHORTEST PROJECTION FROM THE COLUMN OR WALL FACE. THE FORMWORKER SHALL MAKE THE BUILDER AND CONCRETOR FULLY AWARE OF WHERE FORMWORK IS CAMBERED OR PRE-SET IN ORDER THAT THE FULL DEPTH OF THE MEMBERS IS ACHIEVED DURING CONCRETING.
- FOR HORIZONTAL REINFORCED CONCRETE ELEMENTS, FORMWORK MAY BE STRIPPED WHEN THE CONCRETE HAS REACHED 80% OF ITS SPECIFIED 28 DAY STRENGTH UNLESS STRIPPING TIMES ARE OTHERWISE NOTED ON THE DRAWINGS. ALTERNATIVELY, FORMWORK MAY BE STRIPPED AND PROGRESSIVELY BACK PROPPED AFTER 5 DAYS. THE PROPS SHALL REMAIN IN PLACE UNTIL THE CONCRETE HAS REACHED 80% OF ITS SPECIFIED 28 DAY STRENGTH.
- VERTICAL FORMS TO BEAM SIDES, COLUMNS AND WALLS (UNLOADED) MAY BE STRIPPED AFTER 3 DAYS AND WHEN THE FORMWORKER IS SATISFIED STRIPPING WILL NOT DAMAGE THE GREEN CONCRETE.
- 10. STRIPPING AND BACK PROPPING TO POST-TENSIONED SLABS SHALL BE AS DIRECTED BY THE STRESSING DESIGNER.
- 11. CONSTRUCTION AND SUPPORT PROPPING SHALL BE ADDED, OR LEFT IN PLACE, TO AVOID OVERSTRESSING THE STRUCTURE DUE TO CONSTRUCTION LOADING.
- 12. THE FORMWORKER SHALL PROVIDE CLEANOUTS TO ALL COLUMNS LEAVE OPEN FOR ENGINEERS INSPECTION. THEN CLOSE OFF IMMEDIATELY PRIOR TO POURING.

## SUBGRADE PREPARATION - SITEWORK

- THE EXISTING SURFACE IS TO BE STRIPPED OF ANY PAVEMENTS, TOPSOIL OR **OBVIOUS UNSUITABLE MATERIAL**
- EXCAVATE TO ACHIEVE SUBGRADE LEVELS WHERE NECESSARY.
- THE EXPOSED SUBGRADE AFTER STRIPPING AND/OR EXCAVATION TO BE PROOF ROLLED USING NOT FEWER THAN 5 PASSES OF A MINIMUM 8 TONNE DEAD WEIGHT STEEL SMOOTH-DRUM ROLLER UNDER THE SUPERVISION OF AN EXPERIENCED GEOTECHNICAL ENGINEER OR AN EXPERIENCED CIVIL ENGINEER. ANY AREAS ON THE SUBGRADE EXHIBITING EXCESSIVE DEFLECTION / MOVEMENT UNDER ROLLER TO BE EXCAVATED TO A MIN. DEPTH OF 0.5m AND REPLACED WITH APPROVED GRANULAR MATERIAL COMPACTED IN 250mm LOOSE LAYERS OR AS DIRECTED BY THE GEOTECHNICAL ENGINEER.
- ENGINEERED FILL FOR REPLACEMENT OF SOFT OR HEAVING AREAS OR FOR BULK 4. FILLING TO COMPRISE ESSENTIALLY OF GRANULAR MATERIALS (EG EXCAVATED SHALE), WITH A PARTICLE SIZE NOT GREATER THAN 75mm DIAMETER. ENGINEERED FILL TO BE PLACED IN LAYERS NOT EXCEEDING 250mm LOOSE THICKNESS AND COMPACTED TO BETWEEN 98% AND 102% OF STANDARD MAXIMUM DRY DENSITY (SMDD) WITHIN 2% OF OPTIMUM MOISTURE CONTENT (OMC).
- IN RELATION TO ANY IMPORTED FILL MATERIAL, ALL FILL MATERIAL MUST COMPLY 5 WITH THE REQUIREMENTS UNDER THE NSW WASTE REGULATIONS AND OTHER RELEVANT LEGISLATION.
- ALL FILL MATERIAL SHALL BE FROM A SOURCE APPROVED BY THE SUPERINTENDENT AND SHALL COMPLY WITH THE FOLLOWING. FREE FORM ORGANIC AND PERISHABLE MATTER MAXIMUM PARTICLE SIZE = 75mm MAXIMUM PLASTICITY INDEX = 15%

#### SURVEY NOTES:

- 1. THE EXISTING SITE CONDITIONS SHOWN ON THE FOLLOWING DRAWINGS HAVE BEEN SURVEYED BY CBH SURVEYING AND ENGINEERING.
- 2. THE INFORMATION IS SHOWN TO PROVIDE A BASIS FOR DESIGN. HENRY AND HYMAS. DOES NOT GUARANTEE THE ACCURACY OR COMPLETENESS OF THE SURVEY BASE OR ITS SUITABILITY AS A BASIS FOR CONSTRUCTION DRAWINGS. SHOULD DISCREPANCIES BE ENCOUNTERED DURING CONSTRUCTION BETWEEN THE SURVEY DATA AND ACTUAL FIELD DATA, CONTACT THE SUPERINTENDENT .

	I						
SURVEY							
SURVEYED BY CBH							
DATUM: AHD	02	ISSUED FOR CO-ORDINATION	D.Tran	L.Faghihi	Sept 2019		
ORIGIN OF LEVELS: SSM 68340, RL 24.324 (AHD)	01	ISSUED FOR INFORMATION	D.Tran	L.Faghihi	Sept 2019		
	REVISION	AMENDMENT	DRAWN	DESIGNED	DATE	REVISION	AMENDMENT

# SEWER RETICULATION WORKS NARARA ECO VILLAGE STAGE 2 NARARA NSW



LOCALITY PLAN SITE LOCATION

# **EXISTING SERVICES & FEATURES:**

1. THE CONTRACTOR SHALL ALLOW FOR THE CAPPING OFF, EXCAVATION AND REMOVAL (IF REQUIRED) OF ALL EXISTING SERVICES IN AREAS AFFECTED BY WORKS WITHIN THE CONTRACT AREA OR AS SHOWN ON THE DRAWINGS UNLESS DIRECTED OTHERWISE BY THE SUPERINTENDENT.

2. THE CONTRACTOR SHALL ENSURE THAT AT ALL TIMES SERVICES TO ALL BUILDINGS NOT AFFECTED BY THE WORKS ARE NOT DISRUPTED.

PRIOR TO COMMENCEMENT OF ANY WORKS THE CONTRACTOR SHALL GAIN APPROVAL OF HIS PROGRAM FOR THE RELOCATION/ CONSTRUCTION OF TEMPORARY SERVICES.

CONTRACTOR SHALL CONSTRUCT TEMPORARY SERVICES TO MAINTAIN SUPPLY TO EXISTING BUILDINGS REMAINING IN OPERATION DURING WORKS TO THE SATISFACTION AND APPROVAL OF THE SUPERINTENDENT. ONCE DIVERSION IS COMPLETE AND COMMISSIONED, THE CONTRACTOR SHALL REMOVE ALL SUCH TEMPORARY SERVICES AND MAKE GOOD TO THE SATISFACTION OF THE SUPERINTENDENT.

INTERRUPTION TO SUPPLY OF EXISTING SERVICES SHALL BE DONE SO AS NOT TO CAUSE ANY INCONVENIENCE TO THE PRINCIPAL. CONTRACTOR TO GAIN APPROVAL FROM THE SUPERINTENDENT FOR TIME OF INTERRUPTION.

6. EXISTING SERVICES, BUILDINGS, EXTERNAL STRUCTURES AND TREES SHOWN ON THESE DRAWINGS ARE EXISTING FEATURES PRIOR TO ANY DEMOLITION WORKS.

7. EXISTING SERVICES UNLESS SHOWN ON SURVEY PLAN HAVE BEEN PLOTTED FROM SERVICES SEARCH PLANS AND AS SUCH THEIR ACCURACY CANNOT BE GUARANTEED. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO COMPLETE A 'DIAL BEFORE YOU DIG' SEARCH. SERVICE SCANNING AND TO ESTABLISH THE LOCATION AND LEVEL OF ALL EXISTING SERVICES PRIOR TO THE COMMENCEMENT OF ANY WORK. ANY DISCREPANCIES SHALL BE REPORTED TO THE SUPERINTENDENT. CLEARANCES SHALL BE OBTAINED FROM THE RELEVANT SERVICE AUTHORITY.

### TELSTRA - DUTY OF CARE NOTE:

1. TELSTRA'S PLANS SHOW ONLY THE PRESENCE OF CABLES AND PLANT. THEY ONLY SHOW THEIR POSITION RELATIVE TO ROAD BOUNDARIES, PROPERTY FENCES ETC. AT THE TIME OF INSTALLATION AND TELSTRA DOES NOT WARRANT OR UPHOLD THAT SUCH PLANS ARE ACCURATE THEREAFTER DUE TO CHANGES THAT MAY OCCUR OVER TIME.

2. DO NOT ASSUME DEPTH OR ALIGNMENT OF CABLES OR PLANT AS THESE VARY SIGNIFICANTLY. THE CONTRACTOR HAS A DUTY OF CARE WHEN EXCAVATING NEAR TELSTRA CABLES AND PLANT, BEFORE USING MACHINE EXCAVATORS TELSTRA PLANT MUST FIRST BE PHYSICALLY EXPOSED BY SOFT DIG POTHOLING TO IDENTIFY IT'S LOCATION. TELSTRA WILL SEEK COMPENSATION FOR DAMAGES CAUSED TO IT'S PROPERTY AND LOSSES CAUSED TO TELSTRA AND IT'S CUSTOMERS.

### PUMP STATION:

1. PUMP STATION TO BE INSTALLED IN ACCORDANCE WITH KWIKFLO PRODUCT SPECIFICATION.

### REINFORCEMENT

- REFER TO THE CONCRETE NOTES FOR THE SPECIFIED COVERS TO REINFORCEMENT. COVER MUST BE MAINTAINED AT ALL CHAMFERS, DRIP GROOVES AND REGLETS etc. UNLESS NOTED OTHERWISE ON THE DRAWINGS.
- REINFORCEMENT IS SHOWN DIAGRAMMATICALLY. IT IS NOT NECESSARILY SHOWN IN TRUE PROJECTION
- REINFORCEMENT SHALL NOT BE CUT OR WELDED ON SITE WITHOUT APPROVAL BY THE ENGINEER. AT SMALL HOLES LESS THAN 300mm DIAMETER, eg PLUMBING PENETRATIONS, BARS SHALL BE DISPLACED TO EITHER SIDE.
- SITE BENDING OF REINFORCEMENT SHALL BE AVOIDED IF POSSIBLE. WHERE SITE BENDING IS SPECIFIED, OR UNAVOIDABLE, IT SHALL BE CARRIED OUT COLD, WITHOUT THE APPLICATION OF HEAT, AND IN ACCORDANCE WITH THE PRACTICE NOTE RPN1 OF THE STEEL REINFORCEMENT INSTITUTE OF AUSTRALIA.
- SPLICES IN REINFORCEMENT SHALL BE MADE ONLY IN THE POSITIONS SHOWN. THE WRITTEN APPROVAL OF THE ENGINEER SHALL BE OBTAINED FOR ANY OTHER SPLICES. WHERE LAP LENGTHS ARE NOT SHOWN THEY SHALL BE AS INDICATED **BELOW**

BAR SIZE	MINIMUM L	AP LENGTH
N10	300	(300)
N12	400	(500)
N16	600	(800)
N20	800	(1000)
N24	1000	(1300)
N28	1200	(1600)
N32	1500	(1900)
N36	1700	(2200)

\* LENGTHS SHOWN IN BRACKETS APPLY TO HORIZONTAL BARS WITH MORE THAN 300mm OF CONCRETE CAST BELOW THE BAR

THE ABOVE DEVELOPMENT LENGTHS ARE FOR MAIN REINFORCEMENT IN fc=32 MPa CONCRETE WITH 30mm CLEAR COVER FOR WALLS AND SLABS AND 30mm CLEAR COVER TO MIN. R10 FITMENTS FOR COLUMNS AND BEAMS.

REINFORCEMENT SYMBOLS:

N - DENOTES D500N DEFORMED BAR TO AS 4671 R - DENOTES 250R HOT ROLLED PLAIN BAR TO AS 4671 SL/RL - DENOTES HARD DRAWN WIRE REINFORCEMENT FABRIC TO AS 4671 W - DENOTES R500L HARD DRAWN PLAIN WIRE TO AS 4671

- FABRIC REINFORCEMENT SHALL BE LAPPED TWO TRANSVERSE WIRES PLUS 50mm 7
- 8. JOGGLES TO BARS SHALL COMPRISE A LENGTH OF 12 BAR DIAMETERS BETWEEN BEGINNING AND END OF AN OFFSET OF ONE BAR DIAMETER.
- ALL REINFORCEMENT SHALL BE CHAIRED AT MAXIMUM CENTERS AS FOLLOWS:-BARS - 800 CENTERS EACH WAY FABRIC - 600 CENTERS EACH WAY

EXTRA CHAIRS MAY BE REQUIRED ADJACENT TO SLAB EDGES AND JOINTS TO PREVENT THE UPWARD DEFLECTION OF THE FABRIC WHEN STOOD ON.

- 10. ALL STEEL CHAIRS SHALL BE PLASTIC TIPPED. STEEL CHAIRS SHALL ONLY BE USED FOR EXPOSURE CONDITIONS A1 AND A2. FULLY PLASTIC CHAIRS ONLY SHALL BE USED ON ELEMENT FACES HAVING EXTERNAL EXPOSURE IN THE COMPLETED STRUCTURE, WHERE REINFORCEMENT IS GROUND SUPPORTED PROVIDE PLATES UNDER ALL BAR CHAIRS.
- AT THE END SUPPORT OF A SLAB ON A MASONRY WALL. ALL BOTTOM 11. REINFORCEMENT SHALL EXTEND OVER THE MASONRY WALL BY 75mm FOR N12 BARS OR 95mm FOR N16 BARS. IF COVER REQUIREMENTS PROHIBIT THIS THE BARS SHALL BE COGGED.

DRAWING SCHEDUL	
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DRAWING SCHEDULE				
19067_SK_W000	COVER PAGE AND NOTES - SEWER WORKS			
19067_SK_W100	GENERAL ARRANGEMENT - SEWER WORKS			
19067_SK_W200	SECTIONS, SHEET 1 OF 5 - SEWER WORKS			
19067_SK_W201	SECTIONS, SHEET 2 OF 5 - SEWER WORKS			
19067_SK_W202	SECTIONS, SHEET 3 OF 5 - SEWER WORKS			
19067_SK_W203	SECTIONS, SHEET 4 OF 5 - SEWER WORKS			
19067_SK_W204	SECTIONS, SHEET 5 OF 5 - SEWER WORKS			
19067_SK_W205	DETAILS, SHEET 1 OF 2 - SEWER WORKS			
19067_SK_W206	DETAILS, SHEET 2 OF 2 - SEWER WORKS			
SEW-1201	EMBEDMENT & TRENCH FILL - TYPICAL ARRANGEMENT			
SEW-1202	STANDARD EMBEDMENT - FLEXIBLE & RIGID PIPES			
SEW-1301-V	MAINTENANCE HOLES - SEWER<=DN 300 (CAST IN-SITU TYPES C1 & C2)			
SEW-1303-V	MAINTENANCE HOLES - SEWER<=DN 300 (CHANGES IN LEVEL DETAILS)			
SEW-1313-V	MAINTENANCE HOLES - CONNECTION DETAILS (PE AND PROFILE WALL PP PIPE)			
SEW-1314-V	MAINTENANCE SHAFTS - TYPICAL INSTALLATION			
SEW-1316-V	MAINTENANCE SHAFTS - TMS AND CONNECTION			

			NARARA ECO VILLAGE CO-OPERATIVE LTD	Level 5, 79 Victoria Avenue Chatswood NSW 2067	Telephone +61 2 9417 8400 Facsimile
			Surveyor CBH SURVEYING AND ENGINEERING	B B B B B B B B B B B B B B B B B B B	+61 2 9417 8337 Email email@hhconsult.com.au Web
DRAWN	DESIGNED	DATE	This drawing and design remains the property of Henry & Hymas and may not be copied in whole or in part without the prior written approval of Henry & Hymas.	Global-Mark.com.au®	www.nenryananymas.com.au



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COVER PAG SEWER WOI

### CONCRETE

- ALL WORKMANSHIP AND MATERIALS SHALL BE IN ACCORDANCE WITH AS 3600 AND AS 3735 AND ANY OTHER RELEVANT AUSTRALIAN STANDARDS UNLESS VARIED BY THE ENGINEER.
- HOLES, PENETRATIONS, CHASES AND CONSTRUCTION JOINTS, OTHER THAN THOSE SHOWN ON THE STRUCTURAL DRAWINGS SHALL NOT BE MADE IN CONCRETE MEMBERS WITHOUT THE PRIOR APPROVAL OF THE ENGINEER.
- CONSTRUCTION JOINTS SHALL BE PROPERLY FORMED WHERE VERTICAL. THE FIRST POUR SHALL BE THOROUGHLY SCABBLED AND CLEANED OF ALL POORLY COMPACTED MATERIAL AND LAITANCE, THOROUGHLY SOAKED AND PAINTED WITH A 2:1 SAND CEMENT SLURRY IMMEDIATELY BEFORE PLACING THE SECOND POUR. THOROUGHLY COMPACT THE SECOND POUR AGAINST THE FIRST POUR.
- CONDUITS, PIPES AND THE LIKE SHALL BE PLACED WITHIN THE MIDDLE THIRD OF THE SLAB DEPTH AND AT A MINIMUM SPACING OF NOT LESS THAN 3 DIAMETERS. CONDUITS AND PIPES SHALL NOT BE PLACED WITHIN THE CONCRETE COVER OUTLINED BELOW.
- THE FINISHED CONCRETE SHALL BE FULLY MECHANICALLY VIBRATED TO ACHIEVE FULL COMPACTION, COMPLETELY FILLING FORMWORK, THOROUGHLY EMBEDDING THE REINFORCEMENT AND FREE OF STONE POCKETS. ALL CONCRETE, INCLUDING SLABS ON GROUND AND FOOTINGS, SHALL BE FULLY VIBRATED USING A HIGH FREQUENCY MECHANICAL VIBRATOR.
- ALL CONCRETE SHALL BE PROPERLY CURED. CURING SHALL COMMENCE WITHIN 2 HOURS OF POURING AND SHALL CONTINUE FOR A MINIMUM OF 7 DAYS, FOLLOWED BY A GRADUAL DRYING OUT. CURING SHALL BE BY CONTINUOUS SATURATION WITH POTABLE WATER OR BY USE OF AN APPROVED PROPRIETARY CURING COMPOUND COMPLYING WITH AS 3799, APPLIED UNIFORMLY IN ACCORDANCE WITH THE MANUFACTURERS INSTRUCTIONS. THE COMPATIBILITY OF CURING COMPOUNDS WITH PROPOSED APPLIED FINISHES SHALL BE VERIFIED PRIOR TO APPLICATION. FORMED SURFACES EXPOSED WITHIN 14 DAYS OF CASTING SHALL BE SPRAYED WITH AN APPROPRIATE CURING AGENT IMMEDIATELY UPON EXPOSURE.
- SPECIFICATION OF CONCRETE

Element	Slump	Max. Agg.	Cement Type	Admix.	Concrete Grade	Exposure Clasif'n	Fire Resistance Rating	Cover U.N.O.
Footings/piers Reinforced	80	20	GP	NIL	32 MPa	B1	-	50
Walls	80	20	SL	NIL	40 MPa	B1	-	40
Core Filling Grout	230±30	10	GP	NIL	20 MPa	B1	-	-
External Slab on Ground	80	20	SL	NIL	32 MPa	B1	-	40 UNO
1075	-							

OF 600 MICROSTRAINS AS DETERMINED BY TEST IN ACCORDANCE WITH AS 1012.13 AFTER 8 WEEKS OF DRYING WATER CEMENT RATIO OF CONCRETE SHALL NOT EXCEED 0.55 (EXCEPT FOR CORE FILLING GROUT I BLOCK WALLS

- WHERE A VAPOUR BARRIER IS SPECIFIED BENEATH SLABS ON GROUND PROVIDE A 0.2mm BRANDED POLYTHENE MEMBRANE THROUGHOUT. LAP SHEETS 300mm AND SEAL WITH A 50mm WIDE PRESSURE SENSITIVE WATERPROOF TAPE.
- WHERE CONCRETE SLABS BEAR ON MASONRY, INCLUDING CORED BRICKS, THE BEARING SURFACE OF THE MASONRY SHALL BE RENDERED WITH 1:3 CEMENT SAND MORTAR TO GIVE A LEVEL SURFACE AND A METAL SLIP JOINT LAID PROTECTED BY 0.2mm POLYTHENE SHEET TAPED TO FORMWORK BEFORE PLACING CONCRETE. SPECIAL DETAILS SHALL APPLY FOR ROOF SLABS OR SIMILARLY EXPOSED SLABS.
- 10. NON LOAD BEARING MASONRY SHALL BE SEPARATED FROM THE SOFFIT OF SLABS AND BEAMS BY 12mm CANITE OR OTHER MEANS APPROVED BY THE ENGINEER.
- 11. BEFORE THE COMMENCEMENT OF CONCRETING THE BUILDER SHALL ENSURE THE CONCRETOR IS FULLY AWARE OF ANY AREAS OF FORMWORK THAT HAVE BEEN PRE-CAMBERED OR PRE-SET. EXTREME CARE MUST BE TAKEN TO ENSURE THE SPECIFIED DEPTHS OF BEAMS AND SLABS ARE ACHIEVED IN AREAS OF PRE-SET OR PRE-CAMBERED FORMWORK. THIS CANNOT BE ACHIEVED BY LEVELLING THE CONCRETE SURFACE INTO THE NOMINAL FINISHED CONCRETE LEVEL.
- 12. CONSTRUCTION AND SUPPORT PROPPING SHALL BE ADDED, OR LEFT IN PLACE, TO AVOID OVERSTRESSING THE STRUCTURE DUE TO CONSTRUCTION LOADS.
- 13. NO MASONRY OR PARTITION WALLS SHALL BE CONSTRUCTED ON SUSPENDED LEVELS UNTIL 7 DAYS AFTER PROPPING HAS BEEN REMOVED AND THE SLAB PRE-LOADED WITH THE BRICKS OR MATERIALS TO BE USED IN THE WALL.

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# An integrated water cycle management plan

for the proposed Eco-village at LOT 1 DP 1087535 Research Road, Narara

Prepared at the request of Mr B. Nettleton and Mr J. Talbott For Narara Ecovillage Co-operative Ltd



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Document Registered By	Peter Bacon Principal Consultant		

# Copyright

This integrated water cycle management strategy is to provide the Narara Ecovillage Co-operative Ltd with a plan to sustainably manage water and wastewater at the Narara Site.

It is time and site specific, and must not be used for any other purpose.

# Acknowledgements

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# Glossary of technical terms and anagrams

Abbroviation or	Evaluation
	Ελριατιατιστι
acronym	
Al	Aluminium
Available capacity	The active canacity is the volume of the rainwater tanks that is accessible
Available capacity	without stirring up sediment on the tank floor. For a 10 cubic m tank this is
	assumed to be 8.5 cubic m
BOD	Biological Oxygen Demand
	Biological exygen Bernand
С	Carbon
-	
Са	Calcium
CI	Chloride
cm	centimetres
Contour bank	A bank installed upslope of the effluent irrigation area to divert upslope runoff
	towards local drainage systems.
dS/m	decisiemens/metre A measure of electrical conductivity
	(1 dS/m=1000 microsiemens/cm)
DEC	Department of Environment and Conservation
DCP	Development Control Plan produced by Gosford City Council. DCP 175 refers
	specifically to the Narara Site. DCP 165 is concerned with Water Cycle
	Management.
DIPNR	Department of Planning Infrastructure and Natural Resources
	in May 2012, the environmental components had been transferred to the
	Office of Water (NOW) and OEH)
Effective rick	The identification of all notantial borando, their sources and borandous events
Effective lisk	The identification of all potential nazaros, their sources and nazaroous events,
management	and an assessment of the level of fisk presented by each.
Effluent	Tracted wastewater compatings referred to as realising water
Elliueni	Treated Wastewater sometimes referred to as reclaimed water.
	Environmental Management Plan
FSCP	Erosion and Sediment Control Plan
2001	
Field capacity (water	The amount of water held in soil once gravitational water has drained from the
holding capacity)	profile Typically it is reached approximately 48 hr after saturation. It can be
	expressed as a variety of units. In the current report it is in mm of water stored
	in the plant root zone.
Faecal coliforms	Bacteria that are indicative of faecal contamination.
q	arams
5	

GCC	Gosford City Council
К	Potassium
ha	hectare (1 ha=100m*100m)
HACCP	HACCP is the <u>Hazard Analysis and Critical Control Point system</u> . (That is: What can we do to reduce hazards)
Hazard	HAZARD=probability*consequences
	A hazard is a biological, chemical, physical or radiological agent that has the potential to cause harm.
	A hazardous event is an incident or situation that can lead to the presence of a hazard. (what can happen and how).
HRT	Hydraulic Retention Time – the average travel time for water to pass through a system such as a wetland or reaction chamber.
kg	Kilograms
kL	Kilolitres (1000 L)
km	kilometres
L	litres
m	metres
mg	milligrams (10 <sup>-3</sup> g)
Mg	Magnesium
mL	millilitres (10 <sup>-3</sup> L)
ML	megalitres (10 <sup>6</sup> L)
MSDS	Material Safety Data Sheets
Na	Sodium
N	Nitrogen
NEV	Narara Eco Village Co-operative Limited
Р	Phosphorus
PET	Potential Evapotranspiration: Rate of loss of water from plants and soil when there is an unlimited supply.
рН	A measure of acidity
Risk	The likelihood of identified hazards causing harm in exposed populations in a specified timeframe, including the severity of the consequences. (How likely is

	it to happen? How serious are the consequences?)
	Risk is maximum risk in the absence of preventive measures
	Residual risk is the risk after consideration of existing preventive measures.
SAR	Sodium Adsorption Ratio. A measure of the ratio of sodium to calcium plus magnesium. It is used in conjunction with salinity data to determine the stability of irrigation water.
STS	Sewage Treatment System
TSS	Total Suspended Solids
RVZ	Riparian Zone Width as defined in the Water Management Act regulations.
WICA	Water Industry Competition Act (2006).
WSUD	Water Sensitive Urban Design

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Appendix 1. Report on the unnamed gully to the immediate south of lots 35, 22, 21 and 10 Narara Ecovillage, Narara.

Appendix 2. Letter of advice regarding drainage depression

### 1 BACKGROUND

Narara Ecovillage Co-Operative Ltd wishes to establish an eco-village on lands previously owned by NSW Agriculture at Research Road Narara.

The site is being developed by Narara Ecovillage Co-operative Ltd. The development format will provide a range of dwelling types from cluster housing to individual dwellings.

The development will occur in a number of stages. The first stage will involve some 60 units, and much of the report is concerned with this initial development phase. However, where appropriate, and deemed necessary to demonstrate long term sustainability, the full development of some 110 to 130 dwellings is considered.

### Purpose

The purpose of this report is to demonstrate the environmental sustainability and feasibility of establishing an integrated water cycle for the eco-village.

Key aims are:

- To manage the eco-village sustainably, with minimal risk to human or environmental health.
- To treat and reuse sewage and stormwater on site.
- To manage stormwater to meet the performance criteria in Gosford City Council's Development Control Plan 165 (2007) Water Cycle Management.
- To ensure that the water management within the development is consistent with national, state and local government regulations and guidelines.



Figure 1.1 Regional context of subject site. The site is in Narara, some 5 km NW of Gosford.



Figure 1.2. Site details showing original boundaries. The site is on Research Road, Narara. It includes buildings and orchards associated with a disused Horticultural Research Station. There are rural residential lots in the north east of the site. The dam to the north of the development area is critical to the site's water management. (Image source: SIX MAPS).



Figure 1.3. Stage 1 of the development. Eventually areas to the south and north of the first stage will be developed. (Image source: hill thalis). Full development will comprise approximately 110 to 130 dwellings.

### 2 OVERALL CONCEPT

Figure 2.1 shows the overall concept.

Integrated water cycle management concepts shown in figure 2.1 include:

- 1. Capture of roof water (after UV disinfection) for all potable and non-potable internal uses except toilet flushing.
- 2. Runoff water from roads and other surfaces to be treated in a stormwater management system designed to achieve Gosford City Council's Water Cycle Management Guideline performance criteria (GCC, 2007).
- 3. Stormwater conveyance via existing drainage lines following their stabilisation
- 4. Combined wastewater from the homes, visitor centre, etc., to be conveyed to Sewage Treatment Plant (STP). The wastewater to be treated to National Recycled Water Standard for internal use in dwellings (NRMMC/EPHC/AHMC, 2006).
- 5. Recycled water used for toilet flushing, gardens and general irrigation.
- 6. Any wet weather excess volume to be conveyed to wet weather storage.
- 7. Outflow from the wet weather storage is not to occur in more than the 50%ile wet year (DEC, 2004).
- 8. The large dam at the northern portion of the site to provide potable water during low rainfall periods (water will need disinfection to meet Australian Drinking Water Guidelines (NHMRC, NRMMC, 2011)).
- 9. Fire-fighting requirements will be provided to meet NSW Fire and Rescue Service requirements.

The key features include:

- Consistency with National, State and Local Government regulations and guidelines
- Independence from centralised water and sewerage services.
- Productive recycling of stormwater
- Productive recycling of wastewater
- Minimised impact and call on external water bodies, and
- Protection of receiving water from contaminated stormwater outflows.



Figure 2.1 Schematic of an integrated water cycle for the site. Note zero demand on centralised water or sewerage services.


Figure 2.2. Water and wastewater systems overview and flow balance (Source: Aquacell Pty Ltd)

-

### 3 LEGAL AND REGULATORY REQUIREMENTS

This section of the plan identifies the key components of the water cycle, the proposed water sources, the issues associated with using the proposed water sources and the legislation and guidelines determining the quality controls and system safeguards.

It is absolutely critical that each component of the proposed system meets human and environmental health criteria.

Table 3.1.	Relationship	between	water	cycle	components	and	reference	documents	and
guidelines				-					

Water cycle component	Proposed sources	Issues	Reference documents/ guidelines
Laundry and hot water	Roof runoff plus dam	Roof water quality Hot water thermostat setting/UV disinfection	Australian Guidelines for Water Recycling: Managing Health and Environmental Risk (Phase 1), (NRMMC, 2006).
		Need for 1 <sup>st</sup> flush diversion of 20 L Security of supply & back up (dam).	EnHealth. Guidance on use of rainwater tanks. (May 2007) Australian Drinking Water
			Guidelines (NHMŘC, NRMMC, 2011)
			GCC's policy
			Central Coast unregulated and alluvial water sources Water Sharing Plan
			Water License WAL16886
			Climate data
Dicking			Demand data
Drinking water	Root runott	vvater quality	•EnHealth. Guidance on use of rainwater tanks. May 2007
	Plus dam	No overhanging branches,	Australian Drinking Water
		Litter guards on gutters.	
		Frequent cleaning of gutters	Central Coast Water Sharing Plan
		1st flush diversion of 20 L	Water License WAL16886
		Microbial contamination (inline UV)	Climate data
		Security of supply & back up dam.	Demand data
		License to abstract water for urban use.	

Water cycle component	Proposed sources	Issues	Reference documents/ guidelines
Fire water	Dam then concrete buffer storages upslope of the development	Storage capacity Hydrants	Fire and Rescue Service requirements
Recycled wastewater • Toilets, • Gardens • General wash down	Reclaimed effluent	Meets WICA requirements (license, monitoring, maintenance) Must consistently meet water quality guidelines. Sufficient usage so that there is no discharge up to the 50%ile wet year. Monitoring and management expertise	<ul> <li>WICA requirements</li> <li>Australian Guidelines for Water Recycling: Managing Health and Environmental Risk (Phase 1), (NRMMC, 2006).</li> <li>GCC's On-site Sewage Management strategy</li> <li>Central Coast Water Corporation Act 2006</li> <li>GCC's sewerage projects</li> <li>DEC (2004)</li> <li>Climate data</li> <li>Demand data</li> </ul>
Stormwater	Surrounding catchment Dam Rainwater Rainwater Tank overflow Road runoff Pervious and impervious surface runoff	Relatively steep slopes and drainage lines Floodplain and wetland Must meet GCC requirements under DCP 165: 80% removal of TSS 45% removal of N & P No gross pollutants or visible O&G if flow is <25% of 1 Y ARI	<ul> <li>GCC DCP 165</li> <li>GCC Water Cycle Management Plan</li> <li>Water Management Act</li> <li>Australian Guidelines for Water Recycling: Managing Health and Environmental Risk (Phase 2), Stormwater (NRMMC, 2007).</li> <li>MUSIC V5 guidelines</li> <li>Fletcher et al (2004)</li> </ul>

Table 3.1 emphasises the linkage between the quality control systems for each component of the water cycle and the regulations.

Water Supply and Sewerage services within the City of Gosford are provided by Gosford City Council in its capacity as a Water Supply Authority subject to the provisions of the Water Supply Authorities Act, 1987 (From DCP 112, Residential subdivision). However the Narara site is outside the current sewerage reticulation system.

Several pieces of legislation are critical the water cycle management on the site. These include:

- The Water Management Act (2000)
- The Water industry Competition Act (2006)
- Central Coast Water Corporation Act 2006 No 105
- The Protection of the Environment Operations Act (1997)

#### The Water Management Act (2000)

# The Water Management Act (2000) (WMA) provides for the protection, conservation and ecologically sustainable development of the water sources of the State, and for other purposes.

The objects of the Act are to provide for the sustainable and integrated management of the water sources of the State for the benefit of both present and future generations and, in particular:

(a) to apply the principles of ecologically sustainable development, and

(b) to protect, enhance and restore water sources, their associated ecosystems, ecological processes and biological diversity and their water quality, and

(c) to recognise and foster the significant social and economic benefits to the State that result from the sustainable and efficient use of water, including:

(i) benefits to the environment, and

(ii) benefits to urban communities, agriculture, fisheries, industry and recreation, and

(iii) benefits to culture and heritage, and

(iv) benefits to the Aboriginal people in relation to their spiritual, social, customary and economic use of land and water,

(d) to recognise the role of the community, as a partner with government, in resolving issues relating to the management of water sources,

(e) to provide for the orderly, efficient and equitable sharing of water from water sources,

(f) to integrate the management of water sources with the management of other aspects of the environment, including the land, its soil, its native vegetation and its native fauna,

(g) to encourage the sharing of responsibility for the sustainable and efficient use of water between the Government and water users,

(h) to encourage best practice in the management and use of water.

The likely interactions between the proposed development and this act include:

- Accession of water from the dam.
- Construction of water management facilities such as wetlands on the Narara Creek floodplain.
- Crossings, pipe installation and drainage outlets associated with drainage lines within the development area.

#### Access to water in the dam

Water access from streams and dams is addressed in the WATER SHARING PLAN: Central Coast unregulated and alluvial water sources (NSW Dept Water and energy, 2009). Under this plan, extraction of 29 ML/year is permissible from the BRISBANE WATER WATER SOURCE. This extraction is subject to the conditions of the Water Access Licence. The water is currently designated for irrigation.

A Water Supply Works and Use Approval has be received allowing the irrigation water to be used for urban purposes.

#### Construction on the floodplain

In relation to floodplain management the WMA states:

(a) floodplain management must avoid or minimise land degradation, including soil erosion, compaction, geomorphic instability, contamination, acidity, waterlogging, decline of native vegetation or, where appropriate, salinity and, where possible, land must be rehabilitated, and

(b) the impacts of flood works on other water users should be avoided or minimised, and

(c) the existing and future risk to human life and property arising from occupation of floodplains must be minimised.

The simplest approach is to ensure that construction does not affect floodplain flows. As an example, structures such a bund wall should be minimised, and ideally water storages and wetlands should be 'inserted' into the floodplain rather than being constructed using bund walls that could interfere with flood distribution.

The dam is on a second order tributary of Narara Creek. Narara Creek is a 4<sup>th</sup> order stream. The straight drainage lines through the development are 1<sup>st</sup> order watercourses. These 'orders' determine the width of the riparian zones. SEE: NSW Office of Water Guidelines for Riparian Corridors on Waterfront Land July 2012.

#### Riparian corridor widths

Changes to the NSW Office of Water Guidelines for Riparian Corridors on Waterfront Land commenced in July 2012. In the section **Riparian corridor widths** The first sentence states:

The Officer (sic) of Water recommends a VRZ width based on watercourse order as classified under the Strahler System of ordering watercourses and using current 1:25 000 topographic maps.

The guideline changes clarify the activities permitted within 40m of the top of watercourse banks. The Vegetated Riparian Zone (VRZ) width for different stream orders is shown below.

## Table 3.2. Vegetated Riparian Zone widths for various stream orders (Source: the July 2012 changes to NSW Office of Water Guidelines for Riparian Corridors on Waterfront Land).

Watercourse type	Vegetated Riparian Zone (VRZ) width	Vegetated buffer	Total Riparian corridor width (m)
1 <sup>st</sup> order	10m	None	20m + channel width
2 <sup>nd</sup> order	20m	None	40m + channel width
3 <sup>rd</sup> order	30m	None	60m + channel width
4 <sup>th</sup> order or greater (includes wetlands)	40m	None	80m + channel width

Where suitable there can be activities in the outer 50% of the VRZ provided it is offset by an equivalent area connecting to an equivalent area on waterfront land within the development site. For example there can be a stream line shown as a blue line on a 1 in 25,000 topographic map with a portion of its length having only a 5m with of riparian corridor. This is permissible provided there is an equivalent area of riparian corridor added to another portion of this or another riparian corridor in the development.

Note that this provision for equivalent off set does not apply to bridges, cycleways, paths, detention basins stormwater outlets or other essential services. See table 3.3, below.

Table 3.3. Riparian corridor (RC) matrix showing permissible activities for the vegetated riparian zones of different stream orders (Office of Water, 2012).

Stream order	VRZ width	RC off- setting for	Cycleway	Detention basins		Stormwater outlet structures and	Stream re- alignment	Road	crossing	
		non- RC uses		Within outer 50%	On- line	essential services		Any	Culvert	Bridge
1st	10m	~	~	~	~	$\checkmark$	$\checkmark$	~		
2nd	20m	~	~	~	~	$\checkmark$		~		
3rd	30m	~	~	~		✓			✓	✓
4th	40m	~	~	~		✓			✓	✓

Non-RC (Riparian Corridor) uses such as Asset Protection Zones can occur within the outer 50% provided offsets are included as discussed above.

The information in table 3.3 suggests that Narara Creek has a 40m VRZ between its bank and many likely activities. However, a detention basin could be constructed provided it is not closer than 20m to the top of the bank and appropriate offsets are provided.

The drainage lines (shown as blue lines on the 1:25000 Gosford topographic map) coming down slope and through the development area are 1<sup>st</sup> order streams, and items such as stormwater outlets and crossings can be constructed through the VRZ.

#### The Water industry Competition Act (2006)

The Water Industry Competition Act (2006) (WICA) is designed to encourage competition in relation to the supply of water and the provision of sewerage services and to facilitate the development of infrastructure for the production and reticulation of recycled water; and for other purposes.

In the current situation, WICA enables proponents to engage appropriate organisations to provide water supplies and sewerage services for the development. The provider can be an organisation such as Central Coast Water Corporation or a private organisation. The providing organisation will need a license for the project.

The application will be scrutinised to ensure that human and environmental standards and safeguards are in place.

#### Central Coast Water Corporation Act (2006)

Central Coast Water Corporation Act 2006 No 105 is an Act to provide for the constitution and functions of the Central Coast Water Corporation and for its establishment as a water supply authority under the *Water Management Act 2000*; and for other purposes.

(1) The principal objectives of the Corporation are as follows:

(a) to promote the efficient delivery of water supply, sewerage and drainage services for the long-term interests of consumers with respect to price, quality, safety, reliability and security of supply,

(b) to maximise water conservation, demand management and the use of recycled water,

(c) to be a successful business and, to this end:

(i) to operate at least as efficiently as any comparable business, and(ii) to maximise the net worth of the constituent councils' investment in the Corporation,

(d) to exhibit a sense of social responsibility by having regard to the interests of the community in which it operates,

(e) where its activities affect the environment, to conduct its operations in compliance with the principles of ecologically sustainable development contained in section 6 (2) of the *Protection of the Environment Administration Act 1991*.

(2) Each of the principal objectives of the Corporation is of equal importance.

It is understood that this Act had not been proclaimed as at 29 October 2013.

#### The Protection of the Environment Operations Act (1997)

This Act (POEO) is designed to protect the environment.

The objects of the POEO are as follows:

(a) to protect, restore and enhance the quality of the environment in New South Wales, having regard to the need to maintain ecologically sustainable development,

(b) to provide increased opportunities for public involvement and participation in environment protection,

(c) to ensure that the community has access to relevant and meaningful information about pollution,

(d) to reduce risks to human health and prevent the degradation of the environment by the use of mechanisms that promote the following:

(i) pollution prevention and cleaner production,

(ii) the reduction to harmless levels of the discharge of substances likely to cause harm to the environment,

(iia) the elimination of harmful wastes,

(iii) the reduction in the use of materials and the re-use, recovery or recycling of materials,

(iv) the making of progressive environmental improvements, including the reduction of pollution at source,

(v) the monitoring and reporting of environmental quality on a regular basis,

(e) to rationalise, simplify and strengthen the regulatory framework for environment protection,

(f) to improve the efficiency of administration of the environment protection legislation,

(g) to assist in the achievement of the objectives of the Waste Avoidance and Resource Recovery Act 2001.

The proposed development is consistent with many objectives of the POEO. Whilst the development is too small to be a scheduled activity under the Act, it is essential that the development not create a pollution incident.

It is therefore essential that the development has an adequate Operational Environmental Management Plan (OEMP) to address risks associated with the operation of the water and wastewater systems.

#### 4 CLIMATE

The subject site is located within the boundaries of the disused Narara Horticultural Research Station. This research station has been supplying meteorological data since 1916. The station number is 061087. It is at 33.39 Degrees South and 151.33 Degrees East. The elevation is 20m. A selection of the data is shown in table 4.1

 Table 4.1. Meteorological data for Narara horticultural Station (Number 061087). (Source: BoM).

Statistic Element	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Mean maximum temperature (Degrees C)	28	27	26	24	20	18	18	19	21	24	25	27	23
Mean minimum temp (Degrees C)	17	17	15	12	8	7	5	5	8	11	13	15	11
Mean daily temp (degrees C)	22	22	21	18	14	12	11	12	15	17	19	21	17
Mean number of days <= 0 Degrees C	0	0	0	0	0	0.4	1.6	0.6	0	0	0	0	2.6
Mean rainfall (mm)	135	153	149	139	118	131	80	72	69	85	92	104	1325
Decile 1 monthly rainfall (mm)	36	29	27	33	16	19	10	7	14	16	17	20	909
Decile 5 (median) monthly rainfall (mm)	111	117	132	96	80	87	55	49	54	62	82	83	1259
Decile 9 monthly rainfall (mm)	281	313	312	307	276	306	191	190	166	197	193	231	1893

Highest daily rainfall (mm)	211	192	206	218	177	229	195	144	110	129	155	155	229
Mean number of days of rain >= 10 mm	3.4	3.8	3.8	3.3	2.8	3.3	2.1	1.8	1.8	2.2	2.7	2.7	33.7
Mean daily wind run (km)	124	113	103	86	81	83	91	101	113	120	127	128	106
Mean daily solar exposure (MJ/(m*m))	22.4	19.8	17.1	13.8	10.2	8.8	9.8	13.3	17	19.8	21.6	23.1	16.4

The Narara Meteorological Station is within 10 km of the ocean and at 20m elevation. It has a warm, humid climate. Its location at the base of some relatively steep hills means that is protected to some extent from high winds.

The daily rainfall range of 12 degrees is moderate and reflects the separation from the coast. The annual average temperature of 17 degrees indicates a warm climate. Frosts typically occur in June, July and August; however most of the year is sufficiently warm to allow vegetation growth. The site has been successfully used for temperate and subtropical perennial species such as oranges and avocadoes for almost 100 years. This suggests that site conditions do not limit plant growth.

The long-term average rainfall is 1325 mm/year. This is more than double the Australian average and indicates a moist climate. The 10% ile year has 909 mm rainfall while the 90% ile year has 1893 mm. This two-fold difference is smaller than that of most of Australia, and suggests that the rainfall is relatively reliable.

Highest total monthly rainfall occurs in late summer / autumn, whilst late winter-spring is the driest period. Every average month has significant rainfall (>10 mm) in 2 to 4 days. The relatively large number of rainfall days indicates a relatively humid climate with only short periods of moisture stress.

Daily wind-run is highest in summer, but even then it averages less than 150 km/day. This reflects the relatively sheltered nature of the site.

Average daily solar radiation varies almost three fold between June and December. All months have at least moderate sunshine.

It is concluded that the climate is adequate for plant growth for all months. Growth will be limited by low temperatures in winter. Moisture availability will have relatively limited impacts on plant growth.

#### **Rainfall intensity**

Rainfall intensity was determined from IEA (1987). The site has an estimated rainfall Erosivity Factor –R of 3940. Table 4.2 shows the intensity/ duration estimates.

Table 4.2.	Rainfall	intensity	(mm/hr)	for	events	up	to '	1 in	100	year	Average	Recurrenc	e
Interval (AF	RI). (Deri	ved from I	EA, 1987	<b>'</b> ).						-	-		

Dur/ARI	5 min	6 min	10 min	20 min	30 min	1 hr	2 hr	3 hr	6 hr	12 hr	24 hr	48 hr	72 hr
1	91	86	70	51	41	28	19	16	10	7	5	3	2
2	118	111	91	66	54	37	25	20	14	9	6	4	3
5	154	144	119	88	72	50	33	26	17	11	8	5	4
10	174	164	136	101	83	58	38	30	19	13	8	6	4
20	201	190	158	118	97	68	45	34	22	14	10	7	5
50	267	224	187	140	116	82	53	40	26	17	11	8	6
100	264	250	209	157	131	93	59	45	29	18	13	9	7

This data was used to calculate peak flows and then to determine design adequacy (Landcom, 2004).

#### Potential need for irrigation

Figure 4.1 shows the daily rainfall and potential evapotranspiration (FAO 56) from January 2012 to end of February 2013. During this period, there was some 1403 mm of rain and the potential evapotranspiration was 1138 mm. While total rainfall exceeded potential evapotranspiration, there were significant periods when there was no rainfall, but significant potential evapotranspiration.

Irrigation would be needed to maximise plant growth during these times. The relatively frequent rain events mean that irrigation water demand/ha/year will be limited.



### 5 WATER CYCLE COMPONENTS-A. TOTAL DEMAND PER DWELLING

The BASIX policy is one of the NSW Government's key initiatives in promoting a water and energy efficient future for NSW. A Basix Monitoring Program has measured household water demand since 2007 (Sydney Water, 2012). Table 5.1 shows that potable water consumption in BASIX assessed dwellings ranged from 192 cubic m/y<sup>1</sup> in 2007-08 to 209 cubic m/y in 2008-2009.

Outdoor uses, showers; washing machine; toilets and indoor hand taps typically comprise 93-98% of household water use (Thyer et al, 2008).

Table 5.1.	Characteristics of water	consumption	in BASIX	assessed	dwellings	since	2005
(Sydney Water	ater, 2012).						

Component	2007-2008	2008-2009	2009-2010	2010-2011
Number of dwelling sampled	837	1392	2479	5294
Water consumption (L/dwelling/day)	886	890	899	903
Occupancy/dwelling	3.6	3.6	3.7	3.7
Percentage with dual water supply	13%	11%	12%	9%
Average actual potable water consumption (cubic m/year)	192	201	209	208
Potable consumption/occupant (L/day)	246	274	234	244

SWC (2011) examined demand for water from the rainwater tank and total household demand in 50 intensively monitored dwellings. The results are summarised in table 5.2. (SWC, 2011).

## Table 5.2. Annual demand for various water sources based on intensive sampling of 50 dwellings (SWC, 2011).

	Median	Mean	Minimum	Maximum
Demand for water from the tank (cubic m/y)	57	59	5	161
Household demand for all uses (cubic m/y)	180	197	84	556

The average total demand of 197 cubic m/y is similar to the total demand for potable water in table 5.1. The total potable volume used is typically 250 L/occupant/day as table 5.1 shows.

Table 5.3 shows the change in daily demand with change in number of residents/dwelling.

<sup>&</sup>lt;sup>1</sup> 1 kL=1,000 L=1 cubic m=1/1000 ML.

Number of occupants	1	2	3	4	5	6*	7*
Average total water use for							
dwellings with various	233	352	447	529	604	658	700
numbers of residents (L/day)				010			
(Sydney Water, 2011).	24	E 2	74	05	445	420	4.45
	31	55	/4	95	115	130	145
% of total water use	13	15	17	18	19	20	21
% of internal demand	25	25	25	25	25	26	27
Laundry (L/day)	29	53	76	95	113	123	131
% of total demand	12	15	1/	18	19	19	19
% of internal demand	24	25	25	25	25	25	25
Hot Water (L/day)	49	87	119	151	182	197	210
% of total demand	21	25	27	29	30	30	30
% of internal demand	40	41	40	40	40	40	39
Other internal uses (L/day)	13	20	31	37	42	45	48
% of total demand	6	6	7	7	7	7	7
% of internal demand	11	9	10	10	9	9	9
Total internal use (L/day)	122	213	300	378	452	495	534
Internal use excluding	91	160	226	283	337	365	389
toilets (L/day)							
Daily External use (L/day)	111	139	147	151	152	163	166
External use as% of total demand	48	39	33	29	25	25	24
Internal use as % of total demand	52	61	67	71	75	75	76
Likely reclaimed sewage use L/day (toilet + external)	142	192	221	246	267	293	311
% of total demand	61	54	49	47	44	49	49
Roof runoff demand for laundry and hot water L/day	78	140	195	246	295	205	256
% of total demand	33	40	44	47	49	31	37
% of internal demand	64	66	65	65	65	41	48
Potable + non potable roof runoff demand	91	160	226	283	337	365	389
Roof runoff demand as a % of total demand	39	46	51	54	56	56	56
Return to sewer (internal uses) (L/day)	122	213	300	378	452	495	534
Sewer reuse (toilets, gardens) (L/day)	142	192	221	246	267	293	311
Total demand (cubic m/v)	85	128	163	193	220	240	255

Table 5.3. Water use components for individual dwellings with 1 to 7 occupants (derived from SWC reports). The water use by 6 and 7 occupants was derived via extrapolation. Data based on 5294 dwellings.

Table 5.3 shows that water demand varies with number of residents/dwelling. The 2011 Census data for the Gosford Statistical Area (ABS web site, 2013), shows that the average number of persons per dwelling was 2.5. The individual lot dwellings were assumed to have 5 residents. This is effectively double that of the local number of residents/dwelling on census night is 2011.

For the cluster lots it was assumed that there would be 2 persons/bedroom. So a one bedroom dwelling would always have 2 people in residence, while a two bedroom residence would have 4 persons in permanent residence.

Lot	Dwelling	Number of	Number of	Assumed	Assumed
number	classification	dwellings in	bedrooms per	permanent	potable water
		this	dwelling in this	number of	demand (from
		classification	classification	occupants	table 5.3)
15	A	1	2	4	283
	_		_		
15	В	2	2	4	283
4.5	-				
15	C	1	2	4	283
15		2	<u>р</u>	1	202
15	D	2	Z	4	203
15	F	2	3	6	365
10		2	Ū	Ũ	000
15	F	2	3	6	365
15	Total	10			
36	1	4	1	2	160
00		1	•	-	100
36	2	4	1	2	160
36	3	9	2	4	283

#### Table 5.4. Attributes of the dwellings in cluster lot 15 and lot 36.

#### First stage of development

Total potable water consumption in the 27 units within the two cluster lots is predicted to be 6.985 cubic m/day. The 33 individual dwellings on individual lots in the first Stage are assumed to have 5 persons/ dwelling. From table 5.3 the indicative potable demand will be 337 L/dwelling/ day or 11.121 cubic m/day. Therefore the total daily demand for potable water will be 18.106 cubic m.

#### Full development

At full development there is likely to be 115 to 130 dwellings. Assuming that there are 5 persons/dwelling, the average daily potable demand for stage 2 of the development based on an additional 55 to 70 dwellings at 337 L/dwelling would be 18.5 to 23.6 cubic m/day.

The potable demand at full development with up to 130 dwellings would therefore be approximately 37 to 42 cubic m/day. The mid-range figure of 39 cubic m/day was therefore used in estimates of potable water demand at full development.

## 6 WATER CYCLE COMPONENTS-B. INTERNAL DEMAND AND SUPPLY EXCEPT TOILETS

The internal demand was assumed to include all hot and cold water apart from toilet flushing. (The need for disinfection is noted).

According to table 5.3, the estimated total demand, except for toilets, ranges from 91 L/day for a single person to 389 L/day for a dwelling with 7 occupants.

## Table 6.1. Attributes of the demand for potable water and their respective roof areas for dwellings on individual lots and for cluster lot 15 and lot 36.

Lot	Dwelling	Number of	Number of	Assumed	Assumed	Design
number	classification	dwellings in	bedrooms per	permanent	potable	roof
		INIS eleccification	aweiling in this	number of	water	area
		classification	classification	occupants	(from table	
					5.5) L/u.	
Single		33	?	5	337	120
dwellings						
	Total				11,121	
			-			
15	A	1	2	4	283	75
15	В	2	2	4	566	76
15	<u> </u>	1	2	1	283	73
15			2	-	200	10
15	D	2	2	4	566	64
15	F	2	3	6	730	135
	_	_	•	<b>.</b>	100	100
15	F	2	3	6	730	135
15	Total	10			3158	
36	1	4	1	2	640	73
36	2	4	1	2	640	Zero
36	3	9	2	Δ	2547	89
00	5	5	2		2047	00
Total		17			3827	
Total Stage 1 based on 33 individual lots and 2 cluster lots containing 27					18,106	L/d.
dwellings						
Final stage assuming 110 to 130 dwellings, 27 of which are in clusters					34,957 to 41	,696 L/d.

Note that the flows will be recorded for stage 1 dwellings and used as a more accurate estimate for the later stages.

Daily rainfall from 1 January 1970 to 26 February 2013 was used to estimate the volume of water that could be captured from the roof. The assumptions were:

- $\circ$   $\,$  Daily rainfall for Narara from January 1907 to February 2013 was used for the simulation
- The demand/day was as per table 6.1.
- The roof area was as per table 6.1.
- $\circ$  There was a 2 mm/day initial loss of water due to evaporation
- o A first flush loss of 20 L/wet day
- $\circ$  The tank size was 10.5 cubic m, of which 8.5 cubic m was active storage<sup>2</sup>.

These assumptions tend to underestimate supply and overestimate demand. For example,

- the permanent average population is typically 2.5 persons/dwelling of 1.2/bedroom, not 5 or 2 as used in this simulation.
- the demand is for an average family. The emphasis on sustainable living means water use/person is likely to be less than the average.
- the roof area of 120 msq is lower than the typical new home average of over 200 msq for single storey dwellings.

The conservative parameters were used to examine the worst-case scenario.

#### Rainwater tank management

According to ADWG (2011), rainwater systems, particularly those involving storage in aboveground tanks, generally provide a safe supply of water. The principal sources of contamination are birds, small animals and debris collected on roofs. The impact of these sources can be minimised by a few simple measures: guttering should be cleared regularly; overhanging branches should be kept to a minimum, because they can be a source of debris and can increase access to roof catchment areas by birds and small animals; and inlet pipes to tanks should include leaf litter strainers.

*First-flush diverters, which prevent the initial roof-cleaning wash of water (20–25 L) from entering tanks, are recommended. If first flush diverters are not available, a detachable downpipe can be used to provide the same result.* 

#### Effectiveness of a 8.5 cubic m rainwater tank

The consumption parameters above were combined with a rainwater tank with 8.5 cubic m effective storage and daily rainfall data from 1/1/1970 to 26/2/2013.

<sup>&</sup>lt;sup>2</sup> Initial simulations indicated that a 10 cubic m tank was a reasonable compromise between providing water for a reasonable proportion of time and the loss of garden space due to the tank size.

The results are shown in figure 6.1.

Figure 6.1 shows that the tanks will be able to supply water for between 33 and 60% of time depending on the combination of roof catchment and demand for potable water.



#### Effect of increasing tank storage capacity

The effectiveness of 4.5, 9.5 and 14.5 cubic m tanks were compared for the single dwellings assuming the same roof area, runoff characteristics and demand as in table 6.1.



Increasing the tank capacity from 4.5 to 9.5 or 10 cubic m increased the percentage of time the tanks had a minimum of 1 day supply from 47 could supply the demand to 68 and 76% respectively. The 14.5 cubic m tank would have represents 91 cubic m of water being utilised with 40 cubic m going to stormwater drainage in the average year.

There appears to be little advantage in using a 14.5 cubic m tank, conversely a 4.5 cubic m tank is dry for the majority of time. It is suggested at the 10 cubic m tank with 8.5 cubic m of active storage is a reasonable compromise.

#### 7 WATER CYCLE COMPONENTS-C. DEMAND FOR TOILET FLUSHING AND EXCESS WATER PRODUCTION

Table 7.1 summarises the anticipated demand for toilets and external use for dwellings with 1 to 7 persons in full time residence.

Table 7.1.	Effect of number	of residents on	sewage production	and recycled wat	er demand
(Derived for	or SWC reports).				

Number of occupants	1	2	3	4	5	6*	7*
Average total water use	233	352	447	529	604	658	700
for dwelling with various							
numbers of residents							
(Sydney Water, 2011).							
Toilet (L/day)	31	53	74	95	115	130	145
% of total water use	13	15	17	18	19	20	21
% of internal demand	25	25	25	25	25	26	27
Return to sewer (internal	122	213	300	378	452	495	534
uses) (L/day)							
Net difference between	91	160	226	283	337	365	389
wastewater production							
and demand for toilet							
flushing (L/day)							
Sewer reuse (toilets,	142	192	221	246	267	293	311
gardens) (L/day)							
Net difference between	-20	21	79	132	185	202	223
flow to sewer and demand							
for toilet and outside use							
water (L/day)							

Depending on the average number of residents per dwelling, between 31 and 145 L/dwelling/day will be required for toilet flushing. The net difference between toilet flushing demand and the potential supply ranges from 91 to 389 L/day depending on residents/dwelling. Therefore, assuming up to 130 dwellings at full development, between 10.5 and 44.8 cubic m/day will need to be irrigated. This volume is numerically equivalent to the volume to potable water needed.

The potable demand at full development was estimated in section 5 of the current report as being approximately 37 to 42 cubic m/day. The indicative volume of 39 cubic m/day (14.24 ML/y) was therefore used in estimates of excess reclaimed water that will need to be irrigated at full development.

#### Sewage production due to visitors

As an initial input, it was assumed that there were 70 visitors/day (490/week, concentrated into the weekends). It was also assumed that each visitor used the toilets once (7 L dual flush), washed their hands (1.2 L for spring-loaded taps) and 'consumed' 5.5 L via washing up of plates, etc. This gives a total of 13.7 L/visitor (Sturman, et al, 2004). Of this, 7 L was returned to flush the toilets.

Total sewage flow due to visitors is therefore: 70 visitors\*13.7 L=0.959 cubic m/day. Return of treated water for toilet flushing is 70 visitors\*7 L=0.490 cubic m/day, while net production is 0.469

cubic m/day. Staff for visitor facilities is likely to be largely drawn from residents, so there is no additional flow allocation.

#### Sewage flows at stage 1

Stage 1 of the development will consist of 33 individual lot dwellings plus 17 units on lot 36 and 10 units on lot 15. Based on total internal use data in table 5.3, stage will produce 24.3 cubic m/day of sewage of which 6.2 cubic m/day will be returned for toilet flushing and 18.1 cubic m/day will need to be irrigated.

#### Sewage flows at full development

Combined sewer flow of residents (5 persons /dwelling\*115<sup>3</sup> dwellings) plus visitors (70/day) is 51.98+0.96= 53 cubic m/day or 19.3 ML/year.

The net sewerage flows, allowing for recycling for toilet flushing is numerically equivalent to the potable demand. According to section 5, potable demand at full development would be approximately 37 to 42 cubic m/day. The indicative figure of 39 cubic m/day was therefore used in estimates of both potable water demand AND effluent irrigation volume at full development.

Allowing for return of tertiary treated water for toilet flushing, the combined irrigation volume at full development is estimated at 39 + 0.5 or 39.5 cubic m/day. This is equivalent to 14.4 ML/year.

This will obviously vary slightly depending on the final number of dwellings and the average number of residents/dwelling.

<sup>&</sup>lt;sup>3</sup> The final number of dwellings may be up to 130. However the potable demand and sewage flows will depend on number of residents. The water use and irrigation pump volumes from first stage of the development will be used to estimate actual flows that could occur from up to 130 dwellings at full development.

## 8 WATER CYCLE COMPONENTS-D. DEMAND FOR IRRIGATION WATER AND WET WEATHER STORAGE.

The demand for irrigation water is a function of the evapotranspiration demand and the volume of water being supplied. In a humid climate such as at Narara there are likely to be extended periods when water supply exceeds the demand. Water needs to be stored during these periods<sup>4</sup>.

Figure 8.1 shows the generalised relationship between irrigation area and storage volume. The optimal solution depends on local conditions, but it is commonly near the centre of the range in irrigation area.



#### Soil water balance and irrigation demand

Soil water balance and irrigation demand were determined using a combination of rainfall and potential evapotranspiration data. The soil assessment demonstrated that the soil was sand dominant, with loamy sands up to 2m deep overlying clay subsoil.

#### **Model inputs**

Table 8.1 itemises the inputs used to model the site water balance. The balance assumes 5 persons/dwelling and 70 visitors in the average day. This provides a large 'safety' margin.

<sup>&</sup>lt;sup>4</sup> Note that in stage 1, the approach proposed is to utilise the relatively large area of citrus orchard to productively utilise effluent. The proposed application rate of 1 mm /day is 3.5 to 4 times less than the Design Irrigation Rate (DIR) recommended in AS/NZS 1547. The extremely low rate would ensure minimal risk of effluent runoff.

## Table 8.1. Components used to model irrigation demand at full development. Daily data over the 42 years between Jan 1970 and Feb 2013 was used. (Climate data from BoM).

Component	units	Average/y
Raw sewage inflow (51.980 cubic m/day) + 70 visitors*13.7 L=0.959 cubic m/day Total 52.939 cubic m/day	cubic m	19,323
Return for toilet flushing (5 residents (115 L)*115 <sup>5</sup> dwellings = 13.225 cubic m/day + 70 visitors*7 L/visitor= 0.490 cubic m/day. Total of 13.715 cubic m/day <sup>6</sup>	cubic m	5,006
Net effluent production (5 residents (337 L)*115 dwellings (38.755 cubic m/day)+ 70 visitors*6.7= 0.469 cubic m/day) total of 39.224 cubic m/day	cubic m	14,317
Rainfall	mm	1335
Potential evapotranspiration (PET)	mm	1159
Runoff	mm	157
Assumed pond evaporation coefficient: 80% of pan evaporation * the area of water surface within the wet weather storage pond		0.8
Percolation through the base of the pond	0.01 mm/ day	4 mm/y
Rainfall runoff from surrounding lands to the pond	Zero	
Effective root zone	500 mm	
Plant available water in root zone at field capacity	70 mm	
Plant evapotranspiration At PET until 35 mm deficit then a linear fall to zero at permanent wilting point.	mm	774 mm/y without irrigation
Irrigation trigger. Based on daily soil water content. Assumes 70 mm of available water in the root zone. Apply 12.5 mm if water was available and when the available soil water content fell below 50 mm (20 mm deficit). Assumed 95% efficiency in infiltration to soil, so apply 13 mm/irrigation.	mm	A 20 mm deficit

<sup>&</sup>lt;sup>5</sup> This calculation assumes 115 single dwellings. In practice a combination of cluster lots with 27 dwellings with 1, 2 or 3 bedrooms are likely to have lower potable water demand and sewerage system flows than individual dwellings on single lots. It is expected that the flows and demands at full development from a combination of cluster houses and single dwellings on individual lots are likely to be similar to those in table 8.1 for up to 130 dwellings. This will be examined in more detail once actual flows and demands are determined from stage 1 dwellings.

<sup>&</sup>lt;sup>6</sup> Note that there is no allowance for return of effluent for domestic irrigation. This reuse is considered separately below.

#### Sizing of irrigation dam and irrigation area at full development

#### Net effluent production

The design sewage flow at full development is 52.9 cubic m/day<sup>7</sup>. Some 13.7 cubic m/day is required for toilet flushing, so the volume available for irrigation is 39.2 cubic m/day.

This figure assumes 5 persons/ dwelling, plus 490 visitors/week. Based on the 2011 census data, it is highly likely that the net volume for irrigation is only 50 to 70% of this value.

#### Wet weather storage pond

The wet weather storage pond is designed to provide buffer storage and additional capacity storage during wet weather.

A range of irrigation capacities were examined. These were 2, 3 or 4 ML.

#### Irrigation area

The irrigation demand depends on the antecedent weather, irrigation area, the type of irrigation, the vegetation type, the extent of any fallow periods and the soil type. It is assumed that the irrigation will be onto domestic gardens, public open space and possibly commercial horticultural enterprises on the rural residential blocks.

The irrigation areas examined were 2 ha, 3 ha and 4 ha.

#### Adequate design criteria

According to the most recent EPA Guideline (DEC, 2004), overflow in a 50% ile wet year is acceptable for low strength effluent. In practice, it would be preferable to irrigate out the effluent onto wet soil prior to overtopping rather than allow a concentrated stream of water to be discharged. The site has sandy soil, so runoff would not normally be a significant issue. Additionally, it is noted that much of the discharge from the storage would be highly diluted due to the prolonged heavy rainfall needed to trigger the overtopping event.

The 50% ile wet year criterion was used as the benchmark for design adequacy.

<sup>&</sup>lt;sup>7</sup> This could vary up up to 10% depending on final population residing within the site.

#### 9 WASTEWATER MODEL OUTPUT

In the period Jan 1970 to Feb 2013, the average annual rainfall was 1335 mm. Of this 1178 mm infiltrated the soil while 23 mm ran off the site<sup>8</sup>. Some 293 mm of the infiltrated rainfall moved below the 500 mm deep root zone.

Pan evaporation averaged 1468 mm/year while potential evapotranspiration (PET) averages 1158 mm. The predicted evapotranspiration without irrigation averaged 811 mm/year. The PET has a strong annual cycle varying from over 6 mm/day in summer to 1 mm/day in winter. Figure 4.1 shows that a typical annual rainfall pattern is more varied than the potential evapotranspiration, and rain can occur throughout the year. The wet weather storage must be sufficient to retain this water in at least the 50% wet year. Table 9.1 shows the percentage of years when overflow occurs for a range of irrigation areas and wet weather storage pond capacities.

Table 9.1. Effect of varying irrigation storage capacity and irrigation area on the percentile of years when wet weather overflows are predicted to occur.

Wet weather storage pond (ML)	2 ha irrigation	3 ha irrigation	4 ha irrigation
2	Overflow in 86% of years	Overflow in 75% of years	Overflow in 74% of years
3	Overflow in 85% of	<mark>Overflow in 45% of</mark>	<mark>Overflow in 42% of</mark>
	years	years	years
4	<mark>Overflow in 42% of</mark>	Overflow in 33% of	Overflow in 23% of
	years	years	years

The combinations of irrigation dam capacity and irrigation area that met the design criterion are highlighted in <u>yellow</u>. The selection of the most suitable combination will depend on local conditions. However it is generally preferable to minimise the effluent application rate, so a 3 ML storage and 4 ha of irrigation is a preferred option.

Table 9.2 shows the area of gardens for a range of lot sizes that are likely to occur at full development.

<sup>&</sup>lt;sup>8</sup> The runoff rate is extremely low and reflects the sandy soil.

Table 9.2. Estimation of irrigation areas associated with various lot areas. Note that Gosford City Council (2007) requires a minimum previous area/ dwelling of 50 sqm or  $30\%^{\#}$  of the site - whichever is greater

Indicative lot area (msq)	Estimated number of lots	Estimated hardstand including roofs, paths and rainwater tanks/ lot (msq)	Estimated area available for irrigated gardens (msq)	Estimated area among the homes that is available for irrigation (msq)
350	29	300	50	1450
400	12	300	120	1440
550	62	350	200	12400
800	12	350	450	5400

The total individual lot garden area is 2.04 ha. It is assumed that all owners would water their area as needed.

It would be prudent to have at least 2 ha of additional lands (a 141 m \*142 m square or a 71 m \*282 m would be sufficient) that could be intensively irrigated. An irrigation dam with at least 3 ML storage capacity is needed.

#### Alternative strategies during stage one of the development

Stage one of the development will commence with a few individual dwellings, and gradually increase to 60 units. There will be 33 individual dwellings on single lots and 10 dwellings on lot 15 and 17 dwellings, including four, 2 storey buildings with two units in each of them. It is not practical to set up a 3 to 4 ML dam at this stage as the dam would be empty almost all the time and this creates issues with dam wall cracking and potential leakage. Similarly there is little point in establishing 2 to 4 ha of irrigation when there is insufficient flow to operate the system. It is therefore proposed to take an alternative approach until there is sufficient flow to construct the dam. However it will be necessary to have an irrigation area dedicated to effluent disposal during periods when effluent production exceeds the evaporative demand.

According to AS/NZS 1547 (2012), the soil type at Narara Eco Village could sustainably accept an irrigation rate of 3.5 to 4 mm/day. This is equivalent to 3 to 4 L/msq/day.

Assuming a design net flow of 337 L/dwelling/day then some 112 msq is needed for each dwelling. As discussed above the volume of excess reclaimed water is numerically equivalent to the potable water demand. The data in table 6.4 indicates that the potable demand is likely to be approximately 18 cubic m/day for stage 1 of the development.

Reducing the rate to 1mm/day would result in an irrigation area requirement of 18,000 msq. The 33 single dwelling lots cover some 18,700 msq. Assuming 30% of the lots must be garden as per table 9.2, some 6200 msq of irrigation area would occur around the dwellings. Additionally cluster lots 15 and 36 have a combined total irrigation area of approximately 3000 msq. Therefore another 9,000 msq must be sourced. There is sufficient orchard and open space to the south of stage 1 of the development to accommodate an irrigation area of this magnitude. The irrigation area could be located within the existing orchard, south the proposed development area as figure 10.1 shows.

#### 10 LAND CAPABILITY ASSESSMENT FOR RECLAIMED WATER IRRIGATION

The site was inspected by Dr Peter Bacon of Woodlots and Wetlands in August 2013. The inspection activities included the soil and landscape assessment reported below.

#### Landform assessment

Figure 10.1 shows the site and the assessment points and sampling pits. The development area is on an eastern facing slope. Reclaimed water in excess of demand will be irrigated within the disused orchard, the surrounds and within the development footprint. Figure 8.1 also shows that the development site has bush to its west and north and a floodplain to the east. The nearest downslope waterbody is Narara Creek which is over 180 m east of the irrigation area.

#### Soil landscapes

The soil landscape map (Murphy, 1993) shows that the site is split between the Hawkesbury Soil Landscape in the more elevated areas and Erina Soil Landscape over much of the site. Typical attributes are summarised in table 10.1.

## Table 10.1 typical attributes of the Hawkesbury and Erina Soil Landscapes (Source: Murphy, 1993).

Attribute	Hawkesbury Soil Landscape	Erina Soil Landscape
Geology	Hawkesbury Sandstone	Narrabeen Group, including lithic and quartz sandstone, siltstone, claystone and conglomerate
Topography	Rolling very steep hills	Undulating to rolling rises and low hills
Slopes	25 to 100%	>25%
Erosion hazard	Extreme	Low to moderate
Soils classification	Yellow earths and siliceous sands	Yellow earths and yellow podsolics
Fertility	Very low fertility	Low to very low fertility

The typical profile has loamy sand overlying light to medium clay at 2m depth.



Figure 10.1. Landform and soil sampling / assessment sites within the Narara Ecovillage development. (Image source: hill thalis).

#### Landform assessment procedures

Figure 10.1 shows the 15 localities within the proposed development area which were assessed for landform and soil characteristics. The sampling areas were either under orchard or volunteer grass. It is proposed that the majority of the site will be developed for housing; however the orchard to the south of the stage 1 development will be used for effluent irrigation of excess effluent from the first stage.

Table 10.2 summarises the results of the landform assessment.

Table 10.2.	Site attributes and their likely impact on site suitability of effluent irrigation at
the site.	

Attribute	Rationale	Comment
Grid ref	Permanent record of assessment position	
Aspect	Influences solar radiation intensity on lands with more than 10% slope	Slopes towards the east. It will get full morning sun, but little late afternoon sun. There will be reduced exposure to dry westerly winds.
Exposure	Exposed areas have higher evapotranspiration demand	The orchard trees shown in figure 10.1 that are in the development envelope will be removed. Trees near sampling pits 4, 5 and 8 will be retained until stage 2. The irrigation will be established in this area.
Slope %,	Impacts on the erosion and runoff potential	Ranges from 5 to 24% within the main irrigation area (south of the development). Average slope on individual dwelling lots range from 10 to 25%
Slope length	Impacts on the erosion and runoff potential	Up to 350 m
Landscape position	Impacts on the extent on run-on from upper slopes. Impacts on local drainage.	Lower slope. This is not a major issue as the soils are deep and well drained. Run-on from above will be relatively limited. The site drains to the east. There is one gully to the north and east of the development site. Lots 5 and 6 are close to a designated drainage line, but all other sites are at least 50m away.
Local Relief	Indicates the extent of steep slopes	Rolling hills.
Landform element	Identifies drainage issues, e.g. floodplains	Convex, divergent slope, so ideal (DEC, 2004).
Drainage line distance (m)	Indicates risk of stream contamination via runoff. Used in DEC (2004) as a buffer distance guide.	The proposed irrigation system will have low pressure and produce large droplets.
	waterbodies and high pressure spray systems.	means there is extremely low health risk.
Flow patterns	Indicates stream networks and the risk of contamination	There are several 'dry' gullies through the site. These would convey water during severe storms. There is an

Attribute	Rationale	Comment
		opportunity to capture and convey stormwater runoff around the topside of the irrigation area. This will minimise run-on
Run-on/ runoff potential	Identify management needed to minimise excess inflow or losses from the site.	A contour bank/ berm will intercept flow above the development area and convey it to the gullies.
Surface water bodies-dams, ponds, springs DS or US of site	These features are used in DEC (2004) table 4.9 as a buffer distance guide.	No springs or other surface water bodies were evident within the irrigation area. Use of tertiary treatment of the effluent and irrigation at less than the AS/NZS 1547 design irrigation rate(DIR) will minimise risk
Storm water	Risk of external flooding, especially with contaminated water.	A contour bank will intercept flow above the irrigation area.
Salt	Salinisation can limit plants' ability to utilise the effluent. It can indicate poor drainage and the need salt tolerant plants. Salinisation can destroy soil structure leading to increased risk of effluent runoff.	The profiles are well drained. There is no evidence of salinisation.
Erosion potential+/- cult	Erosion potential is used to adjust the cropping/ pasture regime to minimise risk	Low erosion potential once permanent grass cover is established and maintained. There are some minor erosion nick points where overland flow paths discharge to gullies. These need erosion protection.
Rock out crops %	Rocky soil can reduce plant growth, make cultivation difficult and increase runoff.	None.
Depth to hard rock	Soil less than 1m deep can have poor root development and inadequate ability to retain nutrients. They can also become waterlogged.	All sites exceeded 1m to rock. All but 3 sites had at least 2m of soil overlying rotted rock.
Water table depth	Depth to water table is critical in determining the most suitable vegetation. A shallow water table will preclude irrigation in parts of the year.	Sites 3 and 9 had free water at <1m deep. The other sites had at least 2m depth above any water table.
Groundwater	Distance between the irrigation area and groundwater bores used for domestic purposes is a critical issue in risk assessment	The property has a bore on it. Gosford CC installed it to test the potential for supplying town water in 2007, during the Millennium Drought (see figure 10.2). The water pumped from the bore was too saline for use.
Flood risk	Frequent flooding can destroy infrastructure, prevent irrigation and damage crops.	Not an issue
Land use history	Past land use activities such as sheep dips and landfills can result in contaminated lands. These lands are normally unsuited for effluent irrigation because the irrigation will increase the risk of off-site contamination.	Long term orchard and therefore OK

Attribute	Rationale	Comment
Proposed land use	The most suitable land uses should be the ones that result in acceptable minimum risks to human and environmental health.	A combination of disused orchard and pasture.
	At the same time the landuse must be	The dwellings will have a mix of lawn
	suitable for the site and not be too	and gardens.
	expensive to establish or operate.	Therefore OK (assuming <1 E
		coli/100 mL in the effluent).
Distance to	Buffer distances will be a function of the	A minimum of 60m to the nearest
public roads	likely contaminant load and the likely level	public road. This is well beyond the
houses, etc.	of exposure to the effluent.	25 to 30m recommended in the
,		National Guidelines.
Fire hazard	Fire hazard can be significant for landuses	Not considered an issue as the site
	such as woodlots. Fire can destroy both	will have an asset protection zone and
	vegetation and equipment.	it is at the base of an eastern facing
		hill (hot, dry winds typically come from
		the west).



Figure 10.2. Location of the monitoring bore (GW 201197) established by Gosford City Council. The bore is some 190 m from the nearest proposed allotment. The water is too saline for potable use (Site map courtesy of NSW Government).

#### Conclusions from the landform assessment

The land slopes relatively steeply to the east. The slope means that run-on and run-off are likely to be moderate. Conversely, the free draining, sandy nature of the surface metre of soil means high hydraulic conductivity will exceed rainfall intensity in all but a few storms. Consequently

runoff will be minimal in all but severe storms. Additionally a proposed contour bank immediately upslope of the irrigation area will assist in diverting run-on from the forest uphill of the subject site.

Low pressure, low application rate, spray/drip irrigation is proposed. This will minimise risk of runoff and aerosol formation. A permanent pasture cover within the orchard is ideal.

Other site attributes create minimal risk. On this basis, the site appears suitable for application of effluent, especially in view of the relatively low level of contamination in the effluent as discussed in section 11.

#### 11 SOIL ASSESSMENT Insitu soil assessment

A back hoe was used to excavate 15 pits within the development area. The locations were geopositioned and are shown in figure 10.1. DEC (2004) suggests 4 sampling depths. Our soil sampling was based on sampling horizons to at least the surface 2 metres unless rock was encountered. The sample depths varied slightly to reflect the differences in horizon thickness at individual sites. Up to 5 horizons were noted. The results of the field assessment are shown in table 11.1.

#### Field texture

Table 11.1 shows that the field texture typically changed gradually from loamy sands/sandy loams in the surface 60 to 100 cm to clay loams to medium clay at between 1 and 2m depth.

The sand dominant surface horizons mean that the risk of runoff from irrigation is minimal. For example, the saturated hydraulic conductivity of loamy sands to sandy loams ranges from 60 to 700 mm/hr depending on soil conditions (Geeves et al, 2007). A 50 year 2 hr storm has an intensity of 53 mm/hr. So, in theory, even this storm would not create runoff.

The depth to the clayey subsoil varies from 45 cm at site N10 to 2m at site N2. The relatively deep sandy layer is important because hydraulic conductivity of the clay subsoil is likely to be at least 10 times lower than the surface layers. This would result in the rapidly infiltrating water being temporary perched on the clay during prolonged wet weather. However the slope of the site means that the excess water that reached the clay layer would move downslope along the top of the clay subsoil, eventually reaching the lower slopes.

#### Consistency

Consistency varied from loose, single grains in the topsoils at many sites to firm in the clay dominant subsoils

The loose, non-cohesive sand is at risk of erosion from concentrated flows. Therefore permanent grass cover and minimal tillage is recommended. Retention of organic matter on the soil surface and in the topsoil will reduce erosion risk.

#### Pedality

The pedality is not relevant for sand or loamy sands. The clayey dominant subsoils are either massive, apedal, or weak to moderately pedal.

Moderate pedality is preferred in the subsoil, as weak pedality can indicate structural degradation.

#### Fabric

Earthy or rough pedal fabric is preferred as sandy soils can be erosive. The sandy topsoils need a vegetative cover to reduce erosion risk.

Site No.	Depth (cm)	Field texture	Consistency	Fabric	Moisture	Pedality	Colour	Boundaries	Mottles %	Nodules %	Root No.	Biological activity	Texture change	% rock
N1	0 to 33	Loamy sand. Organic matter obvious	Loose	Sandy	Moist	Not applicable	V. dark grayish brown	Gradual	None	None	Common	None	Gradual	None
	33 to 80	Loamy sand	Loose	Sandy	Moist	Not applicable	Pale yellow	Diffuse	None	None	Few	None		None
	80 to 120	Sandy clay loam	Weak	Sandy	Wet	Not applicable	Brown	Diffuse	None	None	Common	None		None
	>120 cm has rotted rock													
N2	0-15	Sandy Ioam	Weak	Sandy	Moist	Not applicable	V dark brown	Gradual	None	None	Common	None	Gradual	None
	15-75	Clayey sand	Loose	Sandy	Moist	Not applicable	Brown	Gradual	None	None	Few	None		None
	75-160	Sandy clay loam	Weak	Sandy	Wet	Not applicable	Dark yellowish brown	Diffuse	None	None	None	None		None
	160- 210	Light clay	Firm	Earthy	Wet	Massive	Brown		10% orange	None	None	None		100 % @ 2.2 m

Table 11.1	. Insitu	soil con	ditions.	(No :	soil fauna	evident.	no water	repellenc	v. hard	settina	of the su	irface.	obvious	hard r	oan or	r bleachine	a).
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Site No.	Depth (cm)	Field texture	Consistency	Fabric	Moisture	Pedality	Colour	Boundaries	Mottles %	Nodules %	Root No.	Biological activity	Texture change	% rock
N3	0-20	Loamy sand	Loose	Sandy	Moist	Not applicable	Dark brown	Gradual	None	None	Common	None	Gradual	None
	20-55	Loamy sand	Loose	Sandy	Moist	Not applicable	Grayish brown	Gradual	None	None	Few	None		None
	55-100	Loamy sand	Loose	Sandy	Wet	Not applicable	Light yellowish brown	Diffuse	None	None	Few	None		None
	100- 170	Sandy Ioam	Weak	Sandy	Wet	Weak	Pale brown		None	Orange & black nodules <1% of volume	None	None		None
N/A	0.20	Loamy	1 0059	Sandy	Dry	Not	V dark	Clear	None	None	Common	None	Gradual	None
114	0-20	sand	LUUSE	Sandy		applicable	brown	Cical	None	NONE	Common	none	Graduar	None
	20-60	Clayey sand	Loose	Sandy	Moist	Not applicable	V. dark grayish brown	Gradual	None	None	Few	None		None
	60-100	Clayey sand	Loose	Sandy	Moist	Not applicable	Strong brown	Diffuse	None	None	None	None		None
	200- 220	Sandy Ioam	Weak	Earthy	Moist	Not applicable	Brown		None	None	None	None		None
N5	0-20	Loamy sand	Loose	Sandy	Dry	Not applicable	V dark gray	Clear	None	None	Common	None	Gradual	None

Site No.	Depth (cm)	Field texture	Consistency	Fabric	Moisture	Pedality	Colour	Boundaries	Mottles %	Nodules %	Root No.	Biological activity	Texture change	% rock
	20-60	Clayey sand	Loose	Sandy	Moist	Not applicable	V. dark grayish brown	Gradual	None	None	Few	None		None
	60-110	Clayey sand	Weak	Sandy	Moist	Weak pedality	Strong brown	Diffuse	None	None	None	None		None
	180- 210	Light medium clay	Weak	Earthy	Moist	Not applicable	Strong brown		5% red	1% black	None	None		None
N6	0-22	Clayey sand	Loose	Sandy	Dry	Not applicable	V dark grayish brown	Clear	None	None	Common	None	Gradual	None
	22-43	Sandy Ioam	Weak	Sandy	Moist	Not applicable	V. dark grayish brown	Gradual	None	None	Few	None		None
		1	<u> </u>		Isolat	ed rock floate	ers @ 50 cm	. Indicative dia	ameter 10	cm	1	1		
	43-100	Light clay	Firm	Earthy	Moist	Weak pedality	Light yellowish brown	Diffuse	20% orange	None	None	None		None
	100- 126	Light medium clay	Firm	Earthy	Moist	Weak	Light yellowish brown		30% orange	None	None	None		None
N7	0-21	Loamy sand	Loose	Sandy	Dry	Not applicable	V. dark grayish	Gradual	None	None	Common	None	Gradual	None
Site No.	Depth (cm)	Field texture	Consistency	Fabric	Moisture	Pedality	Colour	Boundaries	Mottles %	Nodules %	Root No.	Biological activity	Texture change	% rock
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							brown							
	21-75	Clayey sand	Loose	Sandy	Moist	Not applicable	Yellowish brown	Gradual	None	None	Few	None		None
	75-100	Clay loam	Firm	Earthy	Moist	Weak	Yellowish brown	Diffuse	None	None	Few	None		None
	150- 220	Light clay	Firm	Earthy	Moist	Weak	Dark reddish brown		30% red	None	None	None		None
N8	0-25	Loamy sand	Loose	Sandy	Dry	Not applicable	V dark grayish brown	Gradual	None	None	Common	None	Gradual	None
	25-63	Loamy sand	Loose	Sandy	Moist	Not applicable	V. dark grayish brown	Gradual	None	None	Few	None		None
	63-100	Clayey sand	Loose	Sandy	Moist	Not applicable	Strong brown	Diffuse	5% orange	None	Few	None		None
	150- 210	Light clay	Firm	Earthy	Moist	Not applicable	Brown		5% red	None	None	None		None
N9	0-21	Loamy sand	Loose	Sandy	Dry	Not applicable	V. dark grayish brown	Clear	None	None	Common	None	Gradual	None
	21-70	Loamy	Loose	Sandy	Moist	Not	Gray	Gradual	None	None	Few	None		None

Site No.	Depth (cm)	Field texture	Consistency	Fabric	Moisture	Pedality	Colour	Boundaries	Mottles %	Nodules %	Root No.	Biological activity	Texture change	% rock
		sand				applicable								
	70-110	Sand	Loose	Sandy	Moist	Not applicable	Gray	Diffuse	None	None	Few	None		None
	150- 200	Medium clay	Firm	Earthy	Moist	Not applicable	Gray		30% red	None	None	None		None
N10	0-25	Sandy Ioam	Weak	Sandy	Dry	Not applicable	V. dark grayish brown	Gradual	None	None	Common	None	Gradual	None
	25-45	Sandy Ioam	Weak	Sandy	Moist	Not applicable	V. dark gray	Gradual	None	None	Few	None		None
	45-100	Medium clay	Firm	Earthy	Moist	Moderate	Light gray	Clear	30% orange	None	Few	None		None
	175- 210	Light clay	Firm	Earthy	Moist	Massive	Yellowish brown		20% red	None	None	None		None
N11	0-8	Clayey sand	Loose	Sandy	Dry	Loose	Dark brown	Gradual	None	None	Common	None	Gradual	None
	8-44	Clayey sand	Loose	Sandy	Moist	Loose	Yellowish brown	Gradual	None	None	Few	None		None

Site No.	Depth (cm)	Field texture	Consistency	Fabric	Moisture	Pedality	Colour	Boundaries	Mottles %	Nodules %	Root No.	Biological activity	Texture change	% rock
	44-100	Loamy sand	Loose	Sandy	Moist	Loose	Brown	Gradual	None	None	Few	None		None
	100- 220	Sandy Ioam	Weak	Sandy	Moist	Weak	Yellowish brown		None	None	None	None		None
N12	0-15	Sandy Ioam	Weak	Sandy	Dry	Not applicable	V dark gray	Gradual	None	None	Common	None	Gradual	None
	15-60	Clay loam	Firm	Sandy	Moist	Moderate	Dark grayish brown	Gradual	None	None	Few	None		None
	60-100	Clay loam	Firm	Sandy	Moist	Moderate	Yellowish brown	Clear	30% red	None	None	None		None
	100- 125	Sandy clay	Weak	Earthy	Moist	Weak	Gray		30% orange	None	None	None		15% rock
						Ro	otted rock be	elow 1.25 m						<u> </u>
N13	0-25	Loam	Weak	Sandy	Dry	Not applicable	V dark gray	Gradual	None	None	Common	None	Gradual	None
	25-75	Clay loam	Firm	Earthy	Moist	Weak	Brown	Gradual	None	None	Common	None		None
	75-100	Medium clay	Firm	Earthy	Moist	Moderate	Brownish yellow	Gradual	20% red	None	None	None		None

Site No.	Depth (cm)	Field texture	Consistency	Fabric	Moisture	Pedality	Colour	Boundaries	Mottles %	Nodules %	Root No.	Biological activity	Texture change	% rock
	150- 175	Medium clay	Very firm	Earthy	Moist	Moderate	V. pale brown		30% orange	None	None	None		None
N14	0-30	Clayey sand	Weak	Sandy	Dry	Not applicable	Yellowish brown	Gradual	None	None	Common	None	Gradual	None
	30-100	Sandy Ioam	Firm	Earthy	Moist	Moderate	Light yellowish brown	Gradual	None	None	Few	None		None
	150- 200	Clay loam	Firm	Earthy	Moist	Moderate	Grayish brown		30% red	None	None	None		None
N16	0-25	Sandy Ioam	Weak	Sandy	Dry	Single grain	Very dark greyish brown	Gradual	None	None	Common	None		None
	25-65	Clayey sand	Weak	Sandy	Dry	Single grain	Light yellowish brown	Gradual	None	None	Few	None		None
	65-120	Sandy Ioam	Weak	Sandy	Dry	Single grain	Brownish yellow	Gradual	None	None	None	None	Duplex	None
	120- 220	Sandy clay loam	Weak	Sandy	Dry	Weak pedality	Pale yellow		20% red	None	None	None		None

Site No.	Depth (cm)	Field texture	Consistency	Fabric	Moisture	Pedality	Colour	Boundaries	Mottles %	Nodules %	Root No.	Biological activity	Texture change	% rock
N18	0-25	Organic Ioam	Weak	Organic	Dry	Weak	Very dark greyish brown	Gradual	None	None	Common	None	Gradual	No
	25-60	Loam	Firm	Earthy	Dry	Weak	Yellowish brown	Gradual	None	None	Few	None	Gradual	No
	60-100	Clay loam	Weak	Earthy	Dry	Friable, moderate	Red	Gradual	None	None	None	None	Gradual	Non
	100- 200	Clay loam	Firm	Earthy		Friable, moderate	Red		None	None	None	None	Gradual	5%

#### Notes:

1. A 15<sup>th</sup> pit was excavated downslope of the community facility to assess soil conditions in this area. The results are not required for stage 1.

2. There were three additional pits excavated on the northern most rural block on the right hand side of Narara Creek. The results of two of these pit inspections are shown as N16 and N18. This area is expected to be used for irrigation and wet weather storage at full development. Pit 17 was undertaken to assess suitability of the soil for dam construction.



Figure 11.1. Pit 7. The profile changes from loamy sand near the surface (right hand side) to light clay below 2m.



Figure 11.2. Pit 13. The profile has a similar change in colour and texture as the other profiles.



Figure 11.3. Pit 18. The soil has a higher clay content than the soil in the development area. It will be suitable for dam construction.

#### Colour

Soil colour is derived from organic matter, clay mineralogy, and drainage conditions. Pale greys, yellow and whites indicate poor drainage. Dark browns are indicative of organic matter accumulation, while bright reds and oranges are indicative of good drainage.

The topsoils are typically brown to dark gray, indicating organic matter accumulation and moderate drainage. The increasing grey colour with increasing depth indicated imperfect drainage.

## **Boundaries**

The sharpness of the boundaries between the soil layers generally indicates the extent of soil development (Isbell, 1996). There is a gradual increase in clay content with depth. This suggests the soils have developed in situ over a very long time scale. This conclusion suggests that the soil profiles are stable. That is the rate of soil formation approximates the rate of soil erosion.

## Mottle %

Mottles can indicate imperfect drainage, especially if they are yellow. Mottles become evident from 70 to 100 cm. The mottles are typically red or orange, suggesting reasonable drainage.

## Nodule %

There were few if any nodules evident. Site 3 had a few black nodules. This site was relatively wet and the nodules were probably a combination of iron and manganese rich precipitates.

#### Root number

Root number is typically 'common' in the surface 40 cm and 'common' to 'few' in the 40-70 cm layers. Roots were 'few' to 'absent' below 70 cm layer.

There was no evidence of impedance. It is expected that the root frequency will be maintained under permanent vegetative cover. The widespread presence of roots at depth suggests adequate physical conditions throughout the normal rooting depth.

## **Biological activity**

Biological activity indicators include the presence of ants, earthworms, millipedes and insect holes in the ground. The activity was absent. The acidic conditions can reduce soil biota numbers.

Liming and planting of long term grass will increase soil biodiversity, thereby ensuring longevity of the effluent irrigation system.

#### Rock %

More than 10% rock in the surface horizon can increase risk of machinery damage. None of the soils has rock in the surface 40 cm.

Profile N 6 has some small rocks at 50 cm. Continuous rotted rock was evident below 2m at all sites. Site 18 has 5% rock below 1m

# Conclusions and management recommendations based on insitu assessment

The ideal soil for effluent irrigation has sand dominant topsoil overlying moderately structured clay subsoil. The subject site has this desirable attribute. Therefore, the risk of runoff during irrigation is low.

Organic matter is a key agent for soil structure. Increasing organic matter will increase surface soil stability. Consequently, the establishment of long term is strongly recommended for the area.

Soil colour indicates that the subsoils have imperfect internal drainage through the clay subsoil. It is likely that a perched water table develops at depth following intense, prolonged rainfall. This excess water would slowly move downslope and dissipate on the floodplain.

The soils have good root penetration into the surface 50 to 70 cm. This also suggests that the soils are suitable for effluent irrigation.

Rocks are not an issue.

It is concluded that the soils appear suited to effluent irrigation. A good cover of vegetation, either as crops or long term pasture, is critical.

# Soil chemistry

The soil analysis aims to quantify the soil attributes that influence the ability of the site to sustainably utilise the effluent. Soil samples from 5 out of the 15 profiles were analysed in detail. The soil sample depth varied to reflect field conditions. The average depth of the surface horizon was 20 cm, while the second horizon was typically 20 to 71 cm below the soil surface. Table 11.2 sets out the major soil attributes.

Additional samples were taken from the 0.7 to 1m and from the lowest soil layer. All soil samples were then analysed for P sorption capacity. The data was combined with bulk density to estimate P sorption capacity of the soil profiles.

## pH (5<sub>water</sub>:1<sub>soil</sub>)

The pH tends to fall with depth as table 11.2 shows. This may be due to surface application of agricultural lime. The surface 20 cm is ideally between 5.8 and 7 (Slattery, et al, 1999). Soils 7 and 9 are below this range and would benefit from liming. These sites are away from current orchard plantings and may not ever have received lime.

Liming will assist microbial activity in removing contaminants from the effluent.

Application of 200 kg/ha is recommended for areas such as site 16 and 18 which are away from the orchards. Retest after 3 years.

# pH (0.01 M Ca Cl<sub>2</sub>)

This second method of pH measurement is mostly used where the soils are very dispersive. Acid sensitive plants such as medic, peas, onions and celery will have depressed growth when the pH (CaCl<sub>2</sub>) is below 4 to 4.3. Liming is recommended for soil 9 and possibly soils 5 and 7.

## Salinity

Salinity is expressed as electrical conductivity (EC) in saturated paste equivalent. The units are dS/m. Soils with  $EC_{sat paste}$  less than 4 are non-saline (Richards, 1954). Table 11.2 shows that none of the soils are saline. This is an important result as it means that salinity will not limit the site's usefulness for effluent irrigation.

## Cation exchange capacity

Cation exchange capacity (CEC) is a measure of the soil's ability to retain nutrients. The CEC is related to the concentration of clay and or soil organic carbon. The Narara soils are sand dominant, with relatively little clay. Consequently the quantity of soil organic carbon is a critical determinant of soil CEC.

Ideally the CEC should be at least 5, and preferably greater than 12 cmol (+)/kg (Metson, 1961). Table 11.2 shows that sites 2 and 5 have more than 5 cmol (+)/kg CEC. Both these samples have higher concentrations of soil organic carbon than the other samples.

Increasing soil organic carbon, for example via mulching and composting, will assist in retaining and processing nutrients in the irrigated effluent.

## Exchangeable calcium (Ca)

Ideally soils should contain over 10 cmol (+) /kg of exchangeable Ca (Metson, 1961). However soils with 5 to 10 cmol (+) /kg of exchangeable Ca are considered to have moderate concentrations. Table 11.2 shows that only sites 2 and 13 have 'moderate' quantities of exchangeable Ca. The other sites have 'low' concentrations.

Adding good quality agricultural lime will remove Ca deficiency, and increase production of acid sensitive plants such as legumes and celery.

According to Abbott (1989) Ca should make up 65 to 80 % of the sum of cations. Both profiles 7 and 9 are deficient in Exch Ca expressed as a % of the CEC. This can result in Ca deficiency. Addition of 200 kg/ha of lime prior to commencement of irrigation is essential to correct this. The calcium concentration ids low on the rural blocks where effluent irrigation is likely to occur in the long term. Liming will assist in improving productivity on these areas.

The soil should be retested after 3 years.

# Exchangeable magnesium (Mg)

Soils should contain at least 1, and up to 3 cmol (+) of exchangeable Mg (Metson, 1961). The data in table 9.2 show that profiles 2, 5 and 13 have 'sufficient Mg. Profiles 7 and 9 are deficient.

According to Abbott (1989) Mg should make up 10 to 15 % of the sum of cations. All profiles have depths where this range is achieved or exceeded.

The ratio of Exch Ca : Exch Mg should be at least 2:1. This occurs in portions of every profile. Excessive Mg is not an issue.

Application of dolomite is an option, if retesting soil after 3 years' irrigation shows there is still an Mg deficiency in some soils.

Attribute	Units	N2 0- 15	N2 15- 75	N5 0- 20	N5 20- 60	N7 0- 21	N7 21- 75	N9 0- 21	N9 21- 70	N13 0- 25	N13 25-75	N16 0- 25	N16 25-65	N18 0- 25	N18 25-60
P (Bray 1)	mg/kg	27.8	23.1	14.1	3.1	10.5	2.0	109.3	3.1	126.9	13.5	3.5	3.4	1.2	1.0
pH	units	6.07	6.22	5.72	5.32	5.37	4.94	4.94	5.54	5.92	5.14	5.28	5.05	5.44	4.93
Conductivity	dS/m	0.057	0.080	0.048	0.017	0.018	0.014	0.016	0.007	0.032	0.025	0.023	0.010	0.019	0.016
		1.32	1.85	1.10	0.39	0.42	0.32	0.36	0.15	0.30	0.22				
OM	%	8.5	3.0	7.9	2.2	2.5	0.9	2.4	0.1	4.0	1.5	2.5	0.5	3.1	0.9
Calcium	cmol+/Kg	8.33	5.26	4.41	0.86	1.35	0.23	0.34	0.17	5.20	2.43	1.09	0.13	2.50	0.57
Magnesium	cmol+/Kg	2.91	0.79	2.59	0.28	0.58	0.13	0.16	0.08	0.93	0.43	0.63	0.05	1.39	0.42
Potassium	cmol+/Kg	0.45	0.14	0.56	0.20	0.18	0.07	0.07	0.02	0.42	0.13	0.12	0.04	0.13	0.09
Sodium	cmol+/Kg	0.10	0.19	0.10	0.05	0.05	0.04	0.03	0.03	0.08	0.07	0.05	0.02	0.12	0.09
Aluminium	cmol+/Kg	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Hydrogen	cmol+/Kg	0.27	0.17	0.63	2.32	1.72	2.93	2.55	0.31	0.27	3.58	1.71	1.64	2.18	6.89
Effective Cation Exchange Capacity (ECEC)	cmol+/Kg	12.08	6.55	8.31	3.72	3.88	3.41	3.16	0.62	6.91	6.65	3.61	1.89	6.34	8.06
Са	%	69.0	80.2	53.1	23.1	34.8	6.9	10.8	27.9	75.2	36.6	30.3	6.8	39.5	7.1

#### Table 11.2. Attributes of the soil surface horizons.

Mg	%	24.1	12.0	31.2	7.5	14.9	3.7	4.9	13.6	13.5	6.4	17.4	2.8	22.0	5.2
К	%	3.7	2.2	6.8	5.3	4.5	2.1	2.2	2.5	6.1	2.0	3.3	2.0	2.1	1.1
Na	%	0.9	2.9	1.2	1.4	1.2	1.1	1.0	4.3	1.2	1.1	1.3	1.2	1.9	1.1
AI	%	0.1	0.1	0.1	0.2	0.2	0.3	0.3	1.4	0.1	0.1	0.2	0.5	0.1	0.1
H+	%	2.2	2.6	7.6	62.4	44.3	85.9	80.7	50.4	3.9	53.8	47.4	86.8	34.4	85.5
Ca:Mg	ratio	2.9	6.7	1.7	3.1	2.3	1.8	2.2	2.1	5.6	5.7	1.7	2.4	1.8	1.4
С	%	4.87	1.74	4.53	1.25	1.40	0.49	1.38	0.08	2.29	0.84	1.46	0.27	1.78	0.53
N	%	0.269	0.073	0.308	0.060	0.074	0.010	0.069	0.001	0.139	0.041	0.097	0.006	0.104	0.025
C:N	ratio	18.1	23.8	14.7	20.7	18.9	47.0	19.9	83.2	16.5	20.6	15.0	45.9	17.2	21.5
CI	equiv. ppm	37	51	31	11	12	9	10	4	21	16	14	6	12	10

# Exchangeable potassium (K)

Potassium is an essential nutrient, and topsoils should have at least 0.3 cmol (+)/kg. Table 11.2 shows that profiles 7 and 9 are deficient. The effluent will contain potassium, and so the potassium concentrations should increase over time. Soils in the proposed effluent irrigation areas have sufficient potassium.

Retest the soils after 3 years.

## Exchangeable sodium (Na)

Exchangeable Na in soil is important because excessive Na can cause structural instability via deflocculation of clays. This is especially critical in the topsoil, where cultivation or heavy rainfall can make the soil susceptible to structural degradation. The Narara soils have minimal clay, and rely on organic matter to maintain structure.

Generally the potential impact of sodium on soil structure is expressed as Exch Na as a percentage of the sum of cations:

#### Exch Na\*100

#### Exchangeable (Na+K+Ca+Mg+Al)

Less than 5% exchangeable Na is preferred.

Table 11.2 shows that all surface soils have less than 5% Exchangeable Na. The surface soils are therefore non-sodic. Sodicity is also low at depth. Thus sodicity is not an issue in these soils.

## Exchangeable aluminium (Al)

Exchangeable AI is a potentially toxic ion. Ideally its concentration is below detection. It can stunt growth of susceptible plants such as legumes when more than 5% of the total exchangeable cations are AI. None of the sites has excessive AI.

## Soil organic carbon

Soils with less than 1% organic carbon (OC) are likely to have poor structure and low structural stability (Charman and Roper, 2000). Sandy soils similar to the Narara topsoils typically should have at least 1.4% OC. Table 11.2 shows that soils 7 and 9 have around 1.4% organic carbon in the surface 20 cm. These sites have had intensive agricultural use. Sites 16 and 18 in the rural blocks, where effluent irrigation is likely to occur in the long term, have relatively high organic matter reflecting the permanent pasture on these areas.

Ideally the effluent irrigation will be used to produce permanent vegetative cover band this will result in a gradual increase in soil organic carbon concentration. Actions such as compost addition and mulching are recommended as ways of increasing soil organic carbon content.

# **Total Nitrogen**

Soil total nitrogen concentrations less than 0.15% are considered 'low' in nitrogen (Bruce and Rayment (1982). The nitrogen concentrations of soils 7, 9 and 13 are close to or below this value. Some initial fertilisation will stimulate plant growth on these areas.

Nitrogen addition via effluent irrigation should gradually increase site nutritional status.

## C : N ratio

The C : N ratio in typical soils is 10 to 12. The higher values in the current soils suggest that there is accumulation of carbon-rich residues. This may be due to the acidic conditions inhibiting bacterial activity. Liming will assist in normalising carbon transformations.

## Bray No.1 Available phosphorus

Available phosphorus concentration is a measure of the current adequacy of supply of this nutrient. According to Moody and Bolland (1999), a concentration of 10 to 12 mg/kg in the surface 7.5 cm is sufficient for 90% potential yield of pastures. Table 11.2 shows that the surface horizons of sites 9 and 13 have extremely high available phosphorus. This may be because of banding fertiliser or accidental dumping near the orchard. The other profiles have low to medium concentrations of available P.

Soils in the proposed long term effluent irrigation areas have extremely low concentrations of available phosphorus and will benefit from the nutrients in the effluent.

The soils on much of the development area would benefit from the phosphorus in the effluent. So effluent irrigation will increase pasture yield, partly at least by increasing phosphorus supply.

# **P** sorption capacity

Table 11.3 shows the P sorption capacity expressed in mg/kg and kg/ha for each horizon. The P sorption capacity is a measure of the soils' ability to retain phosphorus. It is a function of the P sorption capacity expressed as either mg/kg of soil or kg / metre depth of soil.

The storage capacity ranges from 7.8 t/ha in profile 9 to 17.5 t/ha in profile 7. The average is 13.5 T/ha (Std. Deviation of 3.7 t/ha). These are 'high' storage capacities, as many soils have less than 6 t/ha (DEC, 2004).

Table 11.3 also shows the time till the profiles become saturated with phosphorus. Applying a relatively heavy irrigation rate of 6.8 ML/ha/y will result in saturation after 88 to 197 years. Applying effluent at the recommended rate, equivalent to 1 mm/day, will result in saturation in between 167 and 373 years (average of 287 years).

The extremely low concentrations of available phosphorus in the land proposed for long term irrigation of effluent suggests that there are several centuries of sorption capacity available within these sites.

It is likely that technology changes over the next 3 centuries will ensure the long-term sustainability of the proposed system.

<u>Profile</u>	P sorption (mg/kg)	P sorption (kg/ha)	<u>Profile</u>	P sorption (mg/kg)	P sorption (kg/ha)	<u>Profile</u>	P sorption (mg/kg)	P sorption (kg/ha)	<u>Profile</u>	P sorption (mg/kg)	P sorption (kg/ha)	Profile	P sorption (mg/kg)	P sorption (kg/ha)
<u>N2 0-15</u>	337	657	<u>N5 0-20</u>	353	918	<u>N7 0-21</u>	320	872	<u>N9 0-21</u>	233	636	<u>N13 0-</u> <u>25</u>	250	813
<u>N2 15-</u> <u>75</u>	303	2549	<u>N5 20-</u> <u>60</u>	402	2250	<u>N7 21-</u> <u>75</u>	420	3174	<u>N9 21-</u> <u>70</u>	39	267	<u>N13 25-</u> <u>75</u>	523	3658
<u>N2 75-</u> <u>160</u>	438	5586	<u>N5 60-</u> <u>110</u>	383	5746	<u>N7 75-</u> <u>100</u>	574	6460	<u>N9 70-</u> <u>110</u>	47	423	<u>N13 75-</u> <u>100</u>	729	5468
<u>N2 2m</u>	559	3469	<u>N5 180-</u> <u>210</u>	704	5459	<u>N7 150-</u> 220	646	7013	<u>N9 150-</u> 200	600	6506	<u>N13</u> <u>150-175</u>	700	5422
Profile I (kg/ha)	P storage	12260			14373			17520			7832			15361
Number of saturation kg/ha/y rate, 6.8 M	of years till (89 application ML/ha/y)	138			161			197			88			173
Number of saturation kg/ha/y rate, 3.7 N	of years till (47 application /ll/ha/y)	261			306			373			167			327

## Table 11.3. Phosphorus sorption concentrations and P storage capacity/ha.

# **Conclusions and soil management recommendations**

The soils varied across the site and within individual profiles. However some generalisations can be made:

- The soils are non-saline and non-sodic.
- The soils within the current orchards are more 'fertile' than several soils in the surrounding pastures. This is likely to have resulted from more intensive land management under the orchard.
- The non-orchard soils, especially sites 7, 9, 16 and 18, are acidic, have low soil organic carbon and nitrogen concentrations, are low in CEC, as well as low in exchangeable Ca and K.
- Liming at an initial rate of 200 kg/ha is recommended for areas not currently under orchard.
- Retest all soil in 3 years.
- The soil organic carbon content is critically important, and practices such as composting and mulching will assist long term sustainability of the development.
- The P sorption capacity of the soil is sufficient for an average of almost 300 years at the indicative effluent irrigation rate of 365 mm/year.

These features mean that all the soils tested are suitable for long term irrigation of effluent provided the nutrient deficiencies are addressed and the soil organic carbon content is maintained.

#### The key recommendations:

- Install runoff diversion banks upslope of the development area and divert runoff towards existing drainage lines.
- Apply and incorporate 0.2 t/ha of agricultural lime
- Install surface irrigation
- Retain orchard where practical and trees are healthy. Use for effluent irrigation from stage 1 of the development
- After full development transfer all unrequired effluent to the rural blocks for long term irrigation.
- A wet weather storage will need to be constructed in this area.
- Plant pasture in other areas as soon as possible after the irrigation system is installed and operational.
- The pasture should include a mix of perennial temperate grasses such as perennial ryegrass.
- Facilitate accumulation of soil organic carbon by combinations of long term pasture, mulching and compost addition.
- Retest the soil for nutrients, pH and organic carbon after 3 years of effluent irrigation.

# 12 POTENTIAL FOR USING THE DAM TO SUPPLY POTABLE WATER

# Catchment hydrology and contaminant yield

The stormwater model, MUSIC (Version 5), was used as an initial guide to runoff volumes and contaminant influxes to the dam.

#### **Catchment area**

Inspection of the topographic maps for the area indicated that the catchment draining to the dam was at least 130 ha. In practice the area could be up to 160 ha, but without a more detailed survey, it is considered prudent to use the more conservative figure.

## Catchment soils

The main soil in the catchment is labelled Sydney Town Soil Landscape (Murphy, 1993). The soil is typically 15 - 30 cm of sandy loam overlying up to 50 - 150 cm of clay loam.

There is also some Hawkesbury Soil Landscape in the catchment. This soil is extremely sandy and shallow. It is likely to have a higher runoff coefficient than the Sydney Town Soil Landscape. However the more conservative runoff coefficients for the Sydney Town Soil Landscape were used.

#### Model inputs

The model inputs were derived from the MUSIC (Version 5) Guidelines, and from Fletcher et al (2004). Tables 12.1 to 12.3 show the parameters used in the modelling.

#### Potable water demand at full development

Section 6 shows that the estimated potable water demand based on 5 persons/dwelling is 0.337 cubic m/day. If there are  $115^9$  dwellings then the potable demand is 39 cubic m/day or 14.2 ML/year.

Table 12.1.	Inputs	used t	for the	MUSIC	Model	(Source:	MUSIC	(Version	5)	Guidelines
and Fletcher	r et al 20	004).								

Component	Units	Result
Catchment area	ha	130
Dam surface area	ha	1.1
Dam volume	ML	45
Evaporation rate	As % of potential evapotranspiration	100
Catchment landuse	%	10% rural residential, 10% of which is impervious surfaces

<sup>&</sup>lt;sup>9</sup> The final development may have up to 130 dwellings. Actual consumption data from stage 1 of the development will be used to estimate the effect on demand of various numbers of dwellings at final development.

Component	Units	Result
		90% forest 98% of which is previous

# Table 12.2. Soil hydrological characteristics used in the MUSIC model (Source: MUSIC (Version 5) Guidelines and Fletcher et al 2004).

Component	Units	Result
Catchment soil		20 cm of sandy loam then 30 cm clay loam
Soil water storage capacity (top 50 cm)	mm	107
Soil field capacity moisture storage (top 50 cm)	mm	82
Soil infiltration coefficient (a)	mm/day	250
Infiltration capacity (b)		1.3
Daily recharge rate	%	60
Daily baseflow	%	45
Daily seepage rate	%	0

# Table 12.3. Pollutant concentration parameters used for base flow in the MUSIC model (Source: MUSIC (Version 5) Guidelines and Fletcher et al 2004).

Component	Flow type	Total suspended solids (TSS - mg/L -Log <sub>10</sub> )		Total Phosphorus (TP mg/L - Log₁₀)		Total Nitrogen (TN mg/L -Log <sub>10</sub> )	
		mean	Std dev	mean	Std dev	mean	Std dev
Rural residential	Base	1.15	0.17	-1.22	0.19	-0.05	0.12
	Storm	1.95	0.32	-0.66	0.25	0.30	0.19
Forest	Base	0.78	0.13	-1.52	0.13	-0.52	0.13
	Storm	1.60	0.20	-1.10	0.22	0.05	0.24

Six minute rainfall data from Jan 1970 to August 2010 was used to generate runoff behaviour.

# **Model outputs**

Table 12.4 shows the water and pollutant inflow and exits to the dam.

Attribute	Flow (ML/y)
Flow In	450.1
ET Loss	13
Infiltration Loss	0
Low Flow Bypass Out	0
High Flow Bypass Out	0
Pipe Out	304
Weir Out	120
Transfer Function Out	0
Reuse Supplied	14
Reuse Requested	14
% Reuse Demand Met	100
% Load Reduction	6

The modelled flow into the dam is 450 ML/year. The anticipated demand when there is zero water left in the rainwater tanks is 39 cubic m/day or 14.2 ML/year. The demand is therefore a maximum of approximately 3% of the anticipated catchment yield.

The results suggest that even if the eco-village were totally dependent on dam water supplies it would only use some 3% of the average annual runoff.

# Catchment hydrology-A conservative approach

The daily runoff was estimated using the runoff curve number technique. The RCN selected was 79. This number is relatively high (USDA, 1986) and reflects the shallow soil overlying sandstone in much of the catchment (Murphy, 1993).

Runoff commenced when the rainfall exceeded 18 mm in any one day. This is also relatively conservative, and the assumption under-predicts catchment yield. The reason for using a conservative figure is to demonstrate that even with relatively low water yields, the dam can reliably supply all the water needs of the development.

The average predicted annual runoff since January 1970 is 157 mm or 12%<sup>10</sup>. Over the 130 ha catchment this is 204 ML/year. The dam capacity is estimated at approximately 45 ML, so in the average year the catchment outflow is equivalent to some 4.5 times the dam volume.

<sup>&</sup>lt;sup>10</sup> A 12% runoff coefficient for 1335 mm of rainfall /year is extremely conservative . However it does provide a large margin of safety.



Figure 12.1 shows that there are numerous runoff events. A 90 mm rain event would create a runoff volume that exceeds the dam volume. Figure 10.1 shows that this occurred 9 times in the past 43 years.

# Reliability of the dam as the sole source of potable water

The reliability of the dam was assessed for the extreme example where there was no capture and use of roof water in the eco-village. That is, the dam was the sole source of potable water. The model's assumptions are shown in table 12.5.

Table 12.5 Assumptions and inputs into the dam reliability simulation

Component	Input/ assumption
Climate data	Daily rainfall and evaporation since Jan 1970
Evaporation from the dam surface	80% of pan evaporation
Seepage from the dam	Zero
Catchment area	130 ha
Dam surface area at TWL (top water level)	1.1 ha
Dam capacity at TWL	45,000 cubic m (45 ML)
Dam storage at commencement of simulation	30 ML (i.e. 2/3 full)
Dam storage at commencement of simulation	
Demand for potable water Internal use only for	377 L/dwelling/day
washing, cooking and drinking. Assumes 5	
people/dwelling	
Number of dwellings	115 at full development
Total demand for potable water	39 cubic m/day or 14.2 ML/year.
	1

Figure 12.2 shows the daily water in storage based on the inputs in table 10.1. The dam is nearly full most of the time. The minimum storage is 29 ML. This is 16 ML less than full supply. The result indicates that the dam can supply all the potable needs of the development.



# Reliability of the dam to supplement roof runoff

In this simulation it was assumed that each dwelling had a 10.5 cubic m rainwater tank and that 8.4 cubic m of this volume could be utilised.

Dam water was supplied to the individual tanks on a daily basis once the water in the tank fell below 2.1 cubic m.

The results of this simulation are shown in figure 12.3.



Figure 12.3 shows that whilst there is demand for water in each year, the drawdown is less than in figure 12.2, even in extreme drought years. For example, the minimum water in the dam is 33.5 ML in early 1991. The average demand from the dam is 3.6 ML/year. This is less than 10 % of the dam's 45 ML nominal capacity.

# Effect of abstraction on downstream flows

The conservative runoff model indicates that the average annual inflow to the dam is 203 ML. If all the estimated potable demand 39 cubic m/day were met from the dam then the overflow volume would be 192 ML (i.e. a 6% fall in overtopping volume). However if each dwelling had a rainwater tank with an active storage volume of 8.5 cubic m to supply potable water, then the demand for water from the dam would be less, and the overtopping volume would be 202 ML/year. Under these conditions, the effect of the abstraction to supplement the rainwater tanks would be to reduce overtopping by 0.7%.

Figure 12.4 shows the percentile frequency for flows more than 1 cubic m/day.



The modelling suggests that without any demand on water from the dam, overflow exceeds runoff volume at least to the 96% ile event. The reason for this is that all water falling onto the 1.1 ha dam surface contributes to overtopping once the dam is full. Conversely, runoff from the catchment does not commence until rainfall exceeds the initial loss figure of some 17 mm.

Without abstraction for irrigation or domestic use significant overflow commenced at the 91%ile frequency (i.e. no overflow in 90% of days). Abstracting an average of 3.6 ML/year from the dam results in significant overflows commencing in around the 95%ile frequency. However once the outflows approach 100 cubic m/day there is virtually no difference between the no demand and the 3.6 ML/year demand simulations. This occurs for the flows above the 95%ile frequency.

The overflow from the 14.1 ML/y demand is less than the overflow without demand until at least the 99% ile day. Above this, the volumes entering and overtopping the dam are orders of magnitude greater than the daily demand. Consequently, the effect of the demand on the overtopping becomes trivial.

# Impact of abstraction on downstream biota

The overflow frequency may impact on downstream aquatic biota. However, there are two reasons for considering this impact to be minimal:

- Firstly, the dam overflow under low to moderate rainfall conditions is conveyed via a pipe from a glory hole, and it emerges well downstream close to the confluence with Narara Creek. So the current system largely bypasses to creek bed between the dam and the confluence.
- Secondly, the total distance from the dam wall to Narara Creek is approximately 165 m. Consequently, any impact is confined to an extremely short stretch of the stream immediately before its confluence with a much larger, permanently flowing creek.

The photos below illustrate the conditions in the drainage line between the dam and Narara creek confluence some 165 m downstream.



Figure 12.5. Low to medium flows exit the dam via this partly blocked glory hole. The debris needs to be removed.



Figure 12.6. The glory hole pipe discharges into a drainage line located in this bush near the toe of the embankment, some 30 m downslope of the top of the embankment.



Figure 12.7. The water that exits the dam reaches a stream some 165m downslope of the glory hole.



Figure 12.8. There is a high flow spillway adjacent to the right hand abutment. The condition of the vegetation indicates scouring lfows rarely occur.



Figure 12.9. There is a nick point at the base of the high flow spillway. The spillway is largely protected by an armoured layer of sandstone. The location of the nick point needs to be marked and any future advance monitored.



Figure 12.10. The water downslope of the nick point is very turbid. This indicates dispersing conditions and low ecological value. This drainage line only flows during major overtopping events. Most of the time the entire overflow is conveyed by pipe.

It is concluded that the proposed relatively small change in overflow characteristics is unlikely to have significant impact on downstream aquatic biota.

# Quality of water in the catchment

The Australian Drinking Water Guidelines (2011) provide detailed assessment of the physical, chemical and biological characteristics of potable water. The criteria was used to assess water quality in the catchment.

Water samples were taken from near the glory hole outflow from the dam and a second sample from the upstream end of the catchment. Figure 10.11 shows the sampling locations.

The results of the analyses are shown in table 10.6.



Figure 12.11. Water sampling sites. One is at the headwaters of the creek, from a point some 400 m into the bushland downslope of the dog pound. (This site was chosen because it was below a minor confluence and had running water). The other sample was taken adjacent to the glory hole that provides the dam overflow point.

рН	APHA 4500-H+-B	4.78	5.63	A bit low, but reflects sandstone geology
CONDUCTIVITY (EC) (dS/m)	APHA 2510-B	0.15	0.12	Good
TOTAL DISSOLVED SALTS (mg/L)	calculation using EC x 680	105	84	Good
TURBIDITY (ntu)	АРНА 2130	3	2	Very good, as low turbidity facilitates UV disinfection
ALKALINITY (mg/L CaCO3 equivalent)	** Total Alkalinity - APHA 2320	1	3	Would prefer higher
WATER HARDNESS (mg/L CaCO3 equivalent)	** APHA 2340-C	13	12	Would prefer higher
NITRATE (mg/L N)	АРНА 4500 NO3F	<0.005	<0.005	Good
NITRITE (mg/L N)	APHA 4500 NO3- -I	0.002	0.003	Good
TOTAL COLIFORMS (cfu/100 ml)	** APHA 9222-B	1,710	460	High. Has to be zero therefore disinfect
Ecoli FAECAL BACTERIA (cfu/100 ml)	** APHA 9222-D	110	130	High. Has to be zero therefore disinfect
ALUMINIUM (mg/L)	APHA 3125 ICPMS*note 1&2	0.426	0.191	ОК
ARSENIC (mg/L)	APHA 3125 ICPMS*note 1&2	0.001	<0.001	ОК
CADMIUM (mg/L)	APHA 3125 ICPMS*note 1&2	<0.001	<0.001	ОК
CHROMIUM (mg/L)	APHA 3125 ICPMS*note 1&2	0.001	0.001	Ok
COPPER (mg/L)	APHA 3125 ICPMS*note 1&2	0.001	0.001	Ok
IRON (mg/L)	APHA 3125 ICPMS*note 1&2	0.689	0.391	Minor staining could be an issue
MANGANESE (mg/L)	APHA 3125 ICPMS*note 1&2	0.012	0.034	ОК
NICKEL (mg/L)	APHA 3125 ICPMS*note 1&2	0.001	0.001	ОК

Table 12.6. Quality attributes of water upstream of and within the dam.Sampled 19.3.2013.

LEAD (mg/L)	APHA ICPMS*note	3125 1&2	<0.001	<0.001	ОК
ZINC (mg/L)	APHA ICPMS*note	3125 1&2	0.008	0.004	ОК

The key result is that the water is of 'potable' quality except for microbial contamination. Disinfection will be essential.

Alkalinity and hardness are both very low. Soft water may lead to greater corrosion of pipes, although this will depend on other factors such as pH, alkalinity and dissolved oxygen concentration (NHMRC, NRMMC (2011). Storage of the dam water in concrete tanks will assist in correcting for low pH and alkalinity.

The water being used will be a mixture of roof runoff and dam water so the low alkalinity of the dam water <u>may</u> not be an issue.

# Supply of water for fire fighting

Fire-fighting infrastructure will be provided to meet NSW Fire and Rescue Service requirements. It is assumed that these will be based on AS 2412 (2005).

# Water Licensing

Dams on streams and rivers are contentious issues throughout Australia. However, the Narara site already has a dam on site. This dam was used to provide irrigation water for the horticultural institute. The water was abstracted under license WAL16886. The license was for 29 units/year, with a unit being a ML of water.

The 2009 Water Sharing Plan for Central Coast unregulated and alluvial water sources sets out the water management arrangements.

The license conditions have been rearranged to allow use of the dam water within the development for urban purposes. There are two areas of water demand:

Water supply of up to 15 ML/year for residential use (note that onsite tank water is expected to supply approximately 70 to 80% (10 to 12 ML/year) of the demand. The 15 ML/year is for extreme drought. The anticipated average annual demand for potable water is 4 ML/year.

Additionally the site is relying on recycled water for most of its irrigation and toilet flushing needs. However, it is expected that residents may wish to grow a relatively high proportion of their food needs. This may require irrigation water in excess of the STP outflows at least during extended dry periods.

# Conclusions

A very conservative runoff model demonstrated that the dam could supply all the potable water demand for the site. The maximum volume depression was 16 ML below full supply.

If each dwelling had 8.4 cubic m active storage for potable water, then the demand on the dam would be 4 ML in the average year. According to the modelling, the maximum drawdown for the dam since 1970 would be 11.5 ML below full supply.

In both scenarios, there would be water available for other uses including emergency augmentation of water supplies to Gosford City if requested by Council.

The dam is expected to supply less than 25% of the long-term demand for potable water.

The faecal coliform population density is the main concern with use of dam water. Disinfection is essential.

The alkalinity of water will adjust gradually as the water is stored in concrete buffer tanks. This plus the reliance on rainwater for the majority of time means that alkalinity should not be a major issue.

# Recommendations

- Operate the dam as a backup system for when there is inadequate water in the roof runoff tanks.
- Disinfect any water taken from the dam. The low turbidity means that either chlorination of UV can be used. UV followed by chlorination is recommended because of its residual effect.
- Alkalinity may be an issue; however, the contribution from the dam is expected to be approximately 30 to 55%, so alkalinity is largely determined by rainwater rather than dam water.
- Aquacell Pty Ltd, holder of the WICA license, will be responsible for the water treatment plant.
- Ensure there is sufficient capacity to meet fire fighting requirements. This should be supplied from the dam.

# 13 STORMWATER MANAGEMENT

Urban stormwater is recognised as a significant source of contaminants to urban streams (Duncan, 1999, Fletcher et al, 2004). The contamination arises from a combination of soil disturbance, motor vehicle emissions and mobilisation of pollutants from industrial activities. In some catchments, leaking sewers can make a major contribution to faecal contamination of stormwater as well as elevated concentrations of nutrients and trade waste pollutants.

# Stormwater management objectives

The objectives of Gosford City Council's Development Control Plan 165 are as follows:

- maintain and restore natural water balance whilst reducing the cost of providing and maintaining water infrastructure in a sustainable and efficient manner
- reduce nuisance and high level flooding in urban areas and the cost of providing and maintaining flood mitigation infrastructure whilst improving water quality in streams and groundwater and that on-site retention systems be supported as the main principle
- make more efficient use of water resources, awareness and education of water conservation
- reduce the erosion of waterways, slopes and embankments and protect the scenic, landscape and recreational values of streams
- protect and restore aquatic and riparian ecosystems and habitats

Gosford City Council's Water Cycle Management Guidelines (GCC, 2007) list a range of stormwater management components. These include:

- Reduced Stormwater Discharge
- Quality of Stormwater Discharge
- Natural Water Courses & Drainage Channels
- Additional Requirements include
- Flood management
- Reduced impervious areas
- Alternative water sources such as recycled water
- Maintenance of stormwater infrastructure
- Management of points of discharge

The Narara Ecovillage intends to address each of these elements.

# Council's requirements

Council's Water Cycle Management Guidelines (GCC, 2007) contains a range of specific requirements. These include:

#### a) Use of water saving devices:

• water saving shower heads - WELS 3 star rating or higher

• dual flush toilets 6/3 or 4/3 and waterless/water efficient urinals or urinal equipment - <u>WELS</u> 3 star rating or higher

• tap aerators or tap equipment of WELS 3 star rating or higher

 clothes washing machines and dishwashers where provided shall achieve a <u>WELS</u> 3 star rating or higher

• Any proposed WELS device shall be rated 3 Star or better

- b) Potable Water Substitution where feasible
- c) Onsite Stormwater Detention as per GCC (2007)
- d) Management of stormwater discharge quality
- e) Natural Water Courses & Drainage Channels retention
- f) No impact on flooding
- g) Impervious Areas to be kept to a practical minimum
- h) Alternative water sources to be utilised where practical.

Council requires the expected average annual post-development pollutant loads in stormwater discharges from the site to achieve the values shown in table 11.1.

Table 13.1. Stormwater treatment requirements (GCC, 2007).

Pollutant	Stormwater Treatment Requirements
Suspended Solids	80% retention of the annual average load in the Narara Creek,
(TSS)	Erina Creek and Coastal catchments
Total phosphorus	45% retention of the average annual load in the Narara Creek,
(TP)	Erina Creek and Coastal catchments
Total nitrogen	45% retention of the average annual load in the Narara Creek,
(TN)	Erina Creek and Coastal catchments
Litter	Retention of litter greater than 40 mm in size for flows up to 25% of the 1 year ARI peak flow in all catchments
Oil and grease	No oil or grease to be visible downstream of urban and industrial areas for flows up to 25% of the 1 year ARI peak flow in all catchments

# Narara Ecovillage stormwater management strategy

The Narara Ecovillage development is based on the concepts of Water Sensitive Urban Design (WSUD). Components include:

- Roof water capture, disinfection and reuse within individual dwellings
- Minimised impervious surfaces
- Significant open space within the development

• Use of swales, bioretention systems and other WSUD features to ensure that peak flows and contaminant loads are reduced to achieve the criteria in table 11.1

# Stormwater modelling

MUSIC, a stormwater modelling program, was used to assess the likely impacts of various stormwater management treatments.

Detailed modelling has only been undertaken for the first stage as there is insufficient information on subsequent stages to determine likely impervious surface areas, open space, etc.

# **Approach and MUSIC inputs**

MUSIC Version 5 software was used to model stormwater and the effect of a range of stormwater infrastructure options. The design objective was to ensure that the performance criteria in Gosford City Council's DCP 165 were met.

The inputs to the MUSIC model are discussed below.

## Rainfall

6 minute pluviograph were used in the MUSIC model.

# **Existing landuse**

MUSIC model includes options to assess the impact of changing landuses. It was assumed that the current land use was 'agricultural'.

## **Existing buildings**

The existing buildings consist of a mixture of brick administration buildings, glasshouses, cottages and workshops. Some of this infrastructure will be removed, however much will be retained. It was therefore decided to take a conservative approach and assume they were all retained except where the land has been designated for individual lots. The roof areas of buildings to be removed were used to estimate current imperviousness.

## Existing and new roads

There is already a limited number of narrow roads through the stage 1 development area. The proposed development includes a new set of roads and bridges to meet access requirements for both residents and for emergency services, especially fire fighting.

Additional roads were modelled as 'new' infrastructure.

Road surface area was simply length\* width. Roads were modelled as 100% impervious with a runoff threshold of 1 mm/day.

## **Dwelling configurations**

A maximum of 60 dwellings was assumed for stage 1. The roof area was based on those in table 6.1. Additional impervious surfaces were included to take into account patios and paths. The MUSIC model examined clusters of dwellings draining to a single point. Figure 13.1 shows the model layout.

# Rainwater tank configuration and rainwater demand

This is discussed in detail in sections 5 and 6. The main points are:

Roof catchment area	as per table 6.1.
Rainfall runoff threshold	0.3 mm/day
Roof runoff tank storage active capacity	8.5 cubic m
Demand from roof runoff tank	as per table 6.1.

Excess water from the tank joins other runoff from the lots and enters to stormwater management infrastructure.

## Soil inputs

Soil parameters are critical because they determine the proportion of water that runs off the site or percolates towards the watertable. The surface horizon is sand dominant, so the hydraulic conductivity will be at least 100 mm/hr. consequently there will be little runoff during low to medium rainfall intensities.

The assumed parameters were:

Runoff threshold from impervious surfaces: 1.5 mm/day

#### Soil properties

Soil storage capacity	139 mm
Initial storage (% of capacity)	25%
Field capacity (surface 0.5m)	69 mm
Infiltration Capacity coefficient –a	360
Infiltration capacity exponent-b	0.50
Groundwater properties:	
Initial depth	10 mm
Daily recharge rate	100%
Daily Base flow rate	50%
Daily deep seepage rate	10%

The rates and coefficient above reflect the very sandy nature of the surface 1 to 2m of soil (See MUSIC guidelines for details-available online from Ewater).
### Stormwater management infrastructure

The stormwater infrastructure varies with location and opportunities within the development areas. For example steep grades along some of the roads precluded use of bioretention swales in these areas. Stormwater would therefore be conveyed via combinations of pipes or rock lined drains to flatter areas where bioretention basins could be installed.

Stormwater components included:

- Contour banks upslope of the development, designed to convey bushland runoff to local gullies.
- Protection of gully discharge points via use of TRMs (turf reinforced mesh) and rock riprap (Landcom, 2004).
- Soak-a-ways (shallow infiltration basins) to retain runoff from individual lots where it was difficult to connect to a common swale.
- Pits and pipes/ rock lined drains to convey road runoff where the grades averaged over 7 to 10%.
- Bioretention swales to convey local runoff parallel to roads where grades were moderate
- Bioretention basins in less steep areas to treat runoff converging from roads and lots
- Semi-permanent infiltration basins in lower parts of the landscape
- Inclusion of environmental features such as frog ponds and permaculture beds within the stormwater swales and bioretention ponds.



Figure 13.1. Layout of the MUSIC model for stage 1.





# **Results of MUSIC modelling**

### Data management

Data from the simulations were analysed to assess compliance with DCP 165. The overall analysis compared the current landuse with the whole of the stage 1 of the development. Individual components of the development were then analysed separately.

### Performance targets

The performance targets shown in table 13.2 are taken from DCP 165. MUSIC models Total Suspended Solids (TSS), Nitrogen (N), Phosphorus (P) and gross pollutants. Oil and grease is not modelled, however its removal should approximate TSS removal (See Horner et al, 1994 and other texts).

Table 13.2. Performance targets presented in DCP 165 (Source: Gosford City Council, 2007).

Pollutant	Stormwater Treatment Requirements
Suspended Solids	80% retention of the annual average load in the Narara Creek, Erina Creek and Coastal catchments
(TSS)	
Total phosphorus	45% retention of the average annual load in the Narara Creek, Erina Creek and Coastal catchments
(TP)	
Total nitrogen	45% retention of the average annual load in the Narara Creek, Erina Creek and Coastal catchments
(TN)	
Litter	Retention of litter greater than 40 mm in size for flows up to 25% of the 1 year ARI peak flow in all catchments
Oil and grease	No oil or grease to be visible downstream of urban and industrial areas for flows up to 25% of the 1 year ARI peak flow in all catchments

# Results of modelling

### Pre vs. post development

Table 11.3 compares the 'current' conditions with those anticipated following development which includes WSUD<sup>11</sup> features. Total outflow is reduced by 86% while peak flow is reduced by 38%.

There is almost complete removal of TSS, N and gross pollutants, while P removal averages an 88% reduction compared with pre development conditions.

<sup>&</sup>lt;sup>11</sup> WSUD—Water Sensitive Urban Design. In the current situation with sandy soils this includes a range of swales, infiltration basins and bioretention systems.

These results demonstrate compliance with DCP 165.

Table 13.3.	Effect of the de	evelopment on tl	ne flow and	contaminant	loads exiting th	e combined lo	ots
10-14 and c	luster lot 15.				_		

Component	Pre development	Post development with WSUD	% reduction	Gosford CC DCP 165 criteria	Compliance
Flow (ML/yr)	4.8	2.34	51	Not given	Not applic.
Peak Flow (m3/s)	0.266	0.178	33	Not given	Not applic.
Total Suspended Solids (kg/yr)	326	41.3	87	80	Yes
Total Phosphorus (kg/yr)	1.41	0.335	76	45	Yes
Total Nitrogen (kg/yr)	8.93	2.34	74	45	Yes
Gross Pollutants (kg/yr)	37.6	3.68	90	Not given	Not applic.

The results in table 13.3 show that stormwater outflow volume is reduced by 81% while the peak flow rate is reduced by 51% compared with current conditions. The proposed system is fully compliant with Council's requirements for 80%, 45% and 45% reduction in export of TSS, P and N respectively. Some 98% of the gross pollutants will be retained.

## **Conclusions based on MUSIC modelling**

The combination of rainwater tanks, bioretention and bioretention basins has resulted in the stormwater management trains meeting the DCP 165 performance requirements.

This is due to a combination of very porous soils, use of rainwater tanks to supply all potable water needs wherever available, and between 1 and 2% of the development area being allocated to stormwater management devices.

# 14 MANAGEMENT OF DRAINAGE LINES CURRENTLY WITHIN THE DEVELOPMENT.

The topographic map Gosford (9131-2S) 2001 edition shows two, first order streamlines arising in bushland and traversing the property to the north of the heritage house. Both stream lines travel east to Narara Creek.



# Figure 13.4. Location of streamlines within the subject site (1:25,000 Topographic map. Gosford 9131-2S 3<sup>rd</sup> Edition, LPI).

According to the Water Management Act (2000) Regulations most recent guidelines:

# Waterfront land-Controlled activities-guidelines for riparian corridors on waterfront land, page 2 Riparian corridor widths.

These are first order streams which require a 10 m vegetated riparian zone extending on each side of the drainage line from the top of teach bank.

Additionally another two first order streams commence downslope of Research Road and travel east to Narara Creek. These will also require a 10m wide vegetated riparian zone for both banks.

There are a number of 'drains' within the site. These are not shown on any topographic map, but they need to be managed to avoid increase erosion risk resulting from the proposed development.

The key way to avoid damage to the streamlines is to maintain the vegetation (replacing it as necessary with appropriate native species) and to ensure that stormwater outlets are protected from erosion by appropriate means. See Office of Water (2012).

Discharge points to gullies will be protected with combinations of turf reinforced mesh (TRM) and rock riprap.

### Guidelines for outlet structures on waterfront land

It is preferable to have several discharge points rather than one large one.

## Conclusions

- The proposed combination of rainwater tanks, swales and bioretention systems will ensure that the development's stormwater management will comply with Council's stormwater system performance criteria.
- The outflow volume and peak rates will be less than those that currently occur.
- The contaminant export rates will be less than those that currently occur.
- The stream lines present on the site will need protection from erosion, especially where stormwater outflows are being constructed. The approach should be based on the Office of Water 2012 guidelines.

# 15 EROSION AND SEDIMENT CONTROL

The MUSIC modelling was used to generate peak 6 minute outflows into and out of each component of the stormwater train that were conveyed to a drainage system.

Pipe sizes and erosion and sediment control structures were sized to accommodate these flows. This approach is conceptual at this stage of development.



Figure 14.1. Stormwater treatment features in the southern portion of Narara Ecovillage stage 1. The numbers in red refer to discharge points in table 14.1, 14.2 and 14.3

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Table 14.1. Estimated peak flow from the 13 outlets in figures 14.1 and 14.2 based on maximum 6 minute storm between 1980 and 2010.

Site	Inflow (cubic m/sec)	Outflow (cubic m/sec)
1	0.047	<0.047
2	0.141	0.094
3		0.075
4	0.0196	0.0111
5	0.117	0.114
6	0.119	0.087
7	0.0125	0.0067
8	0.0844	0.0323
9	0.0695	0.0564
10	0.82	0.069
11	0.052	0.034
12	0.038	0.026
13	0.111	0.091
14 (southern gully)	0.63	Not applicable
15 (northern gully)	0.31	Not applicable

Table 14.2. Suitable pipe diameters for the 13 outlets within the development based on the maximum 6 minute flow rate in 29 years. Maximum permissible pipe velocity was set at 2m/sec to minimise risk of scour / erosion in the gullies.

Outlet number	Outflow (cubic m/sec)	Pipe size (CSA msq)
1	<0.047	0.175
2	0.094	0.25
3	0.075	0.225
4	0.0111	0.1
5	0.114	0.275
6	0.087	0.25
7	0.0067	0.1
8	0.0323	0.15
9	0.0564	0.2
10	0.069	0.225
11	0.034	0.15
12	0.026	0.15
13	0.091	0.25

Based on a maximum outlet velocity of 2m/sec and a maximum pipe diameter of 275 mm, the following criteria will suit all the outlets listed above:

- 2 layers of 200 mm D<sub>50</sub>, underlain by filter cloth.
- Maximum rock size should not exceed 300 mm.
- The length of the pad should extend for at least 1metre.
- The pipe should face downstream at an angle of 45 to 60<sup>0</sup>. Ideally the exit should be recessed into the bank
- The rock is to be installed into the floor of the drainage line so that they do not protrude above the natural base.

The exception to this are sites 4 and 7. Their flow is so low that a 0.5m long riprap will be sufficient.

Sites 14 and 15 consist of diversion banks designed to safely discharge clean water into the gullies between the dwellings. The rational method (ARR) was used to calculate peak flow. This information was combined with grade to determine the most suitable dimensions and armouring for the bank. The results are shown in table 14.3.

Table 14.3. Components used to determine suitable sizes and armouring for the diversion bunds upslope of the development area.

Component	Sout (agai fence	hern most area nst S boundary e)	Middle area above lots 31 to 35	Northern area abo lots 27 to 28	
Area (ha)	2.5		1	0.5	
Time of Conc (hr)	0.077	988541			
Time of Conc (min)	4.679	312459	5	4.679312	
Assume 20 Y ARI stability criterion				0	
ff 20	1.12		1.12	1.12	
Design storm 5 min 20 Y ARI	201		201	201	
C10 (F3)	0.75		0.75	0.75	
Flow (cubic m/sec)	1.564	584	0.6258336	0.312917	
Length (m)	65		65	120	
Max grade (%)	20		30	25	
Duration (m)	5		5	5	
Intensity (mm/hr)	201		201	201	
Contour bank details					
Width of base (m)	2		2	2	
Side slope	1 to 3		1 to 3	1 to 3	
Flow depth (m)	0.17		0.17	0.17	
Channel slope(max) %	20		30	25	
Discharge rate for 20Y ARI ToC storm (cubic m/sec)	1.56		0.6258336	0.312917	
			I	I	
Manning's N	0.032	1	0.026	0.327	
Flow duration <6 ha					
Vegetation height (mm)		<50 mm	<50 mm	<50 mm	
Erodibility		high	high	high	

Anticipated maximum velocity (m/sec)	4.3	3.6	2.3
Proposed lining	Medium preformance re-enforced mesh	Medium preformance re-enforced mesh	Mesh reinforced turf
Maximum acceptable velocity (m/sec)	5	5	2.4
Acceptable	Yes	Yes	Yes

# The need for HEC-RAS modelling

Note that HEC-RAS analyses was not undertaken for the gullies because the flows in the gullies were rare; likely to be a few times per year, and then only trickle flow.

For example in November 2013, a total of 101 mm of rainfall fell in the 4 days prior to the photo shown below as figure 14.3 was taken. The rainfall quantities were: 16<sup>th</sup> Nov 19 mm, 17<sup>th</sup> Nov 9 mm, 18<sup>th</sup> Nov 45 mm, 19<sup>th</sup> Nov 28 mm (Station 61319, Glennie St., Gosford). That is, there was no free water in the base of the gully on the afternoon of the 19<sup>th</sup> Nov despite the 101 mm of rainfall in the previous 4 days.



Figure 14.3. There was zero free water in this gully despite over 100 mm of rainfall in the previous 4 days. The evidence suggests that occur following rare, very intense rain events. A HEC-RAS analysis will have little relevance in this situation as the 'capacity' of the gully will far exceed the likely flows.

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# **APPENDIX 1**

Report on the unnamed gully to the immediate south of lots 35, 22, 21 and 10 Narara Ecovillage, Narara.

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# 1. Background

The Narara Ecovillage Co-operative Ltd has purchased the disused Gosford Horticultural Institute, and intends to develop portion of the site for residential use. The site is Lot 1 DP 1087535, Research Road, Narara. Gosford City Council rezoned the site to allow for this landuse change (DCP 175, 2007).

Development Control Plan's objectives are to:

- encourage the orderly development of the residential and rural residential use;
- facilitate traffic management
- make provision for environmental protection
- make provision for bushfire protection;

- restrict development in flood liable areas and consider flooding and drainage issues and to ensure there is no increase in downstream flooding

- protect items of environmental heritage

- ensure the development is carried out in accordance with best practice management for site development

- ensure on-site contamination is addressed
- provide for additional matters in relation to the residue Conservation 7(a) allotment
- ensure the land is adequately serviced.

The DCP 175 calls up the requirement for the preparation of a Plan of Management to provide a prescriptive framework for the future management of the threatened species habitats, weed management etc., including strategies for the ongoing management of the site. This will obviously extend to the gullies and will form part of the future subdivision DA. The Management Statement, which will sit with the community title subdivision of the site, will also include the commitment to implement the recommendations in the Plan of Management.

According to the DCP, the urban development will consist of approximately 120 lots and approximately 5 rural lots.

Figure 1 shows the proposed stage 1 of the urban development. There is a discontinuous line of vegetation shown to the immediate south of lots 35, 22, 21 and 11. This 'line' approximates a gully.



Figure 1. Development details showing the individual lots in Stage 1 and the gully to the south of lots 35, 22, 21 and 10. The location of a vegetated gully is also shown.

# 2. Statement of commitment to environmental action

The Narara Ecovillage Co-operative Ltd is strongly committed to environmental sustainability. As part of its commitment the Co-operative has developed an integrated water cycle management strategy. This strategy includes capture and use of roof runoff. This will reduce the stormwater volumes and contaminant loads exiting the urban development areas.

The Co-operative is also taking a proactive approach to managing its natural environment.

The Co-operative is strongly committed to managing BOTH gullies AND the designated streamlines within the development area. The management commitments include:

- 1. Protection of downstream gullies from scouring stormwater flows
- 2. Replacement of weeds along gullies with a variety of appropriate native vegetation
- 3. Preservation and enhancement of key native vegetation species including the various eucalypts and palms currently growing in and around the gullies.
- 4. Development of a full suite of native vegetation including ground cover, shrubs and trees as appropriate.

It is noted that DCP 175 calls up the requirement for the preparation of a Plan of Management to provide a prescriptive framework for the future management of the threatened species habitats, weed management etc. including strategies for the ongoing management of the site. This will obviously extend to the gullies and will form part of the future subdivision/DA.

The Management Statement, which will sit with the community title subdivision of the site, will also include the commitment to implement the recommendations in the Plan of Management.

# 3. Regulatory Arrangements

In July 2012, the Department of Primary Industries, Office of Water published a document:

Changes to NSW Office of Water Guidelines for riparian corridors on waterfront land (commencing 1 July 2012).

As part of the industry launch of this document, the Office of Water included Planning circular PS 12-003. (issued 6 June 2012). The circular was produced by NSW Department of Planning and Infrastructure . Its title is

'Initiatives to improve housing supply'.

The document refers to the impact of size of corridors and types of uses allowed in them affect housing supply. It then discusses the reforms introduced in July 2012.

The *Water Guidelines for riparian corridors on waterfront land* (commencing 1 July 2012) contains the section:

## Riparian corridor widths

The first sentence states:

The Officer (sic) of Water recommends a VRZ width based on watercourse order as classified under the Strahler System of ordering watercourses and using current 1:25 000 topographic maps.

# 4. Current situation regarding the gully.

Figure 1 shows the location of the gully to the south of lots 35, 22, 21 and 10. Figure 2 shows the area on a 1:25,000 topographic map, while figure 3 shows a close up map of the development area.



Figure 2. The regional drainage lines in the Narara area (1:25000 topographic map for Gosford-9131-2S). (Source: LPI).



Figure 3. Close up view of the 1:25,000 map (Gosford 9131-S2). (Source: LPI). The subject gully is shown as red dashes.

The fact that the gully is not shown on the current 1:25,000 topographic map suggests that it is not a stream line based on current Departmental recommendations.

# 5. Legal discussion of what constitutes a 'stream'.

A review article in the Environmental and Planning Law Journal by Stokes and Taylor (2005), discussed legal definitions of 'rivers' and 'streams'

Some relevant comment includes:

Cooper V The Corporation of Sydney (1853) 1 Legge 765 in which the NSW Supreme Court found that the occasional outflow from a swamp did not constitute a watercourse in the legal sense. This was defined as a regular stream between banks.

Similarly

in Knezovic v Shire of Swan-Guilford (1968) 118 CRL 468: According to Barwick, CJ (at 475-476).

A water course consists of a stream with a bed, banks and water. .... It must, in my opinion, exhibit features of continuity, permanence and unity, best seen, of course, in the existence of a defined bed and banks with flowing water. It must, in my opinion be a stream and be sharply distinguished from a mere drain, or a drainage depression in the contours of the land which serves to relieve upper land of excess water in times of major precipitation. It is not enough that the water, when it does flow, does so in what may be seen as a defined course or channel.

This conclusion was developed for NSW conditions in the NSW Land and Environment Court. (Narrambulla Action Group Inc. v Mulwaree Council No. 40168 of 1995 (1996)(30 July, 1996)). In this case, Bannon, J determined that the watercourse under consideration could, at best,

'be classified as a drainage line with gullies to the east and west, together with intermittent ponds and flood plane (sic), where water flows at rare intervals, under the influence of rain.'

Bannon J concluded that this was insufficient to meet the test of 'continuity, permanence and unity developed in Knezovic v Shire of Swan-Guilford

In Mitchell v Vella (1998) 101 LGERA 333, Sheahan, J, determined that a series of channels which only flowed during times of heavy rain were not a 'waterbody'.

Outhet and Taylor (unpubl) developed a set of criteria against which the presence/ absence of fluvial features could be assessed. These were listed in Stokes and Taylor (2005) and are shown below:

# Table 1. Criteria used to assess fluvial features consistent with a stream (from Outhet and Taylor (unpubl)), cited in Stokes and Taylor (2005).

Are there definable channel banks and a channel bed?

Are there fluvial bedforms, e.g. pools, riffles , sediment point bars, etc. and if so what are they?

Is there any evidence for substantial erosion from water flow within the drainage feature?

Are there any spring lines that may indicate intermittent or perennial or intermittent flow?

Is the catchment large enough to sustain perennial or intermittent groundwater flow?

Are there any indicators of prolonged wetness within the drainage feature?

If surface flow is present, is it continuous and how extensive across the base of the drainage feature is it?

Are there any visible habitats that might sustain aquatic fauna?

Are there any aquatic fauna present that would require periods of uninterrupted moisture?

These criteria were applied during an inspection of the gully on September 21, 2013.

Figure 4 shows the catchment of the gully as well as the assessment points. The catchment area upslope of the road is approximately 4.6 ha. Note that this is less than 25% of the often used 20 ha catchment area from which a 'stream' is likely to flow according to the informal guidelines of the previous DIPNR.



Figure 4. Approximate boundaries of the gully catchment and the assessment points (AP) referred to in the text (Image source: SIX Maps). Catchment area upslope of the road is 4.6 ha.

# 6. Assessment procedures

An assessment of site conditions was made at each of 12 points along a 360 m length of drainage line. The criteria listed in table 1 were used. Photos were taken at each site to provide evidence to support the individual assessments.

### Assessment site 1.

GPS 56 344588 6304078

The photo below is taken looking up the drainage line from a point some 30m above the catchment's discharge into a typha dominated wetland. The drain is thickly vegetated with terrestrial grasses such as (Lambs tongue) *Plantago lanceolata* and ryegrass. Dock, an indicator of wet conditions, is also present.



### Figure 5. AP 1.

The channel is ill-defined and appears to have been straightened. There was no evidence of scouring, sediment or debris deposition or lodging of vegetation. There was no evidence of water upslope of this point. This is despite recent heavy rainfall (22 mm), 5 days before this assessment. Table 2 shows the

assessment in terms of the fluvial criteria. The assessment results show that the drainage line is NOT a stream.

# Assessment site 2.

GPS 56 344583 6304055

344557

6304013

The photo below is the discharge point of the gully onto the floodplain (see figure 4). .



### Figure 6. AP 2.

The channel is virtually indistinguishable from the surrounding lands at this point. There is no evidence of significant discharges from this 600 mm pipe (no sediment, no lodging of vegetation, no debris. It therefore cannot be considered a 'stream' at this location. The assessment against fluvial criteria in table 2 supports this conclusion.

# Assessment site 3.

### **GPS 56** 344557 6304013

The photo below is immediately downslope of the lower road (see figure 4).



### Figure 7. AP 3.

This photo looks downslope from the lower road. The drainage line has a concrete bed.

Table 2 shows that this portion of the drainage line has few of the fluvial criteria characteristic of a stream.

## Assessment site 4.

### GPS 56 344538 6303998

The photo below is taken of the drainage line looking upstream above the upper road. There is a small walking track bridge immediately upslope.



#### Figure 8. AP 4.

The base of the drainage line is covered with *Tradescantia fluminensis* (Wandering Jew). This is a creeping plant common in low light, moist conditions. Note that there is no evidence of disturbance or litter deposition in this relatively large, flat area, despite the antecedent rainfall. This again suggests that the drainage system seldom has free water in it.

The pipe is half full of sediment. However this is not recently deposited material as it is colonised with undisturbed Wandering Jew.

There were no sedges or other aquatic flora present. Aquatic fauna would be unlikely to survive.

These observations and the lack of fluvial criteria as per table 2 leads to the conclusion that the drainage line is not a stream at this point.

Table 2. Comparison of site conditions with fluvial criteria consistent with a drainage line being a stream (from Outhet and Taylor (unpubl)), cited in Stokes and Taylor (2005).

Criterion	AP 1	AP 2	AP 3	AP 4	AP 5	AP 6	AP 7	AP 8	AP 9	AP 10	AP 11	AP 12
			-			-			-			
Are there definable channel banks	In some	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No
	Sections		(concrete)									
Are there fluvial bedforms, e.g	No	No	No	Sediment	No	No	No	No	No	No	No	No
etc. and if so what are they?				area								
Is there any evidence for	No	No	No	No	No	Yes. a	No	No	No	No	No	No
substantial erosion from water flow within the drainage feature?						nick point						
Are there any spring lines that may	No	No	No	No	No	No	No	No	No	No	No	No
indicate intermittent or perennial or intermittent flow?												
Is the catchment large enough to	No	No	No	No	No	No	No	No	No	No	No	No
groundwater flow?												
Are there any indicators of	Dock	Dock	No	Wandering	No	No	No	No	No	No	No	No
drainage feature?				Jew								
If surface flow is present, is it	No flow	No flow	No	No	No	No	No	No	No	No	No	No
continuous and how extensive across the base of the drainage												
feature is it?												
Are there any visible habitats that	No	No	No	No	No	No	No	No	No	No	No	No
might sustain aquatic tauna?												
Are there any aquatic fauna	No	No	No	No	No	No	No	No	No	No	No	No
of uninterrupted moisture?												

## Assessment site 5.

### **GPS 56** 344527 6303989

The photo below is taken of the drainage line upstream of the small walking track. It looks like a grassed swale rather than a drainage line. It has a 'floor' with minimal curvature or cross slope. There are no defined banks, there are simply sides of the gully. The vegetation on the 'floor' is basically terrestrial grasses and forbs. There are no aquatic plants evident. The vegetation on the sides of the gully consists of terrestrials such as lantana and camphor laurel. There is no evidence of sediment or vegetative debris being mobilised. There is no evidence of water in recent times. There were no sedges or other aquatic flora present. Aquatic fauna would be unlikely to survive.



#### Figure 9. AP 5.

The vegetation mix and the lack of any evidence of flowing water despite, antecedent heavy rainfall suggests that the drainage line is not a stream.

Note that even roof runoff from the nearby buildings have not resulted in 'substantial flows' in this drainage line.

These observations and the lack of fluvial criteria as per table 2 leads to the conclusion that the drainage line is not a stream at this point.

### Assessment site 6.

### GPS 56 344506 6303964

The photo below is taken of the drainage line approximately 20 m upslope of AP 5. There is a minor nick point. The gully sides are steep, with some exposed rock.

The ground cover is sparse and largely consists of ferns. There are no sedges or other aquatic flora present.

Immediately upslope of the nick point, there is some plant litter entangled in lantana branches. This suggests there has been some recent flow on the base of the gully. However the area was completely dry 5 days after heavy rainfall. Aquatic fauna would be unlikely to survive.



#### Figure 10. AP 6.

The vegetation mix and dry conditions despite heavy antecedent rainfall suggests that the drainage line is not a stream at this point.

## Assessment site 7.

### GPS 56 344479 6303931

The photo below is taken of the drainage line approximately 26 m upslope of AP 6. The gully floor is bare except for plant litter and the occasional fern. The litter has not been mobilised by antecedent rainfall. This suggests that significant flows are extremely rare. Lantana branches droop onto the bed of the gully, but there is no evidence of litter pack mobilisation.

There are no sedges or other aquatic flora present. Aquatic fauna would be unlikely to survive.



### Figure 11. AP 7.

The vegetation mix, the lack of litter disturbance and the dry conditions, despite heavy antecedent rainfall, suggests that the drainage line is not a stream at this point.
#### Assessment site 8.

#### GPS 56 344456 6303894

The photo below is taken of the drainage line approximately 23 m upslope of AP 7. Palms are the major vegetation along the gully floor. There is considerable litter fall. However this has not been mobilised by antecedent rainfall. This suggests that significant flows are extremely rare.

There are no sedges or other aquatic flora present. Aquatic fauna would be unlikely to survive.



#### Figure 12. AP 8.

The vegetation mix and dry conditions despite heavy antecedent rainfall suggests that the drainage line is not a stream at this point.

#### Assessment site 9.

#### GPS 56 344418 6303863

The photo below is taken of the drainage line approximately 40 m upslope of AP 8. There is almost no vegetation of the floor of the gully. There is a thick litter layer. There is also a considerable mass of loose soil. However neither the soil nor the litter show signs of mobilisation despite recent heavy rainfall. This suggests that significant flows are extremely rare.

There are no sedges or other aquatic flora present. Aquatic fauna would be unlikely to survive.



#### Figure 13. AP 9.

The vegetation mix and dry conditions despite heavy antecedent rainfall suggests that the drainage line is not a stream at this point.

#### Assessment site 10.

#### GPS 56 344412 6303852

The photo below is taken of the drainage line upslope of AP 9. There is a thick litter layer adjacent to a Sydney Blue Gum tree. However, there is no defined bed and banks, possibly because of the slope is very steep. There are no sedges or other aquatic flora present. Aquatic fauna would be unlikely to survive.



#### Figure 14. AP 10.

The vegetation mix and dry conditions despite heavy antecedent rainfall suggests that the drainage line is not a stream at this point.

#### Assessment site 11.

#### GPS 56 344390 6303858

The photo below is of the drainage line some 23 m upslope of AP 10. There is a considerable area of bare earth, however there is no litter against the chicken wire fence (see below). This suggests there has been little or no flow in recent times.

There are a few ferns and palms on the floor of the gully, however there are no aquatic sedges. Aquatic fauna are unlikely to survive in this portion of the gully.



#### Figure 15. AP 11.

The vegetation mix and dry conditions despite heavy antecedent rainfall suggests that the drainage line is not a stream at this point.

The lack of litter against the fence indicates that there has not been sufficient flow to mobilise significant qualities of litter. If there is no significant flow despite the significant antecedent rainfall then the gully should not be considered a 'stream' at this point.

#### Assessment site 12.

#### GPS 56 344383 6303850

The photo below is of the drainage line in the 'forest' upslope of AP 11. The drainage line 'bed' consists of smooth boulders. There is litter on the ground among the boulders. This litter has not been mobilised by recent rainfall runoff. This suggests there has been little or no flow in recent times.

The vegetation is largely palms. There are no aquatic sedges. Aquatic fauna are unlikely to survive in this portion of the gully.



#### Figure 167. AP 12.

The vegetation mix and dry conditions despite heavy antecedent rainfall suggests that the drainage line is not a stream at this point. Any flow would need to be conveyed around the boulders. However there is no evidence of scouring or litter pack development and mobilisation.

If there is no significant flow despite the significant antecedent rainfall then the gully should not be considered a 'stream' at this point.

## 7. Conclusions

The Narara Ecovillage Co-Operative Limited is committed to ecologically sustainable development principles. As part of these principles, the Co-Operative has already commenced weed management within the subject gully. The ultimate aim will be to protect endangered species and to also safely convey any runoff along the drainage line to the floodplain wetlands.

The proposed management of the drainage line will include scour protection around and downstream of stormwater outlets.

A review of law precedents indicate a set of criteria from which to determine if a drainage line is a 'stream'. According to these decisions a stream should have bed, banks and flow. The flow should not simply be in response to immediately preceding rainfall.

An assessment at 12 points along the drainage system produced little evidence that any significant length of the drainage line meets the precedents cited above.

The catchment area is less than 5 ha. There was little evidence of sustained flow despite heavy antecedent rainfall. There were few if any wetland plants, and none of the assessment points would be suitable for aquatic fauna such as fish. It is therefore concluded that the drainage line is <u>not</u> a stream, rather it is a gully which occasionally conveys runoff following significant rainfall.

Nevertheless the Co-Operative will actively manage the vegetation and the environment within the gully consistent with environmental and bush fire protection needs.

### 8. References

Stokes, R., and Taylor, M. (2005). Up the creek: What is wrong with the definition of a river in New South Wales?. Environmental and Planning Law Journal Vol 22 (3), 193-209

## Appendix 2. Letter of Advice regarding drainage depression



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24 October 2013

Peter Bacon Director of Woodlots and Wetlands Pty Ltd Woodlots and Wetlands Pty Ltd 220 Purchase Road CHERYBROOK, NSW 2126

SENT BY EMAIL

Dear Dr Bacon

Advice regarding whether Drainage Depression, south of lots 35,22 21 and 10 constitutes a "River" for the purposes of the *WaterManagementAct2000*(NSW) (the "Act").

1. Your instructions You have requested

advice with respect to the following:

a Whether the drainage depression found immediately south of lots 11, 17, 23 and 31 (the "Drainage Depression") constitutes a River as defined in the Dictionary of the Act.

#### 2. Background

We understand that:

a. Mr Algis Sutas NSW Office of Water ("NOW") has indicated that the Drainage Depression maybe a River for the purposes of the Act and may be a first order watercourse requiring a Core Riparian Zone ("CRZ") of 10 metres width from the top of the bank on either side of the watercourse. website:<u>www.mattilalawyers.com.au</u> Liability limited by a scheme approved under the Professional Standards Legislation b. Such a classification prohibits the building of infrastructure within the CRZ and that Narara Ecovillage Co-operative Ltd (the "Co-operative") will be required to ensure that the CRZ remains, or becomes vegetated with fully structured vegetation. This is in addition to any Vegetation Buffer or Asset Protections Zones required by Council and/or NOW.

#### 3. Advice summary

#### 3.1 Summary

We understand that NOW has indicated that it might classify the Drainage Depression as a River under the Act. Under the Act a River includes:

- a. any watercourse, whether perennial or intermittent and whether comprising a natural channel or a natural channel artificially improved; and
- b. any tributary, branch or other watercourse into or from which a watercourse referred to in paragraph (a) flows; and
- c. anything declared by the regulations to be a river.

The Act does not define "watercourse" and therefore an examination of the relevant case-law is necessary. After examination of the relevant case-law we are of the opinion that NOW's classification of the Drainage Depression is inconsistent with the definition of a River under the Act and the interpretation of the definition of "watercourse" taken by the Courts.

#### 3.2 The test under the case-law

Case law in New South Wales has defined the characteristics of a river or watercourse. These characteristics are continuity, permanence, and unity, set out by Barwick CJ in the High Court of Australia decision of *Knezovic v Shire of Swan-Guildford* [1968] HCA 38 ("*Knezovic*").

It was posited by Taylor and Stokes (Taylor, M., and Stokes R., "Up the Creek: What is wrong with the definition of a river in New South Wales" Environment and Planning Law Journal 22 193 2005) following the introduction of the Act and taking into account the Act objectives, previous case-law could not be relied on when interpreting the definitions of a River or "watercourse". However in *Silva v Ku-ring-gai Council* [2009]

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NSWLEC 1060 ("*Silva*") Taylor C of the NSW Land and Environment Court, at [17], [23-25] and [48], confirms that whilst the Act contains a more expansive definition of

Rivers and watercourses, than in earlier Acts such as the Rivers and Foreshores Improvement Act 1948 (NSW) and the Environment Planning and Assessment Regulation 2000 (NSW), Knezovic remains the authoritative case for determining whether a river or watercourse exists.

Despite the greater inclusiveness of the definitions of "rivers" and "watercourses" under the Act, the decision in *Silva* confirms that the definition does not extend beyond watercourses or tributaries, which are watercourses in their own right and therefore does not capture every instance in which water "occasionally" flows. In determining what constitutes a watercourse under the Act Taylor C followed Barwick CJ's decision in *Knezovic* and held at [53] that what was crucial was whether or not there was a "flow" of water.

Therefore, the test as laid down in *Knezovic* remains the relevant test when determining the existence of a watercourse. However, the Courts did take into account other physical factors when determining the existence of a watercourse. These factors are set out in **section 3.3** below.

#### 3.3 Relevant Factors for Determining the Existence of a Watercourse:

In *Knezovic* the High Court took into account the following factors to determine the existence of a watercourse (at [18]):

- a. a watercourse must exhibit features of continuity, permanence and unity;
- b. a watercourse is a stream with a defined bed, with banks and flowing water;
- c. a watercourse must be a stream and be sharply distinguished from a mere drain, or drainage depression in the contours of the land which serve to relieve the upper land of excess water in times of major precipitation; and
- d. it is not enough that the water, when it does flow, does so in what may be seen as a defined course or channel. When water flows "occasionally" it is not considered a regular flowing stream of water.

In Silva the NSW Land and Environment Court took the following factors into account:

- a. observable areas of organic matter and inorganic sediment that have been moved following preceding rains indicate a watercourse (at [40]);
- b. the presence of aquatic fauna indicates a watercourse (at [40]);
- c. erosion marks in the channel bed such as striations, flutes, grooves, scallops and potholes indicate water flow of a reasonably regular and substantive nature over an extended timeframe (at [44]);

- d. a blue cartographer's line on a map, while not a prescriptive or statutory consideration may be considered (at [44]);
- e. aerial photography of the area showing a watercourse may indicate a watercourse (at [51]);
- f. the Taylor and Stokes nine part test as laid down in Taylor and Stokes (2005) in the Environmental Planning Law Journal, 22, pages 193-211 was also taken into account (at [56]):
  - i. Are there definable channel banks and a channel bed?
  - ii. Are there fluvial bedforms e.g. pools, riffles, sediment point bars etc. and if so what are they?
  - iii. Is there any evidence for substantial erosion from water flow within the drainage feature?
  - iv. Are there any spring lines that may indicate seasonally intermittent or perennial flow?
  - v. Is the catchment large enough to sustain perennial or intermittent groundwater flow?
  - vi. Are there any indicators of prolonged wetness within the drainage feature?
  - vii. If the surface flow is present, is it continuous and how extensive across the base of the drainage feature is it?
  - viii. Are there any visible aquatic habitats that might sustain aquatic fauna?
  - ix. Is there any aquatic flora present that would require periods of uninterrupted moisture?
- g. Consistency with any Development Control Plans (at [65]).

#### 3.4 Applying these factors to the Drainage Depression

This section is to be read in conjunction with Dr Bacon's report on the gully titled: "Report on the unnamed gully to the immediate south of lots 31, 23, 17 and 11 Narara Ecovillage, Narara"

Your report made the following assessments and observations:

At Assessment Site 1:

The channel was described as ill defined and showed no evidence of water upslope of the point despite heavy rainfall (22mm 5 days before assessment) ( p. 10). There was no evidence of scouring sedimentation or lodging of debris. It cannot be considered a 'stream' at this location.

#### At Assessment Site 2:

The channel is virtually indistinguishable from the surrounding lands at this point. There is no lodging of vegetation or debris. It cannot be considered a 'stream' at this location.

#### At Assessment Site 3:

The drainage line has a concrete bed.

#### At Assessment Site 4:

There is no evidence of disturbance or litter deposition in this relatively large, flat area, despite the antecedent rainfall. This suggests that the drainage system seldom has free water in it. The pipe is half full of sediment, but this is not recently deposited material as it is colonized with undisturbed wandering Jew. There were no sedges or other aquatic flora present. Aquatic Fauna would be unlikely to survive. The conclusion is that the drainage line is not a stream at this point.

#### At Assessment Point 5:

The photo below is taken of the drainage line upstream of the small walking track. It looks like a grassed swale rather than a drainage line. The vegetation on the floor is terrestrial grasses and forms. There are no aquatic plants evident. There is no evidence of sediment or vegetative debris being mobilized. There is no evidence of flowing water.

#### At Assessment Point 6:

There is a nick point. There is some plant litter entangled in Lantana branches. This suggests there has been recent flow in the gully, however five days after heavy rainfall the area was completely dry. There is no aquatic flora or fauna present.

#### At Assessment Point 7:

The gully floor is bare except for plant litter and fern. The litter has not been mobilized by antecedent rainfall. The photo shows a slope, but no defined banks.

#### At Assessment Point 8:

Palms are the major vegetation along the gully floor. There is considerable litter fall. However this has not been mobilized by antecedent rainfall, suggesting that significant flows are extremely rare. There are no sedges or aquatic flora present. Conditions are dry.

#### At Assessment Point 9:

There is a thick litter layer, however neither the soil nor the litter show signs of mobilization despite heavy rainfall. This suggests that significant flows are extremely rare. There are no sedges or aquatic flora present. Aquatic fauna would be unlikely to survive.

#### At Assessment Point 10:

There is no defined bed and banks possibly because the slope is very steep. There are no sedges or aquatic flora present.

#### At Assessment point 11:

There is a considerable area of bare earth; however there is no litter against the chicken wire fence. This suggests there has been little or no flow in recent times. There are few ferns and palms on the floor of the gully however, there are no aquatic sedges.

#### At Assessment Site 12:

The drainage line 'bed' consists of smooth boulders. There is litter on the ground among the boulders. This litter has not been mobilized by recent rainfall runoff. This suggests there has been little or no flow in recent times.

#### 3.5 Conclusion

On your observations and applying the test as laid down by the High Court in *Knezovic*, it is clear that this is not a watercourse which exhibits features of "continuity, permanence and unity". This landform feature is evidently a drainage depression which is not a continuous defined channel with an identifiable bed, banks and margins. Your observations suggest that, at numerous points, the Drainage Depression cannot be distinguished from the surrounding land. Additionally, the Drainage Depression has no requisite flow characteristics as required by *Knezovic* and at most has "occasional" flow. At the time of your report was conducted there was no sustained flow, despite heavy antecedent rain. Evidence from your report suggests that significant flows were extremely rare and the Drainage Depression is not a regular stream, which is dry in certain seasons.

### 24 October 2013

In addition your observations satisfy the majority of factors taken into account in *Silva*, which indicates a drainage depression and not a watercourse. For example, no aquatic

fauna was present and there was very little movement of organic matter and inorganic sediment that have been moved as a consequence of preceding rains. Furthermore, aerial photography of the Narara site does not show a watercourse nor is there a blue cartographer's line indicating an identifiable watercourse.

As such, NOW cannot impose CRZ on the Drainage Depression.

#### 4 Recommendations and next steps

We recommend that you provide our advice to Algis Sutas of NOW.

However, we advise that no CRZ can be imposed on the Co-operative with regards to this Drainage Depression.

Should you have any further questions or if you require any further assistance, please contact Jenni Mattila (details below).

Yours faithfully

Jen Mattile

Mattila Lawyers

Contact person: Direct email: Our Ref: Doc. Id Jenni Mattila jennimattila@mattilalawyers.com.au NEV001 3000013835 24 October 2013

# Addendum to Integrated Water Management Cycle Version 6.



Woodlots and Wetlands Pty Ltd 220 Purchase Road Cherrybrook NSW 2126

## 1. Background

The need to accommodate NSW Health Department concerns regarding the flushing of toilets with reclaimed water as per the National Guidelines for effluent reuse has required a revisiting of the site water supply and demand at the Narara Ecovillage. An additional issue is that residents may have to drink rainwater rather than treated dam water.

As an initial step, it was suggested that the reclaimed water could be used for large scale irrigation of public space and rural irrigation. Removal of this source of toilet flush water means that there is increased demand for potable water to flush the toilets. This increase in demand could be met by a combination of rainwater captured in tanks and treated water from the 45 ML dam. Using as high a proportion of the rainwater as possible maximises the 'air-space' in the rainwater tanks and this maximises the ability of the system to reduce stormwater volume and even peak flows. Additionally using water from the tanks will reduce demand on the dam water supply.

## 2. Methodology

The demands for the different types of water were based on the same data set as was used in the Integrated Water Cycle Study. In turn, the original data set was derived from Sydney Water Corporation surveys of several thousand dwellings. Table 2.1 contains the anticipated demands for dwellings with 1 to 7 residents.

### First scenario-tank water used for toilets and laundry

Table 2.1. Water use components for individual dwellings with 1 to 7 occupants
(derived from SWC reports). The water use by 6 and 7 occupants was derived via
extrapolation. Data based on 5294 dwellings.

Number of occupants	1	2	3	4	5	6*	7*
Average total water use for dwellings with various							
numbers of residents (L/day)	233	352	447	529	604	658	700
Toilet (L/day)	31	53	74	95	115	130	145
% of total water use	13	15	17	18	19	20	21
% of internal demand	25	25	25	25	25	26	27
Laundry (L/day)	29	53	76	95	113	123	131
% of total demand	12	15	17	18	19	19	19
% of internal demand	24	25	25	25	25	25	25
Hot Water (L/day)	49	87	119	151	182	197	210
% of total demand	21	25	27	29	30	30	30
% of internal demand	40	41	40	40	40	40	39
Other internal uses (L/day)	13	20	31	37	42	45	48
% of total demand	6	6	7	7	7	7	7
% of internal demand	11	9	10	10	9	9	9
Total internal use (L/day)	122	213	300	378	452	495	534
Internal use excluding	91	160	226	283	337	365	389
toilets (L/day)							
Daily External use (L/day)	111	139	147	151	152	163	166
External use as% of total demand	48	39	33	29	25	25	24
Internal use as % of total demand	52	61	67	71	75	75	76
Likely reclaimed sewage use L/day (toilet + external)	142	192	221	246	267	293	311
% of total demand	61	54	49	47	44	49	49
Roof runoff demand for laundry and hot water L/day	78	140	195	246	295	205	256
% of total demand	33	40	44	47	49	31	37
% of internal demand	64	66	65	65	65	41	48
Potable + non-potable roof runoff demand	91	160	226	283	337	365	389
Roof runoff demand as a % of total demand	39	46	51	54	56	56	56
Return to sewer (internal uses) (L/day)	122	213	300	378	452	495	534
Sewer reuse (toilets, gardens) (L/day)	142	192	221	246	267	293	311
Total demand (cubic m/y)	85	128	163	193	220	240	255

Table 2.1 shows that water demand varies with number of residents/dwelling. The 2011 Census data for the Gosford Statistical Area (ABS web site, 2013), shows that the average number of persons per dwelling was 2.5. The individual lot dwellings were assumed to have 5 residents. This is effectively double that of the local number of residents/dwelling on census night in 2011 and is therefore a very conservative approach.

For the purpose of being consistent with the previous modelling, it was assumed that every dwelling had 5 persons. The anticipated daily demand for toilets and cold water in the laundry was 228 L/dwelling/day as table 2.1 shows.

Each residence had 120 msq of roof catchment draining to a tank with an active storage of 9.5 cubic m. Runoff occurred when the total rainfall in a day exceeded 2 mm. Additionally the first 20 L was 'lost' via a first flush diversion system.

The daily time-step model 'ran' from January 1970 to Feb 2013.

# Second scenario-tank water used for toilets, laundry and irrigation of 100 msq of land

In this scenario, the demand for toilets and cold water into laundry was the same as the first scenario. That is 228 L/dwelling/day is required.

Irrigation demand was based on the Penman equation, and each irrigation applied 12.5 mm of water when the available soil water content fell below 70 mm of available water. This is designed to maximise water use via irrigation. Conversely, it is likely that more than 100 msq of land /dwelling will be irrigated however this is highly dependent on individual owners. In practice property owners are likely to have a higher than anticipated demand in dry weather and a less than expected demand in cooler weather.

Roof runoff behaviour was as per the first scenario.

The daily time-step model 'ran' from January 1970 to Feb 2013.

# Third scenario-tank water used for toilets, laundry and the hot water system

The demand for toilets and cold water into laundry was the same as the first scenario. That is 228 L/dwelling/day is required. According to table 2.1, the hot water system will require an average of 182 L/dwelling/day for dwellings with 5 persons in residence. Therefore, the total daily demand is 410 L/dwelling.

The daily time-step model 'ran' from January 1970 to Feb 2013.

# 3. Results

First scenario-tank water used for toilets and laundry

Figure 3.1 shows the volume in storage each day since 1970.



It is obvious that the volume is highly dynamic. However, there is water in the tank for the majority of time. This is illustrated in figure 3.2.



The tank has a least one day's supply in it in 86% of time. That is, a tank with 9.5 cubic m of active storage could meet anticipated demand for toilet flushing and laundry in a 5 EP dwelling in 86% of time. The median volume in the tank was 5.7 cubic m. Therefore, the median air space was 3.9 cubic m (9.5 cubic m total active volume).

The 228 L/dwelling per day is equivalent to 83.22 cubic m/dwelling/year. Assuming 115 dwellings used this volume/year, the total volume/year used for toilet flushing and laundries would be 9570 cubic m.

If the systems provided water on average for 86% of time then the rainwater consumption within the 115 dwellings would be 8,230 cubic m/ year.

Obviously the average number of residents/dwelling is likely to be closer to the 2.5 persons/ dwelling recorded for the Gosford area in 2011. This would result in lower demand and therefore increase the proportion of time that the tanks could supply water for toilets and laundry.

Based on the 5 EP / dwelling scenario, the tank would overflow some 65 cubic m/dwelling /year. Total runoff from a 120 msq roof is 133 cubic m/year, so the proposed system captures and utilises some 51% of the runoff with the other 49% exiting the tanks via overtopping.

#### Effect of proposed system on the dam

Figure 3.3 shows the impact of the proposed system on the 45 ML dam.



The maximum volume depression in the dam was 15 ML in April 1991. This is approximately 1/3 of the total dam capacity. The result suggests that the system is sustainable.

# Second scenario-tank water used for toilets, laundry and 100 msq of irrigation

Irrigation from the 9.5 cubic m tank occurred 17 times in the average year and some 212 mm were applied (21.2 cubic m/100 msq irrigation/year). This is approximately half the irrigation demand for fully irrigated grass in the Gosford area. Additional water would be required to maximise vegetative growth.

Overflow averaged 45 cubic m/year or approximately 1/3 of the roof runoff volume. Average volume in the tank was 3 cubic m, so the head space averages 6.5 cubic m.

Figure 3.4 illustrates the effect of irrigating the 100 msq of lawn/dwelling. Without irrigation, the tank can supply water in 86% of time, however including irrigation reduced the tank reliability of supply to 60% of time.

If the tanks were automatically given say 1.5 cubic m once the level of water in the tank fell below say 1 cubic m, then there would be significant 'call' on the dam. It would be preferable if this demand was met using reclaimed water.

This suggests that it would be preferable to use reclaimed water for irrigation. The option to use other water sources could be available for periods of high demand.



# Third scenario-tank water used for toilets, laundry and hot

#### water

Table 2.1 shows that the demand /day for toilets (115 L), cold water tap in laundry (113L) and hot water (182L) for a dwelling with 5 persons in residence totals 410 L/day.

Modelling revealed that this system resulted in an average volume in the tank of 2.9 cubic m, giving an 'air' space of 6.6 cubic m. Tank overflow averaged 32% of the inflow or 42 cubic m in the average year.

Figure 3.5 shows that the 9.5 cubic m tank will have less than 1 day's water supply in 43% of time. This is obviously a high proportion of time and there will be significant 'call' on the dam water.







Minimum volume in the dam over the past 40 years is 30,200 cubic m. That is, the maximum dam head space is approximately 15 ML or 1/3 of the estimated dam storage capacity. This volume is similar to the other simulations and is indicative of the fact that demand for internal

uses within dwellings in the Narara Development is small (a maximum of 18 ML/year) compared with the catchment inflows (204 ML/y) to the dam.

# 4. Impact of the rainwater tanks on stormwater management efficiency.

The impact of the rainwater tanks on stormwater management was examined The results of vhte modelling are shown in table 4.1 below.

Table 4.1. Effect of WSUD with and without rainwater tanks of stormwater volumes, peak flows and contaminant loads exiting the development.

	Pre dev	Pos dev no WSUD		with WSUD		% reduction POST Development
Flow (ML/yr)	19.4	22.3	19.4	3.74	0	83.2
Peak Flow (m3/s)	0.817	0.1	0.978	0.498	-19.7	-398
Total Suspended Solids (kg/yr)	670	2.45E+03	670	66.6	0	97.3
Total Phosphorus (kg/yr)	3.91	5.82	3.91	0.489	0	91.6
Total Nitrogen (kg/yr)	32.6	47.2	32.6	3.98	0	91.6
Gross Pollutants (kg/yr)	160	367	160	3.68	0	99

It is obvious that the WSUD components of the stormwater management system have a major impact on stormwater flows, peak discharge rates and contaminant loads. However the benefit to stormwater contamination of the tanks is minimal. This suggests that the main effect of the tanks would be to reduce reliance on the dam water by 60 to 85% depending on the demand for water. Assuming a maximum saving of 84 cubic m/dwelling/year, this would reduce treatment costs by \$167/dwelling /year (assuming \$2/cubic m ). However there will be additional pumping and maintenance costs.

## **5.** Conclusions

The results above show that the proposed 9.5 cubic m rain water tanks will provide 'nonpotable' water for a significant proportion of the year. If the reclaimed water is not used for toilet flushing then roof runoff can be used for this demand as well as for cold water to the washing machine in the laundry and even to the hot water system. Note that using roof runoff in the hot water system is consistent with NSW Health guidelines.

The rain water can also be used for irrigation instead of reclaimed water, but this will mean that additional irrigation area elsewhere will be required to productively utilise the reclaimed water.

Importantly utilising the roof runoff reduces the runoff volume by up to 2/3. This has the additional benefit in that the volume of stormwater to be treated is less.

The size of the dam is sufficient to hold almost 3 times the annual water demand. The average annual inflow from the catchment is over 10 times the total demand. Thus, the dam volume is well buffered, and variation in the demand for use within dwellings will have minimal effect.

The modelling assumes 5 persons in each dwelling. This is double the density reported for the 2011 census. Fewer people mean less water being used, so the demand on the dam will be less.

The dam can also support small scale irrigation, and the irrigation requirements of a few ha of intensive horticulture will have only moderate impact on dam volumes.



# Appendix C2 Existing Activities

A Network Operators License and a Retail License were issued on 4 July 2017.

Construction of Stage 1 water and sewer infrastructure was completed in October 2018.

Commercial operation of Stage 1 of the scheme commenced on 8 May 2019.

Innaco were contracted to provide support services in place of Aquacell Pty Ltd on 1 July 2020.

A rising main connection to council sewer was constructed in 2021 and is awaiting commencement of commercial operation.

The scheme is currently providing water and sewer services to approximately 50 small retail customers.

Construction of infrastructure to supply services to Stage 2 of the development is forecast to commence by the end of 2021 and be completed by the end of 2022.



### Narara Ecovillage Co-operative Pty Ltd Scheme License Area







NSW Land Registry Services 1 Prince Albert Road, Queens Square 2000 GPO Box 15, Sydney NSW 2001 P (02) 8776 3575 E generalenguiry@nswlrs.com.au www.nswlrs.com.au

2 December 2019

Registered Surveyor Campbell Delfs Lachelles Consulting Surveyors 260 Maitland Road MARYLAND NSW 2304 NSW 2216

Your Ref: 19323 Our Ref: LM20190116: GB: Leg2

By email: tom@delacs.com.au

Dear Surveyor Campbell,

#### RE: Boundary Adjustment Lot 1 and Lot 37 in DP270882

We acknowledge receipt of your email of 12 November 2019 requesting the Registrar General to consider a boundary adjustment between Lots 1 and 37 in DP270882 under section 6 of the *Community Land Development Act 1989*.

Section 6 of the *Community Land Development Act 1989* permits the Registrar General to adjust boundaries if satisfied that:

"An adjustment that, in the opinion of the Registrar-General, is a minor adjustment may be made to the boundaries between community development lots and the community property in a community plan by registration of a boundary adjustment plan"

I have reviewed your Surveyor Report of 12 November 2019 and confirm that we are satisfied that the boundary adjustment between Lots 1 and 37 is an adjustment within the meaning of section 6 of the Act. The following conditions are required to be satisfied:

- 1. a replacement sheet for the community property plan showing the altered boundaries of the community;
- 2. an additional sheet for the detail plan of the community plan showing the altered boundaries of affected community development lot;
- 3. a release of the right of access variable width from Lot 37 as the subject easement will only affect association property following the boundary adjustment;
- 4. a review is undertaken of the community management statement; and if necessary, an amendment to the community am management statement (Form ...) is lodged your attention is drawn to Part 3 Mandatory Matters;
- 5. The Folios of the Register for Lot 1 and Lot 37 must be lodged with the boundary adjustment; and
- 6. execution by the relevant parties



A copy of this letter must accompany the boundary adjustment plan.

Should you have any further questions or need further assistance in relation to this matter, please do not hesitate to contact me, Gavin Bartier, Head of Legal Registry Services, Legal and Dispute Resolution; 02 9228 6728 or email: <u>ldr@nswlrs.com.au</u>.

Yours sincerely,

Gavin Bartier Head of Legal Registry Services Legal and Dispute Resolution









Date: 30 August 2016

#### 

### Maddocks

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DX 10284 Sydney Stock Exchange

# Deed of Agreement - Interim Water Connection

Central Coast Council ABN 73 149 644 003

and

Narara Ecovillage Co-Operative Ltd ABN 86 789 868 574

> Interstate offices Canberra Melbourne Affiliated offices around the world through the Advoc network - www.advoc.com
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# **Deed of Agreement - Interim Water Connection**

# Dated

# Parties

Name	Central Coast Council ABN 73 149 644 003
Address	49 Mann Street Gosford
Facsimile	(02) 43232477
Contact	Attention: Richard Brocklehurst
Short name	Council
Name	Narara Ecovillage Co-Operative Ltd ABN 86 789 868 574
Address	25 Research Road, Narara 2250
Facsimile	
Contact	Attention: John Talbott, Project Director
Short name	Owner

# Background

- A. The Council is a water supply authority under the Water Management Act 2000 (WM Act).
- B. The Owner is the registered proprietor of Lot 13 DP 1126998 being 25 Research Road Narara 2250 (**Property**)
- C. The Owner has applied to the Council for the retention of an existing connection to Council's water reticulation system as an interim arrangement during the development of Stage One of DA44994/2013 (**Development Consent**) and construction of water industry infrastructure under the *Water Industry Competition Act 2006* (**WICA**).
- D. Council has agreed to consent to the Owner's temporary retention of its connection to Council's water reticulation system on the terms and conditions set out in this Deed.

### This Deed Witnesses

### 1. Definitions

In this Deed:

#### Authorisation means:

- (a) an approval, consent, declaration, exemption, accreditation, notarisation, licence, permit, certificate, waiver or other authorisation, however described, required by any law; and
- (b) in relation to anything that could be prohibited or restricted by law if an Authority acts in any way within a specified period, the expiry of that period without that action being taken,

including any variation, modification, renewal or amendment with any Authority.

Authority means any:

- (a) government, government department, government agency or government authority;
- (b) governmental, semi-governmental or judicial person carrying out any statutory authority or function; or
- (c) other person (whether autonomous or not) who is charged with the administration of a Law.

**Business Day** means a day other than a Saturday, Sunday or public holiday in New South Wales.

**Claim** means any action, claim, demand or proceeding (including based in contract, tort or statute or under any indemnity, and including any action based on personal injury or death) made against the person concerned however it arises and whether it is present or future, fixed or unascertained, actual or contingent.

**Consequential Loss** means any special, indirect or consequential loss, whether or not a Party has been advised of or is aware of that loss, including:

- (a) any loss of revenue, profit, data, opportunity, business, goodwill or future reputation, any failure to realise anticipated savings, any downtime costs, any damage to credit rating, and any penalties payable under contracts other than this Deed; and
- (b) any other loss or damage which does not naturally or directly result in the ordinary course of events from the breach, action or inaction in question.

**Contribution Amount** means a security amount to be paid to Council by the Owner in lieu of water headworks and augmentation contributions payable under section 306(2)(a) of the WM Act and calculated to be \$65,439 in accordance with section 306(3) of the WM Act and Council's policy: *WS5.03 Water Supply and Sewerage Development Charges*.

Controller means, in relation to a person's property:

(a) a receiver or receiver and manager of that property; or

(b) anyone else who (whether or not as agent for the person) is in possession, or has control, of that property to enforce an encumbrance.

Council means Central Coast Council.

Council's Water means all water supplied through Council's water reticulation system.

Development means the development permitted by the Development Consent.

**Development Consent** means DA4994/2013 approved by Council 8 August 2013, as amended from time to time under the EP&A Act.

**Disconnection Date** means the date that Council issues a written notice to the Owner confirming that the Owner's Water Supply System has been disconnected from Council's water reticulation system.

EP&A Act means the Environmental Planning and Assessment Act 1979.

Insolvency Event means, in respect of a person:

- (a) an order is made, or the person passes a resolution or takes any steps to pass a resolution, for its winding up;
- (b) an administrator is appointed to the person;
- the person resolves to appoint or takes any other steps to appoint a Controller, provisional liquidator, trustee for creditors or in bankruptcy or analogous person to the person or any of the person's property;
- (d) the appointment of a Controller, provisional liquidator, trustee for creditors or in bankruptcy or analogous person to the person or any of the person's property;
- (e) a bank or other financier taking possession of any of the person's property;
- (f) the person entering into a compromise or arrangement with, or assignment for the benefit of all of its members or creditors;
- (g) the person informs the Council in writing or creditors generally that the person is insolvent:
- (h) the person has a meeting of its creditors for the purpose of:
  - (i) entering a scheme of arrangement or composition with creditors; or
  - (ii) placing it under official management;
- execution is levied against a material part of its assets by creditors, debenture holders or trustees under a floating charge; or
- (j) where the person is a company, the company is or becomes unable to pay its debts when they are due or is or becomes unable to pay its debts within the meaning of the *Corporations Act 2001* (Cth) as amended or replaced or is presumed to be insolvent under the *Corporations Act 2001* (Cth) as amended or replaced,

unless this takes place as part of a solvent reconstruction, amalgamation, merger or consolidation that has been approved by the Council.

**Law** includes any legislation or any rule, principle, duty or requirement of or under common law or equity, and for the avoidance of doubt includes any Authorisations and the lawful requirements of Authorities.

Owner means Narara Ecovillage Co-Operative Ltd, the registered proprietor of the Property.

**Owner's Water Supply System** means the internal water supply system on the Property, including a 100kL product tank and pumping station.

Party means a party to this Deed.

POM means the Plan of Management referred to in clause 4.

Property means Lot 13 DP 1126998 being 25 Research Road Narara 2250.

**Subdivision Certificate** means a subdivision certificate issued under Part 4A of the EP&A Act in respect of the Development.

Stage One means Stage 1 as set out in the Development Consent.

**Temporary Water Commencement Date** means the date that the following event has occurred:

(a) Thirty or more dwellings are occupied within the Property as part of the Development.

Temporary Water Disconnection Date means the date that is the earlier of:

- (a) the date that is 18 months after the Temporary Water Commencement Date; and
- (b) the date that:
  - (i) a WICA Licence is granted in relation to the Development; and
  - (ii) the water industry infrastructure that is the subject of the WICA Licence is operational, as verified by an approved auditor under the WICA Act.

WICA means Water Industry Competition Act 2006.

WICA Licence means a licence granted under section 10 of the WICA Act.

WM Act means Water Management Act 2000.

WM Regulations means Water Management Regulations 2011.

### 2. Retention of temporary water supply

The Council agrees to:

- 2.1.1 allow the Owner to retain the temporary connection from Council's water reticulation system to the boundary of the Property; and
- 2.1.2 continue to supply Council's Water to the Owner's Water Supply System to service the Development,

until the Temporary Water Disconnection Date.

#### 3. Disconnection of temporary water supply

- 3.1.1 The Owner must notify the Council in writing as soon as reasonably practicable and in any case within 2 Business Days after:
  - (a) a WICA Licence is granted in relation to the Development; or
  - (b) the water industry infrastructure that is the subject of the WICA Licence is operational, as verified by an approved auditor under the WICA Act.
- 3.1.2 The Owner must disconnect from and submit a written application to the Council to remove all water supply connections from the Property to Council's water reticulation system within 10 Business Days after the Temporary Water Disconnection Date.

#### 4. Plan of Management

#### 4.1 Owner to submit draft POM

- 4.1.1 On or before the date of this Deed the Owner must prepare and submit a draft POM to Council.
- 4.1.2 The draft POM must comply with the terms of this Deed and include emergency water supply arrangements for each of the following circumstances:
  - (a) where the temporary supply of Council's Water is interrupted through system maintenance or failure; and
  - (b) where the water quality within the Property is not at a potable standard or is otherwise compromised.

### 4.2 Review by Council of draft POM

- 4.2.1 Within 10 Business Days of receiving the draft POM, Council must give the Owner written notice:
  - (a) accepting the draft POM;
  - (b) rejecting the draft POM; or
  - (c) otherwise commenting on, or requiring amendments to the draft POM.
- 4.2.2 If Council issues a notice under clause 4.2.1(b) or clause 4.2.1(c), the Owner must promptly re-submit an amended draft POM, in which case clauses 4.1 and 4.2 will reapply.
- 4.2.3 If in respect of a draft POM the Council issues a notice under clause 4.2.1(a), that version of the draft POM will become the final POM.
- 4.2.4 The Owner must ensure that the final POM is in place within 30 Business Days after the date of this Deed.
- 4.2.5 Any alteration to the final POM requires the Council's approval in writing.

#### 4.3 No duty of care, responsibility or obligation etc.

- 4.3.1 The Council does not owe or assume a duty of care or other responsibility or obligation to the Owner to review or check the draft POM for its suitability, or for errors, omissions, inconsistencies, ambiguities, discrepancies or compliance with this Deed.
- 4.3.2 No review of, comment upon or approval or rejection of, or failure to review, comment upon, approve or reject, any draft POM by or on behalf of the Council will:
  - (a) relieve the Owner from, or otherwise limit, alter or affect, the Owner's liabilities or responsibilities under this Deed; or
  - (b) prejudice the Council's rights against the Owner under this Deed.

#### 4.4 Failure to comply is breach of Deed

- 4.4.1 The Owner must ensure that the final POM is complied with at all times until the Disconnection Date.
- 4.4.2 A failure by the Owner or any other person to comply with, or implement, any term or condition of the POM will be a breach of this Deed.

### 5. Contribution Amount

#### 5.1 Contribution Amount

On or before the commencement of this Deed the Owner must pay the Council the Contribution Amount as security for the disconnection of the Owner's Water Supply System from Council's water reticulation system at the Temporary Water Disconnection Date.

#### 5.2 Council Refund

- 5.2.1 Subject to clause 5.2.2, if the Owner has complied with all of its obligations under this Deed, the Council agrees to refund the Contribution Amount to the Owner within 20 Business Days after the Disconnection Date.
- 5.2.2 Despite clause 5.2.1, the Council may retain the Contribution Amount and apply the Contribution Amount for any purpose in its discretion if the Owner's water supply system has not been disconnected from Council's water reticulation system by the date that is 60 Business Days after the Temporary Water Disconnection Date.

### 6. Owner's Water Supply System – general obligations

- 6.1.1 The Owner must maintain water quality to a potable standard within the Owner's Water Supply System.
- 6.1.2 The Council's Water supplied under this Deed must only be used to service lots within the Development.
- 6.1.3 The Council's Water may only be used to fill the product tank forming part of the Owner's Water Supply System between the hours of 10pm to 7am daily, and must not be used for that purpose at other times.

6.1.4 The Owner must ensure that appropriate backflow prevention devices are installed at the Property boundary meter by a licensed plumber so that cross-contamination does not occur from the Property to Council's Water.

## 7. Fire safety

- 7.1.1 The Owner acknowledges that Council's Water Supply is insufficient to meet all fire safety requirements required by Law at the Property.
- 7.1.2 As between the Council and the Owner, the Owner assumes all responsibility and liability for:
  - (a) ensuring that there is adequate fire safety infrastructure and associated water supply at the Property; and
  - (b) complying with all applicable fire safety requirements at the Property required by Law,

and releases the Council accordingly.

### 8. Release and indemnity

#### 8.1 Risk

The Owner uses Council's Water and connects to Council's water reticulation system at its own cost and risk.

#### 8.2 Release

The Owner releases Council from all Claims resulting from any damage, loss, death or injury in connection with:

- 8.2.1 the supply of Council's Water to the Owner's Water Supply System;
- 8.2.2 the quality of Council's Water beyond the water meter on the Property;
- 8.2.3 the use of Council's Water at the Property;
- 8.2.4 the need for or adequacy of fire protection infrastructure and associated water supply in relation to the Property; or
- 8.2.5 the connection or disconnection of Council's water reticulation system to the Property.

#### 8.3 Indemnity

- 8.3.1 The Owner indemnifies the Council against:
  - (a) any Claim made, threatened or commenced against the Council; and
  - (b) any liability, loss (including Consequential Loss), damage or expense (including legal costs on a full indemnity basis), and cost suffered or incurred by Council,

arising in connection with:

- (c) the supply of Council's Water to the Owner's Water Supply System;
- (d) the connection of Council's water reticulation system to the Owner's Water Supply System, including any contamination caused to Council's Water due to the connection;
- (e) the quality of Council's Water beyond the water meter on the Property;
- (f) the use of Council's Water at the Property;
- (g) the need for or adequacy of fire protection infrastructure associated water supply in relation to the Property;
- (h) the disconnection of Council's water reticulation system to the Property, including the failure by the Owner to comply with its obligations under clause 3.1.2; or
- (i) a breach of the Deed by the Owner.
- 8.3.2 The indemnity in clause 8.3.1 does not apply to the extent that a breach of this Deed by Council directly contributed to the circumstances giving rise to the Claim, liability, loss, damage, expense or cost.

#### 8.4 No compensation

Council is not liable to the Owner for any loss or damage incurred by the Owner in connection with the subject matter of this Deed, or acts or omissions of the Owner, including:

- 8.4.1 any damage to the Owner's Water Supply System or any water supply system;
- 8.4.2 any damage or loss to any property of any person;
- 8.4.3 any loss arising from death, disability or any injury to any person,

no matter how it happens.

### 8.5 Survives termination

- 8.5.1 The release in this clause survives termination of this Deed.
- 8.5.2 The indemnity in this clause survives termination of this Deed.

### 9. Termination of Deed on default

## 9.1 Default

- 9.1.1 The Council may, by notice in writing to the Owner, terminate this Deed immediately and exercise any other legal right, if:
  - (a) the Owner commits a breach of this Deed which is not rectifiable (as reasonably determined by the Council);
  - (b) any payment required to be paid under this Deed from the Owner to the Council is in arrears for 20 Business Days, whether or not the Council has demanded payment;

- (c) the Owner fails to rectify a breach of this Deed which is rectifiable within 10 Business Days after receiving a written notice from the Council specifying the breach and requiring the Owner to rectify it;
- (d) the Owner repudiates its obligations under this Deed; or
- (e) an Insolvency Event occurs in respect of the Owner.
- 9.1.2 If the Council ends this Deed under this clause, the Owner shall not be released from liability for any prior breach of this Deed and other remedies available to the Council to recover loss, damage or amounts owing under this Deed shall not be prejudiced.
- 9.1.3 Demand or acceptance of any other moneys due under this Deed by the Council after termination does not operate as a waiver of the termination.

### 9.2 Damages following termination

If the Council terminates this Deed under clause 9.1, the Owner must compensate the Council for any loss or damage the Council suffers in connection with the event that gave rise to the termination.

### 10. No fetter of discretion

- 10.1.1 Nothing in this Deed will be taken to require Council to act in a manner that contravenes the *Local Government Act 1993* (NSW) or the WM Act or to unlawfully fetter the discretions of Council and the provisions of this Deed will be interpreted accordingly.
- 10.1.2 Without limiting clause 10.1.1, the Owner acknowledges that:
  - (a) Council may have a role as consent authority in respect of the Property and may charge inspection fees, and the Council cannot fetter its discretion when performing any function as a consent authority; and
  - (b) Council will not be liable to the Owner under this Deed for any acts or omissions of the Council undertaken in exercising any of its statutory rights, duties or powers under the EP&A Act, WM Act or the *Local Government Act* 1993 (NSW) or the exercise of any other statutory right, power or duty that the Council may lawfully exercise.

### 11. GST

### 11.1 GST Act

In this clause words that are defined in A New Tax System (Goods and Services Tax) Act 1999 have the same meaning as their definition in that Act.

### 11.2 Exclusive of GST

Except as otherwise provided by this clause, all consideration payable under this Deed in relation to any supply is exclusive of GST.

### 11.3 Recipient must pay

If GST is payable in respect of any supply made by a supplier under this Deed, subject to clause 11.4 the recipient will pay to the supplier an amount equal to the GST payable on the supply at the same time and in the same manner as the consideration for the supply is to be provided under this Deed.

#### 11.4 Tax invoice

The supplier must provide a tax invoice to the recipient before the supplier will be entitled to payment of the GST payable under clause 11.3.

#### 12. Notices

#### 12.1 Delivery of notice

- 12.1.1 A notice or other communication required or permitted to be given to a Party under this Deed must be in writing and may be delivered:
  - (a) personally to the Party;
  - (b) by leaving it at the Party's address;
  - by posting it by prepaid post addressed to the Party at the Party's address; or
  - (d) by facsimile to the Party's facsimile number.
- 12.1.2 If the person to be served is a company, the notice or other communication may be served on it at the company's registered office.

#### 12.2 Particulars for delivery

- 12.2.1 The address and facsimile number of each Party are set out on page 1 of this Deed under the heading 'Parties' (or as notified by a Party to the other Parties in accordance with this clause).
- 12.2.2 Any Party may change its address or facsimile number by giving notice to the other Parties.

### 12.3 Time of service

A notice or other communication is deemed delivered:

- 12.3.1 if delivered personally or left at the person's address, upon delivery;
- 12.3.2 if posted within Australia to an Australian address, 2 Business Days after posting and in any other case, 5 Business Days after posting;
- 12.3.3 if delivered by facsimile, subject to clauses 12.3.4 and 12.3.5, at the time indicated on the transmission report produced by the sender's facsimile machine indicating that the facsimile was sent in its entirety to the recipient's facsimile;
- 12.3.4 if received after 5.00pm in the place it is received, at 9.00am on the next Business Day; and

12.3.5 if received on a day which is not a Business Day in the place it is received, at 9.00am on the next Business Day.

#### 13. Governing law

This Deed is governed by the law applying in New South Wales and the Parties submit to the non-exclusive jurisdiction of the courts of New South Wales.

### 14. Interpretation

#### 14.1 Words and headings

In this Deed, unless expressed to the contrary:

- 14.1.1 words denoting the singular include the plural and vice versa;
- 14.1.2 the word 'includes' in any form is not a word of limitation;
- 14.1.3 where a word or phrase is defined, another part of speech or grammatical form of that word or phrase has a corresponding meaning;
- 14.1.4 headings and sub-headings are for ease of reference only and do not affect the interpretation of this Deed; and
- 14.1.5 no rule of construction applies to the disadvantage of the Party preparing this Deed on the basis that it prepared or put forward this Deed or any part of it.

#### 14.2 Specific references

In this Deed, unless expressed to the contrary, a reference to:

- 14.2.1 a gender includes all other genders;
- 14.2.2 any legislation (including subordinate legislation) is to that legislation as amended, re-enacted or replaced and includes any subordinate legislation issued under it;
- 14.2.3 any document (such as a deed, agreement or other document) is to that document (or, if required by the context, to a part of it) as amended, novated, substituted or supplemented at any time;
- 14.2.4 writing includes writing in digital form;
- 14.2.5 'this Deed' is to this Deed as amended from time to time;
- 14.2.6 'A\$', '\$', 'AUD' or 'dollars' is a reference to Australian dollars;
- 14.2.7 a clause, schedule or attachment is a reference to a clause, schedule or attachment in or to this Deed;
- 14.2.8 any property or assets of a person includes the legal and beneficial interest of that person of those assets or property, whether as owner, lessee or lessor, licensee or licensor, trustee or beneficiary or otherwise;
- 14.2.9 a person includes a firm, partnership, joint venture, association, corporation or other body corporate;

# Maddocks

- 14.2.10 a person includes the legal personal representatives, successors and permitted assigns of that person, and in the case of a trustee, includes any substituted or additional trustee; and
- 14.2.11 any body (**Original Body**) which no longer exists or has been reconstituted, renamed, replaced or whose powers or functions have been removed or transferred to another body or agency, is a reference to the body which most closely serves the purposes or objects of the Original Body.

## 15. General

### 15.1 Variation

This Deed may only be varied by a document executed by the Parties.

## 15.2 Counterparts

This Deed may be executed in counterparts, all of which taken together constitute one document.

### 15.3 Entire agreement and no reliance

- 15.3.1 This Deed:
  - (a) constitutes the entire agreement between the Parties; and
  - (b) supersedes and cancels any contract, deed, arrangement, related condition, collateral arrangement, condition, warranty, indemnity or representation imposed, given or made by a Party (or an agent of a Party) prior to entering into this Deed.
- 15.3.2 The Owner acknowledges that in entering into this Deed the Owner has not relied on any representations made by the Council (or its agents or employees) other than matters expressly set out in this Deed.

### 15.4 Liability

If a Party consists of 2 or more people or entities, an obligation of that Party binds each of them jointly and severally.

### 15.5 Severability

- 15.5.1 Any provision of this Deed that is held to be illegal, invalid, void, voidable or unenforceable must be read down to the extent necessary to ensure that it is not illegal, invalid, void, voidable or unenforceable.
- 15.5.2 If it is not possible to read down a provision as required by this clause, part or all of the clause of this Deed that is unlawful or unenforceable will be severed from this Deed and the remaining provisions continue in force.

### 15.6 Waiver

The failure of a Party at any time to insist on performance of any provision of this Deed is not a waiver of the Party's right at any later time to insist on performance of that or any other provision of this Deed.

## 15.7 Further assurance

Each Party must promptly execute and deliver all documents and take all other action necessary or desirable to effect, perfect or complete the transactions contemplated by this Deed.

## 15.8 Legal costs and expenses

- 15.8.1 The Owner must pay its own and the Council's legal and administrative costs and expenses (on a full indemnity basis) in relation to the negotiation, preparation and execution of this Deed, unless expressly stated otherwise.
- 15.8.2 The Parties acknowledge and agree that the total liability of the Owner under clause 15.8.1 is equal to \$4,500.
- 15.8.3 The Owner must pay the costs and expenses of Council that are required to be paid under clause 15.8.1 within 10 Business Days after the Owner receives a tax invoice for those costs and expenses.

#### 15.9 Survival and enforcement of indemnities

- 15.9.1 Each indemnity in this Deed is a continuing obligation, separate and independent from the other obligations of the Parties and survives termination of this Deed.
- 15.9.2 It is not necessary for a Party to incur expense or make payment before enforcing a right of indemnity conferred by this Deed.

#### 15.10 No merger

The warranties, undertakings, agreements and continuing obligations in this Deed do not merge on completion of the transactions contemplated by this Deed.

#### 15.11 Business Day

If a payment or other act is required by this Deed to be made or done on a day which is not a Business Day, the payment or act must be made or done on the next following Business Day.

Maddocks

# **Signing Page**

Executed by the Parties as a deed

**Signed** for and on behalf of **The Central Coast Council ABN 73 149 644 003** by the Chief Executive Officer in the presence of:

Witness

Executed by Narara Ecovillage Co-Operative Ltd ABN 86 789 868 574 in accordance with section 127(1) of the *Corporations Act 2001*:

A

Signature of Director

JOHN TALBOTT

Print full name

Print Title: Downie MARAMA COVILLAGE CO. DINun lins NARARA COMMON SEAL OF B.N. 86 789 868 ...... Director (or Company Secretary) Signature SFFREY FRA Gre

Print full name





22 January 2019

Narara Ecovillage Co-Operative Ltd 25 Research Road NARARA NSW 2250

john@nararaecovillage.com

Attention: John Talbot

Dear John,

# Re: Request for Connection to Councils Water and Sewer Reticulation Systems Narara Eco Village H25 Research Road Narara

I refer to Councils preliminary letter of response dated 26 September 2018 regarding connection of the proposed Narara Eco Village (NEV) to Councils existing water and sewer reticulation systems. Council has completed a review of both water and sewer systems and associated works required to accommodate additional load / demand generated by the proposed NEV development.

Should the developer propose to connect the site to Councils water and sewer reticulation systems the following conditions shall apply:

# Sewer

The developer shall be responsible for payment of a specific downstream sewer contribution charge toward the future augmentation of Councils sewer infrastructure necessary to accommodate additional loads generated by the Narara Eco Village development. The following Council sewer infrastructure will require amplification to accommodate the development:

# Sewer Reticulation Mains (Future Amplification by Council from 150mm to 225mm)

Payment of the following specific charge for Council to undertake future augmentation of the following sewer mains:

LA/3A to LA/11 – 293 metres of 225 mm Sewer @ \$494/m = \$144,742

#### Internal Sewer Infrastructure

The developer shall be responsible for the full cost of design and construction of internal private sewerage infrastructure necessary to connect development within the NEV site to Councils existing sewer reticulation system. The internal sewer infrastructure (including private sewer pump station and rising main infrastructure) shall be owned, operated and maintained by the Narara Eco Village.

Note: – Contributions and works specified are based upon provision of a Leak Tight sewer system as indicated by the developer's representatives. Additional charges may apply should the works not conform to the Leak Tight sewer specifications provided.



# Water

# Water Reticulation Main Research Road - Amplification by Developer from 100mm to 150mm

Prior to provision of a permanent water supply connection to Councils reticulation system the developer shall be responsible for the full cost of design and construction of a 150mm water main between Fountains Road and the boundary of the NEV site in Research Road. The water main designs must be submitted to Council for approval and shall be in accordance with Council's water design standards. Connection by NEV to Councils water reticulation system shall be via this 150mm water main.

# Water & Sewer Developer Services Contributions

Connection to Councils water and sewer reticulation systems shall be subject to payment of water and sewer headworks / augmentation contributions in accordance with Council's Services Charges Policy. The current rate of **\$3478.08 per equivalent tenement (ET)** is valid to 30 June 2019, after which time it shall be reviewed. The actual amount payable shall be based on the number of equivalent tenements assessed within the proposed NEV site, for both current and future developments.

The methodology for determination of equivalent tenements is outlined in Councils Water Supply and Sewerage Development Charges Policy, which may be found on Central Coast Councils Gosford website.

\*Note: It is recommended the applicant confirm the Equivalent Tenement rating for this site with Councils Water Assessment Team representatives as the contribution charges may be significant.

Conditions specified above are based on all lots contained within the Narara Eco Village development site being part of the Community Title Plan. The cost estimates are valid to 30 June 2019, after which time they shall be reviewed.

Should you wish to discuss this matter further please contact Council Officer Mr Rick Brocklehurst on (02) 4325 8821 during business hours.

Yours faithfully,

Rick Brocklehurst Team Leader Water Assessment IRN: 1945797 Tel. 43258821

w&S Resoponse Conditions Connection to Councils Sewer and Water Reticulation Systems H25 Research Road Narara



22 January 2019

Narara Ecovillage Co-Operative Ltd 25 Research Road NARARA NSW 2250

john@nararaecovillage.com

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*Note:* – *Contributions and works specified are based upon provision of a Leak Tight sewer system as indicated by the developer's representatives. Additional charges may apply should the works not conform to the Leak Tight sewer specifications provided.* 



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Should you wish to discuss this matter further please contact Council Officer Mr Rick Brocklehurst on (02) 4325 8821 during business hours.

Yours faithfully,

CR VI

Rick Brocklehurst Team Leader Water Assessment IRN: 1945797 Tel. 43258821

17 August 2020



John Talbott Narara Ecovillage Co-operative Ltd 25 Research Road NARARA NSW 2250

john@nararaecovillage.com

Dear John,

# Development Application No. 44994/13 Lot No. 37, DP: 270882 33 Gugandi Road Narara NSW 2250

# WATER MANAGEMENT ACT 2000 REVISED SECTION 306 STAGE: 1A

With respect to your application for a Section 307 Certificate for the subject development, upon completion of the following conditions, a Certificate will be issued.

1 The payment to the Authority of the following contributions towards the cost of construction of works specified in Schedule 1 which will benefit the development:-

			Rate/ET	No of ET	Total
	a)	Sewer Augmentation (Account No 977)	\$1,855.95	48.80	\$68,791.89
				SUB TOTAL	\$68,791.89
2	Adr (To	ministration Fee be paid equally into A	ccounts 819 and 82	D)	\$334.73
3	Wa	ter Engineering Plan ar	nd Technical Assessr	nent Fee	\$915.37
				TOTAL	\$70,041.99

The Rate/ET and the total contribution amount may be altered as they are subject to annual review. The amount payable is based on the current rate at time of payment. The contributions do not include the cost associated with connection of the service.

4. No water contribution payable apply under stage 1A development and the interim water supply arrangements is in line with the current Deed of Agreement executed August 2016. (ECMD21641835).

- 5. Water contribution will be applied upon termination of the Deed of Agreement (ECMD21641835). Please refer to Section 306 letter for stage 1B development.
- 6. The annual sewerage loading shall not exceed 10,950 kilolitres.
- 7. Should the additional sewer loading to that detailed above, be required by the development, another application is required to be made under Section 305 of the Water Management Act 2000 for a new Section 307 Certificate of Compliance.
- 8. All operations are to comply with Narara Ecovillage Water Utility Network Operator's Licence.
- 9. Connection to live water or sewer mains may only be carried out by Council at the expense of the developer. Council quoted the connection costs separately. Please note that Council will not program any connection works prior to payment of the estimated connection costs.
- 10. The sewer connection will be carried out by the applicant's contractor under Council's inspection. An inspection fee (\$122.96 to account Hotkey 450) is required prior to book in an inspection. Inspection booking shall be made via <u>waterandsewerworks@centralcoast.nsw.gov.au</u>. Please note that min 48 hours early notice is required.
- 11. The developer is responsible for all protection works of all water supply and sewer infrastructure during construction works. The Developer will be responsible for all costs associated with any damage to the water and/or sewer infrastructure and any other damage as a result. Details of proposed protection methods are to be submitted to Council prior to issue of the Construction Certificate.
- 12. The required works are to be provided in accordance with WSA 03 Sydney Water Edition (Gosford Amendments) and AS/NZS 3500.

NOTE: The above fees do not include internal sewer plumbing and drainage inspection fees. If applicable, you are advised to complete the Council's *Application for Plumbing and Drainage Inspection* form. This form is available on the Council's website: <a href="https://www.centralcoast.nsw.gov.au/council/forms/plumbing-and-drainage-inspection-south-application-online-form">https://www.centralcoast.nsw.gov.au/council/forms/plumbing-and-drainage-inspection-south-application-online-form</a>

• Please ensure you bring this letter when making payment.

#### Page 3

# SCHEDULE 1

# Water Headworks

Components of Gosford/Wyong Joint Water Supply Scheme, including:-

- Dams
- Service reservoirs
- Filtration plants
- Trunk mains
- Major pumping stations

# Water Augmentation/Distribution

The components of the water supply scheme which connect a service area to a water supply headworks component, including:-

- Site reservoirs
- Minor pumping stations

# Sewer Augmentation/Distribution

The components of the sewerage system which connect a service area to a sewerage headworks component, including:-

- Minor pumping stations
- Rising mains
- Gravity sewers

Yours faithfully

J.Zhang

For Chief Executive Officer Internal Reference: ECMD24971147 Telephone: 1300 463 954



3 May 2021

John Talbott 25 Research Road NARARA NSW 2250

john@nararaecovillage.com

# WATER MANAGEMENT ACT 2000

# SECTION 307 CERTIFICATE OF COMPLIANCE

Name of Applicant:	]John Talbott
<b>Development Application No:</b>	44994/2013
Development Of:	Narara Eco-Village
Lot No:	37
Deposited Plan:	270882
Street:	33 Gugandi Road
Suburb:	Narara
Council DA Approval Dated:	19 October 2018

In relation to the plan of Subdivision / Development described above, Central Coast Council hereby certifies that the above named applicant has complied with the requirements (Chapter 6 Part 2 Division 5) of the *Water Management Act 2000*.

Yours faithfully

J.Zhang For Chief Executive Officer Internal Reference ECMD24971147 Telephone: 1300 463 954



01/12/ 2020

John Talbott Narara Ecovillage Co-operative Ltd 25 Research Rd NARARA NSW 2250

john@nararaecovillage.com

# Sewer Design for Private Sewer Rising Main Connection

Dear John,

- The sewer design plans submitted for the proposed Private Rising Main connection are approved, subject to amendments shown in RED. Activation of this approval shall occur upon receipt of the following fees and information to Central Coast Council Water Assessment Team Development Engineer via waterandsewerworks@centralcoast.nsw.gov.au :
- i. Contractor's name and accreditation details.
- ii. Supervising Engineer or Surveyor's Name. (To be validated by the nominated professional on company letterhead.)
- iii. Dilapidation Report
- iv. Construction schedule in bar chart form with commencement and completion dates. The plan must detail of site excavation, construction of foundations /shoring and of the house structure which impact Council's asset and access to Council's assets.
- v. Flow Management Plan detailing method to be utilized for the diversion of sewer flows to ensure maintenance of service to Council customers.
- vi. A materials list including, but not limited to: pipe type, class, fittings, manhole components, bedding and manufacturer & supplier of materials listed.
- vii. Copy of contractor's indemnity insurance policy (incorporating Public Liability to min. \$20 million and Workers Compensation).
- viii. Name and details of the nominated NATA accredited pipe tester.
- ix. Inspection fee of Sewer (Hotkey Account 450)

\$ 122.96



**Note:** It should be noted that prior to an initial quality inspection, the contractor shall provide Council's Quality Inspector with a site induction. The inspection fee may be subject to review should Council's Inspector require excessive time to carry out his duties as a result of poor workmanship.

- x. Plan Assessment Fee Sewer \$300.57 (Hotkey Account 825)
- xi. The following maintenance security deposit is required to be paid prior to commencement of any works:

Maintenance security deposit (Hotkey Acc 707)

Sewer \$ 5,000

Please ensure you bring this letter when making payment.

The above estimates are valid for three (3) months from the date of this letter, after which time they will be re-assessed.

Approval of the plans is valid for a period of two (2) years from the date of this letter.

All information and fees must be submitted to Council two (2) weeks before commencement.

The approval of these plans shall not pre-empt approval of any development plans.

Approval of this plan does not include approval to remove vegetation. It is the applicant's responsibility to obtain approval from the relevant approval authority to remove vegetation and / or trees. The applicant shall comply with requirements under Part 4/5 of the Environmental, Planning and Assessment Act, 1979.

The actual maintenance period will commence from the date of acceptance inspection of the work and shall be for a minimum period of twelve (12) months. The maintenance security deposit shall be refunded upon satisfactory final inspection and completion of the maintenance security period. Please provide the name and address to whom the refund is to be sent.

Notice of Commencement is to be provided to Water Assessment Development Engineer via <u>waterandseweroworks@centralcoast.nsw.gov.au</u> at least ten(10) business days prior to commencement of works on site. Once all above-mentioned information are received, a precommence meeting is to be held on site (to be advised by Development Engineer) at least five (5) business days prior to commencement on site

Council requires certified Work as Executed drawings to be submitted to waterandsewerworks@centralcoast.nsw.gov.au within one (1) month of completion of the contractor's work and prior to Council carrying out the acceptance test. The work as executed

detail must cover sewer asset detail from existing manhole KN/13 to existing manhole KZ/01. Work as Executed plans shall be files (email only)) submitted in AutoCad.dwg; Dxf; format in Map Grid or Australia Zone 56 (MGA-56); levels to Gosford Wyong Regional Datum (GWRD) and Excel or CSV file with XYZ MGA-56 co-ordinates and attributes for all water and sewer assets. Include eg. for mains: size; material; manufacturer and assets (fittings): diameter; material; manufacturer, in conjunction with two (2) paper copies of the Work as Executed plan.

A road opening permit at the developer's cost must be obtained from the appropriate road authority. Please note it is the developer's responsibility to obtain relevant approvals from the RMS. A permit to open a Council road may be obtained by contacting Council's Infrastructure Engineer on (02) 4325 8849 before construction can commence in the road reserve.

Council's assessment and subsequent approval of this plan has been based upon information / circumstances provided by the developer or his representative. Approval may be withdrawn should this information be proven inaccurate.

Water Authority requirements with regards building over and adjacent to sewer and water supply assets for the subject development are addressed under separate cover.

All works are to be accepted by Council and all fees paid prior to the issue of an unconditional Section 307 Certificate.

Further enquiries regarding this matter may be made by contacting Council Officer Johnson Zhang, on (02) 4350 5766.

Yours faithfully

Johnson Zhang Team Leader – Water Assessment and Design



# Appendix C6

# **Detailed Water Balance**

A detailed water balance for each stage of works with assumptions, peak and average daily flows, source/ demand and supply volumes

19

7,104

# **Forecast - Full Development**

@

60%

Potable Water		Stage 1		Stage 2			Stage 3 (Full Development)		
Daily Volume	Annual	Average	Peak	Annual	Average	Peak	Annual	Average	Peak
Purchased from Council (kL)	11,840	32	49	19,565	54	80	21,740	60	89
Delivered to Customers (kL)									
Potable	5,440	15	22	9,265	25	38	10,540	29	43
Non-potable	3,600	10	15	6,300	17	26	7,200	20	30
Sewer		Stage 1			Stage 2		Stage	3 (Full Develop	oment)
Daily Volume (kL)	Annual	Average	Peak	Annual	Average	Peak	Annual	Average	Peak

11,739

32

48

13,044

29

36

54



# Assumptions used for modelling

The volumes are projected from actual metered data from Stage 1 of the development.

# Storage requirements

Potable water reservoir 450kL

Non-potable water reservoir 120kL

Sewer buffer storage 360kL

# Peaking factors

Potable and non-potable water consumption 50% above average

# All waste streams and fate of waste/s

All sewage is disposed to council sewer mains

## **Irrigation models**

Not applicable.



# Appendix C.7

# Volume details for services supplied

# **Drinking water**

Potable water is sourced from council via an existing 50mm meter at the site boundary as a temporary arrangement.

Council have agreed that NEV will upgrade council's Research Road water main to 150mm during Stage 2 civil works and the permanent potable water connection will be via a new 90mm meter at the site boundary.

Modelled maximum demand at full development is 4L/s.

Modelled daily extraction rate from council supply at full development is 60kL per day average and 89kL per day peak.

# Non-potable water

Non-potable water is sourced from the village potable water supply.

# Sewage

The site is connected to council sewer via a rising main. A second gravity connection to council sewer is proposed in Stage 2.

The scheme is forecast to deliver 36kL per day average and 54kL per day peak of sewage at full development.

Appendix 4.1.9.1 Narara Eco Village Assessment Summary Paper



# Risk Assessment Summary Paper

# for the proposed potable water supply system at Narara Ecovillage

30 March 2014







# **Risk Assessment Summary Paper**

# for proposed potable water supply system at Narara Ecovillage

30 March 2014

City Water Technology Pty Ltd ABN 92 052 448 094 26 / 924 Pacific Highway, Gordon, NSW 2072, Australia T: +61 2 9498 1444 F: +61 2 9498 1666 W: www.citywater.com.au E: contact@citywater.com.au

in conjunction with

Risk Edge™ Pty Ltd ABN 43 143 242 399 PO Box 268, Killara NSW 2071 T: +61 (0)411 049 544 W: www.riskedge.com.au E: contact@riskedge.com.au

# DOCUMENT ISSUE RECORD

Issue Date	Revision	Issue	Issued To	Prepared By	Approved By
28 <sup>th</sup> March 2014	A	Preliminary	Risk Edge Pty Ltd	S. Loder	-
30 <sup>th</sup> March 2014	В	First release	Aquacell	A. Davison, S. Loder	S. Loder





# **Executive Summary**

# Workshop Background

The Water Industry Competition Act 2006 (NSW) (WICA), which came into effect on 8 August 2008, was developed to encourage competition in the water industry and foster innovation and efficiency<sup>1</sup> while also ensuring the continued protection of public health, consumers and the environment<sup>2</sup>. WICA requires entities (other than public water utilities) to obtain a licence to construct, maintain or operate any water infrastructure, to supply water or to provide sewerage services<sup>3</sup>. WICA is supported by the Water Industry Competition (General) Regulation 2008 (NSW) (WICR), which sets out the matters a licence application must address, standard licence conditions and the retailer of last resort provisions.<sup>4</sup> The legislation is administered by the Department of Finance and Services while administration of licences under WICA/WICR is performed by IPART.

As part of the WICA licensing requirements, the applicant must develop a management plan ('Water Quality Plan') for the water supply scheme. Aquacell, which already holds a Network Operator and a Retail Supplier Licence<sup>5</sup> for non-potable water, is applying for the first potable water scheme licence. The Water Quality Plan must be based on the 12 elements of the *Framework for Management of Drinking Water Quality* (within the current version of the Australian Drinking Water Guidelines) and must include the undertaking of a comprehensive risk assessment of the water supply system from catchment to tap.<sup>6</sup>

The workshop was convened to fulfil this part of the WICA/WICR requirements.

# Workshop Objective

The objectives of the workshop were to:

- Understand the system from catchment to tap from a water quality perspective;
- Understand and prioritise (assess) the events, hazards and risks to drinking water consumers;
- Identify the control measures in place for addressing the identified events, hazards and risks; and
- Identify any additional controls or actions which may be required to improve the risk management and/or system understanding of the scheme.

# Workshop Outline

The outline of the workshop was to:

- Describe the methodology to be used in the workshop;
- Present what was known about water quality risks relating to the source;
- Present knowledge on the proposed Narara Ecovillage's potable water supply system; and
- Capture participant consensus on risks and appropriate controls including identification of further actions to reduce risk where risk was considered unacceptable.

<sup>&</sup>lt;sup>1</sup> Source: NSW Office of Water website (Department of Primary Industries 2012)

<sup>&</sup>lt;sup>2</sup> Source: WICA Fact Sheet: Overview of licensing regime under the Water Industry Competition Act 2006 (IPART 2008a)

<sup>&</sup>lt;sup>3</sup> Source: WICA Fact Sheet: Who needs a licence under the Water Industry Competition Act 2006? (IPART 2008c)

<sup>&</sup>lt;sup>4</sup> Source: IPART website (IPART n.d.)

<sup>&</sup>lt;sup>5</sup> Source: IPART website (IPART 2009)

<sup>&</sup>lt;sup>6</sup> Source: WICA Fact Sheet: *Potable water services – Public health requirements* (IPART 2008c)



# Risk Summary

A total of 61 hazardous events were identified for the Narara Ecovillage (NEV) potable water supply system with 'uncontrolled' or 'maximum risks (before mitigation) and 'controlled' or 'residual' risks (after mitigation) as summarised in the tables below. Refer to Section 5 for definition of risks. A total of 53 actions were identified to address the risks and improve system understanding.

# Maximum Risk Summary (Before Mitigation) - No. of risks by location in water supply system

System Components	Low	Moderate	Significant	High	Not Rated <sup>7</sup>	Grand Total
Catchment		1		3	3	7
Source Water (Dam)	1	1			4	6
Break Tank	1					1
Microfiltration			2	1		3
UV Disinfection		1	3		1	5
Chlorine Disinfection				4	1	5
Calcite Filter					1	1
Potable Water Storage Tank			2	1	1	4
Distribution System			5	4	9	18
General/ Whole of System		1	3		3	7
TOTAL	2	4	13	18	24	61

<sup>&</sup>lt;sup>7</sup> Uncertain or not considered to be an issue for NEV at this point in time. 'Uncertain' risks will need to be reviewed following implementation of the actions to address improvements in system understanding.



System Components	Low	Moderate	Significant	High	Not Rated <sup>7</sup>	Grand Total
Catchment	3			1	3	7
Source Water (Dam)	2				4	6
Break Tank	1					1
Microfiltration	3					3
UV Disinfection	3	1			1	5
Chlorine Disinfection	5					5
Calcite Filter	1					1
Potable Water Storage Tank		3			1	4
Distribution System	2		1	2	13	18
General/ Whole of System	3	2		2	4	11
TOTAL	23	6	1	5	26	61

# Residual Risk Summary (After Mitigation) - No. of risks by location in water supply system



# Comparison of Risks Before and After Mitigation

As seen in the graph above, a number of identified risks were not rated during the workshop due to either uncertainty or because they were not considered by the workshop to be an issue for the NEV system. There were a greater number of unrated residual risks (after mitigation) than maximum risks (before mitigation) and this reflects some uncertainty regarding preventative measures. It is expected that much of this uncertainty will be resolved once further details of the system and its operation have been finalised.


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# 1 Introduction

The Australian Drinking Water Guidelines (ADWG) (NHMRC/NRMMC, 2011) set out a holistic approach to drinking water management including understanding where sources of contamination may arise and how contamination may find its way to the consumer. The approach is termed the Framework for Management of Drinking Water Quality (the Framework, Figure 1-1). As part of the WICA/WICR licensing requirements, the applicant must develop a management plan for the water supply scheme, which meets the 12 Elements of the Framework<sup>8</sup>.



### Figure 1-1: The Framework for Management of Drinking Water Quality<sup>9</sup>

A significant component of the Framework is understanding and managing the risks to drinking water and formed the basis of the workshop.

The list of participants and workshop agenda are provided in Appendix A.

<sup>&</sup>lt;sup>8</sup> Source: WICA Audit Guideline for Greenfield Schemes (IPART 2013)

<sup>&</sup>lt;sup>9</sup> Source: NHMRC/NRMMC (2011)

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## 2 Water Quality Risk Assessment - A Background

### 2.1 ADWG Risk Assessment Components

Element 2 of the Framework provides the following information for undertaking a risk assessment on a water supply system (the section where the specific information is addressed in this paper is shown in brackets).

Water supply system analysis:

- Assemble a team with appropriate knowledge and expertise (Appendix A).
- Construct a flow diagram of the water supply system from catchment to consumer (Section 3.3).
- Assemble pertinent information and document key characteristics of the water supply to be considered (Sections 3 and 4).

Assessment of water quality data:

- Assemble historical data from source waters, treatment plants and finished water supplied to consumers (Section 4 note: limited raw water quality data only available at this stage).
- List and examine exceedances (Section 4).
- Assess data using tools such as control charts and trend analysis to identify trends and potential problems (note: water quality graphs/ trends not available at this stage)<sup>10</sup>.

Hazard identification and risk assessment:

- Define the approach and methodology to be used for hazard identification and risk assessment (Section 5)<sup>11</sup>;
- Identify and document hazards, sources and hazardous events for each component of the water supply system (Workshop Activity);
- Estimate the level of risk for each identified hazard or hazardous event (Workshop Activity);
- Evaluate the major sources of uncertainty associated with each hazard and hazardous event and consider actions to reduce uncertainty (Workshop Activity); and
- Determine significant risks and document priorities for risk management (Workshop Activity).

### 2.2 WICA Risk Assessment Components

The Water Quality Plan, water supply system risk assessment component of the WICA Audit Guideline for Greenfield Schemes (IPART 2013), is similarly based on the Framework information listed above.

<sup>&</sup>lt;sup>10</sup> Note that data analysis was not part of CWT's brief. The data analysis presented in the paper was provided by Aquacell.

<sup>&</sup>lt;sup>11</sup> Note that Aquacell's risk assessment methodology will be used in this workshop, considering also likelihood and consequence descriptors provided in ADWG 2011.



## 3 System Description

### 3.1 Catchment Context

The Narara Ecovillage will be located off Research Road, Narara (Figure 3-1), which is on the outskirts of the NSW Central Coast suburb. The site, formerly occupied by the Gosford Horticultural Institute, is within a sparsely developed area bordering Strickland State Forest.



#### Figure 3-1: Proposed site of the Narara Ecovillage<sup>12</sup>

The proposed water source is a nearby irrigation dam (Figure 3-2) which is fed by a tributary of Narara Creek. The dam, which is surrounded mostly by State Forest, has a capacity of approximately 45 ML and a catchment area of 130 hectares<sup>13</sup>, the boundaries of which have not yet been clearly defined. There are few roads in the area although the risk posed by the Pacific Motorway (located approximately 2.8 km to the west) is currently uncertain. Activities and hazards within Strickland State Forest (such as from recreation, use of hazardous chemicals, feral animals and associated baiting programs) are also uncertain at this stage.

An investigation into the dam's water quality was conducted by Woodlots and Wetlands Pty Ltd on behalf of Narara Ecovillage in 2013 and these results are presented in Section 4 below.

<sup>12</sup> Source: Google Maps

<sup>&</sup>lt;sup>13</sup> Source: An integrated water cycle management strategy for the proposed Eco-village at Lot 1 DP 1087535 Research Road Narara (Woodlots and Wetlands Pty Ltd 2013)

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Figure 3-2: Proposed water source for the Narara Ecovillage (Source: Google Maps)



### 3.2 System Overview

An overview of the proposed water supply system is provided in Table 3-1.

#### Table 3-1: Proposed Water Supply System – Overview Description

SYSTEM COMPONENT	DESCRIPTION
Population Supplied	To be confirmed. Note: Stage 1 Development Application includes 60 dwellings <sup>14</sup> and the full development is expected to include some 100 to 130 dwellings <sup>15</sup> . Assuming 5 people per dwelling <sup>16</sup> , estimated population is 300 for Stage 1 and up to 650 at full development.
Proposed Water Source	Dam
Proposed Water Storage (Before Treatment)	Break Tank (pumped from dam)
Proposed Water Treatment	<ul> <li>Proposed Water Treatment Plant (70 kL/day):</li> <li>Membrane filtration (ultrafiltration)</li> <li>Ultraviolet disinfection</li> <li>Chlorine disinfection (sodium hypochlorite) (provides an additional disinfection step as well as providing a distribution system chlorine residual)</li> <li>Stabilisation and corrosion control (Calcite filter)</li> </ul>
Proposed Water Storage (After Treatment)	Potable Water Storage Tank (roofed, capacity to be determined)
Proposed Distribution of Product	Pumped supply to households and other dwellings within Narara Ecovillage as drinking water (53 kL/day) as well as to recycled water plant for use as make-up water (up to 17 kL/day)
Any Special Controls Required <sup>17</sup>	Quality of chemicals, materials etc used in the production and delivery of the product. Manual verification sampling of water from the distribution network. Backflow prevention. Operation and maintenance of all infrastructure to prevent recontamination.

<sup>&</sup>lt;sup>14</sup> Source: Narara Ecovillage website

<sup>&</sup>lt;sup>15</sup> Source: An integrated water cycle management strategy for the proposed Eco-village at Lot 1 DP 1087535 Research Road Narara (Woodlots and Wetlands Pty Ltd 2013)

<sup>&</sup>lt;sup>16</sup> Source: An integrated water cycle management strategy for the proposed Eco-village at Lot 1 DP 1087535 Research Road Narara (Woodlots and Wetlands Pty Ltd 2013)

<sup>&</sup>lt;sup>17</sup> There is unlikely to be a requirement for trade waste management given the nature of the development.



### 3.3 Process Flow Diagram

Preliminary conceptual flow diagrams for the potable water supply system and the proposed water treatment plant are shown in Figure 3-3 and Figure 3-4, respectively. The purpose of these diagrams is to show key inputs, steps and flow direction for the proposed system.



#### Figure 3-3: Process Flow Diagram for the Proposed Water Supply System





Figure 3-4: Process Flow Diagram for Proposed 70kL/day WTP<sup>18</sup>

<sup>&</sup>lt;sup>18</sup> Source: Aquacell 2014

# 4 Water Quality Risks

### 4.1 Risks Identified in Previous Studies

A study of water quality in the catchment was undertaken by Woodlots and Wetlands Pty Ltd on behalf of Narara Ecovillage in 2013. The results of the analyses are provided in Table 4-1. However, it should be noted that the results are for only one grab sample and do not represent a range of data. An action was identified during the risk assessment to increase the body of water quality data to build information on overall water quality trends and data ranges.

ATTRIBUTE	UPSTREAM	DAM WALL	COMMENT
Conductivity (EC) (dS/m)	4.78	5.63	A bit low, but reflects sandstone geology
Total dissolved salts (mg/L)	0.15	0.12	Good
Turbidity (NTU)	3	2	Very good, as low turbidity facilitates UV disinfection
Alkalinity (mg/L as CaCO <sub>3</sub> )	1	3	Would prefer higher
Water Hardness (mg/L as CaCO <sub>3</sub> )	13	12	Would prefer higher
Nitrate (mg/L N)	<0.005	<0.005	Good
Nitrite (mg/L N)	0.002	0.003	Good
Total Coliforms (cfu/100 mL)	1,710	460	High. Has to be zero therefore disinfect. $^{\rm 20}$
<i>E. coli</i> (cfu/100 mL)	110	130	High. Has to be zero therefore disinfect.
Aluminium (mg/L)	0.426	0.191	OK <sup>21</sup>
Arsenic (mg/L)	0.001	<0.001	OK
Cadmium (mg/L)	<0.001	<0.001	OK
Chromium (mg/L)	0.001	0.001	OK
Copper (mg/L)	0.001	0.001	OK
Iron (mg/L)	0.689	0.391	Minor staining could be an issue. <sup>22</sup>
Manganese (mg/L)	0.012	0.034	OK
Nickel (mg/L)	0.001	0.001	OK
Lead (mg/L)	<0.001	<0.001	OK
Zinc (mg/L)	0.008	0.004	OK

#### Table 4-1: Raw Water Quality Upstream of and Within the Dam (sampled 19/03/2013)<sup>19</sup>

<sup>&</sup>lt;sup>19</sup> Source: Table 10.6, *An integrated water cycle management strategy for the proposed Eco-village at Lot 1 DP 1087535 Research Road Narara* (Woodlots and Wetlands Pty Ltd 2013)

<sup>&</sup>lt;sup>20</sup> ADWG 2011 does not specify a guideline value for total coliforms however this can be an important operational indicator

<sup>&</sup>lt;sup>21</sup> ADWG 2011 aesthetic limit for acid-soluble aluminium is 0.2 mg/L

<sup>&</sup>lt;sup>22</sup> ADWG 2011 aesthetic limit for iron is 0.3 mg/L



The study concluded that while most parameters met ADWG 2011, microbial loads in the source water were noted and disinfection will be required to provide water of a potable standard. Low hardness and alkalinity were also noted, presenting a possibility of corrosion of pipework, and storage of dam water in concrete tanks was recommended.



## 5 Risk Assessment Process

### 5.1 Risk Assessment Methodology

Events and hazards were identified for each process step. Risks posed by each of the events were assessed. Participants were asked to identify the:

Hazardous event	A hazardous event is one that introduces contaminants (hazards) to the water.
	For this risk assessment the hazardous event will be for the level of contamination to be unacceptable for treatment through the downstream processes. Examples of a hazardous events include:
	<ul> <li>Algal blooms (toxic and non-toxic strains) resulting in poor water quality</li> <li>Contamination of reservoir by pests (possums etc.), infiltration from roof, illegal access, corrosion or sediment build-up resulting in poor water quality</li> </ul>
Hazard	A hazard is a physical, chemical or biological agent in the water with the potential to cause an adverse effect.
	Examples of hazards include:
	• Human-infectious pathogens such as Salmonella and Cryptosporidium
Controls in place	Controls are practices and equipment that reduce the hazard or the hazardous event.
	Examples of controls include:
	<ul> <li>Dam management program to reduce the potential for algal blooms</li> <li>Proposed water treatment plant</li> <li>Backflow prevention program</li> </ul>
Controlled Risk (After Mitigation)	Controlled or 'residual' risk was assessed by identifying the likelihood and consequence of the hazardous event occurring with the control in place. The risks were assessed as Likelihood (Table 5-1) + Consequence (Table 5-2).
	A risk assessment matrix was used to assess risks to the identified end uses (Table 5-3).
Maximum Risk (Before Mitigation)	Likelihood and consequence of the hazardous event occurring if the controls were to fail or are inadequate.

The results were captured during the workshop via an Excel® spreadsheet.

'Workshop Starters' were provided to help facilitate discussion during the workshop.



### Table 5-1: Likelihood Table

DATINC		LIKELIHOOD OF OCCURRENCE	
KATING		Aquacell 2011 Descriptor	ADWG 2011 Descriptor
Almost Certain	5	The event <i>will occur</i> within the planning period (Chance of <i>daily</i> occurrence)	ls expected to occur in most circumstances
Likely	4	The event is <i>likely to occur</i> once a week within the planning period (Chance of <i>weekly</i> occurrence)	Will probably occur in most circumstances
Possible	3	The event <i>may occur</i> within the planning period (Chance of <i>monthly</i> occurrence)	Might occur or should occur at some time
Unlikely	2	The event <i>not likely to occur</i> in the planning period (Chance of <i>annual</i> occurrence)	Could occur at some time
Rare	1	The event will only occur in exceptional circumstances	May occur only in exceptional circumstances

### Table 5-2: Consequence Table

		AREA OF IMPACT		
RATING <sup>23</sup>		Customer Service (Aquacell 2011)	<b>Regulatory/ Legal</b> (Aquacell 2011)	Water Quality (ADWG 2011)
Extreme	5	Virtually all customers are effected	Significant legal, regulatory or internal policy failure Loss of licence(s)	Major impact for large population, complete failure of systems
Major	4	Significant portion of customers effected	Major legal, regulatory or internal policy failure Imposition of licence conditions	Major impact for small population, systems significantly compromised and abnormal operation if at all, high level of monitoring required
Moderate	3	Customer or community segment effected	Major legal, regulatory or internal policy failure Imposition of licence conditions	Minor impact for large population, significant modification to normal operation but manageable, operation costs increased, increased monitoring
Minor	2	Separate group(s) of customers effected	Minor legal, regulatory or internal policy failure	Minor impact for small population, some manageable operation disruption, some increase in operating costs
Insignificant	1	Individual customer effected	Insignificant legal, regulatory or internal policy failure	Insignificant impact, little disruption to normal operation, low increase in normal operation cost

<sup>&</sup>lt;sup>23</sup> Source: *Risk Management Procedure* (Aquacell 2011)

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#### Table 5-3: Risk Rating Matrix<sup>24</sup>



### 5.2 Risk Summary

A total of 61 hazardous events were identified for the Narara Ecovillage (NEV) potable water supply. All events have been captured within an Excel-based Risk Register.

Prior to the workshop, the Risk Register template was populated with typical hazardous events relevant to similar systems for consideration. During the workshop, these hazardous events were redefined, added to and subtracted from as required in order to produce a list relevant to NEV.

Note that 'uncertainty' was captured along with any other comments within the Risk Register. The register will need to be reviewed at a set frequency and/or on system changes to satisfy the requirements of WICA/WICR as well as the Framework. The Risk Register, as determined at this workshop, is presented in Appendix B.

Risks remaining 'High' after controls were assessed were as follows:

- Bushfire followed by heavy storm resulting in ash, nutrients washing into the dam;
- Cross connections with recycled water system or any other non-potable sources (e.g. firefighting tank);
- Illegal/unknown connections resulting in introduction of unknown hazards;
- Catastrophic system failure, e.g. bushfire, flood or earthquake taking out key infrastructure e.g. WTP or pump station; and
- Human actions (sabotage).

<sup>&</sup>lt;sup>24</sup> Source: *Risk Management Procedure* (Aquacell 2011)



A single risk remained 'Significant' after controls were assessed:

• Lack of chlorine residual at system extremities.

Risk reduced from 'High' to 'Low' or 'Moderate' with controls in place were as follows:

- Recreation and camping (residents and public) leading to raw water quality that is difficult to treat;
- Faecal matter (including feral animals) and erosion products from agriculture (horticulture and animal husbandry) and forestry reaching waterways and causing a water quality problem in dam;
- Excessive turbidity interfering with the efficiency of the UV disinfection system;
- Insufficient chlorine dose leading to inadequate C.t (contact time x dose) and poor disinfection by chlorine system;
- Insufficient contact time leading to inadequate C.t (contact time x dose) leading to poor disinfection by chlorine system;
- Underdosing from insufficient chemical in dosing tank or equipment failure;
- Overdosing of chlorine;
- Contamination of reservoir by pests (possums etc.), infiltration from roof, illegal access, corrosion or sediment build-up resulting in poor water quality;
- Use of non-potable water (e.g. recycled water) as though it were treated drinking water;
- Significant operator/ contractor error resulting in poor water quality; and
- Failure of critical monitoring devices resulting in unknown water quality.

Risk reduced from 'Significant' to 'Low' or 'Moderate' with controls in place were as follows:

- Membranes may be compromised by cleaning resulting in reduced pathogen removal;
- Membrane breach resulting in pathogen breakthrough;
- Low UV dose leading to poor UV disinfection or UV lamp failure or a fault with the system;
- Excessive micro-organisms in filtrate, above the design value. (Biological contaminants pose a risk to humans via skin contact, inhalation or accidental ingestion). Lamp tube fouling;
- Lamp breakage leading to disinfection failure;
- Poor water quality due to low turnover (including loss of residual disinfectant);
- Low mixing causing dead spots/short circuiting (common inlet outlet) exacerbates water age problems and causing poor water quality;
- Delivery pipes and fittings leaking or bursting;
- Dead ends in reticulation systems leading to stagnation and water quality issues; and
- Incorrect or reduced quality of materials or chemicals resulting in potential for water quality contamination.
- An overall summary of the uncontrolled ('maximum') and controlled ('residual') risks is presented in tabular and graphical form below.



Table 5-4: Maximum Risk Summary (Before Mitigation) - No. of risks by location in water supply system

System Components	Low	Moderate	Significant	High	Not Rated <sup>7</sup>	Grand Total
Catchment		1		3	3	7
Source Water (Dam)	1	1			4	6
Break Tank	1					1
Microfiltration			2	1		3
UV Disinfection		1	3		1	5
Chlorine Disinfection				4	1	5
Calcite Filter					1	1
Potable Water Storage Tank			2	1	1	4
Distribution System			5	4	9	18
General/ Whole of System		1	3		3	7
TOTAL	2	4	13	18	24	61

#### Table 5-5: Residual Risk Summary (After Mitigation) - No. of risks by location in water supply system

System Components	Low	Moderate	Significant	High	Not Rated <sup>7</sup>	<b>Grand Total</b>
Catchment	3			1	3	7
Source Water (Dam)	2				4	6
Break Tank	1					1
Microfiltration	3					3
UV Disinfection	3	1			1	5
Chlorine Disinfection	5					5
Calcite Filter	1					1
Potable Water Storage Tank		3			1	4
Distribution System	2		1	2	13	18
General/ Whole of System	3	2		2	4	11
TOTAL	23	6	1	5	26	61





Figure 5-1: Comparison of Risks Before and After Mitigation

As seen in the graph above, a number of identified risks were not rated during the workshop due to either uncertainty or because they were not considered by the workshop to be an issue for the NEV system. There were a greater number of unrated residual risks (after mitigation) than maximum risks (before mitigation) and this reflects some uncertainty regarding preventative measures. It is expected that much of this uncertainty will be resolved once further details of the system and its operation have been finalised.

A total of 53 actions were identified in the workshop to address the identified risks. In particular, four main areas for improvement were identified as follows:

- System Understanding:
  - Improve understanding of catchment risks by defining the catchment boundaries and liaising with various parties to identify activities within the catchment area.
  - Conduct further sampling and analysis to better understand the expected range of raw water quality within the dam.
- Process Train:
  - Finalise aspects of proposed system design including off-specification water diversion, log reductions, potable water tank design, distribution system design and interactions with firefighting system.
  - o Identify and document critical control points and corrective actions.
- System Processes:
  - Develop NEV policies for ongoing water quality protection including plumbing requirements and protocols, backflow protection, cross connection prevention, trade waste management and management of materials and chemicals.
- Roles and Responsibilities:
  - Define roles and responsibilities and associated training requirements.

An Action List has been developed and is presented in Appendix C.



# 6 References

Aquacell Pty Ltd 2011, *Risk Management Procedure*, Revision 5, 20 December 2011, provided by C. Fisher of Aquacell on 18/03/2014

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- Woodlots and Wetlands Pty Ltd 2013, An integrated water cycle management strategy for the proposed Ecovillage at Lot 1 DP 1087535 Research Road Narara, report prepared for Narara Ecovillage Co-operative Ltd, version 4.3, 6 May 2013, provided by S. Valenzisi on 19/03/2014



# Appendix A Workshop Details

#### Workshop Agenda

ITEM	DESCRIPTION
Date/Time	24 <sup>th</sup> March 2014 / 9:00 am for a 9:30 am start to 5:00 pm
Venue	Syndicate Room 9, MGSM Conference Centre, Level 7, 37 Pitt Street, Sydney
Contacts	Colin Fisher, (02) 4721 0545, colinf@aquacell.com.au (Aquacell representative) Sarah Loder, (02) 9498 1444, sarah@citywater.com.au (Consultant representative)

TIME SESS	ION ITEM		PERSON
Monday 24 <sup>th</sup> M	arch 2014		
09:00 - 09:30	Arrival	Arrival and tea/coffee	All
09:30 - 09:40	Welcome	Introduction roundtable	City Water Technology (CWT)
09:40-09:45	Introduction	Overview of project	Aquacell
09:45 – 10:15	System Description	Scope of workshop Description of the water supply system including catchment description and presentation of flow diagram	CWT
10:15 - 10:30	Break	Morning tea	All
10:30 - 10:45	Flow Diagram	Workshop to confirm flow diagram	All facilitated by CWT
10:45 - 11:00	Workshop Overview	Workshop methodology	CWT
11:00 - 12:30	Risk Assessment	Events, Hazards, Risks and Controls: Workshop events, hazards, identify control measures then assess 'maximum' and 'residual' risks and identify any additional controls required	All facilitated by CWT
12:30 - 13:00	Break	Lunch	All
13:00 - 16:45	Risk Assessment	Continued	All facilitated by CWT
16:45 - 17:00	Close	Workshop close and next steps	CWT



### Workshop Participants

NAME	ORGANISATION
John Talbott	Narara Ecovillage
Geoff Cameron	Narara Ecovillage
Katrina Wall	NSW Health – Water Unit
Kerry Spratt	NSW Health – Central Coast Area Health Unit
Maria Morahan	IPART
Colin Fisher	Aquacell
Gerin James	Aquacell
Belinda Layson	Aquacell
Dr Annette Davison	Risk Edge Pty Ltd (for City Water Technology Pty Ltd)
Sarah Loder	City Water Technology Pty Ltd

### Other Workshop Invitees - Apologies

NAME	ORGANISATION
Warren Johnson	Aquacell



# Workshop Attendance Sheet

Event	Risk Assessment Workshop	
Purpose	WICA Risk Assessment Workshop	
Date / Time	24 <sup>th</sup> March 2014 / 9:00 am for a 9:30 am start to 4:00 p	m
Venue	Syndicate Room 9, MGSM Conference Centre, Level 7,	37 Pitt Street, Sydney
Name	Organisation	Signature
John Talbott	Narara Ecovillage	Stalkoll
Geoff Cameron	Narara Ecovillage	- gla
Katrina Wall	NSW Health – Water Unit	KeDay
Kerry Spratt	NSW Health – Central Coast Area Health Unit	KSA.
Maria Morahan	IPART	litho.
Warren Johnson	Aquacell	APOLOGY
Belinda Layson	Aquacell	Regen
Colin Fisher	Aquacell	(92re)
Dr Annette Davison	Risk Edge Pty Ltd (for City Water Technology Pty Ltd)	AD_
Sarah Loder	City Water Technology Pty Ltd	datch
Gerin James	Dynacell	a
lkacy	l	



# Appendix B Risk Register

		<b>DESIGN / CONCEPT STAGE HACCP</b>		Before Mitigation After						er Mitigation	I			
Risk	Step	Potential Hazard	Preventative Measure	L	С	Maxim	um Risk	L	С	Residu	ual Risk	Uncertainty	Basis/ Notes	Further Actions
No.	Process unit	Physical, chemical, biological, other		1 to 5	1 to 5	Score	Risk Level	1 to 5	1 to 5	Score	Risk Level			
Cmt1	1. Catchment	Biological and physical hazards Recreation and camping (residents and	Water treatment plant (proposed)	4	5	(D + E) 9	High	1	4	(D + E) 5	Low		ALARP	NEV to consider recreational management policy. NEV to liaise with Strickland State Forest managers regarding
		public) leading to raw water quality that is difficult to treat	Gated community Residents aware that dam is water source											location of walking tracks etc. NEV to obtain a definitive map of catchment including aerodrome etc.
			Community rules											
Cmt2	1. Catchment	Biological, physical and chemical hazards Faecal matter (including feral animals) and erosion products from agriculture (horticulture and animal husbandry) and forestry reaching waterways and causing a water quality problem in dam	Water treatment plant (proposed)	4	5	9	High	1	4	5	Low			NEV to double-check land use in area (including agriculture). NEV to liaise with Strickland State Forest regarding feral animal populations and associated baiting programs etc.
Cmt3	1. Catchment	Biological and physical hazards Periodic changes in raw water quality leading to difficulty in treating raw water and increased chlorine demand	Water treatment plant (proposed)			Uncertain	Not rated			Uncertain	Not rated	High uncertainty due to lack of historical data - risk ratings to be determined once further data available.		Aquacell to establish raw water sampling program (capture a range of weather conditions, seasonal changes as much as possible). Include TOC/DOC, dissolved iron and aluminium, colour, turbidity, nutrients plus gross alpha and gross beta (one-off). Refer to Woodlots and Wetlands report for hydrogeology.
Cmt4	1. Catchment	Biological, physical and chemical hazards Eutrophication resulting in low DO, high nutrients, increased possibility of algal blooms causing taste and odour, toxin production, mineral mobilisation resulting in poor water quality	Water treatment plant (proposed)	2	4	6	Moderate	1	4	5	Low		Not considered to be a problem for this system.	
Cmt5	1. Catchment	Physical and chemical hazards Bushfire followed by heavy storm resulting in ash, nutrients washing into the dam	Water treatment plant (proposed)	1	5	6	High	1	5	6	High	Some uncertainty as to whether WTP would be a control - depends on extent of bushfire and rainfall.		NEV to consider water quality issues in bushfire management plan including alternate sources such as leaving town water connected to one of the public buildings, carting water. Liaise with Strickland State Forest, RFS and GCC.
Cmt6	1. Catchment	Physical and chemical hazards Road crossings, accidents and spills, unsealed roads leading to water quality issues	Water treatment plant (proposed)			Uncertain	Not rated			Uncertain	Not rated	Risk ratings to be determined once catchment boundary has been defined.		NEV to define catchment area. NEV to identify relevant stakeholders in incident management plan (HAZMAT, EPA, Police, Fire, NSW Health).
Cmt7	1. Catchment	<i>Biological hazards</i> Failing onsite sewage management systems in catchment leading to high levels of pathogens in source water	Water treatment plant (proposed)			Uncertain	Not rated			Uncertain	Not rated	Risk ratings to be determined once further information has been obtained.	There do not appear to be neighbouring onsite sewage management systems close to waterway. Note that there is an animal shelter on Reeves St which might have a treatment plant. The NEV site does have some onsite sewage management systems downstream of dam.	NEV to identify onsite sewage management systems by liaising with GCC.
Damı	2. Source water (dam)	Biological hazards Dead animals decaying and leaching nutrients resulting in poor water quality entering dam	Water treatment plant (proposed)	2	4	6	Moderate	1	4	5	Low			Dam management plan to be developed by NEV/Aquacell including how this fits with WICA licence.
Dam2	2. Source water (dam)	Chemical and physical hazards Dam stratification/ inversion leading to release of Fe and Mn and turbidity	Shallow dam Water treatment plant (proposed)			Uncertain	Not rated			Uncertain	Not rated	Risk ratings to be determined once further information has been obtained.	Iron and aluminium were elevated in the one available raw water sample analysed to date. This risk is to be scored once more data has been obtained.	NEV to liaise with previous site manager regarding dam stratification/ inversion (including instances of T&O).
Dam3	2. Source water (dam)	Biological, physical and chemical hazards Potential stormwater entry into dam	Stormwater from NEV site will not flow to dam (to Narara Creek) Dilution Water treatment plant (proposed)	1	3	4	Low	1	2	3	Low			
Dam4	2. Source water (dam)	Biological, physical and chemical hazards Short-circuiting and rapid mixing and/or reduced detention time in the dam leading to poor quality water	Water treatment plant (proposed) has not been designed with dam as a barrier			Uncertain	Not rated			Uncertain	Not rated	Risk ratings to be determined once further information has been obtained.		Aquacell/NEV to check time from entry into dam to dam wall (refer Woodlots and Wetlands study).

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DESIGN / CONCEPT STAGE HACCP Before Mitigation After Mitigation														
Risk	Step	Potential Hazard	Preventative Measure	L	С	Maxim	um Risk	L	С	Residu	ual Risk	Uncertainty	Basis/ Notes	Further Actions
No.	Process unit	Physical, chemical, biological, other	1 Γ	1 to 5	1 to 5	Score	Risk Level	1 to 5	1 to 5	Score	Risk Level	]		
						(D + E)				(D + E)				
Dam5	2. Source	Biological, physical and chemical hazards	Water treatment plant			Uncertain	Not rated			Uncertain	Not rated	Risk ratings to be determined	Carbon (adsorption) not to be	NEV to liaise with previous site manager regarding this event
	water (dam)	Algal blooms (toxic and non-toxic strains)	(proposed)									once further information has	considered unless catchment	(including instances of T&O).
		resulting in poor water quality										been obtained.	management studies and raw	Aquacell/NEV to refer to Water Directorate website for algal
													water quality monitoring indicate	management protocols.
													otherwise.	
Dam6	2. Source	Biological, physical and chemical hazards	Water treatment plant			Uncertain	Not rated			Uncertain	Not rated	Risk ratings to be determined	NEV firefighting system likely to	NEV to include use of dam for firefighting in bushfire
	water (dam)	Use of the dam for firefighting resulting in	(proposed)									once further information has	use potable water from NEV	management plan.
		water quality contamination										been obtained.	reticulation for firefighting.	
BIK1	3. Break Tank	Biological, physical and chemical hazards	Good flow-through and not	2	3	5	Low	1	2	3	Low			Aquacell/NEV to include Break Tank in distribution reservoir
		water quality deterioration in Break Tank	excessive storage											management plan.
			Water treatment plant											
			(proposed)											
Flt1	4. Membrane	Biological hazard	Maintain membranes under a	2	4	7	Significant	1	2	3	Low			Aquacell/NEV to review where off-spec water will be diverted
	Filtration	Membranes may be compromised by	regular schedule.	5	-	, í		_	_	5				to and/or re-treated.
		cleaning resulting in reduced pathogen	Ensure all membranes are											
		removal.	replaced periodically.											
			Pressure differential alarm.											
			Pressure decay testing.											
			Still have UV and chlorine.											
			Filter to waste after clean and											
			can divert off-spec water.											
Flt2	4. Membrane	Biological hazard	Pressure decay testing.	3	4	7	Significant	1	2	3	Low		Residual risk score was based on	Aquacell to review the log reductions provided by current
	Filtration	Membrane breach resulting in pathogen	Still have UV and Cl2.										pressure decay testing being in	process train.
		breakthrough	Preventative maintenance										piace.	
			Filter to waste after clean and											
			can divert off-spec water											
Flto	/ Membrane	Biological and physical bazards	Filter to waste after clean and	2	F	8	High	1	2	4	Low			Aquacell/NEV to clarify what will happen to off-spec water in
1105	Filtration	Excessive turbidity interfering with the	can divert off-spec water.	5	5	Ŭ	i ngin	-	5	7	2011			this case.
		efficiency of the UV disinfection system	Turbidity meter is alarmed -											Aquacell/NEV to develop an incident response plan in
		, , , , , , , , , , , , , , , , , , , ,	high alarm diverts off-spec											consultation with NSW Health which includes notification to
			water.											NSW Health when a CCP is breached.
			Online turbidity meter.											
			UVI is alarmed and will shut											
			down plant for high alarm.											
UV1	5. UV	Biological hazard	UV intensity meter - alarmed	3	4	7	Significant	1	4	5	Low			Aquacell/NEV to develop CCP procedure for UV disinfection.
	disinfection	Low UV dose leading to poor UV disinfection												
		or UV lamp failure of a fault with the system	Lamp replacement program											
			Operator training											
			Fault alarms (e.g. ballast failure)											
			Still have chlorine for chlorine											
			sensitive pathogens.											
UV2	5. UV	Biological hazard	Controls on MF including	3	4	7	Significant	1	4	5	Low			
	disinfection	Excessive micro-organisms in filtrate, above	pressure decay testing.											
		the design value. (Biological contaminants	Online turbidity meter.											
		pose a risk to humans via skin contact,	UVI sensor - alarmed, system											
		inhalation or accidental ingestion). Lamp	shuts down for high alarm.											
		tube fouling	Locate UV after MF											
			dewestreem											
			Chlorine dosing for chlorine											
			sensitive pathogens.											
UV٦	5. UV	Physical hazard	Verification testing	2	4	6	Moderate	1	4	5	Low			
- 5	disinfection	Poor hydraulics through the UV (lack of	Equipment and installation		т				т					
		mixing) leading to short circuiting, high flows	compliant with certification of											
		through the UV above the design flow.	system.											
		-	Limiting maximum flow through											
			UV unit to flow capacity of unit.											
			Chlorine dosing for chlorine											
			sensitive pathogens.											

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		<b>DESIGN / CONCEPT STAGE HACCP</b>			Bef	ore Mitigatio	n		Aft	er Mitigation	า		
Risk	Step	Potential Hazard	Preventative Measure	L	С	Maxim	um Risk	L	С	Resid	ual Risk	Uncertainty	Basis/ Notes
No.	Process unit	Physical, chemical, biological, other		1 to 5	1 to 5	Score (D + E)	Risk Level	1 to 5	1 to 5	Score (D + E)	Risk Level		
UV4	5. UV disinfection	<i>Biological hazards</i> Lamp breakage leading to disinfection failure	On-line monitoring of the UVI. Production stopped. Reputable supplier. Operator training. Chlorine dosing for chlorine sensitive pathogens.	3	4	7	Significant	2	4	6	Moderate		Risk ratings were based o amalgam lamps from rep supplier.
UV5	5. UV disinfection	Biological hazard UVT outside of validated range leading to water not meeting log removal requirements	Factory calibrated standard sensor. Regular checks. Chlorine disinfection.			Uncertain	Not rated			Uncertain	Not rated	Risk ratings to be determined once further data has been obtained.	UVT will not be monitore
Clı	6. Chlorine disinfection	Biological hazard Insufficient chlorine dose leading to inadequate Ct (contact time X dose) and poor disinfection by chlorine system.	Upstream MF and UV System designed to USEPA Guidelines Alarms on Chlorine dosing system (low dose, high dose, high back pressure) Flow paced chlorine dosing system Flow switch through dosing cell Free residual chlorine monitoring Process interlocks (out of spec water diverted).	4	5	9	High	2	2	4	Low		Note temperature may a disinfection efficiency.
Cl2	6. Chlorine disinfection	Biological hazard Insufficient contact time leading to inadequate Ct (contact time X dose) leading to poor disinfection by chlorine system.	Upstream MF and UV System designed to USEPA Guidelines Design tanks so that minimum operating level provides required contact time. Baffle design in chlorine contact tank. Free residual chlorine monitoring	4	5	9	High	2	2	4	Low		
Cl <sub>3</sub>	6. Chlorine disinfection	Biological hazard Underdosing from insufficient chemical in dosing tank or equipment failure	Online chlorine level monitoring (alarmed) and visual indicator in dosing tank. Training of service technician. O&M program. Verification monitoring downstream. Process interlocks.	4	4	8	High	2	2	4	Low		Roles and responsibilitie currently being defined.
Cl4	6. Chlorine disinfection	Chemical hazard Overdosing of chlorine	Free residual chlorine monitoring Process interlocks Training of service technician. Customer complaints monitoring.	4	5	9	High	2	2	4	Low		
Cl5	6. Chlorine disinfection	<i>Biological and physical hazards</i> High pH in the water causing reduced disinfection efficiency	On-line pH meters on raw, contact tank and treated water and shut down and divert treated water delivery once pH out of range Still have MF and UV Verification monitoring downstream (program to be developed)			Uncertain	Not rated	1	2	3	Low	Maximum risk rating to be determined once further data has been obtained.	From available data, pH low but this is to be confi through additional moni
Cct1	7. Calcite Filter	Chemical hazard Failure of pH stabilisation leading to potential problems in distribution system	pH monitoring in potable water storage Visual monitoring of Calcite filter Operator training Verification monitoring downstream			Uncertain	Not rated	1	2	3	Low	Maximum risk rating to be determined once further data has been obtained.	Distribution system mate to be determined (likely copper internals)

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	Further Actions
ed on use of reputable	
ored.	Aquacell/NEV to obtain raw water quality data for colour.
iy also affect '.	Aquacell to confirm which guidelines the chlorine system is being designed to. Aquacell/NEV to develop CCP procedures in conjunction with NSW Health.
ties are :d.	
	Aquacell/NEV to consider whether water can be re-treated and prepare CCP procedure accordingly. Aquacell/NEV to consult EPA about environmental discharges or send out of spec water to Break Tank instead of dam.
oH was quite onfirmed onitoring.	Aquacell/NEV to undertake additional raw water quality monitoring.
naterials still ely poly mains,	Aquacell/NEV to undertake additional raw water quality monitoring. Aquacell to determine distribution system materials.



		<b>DESIGN / CONCEPT STAGE HACCP</b>			Befo	ore Mitigatio	n		Aft	er Mitigatior	1			
Risk	Step	Potential Hazard	Preventative Measure	L	C	Maxim	um Risk	L	С	Residu	Jal Risk	Uncertainty	Basis/ Notes	Further Actions
No.	Process unit	Physical, chemical, biological, other		1 to 5	1 to 5	Score	Risk Level	1 to 5	1 to 5	Score	Risk Level			
				)	j	(D + E)		)	j	(D + E)				
PWT1	8. Potable Water Storage Tank	<i>Biological, physical and chemical hazards</i> Contamination of reservoir by pests (possums etc.), infiltration from roof, illegal access, corrosion or sediment build-up resulting in poor water quality	Covered reservoir Good roof design Chlorine residual Verification monitoring Reservoir inspection program (to be developed) Customer complaint monitoring	4	5	9	High	2	4	6	Moderate		Currently there is overhanging vegetation.	Aquacell/ NEV to develop a response protocol (including manual chlorine dosing to reservoir). NEV to reduce vegetation and develop ongoing vegetation management program. Aquacell/NEV to determine appropriate monitoring point for chlorine residual in distribution system.
PWT2	8. Potable Water Storage Tank	<i>Biological, physical and chemical hazards</i> Poor water quality due to low turnover (including loss of residual disinfectant)	Covered reservoir Good roof design Chlorine residual Verification monitoring Reservoir inspection program (to be developed) Customer complaint monitoring	3	4	7	Significant	2	4	6	Moderate		Reservoir inspection program will be developed including operator training and records. Scored based on staging approach.	Aquacell/NEV to develop a response protocol (including manual chlorine dosing reservoir). Aquacell/NEV to consider reducing potential for stagnation in the reservoir. Aquacell/NEV to develop CCPs in consultation with NSW Health. Refer to DWMS examples available online.
PWT <sub>3</sub>	8. Potable Water Storage Tank	Biological and physical hazards Low mixing causing dead spots/short circuiting (common inlet outlet) exacerbates water age problems and causing poor water quality	Chlorine residual Verification monitoring Reservoir inspection program (to be developed) Customer complaint monitoring	3	4	7	Significant	2	4	6	Moderate			Aquacell/NEV to ensure that reservoir design considers mixing.
PWT4	8. Potable Water Storage Tank	<i>Biological, physical and chemical hazards</i> Reservoir cleaning while reservoir is online resulting in risks to water quality	Verification monitoring Customer complaints monitoring			Uncertain	Not rated			Uncertain	Not rated	Preventative measures and risk ratings to be determined once hydraulic considerations finalised.		Aquacell/NEV to determine reservoir inspection/ cleaning program once hydraulic considerations are finalised.
Dst1	9. Distribution System	<i>Biological and physical hazards</i> Water age in mains resulting in chlorine residual decline and potential for regrowth (discoloured water etc.)	Design system with ring mains where possible to reduce dead ends etc. Good practice design being followed for distribution system Design of plant and storage tanks considers demand and water age			Uncertain	Not rated			Uncertain	Not rated	Preventative measures and risk ratings to be determined once reticulation design finalised.		
Dst2	9. Distribution System	<i>Biological, physical and chemical hazards</i> High chlorine demand due to DOC/TOC leading to inability to maintain residuals				Uncertain	Not rated			Uncertain	Not rated	Preventative measures and risk ratings to be determined once further data has been obtained.		Aquacell/NEV to undertake sampling and analysis for DOC/TOC and colour.
Dst3	9. Distribution System	Biological hazards Seasonal conditions affecting water temperature in the raw and treated water and longevity of chlorine residual in the distribution system				Uncertain	Not rated			Uncertain	Not rated	Preventative measures and risk ratings to be determined once further data has been obtained.		Aquacell/NEV to include temperature in raw water and reticulated water monitoring program to better understand temperature variations.
Dst4	9. Distribution System	<i>Biological, physical and chemical hazards</i> Delivery pipes and fittings leaking or bursting	Plumbing installed according to AS/NZS 3500 Use licensed plumbers Materials from reputable suppliers	3	4	7	Significant	2	3	5	Low			Aquacell/NEV to develop handover protocols to householders and plumbing inspection of buildings before occupancy (noting that this will be crucial to granting of licence). NEV to consider including plumbing requirements in by-laws.
Dst5	9. Distribution System	Biological and physical hazards Cross contamination from non-quarantining of sewer and water equipment including CCTV during mains work		3	4	7	Significant			Uncertain	Not rated	Preventative measures and residual risk rating to be determined once procedures determined.		Aquacell/NEV to develop procedures for mains work including separate equipment and clothing, hygiene procedures for water and sewer.
Dst6	9. Distribution System	Biological, physical and chemical hazards Cross connections with recycled water system or any other non-potable sources (e.g. firefighting tank)	Plumbing audit Coloured piping Aquacell has a backflow prevention procedure in place Customer complaints monitoring Verification monitoring Education Higher pressure in potable system than recycled system	5	5	10	High	2	5	7	High		ALARP	Aquacell/NEV to review backflow prevention/ cross connection policies in place for this scheme. Aquacell/NEV to review risk once recycled water treatment plant finalised.

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DESIGN / CONCEPT STAGE HACCP							Before Mitigation After Mitigation									
Risk	Step	Potential Hazard	Preventative Measure	L	С	Maxim	um Risk	L	С	Residu	ual Risk	Uncertainty	Basis/ Notes	Further Actions		
No.	Process unit	Physical, chemical, biological, other		1 to 5	1 to 5	Score (D + E)	Risk Level	1 to 5	1 to 5	Score (D + E)	Risk Level					
Dst7	9. Distribution System	Biological, physical and chemical hazards Backflow from various sources causing water quality problems	RPZ, air gaps Plumbing audit Coloured piping Aquacell has a backflow prevention procedure in place Customer complaints monitoring Verification monitoring Education	3	5	8	High			Uncertain	Not rated		Unlikely to be any high risk activities on site. Perhaps small dairy farm.	Aquacell/NEV to review backflow prevention/ cross connection policies in place for this scheme. Aquacell/NEV to develop trade waste policy. Aquacell/NEV to be aware of DWMS process (refer Public Health Act/ NSW Health Guidelines for DWMS available online).		
Dst8	9. Distribution System	Hazard to be determined No backup potable water available				Uncertain	Not rated			Uncertain	Not rated	Preventative measures and risk ratings to be determined once alternate sources of potable water have been considered.		NEV to consider alternate sources of potable water e.g. keeping GCC water to one building. Liaise with GCC.		
Dst9	9. Distribution System	Biological, physical and chemical hazards Reduced water quality from growth of biofilms				Uncertain	Not rated			Uncertain	Not rated	Preventative measures and risk ratings to be determined once further data (particularly TOC/DOC) has been obtained.				
Dst10	9. Distribution System	<i>Biological, physical and chemical hazards</i> Reactive cleaning of mains resulting in reduced water quality				Uncertain	Not rated			Uncertain	Not rated	Preventative measures and risk ratings to be determined once mains cleaning procedures decided.	Mains cleaning/ maintenance procedures are currently being developed.	Aquacell/NEV to develop distribution system cleaning/ maintenance procedures (currently in progress).		
Dst11	9. Distribution System	Biological, physical and chemical hazards Turnover in water direction, pressure, system operation resulting in reduced water quality	Staging of WTP with staging of development	3	4	7	Significant			Uncertain	Not rated			Aquacell/NEV to ensure that this event is covered in distribution system maintenance plan/procedures.		
Dst12	9. Distribution System	<i>Biological, physical and chemical hazards</i> Reduced water quality from use of water carter connections by approved users				Uncertain	Not rated			Uncertain	Not rated	Preventative measures and risk ratings to be determined once a decision has been made regarding water carters.	It is unlikely that water carters will be allowed to connect to the system.	NEV to consider water carting access and whether it will be appropriate for this system.		
Dst13	9. Distribution System	<i>Biological, physical and chemical hazards</i> Use of fire hydrants stirring up the system and causing water quality issues				Uncertain	Not rated			Uncertain	Not rated	Risk ratings to be determined once firefighting system decided.		NEV to determine how firefighting water supply will be provided.		
Dst14	9. Distribution System	<i>Biological, physical and chemical hazards</i> Main break resulting in entry of contaminants into the system	Customer complaints monitoring Verification monitoring Positive pressure	3	4	7	Significant			Uncertain	Not rated		Likely that potable and recycled water pipework will be in same trenches but sewers separate	Aquacell/NEV to ensure that this event is covered in distribution system maintenance plan/procedures.		
Dst15	9. Distribution System	Biological, physical and chemical hazards Illegal/unknown connections resulting in introduction of unknown hazards	All residents will be part of NEV owners association Education plan Monitoring through water balance (proposed) Chlorine residual Verification monitoring program Customer complaints monitoring Maintain positive pressure in the distribution system Backflow prevention at water meters (proposed)	3	5	8	High	2	5	7	High		ALARP	Aquacell/NEV to consider backflow prevention devices at water meters.		
Dst16	9. Distribution System	Biological, physical and chemical hazards Contamination introduced during laying of new mains by operator and/or other party				Uncertain	Not rated			Uncertain	Not rated					
Dst17	9. Distribution System	Biological, physical and chemical hazards Dead ends in reticulation systems leading to stagnation and water quality issues	Dead ends to be designed out where possible Verification monitoring Customer complaints monitoring Chlorine residual	3	4	7	Significant	2	3	5	Low			Aquacell/NEV to consider how dead ends in the reticulation are dealt with during the staging process.		
Dst18	9. Distribution System	<i>Biological hazard</i> Lack of chlorine residual at system extremities	Verification monitoring program including checking chlorine residual in distribution system Customer complaint monitoring Ability to adjust dosing	4	4	8	High	3	4	7	Significant		Distribution system design not yet finalised. Currently going through re-zoning process which will impact upon distribution system for following stages.	Aquacell/NEV to consider chlorine residual at extremities in chlorination CCP. Aquacell/NEV to develop verification monitoring program with consideration of NSW Health Drinking Water Monitoring Program (available online).		

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		Before Mitigation After Mitigation												
Risk	Step	Potential Hazard	Preventative Measure	L	C	Maxim	um Risk	L	С	Residu	al Risk	Uncertainty Basis/ Note	es	Further Actions
No.	Process unit	Physical, chemical, biological, other	1	1 to 5	1 to 5	Score	Risk Level	1 to 5	1 to 5	Score	Risk Level	,		
		,,,,,,,,,				(D + E)			J	(D + E)				
Gen1	10. General/ Whole of System	Biological, physical and chemical hazards Use of non-potable water (e.g. recycled water) as though it were treated drinking water	Signage Education brochure Coloured pipes Customer complaint monitoring Robust recycled water treatment process	4	4	8	High	2	4	6	Moderate	ALARP. Aquacell wil that's tailore Scored assu plant proces	ill develop a program red for NEV. uming recycled water ss OK.	NEV to review notification regarding non-potable water once program completed by Aquacell. Liaise with PHU regarding this event.
Gen2	10. General/ Whole of System	Biological, physical and chemical hazards Incorrect or reduced quality of materials or chemicals resulting in potential for water quality contamination	Computerised asset planning system Inventory control system for chemicals Buy chlorine as required Only deal with reputable manufacturer Install to manufacturer's specifications. Can divert out of spec water if at WTP and if detected	3	4	7	Significant	2	3	5	Low	Aquacell wil that's tailore	ill develop a program ed for NEV.	NEV to review program for management of materials and chemicals once completed by Aquacell. Aquacell/NEV to develop a system for storing materials and cover in contract. Aquacell to review chemical specifications/ certificates and verify OK for drinking water.
Gen3	10. General/ Whole of System	<i>Biological, physical and chemical hazards</i> Chemicals being delivered to incorrect storage resulting in process contamination or incorrect dosage	Training of operators Chlorine is the only liquid chemical which will be stored onsite	2	4	6	Moderate	1	4	5	Low			Aquacell to consider designing-in different fittings for different chemicals.
Gen4	10. General/ Whole of System	Biological, physical and chemical hazards Prolonged power outages					Not rated			Uncertain	Not rated	NEV will be Currently loo strategy for	e off the grid. boking at energy r the site.	NEV to consider establishing an agreement with a local generator supplier.
Gen5	10. General/ Whole of System	<i>Biological, physical and chemical hazards</i> Catastrophic system failure, e.g. bushfire, flood or earthquake taking out key infrastructure e.g. WTP or pump station		1	5	6	High	1	5	6	High	ALARP		Aquacell/NEV to ensure that water quality impacts are covered within incident management plan/procedures.
Gen6	10. General/ Whole of System	<i>Biological, physical and chemical hazards</i> Human actions (sabotage)	NEV site security (but not near dam) Password protection on SCADA	1	5	6	High	1	5	6	High	ALARP		Aquacell/NEV to review security around dam and WTP. Aquacell/NEV to include security checks in reservoir and site inspection programs.
Gen7	10. General/ Whole of System	<i>Biological, physical and chemical hazards</i> Significant operator/ contractor error resulting in poor water quality	Operator training Remote monitoring Password protection on SCADA (including restriction on changing CCPs - only by Technical Manager)	3	5	8	High	2	4	6	Moderate			Aquacell/NEV to review method for ensuring skills currency and competency for drinking water. Aquacell/NEV to consider water quality awareness and training for contractors also. Aquacell/NEV to ensure that IPART and NSW Health are involved in any changes to CCPs (once in place).
Gen8	10. General/ Whole of System	<i>Biological, physical and chemical hazards</i> Lack of resources resulting in reduction of proactive management work leading to system issues (e.g. control measures not being implemented appropriately)	Checklist for roles and responsibilities between Aquacell and NEV			Uncertain	Not rated			Uncertain	Not rated	Remote moi Aquacell. Onsite O&M Aquacell but Day to day c personnel.	onitoring will be by M tasks probably by Jt to be determined. operations to be by NEV	Aquacell/NEV to develop roles and responsibilities further (including for training and records management).
Gen9	10. General/ Whole of System	Biological, physical and chemical hazards Lack of training/awareness of key staff resulting in potential for poor water quality through incorrect operation of the water supply system	Checklist for roles and responsibilities between Aquacell and NEV			Uncertain	Not rated			Uncertain	Not rated	Remote moi Aquacell. Onsite O&M Aquacell but Day to day c personnel.	onitoring will be by M tasks probably by Jt to be determined. operations to be by NEV	Aquacell/NEV to develop roles and responsibilities further (including for training and records management).
Genio	10. General/ Whole of System	Biological, physical and chemical hazards Resourcing issues due to greying of the workforce, unavailability of appropriately qualified staff, staff turnover leading to water quality issues				N/A	Not rated			N/A	Not rated	Not conside system	ered an issue for this	
Gen11	10. General/ Whole of System	Biological, physical and chemical hazards Failure of critical monitoring devices resulting in unknown water quality	Instrument selection (fit for purpose and capable of holding calibration) Verify calibration through operator checks Calibration schedule Process validation programmed into control system	3	5	8	High	1	4	5	Low			Aquacell/NEV to consider having critical spares available.



# Appendix C Action List

Action No.	Task/ Activity	Responsibility	Risk No.
A1	Consider recreational management policy.	NEV	Cmt1
A2	Liaise with Strickland State Forest managers regarding location of	NEV	Cmt1,
	walking tracks, feral animal populations and associated baiting		Cmt2
	programs, etc.		
A3	Define catchment area including aerodrome etc.	NEV	Cmt1,
			Cmt6
A4	Double-check land use in area (including agriculture).	NEV	Cmt2
A5	Establish raw water sampling program (capture a range of weather	Aquacell	Cmt3,
	conditions, seasonal changes as much as possible). Include		UV5, CI5,
	turbidity, nutrients plus gross alpha and gross beta (one-off)		Dsiz, Dst2
	Refer to Woodlots and Wetlands report for hydrogeology		0315
A6	Consider water quality issues in bushfire management plan	NEV	Cmt5.
	including use of dam for firefighting and alternate sources of		Dam6
	potable water. Liaise with Strickland State Forest, RFS and GCC.		
A7	Prepare incident management plan/ procedures which includes	NEV	Cmt6,
	water quality impacts, identifies relevant stakeholders (HAZMAT,		Flt3,
	EPA, Police, Fire, NSW Health) and also includes notification to		Gen5
	NSW Health when a CCP is breached.		
A8	Identify onsite sewage management systems by liaising with GCC.	NEV	Cmt7
A9	Dam management plan to be developed with consideration as to how this fits with WICA licence.	NEV/Aquacell	Dam1
A10	Liaise with previous site manager regarding evidence of dam	NEV	Dam2,
	stratification/inversion and algal blooms (including instances of		Dam5
	taste and odour).		
A11	Check time from entry into dam to dam wall (refer Woodlots and	Aquacell/NEV	Dam4
	Wetlands study).		
A12	Refer to Water Directorate website for algal management	Aquacell/NEV	Dam5
A10	protocols.		
A13	Consult EDA about onvironmental discharges or cond out of spec	Aquacentitev	
	water to Break Tank instead of dam		C14
A14	Review the log reductions provided by current process train.	Aquacell	Flt2
A15	Develop CCP procedure for UV disinfection.	Aquacell/NEV	UV1
A16	Confirm which guidelines the chlorine system is being designed to.	Aquacell	Cl1
A17	Develop CCPs in consultation with NSW Health. Refer to DWMS	Aquacell/NEV	Cl1,
	examples available online.		PWT2
A18	Consider whether water can be re-treated and prepare CCPs	Aquacell/NEV	Cl4
	procedure accordingly.		
A19	Consider chlorine residual at extremities in chlorination CCP.	Aquacell/NEV	Dst18
A20	Ensure that IPART and NSW Health are involved in any changes to	Aquacell/NEV	Gen7
	CCPs (once in place).		
A21	Determine distribution system materials.	Aquacell	Cct1
A22	Develop a response protocol for reservoir contamination and/or loss of residual disinfectant (including manual chlorine dosing to reservoir).	Aquacell/ NEV	PWT1, PWT2



Action No.	Task/ Activity	Responsibility	Risk No.
A23	Reduce vegetation and develop ongoing vegetation management program.	NEV	PWT1
A24	Determine appropriate monitoring point for chlorine residual in distribution system.	Aquacell/NEV	PWT1
A25	Ensure that reservoir design considers mixing and considers reducing potential for stagnation.	Aquacell/NEV	PWT2, PWT3
A26	Determine reservoir inspection/ cleaning program once hydraulic considerations are finalised and also include Break Tank in this.	Aquacell/NEV	PWT4, BTk1
A27	Develop handover protocols to householders and plumbing inspection of buildings before occupancy (noting that this will be crucial to granting of licence).	Aquacell/NEV	Dst4
A28	Consider including plumbing requirements in by-laws.	NEV	Dst4
A29	Develop procedures for mains work including separate equipment and clothing, hygiene procedures for water and sewer.	Aquacell/NEV	Dst5
A30	Review backflow prevention/ cross connection policies in place for this scheme.	Aquacell/NEV	Dst6, Dst7
A31	Review cross connection risk once recycled water treatment plant finalised.	Aquacell/NEV	Dst6
A32	Develop trade waste policy.	Aquacell/NEV	Dst7
A33	Increase awareness of the DWMS process (See Public Health Act/ NSW Health Guidelines for DWMS available online).	Aquacell/NEV	Dst7
A34	Consider alternate sources of potable water e.g. keeping GCC water to one building, carting water. Liaise with GCC.	NEV	Dst8
A35	Develop distribution system cleaning/ maintenance procedures (currently in progress). Ensure that mains breaks and turnover in water direction, pressure, system operation are covered.	Aquacell/NEV	Dst10, Dst11, Dst14
A36	Consider water carting access and whether it will be appropriate for this system.	NEV	Dst12
A37	Determine how firefighting water supply will be provided.	NEV	Dst13
A38	Ensure that this event is covered in distribution system maintenance plan/procedures.	Aquacell/NEV	Dst14
A39	Consider backflow prevention devices at water meters.	Aquacell/NEV	Dst15
A40	Consider how dead ends in the reticulation are dealt with during the staging process.	Aquacell/NEV	Dst17
A41	Develop verification monitoring program with consideration of NSW Health Drinking Water Monitoring Program (available online).	Aquacell/NEV	Dst18
A42	Review notification regarding non-potable water once program completed by Aquacell. Liaise with PHU regarding this.	NEV	Gen1
A43	Review program for management of materials and chemicals once completed by Aquacell.	NEV	Gen2
A44	Develop a system for storing materials and cover in contract.	Aquacell/NEV	Gen2
A45	Review chemical specifications/ certificates and verify OK for drinking water.	Aquacell	Gen2
A46	Consider designing-in different fittings for different chemicals.	Aquacell	Gen3
A47	Consider establishing an agreement with a local generator supplier.	NEV	Gen4
A48	Review security around dam and WTP.	Aquacell/NEV	Gen6
A49	Include security checks in reservoir and site inspection programs.	Aquacell/NEV	Gen6



Action No.	Task/ Activity	Responsibility	Risk No.
A50	Review method for ensuring skills currency and competency for drinking water.	Aquacell/NEV	Gen7
A51	Consider water quality awareness and training for contractors also.	Aquacell/NEV	Gen7
A52	Develop roles and responsibilities further (including for training and records management).	Aquacell/NEV	Gen8, Gen9
A53	Consider having critical spares available.	Aquacell/NEV	Gen11





Infrastructure Operating Plan

# Potable and Non-potable Water Supply and Sewer Scheme

For

Narara Eco-Village Co-operative Pty Ltd

Site Address:

25 Research Road, Narara, NSW 2250

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## **1. DOCUMENT CREATION AND REVIEW**

Revision	Date	Author	Reviewer	Comments
Draft	31 August 2017	V. Tripathi	J. Taylor	Draft
Rev 1.0	13 Nov 2017	G Cameron		Reviewed and added NEV content
Rev 1.1	14 June 2019	G Cameron	J Ellis	Minor corrections and edits, updated supporting document links
Rev 2	9 November 2020	G Cameron	S Errey	Addition of Sewer Management Plan
Rev 2.1	28 January 2021	G Cameron	S Errey	Minor edits to asset maintenance

### **2. EXECUTIVE SUMMARY**

This IOP contains important information regarding the following temporary water supply and non-potable water scheme:

YEAR OF ISSUE:	2020			
YEAR OF CONSTRUCTION:	2017			
OWNER:	Narara Eco-Village Pty Ltd			
APPLICATION:	Potable and Non-potable Water Supply and Sewer Scheme			
LOCATION:	25 Research Rd			
	Narara NSW 2250			

The potable water supply scheme consists of the following main elements:

- Storage of potable water supplied by Gosford City Council to a 15 kL break tank
- Storage of potable water pumped from the 15 kL break tank to 3 x 150 kL storage tanks
- Chlorination system to maintain free chlorine level in potable water
- Distribution ring main and piping to the end users

The potable water is supplied by Gosford City Council as per the signed deed of agreement up to the site boundary and then via a DN 50 mm line to a 15 kL break tank. The water is then pumped to 3 x 150 kL potable water storage tanks using. The water is gravity fed to the end users via a distribution ring main. Chlorine is monitored and dosed to maintain the required free residual chlorine in the storage tanks.

The non-potable water supply scheme consists of the following main elements:

- Storage of non-potable water in a 120 kL storage tank
- Chlorination system to maintain free chlorine level in non-potable water
- Distribution ring main and piping to the end users

Non-potable water is supplied for:

- Toilet flushing in homes and the community centre
- Irrigation of home and community gardens, lawns and landscaped areas.

The sewer scheme consists of the following main elements:

- Sewage reticulation and collection system
- Storage in 3 x 120kL buffer tanks
- Rising main connected to council sewer.

Wastewater is collected from the residences on site, and the community building kitchens, bathrooms and toilets.

These systems have been installed to sustainably service the Stage 1 population of the Eco Village. Subject to approvals, further stages will be developed on the site which will necessitate upgraded water and sewage facilities. Due to economies of scale, the Stage 1 buffer and storage tanks have been sized to accommodate the development at full population.

Sewer buffer capacity of 360 kL has been provided, which is equivalent to approximately 6-days storage at maximum design flow (56 kL/day) at the forecast full development population. This full buffer capacity is available to the Stage 1 system, and as such, in the initial stages, buffer capacity will be 12-15 times the maximum design flow. This capacity provides sufficient time for planned or unplanned maintenance to occur without interrupting services to the end users. For extended breakdowns, the buffer tanks can be pumpd out until the system is operational again.

The system is managed according to this Infrastructure Operating Plan (IOP) that has been developed specifically for this site, in accordance with NEV's obligations under:

- the Water Industry Competition Act 2006
- Narara Eco-Village Pty Ltd Network Operator's Licence No. 17\_040
- Narara Eco-Village Pty Ltd Retail Supplier's Licence No. 17\_041R

NEV, as the licensee, will ensure that the Infrastructure Operating Plan is fully implemented, is kept under regular review and all of its activities are carried out in accordance with this plan. NEV will, if the Minister so directs, amend this IOP in accordance with the Minister's direction.

The Minister or IPART will be provided with a report, prepared by an approved auditor, if any significant change is made to this Infrastructure Operating Plan.

### 3. WICA LICENSES

The water industry infrastructure referred to in this license are covered under the following Water Industry Competition Act (WICA) licenses:

- Network Operator's Licence number 17\_040 and
- Retail supplier's licence number 17\_041R

These licenses have been obtained in accordance with the Water Industry Competition regulation 2008 and all conditions of these licenses will be adhered to.

Copies of these licenses are available in the following server location:

Nextcloud\NEV Water\WICA Licenses

### 4. PERFORMANCE CRITERIA AND LEVEL OF SERVICE

Water and Wastewater System performance and level of service are measured against two key indicators:

- **Quality** the delivered water quality set out in the current the Drinking Water Management System Development Plan and the Recycled Water Quality Management Plan
- **Quantity** ensuring that potable water and sewage treatment occurs in volumes sufficient to sustain uninterrupted service to the end users allowing for breakdowns and planned maintenance.

Water quality and wastewater system performance is monitored as follows:

- **Quality** critical control points ensure that product which does not meet the water quality criteria in case of potable water and required treated water quality in case of non-potable water is not transferred for use. NEV is able to pump out this water using external contractors or dispose to irrigation.
- **Quantity** flowmeters record the total potable and non-potable water supplied and this volume is reported in a monthly report to NEV.

The end users are supplied with a usage summary which summarises the potable and non-potable water supplied during each month as part of their bill. It also includes significant upcoming work which may need to be undertaken that can affect service or supply.

### **5. ASSET MANAGEMENT**

The assets covered by this plan are used for the treatment, storage and conveyance of potable and nonpotable water. This includes tanks, pumps, valves, instrumentation, dosing equipment and the electrical and control systems associated with these items. The operation and maintenance manual provides a detailed equipment schedule.

All assets are installed at 25 Research Road, Narara.

NEV has carried out an Asset Replacement Risk Assessment specific to the assets at 25 Research Road, Narara which considers production, financial, health and environment impacts. This risk assessment is included in Appendix A. This risk assessment is used to determine asset replacement and maintenance strategies.

### 5.1. Asset Replacement Strategy

The asset replacement risk assessment in Appendix A shows the risk of unforeseen or unpredicted failures that will affect the end user are low. The non-potable water storage has a backup potable water supply which ensures the end user does not experience an interruption to service should an asset fail. Gosford City Council is the bulk supplier of potable water. In case the potable water quality does not meet the Australian Drinking Water Quality criteria, adequate storage and water cart suppliers are available to ensure continued supply of potable water.

NEV has listed plant assets and their life expectancy in the Asset Replacement Schedule shown in the Operations and Maintenance manual and repeated as Appendix B in this document. This schedule allows NEV to forecast asset replacements over an extended period, and budget accordingly.

#### 5.2. Maintenance Strategy

The asset replacement risk assessment indicates that equipment failures have low consequence and no immediate impact on the end users. This analysis has been used to determine the best maintenance strategy for the plant.

The water supply infrastructure and blackwater system is subject to routine servicing by NEV nominated third party technician (Innaco Service Technician) along with NEV trained staff. The purpose of these visits is to check the potable water supply and storage infrastructure and blackwater system and undertake preventative activities to ensure the plant operates without interruption. Equipment is serviced and maintained in line with manufacturer's recommendations and Innaco's experience.

When considering scheduled replacement of assets, the approach has a reactive component. This is a deliberate approach made by considering the asset replacement risk assessment contained in Appendix A which highlights the following conclusions:

- The non-potable water storage system has a potable water back up supply which automatically cuts in should there be an interruption to the operation of the system. This ensures that any component failure, breakdown, or unplanned interruption to the system will not affect the end user.
- Innaco attend site at least monthly as part of a contracted service regime. Service Technicians are able to observe equipment in operation and detect changes in equipment performance that require further investigation
- The system is remotely monitored on a daily basis by Innaco Service Technicians who are able to note changes in operation that may be early indicators of asset failure, for example free residual chlorine levels.
- Components are locally sourced and readily available from suppliers. Typically, lead times are short.
- The skills and expertise required to undertake asset replacement are readily available through NEV contractors should Innaco staff be unavailable to complete the task
- Some plant components have a duty-standby arrangement which allows the plant to operate even in the event of the failure of one unit
- Many assets are relatively low cost compared to the cost of undertaking preventative maintenance activities, ie, the cost to replace pump bearings can exceed the cost of the pump
- Asset components are typically low cost relative to the cost of predictive analysis such as oil sampling, vibration analysis or thermal imaging. Predictive maintenance is not considered a cost effective approach in this situation.

The large buffer capacities enable maintenance activities to be carried out at any time. The end user is advised where there are significant works or there is a prolonged interruption to the provision of non-potable water.

NEV are wholly responsible for operation of the plant, but use Innaco to monitor and maintain the plant as an authorised third party under the WICA license. A Service Agreement is in place which defines the
scope of works. Where required, some tasks are subcontracted to qualified suppliers to complete works for which Innaco does not have the requisite certification or expertise, e.g., electrical works.

## 6. DRINKING WATER SYSTEM MANAGEMENT PLAN

The Drinking Water System Management Plan is the reference document for the operation of the potable water supply system. The DWSMP will be reviewed annually as a minimum. It will also be reviewed and updated if there are any significant changes to the portable water system. The current version of this document is available at the following location:

Nextcloud\NEV Water\IOP

## 7. RECYCLED WATER QUALITY MANAGEMENT PLAN

The Recycled Water Quality Management Plan for NEV has been prepared in accordance with the WIC Act and is the reference document for the plant operation. The RWQMP will be updated annually, at a minimum, in accordance with the WIC Act. The current version of this document is available at the following location:

Nextcloud\NEV Water\IOP

## 8. SEWER MANAGEMENT PLAN

The Sewer Management Plan for NEV has been prepared in accordance with the WIC Act and is the reference document for the sewer system operation. The Sewer Management Plan and Sewage Scheme Risk Assessment will be updated annually, at a minimum, in accordance with the WIC Act. The current version of this document is available at the following location:

Nextcloud\NEV Water\IOP

## 9. RETAIL SUPPLY MANAGEMENT PLAN

The Retail Supply Management Plan relates to NEV's intention, conduct and practices when supplying water under its Retail Supplier's Licence Number 17\_041R. In addition, this Retail Supply Management Plan addresses the events and circumstances that could adversely affect NEV's ability to supply treated water to its customers, and the probability of occurrence of any such event. Included are the measures taken to minimise the effect of the occurrence and arrangements made to provide alternate supplies. The current version of this document is available at the following location:

Nextcloud\NEV Water\Retail

## **10. OPERATIONS AND MAINTENANCE MANUAL**

This manual sets out to identify the systems, applications, materials and approach which are the basis for the ongoing operation and maintenance of the system. It includes emergency procedures, operating procedures and maintenance procedures. The current version of this document is available at the following location:

Nextcloud\NEV Water\IOP

## **11. OTHER SUPPORTING DOCUMENTATION**

#### 11.1. Environmental Management Plan

NEV's Environment Management Procedure (EMP) details the potential environmental impacts from NEV's water, wastewater and other services operations, and the mitigation measures to be employed to minimise or alleviate these potential impacts. The current version of this document is available at the following location:

Nextcloud \NEV Water\Environment

A specific environmental risk assessment (ERA) approach has been undertaken to establish the environmental risks associated with this project. The current version of this document is available at the following location:

Nextcloud \NEV Water\Environment

#### 11.2. NEV's Website

The website is regularly updated and contains information about NEV, the Management team and systems. The site also contains community information, customer information and forms, policies, brochures and FAQ's along with information for plumbing contractors.

https://nararaecovillage.com/nev-utilities/

### **11.3.** Audit Reports

The findings contained in any audit reports will be used as the basis for documentation and procedural modifications as part of NEV's and Innaco's commitment to continual improvement.

Audit reports are available at the following server location:

Nextcloud \NEV Water\Audit

# **12.** APPENDIX A - ASSET REPLACEMENT RISK ASSESSMENT

Project Name:	Narara Ecovillage
Date of Assessment:	1-Nov-2017
Revision:	Original
Created	Justin Taylor
Approved	Colin Fisher
	Justin Taylor, Warren Johnson
Personnel Consulted	Simon Grimwood

	<b>D</b> : 4			Unn	nitigat	ed Risk					Mitigate	d Risk	
Activity	RISK	Impact	Lik	elihood	Co	onsequence	Risk	Control Strategy	Li	kelihood	Co	nsequence	Risk
Operation	Production - Asset failure during operation	Water or sewer system may not be able to operate and provide services to the customer	4	Likely	3	Moderate	7	-Service routine in place to visit site at predetermined intervals. - Equipment inspected during routine service visits to detect early signs of failure - a selection of components have duty standby arrangement to allow plant to continue operation - potable water back up provided if plant is unavailable for a period of time. Customer experiences no loss of service	1	Rare	1	Insignificant	3
	Production - Asset failure goes undetected	Water or sewer system may go into alarm and not be detected resulting in delayed response to asset failure	3	Possible	4	Major	7	<ul> <li>remote monitoring used to monitor plant status and report faults</li> <li>plant automatically protects against any event the leads to out-of- specification water</li> <li>Daily checking of plant status to detect equipment failures</li> <li>Weekly service visits to site to inspect equipment</li> <li>potable water back up provided if plant is unavailable for a period of time. Customer experiences no loss of service</li> </ul>	2	Unlikely	1	Insignificant	3

Production - Replacement asset has long lead time	Water or sewer system may not be able to operate for an extended period until thep part becomes available	3	Possible	5	Extreme	8	<ul> <li>All parts locally sourced and held in stock by suppliers (subject to prior sale)</li> <li>assets are typically off the shelf products that have not been customer designed or are unique to the plant</li> <li>assets are small scale for the industry and therefore readily available</li> <li>Some assets could be substituted with an alternate manufacturer's equivalent</li> <li>Many manufacturers have a facility to hire or loan a piece of equipment if required</li> </ul>	2	Unlikely	1	Insignificant	3
Production - Service response time to asset failure	Water or sewer system may not be able to operate for an extended period because a service technician is unavailable	3	Possible	3	Moderate	6	<ul> <li>Innaco has Sydney based Service</li> <li>Technician and can have a same day response if required</li> <li>Innaco has multiple staff in the</li> <li>Sydney office who could respond to assess the situation if the Service</li> <li>Technician was not immediately available</li> <li>potable water back up provided if plant is unavailable for a period of time. Customer experiences no loss of service</li> </ul>	2	Unlikely	1	Insignificant	3
Production - Installation of replacement asset takes an extended period of time due to its complexity.	Water or sewer system may not be able to operate for an extended period while the asset is replaced	3	Possible	3	Moderate	6	- All assets on the plant could be replaced within one working day of receipt	2	Unlikely	1	Insignificant	3
Production - Ongoing, unforeseen failure of equipment	Excessive maintenance costs and extended down time	3	Possible	3	Moderate	6	- Innaco designed the plant and ensured that all assets specified are fit for purpose and match industry standards	2	Unlikely	1	Insignificant	3

	Personnel - appropriate personnel are not available to undertake an asset replacement	Water or sewer system may not be able to operate for an extended period while personnel are sourced	2	Unlikely	3	Moderate	5	<ul> <li>Innaco technical staff could supervise asset replacement by qualified trades person if required</li> <li>Many asset suppliers are local and offer personnel who could be subcontracted to undertake the work</li> </ul>	2	Unlikely	1	Insignificant	3
	Financial - asset failure during operation and there are no funds available to repair or replace item	Plant may remain idle until funds are available to make repairs	3	Possible	4	Major	7	<ul> <li>Asset replacement allowance included in service agreement to replace assets as required</li> <li>Budget for asset replacement based on asset replacement forecast and known costs of components</li> <li>potable water back up provided if plant is unavailable for a period of time. Customer experiences no loss of service</li> </ul>	2	Unlikely	1	Insignificant	3
	Health - asset failure allows out of specification water to be transferred for end use	Customers exposed to pathogens	3	Possible	4	Major	7	<ul> <li>- CCP's in place to control transfer of treated water to ensure it is within specifications</li> <li>- Equipment designed to fail safe, eg, instrumentation will go off scale and fall outside CCP's</li> <li>- Plant programed to go to critical alarm when there parameters go outside CCP's</li> <li>- Remote monitoring of plant allows all parameters to be viewed remotely</li> </ul>	2	Unlikely	1	Insignificant	3
	Environment - asset failure allows out of specification water to be disposed of to the environment	Uncontrolled discharge to environment which may also cause a trade waste breach	2	Unlikely	2	Minor	4	<ul> <li>- CCP's in place to control transfer of treated water to environment to ensure it is within specifications</li> <li>- Equipment designed to fail safe, eg, instrumentation will go off scale and fall outside CCP's</li> <li>- Plant programed to go to critical alarm when there parameters go outside CCP's</li> <li>- Remote monitoring of plant allows all parameters to be viewed remotely</li> </ul>	2	Unlikely	1	Insignificant	3
Maintenance	Production - normal servicing of equipment creates plant down time	System cannot provide water to customer during this period	5	Almost Certain	1	Insignifican t	6	<ul> <li>treated water storage tanks hold water to cover multi-day interruptions to production</li> <li>potable water back up is available should the stored treated water be insufficient to meet demand</li> <li>where practical, service work timed</li> </ul>	1	Rare	1	Insignificant	2

Infrastructure Operating Plan

8 October 2020

							to have minimum disruption to production					
Production asset replaceme activities o plant dow time	- System cannot provide water to nt customer during reate this period	5	Almost Certain	2	Minor	7	- treated water storage tanks hold water to cover multi-day interruptions to production     - potable water back up is available should the stored treated water be insufficient to meet demand     - where practical, service work timed to have minimum disruption to production	2	Unlikely	1	Insignificant	3

## **13.** APPENDIX B – ASSET REPLACEMENT SCHEDULE

Project No & Name:	A0072	
Site Location:	Narrara Eco Village	
Customer:	Narrara Eco Village Co-op Ltd	
Done By:	Justin Taylor	
Date:	14-Nov-17	
Version:	1	

#### Asset Replacement Schedule

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## 14. APPENDIX C – SYSTEM SCHEMATIC PROCESS FLOW DIAGRAM







# Narara Ecovillage Temporary Potable Water Scheme

# Drinking Water Management Plan

July 2020

A0072-DWMP – Temporary Scheme Revision 24 July 2020





Revision	Date	Ву	Checked	Document	Amendments
				Status	
1	12/06/2014	S. Loder, City Water Technology Pty Ltd (on behalf of Aquacell Pty Ltd)		Preliminary draft	
2	16/06/2014	Colin Fisher	Warren Johnson	For WICA submission	
3	20/07/2017	V Tripathi	J Taylor	For WICA submission	
4	13/11/2017	G Riese	J. Taylor	As built	
5	20/11/2017	G Cameron		For WICA submission	
6	18/05/2018	W Johnson	G Cameron	Final with WICA auditor amendments	Added CCP (Sect. 8.1) and Appendix 2
6.1	25/06/2019	G Cameron	J Ellis	Reviewed	Minor corrections and edits, updated document links
6.2	24/07/2020	G Cameron	J Ellis	Reviewed	Innaco support agreement added





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## 1 Introduction

## 1.1 Purpose of the Drinking Water Management Plan (DWMP)

This DWMP forms part of the Infrastructure Operating Plan (IOP) for the Narara Ecovillage (NEV) water scheme. It states the potable water quality objectives for the temporary drinking water scheme and describes elements of the management plan to ensure those objectives are achieved and maintained. The document contains:

- Responsibilities of the potable water supplier;
- Description of the potable water process, including composition of the source and end use applications for which the potable water is fit-for-purpose;
- Detailed process control and monitoring program to ensure the treated potable water meets the required quality for end use.

## 1.2 Description of the Temporary Water Supply Scheme

The NEV site is located on Research Rd, Narara on the NSW central coast. The development will be staged with 60 lots to be released initially, and expanding to around 130 in the future. Stage One of the development provides the infrastructure for up to 62 dwellings.

A new treatment facility will be constructed to deal with the full development (when approved) which is projected to have a demand of approximately 60kL per day. The sizing and timing for this plant will be confirmed based on water usage rates from the initial development, and the number of dwellings in the proposed development. The DWMP will be updated to reflect the changes once the new plant has been designed.

Potable water will be supplied to the site by Gosford Water. An agreement has been established with the Central Coast Council (CCC) which allows mains water to be taken from the municipal system, provided:

- The water is only taken at between prescribed low demand times;
- No pump is connected to the system;
- CCC are not responsible for the water quality once it crosses the site boundary;
- A Deed of agreement is established between the two parties.

A break tank has been set up to collect the potable water when it comes onto site. A PLC controlled actuated valve ensures that the tank only fills during the prescribed periods, and the break tank satisfies the requirement of not pumping directly from the CCC potable network. An air break at the tank, as well as back flow prevention valves have been installed to ensure there is no risk of backflow from the site to municipal supply.

Water is pumped from the break tank to the potable water storage tanks based on the break tank level. There are three potable water storage tanks, each with a capacity of 150kL. The potable water storage tanks have been sized such that they can buffer potable water for use by the community, and also hold the minimum required volume of water required for firefighting purposes. The total volume is split as:

• 285 kL minimum volume for firefighting;

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• 165 kL available for community use.

The potable water storage tanks are located at an elevation significantly above the residential dwellings to allow gravity feed of water into the homes and community areas. The elevation also ensures that the minimum line pressure required for firefighting is also achieved.

A chlorine recirculation system is used to monitor ORP and maintain a chlorine residual in the potable water storage tanks. Sodium hypochlorite is dosed to maintain a minimum free chlorine residual in the storage tanks.

Potable water from the storage tanks is used for:

- Households via Potable Water Supply Ring Main;
- Recycled water header tank as emergency make-up water;
- Distribution to firefighting network.

A simplified process flow diagram is shown in Figure 1 – Simplified Process Flow





#### 1.3 Management commitment

Narara Ecovillage Co-operative Ltd (the NEV Co-op) is the WICA license holder and also the owner of the temporary potable water supply scheme. The NEV Co-op are committed to ensuring the system is maintained and operated in compliance with relevant guidelines, regulations and standards at all times.

The NEV Co-op will subcontract the operation and maintenance of the temporary water potable treatment scheme to Innaco Pty Ltd, who are an authorised third party under the WICA license. Innaco commit to maintain and operate the system in compliance with the WICA license, and all relevant guidelines, regulations and standards at all times.

Where conflicts arise between NEV and any other authorised third party, the requirements of the WICA license will be paramount.

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# 2 Roles and responsibilities

As system owner and WICA licence holder the NEV Co-op retains responsibility over the temporary potable water scheme including storage after treatment water supplied from CCC, distribution of potable water and treatment before distribution system. The NEV Co-op has delegated the operational responsibility for the treatment to Innaco under the terms of an Operations and Maintenance Agreement between the two organisations.

A table outlining the various roles and responsibilities of the parties is shown in table Table 2-1.

#### Table 2-1 Division of Roles and Responsibilities

Role/Responsibility		Innaco	NEV
Potable Water	WICA License Holder - Network		Х
Scheme	WICA License Holder - Retail		Х
CCC Supply	GCC connection to break tank		х
GCC Supply	GCC break tank, transfer pumps and pipework	Х	
	Design – scope and specification		Х
	Preparation of tender specification		Х
	Coordination of tendering process		Х
	Construction		Х
Potable Water	Construction Supervision		Х
System	Plumbing in accordance with AS/NZS 3500:2003		Х
	Testing and Commissioning		Х
	Cross connection audit ( at installation)		Х
	Cross connection audit (ongoing)		Х
	Repair and Maintenance of potable water distribution system		Х
	Design	Х	
	Installation and Commissioning	Х	
	Operation	Х	
	On site testing and monitoring	Х	Х
	Completing daily site log		Х
	Maintenance – Daily		Х
	Maintenance – Weekly	Х	Х
	Maintenance - Monthly	Х	
	Maintenance – Quarterly	Х	
	Asset Management Plan	Х	
	Instrument Calibrations	Х	
	Training	Х	





Role/Responsibility		Innaco	NEV
	Water sampling and forwarding as per DWQMP		Х
	Management of water quality testing	х	
	Review of sampling results and identification of appropriate actions	х	
	Drinking Water Management Plan		Х
	Network Management Plan		Х
Infrastructure	structure         Environmental Management Plan           ating Plan         Retail Management Plan		Х
Operating Plan	Retail Management Plan		Х
	Dam Safety Management Plan - preparation		Х
	Dam Safety Management Plan - approval		Х
	Development of protocols, response actions, responsibilities and communications		х
	Identification of non-compliances and incidents	х	Х
Incidents and	Statutory reporting of non-compliances and incidents		Х
Emergencies	Emergency repairs to dosing plant	х	
	Emergency repairs to network		Х
	Coordinating emergency potable water tanker when necessary		Х
	Monthly reporting of treatment plant performance to owner	Х	
	Billing of retail Householders and Tenants		Х
Administrativa	Annual reporting as per WICA license requirements		Х
Administrative	Audits as required for WICA license		Х

### 2.1 Supplier

The supplier of potable water is Central Coast Council (CCC). NEV store and distribute this water to the end users.

#### 2.2 Scheme Manager

The scheme manager is NEV Co-op.

#### 2.3 Users

The users are the residents and visitors to the ecovillage.

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# 3 Water Quality Objectives

All the potable water supplied through the temporary water supply scheme will be used for household purposes and other potable purposes by the community facilities. In cases where the recycled water storage tank level is low, the temporary water supply scheme is designed to supply potable water as a top-up to recycled water tank storage for process use or for emergency make-up water.

Reticulated water quality from CCC was reviewed as part of a desktop study and is summarised in Table below. In general, the data show very good water quality, with only rare exceedances of the Australian Drinking Water Guidelines 2011 (ADWG).





ATTRIBUTE	UNITS	ADWG COMPLIANCE	ATTRIBUTE	UNITS	ADWG COMPLIANCE
Aluminium	mg/L	97%	Mercury	mg/L	100%
Antimony	mg/L	100%	Molybdenum	mg/L	100%
Arsenic	mg/L	100%	Nickel	mg/L	98%
Barium	mg/L	100%	Nitrate	mg/L	100%
Boron	mg/L	100%	Nitrite	mg/L	100%
Cadmium	mg/L	100%	рН		96%
Calcium	mg/L	100%	Selenium	mg/L	100%
Chloride	mg/L	100%	Silver	mg/L	100%
Chromium	mg/L	100%	Sodium	mg/L	100%
Copper	mg/L	100%	Sulphate	mg/L	100%
Fluoride	mg/L	100%	Total Dissolved Solids	mg/L	100%
Iodine	mg/L	100%	Total Hardness as CaCO <sub>3</sub>	mg/L	100%
Iron	mg/L	100%	True Colour	Hazen Units (HU)	100%
Lead	mg/L	99%	Turbidity	NTU	100%
Magnesium	mg/L	100%	Zinc	mg/L	100%
Manganese	mg/L	100%			

#### Table 3.1 – Central Coast Council Water Quality Results

**Source:** "NEV1045-01-C Narara Ecovillage Temporary CCC Connection Desktop Study Report" available from server location - Nextcloud\NEV Water\IOP\Risk Assessments

The water supplied by CCC has been found to meet the ADWG standards and the conditions of supply are detailed in a deed of agreement between NEV and CCC. In addition to this, control measures are in place to ensure the required water quality is achieved post storage and within the reticulation system.

A detailed risk assessment study was carried out separately for the temporary water supply scheme. The risk assessment, titled "NEV Potable Water Risk Register" is available at server location - Nextcloud\NEV Water\IOP\Risk Assessments.





## 4 System Assessment

The potable water supply consists of a temporary supply for stage 1 development, and a permanent supply which will service the village at full development. The permanent supply consists of extracting water from an on-site dam and treating it to potable standard.

The original plan for the site was to set up the permanent solution to service stage 1 of the development. A risk assessment was undertaken in 2014 to establish the likely risks and control measures of such an undertaking and has been reviewed throughout the development of the project. Subsequent to the original risk assessment, it was negotiated with CCC (then Gosford Council) that the municipal supply could be used under the circumstances described in Section 1.2.

The original risk assessment has been augmented to include the risks associate with using the temporary scheme. A full copy of the risk assessment, including the revision history and participants at each stage, titled "NEV Potable Water Risk Register" is available at server location - Nextcloud\NEV Water\IOP\Risk Assessments.

# 5 Compliance with Australian Drinking Water Guidelines

The table below lists the 12 framework elements for Drinking Water Quality of the ADWG and shows how NEV's temporary potable water scheme meets the various elements. Actions to improve compliance have been included on the Risk Register Potable Water Supply at Appendix 1.

FRAMEWORK ELEMENT	ACTIVITY	REFERENCE DOCUMENT
Element 1: Commitment to respo	nsible use and management of drinking water quality	
<ul> <li>1.1 Drinking water quality policy:</li> <li>Formulate a drinking water quality policy, endorsed by senior executives, to be implemented throughout the organisation.</li> <li>Ensure that the policy is visible and is communicated, understood and implemented by employees.</li> </ul>	<ul> <li>Drinking water quality has been integrated into NEV's Water Quality Policy</li> <li>NEV's policies are communicated as part of the induction program and are available via IMS/intranet.</li> <li>NEV's policies are published on its web site at www.nararaecovillage.com/nev-utilities/</li> </ul>	NEV's Water Quality Policy available at server location: Nextcloud\NEV Water\Policies & Procedures\Policies
<ul> <li>1.2 Regulatory and formal requirements:</li> <li>Identify and document all relevant regulatory and formal requirements.</li> <li>Ensure responsibilities are understood and communicated to residents and authorise third parties.</li> <li>Review requirements periodically to reflect any changes.</li> </ul>	<ul> <li>Legal requirements are listed in position descriptions. The position descriptions are updated to include drinking water specific requirements.</li> <li>The CEO is responsible for ensuring that updates are communicated to the relevant staff.</li> <li>NEV will review its regulatory and formal requirements against the list of Regulatory and formal requirements shown in Appendix 2 each time this DWMP is reviewed (the CEO is responsible for ensuring currency).</li> </ul>	<ul> <li>WICA Application</li> <li>CCC DA</li> <li>WICA legislation and licenses</li> <li>NEV051 Environmental Management Procedure</li> <li>Environmental Incident Procedure</li> <li>NEV1045-02-B Poor Quality Drinking Water Incident Response Procedure</li> <li>NEV1045-03-B Loss of Drinking Water Supply Incident Response Procedure</li> </ul>

#### Table 2 - ADWG Framework Elements

FRAMEWORK ELEMENT	ACTIVITY	REFERENCE DOCUMENT
<ul> <li>1.3 Engaging stakeholders:         <ul> <li>Identify all stakeholders who could affect, or be affected by, decisions or activities of the drinking water supplier.</li> </ul> </li> </ul>	<ul> <li>Communication with customers and other stakeholders is covered in the Communications section of NEV's Retail Supply Management Plan.</li> <li>The management plan is reviewed periodically.</li> <li>The NEV Co-operative Ltd actively involves all its members in the planning and approval of the development and its infrastructure. The Co-operative operates</li> </ul>	<ul> <li>NEV's existing Community Engagement Procedure CS020-3</li> <li>NEV website</li> <li>NEV Community Management</li> </ul>
<ul> <li>Develop appropriate mechanisms and documentation for stakeholder commitment and involvement.</li> <li>Regularly update the list of relevant agencies.</li> </ul>	<ul> <li>under Dynamic Governance, which seeks to achieve fair, inclusive, transparent, accountable and creative decision-making processes. A working group of interested members has been involved from the early stages of the project looking at the technical aspects of the project and helping to choose technology options and formulate policies.</li> <li>The NEV has a website which contains information on the proposed development</li> </ul>	Statement (draft)
Flowert 2. According to falls the	and water infrastructure with contact details and invitation for comment and further information.	
Element 2: Assessment of the dri	nking water supply system	-
2.1 Water supply system analysis:	<ul> <li>NEV's organisational chart shows the key roles and responsibilities for ensuring</li> </ul>	<ul> <li>Project organisational chart</li> </ul>
- Assemble a team with	water quality objectives are met	(appendix 3.4.2 of the application).
<ul><li>appropriate knowledge and expertise.</li><li>Construct a flow diagram of the</li></ul>	<ul> <li>A process flow diagram is available for the scheme.</li> <li>Key characteristics of the water supply are documented in <i>Narara Eco-Village</i> - <i>Water Management Systems Overview</i> (Appendix 1.1 to the application) and NEV</li> </ul>	- System process flow diagram for temporary connection
water supply system from catchment to consumer.	Potable Water Risk Register Rev F (updated January 2017) including risk and mitigation measures from temporary connection from CCC.	- Narara Eco-Village - Water Management Systems Overview
<ul> <li>Assemble pertinent information and document key characteristics of the water supply system to be considered.</li> </ul>		<ul> <li>NEV Potable water Risk Register Rev F (includes hazardous events and control measures from temporary potable water connection)</li> </ul>

FRAMEWORK ELEMENT	ACTIVITY	REFERENCE DOCUMENT
<ul> <li>2.2 Assessment of water quality data:</li> <li>Assemble historical data from source waters, treatment plants and finished water supplied to consumers (over time and following specific events).</li> <li>List and examine exceedances.</li> <li>Assess data using tools such as control charts and trends analysis to identify trends and potential problems.</li> </ul>	<ul> <li>The raw water monitoring program commenced in July 2014. Other monitoring is carried out as per Element 4 (operational monitoring) and Element 5 (verification monitoring).</li> <li>CCP exceedances show up on SCADA interface. All other exceedances are monitored and reported manually.</li> <li>Innaco's Technical Manager is responsible for ongoing data assessment and analysis at a frequency specified in the monitoring program(s).</li> </ul>	Monitoring and Recording Procedure Water Quality available from server location - Nextcloud\NEV Water\IOP\Sampling & Testing

FRAMEWORK ELEMENT	ACTIVITY	REFERENCE DOCUMENT
<ul> <li>2.3 Hazard identification and risk assessment: <ul> <li>Define the approach and methodology to be used for hazard identification and risk assessment.</li> <li>Identify and document hazards, sources and hazardous events for each component of the water supply system.</li> <li>Estimate the level of risk for each identified hazard or hazardous event.</li> <li>Evaluate the major sources of uncertainty associated with each hazard and hazardous event and consider actions to reduce uncertainty.</li> <li>Determine significant risks and document priorities for risk management.</li> <li>Periodically review and update the hazard identification and risk assessment to incorporate any changes.</li> </ul> </li> </ul>	<ul> <li>A risk assessment was conducted 16 January2017 to include the hazards associate from the operation of the temporary scheme. The Summary Paper includes: <ul> <li>the methodology used for hazard identification and risk assessment</li> <li>the Risk Register, containing: <ul> <li>identified hazards and hazardous events</li> <li>estimated levels of risk for each hazardous event</li> <li>sources of uncertainty and actions to reduce uncertainty</li> <li>identification of significant risks</li> <li>existing control measures in place</li> <li>additional control measures proposed or actions to reduce the residual risk as required</li> </ul> </li> <li>The Risk Register was reviewed at the following stages: <ul> <li>Design</li> <li>Construction</li> <li>Commercial operation</li> <li>Prior to audits (according to ongoing audit schedule)</li> </ul> </li> </ul></li></ul>	<ul> <li>NEV Potable Water Risk Register Rev F (16/01/2017) available from server location - \Nextcloud\NEV Water\IOP\Risk Assessments</li> </ul>

FRAMEWORK ELEMENT	ACTIVITY	REFERENCE DOCUMENT	
Element 3: Preventative measures for drinking water quality management			
<ul> <li>3.1 Preventative measures and multiple barriers: <ul> <li>Identify existing preventive measures from catchment to consumer for each significant hazard or hazardous event and estimate the residual risk.</li> <li>Evaluate alternative or additional preventive measures where improvement is required.</li> </ul> </li> </ul>	<ul> <li>Existing preventive measures were captured at the Risk Assessment Workshop and are detailed within the Risk Register. Where gaps were noted with the existing system, actions to address the gaps were logged in the Risk Register and transcribed to the Action Plan.</li> <li>Preventative measure are reviewed upon review of the Risk Register (as outlined for component 2.3 above).</li> </ul>	- NEV Potable Water Risk Register Rev F (16/01/2017)	
<ul> <li>3.2 Critical control points:</li> <li>Assess preventive measures from catchment to consumer to identify critical control points.</li> <li>Establish mechanisms for operational control.</li> <li>Document the critical control points, critical limits and target criteria.</li> </ul>	<ul> <li>Critical control points (CCPs) have been identified, as summarised in Section 8.1 of this plan</li> <li>Any change in CCPs and CCP conditions are undertaken in consultation with IPART and NSW Health.</li> </ul>	- Section 8.1 of this document.	
Element 4: Operational procedure	es and process control		
<ul> <li>4.1 Operational procedures:</li> <li>Identify procedures required for processes and activities from catchment to consumer</li> <li>Document all procedures and compile into an operations manual.</li> </ul>	<ul> <li>O&amp;M Manual for the temporary water supply scheme.</li> <li>Standard Operating Procedures/ Work Instructions are prepared for the following tasks:         <ul> <li>Plant security and maintenance</li> <li>Chlorine dosing system</li> <li>Walkaround and visual inspections</li> <li>Other plans/procedures will be prepared for the following:</li> <li>Backflow and cross connection prevention</li> </ul> </li> </ul>	<ul> <li>Operation and Maintenance Manual Reticulation Network available from server location - Nextcloud\NEV Water\IOP\Reticulation Network</li> <li>Work instructions</li> </ul>	

FRAMEWORK ELEMENT	ACTIVITY	REFERENCE DOCUMENT
<ul> <li>4.2 Operational monitoring:         <ul> <li>Develop monitoring protocols for operational performance of the water supply system, including the selection of operational parameters and criteria, and the routine analysis of results.</li> <li>Document monitoring protocols into an operational monitoring plan.</li> </ul> </li> </ul>	<ul> <li>Log sheets are developed for CCC supplied and treated water quality monitoring</li> <li>NEV's Head of Water is responsible for reviewing results and reporting.</li> <li>Water quality performance report is supplied with bills.</li> <li>SCADA and telemetry is used to monitor the system.</li> <li>Service inspection sheets are available for asset monitoring and performance</li> <li>An operational monitoring plan is developed for this project.</li> </ul>	Monitoring and Recording Procedure Water Quality available from server location - Nextcloud\NEV Water\IOP\Sampling & Testing
<ul> <li>4.3 Corrective action:</li> <li>Establish and document procedures for corrective action to control excursions in operational parameters.</li> <li>Establish rapid communication systems to deal with unexpected events.</li> </ul>	<ul> <li>Corrective actions are included in CCP tables (see Section 8 of this document).</li> <li>Refer to Element 6 below for incident management.</li> </ul>	- Section 8 of this document
<ul> <li>4.4 Equipment capability and maintenance: <ul> <li>Ensure that equipment performs adequately and provides sufficient flexibility and process control.</li> <li>Establish a program for regular inspection and maintenance of all equipment, including monitoring equipment.</li> </ul> </li> </ul>	<ul> <li>Treatment equipment is of standard and reliable design and is supported by qualified suppliers.</li> <li>Instrument capability and maintenance is carried out via:         <ul> <li>Instrument selection (fit for purpose and capable of holding calibration)</li> <li>Operator checks to verify calibration</li> <li>Calibration schedule</li> </ul> </li> </ul>	<ul> <li>Executed service agreements between NEV Co-op and Innaco for the maintenance and service of the temporary water supply and treatment system are available at server location - Nextcloud\NEV Water\Innaco</li> </ul>

FRAMEWORK ELEMENT	ACTIVITY	REFERENCE DOCUMENT
<ul> <li>4.5 Materials and chemicals:</li> <li>Ensure that only approved materials and chemicals are used.</li> <li>Establish documented procedures for evaluating chemicals, materials and suppliers.</li> </ul>	<ul> <li>All plumbing and drainage work is conducted in a manner conforming to AS/NZS 3500.</li> <li>All materials comply with AS 4020.</li> <li>All chemicals is purchased from reputable suppliers and is checked to confirm suitable for drinking (e.g. no UV stabilisers etc).</li> <li>A chemical handling protocol is available.</li> </ul>	Nextcloud\NEV Water\IOP\Reticulation Network
Element 5: Verification of drinking	g water quality	
<ul> <li>5.1 Drinking water quality</li> <li>monitoring: <ul> <li>Determine the characteristics to be monitored in the distribution system and in water as supplied to the consumer.</li> <li>Establish and document a sampling plan for each characteristic, including the location and frequency of sampling.</li> <li>Ensure monitoring data is representative and reliable.</li> </ul> </li> </ul>	<ul> <li>The verification monitoring program is developed as part of the commissioning phase of the project.</li> <li>The monitoring program is in line with NSW Health requirements</li> </ul>	Monitoring and Recording Procedure Water Quality available from server location - Nextcloud\NEV Water\IOP\Sampling & Testing
<ul> <li>5.2 Customer satisfaction:</li> <li>Establish a consumer complaint and response program, including appropriate training of employees</li> </ul>	<ul> <li>NEV has a Complaints Handling and Dispute Resolution Policy. Requests are logged and reviewed in weekly operations meeting.</li> <li>The first point of contact for customers and associated training/awareness program is NEV's Customer Relationship Manager</li> <li>NEV's Customer Services Charter has been updated to include drinking water.</li> </ul>	<ul> <li>NEV Complaints Handling Dispute Resolution Policy NEV's Customer Services Charter</li> </ul>

FRAMEWORK ELEMENT	ACTIVITY	REFERENCE DOCUMENT
<ul> <li>5.3 Short term evaluation of results:</li> <li>Establish procedures for the daily review of drinking water quality monitoring data and consumer satisfaction.</li> <li>Develop reporting mechanisms internally, and externally, where required.</li> </ul>	<ul> <li>On a day-to-day basis, the system is monitored remotely</li> <li>Water quality issues are discussed at a weekly operations meeting.</li> <li>Trends are reviewed on a monthly basis or more frequently as required.</li> <li>CCPs and other water quality alarms are distributed automatically and corrective actions applied as per CCP tables. Any parameter outlier is referred to NEV's Operations Manager</li> </ul>	
<ul> <li>5.4 Corrective action:</li> <li>Establish and document procedures for corrective action in response to non-conformance or consumer feedback.</li> <li>Establish rapid communication systems to deal with unexpected events.</li> </ul>	<ul> <li>NEV has a Complaints Handling and Dispute Resolution Policy and Procedure. Requests are logged and reviewed in weekly operations meeting.</li> </ul>	<ul> <li>NEV's Complaint Handling and Dispute Resolution Policy</li> <li>NEV's Complaint Handling and Dispute Resolution Procedure</li> </ul>
Element 6: Management of incide	ents and emergencies	
<ul> <li>6.1 Communication:</li> <li>Define communication protocols with the involvement of relevant agencies and prepare a contact list of key people, agencies and businesses.</li> <li>Develop a public and media communications strategy</li> </ul>	<ul> <li>Communication protocols for Incidents and emergencies are covered in NEV's Incident Response Procedures.</li> </ul>	<ul> <li>NEV's NEV1045-02-B Poor Quality Drinking Water Incident Response Procedure and</li> <li>NEV1045-03-B Loss of Drinking Water Supply Incident Response Procedure.</li> </ul>

FRAMEWORK ELEMENT	ACTIVITY	REFERENCE DOCUMENT
<ul> <li>6.2 Incident and emergency response protocols: <ul> <li>Define potential incidents and emergencies and document procedures and response plans with the involvement of relevant agencies</li> <li>Train employees and regularly test emergency response plans</li> <li>Investigate any incidents or emergencies and revise protocols as necessary</li> </ul> </li> </ul>	<ul> <li>Specific emergency response procedures are developed for this site, based on existing NEV's Incident Response Procedures.</li> </ul>	<ul> <li>NEV's NEV1045-02-B Poor Quality Drinking Water Incident Response Procedure and</li> <li>NEV1045-03-B Loss of Drinking Water Supply Incident Response Procedure.</li> </ul>
Element 7: Employee awareness a	and training	
<ul> <li>7.1 Employee awareness and involvement         <ul> <li>Develop mechanisms and communication procedures to increase employee awareness of and participation in drinking water quality management</li> </ul> </li> </ul>	<ul> <li>NEV has a Training Register in place. Any new training requirements are reviewed at the annual performance review, unless identified in the interim. These procedures are adapted to include this scheme.</li> </ul>	- NEV Training Needs Analysis

FRAMEWORK ELEMENT	ACTIVITY	REFERENCE DOCUMENT
<ul> <li>7.2 Employee training:</li> <li>Ensure that employees, including contractors, maintain the appropriate experience and qualifications</li> <li>Identify training needs and ensure resources are available to support training programs</li> <li>Document training and maintain records of all employee training</li> </ul>	<ul> <li>NEV has developed a training plan for this scheme and ensure that personnel are trained to carry out procedures. Roles and responsibilities are developed and training and records management to be covered in this.</li> <li>Records are maintained in the training register. The HR Manager is responsible for maintaining training records.</li> <li>NEV maintains selection criteria and job descriptions to ensure that new staff have appropriate skills and qualifications.</li> <li>NEV uses manufacturer training for the relevant process units.</li> <li>NEV engages qualified third party for specific training needs pertaining to water management.</li> </ul>	- NEV Training Needs Analysis
Element 8: Community involvement	ent and awareness	
<ul> <li>8.1 Community consultation:</li> <li>Assess requirements for effective community involvement.</li> <li>Develop a comprehensive strategy for community consultation.</li> </ul>	<ul> <li>In the NEV Ecovillage development, the key stakeholders are the members of the village community. The community consultation process described in NEV's Governance Guidebook is therefore similar to the stakeholder consultation process described in Element 1. This includes community education and a Dynamic Governance process that seeks to involve all the members in decision making.</li> <li>Specific community engagement for NEV is included in the Community Management Statement (Appendix 4.1.4 to the WICA application).</li> </ul>	<ul> <li>NEV's Governance Guidebook</li> <li>NEV's Community Management Statement</li> <li>NEV website</li> <li>NEV Community Association Charter (draft)</li> </ul>
<ul> <li>8.2 Communication:         <ul> <li>Develop an active two-way communication program to inform consumers and promote awareness of drinking water quality issues.</li> </ul> </li> </ul>	<ul> <li>Communication is included in NEV's Governance Guidebook and Community Management Statement,.</li> </ul>	<ul> <li>NEV's Community Engagement Procedure CS020-3</li> <li>NEV Community Management Statement</li> </ul>

FRAMEWORK ELEMENT	ACTIVITY	REFERENCE DOCUMENT
Element 9: Research and develop	ment	
<ul> <li>9.1 Investigative studies and research monitoring: <ul> <li>Establish programs to increase understanding of the water supply system.</li> <li>Use information to improve management of the water supply system.</li> </ul> </li> </ul>	<ul> <li>NEV engages reliable and qualified third parties on aspects of research and development associated to potable water quality and management.</li> <li>Risk assessment review and weekly operational meetings is used to identify areas for further investigation and research specifically for the NEV scheme.</li> </ul>	
<ul> <li>9.2 Validation of processes:         <ul> <li>Validate processes and procedures to ensure that they are effective at controlling hazards.</li> <li>Revalidate processes periodically or when variations in conditions occur.</li> </ul> </li> </ul>	<ul> <li>Short and long-term evaluation of data is used to assess the effectiveness of existing processes. See Element 5 and 11 above.</li> <li>Processes will be revalidated as future stages in the project come online. This will include a review of capacity and a review of the risk register for drinking water quality.</li> </ul>	
<ul> <li>9.3 Design of equipment:</li> <li>Validate the selection and design of new equipment and infrastructure to ensure continuing reliability.</li> </ul>	<ul> <li>Selection and design of new equipment is subject to equipment supplier's design process which include reviews, approvals, HAZOP and HACCP phases.</li> </ul>	

FRAMEWORK ELEMENT	ACTIVITY	REFERENCE DOCUMENT
Element 10: Documentation and	reporting	
<ul> <li>10.1 Management of documentation and records: <ul> <li>Document information pertinent to all aspects of drinking water quality management.</li> <li>Develop a document control system to ensure current versions are in use.</li> <li>Establish a records management system and ensure that employees are trained to fill out records.</li> <li>Periodically review documentation and revise as necessary.</li> </ul></li></ul>	<ul> <li>NEV's document control procedures are documented.</li> <li>SCADA is also used to record and store data.</li> <li>All documents and records are backed up to external cloud storage systems.</li> <li>Review dates are included in Document Control section on individual documents.</li> </ul>	<ul> <li>NEV002 Document Control Procedure available at server location - Nextcloud\NEV Water\Policies &amp; Procedures\Policies</li> </ul>
<ul> <li>10.2 Reporting:</li> <li>Establish procedures for effective internal and external reporting.</li> <li>Produce an annual report to be made available to consumers, regulatory authorities and stakeholders.</li> </ul>	<ul> <li>The Service Agreement between NEV and Innaco defines reporting procedures.</li> <li>Water quality and plant performance are reported to NEV on a monthly basis by Innaco</li> <li>Senior members of NEV discuss relevant water quality issues on a frequent basis. Decisions on improvements in operational equipment and infrastructure issues arise from these discussions. The NEV scheme is included as part of these discussions.</li> <li>NEV generally undertakes at least an annual review meeting for each of its services offered to the customers.</li> </ul>	<ul> <li>160628 Innaco Contract signed Potable Water</li> <li>160628 Innaco Contract signed Wastewater</li> <li>Innaco monthly reports provided to NEV</li> </ul>

FRAMEWORK ELEMENT	ACTIVITY	REFERENCE DOCUMENT			
Element 11: Evaluation and audit					
11.1 Long-term evaluation of	- NEV's Head of Water is responsible for review of data and long-term evaluation of				
results:	results.				
- Collect and evaluate long-term	<ul> <li>Results are used to inform risk assessment reviews.</li> </ul>				
data to assess performance and	- As outlined above, senior NEV personnel discuss and review issues.				
identify problems.	<ul> <li>Reporting is as outlined in component 10.2 above.</li> </ul>				
- Document and report results.					
11.2 Audit of drinking water quality	- NEV will be subject to WICA licence audits as the operator of the scheme.				
management:	- Internal audits will be scheduled to precede the licence audit by approximately two				
- Establish processes for internal	months.				
and external audits.	<ul> <li>Informal inspections will be undertaken by operators.</li> </ul>				
- Document and communicate					
audit results.					
Element 12: Review and continual improvement					
12.1 Review by senior executive:	- NEV's Head of Water and CEO review the effectiveness of the management system				
- Senior executive review of the	on a project-by-project basis. NEV's current method for review of the management				
effectiveness of the	system is:				
management system.	<ul> <li>Pre-audit (with minutes of meeting)</li> </ul>				
- Evaluate the need for change.	- Risk assessment review (action plan)				
	- This approach will be reviewed for the NEV scheme.				
	- As outlined for Component 10.2 above, senior members of NEV discuss relevant				
	water quality issues on a frequent basis.				

FRAMEWORK ELEMENT	ACTIVITY	REFERENCE DOCUMENT
<ul> <li>12.2 Drinking water management improvement plan: <ul> <li>Develop a drinking water quality management improvement plan.</li> <li>Ensure that the plan is communicated and implemented, and that improvements are monitored for effectiveness.</li> </ul> </li> </ul>	<ul> <li>Actions to improve risk management in the water supply system were identified in the risk workshop of 16<sup>th</sup> January 2017.</li> <li>An Improvement Plan, including the assignation of responsibilities and priorities, has been developed for implementation of the actions.</li> <li>Actions continue to be added to the Improvement Plan as they are identified.</li> </ul>	<ul> <li>DW Improvement Plan at server location - Nextcloud\NEV Water\IOP\PWTP</li> </ul>

# 6 Validation of Treatment Process

The water supplied from the CCC is potable quality as outlined in the Deed of Agreement between NEV and CCC and there is no further treatment prior to the water being supplied to the end user. The temporary infrastructure has been designed to retain the incoming water quality, rather than treat it to a higher standard.

The break tank is 15kL and is not designed to store water for any period of time. Potable water from the Gosford supply will be bought in each day during the approved period which ensure the water in the tank is turned over. The transfer pump system is controlled by a level transducer, and the high and low set points can be optimised to ensure turnover occurs frequently.

The potable water storage tanks have been designed to operate as both firefighting storage tanks, and as a potable water buffer. Of the 450kL capacity, approximately 85% is retained for firefighting purposes. The retention time in the tank is significant and therefore it is likely that the residual free chlorine retained in the potable water from the CCC supply, will decay appreciable.

The potable water storage tanks have been equipped with a chlorine dosing system. A pump system extracts water from the storage tanks and circulates it through a dosing system. The oxidation-reduction potential (ORP) is monitored continuously and a PLC controlled dosing pump is used to add sodium hypochlorite to restore free chlorine to the potable water.

Water returned to the potable water storage tanks from the chlorination system is introduced into each of the three tanks via a mixing adductor. This ensures that the contents of the tank remain homogenous and the residual free chlorine being measured is indicative of the free chlorine in the bulk storage.

The chlorination dosing system also continuously monitors the pH. There are no treatment processes undertaken which are likely to affect the pH. It is therefore unlikely that the pH will vary from the time it is bought onto site. Whilst chlorination can potentially affect the pH, the chlorination system is only intended to replace free chlorine which has degraded over time. The net effect on the pH is therefore likely to be negligible. Given this, the system has no pH correction included. Should the pH fall outside the defined limits in ADWG, the pH would be corrected manually through the addition of chemical.

The PLC will send alarms if the ORP or the pH deviate from pre-determined limits. Where this occurs, corrective actions can be taken to prevent the potable supply deteriorating to a point where is not fit for purpose.

# 7 Operational monitoring and process control

#### 7.1 Monitoring and Corrective actions

NEV personnel are available on site and undertake daily checks at the plant. Weekly, monthly and servicing at other intervals us undertaken by Innaco. The responsibilities for undertaking the works are outlined in the Service agreement between the two parties.

The temporary potable water plant is PLC controlled and is set up to be remotely monitored. Innaco can monitor the plant and respond to process changes remotely. The PLC is set up to warn operators of adverse conditions which allows corrective action to be taken.

Process changes or other corrective actions will be undertaken under the direction of Innaco. This will either undertaken by an Innaco Service Technician, or in some circumstances, the actions will be undertaken by an NEV staff member under the direction of an Innaco service technician.

Key plant parameters are logged which allows Innaco to review plant data for troubleshooting.

#### 7.2 Standard Operating Procedures

An operations and maintenance manual will be supplied with the system to explain detailed operation.

Innaco are operating the temporary potable water infrastructure as an authorised third party under NEV's Network Operator's license. Innaco have the technical and organisational capacity to undertake the operational works. NEV ensure that Innaco maintain this ongoing capacity.

Innaco independently hold Network Operator Licenses for other sites with similar infrastructure, and are therefore periodically assessed by independent auditors to ensure the technical and organisational capacity is retained within the business.

## 8 Verification and Ongoing Monitoring

The temporary potable water scheme does not involve a treatment plant or any treatment processes. Potable water is bought onto site and the water quality is maintained as described in Section 6. For this reason, there is no validation requirement.

Potable water quality in the storage tanks is monitored on an ongoing basis for verification purposes. ORP and pH of the water in the storage tank is monitored continuously and logged periodically.

Potable water quality at point of use is monitored to ensure it is fit for purpose. *Monitoring and Recording Procedure for Water Quality in Distribution Networks* is the document which describes this process. The purpose of this monitoring is to ensure that water quality is retained throughout the distribution network so that users at extreme points are receiving in specification water.

### 8.1 Critical Control Points

A recirculation and chlorine dosing system is installed at the potable water storage tanks. The recirculated water is monitored for pH and ORP. Chlorine is dosed to maintain the ORP setpoint within the desired range. The required ORP setpoint (in millivolts) will be determined during commissioning such that a minimum free chlorine residual of 0.2 mg/L is maintained in the storage tank, and minimum of 0.1 mg/L within the network (target 0.2 - 0.4 mg/L). As a starting point, the ORP low alarm will be set at the mV reading for 0.2 mg/L based on testing of a sample of chlorinated water from the CCC network.

The pH is monitored, but not controlled directly. If pH goes outside the range of 6.5 to 8.5 an alarm is raised that will alert the operator to check the quality of the water in the transfer tank. This is the source water from the CCC and should always be within specification.

A summary of these parameters and associated actions is provided in Table 8.1.

QCP/CCP	Parameter	Control System Response	Operator Actions
CCP1 - Potable Water Storage Tanks	<b>ORP:</b> ORP setpoint (mV) adjusted to achieve a minimum of 0.2 mg/L in the storage tank and 0.1 mg/L in the distribution network (target range is 0.2 to 0.5 mg/L.). Chlorine residual: $\geq$ 0.2 mg/L to $\leq$ 1 mg/L. in the storage tanks.	Chlorination system responds to maintain ORP setpoint. Setpoint tuned as needed to maintain chlorine residual in the network. Warning Alarm: ORP equivalent to 0.2 mg/L.	Check chlorine residual at the CCC inlet to transfer tank to ensure correct water quality. If necessary, manually dose to increase residual.
	<b>pH:</b> 6.5 ≤ pH ≤ 8.5	Warning alarm	Check pH at the CCC inlet to transfer tank to ensure correct water quality provided. If necessary, manually adjust with acid or alkali.

#### Table 8.1 – CCP summary and operator action

## 9 Prerequisite programs

For the effective operation of this DWMP, prerequisite programs that outline detailed procedures and protocols will be provided.

#### **Operations and Maintenance procedures:**

An operations and maintenance manual has been drafted for the scheme. Included in the manual are the Standard Operating Procedures, Maintenance Procedures, Calibration Procedures and Chemical Safety Procedures.

#### Calibration of monitoring instruments:

The calibration of all on-line monitoring instruments will be checked at monthly intervals as part of the monthly servicing of the plant by the authorised third party. The calibration of each instrument is logged and maintained on a standard maintenance record.

#### Inspections:

The plant is under continuous remote supervision by Innaco as the contracted operator and authorised third party. Data logging of key parameters is a part of this supervision. Daily and weekly inspections will be conducted by NEV appointed personnel with Innaco providing training to these individuals. The responsibilities will be clearly delineated in the service agreement. Also in accordance with the service agreement, monthly maintenance including instrument calibration checks are carried out by Innaco and records maintained. Servicing at other intervals will also be carried out by Innaco.

# 10 Incidents and emergencies

Procedures for management of incidents and emergencies are contained in the following NEV documents:

- NEV NEV1045-02-B Poor Quality Drinking Water Incident Response Procedure
- NEV Environmental Incident Procedure
- NEV WHS Incident Procedure
- NEV Bushfire Management Plan

NEV maintains a community contact and FAQ section on its website with procedures relating to the management of emergencies relating to NEV water infrastructure.

Innaco are also available to be contacted during incidents or emergencies related to the assets it manages. Contact details are on the Innaco web site.
#### Table 10-1: Incidents and Emergencies

Hazards and events	Immediate Response		Corrective Action		Authorities		
that may lead to	What	Who	What	Who	What	Who	
emergencies							
Non-conformance of water identified through remote monitoring	If detected by online instrument, Innaco to immediately inform NEV. NEV to work with Innaco's technical assistance to manually dose tanks and restore water quality.	Innaco/ NEV	Innaco and NEV to determine root cause of problem and rectify.	Innaco/ NEV	Has non-compliant water been delivered? If yes, Innaco notify NEV. NEV notify Health and IPART where appropriate	NEV	
Non-conformance of water identified through on-site testing	NEV to immediately inform Innaco. NEV to work with Innaco's technical assistance to manually dose tanks and restore water quality.	Innaco/ NEV	Innaco and NEV to determine root cause of problem and rectify.	Innaco/ NEV	Has non-compliant water been delivered? If yes, Innaco notify NEV. NEV notify Health and IPART where appropriate	NEV	
Cross-connections	If a cross connection is detected, immediately stop use of treated water, and switch to potable water backup.	NEV	Conduct audit to identify location of cross- connection. Rectify. Preventative measures include signage, labelling, colour-coding, information brochures for plumbers and residents Do not reinstate delivery of treated water until cross connect audit has been completed.	NEV	Should a cross-connection be identified, notify NSW Health and IPART	NEV	
Prolonged power outages	Hand held testing at storage tanks to confirm residual chlorine level. Manually dosing as advised by Innaco if required.	NEV	None – plant will resume normal operation once power returns. Potable water supply is gravity feed. Prolonged outage may require water to be trucked in, or generator hire to run system	NEV	No requirement provided water remains in specification		
Leakage/Pipe break	Isolate supply in a manner that minimises disruption to end users	NEV	Arrange repair of leak/break	NEV	Water is potable so no requirement to inform authourities		

# 11 Employee awareness and training

Both NEV and Innaco are individually responsible for ensuring its employees and contractors are familiar with the operation of the scheme and aware of the potential consequences of system failures, and of how their decisions can affect the safety of the scheme and the health of the end users.

Training needs for NEV employees and key contractors are identified and adequate resources made available during the induction phase and ongoing. Annual performance reviews identify additional training requirements and set performance targets. Training records are kept.

Innaco will provide an induction program, operator training and Safe Work Method Statements (SWMS's) training for any NEV employees or contractors who will provide on-site services in relation to the plants Innaco has been contracted to manage.

Innaco will provide an experienced water engineer to monitor the plants it has been contracted to manage. Any staff used on site must be accredited, qualified and have the appropriate level of training.

A site induction will be required for anyone doing work related to this scheme. This will be carried out and recorded by Innaco, or by those appointed and trained by Innaco for this purpose. For plant work this includes familiarisation with Innaco's Safe Work Method Statements (SWMS's) which are site specific. Innaco maintains a partnership with several contractors to ensure continuity of knowledge and technical expertise.

Innaco has an induction program for new employees and written procedures for all areas of responsibility (IMS document HR120).

Training needs for Innaco employees are identified and adequate resources made available during the induction phase. Annual performance reviews identify additional training requirements and set performance targets. Training records are kept.

# 12 Documentation and reporting

### 12.1 Documentation

The following records and documents will be maintained by Innaco as the operator of the temporary potable system:

- Verification and on-going monitoring results
- Plant operation data
- Laboratory testing results and analysis
- Breaches of critical limits and corrective actions taken
- Incidents and emergencies and corrective actions taken
- Inspection and maintenance activities relevant to water quality

Operating data will be collected by online data acquisition system and kept as electronic copy by the plant operator Innaco.

Verification results will be collected by Innaco from a NATA accredited testing laboratory and stored electronically.

A record of any maintenance to the treatment plant will be logged electronically. Any equipment adjusted, repaired, replaced or calibrated will be recorded. Monthly maintenance checks and calibrations are recorded on a monthly maintenance checklist (See Operations and Maintenance Manual).

NEV will record the outcomes of any daily inspections or work which they undertake on the plant. Significant events or observations will be reported to Innaco immediately for assessment and action.

### 12.2 Reporting

There will be a monthly report provided to NEV in relation to the operation and maintenance of the drinking water plant by Innaco.

NEV will prepare an annual compliance report to be submitted to CCC in compliance with the Deed of Agreement.

NEV will comply with all statutory reporting requirements under the WIC Act. Innaco will make available the data required for NEV to prepare these reports.

#### 12.3 Notifications

NEV, as the licence holder will, as soon as practical and within 48 hours, notify NSW Department of Health and IPART should any of the following incidents occur:

- a system failure that may potentially impact on the end users of the potable water,
- an emergency or an incident that potentially places public health a risk,
- any changes to the DWMP or operation of the process that may potentially impact on achieving the required water quality.

Notification should include details of corrective and future preventive action.

Contact details for various key entities in the project are listed in the table below.

Entity	Contact	Details
NSW Health	Public Health Unit	1300 066 055
		Email: waterqual@doh.health.nsw.gov.au
	Central Coast Public Health Unit	(02) 4320 9730
	(PHU)	After Hours: (02) 4320 2111
		(Gosford Hospital) – ask for Public Health
		Nurse on call
EPA NSW	Environment Line	131 555
Central Coast Council	Gosford Water Duty Officer	(02) 4325 8222

NEV Co-op	Geoff Cameron, Head of NEV Water	Phone: 02 4328 1588
		Mobile: 0401 319 051
		Email: water@nararaecovillage.com
Innaco	Warren Johnson, Technical	Address: 64 Alexander St, Crows Nest, NSW
	Manager	2065
		Phone: 02 4721 0545
		Mobile: 0428 529 181
		Email: warrenj@Innaco.com.au

### 13 Auditing

The frequency for independent ongoing audits will be determined by IPART requirements using a risk based approach, but will likely

### 14 Review and improvement

The DWMP is reviewed and updated annually.

Where improvements to the plant or revisions to operation of the plant are identified, such improvements shall only be implemented with the approval of IPART if the improvements or revisions involve altering public health and environment protection measures.

# 15 Commissioning

All operational monitoring, critical alarms and corrective actions within the DWMP will be tested and verified as part of commissioning.

### 16 Plumbing

The Building plumbing and drainage system has been designed in accordance with the Water Supply Code of Australia and in accordance with AS/NZS 3500:2013.

# 17 References

- 1. NHMRC/NRMMC 2011. Australian Drinking Water Guidelines 6, Version 2.0, Updated December 2013
- 2. NSW Health 2005, Drinking Water Monitoring Program, December, ISBN: 0 7347 3880
- 3. Woodlots and Wetlands Pty Ltd 2013, *An integrated water cycle management strategy for the proposed Eco*village at Lot 1 DP 1087535 Research Road Narara

# 18 Appendices

	Potential	Ма	iximu	m Risk	Preventative Measures	Re	sidua	l Risk	Uncertainty	Comments	Further Actions
Risk #	Hazards and Hazardous Event	L	С	Max. Risk Score		L	С	Resid. Risk Score			
TC1	Poor quality water supplied by CCC and distributed to customers	3	4	7	Online pH monitoring Online ORP monitoring Chlorine trim dosing to Potable Water Storage Tanks Customer complaint monitoring Water carting available	2	4	6		Maximum likelihood based on ADWG 2011 descriptor "Might occur or should be expected to occur at some time" - CCC (Gosford CC) has had reticulated water quality issues in the past, but these are not frequent, and past 10 years of water quality data show rare ADWG exceedances Maximum consequence based on ADWG 2011 descriptors "Major impact for small population" and "Abnormal operation" - poor quality water would affect entire ecovillage and may require significant water carting Maximum risk rating of "Significant" similar to comparable water supply systems Residual likelihood based on fact that online pH monitoring, online ORP monitoring, and chlorine trim dosing, will identify and address some water quality issues before water reaches customers Residual consequence unchanged because if poor quality water does	NEV to develop emergency response protocol which details: How poor water quality requiring emergency response is defined (e.g. exceedance of ADWG health guideline value) How poor water quality is identified (i.e. what triggers the emergency response) Any additional monitoring required (e.g. resample, testing of chlorine in

# Appendix 1 Risk Assessment Register

	Potential Hazards and	ntial Maximum Risk		Preventative Measures	Re	sidua	ıl Risk	Uncertainty	Comments	Further Actions	
Risk #	Hazards and Hazardous Event	L	с	Max. Risk Score		L	С	Resid. Risk Score			
										reach customers, then impact is still major Residual risk rating of "Moderate" similar to comparable systems	response to E. coli) Liaison with CCC Water carting procedure How/where poor quality water will be diverted Notification to NEV residents Who is responsible for each of the above actions All relevant contact details

	Potential	Ма	iximu	m Risk	Preventative Measures	Re	sidua	ıl Risk	Uncertainty	Comments	Further Actions
Risk #	Hazards and Hazardous Event	L	С	Max. Risk Score		L	С	Resid. Risk Score			
TC2	Loss of supply from CCC resulting in no water available for customers (e.g. planned maintenance, upstream mains break)	3	4	7	Notification from CCC prior to any planned maintenance (passive control) Large storage volume in Potable Water Storage Tanks (5 days storage according to PoM) Level sensor/ transmitter on Gosford Water Break Tank Level sensors/ transmitters on Potable Water Storage Tanks Water carting available	1	4	5		Maximum likelihood based on ADWG 2011 descriptor "Might occur or should be expected to occur at some time" - planned maintenance and mains breaks do sometimes occur in systems like CCC's Maximum consequence based on ADWG 2011 descriptors "Major impact for small population" and "Abnormal operation" - loss of supply would affect entire ecovillage and would require water carting Residual likelihood based on fact that large storage volume, coupled with level monitoring on tanks, means that water carting and/or return of CCC supply is likely to happen long before Potable Water Storage Tanks run dry Residual consequence unchanged because if tanks did run dry, then impact is still major Note: this line item initially considered as two separate line items, being "Loss of supply with forewarning" and "Loss of supply without forewarning"; however, these were subsequently combined	NEV to develop emergency response protocol which details: How loss of supply is defined (e.g. particular level set point in Potable Water Storage Tanks) How loss of supply is identified (i.e. what triggers the emergency response) Liaison with CCC Water carting procedure Notification to NEV residents Who is responsible for each of the above actions All relevant contact details

	Potential	Potential izards and azardous EventMaximum RiskPreventative MeasuresLCMax. Risk ScoreI		Preventative Measures	htative sures Residual Risk			Uncertainty	Further Actions		
Risk #	Hazards and Hazardous Event			L	С	Resid. Risk Score					
										as the risk scores and majority of the preventative measures were the same.	

<u>R</u> isk F	Potential Hazards and	Maximum Risk			Preventative Measures	Residual Risk			Uncertainty	Comments	Further Actions
Risk #	Hazards and Hazardous Event	L	С	Max. Risk Score		L	С	Resid. Risk Score			
TC3	Backflow from Narara Ecovillage to CCC during routine operation, causing contamination of CCC system (and therefore poor quality water supplied or loss of supply to Narara Ecovillage)	3	5	8	RPZ (reduced pressure zone) on supply line, with annual testing and 5-yearly refurbishment Air gap on Gosford Water Break Tank	1	4	5		Maximum likelihood based on ADWG 2011 descriptor "Might occur or should be expected to occur at some time" - with no controls, backflow could be expected to occur Maximum consequence changed in Rev F to match TC5 to TC8, all of which involve backflow to CCC system Residual likelihood based on fact that with RPZ and air gap in place, backflow is almost physically impossible Residual consequence reduced slightly from maximum because chlorine trim dosing will address some water quality issues, but impact will still be major Note: this risk is considered mainly based on the impact it would have on NEV. Impacts on CCC should be considered in CCC's own drinking water risk assessment.	

TC4 Water cartag to NEV (emergency measure due to loss of supply) introducing poor quality water that is distributed to customers	le 2	5	7	Compliance with NSW Guidelines for Water Carters (passive control), including: - Quality Assurance Program - Tanks, hoses, and fittings made of drinking water appropriate materials - Tanks for drinking water not to be used for carting hazardous materials (e.g. effluent, petroleum) - Tanks, hoses and fittings to be regularly cleaned and disinfected - At least 6 months' records of: * The name of each supplier of drinking from whom the water cater receives water * The place, date, and time at which water is	1	4	5		Main control is compliance with NSW Guidelines for Water Carters, which is a requirement for water carters. Maximum likelihood based on ADWG 2011 descriptor "Could occur at some time" - water cartage would be an emergency measure only, but could be required Maximum consequence based on ADWG 2011 descriptor "Complete failure of systems" - with no controls at all, illness outbreak could feasibly occur from water carting Residual likelihood based on fact that if water carters are fully compliant with NSW Guidelines for Water Carters, then contamination is very unlikely to occur Residual consequence reduced slightly from maximum because chlorine trim dosing will address some water quality issues, but impact will still be major	NEV to develop water carting procedure (standalone or as part of emergency response protocols for Poor Quality Water and Loss of Supply) which details: How water carters are approved for use List of approved suppliers Checks to be performed when water is carted onsite Where and how carted water is to be transferred to NEV storage Actions to take if carted water quality is not acceptable Who is responsible for each of the above actions
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	Potential	Ма	ximu	n Risk	Preventative Measures	Re	sidua	l Risk	Uncertainty	Comments	Further Actions
Risk #	Hazards and Hazardous Event	L	С	Max. Risk Score		L	С	Resid. Risk Score			
TC5	Illegal/unknown connections to temporary connection line resulting in backflow to CCC and causing contamination of CCC system (and therefore poor quality water or loss of supply to NEV)	3	5	8	RPZ (reduced pressure zone) on supply line, with annual testing and 5-yearly refurbishment Temporary connection line will not pass near any development or residential lot - therefore any ground disturbance will be very obvious (passive control) Colour coded piping - blue potable water, lilac recycled water, beige sewer Colour coded warning tape clearly identifying different lines As built drawings will clearly identify location of potable water line (future control)	2	5	7		Maximum likelihood and consequence scores based on line item DS14 Residual likelihood reduced from maximum due mainly to colour coded warning tape and RPZ Residual consequence unchanged from maximum because impact from illegal connections (particularly unknown contaminants) could be catastrophic ALARP Note: this risk is considered mainly based on the impact it would have on NEV. Impacts on CCC should be considered in CCC's own drinking water risk assessment.	

	Potential Maximum Risk	Maximum Risk Preventative Measures				Re	esidua	al Risk	Uncertainty	Comments	Further Actions
Risk #	Hazards and Hazardous Event	L	с	Max. Risk Score		L	с	Resid. Risk Score			
					Online pH monitoring Online ORPI monitoring All residents will be part of NEV owners association Education plan Customer complaints monitoring Maintain positive pressure in the temporary connection line New customer contract New customer connection audit process						

Risk I	Potential Hazards and	Maximum Risk		m Risk	Preventative Measures	Residual Risk			Uncertainty	Comments	Further Actions
Risk #	Hazards and Hazardous Event	L	С	Max. Risk Score		L	С	Resid. Risk Score			
TC6	Contamination to temporary connection line from non- quarantining of sewer and water equipment, resulting in contamination of CCC system (and therefore poor quality water or loss of supply to NEV)	3	5	8	RPZ (reduced pressure zone) on supply line, with annual testing and 5-yearly refurbishment Chlorine residual Use licensed plumbers New pipes therefore unlikely to require works (passive control)	2	4	6		Maximum likelihood and consequence scores based on line item DS5 Residual likelihood based on fact that works are unlikely to be required in the time that the temporary connection will be operational, and if required, RPZ and use of licensed plumbers should make contamination of CCC system unlikely Residual consequence reduced slightly from maximum because chlorine residual will address some water quality issues, but impact will still be major Note: this risk is considered mainly based on the impact it would have on NEV. Impacts on CCC should be considered in CCC's own drinking water risk assessment.	

	Potential	Maximum Risk		m Risk	Preventative Measures	Re	sidua	ıl Risk	Risk Uncertainty Comments		Further Actions
Risk #	Hazards and Hazardous Event	L	с	Max. Risk Score		L	С	Resid. Risk Score			
TC7	Cross connections from temporary connection line to recycled water system or any other non-potable sources, resulting in contamination of CCC system (and therefore poor quality water or loss of supply to NEV)	3	5	8	RPZ (reduced pressure zone) on supply line, with annual testing and 5-yearly refurbishment Air gap on Gosford Water Break Tank Colour coded piping - blue potable water, lilac recycled water, beige sewer Colour coded warning tape clearly identifying different lines As built drawings will clearly identify location of potable water line (future control) Only plumbing contractors with experience in recycled water management will be approved to work on the	2	4	6		Maximum likelihood and consequence scores based on line item DS6 Residual likelihood reduced from maximum due mainly to colour coded pipes and warning tapes, use of plumbers experienced in recycled water, RPZ, and air gap Residual consequence reduced slightly from maximum because chlorine residual will address some water quality issues, but impact will still be major Note: this risk is considered mainly based on the impact it would have on NEV. Impacts on CCC should be considered in CCC's own drinking water risk assessment.	

	Potential	Ma	Maximum Risk		Preventative Measures	Residual Risk		Uncertainty	Comments	Further Actions	
Risk #	Hazards and Hazardous Event	L	С	Max. Risk Score		L	с	Resid. Risk Score			
					potable water and recycled water systems Chlorine residual Higher pressure in potable system than recycled system						

Risk	Potential Hazards and Hazardous Event	Maximum Risk			Preventative Measures Residual Risk			ıl Risk	Uncertainty	Comments	Further Actions
Risk #		L	С	Max. Risk Score		L	С	Resid. Risk Score			
TC8	Rupture of temporary connection line, resulting in entry of contaminants into the system and contamination of CCC system (and therefore poor quality water or loss of supply to NEV)	3	5	8	RPZ (reduced pressure zone) on supply line, with annual testing and 5-yearly refurbishment New pipes therefore unlikely to have mains breaks happening initially (passive control) Only 20m of trench where temporary connection line is co-trenched with sewer (passive control) Chlorine residual Use licensed plumbers	2	4	6		Maximum likelihood based on line item DS13 Maximum consequence same as TC6 and TC7 (both involve incident leading to contamination of CCC system via temporary connection line) Residual likelihood based on fact that rupture is unlikely in the time that the temporary connection will be operational, and if it occurs, RPZ and use of licensed plumbers should make contamination of CCC system unlikely Residual consequence reduced slightly from maximum because chlorine residual will address some water quality issues, but impact will still be major Note: this risk is considered mainly based on the impact it would have on NEV. Impacts on CCC should be considered in CCC's own drinking water risk assessment.	

# Appendix 2 Regulatory and formal requirements

Regulatory or Formal Requirement	Relevance to Drinking Water Quality
NSW Public Health Act 2010 and Regulation 2012	Protection of public health
NSW Health Drinking Water Monitoring Program	Framework for water quality monitoring, response and communication protocols
Australian Drinking Water Guidelines 2011	Framework and guidance for provision of safe drinking water, including water quality targets
NSW Code of practice Plumbing and Drainage 2006 and AS3500 (2003)	Requirements for private water systems located downstream of the water meter.
Protection of the Environment Operations Act 1997	Environment and protection including licensed discharges.
Independent Pricing and Regulatory Tribunal (IPART) licence requirements	IPART administers the licensing of private water utilities in NSW under the Water Industry and Competition Act
Water Industry and Competition Act 2006	
Fluoridation of Public Water Supplies Act 1957	Sets out the requirements for fluoridation of public
NSW Code of practice for fluoridation of Public Water Supplies 2011	is fluoridated by Central Coast Council)



# Drinking Water Management Improvement Plan

Action	ADWG	Task/	Docnoncihil	Risk	Timing/	Status	Comments/
#	Framework	Activity	Responsibil	#	Priority	Status	Notes
A1	3.1	Prepare a recreational management	NEV	Cmt1	Jun-15	Closed	Recreational Policy has been written
		policy for reservoir					
A2	2.1	Liaise with Strickland State Forest	NEV	Cmt1,	Feb-15	Closed	Liason is ongoing
		managers regarding location of		Cmt2			
		walking tracks, feral animal					
		populations and associated baiting					
4.2	2.4	programs, etc.		C	1	Classed	
A3	2.1	Define catchment area including	NEV	Cmt1,	Jan-15	Closed	Catchment map has been prepared
Δ <i>1</i>	2.1	Double-check land use in area	NEV	Cmt2	lan-15	Closed	Agricultural area at extereme
A4	2.1	(including agriculture)		CIIIIZ	1911-12	closed	Western limit of catchment of less
		(including agriculture).					than 1 ha.
A5	2.1	Establish raw water sampling	Aquacell	Cmt3,	Jan-15	Closed	Reservoir sampling program has
		program (capture a range of		UV5, Cl5,			been done and documented.
		weather conditions, seasonal		Dst2,			
		changes as much as possible).		Dst3			
		Include temperature, TOC/DOC,					
		dissolved iron and aluminium,					
		colour, turbidity, nutrients plus gross					
		alpha and gross beta (one-off).					
		Refer to Woodlots and Wetlands					
		report for hydrogeology.					
A6	6.2	Consider water quality issues in	NEV	Cmt5,		Closed	Alternate potable water source will
		bushfire management plan including		Dam6			be permanent connection to council
		use of dam for firefighting and					supply
		alternate sources of potable water.					
		Liaise with Strickland State Forest,					
		RES and GCC.					



Action	ADWG	Task/	Doononsihil	Risk	Timing/	Status	Comments/
#	Framework	Activity	Responsibil	#	Priority	Status	Notes
Α7	6.2	Prepare incident management plan/ procedures which includes water quality impacts, identifies relevant stakeholders (HAZMAT, EPA, Police, Fire, NSW Health) and also includes notification to NSW Health when a CCP is breached.	NEV	Cmt6, Flt3, Gen5	Jun-16	Closed	This information has been addressed in the Drinking Water Quality Management Plan.
A8	2.1	Identify onsite sewage management systems by liaising with GCC.	NEV	Cmt7	Feb-15	Closed	Existing septic system has been upgraded to GCC requirements under conditions of consent for occupation of existing buildings
A9	3.1	Dam management plan to be developed with consideration as to how this fits with WICA licence.	NEV	Dam1	Completion within 6 months from licence issue	Closed	The dam has been de-prescribed. Safety Assessment and Management plan has been prepared.
A10	2.1	Liaise with previous site manager regarding evidence of dam stratification/inversion and algal blooms (including instances of taste and odour).	NEV	Dam2, Dam5	Feb-15	Closed	No significant events were noted. Taste and odour were not recorded as dam has only previously been used for irrigation purposes. Former staff report dam was stocked with edible native fish species and was productive throughought the period since its construction.
A11	2.1	Check time from entry into dam to dam wall (refer Woodlots and Wetlands study).	Aquacell	Dam4	Mar-16	Closed	No longer relevant to scheme
A12	3.1	Refer to Water Directorate website for algal management protocols.	Aquacell	Dam5	Sep-15	Closed	Algal monitoring, management and CCP are covered in the Reservoir Water Management Plan



Action	ADWG	Task/	Deenensihil	Risk	Timing/	Ctatura	Comments/
#	Framework	Activity	Responsibil	#	Priority	Status	Notes
A13	4.3	Review where off-spec water will be diverted to and/or re-treated. Consult EPA about environmental discharges or send out of spec water to Break Tank instead of dam.	Aquacell/ NEV	Flt1, Flt3, Cl4	-	Closed	Off-spec water no longer part of scheme plans
A14	9.2	Review the log reductions provided by current process train.	Aquacell	Flt2	Mar-16	Closed	Treatment of dam water no longer part of scheme plans
A15	3.2	Develop CCP procedure for UV disinfection.	Aquacell/ NEV	UV1	Mar-16	Closed	Treatment of dam water no longer part of scheme plans
A16	9.3	Confirm which guidelines the chlorine system is being designed to.	Aquacell	Cl1	Done	Closed	Treatment of dam water no longer part of scheme plans
A17	3.2	Develop CCPs in consultation with NSW Health. Refer to DWMS examples available online.	Aquacell/NEV	Cl1, PWT2	Jun-14	Closed	CCPs are addressed in the Drinking Water Management System Development Plan
A18	3.2	Consider whether water can be re- treated and prepare CCPs procedure accordingly.	Aquacell/NEV	CI4	Jan-15	Closed	Treatment of dam water no longer part of scheme plans
A19	3.2	Consider chlorine residual at extremities in chlorination CCP.	NEV & Innaco	Dst18	Jun-16	Open	Part of R&D/commissioning and village project staging. Informed by seasonal and usage patterns.
A20	3.2	Ensure that IPART and NSW Health are involved in any changes to CCPs	NEV & Innaco	Gen7	Ongoing	Open	Innaco will only change CCPs and CCP conditions in consultation with IPART and NSW Health.
A21	4.5	Determine distribution system materials.	Aquacell	Cct1	Mar-16	Closed	To comply with AS3500 and AS4020.



Action	ADWG	Task/	Deenensihil	Risk	Timing/	Chatura	Comments/
#	Framework	Activity	Responsibil	#	Priority	Status	Notes
A22	6.2	Develop a response protocol for reservoir contamination and/or loss of residual disinfectant (including manual chlorine dosing to reservoir).	NEV & Innaco	PWT1, PWT2	Sep-15	Closed	The header tanks have residual chlorine monitoring and dosing systems and a recirculation system to ensure residual chlorine levels remain within required limits.
A23	3.1	Reduce vegetation and develop ongoing vegetation management program.	NEV	PWT1	Aug-15	Closed	Vegetation has been removed from dam crest and spillway areas. Draft Dam Management Plan has been prepared.
A24	5.1	Determine appropriate monitoring point for chlorine residual in distribution system.	Aquacell /NEV	PWT1	Mar-16	Closed	Monitoring points are documented in the IOP
A25	9.3	Ensure that reservoir design considers mixing and considers reducing potential for stagnation.	Aquacell/ NEV	PWT2, PWT3	Sep-14	Closed	The header tanks have residual chlorine monitoring and dosing systems and a recirculation system to ensure residual chlorine levels remain within required limits.
A26	4.4	Determine reservoir inspection/ cleaning program once hydraulic considerations are finalised and also include Break Tank in this.	NEV & Innaco	PWT4, BTk1	Jun-16	Closed	Reservoir inspection is included in the Dam Safety Management Plan.
A27	3.1	Develop handover protocols to householders and plumbing inspection of buildings before occupancy (noting that this will be crucial to granting of licence).	NEV	Dst4	Jun-16	Closed	Protocols are detailed in the customer service supply contract and supporting documents.
A28	1.2	Consider including plumbing requirements in by-laws.	NEV	Dst4	Sep-15	Closed	Requirements are included in the customer service supply contract.



Action	ADWG	Task/	D	Risk	Timing/	Chattar	Comments/
#	Framework	Activity	Responsibil	#	Priority	Status	Notes
A29	4.1	Develop procedures for mains work including separate equipment and clothing, hygiene procedures for water and sewer.	NEV	Dst5	Completion within 6 months from licence issue	Closed	Procedures for mains work have been documented.
A30	3.1	Review backflow prevention/ cross connection policies in place for this scheme.	NEV	Dst6, Dst7	Completion within 6 months from licence issue	Closed	Requiremnts are included in customer service supply contract. Appropriate auditing procedures for new customer connections are in place. Water quality awareness training will be ongoing.
A31	2.3	Review cross connection risk once recycled water treatment plant finalised.	Aquacell/ NEV	Dst6	Post- commissioning of plant	Closed	Addressed in customer connection procedure
A32	3.1	Develop trade waste policy.	Aquacell/ NEV	Dst7	N/A for Stage 1	Closed	In Stage 1 there will not be trade waste. Trade waste policy to be developed should they become part of future stages.
A33	7.1	Increase awareness of the DWMS process (See Public Health Act/ NSW Health Guidelines for DWMS available online).	NEV	Dst7	Completion within 6 months from licence issue	Closed	Information is included in customer service supply contract and published on the NEV web site.
A34	6.2	Consider alternate sources of potable water e.g. keeping GCC water to one building, carting water. Liaise with GCC.	NEV	Dst8		Closed	Back up water will be supplied by permanent connection to council supply.
A35	4.1	Develop distribution system cleaning/ maintenance procedures (currently in progress). Ensure that mains breaks and turnover in water direction, pressure, system operation are covered.	NEV	Dst10, Dst11, Dst14	Completion within 6 months from licence issue	Closed	Distribution system cleaning/ maintenance procedures are covered in the IOP.



Action	ADWG	Task/	Deenensihil	Risk	Timing/	Ctatura	Comments/
#	Framework	Activity	Responsibil	#	Priority	Status	Notes
A36	3.1	Consider water carting access and whether it will be appropriate for this system.	NEV	Dst12	Before commercial operation	Closed	Water carting procedure is covered in the IOP.
A37	9.3	Determine how firefighting water supply will be provided.	NEV	Dst13		Closed	Water for fire fighting will be stored in 400 kL buffer tanks and reticulated in common with drinking water and delivered via hydrants located within road reserves.
A38	4.1	Ensure that mains breaks are covered in distribution system maintenance plan/procedures.	NEV	Dst14	Completion within 6 months from licence issue	Open	Mains break procedures are covered in the IOP.
A39	3.1	Consider backflow prevention devices at water meters.	NEV	Dst15		Closed	These have been installed.
A40	9.3	Consider how dead ends in the reticulation are dealt with during the staging process.	NEV & Innaco	Dst17	Mar-16	Open	Ongoing during village construction
A41	5.1	Develop verification monitoring program with consideration of NSW Health Drinking Water Monitoring Program (available online).	Aquacell/ NEV	Dst18	Mar-16	Closed	Treatment of dam water no longer part of scheme plans
A42	8.2	Review notification regarding accidental consumption of non- potable water once program completed by Aquacell. Liaise with PHU regarding this.	NEV	Gen1	Mar-16	Closed	Notification is covered in the IOP.
A43	4.5	Review program for management of materials and chemicals once completed by Aquacell.	NEV	Gen2	Prior to Commercial Operation	Closed	Procedures for management of materials and chemicalsare covered in the IOP.



Action	ADWG	Task/	Docnoncihil	Risk	Timing/	Status	Comments/
#	Framework	Activity	Responsibil	#	Priority	Status	Notes
A44	4.5	Develop a system for storing materials and cover in contract.	Aquacell/NEV	Gen2	Mar-16	Closed	Procedures for storing chemicals are covered in the IOP.
A45	4.5	Review chemical specifications/ certificates and verify OK for drinking water.	Aquacell	Gen2	Completion within 6 months from licence issue	Closed	Chemical specifications are covered in the IOP.
A46	9.3	Consider designing-in different fittings for different chemicals.	Aquacell	Gen3	N/A	Closed	Only sodium hypochlorite in drums. No bulk deliveries.
A47	6.2	Consider establishing an agreement with a local generator supplier.	NEV	Gen4	Prior to site occupancy	Closed	Battery and generator back-up power is part of smart grid design for whole of site.
A48	3.1	Review security around dam and WTP.	Aquacell/ NEV	Gen6	Completion within 6 months from licence issue	Closed	Dam management plan has been prepared. WTP is no longer included in the scheme.
A49	4.1	Include security checks in reservoir and site inspection programs.	Aquacell/ NEV	Gen6	Completion within 6 months from licence issue	Closed	Reservoir inspection is included in the IOP.
A50	7.2	Review method for ensuring skills currency and competency for drinking water.	Aquacell/ NEV	Gen7	Sep-15	Closed	Covered in the relevant position descriptions.
A51	7.2	Consider water quality awareness and training for contractors also.	NEV & Innaco	Gen7	Feb-16	Closed	Include in site induction process.
A52	7.1	Develop roles and responsibilities further (including for training and records management).	Aquacell/ NEV	Gen8, Gen9	Completion within 6 months from licence issue	Closed	Covered in position descriptions and responsibilities and authorities matrix included in the IOP.
A53	4.4	Consider having critical spares available.	Aquacell/ NEV	Gen11	Before commercial operation	Closed	Critical spares are detailed in O&M manual.



Action	ADWG	Task/	Deenensihil	Risk	Timing/	Chatura	Comments/
#	Framework	Activity	Responsibil	#	Priority	Status	Notes
A54	1.2	Update the position descriptions and	Aquacell	-	Before	Closed	Position descriptions and IMS have
		IMS to include drinking water			commercial		beeen updated.
		specific requirements.			operation		
A55	4.1	Liaise with reputable contractors	Aquacell	-	Before	Closed	Reservoir inspection is included in
		such as Aqualift to determine the			commercial		the IOP.
		best way forward for internal			operation		
		inspection and cleaning of					
		reservoirs.					
A56	4.2	Develop service inspection sheets	Innaco	-	Before	Closed	Monthly inspection by Innaco is
					commercial		documeted and reported.
					operation		
A57	4.2	Develop operational monitoring	Nev and	-	Before	Closed	Operational monitoring is detailed in
		program	Innaco		commercial		O&M manual.
					operation		
A58	4.5	Develop chemical handling protocol	Aquacell	-	Before	Closed	Chemical handling protocols are
					commercial		included in the IOP.
					operation		
A59	5.1	Determine the first point of contact	NEV	-	Before	Closed	Contact information is included in
		for customers and associated			commercial		customer service supply contract
		training/awareness program.			operation		and published on the NEV web site.
A60	5.3	Determine how water quality results	NEV	-	Before	Closed	Water quality results are published
		will be communicated for this			commercial		in the minutes of the Water Dept
		scheme.			operation		fortnightly management meeting.
A61	6.1	Review incident and emergency	NEV	-	Before	Closed	Incident and emergency
		management documents in IMS			commercial		management procudures are
		specifically for this project.			operation		documented in the IOP.



Action	ADWG	Task/	Posponsihil	Risk	Timing/	Status	Comments/
#	Framework	Activity	Responsion	"# Priority		Status	Notes
A62	6.2	Develop specific emergency response procedures for this site, based on existing Incident and Emergency Management Procedure IE010-3.	NEV / Aquacell	-	Before commercial operation	Closed	Incident and emergency management procudures are documented in the IOP.
A63	7.1	Adapt existing training documents (plans, procedures and records) for this scheme	NEV and Innaco	-	Prior to plant commissioning	Closed	Addressed in the IOP.
A64	7.2	Review available National Water Package training units for suitability and consider putting staff through NWP279.	NEV / Aquacell	-	Prior to plant commissioning	Open	Prior to plant commissioning
A65	10.2	Review/adapt standard reporting protocols will be refined for this scheme.	NEV / Aquacell	-	Before commercial operation	Closed	Reporting protocols and procudures are documented in the IOP.



# **NEV Water Quality Policy**

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### 1. Context

Narara Ecovillage Co-operative Ltd (NEV) as the network and retail license holder under Water Industry Competition Act (WICA) will be responsible for the construction, operation and maintenance of all potable and non-potable water infrastructure from source to customer connection within the Narara Ecovillage site.

### 2. Purpose

This document sets out NEV's commitment to quality control in supplying its potable and non-potable water products through the application of a management approach that is underpinned by the relevant frameworks within contemporary Australian water cycle guidance, including (but not limited to):

- The Framework for Management of Drinking Water Quality (Australian Drinking Water Guidelines 2011)
- The Framework for Management of Recycled Water Quality and Use (Australian Guidelines for Water Recycling 2006)
- Drinking Water Source Assessment and Treatment Requirements (WSA 2002 –September 2015-1.2)

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### 3. Water Quality Policy

NEV must comply with all applicable health and environmental regulations and any conditions attached to its WICA license in supplying potable and recycled water products to its customers.

NEV is committed to providing safe, high-quality potable and non-potable water that consistently meets the requirements of NSW Health legislation and guidelines, NSW Office of Water (now called DPI Water) approvals, the relevant Australian Guidelines and consumer expectations.

To achieve this NEV will:

- Ensure that the protection of public and environmental health is recognised as being of paramount importance.
- Maintain communication and partnerships with all relevant agencies involved in management of water resources, including waters that can be recycled
- Engage appropriate scientific expertise in developing non-potable water schemes
- Recognise the importance of community participation in decision-making processes and the need to ensure that community expectations are met
- Manage water quality at all points along the delivery chain from source to the water's end use (customer and environment)
- Use a risk-based approach for water product management in which potential threats to water quality along the source-to-end-use supply chain are identified and managed accordingly
- Integrate the needs and expectations of our water users, communities and other stakeholders, regulators and employees into planning processes
- Establish regular monitoring of control measures and water quality and establish effective reporting mechanisms to provide relevant and timely information and promote confidence in the water supply system and its management
- Develop appropriate contingency planning and incident response capability
- Participate in relevant research and development activities to ensure continuous improvement and continued understanding of water quality issues and performance
- Contribute to the development of industry regulations and guidelines and other standards relevant to public health and the water cycle
- Continually improve our practices by assessing performance against corporate commitments and stakeholder expectations

All managers, workers and contractors involved in the supply of potable and non-potable water products are responsible for understanding, implementing, and continuously improving the water product management system as relevant. Membership and participation in professional associations dealing with the management and use of potable and non-potable water products is encouraged.

### 4. Drinking Water Quality Policy

NEV will work on an ongoing basis with our stakeholders to manage the multiple barriers that protect and maintain water quality from catchment to consumer.

Priorities will be set using an objective, risk-based approach to water quality management, to improve the quality of water supplied and the reliability with which that quality is achieved.

A 'quality assurance program' that complies with the Public Health Regulation 2012 (NSW) will be documented within and maintained from our Drinking Water Management System. In turn, this system has adopted the Framework for Management of Drinking Water Quality given in the Australian Drinking Water Guidelines 9 (NHMRC, NRMMC, 2011).

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All NEV members are stakeholders in the water supply and treatment system. As such all members must ensure that their activities do not compromise drinking water quality. All NEV members are required to be alert to external risks to the drinking water, e.g., algal blooms, wildfire, dead animals in the dam and unauthorised access to the dam water. NEV members will facilitate community involvement in water quality management via appropriate activities such as participation in Streamwatch.

The NEV maintenance staff and the NEV Water Utility Management team are responsible for understanding and working in accordance with relevant aspects of the Drinking Water Management System.

Monitoring drinking water quality will be conducted independently by NSW Health and the NEV Water Utility Management team will report the results of that monitoring to the NEV community.

The Drinking Water Management System is an operational management system that will be adequately resourced, maintained and improved indefinitely as a core and ongoing function of Narara Ecovillage Co-operative Limited.

#### 5. Recycled Water Quality Policy

NEV is committed to meeting the relevant regulatory requirements surrounding non-potable water products through the application of a management approach that is underpinned by the relevant frameworks within contemporary Australian water cycle guidance including (but not limited to) the Framework for Management of Recycled Water Quality and Use (Australian Guidelines for Water Recycling 2006).

#### 6. Management Endorsement

This policy has been adopted by the board of Narara Ecovillage and is hereby endorsed as a sign of the organisations commitment to the policies set out here.

Signed:

Name: John Talbott

Position: CEO Narara Ecovillage Co-operative Ltd

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# Narara Ecovillage Recycled Water Scheme

# **Recycled Water Quality Management Plan**

July 2020





Revision	Date	Ву	Checked	Document Status	Amendments
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# 1. Introduction

## 1.1 Purpose of the RWQMP

This RWQMP forms part of the Infrastructure Operating Plan (IOP) for the Narara Ecovillage (NEV) water scheme. It states the microbial quality objectives for the recycled water scheme and describes elements of the management plan to ensure those objectives are achieved and maintained. The document contains:

- Responsibilities of the recycled water supplier;
- Description of the recycled water process, including composition of the source and end use applications for which the treated water is fit-for-purpose.
- Detailed validation of the treatment processes;
- Detailed process control and monitoring program to ensure the treated water meets the required quality for end use.

## 1.2 Description of the scheme

### 1.2.1 Site Description

The NEV site is located on Research Rd, Narara on the NSW central coast. The development will be staged with 60 lots to be released initially and expanding to around 130 lots in future stages.

The sewage collection, irrigation disposal, and recycled water distribution systems will be installed with the capacity to deal with the wastewater treatment demands for the full development. As the construction of new homes on the site will be progressive, the full wastewater treatment demand will not be reached for some time. In order to manage the initially low wastewater volumes a temporary wastewater treatment facility will be provided. This facility will treat up to **25 kL/day** of wastewater for disposal and reuse within the community. A plant layout for temporary NEV recycled water scheme is shown in Appendix 1. This RWQMP is for the temporary wastewater treatment facility.

A new facility will be constructed to deal with the full development which is projected to be 56 kL/day. The sizing and timing for this plant will be confirmed based on wastewater generation rates determined from the initial development. The RWQMP will be updated to reflect the changes once the new plant has been designed.

The temporary recycled water plant proposed will be designed to meet the requirements of the Australian Guidelines for Water Recycling. (Australian Guidelines for Water Recycling: Managing Health and Environmental Risks (Phase 1), 2006). The guidelines are referred to in this document as AGWR.

Wastewater will be collected from the following sources to the treatment system:

• Home and community centre toilets, showers, hand basins, and laundries.

Recycled water will be supplied for:

- toilet flushing in homes and community buildings
- irrigation of home and community gardens, lawns and landscaped areas.

Any excess water will be used to irrigate orchards, crops and broad acre pasture areas on the rural lots to ensure the water is put to beneficial use.





Water that does not meet the full disinfection requirement but has passed through the MBR process (biological treatment and UF) will be disposed of by non-spray irrigation.

Buffer capacity of 360 kL has been provided, which is equivalent to approximately 6-days storage at maximum design flow (56 kL/day), is provided to allow time to deal with breakdowns. This full buffer capacity it available to the temporary plant, and as such, in the initial stages, buffer capacity will be 12-15 times the maximum plant throughput. If this is insufficient time then pump out of the buffer tanks will be carried out until the plant is operational again.

### 1.2.2 System Process Design

Referring to Appendix 2: NEV Temporary Recycled Water Treatment Plant Process Flow Diagram. The system consists of the following:

- A buffer tank for collection of wastewater from the site
- Pre-screen
- Biological treatment and ultrafiltration membrane (together forming the Membrane Bioreactor or MBR).
- Ultraviolet light disinfection
- Chlorine disinfection
- Recycled Water Storage, and Irrigation water storage.
- Overflows and drains to pumpout (back to buffer tank)
- Sludge collection tank (off-site disposal)
- Chemical neutralisation and recycle tank.

### 1.3 Management commitment

Narara Ecovillage Co-operative Ltd (NEV) will be the WICA license holder and also the owners of the recycled water treatment plant. The NEV Co-op are committed to ensuring the system is maintained and operated in compliance with relevant guidelines, regulations and standards at all times.

The NEV Co-op will subcontract responsibility for the operation and maintenance of the wastewater treatment plant (excluding the sewerage collection and recycled water distribution infrastructure) to Innaco Pty Ltd (Innaco). Innaco commit to maintain and operate the system in compliance with relevant guidelines, regulations and standards at all times.

## 2. Roles and responsibilities

As system owner and WICA licence holder the NEV Co-op retains responsibility over the entire recycled water scheme including waste water collection systems, treatment plant, treated water storage and treated water delivery systems. The NEV Co-op has delegated the operational responsibility for the treatment plant to Innaco under the terms of an Operations and Maintenance Agreement between the two organisations.

A table outlining the various roles and responsibilities of the parties is shown in table 1.





## Table 1: Division of roles and responsibilities

Polo/Posponsibility		Wastewater System		
Role/Responsibility		NEV Co-op	Innaco	
Recycled Water	WICA licence holder	x		
Scheme	Owner	х		
	Preparation and Approval	х		
100	Statutory Reporting	x		
IOP	System Audit	x		
	Review	x		
RWQMP			Х	
	Operation		Х	
	Maintenance - Weekly	х		
	Maintenance - Monthly		Х	
	Maintenance – Six Monthly		Х	
	Logs: incident, maintenance,			
	complaint, calibration, audit, non-	х		
Operation and	compliance			
Maintenance	Internal monthly reporting		Х	
	Cross-connection audits	х		
	Plumbing Audit	х		
	Instrument Calibrations		Х	
	Sample collection & forwarding per IOP		Contracted NATA laboratory	
	Management of water quality		x	
	Per WSA-2002. WSAA	Hydraulics Contractor	Plumbing Contractor	
	Plumbing in accordance with			
Plumbing	AS/NZS 3500:2003	Hydraulics Contractor	Plumbing Contractor	
	Education of plumbing contractors	Hydraulics Contractor	Project Manager	
	Initial risk assessment IOP	Hydraulics Contractor	Х	
	Monitor/sampling environment	x		
Ivianage	Tenants/public education		Innaco's website	
Environmental Risk	Development	х		
	Implementation	х		
	Maintenance	х		
Communication	Feedback	х		
Communication	Evaluation	х		
Strategy	Review	х		
	Identification of potential incidents	×		
	and emergencies	^		
Incidents and	Development of protocols, response			
Emergencies	actions, responsibilities and	х		
LINCISCICICS	communications			
Training of	Notification of non-compliances and			
employees and	incidents to IPART	x		
contractors				





Polo /Posponsibility	Waste	Wastewater System		
Role/Responsibility	NEV Co-op	Innaco		
Documentation and	X			
Reporting	^			

### 2.1 Supplier

The supplier of recycled water is Innaco.

### 2.2 Scheme Manager

The scheme manager is Narara Ecovillage Co-operative Ltd.

### 2.3 Users

The users are the residents and visitors of the Narara Ecovillage.

## 3. Water quality objectives

Approximately half of the wastewater generated will be treated for reuse in homes, gardens and community facilties. The remainder represents excess water that will be disposed of through irrigation on rural blocks of undeveloped land as shown on the infrastructure plan in Appendix 3. Non-spray irrigation disposal will also be used for any water that does not meet all the quality requirements for reuse but is assessed as safe for non-spray irrigation. Any water that does not meet the quality requirements either for reuse or non-spray irrigation will be recycled back to the buffer tank for reprocessing.

There are therefore two water quality risks to consider; one for water to be reused, and one for non-spray irrigation disposal. The pathogen quality objectives for reuse are covered in section 3.1, and those for irrigation disposal are addressed in section 3.2.

### 3.1 Pathogen quality objectives for reuse

The AGWR requires a risk-based approach to determining the log removal credits required to treat the source water to the appropriate level for reuse. The risks have been assessed on the basis that treated water will be recycled for use in toilet flushing and irrigation around homes, gardens, orchards, crops and broad acre pasture within the ecovillage.

### 3.1.1 Assumptions

In order to arrive at log reduction requirements for the treatment process, certain assessments must be made regarding exposure to, and possible ingestion amounts of, treated water. The following outlines the assessments made in order to calculate the log reductions necessary.

The possible exposure to treated water at this site:

- 1. Ingestion from cross connections between the drinking and recycled water systems
- 2. Aerosol ingestion from toilets
- 3. Ingestion of water used for irrigation, ingestion of aerosols from spray irrigation

The risk assessments for each of these exposure routes are detailed in the following sections.





### 3.1.2 Ingestion from cross connections between the drinking and recycled water systems.

The recycled water system will be distributed to homes and community facilties via a dual pipe system. Education, signage and labelling will be used to mitigate the risk of cross-connections or inappropriate use of recycled water, however the risk of cross-connection cannot be eliminated. The assumptions provided within table 3.7 of the AGWR have been adopted for the risk calculations.

### 3.1.3 Aerosol ingestion from toilets

Guidance on typical exposure rates and ingestion volumes for toilet flushing are provided in table 3.3. from AGWR. These figures have been adopted for the purposes of calculating performance targets.

### Ingestion of water used for irrigation

The proposed reuse includes irrigation of gardens and lawns around homes and community facilties and orchards, crops and broad acre pasture. There is potential risk from ingestion of sprays or accidental ingestion of recycled water. The figures from table 3.3. of the AGWR have been adopted with consideration for both these potential exposures.

### 3.1.4 Performance Target Calculations

The proposed pathogen removal targets (using sewage as source) to meet the minimum tolerable health risk of 10<sup>-6</sup> DALY as recommended by AGWR have been determined as follows:

With reference to AGWR Table 3.3 and 3.7, and using the above estimates for ingestion, frequency and population:

Use	Ingestion (L)	Frequency	Total	Log Reduction		
-		(/yr)	(L/yr)			
Toilet	0.00001	1100	0.011	Protozoa	Virus	Campylobacter
Cross-connect	1	0.365	0.365	4.9	6.3	5.0
Irrigation –						
Ingestion of spray	0.0001	90	0.009			
when watering						
Irrigation –						
Indirect ingestion	0.001	90	0.09			
through contact						
Irrigation –						
Accidental	0.1	1	0.1			
Ingestion						
			0.575			

#### Table 3.1: Microbial health-based performance targets calculation

The above calculation is based on Appendix 2 of AGWR. Log reduction = log (concentration in source water x exposure (L) x N /DALYd)

Concentration in source water (from AGWR Table A2.1):

- Cryptosporidium is 2000 Organisms per litre in source water (N) (95th Percentile)<sup>a</sup>
- Rotavirus is 8000 Organisms per litre in source water (N) (95th Percentile)<sup>a</sup>





• Campylobacter is 7000 - Organisms per litre in source water (N) (95th Percentile)<sup>a</sup>

a – Hazard concentrations in raw sewage (95th percentile from Australian and international data). Numbers of adenoviruses have been used as an indication of numbers of rotaviruses, because of the lack of enumeration methods for rotaviruses. Adenoviruses were used because these were the most numerous of the viruses detected in Australian monitoring of sewage (data from Virginia Pipeline Scheme in South Australia).

N is the number of exposures per year and DALYd is the dose equivalent to a DALY of 10-6. DALYd includes consideration of dosed response and ratio of infection to illness.

Exposure and N data was found in Table 3.3 of "Australian Guidelines for Water Recycling: Managing Health and Environmental Risks (Phase 1) 2006"

The log reduction number calculated in the above table is as following:

Protozoa Log reduction =  $\log (2000 \times 0.575/1.6 \times 10-2) = 4.9$ 

Virus Log reduction =  $\log (8000 \times 0.575/2.5 \times 10-3) = 6.3$ 

Bacteria Log reduction =  $\log (7000 \times 0.575/3.7 \times 10-2) = 5.0$ 

Notwithstanding the above calculations, the more conservative values from AGWR table 3.8 for dual reticulation, toilet flushing, and garden use have been used, which require 6.5, 5.0, 5.0 for virus, protozoa and bacteria respectively.

Target LRV and treatment train contributions are therefore as follows:

	MBR	UV	Chlorination	Total LRV Achieved	Target LRV
Virus	2.0	0.5	4.0	6.5	6.5
Protozoa	3.0	3.0	0	6.0	5.0
Bacteria	3.0	3.0	4.0	10.0	5.0

#### Table 3.2: Treatment plant performance objectives for reuse

The treated water from the proposed process train should meet or exceed the target LRV.





## 3.2 Pathogen quality requirements for Irrigation disposal

Treated water that does not meet the quality requirements for reuse within the community, may still be acceptable for non-spray irrigation disposal following an appropriate assessment. This may occur due to equipment failures or out of specification water such as low UV dose or chlorine residual post MBR.

The location of the irrigation area is shown on the infrastructure plan in Appendix 3. This irrigation site is remote, has no public access during irrigation, and limited or no contact afterwards. Table 3.8 of the AGWR indicates that for irrigation of non-food crops the target LRV's are 5.0, 3.5, 4.0-log for virus, protozoa, and bacteria respectively.

The AGWR makes provision for employing on-site controls and use restrictions to reduce the focus on treatment. Using secondary treatment with no access during irrigation and a minimum buffer of 30m to the nearest point of public access, the pathogen exposure reduction is 5.0-log (table 3.8, AGWR). However, by convention the exposure reduction allocated to non-treatment measures is often limited to 3.0-log.

Applying a pathogen reduction of 3.0-log due to on-site controls the target quality for this form of disposal becomes 2.0, 0.5, 1.0-log for virus, protozoa, and bacteria respectively. This water quality can be easily met by the MBR process alone, with no post disinfection by UV or chlorine.

The LRV required for irrigation disposal is as indicated below in table 3.3.

	MBR	UV	Chlorination	Total LRV Achieved	Target LRV
Virus	2.0	-	-	2.0	2.0
Protozoa	3.0	-	-	3.0	0.5
Bacteria	3.0	-	-	3.0	1.0

### Table 3.3: Treatment plant performance objectives for irrigation disposal (no reuse)

MBR treatment is therefore the only unit process required for irrigation quality to be met. If this cannot be achieved, the water will be returned to the buffer tank for reprocessing.

### 3.3 Chemical

The source water is blackwater from the residential community and communal facilities. There is no industrial component and the potable water supply is of high quality. There are no known chemical inputs, other than the possible inadvertent disposal of small quantities of cleaning fluids and other minor chemicals into the system from time to time. Excessive volume of these solutions can create pH levels harmful to the biomass in the reactor; however the plant monitors the feed pH constantly and will not accept water unless it is within the specified range. No specific water quality targets for chemicals have therefore been determined.

Sodium hypochlorite is the only chemical added to the treated water for disinfection. See Section 5.2 Free Chlorine System Validation, below.

### 3.4 Environmental

Soil capacity assessment was carried out as part of the Integrated Water Cycle Management Plan. This concluded that all the soils tested are suitable for long-term irrigation of effluent provided the nutrient deficiencies are addressed and the soil organic carbon content is maintained.





As recommended in this report, soils used for irrigation disposal will be retested for nutrients (including nitrogen, phosphorus and potassium), pH, salinity and organic carbon after 3 years of effluent irrigation. This procedure is documented in: NEV051 Environmental Management Procedure available at server location: \Dropbox (NEV)\NEV Businesses\NEV Water\Environment.

## 4. System assessment

A Risk Assessment of the plant was undertaken as a facilitated workshop as recommended by the NSW guidelines. The guidelines require the participants to have appropriate knowledge and expertise. Participants at the workshop to assess this system are outlined in the table below.

Organisation	Participant	Role
Narara Eco Village Co-op Ltd	Geoff Cameron	Director and Head of NEV Water
	Mark Fisher	Project Manager
Innaco Pty Ltd	Warren Johnson	Technical Manager
IPART	Schweta Schrestra	Senior Analyst
NSW Health	Kerry Spratt	Central Coast Public Health Unit
Atom Consulting	Annalisa Contos	Facilitator
	Natalie Crawford	Recorder

A copy of the Risk Assessment report titled "NAV1603J Narara Village Risk Assessment output paper v2.0" is available at server location:

Nextcloud\NEV Water\IOP\Risk Assessments

The system was also subject to an independent Technical Assessment which occurred at design stage. A copy of the Technical Assessment is available on request.

# 5. Compliance with Australian Guidelines for Water Recycling

A Risk Assessment of the Recycled Water Scheme has been completed. A preliminary desktop risk assessment was carried out in March 2016. A water quality risk assessment for Narara Ecovillage recycled water scheme and irrigation disposal took place in April.

A copy of the Risk Assessment report titled "NAV1603J Narara Village Risk Assessment output paper v2.0" is available at server location:

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The table below lists the 12 elements of the framework for managing recycled water quality and use (as per the AGWR) and shows how the scheme will meets the various elements.





Framework element	Activity	Reference Document				
Element 1: Commitment to responsible use and management of recycled water quality						
<b>Components:</b> Responsible use of recycled water	The project parties, NEV Co-op and Innaco, are all committed to the responsible use of recycled water as indicated in section 1.3. The recycled water facility is part of a range of features to achieve sustainability within this development. There is a commitment to ensure correct design installation and management.	Innaco Recycled Water Policy exists. <i>IMS Document EM010</i> Policy statement from NEV-Co- op's Recycled Water Quality Policy also confirms compliance with relevant regulatory requirement for recycled water use				
Regulatory and formal requirements	Approval is being sought from IPART for the installation and operation of the recycled water plant. A Development Application has been consented by Gosford City Council for the Stage 1 development as whole.	WICA Application Gosford City Council DA				
Engaging stakeholders	The Narara Ecovillage Co-operative Ltd actively involves all its members in the planning and approval of the development and its infrastructure. The Co-operative operates under Dynamic Governance, which seeks to achieve fair, inclusive, transparent, accountable and creative decision-making processes. A working group of interested members has been involved from the early stages of the project looking at the technical aspects of the project and helping to choose technology options. The NEV has a website which contains information on the proposed development, its water infrastructure and policies and contact details for comment and further information.	NEV website: www.nararaecovillage.com/nev- water NEV Community Management Statement				
Recycled water policy	The implementation of a recycled water policy is recommended.	Innaco Recycled Water Policy exists. <i>IMS Document EM010</i> NEV's Water Quality Policy				
Element 2: Assessment of the recycled water system						

## Table 5: 12 Framework Elements





Framework element	Activity	Reference Document
Components: Identify intended uses and source of	Uses are for toilet flushing and irrigation of lawns, gardens, orchards, crops and broad acre pasture.	This RWQMP section 1.2.1.
recycled water	Sewage is collected solely from on-site gravity sewerage system services the households and community buildings.	
Recycled water system	The plant receives sewage from the facility. The water is subject to treatment through a membrane bioreactor, ultra-filtration, ultraviolet (UV) disinfection, and chlorination.	Operations and Maintenance Manual
	The treated water is piped to two dedicated storage tanks and distributed for use.	
Assessment of water quality data	As the development is new, there are no existing wastewater quality data available, however published data exists for a similar eco-development at Capo Di Monte in Queensland. This data has been used a guide to the expected wastewater characteristics.	This RWQMP, and AGWR
	The treated water quality will be required to meet the Australian Recycled Water Guidelines (ARWG), and will require a licence under WICA.	
Hazard identification and risk	Human health	
assessment	Preliminary hazard identification and risk assessment for human health found that microbial hazards for humans include bacteria, viruses and protozoa.	Preliminary desktop risk assessment study and NAV1603J
	Environmental performance	Narara Village Risk Assessment
	A land capability assessment found low risk due to salinity, run-off, chemicals, or nutrients.	output paper v2.0
	A HACCP and HAZOP have been conducted and used to identify any potential risks and mitigation strategies.	
Element 3: Preventative measures for	or recycled water management	
Components:	Human health	
Preventative measures and multiple	Preventative measures to manage risks to human health include:	This RWQMP
barriers	Membrane filtration, UV disinfection and chlorine disinfection;	
		AS/NZS 3500:2003





Framework element	Activity	Reference Document
	Pipework (purple and/or with text) and signage at site of use indicating that recycled water is being used;	Community information provided
	Educational of those on site about appropriate disposal of wastes;	on Innaco website and NEV
	Signage at site to alert plumbers to recycled water system and co-ordination of plumbers through site management;	website. NEV Community Management
	Backflow prevention and cross-connection control.	Statement
	Environmental performance	Community page on Innaco and
	Preventative measures to manage risks to the environment include:	NEV WEDSILES
	Education programme for co-operative residents and visitors;	
	Information and open days;	
	Promoting use of environmentally friendly detergents in the toilets and hand basins and avoidance of disposal of chemicals.	
Critical control points	Critical control points have already been identified as part of the risk assessment workshop. These include: MBR filtrate turbidity; UV transmittance Free chlorine residual and treated water pH.	Risk Assessment workshop report NAV1603J Narara Village Risk Assessment output paper v2.0
Element 4: Operational procedures a	and process control	
Components: Operational procedures	Operational procedures were identified for all processes and activities associated with the system, including operation of treatment processes and auditing procedures for cross-	Operations and Maintenance Manual
	connections.	O&M Manual
	Documented procedures must be available to operations personnel and for inspection at any time.	Innaco Trouble Shooting Guide (IMS Document OM070)
	Operators are proficient and are able to recognize the significance of changes in the recycled water treatment plant and water quality. They are able to respond appropriately according to established procedures.	Innaco Work instructions
Operational monitoring	Monitoring includes:	Section 7 of this RWQMP





Framework element	Activity	Reference Document				
	Dissolved oxygen in bioreactor (continuous);					
	pH buffer tank (continuous);					
	Turbidity of filtered water (continuous) – critical limits set;					
	UVI, power and lamp failure (continuous) - critical limits set;					
	Free chlorine residual (continuous) - critical limits set;					
	Effluent pH (continuous) - critical limits set.					
Corrective action	Corrective actions include the following:	Section 7 of this RWQMP				
	Noncompliance with critical limits results in the system being stopped and/or treated water transfer to storage is prevented.					
	If cross-connections detected, flow to property stopped until repairs completed.					
	Site switches to potable water backup until treated water is of suitable quality for reuse. Water that does not meet specification is sent to non-spray irrigation for disposal, if suitable for this purpose, otherwise it will be returned to the buffer tank.					
Equipment capability and maintenance	Treatment plant and disinfection systems of standard and reliable design. Maintained by qualified supplier.	Service agreement between NEV Co-op and Innaco for the maintenance and service of the recycled water treatment system.				
Materials and Chemicals	All plumbing and drainage work is conducted in a manner conforming to AS/NZS standard 3500.	The plant design is approved prior to construction.				
	All chemical used in the plant are obtained from credible suppliers.	MSDS are supplied for each chemical				
Element 5: Verification of recycled w	Element 5: Verification of recycled water quality					
Components:	Human health					
		Section 8 of this RWQMP				





Framework element	Activity	Reference Document
Recycled water quality monitoring (specifically designed for individual systems, taking into account source of water, end uses and receiving environments)	Monitoring of defined parameters is undertaken based on risk assessment and taking into account sources and end uses.	
Application and discharge site	Environmental performance	Innaco Service checklist
monitoring	Irrigation system monitored for operation and soil moisture levels. Long-term monitoring of nutrient levels.	Woodlots & Wetlands - Sewage production , treatment and reuse report
Documentation and reliability	The sampling plan (location, parameters and frequency) will be determined and agreed to	Laboratory NATA certification
	by the relevant authorities.	Records of results
	The testing is performed by an independent, NATA accredited laboratory.	
Satisfaction of users of recycled water	Complaints handling policy in place.	NEV's Complaints Handling and Dispute Resolution Policy and Procedure
Short-term evaluation of results	The customer is supplied with a monthly report regarding the performance of the plant.	Monthly Service Report to NEV
	The Innaco recycled water engineer and service technician will be in regular verbal and e- mail correspondence with NEV Co-op representatives.	Co-op regarding plant operation and performance indicators.
		Audit reports are published on NEV website.
		WICA Network Operators and Retail Suppliers Reporting Manual
Corrective responses	Corrective action depends on the incident. As a minimum, it involves investigation of plant performance records to confirm normal operation, and additional testing to confirm the result and identify the source.	Corrective actions are addressed in section 7.1 and 7.2 of this RWQMP





Framework element	Activity	Reference Document
	If target criteria for environmental parameters are exceeded, preventative measures need to be reassessed and corrective action taken to ensure environmental performance is improved.	
Element 6: Management of incident	s and emergencies	•
<b>Components:</b> Communication	Noncompliance with approval conditions to be reported immediately to IPART and NSW Health. In the case of an incident or emergency that requires a media response, only the CEO is authorized to make any public comment.	Records of incidents or emergencies kept by NEV.
Incident and emergency response protocols	Employees are trained in emergency response and incident protocols. Emergency response procedure described in section 10.	NEV's "Incident and Emergency Management Procedure" RWQMP Section 10 describes responses to Incidents and Emergencies
Element 7: Operator, contractor and	end user awareness and training	•
<b>Components:</b> Operator, contractor and end user awareness and involvement	Operator of treatment plant to be sufficiently skilled to run the plant and investigate any faults End users are made aware of the restrictions on the use of recycled water and any practice that could threaten human health. Community meetings and NEV websites used as places to disseminate information on the wastewater treatment process and recycled water risks. Contractors inducted to site are told of the presence of dual pipe systems and the precautions required.	Technician induction on commencement of employment, operating manuals, supervision from experienced engineers. NEV and Innaco websites contain educational material. Induction records for those coming on site to work.
Operator, contractor and end user training	Operator to be aware of approval conditions and instructed on occupational health and safety requirements	Site Induction program





Framework element	Activity	Reference Document
	Innaco has an induction program for new employees and written procedures for all areas of responsibility.	NEV Training Records and Training Needs Analysis
	Training needs for individual employees are identified and adequate resources made available during the induction phase. Annual performance reviews identify additional training requirements and set performance targets. Training records are kept.	Annual reviewsContractor induction records. Innaco document "Hourly Rate Contractor Requirements"
	Any contractors used on site are accredited, qualified and have the appropriate level of training. A site induction includes familiarization with Innaco's Safe Work Method Statements (SWMS's), which are site specific. Innaco maintains a partnership with several contractors to ensure continuity of knowledge and technical expertise.	Innaco SWMS's
Element 8: Community involvement	and awareness	-
<b>Components:</b> Community consultation	In the NEV Ecovillage development the key stakeholders are the members of the village community. The community consultation process is therefore similar to the stakeholder consultation process described in element 1. This includes community education and a Dynamic Governance process that seeks to involve all the members in decision making.	NEV website NEV Community Management Statement
Communication and education	Various documents on the development proposal and activities have been produced to promote public awareness and education. This information is available online through the Department of Justice website. Innaco maintains a site specific community section on the company website that also contains advice and educational information about sites.	NEV website; NEV Newsletter Innaco' s website community page
Element 9: Validation research and d	levelopment	
<b>Components:</b> Validation of processes	Ongoing investigations into recycled water quality and treatment plant performance to refine assessments. This may enable less conservative critical control points to be adopted or treatment requirements reduced.	Validation according to section 6 of this RWQMP





Framework element	Activity	Reference Document	
Design of equipment	The design of the plant is based on well-documented and validated technologies.	Section 6 of this RWQMP	
Investigative studies and research monitoring	As the depth of operational knowledge regarding this and similar water treatment technologies increases, so the understanding of the weaknesses increases. This results in better opportunity to be proactive regarding operational control and maintenance of the plant.	This RWQMP will be reviewed in 12 monthly intervals as part of the process of continual improvement.	
Element 10: Documentation and rep	orting		
Components:	Design of treatment plant and reticulation system documented;	IOP,	
Management of documentation and	Operating procedures documented;	RWQMP,	
records	All results to be recorded and stored;	Incident and Emergency	
	Innaco has developed an in house Integrated Management System (IMS) that is based on	Management Procedure,	
	the ISO 9000 system, but not yet certified. This is a goal of the company in the future.	(IMS document IE010),	
	Included in this RWQMP and the Operations and Maintenance Manual is information pertaining to preventative measures employed, target and critical limits, critical control	Performance reviews	
	points, operating and corrective action procedures.	Risk Management Procedure	
	These documents, along with the incident and emergency response plans, training	(IMS document RM030)	
	programs and reporting protocols ensure that the plant is operating within set limits at all times.	Innaco Operations and Maintenance Manual	
	The document control system, ensures that only the most current version of any document is available for use. All documents are reviewed on an annual basis.		
Reporting	Internal reporting consists of verbal communication between the Innaco engineer and the site service technician and written reports from the technician to the engineer.	Monthly reporting to NEV Co-op	
	The owners of this treatment plant receive a monthly report detailing all operational and performance parameters and the maintenance performed during that month.		
	Non-compliance breaches are reported immediately to IPART and NSW Health.		





Framework element	Activity	Reference Document				
Element 11: Evaluation and audit						
<b>Components:</b> Long-term evaluation of results	Regular reporting to client on results and maintenance activities. Operational audit performed after 12 months as part of WICA license.	Monthly reports to NEV Co-op External audit reports				
Audit of recycled water quality management	Statutory audit after the first 12-months then ongoing at least every 3 years by third party auditor.	Audit reports				
Element 12: Review and continual improvement						
<b>Components:</b> Review by senior managers	Performance of treatment plant, customer complaints/satisfaction	A senior review of this plant will be conducted annually in combination with the audits				
Recycled water quality management improvement plan	RWQMP reviewed at least annually and more frequently as needed. Any opportunities for improvement identified through staff, customers, or auditors are reviewed and implemented as appropriate.	Improvement actions from audit reports or annual reviews are reviewed and implemented where appropriate.				





# 6. Validation of treatment processes

## 6.1 Membrane Bioreactor Validation

## 6.1.1 Challenge test results

Memcor B40N membranes, supplied by Evoqua, have been selected for the MBR in this project. The required log removals for the MBR are 2.0 for virus and 3.0 for protozoa and bacteria (see section 3.0 for details).

A number of challenge studies have been carried out on the B40 membranes in both clean water conditions and in an MBR environment. One study conducted on membranes that were badly compromised after many years of operation with no repairs carried out, was able to demonstrate log removals of 4.75 – 6.23 for F-specific RNA bacteriophage, 5.41-6.70 for *E. coli*, and 3.66 to 5.19 for somatic coliphages (Pettigrew et al, 2010). This highlights the inherent benefits of operating membranes in an MBR environment where the high solids levels tend to plug any defects that may be present or develop over time.

Despite strong data demonstrating significant pathogen reduction across membranes in an MBR environment, the reference study used for the purposes of supporting the claimed pathogen LRV credits was conducted on clean water and is documented in "Pathogen Removal by Integral and Compromised Siemens Memcor MBR systems" Nov 2010. Clean water represents the worst case, and is a way of establishing the pathogen removal capabilities of the membrane without the benefit of solids present in the water.

This test work was conducted in accordance with the USEPA Membrane Filtration Guidance Manual. Five modules were randomly selected and subjected to challenge testing using MS2 bacteriophage seeded into filtered water. Samples were collected before the start of the filtration cycle and at three points through the filtration cycle. The results showed log reductions ranging from 2.16 to 3.61.

In a separate study to investigate removal of protozoa and bacteria, five B40N modules were tested using the USEPA protocol (Membrane Filtration Guidance Manual) and challenged with *Bacillus subtilis* spores with an average size of around 1  $\mu$ m. The challenge organism was seeded into carbon filtered potable water and supplied to the modules. Samples were collected before the start of the filtration cycle and at three points through the filtration cycle. The results showed log reductions of *Bacillus subtilis* ranging from 5.8 to 7.3.

The above challenge tests confirm the ability of the B40N modules to reject viruses, protozoa, and bacteria at levels well in excess of log credits required for the plant under clean water (worst case) conditions.

## 6.1.2 Integrity Monitoring – Turbidity

The challenge test work reported is based on clean water conditions with integral modules. Online turbidity monitoring is essential in ensuring the required integrity is maintained during operation.

An extensive study carried out by Evoqua on B40N membrane sought to examine the relationship between integrity (measured by pressure decay rate (PDR) and challenge testing) and turbidity, documented in "Pathogen Monitoring of MBR systems using on-line Turbidity, 2012". A rack of 16 modules with known integrity compromise (LRV 2.7 based on PDR), was subjected to a pressure decay test to cause a temporary spike in





turbidity by disrupting any defects that had plugged with solids. The turbidity was monitored following the disruption along with *E. coli*, faecal coliforms, and *C. perfringens*. As expected, there was a spike in turbidity to around 2.6 NTU which coincided with a spike in the presence of pathogens. However, the water quality returned to pre-test conditions (LRV > 6) after 5 minutes of operation. The tests was used to determine a quantitative relationship between turbidity and LRV (measured by pathogen rejection). The result was the following (correlation coefficient of 0.95):

$$LRV = 5.662 - 2.0151 * NTU$$

Using the above with our target LRV of 3.0 the maximum turbidity would be 1.3 NTU. However, it is proposed that we operate the membrane at a more conservative turbidity of 0.2NTU, with an absolute maximum (CCP) of 0.5 NTU. Based on the above, this would achieve an LRV of 6.7, well above the target LRV of 3.0 with a comfortable level of conservatism. This is also consistent with the USEPA Title22 approach for water reuse applications which adopts 0.2 NTU 95% of the time and a maximum of 0.5 NTU 100% of the time.

Based on this analysis is proposed that we set **0.2 NTU as the alarm level, and 0.5 NTU as the CCP maximum**.

## 6.1.3 Integrity monitoring for viruses

Turbidity monitoring can be applied as described in section 6.1.2 for ensuring the integrity of the membrane is maintained above the required LRV for bacteria and protozoa (3-log in this case), which are particles that are completely rejected by an intact membrane (section 6.1.1). However, virus particles are not completely rejected, and as discussed, the membrane will achieve an LRV of 2.16 for virus when intact. It is necessary to confirm that the required virus LRV (2.0-log) can still be achieved even if there is sufficient membrane bypass through defects for the bacteria and protozoa LRV to drop from complete rejection to an LRV of 3.0.

This can be done by a simple mass balance. The log reduction (LRV) of a particle is defined as the log ratio of concentration in the feed ( $C_{feed}$ ) to the concentration in the filtrate ( $C_{filtrate}$ ). The filtrate concentration is in turn made up from particles that pass through the membrane (at concentration  $C_{membrane}$ ) and particles that bypasses the membrane through defects or leaks (at concentration  $C_{bypass}$ ). The concentration in the filtrate can be determined from the flow through the membrane ( $Q_{membrane}$ ) and the flow bypassing the membrane ( $Q_{bypass}$ ).

$$LRV = \log\left(\frac{C_{feed}}{C_{filtrate}}\right)$$
$$= \log\left(\frac{C_{feed}}{\frac{(Q_{membrane} * C_{membrane}) + (Q_{bypass} * C_{bypass})}{(Q_{bypass} + Q_{membrane})}\right)$$

Now, since the bypass flow is very low relative to the membrane flow,  $(Q_{membrane} + Q_{bypass})$  is approximately equal to  $Q_{memrbane}$ . So the above simplifies to:





$$LRV = log\left(\frac{C_{feed}}{C_{membrane} + \left(\frac{Q_{bypass} * C_{bypass}}{Q_{membrane}}\right)}\right)$$
$$= log\left(\frac{1}{\frac{C_{membrane}}{C_{feed}} + \left(\frac{Q_{bypass} * C_{bypass}}{Q_{membrane} * C_{feed}}\right)}\right)$$

Assuming that anything bypassing the membrane has the same concentration as the feed then  $C_{bypass}/C_{feed} = 1$ . Further, since protozoa are removed completely by an intact membrane and we are monitoring for a minimum 3-log reduction then the ratio  $Q_{bypass}/Q_{membrane}$  is  $10^{-3}$ . The results of the virus challenge testing conducted by Evoqua on the B40N module showed a minimum virus log reduction of 2.16. This represents the virus removal capability of an intact membrane, thus  $C_{membrane}/C_{feed} = 10^{-2.16}$ .

Substituting into the above,

$$LRV = log\left(\frac{1}{\frac{C_{membrane}}{C_{feed}} + \left(\frac{Q_{bypass} * C_{bypass}}{Q_{membrane} * C_{feed}}\right)}\right)$$
$$= log\left(\frac{1}{10^{-2.16} + (10^{-3} * 1)}\right)$$
$$= 2.1$$

In other words, if the integrity of the membrane for bacteria and protozoa were to drop to an LRV of 3, the virus LRV would drop from 2.16 to 2.1. This is above the virus LRV of 2.0 required, confirming that protozoa control to an LRV of 3.0 is sufficient to ensure the virus LRV target can be met.

The above assumes that virus passage through the membrane does not degrade with time. Experience has shown that in an MBR environment even relatively large defects plug with time, so virus rejection is always much higher in situ than in clean water test conditions (Pettigrew, 2010). The assumption is therefore conservative.

### 6.2 UV validation

From table 3.2, the UV system is required to achieve pathogen reductions of 3.0-log for both protozoa and bacteria and 0.5-log for viruses.

The UV system must comply with the requirements of the Victoria Department of Health *Guidelines for validating treatment processes for pathogen reduction* (Vic. DH 2013). This requires that the UV systems be validated by a third party in accordance with the requirements of the US EPA *Ultraviolet Disinfection guidance manual for the final long term 2 enhanced surface water treatment rule* (UVDGM)(US EPA 2006).

Table 1.4 of the UVDGM provides the UV dose requirements for pathogens, and is reproduced below.





Target	Log Inactivation							
Pathogens	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0
Cryptosporidium	1.6	2.5	3.9	5.8	8.5	12	15	22
Giardia	1.5	2.1	3.0	5.2	7.7	11	15	22
Virus	39	58	79	100	121	143	163	186

The required validated UV dose to achieve 0.5-log virus reduction is 39 mJ/cm<sup>2</sup>

The protozoa dose requirement for 3.0-log inactivation is 12 mJ/cm<sup>2</sup>. Bacteria are more UV sensitive than protozoa and will therefore be reduced by an amount at least equal to protozoa (e.g. E. coli up to 10 mJ/cm<sup>2</sup> for 4-log inactivation (AWWARF, 2004).

The UV reactor must be validated in accordance with the UVDGM at the required operating conditions for NEV. Innaco have selected a suitable unit, and a confidential validation report has been provided by the manufacturer to Innaco. Analysis of the data in this report confirms that it meets the USEPA requirements and will achieve a validated dose of 39 mJ/cm<sup>2</sup> at end of lamp life under the conditions shown in table 6.1 below.

Table 6.1: Temporary Plant UV operating parameters			
<b>Operating Parameter</b>	Operating Conditions		
Operating Mode	Calculated dose monitoring		
Validated UV Dose	≥39 mJ/cm <sup>2</sup> (virus); ≥12 mJ/cm <sup>2</sup> (protozoa)		
RED setpoint	48.5 mJ/cm <sup>2</sup>		
Flowrate	≤ 187 L/min		
UVT	≥ 60% at 254 nm		
Lamp status	Operating, and hours < 12,000		

An analysis of the proposed UV system and validation of the ability to provide the required dose follows.

### 6.2.1 UV Dose Monitoring

The method of operation chosen for this project to ensure the required UV dose is the calculated dose approach.

The manufacturer of the UV system has had a Validation Study carried out by a third party in order to establish the UV performance in accordance with the requirements of the UVDGM (Carollo (2011)). A confidential copy of the Validation Study has been provided by the manufacturer to Innaco.

For the calculated dose monitoring approach with the ProLine+ 0027 UV the study determined the relationship between the measured MS2 RED (mJ/cm<sup>2</sup>) as a function of lamp output (at optimal water layer), flowrate (gpm) and UV absorbance (UVA) at 254nm, which is presented as equation 1.2/5.14 in the study. This equation is reproduced below as equation 6.1.

$$MS2 \ RED = \ 10^{A} \times UVA^{B \times UVA} \times \left[\frac{S/S_{0}}{Q}\right]^{[C+ln(UVA)]}$$
Equation 6.1





Where: A = 3.6448 B = 6.4947 C = 0.67715 D = -0.0663 Q = Flow (gpm) UVA = log(100/UVT) $S/S_0 = Relative lamp of the second secon$ 

 $S/S_0$  = Relative lamp output, calculated as the ratio of the UV intensity, S (W/m2), to the UV intensity with the lamp operating at maximum power for the given UVT.

The minimum validated UVT is 60% (UVA = 0.22), and minimum validated flow is 5.3 gpm. The expected operating flow at maximum throughput is 17.4 L/min (4.6 gpm), however the minimum validated flow is assumed for the purpose of calculating the RED. A very conservative combined end-of-lamp-life and fouling factor (S/So) can be adopted for this project given the capacity of the UV at these flows, and is chosen to be 0.26. The RED under these conditions is then obtained from equation 6.1:

$$RED = 10^{A} \times 0.22^{B \times 0.22} \times \left[\frac{0.26}{5.3}\right]^{[C+D \times ln(0.22)]}$$
  
RED = 48.5 mJ/cm2

The UV RED calculation from equation 6.1 is coded into the PLC logic using the measured intensity (S) and UVT, and the expected UV intensity for the lamp operating at 100% ballast power with a new lamp and clean sleeve for a given UVT ( $S_0$ ). This RED value is monitored by the PLC for the purposes of determining whether the UV dose is above the CCP monitoring requirement of 48.5 mJ/cm<sup>2</sup>.

The value for  $S_0$  is accurately determined from the validation data using a polynomial fit as a function of ballast power and UVT (equation 5.3/5.4 pg 5-15) and is reproduced below as equation 6.2.

$$S_0 = 10^{A_{wl}} \times UVT^{B_{wl}} \times P^{C_{wl}} \times 10^{(D_{wl} \times P)}$$
 Equation 6.2<sup>1</sup>

A<sub>wl</sub>, B<sub>wl</sub>, C<sub>wl</sub>, D<sub>wl</sub> are determined from multivariable linear regression analysis of the UV intensity data measured during validation testing. These coefficient values were determined at three different water layer thicknesses (wl), 9.6mm, 19.6mm, and 29.6mm. The water layer thickness for this unit is set at the optimal thickness of 23mm. In order to determine the coefficients for this thickness a polynomial interpolation was used from the data for the three measured thicknesses. The values are reported in the validation document and yield the following for the equation 6.2 coefficients:

 $\begin{array}{l} A_{wl} = -12.892 \\ B_{wl} = 2.8445 \\ C_{wl} = 4.5526 \\ D_{wl} = -0.00560215 \end{array}$ 

P = Power (W). The ballast power was 261W at 100% output. As this unit can only operate at 100% ballast power, this is the value adopted for power.

<sup>&</sup>lt;sup>1</sup> There is a typographical error in the validation report. Equation 6.2 shows the correct equation.





Substituting these values into equation 6.2 yields equation 6.3 below. This is the equation programmed into the PLC for a measured UVT and provides the value of  $S_0$  for use in equation 6.1 to determine the MS2 RED.

$$\begin{split} S_0 &= 10^{A_{wl}} \times UVT^{B_{wl}} \times P^{C_{wl}} \times 10^{(D_{wl} \times P)} \\ &= 10^{-12.892} \times UVT^{2.8445} \times 261^{4.5526} \times 10^{(-0.00560215 \times 261)} \\ &= 0.0004445 \times UVT^{2.8445} \qquad \text{Equation 6.3} \end{split}$$

## 6.2.2 Uncertainty of Validation

To obtain the required disinfection credits the UV reactor must deliver a validated dose ( $D_{val}$ ) that is equal to, or greater than, the dose specified in table 6.1 of this document ( $\geq$  39 mJ/cm<sup>2</sup> and  $\geq$  12 mJ/cm<sup>2</sup> for virus and protozoa respectively). The validated dose is given by (UVDGM page 5-42):

$$D_{val} = \frac{RED}{VF}$$
 Equation 6.2

Where VF is the validation factor and RED is the predicted RED from equation 6.1.

The validation factor is determined using:

$$VF = B_{RED} \times \left(1 + \frac{U_{val}}{100}\right)$$
 Equation 6.3

Where  $B_{RED}$  is the bias factor and  $U_{val}$  is the percent uncertainty in the validation.

Combining equation 6.2 and 6.3 yields:

$$D_{val} = \frac{RED}{B_{RED} \times \left(1 + \frac{U_{val}}{100}\right)} \quad \text{Equation 6.4}$$

The UVDGM (page 5-40) states that the U<sub>val</sub> is a calculated by:

$$U_{val} = \sqrt{U_{IN}^2 + U_{DR}^2 + U_S^2} \quad \text{Equation 6.5}$$

Where  $U_{IN}$  is the uncertainty of interpolation using the dose monitoring equation,  $U_{DR}$  is the uncertainty of the test microbe dose response, and  $U_S$  is the uncertainty of the UV sensors during validation.

The UVDGM states (page 5-41) that  $U_{IN}$  is determined from:

$$U_{IN} = \frac{t \times SD}{RED} \times 100\%$$

Where t is the t-statistic at 95% confidence level for the sample size equal to the number of test conditions used to define the dose equation, and SD is the standard deviation of the differences between the measured and predicted RED's. The validation report gives the values for (t x SD) for the ProLine +0027 data as 9.906 mJ/cm<sup>2</sup> (page 1-22). Therefore:

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$$U_{IN} = \frac{9.906}{48.5} \times 100\%$$
$$= 20.4\%$$

The UVDGM states (page 5-19) that  $U_s$  is defined as the largest difference observed between the duty and reference sensor. This value can be set to zero if it is <10%. The difference between the duty and reference sensors is reported in the validation report and is < 3% (figure 5.5a and figure 5.5b on page 5-10) and, hence  $U_s$  is set to zero.

The uncertainty of the UV dose response,  $U_{DR}$ , is given by:

$$U_{DR} = \frac{CI}{RED} \times 100\%$$

Where CI is the confidence interval at the specified dose calculated using statistical approaches. The UVDGM states that the value of  $U_{DR}$  can be set to zero if the calculated  $U_{DR}$  (using the method of Draper and Smith) is less than 15% of the RED at 1-log inactivation. The validation report (table 6.4, page 6-7) indicates that for RED's greater than 20.38 mJ/cm<sup>2</sup>, the value if  $U_{DR}$  is <15%. The required RED is 48.5 mJ/cm<sup>2</sup>, which is greater than 20.38 mJ/cm<sup>2</sup> and so the value of  $U_{DR}$  can be set to zero.

Combining the values for U<sub>IN</sub>, U<sub>DR</sub>, and U<sub>s</sub>, and substituting into equation 6.5 yields:

$$U_{val} = \sqrt{U_{IN}^2 + U_{DR}^2 + U_S^2}$$
$$U_{val} = \sqrt{20.4^2 + 0 + 0}$$
$$U_{val} = 20.4\%$$

### 6.2.3 Validated Dose - Virus

The challenge microorganism used in the validation study was MS2 phage which was determined to have a dose sensitivity of between 20 and 22 mJ/cm2/log i (table 6.2, page 6-3 of the validation study). Table G.17 of the UVDGM indicates a bias factor of 1.0 for virus up to 4-log reduction for sensitivity  $\leq$  25 mJ/cm2/log i. Therefore, a value of 1.0 is adopted for B<sub>RED</sub>. The RED is 48.5mJ/cm<sup>2</sup> (section 6.1.1), and U<sub>val</sub> is 20.4% (section 6.1.2).

Substituting into equation 6.4 yields the validated dose for virus reduction:

$$D_{val} = \frac{RED}{B_{RED} \times \left(1 + \frac{U_{val}}{100}\right)}$$
$$D_{val} = \frac{48.5}{1 \times \left(1 + \frac{20.4}{100}\right)}$$
$$D_{val} = 40.3 \text{ mJ/cm}^2$$





The validated dose of 40.3 mJ/cm<sup>2</sup> is greater than the required dose of 39 mJ/cm<sup>2</sup>, therefore the system is capable of delivering the required virus log reduction of 0.5.

## 6.2.4 Validated Dose - Protozoa

In order to determine whether the UV dose provided is adequate to claim a log reduction of 3.0 for protozoa, and additional calculation of bias factor,  $B_{RED}$ , is required. RED bias values are given in appendix G of the UVDGM as a function of UV sensitivity and UVT of the water. The UV sensitivity or the MS2 used in the validation study is determined as between 20 and 22 mJ/cm<sup>2</sup>/log i (table 6.2, page 6-3 of the validation study) at a RED of 48.5 mJ/cm<sup>2</sup>.

Appendix G, table G.3 of the UVDGM gives RED bias factors for 3.0-log Cryptosporidium down to a UVT of 65%. The Victorian Department of Health *Guidelines for validating treatment processes for pathogen reduction* (Vic. DH 2013), provide guidance in section 9.2.2 for extrapolating the RED bias factor to lower UVT's and is the methodology adopted here. This involves a linear extrapolation of the last two values from the relevant table in appendix G at the challenge UV sensitivity. Figure 6.1 shows a plot of the UVT and RED bias values from table G.3 of the UVDGM for UV sensitivity >20 and  $\leq 22 \text{ mJ/cm}^2$ .



Figure 6.2 – RED Bias factor as a function of UVT from table G.3 UVDGM.

The trendline is a line of best fit for the last two points (75% and 65% UVT) and is shown extrapolated to a UVT of 60%. The RED bias factor at 60% can be calculated from the trendline equation for these two data points and yields an RED bias factor of **2.99**.

Substituting the RED bias factor into equation 6.4 gives:

$$D_{val} = \frac{RED}{B_{RED} \times \left(1 + \frac{U_{val}}{100}\right)}$$





$$D_{val} = \frac{48.5}{2.99 \times \left(1 + \frac{20.4}{100}\right)}$$
$$D_{val} = 13.5 \text{ mJ/cm}^2$$

As the validated dose of 13.5 mJ/cm<sup>2</sup> is greater than the required dose of 12 mJ/cm<sup>2</sup>, the unit is capable of providing the 3-log protozoa reduction.

## 6.2.5 UV validation envelope

The UV validation study indicates a validation envelope extending to a UVT of 60% and a minimum flow of 5 gpm (19 L/min) and up to a maximum flow of 52 gpm (187 L/min), and a UVT of 99% (table 1.4 page 1-14 of the validation study).

UVT is monitored continuously to ensure it remains at or above 60% and therefore within the validated range.

If the flow drops below the validated minimum flow the UV controller automatically adopts the lowest validated flow for the calculated RED output value. Similarly, if the UVT is above the maximum validate UVT the controller adopts the maximum validated UVT for the calculated RED output value.

## 6.2.6 UV Intensity Sensor Location

The location of the sensor should be optimal to ensure the most efficient dose monitoring control. The validation study examined three difference sensor locations and determined the optimum sensor location to be at a water layer of 23 mm. The UV sensor will be installed at the optimum location, which is the basis of equation 6.1.

## 6.2.7 UV Hydraulic Configuration

The UVDGM section 3.6.2 requires that the installation of the reactor have at least 5 pipe diameters of length upstream in addition to the length provided in validation testing. The validation study (figure 1.3b) shows that the validation installation had 8.5" of 2" pipework to the first elbow on the inlet to the UV reactor. The total length required on the installation is therefore 2"x 5 + 8.5" = 18.5" (470 mm). The design provides for approximately 1m of straight pipe upstream which meets this requirement.

## 6.3 Free Chlorine System Validation

Chlorine disinfection is used to achieve 4-log virus and bacteria inactivation (table 3.2). Table 9 of the Victorian *Guidelines for validating treatment processes for pathogen reduction* (DH, 2013) suggests a critical C-T for 4-log virus inactivation is 22 mg·min/L at pH  $\leq$  8.5 and temperature  $\geq$  10 °C, and is the value adopted for this project. Bacteria are more sensitive to chlorine and so a 4-log virus inactivation will also achieve 4-log bacteria inactivation.

The Theoretical Detention Time (TDT) is given as follows:

TDT=V/Q

Where: TDT=Theoretical Detention Time (min)





V= minimum volume of chlorinate contact system (L) Q=peak flow rate (L/min)

Actual detention time (T) is determined by correcting for the impact of potential bypass by the use of a baffling factor (BF) as follows:

T=TDTxBF

Where: T=time that water is contact with chlorine (min) BF=baffling factor (usually between 0.1 - 1.0)

The design for NEV uses a long length of pipe to achieve the chlorine contact time. The *Guidelines for validating treatment processes for pathogen removal* (DH, 2013) allow the assumption that contact time (T) is equal to theoretical contact time (TDT) provided the length to diameter ratio is  $\geq$ 40 (section 8.1.3, DH, 2013). That is, baffling factor (BF) equals one. This is the assumption used for NEV.

The NEV chlorine contact system uses 16 x 2.5m lengths of pipe with internal diameter of 147 mm, and an additional 5m of length due to elbows (32). The calculated L/d = 306 which is above the minimum of 40 needed to assumed plug flow. The calculated detention time for the NEV plant is determined as follows:

Volume (V)	$=\pi * (147/2/1000)^2 * (16 * 2.5 + 5)$
	= 0.764 m <sup>3</sup>
	= 764 L
Max. Flow (Q)	= 25 kL/day
	= 25,000 L/day / 24hrs/day
	= 1,042 L/h
	= 17.4 L/min
TDT	= V/Q
	= 764/17.4
	= 44 min

A concentration of **0.5 mg/L** of free chlorine at the end of chlorine contact is set as the minimum, which gives a minimum required residence time of 44 minutes for C-T of 22 mg·min/L. This equals the actual residence time provided, so meets the C-T requirement.

# 7. Operational monitoring and process control

The following Quality Control Points (QCP) and Critical Control Points (CCP) were determined in a risk workshop (appendix 5).

The QCP and CCP points and responses are outlined below, and are detailed further in the following sections:







QCP 1	CCP 1 & QCP2	CCP 2	CCP 3

## 7.1 Monitoring and corrective actions

QCP1 - Influent	рН		
Alert	pH ≤ 4.0; pH ≥ 9.5		
Critical	-		
What	Influent pH		
How	Sensor		
When	Continuous, Online		
Where	Buffer Tank		
Who	Innaco/Automatic		
Corrective Actions			
What	Buffer Transfer Pump (PF-		
	BUF-01/02) disabled		
How	PLC		
When	Immediate		
Where	Buffer Tank		
Who	Innaco/Automatic		

### Influent pH:

The pH meter is located in the buffer tank. If the pH is out of range the plant does not feed and raises an operator alarm. This provides opportunity for the operator to investigate the cause and take appropriate action. This might include manual pH adjustment in the buffer tank, or processing at a reduced flow.





CCP1 – Membrane Bioreactor	Turbidity
Critical limits/Alert limits	
Alert	0.2 NTU
Critical	0.5 NTU
Monitoring procedures	
What	Turbidity
How	Sensor
When	Continuous, Online
Where	Filtrate line
Who	Innaco/Automatic
Corrective actions	
What	MOS recirculation mode
How	Open recirc. valve
When	Immediately if turbidity
	exceeds 0.5 NTU
Where	Filtrate line
Who	Innaco/Automatic

#### **Turbidity:**

If the turbidity exceeds the critical level of 0.5 NTU the filtrate flow is diverted from treated water to recirculation back to the bioreactor. If after 30 minutes the filtrate turbidity is still > 0.5 NTU, the MBR will go to standby and a "shutdown on high turbidity" alarm will be generated.

Production resumes when the operator resets the turbidity alarm after the cause has been identified and addressed.





QCP2 – Membrane Bioreactor	Dissolved Oxygen
Critical limits/Alert limits	
Alert	< 0.5 mg/L; > 10 mg/L
Critical	
Monitoring procedures	
What	MBR DO
How	Sensor
When	Continuous, Online
Where	Biological tank
Who	Innaco/Automatic
Corrective actions	
What	DO alarm
How	Send to operator
When	Immediate
Where	SCADA
Who	Innaco/Automatic

### Dissolved Oxygen:

If the dissolved oxygen level in the biology tank is out of range, an alarm is raised to warn the operator.





	Monitoring Parameters					
CCP2–UV Disinfection	UV RED	UVT	Lamp age	Lamp status	Water flow	
Critical limits/Alert limits			·			
Alert	50.9 mJ/cm <sup>2</sup>	63%	11,000 hours		> 180 L/min	
Critical	48.5 mJ/cm <sup>2</sup>	60%	12,000 hours	Lamp Fail	> 187 L/min	
Monitoring procedures						
What	UV Controller	UVT Monitor	Hour monitor	Lamp monitor	flowmeter	
How	UVI Sensor, Flow, UVT	UVT sensor	PLC record and UV unit control module	UV Controller	PLC	
When	Continuous, Online	Continuous	Continuous, Online	Continuous	Continuous, online	
Where	UV Controller	UV unit	UV Controller and PLC	UV Controller output	Before UV	
Who	PLC/	PLC/	PLC/	PLC/	PLC/	
	Automatic	Automatic	Automatic	Automatic	Automatic	
Corrective actions						
What	Treated water is sent to irrigation tank					
How	Diversion Valve					
When	Immediate					
Where	PLC					
Who	PLC/Automatic					

### UV dose

The applied UV RED is calculated in accordance with equation 6.1 using the measured flow, UVI and UVT. This is calculated by the PLC and displayed on the HMI.

If the UV dose drops below the alert level an alarm is triggered to warn the operator that the UV system is approaching low UV dose limit. The operator can then check unit operation and rectify before UV dose reaches critical level. If critical level is exceeded the UV unit diverts treated water production to sewer. Return to production requires the UV fault to be rectified for at least 30 minutes. This happens automatically as part of the UV system restart sequence.

### UVT

The UVT is continuously monitored and used to determine the applied UV dose from equation 6.1. If the UVT is below the critical level, then an alarm is raised and the unit diverts treated water to sewer. If the UVT exceeds the maximum validated UVT (99%) then the calculated UV dose will use the maximum validated UVT to determine the applied UV dose.

### Lamp Status:

Lamp status is monitored continuously by the UV control module. If a lamp failure is detected an alarm output is sent to the PLC and production of treated water to storage is stopped immediately by diverting treated water to





sewer. Return to production requires the UV fault to be rectified and diversion of water post chlorine contact for at least 30 minutes. This happens automatically as part of the UV system restart sequence.

#### Water Flow:

The UV unit has been validated for a flowrate of up to 187 L/min. The flowrate is controlled by a variable speed drive and the flow is monitored by an inline flow meter to ensure the flow is controlled at the setpoint at all times. The temporary plant filtrate pump is not capable of delivering this flow, so the likelihood of exceeding this is remote. Nevertheless, if the maximum flow is exceeded an alarm is raised and the flow is diverted to sewer until the cause can be identified and corrected.

If flow falls below the minimum flow, then the calculated dose will assume the minimum flow for the purposes of determining the applied dose from the dose equation.

If the flow is outside the alert range an alarm is generated (UV high flow).

### Impact of measurement time delay

Delays between the point of measurement and the control system response could occur due to signal transmission time delays, PLC delays including noise filtering on alarms, output response delays and valve opening and closing time. In total this has been calculated as 17 seconds. The system is designed such that the UV system is directly ahead of the chlorine contact system. The recirculation valves to return out of specification water back to the UV break tank are downstream of the chlorine contact system. Therefore, if a UV fault is detected that requires the UV to shut down, the comparatively long residence time in the chlorine contact systems ensures that no untreated water will be sent to storage.

There is a time delay in starting up the UV in which partially treated water passes through the UV to the chlorine contact tank. Transfer of treated water to storage will be delayed by the PLC following UV start up by an amount of time calculated to be equal to the detention time in the chlorine system at the set flow.





	Monitoring Parameters					
CCP3- Chlorination	Residual free chlorine	рН	Temperature	Flow		
Critical limits/Alert limits						
Alert	≥ 4.5 mg/L; ≤ 0.6 mg /L	pH≥8.3; pH≤6.3	≤ 12°C	> 16.6 L/min		
Critical	≥ 5.0 mg/L; ≤ 0.5 mg /L	pH≥8.5; pH≤6.0	≤ 10°C	> 17.4 L/min		
Monitoring procedures						
What	Free Residual Chlorine (FRC)	рН	Temperature	flowmeter		
How	Sensor	Probe	Thermocouple in pH probe	PLC		
When	Continuous, Online	Continuous, Online	Continuous, Online	Continuous, online		
Where	At the end of the chlorine contact pipe	At the end of the chlorine contact pipe	At the end of the chlorine contact pipe	Before UV		
Who	PLC/Automatic	PLC/Automatic	PLC/Automatic	PLC/ Automatic		
Corrective actions						
What	Treated water is sent to irrigation tank					
How	Diversion Valve AV-214					
When	Immediate					
Where	Diversion valve after chlorine contact system					
Who	PLC/Automatic					

### **Residual Free Chlorine:**

If the free residual chlorine level drops below the critical level of 0.5 mg/L or rises above the maximum level of 5.0 mg/L then the treated water is diverted to sewer until the chlorine residual is between 0.5 and 5.0 mg/L. An alarm is raised to make the operator aware that delivery of treated water has ceased due to chlorine residual out of range.

The chlorine residual at distant points in the distribution system will be checked periodically as per the recommendations of the risk assessment (Appendix 5; 6-Distribution and Storage Tanks). Based on the results the chlorine residual target range will be adjusted to ensure a residual is present in the network to control biofilm growth. If there are excessive chlorine levels for irrigation, the plant target free chlorine range can be lowered, providing it remains above the critical level.

#### Treated Water pH:

If the pH of the treated water measured at the outlet of the chlorine contact pipe drops below the critical level of 6.0 or rises above the maximum level of 8.5 then the treated water is diverted to sewer until the pH is between 6.0 and 8.5. An alarm is raised to make the operator aware that delivery of treated water has ceased due to pH out of range.





#### Water Temperature:

The chlorine contact system has been designed based on a minimum temperature of 10°C. It is important to ensure that chlorine contact occurs above this temperature so as to ensure effective inactivation of pathogens.

If the temperature of the treated water measured at the outlet of the chlorine contact pipe drops below the critical level of 10°C the treated water is diverted to the dam until the temperature is above 10°C. An alarm is raised to make the operator aware that delivery of treated water has ceased due to temperature out of range.

#### Water Flow:

The chlorine contact system has been designed based on a maximum flow of 17.4 L/min. It is important to ensure that the treated water flow does not exceed this figure so as to ensure effective inactivation of pathogens. The flow is continuously monitored by the PLC. The limits for the chlorine contact system are the same as for the UV as both unit operations are installed in series and the UV system is designed with the same maximum flow.

#### Impact of measurement time delay

Delays between the point of measurement and the control system response could occur due to signal transmission time delays, PLC delays including noise filtering on alarms, output response delays and valve opening and closing time. This has been calculated as ~6 seconds. The design provides for an additional 3 meters of pipework from the measurement point to the diversion valve which provides the required delay for the valve to divert the flow before any non-compliant water is discharged.





## 7.2 Standard operating procedures

An operations and maintenance manual will be supplied with the system to explain detailed operation. This includes a description of the QCP/CCP's and required operator actions.

A summary of the CCP's in provided in table 7.1 along with the control response and operator actions. Further details are provided in the operating and maintenance manual.

QCP/CCP	Parameter	Control System Response	Operator Actions
CCP1 – Membrane Bioreactor	Turbidity ≤0.5 NTU	The MBR atomically monitors turbidity and will shut down after a controlled period of recirculation with no improvement.	The operator should contact Innaco for a detailed investigation. The most likely causes are membrane system leaks (seals or membrane integrity), faulty turbidity readings (due to air bubbles), or bio-growth shedding from pipework.
CCP2 - UV Disinfection	UV Dose: $\geq$ 48.5 mJ/cm <sup>2</sup> Flow: $\leq$ 187 L/min UVT: $\geq$ 60% Lamp age: $\leq$ 12,000 hrs Lamp status: On	This includes monitoring of UVI, UVT, flow, lamp status and lamp hours. The plant diverts water to irrigation if the UV conditions are not all met.	The relevant parameters that affect UV dose are individually monitored and alarmed to guide the operator response.
CCP3 - Chlorine Disinfection	Chlorine residual: ≥ 0.5 mg/L Flow: ≤17.4 L/min Temperature : ≥10 DegC pH: ≤ 8.5	Chlorination pH, chlorine residual, and temperature are monitored continuously. The PLC diverts to irrigation if the treated water does not meet control limits.	Chlorine residual could be affected by changes in chlorine demand, or flows. Establish stable flows and adjust chlorine dose rate as required. pH outside limits could be due to poor biological conditions or changes in feedwater quality. Contact Innaco for investigation.

### Table 7.1 – CCP summary and operator action

## 7.3 Storage and distribution monitoring

Recycled water for reuse is stored in a 120 kL above ground storage tank for gravity distribution to the reuse network. The water within the Recycled Water Storage Tank (RWST) is recirculated using an external recirculation pump that is designed to ensure water in the tank remains well mixed. The recirculation system also includes pH and ORP monitoring instruments and a sodium hypochlorite dosing pump and storage tank. Sodium hypochlorite is added as needed to maintain the ORP to the required ORP setpoint (adjustable by the operator). The ORP setpoint will be determined during commissioning, based on the objective of maintaining a measurable free chlorine residual at distal parts of the recycled water distribution system.




Weekly tests for free chlorine residual in the network will be carried out as part of the water quality monitoring regime detailed in the NEV document "Monitoring and Recording Procedure for Water Quality in Distribution Networks". If the free chlorine residual is not maintained at any of these locations, then the ORP setpoint can be increased to increase the free chlorine residual. Alternatively, or in addition, flushing of some sections of the network that have less use may be required to ensure the required residual can be maintained. If the pH is outside the required range it can be manually adjusted by adding alkali (such as sodium hydroxide) or by adjusting the setpoint for pH at the treatment plant.





# 8. Verification and ongoing monitoring

To provide evidence that the overall system is capable of delivering water of the specified quality, the following verification monitoring plan is proposed. The period of sampling is for 6 weeks.

#### Influent Parameter Units **Influent Compliance Value** Frequency E. coli cfu/100mL Weekly NA BOD mg/L Weekly NA Coliphages pfu/100mL Fortnightly NA Clostridia cfu/100mL Fortnightly NA

#### **Table 8a: Verification Monitoring**

Effluent			
Parameter Units Frequency		Frequency	Effluent Compliance Value
E. coli	cfu/100mL	2 times/week	< 1
BOD	mg/L	2 times/week	< 10
SS	mg/L	2 times/week	< 5
рН	NA	Continuous online	6.5 – 8.5
Turbidity	NTU	Continuous online	<0.5 (maximum)
UV RED	mJ/cm <sup>2</sup>	Continuous online	> 48.8
<b>Residual Chlorine</b>	mg/L	Continuous online	0.75 – 5.0
Coliphage	pfu/100mL	2 times/week	< 1
Clostridia	cfu/100mL	2 times/week	< 1

To provide evidence that the overall system is capable of delivering water of the specified quality on an on-going basis, the following monitoring plan is proposed.

#### Table 8b: On-going recycled water monitoring

Parameter	Effluent Target	Effluent monitoring frequency
E. coli	< 1cfu/100ml	Weekly





# 9. Prerequisite programs

For the effective operation of this RWQMP, prerequisite programs that outline detailed procedures and protocols will be provided.

#### **Operations and Maintenance procedures:**

An operations and maintenance manual will be drafted for the scheme. Included in the manual are the Standard Operating Procedures, Maintenance Procedures, Calibration Procedures and Chemical Safety Procedures.

#### Calibration of monitoring instruments:

The calibration of all on-line monitoring instruments will be checked at monthly intervals as part of the monthly servicing of the plant. The calibration of each instrument is logged and maintained on a standard maintenance record.

#### Inspections:

The plant is under continuous remote supervision by Innaco as the contracted operator. Data logging of key parameters is a part of this supervision. Weekly inspections will be conducted by NEV appointed and Innaco trained individuals. The responsibilities will be clearly delineated in the service agreement. Also in accordance with the service agreement, monthly maintenance including instrument calibration checks are carried out by Innaco and records maintained. Six-monthly servicing is carried out by Innaco and records maintained.





# 10. Incidents and emergencies

Procedures for management of incidents and emergencies are contained in the following NEV documents:

- NEV1045-02-B Poor Quality Drinking Water Incident Response Procedure
- NEV1045-03-B Loss of Drinking Water Supply Incident Response Procedure
- NEV Environmental Incident Procedure
- NEV WHS Incident Procedure
- NEV Site Emergency Response Plan

Current versions of these documents are available at:

Nextcloud\NEV Water\IOP\Incident Response

NEV maintains a community contact and FAQ section on its website with procedures relating to the management of emergencies relating to NEV water infrastructure.

Innaco also maintains a community contact and FAQ section on its website with procedures relating to the management of emergencies relating to its treatment plants.





# Table 10.1: Incidents and emergencies

Hazards and events	Immediate Response		Corrective Action	Authorities					
that may lead to emergencies	What	Who	What	Who	What	Who			
Non-conformance of water with critical limits	If detected by online instrument, plant automatically shuts off supply to treated water storage.	Innaco	Innaco diagnose and rectify.	Innaco	Has non-compliant water been delivered? If yes, Innaco notify NSW Health and NEV.	Innaco			
Monitoring results outside targets set in Table 8b.	If there are any occurrences of positive results for the ongoing water quality monitoring as described in table 8b, supply of recycled water should be stopped, and the cause investigated. Innaco to notify NEV immediately. NEV to notify NSW Health.	Innaco	Innaco to investigate cause and rectify.	Innaco	Innaco notify NSW Health and NEV.	Innaco.			
Accidents that increase level of contamination in source water	Collection tank continuously monitored for pH. Feed pump disabled when pH outside limits.	Innaco	Pause production and wait for operator rectification. Production resumed once pH returns to specification.	Innaco	NA				
Cross-connections	If a cross connection is detected, immediately stop use of treated water, and switch to potable water backup.	Innaco	Conduct audit to identify location of cross- connection. Rectify. Preventative measures include signage, labelling, colour-coding, information brochures for plumbers and public. Do not reinstate delivery of treated water until cross connect audit has been completed.	Innaco	Should a cross-connection be identified, notify NSW Health and NEV.	Innaco			
Prolonged power outages	Plant shuts down in a safe state on power failure. Notify Innaco so that restart procedures and checks can be made and the plant monitored during startup. Potable water backup will provide water needs automatically.	Innaco	Remote operator log-in. Restart operation on return of power.	Innaco	NA				
Leakage, spillage, or runoff of recycled	For minor contained spills, NEV to respond. Notify Innaco for repair If treatment plant is responsible.	NEV	Innaco to action if treatment plant is responsible. Incident report to be prepared and corrective actions implemented	Innaco	If major spill that contaminates or potentially contaminates the environment also contact EPA.	Innaco			





water or sewage on			
site.			





# 11. Employee awareness and training

Both NEV and Innaco are individually responsible for ensuring its employees and contractors are familiar with the operation of the scheme and aware of the potential consequences of system failures, and of how their decisions can affect the safety of the scheme.

Innaco will provide an experienced water recycling engineer to monitor the plant. Any staff used on site must be accredited, qualified and have the appropriate level of training.

A site induction will be required for anyone doing work related to this scheme. This will be carried out and recorded by Innaco, or by those appointed and trained by Innaco for this purpose. For plant work this includes familiarization with Innaco's Safe Work Method Statements (SWMS's) which are site specific. Innaco maintains a partnership with several contractors to ensure continuity of knowledge and technical expertise.

Innaco has an induction program for new employees and written procedures for all areas of responsibility (IMS document HR120).

Training needs for Innaco and NEV employees are identified and adequate resources made available during the induction phase. Annual performance reviews identify additional training requirements and set performance targets. Training records are kept.

# 12. Documentation and reporting

#### 12.1 Documentation

The following records and documents will be maintained by Innaco as the blackwater recycling plant operator.

- Verification and on-going monitoring results
- CCP monitoring results and analysis
- Plant operation data
- Laboratory testing results and analysis
- Breaches of critical limits and corrective actions taken
- Incidents and emergencies and corrective actions taken
- Inspection and maintenance activities relevant to water quality

CCP results and operation data will be collected by online data acquisition system and kept as electronic copy by the plant operator Innaco.

Verification results will be collected by Innaco from a NATA accredited testing laboratory and stored electronically.





A record of any maintenance to the treatment plant will be kept in the plant log book. Any equipment adjusted, repaired, replaced or calibrated will be recorded. Monthly maintenance checks and calibrations are recorded on a monthly maintenance checklist (See Operations and Maintenance Manual).

#### 12.2 Reporting

There will be a monthly report provided to NEV in relation to the operation and maintenance of the blackwater recycling plant by Innaco.

An annual compliance report will be prepared and submitted to IPART certifying that the licensee has complied with its licence obligations.

### 12.3 Notifications

#### 12.3.1 Health

Any of the following is considered a poor quality recycled water incident requiring emergency response:

- Detection of E. coli, protozoa or virus in recycled water that has been distributed for reuse (excludes cases where water has been sent only to the disposal field).
- Failure of a treatment process that has led to inadequately treated water being distributed for reuse.

The emergency response procedure is detailed in the NEV document 112 "Poor Quality Drinking or Recycled Water Incident Response Procedure". This includes the notification requirements and contact details for the authorities for internal and mandatory incident reporting.

#### 12.3.2 Environment

Any incidents that cause or threaten environmental harm, must be dealt with in accordance with the NEV document 071 "Environmental Incident Procedure". This will provide guidance on assessing the risk and determining notification and action requirements.





# 13. Auditing

The frequency for independent ongoing audits will be determined by IPART requirements using a risk based approach, but will occur at least every 5-years.

At least once every two years, NEV's Risk and Audit Committee will conduct an internal quality management audit of NWV Water's quality, safety and environmental management standards. The audit will cover compliance with NEV's Network Operator and Retail license conditions, management plans, policies and procedures. The Risk and Audit Committee will document its findings and report these to the NEV Board of Directors.

The Risk and Audit Committee will retain records of the audit which will include:

- Completed Audit Checklists and/or marked up procedures
- Notes on objective evidence examined, and personnel interviewed
- Audit Findings including any non-conformance with license conditions, management plans, policies and procedures
- Audit Report including corrective actions

# 14. Review and improvement

The RWQMP is reviewed and updated annually.

Where improvements to the plant or revisions to operation of the plant are identified, such improvements shall only be implemented with the endorsement of IPART if the improvements or revisions involve altering public health and environment protection measures such as CCPs, corrective actions, relevant monitoring and inspection programs.

# 15. Commissioning the RWQMP

All operational monitoring, critical alarms and corrective actions within the RWQMP will be tested and verified as part of commissioning.

# 16. Plumbing

The Building plumbing and drainage system has been designed in accordance with the Water Supply Code of Australia and in accordance with AS/NZS 3500:200.





# References

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- 2. EPA Victoria. 2005. *Guidelines for environmental management: dual pipe water recycling schemes health and environmental risk management*, publication 1015: State Government of Victoria, Melbourne.
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- 4. NRMMC et al . 2006. *Australian Guidelines for Water Recycling: Managing Health and Environmental Risks* (*Phase 1*): Environmental Protection and Heritage Council, the National Resource Management Ministerial Council and the Australian Health Ministers' Conference.
- 5. Pettigrew, L., Angles, M., Nelson, N. *Pathogen Removal by a Membrane Bioreactor*. Wastewater Treatment, September 2010.
- 6. USEPA, Membrane Filtration Guidance Manual
- 7. ASTM D6908-03
- 8. Pathogen Removal by Integral and Compromised Siemens Memcor MBR Systems (confidential)
- 9. Validation of Memcor B40N MBR Modules for Protozoa and Bacteria Removal (confidential)
- 10. Pathogen Monitoring of MBR Systems using On-line Turbidity (confidential)





# Appendices



















NEV\_RWQMP\_V7.2





## Appendix 4 Risk Assessment Workshop – Recycled Water Scheme

See separate document "NAV1603J Narara Village Risk Assessment output paper" available at server location - Nextcloud \NEV Water\IOP\Risk Assessments





# Narara Ecovillage

# **Operation & Maintenance Manual**

# Temporary Potable Water Supply System





# **DOCUMENT CREATION AND REVIEW**

Revision	Dat e	Author	Reviewer	Comments						
Rev 0	13 December 2017	J.Hansen	J. Taylor	Draft						
Rev 1	15 December 2017	J.Hansen	\$.Grimwood	Draft						
Rev 2	13 February 2019	G Cameron	J Talbott	Final						
Rev 3	21 September 2020	G Cameron	S Errey	Reviewed and updated						





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# **1 INTRODUCTION**

#### 1.1 **Project Overview**

The Narara Ecovillage (NEV) located on the central coast of NSW. Potable water is supplied to the Narara Ecovillage via a temporary connection from the Central Coast Council (CCC) and is transferred from a break tank to storage tanks on an elevated section of the property for gravity distribution throughout the ecovillage.

A recirculation and chlorination system is used to maintain water quality in the potable water storage tanks.

The Potable Water System control panel and PLC is located at the temporary wastewater plant and contains the logic for control of the potable water system and the recirculation/chlorination system located up the hill near the header storage tanks.

Remote I/O located in a control panel local to the recirculation pumps up the hill, is used for the control of the potable water system and the recirculation/chlorination system.

A HMI (Human Machine Interface) panel is installed at the wastewater plant and also at the recirculation/chlorination shed so that the potable water system can be monitored and controlled from either location.

YEAR OF CONSTRUCTION:	2017
OWNER:	Narara Eco Village Co-operative
APPLICATION:	Potable Water
LOCATION:	Narara Ecovillage Narara NSW

This manual contains important information regarding the equipment purchased. Please ensure it is kept in a safe, dry place with or near the equipment.

Please keep this manual for the life of the system and pass it on to any subsequent owner.





#### **1.2 Scope of Manual**

This manual describes the operation and maintenance of the Potable Water Supply System supplied by Innaco Pty Ltd. This fully automated system receives potable water from the Central Coast Council water supply network for potable water use throughout the ecovillage.

The description of each stage will include the following plant elements as necessary:

Gosford Water Break Tank Chlorine disinfection Potable water storage Tank

#### **1.3 Warnings and Precautions**

Plant maintenance must only be undertaken by suitably trained and authorized personnel and in accordance with all relevant Occupational Health and Safety regulations of the jurisdiction in which the potable water treatment plant is installed.

It is important that care is taken during maintenance to ensure that chlorinated water does not become contaminated, either by inadvertently transferring untreated water into potable water storage vessels or by using equipment (e.g. pumps) for transferring untreated water then treated water, thus risking cross contamination.

The following protocols are to be used to minimise this risk:

- All maintenance operations must be supervised on-site by an authorised representative who is qualified to operate the potable water treatment plant and aware of the risks of contamination during maintenance.
- Where planned maintenance schedules involve work on both the chlorinated water and untreated water systems, perform maintenance on the chlorinated water system first.
- The on-site maintenance supervisor must verify with any contractors that equipment used for repair and maintenance of sewers is not used for repair or maintenance of the potable water system.

Even with these precautions, in the event of contamination of the treated water system, the incident must be immediately reported to Innaco and NEV, as well as recorded in the site logbook, with details of how the incident occurred and what corrective action was taken. NEV will notify any authorities where appropriate.

The potable water infrastructure may not be used until the appropriate all requirements of the sites WICA license have been fulfilled.





#### 1.4 Contact List

Emergencies – Life Threatening Dial: 000 Ambulance Fire Brigade Police

Recycled Water Treatment Plant Operator: Innaco Suite 2.01, 828 Pacific Highway, Gordon NSW 2072 Ph 02 9417 8400 email@innaco.com.au

Recycled Water Reticulation Scheme Owner Narara Eco Village Phone: 02 4328 1588 Mobile: 0401 319 051 Email: water@nararaecovillage.com





#### **1.5 Emergency Protocols**

#### **1.5.1 Incidents and Emergencies**

Incidents or emergencies relating to the potable water infrastructure and the reticulation system are likely to be first identified by a resident, visitor, maintenance contractor. The roles and responsibilities of the parties are detailed in the Drinking Water Quality Management Plan for Narara Ecovillage. Both Innaco and the facility owner/manager are to be notified as soon as possible to any such incidents or emergencies.

Where an incident or emergency is, the situation is to be made safe to the extent it is possible and safe to do so, before immediately contacting NEV management where a decision can be made on appropriate further action.

Where a resident or visitor an urgent repair, they are instructed to notify the facility maintenance contractor. Urgent repairs include:

- Line break in a potable water pipeline
- Flooding or serious flood damage.
- A failure or breakdown of the potable water supply
- An appliance fitting or fixture that uses or supplies potable water and is broken in a way that wastes water.
- A fault or damage that creates an unsafe situation.

NEV will arrange for the urgent repairs to be undertaken. Where the repairs are on the potable water infrastructure, Innaco will provide remote support, or attend site to effect the repairs.

#### 1.5.2 Reporting

Where any event relating to the recycled water system meets the following criteria, Innaco must be contacted by NEV:

- A system failure that may potentially impact the end users of the potable water.
- An emergency or incident that potentially places public health at risk.
- Any changes to the operation of the treatment process that may potentially impact on achieving the required microbial criteria or produce out of specification treated water.

The potable water treatment plant owner and plant operator should have 24 hour emergency contact information of the other parties. NEV, as the WICA license holder have the responsibility to notify relevant authorities of any reportable incident. If practical, such reporting should be on the same day that the incident occurs if that day is a business day, else as early as possible on the next business day. Where this timeline conflicts with any regulatory reporting time frames, the regulatory requirements will take precedence.





# **2 DESIGN PARAMETERS**

#### 2.1 Code and Authorities

The potable water infrastructure is managed according to this Operations and Maintenance manual and has been developed specifically for this site, with reference to the following guidelines:

Australian Drinking Water Guidelines (2004) Plumbing and Drainage Code AS/NZS 3500:2003

#### 2.2 Design Criteria

Potable Water Supply System Specifications								
Storage tank capacity:	3 x 150 kl NPCW (potable water)							
Additional disinfection:	Chlorine dosing							
Treated water quality:	Suitable for potable residual use							

#### 2.3 Occupational Health and Safety

Before commencing any work on the potable water treatment plant, refer to:

- the site induction procedures.
- the Innaco SWMS for the potable water treatment plant.
- the Innaco Occupational Health, Safety and Environment (OHSE) Management Plan.
- any relevant local procedures regarding Occupational Health and Safety (OHS).

#### 2.3.1 Personal Hygiene

Some components of the potable water infrastructure are located at the waste water treatment plant which and as such, there is a possibility of coming into contact with untreated waste water. Untreated water contains species that are potentially harmful to health.

Operators should remain alert to the possibility of contamination and, at completion of works, hands and face should be thoroughly washed with soap and water. Use biocide on hands.

#### 2.3.2 Wash down

For any wash down functions in and around the potable water plant, a mains water tap will be located within the recycled water treatment plant's vicinity. This tap is also available in the event of minor chemical or mixed liquor splashes/spills.

#### 2.3.3 Protective Clothing

Full length trousers and shirt, and steel cap work boots should be worn at all times.

When changing sodium hypochlorite drums, or working on sodium hypochlorite lines, wear a full face shield, elbow length PVC gloves and full length PVC apron. Sodium hypochlorite is a corrosive agent and must be handled with care.

#### 2.3.4 Tank Entry

Under no circumstances must entry be made to any tank or vessel without prior reference to *Work Health and Sa/ety Regulation 2017* and ensuring such entry is in accordance with the regulation.





# **3 SYSTEM DESCRIPTION**

#### 3.1 Site

During the early stages of the development, potable water is provided to the three Potable Water Storage Tanks (PWST) from the Gosford Water Break Tank (GWBT). The GWBT is supplied with potable water from the Central Coast Council water supply network via an airgap and inlet control valve. The actuated valve is required because the agreement with Council allows pumping only during certain hours of the day. The hours of pumping will be set via the HMI so that the transfer system is operational only during these hours. Manual override of these hours is possible in case of emergency.

Three transfer pumps are provided to transfer water from the GWBT to PWST's. These are located in the pump shed adjacent to the temporary wastewater plant.

#### 3.2 Process

Potable water is fed into the system via Central Coast Council's mains supply. The flow chart in





Figure 1 details the process. An automated value on the inlet to the break tank allows flow from in to the tank. The break tank level is constantly monitored.

A triplex pump set located in the pump shed adjacent to the breaktank, delivers water to the potable water storage tanks up the hill. Interconnecting pipework exists between the three storage tanks allowing the water to be recirculated between all tanks. The recirculation pumps operate in duty/ standby mode. ORP and pH measurement occurs on the outlet of the recirculation pumps. Chlorine is dosed to maintain water quality in the potable water storage tanks.



**Figure 1: Process Elements** 







### 3.3 Equipment Schedule

Description	Part
Gosford water transfer pumps	CRI 15-12 Triplex
Potable water recirculation pumps	CRN 45-2
Chlorine dosing pump	EWNB11VCAR

#### 3.4 Instrument Schedule

Description	Part
Potable water break tank level	Trafag ECL Series 8438, 4m
Potable Storage Tank A Level	Trafag ECL Series 8438, 4m
Potable Storage Tank B Level	Trafag ECL Series 8438, 4m
Potable Storage Tank C Level	Trafag ECL Series 8438, 4m
Potable water break tank level Switch	MAC3
Potable Storage Tank A Level Switch	MAC3
Potable Storage Tank B Level Switch	MAC3
Potable Storage Tank C Level Switch	MAC3
Flow cell flow switch	Sick Proximity Sensors IM 12-DCPNP
CCT ORP Probe	E&H CPS12D + Ecofit CPA640-E
CCT pH probe	E&H CPS71D





#### 3.5 Asset Replacement Schedule

The following table outlines the recommended asset replacement schedule.

ASSET	REPLACEMENT SCH	EC	)U	LE	Ξ																	
Project No & Name:	A0072 - Potable Water																					
Site Location:	Narrara Eco Village																					
Customer:	Narrara Eco Village Co-op Ltd																					
Done By:	Justin Taylor																					
Date:	14-Nov-17																					
Version:	1																					
Asset Re	placement Schedule																					
					I																	
Serial	Description	2		1	12	2	2	2	12	2	3	3	12	2	4	1   0	12	2	3	;	12	
1	Tanks	20	vea	ars	14	3	0	3	14	3	U	3	14	J	0	3	14	J	U	3	14	
2	Pumps								<u> </u>		·											
_	Centrifugal Pumps - Complete Unit																				x	
	Centrifugal Pumps - Mechanical Seal										x											
3	Monitoring Equipments																					
	pH meter																				x	
	pH Probe		x		х	-	х		х	-	х		х		х		х		x		x	
	ORP Probe				х				х				х				х				x	
	Level Transmitters																				x	
4	Valves																					
	Actuated valve																				x	
	Butterfly valve	No	) Lin	nite	d Li	feti	me.	On	ly re	epla	ace	wh	enp	orol	blen	n ra	ise					
	Ball valve (PVC)	No	) Lin	nite	d Li	feti	me.	On	ly re	epla	ace	wh	enp	orol	blen	n ra	ise					
	Check valve	No	Lin	nite	d Li	feti	me.	On	ly re	epla	ace	wh	enp	orol	blen	n ra	ise					
5	Others																					
	PLC	Ur	nlimi	ited	life	. Or	nly r	epla	ace	wh	en	pro	bler	n ra	aise	)						
	НМІ	Ur	nlimi	ited	life	. Or	nly r	epla	ace	wh	en	pro	bler	n ra	aise	)						
	Potable Water Pipework	Ur	nlimi	ited	life	. Or	ıly r	epla	ace	wh	en	pro	bler	n ra	aise	,						
	Eloat Switches																					





ASSET	REPLACEMENT								
Project No & Name:	A0072 - Potable Water								
Site Location:	Narrara Eco Village								
Customer:	Narrara Eco Village Co-op Ltd								
Done By:	Justin Taylor								
Date:	14-Nov-17								
Version:	1								

# Asset Replacement Schedule

1																					
											Yea	ar									
Serial	Description		6	;			7	7		-	8	3			ç	)			1	0	
		3	6	9	12	3	6	9	12	3	6	9	12	3	6	9	12	3	6	9	12
1	Tanks																				
2	Pumps																				
	Centrifugal Pumps - Complete Unit																				x
	Centrifugal Pumps - Mechanical Seal										x										
3	Monitoring Equipments																				
	pH meter																				x
	pH Probe		x		x		x		x		x		x		х		x		x		x
	ORP Probe				x				x				x				x				x
	Level Transmitters																				x
4	Valves																				
	Actuated valve																				x
	Butterfly valve	No	Lim	nite	d Li	fetir	me.	On	ly re	epla	ace	wh	enp	orob	olen	n ra	lise				
	Ball valve (PVC)	No	Lim	nite	d Li	fetir	me.	On	ly re	epla	ace	wh	enp	orot	olen	n ra	lise				
	Check valve	No	Lim	nite	d Li	fetir	me.	On	ly re	epla	ace	wh	enp	orob	olen	n ra	lise				
5	Others																				
	PLC	Unl	limi	ted	life	. On	ily r	epl	ace	wh	en	pro	bler	n ra	ise						
	НМІ	Unl	limi	ted	life	. On	ily r	epl	ace	wh	en	pro	bler	n ra	ise	•					
	Potable Water Pipework	Unl	limi	ted	life	. On	ily r	epla	ace	wh	en	pro	bler	n ra	ise						
	Float Switches	Unl	limi	ted	life	. On	ly r	epla	ace	wh	en	pro	bler	n ra	ise						





ASSET	REPLACEMENT																				
Project No & Name:	A0072 - Potable Water																				
Site Location:	Narrara Eco Village																				
Customer:	Narrara Eco Village Co-op Ltd																				
Done By:	Justin Taylor																				
Date:	14-Nov-17																				
Version:	1																				
Asset Re	placement Schedule																				
Serial	Description		1	1			1	2			1:	3			1	4			1	5	
		3	6	9	12	3	6	9	12	3	6	9	12	3	6	9	12	3	6	9	12
1	Tanks																				
2	Pumps																				
	Centrifugal Pumps - Complete Unit																				x
	Centrifugal Pumps - Mechanical Seal										x										
3	Monitoring Equipments																				
	pH meter																				x
	pH Probe		x		x		x		х		x		x		x		x		х		x
	ORP Probe				x				х				x				x				x
	Level Transmitters																				x
4	Valves																				
	Actuated valve																				x
	Butterfly valve	No	Lim	nite	d Li	feti	me.	On	ly re	epla	ce	whe	en p	orol	olen	n ra	ise				
	Ball valve (PVC)	No	Lim	nite	d Li	feti	me.	On	ly re	epla	ce	whe	en p	orol	olen	n ra	ise				
	Check valve	No	Lim	nite	d Li	feti	me.	On	ly re	epla	ce	whe	en p	orol	olen	n ra	ise				
5	Others																				
	PLC	Un	limi	ted	life	Or	nly r	epla	ace	wh	en p	oro	bler	n ra	aise	)					
	HMI	Un	imi	ted	life	Or	nly r	epla	ace	wh	en p	oro	bler	n ra	ise	)					
	Potable Water Pipework	Un	limi	ted	life	Or	nly r	epla	ace	wh	enp	oro	bler	n ra	aise						
	FloatSwitches	Un	imi	ted	life	Or	nly r	epla	ace	wh	enp	oro	bler	n ra	aise	)					

#### 3.6 Component Preventative Maintenance

A routine maintenance program should be put into place to ensure trouble free operation of the plant and equipment, and that there is an uninterrupted supply of potable water.

Plant servicing should be undertaken by an appropriately qualified service technician. Works should not only include mechanical servicing of plant components, but should also pay attention to calibration of instruments, measuring and recording plant operational parameters.

All service activities undertaken on the plant should be recorded and the records maintained for future reference. A typical service check list for the plant is included in this O&M Manual.

As well as scheduled servicing, daily checks of the plant should also be undertaken. These checks are typically observations of the plant and should include:





Checking for leaks or spills Checking for unusual odours Checking for noises or vibrations of equipment that may require further investigation Checking plant status and tank levels on the HMI Checking the HMI for alarms

Results of daily checks should be recorded as objective evidence that the plant is being checked every day.

# **4 OPERATING INSTRUCTIONS**

#### 4.1 General

#### 4.1.1 Components

The potable water system consists of the following components:

Gosford Water Break tank. Chlorine disinfection.

Potable Water Storage Tanks

#### 4.1.2 Control

The potable water infrastructure is run by a Programmable Logic controller (PLC). The PLC has a touch screen interface (HMI), which allows the recycled water treatment plant to be controlled onsite. There is a second HMI at the treated water storage tanks that mimics the HMI in the main control panel at the recycled water treatment plant. The plant and equipment can be controlled from either HMI.

The PLC can also be controlled remotely, with connection through the remote monitoring system.

The PLC controls:

Run/Stop of the water treatment plant. Manual subsystems (Manual, On/Off and Auto). Modify process variables.

In the event of an emergency, activate the emergency stop button and notify NEV immediately. In addition to emergency stop button availability, various fail-safes are built into the logic of the system. These have been developed over time and not only cater for process upsets, but also for catastrophic events such as power failure and mechanical failure.

The potable water plant will run in automatic mode for the majority of its serviceable life. The PLC system controls the plant completely and ensures that out of specification treated water is not delivered to the reticulation system.





#### 4.1.3 Alerts

If the water quality is outside the setting range of the critical control points or motor faults/power failure are detected, the PLC generates alarms, and sends alerts to the operators via email and prevents out of specification water from being distributed to the storage tanks.

In the event of an emergency, activate the emergency stop button located on the control panel and notify facility staff immediately.

#### 4.2 Touchscreen interface

The touch screen interface forms part of the control panel. If required, it can be protected by a key combination/pin system. These details will be provided to the designated operator as required.

The touch screen allows complete control of the potable water plant and hence access to it is must be controlled by the plant owner. The various windows are described in the following sections.

#### 4.2.1 Main Menu Screen

The potable water plant is controlled from the same HMI as the recycled water treatment plant. Figure 2 shows the Main Menu screen of the HMI.

#### For more detail on HM/ screens refer to the Temporary Wastewater Treatment Plant O&M Manual.

Access to control of the potable water storage and recirculation is obtained by pushing the "Potable Water Storage and Recirculation" button under the Mimics heading (see figure 3).

The "Potable Water Storage and Recirculation" button under the Monitoring heading on the right hand side of the main menu allows alarms relating to the system to be reviewed (see figure 5).

The "Level Set Points" (see figure 6) and "CCP and QCP Set Points" (see figure 4) screens also contain parameters relevant to the potable water system.

All other buttons on the main menu relate to the waste water treatment plant. The use of these functions is described in the Operations and Maintenance Manual for the temporary water treatment plant.





#### Figure 2 - Main Menu Screen

	Main	Мепи	15: 07-D
Mimics	Settings and Controls	Trends	Monitoring
Infeed and Biology Mimic	Level Setpoints	Biology Tank Trend	Infeed & Bio Alarms
Membrane Operating System Mimic	Infeed and PreScreen Setpoints	Membrane Operating System Trend	MOS Alarms
UV and Chlorine Dosing Mimic	Biology Tank Setpoints	Chlorine Dosing Trend	CCT Alarms
Treated Water Distribution	Mombrane Operating		Tracted Water
Potable Water Storage And Recirculation	System Setpoints	UV Trend	Distribution Alarms
PID	Membrane Operating System Control		Potable Water Storage and Recirculation
PDRWRPID	Chlorine Dosing		
PDPWRPID	Setpoints		
Filtrate Flow Control	CCP and QCP Setpoints		Alarm Looper
CCT Flow Control	RUN PLAN	IT	Alarni Lögger
PDBI001	Const.		Motor and Valve History

#### 4.2.2 Potable Water Storage and Recirculation

Pressing the Potable Water Storage and Recirculation button under the mimic heading of the main menu brings up the screen shown in 3. This screen shows all the key components of the system as well as key process information. The status of the transfer pumps can also be seen on this screen.





The following information and control is available through the HMI mimic:





Gosford Water Break Tank – the level of the tank (in mm) can be seen on the screen as well as high and low level alarms. The status of the filling valve can also be seen (green indicates it is open). Touching the valve will bring up a window which allows the valve to be put into manual mode and opened and closed manually. Operators should be aware of the Council's restriction on times that water can be taken from the system and opening the valve outside of these times should only be restricted to maintenance activities of emergencies. Gosford Water Transfer Pumps – these pumps transfer the water from the break tank to the storage tanks. The operational status of the pumps can be seen. When the motor is highlighted green, it is in operation. The pumps can also be put into manual mode and turned on and off when required by selecting the pump on the HMI which then brings up a pop up window allowing manual or auto control.

Potable Water Storage Tanks – the level of each of the potable water tanks can be seen as well as high and low level alarms.

Potable Water Recirculation Pumps – these pumps draw water from the potable water storage tanks and circulate it through the chlorine dosing system. The operational status of the pumps can be seen. When the motor is highlighted green, it is in operation. They can also be put into manual mode and turned on and off when required by selecting the pump on the HMI which then brings up a pop up window allowing manual or auto control.

Sodium Hypochlorite Dosing tank – the level of the sodium hypochlorite dosing tanks can be seen as well as low level tank alarms.

Potable Water Chorine Dosing Pump – pump PD-PWR-01 is the dosing pump which doses sodium hypochlorite. The operational status of the pump can be seen. They can also be put into manual mode and turned on and off when required by selecting the pump on the HMI which then brings up a pop up window allowing manual or auto control.

Recycled Water Chlorine Dosing Pump – pump PD-RWR-01 is the dosing pump for recycled water storage tank. Refer to the Operations and Maintenance manual for the waste water treatment plant for details

Groundwater Level – measures the groundwater level at the waste water treatment plants buffer tanks. It is not directly related to the operation of the potable water treatment plant. The potable water ORP and pH values are displayed in yellow text next to the recirculation pumps.





#### 4.2.3 Critical Control Points

The window shown in Figure 2 provides the ability to adjust the critical control points and quality control points of the plant. The CCPs and QCPs ensure that water produced is within the specifications outlined in the Drinking Water Quality Management Plan (DWQMP).

The CCP s must always be set to the values approved in the current version of the Drinking Water Quality Management Plan. CCP s must remain on and active at all times to ensure water is treated to the required specification. Compliance with the specifications set out in the DWQMP is a condition of the WICA operating license, and any changes to the CCP set points must be approved by Innaco s Technical Manager

When servicing the plant, failure of a component may render the plant inoperable with over-riding or changing the CCP. Operators are not authorised under any circumstances to turn off a CCP, or change its set point to get a plant running. Any proposed change, even a short term change, will be reviewed by Aqjacell's Technical Manager. If there is an elevated or unacceptable increase in risk, the Technical Manager will not approve the change. If the risk is acceptable, the Technical Manager will approve the change in writing, outline any temporary control measures which must be substituted, eg, periodic hand held measurements, and how long the change is approved for.



#### Figure 2 - CCP's and QCP's





#### 4.2.4 Active Alarms

Figure 3 shows the active alarms screen for the potable water and chlorine recirculation system. It shows date and time stamped information of exceptions or alarms that are active.



#### Figure 3: Active Alarms Screen

#### 4.2.5 Level Set-point Control

Figure 4 shows the window allows that allows changing of the process variables associated with the level set points. The tank levels are set in millimetres and represent the level of the liquid in the tank to trigger the set point. The operator can set the low and high levels in each tank which are the operational levels of the tanks. The "low-low" and "high-high" are set points are typically alarm levels.

The dead band is a setting used to smooth out small fluctuations that occur around each set point. It is a small measurement around each set point which, for the purposes of plant control, the PLC will not act on. Where changes in level initiate actions, the action will not occur until the current level exceeds the set point by more than the value of the dead band.




#### Figure 4 - Level Set-point Control



#### 4.3 Online Monitoring

The online monitoring system allows Innaco to monitor multiple sites remotely. The system requires an active internet connection to operate. Innaco should be informed of any planned or unplanned interruptions to internet services so that appropriate methods of monitoring can be established.

The PLC controls the plant regardless of whether or not there is an active internet connection. The plant will continue to operate in the absence of a connection, and the CCPS s are still active which ensures that out of specification water is not supplied.

#### 4.4 Potable Water Plant Testing

Testing and balancing will be performed during commissioning of the treatment plant. During this process, the operating conditions and set points are optimised and set points recorded in the commissioning check sheets. These are also the conditions under which the treatment plant is validated to operate. Any changes may require revalidation of the plant.

Upon start-up following any shutdown, if there has been no alteration in the design, the treatment plant should resume operating conditions as outlined in this manual.





#### 4.5 Potable Water Plant Testing

In the event of a power outage, the PLC system resume operation in the same state as when the power was interrupted. As the power supply to the modem and router is sourced from the control panel, any power interruption will also result in a loss of remote monitoring capabilities. Innaco will not be able to control the plant remotely until power is restored.

If the plant is shut down for an extended period due to a power outage or any other interruption to the normal operation of the plant, Innaco will be required to assess the status of equipment and instrumentation and determine what course of action is required to get the plant up and running effectively.

#### 4.6 Sampling and Analysis

Sampling and lab analysis of the chlorinated water must be carried out in accordance with the Recycled Water Quality Management Plan (RWQMP).

Water samples should be collected by an experienced service technician, or by a person from the analysing laboratory. Incorrect sampling can lead to contaminated samples which will give a false indication of the plants performance.

Sample results should be retained as evidence of plant performance. Sampling results must be reported to key stake holders, including regulatory authorities, as outlined in the Infrastructure Operating Plan (IOP).

### **5 MAINTENANCE PROCEDURE**

#### 5.1 General

The recommended maintenance schedule for this system is shown in section 6. A separate parts replacement schedule has been included as indicated in the asset replacement table in Section 3.5.

Please note that any maintenance activity must only be carried out subsequent to the following:

Timing approved by the building owner/operator

- Safe Work Method Statements (SWMS) approved by the building owner/operator
- Scope of work approved by the building owner/operator
- Any specific site inductions have been attended
- MSDS for chemicals are available and have been read by workers.

All maintenance activities must be recorded, with copies of documentation forwarded to the building owner/operator and Innaco.

#### 5.2 Instrument Calibrations

Any instrument calibration procedures are to be as per manufacturers requirements. Refer to manufacturers manuals in Section 9 **Error! Reference source not found.** for specific instrument documentation.





#### 5.3 Health and Safety

Before commencing the task, appropriate Personal Protective Equipment (PPE) must be worn by the operator and others in the vicinity:

Safety goggles in good serviceable condition – without excessive scratching which will impair vision.

Suitable PPE to handle sodium hypochlorite: PVC gloves, long sleeved shirt and trousers, face shield, PVC apron.

Confined space gas meter for air testing prior to entry to tank.

#### 5.4 Reporting

Note the outlet pressure of the recirculation and transfer pumps. Record ORP and pH measurements.

Note in maintenance log the results.

Log site daily hazard assessment form.

Incidents/ accidents form if required.

Motor vehicle log book.

The following checklist should be completed whenever maintenance work is performed on the recycled water treatment plant.





Maintenance Service Checklist		
A0072 Narara Ecovillage (Temporary WTP)		
Date of Service		
Serviced By:		
Comments		
Samples taken (if required)		
Parameter Analysis		
	Hand held meter result	Online SCADA reading*
Chlorinated water pH		
Chlorinated water ORP (mV)		
*Prior to Calibration		
Technical Service		
Inspect chlorinated water (colour, clarity, suspended solids)		
Pumps checked		
Number of 20 L chorine drums loaded in to dosing tank		
Inspect mixing patterns in potable water storage tanks.		
Calibrations and Cleaning		I
Chlorinated water pH		
Chlorinated water ORP		





### **6 TROUBLESHOOTING**

#### 6.1 **Objectives**

This guide indicates some of the situations which may occur over time with the potable water treatment plant. It is intended to assist operation and maintenance personnel with troubleshooting.

#### 6.2 Reporting

Note in maintenance log the fault, the corrective action and any data collected as part of the troubleshooting procedure. Ensure appropriate maintenance records are maintained according to Section 1.5 Emergency Protocols if relevant.

#### 6.3 System Alarm Conditions

ALARM CONDITION Break Water potable water storage tank high alarm.	Potable Water Stansfer pumps faulted.	Check operation of pump. Check pipe lines are not blocked.
	Break tank automated valve faulted.	Check operation of automated valve.
	Level sensors damaged.	Check operation of level sensor. Check breather tube is not crimped and air flow restricted.
High/ low ORP reading.	Fault with dosing pump.	Check dosing pump is operating correctly.
	Injection quill blocked.	Remove injection quill and check for blockages.
	Dosing tank empty.	Check the level of chlorine in the dosing tank.
	ORP probe faulty.	Check calibration of ORP probe.
Motor fault.	Breaker trip.	Check current draw matches nameplate for motor. Repair/replace motor if necessary. Check for obstructions in pump lines.
High/ low pH reading.	pH probe faulty.	Check calibration of pH probe. Check pH reading against hand held meter.
Motor/pump device unavailable.	Motor switched off at panel Power failed and <u>resumed.</u>	Assess reason for motor being switched off – has someone intervened? Is a device not operational? Check generator/power supply for faults.





### 7 DRAWING REGISTER

#### 7.1 Plant Layout

Final as built drawings supplied upon handover of plant.

#### 7.2 Process & Instrumentation Diagram

Final as built drawings supplied upon handover of plant.

#### 7.3 Electrical Drawings

Final as built drawings supplied upon handover of plant.





### 8 MAINTENANCE SCHEDULE

ASSI	ET MAINTENANCE SCHEDUL	Е																											
																													-
	Drain at No. 9 Nome			A	0072																								
	Site Location:		Na	irara	Ecovil	lage		4	-	+	-	-	-				-	-	-	-			-				$\vdash$	-	-
	Done By:		Si	mon	Grimw	/ood		1																-	_				
	Date:			12-[	Dec-14	Ļ																							
	Version:	L			1				_	_	_	_	_	_	_		_	_	_	-	_		_				$\vdash$	_	_
Accet	Management for Service								-	+				-				-		-				-	-	-		-	-
ASSEL	Management for Service								_	-	_	-	_		-		_		_	-	-		_				$\vdash$	_	_
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### 9 MANUFACTURE 'S DATA MANUALS

Hard copies of equipment and instrument manuals are supplied upon handover of the plant.



# NEV Water Operation and Maintenance Manual Reticulation Network

# 1. Document Control

Document Number:	NEV106	Current Version:	2	Document Approver:	Head of NEV Water
Document Owner:	NEV Water	Controlled Document:	No	Date Approved:	22/01/2021

### **History of Revisions**

Version	Revised By	Reviewed By	Date	Nature of Changes
1	G Cameron	T Hester	20/10/2017	First Draft
1.1	G Cameron	T Hester	21/12/2017	Reviewed and updated
1.2	G Cameron	S Errey	2/11/2019	Reviewed and updated post commercial operation
2	G Cameron	S Errey	21/01/2021	Sewer section updated

### 2. Introduction

This Manual serves as a guide to assist Narara Ecovillage Co-operative (NEV) managers, supervisors, contractors and workers in understanding good practice for the operation, maintenance and repair of the potable water, recycled water and sewer reticulation and storage systems at NEV. It covers the key points you need to follow to help reduce risk of exposure of workers, customers and the public to pathogens and other contaminants and to minimise disruption to services.

#### Scope of Manual

This manual describes the operation and maintenance of the potable water, recycled water and sewer reticulation and storage systems which are constructed and operated by NEV. This manual does not cover the operation and maintenance of any Treatment Plants or the Potable Water Supply System. These components are covered in separate O & M manuals.

### 3. Warnings and Precautions

Plant maintenance must only be undertaken by suitably trained and authorized personnel and in accordance with all relevant Occupational Health and Safety regulations.



It is important that care is taken during maintenance to ensure that potable water does not become contaminated, either by inadvertently transferring untreated water into potable water storage vessels or by using equipment (e.g. pumps) for transferring untreated water then treated water, thus risking cross contamination.

The following protocols are to be used to minimise this risk:

- All maintenance operations must be supervised on-site by an authorised representative who is qualified to operate the potable water treatment plant and aware of the risks of contamination during maintenance.
- Where planned maintenance schedules involve work on both the chlorinated water and untreated water systems, perform maintenance on the chlorinated water system first.
- The on-site maintenance supervisor must verify with any contractors that equipment used for repair and maintenance of sewers is not used for repair or maintenance of the potable water system.

In the event of contamination or suspected contamination of the treated water system, the incident must be immediately reported to the Head of NEV Water, as well as recorded in the site logbook, with details of how the incident occurred and what corrective action was taken. NEV will notify any authorities where appropriate.

The licensed water infrastructure may not be used until all applicable requirements of the sites WICA license have been fulfilled.

### 4. Incidents and Emergencies

Incidents or emergencies relating to the reticulation and storage systems may be first identified by a resident, visitor, maintenance contractor or NEV Water staff. The roles and responsibilities of the parties are detailed in the Potable Water and Recycled Water Quality Management Plans for Narara Ecovillage. The Head of NEV Water is to be notified as soon as possible to any such incidents or emergencies.

Where an incident or emergency is identified by NEV Water staff, the situation is to be made safe to the extent it is possible and safe to do so, before immediately contacting Head of NEV Water where a decision can be made on appropriate further action.

Incidents which may require urgent repairs include:

- Line break in a sewage, potable water or recycled water pipe line
- Blocked or broken toilet in community facilities
- Flooding or serious flood damage.
- A failure or breakdown of the potable or recycled water supply
- An appliance fitting or fixture that uses or supplies potable or recycled water and is broken in a way that wastes water.
- A fault or damage that creates an unsafe situation.

NEV Water staff will arrange for the urgent repairs to be undertaken.

For additional information on emergency response procedures refer to separate documents:

- NEV112 Poor Quality Drinking Water Incident Response Procedure
- NEV113 Loss of Drinking Water Supply Incident Response Procedure
- NW Pollution Incident and Emergency Response Management Plan Rev 1

Available from server location: C:\Users\geoff\Nextcloud\NEV Water\IOP



### 5. Hazards

#### a. Biological

The potential for illnesses from contact with viruses, bacteria and other microorganisms in sewage is valid, but limited in possibility. The most serious viral risk is hepatitis and the most serious bacterial risk is tetanus. The main route of exposure is hand-to-mouth contact. Breathing in a suspension of particles (aerosols) is a less common means of exposure but may occur whenever sewage is agitated, such as near incoming wastewater inlets and sludge treatment areas. There are also risks of infection or skin disease via cuts or scratches, or by splashing, eg into the eyes.

#### b. Chemical

Sanitary sewers and similar confined spaces containing sewage can sometimes be deficient in oxygen due to organic oxidation and displacement by carbon dioxide. They can also contain flammable gases such as methane and toxic gases such as carbon monoxide and hydrogen sulphide. Carbon monoxide, carbon dioxide, and other exhaust gases may sometimes be present due to a poorly located gasoline engine or generator exhausting into the confined space.

Gasoline and chemicals can be encountered in sewers from leakage from industrial sites, storage tanks or unlawful chemical dumping. The effects from exposure of these materials range from simple asphyxia to a variety of health problems.

Sewer line workers should be aware of the potential gaseous and chemical hazards associated with sewer lines, and know the procedures for safe sewer entry and applicable rescue measures.

### 6. Worker Education

This section outlines operator, contractor and end user awareness and training requirements.

Records are kept in the NEV Training Register – this lists site inductions, training courses completed and renewal dates including White Cards, Working at Heights and first aid training.

The Environment Health and Safety Officer will ensure all workers are trained in emergency response in the event of an environmental incident.

NEV have developed Safe work method statements (SWMS) for hazardous activities where appropriate.

#### Training and supervision

- Provide supervision ensure that safe work procedures are followed.
- Tell workers, including maintenance workers, what the hazards and risks are.
- Explain the early signs of asthma and dermatitis.
- Explain the dangers of contact with sewage.

Ensure that operators hold (or are undertaking) the TAFE NWP279 (Cert II) qualification (now superseded by NWP20115- Certificate II in Water Industry Operations).

Education about personal hygiene and safe work practices is extremely important to minimize contact with sewage and the prevent illnesses. It is essential information to be provided to the worker and should include the following:

(1) Avoid direct contact with sewage.



(2) Avoid aerosolizing sewage water or minimizing exposure time in areas where this is occurring. Make sure ventilation systems are functioning properly when working around areas where sewage may be aerosolized.

(3) Thoroughly cleanse all exposed injuries with soap and water and keep them covered with a bandage (preferably water-proof) while at work. Seek a physician's advice as soon as possible after suffering cuts or penetrating injuries.

(4) If a worker is suffering from a skin problem; he/she should see a physician before working with sewage.

(5) Avoid touching the face, mouth, hands, eyes or nose with dirty hands or other items and avoiding nail-biting. Use a stiff, soapy nailbrush to clean under the nails.

(6) Thoroughly wash the hands and face with soap and water before eating, drinking or smoking.

(7) Eat/ smoke in designated areas away from sewage contamination. These areas must be kept free from contamination by leaving any protective clothing and boots in a separate area.

(8) Emphasize the requirement and importance of using appropriate protective clothing at work (coveralls) and personal protective equipment (boots, gloves, plastic face shields) and, where required wearing respiratory protective equipment.

(9) Remove personal protective clothing and footwear at the end of the shift and leave it at work.

(10) The importance of daily showering and changing out of work clothes before leaving work.

(11) The need for workers to report damaged equipment.

(12) The need for workers to report potential work-related symptoms to the appropriate supervisor or nurse ( if applicable). These may include:

- cramping stomach pains, diarrhea, vomiting
- yellowing of the skin
- symptoms of breathlessness, chest tightness and wheezing
- redness and pain of the eyes
- skin rash and/or pain

Reporting may aid in the early detection of work-related health effects.

Workers with these symptoms should see a physician. Make sure that the physician is aware of conditions of work and potential exposures.

(13) Workers who accidentally fall into sewage are to shower and cleanse themselves immediately. The incident is to be recorded in the employer's first aid records. If complete immersion occurs, the worker is to be seen by a physician.

Pre-planning, careful attention to personal hygiene and proper use of personal protective equipment (PPE) can greatly reduce the associated risks of exposure to sewage.

Training includes toolbox talks on:

- how to use the right safe working procedures;
- checking for damage;
- how to use RPE and check that it is working;
- personal hygiene;
- how to decontaminate effectively; and
- what to do if something goes wrong.



### 7. NEV Responsibilities Including Implementation of Control Measures

(1) NEV must have first aid supplies and trained first aid personnel as required in the Occupational Health and Safety legislation.

(2) Since micro-organisms are a natural part of sewage, the hazard cannot be eliminated. A sitespecific assessment of the risk of worker's exposure to the hazards of sewage must be completed before work begins at a work site or prior to the construction of a new worksite.

(3) Appropriate controls are needed to minimize the risk of exposure including:

- · engineering controls such as ventilation
- · appropriate work practices and administrative controls
- ensuring that workers and management understand risks through education on hazards, the importance of following safe work practices and the importance of hygiene measures

(4) Ensure workers use appropriate PPE such as liquid-repellent coveralls and gloves, boots, goggles, respirators, and splash-proof eye/face shields. If respirators are needed, a comprehensive program must include respirator fit testing and a respirator code of practice.

(5) Establish a proper system for purchase, inspection and maintenance of PPE.

(6) Ensure areas for storage of clean and contaminated equipment and personal effects are segregated and separate from eating facilities, and have facilities readily available for decontamination of workers.

### 8. Immunization

The following immunizations are recommended:

#### Tetanus-Diphtheria (Td)

All adults should be up to date on their Td immunization. Ensure that the primary immunization of three doses has been completed. Booster doses should be administered once every 10 years.

#### Hepatitis A

There is no evidence that workers exposed to sewage in Australia have an increased incidence of Hepatitis A and the evidence cited from Europe has not been confirmed by others. Hepatitis A vaccine is therefore NOT routinely recommended for workers exposed to sewage however, this is a safe and effective vaccine and there is no contraindication to its administration to anyone wishing to receive it.

### 9. Entry to work in or on a confined space

NEV do not currently have workers qualified to work in or on a confined space and all such work will be undertaken by suitably qualified contractors. Under no circumstances must entry be made to any tank or vessel without prior reference to and full compliance with Work Health and Safety Regulations 2017.

The Water Infrastructure Network Manager must ensure the following controls are implemented where relevant, if risks can't be eliminated.

Controls must be documented in a risk control procedure (unless otherwise stated) with controls relevant to a specific entry on an entry permit.

For traversing, a traverse plan must be prepared and signed off by the responsible manager for the traverse.



The responsible person for entry must not permit entry until relevant controls are confirmed to be implemented.

#### a. Openings used for access

Openings used for access must remain open with standby persons present until the responsible person for entry confirms that all people have either exited from the same point or have arrived at another safe exit.

Openings must be closed and secured when work is finished.

Ensure there are no obstructions around openings when people are entering or exiting.

#### Access via fixed stairways, step ladders, rung ladders and step irons

For vertical access, consult with responsible managers of assets to arrange installation of one of the following if not already installed, in order of preference:

1. Stairways with hand rails. If this is not possible, such as: due to a lack of space or the presence of other hazards, then:

- 2. Step ladders with handrails. If this is not possible, then:
- 3. Rung ladders. If this is not possible, then:
- 4. Step iron ladders.

Responsible managers of assets must document why higher preferences are not reasonably practicable, if a lower preference of access is chosen.

Load force, lengths, staggering of landings, direction changes, angles and other dimensions must comply with AS 1657 Fixed platforms, walkways, stairways and ladders.

#### - Design, construction and installation.

The responsible person for entry must obtain an engineers report before entry if the structural integrity of access is doubtful, or use another safe access.

#### Rope access

A tripod or davit with a working rope, harness and lanyard, and a secondary safety line, must be used to assist vertical access into openings, such as maintenance holes and hatches, where:

- there is no other form of fixed access (e.g. rung ladder)
- and it is too deep to climb in and out unassisted.

A fall arrest device can be used as the secondary safety line.

A winch should be used to minimise manual handling risks.

Tripods and mobile davits must be used in a way that prevents them falling over.

The system must comply with AS/NZS 4488 Industrial rope access systems. Part 2: Selection, use and maintenance.

#### Lighting for access and work

The confined space must be sufficiently lit to allow safe access and work.

Lighting must be intrinsically safe unless air quality testing can confirm flammable gases are below 5% of their LEL, before lights are switched on.

#### Access from roads

Access should be made off roads where possible, to reduce traffic hazards.



If this is not possible, an approved traffic management plan must be implemented if entry or ventilation is on or near a road where it could disrupt traffic or cause a risk to any person. Follow HS-051 Safe Working on Roads to do this.

### b. Isolation or control of potentially hazardous services

#### Hydraulic isolation

Isolate water that may cause a risk to people inside the confined space.

Entry into a confined space hydraulic asset is not permitted until the Water Infrastructure Network Manager has confirmed isolation.

The responsible person for recommissioning must not commence recommissioning until the responsible person for entry cancels the entry permit.

#### Flow management

If hydraulic isolation is not possible, a flow management plan must be implemented.

Entry is not permitted until the relevant area manager or team leader approves the plan.

#### Mechanical or electrical plant and equipment

Isolate any electrical or mechanical plant and equipment that may create a risk to persons inside. Examples include: pumps, mixers, switch rooms and carbon dioxide fire suppression systems.

Entry is not permitted until the Water Infrastructure Network Manager has confirmed it is locked and tagged out.

The responsible person for recommissioning must not commence recommissioning until the responsible person for entry cancels the entry permit.

Chemical dosing units that dose into equipment to be accessed must be isolated, if work is to be done in or near the chamber.

#### Trade waste discharge

Before commencing any sewer work, contact the Infrastructure Network Manager to determine if there are any trade waste sources upstream of the affected area and if there are any known 'significant skin contact' or 'significant air quality' hazards.

If entry is unavoidable and trade waste discharge is required to be isolated before entry, arrange this with the trade waste officer. Alternatively, avoid entry when discharge is occurring, if directed by the trade waste officer or the site hazard information.

#### Cleaning

Chemical storage tanks must be cleaned before entry by a method recommended by the tank manufacturer.

Access chambers or SPS wet wells identified by the Infrastructure Network Manager as having a discharge hazard or chemical dosing point, may need to be washed down before entry.

Grease traps must be pumped out before entry.

Treatment process vessels, such as: digesters and grease traps must be cleaned if it improves hygiene and ease of movement.

#### **Mechanical ventilation**

Control air quality hazards by forced ventilation in confined work spaces.



Mechanical extraction must be used if there is no forced ventilation and the work could generate or release fumes, smoke or vapours, such as: welding, painting or cleaning.

Ensure flammable gases are below 5% of their lower explosive limit (LEL) to do this.

#### Hot work

Hot work in or on a confined space must be done according to an approved hot work permit.

Hot work in or on a confined space that is a zone 0 flammable gas hazard (FGH) area is not permitted.

Maintain a tidy work area and remove combustible materials if doing hot work.

#### Hazardous plant or processes

The following specific hazards a not permitted in a confined space:

• Ignition sources inside or within 3 m of an opening, until flammable gas has been proved safe by air quality testing. This includes any powered plant, as well as: flames, hand tools, power tools, and non-intrinsically safe: lights, radios and phones.

• Liquid oxygen or hydrogen peroxide dosing of a sewer when people are inside. This is to help control the risk of explosion from an oxygen rich atmosphere.

• Gas cylinders (except those used for self-contained breathing apparatus).

Ensure that nearby vehicles or plant, such as: a generator used to power ventilation fans, is positioned so that exhaust or vapours can't enter the confined space.

#### Hazardous atmosphere warning signs

A warning sign must be displayed if air quality hazards are not within the safe limits.

#### **Breathing apparatus**

Breathing apparatus (BA) must be used if entry can't be avoided and non-flammable air

quality hazards can't be controlled to within the safe limits.

Apparatus must comply with AS/NZS 1715 Selection, use and maintenance of respiratory protective equipment.

No person is allowed inside if flammable gases or ionising radiation exceed their safe levels, even if wearing BA.

#### Danger signs at entrance

The responsible person for entry must ensure that the sign 'Danger - Confined Space - Entry by Permit Only' is erected in an obvious position close to each entrance to the confined space, while people are working in and preparing to work in the confined space.

#### Barriers to prevent unauthorised entry

- Erect barriers and notices.
- Warn everyone before isolating the waste water system, and notify them when the work is complete.

Barriers to prevent unauthorised or accidental entry must be placed over or around open vertical access points, such as maintenance holes and hatches, and around open horizontal access points, while work is underway.

They must be designed and positioned so they don't restrict ventilation.

Pay attention to the type of barrier used where falls to children or animals are a risk.



The entrance to the space or leading to the space must be closed and secured when work is finished to prevent unauthorised or accidental entry.

Where practicable, the sides of open concrete stormwater drains must be fenced to restrict access to the enclosed parts.

#### Fall arrest system

A fall arrest system must be used, if protective barriers are not reasonably practicable and there is a risk of falling into an opening with a depth of 2 m or more. The type and its limit of use must be suitable to the task, for instance: working near an open hatch may require a type 2 device with a limited free fall, such as an inertia reel.

The loading of an anchorage must not be exceeded. An engineer must be able to confirm that fixed anchorages and the structure it is fixed to, meet the required strength in the direction of loading for the number of people it is intended for, to a maximum of two.

The manufacturer must be able to confirm this for of tripods and davits.

An anchorage sling may be used to form an anchorage around a solid permanent structure, as long as it is clear to a competent person that it will meet the required strength for the number of people it is intended for, and complies with AS 1891.4

A standby person can anchor to the same tripod as the person on the rope access system, if it meets the required strength for two people.

Fall arrest system components must comply with AS 1891.4 Industrial fall-arrest systems and devices. Part 4: Selection, use and maintenance.

#### Personal protective equipment

The task and conditions inside the confined space will determine what PPE is required, such as: hard hats, hearing protection, eye protection, masks or respirators, gloves, waders and wet suits.

### 10. Cleaning and housekeeping

#### Storage

Segregate clean and contaminated equipment.

#### Equipment and procedures

- Provide dedicated tools/equipment.
- Provide buckets with disinfectant and long-handled brushes for personal decontamination at the exit point.
- Ensure a good standard of general ventilation.

#### Other protective equipment

- Provide eye protection a full-face visor.
- Provide disposable coveralls with a hood.
- Provide wellingtons or waterproof disposable overshoes.
- Provide waterproof, abrasion-resistant gloves, eg nitrile.
- Ensure that all cuts and abrasions are covered.

#### Decontamination

• Assume that everything that might be contacted by sewage is contaminated.



- Clean and disinfect the area after the task.
- Use the 'buddy' system to decontaminate PPE and work clothing minimise the spread of contamination.
- Change out of work clothing before exiting the area.
- Provide bags labelled 'Clinical waste Biohazard' for all contaminated PPE.
- Disinfect or sterilise reusable work equipment.

Caution: If soiled, bag up work clothes for laundry as a separate load.

#### Personal decontamination and skin care

- Wash before eating or drinking, and after touching any surface or object that might be contaminated.
- Provide warm water, mild skin cleansers, nailbrushes, and soft paper, fabric towels or hot air for drying. Avoid abrasive cleansers.
- Replace nailbrushes regularly.
- Instruct workers in how to clean their skin effectively.
- Provide pre-work skin creams, which will make it easier to wash dirt from the skin, and afterwork creams to replace skin oils.

Caution: 'Barrier creams' or 'liquid gloves' do not provide a full barrier.

#### Health surveillance

- Conduct low-level health surveillance for asthma using a respiratory questionnaire administered by a suitably trained responsible person.
- Conduct low-level health surveillance for dermatitis involving skin checks by suitably trained responsible person.
- Keep good records of gastric upsets monitor that personal hygiene is adequate.

### **11. Preventative Maintenance Programs**

A routine maintenance program should be put into place to ensure ongoing safe and trouble free operation of the potable water, recycled water and sewer reticulation and storage systems and delivery of performance standards.

Security checks, APZ and maintenance inspections for reservoirs, WWTP, header tanks, irrigation field and associated infrastructure are detailed in separate document: Reticulation Network Inspection Program. This document is available at server location:

Dropbox (NEV)\NEV Businesses\NEV Water\IOP\Reticulation Network

#### Water Meters

Given that the co-operative members are both owners of the water provider and its customers, any under-measurement of consumption as meters age would apply equally to all members and would not cause any practical issues for the customers or the provider.

A program for replacement of customer water meters to be commenced after 15 years service and completed within a further two years.



#### **Dual Check Valves**

A sample of dual check valves at customer meters to be tested after 10 years service to ensure reliable operation.

All service activities undertaken on the reticulation and storage systems should be recorded and the records maintained for future reference.

### **12. Services Plans and Drawings**

NEV shall maintain a set of comprehensive Services Plans and Drawings showing the location of the potable water, recycled water and sewer reticulation and storage systems. These plans are to be updated whenever alterations are made to the systems.

### 13. Maintenance, Monitoring and Reporting of Standards of Service

#### Performance Criteria and Level of Service

The Performance Criteria and Level of Service NEV Water are contracted to deliver to its customers for potable and recycled water and sewage services are detailed in the NEV Water Customer Contract.

### 14. Resilience and Reliability

The Asset Management Plan and Risk Assessment is detailed in separate document "A0072-Infrastructure Operating Plan" and reviews which items need routine scheduled maintenance but can otherwise be run to fail and which need more proactive maintenance. The approach involves a risk based criticality assessment and considers maximum and residual risk and takes into account customer impacts and redundancy.

It included both technical and non-technical issues.

It is noted that many assets have duty and standby components whilst others could fail but would only trigger a potable water supply backup and/or divert to sewer. The assessment considered possible extended periods of downtime related to factors such as sources of parts, personnel, equipment, etc.

Name	Department/Position	Email	Phone No
Geoff Cameron	Head NEV Water	geoffcameron@ozemail.com.au	0401 319 051
Jon Ellis	NEV Water Retail Manager	jon.ellis2009@gmail.com	0438 645 367
Joy Mozzi	Site Administration Officer	joy.mozzi@nararaecovillage.com	0428 582 258
Steve Errey	Water Infrastructure Network Manager	steve1.4142@internode.on.net	0439 665 838

### 15. Contact Details



For further contact information refer to separate document: "Roles, Responsibilities and Contact Details" which is available at server location:

Dropbox (NEV)\NEV Businesses\NEV Water\Roles and Responsibilities



# **Reticulation Network Inspection Program**

# **History of Revisions**

Version	Revised By	Date	Nature of Changes
1.0	G Cameron	14/11/2017	First Draft
1.1	G Cameron	21/12/2017	Reviewed and updated
1.2	G Cameron	19/10/2018	Reviewed, reservoir roof sealing inspection added
2.0	G Cameron	28/01/2021	Revised sewer inspection section

### Contents

1.	Reservoir Inspection	. 2
2.	Sewer Inspection	. 2
3.	Potable and Non-Potable Reticulation Network	. 3
4.	Cross-connection Check	. 3
5.	Sewer Network	.4
6.	Stormwater System	.4
7.	Log sheets for recording maintenance performed	.4



Performance of the Reticulation Network Inspection Program detailed below is the responsibility of the Water Infrastructure Manager.

Any defects or non-compliance identified during the Reticulation Network inspection must be listed in the Reticulation Network Day Book and rectification works identified and completed.

### **1. Reservoir Inspection**

Description:	Regular inspection of treated water reservoirs for any signs of damage, corrosion, forced entry, or animals.
To be carried out by:	Water Infrastructure Manager
Frequency:	Weekly

- Visual inspection of header tanks and surrounding area leaks (staining, damp patches, puddles), corrosion, damage, leaf-litter build up
- Check reservoir roof edge and penetration sealing for damage, corrosion or wear
- Check for unusual odours, noises or vibrations from equipment
- Fences, gates and shed doors secure and locked
- Air vent with insect screen?
- Drain pipe with insect screen or flap?
- Hatches properly sealed and locked
- Check and record water levels in header tanks.
- Depth of sediment in header tanks
- Chemical volumes on hand bulk tanks and containers
- Chemical tank bunds are clear of litter build-up
- APZ management grass, shrubs, leaf litter, fallen branches

### 2. Sewer Inspection

Description:	Regular inspection of sewer buffer tanks for any signs of damage, corrosion, overflow or odour.
To be carried out by:	Water Infrastructure Manager
Frequency:	Weekly



- Visual inspection of sewer buffer tanks and surrounding area leaks (staining, damp patches, puddles), corrosion, damage, leaf-litter build up
- Check for unusual odours, noises or vibrations from equipment
- Fences, gates and shed doors secure and locked
- Hatches properly sealed
- APZ management grass, shrubs, leaf litter, fallen branches

### 3. Potable and Non-Potable Reticulation Network

#### **Fire Hydrants**

Description:	Regular inspection of fire hydrants for any signs of damage, corrosion, leakage or obstruction of access
To be carried out by:	Water Infrastructure Manager
Frequency:	Weekly

#### **Customer meters**

Description:	Regular inspection of customer meters for any signs of damage, leakage or obstruction of access
To be carried out by:	Water Infrastructure Manager
Frequency:	Monthly

Description:	Test a sample of dual check valves at customer meters after 10 years service
To be carried out by:	Water Infrastructure Manager
Frequency:	After 10 years service – approximately 2028

### 4. Cross-connection Check

Description:	Test customer premises for potable water / recycled water cross connection
To be carried out by:	Water Infrastructure Manager



Frequency:

During building construction and subsequently to be offered as a free re-test every 5 years

During building construction there are three cross-connection inspections, however some may be combined in the one visit:

• R1: From meter to dwelling. This inspection takes place when the recycled water and drinking water meter assemblies and the pipes to the house have been installed and before the slab is poured.

• R2: Rough in. This inspection takes place during construction, before the plasterboard goes on. This is to check that the recycled water pipes are only connected to the approved points.

• R3: Commissioning and fit off. The plumber must be on site for this inspection only. This inspection ensures that the drinking water and recycled water services have been correctly installed and there are no cross connections.

### 5. Sewer Network

Description:	Regular inspection of sewer maintenance pit covers for any signs of damage, leakage or obstruction of access
To be carried out by:	Water Infrastructure Manager
Frequency:	Monthly

### 6. Stormwater System

Description:	Regular inspection of stormwater swales, pit covers, bulkheads and detention basins for any signs of obstruction, damage, leakage or overland flow
To be carried out by:	Water Infrastructure Manager
Frequency:	Monthly

## **7.** Log sheets for recording maintenance performed

Check for recent entries in the Reticulation Network and Header Tanks Day Book – the day book should be used to:



- create a daily record of significant incidents, events or actions
- provide a means of communication between operators
- record details of non-compliances or other problems
- Record locking out and tagging out events
- record staff arrival and departure for health and safety reasons, particularly where they work alone



#### Appendix A Plan of NEV Water Infrastructure





### Narara Ecovillage Water and Sewer Scheme Role Assignments

### 1. Context

Narara Ecovillage Co-operative Ltd (NEV) as the network and retail license holder under Water Industry Competition Act (WICA) will be responsible for all aspects of the operation of the scheme and any conditions attached to the license.

To assist with the design, construction, monitoring and maintenance of the scheme NEV will subcontract specific duties to its experienced third party sub-contractor Innaco Pty Ltd.

Document Name:	Narara Ecovillage Water and Sewer Scheme Role Assignments	Revision Number & Date:	2 – 01/04/2021	Narara Ecovillage Co-operative Ltd
Date of Issue:	01/04/2021	Controlled Document:	No	Page 1 of 4

# 2. Role Assignments

Role/Responsibility				NEV	Innaco	
Potable and	WICA License Holde	er - Network			Х	
Recycled Water Scheme	WICA License Holde	er - Retail			Х	
	Cross connection au	udit ( at installation)			Х	
	Cross connection au	udit (ongoing)			Х	
	Repair and Maintena system	ance of potable water di	stribution		х	
	On site testing and r	monitoring			Х	Х
	Completing daily site	e log			Х	
Potable and	Maintenance – Daily	1			Х	
Recycled Water	Maintenance – Wee	kly			Х	
System	Maintenance - Mont	hly				Х
	Maintenance – Qua	arterly				Х
	Asset Management	Plan			Х	
	Instrument Calibration	ons				Х
	Training				Х	
	Water sampling and	forwarding as per DWQ	MP		Х	
	Management of water quality testing				Х	
Potable and Recycled Water Reticulation System	Review of sampling results and identification of appropriate actions				х	
	Water Managemen	t Plans			Х	
Infrastructure	Network Management Plans				Х	
<b>Operating Plan</b>	Environmental Mana	agement Plan			Х	
	Retail Management Plan				Х	
	Development of prot responsibilities and	tocols, response actions communications	,		Х	
	Identification of non-compliances and incidents		nts		Х	Х
	Statutory reporting of	of non-compliances and	incidents		Х	
Incidents and	Emergency repairs t	to dosing plant			Х	
Emergencies	Emergency repairs t	to network			Х	
	Coordinating emergeneessary	ency potable water tank	er when		х	
	Monthly reporting of treatment plant performance to owner					х
Administrative	Billing of retail Householders and Tenants				Х	
Document Name:	Narara Ecovillage Water and Sewer Scheme Role Assignments			Narara Ecov Co-operative	illage ∋ Ltd	
Date of Issue:	01/04/2021	Controlled Document:	No		Page 2 of 4	

Role/Responsibility		NEV	Innaco
	Annual reporting as per WICA license requirements	Х	
	Audits as required for WICA license	Х	

Document Name:	Narara Ecovillage Water and Sewer Scheme Role Assignments	Revision Number & Date:	2 – 01/04/2021	Narara Ecovillage Co-operative Ltd
Date of Issue:	01/04/2021	Controlled Document:	No	Page 3 of 4

Role/ Assignme	NEV	Innaco	
Sewer	WICA License Holder - Network	Х	
Scheme	WICA License Holder - Retail	Х	
	Design – scope and specification	Х	
	Preparation of tender specification	Х	
	Coordination of tendering process	Х	
Sewer	Construction	Х	
Network	Construction Supervision	Х	
	Plumbing in accordance with AS/NZS 3500:2003	Х	
	Testing and Commissioning	Х	
	Repair and Maintenance of sewerage network	Х	
	Preparation and approval	Х	
Infrastructure	Statutory reporting	Х	
Plan	System audit	Х	
	Review		Х
	Development of protocols, response actions, responsibilities and communications	х	
	Identification of non-compliances and incidents	Х	Х
Incidents and Emergencies	Statutory reporting of non-compliances and incidents	х	
	Emergency repairs to sewer network	Х	
	Coordinating incident and emergency response	Х	
	Monthly reporting of system performance to owner		Х
Administrative	Billing of retail customers	Х	
	Annual reporting as per WICA license requirements	Х	
	Audits as required for WICA license	Х	

Document Name:	Narara Ecovillage Water and Sewer Scheme Role Assignments	Revision Number & Date:	2 – 01/04/2021	Narara Ecovillage Co-operative Ltd
Date of Issue:	01/04/2021	Controlled Document:	No	Page 4 of 4



# **Requirements for Engaging Contractors and Consultants**

### Context

Narara Ecovillage Co-operative Limited (NEV) is creating a socially, environmentally and economically sustainable community (the Project).

As a co-operative owned and managed by its members, NEV relies on the wide and varied skills and experience of volunteers. NEV, being responsible for the funding, design, construction, commissioning, operation and maintenance of roads, buildings, communications, water and electricity infrastructure and distribution networks, will need to procure services from external providers for certain specialised skills and capabilities.

### Purpose

The aim of this policy is to outline the process and conditions NEV will use to procure external services.

### Definitions

High risk: Taking into account financial, reputational, HS&E and delay factors, a risk that is possible and has at least moderate impact on NEV or a risk that is unlikely but has at least major impact on NEV.

Substantial value: A contract that exceeds \$100k, or term is greater than 2 years or is critical to the Project.

### Policy

- Planning and Budget: Before contractors or consultants are appointed, a brief with budget needs to be prepared and approval received from the relevant team and manager holding appropriate delegations, or absent this, Board approval.
- Procurement: In general, NEV members will be given first opportunity to provide services, usually by way of an internally advertised 'Expression of Interest' or EOI. Where necessary, external providers can be contacted and generally a minimum of 2 quotations should be sought. Decisions on accepting a contractor or consultant will be made by the relevant team, taking into account price, local content, sustainability, health and safety record and fit with NEV culture.
- Contracts: NEV has standard requirements for its contracts, which cover background checks and a number of terms and conditions, including liability, insurance, intellectual property, reporting, access to site, assignment, confidentiality and hazardous materials. Any contracts of substantial value or high risk should use standard proformas or have legal review prior to execution by NEV.
- Risks: Particularly for contractors that work on NEV site, a risk assessment needs to be undertaken and all high risks managed or avoided prior to commencement of the work.
- NEV Policies: Contractors and consultants must be obliged to follow relevant NEV polices.

### **Procedures**

NEV Annual Budgeting Process

**NEV Site Induction** 

Document Name:	Requirements for Engaging Contractors and Consultants	Revision Number & Date:	1 – 01/12/2015	Narara Ecovillage Co-operative Ltd
Date of Issue:	01/12/2015	Controlled Document:	Yes	Page 1 of 2

### Notes

This policy should be reviewed at least every two years.

### References

NEV Environment, Health and Safety Policy

NEV Standard Contractor Agreement

NEV Standard Consultant Agreement

NEV Delegation of Authority

Document Number:	Requirements for Engaging Contractors and Consultants	Revision Number & Date:	1 – 01/12/2015	Narara Ecovillage Co-operative Ltd
Date of Issue:	01/12/2015	Controlled Document:	Yes	Page <b>2 of 2</b>



# **NEV Water Management Review Procedure**

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### 1. Context

Narara Ecovillage Co-operative Ltd (NEV) as the network and retail license holder under Water Industry Competition Act (WICA) will be responsible for the construction, operation and maintenance of all potable and non-potable water infrastructure from source to customer connection within the Narara Ecovillage site.

### 2. Purpose

This document sets out NEV's approach for scheduled periodic review and evaluation of system performance and operating procedures in supplying its potable and non-potable water products. This process is underpinned by the relevant frameworks within contemporary Australian water cycle guidance, including (but not limited to):

- The Framework for Management of Drinking Water Quality (Australian Drinking Water Guidelines 2011)
- The Framework for Management of Recycled Water Quality and Use (Australian Guidelines for Water Recycling 2006)
- Drinking Water Source Assessment and Treatment Requirements (WSA 2002 –September 2015-1.2)

### 3. Water Quality Monitoring

The SCADA continuously monitors system performance and compliance with CCPs and set points and generates alert messages when a non-compliance is detected.

Weekly and monthly sampling and testing of potable and recycled water is also carried out as documented in Monitoring and Recording Procedure Water Quality.

Samples are sent for verification testing at an external laboratory as required.

Document Number:	NEV118	Revision Number & Date:	1 – 7/3/2019	Narara Ecovillage Co-operative Ltd
Date of Issue:	7/3/2019	Controlled Document:	Yes	Page <b>1 of 2</b>

### 4. NEV Water Meetings

Every two weeks NEV Water holds a department meeting attended by all department staff and the NEV CEO at which the most recent water testing and SCADA results and actions taken to maintain compliance are reviewed and further actions determined. The list of items reviewed includes:

- SCADA readings and trends
- Water quality test results and trends
- Customer complaints and action taken
- Whether any notifiable events have occurred and what actions were taken
- Any changes to procedures which should be implemented in light of the above items
- Any other events or changes to infrastructure, contractors, customers or the site which may impact on water quality

### 5. Monthly Reports

On or before the 25th day of each month Aquacell submits a monthly report to NEV Water containing a summary of the system performance and actions taken over the preceding month together with a summary of any other significant matters relating to the system or its operation.

### 6. Aquacell Review Meetings

Narara Ecovillage Cooperative and Aquacell meet on or before the 10th day of the month following receipt of the Monthly Report to discuss and resolve the issues identified in the Monthly Report and any other issues either party has requested to be addressed in a Monthly Meeting.

### 7. Preventative Maintenance Program

A detailed preventative maintenance program to be performed by the NEV and Aquacell is detailed in the Operation and Maintenance Manuals for the Temporary Potable Water System, The WWTP and the Reticulation Network.

Aquacell shall notify NEV Water immediately of a material departure from the approved Preventative Maintenance Program which shall include reasons for the material departure and details of any changes to the Preventative Maintenance Program necessary to remedy or account for the material departure.

Review of the most recent preventative maintenance tasks and compliance is a standing item at the NEV Water Meetings.

### 8. Independent Reports

In the event that, in the reasonable opinion of IPART or Narara Ecovillage Cooperative Aquacell repeatedly fails to meet or achieve one or more of the contracted service levels, Narara Ecovillage Cooperative may request a report from an independent consultant agreed by the Parties in respect of that aspect of the Services at the site. Aquacell shall cooperate with any reasonable request by Narara Ecovillage Cooperative's independent consultant to assist with the provision of such report.

### 9. Annual Reviews

At least once per year NEV Management and staff will review the water quality results, customer feedback, operating plans and procedures, NEV policies and contractor arrangements to identify any changes and improvements which should be made to those policies, plans, procedures or arrangements.

Document Number:	NEV049	Revision Number & Date:	1 – 7/9/2017	Narara Ecovillage Co-operative Ltd
Date of Issue:	7/9/2017	Controlled Document:	Yes	Page <b>2 of 2</b>





Whytes Gully Leachate Treatment System Operations and Maintenance Services

Work Health Safety and Environment Management Plan

April 2020


PROJECT	Whytes Gully Leachate Treatment System Operations and Maintenance Services
ORGANISATION NAME	INNACO PTY LTD
ADDRESS	Suite 2.01, 828 Pacific Highway, Gordon, NSW 2072
PHONE	(02) 9417 7728
FAX	(02) 9417 8337
EMAIL	info@innaco.com.au
ACN/ABN	33 119 715 052



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Appendix A – SWMS

Appendix B – OPERATION RULES & INDUCTION WG LTP



### **1.0 Document Control**

#### INNACO PTY LTD

- Maintains an up to date version of this WHSE Management Plan.
- Retains all obsolete pages of the Plan for a <u>minimum</u> of 7 years to demonstrate a record of WHSE management practices.
- Provides a copy of the current version of the Plan to Wollongong City Council
- Reviews the Plan on a Quarterly basis
- Ensures all amendments to the Plan are recorded in the Register of Amendments

	Register of Amendments				
Data	Version	Description of	Prepared	Reviewed	Approved
Date	No.	Amendments	by	by	by
23/09/19	Rev 001	For tender	OS	OS	LH
14/04/20	Rev 002	For tender	OS	OS	LH





Distribution Register				
Version No.	Date of Issue	Name of Recipient	Position / Organisation	
Rev 001	23/09/2019	Luke Mckenzie	Wollongong City Council	
Rev 002	14/04/2020	Chris Brown	Wollongong City Council	

# 2.0 Project Details and Introduction

Organisation Details			
Business/Trading name	INNACO PTY LTD		
ACN/ABN	33 119 715 052		
Contract Job	16746 - Whytes Gully Leachate Treatment System		
Number	Operations and Maintenance Services		
Director/Manager	Rodney Boss		
Address	Suite 2.01, 828 Pacific Highway, Gordon NSW 2072		
Phone	(02) 9417 7728		
Fax	(02) 9417 8337		
Email	rboss@innaco.com.au		

The following table sets out a brief description of the work to be carried-out by INNACO.

Date	Outline of Works	No of Employees Allocated To Project
23/09/2019	Operations and Maintenance Services of the Leachate Treatment System (LTS) at the Wollongong Waste and Resource Recovery Park (Whytes Gully) Kembla Grange. The system is comprised of leachate ponds, a leachate transfer system (including infrastructure and associated instrumentation), biological Leachate Treatment Plant (LTP) using a Sequencing Batch Reactor (SBR) process, and associated mechanical and electrical equipment. INNACO has the role of operating and maintaining the LTS under the specification.	5 (INNACO employees)

The table below identifies the designated person on site responsible for the management of work health safety and environment.



### Work Health Safety and Environment Management Plan (draft for tender)

Name	Contact Details
Omid Sayar	0435158919

The first aid officer on site is nominated in the table below.

Name	Contact Details
Hamid Mehrazmay	0410698286



# 3.0 Work Health, Safety and Environment Policy

At INNACO, a commitment to occupational health, safety and the environment is part of the business.

This is achieved through:

- Complying with statutory requirements, codes, standards and guidelines;
- Setting up objectives and targets with the aim of eliminating work related incidents in relation to our activities, products and services; and
- Defining roles and responsibilities for occupational health, safety and environment.

#### Strategies will include:

- Ensuring occupational health, safety and environment management principles are included in all organisational planning activities;
- Providing ongoing education and training to all of our employees;
- Consulting with employees and other parties to improve decision-making on occupational health, safety and environment matters;
- Ensuring incidents are investigated and lessons are learnt within the organisation;
- Distributing occupational health, safety and environment information, including this policy, to all employees and interested parties;
- Providing enough resources to ensure occupational health, safety and environment is a central part of the organisation; and
- Ensuring effective injury management and rehabilitation is provided to all employees.

Len

Date 14/04/20

Director / Manager



# 4.0 Hazard Identification, Risk Assessment and Control

INNACO will not commence operation and maintenance unless:

- INNACO has undertaken an assessment of the risks associated with the work activities and has prepared a written Safe Work Method Statement (SWMS) and Risk Assessment; and
- INNACO has provided induction training to all employees and sub-contractors.

INNACO maintains and updates the SWMS, and provides the updated SWMS for every subcontractor.

INNACO identifies the potential hazards of the proposed operations and maintenance activities, assess the risks involved and develops controls measures to eliminate, or minimise, the risks. The risk management process is carried-out in consultation with employees and sub-contractors.

#### **IDENTIFY HAZARDS:**

INNACO breakdowns specific operations and maintennce activities into job steps to assist in identifying all potential hazards. These work activities are detailed in a SWMS and JSEA. The SWMS is a list of job steps and other work related practices.

For each of the work activities and associated job steps identified in the SWMS, INNACO has identified potential hazards and their risks.

To assist in identifying hazards and risks, INNACO has considered the use of resources such as codes and standards, industry publications (i.e. safety alerts; hazard profiles for specific trade groups), workplace experience and consultation (i.e. Toolbox Talks).

#### **ASSESS RISKS:**

Rev 002



INNACO has identified a risk class/ranking for potential workplace hazards by referring to the categories ranging from high to low in a Risk Matrix.

The Risk Matrix is used to determine the level of danger or seriousness (i.e. the consequence) of the risk, how likely it is that this risk will occur (i.e. likelihood/probability) and therefore how detailed control measures will need to be to eliminate or minimise the risk.



### 5.0 Scope of Work

INNACO PTY LTD (INNACO) has been engaged to provide Operations and Maintenance Services of the Leachate Treatment System (LTS) at the Wollongong Waste and Resource Recovery Park (Whytes Gully) Kembla Grange. The system is comprised of leachate ponds, a leachate transfer system (including infrastructure and associated instrumentation), biological Leachate Treatment Plant (LTP) using a Sequencing Batch Reactor (SBR) process, and associated mechanical and electrical equipment.

The contract duration is eighteen (18) months and three (3) possible extensions of six (6) months duration each, exercisable at Council's sole discretion.

INNACO will undertake the following Operation and Maintenace Services consistent with the contract documentation.

#### **Sevices Overview**

- 1. Conduct all required LTS operations, including associated sludge management activities;
- 2. Conduct all inspection, routine maintenance and services planning, scheduling and management services for the LTP;
- 3. Develop relavant operational policies, plans and procedures, staff briefing and trainaing;
- 4. Maintain suitable records of all services related communications and meetings, including stakeholder agency meetings;
- 5. Report to Wollongong City Council stakeholders on the delivery of services;
- 6. Provide techncal and advisory consulting services as requeested by Wollong City Council;
- 7. Management of operational interface issues between landfill cell leachate collection systems and the services;
- 8. Provision of informaton to Wollongong City Council realted to current asset documentation and operating technical information;
- 9. Include relevant procedures for the LTS processes into a suitable Operational Management Plan (OMP);
- 10. Update the Process and Insrucmtation Diagram (P&ID) to reflect the existing LTS and revise and reissue throughout the Contract term after any significant system modifications;
- 11. Other relevant unforseen services that are reasonably associated with the general scope of services, as project variations, subject to specific prior approval from Wollongong City Council;
- 12. Monitor the issue of any new Industrial Trade Wastewater guidelines by Sydney Water and ensure that all services documentation complies with current requirements; and



13. Provide time-based design briefings and handover training to the future Contractor as requested by Wollongong City Council.

#### **Contract Commitment**

- Manage the biological treatment process and associated leachate treatment in both the leachate ponds and the LTP to achieve compliance the Trade Water Agreement at the highest throughput possible, considering minimum pond capacities to avoid liner damage from aerators;
- Manage, operate, inspect and maintain the LTP and associated equipment, processing incoming effluent from the storage pond system;
- Proactively monitor and remain aware of storage pond levels and weather conditons and operate the LTP in conjunction with the leachate storage ponds under the guidance of Wollongong City Council; and
- Provide transition period assistance for the handover periods both from the existing contractor and to any subsequent contractor for the long-term operations of the LTP and associated infrastructure; and



### 6.0 Hazard Categories & Risks Identified

The following is a list of the hazards INNACO has identified arising from the contracted/agreed work activities. These hazards are addressed within the Safe Work Method Statement(s).

Οςςι	pational Health and Safety		
$\square$	Access & egress	$\square$	Confined/enclosed spaces
	Coring/chasing	$\square$	Dangerous Goods (Oxy/other)
	Demolition/dismantling		Electricity (power tools/other)
	Explosive/pneumatic power tools	$\square$	Fatigue (shift work/hours of work)
	Formwork erection/dismantling		Fire/explosion
$\boxtimes$	Fumes/gas	$\square$	Hazardous substances
$\boxtimes$	Flying/falling objects/debris	$\boxtimes$	Height & falls
$\boxtimes$	Hazardous material		Hot/cold working environment
	Hot work (cutting/welding/grinding)		Lasers
	Lighting	$\boxtimes$	Manual handling (lifting or twisting)
	Machine/equipment guarding	$\boxtimes$	Moving plant/traffic
$\boxtimes$	Materials handling (crane/forklift/other)	$\square$	Plant & equipment operation
	Noise (hearing)		Structural alterations/support
$\boxtimes$	Public (pedestrians/other)		Services (underground/overhead)
	Subsidence	$\boxtimes$	Ultra Violet Light (sunlight)
	Trenching/excavation		Other
$\square$	Work near/over water		Other
	Young workers/unskilled labour		Other
$\square$	Biological/bacteria		Other



### Work Health Safety and Environment Management Plan (draft for tender)

Environment				
$\square$	Air quality (dust/emissions)		Bulk excavation/spoil	
	Concrete or paint wastes		Contaminated soil/water	
	Dewatering/pump out		Habitats (protected flora/fauna)	
	Heritage & Archaeology	$\boxtimes$	Noise or vibration	
	Noisy work (neighbourhood)	$\boxtimes$	Spills & response	
$\boxtimes$	Slurry or other discharges		Traffic & parking	
	Waste hazardous (paint sludge,	$\square$	Dangerous Goods/Hazardous	
	synthetic min fibre, asbestos/other		Substances (use/storage/spills)	
$\boxtimes$	Stormwater/sediment control		Other	
$\boxtimes$	Waste disposal	D	Other	

### 7.0 Risk Matrix

INNACO has identified a risk class/ranking for potential workplace hazards by referring to the categories in the matrix below.

Step 1: The organisation identifies the consequence for each potential risk by using the table below. Note: If a combination of harm, loss or damage could occur the worst case consequence is selected.

Level	Description of Consequence
High (1)	Potential death, permanent disability or major structural
	failure/damage. Off-site environmental discharge/release not
(High level of harm)	contained and significant long-term environmental harm.
Medium (2)	Potential temporary disability or minor structural failure/damage.
(Medium level of	On-site environmental discharge/release contained, minor
harm)	remediation required, short-term environmental harm.
Low (3)	Incident that has the potential to cause persons to require first aid.
2011 (3)	
(Low level of harm)	On-site environmental discharge/release immediately contained,
	minor level clean up with no short-term environmental harm.

Step 2: Using the following table, the organisation determines how likely it is that the risk will occur and result in the consequence identified above.

Level	Likelihood / Probability
Likely	Could happen frequently
Moderate	Could happen occasionally
Unlikely	May occur only in exceptional circumstances.

Step 3: Using the risk matrix below, the organisation identifies the risk class/ranking.

Consequence	Likelihood / Probability							
	Likely Moderate		Unlikely					
High (1)	1	1	2					
Medium (2)	1	2	3					
Low (3)	2	3	3					

Class/Ranking	Description / Requirements
	Will require detailed pre-planning.
1	Actions will be recorded on a Safe Work Method Statement
	Will require operational planning.
2	Actions will be recorded on a Safe Work Method Statement
3	Will require localised control measures



# Hazards Identified

Description	Task/Hazard	Likelihood of Hazard	Consequence	Class	Mediation	нос	Likelihood of risk	Consequence	Result Class
			Occupatio	nal Heal	th and Safety				
Access & egress	Injury while entry/exit work zone	Moderate	Medium	2	Induction training to Thales site operations, site safety signage	4,5	Moderate	Medium	2
Fumes/gas	Use of gas or fume emitting equipment by others on site	Moderate	Low	3	PPE, Induction training/tool box talk on current site activity	5,6	Moderate	Low	3
Flying/falling objects/debris	Site inspections to areas where work is being carried out above	Unlikely	Medium	3	PPE, Induction training/tool box talk on current site activity	5,6	Unlikely	Medium	3
Hazardous material	Oils, petrol on site for use by others	Unlikely	Medium	3	PPE, Induction training/tool box	5,6	Unlikely	Medium	3



					talk on current site activity				
Materials handling (crane/forklift/other )	Movement and placement of skid equipment by qualified person	Moderate	High	1	Pre start planning with Thales site management, designated work zone, PPE, Toolbox talk	3,4,5 ,6	Moderate	Medium	2
Plant & equipment operation	Injury during plant and equipment operation	Moderate	Medium	2	PPE, Induction training/tool box talk on current site activity	5,6	Moderate	Low	3
Public (pedestrians/other)	Deliveries need to cross pedestrian/Thale s workers paths.	Moderate	Medium	2	Adhere to Wollongong City Council site access controls, induction training, toolbox talk	4,5	Moderate	Medium	2
Biological/bacteria	Sewer exposure during final commissioning	Moderate	Medium	2	Induction training, provision of MSDS, PPE, Toolbox talks	5,6	Moderate	Medium	2



Dangerous Goods (Oxy/other)	Plumbing works being carried out in vicinity of work area	Moderate	High	1	PPE, Induction training/tool box talk on current site activity	5,6	Moderate	Low	3
Fatigue (shift work/hours of work)	General hours of work	Unlikely	Low	3	Maintain works hours to standard day hours.	1	Unlikely	Low	3
Hazardous substances	Glues, solvents, petrol, oils being used by others within the vicinity of the work area	Moderate	Medium	2	PPE, Induction training/tool box talk on current site activity	5,6	Moderate	Low	3
Height & falls	Review of works from a platform or ladder	Moderate	Low	3	Induction training, tool box talk for activities	5	Moderate	Low	3
Manual handling (lifting or twisting)	Unloading and loading from site vehicles	Likely	High	1	use crane or machine where possible, induction training, correct lifting procedures including two	1,5	Likely	Low	2



					person lift, toolbox				
					talk				
	Diant operations				PPE, Induction				
		Madavata	Lish	1	training/tool box	БС	Madavata	D.4 a alivura	2
woving plant/traffic	by others within	woderate	High	1	talk on current site	5,0	woderate	weatum	2
	works vicinity			D	activity				
					,				
					PPE, Induction				
Ultra Violet Light (sunlight)	overexposure to M			2	training/tool box	C	Likely	Low	2
		Moderate	LOW	3	talk on current site	6			
	sunlight				activity				
					,				



			Environ	ment				
Waste disposal	General waste generated	Likely	Low 2	Adhere to Wollongong City Council waste management plan, Induction training/tool box talk	5	Likely	Low	2



Traffic & parking	Travelling to and from site and parking during site visits	Likely	High	1	Pre start planning with Thales site management, designated work zone, PPE, Toolbox talk	2	Likely	High	1
Dangerous Goods/Hazardous Substances (use/storage/spills)	Spill from stored of process chemicals	Unlikely	Medium	3	Use of appropriate bunding and storage procedures. MSDS available on site	3	Unlikely	Low	3
Noise or vibration	Noise from, tools, plant and equipment within work area	Likely	Medium	2	PPE, Induction training/tool box talk on current site activity	5,6	Likely	Low	2



# 8.0 Safe Work Method Statements (SWMS)

Project SWMS Schedule								
SWMS No.	SWMS Title							
16746 -01	Site Inspection Works (Visual)							
16746 -02	Materials Delivery							
16746 -03	Plant Seeding							
16746 -04	Working with Chemicals							
16746 -05	Working with Mechanical equipment							
16746 -06	Water Sampling & Testing							
16746 -07	Manual Handling							

Note: All SWMS are located in Appendix A

SWMS for sub-contractors will be issued separately to this plan.



Safe Work Method State	File No.:			
WHS Regulation 2011				
SWMS No:	Workplace:		Sub Contractor:	
Process:				
Risk Level: Risk Level Class 1 — High Risk, does the hazard have the	e potential to kill or permanently a	lisable		
Attachments:				
Developed by:	Tel:	Reviewed by:		Tel:
Signed	Date:	Signed		Date:
Description of equipment to be used	Qualifications of the personnel doing the work		Most Relevant Codes of Practice	2:
Other relevant equipment	Site Personnel:		Most Relevant Australian Stand	ard:
Safe Work Method State	ement — Health d	& Safety Legislati	ion	
ACTS AND REGULATIONS:	CODES OF PRACTICE AND GUIDE	INES		



WHS Act, 2011 NSW Codes of Practice and Guidelines SA Codes of Practice and Guidelines   WHS Act, 2011 Excavation Work, 2001 Manual Handling, 2006   OLD Workplace OHS Reg 2008 Excavation Work, 2001 Manual Handling, 2006   OLD Dangerous Goods Safety MGT Act 2001 Kisk Managing the Risk of Falls at Workplace, 2007 Manual Handling, 2006   VIC OHS Act 2004 Work Near Overhead Power Lines, 2006 Manual Tasks, 2006   More ADHS Workplace Health and Safety Act 1995 Storage and Handling of Uworkplace Hazardous Substances, 2006 Safe Removal of Absetsors 2 <sup>nd</sup> Edition NOHS: 2002 (2005)   Mork Near Overhead Power Lines, 2006 Manual Tasks, 2007 More Safety Megulations 1995   OHS Workplace Health and Safety Act 1995 Control of Workplace Hazardous Substances, 2006 Safe Removal of Absetsors 2 <sup>nd</sup> Edition NOHS, 2007   Hazardous Substance, 2008 OHS Consultation, 2001 Work Health and Safety Act 2011 Safe Sterewal of Musculoseletal Disorders Caused from Performing Manual Tasks, 2007   Hazardous Substance, 2008 Monuel Tasks, 2007 Monuel Tasks, 2007   Mobile Cranes, 2006 Safe Work with Absetsos Guide, 2008 Work Health and Safety Act 2011   Mazardous Substance, 2008 Monuel Tasks, 2010 Safe Sterewal of Musculoseletal Disorders Caused from Performing Manual Tasks, 2010



# Safe Work Method Statement — Personnel

### WHS Regulation 2001 — Reg 224

Project:		Location:	Supervisor:			
			Signature:	Date		
PERSONNEL INVOLVED		DUTIES	SKILLS/QUALIFICATIONS REQUIRED			
Name:	Signature					



# Safe Work Method Statement — Hazard and Risk Assessment

#### WHS Regulation 2011

PROCEDURE:	POSSIBLE HAZARDS:	INITIAL RISK:		SK:	HAZARD CONTROLS:	нос	ACTIONED BY:	NEW	NEW RISK LEVEL:	
		Р	с	RISK		MEASURE		Р	С	RISK





# Safe Work Method Statement — Risk Ranking Chart

			-	PROBABILITY				
				CERTAIN	LIKELY	POSSIBLE	UNLIKELY	REMOTE
	CONSEQUENCES			Commonly	Has Occurred	Could Occur	Not Likely to Occur	Practically Impossible
Equipment and Operations	Environmental Impact	Personal Injury		А	В	С	D	E
More than \$500,000 loss	Catastrophic Environmental Event (publicity)	Fatality or Permanent Disability	1	1	2	4	7	11
Up to \$500,000 loss	Major Environmental Event (prosecution)	Major LTI (>7 days lost from work)	2	3	5	8	12	16
Up to \$100,000 loss	Serious Pollution (temporary/permanent	Lost Time Injury	3	6	9	13	17	20
Up to \$10,000 loss	Minor Pollution (minor spill - temporary	Medical Treatment Injury	4	10	14	18	21	23
Less than \$500 loss/No Damage	Nil Impacts/ Affects	First Aid/ No Injury	5	15	19	22	24	25

LEGEND:

HIGH RISK

MEDIUM RISK

LOW RISK



### Safe Work Method Statement — Hierarchy of Controls (HOC)





### 9.0 Objectives and Targets

INNACO has established the following objectives and targets to support and maintain the effectiveness of the WHSE Management Plan.

#### Planning

#### **Objective:**

Employees are provided with regular and up-to-date information on WHSE for the duration of the contracted/agreed works.

#### Target:

Review the content of the WHSE Management Plan at maximum 3 month intervals (or more frequent as required) to maintain the currency of information provided to employees and others.

#### **Risk Management**

#### **Objective:**

Employees are familiar with hazards and risks associated with the contracted/agreed works that are assessed as a medium to high risk.

#### Target:

Safe Work Method Statement(s) or the equivalent list as a minimum those hazards and risks associated with the contracted/agreed works that are assessed as a medium to high risk.



#### Consultation

#### **Objective:**

Employees are regularly consulted on matters that affect WHSE.

#### Target:

Toolbox/Pre-start or other agreed methods of consultation are undertaken on a Daily basis.

#### Training

#### **Objective:**

Employees are provided with training to enable work practices to be undertaken that are safe and minimise risk to the environment.

#### Target:

All employees involved with the contracted/agreed work have undertaken as a minimum the three levels of induction training, i.e. general industry (safety awareness) training, site specific training and work activity training as noted in the Safe Work Method Statement(s) specific to the contracted/agreed works.



# **10.0 Personal Protective Equipment (PPE)**

INNACO maintains the following register of all PPE supplied to employees where such PPE is specified as a control measure in the Safe Work Method Statement INNACO ensures all items of PPE are manufactured, used and maintained in accordance with the relevant Standard. Proof of Standard compliance will be provided, e.g. labeling.

Each employee has been instructed and trained in the correct use of the PPE issued.

Employee name	Date of Issue/ replacement	Item supplied	Signature of Recipient I have received the listed PPE with appropriate instruction/training in its correct use.		
Lars Herngren	23/09/2019	Hard Hat, Hi Visibility Vest, Safety Glasses, Safety boots			
Omid Sayar	23/09/2019	Hard Hat, Hi Visibility Vest, Safety Glasses, Safety boots			
Richard Selway	23/09/2019	Hard Hat, Hi Visibility Vest, Safety Glasses, Safety boots			
Shahriyar Nasiri	23/09/2019	Hard Hat, Hi Visibility Vest, Safety Glasses, Safety boots			
Mahdi Madani					
Arman Rashidi	23/09/2019	Hard Hat, Hi Visibility Vest, Safety Glasses, Safety boots			
Hamid Mehrazmay	23/09/2019	Hard Hat, Hi Visibility Vest, Safety Glasses, Safety boots			



# **11.0 WHS Roles and Responsibilities**

INNACO provides the following key trained and competent personnel on site.





#### **ROLES AND RESPONSIBILITIES DEFINED**

The roles and responsibilities of employees within INNACO regarding WHSE are below.

#### PROJECT DIRECTOR

- implementing the WHSE Management Plan;
- using the Hierarchy of Controls in all design, fabrication and construct activities to minimise WHSE risks;
- communicating with the principal contractor to reduce risks;
- being a part of the planning and design stages of trade activities;
- deciding when training on WHSE is required;
- leading by example and promoting sound WHSE practices at every opportunity;
- ensuring safe equipment and plant is provided and maintained;
- reviewing WHSE reports and inspections, and following up on recommendations;
- coordinating incident investigations and reporting to the controller of the workplace and relevant authorities, as required;
- coordinating WHSE meetings and programs;
- monitoring compliance with the WHSE Management Plan, including Safe Work Method Statement; and
- assisting injured employees to return to their pre-injury duties as soon as practicable after a work-related injury.

#### PROJECT MANAGER

- implementing the WHSE Management Plan;
- observing all WHSE rules and regulations;
- making sure that work activities are carried out in a safe and environmentally sound manner;
- planning to do all work safely including any interface with other work activities;
- providing advice and assistance on WHSE matters to employees;
- being part of the planning and design stages of trade activities;
- deciding when training on WHSE is required;
- actioning WHSE reports and carrying out workplace inspections;
- setting up WHSE meetings and programs;
- helping to prepare Safe Work Method Statements for the organisation's work activities;
- investigating hazard reports and ensuring that they are completed and corrective actions undertaken;
- being a part of incident investigations;



- leading by example and promoting sound WHSE practices at every opportunity;
- undertaking inspection of the contracted or planned works to ensure that WHSE control measures are implemented and effective; and
- Other WHSE duties as directed by the Works Manager.

#### SITE SUPERVISOR

- communicating WHSE performance to the Works Manager;
- assisting the Works Supervisor to develop and implement the WHSE Plan;
- providing advice on WHSE to all employees;
- being a part of planning and design in work activities;
- determining WHSE legal requirements for the work activity or trade;
- making sure WHSE work procedures are followed;
- coordinating injury management / return to work for injured employees;
- reviewing WHSE reports and inspections;
- setting up and being a part of WHSE meetings and programs;
- setting up Toolbox Talks on a regular basis;
- insisting on sound WHSE practices at all times;
- carrying out project inductions, Toolbox Talks and team meetings;
- setting up and conducting WHSE inductions;
- conducting incident investigations;
- communicating with the Works Manager/Works Supervisor on WHSE matters;
- making sure records are kept under these guidelines;
- being part of inspections and ensuring recommendations are completed; and
- Other WHSE duties as directed by the Works Manager.

#### INJURY MANAGEMENT COORDINATOR

- assisting injured employees to return to their pre-injury duties as soon as practicable after a work-related injury;
- ensuring that, where appropriate, the injured employee is given access to occupational rehabilitation services;
- liaising with any parties involved in the occupational rehabilitation of, or provision of medical services, to the injured employee;
- monitoring the progress of the injured employee's capacity to work;
- taking steps to prevent recurrence or aggravation of the relevant injury upon the injured employee's return to work; and
- providing assistance to meet all legal requirements regarding injury management and return to work.



#### ENGINEERS/TECHNICIANS

- working in a safe manner without risk to themselves, others or the environment;
- complying with the WHSE Management Plan including all Safe Work Method Statements;
- reporting all incidents to the Works Supervisor;
- reporting all injuries and illnesses to the designated First Aid Officer;
- reporting any WHSE hazards to the Works Supervisor;
- providing suggestion, through agreed consultation methods, on how to improve WHSE issues;
- seeking assistance if unsure of WHSE rules;
- reporting any faulty tools or plant to the Works Supervisor;
- complying with site rules;
- correctly using all personal protective equipment; and
- complying with emergency and evacuation procedures.


### **12.0 Training and Competency Register**

Having regard to the hazards and risks associated with the work activity, INNACO has assured that all employees are trained and competent to perform all tasks in a way that is safe and does not adversely impact on themselves, others or the environment.

The following register contains details of the skills and competencies of the organisation's employees.

Name	Position	Role in this project	Skills	Qualifications	Safety Certificates
Omid Sayar	Manager – Process & Operation Engineering	Project Manager	Project Management, design, construction, commissioning, operation and maintenance and optimization of water, wastewater, leachate and stormwater treatment projects. Currently leading the operation and optimization works for more than 40 treatment plants in NSW, ACT & VIC.	Bachelor Process Engineering Master's Environment Engineering Master's Engineering Management Member of the Institution of Engineers Australia	White Card Conduct local risk control- RIIRIS201D Issue work permits – MSAPMPER300C Observe Permit work- MSAPMER202A Enter & work in confined spaces- RIIWHS202D First Attack Firefighting equipment- CPPFE2005A
				Equipment Connected to Low Voltage Electrical Wiring Training Certificate	Provide Cardiopulmonary resuscitation- HLTAID001 Operate breathing apparatus- MSAPMOHS216A



					Gas test atmospheres –
					MSAPMOHS217A
Arman Rashidi	Process & Operation Engineer	Operation Engineer	10 years' experience in process optimisation and operation of water treatment systems, manufacturing processes and refineries. Highly qualified in operations engineering root	Bachelor Process Engineering Master's Process Engineering	MSAPMOHS217A Undertake confined space rescue- PUASARO25A Work in accordance with an issued permit- MSAPMPER200C White Card Conduct local risk control- RIIRIS201D
			operations engineering, root cause analysis, dynamic simulation, and performance optimisation of water treatment systems.		Issue work permits – MSAPMPER300C Observe Permit work- MSAPMER202A Enter & work in confined spaces- RIIWHS202D First Attack Firefighting equipment- CPPFE2005A Provide Cardiopulmonary resuscitation- HLTAID001 Operate breathing apparatus- MSAPMOHS216A Gas test atmospheres – MSAPMOHS217A



					Undertake confined space rescue- PUASARO25A Work in accordance with an issued permit- MSAPMPER200C
Richard Selway	Electrician and Electrical Servicing Technician	Electrical works and installation	35 years' experience in electrical works within process automation, and a wide variety of other electrical works	Grade A Certified Electrician	White Card Conduct local risk control- RIIRIS201D Work in accordance with an issued permit- MSAPMPER200 Enter & work in confined spaces- RIIWHS202D
Sash Nasiri	Service Engineer	Service Engineer	10 years' experience in automation, servicing, operation and maintenance of water infrastructure including pumps, electrical and process controls, trouble shooting and field rectification works	Bachelor Electrical and Automation Engineering Disconnect Reconnect Equipment Connected to Low Voltage Electrical Wiring Training Certificate	White Card Traffic Controller Certificate Conduct local risk control- RIIRIS201D Work in accordance with an issued permit- MSAPMPER200 Enter & work in confined spaces- RIIWHS202D



Hamid Mehrazmay	HSE Engineer	Site Supervisor Routine Operation	4 years' experience in water treatment operation and equipment service, and piping works.	Bachelor Degree in Environmental Engineering Graduate Certificate in Health, Safety and Environment (HSE)	White Card Conduct local risk control- RIIRIS201D Work in accordance with an issued permit- MSAPMPER200 Enter & work in confined spaces- RIIWHS202D
Mahdi Madani	Process Engineer	Standby Operation Engineer	10 years' experience in process and operation of chemical treatment plants and water treatment systems. Highly qualified in operations engineering and process optimization.	Bachelor Process Engineering Master's Process Engineering	White Card Conduct local risk control- RIIRIS201D Issue work permits – MSAPMPER300C Observe Permit work- MSAPMER202A Enter & work in confined spaces- RIIWHS202D First Attack Firefighting equipment- CPPFE2005A Provide Cardiopulmonary resuscitation- HLTAID001 Operate breathing apparatus- MSAPMOHS216A



	Gas test atmospheres – MSAPMOHS217A Undertake confined space rescue- PUASARO25A Work in accordance with an issued permit- MSAPMPER200C



# **13.0 Consultation**

INNACO promotes the active participation of all employees in WHSE decisions.

Employees are consulted and given opportunity, encouragement and training to be proactively involved in WHSE matters affecting the organisation and their work activities.

Consultation occurs in reference to, but not limited to, the following subjects / topics:

- hazard identification and risk assessment processes;
- control measures for the management of hazards and risks;
- changes to the organisation's policies and procedures or work routines which may affect WHSE;
- make up of and representation on relevant committees; and
- election of WHSE and employee representatives.

All workplace consultation is recorded and forwarded to both Wollongong City Council on a daily basis *prior* to the commencement of works. INNACO maintains original records of all consultation meetings.



# **14.0 Workplace Inspection Checklist**

INNACO inspects the work activity(s) and work area, and completes a Workplace Inspection Checklist each week taking corective action where necessary for the duration of the works.

Workplace Inspection	Report
WHSE Management Plan	
Form No: 2	Date:
Version: 2	Review Date: September 2019
Project:	Supervisor:
1 Housekeeping	

1. Housekeeping							
Work Area clean & tidy	□ Yes	🗆 No	□ N/A	Powerpoints not overloaded	□ Yes	🗆 No	🗆 N/A
Rubbish removed regularly	🛛 Yes	🗆 No	🗆 N/A	Walkways/traffic ways	🛛 Yes	🗆 No	🛛 N/A
Materials/Equipment correctly stored	□ Yes	🗆 No	🗆 N/A	clear - no trip hazards eg. electric leads	□ Yes	🗆 No	🗆 N/A

2. First Aid				
First Aid kit stocked, in		First Aid occurrences		
date & clean		recorded in log book		

3. Chemicals/Workplace Substance								
Safe & proper storage	□ Yes	🗆 No	D N/A	Approved containers with correct labels	□ Yes	🗆 No	🗆 N/A	
MSDS's available at place of use	□ Yes	🗆 No	🗆 N/A	Correct disposal procedures	□ Yes	□ No	🗆 N/A	

4. Personal Protective Equipment (available and worn)									
Council clothing worn (outdoor staff)	□ Yes	🗆 No	🗆 N/A	Safe footwear	□ Yes	🗆 No	🗆 N/A		
Respiratory/breathing equipment	□ Yes	🗆 No	🗆 N/A	Eye protection	□ Yes	🗆 No	🗆 N/A		
Head/face protection	🛛 Yes	🗆 No	🗆 N/A	Hand protection	🛛 Yes	🗆 No	🗆 N/A		
Hearing protection	□ Yes	🗆 No	□ N/A	High visibility clothing	□ Yes	🛛 No	□ N/A		

5. Electrical (compliance with Code of Practice —Electrical Practices for Construction Work)



Plug/switches serviceable	□ Yes	🗆 No	□ N/A	Electric leads correctly stowed in work area	□ Yes	🗆 No	□ N/A
Circuit breakers used/tagged	□ Yes	🗆 No	🗆 N/A	Tools & electric leads	□ Yes	🗆 No	🗆 N/A
Generators used only with ELCB	□ Yes	🗆 No	🗆 N/A	(Construction monthly)			

6. Plant/Tools/Equipment							
Safe Operation	□ Yes	🗆 No	🗆 N/A	Safety notices displayed and legible	□ Yes	🗆 No	🗆 N/A
Guards adjusted/functioning	□ Yes	🗆 No	🗆 N/A	Slings/lifting equipment checked & tagged	□ Yes	🗆 No	🗆 N/A
Isolation/lockout system	□ Yes	🗆 No	🗆 N/A	Daily inspection of plant completed	□ Yes	🗆 No	□ N/A
Operators trained and certified	□ Yes	🗆 No	🗆 N/A	Warning devices/display operating	□ Yes	🗆 No	🗆 N/A

7. Work Systems/Site Condit	ions							
Amenities adequate		Yes	No	N/A	Correct manual handling	Yes	No	N/A
Adequate ventilation		Yes	No	N/A	techniques &/or lifting aids used			
Adequate lighting		Yes	No	N/A	Site access safe for visitors	Yes	No	N/A
Controls for noise		Yes	No	N/A	Warning/hazard signs displayed	Yes	No	N/A
Controls for dust		Yes	No	N/A	Safe movement of pedestrians/public	Yes	No	N/A
Controls for mist/fumes		Yes	No	N/A	Traffic control measures in place	Yes	No	N/A
Environmental measures in place		Yes	No	N/A	Safe procedures for poisons spraying	Yes	No	N/A
No-smoking where prohibited		Yes	No	N/A	Confined space work compliance	Yes	No	N/A
Contractor compliance		Yes	No	N/A	Fall protection provided >1.8m	Yes	No	N/A

8. Fire							
Wardens names displayed	□ Yes	🗆 No	🗆 N/A	Fire extinguishers tagged & in date	□ Yes	🗆 No	🗆 N/A
Adequate fire-fighting equipment	□ Yes	🗆 No	🗆 N/A				

9. Emergency (where applicable	)				
Emergency plan distributed/displayed	□ Yes	🗆 No	🗆 N/A	Date of last emergency/evacuation drill	
All exits clear & signposted	🛛 Yes	🗆 No	🗆 N/A		



10. Comment/Corrective Action

# NOTE: ANY REMEDIAL WORK SHOULD BE INITIATED IMMEDIATELY. IF NOT POSSIBLE, TIMING MUST BE DISCUSSED WITH THE CO-ORDINATOR.

Person Inspecting: (Print Name)	Date:	Co-ordinator: (Sign)	Date:



### **15.0 Plant and Equipment**

INNACO carries out regular inspections and maintenance of all plant and equipment.

INNACO ensures plant and equipment is inspected and maintained in accordance with the relevant standard and manufacturer's recommendations.

The inspection and maintenance history of each item is documented.

Certain items of plant and equipment will be 'Item Registered' and or 'Design Registered' by the Regulatory Authority where required by Legislation

INNACO ensures control measures are implemented and documented for all plant and equipment, including its operation, deemed as high risk. The effect of all plant and equipment on the workplace is considered and documented in the Safe Work Method Statement

Pre-start checks, schedule of maintenance and fault reports are notified to the Works Supervisor, documented in plant log books and made available to relevant parties on request.

Where plant and equipment is hired, the same requirements as above apply.



### **16.0 Plant and Equipment Register**

The following register contains details of all plant and equipment to be used by INNACO during the course of the work activities. Examples include lifting gear, fire fighting equipment, mobile plant, fall restraint equipment and other.

Plant Type	Serial No. / Registration No.	Make / Model	Registration with Authority Required? Y/N	Authority Registration Expiry Date (if applicable)	Date last service or maintenance record available	Required Maintenance Frequency	Alteration Details Y / N / NA	Date On Site	Log Book Available



# **17.0 Plant and Equipment Checklist**

INNACO completes the following checklist prior to modification works and equipment replacement at workplace.

Plant and Equipment Checklist				
WHS&R Management Plan				
Week Ending:		Site:		
Operator's Name:	Current Hours (indicate hours):	Pla	nt No.:	Service Due (indicate hours):
		Ma	chine Type:	

VISUAL PLANT INSPECTION $\checkmark$ C	)к — NO	DEFEC	TS			
Please give a brief description below of fault (if any)	1	2	3	4	Actions taken to remedy fault	By Whom
1. Flashing Lights, warning devices and signs						
2. Hydraulics — leaks, damage, connections						
3. Components — Damaged, broken						
4. Wheels — Tyres, loose nuts, wear						
<ol> <li>Pins — Pivots, rams, lift arms, bucket pins</li> </ol>						
6. Safety Shower, MSDS						
<ol> <li>Conditions of — Hoods, sheaves, chains, tracks</li> </ol>						
8. Cabin — Controls, loose objects, seat belts, windscreen visibility						
9. Warning lights —Gauges						
10. Chemicals (leakage, bond,)						
11. Height restrictors — Functioning check						
12. Hydraulic oil — Engine oil and water check						



13.	Fire extinguisher			
14.	Other — Wiring, etc.			
15. mach	Safety/cover guards with			

Fault Report indicate):	ed (please	Date Reported:	Operators Signature:	Supervisors Signature:
□ Yes	🗆 No			



### **18.0 Hazardous Substances/Dangerous Goods**

INNACO maintains a current (within 5 years of the date of issue) MSDS for all products and substances to be used for the work activity.

Before a product or substance is used for the work activity, INNACO reviews the Material Safety Data Sheet (MSDS) to determine if the product or substance is classified as hazardous.

All employees involved in the use of products classified as hazardous, are provided with information and training to allow safe completion of the required task.

As a minimum standard, all safety and environmental precautions for use listed on the MSDS are followed when using the substance and are included in the Safe Work Method Statement.

No products or substances, including chemicals or fibrous materials, are brought to the workplace without a current MSDS.

All products and substances to be brought to the workplace are be documented.

INNACO considers the following when selecting chemicals and substances for use on site:

- ✓ Flammability and exclusivity;
- ✓ Toxicity (short and long term);
- ✓ Carcinogenic classification if relevant;
- ✓ Chemical action and instability;
- ✓ Corrosive properties;
- ✓ Safe use and engineering controls;
- ✓ Environmental hazards; and
- ✓ Storage requirements.

All storage and use of hazardous substances and dangerous goods is in accordance with the MSDS and legislative requirements.

All hazardous substances and dangerous goods are stored in their original containers with the label intact at all times.

Hazardous substances and dangerous goods of any quantity are not stored in amenities, containers (unless properly constructed for the purpose), sheds or offices.



# **19.0 Hazardous Substances/ Emergency Equipment Register** and Locations

The following Hazardous Substance / Emergency Equipment Register to be filled on site by Operator.

Hazardous Substance / Emergency Equipment Register								
WHSE Management Pla	an							
Project: Whytes Gully L	each	ate Treatment Syste	m					
HAZARDOUS SUBSTANC	CE REO	GISTER						
Product:	Арр	roximate Amount:	User on	Site		MSDS Provided		
						□ Yes	🗆 No	
						□ Yes	🗆 No	
						□ Yes	🗆 No	
						□ Yes	□ No	
						□ Yes	🗆 No	
						□ Yes	🗆 No	
					0	□ Yes	□ No	
						□ Yes	🗆 No	
						□ Yes	🗆 No	
EMERGENCY EQUIPMEN	NT RE	GISTER						
Туре:		Location:		Checked by:	D	ate Last Servi	ced:	

## **20.0 Electrical Equipment**



INNACO ensures that the use of electrical wiring, equipment, portable tools and extension leads is in accordance with applicable codes and standards including AS3012, Electrical Installations – Construction and Demolition Sites and AS3000, Wiring Rules.

INNACO ensures that all electrical equipment brought on site is listed in the Electrical Equipment Register. The register is completed prior to commencement of the works and maintained for the duration of the works on site.

All electrical equipment including leads, portable power tools, junction boxes and earth leakage, or residual current, devices is inspected and tested by a suitably qualified person and labeled with a tag of currency before being used on site.



# **21.0 Electrical Equipment Register**

INNACO records all electrical equipment brought on site in the Electrical Equipment Register.

Note: Testing and Tagging frequency is as required by State or Territory Legislation, codes and relevant standards.

Electrical Equipm	nent
Workplace	Date

Equipment Description	Plant / Serial No.	Date of Inspection/ Test	Results and/or trip current (less 30mA) for Earth Leakage Device	Date of next Inspection/Test	Electrician's / qualified person's Signature	License/ Registration No.



		-	

	Frequency of inspection / test
Electrical item	(in accordance with relevant requirements)
Tools & leads or electrical equipment	
Sub-board earth leakage device	



### 22.0 Hazard Reporting

INNACO employees are to report hazards **immediately** to the safety officer/s. It is the Works Supervisor's ultimate responsibility to ensure any reports have been received INNACO **immediately**.

Where the hazard cannot be corrected immediately, INNACO records the details of the hazard in the Hazard Register

INNACO investigates all reported hazards and implements control measures to eliminate and/or minimise the likelihood of an incident or injury.

INNACO identifies a risk class/ranking for all hazards by referring to the categories ranging from high to low in the Risk Matrix. The Risk Matrix is used to determine the level of danger or seriousness (i.e. the consequence) of the risk, how likely it is that this risk will occur (i.e. likelihood/probability) and therefore how detailed control measures will need to be to eliminate or minimise the risk.

INNACO regularly reviews and evaluates the effectiveness of control measures until the hazard is addressed and/or all risks have been mitigated or reduced.

INNACO will issue a copy of any completed Hazard Report form immediately.



### 23.0 Hazard Report

Where a hazard cannot be immediately corrected, INNACO records the hazard in the Hazard Report.

Incident/Hazard Report WHSE Management Plan Note: A copy of this report should be forwarded to your coordinator. This document is an 'uncontrolled document' if it is printed. <u>Please ensure that you have the latest version of this document.</u>						
Incident No:		Date Report	Date Reported:			
Assessment of Risk: Please tick the appropriate rating		Light	Medium	High	Emergency	
Urgency of investigation: Please tick appropriate rating		Light	Medium	High	Emergency	
PERSON INVOLVED DETAI	ILS — FORWARD TO AN	INNACO DIRE	CTOR WITHIN	24 HOURS		
Given Name:	Family Name:	Position Title:		Please tick box	appropriate	
Address:		Company Name:		INNACO Employee		
				H&H Employee		
Position Title:		DOB: Sub Contr		Sub Contra	ctor	
Company Name:		Gender:	Male	Site Visitor		
Contact Number:		Female	Other			
Has an INNACO Director been notified of the incident?		Yes	No	Date of Incident:		
Name of person notified:	Contact Number:					
DETAILS OF INCIDENT/HA	ZARD					
Act of Violence	Injury/Illness	Incident		Hazard		
Site:			Time:			
Location within site:			Date:			

What were you doing? Describe the activity					
What happened unexpectedly?					
What did you do? Describe what happened					
WAS THERE ANY PROPER	TY DAMAGE?				
Yes No					
Type of property damage	d or stolen:		Reported to police:		
Registration of vehicle (if	applicable):		Yes No		
WERE THERE ANY WITNES	SSES?				
Yes No					
Name of witness (1):		Company:			
		Contact Phone Number:			
Name of witness (2):		Company:			
		Contact Phone Number:	Contact Phone Number:		
SIGNATURE OF PERSON M	IAKING THE REPORT				
Person making the report		Name:	Date:		
		Signature:	Contact Number:		
INNACO Director		Name:	Date:		
the report		Signature:	Contact Number:		
COMPLETE ONLY IF INJUR	Y/ILLNESS SUSTAINED		1		
Description of injury/med	lical condition	Status of person at tin	ne of completing report:		
		Resumed full work du	ties		
		Ceased work			
		Partial return to work			
		Returned to alternate duties			

		Has the injury resulte	d in loss of wor	k hours?	
		Yes No			
		Total number of work hours lost:	Hours:	Days:	
		Is this an aggravation condition?	of a previous ir	ijury or	
		Yes No			
Treatment					
Nil					
First Aid		Name:			
Medical treatment by heal	th professional	Name:	Location:		
Ambulance/Hospital	Name of Hospital:				
Type of Injury	Type of Disease				
Amputation	Heat/stress/exhaustion	Allergic reaction	Loss of consciousnes	s/fainting	
Bruise	Poisoning	Dermatitis/exzema	Seizure		
Cut/laceration	Toxic effects of substance	Disease of circulatory system	Psychologica	I	
Dislocation	Strains/sprains	Disorders of the muscles	Respiratory irritation/dise	ease	
Foreign body	Other (specify below)	Eye disorders	Other disease below)	es (specify	
Fracture		Hearing loss	-		
Grazes/scrapes/abrasions		Hernia			
Head injury		Infectious/parasitic	-		
Bodily Location of Injury —	Indicate Left or Right as A	ppropriate (as L or R ne	ext to body part	:)	
Head	Neck	Shoulder	Нір		
Face	Back upper	Upper arm	Leg upper		

Eyes	Back lower	Elbow	Кпее
Ears	Chest	Forearm	Leg lower
Nose	Abdomen	Wrist	Ankle
Mouth	Groin/Pelvic Region	Hands/fingers & thumb	Foot/toes
Name of Injured Person:		Signature:	Date:

### 24.0 Injury and Incident Investigation

#### **INJURIES:**

All injuries are reported to the desiganted INNACO First Aid Officer in the workplace.

INNACO records all injuries on the Register of Injuries.

Where the injury requires medical attention or off site treatment, INNACO completes an Incident Investigation Report.

Copies of Incident Investigation Reports are provided to Wollongong City Council immediately.

#### **INCIDENTS:**

For all incidents involving near misses, property/plant damage or injury to the public or the environment, Insert Organisation investigates and records the details in an Incident Investigation Report.

Copies of completed Incident Investigation Reports are provided to Wollongong City Council immediately.

#### **NOTIFIABLE INCIDENTS:**

INNACO reports all notifiable incidents to the relevant Authority (WorkCover).

Where such an incident has occurred, INNACO considers whether the site needs to be preserved for investigation by the relevant Authority.

#### **RECORD KEEPING:**

INNACO keeps records of incidents and injuies in accordance with statutory requirements.

### **25.0 First Aid Register**

INNACO records all injuries in the following register.

First Aid Register						
WHSE Management Plan						
Project:						
SUMMARY OF INCIDENT/F	FIRST AID (1)					
Injured Worker: (please print)		Signature:	Date: Contact Number:			
Was First Aid Applied? (pl	ease tick):					
Nil First Aid		Description of injury				
Medical treatment by health professional						
Was further treatment, in	cluding time-off work rec	uired? (please tick):				
Resumed full work duties		Description of treatment				
Ceased work						
Partial return to work		4				
Returned to alternate duti	es					
SUMMARY OF INCIDENT/F	IRST AID (2)					
Injured Worker: (please print)		Signature:	Date:			
Was First Aid Applied? (p)	ease tick):					
Nil		Description of injury				
Nil First Aid		-				

|--|

Ambulance/Hospital

Was further treatment, including time-off work required? (please tick):

Description of treatment

Resumed full work duties

Ceased work

Partial return to work

Returned to alternate duties

#### COMMENTS & POINTS RAISED

### 26.0 WHSE Management Plan Checklist

INNACO reviews all WHSE policies and procedures on a Project Basis or 3 Monthly, which ever is the shorter period, to determine the effectiveness of the WHSE Management Plan in addressing WHSE in the workplace.

General					
Project Name					
Location					
Auditor					
Other Attendees					
Activities Reviewed		Conf	orms		
CHANGES AND DIST	RIBUTION OF THE WHSE MGT PLAN ARE RECORDED	Yes 🗌	No 🗌		
PROJECT DETAILS / DESCRIPTION OF WORKS / ORGANISATION DETAILS       Yes        No          ARE CURRENT       Yes        No        No					
WHSE POLICY SIGNED AND DATED BY DIRECTOR/MANAGER       Yes       No					
HAZARDS ARE IDENT	HAZARDS ARE IDENTIFIED AND RISKS ARE ASSESSED     Yes     No				
CONTROLS FOR HIGH RISK ACTIVITIES ARE DOCUMENTED (SAFE WORK METHOD STATEMENT(S))					
TRAINING AND COMPETENCY REGISTER IS CURRENT     Yes     No					
SITE SPECIFIC INDUCTION TRAINING RECORDS ARE CURRENT			No 🗌		
SWMS TRAINING IS CURRENT					
ROLES AND RESPONSIBILITIES ARE ALLOCATED AND SIGNED					
CONSULTATION ARRANGEMENTS (NATURE, TOPICS, INTERVALS) ARE Ves No					

PLANT / EQUIPMENT REGISTER IS CURRENT	Yes 🗌	No 🗌
HAZARDOUS SUBSTANCES / DANGEROUS GOODS REGISTER IS CURRENT	Yes 🗌	No 🗌
PERSONAL PROTECTIVE EQUIPMENT REGISTER IS CURRENT	Yes 🗌	No 🗌
PERIODIC WORKPLACE INSPECTION CHECKLISTS ARE COMPLETED	Yes 🗌	No 🗌
REGISTER OF INJURIES IS CURRENT	Yes 🗌	No 🗌
INCIDENT INVESTIGATION REPORTS ARE COMPLETED	Yes 🗌	No 🗌
HAZARD REPORTS ARE COMPLETED	Yes 🗌	No 🗌
ELECTRICAL EQUIPMENT REGISTER IS CURRENT	Yes 🗌	No 🗌
INJURY MANAGEMENT AND RETURN-TO-WORK PROGRAM IS DISPLAYED	Yes 🗌	No 🗌
WORKERS COMPENSATION INFORMATION IS CURRENT	Yes 🗌	No 🗌
OTHER:	Yes 🗌	No 🗌
Items Identified for Correction		





Outstanding Issues and Recommendations	Outstanding Issues and Recommendations					
Followup						
Actions required	When					
Completed By						
Name	Position					
Signature	Date					
Signature						

### **27.0 WHS, Injury Management and Return-to-Work**

#### OUR COMMITMENT:

INNACO is committed to the return to work of injured employees.

As part of this commitment, we will:

- prevent injury and illness by providing a safe and healthy working environment;
- participate in the development of an injury management plan and ensure that injury management commences as soon as possible after an employee is injured;
- support the injured employee and ensure that early return to work is a normal expectation;
- provide suitable duties for an injured employee as soon as possible;
- ensure that our injured employees (and anyone representing them) are aware of their rights and responsibilities – including the right to choose their own doctor and rehabilitation provider, and the responsibility to provide accurate information about the injury and its cause);
- consult with our employees and, where applicable, unions to ensure that the returnto-work program operates as smoothly as possible;
- maintain the confidentiality of injured employee's records.
- not dismiss an employee as a result of a work related injury within six months of becoming unfit for employment.

To support the above, INNACO has established the following procedures.

#### NOTIFICATION OF INJURIES:

- All injuries must be notified to the supervisor as soon as possible.
- All injuries will be recorded in the Register of Injuries.
- Our Workers Compensation Scheme Agent will be notified of any injuries that may require compensation within 48 hours.

#### **RECOVERY:**

- All injured employees will receive appropriate first aid or medical treatment as soon as possible.
- The injured employee must nominate a treating doctor who will be responsible for the medical management of the injury and assist in planning return to work.

#### **RETURN TO WORK:**

- A suitable person will be arranged to explain the return to work process to the injured employee.
- The injured employee will be offered the assistance of a WorkCover-accredited rehabilitation provider if it becomes evident that they are not likely to resume their pre-injury duties, or cannot do so without changes to the workplace or work practices.

#### **SUITABLE DUTIES:**

- An individual return to work plan will be developed when the injured employee, according to medical advice, is capable of returning to work.
- The injured employee will be provided with suitable duties that are consistent with medical advice and are meaningful, productive and appropriate to the injured employee's physical and psychological condition.
- Depending on the individual circumstances of the injured employee, suitable duties may be at the same workplace or a different workplace, the same job with different hours or modified duties, a different job and may involve full-time or part-time hours.

#### **DISPUTE RESOLUTION FOR WHS:**

#### 1 Application

This dispute resolution process shall apply to all disputes arising out of or in connection with the employment of INNACO, including disputes arising out of or in connection with any legislation or other statutory instrument applicable to the employment relationship.

#### 2 Procedures

The parties shall follow the dispute resolution procedure set out below:

#### <u>Step 1</u>

The parties to the dispute shall genuinely attempt to resolve the dispute at a workplace level through discussion and negotiation.

#### <u>Step 2</u>

If a dispute is not resolved at the workplace level within 14 days, the dispute shall be referred for facilitative dispute resolution in accordance with clause 8.3 and, if that process is unsuccessful, determination by arbitration.

#### 3 Conducting the Alternative Dispute Resolution

- (a) The alternative dispute resolution process shall be conducted by a person (or persons) who is accredited by the Institute of Arbitrators and Mediators Australia (IAMA) as an ADR Provider and agreed between the parties in dispute on the matter.
- (b) If the parties do not agree on a person to conduct the process, then the process shall be conducted by the person nominated by either the President of IAMA or the President of IAMA's delegate).
- (c) Unless the parties to the dispute agree otherwise, the dispute resolution process shall be conducted in accordance with the IAMA Workplace Dispute ADR Rules.
- (d) The parties will participate in good faith in the dispute resolution process and shall comply with any directions made by the person conducting the process.

#### 4 Prohibition on Conduct of Alternative Dispute Resolution

An employee or employer must not seek the appointment of a person to conduct an alternative dispute resolution process in relation to a dispute if the matter is the subject of proceedings or has already been settled as a result of proceedings, whether before a court or another body, under a law of the Commonwealth or of a State or Territory relating to the prevention of discrimination or to equal opportunity.

#### 5 Conduct during a dispute

An employee who is a party to a dispute must, while the dispute is being resolved:

- Continue to work in accordance with his or her contract of employment, unless the employee has a reasonable concern about an imminent risk to his or her health or safety; and
- Comply with any reasonable direction given by his or her employer to perform other available work, either at the same workplace or at another workplace.

In directing an employee to perform other available work, the employer must have regard to:

- The provisions (if any) of the law of the Commonwealth or of a State or Territory dealing with occupational health and safety that apply to that <u>employee</u> or that other work; and
- Whether that work is appropriate for the employee to perform.

#### 6 Representations

A party to the alternative dispute resolution process may be represented in the process.

The person conducting the dispute resolution process may set reasonable limits on the conduct of the representative in relation to the process.

#### 7 <u>Costs</u>

- (a) Each party will bear their own costs of and incidental to the dispute resolution process.
- (b) The parties will co-operate fully in connection with obtaining funding from the Department of Employment and Workplace Relations under the ADRAS scheme. To the extent that funds from ADRAS are insufficient to meet the fees and expenses of the dispute resolution provider, then as between themselves, the costs of the dispute resolution provider shall be borne equally.

#### 8 Confidentiality

All information disclosed during the dispute resolution process shall be kept private and confidential except:

- (a) If disclosure is compelled by law;
- (b) To the extent necessary to give effect to this Workplace Agreement or to enforce any agreement to settle or resolve the whole or any part of the Dispute or any award made; and

(c) Where disclosure is only of the occurrence of the ADR Process (and not any communication during the ADR Process), and the occurrence of the ADR Process is relevant to subsequent arbitral or judicial proceedings relating to the Dispute.

#### DISPUTE RESOLUTION FOR INJURY AND RETURN TO WORK:

- If disagreements about the return to work program or suitable duties arise, the organisation will work with the injured employee and any union representing them to try to resolve the issue.
- If all parties are unable to resolve the dispute, the organisation will seek to involve the Scheme Agent, an accredited rehabilitation provider, the treating doctor or an injury management consultant.

#### **CONTACTS:**

INNACO's workplace contact for the return-to-work is:

Name	Organisation	Contact Details
Rodney Boss (Director)	INNACO PTY LTD	(02) 9417 7728

INNACO 's preferred WorkCover-accredited rehabilitation providers are:

Organisation	Contact Details
BRS Consulting	(02) 9555 6066

#### INNACO 's workers' compensation Scheme Agent is:

Organisation	Contact Details
iCare	13 77 22
#### **APPENDIX A – SWMS**



Safe   WHS Re	File No.:16746- SWMS#1									
SWMS No: 1		Workplace: Wollongong Waste and Reso (Whytes Gully), Kembla Gran	ource Recovery Park	Company Details: INNACO PTY LTD Level 5, 79 Victoria Avenue CHATSWOOD 2067 PH: (02) 9417 7728 FAX: (02) 9417 8337 ABN: 33 119 715 052						
Description of Works: Visual inspection and data collecting										
Attachments:										
Developed by:	Arman Rashidi	Tel: 0410383424	Reviewed by:	Lars Herngren	Tel: 0448469382					
Signed		Date: 16/09/2019	Signed		Date: 16/09/2019					
Description of Equipment to be used (including minimum PPE)	<ul> <li>High Visibility Clothing</li> <li>Safety Boots</li> <li>Safety Glasses</li> <li>Disposable Gloves</li> </ul>	Qualifications of the personnel doing the work	<ul> <li>Work Cover Induction Card (Attached)</li> <li>Site Safety induction</li> </ul>	<ul> <li>Most Relevant Codes of Practice:</li> <li>OHS Consultation, 2001</li> <li>Work Health and Safety Act 2011</li> </ul>						
Other relevant Plant Equipment (to be registered in HSE 017)	• Nil	Site Personnel:	Site trained personnel and qualified personnel	Most Relevant Australian Standard: Nil						



## Safe Work Method Statement — Health & Safety Legislation

Note: Further relevant legislative requirements are identified in OHSE Plan, and are accessible by Project Manager

ACTS AND REGULATIONS:	CODES OF PRACTICE AND GUIDELINES	
<ul> <li>WHS Act, 2011</li> <li>WHS Regulation, 2011</li> <li>NSW Dangerous Goods Act, 1996</li> <li>QLD Workplace OHS Act, 1995</li> <li>QLD bangerous Goods Safety MGT Act 2001</li> <li>VIC OHS Act 2004</li> <li>VIC OHS Regulations 2007</li> <li>VIC Dangerous Goods Act 1985</li> <li>SA OHS Welfare Act 1986</li> <li>SA OHS Welfare Regulations 1995</li> <li>SA Dangerous Substances Act 1979</li> <li>TAS Workplace Health and Safety Regulations 1998</li> </ul>	NSW Codes of Practice and Guidelines         Excavation Work, 2001         Electrical Practices for Construction Work, 2007         Risk Assessment, 2001         Moving Plant on Construction Sites, 2004         Storage and Handling of Dangerous Goods, 2005         Work Near Overhead Power Lines, 2006         Amenities for Construction Work, 1997         OHS Consultation, 2001         Control of Workplace Hazardous Substances, 2006         Safe Work with Asbestos Guide, 2008         QLD Codes of Practice and Guidelines         Risk Management, 2007         Hazardous Substance, 2003         Manual Tasks, 2010         Mobile Cranes, 2006         Noise, 2004         Traffic Management, 2008         Plant, 2005         VIC Codes of Practice and Guidelines         Communicating OHS across languages, 2008         Workplace Amenities and Work Environment, 2008         Confined Spaces, 2008         Using Earthmoving Equipment near Overhead         First Aid in the Workplace, 2008         Prevention of Falls in General Construction, 2008         Removing Asbestos in Workplaces, 2008         Work safe Guidance note October 2010         —Asbestos Contaminated Soil	<ul> <li>SA Codes of Practice and Guidelines</li> <li>Manual Handling, 2006</li> <li>OH and First Aid in the Workplace, 2007</li> <li>Control of Workplace Hazardous Substances, 2006</li> <li>National Codes of Practice and Guidelines</li> <li>Safe Removal of Asbestos 2<sup>nd</sup> Edition NOHSC: 2002 (2005)</li> <li>Manual Tasks, 2007</li> <li>Prevention of Musculoskeletal Disorders Caused from Performing Manual Tasks</li> <li>Induction for Construction Work, 2007</li> <li>Standards</li> <li>Demolition of Structures AS2601—1991</li> <li>Safe Work in Confined Spaces AS/NZS 2865—2009</li> <li>Selection, Use and Maintenance of Respiratory Protective Devices AS/NZS 1715:1994</li> <li>AS/NZS 3012:2003 Electrical Installations —Construction and Demolition Sites</li> <li>AS3760:2003 In-service Safety Inspection and Testing of Electrical Equipment</li> <li>OFSC Audit Criteria</li> <li>OH3.3, OH12, SC3,4, H1-19</li> </ul>



#### Safe Work Method Statement — Personnel WHS Regulation 2011

Project:	Whytes Gully Leachate Treatment	Location:	Wollongong Waste and Resource	Supervisor: Omid Sayar			
	System		Grang	Signature:	Date 16/09/2019		

PERSONNEL INVOLVED		DUTIES	SKILLS/QUALIFICATIONS REQUIRED		
Name:	Signature				
Hamid Mehrazmay		Service Technician	White Card- Confined Space Rescuer		
Richard Selway		Service Technician	White Card		
Shahriyar Nasiri		Service and Automation Engineer	White Card- Confined Space Rescuer		
Arman Rashidi		Process and Operation Engineer	White Card- Confined Space Rescuer		
Omid Sayar		Manager-Process and Operation Engineering	White Card- Confined Space Rescuer		
Mahdi Madani		Process and Operation Engineer	White Card- Confined Space Rescuer		
Lars Herngren		Water Infrastructure Manager	White Card		



#### Safe Work Method Statement — Hazard and Risk Assessment WHS Regulation 2011

Refer to Risk Matrix on final page for details on Risk Levels

PROCEDURE:	POSSIBLE HAZARDS:	INITIAL RISK:		SK:	HAZARD CONTROLS:	HOC	ACTIONED BY:	NEW RISK LEVEL:		
		Р	С	RISK		1,2,3,4,5,6		Р	С	RISK
1. Access to site	Slips Trips & Falls	В	2	5	PPE to be worn- safety boots	6	Operator	D	2	12
	• Moving machinery, cars or cyclist hazard on entry and exit	В	2	5	<ul> <li>PPE to be worn – High Visibility Clothing</li> </ul>	5	Operator	D	2	12
	<ul> <li>Unknown work activities by others</li> </ul>	В	2	5	<ul> <li>Tool box talk on current activities on site and areas of no entry.</li> </ul>	5	Operator	D	2	12
	Unknown site specific safety requirements	В	2	5	Site induction	5	Operator	D	2	12
	<ul> <li>Toxic gases, and oxygen depletion</li> </ul>	С	1	4	• Use gas monitor, check before entering site and keep he monitor with worker while inside the plant room	5	Operator	D	4	21
2. Safe Movements within the work site	<ul> <li>Injury from other contractor works tasks on site</li> </ul>	В	2	5	<ul> <li>Adhere to site signage and procedures</li> <li>PPE –safety glasses, high visibility clothing and safety boots</li> <li>Report to site office for site induction for current site activities and restricted access areas.</li> </ul>	5,6	Operator	D	2	12
	Works being carried out overhead	В	2	5	<ul> <li>Adhere to site signage and do not enter barricaded off areas.</li> </ul>	3	Operator	D	2	12



PROCEDURE:	POSSIBLE HAZARDS:	INITIAL RISK:		SK:	HAZARD CONTROLS:		ACTIONED BY:	NEW RISK LEV		EVEL:
		Р	С	RISK		1,2,3,4,5,6		Р	С	RISK
					• Report to site office for site induction for current site activities and restricted access areas.					
	Onsite plant and machinery	В	2	5	<ul> <li>PPE – High visibility clothing</li> </ul>	6	Operator	D	2	12
		В	2	5	<ul> <li>Adhere to site signage and do not enter barricaded off areas.</li> </ul>	5	Operator	D	2	12
		В	2	5	<ul> <li>Make eye contact with plant operator before approaching moving plant.</li> </ul>	5	Operator	D	2	12
		В	2	5	<ul> <li>Follow directions of spotters if available, or stop and wait until it is safe to proceed.</li> </ul>	5	Operator	D	2	12
	• Slips, trips and falls	В	2	5	PPE – safety boots to be worn	6	Operator	D	2	12
3. Inspection of Areas at height	• Working at height	В	1	2	<ul> <li>Avoid works at height where possibly – relocate work items to ground to undertake works</li> <li>PPE to be worn safety boots</li> </ul>	1,6	Operator	D	1	7
	• Use of ladder to work at height	В	1	2	<ul> <li>Use only platform ladders with industrial rating (120kg)</li> <li>Visual Inspection of ladders required before every use.</li> </ul>	4	Operator	D	1	7
	• Slips Trips & Falls	В	2	5	• Ensure that your footing is stable with the use of safety boots for appropriate grip	5	Operator	D	1	7
	Tip over whilst working with platform ladder	В	1	2	<ul> <li>Only work within arm's length of ladder platform – do not over stretch.</li> </ul>	5	Operator	D	1	7



PROCEDURE:	EDURE: POSSIBLE HAZARDS: INITIAL RISK: HAZARD CONTROLS:	HAZARD CONTROLS:	HOC	ACTIONED BY:	NEW	EVEL:				
		Р	С	RISK		1,2,3,4,5,6		Р	С	RISK
4. Manual Handling	Lifting injuries	A	2	3	• Eliminate need for manual handling where possible by use of mobility assistance where possible, i.e. trolley/pallet jack	1	Operator	D	3	17
	Manual handling fatigue     leading to injury	В	4	14	Reduce distance between 5 Operator storage location of materials and use location		Operator	D	4	21
	Heavy (>20Kg) manual handling load where mobility assistance devices cannot be used.	В	3	9	• Utilise team lifting	5	Operator	D	4	21
	Back strain whilst manual handling	В	4	14	• Reduce load size of manual handling to 20kg Max and utilize appropriate manual handling techniques including lifting from between legs whilst using legs to raise load, and eliminate any twisting	5	Operator	D	4	21
	Slips trips and falls	В	4	14	<ul> <li>PPE to be worn safety boots</li> <li>Ensure there is space to move whilst carrying load.</li> <li>Review movement route for trip hazards prior to starting manual handling procedure.</li> </ul>	5	Operator	D	4	21
5. Exiting the work site	• Slips Trips & Falls	В	2	5	<ul> <li>PPE to be worn safety boots</li> <li>General House Keeping of designated work area before exiting the site</li> <li>Ensure clear access &amp; egress to work areas</li> </ul>	5,6	Operator	D	2	12



PROCEDURE:	POSSIBLE HAZARDS:	INITIAL RISK:		SK:	HAZARD CONTROLS:	HOC	ACTIONED BY:	NEW RISK LEVEL:		
		Р	С	RISK		1,2,3,4,5,6		Р	с	RISK
	<ul> <li>Moving machinery risks on entry and exit</li> </ul>	В	2	5	<ul> <li>PPE to be worn high visibility clothing</li> <li>Adhere to site signage and avoid areas of moving machinery.</li> </ul>	5,6	Operator	D	2	12
6. Collecting Data	• Hand, foot & hearing	С	2	8	<ul> <li>PPE to be worn boots/ high visibility clothing /safety glasses</li> </ul>	6	Operator	D	4	21
	• damage, crushing of limbs	С	4	18	<ul> <li>PPE to be worn boots/ high visibility clothing /safety glasses</li> </ul>	6	Operator	D	4	21
	• Slips Trips & Falls	В	2	5	<ul> <li>PPE to be worn boots/ high visibility clothing/safety glasses</li> </ul>	6	Operator	С	4	18



# Safe Work Method Statement — Risk Ranking Chart

			PROBABILITY							
				CERTAIN	LIKELY	POSSIBLE	UNLIKELY	REMOTE		
	CONSEQUENCES			Commonly Occurs	Has Occurred	Could Occur	Not Likely to Occur	Practically Impossible		
Equipment and Operations	Environmental Impact	Personal Injury		А	В	С	D	E		
More than \$500,000 loss	Catastrophic Environmental Event (publicity)	Fatality or Permanent Disability	1	1	2	4	7	11		
Up to \$500,000 loss	Major Environmental Event (prosecution)	Major LTI (>7 days lost from work)	2	3	5	8	12	16		
Up to \$100,000 loss	Serious Pollution (temporary/permanent damage)	Lost Time Injury	3	6	9	13	17	20		
Up to \$10,000 loss	Minor Pollution (minor spill - temporary damage)	Medical Treatment Injury	4	10	14	18	21	23		
Less than \$500 loss/No Damage	Nil Impacts/ Affects	First Aid/ No Injury	5	15	19	22	24	25		
				LEGEND:	HIGH RISK 1-6	MEDIUM RISK 7-15	LOW RISK 16-25			

16-25



### Safe Work Method Statement — Hierarchy of Controls (HOC)





Safe whs Re	<b>File No</b> .: 16746 – SWMS#2									
SWMS No: 2		Workplace: Wollongong Waste and Reso (Whytes Gully), Kembla Grar	ource Recovery Park ng	Company Details: INNACO PTY LTD Level 5, 79 Victoria Avenue CHATSWOOD 2067 PH: (02) 9417 7728 FAX: (02) 9417 8337 ABN: 33 119 715 052						
Process: Material Delivery										
Attachments:					-					
Developed by:	Arman Rashidi	Tel: 0410383424	Reviewed by:	Lars Herngren	Tel: 0448469382					
Signed		Date: 16/09/2019	Signed		Date: 16/09/2019					
Description of equipment to be used (including minimum PPE)	<ul> <li>Hard hat</li> <li>High visibility clothing</li> <li>Steel Cap Safety Boots</li> <li>Safety Glasses</li> <li>Hearing protection</li> <li>Gloves</li> </ul>	Qualifications of the personnel doing the work	<ul> <li>Work Cover Induction Card (Attached)</li> <li>Site Safety induction</li> </ul>	<ul> <li>Most Relevant Codes of Practice:</li> <li>Work Health and Safety Act 2011</li> <li>OHS Consultation, 2001</li> <li>Managing the Risk of falls at Workplaces</li> </ul>						
Other relevant equipment (to be registered in HSE 017)	Slings and Chains Pallet Jack Chain Block (2T)	Site Personnel:	Site trained personnel and qualified personnel	Most Relevant Australian Standard: Nil						



## Safe Work Method Statement — Health & Safety Legislation

Note: Further relevant legislative requirements are identified in OHSE Plan, and are accessible by Project Manager

ACTS AND REGULATIONS:	CODES OF PRACTICE AND GUIDELINES			
<ul> <li>WHS Act, 2011</li> <li>WHS Regulation, 2011</li> <li>NSW Dangerous Goods Act, 1996</li> <li>QLD Workplace OHS Act, 1995</li> <li>QLD bangerous Goods Safety MGT Act 2001</li> <li>VIC OHS Act 2004</li> <li>VIC OHS Regulations 2007</li> <li>VIC Dangerous Goods Act 1985</li> <li>SA OHS Welfare Act 1986</li> <li>SA OHS Welfare Regulations 1995</li> <li>SA Dangerous Substances Act 1979</li> <li>TAS Workplace Health and Safety Regulations 1998</li> </ul>	NSW Codes of Practice and Guidelines         Excavation Work, 2001         Electrical Practices for Construction Work, 2007         Risk Assessment, 2001         Moving Plant on Construction Sites, 2004         Managing the Risk of Falls at Workplaces         Storage and Handling of Dangerous Goods, 2005         Work Near Overhead Power Lines, 2006         Amenities for Construction Work, 1997         OHS Consultation, 2001         Control of Workplace Hazardous Substances, 2006         Safe Work with Asbestos Guide, 2008         QLD Codes of Practice and Guidelines         Risk Management, 2007         Hazardous Substance, 2003         Manual Tasks, 2010         Mobile Cranes, 2006         Noise, 2004         Traffic Management, 2008         Plant, 2005         VIC Codes of Practice and Guidelines         Communicating OHS across languages, 2008         Workplace Amenities and Work Environment, 2008         Confined Spaces, 2008         Using Earthmoving Equipment near Overhead         First Aid in the Workplace, 2008         Prevention of Falls in General Construction, 2008         Removing Asbestos in Workplaces, 2008         Work safe Guidance note October 2010	<ul> <li>SA Codes of Practice and Guidelines</li> <li>Manual Handling, 2006</li> <li>OH and First Aid in the Workplace, 2007</li> <li>Control of Workplace Hazardous Substances, 2006</li> <li>National Codes of Practice and Guidelines</li> <li>Safe Removal of Asbestos 2<sup>nd</sup> Edition NOHSC: 2002 (2005)</li> <li>Manual Tasks, 2007</li> <li>Prevention of Musculoskeletal Disorders Caused from Performing Manual Tasks</li> <li>Induction for Construction Work, 2007</li> <li>Standards</li> <li>Demolition of Structures AS2601—1991</li> <li>Safe Work in Confined Spaces AS/NZS 2865—2009</li> <li>Selection, Use and Maintenance of Respiratory Protective Devices AS/NZS 1715:1994</li> <li>AS/NZS 3012:2003 Electrical Installations —Construction and Demolition Sites</li> <li>AS3760:2003 In-service Safety Inspection and Testing of Electrical Equipment</li> <li>OFSC Audit Criteria</li> <li>OH3.3, OH12, SC3,4, H1-19</li> </ul>		



#### Safe Work Method Statement — Personnel WHS Regulation 2011

Project:	Whytes Gully Leachate Treatment	Location:	Wollongong Waste and Resource	Supervisor: Omid Sayar			
	ystem		Grang	Signature:	Date 16/09/2019		

PERSONNEL INVOLVED		DUTIES	SKILLS/QUALIFICATIONS REQUIRED
Name:	Signature		
Hamid Mehrazmay		Service Technician	White Card- Confined Space Rescuer
Richard Selway		Service Technician	White Card
Shahriyar Nasiri		Service and Automation Engineer	White Card- Confined Space Rescuer
Arman Rashidi		Process and Operation Engineer	White Card- Confined Space Rescuer
Omid Sayar		Manager-Process and Operation Engineering	White Card- Confined Space Rescuer
Mahdi Madani		Technical Manager	White Card- Confined Space Rescuer
Lars Herngren		Water Infrastructure Manager	White Card



#### Safe Work Method Statement — Hazard and Risk Assessment WHS Regulation 2011

Refer to Risk Matrix on final page for details on Risk Levels

PROCEDURE:	POSSIBLE HAZARDS:	INI	TIAL RI	SK:	HAZARD CONTROLS:	HOC	ACTIONED BY:	NEW RISK LEVEL:		
		Р	С	RISK		1,2,3,4,5,6		Р	С	RISK
1. Access to site	<ul> <li>Slips Trips &amp; Falls</li> <li>Moving machinery risks on entry and exit</li> </ul>	В	4	14	Refer to SWMS #1	5,6	Operator	D	3	17
2. Delivery of materials to site.	Delivery truck access	С	2	8	Delivery truck access in accordance with WCC Pedestrian and Traffic Management Plan	5	Operator	D	2	12
	<ul> <li>Truck driver competency inadequate</li> </ul>	С	2	8	• Truck driver to complete Innaco Truck Driver Health Safety Environmental Induction for approval by WCC prior to delivery.	5	Operator	D	2	12
	Moving machinery	В	2	5	PPE to be worn - high visibility clothing	6	Operator	D	2	12
	Machinery operation	В	2	5	<ul> <li>Operator to be competent in machine operations with appropriate ticket if required.</li> </ul>	5	Operator	D	2	12
	Machine working order	В	2	5	• Machine to undergo a prestart safety checklist with an inspection of service/maintenance history by a competent person	5	Operator	D	2	12



PROCEDURE:	POSSIBLE HAZARDS:	INI	TIAL RI	SK:	HAZARD CONTROLS: HO	HOC	ACTIONED BY:	NEW RISK LEVEL:				
		Р	С	RISK		1,2,3,4,5,6		Р	С	RISK		
	• Weight of load	В	2	5	<ul> <li>Provide copy of delivery schedule (attached) to machine operator prior to offloading.</li> </ul>	5	Operator	D	2	12		
3. Load transported to lifting hook location (nominated setdown point) via mechanical means (site plant). Innaco to offload from delivery truck and transport to lifting hook location.	<ul> <li>Load excessive for ramp capacity</li> </ul>	С	2	8	<ul> <li>Nominated loads of goods to be provided as delivery schedule to be approved by WCC prior to use.</li> </ul>	4	Operator	D	2	12		
	<ul> <li>Poor placement of load creating load swing on pickup</li> </ul>	В	2	5	<ul> <li>Nominated load setdown/pickup area accessible by forklift of pallet jack</li> </ul>	5	Operator	D	2	12		
4. Move equipment within treatment system area by	Loss of control of load	С	3	14	<ul> <li>Maintain a slow and steady pace with load on pallet jack</li> </ul>	5	Operator	D	3	17		
way of pallet jack	• Pallet jack failure	С	3	14	• Prestart checklist to be completed including review of any log book/maintenance history records by a competent person.	5	Operator	D	3	17		
	Weight of load	С	4	18	<ul> <li>Pallet jack to have SWL appropriate for the loads to be shifted.</li> </ul>	5	Operator	D	4	21		
	Foot crashing injury from moving load	С	3	14	Steel Cap Safety boots to be worn	6	Operator	D	3	17		



# Safe Work Method Statement — Risk Ranking Chard

						PROBABILITY		
				CERTAIN	LIKELY	POSSIBLE	UNLIKELY	REMOTE
	CONSEQUENCES			Commonly Occurs	Has Occurred	Could Occur	Not Likely to Occur	Practically Impossible
Equipment and Operations	Environmental Impact	Personal Injury		А	В	С	D	E
More than \$500,000 loss	Catastrophic Environmental Event (publicity)	Fatality or Permanent Disability	1	1	2	4	7	11
Up to \$500,000 loss	Major Environmental Event (prosecution)	Major LTI (>7 days lost from work)	2	3	5	8	12	16
Up to \$100,000 loss	Serious Pollution (temporary/permanent damage)	Lost Time Injury	3	6	9	13	17	20
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Less than \$500 loss/No Damage	Nil Impacts/ Affects	First Aid/ No Injury	5	15	19	22	24	25
				LEGEND:	HIGH RISK 1-6	MEDIUM RISK 7-15	LOW RISK 16-25	



### Safe Work Method Statement — Hierarchy of Controls (HOC)





<b>Safe</b> WHS Re	<b>File No</b> .: 16746 – SWMS#3				
SWMS No: 3		Workplace: Wollongong Waste and Reso (Whytes Gully), Kembla Gran	ource Recovery Park ng	Company Details: INNACO PTY LTD Level 5, 79 Victoria Avenue CHATSWOOD 2067 PH: (02) 9417 7728 FAX: (02) ABN: 33 119 715 052	9417 8337
Process: Plant Seeding and					
Attachments: MSDS's					
Developed by:	Arman Rashidi	Tel: 0410383424	Reviewed by:	Lars Herngren	Tel: 0448469382
Signed		Date: 16/09/2019	Signed		Date: 16/09/2019
Description of equipment to be used (including minimum PPE)	<ul> <li>Hard hat</li> <li>High visibility clothing</li> <li>Steel Cap Safety Boots</li> <li>Safety Glasses</li> <li>Hearing protection</li> <li>Gloves</li> </ul>	Qualifications of the personnel doing the work	<ul> <li>Work Cover Induction Card (Attached)</li> <li>Site Safety induction</li> </ul>	Most Relevant Codes of Pra • Work Health and Safety Act • OHS Consultation, 2001 • Managing the Risk of falls a	actice: 2011 t Workplaces
Other relevant equipment (to be registered in HSE 017)		Site Personnel:	Site trained personnel and qualified personnel	Most Relevant Australian St Nil	tandard:



## Safe Work Method Statement — Health & Safety Legislation

Note: Further relevant legislative requirements are identified in OHSE Plan, and are accessible by Project Manager

ACTS AND REGULATIONS:	CODES OF PRACTICE AND GUIDELINES	
<ul> <li>WHS Act, 2011</li> <li>WHS Regulation, 2011</li> <li>NSW Dangerous Goods Act, 1996</li> <li>QLD Workplace OHS Act, 1995</li> <li>QLD workplace OHS Reg 2008</li> <li>QLD Dangerous Goods Safety MGT Act 2001</li> <li>VIC OHS Act 2004</li> <li>VIC OHS Regulations 2007</li> <li>VIC Dangerous Goods Act 1985</li> <li>SA OHS Welfare Act 1986</li> <li>SA OHS Welfare Regulations 1995</li> <li>SA Dangerous Substances Act 1979</li> <li>TAS Workplace Health and Safety Act 1995</li> <li>TAS Workplace Health and Safety Regulations 1998</li> </ul>	NSW Codes of Practice and Guidelines         Excavation Work, 2001         Electrical Practices for Construction Work, 2007         Risk Assessment, 2001         Moving Plant on Construction Sites, 2004         Managing the Risk of Falls at Workplaces         Storage and Handling of Dangerous Goods, 2005         Work Near Overhead Power Lines, 2006         Amenities for Construction Work, 1997         OHS Consultation, 2001         Control of Workplace Hazardous Substances, 2006         Safe Work with Asbestos Guide, 2008         QLD Codes of Practice and Guidelines         Risk Management, 2007         Hazardous Substance, 2003         Manual Tasks, 2010         Mobile Cranes, 2006         Noise, 2004         Traffic Management, 2008         Plant, 2005         VIC Codes of Practice and Guidelines         Communicating OHS across languages, 2008         Workplace Amenities and Work Environment, 2008         Confined Spaces, 2008         Using Earthmoving Equipment near Overhead         First Aid in the Workplace, 2008         Prevention of Falls in General Construction, 2008         Removing Asbestos in Workplaces, 2008         Work safe Guidance note October 2010	<ul> <li>SA Codes of Practice and Guidelines</li> <li>Manual Handling, 2006</li> <li>OH and First Aid in the Workplace, 2007</li> <li>Control of Workplace Hazardous Substances, 2006</li> <li>National Codes of Practice and Guidelines</li> <li>Safe Removal of Asbestos 2<sup>nd</sup> Edition NOHSC: 2002 (2005)</li> <li>Manual Tasks, 2007</li> <li>Prevention of Musculoskeletal Disorders Caused from Performing Manual Tasks</li> <li>Induction for Construction Work, 2007</li> <li>Standards</li> <li>Demolition of Structures AS2601—1991</li> <li>Safe Work in Confined Spaces AS/NZS 2865—2009</li> <li>Selection, Use and Maintenance of Respiratory Protective Devices AS/NZS 1715:1994</li> <li>AS/NZS 3012:2003 Electrical Installations —Construction and Demolition Sites</li> <li>AS3760:2003 In-service Safety Inspection and Testing of Electrical Equipment</li> <li>OFSC Audit Criteria</li> <li>OH3.3, OH12, SC3,4, H1-19</li> </ul>



#### Safe Work Method Statement — Personnel WHS Regulation 2011

Project:	Whytes Gully Leachate Treatment	Location:	Wollongong Waste and Resource	Supervisor: Omid Sayar	
	Cystem -		Grang	Signature:	Date 16/09/2019

PERSONNEL INVOLVED		DUTIES	SKILLS/QUALIFICATIONS REQUIRED
Name:	Signature		
Hamid Mehrazmay		Service Technician	White Card- Confined Space Rescuer
Richard Selway		Service Technician	White Card
Shahriyar Nasiri		Service and Automation Engineer	White Card- Confined Space Rescuer
Arman Rashidi		Process and Operation Engineer	White Card- Confined Space Rescuer
Omid Sayar		Manager-Process and Operation Engineering	White Card- Confined Space Rescuer
Mahdi Madani		Technical Manager	White Card- Confined Space Rescuer
Lars Herngren		Water Infrastructure Manager	White Card



#### Safe Work Method Statement — Hazard and Risk Assessment WHS Regulation 2011

Refer to Risk Matrix on final page for details on Risk Levels

PROCEDURE:	POSSIBLE HAZARDS:	INI		SK:	HAZARD CONTROLS:	HOC	ACTIONED BY:	NEW	NEW RISK LEVEL		
		Р	С	RISK		1,2,3,4,5,6		Р	С	RISK	
1. Access to Site	Slips Trips & Falls	В	2	5	PPE to be worn- safety boots	6	Operator	D	3	17	
	<ul> <li>Moving machinery hazard on entry and exit</li> </ul>	В	2	5	<ul> <li>PPE to be worn – High Visibility Clothing</li> <li>Make eye contact with driver, and remain out of vehicle path</li> </ul>	5	Operator	D	3	17	
	Unknown work activities by others	В	2	5	• Daily prestart on current activities on site and areas of no entry.	5	Operator	D	3	17	
	Unknown site specific safety requirements	В	2	5	<ul> <li>Site induction</li> <li>Minimum site PPE of steel cap safety boots, high visibility clothing, hard hat, safety glasses</li> </ul>	5	Operator	D	3	17	
2. Pre-Start biological start up	Slips Trips & Falls	В	2	5	PPE to be worn- safety boots	6	Operator	D	3	17	
	<ul> <li>Moving machinery hazard on entry and exit</li> </ul>	В	2	5	<ul> <li>PPE to be worn – High Visibility Clothing</li> <li>Make eye contact with driver, and remain out of vehicle path</li> </ul>	5	Operator	D	3	17	
	Unknown work activities by	В	2	5	Daily prestart on current	5	Operator	D	3	17	



PROCEDURE:	POSSIBLE HAZARDS:	INI	TIAL RI	SK:	HAZARD CONTROLS:		ACTIONED BY:	NEW	RISK L	K LEVEL:	
		Р	С	RISK		1,2,3,4,5,6		Р	С	RISK	
	others				activities on site and areas of no entry.						
3. Safe Movements Within the Work Site	<ul> <li>Injury from other contractor works tasks on site</li> </ul>	В	2	5	<ul> <li>Adhere to site signage and procedures</li> </ul>	5	Operator	D	3	17	
		В	2	5	<ul> <li>PPE – hard hat, safety glasses, high visibility clothing and safety boots</li> </ul>	6	Operator	D	3	17	
		В	2	5	• Report to site office for site induction for current site activities and restricted access areas.	5	Operator	D	3	17	
	<ul> <li>Works being carried out overhead</li> </ul>	В	2	5	<ul> <li>Adhere to site signage and do not enter barricaded off areas.</li> </ul>	3	Operator	D	3	17	
	<ul> <li>Falling object from works overhead</li> </ul>	В	2	5	PPE – hard hat to be worn at all times	6	Operator	D	3	17	
	Onsite plant and machinery	В	2	5	PPE – High visibility clothing	6	Operator	D	3	17	
		В	2	5	<ul> <li>Adhere to site signage and do not enter barricaded off areas</li> <li>Make eye contact with plant operator and stay out of vehicle path</li> </ul>	5	Operator	D	3	17	
	Slips, trips and falls	В	2	5	<ul> <li>Stay aware of site trip hazards and notify supervisor of any unsafe areas.</li> </ul>	5	Operator	С	4	18	
		В	2	5	PPE to be worn- safety boots	6	Operator	С	4	18	



PROCEDURE:	POSSIBLE HAZARDS:	INI	TIAL RI	SK:	HAZARD CONTROLS:	HOC	ACTIONED BY:	NEW	RISK LEVEL:	
		Р	С	RISK		1,2,3,4,5,6		Р	С	RISK
4. Inspection of Areas at Height	• Falling/working at height	В	1	2	• Avoid works at height where possibly – relocate work items to ground to undertake works	1	Operator	D	3	17
	• Use of ladder	В	1	2	<ul> <li>Use of platform ladder only</li> <li>Undertake prestart check of ladder prior to use, styles and treads for damage. Ensure support struts are in working order.</li> </ul>	5	Operator	D	3	17
	Unstable footing	В	1	2	• PPE to be worn (Safety Boots)	6	Operator	D	3	17
	• Fall from ladder	С	1	4	• Use only platform ladders with industrial rating and remain within styles when ascending and descending.	5	Operator	D	3	17
	Tip over whilst working with platform ladder	С	1	4	<ul> <li>Only work within arms-length of ladder platform – do not over stretch.</li> </ul>	5	Operator	D	3	17
5. Diffusers Inspection	Entry to confined space (Entry will be avoided as much as possible)	С	1	4	Perform the inspection during tank assemble	1	Operator	E	5	25
		С	1	4	• Follow site safety confined space entry permit and procedure. (Innaco entry permit to be obtained)	5	Operator	D	4	21
		С	1	4	• Only approved persons trained in confined space entry to enter the confined space.	5	Operator	D	4	21



PROCEDURE:	POSSIBLE HAZARDS:	INI		SK:	HAZARD CONTROLS:	HOC	ACTIONED BY:	NEW RISK LEVEL:			
		Р	С	RISK		1,2,3,4,5,6		Р	С	RISK	
		С	1	4	<ul> <li>Use of gas detection as per entry permit.</li> <li>Calibration/certification of equipment to be detailed in equipment schedule HSE 017</li> </ul>	5	Operator	D	4	21	
	Inflow to tank during inspection	С	1	4	<ul> <li>Isolation of all connection to the tank as per-entry permit following LOTO procedure.</li> </ul>	5	Operator	D	4	21	
6. Manual Handling	Lifting injuries	A	2	3	<ul> <li>Eliminate need for manual handling where possible by use of mobility assistance where possible, i.e. trolley/pallet jack</li> <li>Refer to attached Fact Sheet for correct lifting techniques and more information.</li> </ul>	1	Operator	D	3	17	
	Manual handling fatigue     leading to injury	С	1	4	<ul> <li>Reduce distance between storage location of materials and use location</li> </ul>	5	Operator	D	5	24	
	Heavy (>20Kg) manual handling load where mobility assistance devices cannot be used.	С	2	8	• Utilise team lifting	5	Operator	D	5	24	
	Back strain whilst manual handling	С	3	13	• Reduce load size of manual handling to 20kg Max and utilize appropriate manual handling techniques including lifting from between legs whilst using legs to raise load, and eliminate any twisting	5	Operator	D	4	21	
	Slips trips and falls	В	2	5	• PPE to be worn (Safety Boots)	6	Operator	С	4	18	



PROCEDURE:	POSSIBLE HAZARDS:	INITIAL RISK:		SK:			ACTIONED BY:	NEW RISK LEVEL:		
		Р	С	RISK		1,2,3,4,5,6		Р	С	RISK
		В	2	5	• Ensure there is space to move whilst carrying load.	5	Operator	С	4	18
		В	2	5	<ul> <li>Review movement route for trip hazards prior to starting manual handling procedure.</li> </ul>	5	Operator	С	4	18
	Site plant and machinery movements	В	2	5	<ul> <li>Wear high visibility PPE and keep clear of all machinery movements.</li> </ul>	Operator	С	4	18	
7. Working with Chemicals	• Exposure to chemicals	С	3	13	• PPE to be worn Respirator, chemical goggles, chemical resistant coveralls and Chemical resistant gloves	6	Operator	С	5	22
		С	3	13	<ul> <li>Safety Shower/eye washer to be installed and operational prior to the use of chemicals on site</li> <li>Ensure and spills are cleaned immediately, even within bunded areas</li> </ul>	5	Operator	С	5	22
		С	3	13	Dosing pumps to be tested with potable water before introducing any chemical	5	Operator	С	5	22
		С	3	13	<ul> <li>SDS readily available on site</li> <li>Ensure safety shower is operational</li> </ul>	5	Operator	С	5	22
		С	3	13	<ul> <li>Tanks to be filled to specified levels in a controlled fashion to avoid spills and overfilling.</li> <li>No mixing of chemicals is to</li> </ul>	5	Operator	С	5	22



PROCEDURE:	POSSIBLE HAZARDS:	INITIAL RISK:		SK:	HAZARD CONTROLS:	HOC	ACTIONED BY:	NEW RISK LEVEL:			
		Р	С	RISK		1,2,3,4,5,6		Р	С	RISK	
					take place.						
	• Fumes from Chemicals	С	4	18	<ul> <li>PPE to be worn chemical goggles/full face shield Chemical resistant gloves and chemical resistant coveralls.</li> </ul>	6	Operator	С	5	22	
		С	3	13	<ul> <li>Dosing pumps to be tested with portable water before introducing any chemical</li> </ul>	5	Operator	С	5	22	
		С	3	13	<ul> <li>Do not mix chemicals and verify tank and chemical prior to filling</li> </ul>	5	Operator	С	5	22	
		С	3	13	<ul> <li>Tanks to be clean and empty from of water before adding any chemicals</li> </ul>	5	Operator	С	5	22	
		С	3	13	• SDS to be readily available on site	5	Operator	С	5	22	
		С	3	13	<ul> <li>Tanks to be filled to specified levels in a controlled fashion to avoid spills and overfilling</li> </ul>	5	Operator	С	5	22	
	• Spills (General)	С	3	13	Make sure spill kit available on site	5	Operator	С	5	22	
	• Disposal of spills (Small)	С	4	18	• Contain small spills with spill control material, shovel and place in a labeled, sealed container for off-site disposal	5	Operator	D	4	21	
	Disposal of Sills (Large)	С	4	18	Transfer large spillage with transfer pump to labeled,	5	Operator	D	5	24	



PROCEDURE:	POSSIBLE HAZARDS:	INITIAL RISK:		SK:		HOC	ACTIONED BY:	NEW RISK L		EVEL:
		Р	С	RISK		1,2,3,4,5,6		Р	С	RISK
					sealable containers for product recovery or safe disposal					
	Storage of chemicals	В	3	9	• Chemical only to be stored in approved labeled storage containers with lids to be closed at all times other than for use.	5	Operator	D	3	17
		В	3	9	<ul> <li>All chemical storage devises are to be bunded, including temporary storage areas.</li> </ul>	5	Operator	D	3	17
8. Chemical Dosing Pump Start-Up	• Exposure to chemicals	С	4	18	<ul> <li>PPE to be worn (Respirator, chemical goggles and Chemical resistant gloves)</li> </ul>	6	Operator	С	5	22
		С	3	13	<ul> <li>Dosing pumps to be tested with potable water before introducing any chemical</li> <li>Ensure safety shower is operational prior to start</li> </ul>	5	Operator	С	5	22
	• Fumes from Chemicals	С	4	18	PPE to be worn (Respirator, chemical goggles and Chemical resistant gloves)	6	Operator	С	5	22
		С	3	13	• Do not mix chemicals and verify tank and chemical prior to filling	5	Operator	С	5	22
		С	3	13	• Tanks to be clean and empty from of water before adding any chemicals	5	Operator	С	5	22
		С	3	13	Understand and adhere to requirements of SDS located in	5	Operator	С	5	22



PROCEDURE:	POSSIBLE HAZARDS:	INITIAL RISK:		SK:	HAZARD CONTROLS:		ACTIONED BY:	NEW RISK LEVEL:		EVEL:
		Р	С	RISK		1,2,3,4,5,6		Р	С	RISK
					Innaco's EHS plan, Appendix "E"					
		С	3	13	<ul> <li>Tanks to be filled to specified levels in a controlled fashion to avoid spills and overfilling</li> </ul>	5	Operator	С	5	22
9. Motor start up (Pumps and Blowers)	• Hand, Foot & Hearing Damage	С	3	13	• Safety glasses, and safety boots to be worn. Ear protection to be worn for motors with no acoustic hood or where noise is excessive.	Operator	D	4	21	
	• Electrical connections	С	1	4	<ul> <li>Pre start check that all 5 Operate electrical boxes are covered and closed properly.</li> <li>Any electrical issues identified or augmentation required to be addressed by a qualified electrician only.</li> </ul>		Operator	E	4	23
	Motor malfunction	С	4	18	<ul> <li>Start up to cease if there is any abnormal vibration, heat, noise smell or leak.</li> </ul>	5	Operator	D	4	21
		С	4	18	<ul> <li>Keep all unnecessary personnel away from the motor. Motor test to be undertaken by appropriately qualified persons only.</li> </ul>	3	Operator	D	4	21
10. Colleting of water samples	• Exposure pathogenic microorganisms	В	3	9	• PPE (safety glasses, gloves)	6	Operator	D	5	24
		В	3	9	<ul> <li>Wash hands with antibacterial soap when finished</li> </ul>	5	Operator	D	5	24



PROCEDURE:	POSSIBLE HAZARDS:	INITIAL RISK:		SK:	HAZARD CONTROLS:	HOC	ACTIONED BY:	NEW RISK LEVEL:		
		Р	С	RISK		1,2,3,4,5,6		Р	С	RISK
		В	3	9	<ul> <li>Don't touch your face, mouth, nose during the procedure</li> </ul>	5	Operator	D	5	24
	<ul> <li>Consumption of Pathogenic microorganisms</li> </ul>	D	2	12	Use dedicated/ labeled sampling containers	5	Operator	E	4	23
• Slip		D	2	12	<ul> <li>Wash hands with antibacterial soap when finished</li> </ul>	5	Operator	E	4	23
		D	2	12	• Don't touch your face, mouth, nose during the procedure	5	Operator	E	4	23
	• Slip, trip and fall	В	2	5	Maintain stable footing with steel cap safety boots	5	Operator	С	4	18
		В	2	5	PPE to be worn boots/ hard hat/ high visibility clothing /safety glasses	6	Operator	С	4	18
	• Spill	В	2	5	Don't over fill sampling containers	5	Operator	С	4	18
		В	2	5	Dispose samples after testing	3	Operator	С	4	18
		В	2	5	Make sure lids are closed properly	3	Operator	С	4	18
		В	2	5	Keep spill kit available on site	5	Operator	С	4	18
11. Onsite water testing	Exposure pathogenic microorganisms	В	3	9	• PPE (safety glasses, gloves)	6	Operator	D	5	24
		В	3	9	Wash hands with antibacterial soap when finished	5	Operator	D	5	24



PROCEDURE:	POSSIBLE HAZARDS:	INITIAL RISK:		SK:		HOC	ACTIONED BY:	NEW	EVEL:	
		Р	С	RISK		1,2,3,4,5,6		Р	С	RISK
		В	3	9	<ul> <li>Don't touch your face, mouth, nose during the procedure</li> </ul>	3	Operator	D	5	24
	Consumption of Pathogenic microorganisms	D	2	12	<ul> <li>Use proper PPE according to the sampling procedure</li> </ul>	6	Operator	E	4	23
		D	2	12	<ul> <li>Use dedicated/ labeled sampling containers</li> </ul>	5	Operator	E	4	23
		D	2	12	<ul> <li>Wash hands with antibacterial soap when finished</li> </ul>	5	Operator	E	4	23
		D	2	12	<ul> <li>Don't touch your face, mouth, nose during the procedure</li> </ul>	5	Operator	E	4	23
	• Slip, trip and fall	В	2	5	<ul> <li>Maintain stable footing with steel cap safety boots</li> </ul>	5	Operator	С	4	18
		В	2	5	<ul> <li>PPE to be worn boots/ hard hat/ high visibility clothing /safety glasses</li> </ul>	6	Operator	С	4	18
	• Spill	С	4	18	<ul> <li>Don't over fill sampling containers</li> </ul>	5	Operator	D	5	24
		С	4	18	Dispose samples after testing	3	Operator	D	5	24
		С	4	18	Make sure lead are closed     properly	3	Operator	D	5	24
		С	4	18	Keep spill kit available on site	5	Operator	D	5	24
		С	4	18	<ul> <li>Clean containers and equipment after every use</li> </ul>	5	Operator	D	5	24



PROCEDURE:	POSSIBLE HAZARDS:	INITIAL RISK:		SK:	HAZARD CONTROLS:	HOC	ACTIONED BY:	NEW	RISK LI	EVEL:
		Р	С	RISK		1,2,3,4,5,6		Р	С	RISK
12. Offsite water testing	Exposure pathogenic microorganisms	С	3	13	• PPE (safety glasses, gloves)	6	Operator	D	5	24
		С	3	13	<ul> <li>Wash hands with antibacterial soap when finished</li> </ul>	5	Operator	D	5	24
		С	3	13	• Don't touch your face, mouth, nose during the procedure	5	Operator	D	5	24
	<ul> <li>Consumption of Pathogenic microorganisms</li> </ul>	D	2	12	<ul> <li>Use proper PPE according to the sampling procedure</li> </ul>	6	Operator	E	4	23
		D	2	12	<ul> <li>Use dedicated/ labeled sampling containers</li> </ul>	5	Operator	E	4	23
		D	2	12	<ul> <li>Wash hands with antibacterial soap when finished</li> </ul>	5	Operator	Е	4	23
		D	2	12	<ul> <li>Don't touch your face, mouth, nose during the procedure</li> </ul>	5	Operator	E	4	23
	• Slip, trip and fall	В	2	5	<ul> <li>Maintain stable footing with steel cap safety boots</li> </ul>	5	Operator	С	4	18
		В	2	5	<ul> <li>PPE to be worn boots/ hard hat/ high visibility clothing /safety glasses</li> </ul>	6	Operator	С	4	18
	• Spill	С	5	22	<ul> <li>Don't over fill sampling containers</li> </ul>	3	Operator	D	5	24
		С	5	22	• Make sure lid is closed properly	5	Operator	D	5	24



PROCEDURE:	POSSIBLE HAZARDS:	INITIAL RISK:		ISK:			ACTIONED BY:	NEW RISK LEVEL:		
		Р	С	RISK		1,2,3,4,5,6		Р	С	RISK
		С	5	22	Clean containers and equipment after every use	5	Operator	D	5	24
13. Data Log	• Hand, foot & hearing	С	2	8	PPE to be worn boots/ hard hat/ high visibility clothing /safety glasses	6	Operator	D	4	21
	• damage, crushing of limbs	С	4	18	PPE to be worn boots/ hard hat/ high visibility clothing /safety glasses	6	Operator	D	4	21
	Slips Trips & Falls	В	2	5	PPE to be worn boots/ hard hat/ high visibility clothing/safety glasses	6	Operator	С	4	18
14. Seeding The Plant	• Exposure to pathogenic microorganisms	С	3	13	<ul> <li>PPE to be worn non-porous overalls, chemical safety glasses/full face shield, chemical resistant gloves</li> <li>Understand and adhere to requirements of SDS located in Innaco's EHS plan, Appendix "E"</li> </ul>	6	Operator	С	4	18
	• Spill	В	2	5	Keep spill kit available on site	5	Operator	С	4	18
		В	2	5	• Don't overfill any tank and keep a safety free board	5	Operator	С	4	18
		В	2	5	<ul> <li>Make sure drain line are unblocked and sump pump is functioning</li> <li>Understand and adhere to requirements of SDS located in Innaco's EHS plan, Appendix</li> </ul>	5	Operator	С	4	18



PROCEDURE:	POSSIBLE HAZARDS:	INITIAL RISK:		SK:	HAZARD CONTROLS:	HOC	ACTIONED BY:	NEW RISK		EVEL:
		Р	С	RISK		1,2,3,4,5,6		Р	С	RISK
					"E"					
		В	2	5	<ul> <li>Consider dry sludge for seeding the plant</li> </ul>	2	Operator	С	4	18



# Safe Work Method Statement — Risk Ranking Chard

				PROBABILITY							
				CERTAIN	LIKELY	POSSIBLE	UNLIKELY	REMOTE			
	CONSEQUENCES			Commonly Occurs	Has Occurred	Could Occur	Not Likely to Occur	Practically Impossible			
Equipment and Operations	Environmental Impact	Personal Injury		А	В	с	D	E			
More than \$500,000 loss	Catastrophic Environmental Event (publicity)	Fatality or Permanent Disability	1	1	2	4	7	11			
Up to \$500,000 loss	Major Environmental Event (prosecution)	Major LTI (>7 days lost from work)	2	3	5	8	12	16			
Up to \$100,000 loss	Serious Pollution (temporary/permanent damage)	Lost Time Injury	3	6	9	13	17	20			
Up to \$10,000 loss	Minor Pollution (minor spill - temporary damage)	Medical Treatment Injury	4	10	14	18	21	23			
Less than \$500 loss/No Damage	Nil Impacts/ Affects	First Aid/ No Injury	5	15	19	22	24	25			
				LEGEND:	HIGH RISK 1-6	MEDIUM RISK 7-15	LOW RISK 16-25				



### Safe Work Method Statement — Hierarchy of Controls (HOC)





<b>Safe</b> WHS Re	File No.: 16746 – SWMS#4					
SWMS No: 4		Workplace: Wollongong Waste and Reso (Whytes Gully), Kembla Grar	ource Recovery Park ng	Company Details: INNACO PTY LTD Level 5, 79 Victoria Avenue CHATSWOOD 2067 PH: (02) 9417 7728 FAX: (02) 9417 8337 ABN: 33 119 715 052		
Process: Working with Che	micals					
Attachments: MSDS's						
Developed by:	Arman Rashidi	Tel: 0410383424	Reviewed by:	Lars Herngren	Tel: 0448469382	
Signed		Date: 16/09/2019	Signed		Date: 16/09/2019	
Description of equipment to be used (including minimum PPE)	<ul> <li>Hard hat</li> <li>High visibility clothing</li> <li>Steel Cap Safety Boots</li> <li>Safety Glasses</li> <li>Hearing protection</li> <li>Gloves</li> </ul>	Qualifications of the personnel doing the work	<ul> <li>Work Cover Induction card</li> <li>Site Safety induction</li> </ul>	tion card on • Work Health and Safety Act 2011 • OHS Consultation, 2001 • Managing the Risk of falls at Workplaces		
Other relevant equipment (to be registered in HSE 017)		Site Personnel:	Site trained personnel and qualified personnel Nil		tandard:	


## Safe Work Method Statement — Health & Safety Legislation

Note: Further relevant legislative requirements are identified in OHSE Plan, and are accessible by Project Manager

ACTS AND REGULATIONS:	CODES OF PRACTICE AND GUIDELINES	
<ul> <li>WHS Act, 2011</li> <li>WHS Regulation, 2011</li> <li>NSW Dangerous Goods Act, 1996</li> <li>QLD Workplace OHS Act, 1995</li> <li>QLD workplace OHS Reg 2008</li> <li>QLD Dangerous Goods Safety MGT Act 2001</li> <li>VIC OHS Act 2004</li> <li>VIC OHS Regulations 2007</li> <li>VIC Dangerous Goods Act 1985</li> <li>SA OHS Welfare Act 1986</li> <li>SA OHS Welfare Regulations 1995</li> <li>SA Dangerous Substances Act 1979</li> <li>TAS Workplace Health and Safety Act 1995</li> <li>TAS Workplace Health and Safety Regulations 1998</li> </ul>	NSW Codes of Practice and Guidelines         Excavation Work, 2001         Electrical Practices for Construction Work, 2007         Risk Assessment, 2001         Moving Plant on Construction Sites, 2004         Managing the Risk of Falls at Workplaces         Storage and Handling of Dangerous Goods, 2005         Work Near Overhead Power Lines, 2006         Amenities for Construction Work, 1997         OHS Consultation, 2001         Control of Workplace Hazardous Substances, 2006         Safe Work with Asbestos Guide, 2008         QLD Codes of Practice and Guidelines         Risk Management, 2007         Hazardous Substance, 2003         Manual Tasks, 2010         Mobile Cranes, 2006         Noise, 2004         Traffic Management, 2008         Plant, 2005         VIC Codes of Practice and Guidelines         Communicating OHS across languages, 2008         Workplace Amenities and Work Environment, 2008         Confined Spaces, 2008         Using Earthmoving Equipment near Overhead         First Aid in the Workplace, 2008         Prevention of Falls in General Construction, 2008         Removing Asbestos in Workplaces, 2008         Work safe Guidance note October 2010	<ul> <li>SA Codes of Practice and Guidelines</li> <li>Manual Handling, 2006</li> <li>OH and First Aid in the Workplace, 2007</li> <li>Control of Workplace Hazardous Substances, 2006</li> <li>National Codes of Practice and Guidelines</li> <li>Safe Removal of Asbestos 2<sup>nd</sup> Edition NOHSC: 2002 (2005)</li> <li>Manual Tasks, 2007</li> <li>Prevention of Musculoskeletal Disorders Caused from Performing Manual Tasks</li> <li>Induction for Construction Work, 2007</li> <li>Standards</li> <li>Demolition of Structures AS2601—1991</li> <li>Safe Work in Confined Spaces AS/NZS 2865—2009</li> <li>Selection, Use and Maintenance of Respiratory Protective Devices AS/NZS 1715:1994</li> <li>AS/NZS 3012:2003 Electrical Installations —Construction and Demolition Sites</li> <li>AS3760:2003 In-service Safety Inspection and Testing of Electrical Equipment</li> <li>OFSC Audit Criteria</li> <li>OH3.3, OH12, SC3,4, H1-19</li> </ul>



#### Safe Work Method Statement — Personnel WHS Regulation 2011

Project:	Whytes Gully Leachate Treatment	Location:	Wollongong Waste and Resource	Supervisor: Omid Sayar			
	Gystem		Grang	Signature:	Date 16/09/2019		

PERSONNEL INVOLVED		DUTIES	SKILLS/QUALIFICATIONS REQUIRED
Name:	Signature		
Hamid Mehrazmay		Service Technician	White Card- Confined Space Rescuer
Richard Selway		Service Technician	White Card
Shahriyar Nasiri		Service and Automation Engineer	White Card- Confined Space Rescuer
Arman Rashidi		Process and Operation Engineer	White Card- Confined Space Rescuer
Omid Sayar		Manager-Process and Operation Engineering	White Card- Confined Space Rescuer
Mahdi Madani		Technical Manager	White Card- Confined Space Rescuer
Lars Herngren		Water Infrastructure Manager	White Card



#### Safe Work Method Statement — Hazard and Risk Assessment WHS Regulation 2011

Refer to Risk Matrix on final page for details on Risk Levels

PROCEDURE:	POSSIBLE HAZARDS:	INITIAL RISK:		SK:	HAZARD CONTROLS: HO		HOC ACTIONED BY:	NEW RISK LEVEL:		
		Р	С	RISK		1,2,3,4,5,6		Р	С	RISK
1. Working With Chemicals	• Exposure to chemicals	С	3	13	• PPE to be worn Respirator, chemical goggles, chemical resistant coveralls and Chemical resistant gloves	6	Operator	С	5	22
		С	3	13	<ul> <li>Safety Shower/eye washer to be installed and operational prior to the use of chemicals on site</li> <li>Ensure and spills are cleaned immediately, even within bunded areas</li> </ul>	5	Operator	С	5	22
		С	3	13	• Dosing pumps to be tested with potable water before introducing any chemical	5	Operator	С	5	22
		С	3	13	<ul> <li>SDS readily available on site</li> <li>Ensure safety shower is operational</li> </ul>	5	Operator	С	5	22
		С	3	13	<ul> <li>Tanks to be filled to specified levels in a controlled fashion to avoid spills and overfilling.</li> <li>No mixing of chemicals is to take place.</li> </ul>	5	Operator	С	5	22
	• Fumes from Chemicals	С	4	18	• PPE to be worn chemical	6	Operator	С	5	22



PROCEDURE:	POSSIBLE HAZARDS:	INITIAL RISK:		SK:	HAZARD CONTROLS: HOC	HOC	HOC ACTIONED BY:		NEW RISK LEVEL:		
		Р	С	RISK		1,2,3,4,5,6		Р	С	RISK	
					goggles/full face shield Chemical resistant gloves and chemical resistant coveralls.						
	С	3	13	<ul> <li>Dosing pumps to be tested with portable water before introducing any chemical</li> </ul>	5	Operator	С	5	22		
		С	3	13	<ul> <li>Do not mix chemicals and verify tank and chemical prior to filling</li> </ul>	5	Operator	С	5	22	
		С	3	13	<ul> <li>Tanks to be clean and empty from of water before adding any chemicals</li> </ul>	5	Operator	С	5	22	
		С	3	13	<ul> <li>SDS to be readily available on site</li> </ul>	5	Operator	С	5	22	
		С	3	13	<ul> <li>Tanks to be filled to specified levels in a controlled fashion to avoid spills and overfilling</li> </ul>	5	Operator	С	5	22	
	• Spills (General)	С	3	13	Make sure spill kit available on site	5	Operator	С	5	22	
	• Disposal of spills (Small)	С	4	18	<ul> <li>Contain small spills with spill control material, shovel and place in a labeled, sealed container for off-site disposal</li> </ul>	5	Operator	D	4	21	
	• Disposal of Sills (Large)	С	4	18	• Transfer large spillage with transfer pump to labeled, sealable containers for product recovery or safe disposal	5	Operator	D	5	24	
	Storage of chemicals	В	3	9	Chemical only to be stored in	5	Operator	D	3	17	



PROCEDURE:	POSSIBLE HAZARDS:	INI	TIAL RI	SK:	HAZARD CONTROLS:	HOC ACTIONED BY:		NEW RISK LEVEL:		
		Р	С	RISK		1,2,3,4,5,6		Р	С	RISK
					approved labeled storage containers with lids to be closed at all times other than for use.					
		В	3	9	<ul> <li>All chemical storage devises are to be bunded, including temporary storage areas.</li> </ul>	5	Operator	D	3	17
2. Chemical Dosing Pump	• Exposure to chemicals	С	4	18	<ul> <li>PPE to be worn (Respirator, chemical goggles and Chemical resistant gloves)</li> </ul>	6	Operator	С	5	22
		С	3	13	<ul> <li>Dosing pumps to be tested with potable water before introducing any chemical</li> <li>Ensure safety shower is operational prior to start</li> </ul>	5	Operator	С	5	22
	Fumes from Chemicals	С	4	18	PPE to be worn	6	Operator	С	5	22
		С	3	13	• Do not mix chemicals and verify tank and chemical prior to filling	5	Operator	С	5	22
		С	3	13	<ul> <li>Tanks to be clean and empty from of water before adding any chemicals</li> </ul>	5	Operator	С	5	22
		С	3	13	Understand and adhere to requirements of SDS located in Innaco's EHS plan, Appendix "E"	5	Operator	С	5	22
		С	3	13	• Tanks to be filled to specified levels in a controlled fashion to avoid spills and overfilling	5	Operator	С	5	22



PROCEDURE:	POSSIBLE HAZARDS:	INITIAL RISK:		SK:	HAZARD CONTROLS:	HOC	ACTIONED BY:	NEW RISK LEVEL:		
		Р	С	RISK		1,2,3,4,5,6		Р	С	RISK
	• Spill	В	2	5	• Keep spill kit available on site	5	Operator	С	4	18
		В	2	5	• Don't overfill any tank and keep a safety free board	5	Operator	С	4	18
		В	2	5	• Understand and adhere to requirements of SDS located in Innaco's EHS plan, Appendix "E"	5	Operator	С	4	18



# Safe Work Method Statement — Risk Ranking Chard

				PROBABILITY				
				CERTAIN	LIKELY	POSSIBLE	UNLIKELY	REMOTE
	CONSEQUENCES			Commonly Occurs	Has Occurred	Could Occur	Not Likely to Occur	Practically Impossible
Equipment and Operations	Environmental Impact	Personal Injury		А	В	с	D	E
More than \$500,000 loss	Catastrophic Environmental Event (publicity)	Fatality or Permanent Disability	1	1	2	4	7	11
Up to \$500,000 loss	Major Environmental Event (prosecution)	Major LTI (>7 days lost from work)	2	3	5	8	12	16
Up to \$100,000 loss	Serious Pollution (temporary/permanent damage)	Lost Time Injury	3	6	9	13	17	20
Up to \$10,000 loss	Minor Pollution (minor spill - temporary damage)	Medical Treatment Injury	4	10	14	18	21	23
Less than \$500 loss/No Damage	Nil Impacts/ Affects	First Aid/ No Injury	5	15	19	22	24	25
				LEGEND:	HIGH RISK 1-6	MEDIUM RISK 7-15	LOW RISK 16-25	



## Safe Work Method Statement — Hierarchy of Controls (HOC)





<b>Safe</b> WHS Re	File No.: 16746 – SWMS#5							
SWMS No: 5		Workplace: Wollongong Waste and Reso (Whytes Gully), Kembla Gran	ource Recovery Park	Company Details: INNACO PTY LTD Level 5, 79 Victoria Avenue CHATSWOOD 2067 PH: (02) 9417 7728 FAX: (02) 9417 8337 ABN: 33 119 715 052				
Process: Working with Equipment								
Attachments: MSDS's								
Developed by:	Arman Rashidi	Tel: 0410383424	Reviewed by:	Lars Herngren	Tel: 0448469382			
Signed		Date: 16/09/2019	Signed		Date: 16/09/2019			
Description of equipment to be used (including minimum PPE)	<ul> <li>Hard hat</li> <li>High visibility clothing</li> <li>Steel Cap Safety Boots</li> <li>Safety Glasses</li> <li>Hearing protection</li> <li>Gloves</li> </ul>	Qualifications of the personnel doing the work	<ul> <li>Work Cover Induction Card (Attached)</li> <li>Site Safety induction</li> </ul>	Most Relevant Codes of Pra • OHS Consultation, 2001 • Managing the Risk of falls a	actice: t Workplaces			
Other relevant equipment (to be registered in HSE 017)		Site Personnel:	Site trained personnel and qualified personnel	tandard:				



## Safe Work Method Statement — Health & Safety Legislation

Note: Further relevant legislative requirements are identified in OHSE Plan, and are accessible by Project Manager

ACTS AND REGULATIONS:	CODES OF PRACTICE AND GUIDELINES	
<ul> <li>WHS Act, 2011</li> <li>WHS Regulation, 2011</li> <li>NSW Dangerous Goods Act, 1996</li> <li>QLD Workplace OHS Act, 1995</li> <li>QLD workplace OHS Reg 2008</li> <li>QLD Dangerous Goods Safety MGT Act 2001</li> <li>VIC OHS Act 2004</li> <li>VIC OHS Regulations 2007</li> <li>VIC Dangerous Goods Act 1985</li> <li>SA OHS Welfare Act 1986</li> <li>SA OHS Welfare Regulations 1995</li> <li>SA Dangerous Substances Act 1979</li> <li>TAS Workplace Health and Safety Act 1995</li> <li>TAS Workplace Health and Safety Regulations 1998</li> </ul>	NSW Codes of Practice and Guidelines         Excavation Work, 2001         Electrical Practices for Construction Work, 2007         Risk Assessment, 2001         Moving Plant on Construction Sites, 2004         Managing the Risk of Falls at Workplaces         Storage and Handling of Dangerous Goods, 2005         Work Near Overhead Power Lines, 2006         Amenities for Construction Work, 1997         OHS Consultation, 2001         Control of Workplace Hazardous Substances, 2006         Safe Work with Asbestos Guide, 2008         QLD Codes of Practice and Guidelines         Risk Management, 2007         Hazardous Substance, 2003         Manual Tasks, 2010         Mobile Cranes, 2006         Noise, 2004         Traffic Management, 2008         Plant, 2005         VIC Codes of Practice and Guidelines         Communicating OHS across languages, 2008         Workplace Amenities and Work Environment, 2008         Confined Spaces, 2008         Using Earthmoving Equipment near Overhead         First Aid in the Workplace, 2008         Prevention of Falls in General Construction, 2008         Removing Asbestos in Workplaces, 2008         Work safe Guidance note October 2010	<ul> <li>SA Codes of Practice and Guidelines</li> <li>Manual Handling, 2006</li> <li>OH and First Aid in the Workplace, 2007</li> <li>Control of Workplace Hazardous Substances, 2006</li> <li>National Codes of Practice and Guidelines</li> <li>Safe Removal of Asbestos 2<sup>nd</sup> Edition NOHSC: 2002 (2005)</li> <li>Manual Tasks, 2007</li> <li>Prevention of Musculoskeletal Disorders Caused from Performing Manual Tasks</li> <li>Induction for Construction Work, 2007</li> <li>Standards</li> <li>Demolition of Structures AS2601—1991</li> <li>Safe Work in Confined Spaces AS/NZS 2865—2009</li> <li>Selection, Use and Maintenance of Respiratory Protective Devices AS/NZS 1715:1994</li> <li>AS/NZS 3012:2003 Electrical Installations —Construction and Demolition Sites</li> <li>AS3760:2003 In-service Safety Inspection and Testing of Electrical Equipment</li> <li>OFSC Audit Criteria</li> <li>OH3.3, OH12, SC3,4, H1-19</li> </ul>



#### Safe Work Method Statement — Personnel WHS Regulation 2011

Project:	Whytes Gully Leachate Treatment	Location:	Wollongong Waste and Resource	Supervisor: Omid Sayar			
	Oystem		Grang	Signature:	Date 16/09/2019		

PERSONNEL INVOLVED		DUTIES	SKILLS/QUALIFICATIONS REQUIRED		
Name:	Signature				
Hamid Mehrazmay		Service Technician	White Card- Confined Space Rescuer		
Richard Selway		Service Technician	White Card		
Shahriyar Nasiri		Service and Automation Engineer	White Card- Confined Space Rescuer		
Arman Rashidi		Process and Operation Engineer	White Card- Confined Space Rescuer		
Omid Sayar		Manager-Process and Operation Engineering	White Card- Confined Space Rescuer		
Mahdi Madani		Technical Manager	White Card- Confined Space Rescuer		
Lars Herngren		Water Infrastructure Manager	White Card		



#### Safe Work Method Statement — Hazard and Risk Assessment WHS Regulation 2011

Refer to Risk Matrix on final page for details on Risk Levels

PROCEDURE:	POSSIBLE HAZARDS:	INI	TIAL RI	SK:	HAZARD CONTROLS:		HOC ACTIONED BY:		NEW RISK LEVEL		
		Ρ	С	RISK		1,2,3,4,5,6		Ρ	С	RISK	
1. Motor start up (Pumps and Blowers)	• Hand, Foot & Hearing Damage	С	3	13	• Safety glasses, and safety boots to be worn. Ear protection to be worn for motors with no acoustic hood or where noise is excessive.	6	Operator	D	4	21	
	• Electrical connections	С	1	4	<ul> <li>Pre start check that all electrical boxes are covered and closed properly.</li> <li>Any electrical issues identified or augmentation required to be addressed by a qualified electrician only.</li> </ul>	5	Operator	E	4	23	
	Motor malfunction	С	4	18	<ul> <li>Start up to cease if there is any abnormal vibration, heat, noise smell or leak.</li> </ul>	5	Operator	D	4	21	
		С	4	18	• Keep all unnecessary personnel away from the motor. Motor test to be undertaken by appropriately qualified persons only.	3	Operator	D	4	21	



# Safe Work Method Statement — Risk Ranking Chard

						PROBABILITY		
				CERTAIN	LIKELY	POSSIBLE	UNLIKELY	REMOTE
	CONSEQUENCES			Commonly Occurs	Has Occurred	Could Occur	Not Likely to Occur	Practically Impossible
Equipment and Operations	Environmental Impact	Personal Injury		А	В	с	D	E
More than \$500,000 loss	Catastrophic Environmental Event (publicity)	Fatality or Permanent Disability	1	1	2	4	7	11
Up to \$500,000 loss	Major Environmental Event (prosecution)	Major LTI (>7 days lost from work)	2	3	5	8	12	16
Up to \$100,000 loss	Serious Pollution (temporary/permanent damage)	Lost Time Injury	3	6	9	13	17	20
Up to \$10,000 loss	Minor Pollution (minor spill - temporary damage)	Medical Treatment Injury	4	10	14	18	21	23
Less than \$500 loss/No Damage	Nil Impacts/ Affects	First Aid/ No Injury	5	15	19	22	24	25
				LEGEND:	HIGH RISK 1-6	MEDIUM RISK 7-15	LOW RISK 16-25	



## Safe Work Method Statement — Hierarchy of Controls (HOC)





Safe   WHS Re	File No.: 16746 – SWMS#6					
SWMS No: 6		Workplace: Wollongong Waste and Reso (Whytes Gully), Kembla Gran	ource Recovery Park	Company Details: INNACO PTY LTD Level 5, 79 Victoria Avenue CHATSWOOD 2067 PH: (02) 9417 7728 FAX: (02) 9417 8337 ABN: 33 119 715 052		
Process: Water Sampling ar	nd Testing					
Attachments: MSDS's						
Developed by:	Arman Rashidi	Tel: 0410383424	Reviewed by:	Lars Herngren	Tel: 0448469382	
Signed		Date: 16/09/2019	Signed		Date: 16/09/2019	
Description of equipment to be used (including minimum PPE)	<ul> <li>Hard hat</li> <li>High visibility clothing</li> <li>Steel Cap Safety Boots</li> <li>Safety Glasses</li> <li>Hearing protection</li> <li>Gloves</li> </ul>	Qualifications of the personnel doing the work	<ul> <li>Work Cover Induction Card (Attached)</li> <li>Site Safety induction</li> </ul>	Most Relevant Codes of Pra • Work Health and Safety Act • OHS Consultation, 2001 • Managing the Risk of falls a	t Workplaces	
Other relevant equipment (to be registered in HSE 017)		Site Personnel:	Site trained personnel and qualified personnel	Most Relevant Australian St Nil	andard:	



## Safe Work Method Statement — Health & Safety Legislation

Note: Further relevant legislative requirements are identified in OHSE Plan, and are accessible by Project Manager

ACTS AND REGULATIONS:	CODES OF PRACTICE AND GUIDELINES	
<ul> <li>WHS Act, 2011</li> <li>WHS Regulation, 2011</li> <li>NSW Dangerous Goods Act, 1996</li> <li>QLD Workplace OHS Act, 1995</li> <li>QLD workplace OHS Reg 2008</li> <li>QLD Dangerous Goods Safety MGT Act 2001</li> <li>VIC OHS Act 2004</li> <li>VIC OHS Regulations 2007</li> <li>VIC Dangerous Goods Act 1985</li> <li>SA OHS Welfare Act 1986</li> <li>SA OHS Welfare Regulations 1995</li> <li>SA Dangerous Substances Act 1979</li> <li>TAS Workplace Health and Safety Act 1995</li> <li>TAS Workplace Health and Safety Regulations 1998</li> </ul>	NSW Codes of Practice and Guidelines         Excavation Work, 2001         Electrical Practices for Construction Work, 2007         Risk Assessment, 2001         Moving Plant on Construction Sites, 2004         Managing the Risk of Falls at Workplaces         Storage and Handling of Dangerous Goods, 2005         Work Near Overhead Power Lines, 2006         Amenities for Construction Work, 1997         OHS Consultation, 2001         Control of Workplace Hazardous Substances, 2006         Safe Work with Asbestos Guide, 2008         QLD Codes of Practice and Guidelines         Risk Management, 2007         Hazardous Substance, 2003         Manual Tasks, 2010         Mobile Cranes, 2006         Noise, 2004         Traffic Management, 2008         Plant, 2005         VIC Codes of Practice and Guidelines         Communicating OHS across languages, 2008         Workplace Amenities and Work Environment, 2008         Confined Spaces, 2008         Using Earthmoving Equipment near Overhead         First Aid in the Workplace, 2008         Prevention of Falls in General Construction, 2008         Removing Asbestos in Workplaces, 2008         Work safe Guidance note October 2010	<ul> <li>SA Codes of Practice and Guidelines</li> <li>Manual Handling, 2006</li> <li>OH and First Aid in the Workplace, 2007</li> <li>Control of Workplace Hazardous Substances, 2006</li> <li>National Codes of Practice and Guidelines</li> <li>Safe Removal of Asbestos 2<sup>nd</sup> Edition NOHSC: 2002 (2005)</li> <li>Manual Tasks, 2007</li> <li>Prevention of Musculoskeletal Disorders Caused from Performing Manual Tasks</li> <li>Induction for Construction Work, 2007</li> <li>Standards</li> <li>Demolition of Structures AS2601—1991</li> <li>Safe Work in Confined Spaces AS/NZS 2865—2009</li> <li>Selection, Use and Maintenance of Respiratory Protective Devices AS/NZS 1715:1994</li> <li>AS/NZS 3012:2003 Electrical Installations —Construction and Demolition Sites</li> <li>AS3760:2003 In-service Safety Inspection and Testing of Electrical Equipment</li> <li>OFSC Audit Criteria</li> <li>OH3.3, OH12, SC3,4, H1-19</li> </ul>



#### Safe Work Method Statement — Personnel WHS Regulation 2011

Project:	Whytes Gully Leachate Treatment	Location:	Wollongong Waste and Resource	Supervisor: Omid Sayar				
	Cystem -		Grang	Signature:	Date 16/09/2019			

PERSONNEL INVOLVED		DUTIES	SKILLS/QUALIFICATIONS REQUIRED
Name:	Signature		
Hamid Mehrazmay		Service Technician	White Card- Confined Space Rescuer
Richard Selway		Service Technician	White Card
Shahriyar Nasiri		Service and Automation Engineer	White Card- Confined Space Rescuer
Arman Rashidi		Process and Operation Engineer	White Card- Confined Space Rescuer
Omid Sayar		Manager-Process and Operation Engineering	White Card- Confined Space Rescuer
Mahdi Madani		Technical Manager	White Card- Confined Space Rescuer
Lars Herngren		Water Infrastructure Manager	White Card



#### Safe Work Method Statement — Hazard and Risk Assessment WHS Regulation 2011

Refer to Risk Matrix on final page for details on Risk Levels

PROCEDURE:	POSSIBLE HAZARDS:	INI	TIAL RI	SK:	HAZARD CONTROLS:	HOC	ACTIONED BY:	NEW RISK LEVEL		
		Р	С	RISK		1,2,3,4,5,6		Р	С	RISK
1. Colleting of water samples	• Exposure pathogenic microorganisms	В	3	9	• PPE (safety glasses, gloves)	6	Operator	D	5	24
		В	3	9	<ul> <li>Wash hands with antibacterial soap when finished</li> </ul>	5	Operator	D	5	24
		В	3	9	• Don't touch your face, mouth, nose during the procedure	5	Operator	D	5	24
	<ul> <li>Consumption of Pathogenic microorganisms</li> </ul>	D	2	12	Use dedicated/ labeled sampling containers	5	Operator	E	4	23
		D	2	12	<ul> <li>Wash hands with antibacterial soap when finished</li> </ul>	5	Operator	E	4	23
		D	2	12	<ul> <li>Don't touch your face, mouth, nose during the procedure</li> </ul>	5	Operator	E	4	23
	• Slip, trip and fall	В	2	5	Maintain stable footing with steel cap safety boots	5	Operator	С	4	18
		В	2	5	<ul> <li>PPE to be worn boots/ hard hat/ high visibility clothing/ safety glasses</li> </ul>	6	Operator	С	4	18



PROCEDURE:	POSSIBLE HAZARDS:	INI	TIAL RI	SK:			ACTIONED BY:	NEW RISK LEVEL:		
		Р	С	RISK		1,2,3,4,5,6		Р	С	RISK
	• Spill	В	2	5	Don't over fill sampling containers	5	Operator	С	4	18
		В	2	5	Dispose samples after testing	3	Operator	С	4	18
		В	2	5	Make sure lids are closed properly	3	Operator	С	4	18
		В	2	5	Keep spill kit available on site	5	Operator	С	4	18
2. Onsite water testing	• Exposure pathogenic microorganisms	В	3	9	• PPE (safety glasses, gloves)	6	Operator	D	5	24
		В	3	9	<ul> <li>Wash hands with antibacterial soap when finished</li> </ul>	5	Operator	D	5	24
		В	3	9	• Don't touch your face, mouth, nose during the procedure	3	Operator	D	5	24
	Consumption of Pathogenic microorganisms	D	2	12	Use proper PPE according to the sampling procedure	6	Operator	E	4	23
		D	2	12	Use dedicated/ labeled sampling containers	5	Operator	E	4	23
		D	2	12	<ul> <li>Wash hands with antibacterial soap when finished</li> </ul>	5	Operator	E	4	23
-		D	2	12	• Don't touch your face, mouth, nose during the procedure	5	Operator	E	4	23
	• Slip, trip and fall	В	2	5	Maintain stable footing with steel cap safety boots	5	Operator	С	4	18



PROCEDURE:	POSSIBLE HAZARDS:	INITIAL RISK:		SK:	HAZARD CONTROLS: HOC		HOC ACTIONED BY:		NEW RISK LEVEL:		
		Р	С	RISK		1,2,3,4,5,6		Р	С	RISK	
		В	2	5	<ul> <li>PPE to be worn boots/ hard hat/ high visibility clothing /safety glasses</li> </ul>	6	Operator	С	4	18	
	• Spill	С	4	18	Don't over fill sampling containers	5	Operator	D	5	24	
		С	4	18	Dispose samples after testing	3	Operator	D	5	24	
		С	4	18	Make sure lead are closed properly	3	Operator	D	5	24	
		С	4	18	• Keep spill kit available on site	5	Operator	D	5	24	
		С	4	18	Clean containers and equipment after every use	5	Operator	D	5	24	
3. Offsite water testing	• Exposure pathogenic microorganisms	С	3	13	PPE (safety glasses, gloves)	6	Operator	D	5	24	
		С	3	13	Wash hands with antibacterial soap when finished	5	Operator	D	5	24	
		С	3	13	• Don't touch your face, mouth, nose during the procedure	5	Operator	D	5	24	
	Consumption of Pathogenic microorganisms	D	2	12	• Use proper PPE according to the sampling procedure	6	Operator	E	4	23	
		D	2	12	Use dedicated/ labeled sampling containers	5	Operator	E	4	23	
		D	2	12	Wash hands with antibacterial soap when finished	5	Operator	E	4	23	



PROCEDURE:	POSSIBLE HAZARDS:	INITIAL RISK:		SK:	HAZARD CONTROLS:		ACTIONED BY:	NEW RISK LEVEL:		
		Р	С	RISK		1,2,3,4,5,6		Р	С	RISK
		D	2	12	• Don't touch your face, mouth, nose during the procedure	5	Operator	E	4	23
	• Slip, trip and fall	В	2	5	<ul> <li>Maintain stable footing with steel cap safety boots</li> </ul>	5	Operator	С	4	18
		В	2	5	<ul> <li>PPE to be worn boots/ hard hat/ high visibility clothing /safety glasses</li> </ul>	6	Operator	С	4	18
	• Spill	С	5	22	<ul> <li>Don't over fill sampling containers</li> </ul>	3	Operator	D	5	24
		С	5	22	<ul> <li>Make sure lid is closed properly</li> </ul>	5	Operator	D	5	24
		С	5	22	<ul> <li>Clean containers and equipment after every use</li> </ul>	5	Operator	D	5	24



# Safe Work Method Statement — Risk Ranking Chard

						PROBABILITY		
				CERTAIN	LIKELY	POSSIBLE	UNLIKELY	REMOTE
	CONSEQUENCES			Commonly Occurs	Has Occurred	Could Occur	Not Likely to Occur	Practically Impossible
Equipment and Operations	Environmental Impact	Personal Injury		А	В	С	D	E
More than \$500,000 loss	Catastrophic Environmental Event (publicity)	Fatality or Permanent Disability	1	1	2	4	7	11
Up to \$500,000 loss	Major Environmental Event (prosecution)	Major LTI (>7 days lost from work)	2	3	5	8	12	16
Up to \$100,000 loss	Serious Pollution (temporary/permanent damage)	Lost Time Injury	3	6	9	13	17	20
Up to \$10,000 loss	Minor Pollution (minor spill - temporary damage)	Medical Treatment Injury	4	10	14	18	21	23
Less than \$500 loss/No Damage	Nil Impacts/ Affects	First Aid/ No Injury	5	15	19	22	24	25
				LEGEND:	HIGH RISK 1-6	MEDIUM RISK 7-15	LOW RISK 16-25	

16-25



## Safe Work Method Statement — Hierarchy of Controls (HOC)





Safe I WHS Re	File No.: 16746 – SWMS#7							
SWMS No: 7		Workplace: Wollongong Waste and Reso (Whytes Gully), Kembla Gran	ource Recovery Park	Company Details: INNACO PTY LTD Level 5, 79 Victoria Avenue CHATSWOOD 2067 PH: (02) 9417 7728 FAX: (02) 9417 8337 ABN: 33 119 715 052				
Process: Materials Handling								
Attachments:								
Developed by:	Arman Rashidi	Tel: 0410383424	Reviewed by:	Lars Herngren	Tel: 0448469382			
Signed		Date: 16/09/2019	Signed		Date: 16/09/2019			
Description of equipment to be used (including minimum PPE)	<ul> <li>Hard hat</li> <li>High visibility clothing</li> <li>Steel Cap Safety Boots</li> <li>Safety Glasses</li> <li>Hearing protection</li> <li>Gloves</li> </ul>	Qualifications of the personnel doing the work	<ul> <li>Work Cover Induction card</li> <li>Site Safety induction</li> </ul>	Most Relevant Codes of Pra • Work Health and Safety Act • OHS Consultation, 2001 • Managing the Risk of falls a	actice: 2011 t Workplaces			
Other relevant equipment (to be registered in HSE 017)	Slings and Chains Pallet Jack Chain Block (2T)	Site Personnel:	ite Personnel: Site trained personnel and qualified personnel Nil					



## Safe Work Method Statement — Health & Safety Legislation

Note: Further relevant legislative requirements are identified in OHSE Plan, and are accessible by Project Manager

ACTS AND REGULATIONS:	CODES OF PRACTICE AND GUIDELINES	
<ul> <li>WHS Act, 2011</li> <li>WHS Regulation, 2011</li> <li>NSW Dangerous Goods Act, 1996</li> <li>QLD Workplace OHS Act, 1995</li> <li>QLD borkplace OHS Reg 2008</li> <li>QLD Dangerous Goods Safety MGT Act 2001</li> <li>VIC OHS Act 2004</li> <li>VIC OHS Regulations 2007</li> <li>VIC Dangerous Goods Act 1985</li> <li>SA OHS Welfare Act 1986</li> <li>SA OHS Welfare Regulations 1995</li> <li>SA Dangerous Substances Act 1979</li> <li>TAS Workplace Health and Safety Regulations 1998</li> </ul>	NSW Codes of Practice and Guidelines         Excavation Work, 2001         Electrical Practices for Construction Work, 2007         Risk Assessment, 2001         Moving Plant on Construction Sites, 2004         Managing the Risk of Falls at Workplaces         Storage and Handling of Dangerous Goods, 2005         Work Near Overhead Power Lines, 2006         Amenities for Construction Work, 1997         OHS Consultation, 2001         Control of Workplace Hazardous Substances, 2006         Safe Work with Asbestos Guide, 2008         QLD Codes of Practice and Guidelines         Risk Management, 2007         Hazardous Substance, 2003         Manual Tasks, 2010         Mobile Cranes, 2006         Noise, 2004         Traffic Management, 2008         Plant, 2005         VIC Codes of Practice and Guidelines         Communicating OHS across languages, 2008         Workplace Amenities and Work Environment, 2008         Confined Spaces, 2008         Using Earthmoving Equipment near Overhead         First Aid in the Workplace, 2008         Prevention of Falls in General Construction, 2008         Removing Asbestos in Workplaces, 2008         Work safe Guidance note October 2010	<ul> <li>SA Codes of Practice and Guidelines</li> <li>Manual Handling, 2006</li> <li>OH and First Aid in the Workplace, 2007</li> <li>Control of Workplace Hazardous Substances, 2006</li> <li>National Codes of Practice and Guidelines</li> <li>Safe Removal of Asbestos 2<sup>nd</sup> Edition NOHSC: 2002 (2005)</li> <li>Manual Tasks, 2007</li> <li>Prevention of Musculoskeletal Disorders Caused from Performing Manual Tasks</li> <li>Induction for Construction Work, 2007</li> <li>Standards</li> <li>Demolition of Structures AS2601—1991</li> <li>Safe Work in Confined Spaces AS/NZS 2865—2009</li> <li>Selection, Use and Maintenance of Respiratory Protective Devices AS/NZS 1715:1994</li> <li>AS/NZS 3012:2003 Electrical Installations —Construction and Demolition Sites</li> <li>AS3760:2003 In-service Safety Inspection and Testing of Electrical Equipment</li> <li>OFSC Audit Criteria</li> <li>OH3.3, OH12, SC3,4, H1-19</li> </ul>



#### Safe Work Method Statement — Personnel WHS Regulation 2011

Project:	Whytes Gully Leachate Treatment	Location:	Wollongong Waste and Resource	Supervisor: Omid Sayar				
	Cystem -		Grang	Signature:	Date 16/09/2019			

PERSONNEL INVOLVED		DUTIES	SKILLS/QUALIFICATIONS REQUIRED				
Name:	Signature						
Hamid Mehrazmay		Service Technician	White Card- Confined Space Rescuer				
Richard Selway		Service Technician	White Card				
Shahriyar Nasiri		Service and Automation Engineer	White Card- Confined Space Rescuer				
Arman Rashidi		Process and Operation Engineer	White Card- Confined Space Rescuer				
Omid Sayar		Manager-Process and Operation Engineering	White Card- Confined Space Rescuer				
Mahdi Madani		Technical Manager	White Card- Confined Space Rescuer				
Lars Herngren		Water Infrastructure Manager	White Card				



#### Safe Work Method Statement — Hazard and Risk Assessment WHS Regulation 2011

Refer to Risk Matrix on final page for details on Risk Levels

PROCEDURE:	POSSIBLE HAZARDS:	INI	TIAL RI	SK:	HAZARD CONTROLS:	HOC	ACTIONED BY:	NEW	RISK L	EVEL:
		Р	С	RISK		1,2,3,4,5,6		Р	С	RISK
1. Access to site	<ul> <li>Slips Trips &amp; Falls</li> <li>Moving machinery risks on entry and exit</li> </ul>	В	4	14	Refer to SWMS #1	5,6	Operator	D	3	17
2. Manual Handling	Lifting injuries	A	2	3	<ul> <li>Eliminate need for manual handling where possible by use of mobility assistance where possible, i.e. trolley/pallet jack</li> <li>Refer to attached Fact Sheet for correct lifting techniques and more information.</li> </ul>	1	Operator	D	3	17
	<ul> <li>Manual handling fatigue leading to injury</li> </ul>	С	1     4     • Reduce distance between storage location of materials and use location     5     Operator		D	5	24			
	<ul> <li>Heavy (&gt;20Kg) manual handling load where mobility assistance devices cannot be used.</li> </ul>	ual     C     2     8     • Utilize team lifting     5     Operator       a mobility cannot     C     2     8     • Utilize team lifting     5     Operator		D	5	24				
	• Back strain whilst manual handling	С	3	13	• Reduce load size of manual handling to 20kg Max and utilize appropriate manual handling techniques including lifting from between legs whilst using legs to raise load, and	5	Operator	D	4	21



PROCEDURE:	POSSIBLE HAZARDS:	INI	TIAL RI	ISK:	HAZARD CONTROLS:	HOC	ACTIONED BY:	NEW	RISK LI	EVEL:
		Р	С	RISK		1,2,3,4,5,6		Р	С	RISK
					eliminate any twisting					
	Slips trips and falls	В	2	5	PPE to be worn (Safety Boots)	6	Operator	С	4	18
	Weight of load	В	2	5	• Provide copy of delivery schedule (attached) to machine operator prior to offloading.	5	Operator	D	2	12
	<ul> <li>Inadequate lifting equipment</li> </ul>	В	3	9	• Visual inspection before use by competent person	5	Operator	D	3	17
		В	3	9	<ul> <li>Lifting equipment register indicating test and inspection dates</li> </ul>	5	Operator	D	3	17
3. Move equipment within room by way of pallet jack	Loss of control of load	С	3	14	<ul> <li>Maintain a slow and steady pace with load on pallet jack</li> </ul>	5	Operator	D	3	17
	• Pallet jack failure	С	3	14	• Prestart checklist to be completed including review of any log book/maintenance history records by a competent person.	5	Operator	D	3	17
	• Weight of load	С	4	18	Pallet jack to have SWL appropriate for the loads to be shifted.	5	Operator	D	4	21
	Foot crashing injury from moving load	С	3	14	Steel Cap Safety boots to be worn	6	Operator	D	3	17



# Safe Work Method Statement — Risk Ranking Chard

				CERTAIN	LIKELY	POSSIBLE	UNLIKELY	REMOTE
	CONSEQUENCES			Commonly Occurs	Has Occurred	Could Occur	Not Likely to Occur	Practically Impossible
Equipment and Operations	Environmental Impact	Personal Injury		А	В	с	D	E
More than \$500,000 loss	Catastrophic Environmental Event (publicity)	Fatality or Permanent Disability	1	1	2	4	7	11
Up to \$500,000 loss	Major Environmental Event (prosecution)	Major LTI (>7 days lost from work)	2	3	5	8	12	16
Up to \$100,000 loss	Serious Pollution (temporary/permanent damage)	Lost Time Injury	3	6	9	13	17	20
Up to \$10,000 loss	Minor Pollution (minor spill - temporary damage)	Medical Treatment Injury	4	10	14	18	21	23
Less than \$500 loss/No Damage	Nil Impacts/ Affects	First Aid/ No Injury	5	15	19	22	24	25
				LEGEND:	HIGH RISK 1-6	MEDIUM RISK 7-15	LOW RISK 16-25	



## Safe Work Method Statement — Hierarchy of Controls (HOC)



### Safe Work Method Statement

General Work with possible exposure to COVID-19 virus



SWMS No: SWMS-C-GSI-11		Site(s): Whytes Gully LTS	i <b>ite(s):</b> Whytes Gully LTS								
Activities: - Site access - Equipment check - Carry out sampling - Carry out manual cleat - Carry out maintenanc Date: this SWMS is to be used	<ul> <li>Site access <ul> <li>Equipment check</li> <li>Equipment check</li> <li>Carry out sampling</li> <li>Carry out manual cleaning</li> <li>Carry out maintenance and equipment replacement</li> <li>Carry out maintenance and equipment replacement</li> </ul> </li> <li>Veveloped by: Saeed Javan, Process and Tel: 0460544373 <ul> <li>Deviaued hum on the process and t</li></ul></li></ul>										
Developed by:	Saeed Javan, Process and Operations Engineer	Tel: 0460544373	Reviewed by:	Omid Sayar, Operation Manager	<b>Tel:</b> 0435158919						
Signed		Date: Jan 2020	Signed		<b>Date:</b> Jan 2020						
Person responsible for ensuring compliance with SWMS: Mahdi Madani, Process and Operations Engineer			Qualifications requir	ed  ✓ White Card							
SWMS has been consulted with: Omid Sayar (Operation Manager) Measures in place to ensure compliance with SWMS: Site induction, toolbox talks, SWMS sign-off			Site Personnel Signed								
PPE Requirement: - Hard Hat - Reflective Vest/Shirt ✓ - Steel Cap Boots ✓ - Respirator (where required - Coveralls - Gloves ✓ - Safety Glasses ✓ - Face Mask✓ - Hand Sanitizer✓ - Face Shield (only for cheat - Sunscreen✓ - Harness/Lanyard - Hearing Protection (where	red) ✓ emical handling) ✓ ere required) ✓		Permit Requirement:         -       Confined Space         -       Traffic control         -       Utilities [power         -       Dial Before You         -       Dial Before You         -       Asbestos Remotes         Other Requirements:       -         -       First Aid Kit ✓         -       Fire Extinguisi         -       Confined Space         -       Ventilation Face	a none required ce Permit I plan er lines/gas/phone] pu Dig Drawings noval Notification ther ce Rescue m							

	High risk construction work	
□ Risk of a person falling more than 2 meters	□ Work on a telecommunication tower	□ Demolition of load-bearing structure
□ Likely to involve disturbing asbestos	Temporary load-bearing support for structural alterations or repairs	□ Work in or near a confined space
□ Work in or near a shaft or trench deeper than 1.5 m or a tunnel	oxtimes work in place with possible exposure to COVID-19 Virus	$\Box$ Work on or near pressurized gas mains or piping
□ Work on or near chemical, fuel or refrigerant lines	Work on or near energized electrical installations or	Work in an area that may have a contaminated or
	services	flammable atmosphere
□ Work on a pressurized pipe work	□ Work on, in or adjacent to a road, railway, shipping lane or other traffic corridor in use by traffic other than pedestrians	$\square$ Work in an area with movement of powered mobile plant
□ Work in areas with artificial extremes of temperature	Work in or near water or other liquid that involves a risk of drowning	□ Sun Exposure
□ Is the work physically demanding	□ Working in extreme hot condition	□ Working in poor air quality

ACTS AND REGULATIONS	STANDARDS
	National Standard for Construction Work, 2005
NSW Work Health and Safety Act 2011	Demolition of Structures AS2601
NSW Work Health and Safety Regs, 2011	Safe Work in Confined Space AS/NZS 2865
Work Health and Safety Regulation 2017	Selection, use and maintenance of respiratory protective devices AS/NZS 1715
Public Health Act 2010	AS/NZS 3012 Electrical installations – Construction and demolition sites.
	AS 3760 In-service safety inspection and testing of electrical equipment
	HS-PRO-007 Working in hazardous atmosphere procedure
	AS/NZS 1716:2012 Respiratory protection devices
	AS/NZS 1715:2009 Selection, use and maintenance of respiratory protective devices
NSW CODES OF PRACTICE AND GUIDELINES	NATIONAL CODES OF PRACTICE AND GUIDELINES
Storage and Handling of Dangerous Goods, 2005	Hazardous Manual Tasks 2011
Work Near Overhead Power Lines, 2006	Managing the Risk of Falls 2011
Managing work Environment and facilities 2011	Induction for Construction Work,2007
Hazardous Manual Tasks 201	How to manage Work Health and Safety Risks 2011
Managing the risk of falls in the workplace 2011	Managing Risks in Construction Work
How to manage work health and safety risk 2011	Public Health (COVID-19) Gatherings Order 2020
Managing noise and preventing hearing loss at work 2011	Safe Design of Structures 2011
Confined Spaces 2011	Managing Electrical Risks at the workplace 2011
Moving plant on Construction sites 2004	Work Health Consult. Cooperation, Coordination
Excavation Work 2000	Guide on exposure to solar ultraviolet radiation (UVR)
Workplace Safety consultation, cooperation and coordination	HS-PRO-025 PPE Procedure
	HS-PRO-030 Safety Induction and training
	HS-PRO-007 Working in hazardous atmosphere procedure
Excavation Work 2000 Workplace Safety consultation, cooperation and coordination	Guide on exposure to solar ultraviolet radiation (UVR) HS-PRO-025 PPE Procedure HS-PRO-030 Safety Induction and training HS-PRO-007 Working in hazardous atmosphere procedure

Risk Assessment Refer to Risk Matrix on final page for details on risk levels												
		Ini	itial R	lisk	Control Measures	нос	R	esidual	Risk			
Steps	Possible Hazards	Р	С	RISK	Control Measures	Measure	Р	С	RISK	Actioned By		
Pre-Start, planning and travel to site	Close contact with an infected person Touching objects or surfaces contaminated by the sneeze or cough of an infected person and then touching your eyes, nose or mouth.	В	2	5 High	<ul> <li>Self-quarantine</li> <li>Workers and others must self-quarantine if they have:</li> <li>travelled overseas in the past 14 days</li> <li>been in close contact with a confirmed case of COVID-19.</li> <li>Workers who need to self-quarantine should notify their employer and stay away from work.</li> <li>Workers should seek immediate medical attention if they become ill during the quarantine period and call ahead of arriving and mention their travel or contact history.</li> <li>The worker should be provided with flexible work arrangements such as working from home.</li> <li>The worker should clean their hands regularly with soap and water or alcohol-based hand sanitiser.</li> <li>The worker should cover their nose and mouth with a tissue or bent elbow when coughing or sneezing, dispose of tissues immediately after use and wash your hands or apply hand sanitiser.</li> </ul>	3,4,5,6	D	2	12 Med	Saeed		

					The worker should avoid touching their face, nose and mouth and shaking hands.					
					They should avoid close contact with anyone who is unwell. Try to stay 1.5 metres away from anyone coughing or sneezing.					
					All workers are appraised for any pre-existing medical conditions. Provide appropriate personal protective					
					equipment (PPE) such as face masks, hand sanitizers, disposable gloves.					
Work In the office	Close contact with an infected person	В	2	5 High	Developing company policies in line with NSW Government recommendations to keep the staff safe.	3, 4,5,6	D	2	12 Med	Saeed
work outside	Touching contaminated objects or surfaces				Minimizing physical contact between the operations team and increasing hygiene practices.					
					Considering the nature of the operation works, the majority of work can be carried out by a single person which reduces the risk of contracting the virus.					
					Supplying all the operation cars and personnel with sufficient PPE including hand sanitizers, masks, liquid handwash and disposable gloves.					
					locating desks sufficiently far apart at the office to meet current government recommendations, and regularly update staff every second day, on Covid-19 changes that may affect them.					
		В	2	5	All crews to have a supply of potable water	3156	D	2	12	Saeed
Carry out sampling, manual cleaning, maintenance and	Health related problem to personnel and Public due to exposure to COVID-19 virus:			High	for washing All crews to have hand sanitizer, and apply it hourly.	3,7,3,0			Med	54004

equipment replacement	<ul> <li>Close contact with an infected person</li> <li>Touching objects or surfaces contaminated by the sneeze or cough of an infected person and then touching your eyes, nose or mouth.</li> </ul>				All crews to practice good personal hygiene, including sneezing into one's elbow if need be. If working inside and within 1.5m of each other, facemasks should be worn If working outside stay 1.5m from other staff wherever possible. Wear gloves and avoid touching other people. Staff should adhere to all government advice on social distancing and other preventative measures. If any flu symptoms, self-isolate immediately					
					and advise your supervisor.					
					Get appropriate medical testing					
Wearing of PPE & Personal hygiene	Not Using appropriate PPE Lack of personal hygiene	В	2	5 High	PPE must be suitable for the nature of the work or hazard; and must be a suitable size and fit for the individual who is required to use it.	3,4,5,6	D	2	12 Med	Saeed
	Exposure to COVID-19 virus: Close contact with an infected person				Provide cleaning products and instruction for cleaning workspaces Barriers to create space at counters, between workstations, seated areas etc.					
	Touching objects or surfaces contaminated by the sneeze or cough of an infected person and then touching your eyes, nose or mouth.				Modifying shifts and rosters to reduce peak periods and actively supporting flexible work arrangements, including working from home. Implementing controls to reduce environmental exposure, including:					

		Inspecting and reviewing air conditioning and ventilation systems		
		Increasing cleaning and disinfection of high traffic areas or shared surfaces		
		Provide instruction and amenities for personal hygiene and infection control		
		Increasing cleaning and disinfection of high traffic areas or shared surfaces		
		Provide instruction and amenities for personal hygiene and infection control		
		PPE must be maintained, repaired or replaced and must be clean, hygienic and in good working order.		


## Safe Work Method Statement — Risk Ranking Chart

			PROBABILITY					
			CERTAIN	LIKELY	POSSIBLE	UNLIKELY	REMOTE	
CONSEQUENCES				Commonly Occurs	Has Occurred	Could Occur	Not Likely to Occur	Practically Impossible
Equipment and Operations	Environmental Impact	Personal Injury		A	В	с	D	E
More than \$500,000 loss	Catastrophic Environmental Event (publicity)	Fatality or Permanent Disability	1	1	2	4	7	- 11
Up to \$500,000 loss	Major Environmental Event (prosecution)	Major LTI (>7 days lost from work)	2	3	5	8	12	16
Up to \$100,000 loss	Serious Pollution (temporary/permanent damage)	Lost Time Injury	3	6	9	13	17	20
Up to \$10,000 loss	Minor Pollution (minor spill - temporary damage)	Medical Treatment Injury	4	10	14	18	21	23
Less than \$500 loss/No Damage	Nil Impacts/ Affects	First Aid/ No Injury	5	15	19	22	24	25
	*			LEGEND:	HIGH RISK	MEDIUM RISK	LOW RISK	

# APPENDIX B – OPERATION RULES AND INDUCTIONS WG LTP







Whytes Gully Leachate Treatment System Operations and Maintenance Services

**OPERATION RULES & INDUCTION** 

September 2016



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#### **INTRODUCTION**

#### Application

These standards apply to all persons entering an INNACO operation site or property. All workers entering any INNACO site are to be instructed of these standards prior to the commencement of any works.

These general standards should be read in conjunction with site specific induction checklists do not take the place of any site specific work method statements.

#### **Industry Best Practice Standards**

Innaco's vision is to provide industry best practice safety standards, practices and performance.

We expect all workers and visitors to go home at the end of each day to family and friends in good health and no practice during work hours should jeopardize this.

It is also expected that the local environment and public be afforded the greatest respect and minimal disruption.

#### **VISITORS, MEDIA AND THE COMMUNITY**

#### Visitors

These standards apply equally to visitors as to workers.

Community Enquiries and Complaints

If a member of the community approaches you regarding an enquiry or complaint, please request the persons name and contact details and advise that an INNACO staff member will contact them.

Please be polite and calm even if the member of the public is not.

Do not try to answer the enquiry or complaint unless you are authorized to do so.

#### Media

If you are approached by the media please direct them to the Operation Manager.

Please do not provide information or respond to enquiries by any media personnel.

#### **INJURIES AND INCIDENTS**

#### **Site Induction**

You are not to commence work until you have completed a site specific induction and the accompanying checklist. The site specific induction will outline the location of first aid facilities, what to do in the event of an injury and any site specific hazards and rules.



#### Safe Work Methods

Your employer is required to plan how you will safely carry out your work without causing harm to yourself, others workers on site, the general public or the local environment. **Licensed Work** 

Licensed work includes any activity which requires a specific license including, but not limited to, machinery operation, electrical works, and scaffolding. You are not to undertake any activity which requires a license unless you hold the appropriate license to do so.

#### **PERSONAL PROTECTIVE EQUIPMENT (PPE)**

#### General

You must always use PPE when required by these standards and/or as specified by the site specific work method statement.

The following are minimum standards for PPE unless specifically allowed otherwise by a safe work method statement that has been formulated after a site specific risk assessment.

If PPE is required and not available then do not start work until your employer has provided the required PPE.

Your employer must provide you with the necessary training to enable you to properly use your PPE.

#### **Foot Protection**

You must wear steel capped boots at all times.

#### **Head Protection**

You must wear a hard hat when another person working with tools on the reactor roof.

#### **High Visibility Clothing**

Reflective high visibility vests or clothing are to be worn at all times when working in the vicinity of moving plant.

#### **Hearing Protection**

You must wear ear plugs or ear muffs whenever you are working in a noisy environment including when you are:

- Using powered hand tools
- Working alongside others using powered hand tools

#### **Eye Protection**

You must wear suitable eye protection whenever there is a risk of a foreign body entering of striking one of your eyes, including when you are:

• Using powered hand tools



- Working with chemicals
- Mixing or handling hazardous substances
- Working in the vicinity of earthmoving equipment
- Welding
- Working in a dusty environment

#### **Hand Protection**

You must wear appropriate gloves whenever there is a risk of bruising, cutting or burning your hands including when you are:

- Handling sheet materials
- Handling chemicals
- Handling cement or wet concrete
- Using vibrating equipment

#### **Breathing Protection**

You must wear appropriate respirators or dust masks whenever there is a risk of inhaling dust or fumes

#### **Ultra violet Protection**

At all times when working outside you must wear sunscreen and clothing that protects your head, shoulders, neck and arms.

#### **Fall Protection**

You must be provided with and instructed in the use of fall protection in any circumstance when you are required to work within 3 meters of a live edge and any other situation where you are at risk of falling.

#### PERSONAL CONDUCT

Horseplay, Bullying and Harassment Horseplay, bullying and harassment are not allowed at any time.

#### Smoking

Smoking is not allowed in any enclosed area or in the vicinity of plant or hazardous materials.

#### Eating

Food is not to be consumed while working including while driving or operating plant.

#### Mobile Phones

Mobile phones are not to be used while operating vehicles, plant or tools.

Mobile phones are not to be used while on or adjacent to roads or other access ways used by vehicles or plant.



Mobile phones are not to be used when using stairs or ladders or when working at height.

#### **Radios and Music Players**

The rules for use of radios and music players are the same as for use of mobile phones.

#### **Warning Signs**

Warning signs must be complied with at all times. If you come across a warning sign that you do not understand, please seek clarification from your supervisor or the INNACO Construction Manager.

#### Swearing

Swearing is not allowed at any time and consideration should be given to other workers and the public around you.

#### **NOT ALLOWED AT SITE**

#### **Alcohol and Drugs**

Alcohol and drugs are not allowed at site at any time.

Persons affected by drugs and/or alcohol are not permitted on site at any time.

#### HOUSEKEEPING

#### Amenities

You must contribute to maintaining the site amenities in a clean and hygienic state:

- Rubbish is to be disposed of
- Spillages are to be cleaned up
- Food past its use-by date is to be disposed of

#### Site

You and your work mates are required to keep your work area(s) tidy; This includes:

- Tidy storage of materials prior to use
- Timely disposal or removal to storage of waste and excess materials
- Maintaining access and egress ways clear of obstructions and trip hazards
- Not leaving tools and leads lying around



#### **HAZARDOUS SUBSTANCES**

You must always use hazardous substances in a safe manner as prescribed by the Material Safety Data Sheet (MSDS). You should not handle any hazardous substance unless you are appropriately trained and/or qualified to do so.

#### **PLANT OPERATIONS**

#### **Pre delivery To Site**

Plant is not to be brought to site without appropriate certificates, registrations and pre delivery maintenance checks having been completed.

#### Plant Access, Movements and Parking

If you are involved in bringing plant and/or equipment to the site, it is your responsibility to ensure you are fully aware of appropriate routes, access, and plant movements around the site.

#### **Operator Qualifications**

You are not to operate any plant or equipment that you are not qualified and authorized to operate.

All plant operators are to carry relevant licenses with them at all times whilst operating plant.

#### **After Hours**

Plant must be secured and keys removed at the end of each shift.

#### **COMMON SITE HAZARDS**

#### If You See A Hazard

If you see a hazard please report it to the INNACO Operation Manager. If you are qualified to rectify the hazard please do so, however the incident shall still be reported.

#### Persons Working In a Hazardous Manner

If you see a person working in a hazardous manner please act immediately by discussing the situation with the person involved in a calm, helpful way. Should the person continue to work in a hazardous manner the situation shall be reported to INNACO's Operation Manager.

#### **Confined Spaces**

A confined space is any work space which may become contaminated by a harmful substance and/or become oxygen deficient. This, for example, includes storage tanks, shafts, pits, boilers, freezers, silos, pipes, and ducts.

You must not enter a confined space without the appropriate confined space work permit and without having received specific training and instruction.



#### **Electrical Safety – Leads**

You are to check lead tags to ensure electrical equipment has been tested and is still within date prior to use. If you find a lead which is damaged, not tagged or not in date, please remove it from service and advise your supervisor.

Always keep electrical leads clear of any water or potential water hazard.

Always keep electrical leads suspended from the floor where possible using devices such as lead stands.

#### **Electric Welding**

If you are undertaking electric arc welding, you shall use screens to protect persons in the vicinity from welding flash.

You must have suitable fire fighting equipment at hand.

If there is a risk of sparks, slag and other welding debris falling to work areas, access ways or public areas, you must ensure the area below is barricaded and warning signage provided.

#### **Elevating Work Platforms (EWPs)**

You are not to set up, operate, or move an EWP unless you are licensed and authorised to do so.

If you required to work from an EWP, you must first be instructed in its emergency lowering procedure.

Areas below EWP work baskets must be barricaded off.

EWPs fitted with outriggers must have the outriggers fully extended when the EWP is being used.

#### **Falling Objects**

You must not tamper with any protective screens or other systems put in place to prevent objects falling from height.

If you are working in an area where materials or tools may fall onto a work or public area, safety measures shall be put in place to prior to the commencement of work.

#### **Working At Heights**

If you work at height you must be protected from falling <u>at all times.</u> You must ensure that work or public areas below are protected from falling tools or materials as a result of your work.



You are not to encroach within 3 meters of a fall hazard without restraint or fall arrest equipment.

Three points of contact to the ladder, all the time needs to be conducted.

#### Penetrations

Penetrations and openings must be securely covered at all times. The cover is to be marked to clearly indicate that there is a penetration below.

#### Power Tools – General

Power tools are only to be used as per the manufactures recommendations.

Home made power tool attachments are not to be used on site.

Safety equipment, including tool guards are to be used at all times.

#### **Power Tools – Angle Grinders**

Angle grinders must be fitted with a "dead man" switch.

Power Tools – Skill Saw Blunt saw blades are not to be used.

#### **Power Tools – Docking/Drop Saws**

Docking and drop saws must be secured to a stable bench or base.

#### Scaffold

You must not erect, modify, dismantle or adjust scaffolding unless you are an licensed scaffolder, and have been instructed to do so.

If you see any incomplete or unsafe scaffolding, you are to report it to your supervisor immediately.

#### Sediment Control

Effective sediment control must be in place in any situation where soil is at risk of washing or being transported onto roadways, footpaths or into natural waterways or stormwater systems. The sediment control system must not be tampered with at any time unless you have been authorised to do so. Should you see any damages or ineffective sediment controls you shall report it to INNACO's Construction Manager straight away.

#### Waste

Waste materials must be promptly disposed of off site. All waste materials are to be recycled where possible. **Appendix A - Induction Checklist-Site Specific Visitor** 



## **Site Specific Induction - Visitor**

#### Site : Whytes Gully Leachate Treatment System

Job No. 16746

No	Items Covered	Yes	No	N/A
1	Have you signed in at the office site?			
2	Have you been shown what to do in an emergency?			
	How to contact help on the site?			
	How an emergency is raised?			
3	Have you been shown the the location on the Emergency	_	_	_
	Assembly Point and Evacuation Route/s?			
4	Have you been shown how to get treatment for an injury?			
5	Have you been shown the location of the first aid facilities/kits			
	and how to obtain treatment/assistance?			
6	Have you been shown what to do of you become separated?			
7	Do you have the correct PPE?	_	_	_
	Hard Hat			
	Safety Glasses			
	Safety Boots			
	Sun Protection Equipment			
	Hi Vis Vest			
	Other			
8	Do you know how to wear the PPE properly?			
9	Have you been shown the major hazards and no-go zones on the			
	site?	-	-	-
10	Do you have any further questions or need clarification on any point?			
I have pa	rticipated in the Visitor induction during which I had the Site Sp	ecific Hea	lth & Safe	ety Rules
explained	to me. I understand the importance of remaining with the site esc	ort at all ti	mes and I	agree to
comply with these safety rules during my visit.				
Inductee I	Name: Signature:	Date:		
Inducted I	By: Signature:	Date:		

turn-key solutions

Appendix B – Visitor Sign in



## **VISITOR SIGN IN BOOK**

## Site: Whytes Gully Leachate Treatment System

Ref: 16746

turn-key solutions

Level 5, 79 Victoria Ave CHATSWOOD NSW 2067 | P +61 2 9417 7728 | F +61 2 9417 8337 | info@innaco.com.au | www.innaco.com.au



## Whytes Gully Leachate Treatment System

NAME	COMPANY	VISITING	TIME IN	TIME OUT

## Innaco Corporate IMS Manual

Work Health and Safety Requirements – AS4801:2001 Quality Management Requirements – ISO9001:2015 Environmental Management Requirements – ISO14001:2015



Innaco Pty Ltd ABN 33119715052 Level 4, 79 Victoria Avenue Chatswood NSW 2067 +61 2 9417 7728



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#### Document revision:

Date	Revision No	Comments	
29 November 2013	1	Initial IMS development	
23 March 2014	2	Review and signing by General Manager	
16 August 2018	3	Review and update	



## 2 Introduction

INNACO is accomplished in the provision of turn-key wastewater, water and stormwater treatment technologies and all civil works surrounding it and with the expertise and back up of a variety of technology suppliers, successful project outcomes are assured. INNACO is a subsidiary of Henry & Hymas consulting engineers who have been at the forefront of infrastructure design for the past decades.

#### 2.1 Scope and applicability

Innaco have developed this management system in line with ISO9001:2015 Quality Management System Guidelines, AS4801:2001 Occupational Health and Safety Management System Guidelines and ISO14001:2015 Environmental Management System Requirements.

The system was developed and implemented to help us to control our internal processes and ensure that we meet our objectives and remain compliant with legislative and statutory requirements.

This management system is documented to address the quality, workplace health and safety and environmental aspects of the business for the delivery of design, documentation, construction and maintenance services related to stormwater infrastructure.

- Demonstrate ability to consistently provide services that meet customer and applicable statutory and regulatory requirements
- Aim to enhance customer satisfaction through the effective application of the system, including processes for improvement of the system and assurance of conformity to customer and applicable statutory and regulatory requirements.

Senior management regularly review the processes and procedures to ensure the system remains compliant, effective and relevant.

There are no exclusions to the Standard.

All personnel and contractors are required to comply with the requirements of this management system.

#### 2.2 Context of Innaco

Innaco will determine the external and internal issues that are relevant to its purpose and strategic direction and that affect its ability to achieve the intended result(s) of its quality management system.

Innaco will include positive and negative factors or conditions for consideration.

#### 2.3 Needs and expectations of stakeholders

In establishing Innaco and developing the quality management system, consideration has been given to stakeholders and stakeholder requirements that have or may have an impact on the ability to consistently provide the services that meet customer and applicable statutory and regulatory requirements. Stakeholders include business owners, regulatory authorities, clients, employees and suppliers. Due to their effect or potential effect we shall determine:



- The stakeholders that are relevant to the quality management system
- The requirements of the stakeholders that are relevant to the quality management system

Innaco shall monitor and review information about these stakeholders and their relevant requirements.

Innaco's General Manager is responsible for keeping abreast of stakeholder requirements through publications, communications, email update services, contract reviews and other sources of information. The management review includes monitoring and review of information regarding interested stakeholders.



Shareholders	Requirements / Expectations
Directors and owner/shareholders	Maintain profitable business.
Staff	Provide sufficient training, systems and resources to complete required tasks safely, competently and efficiently.
	Minimise harm and injury to personnel and others.
Clients, allied health staff, end users	
and community	Meet client requirements.
	Minimise impact on the environment.
Clients and community	
Regulatory authorities	Ensure compliance to required standards and regulatory requirements.
Suppliers and sub-contractors	Product and service provided on time and to requirements.



### 3 Management System Structure

#### 3.1 Management system documentation

The Innaco Management System is made up of several documents as follows:

**Policies** – The policies are single page documents that summarises the overall intent and commitment of the business. Policies are required to be communicated and regularly reviewed to ensure they remain current. The Innaco policies shall be displayed in the office to communicate their intent to staff and visitors. The policies will also be made available to stakeholders and the public upon request.

**Management System Manual (this manual)** – The management system manual provides a general overview of the Innaco business management system. The management system manual is intended to describe the elements of the management system and make reference to specific procedures that have been developed to control our business processes. The manual will be provided to new employees when they commence work as a starting point for getting to know the Innaco management system.

**Procedures** – Procedures have been documented where required by the management system standards or where Innaco has identified specific risks that require control. These procedures are referenced by the management system manual and intended to provide more detail of how to complete specific processes. Each procedure is referenced in this manual by use of *Italics*.

**Project Management Plan** - The Project Management Plan is used to outline project specific quality, safety and environmental information including responsibilities, objectives, approvals, reviews etc. The PMP is used for all projects and meets requirements for documents commonly referred to as a site safety management plan (SSMP), construction environmental management plan (CEMP) and project quality plan (PQP).

**Forms and Registers** – Forms and registers are referenced throughout the manual, procedures and PMP and are used to demonstrate conformity to the management system standards and legislative requirements. All completed forms must be maintained in accordance with the *Records Management Procedure*.



Innaco is accomplished in the provision of turn-key wastewater, water and stormwater treatment technologies and all civil works surrounding it and with the expertise and back up of a variety of technology suppliers, successful project outcomes are assured. Innaco is a subsidiary of Henry & Hymas consulting engineers who have been at the forefront of infrastructure design for the past decades.

Innaco is committed to implementing and maintaining a quality management system that will improve efficiency and productivity, and ensure that all work processes provided by the company meet with the requirements of its private and public sector clients.

In order to realise this commitment, Innaco has established and will maintain a structured and documented management system complying with AS/NZS ISO 9001. The system and quality objectives include:

- Assignment of clear management responsibilities.
- Establishment of defined and documented project management plan.
- Allocation of appropriate and proficient staff to specified project roles.
- Control of document production and flow.
- Control and monitoring of the design process.
- Control of the construction process and defects free handover.
- Verification of project output.
- Provision for continual improvement of processes and services.

The Management Team of Innaco are committed to the implementation of this policy.

dan flages

Lars Herngren

General Manager 23/03/2014



## 5 Innaco Work Health and Safety Policy

Innaco is accomplished in the provision of turn-key wastewater, water and stormwater treatment technologies and all civil works surrounding it and with the expertise and back up of a variety of technology suppliers, successful project outcomes are assured. Innaco is a subsidiary of Henry & Hymas consulting engineers who have been at the forefront of infrastructure design for the past decades.

Innaco are committed to conducting our activities in a manner that minimises risk to health and safety. This includes the activities of our people and the potential safety impacts of our projects.

To demonstrate our commitment to this policy, we will:

- Establish objectives and targets to improve safety performance;
- Comply with relevant legislative and statutory requirements, and advisory standards;
- Conduct safe design reviews for each project where required by legislation;
- Provide premises, plant and equipment together with systems of work that are safe;
- Ensure the work health and safety of all people at work by providing a suitable environment, and the information, instruction, training and supervision required;
- Provide personal protective equipment to staff;
- Provide adequate first aid, emergency procedures and access to appropriately trained personnel;
- Encourage consultation and participation within the company, and our subcontractors, to promote and maintain safe and healthy conditions;
- Investigate reported hazards promptly;
- Investigate promptly any accident, incident or near miss and undertake corrective actions as soon as possible;
- Monitor compliance with the Management System;
- Monitor our WHS performance;
- Develop and continually improve our management system.

Work health and safety is also the responsibility of all management, staff and contractors. Specific WHS responsibilities for each function and level of Innaco are outlined in our management system manual, position descriptions, procedures and plans.

Lars Herngren

General Manager 23/03/2014



### 6 Innaco Environmental Policy

Innaco is accomplished in the provision of turn-key wastewater, water and stormwater treatment technologies and all civil works surrounding it and with the expertise and back up of a variety of technology suppliers, successful project outcomes are assured. Innaco is a subsidiary of Henry & Hymas consulting engineers who have been at the forefront of infrastructure design for the past decades.

Innaco are committed to identifying significant environmental aspects and impacts within our control and implementing improvement programs to reduce these impacts 'whole of life'. This includes our designs as well as our construction and rectification activities.

We will achieve the above commitment through the following:

- Assessing, auditing and monitoring our activities and Identifying and managing the significant 'whole of life' environmental aspects and impacts;
- Replacing any trees requiring removal for our work, with three native species or as specified by the client;
- Reducing pollution;
- Ongoing implementation of our environmental management processes;
- Reviewing and complying with all relevant legal, contractual and other requirements that are applicable to the project and any identified environmental aspects;
- Planning and providing for environmental emergency situations;
- Regular reviews and audits of the project safety and environment management plan and its implementation on site;
- Setting measurable and realistic objectives and targets and
- Reduction, reuse and recycling of materials.

The Directors will review this policy on an annual basis as part of the overall management review process to ensure that we are achieving our objectives, and that the policy is current.

This environmental policy is available to the public upon request

s floge

Lars Herngren

General Manager 16/08/18



## 7 Control of Documents and Records

#### 7.1 Access to documents

Management system documents are available to all Innaco personnel through the Innaco Drive (I Drive). When new personnel commence work with Innaco they will be provided with an overview of the management system documents by the General Manager and then given access to the documents for future reference.

#### 7.2 Document control

Management system documents are required to be controlled to ensure that personnel are always accessing and using the most up to date approved document. This is managed through the use of the *Document Register / Transmittal*.

The *Document Control Procedure* outlines the processes for creating, approving, reviewing and updating documents, identification of revision status, accessing current documents, preventing unintended use of obsolete documents and controlling documents of external origin.

All documents are required to contain document name, revision number and revision date within the footer of the document.

The *Document Control Procedure* specifies requirements for management system documents as well as project documents.

#### 7.3 Control of records

Records are produced by Innaco as part of our day to day operations. In many cases, these records are needed to provide evidence that the contract conditions have been met and that we have complied with our legal obligations.

These records must be maintained in such a way as to ensure that they can be easily retrieved and are free from deterioration for the period required by contracts and legislation. Record retention periods are defined in the *Records Management Procedure*.

The *Records Management Procedure* describes the requirements for records management. This includes the project filing system, management of hard copy records and archiving as well as management of electronic records and backup.

#### 7.4 File manager

File Manager is a program that is used to control project design documents and records, as well as project related correspondence and time. All projects will be managed using the File Manager for design documentation.

The *Records Management Procedure* provides an overview of File Manager and outlines file naming conventions.



## 8 Leadership and Responsibility

#### 8.1 Leadership

The General Manager and Directors shall demonstrate leadership and commitment with respect to the quality of the management system by:

- Taking accountability for the effectiveness of the quality management system;
- Ensuring that the quality policy and quality objectives are established for the quality management system and are compatible with the context and strategic direction of Innaco;
- Ensuring the integration of the quality management system requirements into Innaco's business processes;
- Promoting the use of the process approach and risk-based thinking;
- Ensuring that the resources needed for the quality management system are available;
- Communicating the importance of effective quality management and of conforming to the quality management system requirements;
- Ensuring that the quality management system achieves its intended results;
- Engaging, directing and supporting persons to contribute to the effectives of the quality management system;
- Promoting improvement; and
- Supporting other relevant management roles to demonstrate their leadership as it applies to their areas of responsibility.

#### 8.2 Responsibility

Responsibilities have been defined and communicated for each position at Innaco through the use of *Job Descriptions*. The management system manual and procedures also specify responsibilities for each process and these are presented to personnel at the time of induction.

The General Manager is responsible for ensuring that the processes needed for the integrated management system are established, implemented and maintained. This includes monitoring and reporting on the performance of the management system and promoting awareness of customer requirements throughout Innaco. This reporting occurs as part of the directors meeting.

#### 8.3 Innaco organisational structure

The following diagram outlines the structure and level of authority at Innaco.







## 9 Planning

Annual planning of the management system is carried out as part of the management review process. The Directors will review the management system, Innaco performance and set objectives and targets that are focused on improving the performance of the business. Ongoing monitoring of performance also occurs as part of the regular Directors meetings.

#### 9.1 Objectives and targets

The following objectives and targets have been established to improve the performance of the business in the area of Quality, Safety and Environmental Compliance. These objectives and targets are formally monitored and reviewed annually as part of the management review and informally monitored on an ongoing basis through the Directors meetings.

Objectives	Targets	Resources	Responsibility	Timeframe
Achievement of quality of professional services, and	100% projects delivered on time	Human resources. Project resources as determined by review.	Design Manager Construction Manager	Contract delivery milestone
maintain the management resources and staff to deliver projects on time and within budget.	100% of projects delivered within budget	Quotes and proposals procedure	Design Manager Construction Manager	Ongoing
High quality design documentation	100% of documentation checked before being sent to the client	Time for independent review of drawings prior to submission	Drafters and Project Engineer	Ongoing
	100% compliance of designs to AS and client requirements	Access to current standards	Project Engineer	Ongoing
Provide a high level of communication	Respond to all enquiries	Stable communication systems, email and phone Time management	Project Engineer Site Supervisor	Within 24 hrs
Comply with legislation	Identify all changes to legislation applicable to the business	Legal register Access to legislation updates	General Manager	Weekly



Zero incidents	100% incidents and near misses reported	Training for staff on incident reporting requirements. Forms to record near misses.	All personnel	Within 24 hours after near miss / incident
	All incidents and near misses investigated and corrective actions implemented	Time to complete investigation. Resources required to implement corrective action.	General Manager	Within 3 days of near miss / incident
All hazards identified and assessed	100% Safety and Environment risks identified, assessed and controlled	Time to complete risk assessment.	General Manager, Construction Manager, Design Manager	Annually
Effective communication / consultation	Regular meetings held	2 hours per month	General Manager, Design Manager Construction Manager	Fortnightly
Reduction in impacts of significant environmental aspects for the business. Recycling of waste.	Set printer defaults to double sided Provide paper recycling bins Encourage staff to avoid printing	IT support to set printer defaults Paper recycling bins	All personnel	Ongoing
	Turn off lights in rooms and bathrooms not used Adjust power settings of computers to save energy.	IT Support to adjust power settings	All personnel	Ongoing
High Quality Product	Zero defects	Inspection and test plans	Site Supervisor	Project hand over



#### 9.2 Legal and other requirements

Legislation has been identified that is applicable to our activities. A list of this legislation is maintained in the *Legal Register*. This legislation has been considered in establishing the management system procedures.

Changes to legislation and any new requirements are identified through subscription to the following services:

- WorkCover NSW
- SafeWork NSW
- NSW Government Office of Environment & Heritage
- Consult Australia
- Engineers Australia

The General Manager will monitor changes to legislation to identify any changes that may affect Innaco. When changes are identified the relevant procedures will be reviewed to confirm that the company complies. If changes are required to the procedures, the amendments shall be made in accordance with the *Document Control Procedure*. Changes will be communicated to personnel through emails and staff meetings. Substantial changes to legislation may require more detailed training than a staff meeting. These will be conducted in accordance with the *Human Resources and Training Procedure*. This will be at the discretion of the General Manager.

Records shall be maintained where the management system has been changed as a result of legislative changes. This record will be in the form of archived superseded procedures.



## 10 Resources

Resources are required to achieve the Innaco objectives and implement the management system. The Directors will review resource needs as part of the management review process to ensure that Innaco have the capability to comply with Quality, Safety and Environmental requirements and deliver the projects on time. These resources include human resources, technological, infrastructure, specialised skills, and financial.

#### **10.1** Human resources and training

Innaco maintain a team of personnel that are competent to perform their duties on the basis of appropriate education, training, skills and experience. The Directors are responsible for ensuring that sufficient personnel are provided to deliver the project on time and compliant with Quality, Safety and Environmental requirements. The General Manager shall conduct a review of human resource requirements for a project during the proposal stage.

Competency requirements will be identified for each position based on statutory requirements, risk assessment, staff development and project specific needs.

Competency requirements will be identified in *Job Descriptions*. These will be used as a guide when recruiting a person for the position or promoting from within the company. Where personnel do not hold the required qualification or skills, training will be organised by the General Manager.

Following training, a competency assessment is completed to ensure that the person has obtained the required skills. This competency assessment could be a formal or informal process depending on the type of training provided and what assessment is included in the course.

Records of training that will be maintained include the *Training Register* identifying what training has been completed and individual copies of certificates maintained in personnel folders.

The *Human Resources and Training Procedure* outlines the processes to be followed for identifying training needs, taking action to address training needs, reviewing the effectiveness of training and record keeping.

Any personnel wishing to undertake additional training should contact the General Manager to discuss the relevance of the training to Innaco and future development of the person. The annual performance review is also a time that training is reviewed and planned.

#### 10.2 Time sheets

Time sheets are used to record hours worked on projects. This enables Innaco to track project costs and monitor the time spent working on a project. The Latitude database is used to record timesheets. The *Human Resources and Training Procedure* provides more information regarding timesheets.

#### 10.3 Infrastructure

Innaco are committed to providing infrastructure and a work environment that is conducive to delivery of the service.

To ensure that staff are equipped to provide the services, computer programs and equipment will be provided with sufficient software licenses. In addition to equipment to be



provided, workspaces will also be provided with enough space for personnel to do their work.

The provision of infrastructure and work environment will be reviewed annually by the Directors and General Manager during the management review.



## 11 Consultation, Communication and Reporting

#### 11.1 Consultation

Consultation is an important part of the management system. By consulting with employees on how they perceive the best way to do the activity, it will lead to a management system that is more effective. Consultation is carried out prior to making decisions that affect the health and safety of personnel and in developing procedures. This will typically be carried out through emails and occasionally staff meetings.

Consultation is also carried out on construction sites and includes consultation with subcontractors who undertake the work. This consultation is carried out through tool box talks. These meetings shall be recorded on the *Tool Box Meeting Form*.

The *Communication and Consultation Procedure* outlines the process for complying with consultative legislative requirements and establishing effective methods of communication.

#### **11.2 Communication**

Internal communication includes directors meetings, informal ad hoc staff meetings, toolbox meetings onsite, emails and phone calls. Communication is described in the *Communication and Consultation Procedure*.

Any formal external communication such as communicating with authorities is only undertaken by the General Manager. Innaco has made the decision not to communicate externally regarding significant environmental aspects, as our environmental aspects are of a minor nature.

#### 11.3 Reporting

Reporting is used as a mechanism for the Directors to monitor the performance of the management system. The General Manager will report on the following during the annual management review.

- Results of audits and inspections,
- Incidents, system failures, preventive and corrective action including nonconformance reports, defects and incident / near miss reports,
- Results of hazard identification, risk assessment and control,

Where external reporting is required by contracts or legislation, the reporting will be done by the General Manager.



## 12 Hazard Identification, Risk Assessment and Control

#### 12.1 Identification, assessment and control of safety and environmental risks

*The Risk Management Procedure* outlines the processes to be followed for hazard identification, risk assessment and control. Innaco implements the same process for management of safety hazards and risks as well as environmental aspects and impacts. The term hazard and risks used throughout the integrated management system is used to describe both safety and environment.

All hazards and risks that have the potential to impact Innaco personnel or the environment must be identified, assessed and controlled. These include all safety and environmental risks associated with the office, travel to sites and work onsite.

Corporate hazards and risks are recorded on the corporate *Hazard Register*. These risks are assessed using the risk matrix in the *Risk Management Procedure*. The *Hazard Register* is subject to review annually or when there is a change to the work environment that may introduce new or changed hazards. The General Manager is responsible for maintaining the *Hazard Register*.

For construction projects, whole of project hazards and risks shall be identified by the Construction Manager in consultation with the site supervisor and recorded on a *Hazard Register*. This is known as the project risk assessment and shall be completed for all projects. The project risk assessment shall be provided to sub-contractors at the time of engagement so that they can include these risks in their own risk assessments and safe work method statements. The risk assessment can also be used to assess sub-contractors SWMS to confirm they have included risks that Innaco have identified.

Safe Work Method Statements (SWMS) shall be established for all high risk construction activity onsite. As most of this work is carried out by sub-contractors, the sub-contractors are required to provide SWMS to Innaco for review. Where the sub-contractor cannot provide a SWMS, Innaco will provide one that can be used as a starting point to be modified by the sub-contractor for the project. Refer to the sub-contractor section of this manual for the process for reviewing sub-contractor documentation.

All risk assessment processes shall be reviewed and evaluated annually as part of the management review.

#### 12.2 Environmental management procedures

The *Environmental Management Procedure* has been established to provide generic controls for significant environmental aspects onsite. As part of the risk assessment and project planning process undertaken for each project, the relevant topics in the environmental management procedure shall be incorporated into the project documentation by the Construction Manager. This information shall be revised to be project specific inline with requirements of the development consent conditions and any specifications for the site. This document may also be useful in tender submissions.


Internal / External Issues	Risk	Opportunity	Mitigation / Controls
Site Security	Damage to property	No lost property	Alarm systems, building security, security patrols
Technology	Failure to keep up with technological changes, loss of business	Increased market share with new technology or services	Capital investment review and implement new technology
IT Systems	Virus attack, data failure, loss of data, interruption to business, unauthorised access to data	Ready access to data, Use of data to make improvements	Backups, anti-virus software, nil data breaches, nil system downtime
Regulations	Failure to comply with legislation resulting in fines and loss of reputation	Lower insurance premiums, no fines	Regulatory processes and records in place, fair and truthful advertising, maintain business insurances and membership of industry associations, no breaches of legislation
Financial	Negative cash flow, theft, insufficient funds	Profitable business	Ongoing monitoring of financial reports, accounting software
Suppliers	Poor quality of service, missed deadlines, defects/warranty claims, loss of business and	Reliable supply through ongoing partnerships	Only use reputable service providers, review of purchasing procedures, contracts and



	reputation		agreements, requirements clearly stated
Client sales / market conditions / contractual requirements / service quality	Lack of winning tenders, insufficient profit, warranty issues, late delivery, competition, loss of business, poor quality	Winning tenders, business growth, quality service	Process monitoring data and reports, service records, on-time delivery, understand client and statutory requirements, comply with legislation, ongoing review of market conditions, internal audits and corrective action procedures
Staff	Loss of key staff, staff unable to complete tasks affecting quality and customer satisfaction, poor service and missed deadlines, staff injuries through poor safety resulting in lost time, fines, insurance premiums	Knowledge sharing, wellbeing of staff, less turnover, improved efficiencies	Sound recruitment practices, identify trainaing opportunities, identify key tasks, provide trainaing and assess competency, adequate planning and allocation of tasks, compliance with safety legislation, maintain a safe workplace, monitor safety record and staff turnover

Consistent with a 'whole of life' perspective, Innaco will:

- Establish controls, as appropriate, to ensure that its environmental requirement(s) is (are) addressed in the design and development process for the product or service, considering each life cycle stage;
- Determine the environmental requirement(s) for the procurement of products and services, as appropriate;



- Communicate the relevant environmental requirement(s) to external providers, including contractors;
- Consider the need to provide information about potential significant environmental impacts; and
- Associated with the transportation or delivery, use, end-of-life treatment and final disposal of its products and services.



# **13 Handling and Storage of Substances**

A Safety Data Sheet (SDS) shall be obtained for all chemicals used or stored at each workplace to identify if the substance is hazardous. If the chemical is hazardous then it must be included in the corporate *hazard register* (for office) or SWMS (for site) and recorded on the *Hazardous Chemicals Register* for the location (office or site).

If hazardous materials such as lead or asbestos are discovered as part of a construction project all work shall stop until the material is tested. If tests are positive then Innaco will discuss with their client an appropriate course of action. A licensed contractor will likely be used to remediate the site, before work can recommence.



# 14 Delivery of the Service

#### 14.1 Fee proposals

Client enquiries are generally received by Innaco through the following methods:

- Identification of tender opportunities through paper or website subscriptions,
- Invitation to tender or phone call received directly from the client,
- General marketing.

When a tender opportunity is identified, the General Manager will conduct a review of the tender requirements to confirm that Innaco have the ability to deliver the project based on skills and resources. If the General Manager believes the project is within Innaco capabilities and in-line with the company's direction, then the decision will be made to submit a tender. This review will provide the groundwork for information to be included in the fee proposal and information in the fee proposal will be the record of this review (e.g. resources, past experience etc). Any of the staff will be able to establish the project number to be used through the duration of the project.

Based on the requirements of the tender, the General Manager or Project Manager will compile a tender submission that addresses all of the potential client's requirements. The actual form of tender submission or proposal may vary between clients and may be an Innaco document, a completed client form or a combination of both.

Any omissions from the tender documents or items that are not clear will be clarified with the client prior to completion of the tender / proposal.

The General Manager is responsible for pricing the job, compiling the tender (or delegating), submitting tenders and proposals on time and following up with the client throughout the sales process.

When Innaco are successful in winning the work, formal client approval will be obtained. The approval will typically be a client supplied agreement / contract or purchase order. The General Manager is responsible for reviewing and negotiating agreements.

#### 14.2 Project planning

Project planning is important to ensure that all projects are delivered on time and to satisfy the client's needs. The project planning process commences with a handover meeting from the General Manager to the Design Manager or Construction Manager.

The *Design Management Plan* is used to plan the design of the project. This includes the project objectives, scope, project team, budget, deliverables, project program/milestones, assumptions constraints etc. The Project Engineer is responsible for completing the *Design Management Plan* using the appropriate template.

The *Construction Project Management Plan (PMP)* is used to plan the delivery of the project. This includes the project objectives, scope, project team, budget, deliverables, project program, assumptions constraints etc. A *Project Management Plan* Template has been established to use as the basis for developing the PMP. This includes Quality, Safety and Environmental requirements for delivery of the project.

The Construction Manager is responsible for completing the *Project Management Plan* using the appropriate template.



In addition to the PMP, a project program and project budget shall also be established to plan project milestones and to ensure the project is completed on time and on budget.

#### 14.3 Sub contractors and suppliers

Innaco are responsible for managing the performance of sub-contractors and suppliers. This includes quality of work, safety and environmental performance. As sub-contractors complete most of the construction work it is very important that we maintain good relationships with high quality, safe and reliable suppliers.

Purchasing controls are applied to sub-contractors and suppliers that can impact the delivery of the service to our client or have impact on safety or the environment. Suppliers and sub-contractors are assessed to evaluate their ability to supply the product or services in accordance with Innaco requirements for Quality, Safety and Environmental compliance. It is not only important that the supplier has the ability to supply but they must also have the resources to work on our projects if they are also working on other projects. The *Service Providers and Purchasing Procedure* outlines the process to be followed for reviewing and selecting service providers as well as reviewing sub-contractor documentation and monitoring supplier performance.

The General Manager or Construction Manager are responsible for assessment of new suppliers. Notes, emails and any comparison records shall be maintained.

Once a supplier has been selected, either a purchase order or sub-contract is used to communicate purchasing requirements including:

- Scope of works,
- Applicable contract specifications and drawings,
- Management system requirements Quality, WHS and Environment,
- Environmental compliance requirements and any significant aspects to be aware of,
- Safety compliance requirements and any high risk safety items identified for the project,
- Required qualifications of personnel,
- Milestones,
- Certifications and warranties.

During the supply of products or services, the Site Supervisor shall monitor the supplier's performance to confirm that the supplier is complying with requirements. If this is to be undertaken at the suppliers premise, the purchase order or sub-contract shall specify this. Monitoring service provider's work includes inspection and sign off of ITPs, and monitoring sub-contractor compliance to SWMS, environmental controls and site rules.

Where a sub-contractor fails to comply with requirements, verbal instruction will be given by the Site Supervisor. If the sub-contractor continues not to meet requirements, a *Non-Conformance Report* will be issued in accordance with the *Non-Conformance Procedure*.

For purchased items such as valves, pumps, pipes, etc. Certificates of conformity will be requested from the supplier and maintained with the project records. Refer to the *Service Providers and Purchasing Procedure*.

#### 14.4 Project Delivery

The *Project Control Procedure* outlines the processes to be followed for managing the project including:

• Registration of the project,



- Completing the design and design documentation,
- Design safety and environmental requirements,
- Completing design reviews, verification and validation,
- Project cost control,
- Project deliverables,
- Issuing drawings and reports,
- Financial Management and invoicing.

#### 14.5 Operation, maintenance and auditing projects

In addition to construction and design projects, Innaco also provides operation and maintenance services to maintain client owned infrastructure. Each of these projects is managed by Innaco under an *Operation and Maintenance Manual*. This manual will be established by Innaco in consultation with the client considering any operational and Environmental Protection License conditions.

Auditing of water treatment assets is becoming ever more important to the business. Auditing commonly involves entering confined spaces and WHS Legislation requires that personnel be confined spaces trained and equipped with appropriate rescue equipment consisting of a tripod, harness, and winch.

The *Work Order Database* is used to schedule work for operation, maintenance and auditing contracts. Each day the *Work Order Database* is opened it produces *work orders* that outline details about the site visit and work to be carried out. This scheduling is based on the manufactures recommendation for service intervals or the auditing program.

Work orders are produced approximately two weeks in advance of the work being due. The technician is responsible for scheduling the work in their calendar to be completed on time.

The quality control system that is implemented for these projects is a checklist that is included on the *work order*. These shall be completed by the technician completing the work. When complete this checklist shall be saved to the project folder.

Reporting is typically required for these projects on a monthly or quarterly basis depending on the project. In the case of auditing, a report and data sheet are required for each asset. The Project Manager is responsible for compiling these reports when they are due and providing them to the client.

#### 14.6 Safety and environmental consideration in design work

In addition to managing the safety and environmental aspects of the workplace, Innaco has the ability to influence safety and environmental impacts of our designs.

WHS Legislation requires that the designer of a structure submit a design safety report to the person who commissioned the design. The design safety report must specify the hazards relating to the design of the structure that, so far as the designer is reasonably aware create a risk to persons who are to carry out the construction work and are hazards associated only with the particular design and not with other designs of the same type of structure. The *Design Safety Report* template is used to produce the design safety report.

Additionally, the design has responsibility to eliminate hazards where possible or if not reasonably practicable, reduce the risk through design. Where possible, controls will be designed into the structure in an attempt to eliminate or minimise the hazards and risks.

The environmental impacts of the design must also be considered. The *Environmental Considerations Checklist* is used to identify environmental aspects and impacts associated



with the design. Based on this checklist, the designer should attempt to reduce the impact of the structure. For example use of recycled materials, etc...



# **15 Emergency Preparedness and Response**

#### 15.1 Emergency plans

Risk of emergency in the office is considered to be low. The main potential emergency situation that exists is the potential for a fire.

An emergency plan will be established for each office that clearly describes the evacuation procedure, emergency contact details and location of first aid and fire fighting equipment.

All fire fighting equipment in the office will be tested and tagged on a six monthly schedule in accordance with Australian Standards.

Risk of emergency onsite varies from site to site. As this is the case, the Construction Manager shall assess the risk of emergency for each project and document plans in the *Project Management Plan*.

#### **15.2 Testing of emergency procedures**

All emergency procedures shall be tested by conducting drills. Drills will be held annually for each office. This will be coordinated by the General Manager.

Drills onsite shall be conducted in the first month for each project running and then every 6 months.

Drills shall be recorded on the *Emergency Debrief Form*.



# **16 Monitoring and measurement**

#### **16.1 Inspection and testing**

*The Monitoring and Measurement Procedure* outlines the monitoring and measurement activities to be implemented by Innaco. Monitoring and measurement is carried out to monitor the following:

- Six monthly inspection of risk controls;
- Weekly project site inspections of risk controls and subcontractor compliance;
- Performance against objectives and targets monitored through management review;
- Compliance with legislative requirements through internal audits;
- Reviews of completed work prior to release to the client (described in the *Project Control Procedure*); and
- Completion of Inspection and Test Plans (ITP's) to ensure work completed complies with specifications.

#### **16.2 Health surveillance**

There are no health surveillance requirements for Innaco Personnel.

#### 16.3 Client satisfaction

Information relating to client perception is monitored through regular meetings and discussions with the client. This process is informal, as many of our clients are not permitted to give written recommendations and feedback or just don't have the time. The following methods have been determined for monitoring client satisfaction:

- Following the submission of a quote/proposal/tender, the person managing the sales process will contact the client and request feedback after the client has made their decision so that this information can be included in future tenders. Any items requiring action will be recorded on the *Improvement Register*.
- Ongoing project meetings and discussions with the client will be recorded in meeting minutes.
- Following completion of a project, the client will be contacted to request feedback on our performance. This is an informal process where the client will be asked how they found Innaco to work with and areas that we can improve our service.

The information obtained relating to customer feedback is used to improve Innaco processes. Where the feedback results in action required to improve the system, it will sent to the General Manager for inclusion in the *Improvement Register*.

#### **16.4 Calibration of equipment**

A gas monitor is used by Innaco to confirm that the atmosphere is safe within a confined space before entry. The gas monitor used for this shall be calibrated in accordance with the manufacturers recommendations. The Construction Manager shall maintain records of this calibration.



# **17 Incident Management**

In the event of an incident (safety or environment related), injury or near miss, the General Manager must be notified.

Incidents, injuries and near misses shall be investigated and recorded on the *Incident Report* in accordance with the *Incident Management Procedure*. The purpose of the incident investigation is to identify the underlying cause of the incident so that corrective action can be taken to stop another incident occurring.

Work Cover shall be contacted immediately in the event of any of the following:

- Death of a person;
- Serious injury or illness of a person;
- A dangerous incident.

The area must not be disturbed until an inspector advises it is ok to do so.

Where an incident results in an injury that prevents an Innaco employee from working, the *Return to Work Program* shall be established.

Corrective action following incidents will be managed in accordance with the *Non-Conformance Procedure*.

First aid kits are provided at each workplace and these will be used by Innaco trained first aiders.



# **18 Management of Non-Conformances and Defects**

The *Non-Conformance Procedure* describes the process for management of nonconformances including the implementation of corrective and preventive action.

#### **18.1 Raising non-conformances**

Non-conformances generally fall into 4 categories for Innaco:

- 1. Non-conformances identified through system audits, inspections and day to day activities. These could be related to WHS, Environment or Quality.
- 2. Issues identified as part of an incident investigation.
- 3. Non-conformances (defects) in relation to the product/service identified through independent reviews of documentation, site inspections and customer feedback.
- 4. Complaints Complaints received from customers or members of the public.

Where the non-conformance is received from an external party or specifically relates to an individual poor performance, the *Non-Conformance Report* shall be completed and the non-conformance entered into the *Improvement Register*.

Where the non-conformance is internal, the *Non-Conformance Report* is not required. The issue will be recorded on the *Improvement Register* only.

#### **18.2 Corrective action**

Corrective action is taken when a non-conformance or incident has occurred. Preventive action where trends are identified and as part of risk identification.

When a non-conformance or issue is identified a review shall be carried out to identify the root cause. Corrective action or preventive action shall then be identified and implemented.

After corrective or preventive action has been implemented, the action shall be reviewed to confirm that it has been effective.

The *Non-Conformance Report* and the *Improvement Register* are used to record the actions and any outcomes arising in accordance with the *Non-Conformance Procedure*.



# **19 Internal Management System Audits**

The *Internal Audit Procedure* describes the process for planning and conducting internal audits to confirm that the management system complies with the requirements of the standards, is implemented in accordance with the planned arrangements and is effective.

Internal audits are planned taking into consideration the status and risk of each procedure. The *Internal Audit Schedule* is used to record when audits will be conducted.

The internal audit shall be recorded using the *Internal Audit Report* with any findings requiring action entered into the *Improvements Register*.



# 20 Management Review

#### 20.1 Corporate review

The Directors will review the management system on an annual basis to ensure that it remains suitable, effective and that objectives and targets are being achieved. The management review will include the following:

- Review of actions from previous meetings;
- Assessing opportunities and making recommendations for improvement;
- Assessing the need for changes to the management system;
- Review of resources;
- Review of policies and objectives;
- Results in audits;
- Reviewing customer feedback;
- Reviewing defects trends, and process performances;
- Status of corrective and preventive actions and review of the Improvement Register;
- Changes to legislation;
- Supplier performance;
- Review of risk assessments and risk management procedures;
- Needs and expectations (table);
- Risks and opportunities (table); and
- Incident data.

Following the review of the above items, the output actions from the management review are intended to be aimed at improvement of the effectiveness of the management system, improvement to Innaco services and any identified resource needs.

The management review meeting will be recorded on the Management Review Form.





# Narara Ecovillage



# Sewage Management Plan

Revision	Date	Ву	Checked Document Status		Amendments
Rev 1	21/09/2020	G Cameron	S Errey	Draft	Document created
Rev 1.1	21/01/2021	G Cameron	S Errey	Issued	Risk assessment updated
Rev 1.2	24/5/2021	G Cameron	S Errey	Issued	Sec 7.3.1 Health completed









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# 1. Introduction

#### 1.1 Purpose of the Sewage Management Plan

This Sewage Management Plan forms part of the Infrastructure Operating Plan (IOP) for the Narara Ecovillage (NEV) water scheme. It states the operational objectives for the sewage scheme and describes elements of the management plan to ensure those objectives are achieved and maintained. The document contains:

- Responsibilities of the sewage supplier;
- Description of the sewage process, including composition of the source and end use
- Detailed operational control and monitoring program.

The system is managed according to this Infrastructure Operating Plan (IOP) that has been developed specifically for this site, in accordance with NEV's obligations under:

- The Water Industry Competition Act 2006
- Network Operator's Licence number 17\_040 and
- Retail supplier's licence number 17\_041R
- Section 68 of the Local Government Act

This Sewage Management Plan is to regulate and manage the selection, design, installation, operation and maintenance of on-site sewage management systems.

The purpose of this Sewage Management Plan is to:

- Guide landholders towards sustainable on-site management of domestic sewage and effluent water.
- Protect and enhance the quality of public health and the environment
- Assist NEV to prioritise resources for the efficient regulation and monitoring of on-site sewage management systems.
- Coordinate monitoring, environmental assessment and data collection related to on-site sewage management systems.
- Allow for site assessment on risk management basis

#### 1.2 Description of the scheme

#### 1.2.1 Site Description

The NEV site is located on Research Rd, Narara on the NSW central coast. The development will be staged with 60 lots to be released initially and expanding to around 130 lots in future stages.

The sewage collection, storage and discharge systems will be installed with the capacity to deal with the sewage demands for the full development. As the construction of new homes on the site will be progressive, the full sewage demand will not be reached for some time.. Stage 1 of the development is projected to produce up to 25 kL/day of wastewater.

Sewage production for the full development is projected to be 56 kL/day.





All assets are installed at 25 Research Road, Narara.

#### 1.2.2 System Process Design

See Appendix 1 - Sewer Buffer Tank Layout, Appendix 2 - Rising Main Diagram and Appendix 3 - Water Infrastructure Site Plan.

The sewage infrastructure has been designed to meet the requirements of the WSA 02-2002-2.2 Sewerage Code of Australia.

The system consists of the following:

Wastewater will be collected from the following sources to the treatment system:

• Home and community centre toilets, showers, hand basins, and laundries.

All sewage will be discharged to council sewer main via a rising main.

Buffer capacity of 360 kL has been provided, which is equivalent to approximately 6-days storage at maximum design flow (56 kL/day), is provided to allow time to deal with breakdowns. If this is insufficient time then pump out of the buffer tanks will be carried out until the system is operational again.

NEV has carried out a Sewage Scheme Risk Assessment specific to the assets at 25 Research Road, Narara which considers operational, financial, health and environment impacts. This risk assessment is included in Appendix 4. This risk assessment is used to determine asset replacement and maintenance strategies.

#### 1.3 Management commitment

Narara Ecovillage Co-operative Ltd (NEV) will be the WICA license holder and also the owners of the sewage infrastructure. The NEV Co-op are committed to ensuring the system is maintained and operated in compliance with relevant guidelines, regulations and standards at all times.

The NEV Co-op will subcontract SCADA remote monitoring of the buffer tanks and discharge pumps to Innaco Pty Ltd. Innaco commit to maintain and operate the system in compliance with relevant guidelines, regulations and standards at all times.

#### 2. Roles and responsibilities

As system owner and WICA licence holder the NEV Co-op retains responsibility over the entire sewage scheme including sewer collection systems, storage and delivery systems.

The NEV Co-op will subcontract SCADA remote monitoring of the buffer tanks and discharge pumps to Innaco Pty Ltd

A table outlining the various roles and responsibilities of the parties is shown in table 1.





Polo/Posponsibility		Wastewater System						
Kole/ Responsibility		NEV Co-op	Innaco					
Sewage	WICA licence holder	х						
Scheme	Owner	х						
	Preparation and Approval	х						
	Statutory Reporting	x						
IOP	System Audit	х						
	Review	х						
SMP	Drafting and updating	х						
	Operation	x						
	Maintenance - Weekly	х						
	Maintenance - Monthly		Х					
	Maintenance – Six Monthly		Х					
Operation and	Logs: incident, maintenance,							
Maintenance	complaint, calibration, audit, non-	x						
	compliance							
	Internal monthly reporting	х	Х					
	Plumbing Audit	х						
	Instrument Calibrations		Х					
	Per WSA-2002, WSAA	Hydraulics Contractor	Plumbing Contractor					
	Plumbing in accordance with							
Plumbing	AS/NZS 3500:2003	Hydraulics Contractor	Plumbing Contractor					
-	Education of plumbing contractors	Hydraulics Contractor	Project Manager					
	Initial risk assessment IOP	Hydraulics Contractor	Х					
	Monitor/sampling environment	х						
Manage	Tenants/public education	х						
Environmental Risk	Development	х						
	Implementation	х						
	Maintenance	х						
Communication	Feedback	х						
Stratogy	Evaluation	х						
Sualegy	Review	х						
	Identification of potential	X	Y					
	incidents and emergencies	X	Х					
Incidents and	Development of protocols,							
Emorgoncios	response actions, responsibilities	x						
Emergencies	and communications							
Training of	Notification of non-compliances							
employees and	and incidents to IPART	х						
contractors								
Documentation and		x						
Reporting								

#### Table 1: Division of roles and responsibilities





#### 2.1 Scheme Manager

The scheme manager is Narara Ecovillage Co-operative Ltd.

# 3. Sewerage Infrastructure

#### 3.1 Wastewater minimisation

Water demand management strategy involving mandatory water efficient fixtures, water metering, customer awareness and education.

Residential customer supply agreements or trade waste agreements will be entered with each customer to outline responsibilities for appropriate waste disposal practices to minimise disposal of inappropriate substances to the sewer.

Water tight sewerage system to minimise infiltration of stormwater and groundwater to the sewerage system.

#### 3.2 Low pressure Sewerage network-

Low pressure sewerage network constructed using PN 16 HDPE pipe with welded joints and fittings to minimise infiltration.

#### 3.3 Buffer Tanks.

The sewage buffer tanks comprise three 120kl inground concrete tanks connected in series with dual submersible pumps connected to the rising main. Technical drawings are provided in Appendix 1 Sewer Buffer Tank Layout.

Peak diurnal flows into council sewer are controlled using this buffer storage

#### 3.4 Integrated online monitoring, control and alarm system

Continuous online monitoring, control and alarms for the sewerage infrastructure is centrally managed using the SCADA system.

The SCADA system allows the infrastructure to operate unattended and automatically reports issues requiring operator attention.

The control system is designed to automatically recover following power outage.

#### 3.5 Rising Main

The rising main system comprises dual submersible pumps connected to a DN90 PE 100 rising main. The rising main will discharge to council's sewer immediately outside the southern boundary of the site. Polyethylene pipe has been used for the rising main which is fully sealed by electrofusion welded joints This minimises wet weather inflows Technical drawings are provided in Appendix 2Rising Main Diagram.





### 4. Prerequisite programs

For the effective operation of this SMP, prerequisite programs that outline detailed procedures and protocols will be provided.

#### **Operations and Maintenance procedures:**

An operations and maintenance manual has been drafted for the scheme. Included in the manual are the Standard Operating Procedures, Maintenance Procedures, Calibration Procedures and Chemical Safety Procedures.

#### Calibration of monitoring instruments:

The calibration of all on-line monitoring instruments will be checked at monthly intervals as part of the monthly servicing of the plant. The calibration of each instrument is logged and maintained on a standard maintenance record.

#### Inspections:

The plant is under continuous remote supervision by Innaco as the contracted operator. Data logging of key parameters is a part of this supervision. Weekly inspections will be conducted by NEV appointed and Innaco trained individuals. The responsibilities will be clearly delineated in the service agreement. Also in accordance with the service agreement, monthly maintenance including instrument calibration checks are carried out by Innaco and records maintained. Six-monthly servicing is carried out by Innaco and records maintained.

## 5. Incidents and emergencies

Procedures for management of incidents and emergencies are contained in the following NEV documents:

- NEV Environmental Incident Procedure
- NEV WHS Incident Procedure
- NEV Site Emergency Response Plan

Current versions of these documents are available at:

Nextcloud\NEV Water\IOP\Incident Response

NEV maintains a community contact and FAQ section on its website with procedures relating to the management of emergencies relating to NEV water infrastructure.

Innaco also maintains a community contact and FAQ section on its website with procedures relating to the management of emergencies relating to its treatment plants.





#### Table 2: Incidents and emergencies

Hazards and events	Immediate Response		Corrective Action	Authorities			
that may lead to emergencies	What	Who	What	Who	What	Who	
Accidents/incidents that cause contamination in waste water	Pause rising sewer delivery pumps	NEV	Pause rising sewer delivery pumps and wait for source investigation. Production resumed once cause is identified and corrected.	NEV	Notify Central Coast Water	NEV	
Prolonged power outages	Plant shuts down in a safe state on power failure. Notify Innaco so that restart procedures and checks can be made and the plant monitored during start-up.	NEV	Remote operator log-in. Restart operation on return of power.	Innaco	NA		
Leakage, spillage, or runoff of sewage or sewage on site.	For minor contained spills, NEV to respond. Notify Innaco for repair If treatment plant is responsible.	NEV	Sewage Spill Response Plan to be implemented. Incident report to be prepared and corrective actions implemented.	NEV	If major spill that contaminates or potentially contaminates the environment also contact EPA.	NEV	





### 6. Employee awareness and training

Both NEV and Innaco are individually responsible for ensuring its employees and contractors are familiar with the operation of the scheme and aware of the potential consequences of system failures, and of how their decisions can affect the safety of the scheme.

Innaco will provide an experienced water recycling engineer to monitor the plant. Any staff used on site must be accredited, qualified and have the appropriate level of training.

A site induction will be required for anyone doing work related to this scheme. This will be carried out and recorded by Innaco, or by those appointed and trained by Innaco for this purpose. For plant work this includes familiarization with Innaco's Safe Work Method Statements (SWMS's) which are site specific. Innaco maintains a partnership with several contractors to ensure continuity of knowledge and technical expertise.

Innaco has an induction program for new employees and written procedures for all areas of responsibility (IMS document HR120).

Training needs for Innaco and NEV employees are identified and adequate resources made available during the induction phase. Annual performance reviews identify additional training requirements and set performance targets. Training records are kept.

## 7. Documentation and reporting

#### 7.1 Documentation

The following records and documents will be maintained by NEV as the scheme operator.

- Verification and on-going monitoring results
- CCP monitoring results and analysis
- Plant operation data
- Breaches of critical limits and corrective actions taken
- Incidents and emergencies and corrective actions taken
- Inspection and maintenance activities relevant to water quality

CCP results and operation data will be collected by online data acquisition system and kept as electronic copy by Innaco.

A record of any maintenance to the assets will be kept in the plant log book. Any equipment adjusted, repaired, replaced or calibrated will be recorded. Monthly maintenance checks and calibrations are recorded on a monthly maintenance checklist (See Operations and Maintenance Manual).

#### 7.2 Reporting

There will be a monthly report provided to NEV in relation to the operation and maintenance of the sewer infrastructure by Innaco.



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An annual compliance report will be prepared and submitted to IPART certifying that the licensee has complied with its licence obligations.

#### 7.3 Notifications

#### 7.3.1 Health

The following is considered a sewage incident requiring emergency response:

• Any incident which involves immediate threat or actual impact to human health must be notified in accordance with the NEV document 071 "Environmental Incident Procedure" unless it is trivial.

#### 7.3.2 Environment

Any incidents that cause or threaten environmental harm, must be dealt with in accordance with the NEV document 071 "Environmental Incident Procedure". This will provide guidance on assessing the risk and determining notification and action requirements.

#### 8. Auditing

The frequency for independent ongoing audits will be determined by IPART requirements using a risk based approach, but will occur at least every 5-years.

At least once every two years, NEV's Risk and Audit Committee will conduct an internal quality management audit of NEV Water's quality, safety and environmental management standards. The audit will cover compliance with NEV's Network Operator and Retail license conditions, management plans, policies and procedures. The Risk and Audit Committee will document its findings and report these to the NEV Board of Directors.

The Risk and Audit Committee will retain records of the audit which will include:

- Completed Audit Checklists and/or marked up procedures
- Notes on objective evidence examined, and personnel interviewed
- Audit Findings including any non-conformance with license conditions, management plans, policies and procedures
- Audit Report including corrective actions

#### 9. Review and improvement

The SMP is reviewed and updated annually.

Where improvements to the plant or revisions to operation of the plant are identified, such improvements shall only be implemented with the endorsement of IPART if the improvements or revisions involve altering public health and environment protection measures such as CCPs, corrective actions, relevant monitoring and inspection programs.





The Sewage Scheme Risk Assessment is updated annually to identify changes in hazards, processes or the environment or to identify improvements in risk identification and/or mitigation.

# 10. Plumbing

The Building plumbing and drainage system has been designed in accordance with the Water Supply Code of Australia and in accordance with AS/NZS 3500:200.





# Appendices

Appendix 1 Sewer Buffer Tank Layout



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Appendix 2 Rising Main Diagram



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# Appendix 4 Risk Assessment– Sewage Scheme

Scheme	Hazard	Hazardour Event	Impact			Unmitigated Risk			Control Strategy			ated Risk		
Component	Hazaru	Hazardous Event	Impact	li	ikelihood	C	onsequence	Risk	Control Strategy	li	kelihood	C	onsequence	Risk
Wastewater generation	Trace contaminants in domestic wastewater	Poor household chemical use and disposal practices resulting in excessive contaminant levels in recycled water	Potential environmental impacts on effluent irrigation areas	С	Possible	2	Minor	Moderate	<ol> <li>Customer supply contracts and water use agreement have been signed with each customer and includes obligations and education regarding appropriate substances to be disposed of to sewerage and substances that should be avoided.</li> <li>Ongoing customer awareness campaigns and information provided with each water bill and through the CHB Water Utility website.</li> </ol>	В	Unlikely	2	Minor	Low
	Trace contaminants in commercial wastewater	Poor trade waste management practices resulting in excessive contaminant levels in recycled water	Potential environmental impacts on effluent irrigation areas	D	Likely	2	Minor	Moderate	<ol> <li>Predominately residential sewerage catchment with non residential customers likely to account for less than 1% of all wastewater generated.</li> <li>Trade waste agreement will be developed with each non residential customers to ensure wastewater is pre-treated to domestic standards before discharge into the sewerage system.</li> </ol>	В	Unlikely	2	Minor	Low
	Shock load of chemical	Poor chemical or trade waste management practices resulting in shock load of contaminants on MBR	Potential biomass die off and reduction in effluent quality from council sewage works. Chemicals may also be an OHS hazard.	A	Rare	2	Minor	Low	<ol> <li>Investigation will be undertaken into the source of contamination. This may include review of , water usage data, trade waste agreement etc.</li> <li>O nline water quality monitoring probes can be installed into suspect sewer lines for tracing persistent sources of contamination if required.</li> <li>Road tanker pump out of contaminated water from the buffer tanks if required.</li> </ol>	В	Unlikely	1	Insignificant	Low
	Gross pollutants in raw wastewater	Poor solid waste management practices resulting sewer blockage and overflow.	Potential sewer blockage and overflow	E	Almost certain	2	Minor	Moderate	<ol> <li>Appropriately designed network with self cleansing velocities will minimise the potential for network blockage.</li> <li>Sewer blockage response will include identification of route cause and preventative actions. Where multiple blockages have occurred at the same location, specific customer awareness/education will be implemented and/ or compliance notices issued.</li> <li>Flushing and maintenance regime will be developed for the sewer network.</li> </ol>	С	Possible	2	Minor	Moderate
	Excessive wastewater generation	Peak visitor population or excessive water usage	Build up of raw wastewater in the buffer tanks Potential overflow to the environment.	С	Possible	2	Minor	Moderate	<ol> <li>Water demand management strategy including mandatory best practice water efficient fixtures, smart water metres, customer awareness.</li> <li>Multi-day buffer capacity in buffer tanks.</li> <li>Road tanker pump out from buffer tanks if required.</li> </ol>	В	Unlikely	1	Insignificant	Low
Low Pressure Sewerage Collection System	Inflow and infiltration to the sewerage network	Inflow and infiltration to the sewerage network	Potential overflow from pits or buffer tanks if combined inflows exceed capacity of rising main	D	Likely	2	Minor	Moderate	<ol> <li>Low pressure sewerage system constructed with PN16 HDPE with welded joints and fittings.</li> <li>Contractor induction and education.</li> <li>Inspection and quality assurance during construction.</li> <li>Level monitoring at buffer tanks.</li> <li>Rising main pump operation centrally controlled by the SCADA system.</li> <li>Road tanker pump out if required.</li> </ol>	С	Possible	2	Minor	Moderate
	Inflow and infiltration upstream of mains connection	Inflow and infiltration upstream of mains connection	Potential overflow from pits or buffer tanks if combined inflows exceed capacity of rising main	E	Almost certain	2	Minor	Moderate	<ol> <li>Plumbing inspection of all household plumbing installation prior to connection.</li> <li>Induction and awareness training for all domestic plumbing contractors working in the scheme.</li> <li>Investigation to identify sources of inflow. Customer education and rectification notices will be provided if required.</li> <li>Road tanker pump out from buffer tanks if required.</li> </ol>	С	Possible	2	Minor	Moderate
	High peak diurnal flows	Excessive peak inflows	Potential overflow from pits or buffer tanks if combined inflows exceed capacity of rising main	С	Possible	2	Minor	Moderate	<ol> <li>Buffer tanks provide buffer storage for diurnal flows.</li> <li>Level monitoring at buffer tanks.</li> <li>Rising main pump operation centrally controlled by the SCADA system.</li> <li>Road tanker pump out from buffer tanks if required.</li> </ol>	A	Rare	2	Minor	Low





Scheme						Unmit	tigated Risk					Mitig	ated Risk	
Component	Hazard	Hazardous Event	Impact	li	kelihood	C	onsequence	Risk	Control Strategy	li	kelihood	C	onsequence	Risk
Buffer tanks and rising main	Inflow and infiltration to the sewerage network	Inflow and infiltration to the sewerage network	Potential overflow from pits or buffer tanks if combined inflows exceed capacity of rising main	D	Likely	2	Minor	Moderate	<ol> <li>Low pressure sewerage system constructed with PN16 HDPE with welded joints and fittings.</li> <li>Contractor induction and education.</li> <li>Inspection and quality assurance during construction.</li> <li>Level monitoring at buffer tanks.</li> <li>Rising main pump operation centrally controlled by the SCADA system.</li> <li>Road tanker pump out from buffer tanks if required.</li> </ol>	С	Possible	2	Minor	Modera te
	Structural failures of Buffer tanks	Tank failure	Discharge of process water to environment	С	Possible	3	Moderate	High	<ol> <li>Concrete underground tanks with appropriately engineered design and experienced construction contractor.</li> <li>Quality assurance during tank manufacture.</li> </ol>	А	Rare	3	Moderate	Low
	Pressure main break	Pressure main failure or breakage due to unapproved excavation activity	Discharge of raw sewage to the environment	С	Possible	3	Moderate	High	<ol> <li>All mains constructed with PN16 HDPE pipe with welded joints and fittings.</li> <li>All mains are pressure tested and certified during construction.</li> <li>Pressure sewer main is located at the bottom of a common services trench, hence other pipes will be damaged from poor excavation practices before the pressure sewer.</li> <li>Signage and identification tape installed above pressure mains.</li> <li>All sewer pipe locations registered with dial before you dig service.</li> <li>Sewer Spill Emergency Response Plan and clean-up procedures in Sewer OMM</li> </ol>	В	Unlikely	2	Minor	Low
	Pump Failure	Pump failure by power surge, blockage, loss of suction etc	Potential discharge of raw sewage to the environment	D	Likely	3	Moderate	High	<ol> <li>Dual pumps in buffer tanks.</li> <li>Fail safe in electrical system so pump can operate with failed network connections.</li> <li>High quality robust pumps with long design life.</li> <li>Buffer tanks provide buffer storage.</li> <li>Level monitoring at buffer tanks.</li> <li>Road tanker pump out from buffer tanks if required.</li> </ol>	В	Unlikely	3	Moderate	Moderate
	Power failure	Extended power failure across pressure sewer network	Potential discharge of raw sewage to the environment	E	Almost certain	3	Moderate	High	<ol> <li>Multi day emergency storage is provided in buffer tanks.</li> <li>Sewer network start up and recovery process is included in SCADA logic.</li> <li>Village grid has battery backup and provision for generator connection</li> <li>Road tanker pump out from buffer tanks if required.</li> </ol>	В	Unlikely	2	Minor	Low





#### Risk Assessment Methodology

Events and hazards were identified for the sewer scheme. Risks posed by each of the events were assessed. The desktop study considered the:

Hazardous event	A hazardous event is one that introduces contaminants (hazards) to the water. Loss of drinking water supply was also considered was a hazardous event for this study.
Hazard	A hazard is a physical, chemical or biological agent in the water with the potential to cause an adverse effect. Loss of drinking water supply was also considered as a hazard for this study.
Controls in place	Controls are practices and equipment that reduce the hazard or the hazardous event.
Residual Risk (After Mitigation)	Residual risk was assessed by identifying the likelihood and consequence of the hazardous event occurring with the control in place. The risks were assessed as Likelihood + Consequence.
	A risk assessment matrix was used to assess risks to the identified end uses.
Maximum Risk (Before Mitigation)	Likelihood and consequence of the hazardous event occurring if the controls were to fail or are inadequate.

#### Qualitative measures of likelihood

Level	Descriptor	Example Description from AGWR
A	Rare	May occur only in exceptional circumstances. May occur once in 100 years
В	Unlikely	Could occur within 20 years or in unusual circumstances
С	Possible	Might occur or should be expected to occur within a 5 to 10 year period
D	Likely	Will probably occur within a 1 to 5 year period
E	Almost certain	Is expected to occur with a probability of multiple occurrences within a year

#### Qualitative measures of consequence or impact

Level	Descriptor	Example Description from AGWR
1	Insignificant	Insignificant impact or not detectable
2	Minor	Health — Minor impact for small population Environment — Potentially harmful to local ecosystem with local impacts contained to site
3	Moderate	Health — Minor impact for large population Environment — Potentially harmful to regional ecosystem with local impacts primarily contained to on site
4	Major	Health — Major impact for small population Environment — Potentially lethal to local ecosystem; predominantly local, but potential for off site impacts
5	Catastrophic	Health — Major impact for large population Environment — Potentially lethal to regional ecosystem or threatened species; widespread on site and off site impacts





		Consequences				
Likelihood		1	2	3	4	5
		Insignificant	Minor	Moderate	Major	Catastrophic
Α	Rare	Low	Low	Low	High	High
В	Unlikely	Low	Low	Moderate	High	Very high
С	Possible	Low	Moderate	High	Very high	Very high
D	Likely	Low	Moderate	High	Very high	Very high
E	Almost certain	Low	Moderate	High	Very high	Very high

#### Qualitative risk analysis matrix: Level of risk




## **Risk Assessment - NEV Sewer System**

Risk

			С	onsequence	9	
		1	2	3	4	5
	1	Low	Low	Low	Moderate	High
	2	Low	Low	Moderate	High	Very High
poc	3	Low	Moderate	High	Very High	Very High
eliho	4	Low	Moderate	High	Very High	Very High
Likt	5	Low	Moderate	High	Very High	Very High

#### Qualitative measures of likelihood

Level	Descriptor	Example of Description	
1	Rare	May occur only in exceptional circumstances	very rarely > annual
2	Unlikely	Could occur in unusual circumstances	chance of annual occurence
3	Possible	Might occur or should be expected to occur under certain circumstances	chance of monthly occurence
4	Likely	Will probably occur	chance of weekly occurence
5	Almost Certain	Is expected to occur	chance of daily occurrence

#### Qualitative measures of consequence

Level	Descriptor	Example of Description
1	Insignificant	Insignificant impact or not detectable
2	Minor	Health - Minor impact on contact population, first aid treatment
		Environment - Minimal and short term harm to the environment
3	Moderate	Health - Moderate impact on contact population, medical treatment required
		Environment - Significant harm to the local environment for a short period
4	Major	Health - Major impact on contact population, extensive injuries
		Environment - significant harm to the environment
5	Catastrophic	Health - Potentially lethal on on contact population, death
		Environment - significant, widespread harm outside local area



#### **Risk Assessment - Sewer System**



#### NEV Sewer System Diagram







#### Health and Environment HACCP Checklist

				т																					1
Project Name	:	A0072 Narara Ecovillage		ļ										HACCP W	orkshop Attende	es	Revision 1 Atte	endees	Revision	n 2 Atten	ndees	Rev	visions		
Project Engine	eer:	Environmental Manager											L Herngren - Inn	асо	J Talbott - NEV										
Date of Asses	sment:	28-May-21											A Rashidi - Innad	:0	G Cameron - N	EV									
Revision:		Draft											O Sayar - Innaco		D Parris - NEV										
Approved By	and Date:			To be approv	ed by the Env	ironmental M	lanager						A Sajedi - Innaco	)	S Errey - NEV										
				•																					
DESIGN /			Befor	e Mitigat	ion	Af	ter Mitigat	ion											CONSTRUCTION S	TAGE H	ACCP	COMMISSIONING / H	IANDOVER	STAGE HAC	СР
Step	Potential Hazard	Preventative Measure	Likelihood	Consequ	Resid.	Likelihoo	Conseque	Resid.	Uncertain	Decisi	ion Tree	CCP/	Critic	al Levels	Monitoring	Correct	ive Action	Records	Action Checked	Ву	Date	Action Checked	Ву	Date	Closed Out
			41.6	ence	Risk	d	nce	Risk	ty			QCP		Le co			1								
Process unit	physical, chemical, biological, other		1 to 5	1 to 5	D + E	1 to 5	1 to 5	D+E		Y.	or N		Target	Action	HOW	what	HOW	wnere							
1. Source water	Broken or blocked sewer line	Emergency plumbing services are	2	2	4	2	2	4	1	N			No blockages	Any blockages											
collection lines, pump stations)	non awenings to parter tank	coordinate.																							
	Pumps out of order. Buffer tank full.	use pump out by local tanker until plant is back on line	2	2	4	2	1	3	1	N			No interuptions to service	Any interuptions to service											
	Plant off line for chemical or	Buffer tank has capacity for 8 days at	2	2	4	2	1	3	1	N			No interuptions to	Any interuptions to											
	mechanical reasons, or periodic maintenance.	longer periods off line											service	service											
	Physical contact with	Covers on tanks, locks where	1	3	4	1	3	4	1			No													
	wastewater	appropriate, trained operators to access site, signage, difficult to access. Training of services personnel. Strong diurnal flows.																							
	Physical hazard. (Mineral,	Exclude the public from the immediate	2	1	3	2	1	3	1			No													
	object)	pump station area, correct PPE - gumboots, gloves.																							
	Chemical Hazard	Educate residents on the wastewater	3	1	4	2	1	3	1			No													
		treatment process and the need to avoid disposal of certain wastes to the sewer																							
2. Pre-Treatment	Chemical hazard. Non- compliant waste discharge up stream.	Education of residents. pH monitoring of influent.	3	1	4	2	1	3	1	Y N	Y Y	QCP1	рН 4 — 9	pH < 4 or > 9	Online pH probe	out pH range rasies an alarm to warn operator of potential biological system damage	Automatic valves, control logic, operator procedures.	Control log							
	Tennents / cleaners disposing of chemicals down the drain	Ongoing education of tennents and cleaners.	2	2	4	2	2	4	1			No	No discharge of waste chemical into the recyced water plant.	Any discharge of waste chemical into the recyc water plant.	<ul> <li>Online pH probe, Monitoring of DO and Flux to dertermine the health of the biology</li> </ul>	Stop flow into plant.     Continue to monitor pH     Restart supply if levels return to within target limits     Operator intervention if levels do not return to target limits within 8 hours.	Automatic valves, control logic, operator procedures. • Oistribution of information brochures regarding disposal of waste chemicals. Decusi Sisues a "Tennancy Fit-out Guide" to all tennants. Audits of this information will form part of the annual audit.	Control log							
L	Exposurel hazard, improper use of water.	Education program for occupants. Signage indicating disposal area. No access to the public. Treatment plant operating correctly.	1	3	4	1	3	4	1			No	No improper use if recycled water	Any improper use of recycled water	Forms part of the annual audit	Identify the cause of the improper usage and respond accordingly	"Tennancy Guide" issued by Strata Mamagement Signage indicating recycled water is being used for irrigation.								
3. Buffer Storage Tanks (lines,	Prolonged power outages	Pump out possible for prolonged outages.	1	3	4	1	2	3	1			No													
	Delivery pumps may fail	Duty / Standby cofiguration of critical	1	3	4	1	3	4	1	$\vdash$	+	No	No Failures	Any pump failure	Maintenance plan	If a pump fails it must be replaced	Service contractor	Log book					1		
		pumps. Pump out if needed.													Remote monitoring indicates a fault immediately	without delay.									
	Out of specification water stored due to upstream issues	Subsurface irrigation has low risk. Out of spec water not delivered to storage.	2	2	4	2	2	4	1			No			рН, EC	Dump water via tanker									
	Delivery pipes and fittings	Plumbing installed according to AS/NZS	1	3	4	1	3	4	1	$\square$	++	No	No leaks	Any leaks	Plumbing audits,	Identify and Rectify	Accredited plumber	Log book	-						
	leaking or bursting	3500:200. Any leaks reported to NEV management according to customer information brochure.													customer identifys and reports a leak										
4. Noise	Noise levels from pumps affecting nearby residents	Submersible pumps used.	3	3	6	2	2	4	1																
5. Odour	Odour form system affecting nearby residents	The sewage buffer tank is a covered tank, minimising odours from escaping to the environment. This collection tank is	3	3	6	2	2	4	1														1		
6. General	Prolonged power outages	vented via the inlet sewer main. Buffer tank can accommodate up to 8- days at normal flows. Pump out is used to deal with waste during prolonged outages.	2	3	5	2	1	4	1			No													
1		1	1			1	1	1		1 1		1		1								1	1	1	1





DESIGN /			Befo	re Mitigat	tion	Af	ter Mitigat	ion											CONSTRUCTION S	TAGE HAC	CP	COMMISSIONING / H	ANDOVER	STAGE HAC	CP
Step	Potential Hazard	Preventative Measure	Likelihood	Consequ	Resid.	Likelihoo	Conseque	Resid.	Uncertain	Decisi	ion Tree	e CCP/	Criti	cal Levels	Monitoring	Correct	tive Action	Records	Action Checked	Ву	Date	Action Checked	Ву	Date	Closed Out
				ence	Risk	d	nce	Risk	ty			QCP													
Process unit	Physical, chemical, biological, other		1 to 5	1 to 5	D + E	1 to 5	1 to 5	D + E		Y	or N		Target	Action	How	What	How	Where							
	Extreme weather (flooding)	Sewerage system is new PVC pipework with minimal ingress. Buffer tank provides some backup if flows are high for a short period.	2	4	6	1	3	4	1			No													
	Earth quake	No mitiagating measures idetnified.	1	4	5	1	4	5	1			No													
	Fire	No readily combustable materials nearby. Concrete buffer tank is immune to fires and will still provie backup for pump out if required.	1	3	4	1	3	4	1			No													
	Human actions (sabotage)	Physical isolation of critical or delicate equipment inside locked plant buildings.	1	3	4	1	1	3	1			No				Limit access to plant									
	Transport of pump out truck movements causing disruptions to amenity of residents	Pump out of buffer tank is for emergency use only when pumps are off-line for extended periods. At worst case this woul dbe one truck movement per day (13 kL) for the duration of the outage.	2	2	4	2	1	3	1																





#### HAZOP Checklist

Project Name:	A0072 Narara Ecovillage		HACCP W	orkshop Attendees	Revision 1	L Attendees	Revision	2 Attendees	
Project Engineer:	Technical Manager		L Herngren - Innaco	J Talbott - NEV					
Date of Assessment:	28-May-21		A Rashidi - Innaco	G Cameron - NEV					
Revision:	Draft		O Sayar - Innaco	D Parris - NEV					
Approved By and Date:		To be approved by the Technical Manager	A Sajedi - Innaco	S Errey - NEV					

i									-		-		1		1
DESIGN / CONCI	EPT STAGE HAZOP								CONSTRUCTION			COMMISSIONIN			
									STAGE HAZOP			G / HANDOVER			
												STAGE HAZOP			
Itom	Deviation	Consequence	Causes	Safeguards	Actions	Who	Duo Data	Status	Action Chacked	By	Data	Action Chacked	By	Data	Closed Out
Fauinment tank	Condition such as no	What hannens	14/bu doos it bonnon	Values alarma instrument	To be done to mitigate	WIIO	Due Date	Status	Action checked	Бу	Date	Action checked	Бу	Date	closed Out
nrocess unit	Condition such as no	what happens	why uses it huppen	vuives, ulurins, instrument,	To be done to mitigate										
process and	Jiow, nign Jiow, pH			aesign											
	cnange														
1. Source water	No influent	back up in sewage pipes	Low influent production	Low level switch	Note low level switch			1							
(sewage input					condition over long term. Or										
(sewage input,			Blockage upstream of plant		logic calls for feed and none										
collection lines,				Low level switch	provided										
pump station)					providedi										
	Out of spec influent	Upsets biological process at	Long storage time turns	Education of residents											
	quality	council plant	contic trade waste other	Education of residents											
	quality		septic, trade waste, other												
			upsets												
	Influent feed not	Septicity develops	Low influent flow / no flow.	Storage Full plant condition	Ensure Storage Full plant										
	pumped out		High flow but no processing	g enabled.	condition can operate.										
			due to plant status												
	High influent flow	back up in sewage pipes	High influent production	High level switch	Note high level switch										
					condition over long term.										
			Downstream tanks full		Alarm sent to operator. Truck										
					out if required.										
	Reverse Flow	Back-up in inlet pipe	As for high flow	As for high flow	As for high flow										
	Low level	as for 'no influent'													
	High level in Buffer	Truck out excess volume													
	Tanks														
							-	+	-		_			+	
	High pressure	Pumps trip out	Blockage	Trip and alarm on pump											
	Low pressure	Pumps trip out	Low head in pipe (eg. Pipe	Trip and alarm on pump		1		1		1				1	
			burst)												
	Taalumatura	Call of influent to	Canthernalis, and state	Constatesien, Use of			-	+	-		_			+	
	i ank rupture	spill of influent to	Earthquake, subsidence,	Good design. Use of		1		1		1				1	
		environment	flood, flotation	underground concrete										1	
				tanks.											
	Cleaning	1		Use a tanker truck to clean											
				out										1	
	1		1	1	1	1	1	1		1	1		1	1	1





Item	Deviation	Consequence	Causes	Safeguards	Actions	Who	Due Date	Status	Action Checked	Ву	Date	Action Checked	Ву	Date	Closed Out	20
Equipment, tank, process unit	Condition such as no flow, high flow, pH change	What happens	Why does it happen	Valves, alarms, instrument, design	To be done to mitigate											L
2. Manual Work	Maintenance	Damage to equipment	Poor workmanship	Following Work Instructions	Employee induction, regular review, Tool box meetings.											
	Maintenance	Chemical spills	Chemical handling	Following Work Instructions	Employee induction, regular review, Tool box meetings.											





#### **Retail Risk Assessment HACCP Checklist**

Project Name:	A0072 Narara Ecovillage	
Project Engineer:	Retail Manager	
Date of Assessment:	28-May-21	
Revision:	Draft	
Approved By and Date:		To be approved by the Retail Man

	HACC	P Workshop Attendees	Revision 1 A	ttendees	
	L Herngren - Innaco	J Talbott - NEV			
	A Rashidi - Innaco	G Cameron - NEV			
	O Sayar - Innaco	D Parris - NEV			
ager	A Sajedi - Innaco	S Errey - NEV			

Retail Risk Assess	ment	Be	fore Mitigation			After Mit	igation				
Risk	Potential	Likelihood	Consequence	Resid. Risk	Likelihood	Consequence	Resid. Risk	Uncertainty	Mitigation St	eps	Records
		1 to 5	1 to 5	C + D	1 to 5	1 to 5	F + G		What	How	Where
Insolvency of communit association (customer)	Inability to pay water bills	2	4	6	2	2	4	±1	Costs to maintain and operate the community facilites have been identified up front, and the community association has factored these into planning budgets.	Incoporation into planning from and budgets	Budgets for community association
Insolvency of NEV or Innaco (plant operator)	Plant is not serviced by appropriately licensed entity	2	4	6	2	2	4	±1	There are alternative operators to Aquacell that could be engaged to operate the waste treatment plant. Temporary pump-out for off site disposal could be used.	New operators could be engaged by competitive tender.	
Insolvency of NEV (WICA license holder)	No money to commission or maintain plant until new owner takes control	2	4	6	1	3	4	±1	NEV financing for the project has been secured. The developer is responsible for the operating costs before the plant is brought into operation. After this period ongoing maintenance will be finaced by fees levied on the residents.	NEV financing for the project has been secured until the plant is brought into operation.	
Infrastructure failure	No ability to pump wastewater to council main	2	4	6	2	2	4	± 1	Sufficent redundancy built into plant to minimise impact of failures (see HACCP/HAZOP). Pump out is possible to provide temporary disposal route for the wastewater while damaged infrastructure is repaired or replaced.		



## Narara Ecovillage



# NEV Sewer System Operation & Maintenance Manual

### **Document Creation and Review**

Revision	Date	Author	Reviewer	Comments
Rev 1	29/9/2020	G Cameron	S Errey	Document created
Rev 2	28/01/2021	G Cameron	S Errey	Added schedule of capital works



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## **1** Introduction

## **1.1 Project Overview**

The Narara Ecovillage (NEV) is located on the central coast of NSW.

Wastewater will be collected from the following sources: Home and community centre toilets, showers, hand basins, and laundries.

All sewage will be discharged to council sewer main via a rising main.

Buffer capacity of 360 kL has been provided, which is equivalent to approximately 6-days storage at maximum design flow for the full project (56 kL/day), is provided to allow time to deal with breakdowns. If this is insufficient time then pump out of the buffer tanks will be carried out until the system is operational again.

The system control panel and PLC is located at the wastewater pump shed and contains the logic for control of both the wastewater system and the water recirculation/chlorination systems.

Remote I/O is used for the wastewater plant and the recirculation/chlorination systems. An HMI (Human Machine Interface) panel is installed at the wastewater pump shed and at the recirculation/chlorination shed located at the water header tanks, so that all equipment can be monitored and controlled from either location on site.

### **1.2 Scope of Manual**

This manual describes the operation and maintenance of the sewer infrastructure.

This fully automated system receives wastewater generated by the facility and disposes it to council sewer.

### **1.3 Warnings and Precautions**

Sewer system maintenance must only be undertaken by suitably trained and authorised personnel and in accordance with all relevant Occupational Health and Safety regulations of the jurisdiction in which the sewer system is installed.

It is important that care is taken during maintenance to ensure that sewage does not escape and contaminate the environment.

The following protocols are to be used to minimise this risk:

- All maintenance operations must be supervised on-site by an authorized representative who is qualified to operate the sewer system and aware of the risks of contamination during maintenance.
- Where planned maintenance schedules involve work on both sewer and potable or nonpotable water systems, perform maintenance on the sewer system first.
- The on-site maintenance supervisor must verify with any contractors that equipment used for repair and maintenance of sewers is not used for repair or maintenance of the potable or nonpotable water systems.

Even with these precautions, in the event of contamination of the environment, the incident must be immediately reported to NEV management, as well as recorded in the site logbook, with details of how the incident occurred and what corrective action was taken. NEV will implement its environmental contamination procedure and notify any authorities where appropriate.



The sewer may not be used until the system has been verified and the requirements of the site WICA license have been complied with.

### **1.4 Contact List**

#### **Emergencies:**

Life threatening (Ambulance / Fire Brigade / Police) - dial: 000

#### Sewer Scheme Owner and manager:

Narara Eco Village Water and Sewer Dept Phone: 02 4328 1588 Mobile: 0401 319 051 Email: water@nararaecovillage.com

#### **1.5 Emergency Protocols**

Incidents or emergencies relating to the sewer system and the dual-pipe system are likely to be first identified by a resident, visitor, maintenance contractor or the sewer system operator. The roles and responsibilities of the parties are detailed in the Sewer Management Plan for Narara Ecovillage. NEV are the facility owner/manager and are to be notified as soon as possible to any such incidents or emergencies.

Where an incident or emergency is identified by the sewer system operator, the situation is to be made safe to the extent it is possible and safe to do so, before immediately contacting NEV management where a decision can be made on appropriate further action.

Where a resident or visitor require an urgent repair, they are instructed to notify the facility plumbing maintenance contractor. Urgent repairs include:

- Line break in a sewage or sewer pipeline
- Blocked or broken toilet in community facilities
- Flooding or serious flood damage.
- A fault, damage or power failure that creates an unsafe situation.

NEV will arrange for the urgent repairs to be undertaken.



## **2** Design Parameters

## 2.1 Code and Authorities

The Sewer System has been developed specifically for this site, in accordance with NEV's obligations under:

- National Water Quality Management Strategy Australian Guidelines for Wastewater Recycling: Managing Health and Environmental Risk (Phase 1) 2006.
- Plumbing and Drainage Code AS/NZS 3500:2003

## 2.2 Design Criteria

Design throughput:	56 kL/day
Buffer tank capacity	360 kL

## **3** Occupational Health and Safety

Before commencing any work on the sewer system, refer to:

- the site induction procedures
- the NEV SWMS for the sewer system
- the NEV Occupational Health, Safety and Environment (OHSE) Management Plan
- any relevant local procedures regarding Occupational Health and Safety (OHS)

### 3.1 Personal Hygiene

Untreated sewage contains species that are potentially harmful to health.

Prior to commencing any work on the sewer system, it is recommended hands are protected with a suitable biocide lotion and close-fitting vinyl gloves. At completion of works, hands and face should be thoroughly washed with soap and water. Use biocide on hands.

## **3.2 Protective Clothing**

Full length trousers and shirt, and steel cap work boots should be worn at all times.

Sodium hypochlorite is a corrosive agent and must be handled with care. When changing sodium hypochlorite drums, or working on sodium hypochlorite lines, wear a full-face shield, elbow length PVC gloves and full length PVC apron.

PVC gloves must be worn when working on any equipment associated with the sewer system. Gloves should be washed down at completion of work.

## 3.3 Tank Entry

Under no circumstances must entry be made to any tank or vessel without prior reference to *Work Health and Safety Regulation 2017* and ensuring such entry is in accordance with the regulation.



## **4** System Description

### 4.1 Site

The waste water is collected from the residential and community facilities on the Narara Ecovillage site in a gravity sewer system. The waste water is collected in three interconnected 120kl buffer tanks and pumped to council sewer by dual submersible pumps and a 90mm PE rising main.

## 4.2 Equipment Schedule

Description	Part
Buffer Tank Transfer pumps x 2	Zenox ZSG-220-3
Ground water pressure transmitter	Trafag ECL Series 8438, 4m
Buffer tank Pressure transmitter	Trafag ECL Series 8438, 4m
Buffer tank level switch x 2	Mac3



## 4.3 Asset Replacement Schedule

The following table outlines the recommended asset replacement schedule.

ASSET R	EPLACEMENT SCHEDULE																				
		Y	ear	•																	
Serial	Description	1				2				3				4				5			
		3	6	9	1	3	6	9	1	3	6	9	1	3	6	9	1	3	6	9	1
					2				2				2				2				2
1	Tanks																				
2	Pumps																				
	Submersible Pumps																				х
3	Motors • General																				
	Motor Bearings												x								
	Motor																				
4	Monitoring Equipments																				
	Level Transmitters																				x
5	Valves																				
	Solenoid valve																				x
	Actuated valve																				x
	Butterfly valve	Ν	οL	im	ite	ed	Lif	fet	im	e.	Or	۱ly	re	epl	ac	e					
		w	he	n j	pr	ob	ler	m	rai	se											
	Ball valve (PVC)	Ν	o L	im	ite	ed	Lif	fet	im	e.	Or	٦ly	re	epl	ас	е					
		W	he	n	pro	ob	ler	n	rai	se											
	Check valve	Ν	o L	im	ite	ed	Lif	fet	im	e.	Or	۱ly	re	epl	ас	е					
		w	he	n j	pr	ob	ler	n	rai	se											
6	Others																				
	PLC	U	nlir	mi	te	dl	ife	. C	Dnl	y r	ер	lac	ce	w	he	n					
		р	rob	ble	m	ra	ise	е													
	НМІ	U	nlir	mi	te	dl	ife	. C	Dnl	y r	ep	lac	ce	w	he	n					
		р	rob	ble	m	ra	ise	е													
	Sewage Pipework	Unlimited life. Only replace when																			
		р	rot	ble	m	ra	ise	e													
	Float Switches	U	nlir	mi	te	d I	ife	. C	Dnl	y r	ер	lac	ce	w	he	n					
		р	rob	ole	m	ra	ise	е													



Asset Replacement Schedule continued:

ASSET R	EPLACEMENT SCHEDULE Cont	inu	ed																		
		Y	eai	r																	
Serial	Description	6				7				8				9				1	0		
		3	6	9	1	З	6	9	1	3	6	9	1	3	6	9	1	3	6	9	1
					2				2				2				2				2
1	Tanks																				
2	Pumps																				
	Submersible Pumps																			1	х
3	Motors • General																				
	Motor Bearings																Х				
	Motor				x																
4	Monitoring Equipments																				
	Level Transmitters																				x
5	Valves																				
	Solenoid valve																				х
	Actuated valve																				x
	Butterfly valve																				
	Ball valve (PVC)																				
	Check valve																				
6	Others																				
	PLC																				
	НМІ																				
	Sewage Pipework																				
	Float Switches																				



Asset Replacement Schedule continued.

ASSET R	SSET REPLACEMENT SCHEDULE Continued         erial       Description       11       12       13       14       15         erial       Description       11       12       13       14       15         Tanks       1       3       6       9       1       3       6       9       1       3       6       9       1       3       6       9       1       3       6       9       1       3       6       9       1       3       6       9       1       3       6       9       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1 <td c<="" th=""></td>																				
Serial	Description	1	1			12	2			1	3			14	4			1	5		
		3	6	9	1	З	6	9	1	3	6	9	1	З	6	9	1	3	6	9	1
					2				2		-		2				2				2
1	Tanks																				
2	Pumps																				
	Submersible Pumps																				х
3	Motors • General																				
	Motor Bearings																				X
	Motor								x												
4	Monitoring Equipments																				
	Level Transmitters																				x
5	Valves																				
	Solenoid valve																			1	x
	Actuated valve																				x
	Butterfly valve																				
	Ball valve (PVC)																				
	Check valve																				
6	Others																				
	PLC																				
	НМІ																				
	Sewage Pipework																				
	Float Switches																				



## 4.4 Schedule of Required Capital Works

		Year						
Serial	Description	1	2	3	4	5	6	7
1	Tanks							
2	Pumps							
	Submersible Pumps					3,000		
3	Motors General							
	Motor Bearings			500				
	Motor						х	
4	Monitoring Equipmen	ts						
	Level Transmitters					1,500		
5	Valves							
	Solenoid valve					2,000		
	Actuated valve					3,000		
	Butterfly valve	No Limited	Lifetime. Onl	y replace wh	en problem ra	100	100	100
	Ball valve (PVC)	No Limited	Lifetime. Onl	y replace wh	en problem ra	50	50	50
	Check valve	No Limited	Lifetime. Onl	y replace wh	en problem ra	aise		
6	Others							
	PLC	Unlimited li	fe. Only repla	ice when pro	blem raise			
	HMI	Unlimited li	fe. Only repla	ice when pro	blem raise			
	Sewage Pipework	Unlimited li	fe. Only repla	ice when pro	blem raise			
	Float Switches	Unlimited li	fe. Only repla	ice when pro	blem raise	100	100	100
Total		-	-	500	-	9,750	250	250

Serial	Description	8	9	10	11	12	13	14	15
1	Tanks								
2	Pumps								
	Submersible Pumps			3,000					3,000
3	Motors General								
	Motor Bearings		500						500
	Motor					х			
4	Monitoring Equipmen	ts							
	Level Transmitters			1,500					1,500
5	Valves								
	Solenoid valve			2,000					2,000
	Actuated valve			3,000					3,000
	Butterfly valve	100	100	100	100	100	100	100	100
	Ball valve (PVC)	50	50	50	50	50	50	50	50
	Check valve								
6	Others								
	PLC								
	HMI								
	Sewage Pipework								
	Float Switches	100	100	100	100	100	100	100	100
Total		250	750	9,750	250	250	250	250	10,250



### 4.5 Component Preventative Maintenance

A routine maintenance program has been put into operation to ensure trouble free operation of the system.

Plant servicing should be undertaken by an appropriately qualified service technician. Works should not only include mechanical servicing of system components, but should also pay attention to calibration of instruments, measuring and recording system.

All service activities undertaken on the system should be recorded and the records maintained for future reference.

An Asset Maintenance Schedule is provided in Section 8 below.

As well as scheduled servicing, daily checks of the plant should also be undertaken. These checks are typically observations of the system and should include:

- Checking for leaks or spills
- Checking for unusual odours
- Checking for noises or vibrations of equipment that may require further investigation
- Checking system status and tank levels on the HMI
- Checking the HMI for alarms

Results of daily checks should be recorded as objective evidence that the system is being checked as required.



## **5 Operating Instructions**

#### 5.1 Components

The Sewer system consists of the following major components (refer to Section 6 for drawings):

- Sewer reticulation network
- Buffer tanks.
- Submersible pumps
- Rising sewer main.
- Control panel with programmable logic controller and remote monitoring module.

### 5.2 Control

The sewer system is run by simple level switch and Programmable Logic controller (PLC). The PLC has a touch screen interface (HMI), which allows the sewer system to be monitored and controlled onsite or remotely. The PLC can be monitored and controlled remotely, with connection through the remote monitoring system.

In the event of an emergency, activate the emergency stop button on the PLC and notify NEV immediately. In addition to emergency stop button availability, various fail-safes are built into the logic of the system. These have been developed over time and provide for catastrophic events such as power failure and mechanical failure.

The sewer system will run in automatic mode for the majority of its serviceable life.

The delivery pumps are automatically controlled by a level switch. In addition, there is a low level cut-out switch and a level sensor.

If the buffer tank level is outside the setting range or motor faults/power failure are detected, the PLC will generate an alarm, and send an alert to the operators via email.

### **5.3 Touchscreen interface**

The touch screen interface forms part of the control panel. If required, it can be protected by a key combination/pin access code system. These details will be provided to authorised operators as required.

The various PLC windows are described in the following sections.

#### Main Menu Screen

This window allows the operator to access subsequent screens that allow the system's status, trends,

key operating parameters, and alarms to be viewed and changed. The system can be switched on or off from this screen and the current status of the system is shown – running or stopped. You can also program set points, view current settings, view trends, view the mimic screen for each process, and view alarms, by selecting the appropriate sub-screen.



#### Figure 1: Main Menu Screen



The buttons are broken into the following groups:

#### Mimics:

These screens give a pictorial display of different parts of the system processes and the current status of equipment and instrument values (see figure 3 for infeed and biology mimic).

#### Settings and Controls:

These allow the operator to change equipment and instrument set points.

Each of the mimic screens contain a "setpoints and control button" that takes the operator to the same "setpoints and control screens" displayed on the main menu.

#### Infeed and Biological Mimic Screen

The infeed and biological mimic allows the operator to view the levels of the buffer tanks. Low levels and high levels in the tanks are also reported.

The operational status of the sludge pumps are shown and the operator can control these pumps from this screen.





Figure 3: Infeed and Biology Mimic Screen

Buttons at the bottom of the screen allow the operator to transition between HMI screens. This approach is common to all the mimic screens once the operator leaves the main menu screen.

#### **Active Alarms**

This window shows date and time stamped information of exceptions or alarms that are active.



#### Figure 12: Active Alarms Screen

Gene	ral Alarms		MOS Alar	ms
		Yearning -		
		Warming -		
		Weinterig -		
		Wanning		
		Yourning -		
		Warming -		
		WWWTHING -		
		Waining -		
		Warvers -		
		Etayozy-		
		Ebvelby-		
		Standby		
		Shoutry-		
		Stavelby -		
		Clear Alarms		
Main Menu	Alarm Logger	Infeed and Biology Mimic	Membrane Operating System Mimic	UV and Chlorine Dosing Mimic

Main Menu - takes the operator back to the main menu (see figure 1).

Alarm logger - allows the operator to view the alarm history.

**Clear alarms** - allows the operator to clear alarms that are no longer active. Active alarms cannot be cleared until the alarm condition has been rectified on the system.

The mimic buttons take the operator back to the selected mimic screen.

#### 5.4 Accessing motors and valves

Motors and automated valves have the option of operating in manual or auto mode.

NOTE: When equipment operates in manual mode, all control overrides are inhibited. Equipment must be left in auto mode during normal operation.

The pump or valve of interest can be selected by choosing the appropriate mimic screen that displays the valve and pressing the automated valve/ motor icon on the screen. A pop-up window appears (see figures 15 and 16)



#### Figure 15: Motor pop up Screen



Faults are shown on the pop-up window e.g. VSD fault or Tripped for tripped motor overloads.

Manual on - manually turns the motor on and

Manual off - manually turns the motor off.

Auto - allows the motor to run in Auto mode and it will be controlled by process interlocks.

**Close** - closes the pop-up window.

The current mode of operation is highlighted in green.



#### Figure 16: Automated valve pop up Screen

AVGW01 CLOSED		
Auto Manual		
Manual Open Manual Close		
Close		

Manual open - manually opens the valve on and Manual close manually closes the valve.

Auto - allows the valve to run in Auto mode and it will be controlled by process interlocks.

**Close** - closes the pop up window.

The current mode of operation is highlighted in green.

#### 5.5 Online Monitoring

The online monitoring system allows NEV to monitor multiple sites remotely. There are a number of windows available in the graphical user interface.

The sewer system can be completely controlled via the online system. For this reason only trained NEV staff and authorised personnel have access to the on-line monitoring system. This access is strictly controlled.

#### 5.6 Normal Operation

- On the HMI select the Threed and Biological Treatment screen. This screen shows the level in the buffer tanks and the status of the submersible discharge pumps.
- Select the sewage pump icon with equipment tag PF-BUF -01 or PF-BHF-02.





- A pop-up window will appear on the HMI screen giving the operator the option of turning the pump ON, OFF or AUTO. The position for normal operation is AUTO.
- Select ON to manually start the pump.
- The pump will not start if the low level switch is ON in the buffer tank.

#### 5.7 Start-up after Power Outage

In the event of a power outage, the PLC system resume operation in the same state as when the power was interrupted. As the power supply to the modem and router is sourced from the control panel, any power interruption will also result in a loss of remote monitoring capabilities. NEV will not be able to control the system remotely until power is restored.

#### 5.8 Buffer Tank Pump Out Procedure

The Sewer buffer tank level is continuously monitored in the HMI. If the level reaches an unacceptable level due to equipment failure or unusually high inflow, a specialised waste haulage contractor needs to be contacted to arrange pump out of the sewage into a road tanker for off-site disposal.

Before commencing, inspect the level of the sludge tank by opening the manway and checking that the level transmitter reading is in fact correct and sludge needs to be removed

The sewage removal process is a manual process which involves connecting a suction hose from the sewage buffer tank manway to the tanker.

- Continuously monitor the sludge tank level and stop the transfer of sludge when the tanker is full or when the buffer tank level reaches the required depth as shown on the HMI screen.
- Close isolation valves and disconnect the hose.
- Replace manway lids on the sludge tank and ensure the area is left safe and clean.



## 5.9 Safety

Only suitably trained personnel should operate the sludge pump and carry out the sewage removal process.

PPE must be worn: Full length trousers and shirt, steel cap work boots, PVC gloves and safety glasses should be worn at all times as a minimum.

Always ensure the hose is tightly connected to the tanker and sewage take off valve before opening valves to allow flow. Ensure the tanker is vented before pumping sewage to the tanker. Do not start the pump until all valves are open to prevent the pump dead heading and possibly being damaged. While the pump is in operation the operator must continuously monitor the sewage buffer tank level to ensure the level never drops below the top of the submerged pumps, otherwise the pump may be damaged as it relies on the surrounding liquid to cool the motor.

All residents should be warned to stay away and keep the area clear, before the sewage removal process begins.

## **6 Maintenance Procedure**

### 6.1 General

The recommended maintenance schedule for this system is shown in section 8 below. A separate parts replacement schedule has been included as indicated in the asset replacement table in Section 4 above.

Note that any maintenance activity must only be carried out subsequent to the following:

- Safe Work Method Statements (SWMS) approved by NEV
- Scope of work approved by NEV
- Any specific site inductions have been completed
- MSDS for chemicals are available and have been read by workers.

All maintenance activities must be recorded in the relevant log book.

Activities referred to in the Maintenance Schedule are discussed in more detail in the following sections:

#### 6.2 Instrument Calibrations

Any instrument calibration procedures are to be as per manufacturers requirements. Refer to the manufacturer s manual for detailed instructions.

## 7 Drawing Register

#### 7.1 Sewer Diagram



#### 7.2 Rising Main Diagram



## 7.3 Sewer Buffer Tank Layout





## 8 Asset Maintenance Schedule

ASSE	T MAINTENANCE SCHEDULE																									
		А	007	2																						
Projec	ct No & Name:																									
Site L	ocation:	Ν	ara	ra	Eco	villa	age	9																		
Done	By:	Si	mo	n (	Grin	าพด	000	k																		
Date:		1	2-D	ec-	14																					
Versio	on:	1																								
Asset	Management for Service																									
				Т																						
		Ye	ear											_							_					
	Description	1			2				3			4			5			6		-	7			8		
		3	6	9	1 3	6	9	1	3	6 9	) 1	3	6 9	91	3	6 9	) 1	3 6	9	1 3	36	9	1	3 6	9	1
					2			2			2			2			2			2			2			2
1	Pits																									
	Rinse pits with fresh water		х		x	x		х		х	x		х	x		х	х	x		x	x		x	x		х
2	Feed pumps																									
	Visual check I Freshwater rinse				x			х			x			x			х			x			x			х
	Check bearings							х						х						x						х
	Check mechanical seals							х						х						x						х
3.	Valves																									
	Solenoid valve																									
	Visual check to avoid blocking		x		x	x		х		х	x		х	х		х	х	x		х	х		х	x		х
	Butterfly valve																									
	Visual check to avoid blocking		x		x	x		х		х	x		х	х		х	х	x		х	х		х	x		х
	Ball valve (PVC)																									
	Visual check to avoid blocking		х		x	х		х		х	x		х	х		х	х	х		х	х		х	x		х
	Check valve																									
	Visual check to avoid blocking		х		x	х		х		х	x		х	х		х	х	х		х	х		х	x		х
4	Others																									
	PLC																									
	Visual check		х		x	x		х		х	x		х	х		х	х	x		x	х		х	x		х
	Float switch					4					. 1															
	Visual check		х		x	x		х		х	x		х	x		х	x	x		x	x		x	x		х
	Connections & Fittings					4					. 1															
	Visual check		х		x	x		х		x	x		х	x		x	x	x		x	x		х	x		x
																									1	



		Year         9       10       11       12       13       6       9       1       3       2 <th></th> <th></th> <th></th>																											
	Description	9				10	)			11	1			12	2			13				14	1			15	;		
		3	6	9	1 2	3	6	9	1 2	3	6	9	1 2	3	6	9	1 2	3	6	9	1 2	3	6	9	1 2	3	6	9	1 2
1	Pits																												
	Rinse pits with fresh water		x		х		х		х		x		x		х		х		x		х		х		х		x		x
2	Feed pumps																												
	Visual check I Freshwater rinse				х				х				х				х				х				х				х
	Check bearings								х								х								х				
	Check mechanical seals								х								х					Ш			х		_	_	_
3	Valves										_			_			_		_			—	—						_
	Solenoid valve																												
	Visual check to avoid blocking		х		х		х		х		х		х		х		х		х		х		х		х		х		x
	Butterfly valve																												
	Visual check to avoid blocking		х		х		х		х		х		х		х		x		x		х		х		х		х		х
	Ball valve (PVC)																												
	Visual check to avoid blocking		х		х		х		х		х		х		х		х		x		х		х		х		х		х
	Check valve																												
	Visual check to avoid blocking		х	_	х		х		х		x		х		х		х		x		x		х		х		x	_	x
4	Others				_		_					_		_	_	_	_			_		-		_			_	_	_
	PLC																												
	Visual check		х		х		х		х		х		х		х		х		х		х		х		х		х		х
	Float switch																												
	Visual check		х		х		х		х		х		х		х		х		x		х		х		х		х		х
	Connections & Fittings																												
	Visual check		х		x		x		х		x		х		x		x		х		х		x		x		x		x
																					1								



# Narara Ecovillage



# Pollution Incident Response Management Plan

Revision	Date	Ву	Checked	Document Status	Amendments
Rev 1	28/9/2020	G Cameron	T Hester	Draft	Document created



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## **1** Introduction

## **1.1 About the Document**

The Incident and Emergency Response Plan (IERP) for the Narara Ecovillage (NEV) Wastewater Treatment System has been prepared by Narara Ecovillage Co-operative Water Deft and Innaco Pty Ltd. The purposes of this document are:

- To provide the immediate guide for NEV employees in the case of an incident or emergency involving the sewage scheme;
- To comply with 'Preparation of Pollution Incident Response Management Plans' under Part 5.7A of the POEO Act and the Protection of the Environment operations (General Regulation 2009);
- To comply with Element 6 of the Framework for Management for Recycled Water Quality and Use in the Australian Guidelines for Water Recycling (2006).

Copies of the emergency forms are to be made available in the reception office and break tank pump shed at NEV.

Additionally, any regular site contractors should receive appropriate general training on the existence and use of this document. This should be organised by the Water Infrastructure Manager on an annual basis. This should also include training in the structure and procedures for communication with NEV Water staff during incidents.


## **1.2 Regulatory Compliance**

The tables below detail how this Pollution Incident and Emergency Response Management Plan complies with the regulations and guidelines stated above.

#### **Requirements of The POEO Regulation.**

Requirements of the POEO (G) Regulation	Incident and Emergency Response Plan
<ul><li>3.3.I Descriptions and likelihood of hazards [clause</li><li>98C (I)(a) and (b)]</li></ul>	
3.3.2 Pre-emptive actions to be taken [clause 98C(l)(c)]	Section O - 6.3 Pre-emptive Actions
3.3.3 Inventories of pollutants [clause 98C(l)(d) and (c)]	
3.3.4 Safety equipment [clause 98C(I)(f)]	
3.3.5 Contact details [clause 98C(I)(g) and (h)]	
3.3.6 Communicating with neighbours and the local community [clause 98C(I)(i)]	Section 3.2 - Communication with Neighbours and the Community
3.3.7 Minimising harm to persons on the premises [clause 98C(I)(j)]	
3.3.8 Maps [clause 98C(l)(k)]	
3.3.9 Actions to be taken during or immediately after a pollution incident [clause 98C(I)(I)]	
3.3.IO Staff training [clause 98C(I)(m)]	Section O - 6 Preparing for an Emergency 6.I Training



#### **Requirements Of The Australian Guidelines For Water Recycling (Element 6).**

AGWR Element 6 Requirements	Incident and Emergency Response Plan
2.6.1 Communication	
Define communication protocols with the involvement of relevant agencies and prepare a contact list of key people, agencies and stakeholders.	
Develop a public and media communications strategy.	Section 3.2 - Communication with Neighbours and the Community
2.6.2 Incident and Emergency Response Protocols	
Define potential incidents and emergencies and document procedures and response plans with the involvement of relevant agencies.	
Train Employees and Regularly Test Emergency Response Plans.	Section 0 - 6 Preparing for an Emergency
	6.1 Training
Investigate any incidents and emergencies and revise protocols as necessary.	Section 0 - 6.2 Review of DOCUMENT

### **1.3 How to use this Plan**

This PIRMP is divided into 3 parts:

#### Part 1 – Emergency Plans

This part contains Emergency Operating Plans and can be used in an emergency situation.

#### Part 2 – Response Protocols

This part describes the three incident and emergency levels and the process by which an incident is escalated. Roles and responsibilities are detailed for each level.

#### Part 3 – Preparation Measures

This part details required preparatory measures, including training, document reviews, forms and checklists. Maps, risk assessments and a pollution inventory are also included.

### 1.4 Facilities covered by this PIRMP

This PIRMP relates specifically to the wastewater systems at Narara Ecovillage.



#### 1.5 **PIRMP Review**

This PIRMP is to be reviewed annually by the **NEV Environmental Officer** in conjunction with relevant NEV staff including the **Head of NEV Water.** 

#### **1.6 PIRMP Training**

To ensure that this PIRMP is properly followed in the event of a pollution incident, training programs shall be provided to relevant NEV Employees. The objectives of the training program shall be as follows:

a) To ensure that NEV Employees are knowledgeable of their roles and responsibilities concerning this PIRMP.

b) To ensure that NEV Employees are knowledgeable of the PIRMP's procedures to affect a safe and

appropriate response to pollution incidents.

NEV employees are instructed, as part of their site inductions and ongoing training, in the steps to report and respond to facility conditions or issues that might give rise to pollution incidents where these conditions **or** issues are found to exist. This process should also include appropriate site staff providing general PIRMP awareness training for contractors, with particular attention to the control structure and communication procedures for the site.



# PART 1 - EMERGENCY PLANS

*This part contains Emergency Operating Plans and can be used in an emergency situation.* 

## 2 Incident Response Process (What to do first)

In the event of an incident, the steps described below should be followed.

## 2.1 Incident Response Process.

Step	In the Event of a Po	Reference	
1	Take any immediate action without delay	If necessary, contact emergency services If immediate threat or actual impact to human health or property has occurred or is likely. This should be undertaken by ANY member of staff . Provide any emergency assistance to injured personnel. Reduce the probability of any additional injuries or damage.	
2	Identify and assess incident severity	Level 1 - Routine Incident. Escalate to Level 2 - Major Incident. Escalate to Level 3 - Emergency if incident is severe with broad impacts anticipated to have an extended recovery period, declare an emergency and form an Emergency Response Team.	
3	Notify	Notify Water Infrastructure Manager and Head of NEV Water, and implement the Environmental Protection Authority notification protocol if there is a pollution incident where "a material harm to the environment is caused or threatened".	
4	Manage the incident	Implement relevant Emergency Operating Plans.	
5	Reporting	Complete site incident / debrief report.	



Incident Follow-up

1	Have the relevant authorities been notified?	
2	Has the incident been cleaned up appropriately?	
3	Has the EPA been notified of the incident and a report submitted?	Section 3.1
4	Has a Workplace Incident Report and Investigation Form been completed?	
5	Has the IERP been reviewed and updated?	

## 2.2 Evacuation Assembly Areas

The NEV site has a designated evacuation assembly point, located at the front gate (located on the main access road).

In the event of an incident requiring the evacuation of the site, all NEV employees, any contractors, residents and visitors are to immediately leave the site by the designated route and report to the designated evacuation assembly point.

On arrival at the designated evacuation assembly point all persons will remain until the **NEV Village Manager** has determined the status of all personnel and accounted for all; or ;

Prepared a list of names and / or numbers of missing personnel and location last seen.



2.3 Incident Response Diagram.







# **3** Communication

## 3.1 Pollution Notification Protocol

#### **Notification of Pollution Incidents**

It is a legal requirement for pollution incidents to be notified to particular agencies immediately when they occur.

#### When does the notification requirement apply?

The notification requirement applies to any pollution incident where a "material harm to the environment is caused or threatened".

This requirement means that any incident which involves harm to the health or safety of a person, or an ecosystem, must be notified unless it is trivial. Incidents which result in a cost or damage exceeding \$10,000 must also be notified under this requirement.

#### Who is required to action the notification requirement?

NEV has the duty to notify under the legislation. This duty is to be performed by the person who Manages the department carrying out the activity when the pollution incident occurs.

If the relevant Manager cannot be located then the incident must be immediately referred to the CEO, or any other member of the NEV Board to action the notification.

If the Manager, nor any member of the Executive Team, can be located promptly or without delay, then the staff member who has identified the incident has the duty to notify the relevant agencies in the manner described below.

#### How must a pollution incident be notified?

In the event of a pollution incident:

- 1) Immediate action should be taken to ensure the safety of people and containment of pollution if it is safe to do so.
- Call 000 (or 112 from mobiles) if the incident threatens human health or property. This will mobilise Fire and Rescue NSW, the NSW Police and/or the NSW Ambulance Service (combat agencies) as required.
- 3) If a combat agency is not required then:

As soon as it is safe to do so, the following agencies MUST be notified in the following order:

- The EPA 131 555
- The Ministry of Health via the local Public Health Unit 67648000
- The WorkCover Authority 13 10 50
- Central Coast Council 1300 463 954
- Fire and Rescue NSW 000 (or 112 from mobiles) or 1300 729 579



#### The information that will be required in the notification is:

- a. the time, date, nature, duration and location of the incident;
- b. the location of the place where pollution is occurring or is likely to occur;
- c. the nature, the estimated quantity or volume and the concentration of any pollutants involved, if known;
- d. the circumstances in which the incident occurred (including the cause of the incident, if known);
- e. the action taken or proposed to be taken to deal with the incident and any resulting pollution or threatened pollution, if known.

If information is not known at the time of initial notification, but becomes known at a later time, then additional notification should be made.

#### Other points of note:

The EPA may require others (such as community members or property owners) to be notified by NEV. These instructions must be followed.

This notification procedure does not apply to odour.

If, at the time of making the notification, you believe that some of the above authorities do not need to attend the incident, you may provide that advice. However, the authorities must be notified and all of the information regarding the incident must be passed on to the authorities. It is the responsibility of each authority to decide whether they need to attend the incident.



## 3.2 Communication with Neighbours and the Community

Early warning and regular updates to owners and occupiers of premises who may be affected by an incident emanating from the NEV Wastewater System will be notified as follows:

#### **Properties surrounding the Facility:**

Should a neighbour in the vicinity of the incident be required to take action due to an impending or actual

pollution risk, a telephone call or visit to the residence or business where a pollution impact may be experienced will be made by a NEV staff member. This may be undertaken by any member of staff if immediate action is required. In the event of a major pollution incident, residents or businesses may be further contacted by an emergency service representative, such as in a case where evacuation or critical safety actions are necessary.

An 'all-clear' telephone call or visit will also be made to residents when the incident is no longer of concern or normality has been restored. This will be undertaken by Emergency Services, or by a relevant staff member under instruction from Emergency Services.

#### **Wider Community**

NEV will use the following methods of communication as appropriate to the circumstance:

- NEV website;
- EPA Environmental Pollution Hotline;
- Media releases to local radio stations and newspapers;
- Door knocking and/or letterbox drop.

NEV's **Head of Water Dept** will be responsible for the co-ordination of media interaction with regard to such an emergency event, and will also assume the responsibility of public information dissemination in consultation with the **NEV CEO**.



# 4 **Emergency** operating Plans

These procedures provided a first response to incidents (Levels 1 to 2). For Level 2 - Major Incidents and Level 3 - Emergencies, Emergency Operating Plans (EOP) have been developed which contain further guidance. These plans should be implemented where appropriate.

The following Emergency Operating Plans are included in this section:

Each emergency operating plan has been designed as a 1-page "Rip and Run" document. Each plan provides guidance on appropriate actions has includes space for notes to be recorded during an emergency.



## 4.1 Major Asset Failure

Summary	This emergency operating plan applies to the failure or imminent failure of a major asset						
Initiation and Notification	Initiate this EOP if including: major eq main. Use the Pollu potential for a lea Communication for	EOP if there is a failure or suspected failure of a major asset ajor equipment; trunk main; rising main; pumping station or sewer he Pollution Notification Protocol (flowchart over) if there is the r a leak or a spill to the environment. Refer to Section 3 - tion for full notification details.					
Specific Activities:	I. Assess	1. Shutdown affected assets and assess damage.					
		2. Make area safe.					
	U. Inclute and fix	3. Check welfare of staff and public, provide aid.					
	the problem	4. Alert appropriate starr and emergency response personnel.					
		5. Communicate and liaise with customers.					
		6. Communicate with regulators and authorities.					
	7. Liaise with Emergency Services and assist.						
		<ol> <li>Provide temporary supply or reconfigure delivery system if possible.</li> </ol>					
		9. Provide emergency equipment (pumps, generators, manual systems, local needs etc.).					
	III. Monitoring	10. A monitoring program may need to be developed in relation to the specific failure of the asset					
	IV. Recovery and return to safety	<ol> <li>Conduct repairs and begin planning for permanent repairs or replacement assets.</li> <li>Disinfect and make safe for access as appropriate.</li> </ol>					
	V. Report	13. Conduct a debrief session and develop improvement strategies.					
		14. Complete forms as appropriate:					
		Incident Report Form and Incident and Investigation					
		Incident Record Form B: Overflow from Reticulation System.					

#### **NOTIFICATION PROTOCOL**





## 4.2 Bomb Threat / Criminal Acts / Security Threats

Summary	This emergency operating plan applies to bomb threats, criminal act or security threats.				
Initiation and	Notify Police (000).				
Notification	Notify direct superviso	r.			
	Use the Pollution Noti spill to the environr notification details.	Use the Pollution Notification Protocol if there is the potential for a leak or a spill to the environment. Refer to Section 3 - Communication for full notification details.			
Specific Activities:	I. Assess the problem	<ol> <li>Assess damage I level of threat to affected assets.</li> </ol>			
		2. Check welfare of staff and public, provide aid.			
		3. Check functionality of affected area.			
	II. Isolate and fix the problem	<ol> <li>Alert appropriate staff and emergency response personnel.</li> </ol>			
		5. Communicate with Manager I Director.			
		6. Communicate and liaise with customer.			
	7. Communicate with regulators and au				
		8. Liaise with Emergency Services and assist.			
		<ol> <li>Provide temporary supply or reconfigure delivery system if required.</li> </ol>			
		<ol> <li>Provide emergency equipment (pumps, generators, manual systems, local needs etc.).</li> </ol>			
	III. Monitoring	11. Monitor the system to maintain reticulation system operation and wastewater process if Alternative operation and more frequent monitoring may be required during the event. More frequent monitoring is likely to be required and additional parameters may need to be monitored until the process is stable again.			
	IV. Recovery and return to safety	<ol> <li>Conduct necessary repairs &amp; begin planning for permanent repairs or replacement assets if required.</li> </ol>			
	V. Report of 13. Conduct a debrief session and dev findings improvement strategies.				
		<ol> <li>Record details of incident on Incident Report Form and Incident and Investigation</li> </ol>			



## 4.3 **Power Failure**

Summary	This emergency operating plan applies to power outage at the wastewater or in the reticulation system				
Initiation and Notification	Power outages are notified by the engineer to the team leader I crew Reactive power outages will be notified by the team leader I crew to the engineer (for outages over one hour). Use the Pollution Notification Protocol (flowchart over) if there is the potential for a leak or a spill to the environment. Refer to Section 2				
	- Communication for fu	ull n	otification details.		
	Communicate with regulators and authorities as appropriate.				
Specific Activities	I. Assess the		Make area safe, isolate if necessary.		
	problem	2.	Check welfare of staff & public, provide aid.		
		3.	Determine the extent of the power failure and the likely outage time.		
	II. Isolate and fix the problem	4.	Deploy generators as appropriate.		
		5.	For an extended outage consider:		
			Management of pump station surcharges.		
			Communication with community to reduce inflows.		
		6.	If untreated effluent discharge occurs, consider need to communicate with local land users.		
		7.	Communicate and liaise with customers.		
		8.	Communicate with regulators and authorities.		
	III. Monitoring	9.	Monitor the reticulation system to minimise surcharge impacts.		
		10.	Monitoring wastewater and reticulation system to maintain		
	IV. Recovery and return to safety	11.	Undertake any remediation work (spill management).		
	2		Consider additional or more frequent monitoring as required.		



V. Report of findings

- 13. Conduct a debrief session and develop improvement strategies.
- 14. Complete forms as appropriate:

Incident Report Form

Incident Record Form A: Overflow).



#### **NOTIFICATION PROTOCOL**





## 4.4 Fire or Explosion

Summary	This emergency operations smoke is identified	ng plan applies to a fire or where	Notes
Initiation and Notification	Raise the alarm. Warn anyone in dan immediate area. At NEV outside the front entran Call Fire Brigade. Use 00 Use the Pollution Noti there is the potential fo Refer to Section 3 - Comm		
Specific Activities	I. Assess the problem	<ol> <li>Determine the extent and nature of the fire if it is safe to do so.</li> <li>Verify the presence of all personnel I contractors I visitors at this point.</li> </ol>	
	II. Isolate and fix the problem	<ol> <li>Warn traffic of any hazard which affects traffic (use lights, warning signs, etc.).</li> <li>Take any practical steps to contain the hazard.</li> <li>Communicate and liaise with customers.</li> <li>Communicate with regulators and authorities.</li> </ol>	
	III. Monitoring IV. Recovery and return to safety	<ol> <li>Take any practical steps to prevent the hazard from spreading.</li> <li>Contact Headworks Engineer - Water.</li> <li>Decide with the relevant authority how to manage and</li> </ol>	
	V. Report of Findings	<ul> <li>10. Conduct a debrief session and develop improvement strategies.</li> <li>11. Record details of incident on Incident Report Form (TC-TC-001-SF4684) and Incident and Investigation (TC-RS-SP-002-SF4693).</li> </ul>	







## 4.5 Building or Office Problem

Summary	This emergency operati been affected by an inci	Notes	
Initiation and Notification	Contact ambulance if th Contact supervisor.		
Specific Activities	I. Assess the problem	<ol> <li>Make area safe.</li> <li>Check welfare of staff and public, provide aid.</li> <li>Communicate and liaise with Police I Emergency Services and assist with investigation.</li> </ol>	
	II. Isolate and fix the problem	<ol> <li>Isolate and fix the problem as appropriate (if safe to do so).</li> <li>Communicate and liaise with customers.</li> <li>Communicate with regulators and authorities.</li> </ol>	
	III. Monitoring	<ol> <li>Monitor the problem to determine if it has been fixed.</li> </ol>	
	IV. Recovery and return to safety	8. Conduct repairs and begin planning for permanent repairs or replacement assets.	
	V. Report of findings	<ol> <li>9. Conduct a debrief session and develop improvement strategies.</li> <li>10. Record details of incident on Incident Report Form and Incident and Investigation</li> </ol>	







## 4.6 Natural Disaster

Summary	This emergency operatin bushfire, earthquake, la lightning, drought			
Initiation and	Communicate with Supervisor.			
Notification	Use the Pollution Notification Protocol if there is the potential for a leak or a spill to the environment Refer Section 3 - Communication for full details.			
	Communicate with custo	mer	S.	
	Communicate with regul	ator	s and authorities as appropriate.	
Specific Activities	I. Assess the problem	1.	Shutdown affected assets and assess damage.	
		2.	Make area safe.	
		3.	public, provide aid.	
	II. Isolate and fix the problem	4. 5.	Liaise with Emergency Services and assist where possible. Provide emergency equipment	
			(pumps, generators, manual systems etc.). Consider what may be required to maintain t h e critical system units – e.g. pumps at pump stations, electrical equipment.	
		6.	Communicate and liaise with customers.	
		7.	Communicate with regulators and authorities.	
	III. Monitoring	8.	Monitor the system to maintain reticulation system operation and wastewater process if possible.	
		9.	If repairs have been made, monitor the scheme to successful.	
	IV. Recovery	10.	Conduct repairs and begin planning for permanent repairs or replacement assets.	



V. Report of findings	<ol> <li>Conduct a debrief session and develop improvement strategies.</li> </ol>	
	<ul><li>12. Record details of incident on Incident Report Form &amp; Incident and Investigation</li></ul>	







# Part 2 – Response Protocols

This part describes the three incident and emergency levels and the process by which an incident is escalated. Roles and responsibilities are detailed for each level.



# **5** Response Levels

### 5.1 Level Classification

Depending on the severity of an event, a response may be handled at different levels within NEV. For the NEV wastewater and Effluent Reuse Scheme, a three-tiered structure has been developed.

- Level 1 Incident a small event which can be addressed by normal work crews.
- Level 2 Major incident an event which is escalated to the next level of management
- Level 3 Emergency a serious event with broad impacts anticipated to have an extended recovery period requiring coordination by a management team. It may have an external combat agency as the lead for the initial emergency response.

Specific Examples	Minor Incident (Level 1)	Major Incident (level 2)	Emergency (Level 3)
Sewerage main	Minor main break or blockage with highly localised consequence	Minor main break or blockage with spill to waterway	Main failure with environmental impact or requiring alternate housing or toilet facilities Spill to properties
Sewage pump station	Contained overflow, pump choke, minor plant breakdown	Short contained overflow to waterway	Failure that threatens overflow
Safety	Injury needing first aid	Part of site declared unsafe and closed to staff	Injury needing hospitalisation
			Site / equipment declared unsafe and closed to staff & public
Chemical spill	Contained minor spill	Spill with potential harm to the health of humans or to the ecosystem	Major spill; with health, safety or environmental impacts
Criminal acts	Minor vandalism to	Trespass / break in at	Fraud theft by employees
	facilities	facility	Criminal charges against water business managers;
			Threats received and taken seriously
Major asset failure (incl. power	NIA	Short outage, little effect	Outage, short sewage discharge

#### **Examples of Each Response Level**



failure, fire or explosion)		Minor fire extinguished by staff	Fire causing some damage or injury
Natural Disaster	NIA	Local flooding or small fire causing minor asset damage Local storm damage	Bushfire, major storm, or significant flooding threatening assets
Building / office / IT business systems	Minor damage	Short term loss of part of office Minor outage of key system	Evacuation of office; Partial damage / loss of office; Loss of SCADA
Civil action / Media	Complaints received and routinely dealt with	Verbally aggressive complainant	Protest action / threats towards staff
Staff absence	N/A	Localised illness. Other staff can cover	Loss of a number of staff causing re-prioritizing of work Industrial action reducing maintenance

## 5.2 Escalating Incidents

When an incident occurs, the most senior staff member on-site becomes the **Incident Site Coordinator**. The decision making process used to determine whether an event is a routine, major incident or emergency is as follow:

The Incident Site Coordinator will contact the relevant Supervisor:

If the incident is manageable with normal operational resources, and t	that it should not be escalated
further	Level 1: Incident
Refer the matter to the next level of management	Level 2: Major Incident
Declare an emergency and activate an Emergency Response Team .	Level 3: Emergency

If the supervisor considers the incident is manageable, he / she should continually monitor the event and refer to management if the situation changes.



## 5.3 Level 1: Incident

Level 1 incident or routine incidents (which occur frequently) should be resolved by a wastewater maintenance crew or by a plumbing contractor. Level 1 Incidents require attention but have little operational effect.

An Incident Site Coordinator is responsible for the incident site operation, control and response.

#### LEVEL 1 : INCIDENT ORGANISATIONAL STRUCTURE





### Level 1 : Incident Site Coordinator Role

Role	Incident Site Coordinator	
Undertaken by	Most senior staff member on-site.	
Reports to	Team Leader I Technical Officer.	
Manages	Maintenance crew I wastewater process operators.	
Responsibilities	Ensure the safety of all personnel and those of other organisations.	
	Manage NEV's activity at the incident site.	
	Ensure the incident is controlled by making the site safe.	
	Does not put themself or any other person in danger by tackling an incident outside their capability.	
Notify	<ol> <li>Alert emergency services if necessary and ensure they have access to the site and are given any information they need.</li> <li>Follow notification protocols if the incident is reportable (see Section 3 - Communication.)</li> </ol>	
Actions	3. Determine the scale of incident, considering:	
	<ul> <li>Severity of incident (e.g. damage to property, roads, environment);</li> </ul>	
	<ul> <li>Injures (including nature and number);</li> </ul>	
	<ul> <li>Whether water business assets are affected;</li> </ul>	
	<ul> <li>Whether there are any customers affected.</li> </ul>	
	4. Coordinate all NEV teams at site.	
	5. Liaise with Customer Services, NEV's Corporate Communications Officer.	
	6. Control access to site for all NEV employees.	
Escalate	Grade incident as situation changes and advise Control Room I Emergency Manager of appropriate action and escalate to a Level 2 if unable to be dealt with on site by staff / resources.	
Reporting	Maintain a Site Incident Log Record details of incident on Incident Report Form (TC-TC-001-SF4684).	



## 5.4 Level 2: Major Incident

Incidents are escalated to a Level 2 - Major Incidents when they are unable to be dealt with by initial on site staff or resources. Level 2 - Major Incidents can be handled with normal operational resources and do not require an ongoing management by an emergency response team.

The most senior staff member responding to the incident should take on the role of **Incident Operations Coordinator**.

Key triggers for a major incident are:

- Serious injuries affecting the operation of a wastewater asset or office;
- Wastwater process or equipment failure;
- Environmental impacts;
- Health issues;
- Local flooding or minor building fires;
- Vandalism;
- Limited industrial action, communications / IT failure, power outages.

#### Level 2: Major Incident Organisational Structure





## Level 2 : Incident Operations Role

Role	Incident Operations Coordinator	
Summary	Responsible for incident site operation, control and response.	
Undertaken by	The most senior staff member responding to the incident. Generally, the Technical Officer or Engineer.	
Reports to	Engineer I Operations Manager.	
Manages	Incident Site Coordinator.	
ЕОР	Refer to relevant Emergency Operating Plan where applicable.	
Responsibilities	Ensure the safety of all personnel and those of other organisations. Provide and manage any additional needed staff I resources.	
	Does not put themself or any other person in danger by tackling an incident outside their capability.	
Notify	<ol> <li>Alert emergency services if necessary and ensure they have access to the site and are given any information they need.</li> </ol>	
	<ol> <li>Follow notification protocols if the incident is reportable (see Section 3 - Communication).</li> </ol>	
Actions	3. Determine scale of incident.	
	4. Determine initial response required (including alerting emergency services).	
	5. Establish clear command and communications.	
	6. Ensure the Incident Site Coordinator has secured the site.	
	<ol> <li>Remain at the incident (or at a distance, if the site is unsafe) until such time that emergency resources arrive and facilitate emergency services' access to the site. Liaise and assist.</li> </ol>	
	8. Provide additional stafflresources as needed.	
	<ol> <li>Manage the NEV's own staff and resources on site or delegate to Incident Site Coordinator.</li> </ol>	
	10. Ensure that the Incident Site Coordinator provides situation updates.	
	<ol> <li>Grade incident as situation changes and advise Control Room I Emergency Manager of appropriate action.</li> <li>Grade incident as situation changes and advise Control Room I Emergency</li> </ol>	
Escalate	Manager of appropriate action. Escalate to Level 3 Emergency if necessary.	
Reports	Maintain a Site Incident Log. Record details of incident on Incident Report Form & Incident and Investigation .	



### 5.5 Level 3 : Emergency

A Level 3 - Emergency is a serious incident with broad impacts anticipated to have an extended recovery period requiring coordination by a management team. It may have an external combat agency as the lead for the initial emergency response. Key triggers for an Emergency and activating an **Emergency Response Team** are:

- Injuries, fatality, or significant ongoing threat; serious supply or service problem; serious infrastructure damage (whether owned by NEV or others); investigation by statutory authorities; recurring related incidents;
- Serious injuries, affecting the operation of a wastewater asset or office; major building fires;
- health issues;
- Significant or widespread impact on supply and service operations; significant asset failure or sabotage;
- Spill or emission which requires external resources to mitigate; high volume spill impacting the environment; contamination / failure of a wastewater storage system;
- Disruption requiring corporate or external resources to address; communications / IT failure; significant power outage;
- Wastewater equipment failure.

#### Level 3: Emergency Response Team (ERT)

The Emergency Response Team will be led by the **Emergency Manager**, the most senior person appropriate to the emergency (e.g. the Water Infrastructure Manager).

In the event that an incident is escalated to a Level 3 - Emergency, the Emergency Manager should notify his I her direct manager (e.g. Head of NEV Water).

The Emergency Manager will appoint and convene his / her own **Emergency Response Team** that will include:

- An **Operations Coordinator**, who will liaise with the Incident Site Coordinator;
- A Logistics Coordinator, who will source and coordinate additional resources and skills; and
- The **Support and Administration Coordinator** will coordinate log keeping, management liaison and business needs.



### Level 3 : Emergency Response Team

Role	Emergency Response Team	
Summary	Key responsibilities of the Emergency Response Team are to manage the operational and business implications of an incident.	
Responsibilities	Restoration of operations.	
	Liaison with external agencies.	
	Co-ordination of resources.	
	Management of communications.	
	Notification to General Manager.	
EOP	Refer to relevant Emergency Operating Plan where applicable.	
Notify	<ol> <li>Confirm that emergency services have been alerted, have access to the site and have been given any information they need.</li> </ol>	
	<ol> <li>Confirm that notification protocols have been followed if the incident is reportable (see Section 3 - Communication).</li> </ol>	
Actions	3. Commence and maintain group logs and information boards.	
	<ol> <li>Ensure all key officers have been briefed and ongoing communication protocols established and implemented.</li> </ol>	
	5. Ensure appropriate functional specialists have been activated and briefed.	
	<ol> <li>Advise the Technical Director and establish a communication strategy and updates protocols (may include a communications liaison officer to the Emergency Operations Centre or site).</li> </ol>	
	<ol><li>Review incident for impact on customers. Establish and maintain regular liaison with customers.</li></ol>	
	8. Advise and maintain regular liaison with a designated contact at all appropriate regulators.	
	<ol><li>Determine and continually review operating rules and decision-making processes for the ERT, including support resources.</li></ol>	
	10. Under the direction of the Emergency Manager, conduct regular reviews (every 2 hours or better) and assess the issues identified, provide updates and progress reports on actions taken, and contribute to the development and implementation of the overall response strategies.	
	11. Ensure that all members of the ERT are appraised of major new developments;	
	12. Establish and continually update relevant executives.	
	<ol> <li>Monitor the morale and welfare of affected staff and ensure all necessary support, counselling, and relief is organised.</li> </ol>	
	14. Make arrangements for team member breaks every four hours, and, in the event of prolonged emergency, relief shifts every twelve hours.	
Termination	The decision to terminate an emergency will be made by the Emergency Manager in consultation with the Site Coordinator and a Senior Executive.	



Reporting	Complete forms and reports as appropriate:	
	Incident Report Form	
	Incident Record Form: Overflow from Sewer Reticulation System	

## 5.6 Activation of the Emergency Operations Centre

At any time, during a Level 3 - Emergency event, the Emergency Manager may elect to establish an Emergency Operations Centre. This may be done if significant issues are present or if the emergency requires co-ordination of internal and external resources from two or more facilities or locations and / or cannot be managed at the NEV site.

The location of an Emergency Operations Centre is described in the NEV Business Continuity Plan..

Typical locations for an Emergency Operations Centre would be a NEV meeting room or Board Room.

#### Level 3 : Emergency Response Team Organisational Structure





#### **Emergency Manager**

Who: This role is usually filled by the relevant Department Manager.

**Responsibility:** Manage the overall incident from available resources.

Specific actions include:

- Appoint and coordinate an Emergency Response Team;
- Assess operational and business implications;
- Identify support requirements (especially non-operational, e.g. Communications);
- Inform, advise and liaise with Executive;
- Ensure regular flow of information to the ERT (when activated);
- Maintain log;
- Conduct incident debrief on termination.

#### **Emergency Operations Coordinator**

Who: This role is usually filled by the Water Infrastructure Manager.

**Responsibility:** Provide support to the Emergency Manager from available resources. Specific actions

include:

- Receive briefing and role allocation, and co-ordinate own group;
- Establish communications channels and protocols with Emergency Manager and Incident Site
- Coordinator, then obtain detailed situation update and assessment;
- Identify additional resources required if indicated;
- Assess incident details and collate appropriate reference material (system d r a w i n g s, directories, operating procedures etc.);
- Review technical **and** operational implications and solution options, then provide instructions and advice accordingly to incident site team;
- Maintain master event log issue regular update copies to ERT;
- Assess impact on operability of the NEV's facilities, and consider contingency options to maintain services;
- Provide advice, information updates, and resource support to the ERT;
- Co-ordinate inputs of specialists and other technical advisors;
- Advise Communications personnel on the technical content of media releases;
- Act as liaison point with regional emergency services' staff;
- Handle communication with other external groups as advised by the Communications personnel
- (e.g. emergency services and the regulator);
- Stand down as instructed and contribute to debrief and incident investigation.



#### **Emergency Logistics Coordinator**

Who: For operational emergencies this role will normally be filled by the senior specialist area supervisor.

**Responsibility:** Source and co-ordinate additional resources required at the incident site, or elsewhere.

Specific actions include:

- Liaise with emergency services' command (away from site);
- Liaise with other NEV operations and external providers of services or equipment;
- Liaise with NEV centralised functions which may be required to provide support (e.g. IT or Communications).

#### **Emergency Support and Administration Coordinator**

Who: The Emergency Manager will appoint an individual to this role as he I she sees fit.

Responsibility: Sources administration support to the ERT and plans longer term implications. Specific

actions include:

- Assess long term operations impact;
- Develop strategies to restore or resume disrupted business functions;
- Co-ordinate restoration and resumption of normal operations;
- Provide log-keeping and administrative support to the ERT.

### 5.7 **Termination and Recovery**

#### Termination

The decision to terminate an emergency will be made by the Emergency Manager in consultation with the Site Coordinator and senior executive. Issues they will consider will be the attendance of emergency services at the site, and the impact on customers and the water business.

Termination may proceed if the following have been attended to:

- Injured persons have been hospitalised or otherwise taken care of;
- Next-of kin of staff who have been injured, have been advised and taken care of;
- Staff suffering from trauma have entered a counselling program;
- Any spills and leaks have been stopped, contained and recovered;
- The incident site is free of flammable or toxic vapors;
- Any fire has been extinguished, there is no possibility of fire starting again, and the fire brigade has given the all clear;
- A head count has been carried out by the NEV's Incident Site Coordinator, taking account of all staff and visitors to the premises where the incident occurred;
- All relevant evidence has been preserved to the satisfaction of Police and I or WorkCover;
- All immediate restorations or repairs have been effected to restore services;


#### Recovery

The aim of the recovery phase is to identify, document and manage through to a satisfactory conclusion all operational and strategic issues, including the welfare of staff, members of the public and NEV-owned assets, which will enable the return to a normal level of function.

The recovery phase may continue for a period of time after an emergency has been terminated, and will require ongoing attention from management and staff until all issues arising from the emergency have been resolved.

Area	Considerations			
Customer needs	Immediate needs and wants (welfare, health and convenience) Alternative service arrangements, until normal operations reinstated (bottled water, portable toilets etc.) Public communications advising customers of alternate arrangements Other assistance to customers affected by the incident (e.g. insurance etc.) Assistance to next of kin			
Staff needs	Staff rehabilitation Welfare of staff and next of kin Staff communications strategy			
Community and stakeholder reaction	Damage to community profile Actions to restore goodwill Two way communications strategy External public relations strategy Media relations arrangements			
Environmental impact	Impact on drainage system and water catchment areas Impact on other public infrastructure (roads, railways, power lines etc.) Isolation and containment measures Rehabilitation and clean-up			
Business operations restoration	Repair or replacement of damaged facilities and/or equipment Additional resources required to support business operations Replenishment of all emergency equipment used in the emergency Strategy to restore revenue losses Co-operation with other agencies (especially telecoms and electricity utilities)			
Regulators and compliance with their reporting requirements	WorkCover Department of Health Local Authorities Emergency Services Environment Protection Agency (EPA) Council policies and procedures			

#### ssues To Be Considered During Recovery.



# Part 3 – Preparation Measures

This part details required preparatory measures, including training, document reviews, forms and checklists.



# 6 Preparing for an Emergency

# 6.1 Training

To evaluate the effectiveness of the IERP and to ensure that procedures and practices in this IERP are adequate and are being implemented properly, drills should be conducted regularly. The objectives of the training program are:

- To ensure that NEV employees are knowledgeable of their roles and responsibilities concerning this IERP.
- To ensure that NEV employees are knowledgeable of the IERP's procedures to effect a safe and appropriate response to incidents and emergencies.

### **Training Level**

NEV employees will receive training in the IERP appropriate to the level of their expected involvement.

Training on the IERP will help determine what works and what does not so that revisions can be made accordingly

Training may include:

.

**Orientation Sessions:** These should include basic instructions and explanation of the IERP and Action Plan procedures.

**Table Top Workshops:** Where employees are presented with a fabricated major event. They verbally respond to a series of questions and evaluate whether their response matches the IERP.

**Functional Exercises:** Are designed to simulate a real major event. A team of simulators is trained to develop a realistic situation.

**Full Scale Drills:** Emergency response personnel and equipment are actually mobilised and moved to a scene. A problem is presented to the response personnel and they respond as directed by the IERP and Emergency Response Co-ordinator at the scene.

**Specific Training Courses:** This may include courses such as fire extinguisher use, incident and evacuation management, first aid, and chemical handling courses as appropriate.

#### **Training Frequency**

Training will be conducted annually or when:

- New employees commence;
- New equipment or materials are used; and
- Procedures are updated or revised.

Training and testing of the plan at the table-top level or higher must occur every 12 months. The testing must cover all components of the plan including the effectiveness of the training.



# 6.2 Review of Document

This document should be reviewed annually. Other triggers for review of this document may include:

- Within 1 month of an emergency (regulatory requirement);
- Within 2 months of a change in the wastewater or recycled water operation;

## 6.3 Locations of Emergency Equipment

This table lists the location of existing equipment that may needed to be used in an emergency. Additional equipment can be sourced through Regional Plant Hire and Transpacific.

Equipment Source I Location		Responsible Person
Work Utes	Operators	Operators
Personnel Protective Equipment (gloves, goggles, ear muffs etc.)	Site Managers Office, Pump Sheds	Operators
Fire Extinguishers	Site Managers Office, Water Dept Office	Operators
Harness and Fall Arrestor	Site Manager	Site Manager
Firefighting truck	Machinery Shed	Site Manager
Sandbags	Site Managers Office	Operators
Disinfectant	, Pump Shed	Operators
Pumps	Machinery Shed	Operators
Generator	Machinery Shed	Operators
Traffic Management Equipment	Site Managers Office	Site Manager

# 7 Forms and Checklists

# 7.1 Situation Report (SITREP)

To be used when receiving a report from the first crew member / supervisor attending a scene. SIREPs should be provided by the Initial Crew on a regular basis or whenever the status of the incident changes.

Name of person rec	eiving this call			
Date		Time		
Caller's Name:				
Contact Details: Mo	bile	Tel	Radio	
Have you made con	tact with the pe	rson who reported the incident?	Yes I No	
Confirm Location:	Street:			
	Suburb:			
	Nearest Cross	Street:		
Severity of the Incid	ent: (e.g. damag	ge to property, roads, environmen	t)	
Name and Nature of any Injuries:				
Water Business Assets Affected: (i.e. pipes, valves, pumping station etc.)				
Are Any Customers Affected? (e.g. Flooding, loss of supply etc.)				
Current Action Being Taken (e.g. Have ambulance, Police, fire service been called?)				
Current Resources On-Site (e.g. Number of water utility staff / resources)				
Estimate of Staff / Resources Required:				
Actions Proposed to be Taken:				



## 7.2 Emergency Response Team First Advice

The points below are to assist the Emergency Team Member who took the first alert call to report to the first meeting of the Emergency Response Team. It forms the first entry on the Master Log for the event.

Record the following:

- Nature of Incident;
- Customer Request Management System Number;
- Location;
- Date;
- Time.

Obtain any answers to as many of the questions below as you can.

- What has happened?
- Who is responding to the incident and how?
- Are there injuries or fatalities? If so inform Emergency Services
- Are all wastewater staff accounted for? Initiate action if necessary
- Is there:
  - o wastewater and Recycled water infrastructure damage?
  - o Other water assets I services that will be affected as a consequence?
  - o Non-water business infrastructure damage?
  - Private infrastructure damage?
  - Service disruption?
  - Public health consequences?
  - Environmental consequences?
- Review available information and initiate action if necessary.
- Is the Incident Site Coordinator coping with the situation? (Review and initiate action if necessary).
- What support is required from the NEV as a whole? Initiate necessary action if necessary.
- Which managers have been notified? Operations / Executive / Communications / CEO.

# 7.3 Emergency Response Team Initial Actions

The following table summarises what should be done by the first team members to arrive at the control room after activation, pending the full formal team start up.

Assembly	If the Emergency Operations Centre is to be activated, available staff will help set up the room. Convene as directed as soon as possible, or at the time specified, and advise own staff of your whereabouts I delegation of normal duties.
Activation of the Emergency Operations Centre	<ul> <li>Gather any necessary equipment and material – especially systems maps and asset details.</li> <li>Plug in and allocate telephone lines, and advise all interested groups (including switchboard) of the numbers being used.</li> <li>Set up a fax machine, and arrange printing, copying, and email access.</li> <li>Issue role checklists, other reference material, general stationery, etc.</li> <li>Set up incident log whiteboards and brief team.</li> <li>Arrange security and access control.</li> </ul>
Organisation	Check attendance of all mobilised resources. Confirm key appointments, i.e. Incident Site Coordinator and ERT group Co-ordinators. Organise team-seating arrangements and phones. Consider need for additional specialist and support resources, and facilities. Provide full briefing for mobilised staff, and specify the intended course of action, authorisation levels, and priority tasks I areas of responsibility.
Communication	Establish communications with the incident site and obtain latest situation report. Ensure authorities and emergency services are notified, if not already done by the site team, and all key internal and external stakeholders.
Response	Log and assess the known facts (keep personal logs), consider the key issues and implications, and arrange for provision of any immediate site support needs, including the need for a senior management visit. Develop initial response strategies (operations, communications, and stakeholder liaison), and consider immediate next steps, including priority tasks for each group. Commence team operations and set schedule for next review session.



## 7.4 Emergency Management Start-Up Agenda

This meeting should take no more than 10 minutes before action commences. Provide notepads/pens/pencils for attendees.

#### **Emergency Manager to Chair**

**Attendees**: Emergency Response Team: Operations Coordinator, Logistics Coordinator, Planning and Administration Coordinator + (optional) Relevant Executive, NEV Communications specialist. Minutes are to be kept by the Log Keeper (nominated by the Planning and AdministrationCoordinator).

Emergency Response Team Leaders calls meeting to order.

1.	Outline of the emergency.	ERT Leader (2 minutes)
2.	Outline the roles of the ERT members.	ERT Leader (1 minute)
	Re-read the position checklist and keep checking to ensure all your responsibilities are covered.	
3.	Review all known information to date.	Operations Co-ordinator and Communications Co- ordinator
4.	Review staffing arrangements on site.	Operations Co-ordinator
s.	Review all known actions to date.	Operations Co-ordinator
6.	Consider immediate actions to be undertaken.	ERT Leader to lead I All
7.	Allocate which team members inform stakeholders (e.g. Internal I Regulators I Contractor corporate etc.).	ERT Leader to lead I All
8.	Any questions / comments.	All
9.	Time of next report-back meeting.	ERT Leader



# 8 Plans and Maps

# 8.1 Nev Project Site Aerial View





# 8.2 NEV Sewer Reticulation System – Stage 1



NAME	Easting	Northing	Invert	Des FL	Depth to Inv	
TMS01	344449.580	6303911.900	38.000	39.020	1.020	
MS01a	344435.102	6303948,300	37.500	41,050	3.550	REFER
MS01b	344423.927	6303993.930	35.830	37.570	1.740 7	SHEET
MS02	344411.493	6304039.503	28.737	29.628	0.891	2
MS03a	344444.996	6304015.192	30.000	32.990	2.990	
TMS03	344476.752	6303959.460	31,900	33.030	1.130	
MS04	344417.840	6304053.369	27.150	31.090	3.940	
MS05	344424.017	6304077.425	25.060	28.440	3.380	REFUS
MS05a	344437.357	6304077.953	24.310	27.030	2.720	SHEET
MS06a	344462.369	6304072.620	22.279	24.863	2,584	3
MS07	344520.705	6303995.821	21.315	23.730	2.415	
MS08	344494.968	6304074.478	19,500	21.148	1.648	PERER
MS09	344502.152	6304055.586	18.950	20.607	1.657	CHEET
MS10	344532.444	6304008.598	18.360	22,426	4.066	4
MS11	344543.747	6304014.349	17.800	20.028	2.228	1
MS#219	344586.106	6303919.428	19.780	22.389	2.609	DETER
MS12a	344597.724	6303924.324	18.500	20.768	2.268	SHEET
MS12b	344573.546	6303989.163	15.400	16.894	1.494	6
MS12c	344604.822	6304001.784	10.428	11.950	1.522	
MS13	344508.565	6303917.054	32.000	33.480	1.480	
MS15	344529.478	6303904.872	29,000	30.475	1.475	REFER
MS15a	344518.587	6303938.035	28.300	29.900	1.600	SHEET
MS16	344513.513	6303951.230	26.662	29.000	2.338	5
MS16a	344527.216	6303971.648	24.350	25.410	1,060	
MS17	344539.316	6303978.067	23.000	24.400	1.400	
MS17a	344550.040	6303969.337	22.400	23.180	0.780	
MS18	344575.415	6303916.273	21.810	23.987	2.177	
MS20	344447.613	6303840.341	46.000	47.712	1.712	
MS21	344547.742	6303837.977	28.500	30.031	1.531	REFER
MS21a	344536.528	6303851.629	28.680	30.501	1.821	EHEET
MS21b	344522.822	6303868.329	31.120	32,662	1.542	5
MS22	344601.438	6303787.414	21.450	22.500	1.050	about
MS22a	344588.866	6303847,380	20.948	23.770	2.822	Serta
MS23a	344600.590	6303849.954	20.490	22.020	1.530	SHEEL
MS24	344616.282	6303990.238	10.270	11.000	0.730	4
MS25	344471.465	6304111.327	20.000	22.268	2.268	
MS26	344494.464	6304114.623	16.470	18.500	2.030	REFEI
MS26a	344505.685	6304117.323	12.620	16.010	3.390	SHEET
MS26b	344510.768	6304118.489	12,520	13.620	1.100	7
MS27	344523.403	6304121.484	11.900	13.000	1.100	
MS28	344567.799	6304039.082	10.960	15.174	4.214	

# 9 Risk Assessment

# Description and Likelihood of Risks

This section meets the requirements of clause 98C (1) (a) and (b) of POEO (G) Regulation. General pre-emptive actions are also documented above.

Hazard	Hazardous Event	Impact	Likelihood	Residual Risk Rating	Preventative Measures and Pre-Emptive Action
Pathogens / nutrients	Pipe break I blockage in sewer catchment	Potential health impacts if public contact the sewage Potential environmental impacts if released to local aquatic environments	Preventative measures and pre-emptive actions mean the management of these breaks and chokes make the likelihood of public health and environmental impacts rare. NEV reticulation system has up to 20 breaks and chokes per year.	Low	Asset Management Plan Strategic Business Plan Pipeline maintenance & replacement program Emergency Response Plan
Pathogens / nutrients	Maintenance on sewerage system	Potential health impacts if public contact the sewage Potential environmental impacts if released to local aquatic environments	Unlikely event, NEV has procedures for managing this.	Low	Asset Management Plan Strategic Business Plan Emergency Response Plan Routine Pump Maintenance
Pathogens / nutrients	Surcharge from the reticulation during dry weather	Potential health impacts if public contact the sewage Potential environmental impacts if released to local aquatic environments	Surcharge is likely however the impact is negligible due to the locations of surcharge and the distance to habited area.	Low	Asset Management Plan Strategic Business Plan Buffer storage capacity Emergency Response Plan



Pathogens	Surcharge from the	Potential health impacts if public	Negligible impact however	Low	Reticulation system designed for capacity
/ nutrients	reticulation during	contact the sewage	sites are monitored for		Asset Management Plan
	wet weather	Potential environmental impacts	further action as required.		Emergency Response Plan
		if released to local aquatic			
		environments			



# **10 Pollutant Inventory**

This section meets the requirements of clause 98C (1) (d) (e) and (f) of the POEO (G) Regulation.

**Pollutant Inventory** 

Item	Location	Maximum Quantity
Disinfectant (quaternary ammonium) for spillages / overflows	Pump shed	20L
Sodium Hypochlorite	Header Tank Shed	150L
Oils (machinery)	Machinery shed	20L
Petrol	Machinery shed	40L
Diesel	Farm square	250L

NOTE: Safety Data Sheets (SDS) for chemicals are recorded in folder: Nextcloud\NEV Water\IOP\OH&S SWMS.



# **NEV Environmental Management Procedure**

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# 1. Document Control

Document Number:	NEV051	Current Version:	1.1	Document Approver:	Head of NEV Water
Document Owner:	NEV Water	Controlled Document:	No	Date Approved:	20/9/2017

## History of Revisions

Versio n	Revised By	Date	Nature of Changes
1.0	G Cameron	10/07/2017	First Draft
1.1	G Cameron	6/10/2017	Reviewed and expanded

## 2. Context

The proposed scheme forms part of the NEV residential sub-division project. NEV, as the WICA license holder, is responsible for the construction, operation and maintenance of all water infrastructure from source to customer connection.

## 3. Purpose

The aim of the Environment Management Procedure (EMP) is to detail the potential environmental impacts from NEV's water, wastewater and other services operations, and the mitigation measures to be employed to minimise or alleviate these potential impacts.

The area covered by this procedure is Lot 13 in Deposited Plan 1126998, which is the site of the proposed NEV residential sub-division project.

## 4. Abbreviations

- CAR Corrective Action Request
- ERA Environmental Risk Assessment
- EMP Environment Management Procedure
- HACCP Hazard Analysis and Critical Control Points
- NEV Narara Ecovillage Co-operative Limited
- PIC Peripheral Interface Controller

## 5. Environmental Policy

It is the responsibility of all workers and contractors to adopt environmentally-responsible work practices.



The Environmental Protection Act imposes a General Environmental Duty on all workers, namely that "a person must not carry out any activity that causes, or is likely to cause, environmental harm unless the person takes all reasonable and practicable measures to prevent or minimise the harm."

NEV is committed to responsible environmental management, and conducts all operations considering environmental sustainability. NEV manages all operations and activities in compliance with applicable environmental laws, regulations and licences. NEV provides sustainable solutions in the water recycling industry. All projects are executed in a manner that is sensitive to both the client's and the community's environmental management objectives.

Environmental management objectives include:

- Complying with all relevant environmental, contractual, legal, licence and other requirements
- Minimising direct and indirect emissions to land, air and water
- Considering local environmental conditions and the community
- Ensuring our suppliers and contractors consider our environmental requirements
- Being prepared to respond to environmental incidents and to mitigate impacts

These environmental management objectives are met through:

- Identification of environmental aspects during HACCP workshops
- Evaluation of the potential impacts of these aspects on the environment
- Implementation of a management plan to mitigate or prevent those impacts
- Applying principles of hazard identification, risk assessment and risk control following the Risk Management Procedure
- Establishment of a monitoring and reporting program
- Continual review, upgrade and improvement of objectives and targets within the EMP

In order to maintain a high level of environmental awareness all workers, supervisors and managers work in accordance with formal environmental practices. All requirements for environmental responsibility are integrated into work practices and decision making, and every person, contractor and company operating on behalf of NEV is held accountable for their environmental performance.

NEV management and the NEV Environment Health and Safety Officer in particular shall ensure that all workers, contractors, suppliers and companies operating on NEV work sites are familiar with the Environmental policy.

## 6. Environmental Risk Assessment and Register

A specific environmental risk assessment (ERA) approach is to be undertaken to establish the environmental risks associated with this project. This is conducted by the Environment Health and Safety Officer, and approved by the CEO. The ERA will be conducted in accordance with the below procedure, which is in accordance with AS/NZS 4360:2004 Risk Management. The outcomes are recorded in the *Risk Assessment and Risk Register*.

## 7. Control and Monitoring Measures

Site maps are to be prepared and maintained for:

- Building layout
- Potable and recycled water infrastructure
- Sewerage infrastructure
- Storm water infrastructure
- Power lines
- Gas pipes



Bulk and hazardous substance storage

Control and monitoring measures are implemented to manage environmental risks of NEV projects, defined during the ERA process. These are recorded in the HACCP and ERA process and generally include the below items.

- Production of fit-for-purpose recycled water, utilising ultrafiltration membrane bioreactor technology for recycled water treatment and first-stage disinfection
- Online monitoring with alarms, and sewer bypass where available
- UV disinfection as a second-stage disinfection barrier
- On-line monitoring of UV disinfection process using UV photo-intensity monitoring
- The use of chlorination as a third-stage disinfection barrier
- The implementation of HACCP from design to commissioning
- Applying appropriate buffer zones to maintain sufficient distances from surface waters where irrigation of recycled water is carried out
- Proper signage of recycled water storage tanks and irrigation schemes in accordance with AS 1319 and PIC requirements
- Use of lilac-coloured pipe and plumbing fittings to indicate recycled water, in accordance with relevant plumbing codes
- Compliance with PIC requirements for backflow prevention and discharge from the greywater system to sewer
- The use of enclosures and submersible pumps to reduce noise
- The use of aerobic processes and odour scrubbing and venting to stacks, to mitigate the risk of odour generation
- The implementation of ongoing servicing, monitoring, third-party auditing and reporting systems to maintain consistent recycled water quality
- Community information and education programs where required, designed to assists residents, facility management and visitors to become familiar with the benefits and precautions associated with the recycled water scheme
- Management of the irrigation scheme based on flow monitoring, site and soil assessment

## 8. Environmental Monitoring

## Water quality monitoring

An *Integrated Water Cycle Management* plan has been prepared to sustainably manage water and wastewater at the Narara Site.

Detailed risk assessments have been prepared from source to the customer connection points; sewage management and recycled water. The irrigation scheme has been conceived after completing a Land Capability Assessment, specific to this site, to ensure sustainable irrigation and management of the water cycle. A low rate of irrigation is to be used to minimise the possibility of recycled nutrients entering waterways.

The process design does not involve discharge of water or waste products into the reservoir or streams.

Periodic sampling to monitor source water quality will be included as part of the ongoing management of the Narara Dam reservoir. This will likely include sampling at various locations and depths around the reservoir. The sampling program will be detailed in the *Reservoir Management Plan*.

## Soil Monitoring

Soil capacity assessment was carried out as part of the *Integrated Water Cycle Management Plan*. This concluded that all the soils tested are suitable for long-term irrigation of effluent provided the nutrient deficiencies are addressed and the soil organic carbon content is maintained.



As recommended in this report, soils used for irrigation disposal will be retested for nutrients, pH and organic carbon after 3 years of effluent irrigation.

## Waste Management

The Environment Health and Safety Officer will conduct and document periodic audits to ensure compliance with the site's waste management policies and procedures.

The audit will ensure waste materials are recycled or reused where practical, including:

- Paper and board
- Metals
- Oils
- Plastics
- Plastic wrap
- Wood
- Fluorescent light tubes
- Batteries
- Timber pallets

## **Other Environmental Monitoring**

Environmental odour impacts will be assessed as recommended in the *Odour Impact Assessment Report*.

Environmental noise impacts will be assessed as recommended in the *Noise Impact Assessment Report* and the *Noise and Vibration Management Plan*.

### **Site Inspection**

Site inspections are to be conducted regularly and documented.

Inspections are to include:

- Waste disposal and recycling facilities
- All bulk and chemical storage areas are sealed and bunded to prevent leaching of products onto the soil or waterways
- Erosion and sediment control
- Inspections to assess if there is scope for additional energy and water consumption efficiencies through improved energy and water use practices
- Noting actual and potential situations, considering the full range of operating conditions, including possible incidents, start-up and shut-down operations, observed changes in environmental conditions and potential emergency situations such as fire, explosion and spillage of hazardous materials.

### Audit

The Environment Health and Safety Officer will conduct and document periodic environmental audits to ensure compliance with the environmental policies and procedures.

The Environment Health and Safety Officer will be responsible for the development and implementation of the Environmental Audit Schedule.

The applicable Australian Standard, AS/NZS ISO14010:1996 titled '*Guidelines for environmental auditing - General principles*' defines an environmental audit as a:

"systematic, documented verification process of objectively obtaining and evaluating evidence to determine whether specified environmental activities, events, conditions, management systems or information about these matters conform to audit criteria and communicating the results of this process"



Audit criteria will be determined from the nominated environmental legislation, approvals, policies, standards, codes of practice, guidelines, Project Environmental Management Plans (Project EMP), Contractor's Environmental Management Plans (Contractor's EMP) and procedures.

The audit criteria will provide the basis against which the auditor compares collected audit evidence.

The audit will include whether all environmental incidents are investigated and reported and that environmental audit reports are correctly documented.

The Environment Health and Safety Officer will ensure all workers are trained in emergency response in the event of an environmental incident.

Having completed the collection of evidence, the audit observations should be reviewed and collated to determine if any environmental management activities do not conform to the audit criteria. Adverse or non-conforming activities requiring corrective action should be the subject of a Corrective Action Request (CAR) and be documented in a clear, concise manner and supported by audit evidence.

Minor items that need improvement, but do not constitute a clear breach of environmental standards, may be the subject of an "audit observation". It would be expected that the contractor would respond to an observation by remedying their practices.

Environmental Incident Investigation and Reporting

This procedure applies to the management of environmental incidents occurring on or extending off site. Incidents include complaints from people external to the site.

It is important that NEV workers are able to:

- Identify what is an environmental incident
- Take appropriate immediate action to control an incident
- Know the reporting requirements

The following hierarchy applies in the immediate response to an incident:

- Ensure health and safety first
- Shut off the source, if possible
- Contain contaminants
- Report
- Clean up

Incident management procedures and response should be appropriate to:

- The site
- Scale of the environmental incident
- Resources available
- Geographical location and sensitivity of receiving environment

### 9. **Resources and Documents**

The following documents are to be kept on file by the Environment Health and Safety Officer.

- Technical information on contaminants e.g. Material Safety Data Sheets, ChemAlert database, environmental effects, site specific disposal options
- Site plans/maps showing relevant information e.g. drainage, hazardous substances locations and quantities
- Contact information for emergency services and external specialists/resources
- Environmental Issues Register information

## **10. Procedures/ Work Instructions**



e following documents are to be kept on file by the Environment Health and Safety Officer.

- Checklists (Action cards specific to an officer's role and responsibilities) shall be prepared that detail staff responsibilities, actions to be taken and notification requirements (Note: Ensure that checklists cover workers such as security, operating staff, line management, technical specialists, media liaison officer)
- Procedures shall be prepared that detail site-specific response actions

It is a requirement that a system be established to manage incidents in the longer term to ensure that appropriate follow-up action is completed with the aim of improving environmental performance.

For details of NEV's environmental incident response procedure refer to separate document: Environmental Incident Procedure.



# Appendix C.11

# **Contingency plans**

Contingency plans for potable water supply are detailed in the Drinking Water Management Plan. Drinking water is reticulated by gravity water mains with 450kL of reservoir storage which represents 7 days storage at full development. The plan provides for potable water delivery by licensed contractor in the event of a longer interruption to supply.

Contingency plans for sewage services are detailed in the Sewage Management Plan. The scheme has 360kL of buffer sewage storage which represents 10 days storage at full development. The plan provides for sewage pump out by licensed contractor in the event of a longer interruption to the system.



# Appendix C12

# **Regulatory approvals**

Under Part 4 of the Environmental Planning and Assessment Act 1979

Infrastructure component	Part 3A applicable?	Part 4 consent required or given?	Part 5 applicable?
Reticulated sewage system	No	Yes, DA 44994/2013 approval under the Environmental Planning and Assessment Act, 1979 section 81(1)(a) see details below	No
Reticulated recycled water system	No	Yes, DA 44994/2013 approval under the Environmental Planning and Assessment Act, 1979 section 81(1)(a) see details below	No
Reticulated recycled water system	No	Yes, DA 44994/2013 approval under the Environmental Planning and Assessment Act, 1979 section 81(1)(a) see details below	No
Sewage treatment plant	No	N/A	No

 Table C.1
 Environmental approvals summary table

The proposed scheme forms part of the Narara Ecovillage residential sub-division project.

The Narara Ecovillage is located at 25 Research Road, Narara and is legally referred to as Lot 13 in DP 1126998 now subdivided pursuant to DP270882 registered in 2018. The site has a total site area of approximately 62.69 hectares. It is proposed to develop the site in stages as illustrated in the Staging Plan.

The project site was purchased from NSW Department of Agriculture in 2013 and all of the proposed licensed infrastructure and activities are located within the site.

Stage 1 comprises a 42 lot community tittle subdivision and the construction of cluster housing (18 houses in total) on residential Lots 36 (equivalent to approximately 60 dwellings in total).

Development consent (44994/2013 Part 1) was issued by Gosford City Council on 8 August 2014 for the community title subdivision of the entire NEV site (39 lots) and the construction of associated infrastructure to support Stage 1 of the development

The associated infrastructure includes the essential utility services and infrastructure to service Stage 1 of the development including the integrated water management system (sewer and water supply). The waste water treatment and recycled water system will be constructed in stages with the Stage 1 system capable of handling at least 30kL/day.



A copy of the Development Consent is included in this Appendix.

The following conditions which specifically relate to the water and sewer supply are noted:

Condition 1.1 - references approved plans and supporting information including Statement of Environmental Effects (Stage 1 subdivision and associated works) and relevant plants including Water and Waste Water Systems Overview and NEV Concept Integrated Water Scheme Design prepared by Aquacell;

Condition 2.1.6 - specifies that water use from the existing dam for domestic water supply must be subject to appropriate approvals under the Water Management Act 2000;

Condition 5.8 - requires satisfactory arrangement to be made for the provision of water and sewer services to the land; and

Condition 5.15 - requires a license to be obtained under the Water Industry Competition Act 2006

In relation to these conditions, it should be noted that:

All WICA infrastructure which is the subject of this application is contained within the development consent outlined above;

A Water Access License has been obtained from the NSW Office of Water for 29ML/year from the on-site dam;

The water modeling referred to in 4.1.13 is for the fully developed site, consisting of 130 lots (with some contingency). This is to demonstrate that the site can be sustained through the proposed potable water strategy when fully developed; and

Development applications for the construction of individual dwellings and other development (eg community facilities which are part of the sustainable ecovillage) within Stage 1 and in future stages in the development of the NEV site will be lodged with Gosford City Council, as appropriate.

The Statement of Environmental Effects which was submitted above with the development application is provided at Appendix C14.

A detailed description of the Stage 1 development is provided in Section 3.0 of the Statement of Environmental Effects.

The water and sewer infrastructure is described in detail in Section 3.6 of this Statement of Environmental Effects.

NEV lodged a DA application with council in March 2020 for Stage 2 of the subdivision comprising a further 43 residential lots and associated water and sewer reticulation works. Assessment of that application is progressing.



It is anticipated that future stages of the project will bring the total number of residential lots to be serviced to between 120 and 140 lots.

2 February 2018



Narara Ecovillage Co-Operative Ltd 25 Research Road NARARA NSW 2250 john@nararaecovillage.com

#### APPLICATION NUMBER: 44994/2013 Part 4

PROPOSAL: Amendment under Section 96(1A) of the Environmental Planning and Assessment Act to the Approved Community Title Subdivision (39 Lots) and Associated Infrastructure and Demolition of Various Structures and Buildings - Section 96 Amendment Modification of Consent Conditions 5.5, 5.8, 5.11, 5.19, 5.20, 5.22, 5.24 & 8.3.

**PROPERTY:** LOT: 1 RP: 13044994, LOT: 2 RP: 13044994, LOT: 3 RP: 13044994, LOT: 4 RP: 13044994, LOT: 5 RP: 13044994, LOT: 6 RP: 13044994, LOT: 7 RP: 13044994, LOT: 8 RP: 13044994, LOT: 9 RP: 13044994, LOT: 10 RP: 13044994, LOT: 11 RP: 13044994, LOT: 12 RP: 13044994, LOT: 13 RP: 13044994, LOT: 14 RP: 13044994, LOT: 15 RP: 13044994, LOT: 16 RP: 13044994, LOT: 17 RP: 13044994, LOT: 18 RP: 13044994, LOT: 19 RP: 13044994, LOT: 20 RP: 13044994, LOT: 21 RP: 13044994, LOT: 22 RP: 13044994, LOT: 23 RP: 13044994, LOT: 13 DP: 1126998, LOT: 24 RP: 13044994, LOT: 48 RP: 13044994, LOT: 25 RP: 13044994, LOT: 26 RP: 13044994, LOT: 27 RP: 13044994, LOT: 28 RP: 13044994, LOT: 29 RP: 13044994, LOT: 30 RP: 13044994, LOT: 31 RP: 13044994, LOT: 32 RP: 13044994, LOT: 33 RP: 13044994, LOT: 34 RP: 13044994, LOT: 35 RP: 13044994, LOT: 36 RP: 13044994, LOT: 37 RP: 13044994, LOT: 38 RP: 13044994, LOT: 39 RP: 13044994, LOT: 40 RP: 13044994, LOT: 41 RP: 13044994, LOT: 42 RP: 13044994, LOT: 43 RP: 13044994, LOT: 44 RP: 13044994, LOT: 45 RP: 13044994, LOT: 46 RP: 13044994, LOT: 47 RP: 13044994 No. 47 Gugandi Road NARARA, 19 Gugandi Road NARARA, 21 Gugandi Road NARARA, 23 Gugandi Road NARARA, 25 Gugandi Road NARARA, 27 Gugandi Road NARARA, 19 Kintay Lane NARARA, 17 Kintay Lane NARARA, 15 Kintay Lane NARARA, 51 Gugandi Road NARARA, 53 Gugandi Road NARARA, 55 Gugandi Road NARARA, 57 Gugandi Road NARARA, 59 Gugandi Road NARARA, 5 Syncarpia Crescent NARARA, 1 Kintay Lane NARARA, 3 Kintay Lane



NARARA, 11 Kintay Lane NARARA, 12 Kintay Lane NARARA, 10 Kintay Lane NARARA, 25 Research Road NARARA, 8 Kintay Lane NARARA, 36 Gugandi Road NARARA, 6 Kintay Lane NARARA, 4 Kintay Lane NARARA, 11 Syncarpia Crescent NARARA, 13 Syncarpia Crescent NARARA, 15 Syncarpia Crescent NARARA, 17 Syncarpia Crescent NARARA, 19 Syncarpia Crescent NARARA, 21 Syncarpia Crescent NARARA, 23 Syncarpia Crescent NARARA, 25 Syncarpia Crescent NARARA, 14 Balgara Rise NARARA, 33 Gugandi Road NARARA, 30 Gugandi Road NARARA, 10 Syncarpia Crescent NARARA, 63 Gugandi Road NARARA, 46 Gugandi Road NARARA, 44 Gugandi Road NARARA, 42 Gugandi Road NARARA, 40 Gugandi Road NARARA, 38 Gugandi Road NARARA

Dear Sir/Madam

I refer to your application dated 24 October 2017 for modification of the above consent 44994/2013.

Having regard to the provisions of Section 96(1A) of the Environmental Planning and Assessment Act, 1979, the Council is of the opinion that the amended proposal is a minor modification and is substantially the same development consented to by the Council.

The consent dated 8 August 2014 is hereby modified in the following manner: -

- i The deletion of condition 5.19 and 5.20.
- ii The replacement of conditions 5.5, 5.11, 5.22, 5.24, and 8.3 with the following;

5.5 Any existing buildings within proposed Stage 1, with the exception of the administration building, are required to be upgraded to improve ember protection. This is to be achieved by enclosing all openings (excluding roof tile spaces) or covering openings with a non-corrosive metal screen mesh with a maximum aperture of 2mm. Where applicable, this includes any sub floor areas, openable windows, vents, weepholes and eaves. External doors are to be fitted with draft excluders.

5.11 The execution prior to the issue of the Subdivision Certificate, of the Deed of Deferral of Certain Obligations prepared by Andrews & Holm Lawyers dated 19 January 2018 between the Council and the Narara Ecovillage Co-operative Ltd, in respect of the Voluntary Planning Agreement referred to in condition 5.24.

5.22 The applicant shall obtain a Notice of Decision to commence commercial operations from the Minister responsible for the *Water Industry Competition Act 2006* for sewer services, or should onsite sewage management be proposed and approval to install and operate the onsite sewage management system is to be obtained from Council's Compliance and Health team.

5.24 Compliance with the terms of the Voluntary Planning Agreement - "Deed", prepared by Storey & Gough Lawyers, Ref: CCG:070606, Deed made on 31 May 2013 between Gosford City Council and Narara Ecovillage Co Operative Limited in relation to Lot 13 DP 1126998 25 Research Road, prior to the issue of a Subdivision Certificate, as amended by the Deed of Deferral of Certain Obligations prepared by Andrews & Holm Lawyers dated 19 January 2018 between the Council and the Narara Ecovillage Co-operative Ltd .

8.3 Water and Sewer works shall comply with the *Water Industry Competition Act 2006*, and the WICA License, should water and sewer works not be carried out under the WICA License an application is to be made with Council under the provisions of Section 68 of the Local Government Act 1993 prior to commencement of any works on the site.

iii The addition of Condition 6.13 to read;

6.13 The applicant shall obtain a Notice of Decision to commence commercial operations from the Minister responsible for the *Water Industry Competition Act 2006*, should the provision of water and sewer services to the land be provided by license under the *Water Industry Competition Act 2006*.

iv Refusal of Condition 5.8

Condition 5.8 is refused to be modified as this condition is required to be retained under the *Water Management Act* 2000 and to protect Council's existing infrastructure. A Section 307 Certificate of Compliance was issued under the *Water Management Act* 2000 on 18 January 2018. This condition has been complied with.

v The works (if any) that are associated with this amended development consent may require a modified construction certificate in accordance with Clause 148 of the Environmental Planning and Assessment Regulation 2000.

Please note that the approved amendment does not extend the term of the original consent. Attached to this approval is the reproduced consent as amended, Issue No 4.

Subject to provisions of Section 96AB of the Environmental Planning and Assessment Act the applicant may make an application seeking a review of this determination providing it is lodged within twenty-eight (28) days of notification.

Your attention is drawn to your right to appeal against the conditions to the Land and Environment Court of NSW.

Yours faithfully

Brian Glendenning **Chief Executive Officer** Per: *R Eyre* Date: 2 February 2018

#### **AMENDED CONDITIONS OF CONSENT PART 4**

#### **1.. PARAMETERS OF THIS CONSENT**

#### **1.1a.** Approved Plans and Supporting Documents

The development shall be implemented substantially in accordance with the plans and supporting documents listed below as submitted by the applicant and to which is affixed a Council stamp "*Development Consent*" unless modified by any following condition.

#### Architectural Plans by Chase Burke Harvey

<b>Drawing</b>	Description	<b>Sheets</b>	Issue	Date
<del>\$12242 -1</del>	Community Title Subdivision	<del>1/6</del>	A	<del>02.07.2014</del>
<del>\$12242-2</del>	Community Title Subdivision	<del>2/6</del>	A	<del>02.07.2014</del>
<del>\$12242-3</del>	Community Title Subdivision	<del>3/6</del>	A	<del>02.07.2014</del>
<del>\$12242-4</del>	Community Title Subdivision	4 <del>/6</del>	A	<del>02.07.2014</del>
<del>\$12242-5</del>	Community Title Subdivision	<del>5/6</del>	A	<del>02.07.2014</del>
<del>\$12242-6</del>	Community Title Subdivision	<del>6/6</del>	A	02.07.2014
<del>\$12242</del>	Community Title Subdivision	<del>1/6</del>	A	02.07.2014
<del>\$12242</del>	Community Title Subdivision	<del>1/6</del>	A	<del>02.07.2014</del>

Document	Title	Date
<del>D12242-4</del>	Site Survey (Chase Burke Harvey) Sheets 1 to 3	<del>20.01.2008</del>
<del>3.02</del>	Stage 1 Common Ownership Elements - Layout	<del>06.12.2013</del>
	<del>(Hill Thalis)</del>	
<del>3.03</del>	Stage 1 Common Ownership Elements – Landscape	<del>10.12.2013</del>
	Strategy Plan (McGregor Coxall)	
3.04	Stage 1 Common Ownership Elements -	<del>06.12.2013</del>
	Water Management (Hill Thalis)	
3.05	Stage 1 Common Ownership Elements – Subdivision	<del>06.12.2013</del>
	(Hill Thalis)	
<del>3.06</del>	Stage 1 Common Ownership Elements – Street Pattern	<del>06.12.2013</del>
	and Access (Hill Thalis)	
<del>3.07</del>	Stage 1 Common Ownership Elements -	<del>06.12.2013</del>
	Grouped Facilities(Hill Thalis)	
<del>3.08</del>	Stage 1 Common Ownership Elements – Demolition	<del>06.12.2013</del>
	Plan (Hill Thalis)	
<del>3.11</del>	Stage 1 Common Ownership Elements – Landscape	<del>06.12.2013</del>
	Detail reference plan (McGregor Coxall)	
<del>3.12</del>	Stage 1 Common Ownership Elements – Landscape	<del>06.12.2013</del>
	Plan Detail 1+2 (McGregor Coxall)	
3.13	Stage 1 Common Ownership Elements - Landscape	<del>06.12.2013</del>

	Plan Detail 1+2 (McGregor Coxall)	
3.14	Stage 1 Common Ownership Elements – Landscape	<del>06.12.2013</del>
	Material Pallete (McGregor Coxall)	
3.15	Stage 1 Common Ownership Elements – Landscape	<del>06.12.2013</del>
	Planting Palette (McGregor Coxall)	
Project:	Report on Preliminary Site Investigation (Douglas	August 2013
75583.00	Partners)	5
	Heritage Impact Statement	04.12.2013
	(Chris Betteridge - Musecape Pty Ltd)	
	Conservation Management Plan Review 2013	05.12.2013
	(Chris Betteridge-Musecape Pty Ltd)	
	Arboricultural Inpact Assessment (Michael Shaw)	<del>29 .11.2103</del>
	Flora and Fauna Gap Analysis Survey Report (Rober	December 2013
	Payne)	
	Ecological Restoration Plan (Robert Payne)	December 2013
75583.01	Preliminary Geotechnical Assessment (Douglas	December 2013
	Partners)	
75583.01	Preliminary Slope Stability Assessment Report (Douglas	December 2013
Revision 2	Partners)	
CE12242	Concept Road Grading Plans for Stage 1 – Subdivision	08.12.2013
Sheets 1 to 33	(Chase Burke & Harvey)	
	Stage 1 Road Circulation Plan (Chase Burke & Harvey)	
Ref:2012242	Stage 1 Concept Engineering and Public Utility Services	09.12.2013
	Report (Chase Burke & Harvey)	
SW12242	Concept Stormwater Plans for Stage 1	08.12.2013
Sheets 1 to 2	(Chase Burke & Harvey)	
ES12242	Erosion/ Sedimentation Control Plan	08.12.2013
Sheets 1 to 3		
	Integrated Water Cycle Management Plan	<del>05.12.2013</del>
	(Woodlots and Wetlands Pty Ltd)	
	Water and Wastewater Systems Overview (Aquacell)	<del>03.12.2013</del>
	NEV Concept Integrated Water Scheme Design	
	<del>(Aquacell)</del>	
	Waste Management Plan (Chase Burke Harvey)	<del>18.12.2013</del>
	screened waste storage enclosure to be located as	<del>18.02.2014</del>
	indicated on Draft Dwg No CGS2.01, dated February	
	2014, Amendments issued for comment	
<del>B121881 -2</del>	Bushfire Protection Assessment (Australian Bushfire	<del>04.12.2013</del>
	Protection Planners)	
<del>3301</del>	Transport Impact Assessment (Chris Hallam &	<del>06.12.2013</del>
	Associates)	
L127P_R01_P	NEV Lighting Report	<del>28 June 2013</del>
01		
	Air Quality (Odour Impact Assessment Report (Aubin	02.12.2013
	Environmental)	
<del>29N-13-</del>	Sewage Treatment Plant Noise Impact Assessment	<del>16.12.2013</del>

0156-TRP-	(Vpac Engineering & Scientists Ltd)	
4 <del>72220-1</del>		
<del>29N-13-</del>	Sewage Treatment Plant Noise and Vibration	<del>16.12.2013</del>
<del>0156-TRP-</del>	Management Plan	
4 <del>72220-1</del>	(Vpac Engineering & Scientists Ltd)	
	Aboriginal Cultural Heritage Aboriginal Archaeological	<del>May, 2006</del>
	& Cultural Heritage Assessment Report (Danny O'Brien	
	- Environmental Appraisal & Planning Pty Limited)	
IR 15029234	Statement of Environmental Effects (Sara Roach &	December 2013
	Michael Woodland) - Stage 1 Subdivision infrastructure	
	and associated works	

#### 1.1a. Approved Plans and Supporting Documents

The development shall be implemented substantially in accordance with the plans and supporting documents listed below as submitted by the applicant and to which is affixed a Council stamp "*Development Consent*" unless modified by any following condition.

Drawing	Description	Sheets	Issue	Date
S12242-C	Community Title Subdivision	1/6	С	05.08.2015
S12242-C	Community Title Subdivision	2/6	С	05.08.2015
S12242-C	Community Title Subdivision	3/6	С	05.08.2015
S12242-C	Community Title Subdivision	4/6	С	05.08.2015
S12242-C	Community Title Subdivision	5/6	С	05.08.2015
S12242-C	Community Title Subdivision	6/6	С	05.08.2015

#### **Community Title Subdivision Plans by Chase Burke Harvey**

Document	Title	Date
D12242-4	Site Survey (Chase Burke Harvey) Sheets 1 to 3	20.01.2008
3.02	Stage 1 Common Ownership Elements - Layout	06.12.2013
	(Hill Thalis)	
3.03	Stage 1 Common Ownership Elements – Landscape	10.12.2013
	Strategy Plan (McGregor Coxall)	
3.04	Stage 1 Common Ownership Elements –	06.12.2013
	Water Management (Hill Thalis)	
3.05	Stage 1 Common Ownership Elements – Subdivision	06.12.2013
	(Hill Thalis)	
3.06	Stage 1 Common Ownership Elements – Street Pattern	06.12.2013
	and Access (Hill Thalis)	
3.07	Stage 1 Common Ownership Elements –	06.12.2013
	Grouped Facilities(Hill Thalis)	
3.08	Stage 1 Common Ownership Elements – Demolition	06.12.2013
	Plan (Hill Thalis)	

3.11	Stage 1 Common Ownership Elements – Landscape Detail reference plan (McGregor Coxall)	06.12.2013
3.12	Stage 1 Common Ownership Elements – Landscape Plan Detail 1+2 (McGregor Coxall)	06.12.2013
3.13	Stage 1 Common Ownership Elements – Landscape Plan Detail 1+2 (McGregor Coxall)	06.12.2013
3.14	Stage 1 Common Ownership Elements – Landscape Material Pallete (McGregor Coxall)	06.12.2013
3.15	Stage 1 Common Ownership Elements – Landscape Planting Palette (McGregor Coxall)	06.12.2013
Project: 75583.00	Report on Preliminary Site Investigation (Douglas Partners)	August 2013
	Heritage Impact Statement (Chris Betteridge - Musecape Pty Ltd)	04.12.2013
ECM Doc No:15016753	Conservation Management Plan Review 2013 (Chris Betteridge-Musecape Pty Ltd)	05.12.2013
	Arboricultural Impact Assessment (Michael Shaw)	29 .11.2013
	Flora and Fauna Gap Analysis Survey Report (Robert Payne)	December 2013
ECM Doc No: 15016761	Ecological Restoration Plan (Robert Payne)	December 2013
75583.01	Preliminary Geotechnical Assessment (Douglas Partners)	December 2013
75583.01 Revision 2	Preliminary Slope Stability Assessment Report (Douglas Partners)	December 2013
CE12242 Sheets 1 to 33	Concept Road Grading Plans for Stage 1 – Subdivision (Chase Burke & Harvey)	08.12.2013
	Stage 1 Road Circulation Plan (Chase Burke & Harvey)	
Ref:2012242	Stage 1 Concept Engineering and Public Utility Services Report (Chase Burke & Harvey)	09.12.2013
SW12242 Sheets 1 to 2	Concept Stormwater Plans for Stage 1 (Chase Burke & Harvey)	08.12.2013
ES12242 Sheets 1 to 3	Erosion/ Sedimentation Control Plan	08.12.2013
	Integrated Water Cycle Management Plan (Woodlots and Wetlands Pty Ltd)	05.12.2013
	Water and Wastewater Systems Overview (Aquacell)	03.12.2013
	NEV Concept Integrated Water Scheme Design (Aquacell)	
	Waste Management Plan (Chase Burke Harvey)	18.12.2013
	screened waste storage enclosure to be located as	18.02.2014
	indicated on Draft Dwg No CGS2.01, dated February 2014, Amendments issued for comment	
B121881 -2	Bushfire Protection Assessment (Australian Bushfire Protection Planners)	04.12.2013
3301	Transport Impact Assessment (Chris Hallam &	06.12.2013

	Associates)	
L127P_R01_P 01	NEV Lighting Report	28 June 2013
	Air Quality (Odour Impact Assessment Report (Aubin Environmental)	02.12.2013
29N-13- 0156-TRP- 472220-1	Sewage Treatment Plant Noise Impact Assessment (Vpac Engineering & Scientists Ltd)	16.12.2013
29N-13- 0156-TRP- 472220-1	Sewage Treatment Plant Noise and Vibration Management Plan (Vpac Engineering & Scientists Ltd)	16.12.2013
ECM Doc No: 17234121	Aboriginal Cultural Heritage Aboriginal Archaeological & Cultural Heritage Assessment Report (Danny O'Brien - Environmental Appraisal & Planning Pty Limited)	May, 2006
IR 15029234	Statement of Environmental Effects (Sara Roach & Michael Woodland) - Stage 1 Subdivision infrastructure and associated works	December 2013
ECM Doc No: 21372510	Statement of Environmental Effects Section 96(20 Application - Road Realignment Modification (Sara Roach)	August 2015
Ref: 2012242 ECM Doc No: 21372510	Concept Civil Engineering report (Chase, Burke & Harvey)	27 August 2015
RC 12242-F ECM Doc No: 21372511	Proposed road circulation and road width plan (Chase, Burke & Harvey)	05.08.2015
CE12242-B Sheets 1 to 40 ECM Doc No: 21372512	Concept road grading plans, longitudinal sections and cross sections (Chase, Burke & Harvey) 40 sheets	05.08.2014
SW12242-D Sheets 1 and 2 ECM Doc No: 21372514	Concept Stormwater Plan (Chase, Burke & Harvey) 2 sheets	27.08.2015
SWC12242 ECM Doc No: 21372515	Details of the existing 900mm culvert (Chase, Burke & Harvey)	16.07.2015
ES12242-C Sheets 1 to 3 ECM Doc No: 21372517	Concept erosion /sedimentation control plan (Chase, Burke & Harvey) 3 Sheets	27.08.2015
R2-S96-	Proposed Road Adjustment Plan (Chase, Burke &	

12242	Harvey)	
ECM Doc No:		
21372520		
S96-12242-C	Concept Proposed Adjustment to the approved	05.08.2015
Sheet1/3	community subdivision (Chase Burke and Harvey)	
ECM Doc No:		
21372520		
ECM Doc No:	Traffic Impact Assessment Potential Impacts of Section	20.08.2015
21372513	96 application (B.J Bradley & Associates)	
ECM Doc No:	Total Catchment Stormwater Production and Its	undated
21372516	Management (Woodlots and Wetlands Pty Ltd)	
ECM Doc No:	Heritage Assessment - Proposed lot boundary for	12.08.2015
21372522	former Manager's residence (The "Heritage House")	
	and proposed road Layout (Musecape)	
ECM Doc No:	Tree Impact statement in relation to proposed road	10.08.2015 and
21372524	realignment Section 96 application and letter dated 16	16 October 2015
and	October 2014 replacement of 11 Pecans near former	
21372523	Manager's residence (Michael Shaw Consulting	
	Arborist)	
ECM Doc No:	Section 96(2) Ecological Assessment for modified lot	September 2015
21372525	layout, bridge location and road alignment - Flora and	
	Fauna Supplement (Robert Payne ES&M)	
EEC-12242-F	Plan showing Road 2 and lot 28 compared to the	05.08.2015
ECM Doc No:	Endangered Ecological Community (Chase Burke &	
21372526	Harvey) Issue F and APZ Plan	
ECM Doc No:	Section 96 Bushfire Assessment (Travers Bushfire and	14.08.2015
21372527	Ecology)	
ECM Doc No:	Supplementary Heritage Impact Assessment	16.11. 2015
21797319	(Musecape)	

#### 1.1b. Preliminary Site Works

Preliminary site works (prior to the issue of a Construction Certificate) involving the removal of forty-five (45) trees and sixteen (16) buildings and structures shall be implemented substantially in accordance with the supporting documents listed below as submitted by the applicant, unless modified by any following conditions.

<b>Document</b>	Title	<del>Date</del>
ECM Document	Section 3 of the Statement of Environmental	March 2015
No: 20869107	Effects titled: "Section 96(1A) application	
	Development Consent No.44994/2013 – Early Site	
	Establishment Works", prepared by Sara Roach	
	Planning Services	
ECM Document	Existing Buildings Diagram – Gosford Horticultural	Doc. Date:

No:20542607	Institute	02.04.2015
ECM Document	Heritage Impact Statement	<del>04.12.2013</del>
<del>No: 15016751</del>	<del>(Chris Betteridge – Musecape Pty Ltd)</del>	
ECM Document	Conservation Management Plan Review 2013	<del>05.12.2013</del>
No: 15016752	(Chris Betteridge-Musecape Pty Ltd)	
ECM Document	Arboricultural Impact Assessment (Michael Shaw)	<del>29 .11.2103</del>
No: 15016754		
and		
ECM Document	Waste Management Plan – Demolition only	<del>28 May 2015</del>
<del>No: 20854405</del>	(T Hester) and Appendix to WMP	
ES12242	Erosion/ Sedimentation Control Plan	<del>08.12.2013</del>
Sheets 1 to 3		
ECM Document		
No:15016769		

#### 1.1b. Preliminary Site Works

Preliminary site works (prior to the issue of a Construction Certificate) involving the removal of one hundred and three (103) trees and sixteen (16) buildings and structures shall be implemented substantially in accordance with the supporting documents listed below as submitted by the applicant, unless modified by any following conditions.

Document	Title	Date
ECM Document	Section 3 of the Statement of Environmental	March 2015
No: 20869107	Effects titled: "Section 96(1A) application	
	Development Consent No.44994/2013 – Early Site	
	Establishment Works", prepared by Sara Roach	
	Planning Services	
ECM Document	Existing Buildings Diagram – Gosford Horticultural	Doc. Date:
No:20542607	Institute	02.04.2015
ECM Document	Heritage Impact Statement	04.12.2013
No: 15016751	(Chris Betteridge - Musecape Pty Ltd)	
ECM Doc No:	Heritage Assessment - Proposed lot boundary for	12.08.2015
21372522	former Manager's residence (The "Heritage	
	House") and proposed road Layout (Musecape)	
ECM Document	Conservation Management Plan Review 2013	05.12.2013
No: 15016752	(Chris Betteridge-Musecape Pty Ltd)	
ECM Document	Arboricultural Impact Assessment (Michael Shaw)	29 .11.2103
No: 15016754		
and		
ECM Doc No:	Tree Impact statement in relation to proposed	10.08.2015 and
21372524 and	road realignment Section 96 application and letter	16 October 2015
21372523	dated 16 October 2014 replacement of 11 Pecans	
	near former Manager's residence (Michael Shaw	

	Consulting Arborist)	
ECM Document	Waste Management Plan – Demolition only	28 May 2015
No: 20854405	(T Hester) and Appendix to WMP	
ES12242-C	Concept erosion /sedimentation control plan	27.08.2015
Sheets 1 to 3	(Chase, Burke & Harvey) 3 Sheets	
ECM Doc No:		
21372517		

#### 1.2. Building Code of Australia

All building works must be carried out in accordance with the Building Code of Australia.

- 1.3. The proposed subdivision is to be consistent with all provisions of the Voluntary Planning Agreement (VPA) under s93F of the EP&A Act 1979 which has been prepared and deed made on 31 May 2013 and signed by the Narara Ecovillage Co-operative Limited and Council for the NEV site, including specific provision for the dedication to Council of the 6(a) Open Space zoned portion of the site (being that land immediately to the east and contiguous with the 2(a) residential land), together with a small area of land upon which a stand of *Araucaria cunninghamii* (Hoop Pines) are located.
- 1.4. The proposed amended building footprints (cluster development on proposed lot 36), additional driveways to individual allotments, car parking areas (other than those approved on proposed lot 36) and amended waste enclosure as detailed on the section 96 application-Part 3 subdivision and engineering plans, are not subject of this consent. Additional information including vehicle turning templates, car parking dimensions, driveway gradient will be required to properly assess the amended design.

#### 2.. PRIOR TO ISSUE OF ANY CONSTRUCTION CERTIFICATE

- 2.1. No activity is to be carried out on site until any Construction Certificate has been issued. Other than:
  - a Site investigation for the preparation of the construction, and/or
  - b Implementation of environmental protection measures, such as erosion control etc that are required by this consent.
- 2.1. No activity is to be carried out on site until any Construction Certificate has been issued. Other than:
  - a. Site investigation for the preparation of the construction;
  - b. Implementation of environmental protection measures, such as erosion control etc that are required by this consent;
  - c. Demolition of a total of sixteen (16) buildings and structures identified as Building Nos. 3, 5 to 8, 11 to 13, 15, 25 to 28, 39, 47 and 52; and
  - d. Removal of forty-five trees identified for removal.

- 2.1. No activity is to be carried out on site until any Construction Certificate has been issued. Other than:
  - a. Site investigation for the preparation of the construction;
  - b. Implementation of environmental protection measures, such as erosion control etc. that are required by this consent;
  - c. Demolition of a total of sixteen (16) buildings and structures identified as Building Nos. 3, 5 to 8, 11 to 13, 15, 25 to 28, 39, 47 and 52; and
  - d. Removal of 103 trees identified for removal.
- 2.2. All work required to be carried out within a public road reserve must be separately approved by Council, under Section 138 of the Roads Act 1993.

Engineering plans for the required work within a public road must be prepared and designed by a suitably qualified professional, in accordance with Council's "Civil Construction Specification", "GCC Design Specification for Survey, Road and Drainage Works" and "Policy 'D6.46 Erosion Sedimentation Control".

If at the time of lodgement of a Roads Act application a small section at the end of Research Road is still a Crown Road, then permission to lodge the application from the Department of Lands will be required with the Road Act application upon lodgement with Council.

The required works to be designed are as follows:

- a. T-turning head & road works at the end of the public road section of Research Road including kerb and guttering, subsoil drainage, footpath formation, drainage and a road pavement. The configuration of the turning head is to be as advised by Council and is to maintain property accesses to adjoining properties.
- b. Footway formation with a minimum width of 2.0m and graded up at +2% from the top of kerb toward the property boundary, around the extents of the required turning head.
- c. 1.2m wide reinforced (SL72 steel fabric, 100mm thick) concrete footpath in an approved location around the extents of the required turning head.
- d. Heavy-duty vehicle crossing for the subject site as required to tie-in the required turning head & road works to the property boundary, and that has a minimum width of 5.5m and constructed with 200mm thick concrete reinforced with 1 layer of SL72 steel fabric top and bottom.
- e. Heavy-duty vehicle crossing to the driveway for No's 19, 21, & 23 Research Road, as required to tie-in to the required turning head & road works, and constructed with 200mm thick concrete reinforced with 1 layer of SL72 steel fabric top and bottom.
- f. Adjustments to the vehicle crossing to No 15 Research Road as required to tie-in to the required road works and constructed with 150mm thick concrete reinforced with SL72 steel fabric.
- g. All redundant dish crossings and/or damaged kerb and gutter are to be removed and replaced with new kerb and gutter.
- h. All redundant vehicular crossings to be removed and the footway formation reinstated with turf and a 1.2m wide reinforced (SL72 steel fabric, 100mm thick) concrete footpath in an approved location.
  - Roadside furniture and safety devices as required including fencing, signage, guide
posts, chevrons, directional arrows and guard rail in accordance with RMS and Australian Standards.

- j. Pram ramp as required to tie-in the footpath to the turning head.
- k. Connection of stormwater from Research Road to the existing stormwater system within the site.
- I. Public road access shall comply with section 4.1.3 (1) of 'Planning for Bush Fire Protection 2006'.

The engineering plans must be approved by Council prior to the issuing of the Construction Certificate required under this consent.

2.3. A pavement report for works within a public road reserve shall be prepared by a practising Geotechnical Engineer. This report must be submitted with the engineering plans and approved by Council under the Roads Act, 1993.

The pavement depths must be determined in accordance with Council's specifications and the following traffic loadings:

Name of Street	Traffic Loading (ESAs)
Research Road	2x10 <sup>6</sup>

- 2.4. A dilapidation report must be submitted to Council prior to issue of any Construction Certificate and/or approval of engineering plans under the Roads Act. The report must document and provide photographs that clearly depict any existing damage to the road, kerb, gutter, footpath, driveways, street trees, street signs or any other Council assets in the vicinity of the development.
- 2.5. A security deposit of \$50,000 must be paid into Council's trust fund prior to the issue of any Construction Certificate. The payment of the security deposit is required to cover the cost of repairing damage to Council's assets that may be caused as a result of the development. The security deposit will be refunded upon the completion of the project if no damage was caused to Council's assets as a result of the development.
- 2.6. Design of the following engineering works within private property:
  - a. Internal roads in accordance with AMCORD guidelines and the requirements of RFS *Planning* for Bushfire Protection 2006, and generally in accordance with the concept road grading plans, prepared by Chase Burke Harvey (Ref: Drawing CE 12242, Sheets 1-33 dated 08/12/13). Furthermore, internal roads shall include also the following:
    - Internal roads shall be sealed to prevent erosion.
    - Temporary "T" turning heads shall be provided at the terminus of dead-end roads created in the construction of the individual development designs.
    - Access roads within the development shall be constructed to comply with the specifications of Section 4.1.3(1) of Planning for Bushfire Protection 2006 with a minimum pavement width of 5.5 metres for the main entrance road and perimeter road and a minimum pavement width of 3.5 metres for the one-way internal roads.

- Parking Bays [minimum 2.6m wide] shall be designed and constructed clear of the road pavement and complying Passing Bays [20m long x 2.0m wide] provided in the locations shown on the Concept Plan.
- Property access roads to individual lots shall be designed and constructed to comply with the deemed-to-satisfy provisions of Section 4.1.3(2) of Planning for Bushfire Protection 2006, with a minimum width of 4.0 metres located in a 6.0 metre wide managed corridor.
- b. All parking areas in accordance with Australian Standard AS/NZS 2890.1:2004.
- c. Vehicular access near the waste storage area in accordance with AS2890.2:2002.
- d. Internal drainage and pathways.
- e. Roadside furniture and safety devices including fencing, signage, guide posts, chevrons, directional arrows and guard rail in accordance with RMS and Australian Standards.
- f. Services in accordance with the relevant authorities' specifications and requirements.
- g. On-site stormwater detention system/s designed in accordance with Council's DCP 165 -Water Cycle Management that shall limit post development flows from the proposed development to less than or equal to predevelopment flows for all storms up to and including the 1%AEP storm event. A runoff routing method is to be used. An on-site stormwater detention report including an operation and maintenance plan shall accompany the design. The on-site stormwater detention shall be generally in accordance with the 'Integrated Water Cycle Management Plan' prepared by Woodlots & Wetlands dated 5 December 2013.
- h. Nutrient/pollution control measures designed in accordance with Council's DCP 165 -Water Cycle Management. A nutrient/pollution control report including an operation and maintenance plan shall accompany the design. The nutrient/pollution controls shall be generally in accordance with the 'Integrated Water Cycle Management Plan' prepared by Woodlots & Wetlands dated 5 December 2013.
- i. Connection of all stormwater from impervious areas within the site to the nutrient/pollution control facilities and receiving waters generally in accordance with the 'Integrated Water Cycle Management Plan' prepared by Woodlots & Wetlands dated 5 December 2013.
- j. All culvert crossings are to be designed by a suitably qualified and experienced hydraulic consultant. The culvert crossing is to convey the 1% AEP stormwater flow without overtopping of the road. A 50% pipe blockage is to be assumed.
- <u>k.</u> Signage and line marking. Signage shall include "No Parking" restrictions for bushfire access as recommended by the bushfire consultant (Australian Bushfire Protection Planners Pty Ltd). Signage indicating a maximum loading of 15 tonnes shall be provided on the approaches to the bridges over the watercourses traversing roads 2 & 4. Signage and line marking is to also designate/regulate the one-way & two way movements within the site.
- I. Water, electricity and gas are to comply with section 4.1.3 of 'Planning for Bush Fire Protection 2006'.

The design of these details and any associated reports shall be included in any construction certificate.

2.6. Design of the following engineering works within private property:a. Internal roads in accordance with AMCORD guidelines and the requirements of RFS

Planning for Bushfire Protection 2006, and generally in accordance with the concept road grading plans, prepared by Chase Burke Harvey (Ref: Drawing CE 12242-B, Sheets 1-40 dated 5/8/2015). Furthermore, internal roads shall include also the following:

- Internal roads shall be sealed to prevent erosion.
- Temporary "T" turning heads shall be provided at the terminus of dead-end roads created in the construction of the individual development designs.
- Access roads within the development shall be constructed to comply with the specifications of Section 4.1.3(1) of Planning for Bushfire Protection 2006 with a minimum pavement width of 5.5 metres for the main entrance road and perimeter road and a minimum pavement width of 3.5 metres for the one-way internal roads.
- Parking Bays [minimum 2.6m wide] shall be designed and constructed clear of the road pavement and complying Passing Bays [20m long x 2.0m wide] provided in the locations shown on the Concept Plan.
- Property access roads to individual lots shall be designed and constructed to comply with the deemed-to-satisfy provisions of Section 4.1.3(2) of Planning for Bushfire Protection 2006, with a minimum width of 4.0 metres located in a 6.0 metre wide managed corridor.
- b. All parking areas in accordance with Australian Standard AS/NZS 2890.1:2004.
- c. Vehicular access near the waste storage area in accordance with AS2890.2:2002.
- d. Internal drainage and pathways.
- e. Roadside furniture and safety devices including fencing, signage, guide posts, chevrons, directional arrows and guard rail in accordance with RMS and Australian Standards.
- f. Services in accordance with the relevant authorities' specifications and requirements.
- g. On-site stormwater detention system/s designed in accordance with Council's DCP 165 Water Cycle Management that shall limit post development flows from the proposed development to less than or equal to predevelopment flows for all storms up to and including the 1%AEP storm event. A runoff routing method is to be used. An on-site stormwater detention report including an operation and maintenance plan shall accompany the design. The on-site stormwater detention shall be generally in accordance with the 'Integrated Water Cycle Management Plan' prepared by Woodlots & Wetlands dated 5 December 2013, and as amended by the Concept Stormwater Plans SW 12242-D Sheets 1-2 prepared by Chase Burke Harvey dated 27/8/2015, the Plan of the existing RCP to be retained SWC 12242 prepared by Chase Burke Harvey (undated) and the Report prepared by Woodlots & Wetlands titled "Total Catchment Stormwater Production and Its Management" dated August 2015.
- h. Nutrient/pollution control measures designed in accordance with Council's DCP 165 -Water Cycle Management. A nutrient/pollution control report including an operation and maintenance plan shall accompany the design. The nutrient/pollution controls shall be generally in accordance with the 'Integrated Water Cycle Management Plan' prepared by Woodlots & Wetlands dated 5 December 2013, and as amended by the Concept Stormwater Plans SW 12242-D Sheets 1-2 prepared by Chase Burke Harvey dated 27/8/2015 and the Report prepared by Woodlots & Wetlands titled "Total Catchment Stormwater Production and Its Management" dated August 2015.
- i Connection of all stormwater from impervious areas within the site to the nutrient/pollution control facilities and receiving waters generally in accordance with the 'Integrated Water Cycle Management Plan' prepared by Woodlots & Wetlands

dated 5 December 2013, as amended by the Concept Stormwater Plans SW 12242-D Sheets 1-2 prepared by Chase Burke Harvey dated 27/8/2015 and the Report prepared by Woodlots & Wetlands titled "Total Catchment Stormwater Production and Its Management" dated August 2015.

- j. All culvert crossings are to be designed by a suitably qualified and experienced hydraulic consultant. The culvert crossing is to convey the 1% AEP stormwater flow without overtopping of the road. A 50% pipe blockage is to be assumed.
- k. Signage and line marking. Signage shall include "No Parking" restrictions for bushfire access as recommended by the bushfire consultant (Australian Bushfire Protection Planners Pty Ltd). Signage indicating a maximum loading of 15 tonnes shall be provided on the approaches to the bridges and/or culverts over the watercourses traversing roads 2 & 3. Signage and line marking is to also designate/regulate the one-way & two way movements within the site.
- I. Water, electricity and gas are to comply with section 4.1.3 of 'Planning for Bush Fire Protection 2006'.

The design of these details and any associated reports shall be included in the construction certificate.

2.7. A pavement report for works within the private property shall be prepared by a practising Geotechnical Engineer. This report must be submitted with the engineering plans for the internal subdivision works.

The pavement depths must be determined in accordance with Council's specifications and the following traffic loadings:

Name of Street	Traffic Loading (ESAs)
Internal access roads	3x10 <sup>5</sup>

- 2.8. Proposed retaining walls, greater than 600mm in height, are to be designed by a practising Structural/Civil Engineer. The plans for the proposed retaining walls shall form part of any Construction Certificate.
- 2.9. Designs for the bridges over Roads 2 and 4 must be undertaken by a practising Structural/Civil Engineer in accordance with the AUSTROADS Australia Bridge Design Code and relevant Australian Standards. These bridges shall be designed with a minimum loading of 15 tonnes to comply with the RFS Planning for Bushfire Protection 2006 requirements. The underside of the bridges are to be a minimum of 0.5m above the 1% AEP flood level in the watercourse. Supports for the bridges shall not encroach within the 1%AEP flood area within the watercourses. The plans for the proposed bridge shall form part of any Construction Certificate.
- 2.9. Designs for the bridges and/or culverts over Roads 2 and 3 must be undertaken by a practising Structural/Civil Engineer in accordance with the AUSTROADS Australia Bridge Design Code and relevant Australian Standards. These bridges and/or culverts shall be designed with a minimum loading of 15 tonnes to comply with the RFS Planning for Bushfire Protection 2006 requirements. If bridges are proposed, the underside of the bridges are to be

a minimum of 0.5m above the 1% AEP flood level in the watercourse, and the supports for the bridges shall not encroach within the 1% AEP flood area within the watercourses. If culverts are proposed, they shall accommodate the 1%AEP stormwater flows including a 50% blockage. The plans for the proposed bridges and/or culverts shall form part of any Construction Certificate.

- 2.10. Prior to the issuing of a construction certificate or releasing engineering plans for the subdivision / development works, Council will be issued with a Site Audit Statement by an accredited EPA Auditor stating the land has been remediated and is suitable for its intended land uses.
- 2.11. Submission of a signed and dated Waste Management Plan in accordance with the Gosford City Council Development Application Guide. Site and development specific details are required to provide advice in relation to site preparation, demolition, use of premises and on-going management of all proposed establishment and associated infrastructure works.

Note: The submitted SEE provides advice in relation to cut/fill, bulk earthworks, construction of bridges and other infrastructure i.e. water treatment plant, waste water treatment plant etc.

- 2.12. Construction Certificate plans are to be overlayed with swept turning path templates to AS2890 to demonstrate access for a rear loading, rear dual axle HRV into the waste truck servicing area to allow exit from the site in a forward direction.
- 2.13. Submission of a fully dimensioned detail of the waste storage area sized to accommodate 2 x 1.5m<sup>3</sup> bulk bins and 2 x 240 litre MGB's for twice weekly servicing of mixed waste and 2 x 1.5m<sup>3</sup> bulk bins and 2 x 240 litre MGB's for twice weekly servicing of recycled waste for 60 residential units as advised by K. Hay. The waste enclosure to be capable of extension for future stages. Screening details to be clearly indicated.
- 2.14. A **Geotechnical report** shall be prepared by a practising Geotechnical Engineer for all lots that are filled more than 0.5 metres above natural surface level. This report must be submitted with the engineering plans for the internal subdivision works.
- 2.15. The Construction Certificate will not be issued over any part of the site requiring a controlled activity approval until a copy of the approval has been provided to Council.
- 2.16. The proponent must obtain the appropriate approvals or provide evidence that the appropriate approvals are currently held under the Water Management Act 2000 in relation to any proposed water use of the existing dam for domestic water supply, prior to the issue of any construction certificate.
- 2.17. Surface water collected on driveways, parking areas and other impervious areas are to be treated so as to control pollution in accordance with one or more of the methods detailed in Section 10 of the Water Cycle Management Guidelines referenced by DCP 2013 Chapter 6.7 Water Cycle Management.

2.18. The Structural Engineer's details are to be certified that they have been prepared in<br/>DA 44994/2013Page 17 of 38

accordance with the details and recommendations of the Geotechnical Assessment Report No. 75583.01, prepared by Douglas Partners, dated December 2013.

- 2.19 Surrender Development Consent No. 44898/2013 for the approved cluster housing development, prior to the issue of a Construction Certificate. The notice of surrender of consent must include the details specified in Clause 97A of the *Environmental Planning & Assessment Regulation 2000*.
- 2.20 Prior to the issuing of a construction certificate or releasing engineering plans for the subdivision / development works, Council will be issued with a Site Audit Statement by an accredited EPA Auditor stating the land has been remediated and is suitable for its intended land uses.

Submit any relevant contamination information to Council's Environment Officer for review and approval, including detailed site investigations, remediation action plans and validation reports, should they be required as part of the remediation process.

#### **3.. PRIOR TO COMMENCEMENT OF ANY WORKS**

3.1. Any construction certificate for the building work is to be issued and the person having the benefit of the development consent must appoint a Principal Certifying Authority prior to the commencement of any building works.

The Principal Certifying Authority (if not the Council) is to notify Council of their appointment and notify the person having the benefit of the development consent of any critical stage inspections and other inspections that are to be carried out in respect of the building work no later than 2 days before the building work commences.

- 3.2. A copy of the stamped approved plans must be kept on site for the duration of site works and be made available upon request to either the Principal Certifying Authority or an officer of the Council.
- 3.3. Site works are not to commence until the sediment control measures have been installed in accordance with the approved plans.
- 3.4. A sign is required to be erected in a prominent position on any work site on which building or demolition work is being carried out. The sign shall indicate:
  - a The name, address and telephone number of the principal certifying authority for the work; and
  - b The name of the principal contractor and a telephone number at which that person may be contacted outside of working hours; and
  - c That unauthorised entry to the work site is prohibited.

The sign is to be removed when the work has been completed.

3.5. The removal of more than 10 square metres of non-friable asbestos or asbestos containing

material must be carried out by a licensed non-friable (Class B) or a friable (Class A) asbestos removalist. Friable asbestos (of any quantity) must only be removed by a licensed removalist with a friable (Class A) asbestos removal licence.

The person having the benefit of this consent must provide the principal certifying authority with a copy of a signed contract with such licensed removalist before any development pursuant to the development consent commences.

Any such contract must indicate whether any non-friable asbestos material or friable asbestos material will be removed, and if so, must specify the landfill site (that may lawfully receive asbestos) to which the non friable asbestos material or friable asbestos material is to be delivered.

If the contract indicates that non friable asbestos material or friable asbestos material will be removed to a specified landfill site, the person having the benefit of the complying development certificate must give the principal certifying authority a copy of a receipt from the operator of the landfill site stating that all the asbestos material referred to in the contract has been received by the operator.

The person having the benefit of the consent must provide the principal certifying authority with a clearance certificate to be prepared by a competent person such as a qualified hygienist at completion of asbestos removal/work from the site.

If a residential premise is a workplace, the licensed asbestos removalist must inform the following persons before licensed asbestos removal work is carried out:

- the person who commissioned the work
- a person conducting a business or undertaking at the workplace
- the owner and occupier of the residential premises
- anyone occupying premises in the immediate vicinity of the workplace (as described in section 467 of the NSW Work Health and Safety Regulation 2011).

# 3.6. Any Construction Certificate for the subdivision works within the private property must be issued prior to the commencement of any work.

- 3.6. Any construction certificate for the subdivision works within the private property must be issued prior to the commencement of any works, with the exception of those works specified in Condition 2.1 of this consent.
- 3.7. The Principal Certifying Authority must ensure that the Project Arborist has clearly marked trunks of trees on site that are to be removed and ensure all parties/trades working on the site are fully aware of their responsibilities with respect to protection of trees to be retained.
- 3.8. Compliance with all recommendations of the Preliminary Geotechnical Assessment (Douglas Partners, Reference: 75583.01, dated December 2013)
- 3.9. All parking areas shall comply with AS2890.1:2004 and vehicular access near the waste storage area shall comply with AS2890.2:2002

- 3.10. Tree Protection is to be undertaken in accordance with the recommendations of the Arboricultural Impact Assessment, by Michael Shaw, dated 29/11/13.
- 3.10 Tree Protection is to be undertaken in accordance with the recommendations of the Arboricultural Impact Assessment, by Michael Shaw, dated 29 .11.2013, as amended by supplementary *Tree Impact Statement in relation to proposed road realignment Section 96 application*, by Michael Shaw Consulting Arborist, dated 10 August 2015.
- 3.11. Compliance with the recommended mitigation measures contained within Section 5.5 of the *"Heritage Impact Statement for proposed Stage 1 Community Title Subdivision and associated infrastructure works"*, prepared by Chris Betteridge, MUSEcape Pty Ltd, dated 4 December 2013.
- 3.11 Compliance with the recommended mitigation measures contained within Section 5.5 of the "Heritage Impact Statement for proposed Stage 1 Community Title Subdivision and associated infrastructure works", prepared by Chris Betteridge, MUSEcape Pty Ltd, dated 4 December 2013 and supplementary "Heritage Impact Reports: Heritage Assessment - Proposed lot boundary for former Manager's residence (The "Heritage House") and proposed road layout", dated 12.08.2015 and Supplementary Heritage Impact Assessment, dated 16.11.2015, prepared by Chris Betteridge, MUSEcape Pty Ltd.

#### 4.. DURING WORKS

4.1. Clearing of land, excavation, and/or earthworks, building works, and the delivery of building materials shall be carried out between the following hours:

Mondays to Fridays - 7:00am to 6:00pm

Saturdays - 8:00am to 4:00pm except as noted in Clause 'b'

- a No work is permitted on Sundays and Public Holidays
- b No work is permitted on:
  - Saturdays when a public holiday is adjacent to that weekend.
  - Construction industry awarded rostered days off.
  - Construction industry shutdown long weekends.

Clause b does not apply to works of a domestic residential nature as below:

- i Minor renovation or refurbishments to single dwelling construction.
- ii Owner occupied renovations or refurbishments to single dwelling construction.
- iii Owner builder construction of single dwelling construction; and/or
- iv Any cottage constructions, single dwellings or housing estates consisting of predominantly unoccupied single dwellings.
- 4.2. Should any Aboriginal objects or artefacts be uncovered during works on the site, all works shall cease. The Office of Environment and Heritage shall be contacted immediately and any directions or requirements complied with.

- 4.3. To minimize the opportunity for crime, the development must incorporate the following:
  - a Adequate lighting to AS1158 is to be provided to common areas.
  - b Landscaping adjacent to mailboxes and footpaths must not provide for the concealment opportunities for criminal activity.
  - c Adequate signage within the development to identify facilities, entry/exit points and direct movement within the development.
- 4.4. This development is subject to DCP 2013 Chapter 7.2 Waste Management. The Waste Management Plan submitted as supporting documentation with this development consent is required to be implemented during all stages of demolition and construction.
- 4.5. All recommendations of the geotechnical report must be implemented during works. This includes, but is not limited to, the carrying out of all inspections as required by the geotechnical engineering report with a view to the geotechnical engineer providing written certification to the Principal Certifying Authority's satisfaction that all works have been carried out on site in accordance with the recommendations contained within the geotechnical engineers report.
- 4.6. The works within the road reserve that required approval under the Roads Act shall be constructed in accordance with Council's 'Civil Construction Specification', 'GCC Design Specification for Survey, Road and Drainage Works' and Policy 'D6.46 Erosion Sedimentation Control'.
- 4.7. The engineering works within private property that formed part of any Construction Certificate shall be constructed in accordance with Council's 'Civil Construction Specification', 'GCC Design Specification for Survey, Road and Drainage Works' and Policy 'D6.46 Erosion Sedimentation Control'.
- 4.8. Filling or debris must not be placed within any watercourse or drain.
- 4.9. Arrangements must be made with Energy Australia, Australian Gas Light Company and Telstra for the supply of services concurrent with the engineering work. Arrangements must include any relocation of existing mains and services and dedication of easements for mains and services.
- 4.10. Formed vehicular access must be provided to all residential lots, where Council's standard vehicular access cannot be achieved.
- 4.11. All existing building and structures must be connected to the stormwater systems.
- 4.12. All existing building and structures must be connected to the proposed sewer systems.
- 4.13. Supervision and certification for the construction of the bridges must be undertaken by a practicing Structural/Civil Engineer.

4.13. Supervision and certification for the construction of any bridge must be undertaken by a<br/>DA 44994/2013Page 21 of 38

practicing Structural/Civil Engineer.

- 4.14. All internal water, sewer and drainage systems shall be installed in accordance with AS/NZ 3500:2003, the NSW Plumbing Code of Practice 2006 and the Water Supply Code of Australia (Sydney Water Edition) WSA 03-2002.
- 4.15. A fire-fighting water supply shall be provided with Hydrant spacing, sizing and pressure complying with the specifications of Australian Standard A.S. 2419.1 2005 and have a flow rate of 10 litres / second.
- 4.16. Hydrant locations shall be delineated by blue markers placed on the hydrant side of the centreline of the road pavement.
- 4.17. During works a suitably qualified & licensed ecologist or wildlife handler must be located on site to inspect the removal of the hollow bearing tree 191. The hollow bearing tree to be removed must be sectionally dismantled and any resident fauna cared for and relocated as appropriate. A constructed nesting box will replace the removed hollow as recommended in the Flora & Fauna Gap Analysis Report (Robert Payne Ecological Surveys & Management, dated December 2013).

Following the removal of the hollow bearing tree numbered 191 in accordance with this condition, the suitably qualified & licensed ecologist or wildlife handler shall notify Council in writing of compliance with this condition within 14 days.

4.17 During works a suitably qualified & licensed ecologist or wildlife handler must be located on site to supervise the removal of the hollow bearing tree No.191 and all trees within E2 zoned land.

Any hollow bearing trees to be removed must be sectionally dismantled and any resident fauna cared for and relocated as appropriate. A constructed nesting box will replace the removed hollow/s as recommended in the Flora & Fauna Gap Analysis Report (Robert Payne Ecological Surveys & Management, dated December 2013).

Following the removal of the hollow bearing tree No. 191 and all trees within E2 zoned land, the suitably qualified & licensed ecologist or wildlife handler shall notify Council's Environment Officer in writing of compliance with this condition within 14 days.

- 4.18. To minimize the potential for erosion and sedimentation, fuel management must only remove the aerial parts of plants; roots of all plants must remain so that soil is undisturbed.
- 4.19. Erosion and Siltation control measures must be undertaken and maintained in respect to any part of the land where the natural surface is disturbed or earthworks are carried out. The controls shall comply with Council's Code of Practice of Erosion and Sedimentation Control.
- 4.20. Plant species used for landscaping must be restricted to locally native species appropriate to the locality and/or those introduced species that do not have known potential to become environmental weeds.

- 4.20 Plant species used for landscaping must be restricted to locally native species appropriate to the locality and/or those introduced species that do not have known potential to become environmental weeds, apart from replacement Pecan tree plantings as required by Condition 6.11.
- 4.21. Stockpile of soil and other material shall be located away from sensitive environmental receptors, and if not to be used immediately, must be covered with an appropriate control such as geotextile fabric.
- 4.22. Any required fill material will only comprise of;
  - i. Virgin Excavated Natural Material (VENM) as defined under Schedule 1 of the *Protection* of the Environment Operations (POEO) Act 1997.

This definition is as follows:

"virgin excavated natural material" means natural material (such as clay, gravel, sand, soil or rock fines):

- (a) that has been excavated or quarried from areas that are not contaminated with manufactured chemicals, or with process residues, as a result of industrial, commercial, mining or agricultural activities, and
- (b) that does not contain any sulfidic ores or soils or any other waste,

and/or

ii. Excavated Natural Material (ENM) that has been issued with an exemption under the *Protection of the Environment Operations (Waste) Regulation 2005* in accordance with the Excavated Natural Material exemption 2012.

The placement of any other type of fill material other than that defined under VENM or ENM is classified as prohibited under this consent.

- 4.23. The applicant shall provide Council with validation documents verifying and certifying that the material complies with the definition of VENM under Schedule 1 of the *POEO Act 1997* or an exemption issued under the Excavated Natural Material Exemption 2012 if ENM is placed on the land.
- 4.24. Any exposed soil surface areas must be grassed/landscaped to minimise soil erosion.
- 4.25. All external night lighting is to be designed and operated in accordance with the Narara Eco Village Lighting Report (Lighting, Art + Science, Ref: L127P\_R01\_P1, dated 28 June 2013).
- 4.26. The Ecological Restoration Plan (Robert Payne Ecological Surveys & Management, dated December 2013) is to be implemented.

- 4.27. Trees to be removed are to be those located within the footprint of road works and as listed within Appendix 2 "Tree survey data table", within the Arboricultural Impact assessment by M Shaw 29 Nov 2013 (except for 187f). Trees must be removed in a manner so as to prevent damage to those trees that are to be retained.
- 4.27. Trees to be removed are to be those located within the footprint of road works and as listed within Appendix 2 "Tree survey data table", within the Arboricultural Impact assessment by M Shaw 29 November 2013 (except for tree numbered 187f) and additional trees as listed in Appendix 1 of the Aboricultural Impact Assessment prepared by Michael Shaw dated 10 August 2015. Trees must be removed in a manner so as to prevent damage to those trees that are to be retained.
- 4.28. Heritage item trees (DCP175) are to be protected by accurately locating, fenced off and sign posted to warn of purpose, when within 20m of works.
- 4.29. The internal road strength used by the waste trucks must be sufficiently strong enough to withstand a truck loading of 22.5 tonnes.
- 4.30. No obstructions to the wheel out of the waste bins being permitted including grills, speed humps, barrier kerbs etc.
- 4.31. The driveway design and loading area layout is to be designed in accordance with AS 2890.2-2002 Parking Facilities - Off Street Commercial Vehicle Facilities.
- 4.32. The waste truck servicing grade is to be 3% or less for the following areas:
  - Within the enclosure
  - For bulk bin roll out pads
  - Within the 13m bulk bin and truck service area
- 4.33. The screened waste storage enclosure to be located as indicated on Draft Dwg No CGS2.01, dated February 2014, Amendments issued for comment 18 February 2014.
- 4.34. Buildings are to be demolished in a safe and systematic manner in accordance with the requirements of Australian Standard *AS 2601-2001 Demolition of Structures*, and disposed of in an approved manner.
- 4.28. Any works to be carried out on a heritage listed building are to be carried out under the supervision of a suitably qualified heritage consultant.
- 4.29. Significant building elements, features, fixtures, fittings and fragile materials shall be adequately protected during construction from potential damage. Protection systems must ensure historic fabric is not damaged or removed.

#### 5.. PRIOR TO ISSUE OF ANY SUBDIVISION CERTIFICATE

- 5.1. Prior to the issue of any Subdivision Certificate an instrument under the Conveyancing Act 1919 must be created on the Certificate of Title establishing a restrictive covenant detailing the areas to be maintained as a Asset Protection Zone in accordance with the Bushfire Protection Assessment Report, prepared by G. Swain - Australian Bushfire Protection Planners Pty Ltd, dated 4.12.2013 Ref: B121881-2. The restriction shall ensure the owner continually maintains the Asset Protection Zone in accordance with the recommendation and findings detailed in the Bushfire Report. The restriction is to be created at the applicants cost with the Council having the sole authority to release or modify.
  - a. All lots within proposed Stage 1 shall be managed in perpetuity as an inner protection area (IPA) and all residual land zoned as residential within the remainder of the future development shall be managed as an asset protection zone(APZ) as outlined within section 4.1.3 and Appendix 5 of 'Planning for Bush Fire Protection 2006' and the NSW Rural Fire Services' document 'Standards for Asset Protection Zones'.

Written verification from a qualified person in Bushfire Protection or accredited by Fire Protection Association of Australia shall be submitted with the Subdivision Certificate attesting to the completion of such works.

- 5.1. Prior to the issue of any Subdivision Certificate an instrument under the Conveyancing Act 1919 must be created on the Certificate of Title establishing a restrictive covenant detailing the areas to be maintained as Asset Protection Zones in accordance with the Bushfire Protection Assessment Report, prepared by G. Swain- Australian Bushfire Protection Planners Pty Ltd, dated 4.12.2013 Ref: B121881-2, as amended by the Bushfire Assessment Report prepared by Travers Bushfire & Ecology, dated 14 August 2015. The restriction shall ensure the owner continually maintains the Asset Protection Zone in accordance with the recommendation and findings detailed in the Bushfire Report except where inconsistent with the general terms of approval for a Bush Fire Safety Authority issued by the BNSW Rural Fire Service. The restriction is to be created at the applicants cost with the Council having the sole authority to release or modify.
  - a. All lots within proposed Stage 1 shall be managed in perpetuity as an inner protection area (IPA) and all residual land zoned as residential within the remainder of the future development shall be managed as an asset protection zone (APZ) as outlined within section 4.1.3 and Appendix 5 of 'Planning for Bush Fire Protection 2006' and the NSW Rural Fire Services' document 'Standards for Asset Protection Zones'.

Written verification from a qualified person in Bushfire Protection or accredited by Fire Protection Association of Australia shall be submitted with the Subdivision Certificate attesting to the completion of such works.

5.2. Water, electricity and gas are to comply with section 4.1.3 of 'Planning for Bush Fire Protection 2006'.

- 5.3. Public road access shall comply with section 4.1.3 (1) of 'Planning for Bush Fire Protection 2006'.
- 5.4. Temporary "T" turning heads shall be provided at the terminus of dead-end roads created in the construction of the individual development designs.
- 5.5. Any existing buildings within proposed Stage 1 are required to be upgraded to improve ember protection. This is to be achieved by enclosing all openings (excluding roof tile spaces) or covering openings with a non-corrosive metal screen mesh with a maximum aperture of 2mm. Where applicable, this includes any sub floor areas, openable windows, vents, weepholes and eaves. External doors are to be fitted with draft excluders.

Any existing buildings within proposed Stage 1, with the exception of the administration building, are required to be upgraded to improve ember protection. This is to be achieved by enclosing all openings (excluding roof tile spaces) or covering openings with a non-corrosive metal screen mesh with a maximum aperture of 2mm. Where applicable, this includes any sub floor areas, openable windows, vents, weepholes and eaves. External doors are to be fitted with draft excluders.

5.6. Works within the road reserve that required approval under the Roads Act are to be completed in accordance with Council's 'Civil Construction Specification', 'GCC Design Specification for Survey, Road and Drainage Works' and Policy 'D6.46 Erosion Sedimentation Control', and documentary evidence for the acceptance of such works obtained from the Roads Authority prior to the issue of any Subdivision Certificate.

Note 1: A maintenance bond shall be paid on completion of the works in accordance with Section 1.07 Maintenance of the 'Civil Construction Specification'.

- 5.7. Any damage not shown in the dilapidation report submitted to Council before site works had commenced, will be assumed to have been caused as a result of the site works undertaken and must be rectified at the applicant's expense, prior to release of any Subdivision Certificate.
- 5.8. Satisfactory arrangements must be made for the provision of water and sewer services to the land. A copy of the Certificate of Compliance under Section 307 of the Water Management Act 2000 must be obtained from the Water Authority (Council) prior to the issue of the Subdivision Certificate.
- 5.9. A Subdivision Certificate must be issued for the subdivision prior to the registration of the final plan of subdivision and Section 88B Instrument.
- 5.10. Prior to issue of the Subdivision Certificate, separate underground electricity, gas and telephone or appropriate conduits for the same, must be provided to each allotment to the satisfaction of the utility provider. A suitably qualified and experienced engineer or registered surveyor is to provide certification that all new lots have ready underground access to the services of electricity, gas and telephone. Alternatively, a letter from the relevant supply authorities stating the same may be submitted to satisfy this condition.

5.11. Proposed Lot 38 shown on the approved plan must be dedicated free of cost to Council as a public reserve, prior to the issue of the Subdivision Certificate.

The execution prior to the issue of the Subdivision Certificate, of the Deed of Deferral of Certain Obligations prepared by Andrews & Holm Lawyers dated 19 January 2018 between the Council and the Narara Ecovillage Co-operative Ltd, in respect of the Voluntary Planning Agreement referred to in condition 5.24.

- 5.12. Completion of the engineering works required within the development site in accordance with Council's 'Civil Construction Specification', 'GCC Design Specification for Survey, Road and Drainage Works' and Policy 'D6.46 Erosion Sedimentation Control', prior to the issue of the Subdivision Certificate.
- 5.13. Prior to the issue of the Subdivision Certificate the plan of subdivision and an instrument under the Conveyancing Act 1919 must establish the following restrictive covenants; with the Council having the benefit of these covenants and having sole authority to release and modify. Wherever possible, the extent of land affected by these covenants shall be defined by bearings and distances shown on the plan of subdivision
  - a. To create a Restriction As To User over all lots containing an on-site stormwater detention system restricting any alterations to such a facility or the erection of any structure over the facility or the placement of any obstruction over the facility.
  - b. To create a Restriction As To user over all lots containing a nutrient/pollution control facility restricting any alteration to such a facility or the erection of any structure over the facility or the replacement of any obstruction over the facility.
  - c. To create a right of access, right of carriageway and an easement for services as indicated on the approved plans and required under the Voluntary Planning Agreement. All right of ways shall be maintained at the full cost of the Co-operative
- 5.14. An instrument under the Conveyancing Act 1919 must establish the following positive covenants; with the Council having the benefit of these covenants and having sole authority to release and modify. The covenant must be prepared by Council's Solicitor at the owner's cost prior to the issue of the Subdivision Certificate.
  - a. To ensure on any lot containing an onsite stormwater detention system that:
    - The facility will remain in place and fully operational.
    - The facility is maintained so that it operates in a safe and efficient manner.
    - Council staff are permitted to inspect and repair the facility at the owner's cost.
    - Council is indemnified against all claims of compensation caused by the facility.
  - b. To ensure on any lot containing a nutrient/pollution control facility that:
    - The facility will remain in place and fully operational.
    - The facility is maintained so that it operates in a safe and efficient manner.
    - Council staff are permitted to inspect and repair the facility at the owner's cost.
    - Council is indemnified against all claims of compensation caused by the facility.
- 5.15. The applicant shall obtain a licence under the Water Industry Competition Act (WICA) 2006 prior to the issue of a Subdivision Certificate.

- 5.16. Council will require an indemnity against claims for loss or damage to the pavement or other driving surface and against liabilities losses, damages and any other demands arising from any on-site collection service prior to the issue of any Occupation Certificate together with the creation of a S88B instrument under the Conveyancing Act to this effect and at the applicant's cost.
- 5.17. The screened waste storage enclosure to be located as indicated on Draft Dwg No CGS2.01, dated February 2014, Amendments issued for comment dated February 2014.
- 5.18. Street tree planting and landscaping is to be provided generally in accordance with the Landscape Strategy Plan drawing 3.03, Landscape Detailed Reference plans drawing 3.11, Landscape Plan detail 1+2 drawing 3.12, Landscape Plan detail 3+4 drawing 3.13, Landscape Materials Pallete drawing 3.14 and Landscaping Planting Palette- drawing 3.15 (6 sheets), prepared by McGregor Coxall and dated 6 December 2013.
- 5.19. Prior to the issue of a subdivision certificate, the land upon which stand of *Araucaria cunninghamii* (Hoop Pines) is to be determined and transferred at no cost to Council and to be managed in conjunction with the open space/drainage system and floodplain. DELETED
- 5.20. The applicant shall obtain a Notice of Decision to commence commercial operations from the Minister responsible for the Water Industry Competition Act (WICA) 2006 prior to the issue of any Subdivision Certificate for the development. DELETED
- 5.21. Prior to the issue of any Subdivision Certificate, the applicant must obtain the appropriate approvals or provide evidence that the appropriate approvals are currently held under the Water Management Act 2000 in relation to any proposed use of the existing dam for domestic water supply.
- 5.22. An Approval to Operate the on-site sewage management system is to be issued by Council's Waste and Emergency Services prior to the issue of a Subdivision Certificate

The applicant shall obtain a Notice of Decision to commence commercial operations from the Minister responsible for the *Water Industry Competition Act 2006* for sewer services, or should onsite sewage management be proposed and approval to install and operate the onsite sewage management system is to be obtained from Council's Compliance and Health team.

- 5.23. Prior to the issue of any subdivision certificate, a geotechnical engineer shall provide written certification to the Principal Certifying Authority's satisfaction that all works have been carried out on site in accordance with the submitted geotechnical report recommendations.
- 5.24. Compliance with the terms of the Voluntary Planning Agreement "Deed", prepared by Storey & Gough Lawyers, Ref: CCG:070606, Deed made on 31 May 2013 between Gosford City Council and Narara Ecovillage Co Operative Limited in relation to Lot 13 DP 1126998 25 Research Road, prior to the issue of a Subdivision Certificate.

Compliance with the terms of the Voluntary Planning Agreement - "Deed", prepared by Storey & Gough Lawyers, Ref: CCG:070606, Deed made on 31 May 2013 between Gosford City Council and Narara Ecovillage Co Operative Limited in relation to Lot 13 DP 1126998 25 Research Road, prior to the issue of a Subdivision Certificate, as amended by the Deed of Deferral of Certain Obligations prepared by Andrews & Holm Lawyers dated 19 January 2018 between the Council and the Narara Ecovillage Co-operative Ltd .

- 5.25. Submission of a Development Contract and Management Statement which is consistent with conditions of consent to the Principal Certifying Authority, prior to the issue of a Subdivision Certificate.
- 5.25 Submission of a Management Statement to the Principal Certifying Authority, prior to the issue of a Subdivision Certificate. Such statement to be consistent with conditions of this consent and relevant provisions under the *Community Land Management Act 1989* and *Community Land Development Act 1989*.

#### 6.. ONGOING OPERATION

- 6.1. All external lights shall be operated and maintained in accordance with the Australian Standard AS4282 Control of the Obtrusive Effects of Outdoor Lighting so as not to cause a nuisance or adverse impact on the amenity of residents of the surrounding area or to motorists on nearby roads.
- 6.2. The Ecological Restoration Plan (Robert Payne Ecological Surveys & Management, dated December 2013) is to be implemented.
- 6.2 The Ecological Restoration Plan (Robert Payne Ecological Surveys & Management, dated December 2013) is to be implemented.

To demonstrate compliance with the Ecological Restoration Plan, submit progress reports to Council's Environment Officer 1 year, 2 years, 5 years and 10 years after works have commenced.

- 6.3. Waste and recycling bulk waste bins and MGB's to be presented for collection/servicing adjacent to the waste truck servicing location prior to servicing by the residents, caretaker or other internal management arrangement and returned to the screened waste storage enclosures immediately after servicing.
- 6.4. To ensure the survival and establishment of the landscaping, all works associated with the approved Landscape Plans are to be maintained for a period of 12 months from the date of the issue of an Occupation Certificate.
- 6.5. At the completion of the landscaping maintenance period any areas of lawn and plantings, including adjoining road reserve areas that are in a state of decline, damage or missing are to be replaced or restored to a healthy and vigorous condition and compliant with the

approved detailed Landscape Plans and Development Consent Conditions.

- 6.6. Management of the Inner Protection Area (IPA), as required by the NSW Rural Fire Service.
- 6.7. Use of any private water supply shall comply with Australian Drinking Water Guidelines. The NSW Health Private Water Supply Guidelines should be followed to assist the operator in managing their water supplies and ensuring the water is safe to use.
- 6.8. Compliance with all recommendations contained within the Bushfire Protection Assessment, reference B121881-2 dated 4.12.2013 prepared by G.L. Swain Australian Bushfire Protection Planners Pty Ltd except where such requirements are inconsistent with the general terms of approval issued by the NSW Rural Fire Service for a Bushfire Safety Authority under s100B of the Rural Fires Act 1997 and general terms of approval issued by the NSW Office of Water for a controlled activity approval under the Water Management Act 2000 with respect to protection of riparian vegetation.
- 6.8. Compliance with all recommendations contained within the Bushfire Protection Assessment, reference B121881-2 dated 4.12.2013 prepared by G.L. Swain Australian Bushfire Protection Planners Pty Ltd as amended by the Bushfire Assessment Report prepared by Travers Bushfire & Ecology, dated 14 August 2015, except where such requirements are inconsistent with the general terms of approval issued by the NSW Rural Fire Service for a Bushfire Safety Authority under s100B of the Rural Fires Act 1997 conditions 7.1 to 7.4 and general terms of approval issued by the NSW Office of Water for a controlled activity approval under the Water Management Act 2000 with respect to protection of riparian vegetation.
- 6.9. All heritage items are to be used and managed in accordance with the relevant Heritage Inventory Data sheets held in the office of the Council.
- 6.10. The Main Entrance gates, syncarpai glomulifera (Turpentine) and taxodium distichum (Bald Cypress) are to be retained and incorporated into an entrance statement for the subdivision/development, with consideration for interpretative signage.
- 6.11 Propagate materials from the existing significant trees on site, including the Pecan trees to allow succession plantings. Replace the Pecan trees along the drive up to the former Manager's residence with Pecan Trees rather than indigenous trees. Manage and nurture replacement tree plantings to maturity using best horticultural practices using qualified horticulturalists.
- 6.12 The existing stair access to the heritage manager's cottage, adjoining Road 1 & opposite Lot 45 is to be replaced with new steps constructed to the same design and in matching concrete which, on close inspection, should be obvious as new work, in compliance with the requirements of the Burra Charter. The alignment of the path and the majority of its fabric are to be retained.
- 6.13 The applicant shall obtain a Notice of Decision to commence commercial operations from the Minister responsible for the *Water Industry Competition Act 2006*, should the provision of water and sewer services to the land be provided by license under the *Water Industry*

#### Competition Act 2006.

#### 7.. OTHER APPROVALS

#### Integrated Approval (NSW Rural Fire Service – Bush Fire Safety Authority)

- 7.1. At the issue of subdivision certificate and in perpetuity, all lots within proposed Stage 1 shall be managed as an inner protection area (IPA) as outlined within section 4.1.3 and Appendix 5 of 'Planning for Bush Fire Protection 2006' and the NSW Rural Fire Service's document 'Standards for asset protection zones'.
- 7.2. At the issue of subdivision certificate and in perpetuity, all residual land zoned as residential within the remainder of the future development shall be managed as an asset protection zone(APZ) as outlined within section 4.1.3 and Appendix 5 of 'Planning for Bush Fire Protection 2006' and the NSW Rural Fire Service's document 'Standards for asset protection zones'.
- 7.3. Water, electricity and gas are to comply with section 4.1.3 of 'Planning for Bush Fire Protection 2006'.
- 7.4. Public road access shall comply with section 4.1.3 (1) of 'Planning for Bush Fire Protection 2006'.
- 7.5. Temporary "T" turning heads shall be provided at the terminus of dead-end roads created in the construction of the individual development designs.
- 7.6. Any existing buildings within proposed Stage 1 are required to be upgraded to improve ember protection. This is to be achieved by enclosing all openings (excluding roof tile spaces) or covering openings with a non-corrosive metal screen mesh with a maximum aperture of 2mm. Where applicable, this includes any sub floor areas, openable windows, vents, weepholes and eaves. External doors are to be fitted with draft excluders.

#### Integrated Approval (NSW Rural Fire Service – Bush Fire Safety Authority)

7.1 At the issue of subdivision certificate and in perpetuity, all lots within proposed Stage 1 shall be managed as an inner protection area (IPA) as outlined within section 4.1.3 and Appendix 5 of Planning for Bush Fire Protection 2006 and the NSW Rural Fire Service's document Standards for asset protection zones.

Furthermore outside these lots the land shown as green on the diagram created by Travers Bushfire & Ecology, referenced A15097 \_BF001\_ Schedule 1 - Bushfire Protection Measures, dated 17/8tj15 shall be managed as an IPA.

7.2 Water, electricity and gas are to comply with section 4.1.3 of Planning for Bush Fire Protection 2006.

- 7.3. Public road access shall comply with the following;
  - Public roads are two wheel drive, all weather roads.
  - Temporary "T" turning heads shall be provided at the terminus of dead end roads created in the construction of the individual development designs.
  - Access within the development shall be constructed to comply with section 4.1.3(1) of Planning for Bush Fire Protection 2006 with a minimum pavement width of 5.5 metres for the main entrance road and perimeter road and a minimum pavement width of 3.5 metres for one-way internal roads where each road shall display no parking on either side.
  - Parking Bays (minimum 2.6 metres wide) shall be designed and constructed clear of the road pavement and complying passing bays (20 metres long x 2 metres wide) provided in the locations shown on the concept plan.
  - Property access roads to individual Lots shall be designed and constructed to comply with the deem to satisfy provisions of section 4.1.3(2) of Planning for Bush Fire Protection 2006, with a minimum width of 4 metres located in a 6 metres wide managed corridor.
- 7.4. Any existing building within proposed Stage 1 are required to be upgraded to improve ember protection. This is to be achieved by enclosing all openings (excluding roof tile spaces) or covering openings with a non-corrosive metal screen mesh with a maximum aperture of 2mm. Where applicable, this includes any sub floor areas, openable windows, vents, weepholes, and eaves. External doors are to be fitted with draft excluders.

<u>NSW Rural Fire Service General Advice</u> -This approval is for the subdivision of the land only. Any further development application for class 1, 2, and 3 buildings as identified by the Building Code of Australia may be subject to separate application under section 79BA of the Environmental Planning and Assessment Act 1979 and address the requirements of Planning for Bush Fire Protection 2006.

#### Integrated Approval (NSW Office of Water – Controlled Activity Approval)

- 7.7. Prior to the commencement of any controlled activity (works) on waterfront land, the consent holder must obtain a Controlled Activity Approval (CAA) under the Water Management Act 2000 from the NSW Office of Water. Waterfront land for the purposes of this DA is land and material in or within 40 metres of the top of the bank of the rivers that occur onsite. (For the purpose of these GTA, the watercourses described as the northern gully and the middle western gully are both considered to be rivers).
- 7.7. Prior to the commencement of any controlled activity (works) on waterfront land, the consent holder must obtain a Controlled Activity Approval (CAA) under the Water Management Act 2000 from the NSW Office of Water. Waterfront land for the purposes of this DA is land and material in or within 40 metres of the top of the bank of the rivers that occurs on site. (For the purpose of these GTA, the watercourse described as the northern gully is considered to be a river).
- 7.8. Compliance with the attached General Terms of Approval issued by the NSW Office of Water (Reference No.: 20 ERM2014/0011), dated 25 February 2014 for works requiring a controlled activity approval under the *Water Management Act 2000* (WM Act).

- 7.8. Compliance with the attached General Terms of Approval issued by the NSW Office of Water (Reference No.: 20 ERM2014/0011), dated 25 February 2014 for works requiring a controlled activity approval under the *Water Management Act 2000* (WM Act), as amended by the letter from the Department of Primary Industries (Reference No.: 20 ERM2014/0011) titled "Controlled Activity Approval (CAA) requirements for Gully A, (Middle Western Gully). Narara Ecovillage" dated 31 March 2015.
- 7.9. The Construction Certificate will not be issued over any part of the site requiring a controlled activity approval until a copy of the approval has been provided to Council.
- 7.10 In relation to the proposed use of the existing dam for domestic water supply, the applicant must obtain the appropriate approvals or provide evidence that the appropriate approvals are currently held under the Water Management Act 2000 in relation to any proposed water use, prior to the issue of a construction certificate.

#### 8.. ADVICE

- 8.1. The public authorities may have separate requirements and should be consulted in the following aspects:
  - a *Australia Post* for the positioning and dimensions of mail boxes in new commercial and residential developments;
  - b Jemena Asset Management for any change or alteration to the gas line infrastructure;
  - c *Energy Australia* for any change or alteration to electricity infrastructure or encroachment within transmission line easements;
  - d *Telstra, Optus* or other telecommunication carriers for access to their telecommunications infrastructure.
  - e *Gosford City Council* in respect to the location of water, sewerage and drainage services.
- 8.2. All work carried out under this Consent should be done in accordance with WorkCover requirements including the Workplace Health and Safety Act 2011 No 10 and subordinate regulations, codes of practice and guidelines that control and regulate the development industry.
- 8.3. Any water or sewer works are to be undertaken with the consent of Council. Application is to be made with Council under the provisions of Section 68 of the Local Government Act 1993 prior to commencement of any works on the site.

Water and Sewer works shall comply with the *Water Industry Competition Act 2006*, and the WICA License, should water and sewer works not be carried out under the WICA License an application is to be made with Council under the provisions of Section 68 of the Local Government Act 1993 prior to commencement of any works on the site.

#### 8.4. Dial Before You Dig

Underground assets may exist in the area that is subject to your application. In the interests

of health and safety and in order to protect damage to third party assets please contact Dial Before You Dig at <u>www.111.1100.com.au</u> or telephone on 1100 before excavating or erecting structures (This is the law in NSW). If alterations are required to the configuration, size, form or design of the development upon contacting the Dial Before You Dig service, an amendment to the development consent (or a new development application) may be necessary. Individuals owe asset owners a duty of care that must be observed when working in the vicinity of plant or assets. It is the individual's responsibility to anticipate and request the nominal location of plant or assets on the relevant property via contacting the Dial Before You Dig service in advance of any construction or planning activities.

Telecommunications Act 1997 (Commonwealth)

Telstra (and its authorised contractors) are the only companies that are permitted to conduct works on Telstra's network and assets. Any person interfering with a facility or installation owned by Telstra is committing an offence under the Criminal Code Act 1995 (Cth) and is liable for prosecution. Furthermore, damage to Telstra's infrastructure may result in interruption to the provision of essential services and significant costs. If you are aware of any works or proposed works which may affect or impact on Telstra's assets in any way, you are required to contact: Telstra's Network Integrity Team on phone number 1800 810 443.

- 8.5. A fee for the approval of engineering plans under the Roads Act 1993 applies. The amount of this fee can be obtained by contacting Council's Customer Services on (02) 4325 8222.
- 8.6. The inspection fee for works associated with approvals under the Roads Act is calculated in accordance with Council's current fees and charges policy.
- 8.7. Developers should make early application for a Section 307 Certificate under the Water Management Act 2000 from the Water Authority (Council). For a copy of the application form 'Application for Certificate under Section 305' contact Customer Service on (02) 4325 8200 or visit Councils web site www.gosford.nsw.gov.au to download a form from the Water & Sewerage forms index.
- 8.8. Payment of a Subdivision Certificate fee must be made at time of lodgement of the subdivision plan with Council. The fee may be obtained from Council's Customer Service Unit on 4325 8222 or from Council's website <u>http://www.gosford.nsw.gov.au</u>.
- 8.9. The developer is referred to the requirements of the Environmental Planning and Assessment Act Section 109E (2). To clarify this section of the Act, you are advised that Gosford City Council's Environment Planning instrument does not permit accredited certifiers to undertake the role of the principal certifying authority for subdivisions in the Gosford Local Government area and therefore Gosford City Council can only be appointed as the Principal Certifying Authority (PCA).

In accordance with Section 81A (3) subdivision of the land (4) (b), it is the developer's responsibility to formally notify council of their appointment as the PCA and to notify Council the intention to commence works. Upon receipt of these notifications, Council will issue the developer with 'Terms of Appointment' which formalises the acceptance of the role of the

PCA by council and sets out conditions to be satisfied prior to (including payment of inspection fees), during the course of the works, and upon completion.

As the PCA, Council will be responsible for undertaking all critical stage inspections as detailed in the Gosford City Council Construction Specifications. Council will issue a subdivision certificate upon conditions of consent being satisfied and all works being completed in accordance with Council's Design and Construction Specifications.

Council reserves the right to undertake all critical stage inspections as per the specification as deemed necessary in order to satisfy Council that the work is in accordance with the conditions, specifications, industry standards and accepted practice prior to issue of a subdivision certificate. Appointment of accredited certifiers for critical stage inspections by the developer shall not be accepted by Council unless expressly approved to do so in the 'Terms of Appointment'.

- 8.10. All right of ways shall be maintained at the full cost of the Co-operative.
- 8.11. This approval is for the subdivision of the land and ancillary works. Any further development application for class 1,2 & 3 buildings as identified by the 'Building Code of Australia' may be subject to separate application under section 79BA of the EP & A Act and address the requirements of 'Planning for Bush Fire Protection 2006'.
- 8.12. The access roads across the floodplain to the E3 zoned area of Pt Lot 37 are not to be constructed. If development is to take place on this land further consent will be required and the standard of access works within the right of carriageway shall be determined by Council including the provision of flood free access to this land.
- 8.13. In relation to the proposed use of the existing dam for domestic water supply, the applicant must obtain the appropriate approvals or provide evidence that the appropriate approvals are currently held under the Water Management Act 2000 in relation to any proposed water use. For further information regarding water licence approvals, please contact Alison Collaros, alison.coilaroswater.nswgov.au or 49042527.
- 8.14. Should the proponent fail to obtain a Licence and Notice of Decision under WICA and require connection to Councils water supply and sewerage reticulation systems then the proponent would need to lodge a section 96 application to modify the development consent.

The following conditions shall apply:

 Connection of the proposed development to Councils water and sewer reticulation systems shall be subject to the existing water and sewer systems having sufficient capacity to accommodate the proposed development. The applicant shall be responsible for undertaking a water and sewer systems capacity analysis. The analysis shall extend to a point within the water supply and sewerage reticulation systems where proposed demands / loads from the development represent 5% or less of the total capacity of the respective systems. The analysis shall assess the impact of the proposed development on Council's existing water and sewerage reticulation systems. The capacity analysis shall be carried out in accordance with the WSAA method for determining system capacity and shall be based upon full development of the area serviced by the water and sewer systems utilising the current land zonings without the development and a second analysis with the inclusion of additional demands / loads created by the proposed development.

- The developer shall be responsible for the design and full cost of augmentation to both water supply and sewerage reticulation systems required as a result of extra loading from proposed development. In addition, augmentation works may need to be completed before Council could allow connection of the development to the water supply and sewerage systems.
- Payment of the current water and sewer headworks and augmentation contributions, in accordance with Council's policy.
- The applicant shall be responsible for the design and construction of water supply and sewerage works required to connect the development to Councils existing water supply and sewerage systems. The water and sewer designs must be submitted to Council for approval and shall be in accordance with Council's water and sewer design standards.
- The applicant shall be responsible for the design and construction of water supply and sewerage works within the development site. The water and sewer designs must be submitted to Council for approval and shall be in accordance with Council's water and sewer design standards.
- 8.15. Aboriginal Cultural Heritage

The importance of protecting Aboriginal cultural heritage is reflected in the provisions under Part 6 of the *National Parks and Wildlife Act 1974* (NPW Act). The NPW Act clearly establishes that Aboriginal objects and places are protected and may not be harmed, disturbed or desecrated without appropriate authorisation. Importantly, approvals under Parts 4 of the EP&A Act do not absolve the proponent of their obligations under the NPW Act.

The proponent should note that the provisions of the NPW Act have recently been amended and they should ensure they are familiar with the new requirements during the development and any subsequent assessment processes. Further advice regarding Aboriginal cultural heritage can be found on OEH's website at:

www.environment.nsw.gov.au/cultureandheritaqe.htm.

The NPW Act requires consultation to be in accordance with the Aboriginal cultural heritage consultation requirements for proponents 2010' if impact to Aboriginal cultural heritage is unavoidable.

- 8.16. It is an offence under the National Parks and Wildlife Act 1974 to knowingly disturb an Aboriginal object or artifact without consent.
- 8.17. The location of sensitive sites as identified by the Aboriginal Cultural Heritage Aboriginal Archaeological & Cultural Heritage Assessment Report, dated May, 2006 prepared by Danny O'Brien - Environmental Appraisal & Planning Pty Limited should be considered during any future planning activities or development of the area. In this regard the following requirements shall apply:

sensitive Aboriginal sites as indicated on the attached plan.

- The provision of fire trails or Asset Protection Areas (APZ) to protect any future development of the site, then these fire trails or APZ should not be constructed within or towards the direction of Aboriginal sites or to any location near Aboriginal sites present within or adjacent to the subject site.
- That should fire trails or Asset Protection Zones be required to be established to protect future dwellings, then a detailed Aboriginal archaeological site survey be undertaken to ensure that any cryptic or sub-surface sites are considered.
- That prior to any hazard reduction burns undertaken by the NSW Rural Fires Service (RFS) in the future, or with the development of Fire Management Plans t be prepared for the area, then the scarred and carved trees should be located on the ground to ensure that these trees are fully protected from direct flame. It is critical that the Department of Environment & Conservation's National Parks & Wildlife Service's Cultural Heritage unit, the Darkinjung Local Aboriginal Land Council and an archaeologist be contacted in relation to any hazard reduction fires within the subject site in the future. Scarred or carved trees are highly sensitive to the effects of bushfires and need to be protected from bushfire events.
- That the occurrence of Aboriginal sites within the subject site or environs not be advertised or made public.
- That strict erosion and sedimentation control plans be developed to ensure that sedimentation does not impact on any Axe-grinding grooves in the locality.
- Should any Aboriginal relics, Aboriginal cultural artefacts or archaeological deposits be uncovered in the development areas, then all works should cease and the Darkinjung Local Aboriginal Land Council shall be contacted. Should the remaining areas be at a later stage considered for development, that a more intense archaeological assessment be undertaken.

#### 9.. PENALTIES

Failure to comply with this development consent and any condition of this consent may be a *criminal offence*. Failure to comply with other environmental laws may also be a *criminal offence*.

Where there is any breach Council may without any further warning:

- Issue Penalty Infringement Notices (On-the-spot fines);
- Issue notices and orders;
- Prosecute any person breaching this consent, and/or
- Seek injunctions/orders before the courts to retain and remedy any breach.

#### Warnings as to Potential Maximum Penalties

Maximum Penalties under NSW Environmental Laws include fines up to \$1.1 Million and/or custodial sentences for serious offences.

### **10.. RIGHT OF APPEAL**

- 10.1. Section 97 of the Act, confers on an applicant who is dissatisfied with the determination of a consent authority a right of appeal to the Land and Environment Court within six (6) months, from the date of determination.
- 10.2. To ascertain the date upon which the determination becomes effective refer to Section 83 of the Act.



















Req:R748282 /Dos:DF 0270882 P /Rev:12-Jun-2018 /Sts:BC.CK /Pgs:AlL /Prt:13-Jun-2018 09:23 /Seq:6 of 17







Req:R748282 /Doc:DF 0270882 F /Rev:12-Jun-2018 /Sts:SC.OK /Fgs:ALL /Frt:13-Jun-2018 09:23 /Seq:9 of 17

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Req:R748282 /Dog:DF 0270882 P /Rev:12-Jun-2018 /Sts:SC.OK /Pgs:ALL /Prt:13-Jun-2018 09:23 /Seq:10 of 17 Ref:13/208 /Src:M

## DP270882

#### **COVER SHEET FOR SIGNATURE/ADMINISTRATION SHEETS**

# ATTENTION

#### .....

A Community Plan may be subject to future subdivision that may contain a Signature/Administration Sheet. This document will then comprise separate Signature/Administration Sheets registered on different dates.

Particulars of each Signature/Administration Sheet are as follows:-

Sig/Admin Sheet Number	Number of Sig/Admin Sheets	Contains U.E. Schedule (Y/N)	Registration Date	Number of Sheets in Subject Plan	Lot Numbers Created
Document A	7	Y	8.6.2018	9	1-48
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748282 /Dod:DP 0270882 3/208 /Sra:M DIAN CODM 6 (2012)	2018 09:23 /Seq:11 of : ePlan			
	DEPOSITED PLAN AD	DEPOSITED PLAN ADMINISTRATION SHEET		
	Office Use Only		Office Use Only	

Office Use Only	Office Use Only
Registered:	DP270882
Title System: TORRENS	
Purpose: SUBDIVISION	
PLAN OF SUBDIVISION OF	LGA: CENTRAL COAST
LO1 13 IN DP 1126998	Locality: NARARA
	Parish: GOSFORD
	County: NORTHUMBERLAND
Crown Lands NSW/Western Lands Office Approval	Survey Certificate
4 (Authorised Officer) in	I, STEPHEN CRAIG BISHOP
approving this plan cortify that all necessary approvals in regard to the allocation of the land shown herein have been given.	of CHASE, BURKE & HARVEY, PO BOX 3041, ERINA NSW 2250
Signature:	a surveyor registered under the Surveying and Spatial Information Act 2002, certify that:
Date:	*(a) The land shown in the plan was surveyed in accordance with the
File Number:	and the survey was completed on 30/06/2017
CINCLE AREA AND AND AND AND AND AND AND AND AND AN	*(b) The part of the land shown in the plan (*being/*excluding ^)
Subdivision Certificate          I       OFFM         *Authorised Person/*General Manager/*Accredited Certifier, certify that the provisions of s.109J of the Environmental Planning and Assessment Act 1979 have been satisfied in relation to the proposed subdivision, new roadop reserve set out herein.         Signature:       Accreditation number:         Accreditation number:       Consent Authority:         Consent Authority:       CENTRAL COAST COUNCIL         Date of endorsement:       15:03:20.18         Subdivision Certificate number:       449944         File number:       449944         *Strike through if inapplicable.         Statements of intention to dedicate public roads create public reserves	<ul> <li>was surveyed in accordance with the Surveying and Spatial Information Regulation 2012, is accurate and the survey was completed on,</li></ul>
and drainage reserves, acquire/resume land.	DP 263748 DP 1123567 DP 599356 DP 1126998 DP 599828 DP 1149939 DP 732019 N219-1501 DP 811628 N710-2111 DP 881013 N8507-2111 DP 1087535
PLAN FORM 6A	

Req:R748282 /Doo:DP 0270882 P /Rev:12-Jun-2018 /Sts:SC.OK /Pgs:ALL /Prt:13-Jun-2018 09:23 /Seq:12 of 17 Ref:13/208 /Src:M UF2/U602\_1

PLAN FORM 6A (2012) WARNING: Creasing or fo	Iding will lead to rejection ePlan
DEPOSITED PLAN AD	MINISTRATION SHEET Sheet 2 of 7 sheet(s)
Office Use Only Registered: 8.6.2018	
PLAN OF SUBDIVISION OF LOT 13 IN DP 1126998	DP270882 (DOC.A)
Subdivision Certificate number: $44994/2013$ Date of Endorsement: $15.03.2018$	<ul> <li>This sheet is for the provision of the following information as required:</li> <li>A schedule of lots and addresses - See 60(c) SSI Regulation 2012</li> <li>Statements of intention to create and release affecting interests in accordance with section 88B Conveyancing Act 1919</li> <li>Signatures and seals- see 195D Conveyancing Act 1919</li> <li>Any information which cannot fit in the appropriate panel of sheet 1 of the administration sheets.</li> </ul>
PURSUANT TO SECTION 88B OF THE CONVEYANCING	ACT, 1919, AS AMENDED IT IS INTENDED TO CREATE:
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23	SYNCARPIA	CRESCENT	NARARA	
25	SYNCARPIA	CRESCENT	NARARA	
14	BALGARA	RISE	NARARA	
33	GUGANDI	ROAD	NARARA	
30	GUGANDI	ROAD	NARARA	
10	SYNCARPIA	CRESCENT	NARARA	
3	SYNCARPIA	CRESCENT	NARARA	
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Sara RoachMichael WoodlandPlanning Services&Consulting Pty Ltd

## **DEVELOPMENT APPLICATION** Statement of Environmental Effects

# Narara Ecovillage: 25 Research Road, Narara:



## Development Application: Stage 1- Subdivision, infrastructure and associated works.

## Submitted to Gosford City Council On behalf of Narara Ecovillage Co-operative Ltd December 2013

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Michael Woodland Consulting Pty Ltd michael@michaelwoodlandconsulting.com.au

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G-	Stage 1 Heritage Impact Statement	MUSEcape
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## 1.0 Introduction and Background

## **1.1** Introduction

This Statement of Environmental Effects (SEE) is submitted to Gosford City Council (Council) as part of a Development Application (the application) which seeks approval under Part 4 of the *Environmental Planning and Assessment Act 1979* (the Act) for Stage 1 works associated with the establishment of an ecovillage at 25 Research Road, Narara. The application proposes a 40 lot community title subdivision and ancillary works required to support the future development of the Narara Ecovillage site (NEV site).

The NEV site comprises approximately 62.97 hectares of land which was acquired by Narara Ecovillage Co-operative Ltd (the Co-operative) from the Department of Primary Industries in September 2012 (settlement in May 2013). Prior to the sale of the land, the site was zoned 5(a) Special Uses (Experimental Station) pursuant to Gosford Interim Development Order No. 122 and it was occupied and operated as the Gosford Horticultural Research and Advisory Station (Horticultural Institute).

On 1 February 2008, Gosford Local Environment Plan No. 464 was gazetted, amending the Gosford Planning Scheme Ordinance (GPSO) and rezoned the NEV site to facilitate the future development and use of the land primarily for residential purposes. Approximately 11.5 hectares of the land is now zoned 2(a) Residential and is able to support as range of housing types including conventional dwellings and cluster housing, subject to approval. Importantly, the significant rural, ecological and heritage features on the site are preserved in GPSO by zoning a portion of the site 7(a) Conservation, 7(c2) Rural Small Holdings and 6(a) Open Space.

The SEE has been prepared in accordance with the requirements of Part 4 of the Act and Part 6 of the Environmental Planning and Assessment Regulations 2000 (the Regulations). The application is integrated development pursuant to section 91 of the Act. In order for the development to be carried out, Terms of Approval will be required to be issued by the NSW Office of Water and the RFS under the *Water Act 2000* and the *Rural Fire Services Act 1997*. The application is not designated development pursuant to Clause 4 of the Regulations.

The Co-operative proposes to lodge a concurrent application with the Independent Pricing and Regulatory Authority Tribunal (IPART) for a retail operator's licence and network operator's licence under the Water Industry Competition Act 2006 (WICA) for the integrated water management system (water and sewer) which forms part of this application.

The Co-operative has also lodged 3 other applications for the use of the site and 2 cluster housing developments on lots 15 and 36. These applications are currently being assessed by Council.

The application is supported by a range of technical reports which demonstrate that the proposal will result in minimal environmental impact. Therefore, favourable consideration of the application is requested.

## **1.2 Overview of the Project**

#### The Concept Plan and Project Objective

The key overall objective for the NEV site is to recast the Horticultural Institute into an ecovillage with a key emphasis on environmental, social and economic sustainability. The Concept for the ecovillage is to establish a community of people living in a sustainable way, focusing on the principles of environmental sensitive property design and living practices, active community relationships and events, and developing sustainable economic activities.

Specifically, the vision for the site is as follows:

"to create, live in and continue to learn and improve in, a model ecovillage with a joyful, unified, effective and sustainable community intelligent and sustainable uses of the earths resources throughout the life of the ecovillage."

In line with this vision, the Stage 1 application seeks to establish the foundations for the future development of the site. The design focuses on retaining as mainly of the existing site features including the road network and the landform and minimising site intervention in recognition of the important ecological and heritage values of the site.

A non-statutory Concept Plan has also been prepared for the NEV site and is submitted with this Stage 1 DA. The Concept Plan prepared by Hill Thalis Architecture + Urban Projects (Hill Thalis) illustrates the proposed redevelopment of the site in 3 Stages (refer to Plan 2.21 in Design Report at **Appendix B**), the integration of services including water and sewer management system, road and pedestrian circulation, the network of community association land and open space through the site.

The Concept Plan proposes the community title subdivision of the site for residential purposes with supporting land uses including community uses and neighbourhood shops. Fundamental to the Concept Plan is the integration of the ecovillage with the existing heritage and ecological values of the site.

The Concept Plan is included in the Design Report prepared by Hill Thalis included at **Appendix B**. The Design Report contains detailed strategies for the arrangement of the subdivision, the street pattern and the provision of site facilities and the design principles for elements including dwelling siting and design, landscaping and water management which underpin the Stage 1 development of the NEV site.

The Concept Plan for the redevelopment of the NEV site envisages the progressive staged development of the site as an ecovillage.

The illustrative Concept Plan is provided in Figure 1 below.



Figure 1: Illustrative Concept Plan for NEV Site (Source: Hill Thalis)

#### The Development Proposal

The Stage 1 DA for the redevelopment of the NEV site seeks approval to subdivide the site under the provisions of the *Community Land Development Act 1989* to create a Community Title Scheme. The Conceptual Draft Community Subdivision Plan proposes a 40 lot subdivision. To support the subdivision of the site and to meet the servicing requirements for Stage 1, the following ancillary works are also proposed:

- remediation of the site;
- the demolition of 15 redundant site structures and removal of 45 trees;
- the construction of the road network including new internal circulation roads and two (2) bridges over the middle western gully;
- provision of essential utility services and infrastructure to service the site including the construction of an integrated water management system (water recycling facility and sewer reticulation system);
- the implementation of the first stage in a comprehensives landscape strategy for the site;
- works to make the site bushfire safe including the establishment of asset protection zones; and
- the first stage in the ecological restoration of the site.

The application is predominantly limited to the land on the site which is current zoned 2(a) residential under the GSPO. However, due to the irrational alignment of the eastern boundary of the 2(a) land with the contiguous 6(a) open space land, some civil works are proposed on the 6(a) zoned land, to ensure that road access is suitably upgraded to service the NEV site. The concept for the Stage 1 development of the NEV site is illustrated in **Figure 2**.

#### **Other applications**

The Concept Plan proposes 3 stages in the development of the NEV site, which will be subject to separate development applications. The development of these stages will broadly accord with the concept proposal and design principles prepared for the NEV site by Hill Thalis.

The Co-operative has lodged several recent development applications with Council for the development of the site. These are as follows:

- **Application No.0011.2013.0044899.001:** DA for demolition of existing structures and construction of 17 cluster housing units and associated works on proposed Lot 36;
- Application No. 0011.2013.0044898.001: DA for demolition of existing structures and construction of 10 cluster housing units on proposed Lot 18; and
- Application No. 0011.2013.0044650.001: DA to formalise the community use of the existing Visitors Centre and the Administration Block. The residential occupation of both the Managers Cottage and Foremans Cottage is also proposed and is necessary to establish a permanent presence on the site, and to facilitate the care, maintenance and security of the site head of obtaining any future approval for the redevelopment of the site.

The determination of the two cluster housing applications is contingent on the registration of the Plan of Subdivision proposed in this application with the Land and Property Information (LPI).



Figure 2: Stage 1 Concept Plan (Source: Hill Thalis)

## **1.3** Consultation

#### **Gosford City Council**

The Co-operative and the specialist consultant team have held a series of meetings with Gosford City Council throughout the design development of the Concept Plan for the NEV site. The most recent meeting was convened with senior staff of Council on 13 November 2013. The Minutes of the meeting provided by Council are included at **Appendix C**.

This application has been prepared in accordance with the direction discussed at the pre-lodgement meeting with Council. In accordance with Council's requirements, this application specifically includes details regarding the following:

- Compliance with the key provision of the Gosford Planning Scheme Ordinance, Interim Development Order No.122 and Draft Gosford Local Environmental Plan 2013- refer **Section 4.0** and **Appendix Z** of the SEE;
- Compliance with key State environmental planning policies- refer Section 4.0 of the SEE;
- Compliance with relevant Council Development Control Plans including Development Control Plan No. 175: Gosford Horticultural Institute Rezoning and Development Control Plan No.112: Residential Subdivision- refer **Section 4.0** of the SEE and **Appendix Z**.
- The integrated development provisions and the designated development provisions of the Actrefer to **Section 4.0** of the SEE.
- The development staging- refer to Plan 2.21 in Design Report at **Appendix B**.
- The engineering requirements of Council including:
  - Traffic Impact Assessment- refer to Transport Impact Assessment has been prepared by Chris Hallam & Associates **Appendix W**.
  - Road Design- refer to Concept Road Grading Plans and the Concept Engineering & Public Utility Services Report prepared by Chase Burke Harvey at Appendix N and Appendix P, respectively.
  - Stormwater Management- refer to Concept Stormwater Plans have been prepared by Chase Burke Harvey and the Integrated Water Cycle Management Plan prepared by Woodlots & Wetlands at Appendix Q and Appendix S, respectively.
  - Water Cycle Management- Refer to the Integrated Water Cycle Management Plan prepared by Woodlots & Wetlands and the Water Systems Management Overview prepared by Aquacell at Appendix S and Appendix T, respectively.
  - Waste Services- refer to the Preliminary Waste Management Plan has been prepared in accordance with the requirements of DCP 106 at **Appendix V**.
- The environmental requirements of Council including the following:
  - Tree Schedule/Arboricultural Report- refer to Arboricultural Impact Assessment prepared by Michael Shaw at **Appendix I**.
  - Flora and Fauna Assessment- refer to the Flora and Fauna Gap Analysis Survey Report and an Ecological Restoration Plan prepared by Robert Payne at **Appendix J** and **Appendix K**, respectively.
  - Soil and Water Management- refer to the Concept Erosion and Sediment Control Plan prepared by Chase Burke Harvey at **Appendix R**.
  - Landscape Plan- refer to Landscape Plans prepared by McGregor Coxall at **Appendix B**.

- Aboriginal Cultural Heritage Assessment- The findings of the Aboriginal Archaeological & Cultural Heritage Assessment Report prepared by Danny O'Brien for the rezoning, remains valid and relevant to the current DA. A new Report has not been commissioned.
- Site Contamination Assessment- refer to the Phase 1 Contamination Assessment has prepared by Douglas Partners at **Appendix F**.

Further to the above, the application has addressed the requirements of the Voluntary Planning Agreement in relation to the dedication the land that is zoned 6(a) Open Space, together with land identified as containing the stand of *Araucaria cunninghamii* (Hoop Pines). VPA requires that the land be dedicated free of cost to Council on registration of a plan of subdivision of the land. This land is proposed as Lot 38 in the Draft Plan of Subdivision prepared by Chase Burke Harvey and provided at **Appendix E**.

As detailed by Council in the pre-lodgement meeting, part of the 7(a) land has been identified within the Coastal Open Space System (COSS) as being desirable for future voluntary acquisition in full or in part by Council's Minute 2008/457. The Co-operative notes the comments of Council and would welcome the opportunity to discuss a land contribution toward the COSS to offset the 6(a) land dedication. This matter is discussed in further detail in **Section 4.1.2** of this SEE.

#### NSW Rural Fire Service (RFS)

A number of meetings (including a site visit) have been convened with the RFS to discuss appropriate fire protection measures for the NEV site. Fundamental to the design resolution of the concept proposal has been the resolution of the following elements of the Stage 1 proposal:

- the perimeter access road network including the design road width, requirement for passing bays and off-pavement parking bays, and circulation within the NEV site;
- the application of appropriate APZ's and their management to meet the requirements of Planning for Bushfire Protection 2006; and
- the treatment of the middle western gully, which is now proposed to be managed to an Asset Protection Zone standard, therefore removing the Category 1 Bushfire Prone Vegetation classification.

It is understood that the current Concept Proposal and the scope of the Stage 1 works, including the implementation of necessary bushfire protection measures, are consistent with RFS requirements. Referral to the RFS is required under the integrated provisions of the Act.

#### NSW Office of Water (NOW)

The Stage 1 area of the NEV site is punctuated by two (2) gullies which run west to east/north-east. The Stage 1 DA proposes works to these gullies which are hereafter referred to as the middle western gully and northern gully which dissect the 2(a) zoned land on the site. The location of the gullies is shown in **Figure 3** below:

Consultation has been undertaken with NOW regarding works proposed to the gullies. NOW has indicated that the drainage depression to the south of proposed Lots 10, 21, 22 and 35 (the middle western gully) may constitute a river under the *Water Management Act 2000* and therefore, may be a first order watercourse. This would require a Core Riparian Zone ("CRZ") of 10 metres in width from the top of the bank on either side of the watercourse.

The consequence of this classification is significant for the Co-operative, as it prohibits the building of infrastructure within the CRZ and the Co-operative would be required to ensure that the CRZ remains, or becomes vegetated with fully structured vegetation.

An examination of relevant case law has been undertaken by Mattila Lawyers and supports the position that the middle western gully is in fact a drainage depression (refer **Appendix T1**). Mattila Lawyers conclude that NOW's classification of the drainage depression is inconsistent with the definition of a "River" under the *Water Management Act 2000* and the interpretation of the definition of "watercourse" taken by the Courts. The Co-operative and the consultant team, therefore maintain that the gully is a drainage depression and is not a river and therefore, that a CRZ should not be established. Based on this position, the current DA does not accommodate a CRZ and the gully is now proposed to be managed to an Asset Protection Zone standard.



Figure 3: Location of gullies within Stage 1 area

This matter will be the subject of further discussion with NOW during the assessment phase of this Stage 1 DA. Notwithstanding this, works are proposed within 40 metres of the northern gully and referral to NOW under the integrated provisions of the Act is required. Refer to further discussion in **section 4.1** of this report.

#### **Community Engagement**

The Co-operative has undertaken ongoing consultation with the local community of Narara since their acquisition of the land. The communication strategy has typically includes regular letter box drops, information meetings and open-days on site. Details regarding the proposed redevelopment of the NEV site are also posted on the Narara Ecovillage website <u>www.nararaecovillage.com</u>.

On 14 December 2013, another community information session was held to inform the community of the impending lodgement of the Stage 1 DA. Approximately 500 letters were distributed by letterbox drop to local residents of Narara. The meeting had limited attendance. Notwithstanding this, all attendees were in support of the proposal. Only one resident raised a concern in relation to potential traffic impacts on the local road network as a result of the redevelopment of the site.

The Co-operative intend to keep the community well informed in relation to future stages in the development of the site and will continue with its communication policy and website.

## **1.4** The Applicant and the Project Team

#### 1.4.1 The Applicant

Narara Ecovillage Co-operative Ltd (the Co-operative) is incorporated as a trading co-operative under the *Co-operative Act 1992* (NSW). The Co-operative is controlled by a Board of 5 directors. The role of the Co-operative is to raise members share capital and bank financing for the purchase and development of NEV.

Specifically, the Co-operatives role in the development of NEV, as a community title development, includes:

- the engagement of the property development core team;
- to facilitate negotiations and respond to necessary requirements of Gosford City Council as part of the development approvals process;
- the sale of lots to members as part of the staged development of the site; and
- the retention of part of the property for commercial use to contribute to the Community Association sinking fund.

Once development consent is secured for the community title subdivision of the site, the Board will establish the Narara Ecovillage Community Association (NECA). Subject to the registration of the NEV community title plan with the LPI, The NECA will be constituted under the *Community Land Development Act 1989* (NSW).

The responsibilities of the NECA will include the following:

- administration and enforcement of the by-laws of the community scheme;
- raising funds by levying its members in the scheme to carry out its duties; and
- managing the administrative find and sinking fund to cover the costs of maintaining the association property and any other relevant expenses.

The Co-operative will maintain an ongoing role in the development and management of the site.

#### 1.4.2 The Project Team

This SEE has been prepared on behalf of the Co-operative, the proponent for the project. The specialist consultant team are detailed in **Table 1** below:

CONSU	LTANT	FIELD
•	Hill Thalis	Concept Planning and Architecture
٠	Sara Roach Planning Services/ Michael Woodland Consulting Pty Ltd	Urban Planning Consultants
•	McGregor Coxall	Landscape Architecture
٠	Chase Burke Harvey	Civil Engineering
•	Chase Burke Harvey	Surveying
•	Robert Payne	Ecology
•	Michael Shaw	Arboriculture
•	АРВВ	Bushfire
•	Douglas Partners	Geotechnical and Contamination
•	Woodlots & Wetlands	Integrated Water Management System
•	Harris Page/ Aquacell	Hydraulic Engineering (water & sewer)
•	Chase Burke Harvey	Waste Management
•	Musecape	Heritage
•	Lighting Art Science	Lighting
•	City Plan Services	Project Management

Table 1: Consultant team for the NEV site

#### **1.5 Report Structure**

This SEE provides an assessment of the proposal against the relevant matters for consideration under Part 79C of the *Act*. The proceeding sections of the SEE are structured as follows:

Table 2: Report Structure

Section		Title
• Section 2.0	•	The Site and its Context
• Section 3.0	•	The Stage 1 Development Proposal
• Section 4.0	•	The Statutory and Strategic Planning Framework and Assessment
• Section 5.0	•	Environmental Assessment
• Section 6.0	•	Conclusion

## 2.0 The Site and its context

## 2.1 The Site

The NEV site is located at 25 Research Road, Narara and is legally referred to as Lot 13 in DP 1126998. The NEV site has a total area of approximately 62.97 hectares of which the portion of the site zoned 2(a) Residential pursuant to Gosford Planning Scheme Ordinance (GPSO) is approximately 11.5 hectares (refer **Figure 4** below). The remainder of the site is zoned 7(c2) Scenic Protection Rural Small Holdings, 7(a) Conservation and 6(a) Open Space.



Figure 4: Site Aerial (Source: Hill Thalis)

The Narara Ecovillage site contains in excess of 56 buildings and structures which were used during the sites' former occupation as the Gosford Horticultural Research and Advisory Station. The Plan at **Appendix D** illustrates the location of a number of existing buildings on the site.

The existing structures include a number of glasshouses, sheds, workshops and offices associated with horticultural research and production. Two dwellings are located on the site, being the Foremans Cottage (identified as '3' in **Figure 4**) and the Managers Cottage (identified as '4' in **Figure 4**), the latter of which is identified as a heritage item in Schedule 8 of the GPSO. A number of large multi-purpose buildings including a Visitors Centre (identified as '1' in **Figure 4**) and Administration Block (identified as '2' in **Figure 4**) are located at the southern end of the site and are directly accessed from Research Road. A number of marked and informal parking spaces are currently available in close proximity to these administrative buildings and are also accessed from Research Road.

The location of the NEV site is illustrated in **Figure 5**. It is accessed off Fountain Road to the south east. The site includes a series of internal road (private roads) with the main spine road through the site named Research Road- refer **Figures 6** and **7** below.



Figure 5: Location Plan- Narara Eco Village (Source: Hill Thalis)



**Figure 6**: Access to the site from Fountain Road. Dwellings on Fountain Road to the south-east of the site.



Figure 7: Research Road looking north from the entry off Fountain Road.

The NEV site contains varied topography. Narara Creek runs across part of the site, flowing from the State Forest to the 2(a) residential zoned land to the south. The areas surrounding Narara Creek are flood liable.

The land is steeper along the western parts of the site. There are a number of gullies running from the west to the east through the site towards Narara Creek. Generally, the western slopes of the valley fall to the northeast at approximately 10-15°, with surface levels ranging from RL 55 AHD along the western end of Stage 1 to approximately RL 10m AHD along the eastern side of the site.

The section of the site which is the subject of this application mainly consists of citrus orchards and managed vegetation including the gardens surrounding the buildings and mown grass within the open areas of the site. The vegetation on the remainder of the site includes Dry Sclerophyll Low Open Forest on the ridgelines to the northwest, Closed Forest growing on the alluvial flats of Narara Creek to the northeast, and Closed Remnant Freshwater Grassland with sedgeland/rushland along the alluvial flats of Narara Creek.

A 30 metre wide electricity easement crosses the site in a south westerly to a north easterly direction, as illustrated in the site survey at **Appendix A**.

An existing dam is located in the north-western corner of the site and was previously used for onsite irrigation for the Gosford Horticultural Research and Advisory Station. The dam has a capacity of approximately 43.3 mega litres.

Figures 8 to 13 illustrate the general site features.



Figure 8: Existing orchards in south-eastern corner of the site



Figure 9: View over 6(a) zoned land (flood liable) looking north-east.



Figure 10: View of Fisheries Building looking south along Research Road.



Figure 11: View looking north west towards Managers Cottage from Research Road



Figure 12: View looking west towards the Foreman's Cottage. Strickland State Forest is in the background.



Figure 13: The dam- view from eastern edge looking north-west. Strickland State Forest is in the background.

### 2.2 Local Context

The NEV site is bounded by rural residential development to the south and the east, residential lots to the east and the south- east, and dense bushland to the west, north, north-east and south-west (**Figure 5**). The surrounding residential development predominantly comprises standard residential lots with a mix of single and two storey dwellings.

Strickland State Forest adjoins the site to the north and the west and it covers an area of approximately 468 hectares. Strickland State Forest includes areas of dense open forest and closed forest (rainforest) vegetation and exposed low open woodland vegetation. There is no formal public access from the NEV site to Strickland State Forest.

Narara train station is located approximately 1.3 kilometres to the east of the site. A small local shopping centre is located at the eastern end of Dean Street. The Narara Valley High School is located on Fountain Road amongst predominantly residential development. The Narara Valley Community Centre is located on the corner of Pandala Road and Carrington Street (**Figure 5**).

Niagara Park Shopping Centre, High School and recreation facilities are located to the north east of the site.

Employment areas of West Gosford, Niagara Park and Wyoming are all located within close proximity to the site. Gosford Town Centre is located approximately 4 km to the south of the site.

Figure 14 below illustrates the proximity of the subject buildings to neighbouring land.



Adjoining residential development in Monarchy Way.

Figure 14: Proximity of NEV site to neighbouring residential development.

**Figures 15** and **20** illustrate the surrounding site context and the condition along the south-eastern boundary of the NEV site relative to the dwellings on the western side of Monarchy Way.



Figure 15: View looking north along Fountain Road toward the NEV site.



Figure 16: Fountain Road looking east towards Narara High School.



Figure 17: View of Monarchy Way looking north.



Figure 18: Dwellings on western side of Monarchy Way.



Figure 19: View from Research Road (southern end of site) looking to rear of dwellings on Monarchy Way.



Figure 20: View looking south east across the orchards to Fountain Road and dwellings beyond.

## 3.0 The Stage 1 Development Application

The information included in this section of the SEE is based on information provided by the Cooperative and should be read in conjunction with the appended supporting technical reports.

## 3.1 Stage 1 Overview

This Stage 1 application for the NEV site seeks approval to subdivide the site under the provisions of the *Community Land Development Act 1989* to create a Community Title Scheme. The scope of the Stage 1 works is illustrated in the Stage 1 Concept Plan prepared by Hill Thalis (refer **Appendix B1**). This plan illustrates the general arrangement for the subdivision, site access, existing structures to be retained and demolished; and existing and proposed landscape features and supporting infrastructure.

Specifically, the Stage 1 application seeks approval for the following works:

- The creation of a community title scheme comprising a 40 lot subdivision.
- To support the subdivision of the site and to meet the servicing requirements for Stage 1, the following ancillary works are also proposed:
  - Remediation of the site;
  - $\circ~$  The demolition of 15 redundant site structures and the removal 45 trees including 1 hollow bearing tree;
  - Limited bulk earthworks to enable the construction of the Stage 1 works (roadways and infrastructure);
  - The construction of the site's road network including new internal circulation roads accessing the community title lots and to facilitate servicing of the site by emergency services. The Stage 1 works also include two (2) bridges over the middle western gully and the construction of visitor car parking and the concept design for access to the private residential lots;
  - Provision of essential utility services and infrastructure to service Stage 1 of the development including the construction of an integrated water management system (water recycling facility and sewer reticulation system), the extension and augmentation of electricity and telecommunications through the site; a waste storage area and mail room;
  - The implementation of the first stage in a comprehensives landscape strategy for the site including the greening of common areas, key access ways through the site, the creation of contour gardens and feature entry detail. The works include specific landscape treatment adjacent to the internal roads;
  - All works relevant to Stage 1 to make site bushfire safe including the establishment of asset protection zones; and
  - The first stage in the ecological restoration of the site including enhancement works to the green corridors and implementation of significant landscape works to offset tree loss on the site.

The section below provides a detailed description of the proposed development works which comprise this Stage 1 application. This section should be read in conjunction with the documents and plans appended to the report. In particular, the Stage 1 DA should be read in conjunction with

the Draft Community Title Subdivision Plan (**Appendix E**) and the Civil Works Package prepared by Chase Burke Harvey (**Appendix L-N**) and the Design Report prepared by Hill Thalis (**Appendix B**).

### 3.2 Subdivision

The Concept Plan for the site envisages the subdivision of the development under the *Community Land Development Act 1989* (NSW) to create a Community Title Scheme. The concept for the Draft Community Title Subdivision Plan (Draft Plan of Subdivision) has been prepared by Chase Burke Harvey and is provided at **Appendix E**.

The indicative layout for the 40 lot community title subdivision, which also proposes the creation of the 35 private residential lots for Stage 1, is illustrated in **Figure 21**.

The subdivision and lot layout provides for creation of the following:

- Lot 1: A Community Association Lot- Lot 1 is vested in the community association that is entrusted with the ownership and management of the community property for the benefit of its members. This includes the site infrastructure, access ways, roadways, gullies and associated landscaped/open space areas.
- Lots 2-36: 35 Private Residential Lots- these lots are proposed to be individually sold for future dwelling house development. The lot sizes for future residential development in Stage 1 range from 474 to 800sqm for conventional residential development. Two large lots for cluster housing comprising 7299sqm (Lot 15) and 6243sqm (Lot 36) are also proposed.
- Lot 37- A Private Lot: Lot 37 will be initially owned by the Co-operative (as the developer). The lot configuration has been created to reflect future stages in the development of the NEV site. This lot may be subject to further subdivision associated with the staged development of the site and will require community association approval. There are no development contracts proposed in this community title subdivision.

Lot 37 contains a number of existing buildings including the Administration Building and the Visitors Centre and these will be retained by the Co-operative. It is noted that these buildings are the subject of separate license agreements constituted under common law between the Co-operative and the Sydney Coastal Ecovillage Incorporated (SCEV). These licenses allow SCEV to enter, occupy, and use these buildings and the surrounding land for community purposes. The community use of the site is subject of a current DA being considered by Council, as detailed in **Section 1.2** of this SEE.

- Lot 38: Lot comprising 6(a) zoned Land- this lot contains all land currently zoned 6(a) pursuant to GPSO. This land is proposed to be dedicated to Council under the terms on an existing Voluntary Planning Agreement (VPA) which has been prepared for the NEV site in accordance with the requirements of the rezoning process undertaken by DPI and as stipulated in Section 8.1 of DCP No.175. The VPA makes specific provision for the dedication to Council of the 6(a) Open Space zoned portion of the site, together with a small area of land upon which a stand of Araucaria cunninghamii (Hoop Pines) are located.
- Lot 39: Lot comprising 7(c2) zoned land: Lot 39 will be initially owned by the Co-operative (as the developer). The lot configuration has been created to reflect the current zoning boundary.

This lot may be subject to further subdivision associated with the staged development of the site.

• Lot 40: Lot comprising 7(a) zoned land: Lot 40 incorporates the 7(a) bushland, the residual 7(a) land (which has one dwelling entitlement) and the dam. This land has been incorporated into one lot so as not to create a "split zone lot".



Figure 21: Proposed 40 lot Community Title Subdivision. (Source: CBH)

The Draft Plan of Subdivision also includes various easements associated with services and drainage, and proposed rights of way. A proposed restriction on the use of the land (6m wide) is also proposed at the rear of a number of private dwelling lots where this land forms part of the communal garden strategy.

The structure for the community title subdivision also details how Lots 15 and 36 will be subject to future subdivision (cluster housing lots) and Lot 37 will be potentially structured to accommodated Stage 2 and 3 in the development of the NEV site (**Figure 22**).



Figure 22: Community Title Structure (Source: CBH)

The application is supported by a draft Community Management Statement prepared by Andrews & Holms Lawyers, which will be provided to Council under separate cover. Pursuant to Schedule 3 of the *Community Land Development Act 1989;* management statement includes the following mandatory matters:

- The location, control, management, use and maintenance of all parts of the community property that is an open accessway.
- The control, management, use and maintenance of any other parts of the community property.
- Storage and collection of garbage and the related obligations of the community association.
- Maintenance of water, sewer, drainage, gas, electricity, telephone and other services.
- Insurance of community property.
- Executive committee of the community association, office-bearers of the committee and their functions.
- Meetings of the executive committee otherwise than at a meeting of the committee; and
- The keeping of records of proceedings of the executive committee.

The control, maintenance and management of the subdivision are proposed to be regulated through the by-laws contained in the management statement. These by-laws address the following matters:

- Ongoing service and maintenance contracts.
- Bushfire controls and requirements for maintenance.
- The implementation of the Property Vegetation Management Plan and Vegetation Management Plan (Ecological Restoration Plan).
- The heritage conservation of the site.

- The role and function of the network and retail operators licences under the Water Industry Competition Act 2006 (NSW).
- The allocation of unit entitlements for each lot.

#### 3.3 Remediation

The area which comprises the Stage 1 site is proposed to be remediated prior to the issue of a construction certificate for the Stage 1 works. A Phase 1 Preliminary Site Assessment report (PSA Report) has been prepared by Douglas Partners in accordance with SEPP 55 and is included at **Appendix F.** 

Douglas Partners has recommended that a Sampling and Analysis Quality Plan be prepared followed by a Phase 2 Environmental Site Assessment and a Remediation Action Plan. In accordance with the requirements of DCP No. 175, a Site Audit Statement will be issued for the site prior to the issue of a construction certificate for the Stage 1 works.

#### 3.4 Stage 1 Construction Enabling Works

The site preparation and construction enabling works for Stage 1 include demolition of existing structures, the clearing of existing vegetation required for the construction of the roadways and infrastructure and bulk earthworks. These matters are addressed separately below.

#### 3.4.1 **Demolition**

A number of buildings and structures on the site have been identified for demolition. The structures are typically located across lot boundaries proposed in the Draft Plan of Subdivision or are impacted by the infrastructure layout and therefore, retention is not feasible.

Fifteen (15) buildings have been identified for demolition. These buildings are identified as Buildings 3, 8, 11, 13, 30, 39, 45, 47 to 52, the fence around Building 17 and an unnumbered structure at the rear of Building 17, and are located on **Figure 23** below. Where possible, building materials will be stockpiled on site for recycling and adaptive re-use.

A number of the buildings proposed for demolition (Buildings 3, 8, 11, 13 and 30) have been identified as containing hazardous materials. Where buildings to be demolished have been identified as containing asbestos products, they will be removed by an AS-1 licensed asbestos removalist contractor in accordance with the NOHSC Code of Practice for the Management and Control of Asbestos in Workplaces and disposed of as asbestos waste to an appropriately licensed facility.

No heritage items listed in Schedule 8 (Environmental Heritage) of the Gosford Planning Scheme Ordinance are proposed to be removed to accommodate the proposal. All buildings and structures have been assessed as having low significance and not requiring retention. The exception is Building 39, an old A-Framed Glasshouse, which has been identified as being of 'moderate significance. MUSEcape has recommended that this structure be archivally recorded or alternatively, relocated on the site.


Figure 23: Buildings proposed to be demolished.

## 3.4.2 Tree Removal

Approximately 65 trees have been identified as being impacted by the Stage 1 works. A total of 45 of these trees will require removal to accommodate the scope of works proposed in this application. All trees identified for removal, with exception of a *Syncarpia glomulifera* (Turpentine, Tree 244, located in south-western bend in Road 2- refer **Figure 24** below), have been assessed as having low to moderate arboricultural significance. The Tree 244 has been allocated a high arboricultural significance rating and a moderate retention rating.

The tree removal includes 7 non-heritage listed specimens of *Pyrus calleryana* (Callery Pear) in a row along the entrance drive, 5 specimens of *Carya illinoinensis* (Pecan) north of the former Grafting Shed / Administration Office (Building 24) and one specimen of *Carya illinoinensis* in the row north of the former Manager's residence are also proposed to be removed.

In addition to the above, a small area of native vegetation will be required to be removed from the southern bank of the middle western gully to accommodate the proposed asset protection zone. Therefore, approval will be required under the *Native Vegetation Act 2003*.

One hollow bearing tree (Tree 191) is required to be removed as it is located within the road reserve- refer **Figure 25**. The Tree is a multi-stemmed *Callistemon viminalis* with a hollow at the base. The project ecologist has recommended that the loss of this Tree 191 be offset and substituted with a bat roosting box.

No heritage listed trees in Schedule 8 (Environmental Heritage) of the Gosford Planning Scheme Ordinance are proposed to be removed to accommodate the proposal.

An arboricultural audit of the trees on the NEV site has been undertaken by the project appointed arborist, Michael Shaw and is provided at **Appendix I.** All trees proposed for removal will be replaced by sympathetic new landscaping of an equivalent landscape contribution and size at maturity.



Figure 24: Location of Tree 244 (Source: Michael Shaw)



**Figure 25:** Location of Hollow Bearing Tree No.191- note, Plan shows location of 10 hollow bearing trees within the Stage 1 area (Source: Robert Payne)

## 3.4.3 Bulk Earthworks

The bulk earthworks for Stage 1 are principally associated with the road construction. To allow for the provision of underground services/utilities an additional unpaved width of 1.2m adjacent to the road pavement and at the same cross fall as the road pavement has been adopted, this will double as an informal pedestrian footway. There will also be some temporary regrading of sites relative to the new road formation to reconcile level changes and to reduce the steepness of a number of batters alongside the roads. Batters of 2.0H:1V have been generally adopted for the project in accordance with the Slope Stability Report prepared by Douglas Partners, which is provided at **Appendix M**.

Concept site regrading plans and sections have been prepared for the site by Chase Burke Harvey and are provided at **Appendix N** and **Appendix N1**. One of the overarching design principles for the NEV site has been to minimise the extent of cut and fill to accommodate future development. In most instances, the regrading associated with the roads is generally less than 1.0m. However, there are a number of areas particularly, adjacent to the western extent of Stage 1 where regrading will result in up to 2.0m variation in the current site levels.

It is estimated that the extent of cut and fill associated with Stage 1 works comprise approximately 3700m<sup>3</sup> of cut and 2700m<sup>3</sup> of fill. The net balance of the fill is proposed to be stockpiled on site for future use.

Erosion/sedimentation controls are proposed to be installed prior to commencement of any construction works and will be maintained until the finished works have been stabilised. Concept details of the erosion/sedimentation control requirements for this development have been prepared by Chase Burke & Harvey and are detailed on Plan ES12242 at **Appendix R**.

## 3.5 Road network

The road network proposed for the NEV site is based on the concept which utilises and builds on the existing pattern of streets to make a connective and walkable network through the site. All roads will be maintained as private road and will be encumbered by various rights-of-way and easements, as appropriate.

The components of the road network are illustrated in the NEV Design Report provided at **Appendix B** and include:

- establishing contour streets as the primary way of ordering redevelopment of the site;
- widening the space at the ends of contour streets to spatially modulate the street;
- consolidating plantings and accommodate small groupings of shared car parking; and
- introducing cross streets (perpendicular to the slope) with more regular reservation widths for increased connections.

The road network design is illustrated in **Figure 26** below and consists of a series of one-way and two-way roads. The road network includes the construction of two (2) bridges over the middle western gully to facilitate efficient site access and in order to minimise the extent of site invention and excavation.

The carriageway width for a one-way road is proposed to be 3.5m and the carriageway width for a two-way road is proposed to be 5.5m. The road circulation and the location roads have been prepared to promote practical access to the all lots and to comply with the requirements of *Planning for Bushfire Protection*. The grade requirements of AS2890.1 have been adopted for the proposed road network.

The road network is illustrated in the Stage 1 Road Circulation Plan prepared by Chase Burke & Harvey's Plan RC12242 at **Appendix O**. This plan should be read in conjunction with the Road Grading Plans provided at **Appendix N** and **Appendix N1**.



Figure 26: Stage 1 Circulation Road Plan (Source: CBH)

## 3.6 Infrastructure and Services

#### 3.6.1 Water and Sewer

A key component of the water and sewer infrastructure proposal for the site is an Integrated Water Management System (IWMS). The IWMS is a water recycling facility and sewer reticulation system with a maximum capacity of 50 kilolitres per day and is a closed system. The IWMS will capture waste water from the development and distribute it for beneficial use within the development site.

A report on the IWMS has been prepared by Woodlots & Wetlands and is provided at **Appendix S**. The Concept Design and an overview of the IWMS is provided at **Appendix T1** and **Appendix T**. The design refinement of the IWMS will be subject to detailed consultation with the IPART as part of the application which will be lodged concurrently for a Retail Operator's Licence and a Network Operator's Licence.

This infrastructure will be privately owned and operated and maintained in accordance with WICA licensing requirements. No connection to Council water or sewer services will be required. Once Stage 1 of the IWMS is fully operation, the existing connections to Council's sewer and water system will be discontinued.

The key infrastructure to be installed on the site is as follows:

- 1. **Potable and Recycled Water Systems** this will comprise a combination of rainwater (collected from roofs of dwellings), potable water (water supply originates from the on-site dam) and recycled water. In the future water tanks with a 10 cubic metre capacity will be installed on all residential lots as part of each residential development.
- 2. Wastewater treatment and recycled water system (waste water treatment plant)- this will comprise the installation of a Membrane Bioreactor (MBR) as the primary treatment technology-although, the final treatment process selected will be determined in consultation with NSW Health and its operation will be subject to a WICA license. This infrastructure will combine biological treatment with ultra filtration to produce high quality treated water.

The MBR is proposed to be located on the eastern boundary of the site adjacent to the 6(a) zoned land and directly to the south-east of the Fisheries Building. The treated water will be sent to two (2) treated water storage tanks (each 100 kilolitres in volume) for reuse within the NEV community and for irrigation. An example of the scale and visual appearance of an MBR is provided in **Figures 27** and **28** below.

**3.** Potable water supply- this will be supplied from an existing dam on the site. A treatment plant, to improve the water quality and ensure it meets the requirements of the Australian Drinking Water Guidelines and WICA requirements, is proposed to be installed near the existing dam in the vicinity of the existing pump station. The treated water will be stored in header tanks near the dam and is proposed to be supplied by gravity to all future dwellings.

The IWMS is fully detailed in the Integrated Water Cycle Management Plan prepared by Woodlots and Wetlands Pty Ltd provided at **Appendix S**. This Plan includes an assessment of demand and supply for the water cycle components based on a maximum density of 130 residential lots, the demand for irrigation water and wet weather storage, waste water modelling output and the use of dam water to supply potable water to the NEV site. In addition, the Plan includes a land capability assessment for a proposal for reclaimed water irrigation and an associated soil assessment.

It is proposed to construct the IWMS in two stages. Details regarding the staging are provided in **Section 3.6.2** below. The Stage 1 construction will ensure the capacity of the network can accommodate the demand and supply requirements of 60 dwelling and other on-site uses.



Figure 27: Example of the MBR which has been installed at the Blacktown Workers Club (Source: Aquacell)



Figure 28: Typical details for MBR dimensions and details. (Source: Aquacell)

#### 3.6.2 Staged Implementation of IWMS

It is proposed to construct the IWMS in 2 stages to largely respond to anticipated population and the capacity of the system. The stages are anticipated as follows and are detailed in the Water and Waste Water System Overview and Integrated Water Cycle Management Plan at **Appendices T** and **S**, respectively.

## • Wastewater treatment and recycled water system-

- <u>waste water treatment plant</u>: the plant will be constructed in 2 stages to correlate with the future increase in population on the site. The first stage will be capable of handling at least 30 kL/day, whereas the demand for Stage 1 is estimated at 24.3 kL/day).
- <u>Screening, buffer and treatment water storage</u>: The first stage will include infrastructure for the full plant capacity for screening, buffer and treated water storage.
- <u>Biological Treatment:</u> this infrastructure will be split into 2 equal stages. This allows the necessary control over the biological system during the early stages of development when the population and wastewater supply volume is low.
- <u>Effluent Irrigation</u>: Woodlots & Wetlands has estimated that in the development of Stage 1, there is likely to be extended periods when reclaimed water supply exceeds demand and accordingly, it is proposed to use this water to irrigate the citrus orchard to the south of Stage 1 (part of proposed Lot 37). At Stage 2, when there is sufficient water flows, an irrigation dam with a storage capacity of 3ML will be required. The location of the dam to be constructed in Stage 2 will be resolved in consultation with IPART as part of the WICA licence.
- The potable water supply system:- all infrastructure associated with the potable water supply will be constructed upfront in 1 stage.

## 3.6.3 Public Utilities

All public utilities services including Telstra, Gas & Power are available at the Research Road Frontage of the site and are available to the site. Preliminary contact has been made with the relevant service authorities, which has confirmed that these services will be available to the site.

Some public utilities have previously been extended onto the site to service the existing buildings. However, it is likely that these will be adjusted or removed, as required to suit the development.

The proposal for Stage 1 envisages that the public utilities will generally be located parallel to the proposed road network within a 1.2m allocated corridor. When the public utility services are extended through the site to existing buildings, these will be adjusted or retrofitted to the requirements of the relevant authority and to suit the overall development of Stage 1.

Details of the preliminary consultation with public utility companies is provided at Appendix P.

## 3.7 Stormwater Management

The stormwater management system proposed for the NEV site is based on Water Sensitive Urban Design principles and is detailed in the Integrated Water Management Plan prepared by Woodlots & Wetlands at **Appendix S**. The concept for the stormwater management for Stage 1 is illustrated on the Concept Stormwater Plans prepared by Chase Burke and Harvey at **Appendix Q**.

The stormwater management system will typically incorporate the use of bio-retention swale drains. Where it is not practical to utilised swale drains, a kerb, pit and pipe system will be constructed. Where the slope of the site prevents the use of swale drains, smaller rock lined/pitched open drains, stabilised with geo fabric, will be constructed to direct stormwater flows to a piped system. Based on this approach, the key components of the stormwater system include:

- contour banks upslope of the development, designed to convey bushland runoff to local gullies;
- protection of gully discharge points via use of turf reinforced mesh and rock rip rap;
- soak-a-ways (shallow infiltration basins) to retain runoff from individual lots where it is difficult to connect to a common swale;
- pits and pipes/ rock lined drains to convey road runoff where the grades average over 7 to 10%;
- bio-retention swales to convey local runoff parallel to roads where grades are moderate;
- bio-retention basins in less steep areas to treat runoff converging from roads and lots;
- semi-permanent infiltration basins in lower parts of the landscape; and
- inclusion of environmental features such as frog ponds and permaculture beds within the stormwater swales and bio-retention ponds.

A typical detail for the stormwater design is illustrated in **Figure 29** below. It is noted that the swale drain illustrated at the rear of Lots 10 to 15 and 16-21 is part of the contiguous common gardens at the rear of the residential lots which will form part of the network of landscaped gardens and pathways through the site. Refer to further discussion in **Section 3.9** below.



Figure 29: Extract from Stormwater Management System (Source: CBH)

## 3.8 Landscape Strategy

The landscape strategy for the NEV site has been prepared by McGregor Coxall and is detailed in the Design Report at **Appendix B**. The key principles underpinning the strategy are:

- to work with the site's existing history in terms of its native forest and introduced exotic plantings that were part of its historic past;
- to recognise and respond to the site's unique topography and water movement; and
- to minimise environmental impact of the construction of the landscape, in terms of materials by employing environmentally sustainable strategies including recycled materials.

The first stage of this strategy is proposed to be implemented in Stage 1 and includes the following elements as illustrated in **Figure 30**:

- Potential entry planting external to the site;
- Landscaping of the main entry road (Research Road) and other new roads within Stage 1 including new street planting and landscaping to carriageways including landscaping to drainage swales. It is proposed to work with the existing landscape to reinforce the character of the site. Exotic tree species are proposed to be planted along Research Road and endemic species to all other roads- refer Landscape Planting Palette in the Design Report.
- Streetscape treatments between a number of road edges and the boundaries of proposed Lots;
- Restoration of gullies through the site in accordance with the Ecological Restoration Management Plan- refer further discussion in **Section 3.10** below.
- The landscape treatment of the swales which form the common gardens are the rear of the proposed residential lots. This strategy builds on the concept devised for the site by Hill Thalis of creating a linear accessways through the site which connect into the network of roads and open space throughout.

As detailed in section 3.4.3 above, some regrading works will be required adjacent to new roads to stabilise the land. Where batters are required, some temporary measures (including grass seeding) will be employed to stabilise the batters and prevent soil erosion prior to the development of the individual lots.

**Figures 31** and **32** illustrate the typical landscape detail for the Research Road, including the proposed palette of materials and finishes and the general arrangement for the landscaping treatment to the carriageway edge comprising street tree planting, the swale, access to residential lots and potential car parking provision. Driveway access will not be provided to the individual lots as part of this application however, concept details have been prepared to show how access will be typically achieved.



Figure 30: Landscape Plan for Stage 1 of the NEV site (Source: McGregor Coxall)



Figure 31: Typical landscape detail for Research Road. (Source: McGregor Coxall)



Figure 32: Selected section through Research Road (Source: McGregor Coxall)

## 3.9 Bushfire

The NEV site is identified as containing bushfire prone vegetation (Category 1 and 2 Bushfire Prone Vegetation). Subdivision of bushfire prone land is Integrated Development as defined by Section 91(1) of the Act and requires the consent of the Commissioner of the NSW Rural Fire Service, under Section 100B of the *Rural Fires Act 1997*. Council Bushfire Prone Land Map has mapped the unmanaged vegetation within the development site as Category 1 Bushfire Prone Vegetation, except for a small area of Category 2 vegetation located to the south of the large dam.

The requirement for 100 metre wide buffer zone to the Category 1 vegetation impacts the existing cleared areas of the development site, therefore triggering the requirements of Sections 79BA and the integrated provisions of the Act.

A Bushfire Protection Assessment Report has been prepared by ABPP (**Appendix V**). The Report undertakes an assessment of the bushfire protection measures required to address the bushfire risk to the future development of the site, in accordance with Planning for Bushfire Protection and the requirements of the Rural Fires Regulation 2008.

In order to mitigate the risk of bushfire hazard, ABPP has advised that the bushfire loads on the site and within the designated APZ's will need to be managed including to minimise fuel loading at ground floor level to ensure that fuels are discontinuous and to avoid transfer of fire to the development from fires burning in the adjoining bushfire prone vegetation. These works will be undertaken as part of this application and in order to ensure that the site is bushfire safe and maintained to current recognised standards.

The required APZ's have been graphically presented by ABPP on plan for the concept proposal and Stage 1, as illustrated in **Figures 33** and **34** below:



Figure 33: APZ's- Concept Plan

Figure 34: APZ's Stage 1

In addition to the APZ requirements, a number of additional bushfire protection strategies for the proposed subdivision are recommended and will be completed as part of the Stage 1 works. These works include the following:

- the provision of fire fighting water supplies;
- the construction of access requirements for emergency service vehicles; and
- the preparation of an evacuation management plan.

## 3.10 Ecology

The Ecological Restoration Plan prepared by Robert Payne (**Appendix K**) includes recommendations for the appropriate ecological management of the NEV site and is required to be prepared in accordance with section 8.3 of DCP 175. The Ecological Management Plan provides a prescriptive framework for the management of known threatened species habitat; weed management, potential impacts associated with the sub-division and ongoing management. Management matters include replacement tree planting for Camphor Laurel, threatened plant species management, feral animal control, removal of weeds, and ecological restoration of floodplain wetlands and riparian grasslands.

Ecological Restoration Plan mainly addresses both embellishment of the DCP 175 area and the eradication of weeds, particularly any noxious weeds or weeds of national significance including Lantana, Small-leaved Privet and Fireweed and are in need of more urgent eradication.

The works indentified in the Ecological Restoration Plan proposed to be implemented as part of the Stage 1 include the following:

- To provide for a 20m buffer zone around the known location of Syzygium paniculatum.
- To regenerate the native riparian grassland alongside drainage lines within the 10m riparian buffer zone, where required by the NSW Department of Water.
- To take steps, through discussions with Government Authorities, to eradicate the European Fox, the European Rabbit and Feral Cats.
- To undertake weed management including:
  - To eradicate the Small-leaved Privet from all relevant drainage lines and paddock areas;
  - To remove all noxious weeds that apply to the stage 1 area; and
  - To remove all weeds of national significance that apply to the stage 1 area.

The Co-operative has prepared a Property Vegetation Plan in conjunction with the Hunter Central River Catchment Management Authority (Catchment Management Authority) as required by Section 8.9 of the DCP 175. This Plan is currently under final review by the Catchment Management Authority. Any works required to be undertaken to the 7(a) zoned land will be negotiated with Council and the Catchment Authority as part of the development assessment process and implemented by the Co-operative as required to ensure the protection of the high environmental and scenic qualities of this western section of the site.

## 3.11 Construction Staging- Integrated Water Management System

An application will also be lodged concurrently with IPART for a Network Operators Licence and Retail Suppliers Licence under the WICA. This will specifically relate to the operation and supply of water and sewer services within the NEV site.

The application will seek approval for the entire IWMS and will acknowledge that the system will be implemented in 2 stages. Relevant to the obtaining the WICA Licence, is the need to obtain development consent in the first instance for the infrastructure pursuant to section 105 of State Environmental Planning Policy (Infrastructure) 2007 (refer further discussion in section 4.2.1 of this report).

In order to the WICA Licence to be issued for the entire IWMS (as opposed to only Stage 1), it is imperative that the determination of this application acknowledge the entire IWMS and that it will be constructed in two stages. Furthermore, that any conditions imposed on any development consent permit the following:

- Separate construction certificates and occupation certificates to be issued for the two stages of construction of the IWMS.
- That any restriction on the registration of the community title subdivision with the LPI be linked only to the completion of Stage 1 of the IWMS works (and not the entire IWMS), as these works are relevant to the supply of water and the sewage services associated with Stage 1 of the development of the NEV site.

## 3.12 Future Stages:

The development of Stage 1 will require future approval to be obtained for each dwelling house proposed to be constructed on each the private residential lots. It is anticipated that development will commence as soon as practicable and following the registration of the community title scheme with NSW Land & Property Information (LPI).

Fundamental to the design of all future housing will be the consideration of and general adherence to the design principles and consistency with the concept for the NEV site detailed in the Hill Thalis Design Report.

# 4.0 The Statutory and Strategic Planning Framework and Assessment

## 4.1 Statutory Planning Framework- Key Legislation

## 4.1.1 Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act)

The EPBC Act is the Commonwealth government's central piece of environmental legislation. It provides the legal framework to protect and management eight nationally and internationally important items including flora, fauna, ecological communities and heritage places. These items are referred to in the EPBC Act as matters of National Environmental Significance (NES).

Under the EPBC Act, any action (including a development, project or activity) that is considered likely to have a significant impact on matters of NES must be referred to the Commonwealth Department of Sustainability, Environment, Water, Population and Communities (SEWPAC). The purpose of the referral is to allow a decision to be made about whether an action requires approval at a Commonwealth level. If the action is declared a 'controlled action' then the approval of the Commonwealth is required.

The Flora and Fauna Assessment Gap Analysis Report (**Appendix J**) includes an assessment of the potential impact of this application on the significance of the identified flora and fauna species. The report should be read in conjunction with the Flora and Fauna Assessment prepared by Andrews Neil Pty Ltd (February 2006) for the site rezoning. In combination, the site surveys undertaken have indentified that the NEV site contains the following vulnerable species listed under the EPBC Act:

- the Magneta Lilly Pilly, *Syzygium paniculatum:* a single tree was located- refer to Addendum to Flora and Fauna Gap Analysis Survey Report at **Appendix J**; and
- Grey-headed Flying Fox.

In addition, the NEV site has been identified as containing 2 Endangered Ecological Communities (EEC's) comprising the Lowlands Rainforest and Freshwater Wetlands. The Flora and Fauna Assessment Gap Analysis concludes that potential impacts to the Lowland Rainforest will be minimised by the ensuring that new infrastructure is located away from the gullies. It is noted that the middle western gully has not been classified as being part of the Rainforest EEC. As the Freshwater Wetlands EEC is confined to the alluvial flats and therefore, is outside the Stage 1 development area, there is limited potential for impact on the EEC. Notwithstanding this, it is recommended that the wetland be appropriately managed and protected including to prevent the habitat becoming dominated by Cumbungi and to allow waterbirds to continue to utilise the habitat for feeding. Measures have been included in the Ecological Restoration Plan to address this matter and the management of the gullies.

Having regard to the findings of the commonwealth assessment undertaken by Robert Payne, it has been concluded that the Stage 1 works will have little impact on the Commonwealth listed species and that the proposed development is not expected to have any significant impacts on matters of NES listed under the EPBC Act. It is noted that a restriction on the land use for a 20 metres radius around the Magneta Lilly Pilly is included in the Draft Plan of Subdivision.

On this basis, it is advised that no approval is required through the Commonwealth under the EPBC Act.

## 4.1.2 Environmental Planning and Assessment Act 1979 (the Act) & The Environmental Planning and Assessment Regulation 2000 (the Regulation)

The Act and the Regulation provide the overarching planning legislation in NSW. The Act provides for the creation of the planning instruments that guide land use planning and development in the State. The key provisions of the Act and the Regulations as relevant to the proposal are addressed below.

#### Section 5 A

Section 5A of the Act provides for the consideration of environmental and biodiversity values and specifically the effects of development on species, populations and ecological communities and their habitats. Specifically, Section 5A(2) requires that the consent authority must take into account the following when determining an application:

- (2) The following factors must be taken into account in making a determination under this section:
  - (a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,
  - (b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,
  - (c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
    - (i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
    - (ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,
  - (d) in relation to the habitat of a threatened species, population or ecological community:
    - (i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and
    - (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and
    - (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the longterm survival of the species, population or ecological community in the locality,
  - (e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),
  - (f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,
  - (g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Matters relating to the assessment of the impact of the application on the species, populations and ecological communities and their habitats on the NEV site have been relevantly addressed in the Flora and Fauna Gap Survey at **Appendix J**. This report concludes that the project is unlikely to have a significant impact on threatened species and their habitat identified on the site. A number of mitigation works and strategies are recommended in the Flora and Fauna Gap Survey to ensure that the environment of the NEV site is improved above its current condition and to minimise impacts to threatened species and their habitats. Specifically, these measures include:

- 1. to undertake weed removal around the tree of *Syzygium paniculatum* for a distance of 20 metres (as set out in DCP 175) and not to introduce any impure forms of *Acmena spp*. or *Syzygium spp*. into the site through the horticultural trade for landscaping purposes elsewhere throughout the property. The removal of the unwanted intrusive *Acmena sp*. from the middle-western gully and any other gully in which it occurs.
- 2. To install only low level lighting against the forest edge and the dam because of the presence of foraging threatened fauna species.
- 3. To inspect buildings prior to demolition to ensure that no bat roosts are apparent behind battons and struts.
- 4. To install a number of microbat roost boxes, suitable for colonization by the Greater Broadnosed, Southern Myotis and the other forest bats along the forest edge, equivalent to the number of hollow trees which will be removed.
- 5. To place restrictions for domestic dogs and cat management due to the fact that there is the potential for the Long-nosed Potoroo to become established on the site.
- 6. To implement best practice soil erosion and sediment control structures to protect the Freshwater Wetland EEC and Narara Creek.
- 7. To ensure that procedures for tree pruning minimize environmental impacts to threatened fauna.

Based on the above mitigation measures and the ecological restoration works for the NEV site, the application is unlikely to have a significant impact on threatened species or their habitat.

#### Section 79C

The proposed development has been assessed and evaluated against the relevant heads of consideration pursuant to Section 79C of the Act. Section 79C of the Act requires the following matters be considered in the assessment of the proposed development.

#### 79C Evaluation

#### (1) Matters for consideration—general

In determining a development application, a consent authority is to take into consideration such of the following matters as are of relevance to the development the subject of the development application:

(a) the provisions of:

(i) any environmental planning instrument, and

(ii) any draft environmental planning instrument that is or has been placed on public exhibition and details of which have been notified to the consent authority (unless the Director-General has notified the consent authority that the making of the draft instrument has been deferred indefinitely or has not been approved), and

(iii) any development control plan, and

(iiia) any planning agreement that has been entered into under section 93F, or any draft planning agreement that a developer has offered to enter into under section 93F, and

(iv) the regulations (to the extent that they prescribe matters for the purposes of this paragraph), that apply to the land to which the development application relates,

- (b) the likely impacts of that development, including environmental impacts on both the natural and built environments, and social and economic impacts in the locality,
- (c) the suitability of the site for the development,
- (d) any submissions made in accordance with this Act or the regulations,
- (e) the public interest.

The key statutory and non-statutory framework reference in 79C(1) (a) is addressed in this section of the report. The assessment of the likely environmental impacts of the proposal and matters for consideration with reference to section 79C(1) (c) to (e) are addressed in **Section 5.0** of this report.

The provisions of Act and the Regulations that are relevant to the proposal are considered below.

## **Objects of the Act**

The proposal is considered to be consistent with the objects of the Act for the following reasons:

- it promotes the orderly and economic use of the land;
- it will provide social and economic benefits to the broader community through opportunities to support additional housing and housing choices in the Gosford LGA;
- it has been designed to the heritage and significant environmental qualities of the site and will not result in unacceptable environmental impacts; and
- it is will provide an outcome that is consistent with the principles of ecologically sustainable development.

#### Integrated Development

As required by Section 91 of the Act, additional approvals will be required in order for the development to be carried out. The development is integrated development with respect to the *Rural Fires Act 1997* and the *Water Management Act 1997*, as set out in **Table 3** below:

Relevant (NSW)	Act	Comment	Referral
Rural Fires 1997	Act	As the land which is subject to the community title subdivision is identified as bushfire prone land on Council's Bushfire Prone Land Map, the application is integrated development as defined by section 91(1) of the EP&A Act and requires the consent of the Commissioner of the NSW RFS under Section 100B of the <i>Rural Fires Act 1997</i> .	The application is integrated development and referral to the NSW RFS is required pursuant to section 91A of the EP& A Act
Water Management 2000	Act	Works are proposed within 40 metres of waterfront land including to regenerate the native riparian grassland alongside drainage lines within the 10m riparian buffer zone (applies to the northern gully only as first order streams, noting that the middle western gully is not a first order stream), road and infrastructure works- Refer to works illustrated in <b>Figure 35</b> below. Therefore, an approval under section 90 of the <i>Water Management Act</i> 2000 will be required and the application is therefore, integrated development as defined by section 91(1) of the EP&A Act.	The application should be referred to the NSW Office of Water for consideration.

Table 3: Integrated Development



Figure 35: Works proposed adjacent to the northern gully (Source: CBH-Extract from Concept Road Grading Plan)

## **Designated Development**

In accordance with Section 77A of the Act, designated development is development that is declared designated development by either an environmental planning instrument or the Regulations. This application includes the construction of an IWMS comprising a water recycling facility and a sewerage reticulation system. As relevant to this application, Schedule 3 of the Regulation establishes the triggers for when development of this type is 'designated development'.

Pursuant to Clause 29, Part 1 of Schedule 3 of the Regulation, the IWMS proposed for the NEV site is defined as a 'sewerage system' and therefore, is designated development. However, Clause 37A of Schedule 3 states the following:

"(1) Development of a kind prescribed in Part 1 is not designated development if:

- (a) It is ancillary to other development, and
- (b) It is not proposed to be carried out independently of that other development

(2) Subclause (1) does not apply to development of a kind specified in clause 29(1)(a)."

The IWMS is considered to be ancillary development as the dominant purpose of the development application is the subdivision of the land. The IWMS is ancillary as its entire purpose is to service the subdivided allotments and it is not proposed to be carried out independently of the subdivision of the land. We note that clause 37A(2) does not apply to the application as the sewerage system does not have an intended processing capacity of more than 2,500 persons equivalent capacity or 750 kilolitres per day. Therefore, by virtue of clause 37A of the Regulation, the IWMS is not designated development.

## Voluntary Planning Agreement

Section 79C(1)(a)(iia) of the Act requires that a consent authority take into consideration any planning agreement that has been prepared pursuant to section 93 of the Act. A Draft Voluntary Planning Agreement (Draft VPA) has been prepared for the NEV site in accordance with the requirements of the rezoning process undertaken by DPI and as stipulated in Section 8.1 of DCP No.175. The Draft VPA makes specific provision for the dedication to Council of the 6(a) Open Space zoned portion of the site (being that land immediately to the east and contiguous with the 2(a)

residential land), together with a small area of land upon which a stand of *Araucaria cunninghamii* (Hoop Pines) are located.

In accordance with the terms of the VPA, the Draft Plan of Subdivision prepared for this application (refer **Appendix E**) includes the creation of a single allotment (Lot 38) which incorporates the entire 6(a) Open Space zoned land and the Hoop Pines. The Draft Plan of Subdivision includes a number of encumbrances on this land to provide for easement for services and proposed access to Lot 39. A proposed right-of-way is proposed over Lot 1 to provide access to the Lot 38 as required by the terms of the VPA.

The 6(a) Open Space land is an important parcel of land for the Co-operative both in terms of its location, as it provides a contiguous link to western and eastern portion of the site and its potential to provide opportunities for community gardens and further embrace sustainable living pursuits on the site.

The Co-operative is willing to pursue further discussions with Council with respects to the potential for a land swap between the 6(a) open space zoned land and a component of the 7(a) Conservation land to the west and south-west of the transmission easement. It is understood that this 7(a) Conservation land is strategically important to the integration of the Coastal Open Space System (COSS) and provides an integral link between land currently managed by Council to the south of the site and Strickland State forest.

Alternatively, an agreement for management of the 6(a) land under license could be designed to allow the Co-operative use of the land whilst reducing maintenance and management costs to Council.

## 4.1.3 Water Industry Competition Act (WICA)

WICA provides the key enabling legislation which permits private sector innovation and investment in water and waste water infrastructure. WICA is supported by the Water Industry Competition (General) Regulation 2008 which sets out the matters a licence application must address, standard licence conditions and the retailer of last resort provisions.

As detailed in **Section 3.12** of this report, the Co-operative propose to lodge an application under the WICA for a retail operator's licence and network operator's licence with IPART.

It is understood that Council will be consulted as part of IPART's consideration of the application for a WICA licence. Furthermore, it is noted that the design of the IWMS may be amended and refined to respond the IPARTS's requirements.

## 4.1.4 Other relevant NSW Acts

A number of other NSW Acts are relevant to the application and additional approvals may be required to permit the proposed development to occur. An overview of this legislation and its relevance to the application is addressed in **Table 4** below.

Name of Act	Comment	Relevance of Act
Native Vegetation Act 2003	The only vegetation clearing which will trigger the <i>Native</i> <i>Vegetation Act 2003</i> , is the middle western gully, where depending on discussion between Gosford City Council, the NSW Department of Water and the Hunter Central Rivers Catchment Management Authority, a small area will be required to accommodate a fire asset protection zone. At this location there is a short gully present which is not shown on the state mapping system and some native riparian vegetation will need to be removed from the southern side slope on the bank and overbank. The Co-operative notes that development consent under the <i>Native Vegetation Act 2003</i> may be required. The Minister for the Environment is the consent authority.	The Council may refer the application to the Department of Environment, Climate Change and Water for consideration.
Protection of the Environment Operations Act 1997	The development is too small to be a scheduled activity under the POEO Act (see Clause 36 of Schedule 1) and therefore, an Environment Protection Licence is not required.	Not relevant to this application
Threatened Species Conservation Act 1995The TSC Act is the key piece of legislation in NSW relating to the protection and management of biodiversity and threatened species. The Fauna and Fauna Gap Analysis Survey Report (Appendix J) has identified a number of threatened species, populations, communities and their habitats which are potentially impacted by the development. The NEV site contains lowland rainforest endangered ecological community. The potential impacts of the development have been assessed through seven-part tests and have concluded that the development will not result in unacceptable environmental impacts		The Council may consider that consultation and concurrence of the Director- General of the Department of Environment, Climate Change and Water pursuant to section 79B(3) of the Act is required.
Roads Act 1993	Approval from the RMS under Section 138 of the <i>Roads Act 1993</i> will not be required for this development. No road works are proposed outside the boundary of the site.	Not relevant to this application
Pipelines Act 1967All pipelines proposed to be constructed and associated integrated water management system are proposed to be contained wholly within the site. Therefore, the Pipeline: does not apply to require a licence, in accordance with si 5(1)(c).		Not relevant to this application

 Table 4: Overview of other relevant Acts

## 4.2 State Environmental Planning Policies

## 4.2.1 State Environmental Planning Policy (Infrastructure) 2007 (ISEPP)

## *Clause* 104

Clause 104 of ISEPP relates specifically to the referral of certain development applications to the RTA (now RMS) prior to their determination based on these developments being defined as 'traffic generating development' in Schedule 3 of the SEPP. With respect to subdivision of land, Schedule 3 of the SEPP specifies that referral to the RMS is required for '200 or more allotments where the subdivision includes the opening of a public road'. As the proposal is limited to a 40 lot subdivision, referral to the RTA is not considered to be warranted in the circumstances, as the proposal is not considered to meet the other relevant size or capacity requirement.

#### Clause 105

Pursuant to Clause 105 of ISEPP, the integrated water management system proposed to be constructed on the NEV site is considered a 'water recycling facility' and a 'sewer reticulation system'. As the IWMS is not being carried out in a prescribed zone defined in Clause 105 of the SEPP, pursuant to Clause 106 of the SEPP development consent is required. It is noted that such works are only permitted to be carried out in a prescribed zone where the proponent is a public authority or a person is licensed under the WICA.

## 4.2.2 State Environmental Planning Policy No.55- Remediation of Land (SEPP 55)

SEPP 55 aims to provide a state wide approach to the remediation of contaminated land. In particular, SEPP 55 aims to promote the remediation of contaminated land to reduce the risk of harm to human health and the environment by specifying under what circumstances consent is required, specifying certain considerations for consent to carry out remediation work and requiring that remediation work undertaken meets certain standards.

As outlined in Section 3.3, a PSA Report has been prepared by Douglas Partners and is included at **Appendix F**. The Stage 1 PSA Report has identified and assessed key areas of environmental concern and provided advice on the need for further site investigations and management, in order to ensure that the requirements of SEPP 55 have been satisfied.

The Stage 1 PSA Report has identified that there is a low to moderate risk of contamination across the site. Given the sites former use as a horticultural institute, the site has been subject to potentially contaminating activities and land uses. Subsequently, a number of areas of higher contamination potential and areas of environmental concern have been identified by Douglas Partners and will require further site investigations.

In order to inform the remediation process, Douglas Partners has recommended that a Sampling and Analysis Quality Plan be prepared followed by a Phase 2 Environmental Site Assessment and a Remediation Action Plan. In accordance with the requirements of DCP No. 175, a Site Audit Statement will be issued for the site prior to the issue of a construction certificate for the Stage 1 works including road and servicing infrastructure.

## **4.2.3** State Environmental Planning Policy No. 19- Bushland in Urban Areas (SEPP 19)

The general aim of SEPP 19 is to protect and preserve bushland within areas referred to in the SEPP, this includes the Gosford LGA. Relevant consideration of the SEPP 19 has been provided in the Compliance Table for DCP 112- Residential Subdivision. Reference should also be made to the Flora and Fauna Gap Analysis Survey Report at **Appendix J**.

## 4.3 Key State Policies, Plans and Guidelines

## 4.3.1 Central Coast Regional Strategy

The Central Coast Regional Strategy sets out the NSW Government position to guide sustainable growth and economic development within the Central Coast for the period 2006 - 2031. The Strategy incorporates the Gosford LGA.

The implementation of the Strategy is through the Action Plans outlined in the NSW State Plan. The key aims of the Strategy, as relevant to the NEV site are to:

- provide 56,000 new dwellings by 2031 in order to accommodate an additional 100,000 people expected in the Region by 2031;
- ensure that there is an adequate supply of land strategically located to support economic growth and the capacity for an additional 45,000 new jobs by 2031;
- increase densities and revitalise areas around major centres and towns to provide housing choice and to support economic growth in accessible locations;
- provide housing choice including more units and townhouses in key centres to provide a better housing mix; and
- promote a Regional City at Gosford focusing on business activity, housing opportunities and employment generation.

The Strategy also provides detailed objectives for Gosford as a Regional City. This includes a target of 6,000 additional dwellings and 10,000 additional jobs. The Strategy estimates that existing and planned urban areas within the entire Central Coast Region can supply approximately 56,000 dwellings to 2031.

The NEV site is strategically located to contribute both to the housing and job targets included in the Strategy. The Concept Plan for the NEV site incorporates opportunities for a range of housing types and short term and long term employment opportunities link both to the construction and occupation phase. It is expected that the NEV site can provide for a total of approximately 400 future residents, with ability for 50 future jobs.

The NEV site is identified as the only 'urban release area' in the Draft Gosford Local Environmental Plan 2013 and therefore, this development plays an important role in contributing to the key the aims and objectives underpinning the Central Coast Regional Strategy.

## 4.4 Local Environmental Planning Instruments

## 4.4.1 Gosford Planning Scheme Ordinance

The key provisions included in the GPSO of relevance to the NEV site are considered in the Compliance Table provided at **Appendix Z**. In summary, the proposal is consistent with the key provisions in GPSO as detailed below:

- The development proposed in this application is permitted with consent pursuant to the provisions of Part III of GPSO.
- The allotment sizes proposed for the 2(a) land comply with the provisions of Clause 30AAA.
- The application seeks consent for demolition, as required by Clause 26C of GPSO.
- The application is supported by a Heritage Impact Statement and therefore, satisfies the requirements of Clause 49T of GPSO.

With respect to Clause 49U of GPSO, which sets out the requirements for subdivision and regional transport infrastructure, the application will result in the urban intensification of the 2(a) zoned land.

Accordingly, the provisions of Clause 49U(3) require that the subdivision of the land must not be granted by Council for the additional allotments proposed unless 'satisfactory arrangements' have been made to contribute to the provision of regional transport infrastructure and services.

The Co-operative advises that a Memorandum of Understanding (MOU) was executed between the then Minister for Primary Industry and the then Minister for Planning on 18th August 2008 setting out the requirement for the rezoning of the site (which will enable it to be subdivided into 121 residential allotments and 5 rural residential allotments) to be subject to the payment of a regional infrastructure contribution. The MOU establishes that an amount of \$567,000 will be paid by the Minister for Primary Industry to the Minister for Planning 7 days before the settlement of the sale of the Property.

The Co-operative has made enquiries to the DPI regarding this matter. The DPI is yet to confirm whether or not the contribution has been paid and therefore, whether 'satisfactory arrangements' have been made to contribute to regional transport infrastructure.

## 4.4.2 Gosford City Council Interim Development Order No.122

The key provisions included in Gosford City Council Interim Development Order No.122 (IDO 122) of relevance to the NEV site are considered in the Compliance Table provided at **Appendix Z**.

In summary, the proposal is consistent with the key provisions in GPSO as detailed below:

- The application proposes the subdivision of the 7(c2) land to created an allotment with an area of 5.534 hectares. The allotment size therefore complies with Clause 18(3)(e).
- The application proposed the subdivision of the 7(a) land to create an allotment with an area of 34.21 hectares. The allotment size is less than the minimum allotment size stipulated in Clause 18(3)(a) of 40 hectares. However, the allotment is proposed as a single allotment reflecting the extent of the 7(a) zoning and is consistent with Clause 19, as the proposed allotment does not constitute a split zoning allotment.

## 4.5 **Development Controls Plans**

## 4.5.1 Development Control Plan No.175- Gosford Horticultural Institute Rezoning

DCP 175 is the key DCP which applies to the NEV site. The stated purpose of this DCP is "to provide more detailed guidelines for the development and use of the land for a residential subdivision into approximately 120 lots, approximately four rural residential lots to be zoned Scenic Protection Rural Small Holdings 7(c2), and one residue rural residential lot to be zoned Conservation 7(a) or other permissible development".

Section 6 of the DCP requires that where a development application is lodged which relates to land to which this Plan applies, Council shall take the provisions of this Plan into consideration in determining that application.

The key provisions included in DCP 175 of relevance to the application are considered in the Compliance Table provided at **Appendix Z**.

#### 4.5.2 Development Control Plan No. 112 – Residential Subdivision

The key provisions included in Development Control Plan No.112- Residential Subdivision (DCP 112) of relevance to the NEV site are considered in the Compliance Table provided at **Appendix Z**.

#### 4.5.3 Development Control Plan No.5 – Narara

The objectives of this Development Control Plan are as follows:

a) Encourage orderly development of urban land in the most economic and unconstrained manner

*b)* Enhance the residential amenity as a living environment, having regard to the local environment and life styles of people.

c) Provide for the accommodation of adequate community and recreation facilities and services.

d) Encourage maximum desirable utilisation of the land for residential purposes in close proximity to community, recreation and transport facilities.

*e)* Encourage multi-unit type development to take advantage of developable land, the natural setting and reducing the land cost component of housing.

f) Integrate areas with the existing suburban and rural settlement patterns.

*g*) Facilitate the flow of through traffic along arterial and sub-arterial routes with minimum disruption to residential areas.

*h)* Protect and preserve any attractive or significant features of the environment, eg retain prominently located trees.

*i*) Facilitate the flow of stormwater along drainage lines and retarding basin areas.

*j)* Minimise any likely adverse effects of development.

*k*) Provide a system of pedestrian footpaths integrated with areas of open space, playgrounds and passive recreational uses.

*I)* To ensure that development takes account of the existing physical constraints of the land.

*m*) *To promote* development in harmony, rather than in conflict, with the environment.

This proposal is consistent with the aims of DCP 5 by providing for development which complements existing development and will not place additional demands on infrastructure or natural resources. The technical reports which support that application demonstrate that the proposal will result in a suitable use of the land, will provide opportunities for a range of housing types and will minimise likely environmental impacts.

#### 4.5.4 Development Control Plan No. 89- Scenic Quality

The objectives of the Development Control Plan in relation to the Narara Creek Geographic Unit are as follows:

a) Restrict zoning density of development to current levels on higher slopes, particularly Steep Land zoned areas.

*b)* Opportunities for increases in densities and scale are available in areas not subject to visibility constraints or other physical constraints. Visually constrained land includes lands on higher slopes.

c) Maintain broad patterns of land use within area to ensure protection of landscape diversity and in particular Scenic Protection and Conservation areas.

d) Recognise importance of Brisbane Water Escarpment with its visual integrity and naturalness being valuable assets which need to be protected from development involving rezonings which increase development densities and/or increase the range of uses permissible.

*e)* Continue to attempt to secure lands identified for inclusion in the Coastal Open Space System as part of the visual landscape.

*f*) Retain current subdivision standards in scenic protection zoned areas to ensure continuing dominance of landscape features over built environment.

*g)* Recognise importance of privately owned Conservation zoned land in providing a complimentary land system to and a buffer area for COSS lands.

This proposal is consistent with the objectives of the DCP. The Draft Plan of Subdivision proposes that the residential subdivision be limited to the already cleared sections on the lower slopes of the site, thereby maintaining the landscape diversity and scenic qualities of the 7(a) and 7(c2) zoned land (albeit that these zones also have limited dwelling entitlements). Opportunities for the NEV site to contribute to the COSS have been outlines in Section 4.1.2 above.

#### 4.5.5 Development Control Plan No. 115- Building on Flood Liable Land

The objectives of this Development Control Plan are as follows:

a) To bring to the attention of the community, Council's policy in relation to building on flood liable land in the area.

*b)* To insist that buildings and other structures built in flood liable areas are designed and constructed to withstand the likely stresses of the highest probable flood.

c) To limit building that may reduce the ability of the flood plain, and in particular the floodway, to carry water and subsequently add to the height of floods.

d) To minimise the financial burden to owners of flood liable land and to the general public.

*e)* To reduce flood losses by restricting and controlling building so that it is less susceptible to flood damage and minimises risks to residents and those involved in rescue operations during floods.

The subdivision layout has been designed in consideration of potential flooding impacts. As illustrated in **Figure 36** below, the residential lots and the community association land are located well to the west of the 1 in 100 year flood level. The flood affectation is principally restricted to the 6(a) land.

The 1 in 100 year flood level does impact the western edge of the Lot 39 comprising the land zoned 7(c2). Notwithstanding this, the topography of the land in conjunction with the size of the lot can ensure that dwellings are sited 0.5 metre above the 1% AEP flood level to achieve 0.5 metre freeboard in accordance with the requirements of DCP 175.

Having regard to the above, it can be concluded that the subdivision of the land and its future development will be largely unaffected by flooding and complies with the provisions of DCP 115. No flood mitigation measures are proposed as part of this application.

#### **Dambreak**

The existing dam on the NEV site was built in 1985 and was historically used for irrigation of the Narara Horticultural Research Station. The dam is built on a creek tributary that drains into Narara Creek. The local catchment area for this tributary covers an area of 159.20ha.

A number of studies were commissioned by the NSW Primary industries to support the rezoning and sale of the NEV site. The studies were undertaken by NSW Department of Commerce, Dams & Civil Section and were prepared to simulate and assess the failure of the dam and the possible downstream flooding impacts.

A more recent study undertaken in November 2011 by NSW Public Works re-examined the flood consequences utilising updated modelling results. The Study concluded that under various cases or scenarios (ie. sunny day dambreak, 1 in 100 AEP Flood both with and without dambreak, and dam crest flood both with and without dam break) the risk of dam failure and downstream flooding was found to create minimal additional flood affects. Furthermore, a sunny day dambreak event was found to have no flood effects on the Population at Risk largely as the floodwater remain in channel and within its local floodplain.

As a consequence of these recent findings, it can be concluded that the 2(a) zoned land on the NEV site will be unaffected by a dam break. No further dam break analysis has been prepared to support this application. As the 1:100 year floor level is located to the east of the residential lots well within the 6(a) land, flood inundation to the residential lots and STP as a result of dam failure or flooding is unlikely.



Figure 36: Location of 1 in 100 year flood level on NEV site.

## 4.5.6 Development Control Plan No. 159 – Character (Narara)

Development Control Plan No.159- Character (DCP 159) establishes the future desired character for the broader Narara Area. The NEV site is identified as Narara 14 (scenic buffers) and Narara 15 (scenic conservation). DCP 159 stipulates that the future desired character for the NEV site should preserve its rural-residential character and its ecological and scenic qualities.

The proposed subdivision of the site meets the aims of this DCP in that the vegetated slopes will be maintained and there will be minimal impact on scenic quality. The subdivision will not facilitate the future development of the western slopes or northern part of the site and therefore, there will be no loss of the scenic or the ecological qualities of these areas. In this regard, development is proposed on the lower slopes that are not vegetated and whilst the proposed development will increase the number of buildings on the site, the impact on scenic quality will be minimal given that

the majority of vegetation will be retained and will be embellished as part of the site redevelopment. As such, it is considered that the proposed development can be accommodated without unacceptable changes to the perception of the site as viewed from major viewing points.

Consistent with the desired future character for Narara 14 and 15, the proposal will achieve the following:

- It will maintain the ecological values of the site including the habitat values and informal scenic quality, by limiting residential subdivision principally to the cleared areas of the site.
- Whilst providing for a variety of housing types, the predominant development will be low density- residential development. The rural character of the 7(c2) zone will be preserved. Therefore, the scale of development will be consistent with the prevailing scale of development in neighbouring areas.
- It will allow for the development of the NEV site with minimal site intervention including hazard reduction clearing to achieve APZ's, minimising the extent of cut/fill and landform modification.
- It will provide for the implementation of an Ecological Restoration Plan which aims to eliminate noxious weeds and to plant trees which are predominantly indigenous to complement the established tree canopy.
- It will enable the future development of the site in accordance with the Hill Thalis Design Report which establishes the design principles which are in keeping with the future desired character for Narara. These principles include:
  - Providing generous rear setbacks to create consolidated bands along the contour gardens across each block thereby contributing to the landscape quality of the site and complementing the established tree canopy.
  - Limiting the footprint and size of all houses to minimise energy consumption and resource, so that the landscape becomes pre-eminent.
  - Source low embodied energy, recycled or recyclable plantation or certified materials as the predominant construction materials for dwellings.

For the above reasons, the application is considered to be consistent with the provision of DCP 159.

## 4.5.7 Other Development Control Plans

A number of other development controls plans are relevant to the application and have been considered in the various technical reports and documents which support this application, as detailed in **Table 5** below. Consideration should be given to these technical reports and documents with respect to compliance with the relevant DCP provisions.

Rel	evant Development Control Plan (DCP)	Relevant reference within SEE
•	DCP No. 111 - Car Parking (Amendment No 1)	Refer to Transport Impact Assessment at Appendix W.
•	DCP No. 106 - Controls for Site Waste Management	Refer to Waste Management Plan at Appendix V.
•	DCP No. 165 - Water Cycle Management (Amendment 1) and related WCM Guidelines	Refer to Integrated Water Management Plan at Appendix S.
٠	DCP No. 163 - Geotechnical Requirements for DAs	Refer to Stage 1 Preliminary Geotechnical Report at Appendix L.
•	DCP No. 122 - Cut and Fill Restrictions	Refer to Concept Road Grading Plans at <b>Appendix N</b> and the Concept Engineering & Public Utilities Report at <b>Appendix P</b> .

Table 5: Other Development Control Plans

## 4.6 Draft Gosford Local Environmental Plan 2013

The key provisions included in Draft Gosford Local Environmental Plan 2013 (Draft GLEP 2013) of relevance to the NEV site are considered in the Compliance Table provided at **Appendix Z**. In summary, the proposal is consistent with the key provisions in Draft GLEP 2013 as detailed below:

- The development proposed in this application is permitted with consent pursuant to the Land Use Tables.
- The allotment sizes proposed comply with the provision of Draft GLEP 2013 and are not subject to the minimum lots sizes stipulated in Clause 4.1 (ie. the minimum lots size provisions do not apply to community title subdivision).
- The application seeks to preserve trees and development consent is sought for tree removal in accordance with Clause 5.9.
- The application is supported by a Heritage Impact Statement and therefore, satisfies the requirements of Clause 5.10.

With respect to Part 6- Urban Release Areas of Draft GLEP 2013, the NEV site is identified as the only urban release area. The following comments are relevant with respect to the consideration of these provisions:

- **Clause 6.1-** the discussion in section 5.3.1 above, remains relevant with respect to the making of 'satisfactory arrangements' to contribute to the provision of regional transport infrastructure and services.
- **Clause 6.2** the development seeks approval for infrastructure provision to service the urban release area. The application demonstrates that adequate arrangements can be made to service the NEV site.
- **Clause 6**.3- the application proposes that the development of site occur in a logical and costeffective manner, in accordance with a staging plan and principles included in the Hill Thalis Design Report. Whilst a DCP has not been prepared, the Hill Thalis Design Report is considered to adequately address the staged development of the NEV site and those specific matters listed in subclause 3.

## 4.7 Draft Gosford Development Control Plan 2013

The development controls included in Draft Gosford Development Control Plan 2013 (Draft GDCP 2013) are consistent with those contained in the current range of DCP's which apply to the NEV site and which have been addressed in section 4.3 above. For this reason, further consideration of Draft GDCP 2013 is not warranted.

## 5.0 Environmental Assessment

This section of the report includes discussion and assessment of the key issues and matters for consideration pursuant to Section 79C(1)(b) to (e) of the Act. These matters for consideration include the likely environmental, social and economic impacts of the development, the suitability of the site for the development, and the public interest.

These matters for consideration are addressed separately below, as relevant to the proposal.

## 5.1 Subdivision Layout and Urban Design

## 5.1.1 Subdivision Layout

The subdivision layout illustrated in the Hill Thalis Design Report at **Appendix B** has been informed by a detailed site analysis. The lot layout has been devised to create a variety of housing lots whilst responding to the aspect and the topography of the site. This has resulted in a range of residential lots sizes, a network of open space through the site and the road network which build on the existing road pattern and responds to the requisite lot access and the servicing requirements of the site. This analysis has underpinned the final subdivision proposal detailed in the Draft Plan of Subdivision (**Appendix E**) and the key elements of the subdivision, as follows.

- To minimise the modification to the landscape including the extent of cut and fill by arranging the allotments to conform as closely as possible with the existing landform features, including the terrace nature of the site and the established road network;
- To maximise the northerly aspect and to configure lots to maximise the potential for solar access to future dwellings;
- To maximise the opportunity for a variety of housing forms by proposing a range of allotment sizes;
- To maximise site amenity and appreciation of the environmental qualities of the site including the gully, surrounding bushland and views across the valley;
- To establish APZ with minimal impact to bushland and to ensure the preservation of the landscaped character of the site;
- To incorporate common gardens as a key element of the open space and access network through the site and secure their provision through easements on title; and
- To establish an identifiable landscape concept for the accessways through the site including to retain significant existing vegetation and to provide for the dual use of the landscape street verges as part of the integrated water management on-site by utilising water sensitive urban design principles.

The lot layout has been designed having regard to the objectives DCP 112- Residential Subdivision, which are:

- (a) to ensure that residential land developed for subdivision is done so in an efficient and orderly manner;
- (b) to ensure that all lots created are satisfactorily serviced by infrastructure;
- (c) to maximise development potential of residential land whilst retaining any significant environmental characteristic that may occur on the land;
- (d) to encourage a variety of allotments to cater for different housing needs.

The Stage 1 DA is considered to meet the intent of the above objectives for the following reasons:

- The subdivision of the site in accordance with the proposed development stages (Sheet 2.21 **Appendix A**), ensure the site is developed in a planned and orderly manner. The application proposes that all allotments have frontage to a street and are integrated with the planned network of open space and accessways through the site. All allotments are readily accessible to common car parking areas and other group facilities including mail and garbage.
- The upfront provision of utility services and essential infrastructure will ensure that the development of the allotments can occur in an efficient and co-ordinated manner. The infrastructure provision proposed in the application is essential to service Stage 1 of the development and to provide the foundation for the future amplification of the systems and networks to services future Stages 2 and 3 in the development of the NEV site.

The provision of the IWMS is a fundamental component of the site infrastructure. Its staged implementation, will provide for an environmentally sustainable system of the water management. The IWMS is proposed to be implemented in stages to respond to the anticipated site demands for water and sewer services and to ensure it is economically feasible.

- The subdivision layout has had regard to the key environmental and heritage qualities of the site. Importantly, all significant vegetation identified on the site has been retained and the residential subdivision has largely been restricted to the cleared sections of the site. Appropriate management and mitigation measures have been recommended by the project appointed arborist to minimise impacts as a result of construction on existing vegetation. Significant landscaping works and ecological restoration works are proposed as outlined in sections 3.8 and 3.10 of the SEE to improve the ecological quality of the site.
- The impact of the subdivision on the heritage values have been minimised through the lot layout and importantly, opportunities for the future siting of development. The allotment sizes and configuration have taken into account curtilages to all heritage items and groups of significant trees.
- The subdivision layout has been designed to conform with the existing features including the
  road layout and the site topography. This has ensured that the impact of the subdivision on the
  environmental characteristics of the site have been minimised. This approach has result in the
  extent of cut and fill on the site being minimised to accommodate the subdivision layout.
  Consequentially, the visual impact of the subdivision has been minimised, with significant
  bushland to the north and west of the site being retained.
- The subdivision design includes a range of allotment sizes and configurations to provide opportunities for a range of housing options as currently permitted under GPSO. Typically, the residential allotments will accommodate single dwelling houses with opportunities for dual occupancy development. The Hill Thalis Design Report establishes the design principles for the placement of houses on allotments and to establish that all houses design must be based on the principle of environmental sustainability, incorporating passive solar design and the sustainable use of energy and resources.

The Stage 1 application includes provision for two cluster housing developments, which are currently being considered by Council.

Therefore, it is considered that the application provides sufficient opportunities for a variety of housing types and complies with the key objectives of the DCP.

Further matters in relation to lot layout have been detailed in the Compliance Table at **Appendix Z** and the Hill Thalis Design Report at **Appendix B**.

## 5.1.2 Crime Prevention Through Environmental Design

The subdivision layout has been informed by the CPTED principles of natural surveillance, access control, territorial reinforcement and space management. The design and layout of the lots appropriately respond to the CPTED principles of reducing the potential for crime and increasing perception that the development provides a safe environment. From a design perspective, crime deterrence on the site has been achieved by the following initiatives:

- providing opportunities for clear sightlines and for passive surveillance between the community association land (proposed Lot 1) and private realm (each dwelling lot);
- providing opportunities for effective lighting of the common areas during evening hours;
- incorporating landscaping that will make the place attractive and will complement existing site landscaping, but does not provide offenders with a place to hide or entrap victims; and
- providing clearly defined paths of travel between dwelling lots, car parking and the common areas.

In addition to the above, the planned road and pedestrian network through the NEV site, is anticipated to be well utilised by residents and visitors of the ecovillage, thereby reducing opportunities for crime including to deter opportunities for vandalism and graffiti.

Having regard to the above, it is considered that the development adequately addresses the CPTED principles.

## 5.1.3 Objectives of the Local Controls

As demonstrated in the Compliance Tables at **Appendix Z**, the application complies with the key objectives and policy controls of Council's development controls plans which are applicable to the NEV site and the nature of the development. The application is considered to provide an appropriate and well considered response to the site conditions and the surrounding context.

## 5.2 Geotechnical and Slope Stability

## 5.2.1 Geotechnical

Douglas Partners has undertaken a preliminary assessment of the geotechnical condition of the site (refer **Appendix L**). The Report outlines the findings of field work investigations which included 7 borehole tests in the area of the Stage 1 subdivision, laboratory testing and engineering analysis. The aim of the investigation was to assess the subsurface soil and groundwater conditions across the site in order to provide indicative site classifications and pavement thickness designs for the new roads.

The report advises that the site is located in an area mapped as Terrigal Formation which typically comprises sandstone with minor siltstone and claystone and is also located in an area mapped as having no known occurrence of acid sulfate soils. Within the Stage 1 area, the surface conditions generally encountered in the bores consisted of filling and/or topsoils to 0.2-0.6 metres underlain by firm or stiff sandy clay and silt or medium dense clayey sand/silty sand to depths of up to 1.8 metres. This was further underlain by stiff through to hard clay over the remaining depth of the investigation.

The result of clay testing on the site indicates that the natural clay soils on the site are slightly to moderately susceptible to shrinkage and swelling movements associated with variations in soil

moisture content but that they do not undergo significant loss in strength following saturation. The tests undertaken were carried out in accordance with AS1289.6.3.2 to provide information on the relative strength and densities of the soils and to test the reactivity of the soil, standard compaction and field moisture content to provide indicative site classifications in accordance with AS2870-2011: *Residential Slabs and Footings*.

The results of the testing have informed the recommendation for the engineered design of road network and infrastructure. These have included specific recommendation in relation the following:

- site preparation;
- anticipated subgrade conditions;
- the design of subgrade CBR Values;
- design traffic loading;
- subsurface preparation;
- flexible pavement thickness design;
- material quality and compaction requirements; and
- drainage requirements.

The investigations indicate that the geotechnical conditions of the Stage 1 site can accommodate the development. Further site investigations are recommended at the construction certificate stage when the detailed engineered design for the project will be finalised.

## 5.2.2 Groundwater

The geotechnical investigations undertaken by Douglas Partners, as outlined in section 5.2.1 above, did not encounter any ground water within the borehole testing undertaken on the site. Given the limited extent of the excavation proposed, particularly adjacent to the floodplain (ie. 6(a) zoned land), it is unlikely that any works will result in the groundwater being intercepted.

## 5.2.3 Slope Stability

Douglas Partners has also prepared a Slope Stability Assessment Report to provide a broad overview of slope instability issues associated with the Stage 1 site. As detailed in Section 2.0, the topography of the site is varied and ranges in slope from 10-18° in the higher western area falling to 5-10° in north-eastern area of Stage 1. For the purposes of this report, Douglas Partners has based the slope classifications for the subdivision on Tables M1 and R1 within DCP 163 (Geotechnical Requirements for DA's), which applies to sites underlain by sandstone sequences of the Terrigal Formation.

Based on the site conditions observed, Douglas Partners has advised of the following:

- the northern group of residential lots and part of Lot 15 have slopes ranging from 5<sup>o</sup>-10<sup>o</sup>. The slope is therefore classified as Category 1- Low Hazard Area.
- The residential lots that are located away from the existing gully and do not include existing building terraces, fall to the north-east at about 12<sup>o</sup> 15<sup>o</sup>, and are classified as Category 2-Medium Hazard Area.
- A number of areas across the site which include retaining walls and batters and lots that are located close to the inner western gully are classified as Category 3- High Hazard Areas.

The slope classifications across the site are illustrated in **Figure 37** below. In accordance with DCP 163, those sites which have been assigned a classification of either Category 2 or 3 will be subject to further slope stability assessment and risk assessment at the individual DA stage.



Figure 37: Slope Classifications across the Stage 1 site.

In order to counteract slope instability issues, including those associated with soil creep and slumping/wash away/local slip of cuttings and embankments, Douglas Partners has recommended that the batter slopes at the site should be as follows:

- 2.5H:1V within controlled fill;
- 2.5H:1V within existing filling and alluvial/colluvial soils; and
- 2H:1V within stiff residual clay.

The above recommendations have been incorporated into the project design for the Stage 1 infrastructure works as illustrated in the Concept Road Grading Plans prepared by Chase Burke Harvey (Appendix N).

## 5.3 **Contamination**

Matters in relation to site contamination and compliance with SEPP 55 have been addressed in Section 4.2.2 of this report. Reference should also be made to the Phase 1 Preliminary Site Assessment prepared by Douglas Partners at **Appendix F**.

## 5.4 Stormwater Management

The stormwater management strategy (stormwater strategy) for the site has been prepared by Woodlots & Wetland and is included in the Integrated Water Cycle Management Plan at **Appendix S**. Concept Stormwater Plans and Erosion and Sediment Control Plans have been prepared by Chase Burke Harvey to reflect the stormwater management strategy and are included at **Appendix Q** and **Appendix R**, respectively.

The stormwater strategy is based a Water Sensitive Urban Design (WSUD) approach to manage stormwater quality and quantity. The key components of this approach include:

- Roof water capture, disinfection and re-use within individual dwellings;
- Bio-retention systems to provide significant water quality treatment to runoff from impervious areas while at the same time providing additional stormwater detention; and
- WSUD features, including swales, to convey stormwater and to ensure peak flows and contaminant loads are reduced to achieve compliance with Council's stormwater treatment requirements.

Stormwater modelling using MUSIC Version 5 has been undertaken. The stormwater modelling demonstrates that the proposed stormwater system will meet the performance criteria of DCP 165 with the stormwater outflow volume being reduced by 81% and the peak flow rates reduced by 51% when compared with current conditions. Additionally, contaminant loads were shown to meet the performance targets presented in DCP 165.

Stormwater management also includes measure to avoid damage to gullies and streamlines. It is proposed that discharge points be protected with a combination of turf reinforced meshing and rock riprap, as illustrated in the Concept Stormwater Plans at **Appendix Q**.

The Concept Stormwater Plans illustrate the proposed layout for the stormwater system and its components. These plans illustrate that the majority of the system (pipes and swales) is designed to run parallel with the road network (i.e. within the 1.2 metre servicing corridor) in order to minimise site disturbances and requisite excavation.

Through the implementation of the measures proposed in the stormwater strategy, the proposal can ensure a safe and ecological sustainable environment and will comply with DCP 165 and Council's Water Cycle Management Guidelines.

## 5.5 Integrated Water Management System

## 5.5.1 Design

The key components of the IWMS have been detailed in **Section 3.6** of this SEE and are located in **Figure 38** below. The key consideration in the siting of the infrastructure has been to maximise the efficiency of the system in addition to ensuring that the IWMS can be installed in an orderly and economic manner. This will require the staged implementation of the IWMS.



Figure 38: Location of key components of the IWMS (source: Aquacell)

Importantly, the IWMS will ensure that water and sewer management on the site is undertaken in an environmentally sensitive manner and with considerable environmental benefits to NEV site and the broader community. The modelling of the IWMS presented in the Integrated Water Cycle Management Plan at **Appendix S**, demonstrates that the staged implementation of the system is appropriate and can more than satisfy the servicing requirements of the ecovillage. The installation of the IWMS will ensure that the development will not place unreasonable demands on local services and furthermore, that appropriate human and environmental standards and safeguards can be put in place in accordance with regulatory requirements.

The final design of the IWMS will be resolved in consultation with the IPART. However, as currently proposed, the technical assessment of the IWMS indicates that it will have minimal adverse environmental impacts for the following reasons:

- The locations selected for the infrastructure are well within the NEV site and therefore, the IWMS will have minimal visual impact. Landscaping is proposed to the perimeter of the STP to ensure that it is suitably integrated within the Stage 1 site and its impact when viewed from the 6(a) land minimised. Notwithstanding this, by design, the STP is low in scale (refer **Figure 27**) and will not dominate the landscape. The location for the water treatment plant (WTP) is proposed adjacent to existing pumping station and will be suitably integrated into the setting of the dam.
- The construction footprints will not adversely affect the EEC's or threatened species identified in the Flora and Fauna Gap Analysis Report.
- No direct clearing or tree removal is required for the STP or the WTP.
- Construction can be managed to ensure impacts are controlled and appropriate tree protection zones and sediment and erosion controls measures are in place.
- Most of the pipes associated with IWMS will be integrated with the other servicing and can be sited within the 1.2m services corridor which runs parallel with the road network. This will
ensure the efficient provision of services to the individual lots and will minimise site disturbances and requisite excavation.

- The Air Quality Assessment and the Noise Impact Assessments prepared for the STP have concluded that odour and noise generated will be within acceptable limits and that there are unlikely to be adverse amenity impacts to surrounding development including within the NEV site and neighbouring dwellings- refer discussion in Sections 5.12 below.
- The capability of the landform and soil character is suitable for the IWMS- refer to further discussion in Section 5.5.2 below.

#### 5.5.2 Water Supply

The Integrated Water Cycle Management Plan includes modelling of water demand for the site based on the estimated number of dwellings at Stage 1 and at full development and estimated water demand. The daily potable water source for the development will be derived from tank water and the dam. The modelling has considered various scenarios to ensure that water supply can be available to the development including where the dam is the sole source of water ie. there is no capture and use of roof water in the ecovillage.

The modelling shows that flows into the dam are approximately 450ML per year and it is estimated that maximum demand for potable water (i.e. without use of water tanks) will be 14.2 ML/year. The demand for water therefore, represents approximately 3% of the average annual runoff/ anticipated catchment yield. It is estimated that the dam will typically supply less than 25% of the long term demand for water within the ecovillage, equivalent to 4ML in the average year.

Having regard to the storage capacity of the dam and climatic factors, under these scenarios it has been determined that the dam in conjunction with tank water can meet the potable water needs of the development and that it is a reliable water source, subject to the water being disinfected and treated prior to use to meet Australian Drinking Water Guidelines.

#### 5.5.3 Land Capability

The Integrated Water Cycle Management Plan includes a land capability assessment of the land proposed to be used for reclaimed water irrigation. It is estimated that during Stage 1 excess reclaimed water will need to be disposed of through irrigation. The modelling provided in the Integrated Water Cycle Management Plan indicates that the orchard area to the south of Stage 1 provides sufficient area and has suitable site attributes to accommodate the irrigation. This area is illustrated in **Figure 39** below. **Figure 39** also show the potential location of the proposed wet weather storage and irrigation proposed for Stage 2.

The land capability analysis has assessed the capability of the landform and soil character to support the proposed irrigation. Woodlots & Wetlands concludes from the analysis that the site is suitable for irrigation. It is recommended that a low pressure, low application rate, spray/drip irrigation be installed to minimise of runoff and other environmental risks. In order to minimise the environmental impacts from the irrigation, Woodlots & Wetland has also recommended that the following measures be employed:

- a contour bank be constructed to the west of the site to divert run-off from the forested areas;
- a long term strategy be developed to increase the organic matter in the soil and to increase soil structure and stability; and

• a good cover of vegetation either crops or long term pasture is critical to the irrigation areas.

Subject to the above recommendations, it is concludes that the site is suitable for irrigation and that effluent irrigation can form an appropriate strategy to eliminate excess reclaimed water. The measures recommended will ensure that the potential for environmental impacts are minimised. It is not anticipated that there will be any visual or adverse amenity impact arising from the irrigation.



Figure 39: Landform and soil sampling assessment sites (Source: Woodlots & Wetlands)

Reference should be made to the detailed discussion in the Integrated Water Cycle Management Plan prepared by Woodlots & Wetlands with respect to the design and further measures to minimise the environmental impacts of the proposal.

## 5.6 Flora and Fauna

An assessment of flora and fauna on the site has been undertaken by Robert Payne. This assessment has relied on previous site survey work undertaken by Andrews Neil and has supplemented the results with additional targeted survey work and site investigations. The Flora and Fauna Gap Analysis Survey Report (Flora and Fauna Report) is provided at **Appendix J.** 

Based on the surveys of the NEV site, the Flora and Fauna Report has identified that the following threatened species are present or have been identified from anecdotal evidence:

- The Eastern Bent-wing Bat
- The Powerful Owl
- The Sooty Owl
- The Grey-headed Flying Fox
- Evidence of the Yellow-bellied Glider
- The Magenta Lilly Pilly
- The Red-crowned Toadlet
- The Glossy Black-cockatoo
- Black Bittern

The vegetation community present on the site includes 2 endangered ecological communities that are protected under the Threatened Species Conservation Act 1995 and the EPBC Act, as detailed Section 4.1.1 of this SEE.

Table 6 below provides a summary of the threatened species impacts from the proposal:

**Table 6:** Summary of Threatened Species Impacts from the proposed development(Source: Flora and Fauna Gaps Analysis Survey Report)

Species	Identified impact on individual species		
Magenta Lilly Pilly	One tree located in the 7(a) zoned land. Twenty metre exculsion zone set (see Figure 13). Second tree unable to be located. Will not be impacted		
Yellow-bellied Glider	Sap site tree found during previous AN survey and area added to Strickland State Forest. Now protected in Strickland SF.		
Grey-headed Flying Fox.	Possibly feeding in orchards. Therefore maybe some loss of these feed trees. Expected minimal impact from development except for any lighting at forest edges, where some feed trees exist.		
Eastern Bent-wing Bat	Would feed between and beside forest remnants. Lighting could impact feeding regime.		
Little Bent-wing Bat	Would feed between feeding regime.	n and beside forest remnants. Lighting could impact	
Eastern Free-tail Bat	Forest edges and cle could impact feeding	earing for foraging. Roosts in tree hollows. Lighting g regime.	
Southern Myotis	Feeds over dam. Requires roosts in tree hollows nearby but mayuse some of the old buildings, even culverts and bridges. Lighting could impact feeding regime.		
Greater Broad- nosed Bat	Feeds over freshwater wetland. Requires roosts in tree hollows,		
Sooty Owl	Requires forest are impact from develop	eas for breeding, roosting and feeding. Minimal oment except for any lighting at forest edges.	
Powerful Owl	Requires forest areas for breeding, roosting and feeding. Minimal impact from development except for any lighting at forest edges.		
Glossy Black Cockatoo	Confined to DCP land. Large hollows found on ridge & food trees are found on dry slopes. Will not be impacted.		
Red-crowned Toadlet	Confined to DCP land in ephemeral re-entrants on the ridge. Will not be affected.		
Giant Burrowing Frog	Confined to DCP land in ephemeral re-entrants and wet areas on the ridge. Will not be affected.		
Stuttering Frog	Prefers rainforest riparian habitats. Will not be affected.		
Black Bittern	Confined to alluvial flats in wetland. Outside zone for this development application.		
Endangered ecolo	gical community	Identified impact on EEC	
Lowland Rainforest		Unlikely to be impacted provided infrastructure is kept well away from relevant gullies.	
Freshwater Wetland		Confined to alluvial flats in wetland. Outside zone for this development application.	

Further to the above, it has been identified that 10 hollow bearing trees are located on the site. It has been determined that 1 hollow bearing tree (Tree 191- refer Figure 25) will need to be removed to accomodate the development. It is recommended that the removal of this tree, whilst contrary to the provision in Section 8.3 of the DCP 175, can be suitably offset by the provision of a bat roosting box.

Based on the above assessment, the Flora and Fauna Report concludes as follows with the respect to potential impact on the Flora and Fauna on the site:

Given the fact that all of the vegetated slope and ridge area is unlikely to be compromised by the development proposed by the proponent it would be difficult to conclude a significant impact would result on threatened species and endangered ecological communities. When all matters are considered together the resources required by the known threatened species to survive are mostly captured by the slope and ridge vegetation although it is somewhat disturbed. This current disturbance is not a function of the proposed development. Following on, the likely impacts of the development on the DCP land are expected to be minimal because the impact zone is all downslope of the vegetated area and would impact through the site by way of Narara Creek only.

Based on the above conclusion, a number of actions are recommended in respect of the maintenance and development planning for the site. The actions have been included in the Ecological Restoration Plan and the Property Vegetation Plan, and as relevant to the Stage 1 works including the following:

- 1. Undertake weed removal around the tree of *Syzygium paniculatum* for a distance of 20 metres as set out in DCP175. Do not introduce any impure forms of *Acmena spp.* or *Syzygium spp.* into the site through the horticultural trade for landscaping purposes elsewhere throughout the property. Remove the unwanted intrusive *Acmena sp.* from the middle-western gully and any other gully in which it occurs.
- 2. Install only low level lighting against the forest edge and the dam because of the presence of foraging threatened fauna species.
- 3. During the demolition of any old buildings care must be taken that no bat roosts are apparent behind batons and struts. Care should be taken during the demolition process and if any species are found the Ecologist should be contacted for further advice.
- 4. At least three months prior to construction install along the forest edge a number of microbat roost boxes, suitable for colonization by the Greater Broad-nosed, Southern Myotis and the other forest bats, equivalent to the number of hollow trees which will be removed. At this stage consider establishing four bat roosting boxes one of which is to replace the tree hollow in tree 191.
- 5. Removal of tree No. 191 is recommended because of its location with a proposed feeder road. A tree protection zone of an estimated radius of 4.8m under AS 4970-2009 is not possible. Recommendation 9 also applies to this tree.
- 6. Due to the fact that there is the potential for the Long-nosed Potoroo being present establish community title for the project. Further establish a condition through a section 88b instrument that all dogs shall be on a leash at all times and cats will only be allowed within a cat run. The latter must be in place prior to accommodation.
- 7. During construction implement best practice soil erosion and sediment control structures to protect the Freshwater Wetland EEC and Narara Creek.

- 8. If in the event an Aboriginal relic is found during work procedures the location and detail is to be reported immediately to NSW OEH.
- 9. The following tree pruning procedure will be applicable to any tree with a hollow to minimize environmental impacts to threatened fauna. With the aid of a "Cherry Picker" inspect any vertical and horizontal hollow for the presence of nocturnal animals with the aid of a spotlight or similar.

If no animals are found to be present then proceed to take off sections of the tree. This will be done according to best practice guidelines and with safety.

If an animal is found to be present in the vertical or horizontal hollow then at nightfall wait for the animal to exit the hollow. Then bag the entrance to the hollows ensuring that each bag is tied securely. This will prevent the animal re-entering any of the hollows just prior to dawn.

Next day proceed to take off sections of the tree up to a limit of three metres depth. This will be done with the supervision of an Arborist who will organize the removal of the hollow bearing stem with safety.

#### 5.6.1 Tree Removal and Ecological Restoration

The subdivision and associated infrastructure has been designed to maximise the number of trees retained with the Stage 1 site.

Michael Shaw (**Appendix I**) has undertaken an audit of significant trees on the site. 300 trees were individually assessed and it has been determined that 65 tree will be potentially affected by the Stage 1 works, including a requirement to remove 45 of the trees. Mitigation measures have been recommended to ensure the protection and retention of all other trees.

All trees proposed to be removed have been assessed as having low to moderate arboricultural rating and have been allocated a low to moderate level of heritage significance by MUSEcape in the Heritage Impact Statement (**Appendix G**) and the Conservation Management Plan Review 2013 (**Appendix H**). The exception is Tree 244 identified in **Figure 24**, which has been allocated a high arboricultural rating. Subject to suitable replacement planting of locally endemic species to compensate for the loss of the tree, its removal is supported.

As detailed in section 3.8 and the 3.10 of the SEE, the Concept Plan for the site includes a comprehensive landscape strategy and ecological restoration works, some of which will be implemented as part of the Stage 1 works. These works are considered to result in positive ecological outcomes for the site and will more than compensate for the tree removal. In addition, these works are consistent with the anticipated environmental and ecological site improvements intended by Section 8.3 of the DCP 175 and required as result of the sites redevelopment. In accordance with DCP 175, no yellow bellied sap trees are proposed to be removed.

#### 5.6.2 Riparian Corridor

The Ecological Restoration Plan includes works to regenerate the riparian corridor of the northern gully alongside the drainage lines within the 10m riparian buffer zone. It is also proposed to cultivate and propagate the riparian floodplain grasses, particularly *Ottochloa gracillimus* and take steps to reintroduce these grasses as a community within and beside the gully drainage lines or as part of the buffer/asset protection zone. In addition, weed removal will be undertaken to allow for the natural understorey to re-generate. These works will have a positive impact on the environmental quality of the riparian corridor. The scope of works proposed to be undertaken in Stage 1 are outlined in the Ecological Restoration Plan (**Appendix K**) and are part of the Co-operative's strategy to improve the quality of the riparian corridor and manage the impacts associated with the subdivision of the site.

# 5.7 Environmental Sustainable Development

The Design Report includes opportunities for sustainable design features to be incorporated into Stage 1. These are predominantly relevant to the future development of the residential lots. Notwithstanding this, the proposal is considered to provide genuine sustainable environmental outcomes and with positive environmental benefits due to the following:

- Installation of the IWMS;
- the beneficial re-use of materials within in the site; and
- the use of materials with low-embodied energy in construction.

The sustainable environmental design features to be incorporated into the future development of Stage 1 of the ecovillage are included in sheet 4.06 of the Design Report (**Appendix B**) and include the following design principles:

- provide all houses with water tanks to locally capture rain water for productive reuse;
- provide all houses with the potential for renewable energy generation to meet energy requirements;
- select all appliances and systems based on their environmental performance;
- use materials in construction with potential of end of life recycling or which are manufactured with high levels of recycled or waste materials;
- employ both passive design and active systems which achieve best possible environmental performance, adopting the principles of long life, loose fit and low energy;
- site and design all houses to optimise the sun and minimise overshadowing or neighbours, relative to each season; and
- design all houses to maximise natural ventilation.

# 5.8 Heritage

#### 5.8.1 Cultural Heritage

The Heritage Impact Statement prepared by MUSEcape to accompany this Stage 1 application and is provided at **Appendix G**. The HIS has been prepared to satisfy the requirements of Clause 49T of the GPSO. The HIS identifies the site as a place of heritage significance with historical, associational, aesthetic, social and potential archaeological, educational and technical research significance as it features some rare built and landscape elements and is representative of horticultural research facilities in coastal NSW retaining evidence of research activities spanning more than a century.

The HIS also identifies that documentary and physical evidence of the site suggests that it contains potential archaeological evidence relating to its early development including with links to the original Gosford Forestry Nursery site, the short-lived Narara Forestry School and the use of the site as an adjunct to the Gosford Farm Home. The cultural landscape is also identified as including a number of rare elements, particularly the former Manager's Residence, the former Grafting Shed /

Office building and an early glasshouse. Rare plantings include the *Pyrus calleryana* D6 type specimen and a number of mature ornamental plantings which are locally uncommon are also present on the site.

Based on their assessment of the Stage 1 proposal, MUSEcape advise that:

- The subdivision layout has retained listed heritage items and a number of existing buildings with
  potential for adaptive reuse, to provide environmentally sustainable orientation of new
  buildings and sympathetic site landscaping which enhances retained significant native
  vegetation and historic trees within new plantings of suitable species.
- The proposed subdivision layout is sympathetic to the cultural landscape of the site, interpreting the plantations that previously characterised the site.
- The conceptual built forms, siting, proportions and landscaping have all been designed to be sympathetic to the heritage items and at the same time environmentally sustainable in terms of their orientation, solar access and contribution to local amenity.
- The visual absorption capacity of the area is such that the proposed development can be accommodated without unacceptable changes to the perception of the site as viewed from major viewing points within the heritage items' curtilages and the former Primary Industries Institute site generally.
- The proposed landscaping will respect the cultural landscape qualities of the site and minimise impacts of new dwellings by recognising and responding to the site's topography, water movements, natural vegetation and horticultural heritage.

The proposed landscaping will enhance the settings of new dwellings and make a positive contribution to the landscape which has become downgraded to a degree by weed invasion and relative lack of maintenance in recent years.

 Only one building, the old A-frame Glasshouse (Building 39) has been assessed as being of moderate significance in the CMP Review 103. If it cannot be relocated on site it should be archivally recorded prior to demolition. All other buildings proposed for demolition have been assessed as being of low significance.

A number of mitigation measures have been recommended by MUSEcape to reduce any adverse impacts likely to arise from implementation of the Stage 1 works. These are outlined below:

- 1. Designs, materials and exterior finishes of new dwelling units should be chosen to minimise visual impacts when viewed from the listed heritage items and major viewing points within the former Horticultural Institute.
- 2. Site to be landscaped with plant species appropriate to the locality, to meet one or more of the following requirements:
  - (a) Known to be part of the original plant community;
  - (b) Environmentally sustainable;
  - (c) Non-invasive;
  - (d) Any exotic ornamentals should be historically appropriate for the cultural landscape of the area.
- 3. Measures should be taken to ensure that during construction there is no runoff or spillage of concrete, adhesives or other waste from the site that might have a negative impact on heritage values or the environment generally.

- 4. Any existing significant trees or other vegetation to be retained should be protected during implementation of the Proposal in accordance with current best practice in arboriculture, as recommended by the consulting arborist.
- 5. Any major trees required to be removed for infrastructure construction to comply with relevant controls / standards should be replaced where feasible with specimens of the same species, ideally propagated from the removed trees, and planted close-by if conforming with landscape design intent or, if not, in another more appropriate location on site.
- 6. If the Old A-frame Glasshouse (Building 39), which has been assessed as of moderate significance, cannot be relocated on site for adaptive re-use, then it should be archivally recorded prior to its demolition.
- 7. An interpretive strategy should be prepared to comply with the requirements of clause 8.6(e) of Gosford DCP No.175 Gosford Horticultural Institute Rezoning. Any interpretive devices at the entry to the site should be designed to be culturally appropriate, visually unobtrusive and located to minimise visual impacts on the heritage listed historic gate posts and name panels.
- 8. New way-finding, informational, safety and interpretive signage at the entrance to the site and within the site should be designed and located to minimise visual impacts on listed heritage items and the cultural landscape values generally.

Finally, MUSEscape recommends that an Archaeological Management Plan (AMP) be prepared to cover both indigenous and non-indigenous cultural heritage. Given the age and significance of the Narara site, MuSEcape has advised that is likely that any early archaeological artefacts, objects or other sub-surface material evidence that may be unearthed on the site will be of at least local significance.

It is concluded that the proposal is within the limits of acceptable change for the listed heritage items and the site generally, and any impacts are manageable.

#### 5.8.2 Aboriginal Cultural Heritage

An Aboriginal Archaeological & Cultural Heritage Assessment Report (AA&CHA Report) was prepared for the Gosford Horticultural Research Statement rezoning in May 2006. The AA&HCA Report was commission by NSW Department of Commerce and was prepared by Danny O' Brien.

The AA&HCA Report included background data on pre-recorded Aboriginal sites for the township of Narara and its environs. Fifty-two (52) registered Aboriginal archaeological sites were found to occur, of which none were registered AHIMS Aboriginal sites located within or adjacent to the subject site.

The AA&HCA Report also included the results of field assessment and whilst fifteen (15) additional 'new' or previously unrecorded sites were identified, none of these were recorded within or immediately adjacent to the proposed development precinct (ie. the including Stage 1 are which is the subject of this application).

Based on the above findings it was concluded that the identified Aboriginal archaeological sites will not be directly affected by any future development, as these sites are not located within the proposed developable precincts of the subject site. It was also advised that the Darkinjung Local Aboriginal Land Council had no objection to the future development of the developable precincts identified at the rezoning stage. The development area identified in the Concept Plan and the Stage 1 DA remains consistent with the development precincts identified in the rezoning, with the works being largely contained within that portion of the site zoned 2(a) residential.

In light of the conclusions of the AA&HCA Report, no further archaeological investigations of the site have been undertaken. However, further consultation will be undertaken with the Darkinjung Local Aboriginal Land Council during the DA assessment phase as required by Clause 49T(7) of the GPSO and prior to the commencement of development on the site.

A number of recommendations contained in the AA&HCA Report remain valid and relevant to the current application, as outlined below:

- That no plans should be made to include walking trails within the subject site that lead to sensitive Aboriginal sites.
- That should fire trails or APZ be required to be established to protect future dwellings, then a detailed Aboriginal archaeological site survey be undertaken to ensure that any cryptic or sub-surface sites are considered.
- Should any Aboriginal sites be located during the construction phases for any future development including for road, infrastructure or dwellings, then all works at this location should cease, and the Department of Environment & Conservation's National Park & Wildlife Services should be contacted for further advice.

Should any artefacts be unearthed, the Co-operative is aware of its legal responsibility in respect to any requirement to obtain a permit under the Heritage Act and that Aboriginal sites and artefacts are protected under *the National Parks and Wildlife Act 1974*.

# 5.9 Transport and Accessibility

A Transport Impact Assessment has been prepared by Chris Hallam & Associates (**Appendix W**). This assessment has identified the existing transport context, including the current traffic generation and capacity of the surrounding road network. This assessment has also assessed the expected traffic generation, access and parking arrangements for the proposed development including the concurrent community use of the site.

The TIA includes consideration of the Traffic Assessment Reports undertaken for the site rezoning by BJ Bradley and based on a 150 lot residential subdivision of the NEV site. Significantly, these TIA's conclude that the traffic generated by the development will not have an adverse impact on the level of service, level of safety or capacity of the local road network and that the traffic impacts associated with the development of the site would be negligible. These conclusions were based on an estimated weekday peak hour traffic generation of about 130 vehicles/hour, and an estimated daily traffic generation of 1,350 vehicles/day, based on standard RMS traffic generation rates. Since the completion of these TIA's, there has been only a minor change in traffic generation as a result of new development in the local area and therefore, the conclusion of these studies remain valid and relevant to the current application.

#### 5.9.1 Traffic Generation

The site is currently serviced by an efficient functioning local road network. The TIA includes the results of recent traffic counts of the local road network to determine the current traffic flows and predicted traffic impacts resulting from the application.

The key conclusions from the TIA with respect to the current traffic situation are summarised below:

- Current traffic flows in Fountain Road are well within the environmental goal for local streets established by the RMS environmental capacity guidelines.
- A Sidra Analysis of the Manns Road/Carrington Street junction operates at a 'good' to 'satisfactory' level of operation during the current AM and PM peak hours depending on the chosen movement and therefore, achieves a Level of Service between 'A' and 'C'. The right turn movement into Carrington Street during the AM peak achieves a Level of Service 'D' and during the PM peak of 'C' which indicates that it operating at a level between 'satisfactory' and 'near capacity'.

The predicted traffic generation associated with the development has been based on the recommended RMS *Guidelines for Traffic Generating Development*. The intersection modelling has been based on the full development of the ecovillage as reflected in the current Concept Plan ie. 120 dwellings. This would result in a weekday peak hour flow of 78 vehicles/hour being added to the road network. Having regard to this traffic increase, the TIA concludes that:

- Peak traffic flows at the junction of Fountain Road and Hanlan Street South will continue to have satisfactory capacity and the Level of Service of the intersection will remain 'satisfactory'.
- At Manns Road and Carrington Street junction, the through traffic on Manns Road would remain undelayed. The right turn out of Carrington Street is currently delayed and this would increase as a result of the proposal. The signalisation of this intersection would result in further delays to traffic including to the through traffic along Manns Road and therefore, it is recommended that the intersection be retained as existing. It is however, noted that drivers would have the option of using Deane Street to make a right turn onto Narara Valley Road- Manns Road.

Given Stage 1 of the development only proposes a maximum of 60 dwellings, Chris Hallam & Associates has concluded that the traffic generation resulting from the development will be satisfactory. On this basis, no mitigation measures or local traffic improvement measures are recommended.

#### 5.9.2 Road Network

The proposed access to the site is maintained via the existing entry to the site off Fountain Road in accordance with the requirements of DCP 175. The access will be upgraded and the carriageway width increased to 5.5 metres.

TIA has assessed the proposed road network and design illustrated in the Road Circulation Plan prepared by Chase Burke Harvey (**Appendix O**). The TIA concludes that the road network design is satisfactory for the following reasons:

• The ecovillage roads would be private roads rather than public roads. Accordingly, the road layout has not been designed to conform with DCP 122- Residential Subdivision.

- The roads have been designed on AMCORD principles. The AMCORD principles are considered to set an appropriate standard for road design for the ecovillage based on the low level of traffic generation.
- The road network complies with the RFS Guidelines contained in Planning for Bushfire Protection.
- The AMCORD guidelines provide for shared car and pedestrian travel. The 1.2 metre services corridor adjacent to the carriageway, will also double as an informal pedestrian footway and is an appropriate design response for pedestrian movement and low traffic volumes. The footpaths will be provided through some of the common gardens and within common areas.

#### 5.9.3 Green Travel Plan and Parking

The Co-operative intends to develop a Green Travel Plan to limit traffic congestion and car dependency and to encourage the use of public transport and non-motorised modes such as walking and cycling within the ecovillage itself and neighbouring sites. This approach is in recognition of the increasingly detrimental impact car travel is having on the environment, road safety and personal health. Additionally, this approach is intended to reduce the dominance of cars within the ecovillage, including its design layout and general functioning of as 'pedestrian priority' concept.

The Green Travel Plan will include measures tailored to suit the ecovillage, including the investigation of opportunities for a community bus service to provide regular visits to the train station and local shopping centres, the use of a electric buggies and car sharing schemes.

It is considered that this approach will provide real environmental benefits to the ecovillage and raise general awareness in the community about the benefits of choosing alternative transport means, including to reduce emissions of greenhouse gases, improving local air quality, minimising health risks and reducing congestion, noise, dirt and fumes. Overall, it is anticipated that this approach will have a real impact on reducing car dependence and therefore, will reduce the overall number of vehicle trips generated by the ecovillage and the demand for car parking.

The Concept Plan for the NEV site proposes that most car parking being provided in common street reserves. Opportunities for on-site parking on individual residential lots can be accommodated subject to design impacts being minimised and sensitively integrated with the streetscape qualities of the ecovillage. Free standing enclosed garages will not be permitted and the use of cluster parking areas on common property is encouraged.

To meet the requirements of DCP 111- Car Parking, the Concept Plan proposes that car parking be limited to 1 space per dwelling. This may be provided in common areas (i.e. as part of the group facilities approach included in the Concept Plan) and therefore, may not meet a number of the requirements in the DCP in terms of siting and design for car parking.

The Stage 1 application proposed the construction of a number of common car parking areas along the Research Road as illustrated in the Road Circulation Plan at **Appendix O**. These spaces are centrally located meet the anticipated demand for parking generated by the existing community uses on the site and will be located within proposed Lot 1. The parking for individual dwelling lots proposed in the subdivision will be considered with each future development application.

# 5.10 Bushfire

A Bushfire Protection Assessment Report (BPA Report) has been prepared by ABPP for the proposal and is included at **Appendix V**. The BPA Report provides a detailed analysis of the proposal with regard to bushfire risk and management in response to the aims and objectives for *Planning for Bushfire Protection 2006*.

Gosford's Bushfire Prone Land Map shows that the development site contains areas of Category 1 & 2 Bushfire Prone Vegetation.

The BPA Report includes an assessment of the assets protection zones (APZ's) for the development required in accordance with the Appendix 2 of *Planning for Bushfire Protection 2006*. The assessment concludes that the proposed subdivision complies with the APZ requirements. An extract from the assessment tabulating these findings is provided in **Table 7** below. It is noted that the middle western gully (referred to as the southern gully) is proposed to be managed to an APZ standard, therefore removing the Category 1 Bushfire Prone Vegetation classification from this gully.

Aspect	Vegetation within 140m of development	Predominant Vegetation Class (Table A2.1 of P <i>f</i> BFP 2006)	Average Slope of Land	Recommended Width of Asset Protection Zone (Table A2.4 of PfBFP 2006))	Width of Asset Protection Zone Provided	Compliance with Table A2.5 of PfBFP 2006.
West of Lot 16; 27 – 36; 47 – 51;	Dry Sclerophyll Low Open Forest	Forest	> 15 degrees upslope	Minimum 20.0 metres required by Table A2.4.	25 metres provided by setback to dwellings.	YES – complies with P <i>f</i> BFP 2006
South of Lots 51 & 52	Managed land on adjoining property	Not Classified	> 15 degrees upslope	Nil required by Table A2.4.	N.A.	N.A.
South west of Lots 54 – 58	Dry Sclerophyll Low Open Forest	Forest	Level & < 15 degrees upslope	20 metres required by Table A2.4.	25 metres provided by setback to dwellings	YES – exceeds width required by P/BFP 2006
North west of Lot 59	Dry Sclerophyll Low Open Forest	Forest	Level - follows contours	Minimum 20.0 metres required by Table A2.4.	> 25 metres provided by setback to dwelling.	YES – complies with P <i>f</i> BFP 2006
South west of Lot 59	Dry Sclerophyll Low Open Forest	Forest	< 15 degrees upslope	Minimum 20.0 metres required by Table A2.4.	> 25 metres provided by setback to dwelling.	YES – complies with PfBFP 2006
Riparian/ Habitat Corridors [except for southern gully]	Wet/Dry Sclerophyll Low Open Forest – except for southern gully which is to be managed	Forest reclassified as 'rainforest' due to low hazard [width being less than 50m]	< 10 degrees down slope	15 metres recommended by Table A2.4.	Minimum 15 metres	YES – complies with P/BFP 2006

Table 7:	Determination	of Asset	Protection Zones
rabic 7.	Determination	UI ASSCI	

In order to mitigate the risk of bushfire hazard, ABPP has advised that the bushfire loads on the site and within the designated APZ's will need to be managed including to minimise fuel loading at ground floor level and to ensure that trees and shrubs are located away from buildings to minimise radiant heat and direct flame attack.

ABPP has assessed the road design, as detailed in the Road Circulation Plan provided at **Attachment O**, and has advised that:

- the perimeter road network, which has been designed with a trafficable width of 5.5 metres with designated passing bays and off-pavement parking bays, satisfies the perimeter road design requirements of *Planning for Bushfire Protection 2006*.
- the internal one-way roads, which have been designed to provide a trafficable width of 3.5 metres with designated off pavement parking bays and passing bays strategically located satisfy the performance criteria of one-way roads within section 4.2.3(1) of *Planning for Bushfire Protection 2006.*

A number of management and mitigation measures are recommended to address the requirements of Section 44(g) of the *Rural Fires Regulation 2008* and the deemed-to-satisfy provisions of *Planning for Bushfire Protection 2006* as a prerequisite for the issue of a Bushfire Safety Authority under Section 100B (4) of the *Rural Fires Act* for the subdivision, as follows:

- Asset Protection Zones: The APZ's to future dwellings shall be determined to maintain a maximum 29kW/m2 radiant heat flux on the exterior of the buildings.
- Management of vegetation: The APZ's and vegetation within the future residential lots shall be maintained as an Inner Protection Area and a Section 88B instrument be applied to the title of all future residential lots, the residual lots and the community association lot (Lot 1) to ensure the long term management of the vegetation in order to maintain minimum fuel loads.
- **Construction Standards:** the future dwellings on the lots created by the subdivision of the land shall be located with a separation distance from unmanaged bushfire prone vegetation (including the vegetation within the habitat/riparian corridors) which maintains the bushfire construction standard requirement to maximum BAL 29. All dwellings within 100 metres of bushfire prone vegetation shall be constructed to a minimum standard of BAL 12.5 and fitted with non-combustible gutter ember protection devices.
- **Fire-fighting access:** Access road within the development shall be constructed with a minimum pavement width of 5.5 metres for the main entrance road and the perimeter road and a minimum pavement width of 3.5 metres for the one-way internal roads. The property access roads to the individual lots shall be designed and constructed to a minimum width of 4.0 metres located in a 6.0 metre wide managed corridor. Temporary 'T' turning heads shall be provided at the terminus of 'dead-end' roads created in the construction of the individual development stages.
- Water Supply for fire-fighting operations: the water supply shall be provided with hydrant spacing, sizing and pressure complying with the specifications of AS 2419.1-2005 and have a flow rate of 10 litres/second.
- **Bushfire Survival:** The owners of lots directly exposed to the bushfire hazard prepare a 'Bushfire Survival Plan'.

Subject to compliance with these recommendations, ABPP has advised that the proposal complies with the 'deemed-to-satisfy' provisions set out in Chapter 4 (performance based controls) and the aims and objectives of *Planning for Bushfire Protection 2006,* and therefore, the proposal complies with Section 8.4 of DCP 175.

# 5.11 Waste Management

#### **5.11.1 Construction Waste**

A Preliminary Waste Management Plan (PWM Plan) has been prepared for Stage 1 construction and is included at **Appendix U**.

The PWM Plan is based on minimising off-site removal of waste and maximising the beneficial re-use of the waste. The key sources of waste from the Stage 1 works will be associated with the removal of trees, the demolition of existing structures and the regrading works as following:

- A number of trees will be felled to accommodate the regrading works and infrastructure installation. These trees will be chipped and stockpiled on site for future re-use.
- Approximately 1000m<sup>3</sup> of net cut will be available as a result of the bulk earthworks for the construction of the road and associated regrading. This material will be stockpiled on site for future re-use.
- Bricks, concrete and other construction material associated with the building demolition will be stockpiled on site for future re-uses. Where buildings to be demolished have been identified as containing asbestos products, they will be removed by an AS-1 licensed asbestos removalist contractor in accordance with the NOHSC *Code of Practice for the Management and Control of Asbestos in Workplaces* and disposed of as asbestos waste to an appropriately licensed facility.

The design philosophy for the NEV site is underpinned by environmental responsible design principles. A design using sustainability and recycled materials will provide both short and long term cost benefits in terms of the health of the environment. These design principles are incorporated into the Design Report and encourage the use of the following:

- recycled materials wherever possible, this includes recycled compacted site fill behind the rubble walls;
- recycled rubble as a facing material in gabion walls;
- recycled aggregates for drainage and edging;
- recycled soils and mulch; and
- recycled timber from removed trees for seats, decking, walls and informal play equipment.

A final Waste Management Plan quantifying the volumes of waste and the relevant waste facilities to be utilised will be prepared once a construction manager and building contractors have been engaged.

## **5.11.2 Operational Waste**

There will be minimal operational waste associated with the Stage 1 works. However, the proposal includes the construction of the communal garbage store for the site required to service the future residential needs of Stage 1. The waste management area has been designed in consultation with Council's Waste Officer and to meet the requirements of DCP 106.

The bins store has been designed to accommodate a dual axle 9.8 metre truck with a HRV turning radius of 12.5 metres, in accordance with Council waste services requirements.

As illustrated in **Figure 40** below, the garbage store is setback 4.5 metres from the eastern boundary of the site. This setback will be landscaped in order to suitably screen the garbage store from neighbouring residential properties to the east. It is likely that the area will also be partially enclosed at the eastern end to minimise any adverse amenity impacts to neighbouring residential premises.



Figure 40: Location and design of communal garbage store (Source Hill Thalis Design Report)

The garbage store will be maintained and managed by the site manager.

It has been estimated the 60 residences proposed in Stage 1 will generate 7.2m<sup>3</sup> off mixed waste per week and therefore, require 10 bulk bins. An equivalent number of bins will technically be required to store recyclable waste. The amount of waste will be minimised on site and were possible will be composted and beneficially used in gardens. This will substantially reduce off-site disposal of waste. All residents will be responsible for transferring their waste as required to the communal garbage store.

Having regard to the above, the proposal is considered to be consistent with key provisions of DCP 106.

# **5.12 Amenity Impacts**

#### 5.12.1 Air Quality

The installation of the sewerage treatment plant (STP) has the potential to generate odours as a result of the treatment process. Accordingly, an Air Quality Assessment Report (AQA Report) has been prepared by Aubin Environmental to assess the likely emissions from the STP and to determine whether these emissions are likely to have a detrimental impact on air quality both within and surrounding the NEV site. The AQA Report is included at **Appendix Y**.

As detailed in Section 3.6 of the SEE, the STP is referred to as a Membrane Bio-Reactor (MBR). MBR provides for a biological process that is highly controlled and this reduces the risk of generating odorous compounds produced under anaerobic conditions.

The AQA Report includes an assessment of impact of potential emissions from the STP to the surrounding area using AUSPLUME v6 dispersion model in accordance with the methodology in the *NSW EPA's Technical Framework: Assessment and Management of odour from stationary sources in NSW" (November 2006).* The Ausplume model was configured to measure the maximum ground level concentrations at each junction of a grid that spans 1km x 1km around the STP and to determine the worst impact to the nearest sensitive receptors. This is based on ground level concentrations at each grid intersection within the assessment area for every hour in one calender year. The area covered by the dispersion assessment is shown in **Figure 41** below and includes residential development to the east of the NEV site (SR1 & SR2), and residential development within the NEV site itself (SR3-SR5).



Figure 41: Area included in the dispersion assessment (Source: Aubin Environmental)

The modelling showed that in all instances, the results of the testing were significantly lower than the assessment criteria. Based on the odour assessment criteria adopted for the site of '4', it was determined that the ground level concentrations at sensitive receptors SR1 and SR2 were 0.6 and 0.8, respectively. Within the NEV site itself, the levels are slightly higher but still remain well below the assessment criteria. In this regard, the concentrations at ground level for SR5 and SR3 ranged from 0.5 to 1.5, respectively. SR4 had an estimated concentration of 1.1, as illustrated in **Figure 42** below. It is noted that the ground level concentrations at the STP are estimated to be above '4' and that this level was detected at 5 out of the 448 locations assessed in the modelling. However, the

frequency at which the ground level concentrations at these locations were above 4 were predicted to range from 1-10 hours in any calender year, and for this reason were determined to be acceptable. Aubin Environmental have also advised that in reality the ground level concentrations of odours are likely to be lower in reality due to the conservative basis upon which the modelling was undertaken.



Figure 42: Contour plot showing predicted ground level odour impact

Based on the assessment Aubin Environmental concluded that there are unlikely to be any negative air quality impacts resulting from the operation of the STP.

#### 5.12.2 Noise

A Noise Impact Assessment (NIA) of the proposed STP has been undertaken by VIPAC and is provided at **Appendix Y**. The assessment has been undertaken to determine potential noise impacts from the operation of the STP on the nearest sensitive receptors in the surrounding areas, including on the NEV site and existing neighbouring residential areas.

The NIA uses the standards and guidelines in the EPA's Industrial Noise Policy and Australian Standard AS 1055-1997- "Acoustics Description and Measurement of Environmental Noise, Part 1-General Procedures". The existing baseline environmental noise levels were determined from the results of noise logging undertaken at two locations.

The main noise contributors associated with the STP are anticipated to be Bio Blowers and MBR Blower. This equipment would be contained within a STP building and therefore, the acoustic performance of the building's facade is likely to reduce noise impacts.

VIPAC's assessment included modelling 4 scenarios for the STP using the SoundPlan Program under both neutral and worst weather conditions for the day, evening and night periods, given the STP will operate 24 hours a day. The predicted noise impact from the STP on noise sensitive receivers ranged from between 4 to 42dB(A) and therefore, is well within the applicable criteria during the day, evening and night time period.

VIPAC therefore conclude that the STP will not result in adverse noise impacts to neighbouring residential development both within the NEV site and in neighbouring residential areas.

VIPAC has also prepared a Noise and Vibration Management Plan (N&VM Plan) to address impacts associated with the construction of the STP (**Appendix Y**). The N&VM Plan predicts construction associated with the STP will result in the following:

- the predicted construction noise levels at all noise sensitive receivers will be within the Noise Management Levels and the Noise-Affected Levels of the NSW Interim Construction Guidelines for construction work undertaken during standard construction hours; and
- the predicted vibration impacts produced will be of a low to mid frequency. Consequently, excavation equipment is unlikely to have an impact on the nearest sensitive receiver.

The N&VM Plan includes a recommendation for community enquiries management, including notification before and during construction and complaints handling. The Co-operative will comply with these recommendations.

## 5.12.3 Lighting

A Lighting Report has been prepared by Light, Art + Science and is provided at **Appendix X**. This report specifically responds to the requirements of Section 8.3(f) of DCP 175 which requires that any external night lighting associated with the future development of the site be designed to reduce light spillage into the adjacent forested areas.

The Flora and Fauna Gap Assessment prepared by Robert Payne (refer **Appendix J**) has identified that a number of threatened species may be impacted by lighting of the forest edges by the development and that this could impact on feeding regime of a number of species including: Greyheaded Flying Fox, Eastern Bent-wing Bat, Little Bent-wing Bat, Eastern Free-tail Bat, Southern Myotis, Sooty Owl, Powerful Owl. Accordingly, the installation of low level lighting against the forest edge and the dam because of the presence of foraging threatened fauna species has been recommended.

Having regard to the lighting requirement of the NEV and the potential for impacts to foraging species, the Lighting Report makes specific recommendations to ensure compliance with the AS/NZS

1158.3.1 Lighting of roads and public spaces Part 1.1 Vehicular traffic (Category V) lighting-Performance and Design Requirements and AS/NZs 1158.3.1 Lighting of road and public spaces Part 3.1 Pedestrian Area (Category P) Lighting – Performance and Design Requirements. Specifically, the Lighting Report concludes that the selection of luminaires should comply with the following requirements:

- Light source for external lighting should be of colour temperature 3000K;
- Street lighting should be pole mounted at no higher than 7.5m and have a full cut of lense based LED luminaire;
- Pathways lighting should be poled mounted at a height of 5m to 5.5m and have a full cut off lense based LED luminaire;
- Landscaping accent lighting should be directed to the item intended to be lit, have suitable light distribution that avoids light spillage and be fitted with a glare shield. The light source should be LED or low wattage ceramic metal halide.
- Building lighting should be ensure the majority of the lighting is below the horizontal if wall mounted or fully recessed if in an awning. Uplighting should only be used if it is under an awning or soffit. The light source should be LED, low wattage ceramic metal halide or compact fluorescent.

The Lighting Report includes the results of a sample section of street lighting that was modlled to calculate the spill light into the surrounding areas using horizontal illuminance calculation points in the forest areas of the NEV site. The test results showed that the horizontal calculation points fall to zero at around 30 metres beyond the street lighting if full cut off LED luminaires are used (as opposed to convention style metal halide street lighting).

The road design for the NEV site (refer plan RC12242 at **Appendix O**) proposes that the new perimeter road (Road 2) be setback from the boundary of Lot 40 which defines the extent of the 7(a) conservation land (bushland). Therefore any potential lighting spill to the west towards the bushland would be reduced. It is noted that the area between the 7(a) conservation land and the Stage 1 development will be maintained as an APZ.

The Co-operative proposes to finalise the design of the street lighting including the location and pole spacing at the construction certificate stage. Subject to compliance with the recommendations of the Lighting Report, it is considered that the proposal will comply with Section 8.3f of the DCP 175.

# 5.13 Visual Impacts

Matters in relation to the visual impact of the land subdivision have been addressed with reference to the relevant development controls in the Compliance Tables provided at **Appendix Z**.

The residential subdivision has been limited to the predominantly cleared sections of the site. The significant bushland and established landscaping throughout the site will be maintained. The topography of the site will ensure that many views of the development are screened by existing vegetation and the natural lay of the land. The Design Report demonstrates how future development of the residential lots can be designed to accommodate existing site features and

furthermore, through the selection of materials and finishes, can appropriately integrate with the character of the site.

The landscape strategy prepared for the site (**Appendix B**) includes significant new planting thoughout the Stage 1 site including planting along the reformed Research Road to provide an avenue of trees. The Ecological Restoration Plan (**Appendix K**) also makes recommendation for the embellishment of the site including the eradication of weeds. In combination, these works will significantly improve the visual quality of the site.

Having regard to the above, it is considered that the proposed subdivision will not result in unacceptable visual amenity impacts to neighbouring lands.

# 5.14 Social and Economic Impacts

The project will deliver social and economic benefits to the local economy through direct job creation associated with the design development and construction phases. There will be resultant multiplier effects generated throughout the local economy including related to trade employment and supply of construction materials.

Given the overall development of the NEV site is to be staged, job creation linked to the construction phase of the development will be ongoing for considerable period of time.

Post completion of the project, it is estimated that the project will create a number of ongoing jobs associated with the maintenance and management of the ecovillage. Employment may also be linked to some of the proposed complementary uses on the site.

The proposal will provide opportunities for housing choices in the Gosford LGA and will assist in meeting the dwelling targets in the Central Coast Regional Strategy. The location of the site, including its convenient access to transport and services in the area and its environmental and scenic qualities will result in positive social impacts. The design principles for the development of the ecovillage have embraced these qualities and this will deliver social benefits to residents of the ecovillage.

The development of the site will also provide positive social impacts principally relating to the increased opportunities for the public to engage with and better understand the environmental and historic significance of the site, and through the provision of the 6(a) land to Council's open space network.

Overall, the development will deliver positive social and economic benefits to the local area and the broader Gosford LGA.

# **5.15 Construction Impacts**

Construction activities associated with the development are largely contained well within the site boundaries. In order to minimise the potential for noise and vibration impacts to nearby sensitive receivers, construction work is proposed to be undertaken during Council's standard daytime construction periods (ie. 7.00am to 6.00pm Monday to Friday and 8,00am to 1pm on Saturday).

Prior to the commencement of construction, when the construction methodology and program has been finalised, a Construction Environmental Management Plan will be prepared. This will address each stage of construction and identify the appropriate mitigation and management measures to be employed to minimise construction impacts including traffic, noise, vibration and dust.

The Soil and Sediment Control Plan included at **Appendix R** proposed water quality management appropriate to mitigate on-site and off-site soil and sediment impacts to watercourses. The proposed soil and sediment control measures will be in place and maintained during construction.

# 5.16 Suitability of the Site for the Development

Having regard to the characteristics of the site and its location, the site is considered suitable for the proposed use in that:

- It is appropriately zoned to accommodate the proposed development and the development is consistent with the provisions in GPSO and the Draft Gosford LEP 2013, which promote land uses that are compatible with the low density residential character of the area;
- The existing buildings and the environmental qualities of the site lend themselves to the establishment of an ecovillage;
- The reports which support this application demonstrate that the subdivision of the site and associated development will result in minimal environmental impact including to the existing environment, heritage, road network and scenic quality of the site;
- The site is conveniently located to a number of schools, shopping centres and local business including Gosford City centre;
- The site has good access to a range of public transport option including local bus services and Narara Railway Station; and
- It will not result in any material environmental impacts to the adjoining properties.

## 5.17 Any submissions made in accordance with the Act or Regulation

The proposed development will be notified in accordance with Council's notification policy. Any submissions received will be duly considered by Council prior to the determination of the application.

Prior to the determination of the application, Council is also required to obtain general terms of any approval proposed to be granted in relation to the development from the NSW Rural Fire Service and the NSW Office of Water in accordance with Section 91A of the Act.

## 5.18 The Public Interest

The proposal is considered to be in the public interest as it will achieve the following:

- facilitate the use of the site and in doing so, will aid in the conservation, protection, security and enhancement of the environmental and heritage of the site;
- contribute to Council's open space network through the dedication of the 6(a) land;

- provide opportunities for greater housing choice in the Gosford LGA and will assist in meeting the dwelling targets in the Central Coast Regional Strategy; and
- development that is compatible with the surrounding residential areas and is a permissible use with consent pursuant to the provisions of GPSO and therefore, will promote the orderly and economic use of the land.

The proposal is considered to uphold the public interest as no adverse environmental, social or economic impact is to result from the development.

# 5.19 Summary

The environmental assessment on the proposal has demonstrates that the Concept Plan and the implementation of the Stage 1 works will result in the following key outcomes:

- The orderly and economic development of the site;
- A subdivision layout which delivers a variety of housing lots capable of supporting a variety of housing choices;
- A road network and parking provision which meets the needs of the ecovillage and the access arrangements of the RMS and minimises impacts to the local road network;
- The provision for on-site contamination to be addressed;
- The incorporation of appropriate and sound provisions for environmental protection and ecological restoration;
- Relevant and appropriate provisions to ensure the bushfire protection of the site;
- Restricts development in flood liable areas;
- Provides genuine sustainable environmental outcomes and with positive environmental benefits;
- Demonstrates that public utility services are available to the site;
- Protects items of environmental heritage on the site and establishes a range of relevant conservation policies;
- Contributes to the public open space network through the dedication of the 6(a) zoned land to Council; and
- No adverse environmental impacts to neighbouring land.

On this basis, it is considered that the proposal is worthy of Council's support.

# 6.0 Conclusion

This application seeks approval for Stage 1 works associated with the establishment of an ecovillage on the NEV site. The application proposes a 40 lot community title subdivision and ancillary works required to support the future development of the NEV site.

This Statement of Environmental Effects has assessed the proposal having regard to the section 79C of the Act. The assessment has demonstrated that the proposal complies with the relevant environmental planning instruments and complies with the key objectives and controls of the relevant development controls plans which apply to the site, as demonstrated in the SEE and the accompanying compliance tables. The assessment has also concluded that the proposal positively responds to site conditions and will result in positive economic, environment and social benefits to the community. Importantly, the proposal will increase the provision of future housing stock in the Gosford LGA in line with local and regional planning strategies.

The relevant technical reports which support the application demonstrate that the site is capable of supporting the proposal and that it can be fully serviced (including via an integrated water management system) and that the development of the site will not pose any significant risks to the environment or hazards to future residents. The detailed analysis provided in this SEE and the supporting technical reports demonstrate that the proposal does not give rise to any unreasonable adverse amenity impacts to adjoining properties.

The application establishes the foundations for the future development of the ecovillage. The ecovillage has been designed to embrace the site conditions. Considerable community benefits will result from the proposal including through its sustainable design approach which will foster economic, environmental and social well-being, housing choice and the enhancement of the environmental and cultural heritage of the site. In addition, the proposal will make a positive contribution to Council's open space network and provides for the ecological restoration of the site. The Design Report provided with the application demonstrates that the development of the site will occur in an orderly and planned manner and that a high quality urban design outcome will be achieved.

For the above reasons, the proposal represents an appropriate development outcome for the site. It is recommended that the application be approved by Council.

Sara Roach Planning Services

# **DEVELOPMENT APPLICATION**

Statement of Environmental Effects

# Narara Ecovillage: 33 Gugandi Road, Narara



# **Development Application: Stage 2-** Subdivision, infrastructure and associated works

# Submitted to Central Coast Council On behalf of *Narara Ecovillage Co-operative Ltd* March 2020

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		Surveyors
В-	Stage 2 DA Design Report	Envirotecture / ELKE Landscape Architect +
		Consulting Arborist
C-	NEV Concept Plan	Hill Thalis Architecture +Urban Projects
D-	D1- Pre-DA Lodgement Meeting Minutes (11 October 2018)	Central Coast Council
	D2- Letter from Council- Request for Connection to Council's water and sewer reticulation system (22 January 2019)	Central Coast Council
	D3- Flyer- NEV Open Day & Stage 2 DA Information Session	Narara Ecovillage
E-	NEV- Existing Buildings Diagram	MUSEcape
F-	F1- Stage 2 Draft Plan of Subdivision	Delfs Lascelles Consulting Surveyors
	F2- Subdivision advice	Delfs Lascelles Consulting Surveyors
G-	G1- Narara Ecovillage Community Management Statement	Narara Ecovillage
	G2- Landscape Design Standards	Narara Ecovillage
Н-	Detailed Site Investigation Report	Benviron Group
<i>I</i> -	Stage 2 Heritage Impact Statement	Betteridge Heritage
J-	Conservation Management Plan Review 2013	MUSEcape
К-	Landscape Architectural Plans and Tree Removal Plans	ELKE Landscape Architect + Consulting Arborist
L-	Arboricultural Impact Assessment Report	ELKE Landscape Architect + Consulting Arborist
М-	Ecological Assessment Report	Anderson Environmental Pty Ltd
N-	Stage 2 Geotechnical Assessment Report	Benviron Group
0-	Utility Services Submissions	Narara Ecovillage / TCB Project Management
P-	Water Cycle Management Plan Report	Henry & Hymas Consulting Engineers Pty Ltd
Q-	Potable Water & Recycled Water Reticulation Plans	Henry & Hymas Consulting Engineers Pty Ltd
<i>R</i> -	Advice on First Order Stream	Woodlots & Wetlands
S-	Sewer Reticulation Works Plans	Henry & Hymas Consulting Engineers Pty Ltd
<i>T-</i>	Civil Engineering Report	Henry & Hymas Consulting Engineers Pty Ltd
U-	Civil Engineering Works Plans: Roads- general arrangements, detail plans, sections, road cross sections.	Henry & Hymas Consulting Engineers Pty Ltd
V-	Civil Engineering Works Plans: Stormwater, OSD.	Henry & Hymas Consulting Engineers Ptv Ltd
-	Bioretention basin details, stormwater catchment plan.	
	sediment and erosion control plans.	
<i>W</i> -	Bulk Earthworks Cut and Fill	Henry & Hymas Consulting Engineers Pty Ltd

X-	Drains Modelling	Henry & Hymas Consulting Engineers Pty Ltd
<b>Y</b> -	MUSIC Modelling	Henry & Hymas Consulting Engineers Pty Ltd
Z-	Z1- Waste Management Plan	Narara Ecovillage / TCB Project Management
	Z2- Plan of Waste Storage Area	Envirotecture
AA-	Bushfire Protection Assessment Report	Traverse Bushfire & Ecology
BB-	Traffic, Access and Parking Assessment Report	Transport & Urban Planning Pty Ltd
CC-	Compliance Tables-	Sara Roach Planning Services
	Interim Development Order No.122	
	Gosford Local Environmental Plan 2014	
	Gosford Development Control Plan 2013	

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# 1.0 Introduction and Background

# **1.1** Introduction

This Statement of Environmental Effects (SEE) has been prepared by Sara Roach Planning Services on behalf of Narara Ecovillage Co-Operative Ltd (the Co-Operative) to accompany a Development Application (DA) for a 43 lot residential subdivision of Part Lot 50 DP 270882 of the NEV Community Title Scheme and the provision of essential servicing infrastructure (roads, power, water, sewage and telecommunications) and associated works at 33 Gugandi Road, Narara.

This DA comprises Stage 2 (hereafter referred to as the "Stage 2 DA") in the development of the Narara Ecovillage (NEV) and consists of land at the southern end of the site contiguous with the entry to the Ecovillage off Research Road. The Stage 2 DA comprises approximately 3.6 hectares of NEV land and includes land immediately to the south of the NEV site (Nos.21 and 23 Research Road) to construct a perimeter access road. Additional works on Council land are also proposed to integrate the new perimeter road with Research Road.

The total NEV site comprises approximately 62.97 hectares of land, of which approximately 11.5 hectares of land is currently zoned *R2 Low Density Residential* pursuant to *Gosford Local Environmental Plan 2014* (GLEP 2014). The Co-Operative acquired the land from the Department of Primary Industries in September 2012, with settlement in May 2013. Prior to the sale of the land, the NEV site was occupied and operated as the Gosford Horticultural Research and Advisory Station (Horticultural Institute). A number of the former horticultural and research buildings and structures remain on the site.

Development consent (DA No. 44994/2013 Part 1) for Stage 1 of the NEV was issued by the former Gosford City Council on 8 August 2014 (the Stage 1 consent). The Stage 1 consent comprised the community title subdivision of the site, the demolition of various structures and buildings and the provision of essential servicing infrastructure for Stage 1 of the ecovillage. This consent established the broad principles for the future staged development of the NEV site and was supported by a Concept Plan prepared Hill Thalis Architecture +Urban Projects and McGregor Coxall.

The Stage 1 consent has been subsequently amended on five (5) occasions. The approved scope of works pursuant to this consent including the road infrastructure and associated civil works are now complete and dwellings are currently being constructed on the lots created by the subdivision. The Community Title Scheme was registered with the NSW Land Registry Services on 8<sup>th</sup> June 2018. The registered Plan of Subdivision includes Part Lot 50 DP 270882, which is owned by the Co-operative (as the developer) and which was identified in the Stage 1 DA for further subdivision associated with the staged development of the NEV site.

This SEE is submitted to Central Coast Council (Council) pursuant to the provisions of Part 4 of the *Environmental Planning and Assessment Act* 1979 (EP&A Act) and Part 6 of the *Environmental Planning and Assessment Regulations 2000* (the Regulations). The DA is integrated development pursuant to section 4.46 of the EP&A Act will require terms of approval to be issued by the RFS under the *Rural Fire Services Act 1997*. Approval is also required under section 138 of the *Road Act 1993* for works proposed on Research Road to integrate with the new perimeter road. However, this aspect of

the proposal does not constitute integrated development under the provisions section 4.46(3) of the EP&A Act. It is also contended that a controlled activity approval under the section 91 of the *Water Management Act 2000* is not required in this instance and therefore, the application is not integrated development in respect of the EP&A Act.

This DA is not designated development pursuant to Clause 4 of the Regulations.

This Stage 2 DA will enable the continued orderly and ongoing development of the site in keeping with the NEV Concept Plan. This SEE describes the site, its surroundings, the proposal and provides an assessment of the proposal in terms of the matters for consideration under Section 4.15(1) of the EP&A Act. This SEE demonstrates that the proposal is generally consistent with the provisions of the following Council environmental planning instruments and development control plans:

- Gosford Local Environmental Plan 2014
- Interim Development Order No. 122 (City of Gosford)
- Draft Central Coast Local Environmental Plan
- Gosford Development Control Plan 2014 (GDCP 2014)
- Draft Central Coast Development Control Plan

The application is supported by a range of technical reports which demonstrate that the proposal will result in minimal environmental impact and will provide substantial net benefits to NEV and the broader community. Therefore, Council's favourable consideration of the application is requested.

It should be noted that concurrently with the lodgement of this DA, the Co-operative has submitted an application to Council under Section 305 of the *Water Management Act 2000* for the provision of water and sewer services to the site via a connection to Council's network. Notwithstanding this, the Co-operative will remain the water and sewer retailer for the site under a retail operator's licence and network operator's licence issued under the *Water Industry Competition Act 2006* (WICA) by the Independent Pricing and Regulatory Authority Tribunal (IPART).

# **1.2 Overview of the Project**

#### 1.2.1 The Concept Plan and Project Objective for Stage 1

The overall objective for the NEV site is to recast the Horticultural Institute into an ecovillage with a key emphasis on environmental, social and economic sustainability. The Concept for the ecovillage is to establish a community of people living in a sustainable way, focusing on the principles of environmental sensitive property design and living practices, active community relationships and events, and developing sustainable economic activities.

Specifically, the vision for the NEV site is as follows:

"to research, design and build a stylish, intergenerational, friendly demonstration ecovillage at Narara blending the principles of ecological and social sustainability, good health, business, caring and other options that may evolve for our wellbeing." As stated above, the Stage 1 consent established the foundations for the future development of the site with its design retaining many of the existing site features and minimising site intervention in recognition of the important ecological and heritage values of the site. The non-statutory Concept Plan prepared for the NEV site (submitted with the Stage 1 DA) identified the progressive staged development of the site. It established the broad principles for road and pedestrian circulation and the network of community association land and open space through the site. The Concept Plan also proposed the community title subdivision of the site for residential purposes with land uses to support the village economy including community uses and neighbourhood shops.

The Concept Plan is outlined in the Stage 2 DA Design Report prepared by Envirotecture at **Appendix B** and selective extracts from the Concept Plan prepared by Hill Thalis Architecture +Urban Projects and McGregor Coxall are included at **Appendix C** for information purposes. The Stage 2 DA Design Report contains detailed strategies for the arrangement of the subdivision, the street pattern and the provision of site facilities and the design principles for elements including dwelling siting and design, landscaping and water management which underpin the overall development of the NEV site.



The illustrative Stage 1 Concept Plan is provided in Figure 1.

Figure 1: Illustrative Stage 1 Concept Plan for NEV Site, Stage 1 DA (Source: Hill Thalis)

#### 1.2.2 The Development Proposal- Stage 2 Subdivision

The Stage 2 DA seeks approval to subdivide Part Lot 50 in DP 270882 in the NEV Community Title Scheme and to create 43 new residential allotments. The Stage 2 DA is integrated development pursuant to Division 4.8 of the EP&A Act in respect of the *Rural Fires Act 1997*.

The Draft Plan of Subdivision proposes:

- the creation of 43 residential lots ranging in size from 550sqm to 1371sqm (identified as Lots 51 to 93 in DP 270882 on the Stage 2 DA Draft Plan of Subdivision at **Appendix F**);
- the expansion of Lot 1 within the Stage 2 site area, being the community association lot. Lot 1 includes the site infrastructure, car parking (where not located on residential lots), access ways, roadways and associated landscaped/open space areas; and
- a number of restrictions on title in respect to rights of carriageway, easements for common gardens, access and services.

To support the Stage 2 subdivision and to meet the servicing requirements for the future development, the following ancillary works are also proposed:

- the demolition of one (1) multi-span greenhouse and the existing the driveway access to Lots 209 and 210 in DP263748 (being Nos. 21 and 23 Research Road, Narara);
- the removal of 40 trees and the remnants of the citrus orchard and plantings of the former Horticultural Institute within the Stage 2 site;
- earthworks for the construction of the roads, pathways and essential utility services and associated retaining walls and batters;
- the construction of the road network including the extension of the Stage 1 perimeter road through the Stage 2 site providing direct access onto Research Road, and a new internal loop road accessed off Gugandi Road;
- the construction of essential utility services required to service the site including infrastructure for water management (i.e. potable water, non-potable water and sewer); electricity and telecommunications;
- the construction of the integrated stormwater management strategy for the site including onsite detention and bioretention basins;
- the implementation of a comprehensives landscape strategy; and
- works to make the site bushfire safe.

The application is predominantly limited to the land on the NEV site which is current zoned R2 Low Density Residential under *Gosford Local Environmental Plan 2014* (GLEP 2014). However, due to the irregular boundary alignment in the south west corner of the site, some civil works are also proposed on land zoned *E2 Environmental Conservation* in order to provide a logical geometry and compliant grading to the perimeter road. The perimeter road also extends onto land identified as 'deferred land' in GLEP 2014 to the south (currently zoned *7(c2) Conservation and Scenic Protection* pursuant to IDO No. 122) to rationalise and simplify the access arrangements between NEV and this neighbouring land.

The concept for the Stage 2 subdivision is illustrated in Figure 2.



Figure 2: Stage 2 Subdivision Concept (Source: Envirotecture)

# **1.3** Consultation

## **1.3.1 Central Coast Council**

The Co-operative and the specialist consultant team have held a series of meetings with Council throughout the design development of the Stage 2 DA. A preliminary meeting was convened on 11<sup>th</sup> October 2018, with the most recent meeting convened with senior staff of Council on 31<sup>st</sup> October 2019. The Council Minutes of the preliminary meeting are provided at **Appendix D**.

This Stage 2 DA has been prepared in accordance with the key issues and considerations discussed with Council at these meetings, as summarised in **Table 1** below.

Table 1. Rey issues / matters discussion in pre-lougement meetings with council
---

lssues / Matter discussed	NEV's response	Reference in the SEE
Council considers the development to be	NEV no longer intends to progress with its integrated wastewater treatment plant and has lodged an application	Section 4.2 of the SEE
Designated Development	under section 305 of the <i>Water Management Act 2000</i> to connect Stage 1 of the development to Council's water and	Appendix P- Water Cycle Management Plan
	sewer network. NEV intends lodging a further application for Stage 2 of the development to connect to Council's water and sewer network as detailed in the Water Cycle Management	Appendix O- Utility Services Submissions
	Plan and the Utility Services Submissions. On this basis, the development does not meet the requirements of Part 1 of	
	Schedule 3 of the EP&A Regulations and cannot be declared to be designated development.	
--	---	---
The proposal isIntegrateddevelopmentunders.4.46 of the EP&A Act.	This Stage 2 DA has been lodged as an integrated development application and the bush fire safety authority is required to be issued for the development under s.100B of the <i>Rural Fires Ac 1997</i> .	Section 4.2.1 Appendix AA- Bushfire Protection Assessment Report
The minimum subdivision lot size should comply with Gosford LEP 2014	The application complies with Clause 4.1AA(3) of GLEP 2014 regarding the minimum lot size for community title development. The minimum lot size proposed in the Stage 2 DA is 550sqm. Note: the Stage 2 DA includes a number of large lots which may be subject to further subdivision in the future should the relevant LEP be amended.	Sections 3.2 and 5.1 Appendix F- Stage 2 Draft Plan of Subdivision
The requirements of Chapter 5.8 (Narara, Gosford Horticultural Institute) of Gosford DCP 2013 should be addressed	The Stage 2 DA has been designed having regard to the relevant provisions in the Gosford DCP 2013 including Chapter 5.8, as detailed in the Compliance Table at Appendix CC.	Appendix CC- Compliance Tables
The DA should be accompanied by Landscape Masterplan	Landscape Masterplan has been prepared for Stage 2 by Elke Landscape Architect + Consulting Arborist. The Masterplan proposes a comprehensive landscape treatment for the site which integrates with the approved Stage 1 design.	Sections 3.8 and 5.6 Appendix K- Landscape Architectural Plans
Demonstrate emergency services accessibility	The road network has been designed to facilitate emergency vehicle access around the Stage 2 site and to integrate with the completed Stage 1 perimeter road. The Bushfire Protection Assessment Report (Appendix AA) demonstrates that the proposal complies with the performance criteria outline in the <i>Planning for Bushfire Protection</i> 2018 for the access and road design (perimeter roads and non-perimeter roads).	Sections 3.9 and 5.10 Appendix AA- Bushfire Protection Assessment Report
Provide details of cut and fill and a geotechnical assessment	A bulk earthworks Cut & Fill Plan has been prepared by Henry & Hymas for the Stage 2 DA. Geotechnical Assessment Report has been prepared by Benviron Group for the Stage 2 DA.	Sections 3.4.3 and 5.2 Appendix W- Bulk Earthworks Cut and Fill Appendix N- Stage 2 Geotechnical Assessment Report
Provide documentation regarding the Community Title Scheme	A copy of the existing Community Management Statement is appended to the SEE. A schedule of proposed amendments to the CMS to make it relevant to the Stage 2 development is included in Section 3.2 of this SEE.	Section 3.2 Appendix G1
Detail parking allocation within the development and a Traffic & Transport Strategy	The parking allocation is documented in the Stage 2 DA Design Report prepared by Envirotecture and the Traffic, Access and Parking Report prepared by Transport & Urban Planning Pty Ltd. A total of 99 on-street parking spaces are proposed in Stage 2 comprising 51 resident spaces and 48 visitor spaces.	Sections 3.5 and 5.9 Appendix B- Stage 2 DA Design Report Appendix BB- Traffic, Access and Parking Report
Provide a Stormwater (Water Cycle) Integrated Strategy	A Water Cycle Management Plan and associated civil engineering works plans have been prepared by Henry & Hymas. The concept for the water cycle management has considered the relevant provisions in Chapter 6 of Gosford DCP 2013 and includes on-site detention and water sensitive urban design.	Sections 3.7 and 5.5 Appendix P- Water Cycle Management Plan Appendix Q- Potable Water & Recycled Water Reticulation Plans Appendix S- Sewer Reticulation Works Plans Appendix V- Civil Engineering Works Plans
Address the following requirements: • NSW Biodiversity legislation	An Ecological Assessment Report (Appendix M) has been prepared by Anderson Environmental Pty Ltd. The report has addressed the provisions of the NSW Biodiversity legislation and has concluded that the proposal will have:	Sections 4.2 and 5.6 Appendix M

<ul> <li>Appendix 8.2 Vegetation Management Plan</li> <li>Wildlife Management Strategy</li> </ul>	<ul> <li>minimal impact on native vegetation and will not trigger the Biodiversity Offsets Scheme.</li> <li>A Vegetation Management Plan for the Stage 2 site has not been prepared due to the limited impact on site Flora and Fauna. However, recommendations have been made for the future management of the native vegetation on the land zoned E2 Environmental Conservation to the west of the subject site including a requirement to manage lantana.</li> <li>Due to the limited impact of the proposal on fauna and potential habitat, the project Ecologist has determined that a Wildlife Management Strategy is not required in this instance.</li> </ul>	
Provide a tree removal survey plan	A Tree Removal Plan and Arboricultural Impact Assessment Report has been prepared by ELKE Landscape Architect + Consulting Arborist for the Stage 2 DA.	Sections 3.8 and 5.6 Appendix K- Tree Removal Plan Appendix L- Arboricultural Impact Assessment Report
Provide a due diligence assessment of Aboriginal Heritage	No identified Aboriginal archaeological sites in Narara are within or immediately adjacent to the site (or the broader development precinct of NEV). A Report has not been commissioned.	Section 5.8
Address the requirements of Chapter 6 of Gosford DCP 2013.	A comprehensive DCP Compliance Table addressing the relevant provisions of Gosford DCP 2013 has been prepared for the Stage 2 DA.	Section 4.6 Appendix CC- Compliance Tables
Detail the existing Commercial Treatment Plant license under WICA	A waste water treatment plant no longer forms part of NEV water cycle management plan. Matters relevant to the WICA license are addressed in the Water Cycle Management Plan.	Sections 1.32 and 3.6 Appendix P- Water Cycle Management Plan
Provide a Waste Management Plan	A Preliminary Waste Management Plan addressing the requirement of Chapter 7.2 of Gosford DCP 2013 has been prepared for the Stage 2 DA by the Co-operative and TCB Project Management.	Section 5.11 Appendix Z- Waste Management Plan

In addition to the matters detailed above, at the meeting with Council on 31 October 2019, Council indicated a preference for that section of land proposed for the construction of part of the perimeter road on No's 21 and 23 Research Road to be incorporated into the NEV site through a boundary realignment. Council advised that the provisions of Clause 20 of IDO No. 122 could be relied upon for this purpose. Subsequent to this meeting, NEV has sought advice from the Project Surveyor, Delfs Lascelles Consulting Surveyor in relation to this proposal which would technically result in the expansion of the area covered by the community title scheme. Following consulting with the NSW Land Registry Services, Delfs Lascelles Consulting Surveyors has confirmed that it is not technically possible under the current provisions of the *Community Land Development Act 1989* to amend the boundaries of a community title scheme to include land outside the scheme. Written advice addressing this issue from Delfs Lascelles Consulting Surveyors is provided at **Appendix F2**.

Notwithstanding the above, it is noted that reforms to the community title legislation are currently being proposed by Fair Trading NSW. The *Community Land Management Bill 2019* and the *Community Land Development Bill 2019* are currently being exhibited and collectively, they propose to rewrite the NSW community schemes laws including to make community land development legislation more flexible. A key component of the proposed reforms is to enable a community association to approve the addition of land to a scheme by special resolution where the land adjoins the scheme. The reforms propose that this land can be added either as association property or as a lot. NEV may reconsider its options in the future with respect to No's 21 and 23 Research Road, should this reform proceed to gazettal.

#### 1.3.2 Independent Pricing and Regulatory Authority

NEV Water holds both a Network Operator License and Retail License under the *NSW Water Industry Competition Act 2006* (WICA). This means that NEV Water has the relevant licenses to provide all wastewater, potable water and non-potable water services to the site. However, as detailed above (and in the Water Cycle Management Plan at **Appendix P**), NEV has now abandoned plans to provide wastewater and potable water to the site in favour of pursuing connection to Council water and sewer reticulation systems. Notwithstanding this, all infrastructure on the site (and that proposed in this Stage 2 DA) will be owned and operated by NEV Water and connected to Council's systems at the boundary of the NEV site. NEV Water will be responsible for supplying NEV customers on the site (i.e. through the network of sewer and water infrastructure), maintaining the infrastructure and billing the customers.

Consultation has been undertaken with IPART in relation these changes and NEV has been advised that changes to the License's will not be required. The Co-operative has also sought separate legal advice in relation to this matter which has also confirmed that the proposed connection to Council's systems will not require an application to IPART for a variation under the Network Operator License. This advice can be provided to Council under separate cover if considered relevant to the assessment of this Stage 2 DA.

Further to the above, the Co-operative and its specialist consultants have consulted with Council's Team Leader Water Assessment in respect to the proposed connection to Council's water and sewer reticulation systems. Advice provided by Council in relation to this matter is provided at **Appendix D2**. Subsequent to receipt of this advice, the Co-operative lodged the Section 305 application with Council to allow connection to Council's sewer and water reticulation system for Stage 1.

#### 1.3.3 NEV Community Engagement

The Co-operative has undertaken ongoing consultation with the local community of Narara since their acquisition of the site in 2012. The communication strategy has typically included regular letter box drops, information meetings and open days at the site. Details regarding the proposed redevelopment of the NEV site are also regularly posted on the Narara Ecovillage website (www.nararaecovillage.com).

NEV conducted a November 2019 Open Day and Stage 2 DA information session on Sunday 23 November 2019. Approximately 400 flyers (refer **Appendix D3**) were distributed via a letter box drop to neighbouring properties (including in Research Road, Monarchy Way, Republican Close, Fountains Road, Treeline Close, Orchard Downs Road, Callistemon Road, Carrington Road, Pandala Road, Isabella Close, Hanlan Road, Deane Street and Nursery Road) within the ten days prior to the Open Day. The agenda for the Open Day included a presentation on the Stage 2 DA and the opportunity for the community to engage with the NEV project team and Project Director on the proposal.

NEV has advised that only 16 people attended the Stage 2 DA information session. **Table 2** below documents the questions asked during the session that are directly relevant to the Stage 2 DA and a summary of NEV's response to each question is also provided. **Table 2** also outlines where further information on each issue can be found in the SEE.

 Table 2: Consultant team for the NEV site

Question / Issue	NEV Response	Location of further information in the SEE
How will you develop the land? Will everything be stripped and de-stabilised? We had a bad experience of a developer in flood prone land.	Earthworks will be completed as part of the Stage 2 DA associated with the road works and servicing requirements. Individual owners will prepare their sites for future development. Note: the Stage 2 site is not flood prone land.	Section 3.4.3 Appendix W- Civil Engineering Work Plans
Will all the trees go?	We have made every effort to keep as many trees as possible, but a number will go, and more will be planted.	Sections 3.4.2 and 5.6 Appendix K- Landscape Architectural Plans and Tree Removal Plans
What will be the effect on traffic in the local area?	Our consultant's study shows that the traffic generated by the development is not significant.	Section 5.9 Appendix BB- Traffic, Access and Parking Assessment
I am concerned by the speed of vehicles once they leave the ecovillage and then speed along Research Road. Can the Council put up signs to slow traffic?	NEV are aware of this and it seems to be mainly tradesmen working on the site. We will be consulting with the tradesmen to address this issue.	Not relevant to the DA.

The Co-operative intend to keep the community well informed in relation to future stages in the development of the site and will continue with its communication strategy including to update its website on a regular basis.

## 1.4 The Applicant and the Project Team

#### 1.4.1 The Applicant

Narara Ecovillage Co-operative Ltd operates as a distributing co-operative under the *Co-operative National Law* (NSW). The Co-operative is controlled by a Board of seven (7) directors. The role of the Co-operative is to raise members share capital and bank financing for the purchase and development of NEV.

Specifically, the Co-operatives role in the development of NEV, as a community title scheme, includes:

- the engagement of the property development core team;
- to facilitate negotiations and respond to necessary requirements of Council as part of the development approvals process;
- the sale of lots to members as part of the staged development of the site; and
- the retention of part of the property for commercial use to contribute to the Community Association sinking fund.

On registration of the NEV community title plan with the NSW Land Registry Services, The Narara Ecovillage Community Association (NECA) was constituted under the *Community Land Development Act 1989* (NSW). The responsibilities of the NECA includes following:

- administration and enforcement of the by-laws of the community scheme;
- raising funds by levying its members in the scheme to carry out its duties; and

• managing the administrative fund and sinking fund to cover the costs of maintaining the association property and any other relevant expenses.

The Co-operative will maintain an ongoing role in the development and management of the site through its various stages of development and operation.

#### **1.4.2** The Project Team

This SEE has been prepared on behalf of the Co-operative. The specialist consultant team for the Stage 2 Subdivision DA is detailed in **Table 3** below:

со	NSULTANT	EXPERTISE
٠	Envirotecture	Concept Planning and architecture
٠	ELKE Landscape Architect + Consulting Arborist	Landscape Architecture and Arboricultural Services
•	Henry & Hymas Consulting Engineers Pty Ltd	Civil Engineering
٠	Delf Lascelles Consulting Surveyors	Surveying and Subdivision
•	Anderson Environmental Pty Ltd	Ecology
٠	Traverse Bushfire & Ecology	Bushfire
•	Woodlots & Wetlands	Hydrology
٠	Benviron Group	Geotechnical and Contamination
•	Henry & Hymas Consulting Engineers Pty Ltd	Integrated Water Management System
٠	Henry & Hymas Consulting Engineers Pty Ltd	Hydraulic Engineering (water & sewer)
•	TCB Project Management	Waste Management
٠	Betteridge Consulting Pty Ltd	Heritage
•	Transport and Urban Planning Pty Ltd	Traffic and Transport
٠	TCB Project Management	Project Management
•	Sara Roach Planning Services	Town Planning

Table 3: Consultant team for the NEV site

#### **1.5 Report Structure**

The SEE has been prepared in accordance with the requirements of Part 4 of the EP&A Act and Schedule 2 of the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation). The structure of the report is as follows:

Table 4: Report Structure

	Section		Title
1.	Introduction	•	Introduction to the SEE and the Stage 2 DA, consultation undertaken and the project team.
2.	Site and locality	•	A description of the site, the context and opportunities and constraints presented by the site.
3.	The Proposal	•	A detailed description of the proposed Stage 2 DA and site operations.
4.	The Statutory and Strategic Planning Framework and Assessment	•	A detailed review of the proposal against the key strategic and strategic planning controls and framework.
5.	Assessment of Environmental Effects	•	An in-depth assessment of the relevant statutory planning controls, existing environment, proposal and potential impacts and public benefits arising from the proposed DA.
6.	Conclusion	•	A concluding statement taking into account the assessment of the proposal and a recommended course of action with regard to the determination of the application.

## **1.6 Consent authority**

The cost of works for the purpose of determining the DA fee for the proposal, calculated in accordance with Clause 255(1) of the EP&A Regulation is \$4.1 million. A Cost Summary Report can be provided to Council under a separate cover, if required.

As the estimated cost of works does not exceed \$5 million, the DA will be determined by Council.

# 2.0 The Site and its context

## 2.1 The NEV Site

The NEV site is located at 33 Gugandi Road, Narara (previously referred to as 25 Research Road, Narara). The NEV site has a total area of approximately 62.97 hectares of which approximately 11.5 hectares is zoned *R2 Low Density Residential* under GLEP 2014 (**Figure 4**). The remainder of the site is zoned *E2 Environmental Conservation* (predominantly, the bushland to the west), *RE1 Public Recreation* (the floodplain to the east) and *E3 Environmental Management* (land to the north-east of the floodplain).



Figure 4: Site Aerial (Source: Hill Thalis)

The Stage 2 DA site area includes a number of structures which were used during the sites' former occupation as a Horticultural Institute. This includes the Managers Cottage (identified as '1' on Figure 4) and one (1) multi-span greenhouse (identified as '2' on Figure 4).

The location of the NEV site is illustrated in **Figure 5**. It is accessed off Fountain Road and Research Road to the south east. The site includes a series of internal road (private roads owned by the community association) with the main spine road through the site named Gugandi Road (formerly, Research Road)- refer **Figures 6** and **7** below.



Figure 5: Location Plan- Narara Ecovillage (Source: Hill Thalis)



Figure 6: Access to the site from Research Road.



Figure 7: Research Road looking north-west from the entry of NEV at Gugandi Road.

The land which is the subject of this DA mainly consists of citrus orchards and managed vegetation and grass within the open and cleared sections at the southern end of the NEV site. Refer to further details on the legal description and ownership of the land at Section 2.2 of this SEE.

A site survey showing the full extent of the NEV site is provided at **Appendix A**.

An existing dam is located in the north-western corner of the site and was previously used for onsite irrigation for the Horticultural Institute (**Figure 5**). The dam has a capacity of approximately 43.3 mega litres and will be the source of non-potable water for the ecovillage.

**Figures 8** to **14** illustrate the general features of the Stage 2 site including the land immediately to the south (i.e. No's 21 and 23 Research Road, Narara).



Figure 8: Existing orchards in south-western corner of the site



Figure 9: Current driveway access to No's 21 and 23 Research Road. View looking east with the ecovillage boundary on the left of the photo.



Figure 10: Southern boundary conditions between Stage 2 of NEV and adjoining Nos 21 and 23 Research Road.



Figure 11: View looking towards the south-west boundary of the site from within the Stage 2 site.



**Figure 12:** View looking south-east from in front of the Caretaker's Cottage showing the Stage 2 site area. The multi-span greenhouse is on the left of the photograph.



Figure 13: View looking west towards the Foreman's Cottage from the north. The E2 zone bushland is in the background.



**Figure 14:** View looking north / north-east showing the southern end of the perimeter road which was constructed in Stage 1. The proposed Stage 2 extension of the perimeter road will connect at this point. The approved Cluster Housing development (under construction) within Stage 1 site is in the centre of the photograph.

## 2.2 The subject site

The subject site for the purposes of this Stage 2 DA is generally described as 33 Gugandi Road, Narara, being the address of the NEV community title scheme. However, this Stage 2 DA also proposes works on land which is located outside the boundary of the NEV Community Title scheme.

The land which is the subject of this Stage 2 DA occupies various addresses / allotments and is legally described in **Table 5** and illustrated in **Figure 15**.

The respective owners of the subject land have issued land owners consent for the lodgement of the Stage 2 DA. Approval from Council for the works on Research Road forms part of this application.

Address	Legal Description	Owner	Notes /scope
33 Gugandi Road,	Part Lot 50 DP 270882		
<b>Narara</b> NEV community title scheme- Stage 2	Part Lot 1 DP 270882 (community association land) Part Lot 39 DP 270882 (E2 zoned land)	Narara Ecovillage Co- operative Ltd	Proposed residential subdivision and associated infrastructure works (roads, services and landscaping) will be located principally on this land. The 43 residential lots are located entirely on Part Lot 50.
21 Research Road, Narara	Lot 209 DP 293748	Verena Olivier (NEV member) (land not part of the Community Title Scheme)	Part of the proposed perimeter road and associated landscaping, services and drainage works is located on this land. Rights of carriageway and easements for access and services will need to be created over this land.
23 Research Road, Narara	Lot 210 DP 293748	Narara Ecovillage Co- operative Ltd (land not part of the Community Title Scheme)	Part of the proposed perimeter road and associated landscaping, services and drainage works is located on this land. Rights of carriageway and easements for access and services will need to be created over this land.
Research Road	Defined as a public road under s.138 of the Roads Act	Central Coast Council	Works to the road to integrate with the entrance to the NEV site and at the junction with the new perimeter road.

Table 5: Land title and ownership



Figure 15: Stage 2 DA and land ownership

#### 2.3 Local Context

The NEV site is bounded by rural residential development to the south and the east, residential lots to the east and the south-east, and dense bushland to the west, north, north-east and south-west (**Figure 5**). The surrounding residential development predominantly comprises standard residential lots with a mix of single and two storey dwellings.

Strickland State Forest adjoins the site to the north and the west and it covers an area of approximately 468 hectares. Strickland State Forest includes areas of dense open forest and closed forest (rainforest) vegetation and exposed low open woodland vegetation. There is no formal public access from the NEV site to Strickland State Forest.

Narara train station is located approximately 1.3 kilometres to the east of the site. A small local shopping centre is located at the eastern end of Dean Street. The Narara Valley High School is located on Fountain Road approximately 400 metres from the site. The Narara Valley Community Centre is located on the corner of Pandala Road and Carrington Street (**Figure 5**).

Niagara Park Shopping Centre, High School and recreation facilities are located to the north east of the site.

The employment areas of West Gosford, Niagara Park and Wyoming are all located within close proximity to the site. Gosford Town Centre is located approximately 4 km to the south of the site.

**Figure 16** below illustrates the proximity of the subject site to neighbouring residential development on Monarchy Way (to the east of the site) and Reseach Road (to the south and south east of the site).



Figure 16: Proximity of NEV site (Stage 2) to neighbouring residential development.

**Figures 17** and **21** show the surrounding site context and the condition along the eastern boundary of the NEV site relative to the dwellings on the western side of Monarchy Way and on Research Road and Fountain Road.



Figure 17: View looking north-west along Fountain Road toward the NEV site.



Figure 18: Fountain Road looking east towards Narara High School.



Figure 19: View of Monarchy Way looking north.



Figure 20: Development at the northern end of Research Road just beyond the entry to the NEV site.



**Figure 21**: View from Gugandi Road (southern end of site) looking to rear of dwellings on Monarchy Way (in vicinity of proposed Lots 42 and 43).

# 2.4 Relevant site planning history

The development of NEV has been the subject of a number of previous development applications as summarised in **Table 6**.

Table	6-	Summary	v of	previous	relevant	DAs
- and the	•	Sammar	, 0.	previous	1 CIC Valle	0,00

DA Ref	Summary Description	Determination
DA 44994/2013	Stage 1 Development application– Community Title Subdivision and associated infrastructure and demolition of various structure and buildings. This application has been amended on five (5) occasions as follows:	Approved by IDEP: 8 August 2014
	<ul> <li>DA 44994/2013.2- to permit preliminary site works including building demolition and tree removal to be undertaken prior to the issue of a construction certification. Amendments to a number of conditions of consent.</li> </ul>	Approved by Director E&P: 22 June 2015
	<ul> <li>DA 44994/2013.3- amendments to subdivision layout, road design, civil works, tree removal, fire protection measures and a number of conditions of consent.</li> </ul>	Approved by Development Manager: 17 March 2016
	• DA 44994/2013.4- amendments to various conditions of consent.	Approved under delegation: 2 February 2018
	<ul> <li>DA 4499423013.5- amendment to condition 5.2 to reflect the WICA process.</li> </ul>	Approved under delegation: 1/ March 2018
	• DA 44994/2013.6- increase the number of lots from 48 to 49.	Approved under delegation: 19 October 2018
DA 44899/2013	DA for demolition of existing structures and construction of 17 x cluster housing units and associated infrastructure and landscaping works on Lot 36.	Approved by IDEP: 07 April 2014
	This application has been amended on one (1) occasion, as follows:	
	<ul> <li>DA 44899/2013.2- minor design, layout changes, increase in number of clusters houses from 17 to 18 and amendments to a number of conditions of consent.</li> </ul>	Approved under delegation: 13/10/2017
DA 44898/2013	DA for demolition of existing structures and construction of 10 cluster houses and associated infrastructure and landscaping works on Lot 18.	Approved by IDEP: 14 April 2014
DA 44650/2013	DA to formalise the community use of the existing Visitors Centre and the Administration Black and the continued residential occupation of both the	Approved by IDEP:
	Manager's Cottage and Foreman's Cottage.	SI January 2014
	This application has been amended on one (1) occasion, as follows:	Approved by Director E&P:
	• DA 44650/2013.2- amendment to the asset protection zone around the administration building and changes to a number of conditions of	5 January 2017
	consent.	

Following the approval of Stage 1 development application (DA 44994/ 2013), the Community Title Scheme was registered with NSW Land Registry Services on 8<sup>th</sup> June 2018. Subsequently, development applications have been lodged for the construction of a number of dwellings within Stage 1. At the time of preparing this Stage 2 DA, approximately 15 dwellings have been completed or are at various stages of construction.

# 3.0 The Stage 2 Development Application

The information included in this section of the SEE is based on information provided by the Cooperative and should be read in conjunction with the technical reports appended to this SEE.

#### 3.1 Stage 2 Overview

This DA seeks approval to subdivide Part Lot 50 in DP 270882 of the Narara Ecovillage Community Title scheme and to create residential lots for the second stage in the development of the ecovillage. The DA also relies on neighbouring land (Lots 209 & 210 in DP 263748 and Part Lot 39 in DP 270882) to provide access and associated works.

The scope of the Stage 2 works is illustrated in the Stage 2 Concept Plan prepared by Envirotecture (**Appendix B**). This plan illustrates the general arrangement for the subdivision, site access, existing structures to be demolished, and existing and proposed landscape features and supporting infrastructure.

The Stage 2 DA is integrated development pursuant to Section 4.46 of the EP&A Act in respect of the *Rural Fires Act 1997*.

The Draft Plan of Subdivision prepared by Delfs Lascelles (Appendix F) proposes:

- the subdivision of Part Lot 50 in DP 270882 to create 43 residential lots ranging in size from 550sqm to 1371sqm. These lots are identified as new Lots 51 to 93 in DP 270882 on the Draft Plan of Subdivision; and
- the expansion of Lot 1 within the Stage 2 site area, being the community association lot. Lot 1 includes the site infrastructure, car parking (not located on residential lots), access ways, roadways and associated landscape / open space areas; and
- a number of restrictions on title in respect to rights of carriageway, easements for common gardens, access and services.

Figure 22 illustrates the Draft Plan of Subdivision superimposed over an aerial photograph of the site.

To support the Stage 2 subdivision and to meet the servicing requirements for the future development, the following ancillary works are also proposed:

- the demolition of one (1) multi-span greenhouse and the existing driveway access to Lots 209 and 210 in DP263748 (21 and 23 Research Road, Narara);
- the removal of 40 trees and the remnants of the former citrus orchard and plantings of the former Horticultural Institute on the Stage 2 site. 87 existing trees are proposed to be retained;
- earthworks for the construction of the roads, pathways and essential utility services and associated retaining walls, batters, on-site detention and bioretention basins;
- the construction of the road network including:
  - a new perimeter road which connects to the Stage 1 perimeter road in the north-western corner of the site at the intersection of Balgara Rise and Syncarpia Crescent and then extends along the western boundary and the southern boundary including traversing onto Lots 209 and 210 in DP 263748 (outside the boundary of the NEV site) providing direct access to Research Road. Works to integrate and reconcile the existing driveways on Lots 209 and 210

in DP 263748 with the new perimeter road and the perimeter roads access onto Research Road is also proposed;

- o a new internal loop road in the centre of the site with access off Gugandi Road; and
- o 99 on-street parking spaces comprising 51 resident spaces and 48 visitor spaces.
- the construction of essential utility services required to service the site including the following:
  - infrastructure for water management including for potable water, non-potable (recycled) water and sewer approved under the WICA License;
  - o electricity; and
  - o telecommunications.
- the construction of swales, on-site detention and bioretention basins as part of the integrated stormwater management strategy for the site;
- the implementation of a comprehensives landscape strategy for the Stage 2 site including street tree planting, landscaping of common garden areas, the recreation areas and greenways through the site. Approximately 370 new trees are proposed to be planted across the Stage 2 site. The landscape works include the installation of the heritage listed main entrance gate posts (Item No. 127 in Schedule 5 of GLEP 2014) at the entry to the site; and
- works to make the site bushfire safe including the establishment of asset protection zones and the Bushfire Attack Level (BAL) ratings for the site.

The application is predominantly limited to the land on the NEV site which is current zoned R2 Low Density Residential under *Gosford Local Environmental Plan 2014*. However, due to the irregular boundary alignment in the south west corner of the site, some civil works are also proposed on land zoned E2 Environmental Conservation in order to ensure a practical and logical geometry and grading to the perimeter road. The perimeter road also extends onto the land to the south (currently zoned 7(c2) Conservation and Scenic Protection pursuant to IDO No. 122) to rationalise and simplify the access arrangements between NEV and this neighbouring land.

The section below provides a detailed description of the proposed development works which comprise this Stage 2 DA. This section should be read in conjunction with the documents and plans appended to this SEE. In particular, the Stage 2 DA should be read in conjunction with the Draft Plan of Subdivision (**Appendix E**) and the Civil Works Package prepared by Henry & Hymas (**Appendices L-N**) and the Stage 2 DA Design Report prepared by Envirotecture (**Appendix B**).



**Figure 22:** Extract from the Draft Plan of Subdivision of Pt Lot 50 and Part Lot 1 in DP 270882 overlayed over an aerial photograph of the site (Source: Delfs Lascelles)

## 3.2 Subdivision

The draft Plan of Subdivision for Stage 2 proposes the subdivision of Part Lot 50 in DP 270882 of the NEV Community Title Scheme and the creation of 43 new residential lots.

The subdivision and lot layout provides for the creation of the following, as illustrated in Figure 23:

- Expansion of Lot 1 within the Stage 2 DA site (the Community Association Lot)- Lot 1 is vested in the community association that is entrusted with the ownership and management of the community property for the benefit of its members. This community property includes the site infrastructure, access ways, community parking and visitor parking, roadways and associated landscaped/open space areas.
- Lots 51-93: 43 Private Residential Lots- these lots are proposed to be individually sold for future residential development. The lot sizes range from 550sqm to 1371sqm for conventional residential development. Four large lots over 1000sqm (Lots 64, 65, 79 and 85) are also proposed and may be subject to further subdivision should the relevant LEP be amended in the future.

Table 7 provides a summary of the 43 residential lots proposed in this application. It is noted that the draft lot numbers referenced in the Stage 2 DA Design Report differ from those shown on the Draft Plan of Subdivision, as detailed in **Table 7**.

As the Stage 2 DA only proposes the subdivision of Part Lot 50 in DP 2070882, the remainder of Lot 50 will remain in the ownership of the Co-operative (as the developer).

It is noted that the residential subdivision is contained wholly within the land zoned *R2 Low Density Residential* pursuant to GLEP 2014 and no residential allotments are proposed to be located on the land zoned E2 Environmental Conservation or the 7(c2) Conservation and Scenic Protection (Scenic Protection- rural small holdings).



There are no existing or proposed development contracts in this community title subdivision.

Figure 23: Extract from the Draft Plan of Subdivision of Pt Lot 50 in DP 270882.(Source: Delfs Lascelles)

Lot Number	Lot size	Lot Number	Lot size	Lot Number	Lot size
1 (51)*	550.8	16 (66)*	912	31 (81)*	550.8
2 (52)*	550.8	17 (67)*	556.4	32 (82)*	550.8
3 (53)*	624.1	18 (68)*	553.4	33 (83)*	550.8
4 (54)*	550.8	19 (69)*	563.7	34 (84)*	550.8
5 (55)*	550.8	20 (70)*	564.4	35 (85)*	1026
6 (56)*	550.8	21 (71)*	565.3	36 (86)*	621.3
7 (57)*	550.8	22 (72)*	579.1	37 (87)*	551.3
8 (58)*	550.8	23 (73)*	562	38 (88)*	551.3
9 (59)*	903.2	24 (74)*	562	39 (89)*	624.6
10 (60)*	612.1	25 (75)*	562	40 (90)*	990.3
11 (61)*	638.1	26 (76)*	562	41 (91)*	956
12 (62)*	667.8	27 (77)*	562	42 (92)*	777.1
13 (63)*	660.6	28 (78)*	562	43 (93)*	551.5
14 (64)*	1371	29 (79)*	1017		
15 (65)*	1238	30 (80)*	668.3		

Table 7- Summary of the proposed 43 residential lots

\*(X) represents the lot number as shown on the Draft Plan of Subdivision at Appendix F1.

The Draft Plan of Subdivision also includes various easements associated with services and drainage, and proposed rights of carriageway and easement for access and services over No. 21 and 23 Research Road to provide access in perpetuity to the NEV site. A proposed restriction on the use of the land (typically 2m wide) is also proposed for most of the residential lots, where this land forms part of the common garden / access strategy.

It should be noted that a minor boundary adjustment between Lot 1 and Lot 50 in 270882 is required to reconcile an inconsistency between the current Registered Plan of Subdivision and the Stage 1 development consent, prior to the determination of this Stage 2 DA. This boundary adjustment will amend Lot 1 to incorporate the final approved location of the waste storage area (in accordance with the Stage 1 consent) and in doing so, will modify (and correct) the extent of Part Lot 50 and subsequently, enable the creation of new Lot 93 proposed in the Stage 2 DA Draft Plan of Subdivision (refer **Appendix F** and the location of Lot 93 in **Figure 23** above). The NSW Land Registry Office (LRS) has been consulted in relation to this matter and has confirmed in writing that the boundary adjustment between Lots 1 and 37 is able to be made under Section 6 of the *Community Land Development Act* 1989 subject to certain conditions (refer **Appendix F**). NEV is in the process of satisfying these conditions which will include obtaining Council's consent to the boundary realignment by completing the *Certificate of Consent Authority in respect of a Boundary Adjustment* (Approved Form 19 under the *Community Land Management Act*). NEV propose to consult with Council in relation to this matter of 2020, to enable this boundary adjustment to be registered prior to the determination of this Stage 2 DA.

#### **Community Management Statement**

The registered Community Management Statement (NEV CMS) prepared by Andrews & Holms Lawyers for the NEV site is provided at **Appendix G** for information purposes. Pursuant to Schedule 3 of the *Community Land Development Act 1989*, the NEV CMS includes the following mandatory matters:

- The location, control, management, use and maintenance of all parts of the community property that is an open accessway.
- The control, management, use and maintenance of any other parts of the community property.

- Storage and collection of garbage and the related obligations of the community association.
- Maintenance of water, sewer, drainage, gas, electricity, telephone and other services.
- Insurance of community property.
- Executive committee of the community association, office-bearers of the committee and their functions.
- Meetings of the executive committee otherwise than at a meeting of the committee; and
- The keeping of records of proceedings of the executive committee.

The control, maintenance and management of the community scheme is regulated through the bylaws contained in the CMS. The by-laws currently address the following matters:

- Ongoing service and maintenance contracts.
- Bushfire controls and requirements for maintenance.
- The implementation of the Ecological Restoration Plan.
- The allocation / use of parking located on community association land.
- The heritage conservation of the site.
- The establishment of waste management targets.
- The role and function of the network and retail operators licences under the *Water Industry Competition Act 2006* (NSW).
- The allocation of unit entitlements for each lot.

Amendments will be incorporated into the NEV CMS specific to Stage 2, should this DA be approved. These are anticipated to address the following matters:

- to update the Community Plan to include the Stage 2 development lots;
- to reference a number of the Stage 2 DA sub-consultants reports and plans throughout the CMS (as relevant);
- to update the Plan of Accessways (Schedule 1) to include Stage 2;
- to update the Plan of Services (Schedule 2) to include Stage 2; and
- to amend the definitions, including the definition of the 'development consent', 'bushfire management plan' and 'Ecological Restoration Plan' to include reference any Stage 2 development consent and relevant technical reports.

#### 3.3 Remediation

A Detailed Site Investigation Report (DSI Report) prepared by the Benviron Group in accordance with *State Environmental Planning Policy No.55- Remediation of Land* is included at **Appendix H.** The DSI found no soil and groundwater contamination on the site and concluded that subject site is suitable for its intended purpose- refer to further discussion in **Section 4.3.2** of this SEE. On this basis, this Stage 2 DA does not seek approval for remediation work.

## 3.4 Stage 2 Construction Enabling Works

The site preparation and construction enabling works for Stage 2 include demolition of existing structures and surfaces and the clearing of existing vegetation on the site required for the construction of the roadways and services infrastructure and associated works. These works are described in more detail separately below.

#### 3.4.1 Demolition

This stage 2 DA seeks approval for the demolition of the multi-span greenhouse and the existing driveway access to No's 21 and 23 Research Road. It is noted that the four (4) greenhouses, identified as Buildings 49-51 were approved for demolition under the Stage 1 DA.

No heritage items listed in Schedule 5 (Environmental Heritage) of the *Gosford Local Environmental Plan 2014* are proposed to be demolished to accommodate the proposal. It is noted that the Conservation Management Plan for the site identifies the multi-span greenhouse as having low significance and not requiring retention- refer to selected extracts from the CMP at **Appendix J**.

#### 3.4.2 Tree Removal

To enable to the subdivision of the land and the construction of the roads, retaining walls and services, a total of 40 trees will require removal. A total of 87 existing trees within the boundary of the Stage 2 site are proposed for retention.

In addition to the above, a small area of native vegetation will be required to be removed from the south-west corner of the site to accommodate the perimeter road and the associated works. The area of impact has been estimated to be 1350sqm. The project Ecologist, Anderson Consulting has advised that the proposal does not trigger the Biodiversity Offset Scheme. The Stage 2 works will also include the continued implementation of the Restoration Management Plan for the site (submitted with Stage 1 DA) and the implementation of additional weed eradication measures detailed in the Ecological Assessment Report (**Appendix M**).

An arboricultural audit of the trees on the NEV site has been undertaken by the project appointed arborist, Elke Haege Landscape Architect and Consulting Arborist and is provided at **Appendix L**. A Tree Removal Plan identifying all trees for removal is provided at **Appendix L** and an extract is provided below at **Figure 24** (with trees identified for removal shown in red).



Figure 24: Extract from Tree Removal Plan (Source: ELKE Landscape Architect + Consulting Arborist).

#### 3.4.3 Bulk Earthworks

The bulk earthworks for Stage 2 are principally associated with the road construction and services installation. This application does not seek approval to bench or level the residential lots for future construction purposes.

Some regrading of residential lots relative to the new road formation is proposed to reconcile level changes and to reduce the steepness of a number of the batters alongside the roads. Batters of 1:3 and 1:4 have generally been adopted for the project in accordance with the Geotechnical Report prepared by the Benviron Group, which is provided at **Appendix N**.

Concept site regrading plans have been prepared for the site by Henry & Hymas and are included at **Appendix W**. The proposal seeks to minimise the extent of cut and fill to accommodate future development. In most instances, the regrading associated with the roads is generally less than 1.0m. However, there are a number of areas particularly, adjacent to the western and southern boundaries of Stage 2 where regrading will result in up to 2.0+m variation in the current site levels. The retaining walls adjacent to the road edge (Road 1) are typically 0.5-2 metres high. The exception is the retaining wall on the western edge of Road 3 and the eastern edge of Road 2 adjacent to the central recreation area where retaining walls of 3 metres are proposed.

It is estimated that the extent of cut and fill associated with Stage 2 works will comprise approximately 3,594m<sup>3</sup> of cut and 10,793m<sup>3</sup> of fill. The extent of cut and fill proposed is detailed on Plan DA\_BE01 Rev. 01 prepared by Henry & Hymas and included at **Appendix W**.

Erosion/sedimentation controls are proposed to be installed prior to commencement of any construction works and will be maintained until the finished works have been stabilised. Concept details of the erosion/sedimentation control measures for this development have been prepared by Henry & Hymas and are detailed on Plans DA\_SE01 Rev 01 and DA\_SE02\_Rev 01 at **Appendix V**.

#### 3.5 Road network

The concept for the road network builds on the existing pattern of roads established in Stage 1 to make a connective, trafficable and walkable network through the site. The perimeter road connects into the Stage 1 constructed section of the perimeter road in the north-west corner of the Stage 2 site at Balgara Rise and its design is consistent with that approved for Stage 1.

The road network design is illustrated in **Figure 25** below and consists of a series of two-way roads. The carriageway width for the two-way road perimeter road and the loop road is proposed to be 5.5 metres.

Three (3) pavement types are proposed for the road construction. Pavement Type 1 which comprises a light weight asphalt pavement is proposed for the perimeter road (Road 1) and access to the loop road (Road 2). The loop road is partially proposed to be constructed of a permeable light weight pavement where it allows for circulation around the central recreation area. The parking and connections from Gugandi Road to Lots 22-24 and 25-28 are proposed to be constructed of a light duty concrete pavement. Details of the pavement types is provided in the Pavement Plan prepared by Henry & Hymas at **Appendix U** and as illustrated in **Figure 25** below.



Figure 25: Stage 2 DA Road Design and Pavement Types\_ (Source: Henry & Hymas)

Where possible, opportunities for residential and visitor parking have been included in the road design. In total, 99 parking spaces are proposed and are typically located parallel to the road and are located to be conveniently accessible to the neighbouring residential lot. The parking spaces have been designed to comply with the requirements of AS2890.1.

#### 3.6 Infrastructure and Services

#### 3.6.1 Potable Water

Potable water for the Stage 2 is proposed to be provided through connection to Council's water infrastructure near the entry at Research Road. Separate approval will be sought from Council under Section 305 of the *Water Management Act 2000* to connect to Council's water infrastructure.

The potable water infrastructure onsite will be owned and operated by NEV Water under the current license they hold under the WICA.

The potable water layout proposed for Stage 2 by Henry & Hymas is illustrated at Figure 26.

Refer to further discussion in **section 5.5.3** of this report and the potable water reticulation plans at **Appendix Q.** 



Figure 26: Potable Water proposal for Stage 2 (Source: Henry & Hymas)

#### 3.6.2 Non-potable (recycled) Water

The existing dam in the north west corner of the site is proposed to supply the non-potable water to Stage 2 of the development. This water is to be taken from the dam under an extraction license which

has been issued by the NSW Office of Water and will be treated in accordance with the Australian Guidelines for Water Recycling to a standard suitable for toilet flushing and irrigation.

The non-potable water reticulation for Stage 2 has been designed by Henry & Hymas and is illustrated at **Figure 27**.

Refer to further discussion in **section 5.5** of this report and the recycled water reticulation plans at **Appendix Q.** 



Figure 27: Recycled Water proposal for Stage 2 (Source: Henry & Hymas)

#### 3.6.3 Wastewater

The wastewater infrastructure for the Stage 2 is proposed to be collected around the site through connection of pipes owned and operated by NEV Water under the current license they hold under the WICA. The proposal is reliant on a wastewater connection to Council's sewer infrastructure at the Research Road frontage of the site. The wastewater will be reticulated through the site by gravity with the exception of the part of the Stage 2 network (eastern side of Gungani Road) which is proposed to connect to the Stage 1 wastewater infrastructure.

The wastewater infrastructure for Stage 2 has been designed by Henry & Hymas and is illustrated at **Figure 28**. The wastewater pipes are typically located at the rear of the properties or on the frontage to Gugandi Road.



Figure 28: Recycled Water proposal for Stage 2 (Source: Henry & Hymas)

#### 3.6.4 Utilities services

Utilities services are available to the site and have been reticulated through the site for Stage 1 of the development. The following arrangements are proposed for Stage 2:

- NEV Water, a division of the Co-operative will be the retail supplier and network operator for potable water, non-potable water and sewer (wastewater) under the terms of their Network Operator Licences (No.17\_040) and Retail Supplier License (No.17\_041) issued under WICA.
- NEV Power Pty Ltd will be the retail supplier and network operator of the electrical power grid. NEV has approval (No. E-2113) from the Australian Energy Regulatory (part of the Australian Competitions and Consumer Commission). The energy for Stage 2 is proposed to be supplied from a 11kV supply from Ausgrid.
- Registration has been made with NBNCo to supply services to the NEV site for 120 premises.

Letter submissions from the above utility providers are provided at **Appendix O**. The existing utility services to the site are illustrated in Schedule 2 of the NEV CMS at **Appendix G**.

#### 3.7 Stormwater Management

The stormwater management proposed for Stage 2 is based on Water Sensitive Urban Design principles and is detailed in the Water Cycle Management Plan Report prepared by Henry & Hymas at **Appendix P**. The concept for the stormwater management for Stage 2 is illustrated in the Civil Engineering Plans prepared Henry & Hymas at **Appendix V**.

The stormwater management system is proposed to collect all flows from the residential lots and impervious surfaces typically via a piped drainage network. A number of swales, bioretention basins and on-site detention (OSD) are also proposed to further manage the water and water quality prior to discharge. The drainage network and the OSD have been designed to convey the 1 in 10-year ARI and the 1 in 100-year ARI safely off the site, respectively and to ensure that post-development flows do not exceed the pre-development flows.

Having regard to the above, the key components of the stormwater system include:

- piped drainage system to convey runoff from impervious surfaces;
- 2-metre wide swales on either side of the perimeter road;
- bio-retention basins in less steep areas to treat runoff;
- OSD to manage runoff from the development; and
- semi-permanent infiltration basins in lower parts of the landscape.

The proposed stormwater management system for the south-eastern quadrant of Stage 2 is illustrated in **Figure 29** below. This illustrates the location of the swales adjacent to the road network, the piped drainage network and the bio-retention and OSD basins which are integrated into the landscape treatment at the entry to the site.



Figure 29: Extract from Stormwater Management System (Source: Henry & Hymas)

#### 3.8 Landscape Strategy

The landscape strategy for Stage 2 has been prepared by Elke Haege Landscape Architect + Consulting Arborist and builds on the Stage 1 masterplan prepared by McGregor Coxall for the site. The key principles underpinning the landscape strategy are:

 to work with the site's existing history in terms of its native forest and introduced exotic plantings that were part of its historic past;

- to recognise and respond to the site's unique topography and water movement; and
- to minimise the environmental impact of the construction on the landscape.

The Stage 2 strategy is proposed to be implemented as part of this DA and includes the following elements as illustrated in **Figure 29**:

- Landscaping adjacent to the new roads within Stage 2 including new street planting and landscaping adjacent to carriageways including to the drainage swales. It is proposed to work with the established site landscaping to reinforce the character of the site.
- Streetscape treatments between a number of road edges and the boundaries of proposed Lots.
- The landscape treatment of the swales which form the common gardens at the rear of the proposed residential lots. This strategy builds on the concept prepared for the site by Hill Thalis of creating a linear accessways through the site which connect into the network of roads and open space throughout.
- Landscape treatment to enhance the entrance to the site including to incorporate the heritage listed entry gate posts.
- Landscaping of the common open space areas including the new central park in the centre of Stage 2.

As detailed in section 3.4.3 above, some regrading works will be required adjacent to new roads to stabilise the land. Where batters are required, some temporary measures (including grass seeding) will be employed to stabilise the batters and prevent soil erosion prior to the development of the individual residential lots.

**Figure 30** illustrates the typical landscape detail for the perimeter road and the general arrangement for the landscaping treatment to the carriageway edge comprising street tree planting, the swale, access to residential lots and car parking provision.



Figure 30: Landscape Plan for Stage 2 of the NEV site (Source: Elke Haege Landscape Architect + Consulting Arborist)

## 3.9 Bushfire

The Stage 2 site is identified as containing bushfire prone vegetation (Category 1, Category 2 and Category 3 Bushfire Prone Vegetation). Subdivision of bushfire prone land is Integrated Development as defined by Section 91(1) of the Act and requires the consent of the Commissioner of the NSW Rural Fire Service, under Section 100B of the *Rural Fires Act 1997*.

A Bushfire Protection Assessment Report has been prepared by Travers Bushfire and Ecology (Travers) (**Appendix AA**). The Report undertakes an assessment of the bushfire protection measures required to address the bushfire risk to the future residential development of the Stage 2 site, in accordance with *Planning for Bushfire Protection 2018* and the requirements of the *Rural Fires Act 1997*.

The assessment concluded that the forest vegetation to the south and west of the Stage 2 site has the potential to expose the future development to potential radiant heat and ember attack. In order to mitigate the risk of bushfire hazard, Travers has advised that specific bushfire protection measures will need to be put in place and managed in perpetuity. These works will be undertaken as part of this application and in order to ensure that the site is bushfire safe and maintained to current recognised standards. Refer to detailed discussion in **Section 5.10** of this SEE.

## 3.10 Waste Management

This application does not seek approval to construct a waste storage area for the future development within Stage 2. A waste storage area for NEV development was constructed as part of the Stage 1 development (DA 44994/2013). In accordance Condition 2.13 of the Stage 1 consent, the waste storage facility located off Gugandi Road was required to be constructed and has the capacity to accommodate the waste storage requirements of Stage 2.

The application is supported by a Waste Management Plan (refer **Appendix Z1**) which details the anticipated waste generation through the construction and occupation stages of the development. A plan prepared by Envirotecture showing the proposed layout of the waste storage area accommodating the storage bin requirements for both Stage 1 and 2 is provided at **Appendix Z2**.

# 4.0 The Statutory and Strategic Planning Framework and Assessment

## 4.1 Section 4.15(1)(a) – Statutory Planning Considerations

In determining the subject DA, Council is required to consider those relevant matters listed in Section 4.15(1) of the EP&A Act. Section 4.15(1)(a) requires the consent authority to take into consideration matters listed at **Table 8**.

Table 8 - Section 4.15(1)(a	) consideration	of statutory matters
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Relevant Provision		Comment
(a) the pro	ovisions of:	
(i)	any environmental planning instrument	The relevant environmental planning instruments, including State Environmental Planning Policies (SEPPs) and LEP's, are addressed in Section 4.2, 4.3 and 4.5. Detailed consideration of the GLEP 2014, Gosford Planning Scheme Ordinance and Interim Development Order No. 122 is provided in the Compliance Tables at <b>Appendix CC</b> .
(ii)	any proposed instrument that is or has been the subject of public consultation under this Act and that has been notified to the consent authority (unless the Planning Secretary has notified the consent authority that the making of the proposed instrument has been deferred indefinitely or has not been approved)	<ul> <li>Consideration of the following Draft environmental planning instruments is provided below:</li> <li>Draft State Environmental Planning Policy (Environment)- section 4.3.4</li> <li>Draft Central Coast Local Environmental Plan 2018- section 4.5.3</li> </ul>
(iii)	any development control plan	Gosford Development Control Plan 2013 (GDCP 2013) is addressed in <b>section 4.6.1</b> . Draft Central Coast Development Control Plan 2018 (Draft CCDCP 2018) is addressed in <b>section 4.6.2</b> below.
(iiia)	any planning agreement that has been entered into under section 7.4, or any draft planning agreement that a developer has offered to enter into under section 7.4	A VPA currently applies to the entire NEV site. Refer to discussion in <b>Section 4.2.1</b> below.
(iv)	the regulations (to the extent that they prescribe matters for the purposes of this paragraph)	There are no known matters prescribed by the <i>Environmental Planning</i> and Assessment Regulations 2000 (EP&A Regulation) that are relevant to the consideration of this application.

# 4.2 Statutory Planning Framework- Key Legislation

The provisions of EP&A Act that are relevant to the proposal are considered below.

#### 4.2.1 Environmental Planning and Assessment Act 1979

#### **Objects of the Act**

The proposal is considered to be consistent with the objects of the EP&A Act for the following reasons:

- it promotes the orderly and economic use of the land;
- it will provide social and economic benefits to the broader community through opportunities to support additional housing and housing choices;
- it has been designed to respond to the heritage and significant environmental qualities of the site and will not result in unacceptable environmental impacts; and
- it will provide an outcome that is consistent with the principles of ecologically sustainable development.

#### Integrated Development

As required by Section 4.46 of the EP&A Act, additional approval will be required in order for the development to be carried out. The development is integrated development with respect to the *Rural Fires Act 1997* only as set out in **Table 9** below:

Relevant Act (NSW)	Comment	Referral
Rural Fires Act 1997	As the land which is subject to this Stage 2 DA is identified as bushfire prone land on Council's Bushfire Prone Land Map, the application is integrated development as defined by section 4.46(1) of the EP&A Act and requires the consent of the Commissioner of the NSW RFS under Section 100B of the <i>Rural Fires Act 1997</i> .	The application is integrated development and referral to the NSW RFS is required pursuant to section 4.46(1) of the EP&A Act
Water Management Act 2000	Whilst the application does propose works within 40 metres of a mapped first order stream, it is submitted that the first order stream is incorrectly mapped on the site and therefore, does not trigger the need for a controlled activity approval under section 91 of the <i>Water Management Act 2000.</i> This being the case, it is contended that the development is not integrated development under the <i>Water Management Act 2000,</i> for the purposes of section 4.46(1) of the EP&A Act. Refer to further discussion below.	Referral to the NSW Office of Water for consideration is a matter for Council.
The Roads Act	The application will require changes to the Research Road (on council land) at the entry to the site to allow for the integration of the new perimeter road. However, Section 4.46(3) of the EP&A states that "development is not integrated development in respect of the consent required under section 138 of the Roads Act 1993 if, in order for the development to be carried out, it requires the development consent of a council and the approval of the same council." These provisions apply in the circumstance of the application.	The application is not integrated development pursuant to section 4.46(3) of the EP&A Act.

Table 9: Integrated Development

#### Water Management Act 2000

The application is supported by advice from Woodlots and Wetlands (**Appendix R**) which concludes that the first order stream north of proposed Lot 42 has been incorrectly mapped on the site. The location of the first order stream is illustrated in **Figure 31** below and its location matches that currently shown on the relevant hydro line spatial data map (Water in NSW (DPIE)). Lines distanced 5 metres, 10 metres and 40 metres from the hydro line are also illustrated on Figure 30. It is noted that the 10 metre line is representative of the Vegetation Riparian Zone (VRZ) and the 40 metre line is representative of the distance within which development triggers a controlled activity approval under the terms of the *Water Management Act 2000*. Figure 30 illustrates that the 40 metres line impacts a significant portion of Lot 42, however that the 10 metres line (i.e. the VRZ) is well distanced from the northern boundary of the Lot 42.

The advice from Woodlots and Wetland includes details of site investigations undertaken which demonstrate that the mapped watercourse is not representative of the site conditions and furthermore, based on relevant case law, does not have the characteristics of a river or a watercourse. It is therefore submitted that the mapped hydro line is representative of a drainage depression and should not be considered integrated development for the purposes of the *Water Management Act 2000* or trigger the requirement for a controlled activity approval under section 91 of the *Water Management Act 2000*. For these reasons, this application has not been submitted as integrated development for the purposes of the purposes of the purposes of the *Water Management Act 2000*.


**Figure 31:** Plan showing the location of the first order stream based on the hydro line spatial data map (Water in NSW (DPIE)) (*Source:* Envirotecture)

#### **Designated Development**

In accordance with Section 4.10 of the Act, designated development is development that is declared designated development by either an environmental planning instrument or the EP&A Regulation (Regulation). As relevant to this Stage 2 application, Schedule 3 of the Regulation establishes the triggers for when development of this type is 'designated development'.

Pursuant to Clause 29, Part 1 of Schedule 3 of the Regulation, a 'sewerage system or works ' which meet the stated criteria is a form of designated development. However, as documented in the Chapter 3 of the SEE, NEV no longer proposes to operate the wastewater treatment system on site and instead is seeking to connect to Council water and sewer system. This being the case, the proposal does not satisfy the requirements of Clause 29 of the Regulation and is not designated development. Notwithstanding this, had the development included a sewerage system or works, the provisions of Clause 37A of Schedule 3 would have apply in the circumstances and these works would be considered 'ancillary' the dominant purpose of the development application and therefore, would not be designated development.

#### Voluntary Planning Agreement

Section 4.15(1)(iiia) of the Act requires that a consent authority take into consideration any planning agreement that has been prepared pursuant to section 7.4 of the Act. A Voluntary Planning Agreement (VPA) (AH773078) has been prepared for the NEV site in accordance with the requirements of the rezoning process undertaken by DPI and as required by Section 5.8 of Gosford DCP 2013. The VPA makes specific provision for the dedication to Council of the land formerly zoned 6(a) Open Space (now zoned RE1 Public Recreation), being that land immediately to the east and contiguous with the

2(a) residential land), together with a small area of land upon which a stand of *Araucaria cunninghamii* (Hoop Pines) are located.

Condition 1.3 of the Stage 1 consent required that the subdivision of the land be consistent with all aspects of the VPA executed by Council and the Co-operative, including in respect to various easements for services and rights-of-way.

The VPA is relevant to the Stage 2 DA in so far as it provides an agreement which sets out the land dedication and requirements in respect to the future development of the site anticipated by its rezoning. In this regard, the terms of the VPA provide the public benefit commensurate with the development of the entire site. As the dedication and requirements of the VPA have been dealt with under the terms of the rezoning and the Stage 1 DA and there is no VPA proposed as part of this Stage 2 DA.

It is noted that Council and NEV are in the process of amending the terms of the VPA. The amendment would see the RE1 zoned land retained by NEV in exchange for Council taking possession of approximately 10 hectares of land zoned E2 Environmental Conservation identified for inclusion into Council's Coastal Open Space (COSS) land. A Deed of Deferral was granted by Council in 2018 that allowed for the negotiation and overrode the consent Condition 5.11 that required dedication of the land zoned 6(a) Open space prior to the issue of the subdivision certificate.

#### 4.2.2 Environmental Planning and Assessment Regulations 2000

This Statement of Environmental Effects has been prepared in accordance with the requirements of Part 1 of Schedule 1 of the *EP&A Regulations*.

#### 4.2.3 Other relevant legislation

#### Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act)

Under the *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth) (EPBC Act), proposed 'actions' that have the potential to significantly impact on matters of national environmental significance or the environment of Commonwealth land, or 'actions' that are being carried out by a Commonwealth agency, must be referred to the Australian Government. If it is determined that a referred project is a 'controlled action', the approval of the Minister for the Environment will be required for the project. Based on the results of the environmental significance and the environment of Commonwealth land are not likely to be significantly impacted by the project.

The Ecological Assessment Report prepared by Anderson Consulting includes an assessment of the potential impact of this application on identified flora and fauna species on the site, including the vegetation communities (**Appendix M**). It concludes that the Stage 2 works will have little impact on the Commonwealth listed species and that the proposed development is not expected to have any significant impacts on matters of national environmental significant listed under the EPBC Act. Furthermore, the assessment has determined that the vegetation communities on the site do not represent listed vegetation communities under the *Biodiversity Conservation Act 2016* or the EPBC Act.

On this basis, it is advised that no approval is required through the Commonwealth under the EPBC Act.

#### Water Industry Competition Act (WICA)

WICA provides the key enabling legislation which permits private sector innovation and investment in water and waste water infrastructure.

As detailed in **Section 1.3.2** of this report, the Co-operative has obtained a retail operator's licence and network operator's licence under the WICA from NSW Independent Pricing and Regulatory Tribunal. This means that NEV will be responsible for the reticulation of water and sewer around the Stage 2 site (and the remainder of the site) utilising NEV infrastructure. NEV has lodged a section 305 application with Council to allow connection to Council's sewer and water reticulation system. This will not require any modification to the WICA licence.

#### **Other Relevant Acts**

A number of other NSW Acts are relevant to the application and additional approvals may be required to permit the proposed development to occur. An overview of this legislation and its relevance to the application is addressed in **Table 10** below.

Name of Act	Comment	Relevance of Act
<i>NSW Biodiversity Conservation Act 2016</i>	In accordance with the <i>Biodiversity Conservation Act 2016</i> (BC Act), an assessment of the proposal's biodiversity impacts must be undertaken. The Ecological Assessment Report (Appendix M) documents this matter and determines that pursuant to Section 7.2, the proposal is unlikely to significantly affect any threatened species or ecological communities or their habitats; the proposed development does not exceed the Biodiversity Offset Scheme; and the development is not being carried out in a declared area of Outstanding Biodiversity Value. This being the case, the development is not accompanied by a biodiversity development assessment report (BDAR) (Section 7.7(2) of the BC Act).	BDAR is not required for this application. Refer to further discussion in <b>Section 5.6</b>
Protection of the Environment Operations Act 1997	The development is too small to be a scheduled activity under the POEO Act (see Clause 36 of Schedule 1) and therefore, an Environment Protection Licence is not required.	Not relevant to this application
Roads Act 1993	Approval under Section 138 of the <i>Roads Act 1993</i> will be required for the works proposed at the entrance to NEV on Council land (the public road reserve). These works are required to reconcile the road alignment (and levels) with the new perimeter road.	Approval will be required under s.138 of the Roads Act 1993 prior to commencement of the construction works.

 Table 10: Overview of other relevant Acts

## 4.3 State Environmental Planning Policies

#### 4.3.1 State Environmental Planning Policy (Infrastructure) 2007

State Environmental Planning Policy (Infrastructure) 2007 (ISEPP) aims to facilitate the effective delivery of infrastructure across the State by improving regulatory certainty and efficiency through a consistent planning regime for infrastructure and the provision of services and by identifying matters

to be considered in the assessment of development adjacent to particular types of infrastructure development.

Division 17 Roads and Traffic Clause 104 (traffic generating development) states that developments listed in Schedule 3 of the ISEPP are to be referred to the RMS (now TfNSW). Schedule 3 lists categories and sizes or capacity of developments which have access to any road. In respect to subdivision. referral to the RMS is required either where:

- the subdivision of land is for 200 or more allotments where the subdivision access to a public road; or
- 50 or more allotment are proposed with access to classified road or to road that connects to classified road (if access within 90m of connection, measured along alignment of connecting road).

The nature of the proposed development does not trigger referral under the ISEPP, as the proposed subdivision is limited to the creation of 43 residential lots.

#### 4.3.2 State Environmental Planning Policy No.55- Remediation of Land

State Environmental Planning Policy No.55 – Remediation of Land (SEPP 55) provides a state-wide planning approach for the remediation of land and aims to promote the remediation of contaminated land to reduce the risk of harm to human health or the environment. Clause 7(1) of SEPP 55 requires the consent authority to consider whether land is contaminated prior issuing a development consent.

A Detailed Site Investigation Report (DSI Report) prepared by the Benviron Group in accordance with SEPP 55 is provided at **Appendix H.** The DSI Report details the scope of works undertaken for the Stage 2 site investigations including the desktop study, site inspections, targeted soil boring / sampling investigations, ground water monitoring and laboratory analysis.

The DSI Report concluded that:

- all soil samples were below the adopted detection limits and / or relevant guideline criteria;
- no asbestos was identified in the soil samples; and
- minor levels of dissolved zinc were detected the ground water. However, Benviron concluded that these excursions were representative of the background levels (likely to be associated with the progressive development and an increase in population growth in the area) and therefore, of limited concern.

Based on the above, the Benviron Group concluded that the site is suitable for the proposed development and that no remediation works are required within the Stage 2 site. The DSI Report recommends that any soil required to be removed from the site, as part of the future site works, be classified in accordance with the "*Waste Classification Guidelines, Part 1: Classifying Waste*" NSW EPA (2014) and furthermore, that if unexpected odours or materials are encountered during the site works, that works cease immediately and that an environmental consultant be instructed to set up an appropriate response to the unexpected find.

The controls relevant to contamination in Parts 3.5 (Natural Hazards) and 5.8 (Narara- Gosford Horticultural Institute) of Gosford DCP 2013 are addressed in the Compliance Table at **Appendix CC** of this report.

#### 4.3.3 State Environmental Planning Policy No. 19- Bushland in Urban Areas (SEPP 19)

The general aim of SEPP 19 is to protect and preserve bushland within areas referred to in Schedule 1 of the SEPP, this includes the Central Coast LGA. In addition, SEPP 19 aims to promote the management of bushland in a manner which protects and enhances the quality of the bushland and facilitates public enjoyment of the bushland compatible with its conservation. The provisions of SEPP 19 relevant to this Stage 2 DA are addressed in Part 3.5.5.4 of the GDCP 2013 compliance table at **Appendix CC**.

#### 4.3.4 Draft State Environmental Planning Policy (Environment)

The Draft SEPP proposes revisions to seven (7) current SEPPs to remove unnecessary or outdate policy. The new SEPP is proposed to deliver a new policy instrument that contains a single set of planning provisions for catchments, waterways, bushland and protected areas.

Only one of the affected SEPPs applies to the DA, being State Environmental Planning Policy No. 19-Bushland in Urban Areas. There appear to be no proposed changes as part of the draft SEPP that would directly affect the proposal and therefore, is it is considered that the DA is consistent with the Draft SEPP. Refer to discussion above in respect to State Environmental Planning Policy No. 19- Bushland in Urban Areas.

## 4.4 Key State Policies, Plans and Guidelines

#### 4.4.1 Future Transport 2058

The Future Transport Strategy is a 40-year vision for the NSW's transport system and seeks to ensure that transport planning is prepared for technological changes and new ways of travel into the future. The Strategy acknowledges the vital role that transport plays in the land use, tourism and economic development of cities and towns. In this regard, the strategy acknowledges that the strength of the economy needs to be supported by an advanced transport system.

The Strategy identifies Gosford as a 'satellite city' as part of a hub-and-spoke network that improves transport connections between Greater Sydney and regional centres. Gosford Station has been identified for potential higher speed rail in the future.

Given the proximity of the site to Gosford, the proposed subdivision will help support future investment in a modern, innovative transport network.

#### 4.4.2 State Infrastructure Strategy 2018-2038

The State Infrastructure Strategy sets out Infrastructure NSW's independent advice on the needs and priorities for the next 20 years including to identify policies and strategies needed to provide infrastructure to meet the needs of a growing population and economy.

The Strategy identifies the Central Coast (between Sydney and Newcastle) as Sydney's fastest growing corridor, where the population is expected to grow to 1.1 million by 2036. The strategy identifies that "Gosford will flourish as the region's capital and centre of administration, civic and commercial services. Improvements to health, transport, education, sporting and civic infrastructure will bolster its expanding cultural, residential and employment functions. Good building design will capitalise on its attractive waterfront setting."

The proposal is considered to align with the Strategy as it provides an opportunity for increased residential development (including to provide innovative and sustainable residential design solutions) in close proximity to Gosford. In this regard, it will support the Strategy's objectives for Gosford City Centre including in relation to its cultural, civic and employment functions.

#### 4.4.3 Central Coast Regional Plan 2036

The Central Coast Regional Plan 2036 (the 2036 Plan) sets out the NSW Government position to guide sustainable growth and economic development within the Central Coast for the next 20 years. Its vision is for a healthy natural environment, a flourishing economy and well–connected communities.

It aims to build a strong economy capable of generating jobs, providing greater housing choice, essential infrastructure, lively centres for shopping, entertainment and dining, and protecting the natural environment.

The NEV site is strategically located to contribute both to the housing and employment. The Concept Plan for the NEV site incorporates opportunities for a range of housing types and short term and long term employment opportunities link both to the construction and occupation phases of the development. Once completed, it is expected that the NEV site can provide for a total of approximately 400 future residents, with ability for 50 future jobs.

The NEV site is identified as an 'urban release area' in the GLEP 2014 and therefore, this development plays an important role in contributing to the key aims and objectives underpinning the 2036 Plan. As demonstrated in this SEE, the proposal is also consistent with the 2036 Plan as it will:

- protect areas of environmental value and scenic amenity
- address bushfire planning requirements onsite
- satisfy the utility services requirements generated by the development
- can comply with Council's drainage requirements
- creates future housing opportunities (including a diversity of lot sizes) which complements Stage 1 of NEV and neighbouring lands.

## 4.5 Local Environmental Planning Instruments

#### 4.5.1 Gosford Local Environmental Plan 2014

The key provisions included in GLEP 2014 of relevance to Stage 2 are considered in detail in the Compliance Table provided at **Appendix CC**. In summary, the proposal is consistent with the key provisions in GLEP 2014, as detailed below:

- The application seeks approval for demolition and subdivision of the land and is subject to the provisions of Clauses 2.6 and 26A.
- The development proposed in this application is permitted with consent in the R2- low density residential zone pursuant to the Land Use Tables.
- All lots proposed in the subdivision exceed 550sqm and therefore, comply with the minimum allotment sizes stipulated in Clause 4.1AA.

• The application is supported by a Heritage Impact Statement which assesses the impacts of the proposal on the heritage significance of the site and therefore, satisfies the requirements of Clause 5.10.

The NEV site is identified as an urban release area on the Urban Release Area Map Sheet CL2\_014 B. The provisions of Clause 6.1 to 6.4 are therefore relevant to the proposal and are considered below:

- Clause 6.1- this clause requires that Council must not grant consent to the subdivision of land in a urban release area unless 'satisfactory arrangements' have been made to contribute to the provision of regional transport infrastructure and services. In respect to this matter, Co-operative advises that a Memorandum of Understanding (MOU) was executed between the then Minister for Primary Industry and the then Minister for Planning on 18th August 2008 setting out the requirement for the original rezoning of the site (which would then enable the Gosford Horticultural Institute to be redevelopment) to be subject to the payment of a regional infrastructure contribution. The MOU established that an amount of \$567,000 was to be paid by the Minister for Primary Industry to the Minister for Planning 7 days before the settlement of the sale of the Property. The Co-operative provided information to Council as part of the Stage 1 DA, including a letter from the then Department of Planning and Infrastructure, to demonstrate that the infrastructure contribution had been paid and therefore, that 'satisfactory arrangements' had been made to contribute to regional transport infrastructure in relation to the future development of the site.
- **Clause 6.2-** the development seeks approval for infrastructure to service the land. The application demonstrates that adequate arrangements can be made to service the NEV site.
- Clause 6.3- the application proposes that the development of site occur in a logical and cost-effective manner, in accordance with the staging plan and principles included in the Hill Thalis Design Report (submitted with the Stage 1 DA) and the Stage 2 DA Design Report (refer Appendix B). Whilst a NEV specific DCP has not been prepared, the Hill Thalis Design Report is considered to adequately address the staged development of the NEV site and those specific matters listed in subclause 3. Furthermore, site specific controls for the Gosford Horticultural Institute are included in Section 5.8 of Gosford DCP 2013 and remain relevant considerations in the future development of the site- refer to the Compliance Table at Appendix CC.

### 4.5.2 Interim Development Order No.122- Gosford

The provisions of Interim Development Order No.122- Gosford (IDO 122) are only relevant to the land identified on the Land Application Plan of GLEP 2014 as a 'deferred matter' and in this instance relate specifically to Lots 209 and 210 in DP263748, being the land immediately to the south of the NEV site. On this land, construction of part of the perimeter road and associated works are proposed. In order to facilitate this work, tree removal and the demolition of the existing driveway are required.

The proposal is consistent with the key provisions in GPSO as detailed below:

 The application proposes the construction of a private road and associated services on the subject land which is zoned 7(c2)- Conservation and Scenic Protection (Scenic Protection- rural small holdings). Pursuant to the land-use table, roads and utility installations are permitted in the zone with development consent.

- The application proposes the demolition of the existing driveway on the subject land and therefore, the provisions of Clause 13 (demolition) are relevant. In accordance with Clause 13, the application seeks approval for the demolition.
- The application does not propose the subdivision of the land and therefore, the provisions of Clauses 18 to 20 do not apply- refer to discussion in section 1.3.1 of this report.
- The application proposes the removal of trees on the subject land and therefore, the provisions of Clause 34 (tree preservation) is relevant. In accordance with Clause 34, the application seeks approval for tree removal and replacement landscaping.

The key provisions in IDO 122 of relevance to the subject land are considered in further detail in the Compliance Table provided at **Appendix CC**.

#### 4.5.3 Draft Central Coast Local Environmental Plan 2018 (Draft CCLEP 2018)

The proposals compliance with the key relevant provisions of Draft CCLEP 2018 are summarised below:

*Zoning:* the zoning for the site remains consistent with GLEP 2014 (i.e. R2 Low Density Residential) and the proposal remains consistent with the objectives of the zone for the reasons specified for GLEP 2014 above.

*Permissibility:* The proposal remains permissible with consent pursuant to the land use Table. It is also noted that subdivision and demolition requires consent pursuant to Clause 2.6 and Clause 2.7.

*Minimum Lot sizes:* the minimum lot size specified for subdivision within a community title development scheme on the relevant Lot Size Map pursuant to Clause 4.1AA is 450sqm. The minimum lot size proposed in this application is 550sqm and therefore, the proposal remains compliant with the draft provisions.

It is noted that Draft CCLEP 2018 proposes to expand the range of permissible residential accommodation (i.e. dual occupancy and semi-detached dwellings) and therefore, the diversity of lot sizes proposed in this application and the potential for re-subdivision of the larger lots may be permitted if the change to the minimum lot size is retained in the final Plan.

Draft CCLEP 2018 also includes an amendment to the objectives of Clause 4.1AA to incorporate a new objective (4.1AA(1)(a)) as follows:

(1)(a) to ensure that the creation of lots within a community title scheme occurs in a manner that is compatible with the desired future character of the area, protects the physical characteristics of the land, does not create potential physical hazard or amenity issues for neighbours, can be satisfactorily serviced and will not, through its potential cumulative effects, create capacity problems for existing infrastructure.

The proposal is considered to be consistent with this new draft objective for the reasons detailed in Section 5.0 of this SEE.

*Essential services:* New clause 7.11 requires that development consent must not be granted to development unless the consent authority is satisfied that services essential for the development are available or that adequate arrangements have been made to make them available when required.

Sections 3.6 of this SEE addresses this matter and demonstrate that services and relevant infrastructure can be made available to meet the ongoing demands of the future residential development.

**Development requiring the preparation of a development control plan (key sites):** New Clause 7.13 does not appear to apply to this development as the NEV site is currently not identified as a 'key site' in GLEP 2014 and the planning proposal (exhibited documents) does not appear to include an amended Key Sites map.

## 4.6 Development Controls Plans

#### 4.6.1 Gosford Development Control Plan 2013

A detailed assessment of the relevant provisions in GDCP 2013 is provided at **Appendix CC**.

A summary of the relevant provision is provided below and should be read in conjunction with Appendix CC.

#### Part 2 Scenic Quality and Character

This proposal is consistent with the objectives of Part 2 of the DCP and the desired future character for Narara. The Draft Plan of Subdivision proposes that the residential subdivision be limited to the already cleared sections on the lower slopes of the site, thereby maintaining the landscape diversity and scenic qualities of the surrounding bushland, which will be maintained as the scenically-prominent backdrop to the new development and retained in views from neighbouring properties.

The proposed subdivision establishes the general arrangements for the future development of the site. In relation to the controls in Part 2 and in particular the retention of the natural slope and achieving the desired scenic quality, the following key features of the proposal are noted:

- There will be minimal change to the general landform to maintain the natural slope and character;
- There is minimal intervention into the bushland thereby preventing the further fragmentation of the tree canopy;
- Opportunities for future development are concentrated in the existing cleared sections of the site;
- There will be minimal clearing of the bushland to comply with PBP 2018 including hazard reduction clearing;
- The landscape strategy establishes the foundation for significant landscaping across the site which will complement the established tree canopy and the Ecological Restoration Plan approved in Stage 1, which aims to eliminate noxious weeds will continue to be implemented; and
- The Hill Thalis Design Report, as amended by the Stage 2 DA Design Report, establishes design principles which are in keeping with the future desired character for Narara. These principles include:
  - a. Providing generous rear setbacks to create consolidated gardens across each block thereby contributing to the landscape quality of the site and complementing the established tree canopy.
  - b. Limiting the footprint and size of all houses to minimise energy consumption and resource, so that the landscape becomes pre-eminent.

c. Sourcing low-embodied energy, recycled or recyclable plantation or certified sustainable materials as the predominant construction materials for dwellings.

For the above reasons, the proposal is considered to be consistent with theses provision of DCP. Whilst the proposed development will increase the number of buildings on the site, the impact on scenic quality will be minimal given the majority of vegetation will be retained where the site is not already cleared and will be embellished as part of the site redevelopment. As such, it is considered that the proposed development can be accommodated without unacceptable changes to the perception of the site as viewed from major viewing points.

#### Part 3.5- Residential Subdivision

The key provisions included in Part 3.5 of relevance to the NEV site are considered in detail in the Compliance Table provided at **Appendix CC**.

#### Part 5.8- Narara Gosford Horticultural Institute

Part 5.8 of GDCP 2013 provides detailed guidelines for the development and use of the land for a residential subdivision. The DCP requires that where a development application is lodged which relates to land to which this Plan applies, Council shall take the provisions of this Plan into consideration in determining that application.

The key provisions included in Part 5.8 of relevance to the application are considered in the Compliance Table provided at **Appendix CC**.

#### 4.6.2 Draft Central Coast Development Control Plan

The development controls included in Draft Central Coast Development Control Plan 2013 (Draft CCDCP) are generally consistent with those contained in Gosford DCP 2013 which applies to the NEV site (refer section 4.6.1 above and **Appendix CC**). For this reason, consideration of only those controls where changes are proposed are detailed below.

#### **Chapter 4.2 subdivision**

*Corner lot sizes*: the draft control requires that corner residential lots be greater than 150sqm above the minimum lot size i.e. 600sqm if the minimum lot size of 450sqm is specified in the LEP. The proposal incorporates a number of corner lots being Lots 59, 65, 66, 74, 75 and 91 (lot number references are those contained in the Draft Plan of Subdivision- **Appendix F**). With the exception of Lots 74 and 75, all corner lots would comply with the draft provisions. Lots 74 and 75 have proposed site areas of 562sqm or a non-compliance of 38sqm.

Detailed consideration of this issue is addressed in **Section 5.1.2** of this report. Based on this discussion, it is considered that the non-compliance with the minimum lots size for corner lots is acceptable in the circumstances.

*Slope consideration- increased lot size:* the application proposes a number of residential lots which do not comply with the minimum lot sizes recommended in the Draft DCP where slope is greater than 15%. This is because the proposal seeks to minimise the extent of intervention to the natural landform whilst optimising housing opportunities on the site.

The application is supported by a Geotechnical Report which makes recommendations for future development on sloping lots including in respect to footing design and building foundations.

Therefore, it is considered that the slope of the site is not a constraint to future development within Stage 2 nor does it necessitate a need for larger lots sizes within the ecovillage. The development completed within Stage 1 of the ecovillage is evidence that the slope of the site is not a constraint to future development.

Refer to further discussion in **Section 5.1** of this SEE.

*Street trees:* the draft control requires that one semi-advanced tree is planted per 15 metres of frontage. The landscape site plan (L\_102 Rev E) illustrates that street tree planting is proposed at irregular intervals along all street frontages within Stage 2 (refer **Appendix K**). In excess of 250 new trees are proposed to be planted along the street frontages of the new allotments as part of this proposal. This number of trees well exceeds Council's requirements and is further supplemented by the new planting proposed within the common gardens.

*Walking distances:* the draft control requires that all lots be within 400 metres of public open space and 500 metres from a playground. Stage 2 proposes the construction of new central park in the centre of the subdivision (refer **Figure 29**). This park is within 400 metres of all lots and is easily accessible via the common gardens. This central park also includes a playground (refer **Appendix K**). Furthermore, the ecovillage site includes significant areas of open space which are accessible to all residents and provides ample opportunity for active and passive recreation.

### **Chapter 2.13 Transport and Parking**

**Parking:** the draft control requires that parking be provided at a rate of 1 space per dwelling if 3 or less bedrooms and 2 spaces per dwelling if 4 or more bedrooms. Parking for each lot has been provided at rate of 1 space for small lots (i.e. lots under 880sqm) and 2 spaces for larger lots (i.e. lots over 880+sqm. Any requirement for additional parking based on dwelling size can be addressed at the future DA stage.

Having regard to the above, the proposal is considered to achieve a reasonable level of compliance with the new controls in the Draft CCDCP. Where compliance is not achieved, the variation is not considered to result in an adverse amenity outcome or to reduce the quality of the proposed subdivision.

# 5.0 Environmental Assessment

Section 4.15(1)(b) to (e) of the Act requires the consent authority to consider the following:

- (b) the likely impacts of that development, including environmental impacts on both the natural and built environments, and social and economic impacts in the locality,
- (c) the suitability of the site for the development,
- (d) any submissions made in accordance with this Act or the regulations,
- (e) the public interest.

This section of the report includes discussion and assessment of the key issues and matters for detailed above.

## 5.1 Subdivision Layout and Urban Design

#### 5.1.1 Subdivision Layout

The subdivision layout illustrated in the Stage 2 DA Design Report (**Appendix B**) has been informed by a detailed site analysis. The subdivision has been limited to the predominantly cleared sections of the site in accordance with the provisions of GDCP 2013. The bushland on the western edge of the development and established and significant trees throughout the site are proposed to be maintained where practicable. The lot layout has been devised to create a variety of housing lots whilst responding to the aspect and the topography of the site. This has resulted in a range of residential lots sizes, a network of open space through the site and a road network which build on the existing road pattern and appropriately responds to the Stage 1 subdivision layout.

A key consideration in the subdivision layout has been the access to each lot. Most lots are provided with direct road frontage. However, five (5) lots (19, 20 21, 33 and 34) do not have direct street frontages. Access to these lots will be via the common gardens which are proposed as the principal pedestrian network through the site.

Where possible the lots have been arranged to maximise their northerly aspect and to maximise the potential for solar access for future dwellings. Of the 43 lots proposed, 25 of the lots have a north/south orientation and the remaining 18 lots have an east/west orientation. The high number of east/ west lots is a direct response to the existing location of Gugandi Road, the proposed location of the perimeter road and maximising opportunities for direct street access. The Stage 2 DA Design Report proposes building controls to optimise solar access to these lots by proposing 3 metres side setback for all east/west lots. Those lots with east / west orientation are identified in **Table 11**. All lots comply with the 15m minimum width at building line however, they do not always comply with the Council's requirement for increased width on sloping site (refer to further discussion in section 5.1.2).

The design team has stress tested the lots configuration to ensure that comfortable, efficient and healthy homes can be accommodated on each lot. With each lot having at least 13-14 metres of northern frontage, adequate solar access and north facing private open space can be easily provided.

Table 11: Summary of the proposed residential lots- size, orientation and lot width

Lot Number	Lot size (sqm) / orientation	Lot width (metres)- frontage to street	Lot Number	Lot size (sqm) / orientation	Lot width (metres)- frontage to street
1 (51)*	550.8 north/south	16.2	23 (73)*	562	15
2 (52)*	550.8 north/south	16.2	24 (74)*	562 east/west	15
3 (53)*	624.1 north/south	18.355	25 (75)*	562 east/west	15
4 (54)*	550.8 north/south	16.2	26 (76)*	562 east/west	15
5 (55)*	550.8 north/south	16.2	27 (77)*	562 east/west	15
6 (56)*	550.8 north/south	16.2	28 (78)*	562 east/west	15
7 (57)*	550.8 north/south	16.2	29 (79)*	1017 north/south	43.695
8 (58)*	550.8 north/south	16.2	30 (80)*	668.3 north/south	13.92, 21.865
9 (59)*	903.2 north/south	Varied 11.6, 16.69, 17.175	31 (81)*	550.8 north/south	16.2
10 (60)*	612.1 east/west	17.815	32 (82)*	550.8 north/south	16.2
11 (61)*	638.1 east/west	15.4	33 (83)*	550.8 north/south	Nil
12 (62)*	667.8 east/west	15.01	34 (84)*	550.8 north/south	Nil
13 (63)*	660.6 east/west	15.065	35 (85)*	1026 north/south	38.785
14 (64)*	1371 east/west	34.28	36 (86)*	621.3 north/south	Nil
15 (65)*	1238 north/south	varied	37 (87)*	551.3 north/south	15.75
16 (66)*	912 north/south	28.5	38 (88)*	551.3 north/south	15.75
17 (67)*	556.4 north/south	16.5	39 (89)*	624.6 north/south	21.84
18 (68)*	553.4 east/west	10.385 23.77	40 (90)*	990.3 north/south	9.135, 16.775
19 (69)*	563.7 east/west	Nil	41 (91)*	956 north/south	46.775, 31.865
20 (70)*	564.4 east/west	Nil	42 (92)*	777.1 east/west	21.32
21 (71)*	565.3 east/west	Nil	43 (93)*	551.5 east/west	21.22
22 (72)*	579.1 east/west	15.9			

\*lots number as reference on the Draft Plan of Subdivision

The allotment layout has been designed having regard to the objectives of Chapter 3.5.3- Residential Subdivision of GDCP 2013, which are:

- a. To provide sufficient area and dimensions to enable the construction of dwellings, ancillary outbuildings, private open space, vehicle access and parking.
- b. To ensure that allotments and the resulting residential development is in character with the locality and specific landform features of the site such as slope, aspect, vegetation, and position in relation to adjacent building.
- c. To ensure that elements of the site including size, slope, orientation, etc. provide maximum opportunities for future building design, privacy, orientation, solar access and useable outdoor living space on site.
- d. To encourage a variety of allotments to cater for the different housing needs within the community.

The Stage 1 DA is considered to meet the intent of the above objectives for the following reasons:

- All lots comply with the minimum allotment size provisions in GLEP 2014 and generally comply with the minimum width dimensions in GDCP 2013 (refer to further discussion in Section 5.1.2 below). The subdivision layout proposes that the majority of allotments have frontages to a street and that all allotments are integrated with the planned network of open space and accessways through the site. All allotments are readily accessible to parking areas and are within easy access to the village facilities including garbage storage which is provided within Stage 1.
- The subdivision layout has had regard to the key environmental and heritage qualities of the site. The Subdivision layout will have minimal impact on significant site vegetation and the residential subdivision has largely been restricted to the cleared sections of the site. Appropriate management and mitigation measures have been recommended by the project appointed arborist to minimise impacts as a result of construction on existing vegetation. Significant landscaping works and ecological restoration works are proposed as outlined in sections 3.8 and 5.6 of the SEE to improve the ecological quality of the site.
- The subdivision layout has been designed to conform with the existing features including the road layout and the site topography. This has ensured that the impact of the subdivision on the environmental characteristics of the site have been minimised. This approach has result in the extent of cut and fill on the site being minimised to accommodate the subdivision layout. Consequentially, the visual impact of the subdivision has been minimised.
- The subdivision design includes a range of allotment sizes and configurations to provide opportunities for a range of housing options as currently permitted under GLEP 2014. Typically, the residential allotments will accommodate single dwelling houses with opportunities for secondary dwellings. The Hill Thalis Design Report as amended by the Stage 2 DA Design Report establishes the design principles for the placement of houses on allotments and to establish that all houses design must be based on the principle of environmental sustainability, incorporating passive solar design and the sustainable use of energy and resources.

The Stage 2 subdivision layout includes a number of larger lots, including eight (8) lots over 800sqm. These lots may be capable of future subdivision, should the relevant LEP be amended in the future. Therefore, it is considered that the application provides sufficient opportunities for a

variety of housing types (albeit that they are currently limited under the provisions of GLEP 2014) and complies with the key objectives of the DCP.

Having regard to the above, the application complies with the key objectives applicable to the NEV site and the nature of the development. The application is considered to provide an appropriate and well considered response to the site conditions and the surrounding context. Further matters in relation to subdivision design and compliance with GDCP 2013 are provided in the Compliance Table at **Appendix CC** and the Stage 2 DA Design Report at **Appendix B**.

#### 5.1.2 Allotment size and slope

Chapter 3.5.3 (arrangement of lots) of GDCP 2013 requires that all lots on land zoned R2 Low Density Residential have a minimum site area of 550sqm and a minimum width of 15 metres at the building line. Columns 2 /3 and 7 /8 of **Table 12** illustrates that the draft subdivision complies with this requirement. However, Council controls also require that both the size and width of the allotments increase where the lots have slopes of greater than 15%. Specifically, where lots have slopes greater than 15%, GDCP 2013 requires the following:

- 15% or greater but less than 20%: that the minimum area and widths be increased to 650sqm and 18 metres, respectively; and
- 20% or greater: that the minimum area and widths be increased to 800sqm and 20 metres, respectively.

Furthermore, GDCP 2013 requires that the minimum size of corner lots be increased by 50sqm. The proposal incorporates a number of corner lots being Lots 59, 65, 66, 74, 75 and 91.

Table 12 illustrates the proposals compliance with these controls.

Lot Number	Lot size (sqm)	Lot width (m)- frontage to street	Slope	Complies	Lot Number	Lot size (sqm)	Lot width (m)- frontage to street	Slope	Complies
1 (51)*	550.8	16.2	<15%	Yes	23 (73)*	562	15	>20 (approx. 66% of the site <10%	No- min. area No- min. width
2 (52)*	550.8	16.2	<15%	Yes	<b>24 (74)*</b> Corner lot	562	15	>20 (approx. 49% of the site <10%	No- min. area No- min. width No- min. area for corner lot
3 (53)*	624.1	18.355	15-20%	No- min. area	<b>25 (75)*</b> Corner lot	562	15	<15%	No- min. area for corner lot
4 (54)*	550.8	16.2	>20%	No- min. area No- min. width	26 (76)*	562	15	<15%	Yes
5 (55)*	550.8	16.2	15-20%	No- min. area No- min. width	27 (77)*	562	15	<15%	Yes
6 (56)*	550.8	16.2	15-20%	No- min. area No- min. width	28 (78)*	562	15	<15%	Yes
7 (57)*	550.8	16.2	>20%	No- min. area No- min. width	29 (79)*	1017	43.695	<15%	Yes
8 (58)*	550.8	16.2	>20%	No- min. area No- min. width	30 (80)*	668.3	13.92, 21.865	<15%	Yes

 Table 12: Summary of the proposed residential lots- size and slope

9 (59)* Corner lot	903.2	Varied 11.6, 16.69, 17.175	>20%	Yes	31 (81)*	550.8	16.2	15-20%	No- min. area No- min. width
10 (60)*	612.1	17.815	>20%	No- min. area No- min. width	32 (82)*	550.8	16.2	15-20%	No- min. area No- min. width
11 (61)*	638.1	15.4	>20%	No- min. area No- min. width	33 (83)*	550.8	Nil	>20%	No- min. area No- min. width
12 (62)*	667.8	15.01	>20%	No- min. area No- min. width	34 (84)*	550.8	Nil	15-20%	No- min. area No- min. width
13 (63)*	660.6	15.065	>20%	No- min. area No- min. width	35 (85)*	1026	38.785	>20%	Yes
14 (64)*	1371	34.28	>20%	Yes	36 (86)*	621.3	Nil	>20%	No- min. area No- min. width
15 (65)* Corner lot	1238	varied	>20%	Yes	37 (87)*	551.3	15.75	15-20%	No- min. area No- min. width
16 (66)* Corner lot	912	28.5	15-20%	Yes	38 (88)*	551.3	15.75	>20%	No- min. area No- min. width
17 (67)*	556.4	16.5	15-20%	No- min. area No- min. width	39 (89)*	624.6	21.84	15-20%	No- min. area
18 (68)*	553.4	10.385 23.77	>20%	No- min. area No- min. width	40 (90)*	990.3	9.135 <i>,</i> 16.775	>20 (approx. 48% of the site <10%	Yes
19 (69)*	563.7	Nil	>20%	No- min. area No- min. width	<b>41 (91)*</b> Corner lot	956	46.775 <i>,</i> 31.865	>20 (approx. 85% of the site <10%	Yes
20 (70)*	564.4	Nil	>20%	No- min. area No- min. width	42 (92)*	777.1	21.32	<15	Yes
21 (71)*	565.3	Nil	>20%	No- min. area No- min. width	43 (93)*	551.5	21.22	<15	Yes
22 (72)*	579.1	15.9	>20 (approx. 50% of the site <10%	No- min. area No- min. width					

\*lots number as reference on the Draft Plan of Subdivision

**Table 12** illustrates that not all lots comply with the minimum size and width dimension of GDCP 2013 when the slope of the lots is taken into consideration. Specifically, 27 of the 43 lots do not meet the minimum lot size requirements. In addition, Lots 74 and 75 do not meet the minimum lots sizes for corner lots.

In this instance, the non-compliances with the minimum lot size requirements in the DCP are considered acceptable for the following reasons:

- The lots comply with the minimum lot sizes specified in both GLEP 2014 and Draft CCLEP 2018.
- The proposal is a community title subdivision and therefore, is not representative of a typical Torrens-title residential subdivision. Specifically, future development on these sites will be subject to the following:
  - Assessment against the Concept Plan and Design Report which provides guidance for future residential development including to recommend minimum house sizes, setbacks and development controls which specifically respond to the site conditions and set the design standards for the ecovillage.

- Review and approval of the Building Review Panel established under the Community Management Statement including an assessment against the Narara Ecovillage Building Standards and Landscape Standards. This review includes detailed consideration of the potential impacts on neighbouring properties in terms of solar access and building siting.
- The subject lots are located well within the boundaries of the ecovillage and therefore, future development on these lots will not adversely impact the amenity of neighbouring properties beyond the NEV site.
- The ecovillage seeks to provide a range of lots sizes capable of supporting a range of housing options including affordable housing and tiny homes. The lots proposed are capable of supporting this intention.
- Homes constructed in Stage 1 of NEV have been engineered to respond to the steep and varied site conditions. The Geotechnical Assessment Report submitted with the Stage 2 DA has made appropriate recommendations in respect to footing and foundation designs which need to be considered in the future dwelling design.

Further to the above, Envirotecture has stress tested all lots to ensure that the site slope will not adversely impact on the viability of each lot. All lots have been found to provide a viable area for development / building siting whilst achieving recognised solar access and compliance with the setback requirements in the Design Report.

Having regard to the above, the subdivision design is considered to be acceptable on merit and to meet the intent of Council's controls.

#### 5.1.2 Crime Prevention Through Environmental Design

The subdivision layout has been informed by the CPTED principles of natural surveillance, access control, territorial reinforcement and space management. The design and layout of the lots appropriately respond to the CPTED principles of reducing the potential for crime and increasing perception that the development provides a safe environment. From a design perspective, crime deterrence on the site has been achieved by the following initiatives:

- providing opportunities for clear sightlines and for passive surveillance between the community association land (proposed Lot 1 including the roads and open space) and private realm (each dwelling lot);
- providing opportunities for effective lighting of the common areas during evening hours;
- incorporating landscaping that will make the place attractive and will complement existing site landscaping, but does not provide offenders with a place to hide or entrap victims; and
- providing clearly defined paths of travel between dwelling lots, car parking and the common areas.

In addition to the above, the planned road and pedestrian network through the NEV site, is anticipated to be well utilised by residents and visitors of the ecovillage, thereby reducing opportunities for crime including to deter opportunities for vandalism and graffiti.

Having regard to the above, it is considered that the development adequately addresses the CPTED principles.

## 5.2 Geotechnical and Slope Stability

### 5.2.1 Geotechnical

The Benviron Group has undertaken a preliminary assessment of the geotechnical conditions of the site (**Appendix N**). The Report outlines the findings of field work investigations which included mechanical excavation of ten (10) testpits, twenty (20) boreholes and the installation of two (2) ground water piezometers and three (3) inclinometers across the Stage 2 site. The aim of the investigation was to assess the site surface and subsurface conditions across the site. Laboratory testing and engineering analysis have also been undertaken in order to provide geotechnical recommendations for the design and construction of the works proposed. Where relevant, recommendations have also been made in respect to the future development on the residential lots.

The site is identified as being located in an area mapped as Terrigal Formation which typically comprises sandstone with minor siltstone and claystone and is also located in an area mapped as having no known occurrence of acid sulfate soils. Within the Stage 2 area, the ground profile encountered within the boreholes varied including the depth of fill, natural soils, residual soils and bedrock. Based on the investigations and analysis undertaken by the Benviron Group, a number of recommendations have been made to inform the detailed design of the project including in relation to:

- site preparation and earthworks;
- anticipated subgrade conditions;
- preliminary pavement design; and
- engineering requirements for batter design, retaining walls and surface stability.

The investigations indicate that the conditions of the Stage 2 site can accommodate the development subject to the geotechnical recommendations and the risk mitigation measures contained in the report. Further site investigations are recommended at the construction certificate stage when the detailed engineered design for the project will be finalised.

### 5.2.2 Slope Stability

The Geotechnical Report undertaken by the Benviron Group includes an assessment of the proposed lots and slope instability issues associated with the Stage 2 site. As the topography of the site is varied, the geotechnical recommendations based on the lot classifications in accordance with AS 2780-2011 are also varied. The majority of the proposed lots have been classified at Class H1 (land sloping angle under 18%) or Class P (land sloping angle over 15%).

Based on the classification of the lots, the Benviron Group has made recommendations with respect to the future foundation design based on the further slope stability assessment and risk assessment at the individual DA stage.

Notwithstanding sloping nature of the site, fieldwork observations undertaken by the Benviron Group indicate that there was no major sign of landsliding on the site and accordingly, the level of landslide (soil creep) has been assessed as being 'very low'. Specific risk mitigations and control measures have been recommended to maintain to risk of land sliding to a very low level.

Subject to compliance with the recommendations in the Geotechnical Report, the Benviron Group considers the proposed development to be feasible, including its capability to support future

residential development. It is noted that the site conditions which will be encountered over the Stage 2 site are not indifferent to those on the Stage 1 site. In this regard, progressive development within the Stage 1 site has demonstrated that despite the sloping nature of the site, design solutions can be engineered to respond to the site conditions.

### 5.3 Contamination

Matters in relation to site contamination and compliance with SEPP 55 have been addressed in Section 4.3.2 of this report. The Detailed Site Investigation report prepared by the Benviron Group (**Appendix H**) which includes desktop assessment and analysis of soil samples and site investigations, has concluded that no remediation work is required on the Stage 2 site and on this basis, that the site is suitable for its intended use.

### **5.4 Utility Services**

Clause 6.2 of GLEP 2014 requires that consent not be granted for new development within an urban release area unless Council is satisfied that the relevant public utility infrastructure is available (or can be made available) to the proposed development. The proposed arrangement for provision of utility services throughout the site have been addressed in **Section 3.6.4** of this SEE. By-law 23 of the Community Management Statement establishes that the relevant statutory services will be made available to all lots within the Community title scheme.

Submissions from the utility services providers (refer **Appendix O**) indicate that services are available to the site and have the capacity to service the demands of the Stage 2 development. The proposal for Stage 2 envisages that services will generally be located parallel to the proposed road network and within the allocated services corridor and will minimise the need for further site interventions.

Having regard to the submissions at **Appendix O** and the arrangement in respect to water and sewer detailed in Section 5.5 below, Council can be satisfied that the relevant infrastructure will be available to service Stage 2 of NEV and the proposal complies with the provision of Clause 6.2 of GLEP 2014.

## 5.5 Water Cycle Management Plan

A Water Cycle Management Plan Report (WCMP) has been prepared for the Stage 2 DA by Henry & Hymas (**Appendix P**). The WCMP includes a concept for water management on the site relevant to the proposed subdivision and future development of the site for residential purposes. The key elements in respect to stormwater, wastewater and potable water and non-potable water supplies are detailed in the WCMP including the modelling of water demand for the site based on the estimated number of dwellings in Stage 2.

This assessment demonstrates that all elements of the WCMP are able to be treated to an acceptable level and water supplies to the development are available in accordance with the requirements of Parts 3.5.7 and 6.7 of Council's DCP.

It is noted that NEV's Community Management Statement (Building Standards) includes water usage goals which all residents and the Community will be required to actively support.

#### 5.5.1 Stormwater

The key objective of the stormwater controls proposed for the site are to ensure that stormwater impacts are appropriately managed on-site through the implementation of various on-site detention and water quality treatment measures and furthermore, that discharge flow rates from the site and the quality of that stormwater do not impact the downstream ecosystem.

The stormwater strategy is based a Water Sensitive Urban Design (WSUD) approach to manage stormwater quality and quantity. The stormwater design is illustrated in the civil engineering works plans (**Attachment V**) and detailed in the Civil Engineering Report (**Attachment T**). The Stormwater Plans illustrate the proposed layout for the stormwater system and its components. These plans illustrate that the majority of the system (pipes and swales) is designed to run parallel with the road network (i.e. within the servicing corridor) in order to minimise site disturbance and requisite excavation.

The drainage system has been designed and modelled to collect all concentrated flows from the development site including the future building pads on each allotment, and impervious surfaces including the road, driveways and footpaths. The piped system has been designed to generally convey the 1 in 10-year ARI with adequate provision for the 1 in 100-year ARI to be safely conveyed overland. The system includes the use of bioretention basins and on-site detention to ensure that the water quality and run-off from the development is appropriately management and does not exceed the predevelopment flows for storms up to the 1 in 100-year ARI. It is noted that all future lots within the development will be required to provide OSD, in accordance with the recommendations in the Civil Engineering Report. DRAINS modelling (**Appendix X**) has been run based on a set of assumptions for OSD storage and orifice size. This confirms that each residential lot will be required to provide a 2.25kL rainwater tank.

Water quality measures are proposed to be incorporated into the stormwater design to meet Council's water quality treatment targets as set out in section 6.7.7.3.2 of the GDCP 2013. MUSIC modelling (**Appendix Y**) has been undertaken to determine the effectiveness of the water quality treatment measures proposed and whether compliance with Council's water quality treatment targets can be achieved. **Table 13** below illustrates that the proposal achieves compliance with Council's requirements.

Pollutant	Council reduction requirement	Proposed reductions
Total suspended solids	80%	83.8 %
Total Phosphorous	45%	62.4 %
Total Nitrogen	45%	48.5%
Gross Pollutant	90%	100 %

 Table 13: Total pollutant reductions

The WCMP includes a number of monitoring, maintenance and management requirements to ensure that the quality and quantity of water functions effectively, and the integrity of the system is assured. Through the implementation of the measures proposed in the stormwater strategy, the proposal can ensure a safe and ecological sustainable environment and will comply with Council's DCP and Council's Water Cycle Management Guidelines.

#### 5.5.2 Wastewater

As detailed in Section 3.3.6 of this SEE, the wastewater infrastructure for the Stage 2 is proposed to be collected around the site through a piped system to be owned and operated by NEV Water under the current license they hold under the WICA. This will mean that NEV will be the bulk supplier and network operator for all waste water. The wastewater will be reticulated through the site by gravity with the exception of the part of the Stage 2 network (eastern side of Gungani Road) which is proposed to connect to the Stage 1 wastewater infrastructure. The proposal is reliant on a wastewater connection to Council's sewer infrastructure at the Research Road frontage of the site.

The wastewater infrastructure for Stage 2 has been designed by Henry & Hymas (**Appendix V**). With the exception of 7 lots within the Stage 2 subdivisions (Lots 22-28), all wastewater will be gravity drained and discharged to connect to Council's infrastructure. Modelling of the estimated wastewater generation has been undertaken based on estimated generated per dwelling of 100 L/ person / day, in accordance with the estimates generated by Woodlots and Wetlands for the Stage 1 of NEV. It is estimated that the total wastewater generation from Stage 2 will be in the order of 12.9KL / day.

Approval will be sought from Council under Section 305 of the *Water Management Act 2000* to connect to Council's water infrastructure. The design flows for Stage 2 are detailed in the WCMP (**Appendix P**) and demonstrate that compliance with the relevant Sewerage Code of Australia can be achieved.

#### 5.5.3 Potable Water

The application proposes that potable water be provided to the site via connection to Council's water infrastructure near the boundary of the site. The potable water from the connection to Council's infrastructure is then proposed to be pumped via a 30KL tank to potable water distribution header tanks on the site. The potable water will be reticulated through the site from these tanks by gravity.

The location of potable water pipes is typically within a services corridor adjacent to the road network (refer **Appendix Q**). Fire hydrants are provided at regular intervals along the network to ensure access to reticulated water for firefighting. The spacing, design and size complies with AS2419.1.2005.

As detailed in section 3.6.1 of this SEE, separate approval will be sought from Council under Section 305 of the *Water Management Act 2000* to connect to Council's water infrastructure. The potable water infrastructure onsite will be owned and operated by NEV Water under the current license they hold under the WICA.

Potable water demands for Stage 2 of the development have been estimated by Henry & Hymas based on an average daily potable water demand for each lot of 500L/ dwelling / day for a dual reticulation system. The storage capacity has been designed to 350KL, which is equivalent to 15 days potable water supply with no inflow.

The network design and hydraulic modelling for the potable water is detailed in the WCMP at **Appendix P**. It demonstrates that a potable water supplied can be assured and that proposal complies with the Water Supply Code of Australia, AS 2419.1.2017 and Council's DCP requirements.

#### 5.5.4 Non-potable (recycled) Water

The Stage 2 non-potable water reticulation has been designed to connect into the Stage 1 network. The water will be treated at the non-potable water treatment plant located near the existing dam on the site. The non-potable water will then be pumped to via dual reticulation system through the site from an existing 150KL non-potable water header tank. In order to ensure a guaranteed water supply for toilet flushing and irrigation, a potable top-up is proposed for filling the non-potable water tank.

The location of non-potable water pipes is typically within a services corridor adjacent to the road network, with the exception of where the pipes are extended along property boundaries to supply a number of lots which do not have direct street frontage. The non-potable water infrastructure onsite will be owned and operated by NEV Water under the current license they hold under the WICA.

The non-potable water reticulation also makes allowances for a third non-potable water pipe which is proposed to supply water to laundries. This aspect of the proposal is subject to further approval from IPART.

The design for the non-potable water system has been prepared by Henry & Hymas and is detailed in the WCMP (**Appendix P**) and illustrated in the plans at **Appendix V**. Non-potable water usage has been estimated at 297 L / dwelling / day and is based on estimates previously generated by Woodlots and Wetlands for Stage 1 of NEV, which is comparable to recognised standards established in the Water Systems Planning Guideline (Sydney Water 2014).

The hydraulic modelling undertaken by Henry & Hymas demonstrates that the demand for nonpotable water likely to be generated by the development can be satisfied by the system proposed and compliance can be achieved with the Water Supply Code of Australia, AS 2419.1.2017 and Council's DCP requirements.

### 5.6 Flora and Fauna

An assessment of flora and fauna on the site has been undertaken for Stage 2 of NEV by Anderson Consulting and is detailed in the Ecological Assessment Report at **Appendix M**. This assessment has relied on previous site survey work undertaken by Andrews Neil and Robert Payne and has supplemented the results with additional random meander survey works and site investigations undertaken in 2019. An assessment of likely impacts of the development on flora and fauna is included in the report and mitigation measures are recommended to management potential impacts.

Anderson Consulting has advised of the following in relation to the site conditions:

 the site is highly modified and is no longer representative of any native vegetation community. In this regard, the site has been terraced for planting and maintenance and modified for drainage. Numerous fruit trees from the former Horticultural Institute are still present on the site and the central portion of the Stage 2 site contains a large number of exotics with few remnant scattered overstorey eucalypts.

- The land on the southern boundary of the site which is proposed to be disturbed for the construction of the perimeter road, represent cleared and maintained rural residential lots with only overstorey eucalypts to be removed.
- The bushland on the south-western boundary which is proposed to be cleared comprises 1350sqm of native vegetation which includes 325sqm of land E2 zoned. This land has been classified as Coastal Narrabeen Moist Forest and Coastal Narrabeen Ironbark Forest. Clearing of this land is required to accommodate the perimeter road. The location of the native vegetation is illustrated in the **Figure 32**.
- No significant geological features including karsts, caves, crevices of cliffs are present on the Stage 2 site.



Figure 32: Location of native vegetation and communities (Source: Anderson Consulting).

Anderson Consulting has identified that numerous threatened flora species have been identified in the past as being present within a 10km radius of the site including in the BioNet Atlas. These species include Spider Orchid, the Magneta Lilly Pilly and the Hairy Geebung. However, Anderson Consulting has advised that none of these species were detected on the site during the survey work undertaken, that no hollow bearing trees were observed and furthermore, that no listed threatened species, communities or critical habitats listed under the EPBC Act or the BC Act were detected.

Anderson Consulting has also advised that whilst numerous fauna species have been identified as being present within a 10km radius of the site in the past including amphibia, aves, mammalia and reptillia, none of these species were detected on the site during the recent inspections. The following observations were also made:

• The low quality of the habitat and the limited areas for water to pool, means that the Giant Burrowing Frog and Red-crowned Toadlet are unlikely to be significantly impacted by the proposal, as it is unlikely to form a breeding ground for any threatened species of amphibians.

- The site provides foraging, breeding and roostering resources for a variety of native birds including the potential for Bush Stone Curlew, Gang Cockatoo, Little Lorikeet, Powerful Owl and the Sooty Owl, that have been previous recorded in the area. However, modified nature of the habitat and the small area of native vegetation to be removed would not significantly impact these species.
- No listed reptiles or mammals were detected in the area and the areas of habitat to be removed are not representative of the species known to occur in the area.

Based on the above assessment, the Ecological Assessment Report advises as follows with the respect to potential impact on the flora and fauna on the site:

- the proposal is unlikely to significantly affect any threatened species or ecological communities or their habitats according to the 5-part test provided for under Section 7.2 of the *Biodiversity Conservation Act 2016*.
- the proposed development does not exceed the Biodiversity Offset Scheme (BOS) threshold.
- the proposed development is not being carried out in a declared area of Outstanding Biodiversity Value (OBV).

On this basis, it is concluded that the proposal is considerate of the local ecology including to retain as much of the natural vegation and possible. To reduce direct and indirect impacts on the biodiversity values of the site a number of actions are recommended in respect of the maintenance and development planning for the site. The actions will be undertaken in addition to those documented in the Stage 1 Ecological Restoration Plan, including the following:

- 1. Standard sediment and erosion controls should be utilised in all phases of the project to protect downslope areas from sediment.
- 2. Clear barrier fencing should be erected on the southern and western boundaries to clearly define the extent of the required earthworks to protect vegetation from accidental clearance by earthworks contractors.
- 3. Tree protection barriers should be erected for any trees being retained on site as per the Arborist Report recommendations.
- 4. Endemic site-specific landscape species should be used from the list of native species known to occur on the site.
- 5. As light pollution may impact some fauna species which may use the western portion of the forest adjoining the proposed development area, it is recommended that low level lighting be used facing this forested area.

### 5.6.1 Tree Removal and Ecological Restoration

Elke Landscape Architect + Consulting Arborist has undertaken an audit of significant trees on the site (**Appendix L**). 127 trees were individually assessed, and it has been determined that the removal 40 of the trees will be required. Mitigation measures have been recommended to ensure the protection and retention of all other trees including specific requirements for tree protection zones, construction management and regular inspections and monitoring.

Six (6) of the trees proposed for removal have been assessed as having a 'high' retention value (refer Figure 24 and the tree removal plan at **Appendix L**). The high proportion of the trees identified for removal are located in the south west corner of the site and in the vicinity of the new perimeter road

construction on No's 21 and 23 Research Road. No trees listed as heritage items in Schedule 5 of Gosford LEP 2014 are proposed to be removed to accommodate the proposal. Subject to suitable replacement planting to compensate for the loss of these trees, their removal is supported by the project arborist.

As detailed in section 3.8 of the SEE, the DA includes a comprehensive landscape strategy and ecological restoration works, some of which will be implemented as part of the Stage 2 works. These works are considered to result in positive ecological outcomes for the site and will more than compensate for the tree removal. In addition, these works are consistent with the anticipated environmental and ecological site improvements intended by Part 5.8 of Council's DCP and required as result of the sites redevelopment.

Having regard to the above, the project arborist has concluded as follows:

The overall balance of the tree numbers is significantly greater though the subdivision development of Stage 2.

Numerous trees on the edge of Stage 2 are recommended to be protected and retained, the landscape amenity and accessibility improved with road and path networks proposed, and the proposed site lots will become more functional and provide opportunity for more tree planting and landscaping. The 'bushfire safe' APZ and overall value of the site is generally improved.

With the co-ordination of a team of consultants over the years, and with the benefit of a client that values landscape and environmental qualities of trees, as well as lessons gained from Stage 1, the overall result in arboricultural terms is of best practice.

### 5.7 Environmental Sustainable Development

The Hill Thalis Design Report submitted with the Stage 1 DA outlined opportunities for sustainable design features to be incorporated into the future development of the Ecovillage. These opportunities are predominantly relevant to the future development of the residential lots (including in Stage 2) and include the following design principles:

- provide all houses with water tanks to locally capture rainwater for productive reuse;
- provide all houses with the potential for renewable energy generation to meet energy requirements;
- select all appliances and systems based on their environmental performance;
- use materials in construction with potential of end of life recycling or which are manufactured with high levels of recycled or waste materials;
- employ both passive design and active systems which achieve best possible environmental performance, adopting the principles of long life, loose fit and low energy;
- site and design all houses to optimise the sun and minimise overshadowing of neighbours, relative to each season; and
- design all houses to maximise natural ventilation.

It is noted that ESD initiatives have been incorporated into the NEV CMS (**Appendix G**) and this will mean that the future development of the site will deliver genuine sustainable environmental outcomes and with positive environmental benefits. By-Law 54 requires that all parties make provision

for the generation of electricity from renewable sources and furthermore, that the amount of renewable electricity generated for a year by each dwelling on a Lot be at least equal to the amount of household electricity consumed for the same period. Energy and emission goals and principles are also incorporated into the By-laws which obligate the Community Association to use best endeavours to use energy efficiently and to minimise the production of harmful emissions such as greenhouse gases and particulates.

### 5.8 Heritage

#### 5.8.1 Cultural Heritage

The Heritage Impact Statement prepared by Betteridge Heritage to accompany this Stage 2 application is provided at **Appendix I**. The HIS has been prepared to satisfy the requirements of Clause 5.10(f) of GLEP 2014 which requires development consent for the subdivision of land on which a heritage item is located.

The HIS identifies the overall NEV site as a place of heritage significance with historical, associational, aesthetic, social and potential archaeological, educational and technical research significance as it features some rare built and landscape elements and is representative of horticultural research facilities in coastal NSW retaining evidence of research activities spanning more than a century. The cultural landscape is also identified in the HIS as including a number of rare elements, particularly the former Manager's Residence, the former Grafting Shed / Office building and an early glasshouse. Rare plantings include the *Pyrus calleryana* D6 type specimen and a number of mature ornamental plantings which are locally uncommon are also present on the overall site.

Schedule 5 of GLEP 2014 currently list nine (9) items on the NEV site as heritage items of GLEP 2014 (items No. 119 to 127). All items listed are identified as being located on the former consolidated land holding (Lot 13, DP 1126998), which has not been amended and updated to reflect the registered subdivision of the site. In relation to the land which forms the subject of the Stage 2 DA, there is only one identified heritage item which is of relevance to the proposal, being the Main entrance gate posts (Item No. 127) which are proposed to be reinstated at the entry to the site. No other heritage items are located on the Stage 2 site and no heritage items are proposed to be demolished as part of this proposal.

Based on their assessment of the Stage 2 proposal, Betteridge Heritage has advised that:

- The subdivision layout and infrastructure have been designed to minimise impacts on listed heritage buildings and their setting and listed landscape elements. The subdivision lots are configured so that they contribute to a site-wide system of 'greenways' and common gardens. This is considered sympathetic to the cultural landscape of the site, interpreting the plantations that previously characterised the site.
- The curtilages of the heritage items on the NEV site are outside the Stage 2 DA area and considered sufficient to retain their heritage significance.
- The subdivision layout and the future new dwelling will minimise impacts on the cultural landscape qualities by recognising and responding to the sites' topography, water movements, natural vegetation and horticultural heritage. The proposed lot layout provides for retention of the views out to these heritage items and to adjoining bushland and the Narara Valley.

- Future new buildings will have some impact on views to and from the nearby listed heritage items but these impacts are considered acceptable and manageable through a range of siting and design solutions. However, the future new buildings can be sited and designed so that they do not visually dominate them.
- The removal of trees, which have been assessed as having no heritage significance, is necessary to support the future development of the site.
- The proposed site landscaping enhances the retained vegetation with new planting of suitable species and will respect the cultural landscape qualities of the site.
- The reinstatement of the historic entrance gate posts from the former Gosford Horticultural Institute will be sympathetically reinstated as part of the Stage 2 landscaping.
- The removal of the multispan greenhouse No.1 is acceptable, noting that it is identified as being of low significance and not requiring retention on the 2013 CMP Review.
- The proposed subdivision (and future housing) will result in a change to the public perception of the setting of the historic entry gates and the nearby heritage items (Group of *Taxodium distichum* (Item No. 121) and specimen of *Syncarpia glomulifera* (Item No. 122), the change is considered to be within acceptable limits.
- Residents and visitors to NEV will still be able to view the heritage items and appreciate their significance as built and landscape elements relating to the former horticultural institute. The appreciation of the site history and the significance of the site would be enhanced by implementation of a site-wide interpretation strategy and plan.
- The proposed subdivision is not located in any known or potentially significant archaeological deposits. It is noted that none of the early structures relating to the former horticultural research facility is known to have been located within the Stage 2 DA area.

A number of measures have been recommended by Betteridge Heritage to mitigate impacts likely to arise from implementation of the Stage 2 proposal including in respect to the following:

- 1. Designs, materials and exterior finishes of new dwelling;
- 2. Site landscaping, replacement planting and tree protection measures;
- 3. The reinstatement of the historic gateposts;
- 4. The preparation of an interpretative strategy; and
- 5. New way-finding, informational, safety and interpretive signage at the entrance to the site and within the site.

Subject to these mitigation measures being implemented, Betteridge Heritage has concluded that the Stage 2 DA proposal (and the future development) will result in a perceptible but acceptable change to the cultural landscape of the site. Furthermore, it is concluded that the visual absorption capacity of the area is such that the proposed future development can be accommodated without unacceptable changes to the perception of the site as viewed from major viewing points within the heritage item's curtilages and the site generally.

### 5.8.2 Aboriginal Cultural Heritage

An Aboriginal Archaeological & Cultural Heritage Assessment Report (AA&CHA Report) was prepared for the Gosford Horticultural Research rezoning in May 2006. The AA&HCA Report was commission by NSW Department of Commerce and was prepared by Danny O' Brien. The AA&HCA Report included background data on pre-recorded Aboriginal sites for the township of Narara and its environs. Fiftytwo (52) registered Aboriginal archaeological sites were found to occur, of which none were registered AHIMS Aboriginal sites located within or adjacent to the subject site.

The AA&HCA Report also included the results of field assessment and whilst fifteen (15) additional 'new' or previously unrecorded sites were identified, none of these were recorded within or immediately adjacent to the proposed development precinct (i.e. the including Stage 2 area which is the subject of this application).

Based on the above findings, it was concluded that the identified Aboriginal archaeological sites will not be directly affected by any future development, as these sites are not located within the proposed developable precincts of the subject site. It was also advised that the Darkinjung Local Aboriginal Land Council had no objection to the future development of the developable precincts identified at the rezoning stage. The Stage 2 DA development area remains within the development precincts identified in the rezoning, with the works being largely contained within that portion of the site previously zoned 2(a) residential.

In light of the conclusions of the AA&HCA Report, no further archaeological investigations of the site have been undertaken.

A number of recommendations contained in the AA&HCA Report remain valid and relevant to the current Stage 2 application, as outlined below:

- That no plans should be made to include walking trails within the subject site that lead to sensitive Aboriginal sites.
- That should fire trails or APZ be required to be established to protect future dwellings, then a detailed Aboriginal archaeological site survey be undertaken to ensure that any cryptic or sub-surface sites are considered.
- Should any Aboriginal sites be located during the construction phases for any future development including for road, infrastructure or dwellings, then all works at this location should cease, and the Department of Environment & Conservation's National Park & Wildlife Services should be contacted for further advice.

Should any artefacts be unearthed, the Co-operative is aware of its legal responsibility in respect to any requirement to obtain a permit under the *Heritage Act 1977* and that Aboriginal sites and artefacts are protected under *the National Parks and Wildlife Act 1974*.

## 5.9 Transport and Accessibility

A Transport, Access and Parking Assessment Report (TAPA Report) has been prepared by Transport & Urban Planning Pty Ltd (**Appendix BB**). This assessment includes an assessment of the existing transport context, including current traffic generation and capacity of the surrounding road network. This assessment then assesses the likely impacts of the Stage 2 development including the expected traffic generation, access and parking arrangements for the proposed development.

The TAPA Report has been prepared with respect to the findings of the Traffic Assessment Reports undertaken for the site rezoning by BJ Bradley and based on a 150 lot residential subdivision of the NEV site and the Traffic Impact Assessment prepared for the Stage 1 DA by Chris Hallam and Associates Pty Ltd. Significantly, these reports conclude that the traffic generated by the development will not

have an adverse impact on the level of service, level of safety or capacity of the local road network and that the traffic impacts associated with the development of the site would be negligible. These conclusions were based on an estimated weekday peak hour traffic generation of about 130 vehicles/hour, and an estimated daily traffic generation of 1,350 vehicles/day, based on standard RMS traffic generation rates. Since the completion of these TIA's, there has been only a minor change in traffic generation as a result of new development in the local area and therefore, the conclusion of these studies remain valid and relevant to the current application.

#### 5.9.1 Traffic Generation

The site is currently serviced by an efficient functioning local road network including enjoying good road and footway access to the adjoining road network. Based on an assessment of the Stage 2 proposal including the results of recent traffic counts of the local road network to determine the current traffic flows, the TAPA Report indicates that:

- The existing AM and PM peak hour traffic from the site (including taking into account the project Stage 1 traffic) would be in the order of 52 trips per hour.
- A Sidra Analysis of the Manns Road /Carrington Street and Manns Road / Deanne Street junctions indicates as follows:
  - Manns Road / Carrington Street- operates at a 'satisfactory' (Level of Service (LOS) C) to 'near capacity' (LOS D) level of operation during the current AM and PM peak hours.
  - Manns Road / Dean Street- operates at a 'satisfactory' (LOS C) to 'near capacity' (LOS D) level of operation during the current AM and PM peak hours.

The predicted traffic generation associated with the development has been based on the recommended RMS *Guidelines for Traffic Generating Development*. Based on the assumption that 51 dwellings will be accommodated on the future Stage 2 development site (i.e. based on 35 x 550sqm lots and 8 x large lots with multiple houses) it is estimated that an additional 46 peak hour trip would result during the peak period or an additional 459 trip per day. Having regard to this traffic increase, the TAPA Report concludes that:

- The Stage 2 development (including to take into account Stage 1) would result in a total of 98 peak hour trips distributed onto the local road network or roughly one (1) additional trip per minute.
- Whilst the average delay at the key intersections of Manns Road / Carrington Street and Manns Road / Dean Street will increase marginally, the level of service is should remain relatively unchanged.
- The ancillary uses on the site (including of the NEV visitor centre and the administration block) are relatively infrequent and unlikely to impact on peak Monday- Friday traffic flows to and from the site.
- The existing traffic conditions on the road network adjacent to the site are good with a LOS of 'A'.

Having regard to the above, the TAPA Report concludes that the future development of the site (which would precede the subdivision) is likely to result in moderate residential traffic generating development. However, it will result in minimal additional impact on the existing road network. Accordingly, post development, no significant changes to the operation of the road network is anticipated and no additional traffic management facilities (measures) are recommended.

#### 5.9.2 Road Network

The internal road design for Stage 2 is consistent with the design standards approved (and constructed) for Stage 1. In this regard, the perimeter road has a width of 5.5 metres and within the Stage 2 site area, will complete the southern section of the perimeter road (i.e. linking into the Stage 1 completed section of the road at the intersection of Balgara Rise and Syncarpia Crescent) and provide access to the proposed residential subdivision.

The road circulation and the location of the roads has been designed to promote practical and safe access to the residential lots (including No.s 21 and 23 Research Road) and to comply with the requirements of *Planning for Bushfire Protection 2018* (PBP 2018). The grade requirements of AS2890.1 have been adopted for the proposed road network.

The internal road networks does not fully comply with road design requirements in Chapter 3.5.6 (Transport Network) of GDCO 2013. However, given the ecovillage is a community title development and the road network function, the road design is considered to be acceptable for the following reasons:

- The ecovillage roads would be private roads rather than public roads.
- The AMCORD principles are considered to set an appropriate standard for road design for the ecovillage based on the low level of traffic generation.
- The road network complies with the RFS Guidelines contained in PBP 2018.
- The AMCORD guidelines provide for shared car and pedestrian travel. The 1.2 metre services corridor adjacent to the carriageway, will also double as an informal pedestrian footway and is an appropriate design response for pedestrian movement and low traffic volumes. The key pedestrian route through the development will be through the common gardens and within common areas.

The TAPA Report includes an assessment of the road design and its suitably to service the ecovillage. It concludes that road design is suitable for the development for the following reasons:

- The road design is in keeping with the AMCORD guidelines for lower volume and lower speed residential streets, with a 10km/ hour pedestrian shared zone.
- The sight lines at existing intersection locations are good and met AUSROAD requirements for 50km/ hour operating speed limits on the adjoining roads.
- Vehicles entering and leaving the precinct via Research and Fountain Roads will cause minimal potential conflicts with existing low speed traffic using these local roads. This should result in no significant impact in terms of traffic capacity or road safety on either streets.

#### 5.9.3 Green Travel Plan

A Green Travel Plan has been developed for NEV to limit traffic congestion and car dependency and to encourage the use of public transport and non-motorised modes such as walking and cycling within the ecovillage itself and neighbouring sites. It is considered that this approach will provide real environmental benefits to the ecovillage and raise general awareness in the community about the benefits of choosing alternative transport means, including to reduce emissions of greenhouse gases, improving local air quality, minimising health risks and reducing congestion, noise, dirt and fumes. This approach is also intended to reduce the dominance of cars within the ecovillage and promote its general functioning of as 'pedestrian priority' concept.

The Green Travel Plan includes measures tailored to suit the ecovillage, including the investigation of opportunities for a community bus service to provide regular visits to the train station and local shopping centres, the use of electric buggies and car sharing schemes.

Overall, it is anticipated that this approach will have a real impact on reducing car dependence and therefore, will reduce the overall number of vehicle trips generated by the ecovillage and the demand for car parking.

#### 5.9.4 Car Parking

The Concept Plan for the NEV site proposes that most car parking being provided in common street reserves. Opportunities for on-site parking on individual residential lots can be accommodated subject to design impacts being minimised and sensitively integrated with the streetscape qualities of the ecovillage. In line with this concept, the Stage 2 DA proposes to incorporate on-street parking throughout the site and its integration with the site landscape strategy as illustrated in the civil engineering works plans at **Appendix U**.

The Stage 2 DA proposed a total of 99 on-street parking space, with 62 spaces being allocated to the residential lots and 48 visitor parking spaces. The residential parking spaces have been based on the provision of 1 space per residential lot (i.e. 550sqm) and 2 spaces for larger lots (i.e. +880sqm). It is noted that GDCP 2013 requires the provision of car parking to be based dwelling size. Given this application is limited to subdivision works and the provision of site infrastructure, the provision of additional parking opportunities can be considered on each residential lot at the future development application stage.

Where the road network can accommodate additional parking, opportunity for visitor parking has been incorporated into the Stage 2 design and this will assist in meeting on-site requirements for community events. As detailed above, the parking design is integrated in the overall landscape and access strategies for the site, with street tree planting and grass swales providing a common green element along the street edge.

The TAPA Report has assessed the parking provisions proposed and considers the proposal to be acceptable having regard to the Green Trave Plan and to be compliant with AS2890.1. TAPA Report concludes that additional opportunities for parking can be explored as the site develops and if required to achieve compliance with Council's DCP.

### 5.10 Bushfire

A Bushfire Protection Assessment Report (BPA Report) has been prepared by Travers Bushfire & Ecology (Travers) and is included at **Appendix AA**.

The subject site is identified on Council's Bushfire Prone Land Map as being bushfire prone land, as illustrated in **Figure 33**. The vegetation has been classified as follows:

- West- North Coast Wet Schlerophyll
- South- North Coast Wet Schlerophyll
- North (approved Stage 1)- managed land

- North of proposed Lots 42 and 43- Management land / excluded vegetation
- East- Managed land



Figure 33: Extract from Council's Bushfire Prone Land Map (source: Travers Bushfire & Ecology).

The BPA Report includes an assessment of the assets protection zones (APZ's) for the development required in accordance with the Appendix 2 of *Planning for Bushfire Protection 2006* and provides advice on mitigation measures for the future construction of dwellings on the subject site and other related fire management issues. The BPA Report includes a bushfire attack assessment based on an assessment of the hazardous fuels, effective slope and proposes an alternative solution for the Asset Protection Zone (APZ) of 12 metres and 16 metres, respectively from the west and the south. An extract from the bushfire attack assessment tabulating these findings is provided in **Table 14** below.

Aspect	Vegetation classification within 140m of development	Effective slope of land	Minimum APZ required (Pre-release PBP 2018)	APZ provided (alternative solution) Refer Note 1 & Schedule 1 attached)	
West	North Coast Wet	15° <sup>u</sup>	24m	12m (provided by road & residual land managed under Community Title )	
South	Sclerophyll Forest	9° u	24m	16m (provided by road & residual land managed under Community Title )	
East					
North (Approved Stage 1)	Managed land	Level	N/A	>100m	
North (proposed Lot 42 & 43)	Managed land / excluded vegetation	Level	N/A	>100m	

Table 14: Determination of Asset Protection Zones (source: Travers Bushfire & Ecology).

Note 1 – A performance-based assessment using Appendix B of AS3959 was undertaken to determine the required APZ and BAL levels based on the comprehensive fuel loads associated with North Coast Wet Sclerophyll Forest and the upslope topography of 15 and 9 degrees. The results of the assessments above are provided within Appendix 2 and were prepared using the bushfire attack level calculator developed by *Flamesol*. The application of the APZ's to the subject site is illustrated in **Figure 34** below. **Figure 34** also indicates the BAL ratings which should apply to future dwellings to be constructed within 12- 100 metres of the edge of the road / or the zone boundary (as relevant).



Figure 34: Plan of proposed Bushfire Protection Measures. (source: Travers Bushfire & Ecology)

In order to mitigate the risk of bushfire hazard, Travers Bushfire & Ecology has advised that all residential allotments and the residual land surrounding the access road will be required to be managed as an inner protection zone and furthermore, that this can be managed through normal site maintenance. It is recommended that a Section 88B instrument be applied to the title of all future residential lots, the residual lots and the community association lot (Lot 1) to ensure the long-term management of the vegetation in order to maintain minimum fuel loads.

Travers has also assessed the proposal in respect to access to fire fighting operations. This assessment concludes that the perimeter road (which has been designed to be consistent with the Stage 1 perimeter road with a trafficable width of 5.5 metres with designated passing bays and off-pavement parking bays), the internal loop road (with a trafficable width of 5.5 metres) and the hydrant locations provide an acceptable solution when assessed against the performance criteria outlined in *PBP 2018*.

A number of management and mitigation measures are recommended to address the requirements *PBP 2018*. The key recommendations are listed below:

- APZ are to be provided to the proposed development as outlined in the report (as illustrated in **Figure 33** above).
- All residential allotments and residual land surrounding the access road to the E2 zone boundary
  will be required to be managed as an inner protection area. An 88B covenant shall be created on
  the title of the residential allotments and community land to ensure the ongoing management of
  this land.

- Building construction standards for proposed future dwellings will be subject to a separate bushfire report or BAL certificate.
- Water and electricity supply are to comply with Section 5.3.4 of PBP 2018.
- Public roads are to be two-wheel drive, all weather roads and access shall be constructed to comply with Section 5.3 of PBP 2018 with a minimum pavement with of 5.5 metres.
- Parallel parking bays shall be designed and constructed clear of the road pavement and complying passing bays (20 metres long x 2 metres wide) are to be provided in locations as shown on the concept plan.

Subject to compliance with these recommendations, Travers Bushfire & Ecology has advised that the bushfire risk to the development can be mitigated as appropriate bushfire protection measures will be in place and the site can be appropriately managed in perpetuity.

## 5.11 Waste Management

#### **5.11.1 Construction Waste**

A Preliminary Waste Management Plan (PWM Plan) has been prepared for the Stage 2 proposal in accordance with Council's waste management requirements (**Appendix Z1**).

The PWM Plan proposes to minimise off-site removal of waste and maximising the beneficial re-use of the waste. The key sources of construction waste from the Stage 2 works identified in the PWM Plan are as following:

- A number of trees will be felled to accommodate the regrading works and infrastructure installation. These trees will be chipped and stockpiled on site for future re-use.
- Concrete and other construction material associated with the building demolition will be stockpiled on site for future re-uses. Where possible concrete will be broken down and reused to provide all weather surfaces. As required, other materials which need to be disposed of off-site will be transported to an appropriately licensed waste facility by the appointed contractor.
- All excavation material (estimated to be 3,594m<sup>3</sup>) will be beneficially re-used within the development including for the earthworks associated with the construction of the roads and associated regrading, and landscape works. This material will be stockpiled on-site for re-use, as required.
- It is estimated that 100m<sup>3</sup> of organic material will be available for re-use in the implementation of the site landscaping.
- All material packaging will be disposed of by the civil contractor to a licensed waste facility.

The design philosophy for the NEV site is underpinned by environmental responsible design principles. A design using sustainability and recycled materials will provide both short and long term cost benefits in terms of the health of the environment. These design principles are incorporated into the Stage 1 Design Report (refer Stage 1 DA) and remain relevant and will be implemented as part of the Stage 2 works including the use of the following:

- recycled materials wherever possible, this includes recycled compacted site fill behind the rubble walls;
- recycled rubble as a facing material in gabion walls;

- recycled aggregates for drainage and edging;
- recycled soils and mulch; and
- recycled timber from removed trees for seats, decking, walls and informal play equipment.

A final Construction Waste Management Plan quantifying the volumes of waste and the relevant waste facilities to be utilised will be prepared once a construction manager and building contractors have been engaged.

#### 5.11.2 Operational Waste

The registered Community Management Statement (**Appendix G**) for NEV includes a mandatory By-Law in respect to waste generation and management. Significantly, the ecovillage aims to achieve zero waste to landfill. The Community Management Statement states that waste reduction will be achieved through initiatives such as the following:

- reducing, rethinking, reusing, repairing and recycling materials where possible;
- reducing the consumption of unrecyclable materials; and
- the hygienic storage and handling of waste.

Notwithstanding the above and in order to satisfy Council operation waste management requirements, waste generated by Stage 2 development (future dwellings) is proposed to utilise the existing communal garbage storage area constructed under the Stage 1 approval (DA 44994/2013). As detailed in section 3.10 of this SEE, this waste storage area is located off Gugandi Road, is conveniently accessible from the Stage 2 area and has the capacity to accommodate the waste storage requirements of Stage 2. This area was designed and constructed in consultation with Council's Waste Officer and to meet the requirements of Gosford DCP 106 (which was applicable at the time) and has been designed to accommodate a dual axle 9.8 metre truck with a HRV turning radius of 12.5 metres.

The waste anticipated to be generated by the future Stage 2 development (based on 43 residential lots) has been estimated to be 10.32 cubic metres of household waste and recycling which requires seven (7) bins new bins or a total of sixteen (16) bins taking in to account the requirements of Stage 1. In accordance with the Ecovillage aim to reduce waste, it is anticipated that the amount of waste will be minimised on site and were possible will be composted and beneficially used in gardens. This will substantially reduce off-site disposal of waste. All residents will be responsible for transferring their waste as required to the communal garbage storage area, which will continue to be maintained and managed by the site manager.

The location and design of the communal garbage storage area is illustrated in **Figure 35**. Reference should also be made to the Plan at **Appendix Z2** which includes a detailed summary of the likely waste volumes to be generated based on Council's requirements.

Having regard to the above, the Stage 2 proposal can comply with Council's waste management requirement.



Figure 35: Location and design of communal garbage store (Source: Envirotecture)

## 5.12 Amenity Impacts

#### 5.12.1 Lighting

A Lighting Report was prepared by Light, Art + Science (refer **Appendix X** of the Stage 1 DA) to assess the potential for external night lighting associated with the future subdivision of the site to adversely impact the adjacent forested areas. In this regard, Part 5.8 of DCP 2014 specifically requires that external night lighting associated with any future subdivision/development layout will be designed to reduce light spillage into adjacent forested areas.

The Lighting Report recommends that external night lighting associated with the future development of the site be designed to reduce light spillage into the adjacent forested areas. The recommendations of this report remain relevant to the Stage 2 DA and have also been incorporated into the Ecology Assessment Report. Specifically, the Ecology Report recommends that the low-level lighting be provided against the forest edge to ensure that artificial light pollution is keep as low as possible to ensure that impacts on the natural ecological conditions are minimised.

Having regard to the lighting requirements of NEV and the potential for impacts to foraging species, the Lighting Report makes specific recommendations to ensure compliance with the AS/NZS 1158.3.1 Lighting of roads and public spaces Part 1.1 Vehicular traffic (Category V) lighting- Performance and Design Requirements and AS/NZS 1158.3.1 Lighting of road and public spaces Part 3.1 Pedestrian Area (Category P) Lighting – Performance and Design Requirements. Specifically, the selection of luminaires for Stage 2 of the design will also comply with the following recommendations of the Lighting Report:

• Light source for external lighting should be of colour temperature 3000K.
- Street lighting should be pole mounted at no higher than 7.5m and have a full cut of lense based LED luminaire.
- Pathways lighting should be poled mounted at a height of 5m to 5.5m and have a full cut off lense based LED luminaire.
- Landscaping accent lighting should be directed to the item intended to be lit, have suitable light distribution that avoids light spillage and be fitted with a glare shield. The light source should be LED or low wattage ceramic metal halide.
- Building lighting should ensure the majority of the lighting is below the horizontal if wall mounted or fully recessed if in an awning. Uplighting should only be used if it is under an awning or soffit. The light source should be LED, low wattage ceramic metal halide or compact fluorescent.

The Co-operative proposes to finalise the design of the street lighting and lighting of the open space at the construction certificate stage. Subject to compliance with the recommendations of the Lighting Report, it is considered that the proposal will comply with the provisions of section 5.8 of GDCP 2013.

#### 5.13 Visual Impacts

Matters in relation to the visual impact of the land subdivision have been addressed in the Compliance Tables provided at **Appendix CC**. In this regard, it is noted that the residential subdivision has been limited to the predominantly cleared sections of the site, with significant bushland and established landscaping throughout the site being maintained. The topography of the site will ensure that many views of the Stage 2 are screened by existing vegetation and the natural topography of the land. From the south and south-east, the Stage 2 site will once developed will present as visually different. However, this change is considered to be within reasonable limits and consistent with the long-term vision for the development of the site including that residential development be limited to the land zoned R2 low density residential development.

The landscape strategy prepared for the site includes significant new planting throughout the Stage 2 site including to a new entry treatment to the Ecovillage which will integrate with the water quality measures to be implemented on the site (i.e. swales and bioretention basins). These works will significantly enhance the visual quality of the site and the arrival experience.

Having regard to the above, it is considered that the Stage 2 proposal will not result in unacceptable visual amenity impacts.

#### 5.14 Social and Economic Impacts

The project will deliver significant social and economic benefits to the local economy through direct job creation associated with the construction phase of the development. There will be resultant multiplier effects generated throughout the local economy including related to trade employment and supply of construction services.

Post completion of these Stage 2 works, the project will generate further employment associated with the design, approval and construction of dwelling houses and associated works.

The proposal will provide opportunities for housing choices in the LGA and will assist in meeting the dwelling targets in the Central Coast Regional Plan 2036. The location of the site, including its

convenient access to transport and services in the area and its environmental and scenic qualities will result in positive social impacts. The design principles for the development of the ecovillage have embraced these qualities and this will deliver social benefits to residents of the ecovillage.

The development of the site will also provide positive social impacts principally relating to the increased opportunities for the public to engage with and better understand the environmental and historic significance of the site and environmentally sustainable lifestyle options.

#### **5.15 Construction Impacts**

Construction activities associated with the development will be contained within the Stage 2 site boundaries. Prior to the commencement of construction, a Construction Environmental Management Plan will be prepared for the development. This will outline the construction activities and identify the appropriate mitigation and management measures to be employed to minimise construction impacts including those resulting from traffic, noise, vibration and dust.

Based on the construction activities and associated items of equipment, 'feasible and reasonable' mitigation measures will be implementation during construction of the project to minimise construction impacts to nearby sensitive receivers. This will include:

- adherence to the standard approved working hours for construction projects.
- locating any plant (including air-compressors, generators, as relevant) as far away as possible from sensitive receivers.
- using natural screening by topography to reduce noise impacts.
- ensuring any spoil is placed and not dropped into awaiting trucks.
- establishing load points as far as practicable from sensitive receivers.
- use of less noise-intensive equipment, where reasonable and feasible.
- the use of non-tonal reversing alarms fitted on construction vehicles.
- watering and grass seeding of exposed areas to minimise dust, stabilise the surface and prevent soil erosion.
- a Community Consultation Strategy to inform the neighbours of planned construction activities, construction noise complaints handling procedures.
- implementing universal work practices at all times.

The sediment and erosion control plan included at **Appendix V** identifies the soil and sediment control measures that are proposed to be established and maintained during construction. These measures are considered to be appropriate to mitigate on-site and off-site soil and sediment impacts during construction.

#### 5.16 Suitability of the Site for the Development

Having regard to the characteristics of the site and its location, the site is considered suitable for the development proposed in this Stage 2 DA for the following reasons:

• It is appropriately zoned to accommodate the proposed development and the development complies with the relevant provision in IDO No. 122, GLEP 2014 and Draft CCLEP, which promote land uses that are compatible with the low density residential character of the area;

- The environmental qualities of the site lend themselves to the establishment of an ecovillage and the Stage 2 development will continue to align with the design parameters and principles established for Stage 1;
- The reports which support this application demonstrate that the subdivision of the site and associated development will result in minimal environmental impacts including to the existing environment, heritage, road network and scenic quality of the site;
- The site is conveniently located to a number of schools, shopping centres and local business including Gosford City centre and therefore, the future residential development will have convenient access to these services and facilities;
- The site has good access to a range of public transport options including local bus services and Narara Railway Station; and
- It will not result in any material environmental impacts to the adjoining properties.

#### 5.17 Any submissions made in accordance with the Act or Regulation

The proposed development will be notified in accordance with Council's notification policy. Any submissions received will be duly considered by Council prior to the determination of the application.

Prior to the determination of the application, Council is also required to obtain general terms of approval proposed to be granted in relation to the development from the NSW Rural Fire Service in accordance with Section 4.47(2) of the EP&A Act.

#### 5.18 The Public Interest

The proposal is considered to be in the public interest as it will achieve the following:

- facilitate the use of the site and in doing so, will aid in the conservation, protection, security and enhancement of the environmental and heritage of the site;
- provide opportunities for greater housing choice in the Central Coast LGA and will assist in meeting the dwelling targets in the Central Coast Regional Strategy; and
- promote the orderly and economic development of the land in a manner that is compatible with the surrounding residential areas and is a permissible with consent pursuant to the provisions of GLEP 2014.

The proposal is considered to uphold the public interest as no adverse environmental, social or economic impact is to result from the development.

#### 5.19 Summary

This environmental assessment has demonstrated that the Stage 2 DA will result in the following key outcomes:

- The planned orderly and economic development of the site;
- A subdivision layout which delivers a variety of housing lots capable of supporting housing diversity;

- A road network and parking provision which meets the needs of the ecovillage and the access requirements of the RFS and minimises impacts to the local road network;
- The incorporation of appropriate and sound provisions for environmental protection;
- Relevant and appropriate provisions to ensure the bushfire protection of the site and future development;
- Sustainable environmental outcomes and with positive environmental benefits;
- The delivery of utility services that meet the demands of the development;
- The protection of environmental heritage on the site;
- Integration with Stage 1 of the ecovillage including to continue the road and open space networks through the site; and
- No adverse environmental impacts to neighbouring land.

On this basis, it is considered that the proposal is worthy of Council's support.

#### 6.0 Conclusion

This application seeks approval for the subdivision of Part Lot 50 in DP 270882 and associated works to enable the development of Stage 2 of Narara Ecovillage. The application proposes 43 residential lots in the community title scheme and ancillary works required to support the future development of the NEV site.

This Statement of Environmental Effects has assessed the proposal having regard to the section 4.15 of the EP&A Act. The assessment has demonstrated that the proposal complies with the relevant environmental planning instruments and complies with the key objectives and general controls in GDCP 2013, as detailed the SEE and the accompanying compliance tables. The assessment has also concluded that the proposal positively responds to site conditions and will result in positive economic, environment and social benefits to the community. Importantly, the proposal will increase the opportunity for future housing stock in line with local and regional planning strategies.

The relevant technical reports which support the application demonstrate that the site is capable of supporting the proposal, that it can be fully serviced and that the development of the site will not pose any significant risks to the environment or hazards to future residents. The detailed analysis provided in this SEE and the supporting technical reports demonstrate that the proposal does not give rise to any unreasonable adverse amenity impacts to adjoining properties.

This Stage 2 DA builds on the foundations established for the development of the ecovillage in the Stage 1 DA. The ecovillage has been designed to embrace the site conditions. Considerable community benefits will result from the proposal including through its sustainable design approach which will foster economic, environmental and social well-being, housing choice and the enhancement of the environmental and cultural heritage of the site. The Design Report provided with the application demonstrates that the development of the site will occur in an orderly and planned manner and that a high quality urban design outcome will be achieved.

For the above reasons, this Stage 2 DA is considered to represents an appropriate development outcome for the site. It is recommended that the application be approved by Council.



# THREATENED SPECIES TEST OF SIGNIFICANCE REPORT FOR A PROPOSED DEVELOPMENT AT NARARA ECOVILLAGE NARARA

# CENTRAL COAST COUNCIL LOCAL GOVERNMENT AREA

Job number: 2321

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## Version 3

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Jason Anderson (Director)		3/03/2020		





## **Executive Summary**

#### **Introduction**

This report describes the results of a Threatened Species Test of Significance Report conducted to inform a development at Narara Ecovillage, Narara, in Central Coast Council Local Government Area (LGA), hereafter referred to as the subject site. The activity is a Part 4 Activity under the EP&A Act (1979).

The Framework for determining whether significant impacts are likely is provided in the **Threatened Species Test of Significance Guidelines** which provides the following (page 1). The assessment followed this guideline assessment process as outlined below.

Section 7.2 of the BC Act provides that development under the Environmental Planning and Assessment Act 1979 (EP&A) is likely to significantly affect threatened species if:

- (a) it is likely to significantly affect threatened species or ecological communities, or their habitats, according to the test in section 7.3, or
- (b) the development exceeds the biodiversity offsets scheme threshold if the biodiversity offsets scheme applies to the impacts of the development on biodiversity values, or
- (c) it is carried out in a declared area of outstanding biodiversity value.

For an activity under Part 5 of the EP&A Act clause (b) does not apply, so an activity will only be likely to significantly affect a threatened species if:

- (a) it is likely to significantly affect threatened species or ecological communities, or their habitats, according to the test in section 7.3, or
- (b) it is carried out in a declared area of outstanding biodiversity value.

A development application that is likely to significantly affect a threatened species must be accompanied by a biodiversity development assessment report (BDAR). In the case of State significant development or State significant infrastructure an application must be accompanied by a BDAR unless the Secretary of the Department of Planning and Environment and Chief Executive of the Office of Environment and Heritage determine that it is not likely to have any significant impact on biodiversity values.

For an activity under Part 5, an assessment of an activity that is likely to significantly affect a threatened species must be accompanied by a species impact statement or, if the proponent elects to participate in the biodiversity offsets scheme, a BDAR.

The subject site is proposed to be developed as a small Ecologically Sensitive Subdivision. The site whereupon the development is proposed represents the old Agricultural Research Station comprising mainly old fruit trees as part of the former agricultural research station. A perimeter road is proposed coming off Syncarpia Crescent on the western edge of the existing cleared area. This represents Stage 2 of the Narara Ecovillage.

The subject site (proposed development area) is composed of a mixture of native and exotic species with a small portion of native vegetation on the western edge which would be removed. The whole proposal and concept for the subdivision of Narara Ecovillage has been to limit environmental and Biodiversity impacts as far as possible.

The proposed development does not trigger the Biodiversity Offsets Scheme. This is defined as:

• local development (assessed under Part 4 of the *Environmental Planning and Assessment Act 1979*) that triggers the Biodiversity Offsets Scheme threshold or is likely to significantly affect threatened species based on the test of significance in section 7.3 of the *Biodiversity Conservation Act 2016*.

The proposal would involve minimal native vegetation removal on the site to facilitate the

proposal.

# The land is not mapped on the NSW Native Vegetation Regulatory (NVR) Map and is not declared an Area of Outstanding Biodiversity Value (AOBV).

An area of  $1350m^2$  of native vegetation which forms part of the larger tract of bushland along the western boundary of the property would be impacted (this  $1350m^2$  includes  $325m^2$  of E2 zoned land on the south-western side of the proposed development area). The area to the southern boundary of the property represents managed yard of approximately 790 m<sup>2</sup> with the rest being the existing residential concrete driveway and its verges. This land is zoned 7(c2) under IDO No.122. The areas being retained as part of the larger bushland area to the west occur upslope of the road and as such there would be negligible impacts past the proposed area of clearance due to runoff or other edge related impacts.

#### **Methodology**

Prior to the site survey a range of secondary resources are often consulted. These generally include:

- Biodiversity Values Mapping (Biodiversity Offsets Scheme Entry Tool);
- Bionet Vegetation Classification (formerly known as the NSW Vegetation Information System Classification Database);
- Threatened Biodiversity Data Collection (formerly known as the Threatened Species Profile Database);
- BioNet Atlas (formerly known as the NSW Wildlife Atlas);
- Directory of Important Wetlands of Australia (DIWA);
- Vegetation Mapping Databases;
- NSW Native Vegetation Regulatory Mapping;
- NSW Office of Environment and Heritage (OEH) database;
- Soils types information databases;
- Commonwealth Protected Matters Search Tool (PMST);
- Aerial Photography;
- Council Local Environment Plans.
- Narara Ecovillage Flora and Fauna Gap Analysis Report (2013) Robert Payne.
- SEPP (Vegetation in Non-Rural Areas) 2017

Surveys were conducted on the 30/09/2019 and the 22/10/2019 by one ecologist from Anderson Environmental. Surveys consisted of a random meander survey throughout the areas to be disturbed and their peripherals. The other areas of the site were examined for fauna potential habitat as due to the design of the proposal and the bushland area being upslope there is no risk of impacts from sedimentation or nutrient enrichment. The aim of the assessment was to identify resident fauna, their habitats, present vegetation assemblages and important faunal and floral microhabitat features. Fauna surveys consisted of detailed habitat searches of microhabitats (waterbodies, leaf litter, fallen timber, creeklines etc.) as well as a census of habitat trees within the subject site along with detailed habitat assessments.

Previous surveys by Payne (2013), detected *Syzygium paniculatum* the Magental Lilly Pilly and four threatened fauna species, the Yellow-bellied Glider *Petaurus australis* (as anecdotal evidence), the Eastern Bent-wing Bat *Miniopterus schreibersii oceanensis*, the Sooty Owl *Tyto* 

*tenebricosa* and the Powerful Owl *Ninox. strenua*. The Sooty Owl had been recorded previously (Andrews Neil, 2006a).

As Part of the Approval of Stage 1 an Ecological Restoration Plan (Robert Payne Ecological Surveys & Management, dated December 2013) has been implemented. There has been approximately 3400 hours of work undertaken since 2017 on implementation of this plant to target priority weed removal.

The Tree Health report undertaken by Elke (11<sup>th</sup> December 2019) provides a health assessment of all the trees within the development areas. If possible, some of the branches and logs from the removal of some of these trees could be used to improve fauna habitat within the upslope areas following the removal of the Lantana as recommended in this report. Lantana is a Weed of National Significance because of its invasiveness, potential for spread. and economic and environmental impacts. Landowners are required to control this weed on their lands.

#### **Results**

The background searches and site analysis including field assessments produced the following results.

Resource	Result
NSW Office of Local Government Biodiversity Assessment	Biodiversity Development Assessment Report (BDAR) not
and Approvals Register Assessment Approvals Navigator	required
Biodiversity Offset Scheme Entry Threshold Tool -	Analysis of the area to be disturbed indicated that no
Biodiversity Values Map	assessment under the BAM was required as no areas with
	mapped biodiversity values would be disturbed.
Area of Outstanding Biodiversity Value (Critical Habitat) -	Not Present
Register of Declared Areas of Outstanding Biodiversity Value	
(included in Biodiversity Values Map)	
Items of Ecological Significance to be impacted (state or	No items of Ecological Significance likely to be significantly
federal listed ecological communities, threatened species or	impacted.
their habitats.	
5 Part Test - Threatened Species Test of Significance	No significant impacts likely
Area Clearing Threshold – Minimum Lot Size Under Local	Not Triggered (<0.25ha or <2500m2 to be cleared)
Environment Plan	
EPBC Act Matters of National Environmental Significance	No impacts on any listed matters would occur
(MNES)	

The land to be disturbed on the southern boundary represents cleared and maintained rural residential allotments (3 in total) with only overstorey eucalypts to be removed (and a mown understory) while the area along the western boundary represents an intergrade of the two communities as below. It has been disturbed somewhat in the past by a table drain to drain water from the existing vehicle track on the boundary and to direct water away from the agricultural research station.

- (Coastal Narrabeen Moist Forest) PCT 1564 Blackbutt Rough-barked Apple -Turpentine - ferny tall open forest of the Central Coast intergrading with;
- (Coastal Narrabeen Ironbark Forest) PCT 1915 Blue Gum-Bangalay Turpentine / Cheese Tree - Lilly Pilly tall moist forest on coastal flats of the northern Sydney basin.

The definition of the exact boundaries of these communities is problematic due to the occurrence of some of the overstorey trees on the lower slopes of the cleared areas intermixed

with species indicative of Coastal Narrabeen Moist Forest. Generally however the community to be removed conforms more to Coastal Narrabeen Moist Forest than Coastal Narrabeen Ironbark Forest as the Ironbarks occur further upslope on the site.

As such, Coastal Narrabeen Moist Forest occurs within approximately a 100 metre distance to the west of the boundary of the native vegetation area and the cleared former Research Station with the Coastal Narrabeen Ironbark Forest occurring upslope further to the west past this intergrade boundary. This is the most likely boundary line to divide the two communities although significant boundary intergrading is present on the site.

The open areas of the site formerly used as the research station represent no native vegetation community. The existing fruit trees and other exotic trees on this section of the site to be removed as part of the Stage 2 DA have no ecological value. The paddock eucalypts present do not represent significant habitat trees for fauna and no signs of active fauna use were found in the form of Owl Pellets or whitewash or Glider Chews. These trees do not form critical habitat for any threatened species in the locality.

No threatened flora species or populations were identified on the subject site during the surveys and none are considered likely to be present within the areas to be disturbed by the proposal. The Vegetation Communities do not represent listed vegetation communities on the BC Act 2016 or the EPBC Act 1999.

The development was found to be consistent with the objectives of State Environmental Planning Policy No. 19- Bushland in Urban Areas (SEPP 19) as it is an ecologically sensitive development which will remove minimal vegetation and have strict development controls for the protection of the ecological values of the site. Strict erosion and sedimentation controls will also be part of the proposed development thus providing downstream protection.

#### SEPP 19 Aims and Objectives.

- (a) its value to the community as part of the natural heritage,
- (b) its aesthetic value, and
- (c) its value as a recreational, educational and scientific resource.
- (2) The specific aims of this policy are:
- (a) to protect the remnants of plant communities which were once characteristic of land now within an urban area,
- (b) to retain bushland in parcels of a size and configuration which will enable the existing plant and animal communities to survive in the long term,
- (c) to protect rare and endangered flora and fauna species,
- (d) to protect habitats for native flora and fauna,
- (e) to protect wildlife corridors and vegetation links with other nearby bushland,
- (f) to protect bushland as a natural stabiliser of the soil surface,
- (g) to protect bushland for its scenic values, and to retain the unique visual identity of the landscape,
- (*h*) to protect significant geological features,
- (i) to protect existing landforms, such as natural drainage lines, watercourses and foreshores,
- (j) to protect archaeological relics,
- (k) to protect the recreational potential of bushland,
- (*l*) to protect the educational potential of bushland,
- (m) to maintain bushland in locations which are readily accessible to the community, and
- (*n*) to promote the management of bushland in a manner which protects and enhances the quality of the bushland and facilitates public enjoyment of the bushland compatible with its conservation.

There is a first order stream mapped on the eastern side of the site which runs to the north from where this man made drain occurs.

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<sup>(1)</sup> The general aim of this Policy is to protect and preserve bushland within the urban areas referred to in Schedule 1 because of:

#### Riparian corridor widths

The Officer of Water recommends a VRZ width based on watercourse order as classified under the Strahler System of ordering watercourses and using current 1:25 000 topographic maps (see Figure 2 and Table 1). The width of the VRZ should be measured from the top of the highest bank on both sides of the watercourse.



Table 1.	Recommended	riparian	corridor	(RC)	widths
rable i.	Recommended	inpanan	connuor	(INC)	Widths

Watercourse type	VRZ width (each side of watercourse)	Total RC width
1 <sup>st</sup> order	10 metres	20 m + channel width
2 <sup>nd</sup> order	20 metres	40 m + channel width
3 <sup>rd</sup> order	30 metres	60 m + channel width
4 <sup>th</sup> order and greater (includes estuaries, wetlands and any parts of rivers influenced by tidal waters)	40 metres	80 m + channel width

Note: where a watercourse does not exhibit the features of a defined channel with bed and banks, the Office of Water may determine that the watercourse is not waterfront land for the purposes of the WM Act

2 NISIM Office of Mater July 2012

In relation to SEPP (Vegetation in Non-Rural Areas) 2017 this proposal would not entail clearing which exceeds the Biodiversity Offsets Scheme Threshold (part 2 below).

The clearing of vegetation in non-rural areas that requires authority under this Policy

(1) A person must not clear vegetation in any non-rural area of the State to which Part 3 applies without the authority conferred by a permit granted by the council under that Part.

(2) A person must not clear native vegetation in any non-rural area of the State that exceeds the biodiversity offsets scheme threshold without the authority conferred by an approval of the Native Vegetation Panel under Part 4. This subclause does not apply to clearing on biodiversity certified land under Part 8 of the Biodiversity Conservation Act 2016.

(3) Clearing of vegetation is not authorised as referred to in this clause unless the conditions to which the authorisation is subject are complied with. This subclause extends to conditions that impose obligations on the person who clears the vegetation that are required to be complied with before or after the clearing is carried out.

(4) This clause is subject to clause 8.

#### **Conclusions**

The assessment of the potential impacts of this proposal on this site indicated that:

- 1. The proposal is unlikely to significantly affect any threatened species or ecological communities or their habitats according to the **5-part test** (Environmental Planning and Assessment Act (1979) (EP&A) provided for under Section 7.2 of the Biodiversity Conservation Act (2016).
- 2. The proposed development does not exceed the **Biodiversity Offsets Scheme** (BOS) threshold.
- 3. The proposed development is not being carried out in a declared area of **Outstanding Biodiversity Value** (OBV).

Overall the main aspect of the whole development is an Environmentally Sensitive and as far as possible Sustainable Ecovillage. The design has been considerate of the local ecology in order to retain as much of the natural vegetation as possible and to reduce direct and indirect impacts on the biodiversity values of the site. The recommendations in this report will further reduce the potential impacts of this proposal.

#### **Certification**

I certify that this report has been undertaken in accordance with the current legislative requirements and that report was undertaken without bias and the findings would be the same regardless of the client or their objectives and is an entirely independent report based solely on the site conditions and background information available at the time of the assessment.

Yours Sincerely

Jason Anderson

#### Jason Anderson

B.App.Sc – 1992 (Conservation Technology - University of New England) BAAS17059 Certified Biodiversity Method Assessor under the Biodiversity Conservation Act 2016 (NSW) Certified Practicing Ecological Consultant (#5) – Ecological Consultants Association of NSW 3<sup>rd</sup> March 2020



# **Glossary of Acronyms**

AOBV	Area of Outstanding Biodiversity Value
BAR	Biodiversity Assessment Report; includes
	Biodiversity Development Assessment Reports
	(BDARs), Biodiversity Certification
	Assessment Reports (BCARs) and Biodiversity
	Stewardship Site Assessment Reports
	(BSSARs)
BAM	Biodiversity Assessment Method
BC Act	Biodiversity Conservation Act 2016 (NSW)
BC Regulation	Biodiversity Conservation Regulation 2017
	(NSW)
BOS	Biodiversity Offsets Scheme
CEEC	Critically endangered ecological community
Chief Executive of OEH	Chief Executive of the Office of Environment
	and Heritage
Calculator	Biodiversity Assessment Method Calculator
DIWA	Directory of Important Wetlands in Australia
DPE	NSW Department of Planning and Environment
EEC	Endangered ecological community
EIS	Environmental impact statement
EP&A Act	Environmental Planning and Assessment Act
	1979 (NSW)
EPBC Act	Environment Protection and Biodiversity
	Conservation Act 1999 (C'th)
Fisheries NSW Policy and Guidelines	Fisheries NSW Policy and guidelines for fish
	habitat conservation and management
LLS	Local Land Services
LLS Act	Local Land Services Act 2013 (NSW)
the Manual	Biodiversity Assessment Method Operational
	Manual (this Manual)
MNES	Matters of National Environmental Significance
OEH	Office of Environment and Heritage NSW
PCT	Plant community type
SEPP	State Environmental Planning Policy
the Standard	Native Vegetation Interim Type Standard1
TBDC	Threatened Biodiversity Data Collection
TEC	Collective term for threatened ecological
	communities (VECs, EECs, CEECs)
VPA	Voluntary planning agreement

1 Sivertsen D 2009, Native Vegetation Interim Type Standard, Department of Environment, Climate Change and Water NSW, Sydney.

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## 1. INTRODUCTION

#### 1.1 BACKGROUND

This report describes the results of a Threatened Species Test of Significance Report conducted to inform a development at Narara Ecovillage, Narara, in Central Coast Council Local Government Area (LGA), hereafter referred to as the subject site. The activity is a Part 4 Activity under the EP&A Act (1979).

The proposal is for an extension of the master planned subdivision into the remaining cleared area of the former Agricultural Research Station.

Previous surveys by Payne (2013), detected *Syzygium paniculatum* the Magental Lilly Pilly and four threatened fauna species, the Yellow-bellied Glider *Petaurus australis* (as anecdotal evidence), the Eastern Bent-wing Bat *Miniopterus schreibersii oceanensis*, the Sooty Owl *Tyto tenebricosa* and the Powerful Owl *Ninox. strenua*. The Sooty Owl had been recorded previously (Andrews Neil, 2006a).

The Tree Health report undertaken by Elke (11<sup>th</sup> December 2019) provides a health assessment of all the trees within the development areas. If possible, some of the branches and logs from the removal of some of these trees could be used to improve fauna habitat within the upslope areas following the removal of the Lantana as recommended in this report. Lantana is a Weed of National Significance because of its invasiveness, potential for spread. and economic and environmental impacts. Landowners are required to control this weed on their lands.

There is a first order stream mapped on the eastern side of the site which runs to the north from where this man made drain occurs.

#### **1.2 SITE DESCRIPTION**

#### 1.2.1 Location

The subject site occurs at the existing Narara Ecovillage development at Narara within Central Coast Council Local Government Area. The land of the former research station has been intensively managed as part of the activities which were being undertaken at this facility. **Figure 1.1** below shows the location of the subject site and its local context.

#### 1.2.2 Physical Environment

The subject site represents the cleared former research station. It slopes to the south-east and represents a hillside which was used for planted orchard species as part of the agricultural research station. The site has been somewhat terraced to allow for maintenance between the rows of fruit trees. The area which will be disturbed on the western extent of the site by the road has had previous soil disturbance by way of a table drain in the bushland to control water flow down the slope towards the rows of fruit trees. This directs down into the gully line then exits on the eastern side of the site as a constructed channel which is lined with a combination of rock and on the lower slope to the east of the access road to the ecovillage it is lined with tyres. This represents a man-made channel which is quite large due to the volume of water it was designed to control from the upper slopes for the width of the former agricultural research station. There is a first order stream mapped on the eastern side of the site which runs to the

north from where this man made drain occurs.



Figure 1.1: Location of the subject site showing local context



Figure 1.2: Location Development Area and Subdivision Design showing Asset Protection Zone disturbance extent – (by Travers Bushfire and Ecology)

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Figure 1.3: Plan Showing Trees Requiring Removal in Red (by Elke Consulting Arborist) – See Arborist Report for Tree Detail

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#### 1.3 LEGISLATIVE REQUIREMENTS

This threatened species test of significance report was undertaken with reference to the following legislation;

- NSW Environmental Planning and Assessment Act 1979 (EP&A Act 1979);
- Threatened Species Test of Significance Guidelines (2018);
- NSW Biodiversity Conservation Act (2016);
- Biodiversity Assessment Method Operational Manual Stage 1 (2018);
- Biodiversity Assessment Method (BAM) (2017);
- Biodiversity Conservation Regulation (2017);
- Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act);
- State Environmental Planning Policy 19 (SEPP10);
- SEPP (Vegetation in Non-Rural Areas) 2017

The site was also assessed in relation to the 'improve or maintain principals' adopted by most local councils.

#### 1.4 LIMITATIONS

No survey can detect all species at any one point in time however allowances were made for species which may occur based on known current research and habitat preferences. The survey recorded species as they were encountered, and the survey aimed to detect threatened species or Threatened Ecological Communities (TECs) as listed under state and federal legislation. The survey focussed on the identification of the vegetation communities and any threatened flora or potential habitat for threatened flora. No attempt was made to record every single species on the site and not all specimens are visible in all seasons. Surveys for fauna entailed detailed habitat searches.

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This report has been undertaken with the government resources available at the time of assessment and writing and under the current accompanying legislation. Anderson Environmental accepts no responsibility for any omissions or inaccuracies due to changes to the legislative framework following submission of this report.

All figures in this report are to be considered indicative only. Anderson Environmental accepts

no responsibility for decisions taken based on these figures.

### 2. METHODOLOGY

The project was assessed according to the threatened species test of significance. This is used to determine if a development or activity is likely to significantly affect threatened species or ecological communities, or their habitats. It is applied as part of the Biodiversity Offsets Scheme entry requirements and for Part 5 activities under the Environmental Planning and Assessment Act 1979. The test of significance is set out in s.7.3 of the Biodiversity Conservation Act 2016. If the activity is likely to have a significant impact, or will be carried out in a declared area of outstanding biodiversity value, the proponent must either apply the Biodiversity Offsets Scheme or prepare a species impact statement (SIS).

Local development (assessed under Part 4 of the *Environmental Planning and Assessment Act 1979*) that triggers the Biodiversity Offsets Scheme threshold or is likely to significantly affect threatened species based on the test of significance in section 7.3 of the *Biodiversity Conservation Act 2016* requires a Biodiversity Development Assessment Report (BDAR).

The proposal was assessed against the following factors to determine whether it required assessment under the Biodiversity Offsets Scheme (BOS). If the project is in adherence to these factors then it does not trigger the Biodiversity Offsets Scheme (BOS) and a Threatened Species Test of Significance is required.

1.) The proposal is unlikely to significantly affect any threatened species or ecological communities or their habitats according to the 5-part test – (Environmental Planning and Assessment Act (1979) (EP&A) provided for under Section 7.2 of the Biodiversity Conservation Act (2016).

2.) The proposed development does not exceed the Biodiversity Offsets Scheme (BOS) threshold.

3.) The proposed development is not being carried out in a declared area of Outstanding Biodiversity Value (OBV).

#### 2.1 FIELD METHODOLOGY

Surveys were conducted on the 30/09/2019 and the 22/10/2019 by Jason Anderson B.App.Sc (1992 – Conservation Technology), University of New England. Surveys consisted of a random meander survey throughout the areas to be disturbed and their peripherals. In the area to the west where the road is proposed the surveys targeted these areas with linear transects approximately 2 metres apart. The other areas of the site were examined for fauna potential habitat as due to the design of the proposal and the bushland area being upslope there is no risk of impacts from sedimentation or nutrient enrichment. The aim of the assessment was to identify resident fauna, their habitats, present vegetation assemblages and important faunal and floral microhabitat features. Fauna surveys consisted of detailed habitat searches of microhabitats (waterbodies, leaf litter, fallen timber, creeklines etc.) as well as a census of habitat trees within the subject site along with detailed habitat assessment. Weather conditions were fine and sunny during the survey. There were large amounts of Lantana in many places in the native bushland on the west of the area which is proposed to be developed and this made survey difficult in some areas. Weed management of this area to remove the Lantana would occur as part of the management of this site.

#### 2.2 DESKTOP STUDY

Prior to the commencement of field surveys an extensive desktop study was conducted.

The desktop studies generally consult a variety of secondary sources which often comprise:

- > The NSW Office of Environment (OEH) Bionet Atlas database;
- > The federal Protected Matters Search Tool (PMST);
- Vegetation mapping from the NSW Office of Environment and Heritage (OEH) and the NSW National Parks and Wildlife Service (NPWS);
- > Present and past aerial imagery of the subject site and local area through Google Earth;
- > Relevant State Environmental Planning Policies (SEPPs); and
- The NSW threatened species committee determinations for threatened species and Threatened Ecological Communities (TECs).

This background research was used to inform the field surveys. It assisted in the identification of areas of potential TECs in the study area, potential microhabitats (creek lines, waterbodies etc.) as well as threatened species known to occur in the local area which could be present within the study area.

#### 2.3 FLORA

#### 2.3.1 Methodology

The survey involved targeted random meanders across the site area approximately 3-5 metres apart in a north-south direction thus forming parallel line transects to enable a sound census of the flora species present and to fully evaluate the potential fauna habitat.

This survey included targeted searches for endangered species, populations and communities known to occur within the LGA and within 10km, as identified in the desktop study. Landscape features were also recorded for greater ecological context.

#### 2.3.2 Taxonomy and References

Taxonomy is from Harden (1990 – 1993, 2000 and 2002) and from any recent updates from the Royal Botanic Gardens (RBG), Sydney. The Royal Botanic Gardens' PlantNet website (plantnet.rbgsyd.nsw.gov.au) incorporating Flora Online is the major source for updated taxonomy. The main references utilised for this assessment include; NSW National Parks and Wildlife Service (NPWS) (1997), Robinson, L (1997), Fairley, A and Moore, P (1995), Threatened Species Profiles compiled by NSW NPWS and from field and research experience.

#### 2.4 FAUNA

#### 2.4.1 Methodology

The methodology for the survey involved searching the subject site for any evidence of threatened fauna species or potential habitat in terms of sheltering/foraging/breeding for any threatened fauna. The methodology for these surveys encompassed the following.

- Opportunistic Observations Opportunistic observations of fauna species through visual sighting or auditory confirmation, while searching for potential habitat was conducted throughout the survey areas;
- Habitat Analysis Assessments of potential habitat for threatened species was undertaken. This included an assessment of the condition of the habitat once found; and
- Searches for Indirect Evidence of Fauna Species This included searching for glider chews, scratches on eucalypts, diggings, borrowings, scats, tracks, searches for owl pellets, owl whitewash, and identification of any specific habitat components for threatened fauna. Logs were turned over in search of reptiles then replaced in their original positions. Similarly, thick understory and dense thickets were also investigated for ground dwelling fauna and small bush birds.

Areas or items of significant fauna habitat value (rock outcrops, caves and crevices, waterbodies and creeklines, habitat-bearing trees etc.) were noted, locations recorded using a GPS device and representative photos taken where relevant. For habitat-bearing trees the following additional data was collected:

- $\succ$  Tree species;
- ➢ Height in meters;
- > Diameter at Breast Height (DBH) in millimetres;
- > Number of hollows present;
- ➤ Size class of hollows (S=5-15cm, M=15-25cm and L=25+cm); and
- > Other notable observations (presence of fauna or signs of inhabitation etc.).

#### 2.4.2 Taxonomy and References

Taxonomy is from the following sources; Mammals (Churchill, 2009 and Strahan, 1995), Reptiles and Amphibians (Cogger, 1994), and Birds (Simpson and Day 1993). The main references utilised for this assessment include; Strahan, R (1995), Cogger, H (1994), Simpson and Day (1993), State Forests of NSW (1995), Robinson M (1995), Threatened Species Profiles compiled by NSW NPWS and from field and research experience of the authors.

## 3. RESULTS

#### 3.1 ELIGIBILITY ASSESSMENT

Most developments impacting on biodiversity values require assessment under the Biodiversity Assessment Method (BAM), however some projects are exempt. Exemptions apply to Part 4 only, specifically developments or activities where:

- the clearing area is within the bounds of the **relevant clearing threshold** (see Table 3.1 below); and
- the development is not located in an area identified on the "**Biodiversity Values Map**" and
- the development is not to be carried out in a declared area of **Outstanding Biodiversity Value** and
- the development is not "**likely to significantly affect threatened species**" using the test of significance in the BC Act

The results of the background searches and site analysis including field assessments produced the following results.

Resource	Result
NSW Office of Local Government Biodiversity Assessment	Biodiversity Development Assessment Report (BDAR) not
and Approvals Register Assessment Approvals Navigator	required
Biodiversity Offset Scheme Entry Threshold Tool -	Analysis of the area to be disturbed indicated that no
Biodiversity Values Map	assessment under the BAM was required as no areas with
	mapped biodiversity values would be disturbed.
Area of Outstanding Biodiversity Value (Critical Habitat) -	Not Present
Register of Declared Areas of Outstanding Biodiversity Value	
(included in Biodiversity Values Map)	
Items of Ecological Significance to be impacted (state or	No items of Ecological Significance likely to be significantly
federal listed ecological communities, threatened species or	impacted.
their habitats.	
5 Part Test – Threatened Species Test of Significance	No significant impacts likely
Area Clearing Threshold – Minimum Lot Size Under Local	Not Triggered (<0.25ha or 2500m2 to be cleared)
Environment Plan	
EPBC Act Matters of National Environmental Significance	No impacts on any listed matters would occur
(MNES)	

|--|

Minimum lot size associated with the property*	Proposed native vegetation clearing area limit
<1ha	0.25ha or more
>1ha to <40ha	0.5ha or more
>40ha to <1 000ha	1ha or more
>1 000ha	2ha or more

\*Refers to the minimum lot size for the zonation of the site under the relevant LEP

An area of  $1350m^2$  of native vegetation which forms part of the larger tract of bushland along the western boundary of the property would be impacted (the  $1350m^2$  includes  $325m^2$  of E2 zoned land on the south-western side of the proposed development area). The area to the southern boundary of the property represents managed yard of approximately 790 m<sup>2</sup> with the rest being the existing residential concrete driveway and its verges. This land is zoned 7(c2) under IDO No.122. The areas being retained as part of the larger bushland area to the west occur upslope of the road and as such there would be negligible impacts past the proposed area of clearance due to runoff or other edge related impacts.

#### 3.2 FLORA RESULTS

The assessment detected no listed threatened species, communities or critical habitat listed under the Biodiversity Conservation Act (2016) or the Environment Protection and Biodiversity Conservation Act (1999). The full list of flora recorded is provided in Appendix 2. Searches of the BioNet Wildlife Atlas were also undertaken to determine species records occurring within a 10km grid of the study site. It should however be remembered that records of occurrence are often a reflection of the number of surveys undertaken in the local area and as such habitat analysis of the actual site is often a more accurate predictor of potential occurrence. Review of the report by Robert Payne (2013) indicated that no threatened flora were detected in this previous survey within this area.

Note: the Threatened Species Conservation Act (1995) was repealed by Sch 10 to the Biodiversity Conservation Act 2016 No 63 with effect from 25.8.2017.

The site itself is represented by what was the former Agricultural Research Station. It is a highly modified environment having been terraced and modified for drainage. It has also been terraced for the planting and maintenance of the numerous fruit trees which are still on the site. This central portion of the site proposed for development contains large numbers of exotics with a few remnant scattered overstorey eucalypts. Due to its high levels of modification through clearing and use as the research station including planting of experimental trees this central areas where the development is proposed no longer represents any native vegetation community.

The land to be disturbed on the southern boundary represents a cleared and maintained rural residential allotment with only overstorey eucalypts to be removed while the area along the western boundary comprising the  $1350m^2$  represents;

- (Coastal Narrabeen Moist Forest) PCT 1564 Blackbutt Rough-barked Apple -Turpentine - ferny tall open forest of the Central Coast intergrading with;
- (Coastal Narrabeen Ironbark Forest) PCT 1915 Blue Gum-Bangalay Turpentine / Cheese Tree - Lilly Pilly tall moist forest on coastal flats of the northern Sydney basin.

The definition of the exact boundaries of these communities is problematic due to the occurrence of some of the overstorey trees on the lower slopes of the cleared areas intermixed with species indicative of Coastal Narrabeen Moist Forest.

Coastal Narrabeen Moist Forest occurs within approximately a 100 metre distance to the west of the boundary of the native vegetation area and the cleared former Research Station with the Coastal Narrabeen Ironbark Forest occurring upslope further to the west past this intergrade boundary. This is the most likely line to divide the two communities although significant boundary intergrading is present on the site.

No significant karsts, caves, crevices, cliffs or other area of geological significance are present within the site area to be disturbed by the proposed development.

#### 3.2.1.1.1 Threatened Flora

Numerous threatened flora species were identified as present in the local area (10km radius from the subject site), from the BioNet Atlas (shown below). None of these species were detected on the area to be impacted during the surveys which were undertaken.

<u>Flora</u>						
Scientific Name	Common Name	NSW Status	Comm Status	BioNet Atlas 1km	BioNet Atlas 5km	BioNet Atlas 10km
Acacia pubescens	Downy Wattle	V	V	No	No	Yes
Ancistrachne maidenii		V		No	No	No
Baloskion	Dense Cord-	V	V	No	Vec	No
lonaines	rush	v	· ·	No	103	110
Callistemon	Netted Bottle	V.3		No	Yes	Yes
linearifolius	Brush	1,0			105	105
Cryptostylis	Leafless	V.P.2	V	No	Yes	No
hunteriana	Tongue Orchid					
Darwinia		V		No	No	No
glaucophylla						
Dendrobium	Spider orchid	E1,P,2		No	No	Yes
melaleucaphilum						
Epacris		V		No	No	No
purpurascens						
var.						
purpurascens						
Eucalyptus	Camfield's	V	V	No	Yes	Yes
camfieldii	Stringybark					
Eucalyptus	Slaty Red	V	V	No	Yes	No
glaucina	Gum					
Grevillea shiressii		V	V	No	No	No
Hibbertia	Spreading	E1		No	Yes	Yes
procumbens	Guinea					
	Flower					
Lindsaea fraseri	Fraser's	E1,3		No	Yes	No
	Screw Fern					
Melaleuca	Biconvex	V	V	Yes	Yes	Yes
biconvexa	Paperbark					
Melaleuca	Deane's	V	V	No	No	Yes
deanei	Paperbark					
Persoonia hirsuta	Hairy Geebung	E1,P,3	E	No	No	Yes
Prostanthera	Tranquility	F1	F	No	Ves	Vos
askania	Minthush		L	NO	163	165
Prostanthera	Somershy	F1	F	No	Ves	Ves
iunonis	Mintbush		-		105	105
Rhodamnia	Scrub	F4A		Yes	Yes	Yes
rubescens	Turpentine					
Rhodomyrtus	Native Guava	E4A		No	Yes	Yes
psidioides						
Senna acclinis	Rainforest	E1		No	No	Yes
	Cassia					
Syzygium	Magenta Lilly	E1	V	No	Yes	Yes
paniculatum	Pilly					
Tetratheca	, , , , , , , , , , , , , , , , , , ,	V		No	No	No
glandulosa						
Tetratheca	Black-eyed	V	V	No	Yes	Yes
juncea	Susan					

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#### 3.3 FAUNA RESULTS

The assessment detected no listed threatened species, communities or critical habitat listed under the Biodiversity Conservation Act (2016) or the Environment Protection and Biodiversity Conservation Act (1999). A full species list of fauna encountered during survey is provided in Appendix 3. Searches of the BioNet Wildlife Atlas were also undertaken to determine species records occurring within a 10km grid of the study site. It should however be remembered that records of occurrence are often a reflection of the number of surveys undertaken in the local area and as such habitat analysis of the actual site is often a more accurate predictor of potential occurrence.

<u>Note:</u> the Threatened Species Conservation Act (1995) was repealed by Sch 10 to the Biodiversity Conservation Act 2016 No 63 with effect from 25.8.2017.



Photograph 3.1: Showing Agricultural Research Station and proposed development area



Photograph 3.2: Showing track with western bushland interface and former orchards

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None of the trees to be removed on the site had obvious hollows present. Smaller hollows are however sometimes difficult to locate. Whilst there was a small amount of shedding bark on some trees present it was not considered good quality potential roosting habitat for microchiropteran bats from a breeding perspective. It is unlikely that microchiropteran bats or arboreal mammals would rely on the vegetation proposed for removal as a part of their critical habitat. No signs of owls in the form of owl pellets or whitewash or prey refuse was located and no glider chews on any trees was located.

Several threatened bat species have been detected during previous surveys of the site as indicated in the table below from Payne, R.

SPECIES	FOREST EDGE	DAM	RIDGE	WETLAND
	Andrews-Neil survey	(Site NAECD)	This survey	(Site NACCW)
Rhinolophus megaphyllus Eastern Horseshoe-bat				
Mormopterus norfolkensis Eastern Freetail-bat				
Mormopterus sp. 2 A Freetail-bat				
Tadarida australis White-striped Freetail-bat				
Miniopterus australis Little Bent-wing Bat				
Miniopterus shreibersii oceanensis Eastern Bent-wing Bat				
Chalinolobus gouldii Gould's Wattled Bat				
Chalinolobus morio Chocolate Wattled Bat				
Myotis macropus Southern Myotis				
Scoteanax rueppellii Greater Broad-nosed Bat				
Scotorepens orion Eastern Broad-nosed Bat				
Vespadelus darlingtoni Large-forest Bat				
Vespadelus pumilus Little Eastern Forest Bat				
Vespadelus vulturnus Little Forest Bat				

The highly disturbed habitat being removed and the lack of good hollow habitat trees for the threatened species above which are hollow dependent indicates that the removal of this habitat would not significantly impact any of these species as the habitat represents potential foraging habitat and not potential breeding habitat.

#### 3.3.1 Amphibians

The site contains a man-made drainage channel which runs from the top of the cleared area of the former Research Station to the lower area and exits next to the car park of the Ecovillage where the garbage bins are kept. There was no free water in this drainage channel at the time of survey of the site however and it appears that the drainage line (which is lined with rocks on the research station side and progresses into the channel being lined with tyres on the eastern side of the Ecovillage Road) is usually dry based on its structure and slope. The Giant Burrowing Frog and Red-crowned Toadlet have database records within 1km of the study site. The Giant Burrowing Frog is unlikely to occur or utilise the drainage line based on its structure, location and the negligible quality habitat it provides based on this species known habitat requirements. The Red-crowned Toadlet does have low quality potential habitat in the Coastal Narrabeen Moist Forest in its upper sections on the western side of the site. This occurs outside the area to be impacted by the proposal. The habitat is relatively low quality as there are few areas for water to pool in order for this species to breed. Neither of these species or their habitats

are likely to be significantly impacted by the proposal. Overall the area being disturbed is unlikely to form critical breeding habitat for any threatened species of amphibians.

#### 3.3.2 Birds

The subject site provides foraging, breeding and roosting resources for a variety of native bird species. The area of potential habitat to be removed is small due to the design of the development to retain as much vegetation as possible. The Bush Stone Curlew, Gang Cockatoo, Little Lorikeet, Powerful Owl and Sooty Owl have database records within 1km of the subject site. The Bush Stone Curlew prefers habitat representing open paddocks with good levels of ground cover and sheltering vegetation by way of trees and shrubs interspersed with open areas. The modified habitat on the site is not what this species would generally prefer and the general lack of fallen sheltering timber makes it unlikely that it would rely on the modified habitat on this site. There were no sightings of the Gang Cockatoo or Little Lorikeet during the assessments which were undertaken and the potential habitat to be removed for these two species is considered negligible. No signs of the Powerful or Sooty Owl were detected in the way of actual sightings, owl pellets or whitewash. These species forage over large areas, often hundreds or sometimes over 1000 hectares and the removal of the small area of native vegetation would not be significant for either of these species. Most of the site comprises non-native vegetation and the proposal would not significantly impact these species.

#### 3.3.3 Mammals

The vegetation being disturbed by the proposed development represents the edge of an area which has previously been disturbed for drainage as part of the former Agricultural Research Station. The amount of vegetation to be removed is very small and there would be no fragmentation as a result of its removal of the larger area of bushland to the west of the proposal area. None of the trees had hollows present which would represent good quality habitat for arboreal mammals or microchriopteran bats or hollow dependent birds as there were negligible hollows detected. Due to the nature of the overstorey species present such as Turpentine which do not hollow regularly the potential for hollows to develop is considered low for this tree species. None of the trees had obvious hollows present and as such are unlikely to be used by hollow dependent fauna such as arboreal mammals. Some of the shedding bark may be used by some microchiropteran bat species such as *Nyctopilus sp* however they generally do not breed in bark shelter sites and utilise hollows. No signs of Glider Chews or scats were detected.

#### 3.3.4 Reptiles

No listed reptiles were detected on the area to be impacted or are likely to occur. The areas to be removed are small and do not represent habitat for the species known to occur in the local area.

#### 3.4 Threatened Fauna

Numerous threatened fauna species were identified as present in the local area (10km radius from the subject site), from the BioNet Atlas (shown below). None of these species were detected or are expected to occur on the areas to be disturbed by the proposal.

<u>Fauna</u>						
Amphibia						
Scientific Name Common Name		NSW Status	Comm Status	BioNet Altas 1km	BioNet Altas 5km	BioNet Altas 10km
Heleioporus australiacus	Giant Burrowing Frog	V,P	V	Yes	Yes	Yes
Litoria aurea	Green and Golden Bell Frog	E1,P	V	No	Yes	Yes
Litoria brevipalmata	Green-thighed Frog	V,P		No	Yes	Yes
Mixophyes balbus	Stuttering Frog	E1,P,2	V	No	Yes	No
Mixophyes iteratus	Giant Barred Frog	E1,P,2	E	No	Yes	No
Pseudophryne australis	Red-crowned Toadlet	V,P		Yes	Yes	Yes
Aves					-	
Scientific Name	Common Name	NSW Status	Comm Status	BioNet Altas 1km	BioNet Altas 5km	BioNet Altas 10km
Anseranas semipalmata	Magpie Goose	V,P		No	Yes	No
Anthochaera phrygia	Regent Honeyeater	E4A,P	CE	No	Yes	Yes
Ardenna carneipes	Flesh-footed Shearwater	V,P	J,K	No	No	Yes
Artamus cyanopterus	Dusky Woodswallow	V,P		No	No	Yes
Botaurus poiciloptilus	Australasian Bittern	E1,P	E	No	Yes	No
Burhinus grallarius	Bush Stone-curlew	E1,P		Yes	Yes	Yes
Callocephalon fimbriatum	Gang-gang Cockatoo	V,P,3		Yes	Yes	Yes
Calyptorhynchus lathami	Glossy Black- Cockatoo	V,P,2		No	Yes	Yes
Daphoenositta chrysoptera	Varied Sittella	V,P		No	Yes	Yes
Ephippiorhynchus asiaticus	Black-necked Stork	E1,P		No	No	Yes
Glossopsitta pusilla	Little Lorikeet	V,P		Yes	Yes	Yes
Grantiella picta	Painted Honeyeater	V,P	V	No	No	Yes
Haematopus fuliginosus	Sooty Oystercatcher	V,P		No	No	Yes
Haematopus longirostris	Pied Oystercatcher	E1,P		No	No	Yes
Haliaeetus leucogaster	White-bellied Sea- Eagle	V,P	C	No	Yes	Yes
Hamirostra melanosternon	Black-breasted Buzzard	V,P,3		No	Yes	No
Hieraaetus morphnoides	Little Eagle	V,P		No	Yes	Yes
Ixobrychus flavicollis	Black Bittern	V,P		No	Yes	Yes
Lathamus discolor	Swift Parrot	E1,P,3	CE	No	Yes	Yes

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Scientific Name	Common Name	NSW Status	Comm	BioNet	BioNet	BioNet			
		Status	Status	1km	5km	10km			
Lophoictinia isura	Square-tailed Kite	V,P,3		No	Yes	Yes			
Neophema pulchella	Turquoise Parrot	V,P,3		No	Yes	No			
Ninox connivens	Barking Owl	V,P,3		No	Yes	Yes			
Ninox strenua	Powerful Owl	V,P,3		Yes	Yes	Yes			
Pandion cristatus	Eastern Osprey	V,P,3		No	Yes	Yes			
Petroica boodang	Scarlet Robin	V,P		No	No	Yes			
Pomatostomus temporalis	Grey-crowned Babbler (eastern subspecies)	V,P		No	Yes	No			
Pterodroma nigripennis	Black-winged Petrel	V,P		No	Yes	No			
Ptilinopus magnificus	Wompoo Fruit- Dove	V,P		No	No	Yes			
Ptilinopus superbus	Superb Fruit-Dove	V,P		No	No	Yes			
Tyto novaehollandiae	Masked Owl	V,P,3		No	Yes	Yes			
Tyto tenebricosa	Sooty Owl	V,P,3		Yes	Yes	Yes			
Xenus cinereus	Terek Sandpiper	V,P	C,J,K	No	No	Yes			
Mammalia									
Scientific Name	Common Name	NSW Status	Comm Status	BioNet Altas 1km	BioNet Altas 5km	BioNet Altas 10km			
Cercartetus nanus	Eastern Pygmy- possum	V,P		No	Yes	Yes			
Chalinolobus dwyeri	Large-eared Pied Bat	V,P	V	No	Yes	Yes			
Dasyurus maculatus	Spotted-tailed Quoll	V,P	E	No	Yes	Yes			
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V,P		Yes	Yes	Yes			
Macropus parma	Parma Wallaby	V,P		No	No	Yes			
Micronomus norfolkensis	Eastern Coastal Free-tailed Bat	V,P		Yes	Yes	Yes			
Miniopterus australis	Little Bent-winged Bat	V,P		Yes	Yes	Yes			
Miniopterus orianae oceanensis	Large Bent-winged Bat	V		Yes	Yes	Yes			
Myotis macropus	Southern Myotis	V,P		No	Yes	Yes			
Petaurus australis	Yellow-bellied Glider	V,P		No	Yes	Yes			
Petaurus norfolcensis	Squirrel Glider	V,P		No	Yes	Yes			
Phascolarctos cinereus	Koala	V,P	V	No	Yes	Yes			
Phoniscus papuensis	Golden-tipped Bat	V,P		No	No	Yes			
Potorous tridactylus	Long-nosed Potoroo	V,P	V	No	Yes	Yes			
Pseudomys gracilicaudatus	Eastern Chestnut Mouse	V,P		No	No	Yes			
Pteropus poliocephalus	Grey-headed Flying-fox	V,P	V	Yes	Yes	Yes			

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Scientific Name	Common Name	NSW Status	Comm Status	BioNet Altas 1km	BioNet Altas 5km	BioNet Altas 10km			
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V,P		No	Yes	Yes			
Scoteanax rueppellii	Greater Broad- nosed Bat	V,P		No	Yes	Yes			
Vespadelus troughtoni	Eastern Cave Bat	V,P		No	Yes	No			
Reptilia									
Scientific Name	Common Name	NSW Status	Comm Status	BioNet Altas 1km	BioNet Altas 5km	BioNet Altas 10km			
Caretta	Loggerhead Turtle	E1,P	E	No	No	Yes			
Chelonia mydas	Green Turtle	V,P	V	No	Yes	Yes			
Hoplocephalus bitorquatus	Pale-headed Snake	V,P		No	No	Yes			
Hoplocephalus bungaroides	Broad-headed Snake	E1,P,2	V	No	Yes	No			
Hoplocephalus stephensii	Stephens' Banded Snake	V,P		No	No	Yes			
Scientific Name	Common Name	NSW Status	Comm Status	BioNet Altas 1km	BioNet Altas 5km	BioNet Altas 10km			
Varanus rosenbergi	Rosenberg's Goanna	V,P		No	No	Yes			

### 4. IMPACT ASSESSMENT

#### 4.1 INTRODUCTION

All developments have an impact on the floral and faunal diversity of a subject site. These consist of:

- Primary impacts such as the clearing of vegetation, waterbodies and other habitat features; and
- secondary impacts through mechanisms such as increased surface and sediment runoff, introduction of exotic species and diseases, increased disturbances through greater pedestrian and traffic utilisation, increased noise and light pollution and introduction of exotic domestic herbivores (sheep, cattle etc.) and predators (cats and dogs).

These impacts are associated with all phases of a development, from initial land clearing through to occupancy by new landowners/tenants. Although all proposed developments have impacts on floral and faunal values, a biodiversity sensitive approach can lead to a substantial decrease the in potential impacts of any development. In addition, a variety of techniques and technologies are available to reduce the potential impacts of a proposed development throughout all stages.

This section provides an assessment of the impacts of the proposed development in its current form (as shown in the site plan in Appendix 4) and makes suggestions for an alternative approach to reduce potential impacts or provide suitable compensation for these impacts (where appropriate).

The proposed development would develop all of the disturbed area for housing and roads. There would be a small area of vegetation removal on the western side of the property for the road and removal of a line of trees on the southern side of the property which line an existing driveway for the neighbouring property.

#### 4.1.1 Avoiding and minimising impacts on biodiversity values

When assessing the biodiversity impact of a proposed development the consideration of three approaches provides a comprehensive raft of potential options. These three approaches are listed in a descending order of best biodiversity outcomes:

- Avoid: modify the proposed development so no significant impact on resident biodiversity values would occur. This is typically impractical but can help guide mitigation measures;
- Mitigate: modify the proposed development to reduce the significant impacts on biodiversity values to the maximum extent possible. This is typically achieved through modification of proposed dwelling envelopes to avoid removing vegetation etc.; and
- Compensate: include measures in the proposed development to compensate for the biodiversity values lost. This can be achieved through an on-site offset (such as a proposed association lot or other offset area) which reserves a portion of the subject site in perpetuity for conservation and rehabilitation purposes. It can also be achieved through an off-site offset under the NSW Biodiversity Offset Scheme. This allows for the proponent of a proposed development to purchase biodiversity credits of an equal

value to the credit value of the biodiversity assets being removed on a subject site. These credits will then be used to preserve an area of equivalent biodiversity value offsite.

**Table 3.10** below details recommended avoidance and mitigation measures for all stages of the proposed development.
Table 3.10: Recommended avoidance and mitigation measures for current and projected impacts on the subject site

Impact	Action	Outcome	Timing	Responsibility
Sediment and contaminant	Sediment fencing is to be installed	Prevention of migration of	Prior to any soil disturbance	Contractors responsible for
exposure caused by	below all areas of exposed soil	unconsolidated soil into areas	works.	works
development construction	during works.	of retained native vegetation		
		and downslope areas towards	Maintained and repaired as	
		the creekline	required. Retained until soil is	
			stabilised by another mechanism	
Sediment, weed and	Any impact on adjacent vegetation	Minimisation of	Planning stage/during	Proponent/development
contaminant migration from	can be mitigated through the use of	contaminated stormwater	development	planner
development area offsite	appropriate stormwater	entering First Order Stream		
downslope of the development	infrastructure that will maximise	on the eastern side of the site.		
area	uptake of stormwater in the subject			
	site (semi-permeable surfaces,			
	vegetated swales etc.)			
Greater pedestrian and vehicle	The surrounding environment is	Minimal disturbance to the	During and following	Proponent/development
traffic increasing the level of	already heavily urbanised.	habitat utility of nearby	development	planner
disturbance, affecting the		native vegetation for native		
quality of usable habitat and	The proposed development is not	fauna.		
leading to potential collisions	considered likely to significant			
with resident native fauna	exacerbate this impact in the	Prevention of vehicle		
	locality	collisions with native fauna		
Increased noise and light	Unlikely to be a significant impact	Minimal disturbance to	During all development works	Contractors responsible for
pollution during development	as the local area already has	sensitive fauna using habitat		works
	industrial development	on adjacent lands		
Increased population of exotic	The surrounding environment is	Minimisation of increased	Following development	Proponent/development
predators (dogs and cats).	already heavily urbanised.	predation pressure from		planner
This could increase predation		additional domestic exotic		
pressure on resident native	The proposed development is not	predators		
fauna	considered likely to significantly			

Impact	Action	Outcome	Timing	Responsibility
	exacerbate this impact in the			
	locality			
	Education of future residents as to			
	the potential impact these predators			
	can have and recommendations on			
	how to mitigate this impact (not			
	allowing pets to roam at night,			
	containment of pets within			
	backyards etc.).			

#### 4.2 ASSESSMENT OF IMPACTS

#### 4.2.1 Biodiversity Conservation Act (2016) – 5-Part Test of Significance

Threatened species impact assessment is an integral part of environmental impact assessment. The objective of section 7.3 of the Biodiversity Conservation Act 2016 (BC Act), the test of significance, is to provide standardised and transparent consideration of threatened species and ecological communities, and their habitats, through the development assessment process.

#### (a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

No threatened species or good quality habitat for threatened species is to be removed or significantly disturbed as part of the proposal. The development has aimed to reduce the impacts of the proposal as far as possible by using the cleared former Agricultural Research Station as the main disturbance area for the homes with the only native vegetation being impacted to form the perimeter road on the western side of the property. The area where the perimeter road is located has been previously disturbed by construction of a table drain to direct water across slope to the constructed drain in the centre of the property so the impacts on the fruit trees would be minimised.

The habitat on the main part of the former Research Station has been quite degraded through many decades of use with there being mainly exotic species present other than a few overstorey eucalypts. As such the fauna habitat and potential threatened flora species habitat is considered negligible in that area which forms the major impact area for the proposal. No individual threatened flora or fauna species were detected as part of the assessment. The small native bushland area where the bushland is to be removed on the western side of the site to facilitate the road is not representative of a listed vegetation community under either state or federal legislation and no listed species were detected in this area. There would be no adverse effects such that the lifecycle of any species would be impacted such that a viable local population would be placed at risk of extinction. A Vegetation Management Plan has been provided as part of the site and this will result in an overall biodiversity improvement to the overall site.

(b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

No listed communities occur on this site.

(c) in relation to the habitat of a threatened species or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and
(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and
(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the

(ui) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality The extent of vegetation removal as outlined in this report would not result in the removal, modification, fragmentation or isolation of habitat such that any individual threatened species or ecological community would be significantly impacted in the locality. The Ecovillage has designed the project as far as possible to maintain the ecology of the site and as such there is minimal vegetation removal required. The assessment of the vegetation to be removed along with direct and indirect impacts indicates that there would be no significant impacts. The vegetation is on the fringe of the existing cleared area and has itself been disturbed in the past.

# (d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)

No areas of outstanding biodiversity value would be impacted either directly or indirectly. The site is not mapped as an area of outstanding biodiversity.

# (e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process

The following key threatening processes are listed under Schedule 4. The key threatening processes currently listed at the time of writing are provided below. The proposed development would remove some of the trees and native vegetation on the site. This would not increase the likely impact of any current key threatening process as listed below.

- Aggressive exclusion of birds from woodland and forest habitat by abundant Noisy Miners, Manorina melanocephala (Latham, 1802)
- Alteration of habitat following subsidence due to longwall mining
- Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands (as described in the final determination of the Scientific Committee to list the threatening process)
- Anthropogenic Climate Change
- Bushrock removal (as described in the final determination of the Scientific Committee to list the threatening process)
- Clearing of native vegetation (as defined and described in the final determination of the Scientific Committee to list the key threatening process)
- Competition and grazing by the feral European Rabbit, Oryctolagus cuniculus (L.)
- Competition and habitat degradation by Feral Goats, Capra hircus Linnaeus 1758
- Competition from feral honeybees, *Apis mellifera* L.
- Death or injury to marine species following capture in shark control programs on ocean beaches (as described in the final determination of the Scientific Committee to list the key threatening process)
- Entanglement in or ingestion of anthropogenic debris in marine and estuarine environments (as described in the final determination of the Scientific Committee to list the key threatening process)
- Forest eucalypt dieback associated with over-abundant psyllids and Bell Miners
- Habitat degradation and loss by Feral Horses (brumbies, wild horses), Equus caballus Linnaeus 1758
- Herbivory and environmental degradation caused by feral deer
- High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition
- Importation of Red Imported Fire Ants Solenopsis invicta Buren 1972
- Infection by Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species and populations
- Infection of frogs by amphibian chytrid causing the disease chytridiomycosis
- Infection of native plants by Phytophthora cinnamomi
- Introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae
- Introduction of the Large Earth Bumblebee Bombus terrestris (L.)
- Invasion and establishment of exotic vines and scramblers
- Invasion and establishment of Scotch Broom (Cytisus scoparius)
- Invasion and establishment of the Cane Toad (Bufo marinus)
- Invasion, establishment and spread of Lantana (Lantana camara L. sens. lat)
- Invasion of native plant communities by African Olive Olea europaea subsp. cuspidata (Wall. ex G. Don) Cif.
- Invasion of native plant communities by *Chrysanthemoides monilifera*
- Invasion of native plant communities by exotic perennial grasses
- Invasion of the Yellow Crazy Ant, Anoplolepis gracilipes (Fr. Smith) into NSW

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- Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants
- Loss of hollow-bearing trees
- Loss or degradation (or both) of sites used for hill-topping by butterflies
- Predation and hybridisation by Feral Dogs, Canis lupus familiaris
- Predation by *Gambusia holbrooki* Girard, 1859 (Plague Minnow or Mosquito Fish) (as described in the final determination of the Scientific Committee to list the threatening process)
- Predation by the European Red Fox Vulpes (Linnaeus, 1758)
- Predation by the Feral Cat Felis catus (Linnaeus, 1758)
- Predation by the Ship Rat Rattus on Lord Howe Island
- Predation, habitat degradation, competition and disease transmission by Feral Pigs, Sus scrofa Linnaeus 1758
- Removal of dead wood and dead trees

#### 4.2.2 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) lists Matters of National Environmental Significance (MNES) and provides administrative guidelines provided under the act, for the assessment of these matters.

#### (a) Lead to a long-term decrease in the size of a population;

The proposed development would remove some overstorey species on the former research station cleared area and a small area of native vegetation on the western side of the property to facilitate the road. This would not lead to any long-term decrease in the size of any population of any threatened species. The habitat does not represent habitat on which any threatened species would be dependent upon for their survival. The vegetation represents no listed vegetation community.

#### (b) Reduce the area of occupancy of the species;

There would be no reduction in any area of potential occupancy for any threatened species.

#### (c) Fragment an existing population into two or more populations;

The proposed development would not cause any significant local fragmentation.

#### (d) Adversely affect habitat critical to the survival of a species;

Not adverse impact on critical habitat would occur for any species as a result of the proposed development.

#### (e) Disrupt the breeding cycle of a population;

No suitable breeding habitat for any potential threatened species would be disturbed as part of the proposed development.

# (f) Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;

Negligible quality habitat for any threatened species would be removed. The existing habitat has already been impacted by land use practices on the site over a number of years. The removal of the vegetation would not cause a significant decline in available habitat for any threatened species.

## (g) Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat;

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The locality already has a significant population of domestic predators (cats and dogs). The proposed development is not considered likely to significantly increase this population. There are also many weeds present and the development would not increase the risk of weeds. The Vegetation Management Recommendations (Appendix 4) would improve the quality and viability of the vegetation on the site.

#### (h) Introduce disease that may cause the species to decline, or

The proposed development is not considered likely to introduce potential pathogens for this species. The proposed development does not include the importation of potentially infected host fauna or potentially infected media (soil, water etc.).

#### (i) Interfere with the recovery of the species.

The proposed development would not interfere with the recovery of any species.

#### Conclusion

The subject site has been highly modified due to its use as a research station over several decades. The proposal has been designed to reduce ecological impacts as far as possible. The proposal would not significantly impact any threatened species, their habitats or any listed communities at a site, local, regional, state or national level.

## **4** CONCLUSIONS

This assessment indicates that the proposal does not require a Biodiversity Development Assessment Report (BDAR) under the Biodiversity Assessment Methodology (BAM). The vegetation on the site is represented by a highly disturbed environment which was part of the former Agricultural Research Station. The development has been designed as far as possible to reduce any ecological impacts and no threatened species, populations or listed communities under state or federal legislation would be significantly impacted as a result of the proposal.

No further ecological assessment is deemed to be required.

## **5 RECOMMENDATIONS**

Although the levels of potential impacts on flora and fauna values are low for this proposal due to it utilising almost entirely an area which is largely cleared and modified as part of the former agricultural research station several recommendations are provided below to assist in reduction of potential impacts.

- Standard Sediment and Erosion Controls should be utilised in all phases of the project to protect downslope areas from sedimentation.
- Clear barrier fencing should be erected on the southern and western boundaries to clearly define the extent of the required earthworks to protect vegetation from accidental clearance by earthworks contractors.
- Tree protection barriers should be erected for any trees being retained on site as per the Arborist Report Recommendations.
- Endemic site specific landscaping species should be used from the list of native species known to occur on the site.
- As light pollution may impact some fauna species which may use the western portion of forest adjoining the proposed development area it is recommended that low level lighting be used facing this forest area. Some species such as microchiropteran bats may be positively impacted as they often feed around street-lamps due to the insects which lights attract however to keep the ecology of the area as natural as possible it is recommended to keep artificial light pollution as low as possible along this urban/forest interface.

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## 7 APPENDIX 1: DISCLAIMER AND LIMITATION OF LIABILITY

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## 8 APPENDIX 2: FLORA SPECIES LISTS

#### Flora species list

Scientific name	Cleared Research Station Area	Western Area to be impacted and larger tract of bushland and small artificial drainage line exit on east of property
Acacia decurrens	$\checkmark$	
Acacia elongata		$\checkmark$
Acacia filicifolia	√	√
Acacia floribunda	✓	√
Acacia longissima	✓	$\checkmark$
Acronychia wilcoxiana		$\checkmark$
Adianthum aethiopicum		√
Alphitonia excelsa		$\checkmark$
Andropogon virginicus *	√	
Angophora floribunda		$\checkmark$
Anredera cordifolia *	✓	$\checkmark$
Asparagus aethiopicus*	✓	
Asparagus asparagoides*	$\checkmark$	
Asplenium flabellifolium		$\checkmark$
Asplenium nidus		$\checkmark$
Axonopus affinis *	√	
Axonopus compressus *	√	
Bidens pilosa*	√	
Blechnum cartilagineum		$\checkmark$
Callistemon saliginus	√	
Callistemon viminalis	√	
Calochlaena dubia		$\checkmark$
Calochlaena dubia		$\checkmark$
Centella asiatica	✓	$\checkmark$
Ceratopetalum apetalum		$\checkmark$
Cinnamomum camphora *	√	
Cirsium vulgare *	√	
Cissus hypoglauca	$\checkmark$	$\checkmark$
Citrobatus spinescens	$\checkmark$	$\checkmark$
Claoxylon australe	$\checkmark$	$\checkmark$
Clematis aristata		$\checkmark$
Conyza bonariensis *	$\checkmark$	
Corymbia gummifera		✓
Cynodon dactylon	✓	
Dichondra repens	✓	✓
Doodia aspera		✓
Endiandra muelleri	✓	✓

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Scientific name	Cleared Research Station Area	Western Area to be impacted and larger tract of bushland and small artificial drainage line exit on east of property
Entolasia marginata	✓	✓ ✓
Entolasia stricta	✓	√
Eucalyptus acmenoides	$\checkmark$	$\checkmark$
Eucalyptus paniculata	✓	✓
Eucalyptus pilularis	✓	✓
Eucalyptus punctata	✓	
Eucalyptus saligna	✓	✓
Eucalytpus pilularis		✓
Eucalytpus robusta	✓	
Eustrephus latifolius		✓
Ficus macrophylla		✓
Glochidion ferdinandi	$\checkmark$	$\checkmark$
Grammitis billardieri		✓
Hedycarya angustifolia		$\checkmark$
Histoppteris incisa		$\checkmark$
Lantana camara *	$\checkmark$	✓
Lepidosperma laterale		$\checkmark$
Ligustrum lucidium *	$\checkmark$	✓
Ligustrum sinense *	$\checkmark$	$\checkmark$
Livistonia australis		$\checkmark$
Lomandra longifolia	$\checkmark$	$\checkmark$
Lonicera japonica *	$\checkmark$	$\checkmark$
Ochna serrulata *	$\checkmark$	$\checkmark$
Paspalum dilatatum *	$\checkmark$	
Pennisetum clandestinum *	$\checkmark$	
Pittosporum undulatum	$\checkmark$	$\checkmark$
Plantago lanceolata *	$\checkmark$	
Pteridium esculentum	$\checkmark$	$\checkmark$
Rapanea variabilis		$\checkmark$
Rumex obtusifolius*	$\checkmark$	
Senecio madagascariensis *	$\checkmark$	
Sida rhombifolia*	$\checkmark$	
Smilax australis	$\checkmark$	$\checkmark$
Solanum mauritianum *	$\checkmark$	$\checkmark$
Stephania japonica var discolor		$\checkmark$
Sticherus flabellatus	$\checkmark$	$\checkmark$
Syncarpia glomulifera	$\checkmark$	$\checkmark$
Taraxacum officinale *	$\checkmark$	
Trifolium repens *	$\checkmark$	
Verbena bonariensis *	$\checkmark$	

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Scientific name	Cleared Research Station Area	Western Area to be impacted and larger tract of bushland and small artificial drainage line exit on east of property
Wilkiea huegeliana		✓

\*= Indicates Exotic Species

Common Name	Scientific Name	Type of Observation
Eastern Water Skink	Eulamprus quoyii	0
Garden Skink	Lampropholis	0
	guichenoti	
Australian Magpie	Gymnorhina tibicen	0
Pied Butcherbird	Cracticus nigrogularis	0
Galah	Cacatua roseicapilla	0
Sulphur-crested	Cacatua galerita	0
Cockatoo		
Eastern Whipbird	Psophodes olivaceus	0
Brown Cuckoo-Dove	Macropygia	0
	amboinensis	
White-headed Pigeon	Columba leucomela	0
Magpie-lark	Grallina cyanoleuca	0
Laughing Kookaburra	Dacelo novaeguineae	0
Superb Fairy-wren	Malurus cyaneus	0
Australian Brush-	Alectura lathami	0
turkey		
Bell Miner	Manorina melanophrys	0
Noisy Miner	Manorina	0
	melanocephala	
Red Wattlebird	Anthochaera	0
	carunculata	
Australian King-Parrot	Alisterus scapularis	0
Crimson Rosella	Platycercus elegans	0
Rainbow Lorikeet	Trichoglossus	0
	haematodus	
Common Ringtail	Pseudocheirus	Drey
Possum	peregrinus	

## 9 APPENDIX 3: FAUNA SPECIES LISTS

## 10 APPENDIX 4: VEGETATION MANAGEMENT OF RETAINED WESTERN FORESTED AREA

The retained western forested area represents an area of good quality native vegetation within the E2 Zoning. It is in good condition both structurally and floristically and provides good quality habitat for a range of flora and fauna species. Due to its upslope location from the proposed development it will not be impacted by sedimentation from any erosion or any nutrients from the use of fertilizers in the residential yards.

The main weed present in this area is Lantana. It is at moderate levels of infestation. The Ecovillage is a chemical free village and as such they do not like to use herbicides for control of weeds. The Lantana in this area could be effectively controlled via hand by cutting it off at the base as close to the ground as possible. Whist it would be best to undertake a cut stump application of herbicide once the Lantana is cut to kill the entire root system, regular cutting every 4 months of young plants to ground level will effectively control this weed within this area. This can be undertaken by hand using large diameter bypass lopper shears of which many models can cut from 50mm to 70mm diameter. Alternatively a brush cutter with saw blade or chainsaw or handsaw could be used. For ease of use and safety however hand equipment such as a handsaw and bypass loppers are preferred.

Monitoring of the levels of weeds could be undertaken by 20 metre by 20 metre plots. Surveys of the density of the weeds could be effectively achieved with 4 plots. A report should be written as a baseline report. This would enable a census of the weeds to be provided and then once the weed control commenced annual monitoring could be undertaken which would provide a good level of analysis to determine the effectiveness of the weed control for the management area.

Care should be taken not to remove the Lantana all at once as it is currently providing habitat for small birds. It should be removed progressively in patches to enable the fauna to respond to the changes in the habitat it currently provides and to reduce the potential for erosion due to the removal of vegetation coverage.

As Part of the Approval of Stage 1 an Ecological Restoration Plan (Robert Payne Ecological Surveys & Management, dated December 2013) has been implemented. There has been approximately 3400 hours of work undertaken since 2017 on implementation of this plant to target priority weed removal. Weed control works should continue for the western section of the site as described above.

11 APPENDIX 5: SITE LANDSCAPE PLAN



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## **DETAILED SITE INVESTIGATION (DSI)**

## **Property Address**

Narara Ecovillage Stage 2 33 Gugandi Road, Narara NSW (Lot 1& 37 DP 270882)

**Prepared for** Narara Ecovillage Cooperative Ltd

Date

November 2019

## **DOCUMENT CONTROL REGISTER**

	Document Information
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Document Number	1
Report Title	Detailed Site Investigation (DSI)
Site Address	33 Gugandi Road, Narara NSW ( Lot 1& 37 DP 270882)
Prepared for	Narara Ecovillage Cooperative Ltd

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## ABBREVIATIONS

AIP	Australian Institute of Petroleum	QA/QC	Quality Assurance, Quality Control
	Ltd		
ANZECC	Australian and New Zealand	RAC	Remediation Acceptance Criteria
	Environment and Conservation		
	Council		
AST	Aboveground Storage Tank	RAP	Remediation Action Plan
BGL	Below Ground Level	RPD	Relative Percentage Difference
BTEX	Benzene, Toluene, Ethyl benzene	SAC	Site Assessment Criteria
	and Xylene		
COC	Chain of Custody	SVC	Site Validation Criteria
DA	Development Approval	TCLP	Toxicity Characteristics Leaching
			Procedure
DP	Deposited Plan	ТРН	Total Petroleum Hydrocarbons
DQOs	Data Quality Objectives	UCL	Upper Confidence Limit
EPA	Environment Protection Authority	UST	Underground Storage Tank
ESA	Environmental Site Assessment	VHC	Volatile Halogenated Compounds
HIL	Health-Based Soil Investigation	VOC	Volatile Organic Compounds
	Level		
LGA	Local Government Area	DPI	Department of Primary Industries
NEHF	National Environmental Health	TRH	Total Recoverable Hydrocarbons
	Forum		
NEPC	National Environmental Protection	SAQP	Sampling Analysis Quality Plan
	Council		
NHMRC	National Health and Medical	HSL	Health Screening Levels
	Research Council		
ОСР	Organochlorine Pesticides		
OPP	Organophosphate Pesticides		
PAH	Polycyclic Aromatic Hydrocarbon		
РСВ	Polychlorinated Biphenyl		
PID	Photo Ionisation Detector		
PQL	Practical Quantitation Limit		

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## **EXECUTIVE SUMMARY**

Benviron Group was appointed by Narara Ecovillage Cooperative Ltd to undertake a Detailed Site Investigation (DSI) for the property situated at 33 Gugandi Road, Narara NSW ("the site").

Refer to **Figure 1** - Site Location and **Figure 2** - Site Features, Borehole Locations and Exceedance Plan.

The site is currently occupied by one rural residential property in the northwestern corner, four small greenhouse structures located along the eastern boundary, one large greenhouse structure along Gugandi Road on the eastern boundary, the remainder of the site is covered with trees, grasses and driveway /pathways. The site is proposed to be subdivided into multiple residential lots including landscaping areas including common gardens & a recreation / gathering area and new roads. The Site Assessment forms part of SEPP 55 Guideline (Remediation of Land) with a proposed redevelopment to determine the end land-use suitability of the property.

Soils sampled across the Site were assessed against the Site Acceptance Criteria (SAC) provided by the National Environment Protection (Assessment of Site Contamination) Measure (NEPM 2013) Table 1A - Residential A.

The following known/potential contamination source areas identified in the CSM were considered of low risk:

- Historical uses & current uses rural residential & agricultural;
- Where pesticides were potentially utilised laboratory results indicate no issues;
- Carpark areas / driveways where leaks and spills from cars may have occurred preliminary laboratory results indicate no issues; and

• Degrading building features – can be managed during demolition works.

The investigation revealed the following:

- The laboratory results for all soil samples were below the adopted detection limits and/or the relevant guideline criteria.
- No asbestos was detected in the soil samples analysed.
- Minor levels of dissolved zinc were detected marginally above groundwater investigation levels. However, these excursions were considered to be background levels and therefore of limited concerns. Benviron Group has extensive contaminated land experience in the Sydney Basin, which has indicated a common pattern of groundwater to be impacted by heavy metals. This is likely to be associated with progressive development and an increase in population growth and/or density.

Based on the results of the investigation, the site is considered *suitable* for the proposed development, subject to the following;

 Any soil requiring removal from the site, as part of future site works, should be classified in accordance with the "Waste Classification Guidelines, Part 1: Classifying Waste" NSW EPA (2014).

If during any potential site works, significant odours and / or evidence of gross contamination (including asbestos) not previously detected are encountered, or any other significant unexpected occurrence, site works should cease in that area, at least temporarily, and the environmental consultant should be notified immediately to set up a response to this unexpected occurrence. Thank you for the opportunity of undertaking this work. We would be pleased to provide further information on any aspects of this report.

## 1.0 INTRODUCTION

Benviron Group was appointed by Narara Ecovillage Cooperative Ltd to undertake a Detailed Site Investigation (DSI) for the property situated at 33 Gugandi Road, Narara NSW- Lot 1 & 37 DP 27882 ("the site").

Refer to **Figure 1** - Site Location and **Figure 2** - Site Features, Borehole Locations and Exceedance Plan.

The site is currently occupied by one rural residential property in the northwestern corner, four small greenhouse structures located along the eastern boundary, one large greenhouse structure along Gugandi Road on the eastern boundary, the remainder of the site is covered with trees, grasses and driveway /pathways. The site is proposed to be subdivided into multiple residential lots including landscaping areas including common gardens & a recreation / gathering area and new roads. The Site Assessment forms part of SEPP 55 Guideline (Remediation of Land) with a proposed redevelopment to determine the end land-use suitability of the property.

Soils sampled across the Site were assessed against the Site Acceptance Criteria (SAC) provided by the National Environment Protection (Assessment of Site Contamination) Measure (NEPM 2013) Table 1A - Residential A.

## 2.0 OBJECTIVE

The NSW Office of Environment and Heritage (OEH) indicate that a Detailed Site Environmental Investigation should provide comprehensive information on:

- Any issues raised in preliminary investigations;
- The type, extent and level of contamination;
- Contaminant dispersal in the air, surface water, soil and dust;
- The potential effects of contaminants on public health and the environment;
- Where applicable, off-site impacts on soil, sediment and biota; and
- The adequacy and completeness of all information available to be used in making decisions on remediation.

The project objectives of this Detailed Site Investigation (DSI) are to satisfy the stated OEH Detailed Site Investigation requirements in accordance with *NSW OEH Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites, 2011.* Specifically, this investigation will consider the potential for suspected historical activities to have caused contamination at the Site and determine land use suitability for the proposed land use.

The proposed investigation program and the Detailed Site Investigation are designed to assess the presence of any unacceptable on site or off-site risk to human health or the environment. The report will draw conclusions regarding the land use suitability of the Site for the proposed land use or provide recommendations to enable such conclusions and determine the need for a further assessment.

## 3.0 SCOPE OF WORKS

The scope of works for this Detailed Site Investigation (DSI) included:

- Collecting site information, review of historical information and past site practices, (site surveys, site records on waste management practices, NSW Land Titles Office records of ownership, aerial photographs obtained from the NSW Department of Lands, WorkCover NSW records and site interviews);
- A site inspection to identify areas of environmental concern, on-site waste disposal practices and location of sewers, drains, holding tanks, Underground Storage Tanks, Aboveground Storage Tanks and pits, spills and ground discolouration etc.;
- A targeted soil boring/sampling investigative study formulating and conducting a sampling plan and borehole investigation; the soil samples are taken and submitted for analysis on particular contaminants;
- Groundwater monitoring, well installation and sampling program based on site access;
- Laboratory analysis and results from sample analysis findings and comparison to regulatory guidelines;
- Quality Assurance/Quality Control (QA/QC) all QA/QC procedures were undertaken in accordance with the Benviron Group Quality Assurance/Quality Control manual;
- Interpretation of results and findings; and
- Recommendations and final conclusions drawn from interpretation of the results.

## 4.0 SITE IDENTIFICATION AND SITE HISTORY REVIEW

#### 4.1 Site identification

The site is identified as follows:

#### Table 1: Site Identification Review

Site Identifier	Site Details		
Site Location	Narara Ecovillage Stage 2, 33 Gugandi Road, Narara NSW		
Lot/DP	Lot 37 in DP270882		
	Lot 1 in DP270882		
Site Coordinates #	NW corner: Latitude: -33.393487, Longitude: 151.327179		
	NE corner: Latitude: -33.939496 , Longitude: 151.328673		
	SE corner: Latitude: -33.395283, Longitude: 151.329477		
	SW corner: Latitude: -33.394983, Longitude: 151.327203		
Parish	Gosford		
County	Cumberland		
Site Area	Approximate 3.5 Hectare		
Local Government Area (LGA)	Central Coast		
Zoning##	R2 - Low Density Residential		
Surrounding Land Uses	North	Construction Site	
	South	Residential House & Vacant land	
	East	Residential House	
	West Forest		

Notes: # Six Maps

## refer to NSW Planning Portal

https://www.planningportal.nsw.gov.au/spatialviewer/#/find-a-property/address //www.planningportal.nsw.gov.au/find-a-property

#### 4.2 Review of Historical Maps

A review of the maps originally produced by Higinbotham & Robinson from latenineteenth-century was undertaken. No relevant information was found as part of this assessment.

#### 4.3 Underground Services

Dial Before You Dig' plans were requested and reviewed for the Site. Plans were provided by Central Coast Council, Jemena Gas North, Ausgrid, NBN Co & Telstra NSW. The plans did not indicate the presence of any major underground services or utility easements at the Site. The NBN & Telstra plan indicated there are pits & cables running through the site along the east boundary and the Ausgrid plan indicates cables running along Research Road / Gugandi Road. It is noted that these underground services are considered a potential preferential pathway.

Refer to **Appendix A** – DBYD Plans.

#### 4.4 Review of aerial photographs

The following information regarding the aerial photographs has been obtained and the summary of this review are presented in the following table:

# Table 2 Review of Aerial Photographs

Year	Site		Surrounding areas
1954	Agricultural	The site appeared to be used for agricultural purposes	The surrounding area looks like were using for agriculture purpose
1975	Agricultural / Rural Residential	A house was constructed in the north western portion of the site.	Rural residential/ vacant land and trees.
1994	Agricultural /Rural Residential	No major changes	No major changes with the exception of some commercial/industrial type buildings developed to the north and some residential houses constructed to the southeast.
2006	Agricultural/Residentia I	Some small shed / warehouse / greenhouse type buildings have been constructed in the northeastern area.	No major changes with exception of more residential houses to the southeast.
Current	Residential/Vacant	Refer to Site Inspection	No major changes with the exception of some buildings to the north had been demolished and more houses built to the east

The aerial photographs have indicated the site appeared to be occupied by an agricultural and rural residential property from 1954 to the present date.

The surrounding land appeared to be agricultural until 1975. More residential development towards the south-east & some industrial/commercial type buildings were noticed since at least 1994.

Refer to **Appendix N** – Aerial Photograph
### 4.1 Title search

A review of historical documents held by Direct Info (approved LPI NSW Information broker) was undertaken to characterise the previous land use and occupiers of the site.

Lot 37 in DP270882								
Year	Proprietor	Company/Personal Occupation						
2013-Current	Narara Ecovillage Co-Operative Ltd	Property Development Company						
2012	State Property Authority/ Government Property NSW	Government Agency						

## Table 3 Historical land title data

Lot 1 in DP270882								
Year	Proprietor	Company/Personal Occupation						
Current	Community Association DP270882 For Narara Ecovillage							
2013	Narara Ecovillage Co-operative Ltd							
2008	State Property Authority/ Government Property NSW	Government Agency						

In summary, the land titles have indicated the following:

The land has been owned by a government agency before 2013 and then transferred to current owner/ property developer - Narara Ecovillage Co-operative Ltd.

The land title information has not indicated any potential contaminating activity to have occurred.

Refer to Appendix M – Land Titles

### 4.2 Anecdotal Evidence

No anecdotal evidence was available at the time of the investigation.

### 4.3 NSW EPA Records

The NSW EPA publishes records of contaminated sites under Section 58 of the Contaminated Land Management (CLM) Act 1997. The notices relate to investigation and/or remediation of site contamination considered to pose a significant risk of harm under the definition in the CLM Act.

A search of the database revealed that the subject site is not listed and there were no listed properties in the suburb of Narara.

It should be noted that the NSW EPA record of Notices for Contaminated Land does not provide a record of all contaminated land in NSW.

Refer to **Appendix B** – NSW EPA Records.

### 4.4 NSW EPA POEO Register

A search of the POEO Register revealed that the site was not listed.

Refer to **Appendix B** – NSW EPA Records.

### 4.5 Council Records

The Central Coast Council database was accessed in order to disclose file records relating to the site. The records do include information relating to the works in the <u>Stage 1 Narara</u> site. The records are not designed to be extensive, however there are the information provided from an informal search and indicated the following:

#### 33 Gugandi Road:

- The Central Coast Council database was accessed in order to disclose file records relating to the site and the search revealed the following:
  - A development application was submitted in 2018 under DA54060/2018.
    The development application was for the adaptive re-use of a community building as a dwelling house, minor demolition and external alterations.
  - In 9<sup>th</sup> March 2018, a statement of environmental effects was issued by Dean Wooding. The proposed development is for the adaptable re-use of the former administration block of the Gosford Horticultural Institute as a dwelling house.
  - On the 10<sup>th</sup> March 2018, Waste Management plan has been issued for the adaptable re-use of the former administration block of the Gosford Horticultural Institute as a dwelling house.

## 4.6 Previous Reports for Stage 1 & 2

Three previous reports were provided regarding the <u>Stage 1 & 2 works</u> at the Narara Ecovillage and are listed below:

- Douglas Partners Sydney (2013), Stage 1 Preliminary Site Investigation, Part of 25 Research Road, Narara NSW, Project 75583.00, dated August 2013.
- Ramboll Environ (2016), Site Audit report, Stage 1, Research Road, Narara NSW, Reference AS121784, dated 29<sup>th</sup> June 2016.
- Noel Arnold & Associates (2005), Department of Commerce: Gosford Horticultural Institute, Research Road, Narara NSW, "Hazardous Material Survey Report", Ref:SD0100: 44151-1/2, dated October 2005.

### Douglas Partners PSI

Douglas Partners Sydney was engaged by Mr John Talbott of Narara Ecovillage Cooperative Ltd and undertaken consultation with Mr Bill Nettleton of City Plan services to prepare a Stage One Preliminary Site Investigation (PSI) for Part of 25 research Road, Narara NSW.

## Oral Site History

As part of the Noel Arnold & Associates Pty Ltd (2005) report, an informal discussion was conducted with Paul Andersen (Site Manager). A summary of the information provided in the previous report comprised:

- Clearing of the area began in 1913 for cultivation;
- The area designated for viticulture has not been cultivated. It is not known why the area was cleared;
- An underground storage tank is located adjacent to Building 25, and has a bowser attached. It was used for petrol, not diesel;
- There is an above-ground diesel tank adjacent to Building 21;
- The site has been used historically for orchards, in particular citrus;
- Some vegetable planting has occurred on the eastern side of the site;

- Traditionally, insecticides, nutritional sprays and herbicides (particularly around the base of trees) were used on the site. It was considered that the herbicides are of highest risk for contamination;
- The dam is fed from Narara Creek and then reforms downstream. The Creek is fed from the Sydney to Newcastle Freeway and is filling with sand;
- The eastern side of the site floods, generally only during large storm events. The rate of draining of the area depends on the tides, as the Narara Creek flows into Brisbane Waters;
- The majority of the site is not fenced and the boundaries are not marked;
- The site holds no biological licences and no radioactive materials.

As previously noted, the information provided above related to the larger facility and comments relating to the above-ground diesel tank, vegetable planting, the dam and site flooding issues relate to areas not within the current assessment area.

The site has been abandoned for several years, however, a former employee (Mr Glenn Douglas) acts as the site supervisor. A brief interview was conducted with Mr Douglas as part of the site walkover on 12 April 2013. Mr Douglas has been familiar with site activities for approximately 17 years and currently lives in the Foreman's Cottage (Building 23). A summary of the information provided comprised:

- The larger facility area was first developed/establish from bushland in 1912 (circa 1913);
- Greenhouses, identified as Buildings 46 to 52, were constructed in circa 2001 and the level building pads were constructed using cut to fill construction methods (no bulk filling materials were imported for the construction);
- Asbestos building products have previously been identified in several of the buildings within the site.

- Stormwater runoff within the developed portions of the site is typically directed via overland flow or the on-site stormwater drainage system to the intermittent watercourses that bisect the site that then discharge into Narara Creek. It was also understood that this also included effluent from the numerous greenhouse buildings throughout the site.
- On-site sewage effluent from the facility was generally processed by on-site effluent treatment systems. It was understood that effluent from the main administration and laboratory building, and Building 23 was directed to a single treatment system and discharge area located beyond (and downslope) of the current site area. The Manager's Cottage (Building 17) was unlikely to be connected to this system and it was likely that the building had a separate domestic scale system (possibly a storage system with periodic removal by waste contractors). It was understood that no effluent was applied to the land within the current site area.
- All laboratories typically used only minor quantities of chemicals. Waste chemicals were taken to the Waste Chemical Storage Container (Building 43) for storage and then off-site disposal by a licensed contractor.
- The 'Chilled Water System', located adjacent to Building 43, was reported to contain a 'Glycol' (ethyl glycol) additive.
- No spill incidents in the chemical storage/disposal area or in other areas of the site had historically occurred. As part of the facility abandonment the infrastructure was removed from the site.
- The Manager's Cottage (Building 17) was understood to be a 'Boys Home" prior to the 1950s and that portions of the original structure were demolished/renovated as part of its conversion into the Manager's Cottage.
- The building identified as the original 'Incubator Building' was historically partially demolished and replaced with portable office buildings (Building 13).

- Most buildings (with the exception of the greenhouses, residences and portable buildings) comprised concrete slab on ground construction.
- Chemical usage on plants throughout the facility (particularly for the last ~ 20 years) was very limited, as the overall strategy was to develop plants that were naturally pest/disease resistant. However, use of chemicals prior to approximately the last 20 years was not known.

Based on a review of the available desktop search data, the following conclusions and recommendations has been made by DP Sydney (2013):

- The Site could be suitable (in the context of land contamination) for the proposed redevelopment if the DSI and any requisite remediation works is applied.
- The contamination risk across the site is assessed to be low to moderate, the preliminary CSM can form the basis for Development SAQP prior to the completion of DSI.
- Combination of Systematic and Judgemental sampling strategies be adopted for a DSI to substantiate DP's assessment at the site.
- Any remedial works are unlikely to prevent redevelopment of the site for both proposed mixed residential and commercial uses.

## <u>Site Audit</u>

Ramboll Environ Australia (2016) was commissioned by Narara Ecovillage Co-operative Ltd to assess the suitability of the site for proposed development its intended mixed residential and commercial.

Based on a review of the available desktop search data, the following conclusions and recommendations has been made by Ramboll Environ Australia (2016),

- Based on Coffey's Detailed Site Investigation report, the site is "now considered to be suitable, from a contamination viewpoint, for the proposed Ecovillage land use".
- Based on the information presented in Coffey's reports and observation, and following the Decision Process for Assessing Urban Redevelopment Sites in DEC (2016) *Guidelines* for the Audit Scheme, Auditor concludes that the site is suitable for the purposes of 'Residential with gardens and accessible soil'.

### Noel Arnold & Associates (2005) - Hazardous Materials Survey Report

The report presents the findings of a Hazardous Materials Survey Report conducted at the Gosford Horticultural Institute located at Research Road, Narara NSW. A total of sixty-one (61) buildings were surveyed.

The buildings applicable to the <u>Stage 2</u> area include:

- Building 46 = Greenhouse 46 is listed as Multispan Greenhouse No 1;
- Building 48-51 = listed as Propagator Greenhouses No 2, 3, 4 & 5;
- Building 23 = Foreman's Cottage (the report notes that this property has not been surveyed and needs to be surveyed prior to demolition/ alteration).

## 4.7 SafeWork NSW

Benviron Group submitted a request for information on the Storage of Hazardous Chemicals at the site from the database records of SafeWork NSW. The search result has located the following information:

• Three depots were listed in the search results and depot one was a 1,800L underground storage tank containing unleaded petrol.

- The second depot was listed as a poison storage area with capacities of 500L & 300kg.
- The third depot was listed as a flammable liquid storage area with a maximum capacity of 1000L.
- A site plan has been provided with the SafeWork and these three depots correspond within the Stage One area and/ or beyond. They are not located in the Stage 2 area.

Refer to **Appendix Q** – SafeWork NSW.

### 4.8 Summary of site history

In summary:

- The aerial photographs have indicated the site appeared to be occupied by an agricultural and rural residential property from 1954 to the present date. The surrounding land appeared to be agricultural until 1975. More residential development towards the south-east & some industrial/commercial type buildings were noticed since at least 1994.
- The land titles have shown the site has been owned by a government agency prior to 2013 and then transferred to current owner/ property developer -Narara Ecovillage Co-operative Ltd. The land title information has not indicated any potential contaminating activity to have occurred on site
- NSW EPA Records reveal that the subject site is not listed.
- The SafeWork NSW Records have been searched and the following was located:
  - Three depots were listed in the search results and the depot one was a 1,800L underground storage tank containing unleaded petrol.

- The second depot was listed as a poison storage area with capacities of 500L & 300kg.
- The third depot was listed as a flammable liquid storage area with a maximum capacity of 1000L.
- A site plan has been provided with the SafeWork and these three depots correspond with the Stage One area and are not located in the Stage 2 area.
- The Central Coast Council database was accessed in order to disclose file records relating to the site and the search revealed no concerns in relation to potential land use / contamination.
- The Douglas Partners PSI indicated the greenhouses, identified as Buildings 46 to 52, were constructed in circa 2001 and the level building pads were constructed using cut to fill construction methods (no bulk filling materials were imported for the construction). It is noted that the greenhouses identified as 46, & 48-51 are located in the Stage 2 area. Refer Appendix O Douglas Partners Previous Report Site Layout Plan
  - Greenhouse 46 is listed as Multispan Greenhouse No 1; and
  - Greenhouse 48-51 are listed as Propagator Greenhouses No 2, 3, 4 & 5;

## 4.9 Integrity Assessment

The information found in the historical sources has been found to be in general concurrence. It is therefore considered that accuracy of this data is acceptable for this investigation.

# 5.0 REVIEW OF ENVIRONMENTAL INFORMATION

Site Information	Descriptions
Sensitive Receivers	The nearest sensitive human receptors are the current and future
	users of the site, construction workers during the site
	redevelopment and the general public.
	The nearest watercourse is Narara Creek. A tributary / drainage
	line connect to Narara Creek is located approximate 100m to the
	east of the site.
Soil Landscape	The Soil Landscape Map viewed on NSW ESPADE indicates that
Review of NSW Soil and Land	the site is located within the Erina landscape area. These soils are
Information website ESPADE.	underlain by Terrigal Formation of the Narrabeen Group, lithic
	and quartz sandstone and siltstone, minor sedimentary breccia,
	claystone and conglomerate.
Topography	The topography viewed on NSW ESPADE indicated the following
Review of NSW Soil and Land	for the Glenorie Landscape:
Information website ESPADE.	
	Low rolling and steep hills. Local relief <60m, slope <25%. High
	soil erosion hazard, localised high run-on, seasonal waterlogging
	of foot slopes.
	Based on the site inspection it was determined that the site had
	an approximate slope of 5-20° to the east.

## Table 4: Site Condition and Surrounding Environment Review

Site Information			Descr	iptions				
Geological Profile	The Geolo	gical Map	of Gosf	ord-Lake	Macquarie ((	Geological		
	Series She	et 9131 &	part of	sheet 92	231, Scale 1	:100,000),		
	published by the Department of Minerals and Energy indicates							
	the residua	l soils withir	the site	was locate	ed at Terrigal	formation		
	of Gosford	Subgroup to	o be inte	rbedded la	aminite, shale	e and fine		
	to coarse g	grained qua	rtz to qu	uartz-lithic	sandstone, r	minor red		
	claystone.							
Presence of Acid Sulphate Soils	A review of	f the "Gosfo	rd" map	indicated t	the site is loca	ated in an		
Review of NSW Department of	area of no	known occ	urrence.	Therefore	, no acid sul	phate soil		
Land & Water Conservation	material is	expected wi	thin the s	oil profile.				
(DLWC) Acid Sulphate Soil Risk								
Maps (Edition Two, December	Furthermore, and in accordance to the Gosford Local							
1997, Scale 1:250,000 <b>.</b>	Environme	ntal Plan 2	2014 "A	cid Sulfat	e Soils Ma	ps Sheet		
	ASS_014B"	the site is lo	cated in	Class 5.				
A copy of the Council Risk Map								
is located in Appendix J.	A number of	of Acid Sulp	hate Soil	field tests	have been c	ompleted		
	during the I	DSI investiga	ition. Ref	fer to Secti	on 14.6.			
Localised Hydrogeology	Number	Location	Depth	SWL	Use	Water		
		from Site				Bearing		
Review of DPI (Office of Water)	014405000	250 014				Zones		
Database. Copies of the	GW102939	250m SW	-	-	-	-		
groundwater bore records are								
located in:								
	CW201107	FOOm N	15.00	0.7	Manitarian	Ciltu Cond		
Appendix D – DPI (Office of	GW201197	500m N	15m	0.7	wonitoring	Sitty Sand		
Water) Database Records.								

Site Information	Descriptions
Nearest Surface Water Body	The nearest watercourse is Narara Creek. A tributary / drainage
	line connect to Narara Creek is located approximate 100m to the
	east of the site.
Nearest Active Service Station	2.119km east of the site.
(Google Maps Search)	
Local Meteorology	The monthly rainfall of the local surrounding area is represented
(Bureau of Meteorology BOM	by the data collected from the BOM rainfall gauge located in
website)	Gosford north (Glennie ST), which is located approximately 1.6km
Appendix E – BOM Data.	from Narara. The records indicate that the median monthly
	rainfall in July (date of fieldwork) was 56mm and the highest
	monthly rainfall was 245.5mm.

## 6.0 REVIEW OF CONSTRUCTION AND SERVICE INFORMATION

#### 6.1 Proposed Development

The site is currently occupied by one rural residential property in the northwestern corner, four small greenhouse structures located along the eastern boundary, one large greenhouse structure along Gugandi Road on the eastern boundary, the remainder of the site is covered with trees, grasses and driveway /pathways. The site is proposed to be subdivided into multiple residential lots including landscaping areas including common gardens & a recreation / gathering area and new roads.

Refer to **Appendix F** - Proposed Subdivision Plans.

# 7.0 SITE VISIT

### 7.1 General

The site was visited on the 24<sup>th</sup>, 30<sup>th</sup>, 31<sup>st</sup> July & 23<sup>rd</sup> August 2019 by Benviron Group Environmental Scientists to inspect the site for any potential sources of contamination.

The following items were considered as part of the site visit:

- Description of the building structures;
- Site surroundings;
- Present and past industrial processes and operations at the site;
- Surface water, groundwater, stormwater and sewer;
- Present and past storage of chemicals and wastes associated with site use and their on-site location;
- Waste management practices and management of hazardous materials;
- Presence of Underground Storage Tanks or Above Ground Storage Tanks;
- Odour; and
- Occupational health and safety.

## 7.2 Site observations

At the time of the site visit the following observations were made as per the following table:

Factors Considered	Description
Buildings & Structures on Site	The property consists of one rural residential property in the
	northwestern corner, four small greenhouse structures located
	along the eastern boundary, one large greenhouse structure along
	Gugandi Road on the eastern boundary and it has been used as a
	garage, the remainder of the site is covered with trees, grasses and
	driveway/pathways. The site has been used as a part of Selected
	area of Gosford Horticultural Research and advisory station by
	Department of Commerce.
Percentage Hard-standing	2%
surface	
Concrete Condition	NA
Chemical Storage	No Chemical storage area were noticed on the site within accessible
	areas.
Above and Underground	USTs and ASTs were not identified within the property.
Storage Tanks	
Trade Waste Pits	No trade waste agreements or pits were identified for the building.
Nearby Electrical Transformers	No electrical transformers were identified within the site
Asbestos	No fibro cement sheeting was identified within the building
	structures in accessible areas.
Soil Staining and Odours	No odours were identified within the property. No significant soil
	staining was noted during the inspection
Stormwater and Sewer	Stormwater and sewage were connected to the local utilities.

# Table 5: Site Inspection Review

Refer to Figure 2 - Site Features, Borehole Locations and Exceedance Plan and Appendix

**C** – Site Photographs.

# 8.0 PRELIMINARY CONCEPTUAL SITE MODEL (CSM)

Based on the above information, site history and site walkover, the areas of potential concern and associated contaminants for the site CSM were identified. These are summarised in the following table.

Known and potential contamination source	Associated Contaminants
Historical Site Uses (agricultural including orchard)	Heavy Metals, TRH, BTEX, PAH, OCP, OPP, PCB, Carbamates
Imported Fill	Heavy Metals, TRH, BTEX, PAH, OCP, PCB
Car parking Areas	TRH, BTEX, PAH
Building degradation/ Demolition	Heavy Metals and Asbestos

### Table 6: Areas and Contaminants of Concern

### Table 7: Potentially Contaminated Media

Known and potential	Associated Contaminants
contamination source	
Fill Material	There is the potential for contamination to be present
	in the upper fill material.
Groundwater	There is the potential for the leaching of contaminants
	into groundwater onsite and also migration of the
	contaminants.

### **Potential for Migration**

Contaminants generally migrate from site via a combination of windblown dusts, rainwater infiltration, groundwater migration and surface water runoff. The potential for contaminants to migrate is a combination of:

- The nature of the contaminants (solid/liquid and mobility characteristics);
- The extent of the contaminants (isolated or widespread);
- The location of the contaminants (surface soils or at depth); and
- The site topography, geology, hydrology and hydrogeology.

The potential contaminants identified as part of the site history review, site inspection and previous reports are present in solid (e.g. impacted fill, asbestos) & liquid (e.g. dissolved in water).

Aerial photography has indicated that there were significant unsealed ground surfaces and therefore, there is the potential for migration of contaminants via wind-blown dust.

Rainfall infiltration at the site is expected to occur in unsealed areas. There is therefore the potential that soil contamination could result in impacts to groundwater.

### Potential Exposure Pathways

Potential exposure pathways include:

- Dermal;
- Ingestion; and
- Inhalation.

Due to the presence of exposed potentially impacted soil/fill on ground surfaces, dermal and inhalation exposure is considered a potential exposure pathway.

The potential for ingestion of soil is considered as a potential exposure pathway. Although groundwater is not used at the site, there is the potential, for ingestion of contaminants via groundwater removed from monitoring wells.

The proposed development includes the construction of low-density residential dwellings. Because of this dermal and inhalation exposure pathway by potentially contaminated groundwater is limited.

### **Receptors**

Potential receptors of environmental impact present within the site which will be required to be addressed with respect to the suitability of the site for the proposed use include:

- Excavation/construction/maintenance workers conducting activities at the site, who may potentially be exposed to COPCs through direct contact with impacted soils, Vapour Intrusion and/or groundwater present within excavations and/or inhalation of dusts/fibres associated with impacted soils;
- Future occupants/users of the site may potentially be exposed to COPCs through direct contact with impacted soils and/or ingestion of impacted soils and/or inhalation of dusts/fibres associated with impacted soils and/or exposure to vapour; and/or
- Offsite sensitive receptors of groundwater; and/or
- Flora species to be established on vegetated areas of the site.
- Narara Creek

### Preferential Pathways

For the purpose of this assessment, preferential pathways have been identified as natural and/or man-made pathways that result in the preferential migration of COPCs as either liquids or gases.

Man-made preferential pathways are present throughout the site, generally associated with fill materials and services present beneath existing ground surface. Fill materials and service lines are anticipated to have a higher permeability than the underlying natural soil and/or bedrock.

The NBN & Telstra plan indicated there are pits & cables running through the site along the east boundary and the Ausgrid plan indicates cables running along Research Road / Gugandi Road. It is noted that these underground services are considered a potential preferential pathway.

# 9.0 REVIEW OF DATA QUALITY OBJECTIVES

The DQOs were also prepared using Appendix IV of the Site Auditor Guidelines. These require 7 steps. The steps being

- a. State the problem
- b. Identify the decisions
- c. Identify inputs to decision
- d. Define the study boundaries
- e. Develop a decision rule
- f. Specify limits on decision errors
- g. Optimise the design for obtaining data

### 9.1 State the Problem

The site requires to be confirmed suitable for the proposed development. The site is proposed to be redeveloped and has had some areas of potential concern, those being historical land uses (agricultural including orchard), possible areas of imported fill of unknown origin, degradation of the building materials and leakages from vehicles on site.

Technically defensible evidence needs to be provided so that the identified Site does not present an unacceptable risk to human health or the environment and is suitable for the intended land use.

### 9.2 Identify the Decisions

The decisions to be made on the contamination and the new environmental data required includes considering relevant site contamination criteria for each medium (fill, soil and sediment). A proposed use of the 95% UCL on the mean concentrations for all soil chemicals of potential concern must be less than the site criteria identified for the relevant land use suitability.

The decisions made in completing this assessment are as follows:

- Does the site or is the site likely to present a risk of harm to humans or the environment
- Is the site currently suitable for the proposed land use being residential with soil access?
- Is there a potential for soil and groundwater contamination?
- Is there a potential for offsite migration issues?
- Do the sampling results meet the site criteria proposed?
- If not, does the site require remediation works

## 9.3 Identify Inputs to Decision

This step requires the identification of the environmental variables/characteristics that need measuring, identification of which media (fill, soil etc.) need to be collected, identification of the site criteria for each medium of concern and appropriate analytical testing. Inputs include:

- Existing site information
- Site history

- Regional geology, topography and hydrogeology
- Potential contaminants
- Proposed Land Use
- Site assessment criteria
- Results as measured against criteria

### 9.4 Define the Study Boundaries

Specific spatial and temporal aspects must be provided to identify the boundaries of the investigation and to identify any restrictions that may hinder the assessment process. The site is located at 33 Gugandi Road, Narara NSW. The site is approximately 3.5 hectares in area.

Refer to **Figure 1** - Site Location and **Figure 2** – Site Features, Borehole Locations & Exceedance Plan.

### 9.5 Develop a Decision Rule

The information obtained through this assessment will be used to characterise the soils and the groundwater on the site in terms of contamination issues and risks to human health and the environment. The decision rule in characterising the site will be as follows:

- Laboratory test results will be measured against the criteria provided within this report
- The site will be deemed suitable for the proposed use if the following criteria are fulfilled:

- Soil and groundwater concentrations are within background levels
- QA/QC shows data can be relied upon
- Results generally meet regulatory criteria
- Results are from NATA accredited laboratories
- o Detection limits are below assessment criteria
- Results can be shown to be of minimal concern

## 9.6 Specify Limits on Decision Errors

The limits on decision errors for this assessment are as follows:

- The assessment criteria adopted from the guidelines within this report have risk probabilities already incorporated.
- The acceptable limits for inter/intra laboratory duplicate sample comparisons are laid out within our protocols.
- The acceptable limits for laboratory QA/QC parameters are based upon the laboratory reported acceptable limits and those stated within the NEPM 2013 Guidelines.

## 9.7 Optimise the Design for Obtaining Data

A resource-effective sampling and analysis design was undertaken for data collection that satisfies the DQO's. The sampling and analytical plan is designed to avoid Type 1 and Type 2 errors and includes defining minimum sample numbers required to detect contamination as determined with procedures provided in the NSW EPA 1995 Sampling Design Guidelines and AS 4482.1 - 2005 and appropriate quality control procedures. Furthermore, only laboratories accredited by NATA for the analysis undertaken were used. The laboratory data was assessed from quality data calculated during this assessment. Field QA/QC protocols adopted and incorporate traceable documentation of procedures used in the sampling and analytical program and in data verification procedures.

## **10.0 INTRUSIVE SOIL INVESTIGATION**

The intrusive soil investigation took place on the 24<sup>th</sup>, 30<sup>th</sup>, 31<sup>st</sup> July & 23<sup>rd</sup> August 2019 and was designed to meet the Data Quality Objectives.

### 10.1 Soil Assessment

Samples were recovered from forty-six (46) sample location consisting of thirty (36) borehole locations and ten (10) test pits across the site and were labelled BH1 to BH36 & TP1 to TP10. These locations were selected to detect any contamination that may have originated from past and present activities, and due to potential excavation and future development in these areas.

Anal	yte / Analyte Group				1					1			
		SAMPLING DATE	HEAVY	TRH	BTEX	РАН	OCP	OP	PCB	PH / CEC /	Carbamates	TRH C6-C10	Ashestos
0 annala	Durath (m)	SAME ENO DATE	METALS (8)	INIT	DIEX	1.00	001	01	100	%CLAY	(3 analytes)	& BTEXN	A3063103
Sample	Depth (m)		-										
	1					<u> </u>							
TP1	0.2-0.3	24.7.2019	x	х	х	x	x	x	x				
TP1	0.8-0.9	24.7.2019	x	х	х	х	x	x	x				
TP2	0.2-0.3	24.7.2019	x	x	×	x	x	x	x				
700	0.2 0.0	24 7 2010	×	×	Y	×	×	×	×				
IP3	0.2-0.3	24.7.2019	^	^	^	^	^	^	^				
TP4	0.2-0.3	24.7.2019	x	х	x	x	х	х	х				
TP5	0.2-0.3	24.7.2019	x	х	x	х	x	x	x				
TD5	0607	24 7 2019	x	x	×	x	x	x	x				
11.5	0.0-0.7	04.7.0040											
IP6	0.2-0.3	24.7.2019	^	~	^	~	^	^	~				
TP7	0.2-0.3	24.7.2019	x	х	x	x	х	x	x	х			
TP7	0.6-0.7	24.7.2019	x	х	x	х	x	x	x	x			
TP8	0.2-0.3	24.7.2019	x	x	x	×	x	x	×		x		x
110	0.2-0.3	04.7.0040	~		~	~	~	~	~		~		~
TP8	0.6-0.7	24.7.2019	x	X	x	x	x	x	x				
TP9	0.2-0.3	24.7.2019	x	х	x	x	х	х	х				
TP9	0.6-0.7	24.7.2019	x	х	x	х	х	х	x				
7040	0.000	24 7 2019	×	Y	×	×	×	Y	x				
IPIU	0.2-0.3	24.7.2010	~	~	^	~	~	~	~				
BH1	0.1-0.2	31.7.2019	x	x	x	x	x	x	x				
BH2	0.2-0.3	30.7.2019	х	х	х	х	х	х	х				
BH3	0-0.1	24.7.2019	х	x	x	х	х	х	х				х
BLID	0.005	24 7 2010	×	v	×	v	×	×	×				
BH3	U.4-U.5	24.7.2018	^	^	<u> </u>	^	^	^	<u> </u>				
BH4	0.2-0.3	31.7.2019	х	х	x	х	х	х	х		L		x
BH5	0.2-0.3	31.7.2019	х	x	x	х	х	х	x				
BH6	0.2-0.3	24.7.2019	х	х	х	х	х	х	х				
BIR	1244	24 7 2010	~	~	~	v	v	v	v				
BH6	1.3-1.4	24.7.2018	^	*			^		^				
BH7	0.2-0.3	31.7.2019	х	х	х	х	х	х	х				
BH8	0.2-0.3	30.7.2019	х	х	х	х	х	х	х				
BH9	0.2-0.3	30.7.2019	х	x	x	х	х	х	х				
0,00	0.2 0.0	30 7 2010	~	~	~	~	~	~	~				
BH10	0.2-0.3	30.7.2019	~	*	~	*	^	~	^				
BH11	0.2-0.3	31.7.2019	х	х	х	х	х	х	х				
BH12	0.2-0.3	31.7.2019	х	x	х	х	х	х	х				
BH13	0203	31.7.2019	x	x	x	х	x	x	x				
5013	0.2-0.3	30 7 2010	-	~	, î	~			~				
BH14	0.2-0.3	30.7.2019	X	x	×	X	×	X	×				
BH15	0.2-0.3	30.7.2019	х	x	х	х	х	х	х				
BH16	0.2-0.3	30.7.2019	x	х	x	x	x	х	x				
PU17	0.2.0.2	30 7 2019	×	x	×	×	x	¥	×				
BHI7	0.2-0.3	00.7.2010	^	~	^	~	~	~	~				
BH18	0.1-0.2	31.7.2019	x	x	X	x	x	x	x				
BH19	0.2-0.3	30.7.2019	x	x	х	х	x	x	х				
BH20	0.1-0.2	24.7.2019	х	х	х	х	x	х	x				
PH20	0.5.0.6	24 7 2019	×	Y	×	×	×	Y	x				
BH20	0.5-0.0	24.7.2010	^	~	<u> </u>	~	~	~	~				
BH21	0.2-0.3	24.7.2019	x	x	x	x	x	x	x		x		x
BH22	0.2-0.3	30.7.2019	x	х	x	х	х	x	x				x
BH23	0.2-0.3	30.7.2019	x	х	х	х	х	х	х				х
B1104		30 7 2010	×	×	×	×	×	×	×				×
BH24	0.2-0.3	30.7.2013	^	^	^	^	^	^	^				^
BH25	0.2-0.3	24.7.2019	x	x	x	х	x	x	x				x
BH25	0.6-0.7	24.7.2019	х	х	х	х	х	х	x				
BH26	0.2-0.3	30.7.2019	х	x	x	х	х	х	х				х
0/120	0.2-0.3	30 7 2010		~	, v	v	~	~	~				, v
BH27	0.2-0.3	30.7.2019	^	~	~	~	^	~	^				^
BH28	0.2-0.3	24.7.2019	х	х	х	х	х	х	х				
BH29	0.2-0.3	24.7.2019	х	x	x	х	х	х	x		х		
BH30	0.2-0.3	24.7.2019	х	х	х	х	х	х	х	х			х
BLIDO	0.6.0.7	24 7 2010	~	~	~	v	v	v	v	v			
BH30	U.Ծ-U.7	24.7.2018	*	*		*		~	^	*			
BH31	0.1-0.2	23.08.2019	х	x	x								
BH32	0.1-0.2	23.08.2019	х	x	х								
BH33	0.1-0.2	23.08.2019	х	х	х								
PLIO 4	0.1.0.0	23 08 2019	Y	v	×								
BH34	0.1-0.2	20.00.2010	^	^	^ 								
BH35	0.1-0.2	23.08.2019	x	x	x	L					L		
BH36	0.1-0.2	23.08.2019	х	х	х								
D1	-	31.7.2019	х	x	x	х	х	х	х				
	1 -	30 7 2010	~	~	~	~	~	~	~				
02		30.7.2019	~	*	~	*	*	*	^				
D3		24.7.2019	х	х	x	х	х	х	х				
SS1	-	31.7.2019	х	х	х	х	х	х	х				
882	-	30.7.2019	x	x	x	х	х	х	х				
002	1	24 7 2010		~		~	~	~	~				
SS3		24.7.2019	X	x	X	X	x	X	X		L		
TS1		24.07.2019										х	
TB1		24.07.2019										х	
TS2		30.07.2010				1				1	1	×	
182	+ -	30.07.2019			l	<u> </u>						^	
TB2		30.07.2019										х	
TS3		31.07.2019										х	
TR3	-	31 07 2019										x	
	1	23 08 2010			1	1						~	
IS TS		20.00.2019				l							
IB		23.08.2019			1	1		1		1	1	I X	1

# **Table 8: Sampling Information - Soil**

The locations of the boreholes and samples are shown in **Figure 2** and details of the boreholes are presented in **Appendix G** – Borehole Logs.

Based on information from all boreholes, the surface and sub-surface profile across the site is generalised as follows:

- Fill: Sandy Silt, Silty Sand, Sandy Clay, Clayey Silt, Sandy Silty Clay & Silty Clay
- Natural: Silty CLAY, Silty SAND, Sandy CLAY & Sandy SILT

## 10.2 Sampling Density and Rationale

The NSW EPA "Sampling Design Guidelines" (September 1995) requires a minimum sampling density of forty-five (45) sampling points for a site approximately area of 3.5 hectares.

Thirty-six boreholes labelled (BH1 to BH36) and ten (10) test pits labelled (TP1 to TP10) were drilled by adopting a grid based systematic sampling pattern across the site and to provide general site coverage with consideration given to accessibility and limitations in relation to underground services & access.

## **10.3** Sampling Methodology

In summary:

• Soil samples were also collected directly from the push tube / split spoon sampler.

- Soil samples were collected using a hand auger, DCP and U50 to collect undisturbed samples.
- Samples were transferred directly into appropriately labelled clean laboratory supplied containers;
- Samples were transferred into chilled eskies for sample preservation;
- A Chain of Custody was completed and forwarded to the laboratory. Sampling analysis was based on field observations and were in accordance to the schedule outlined in Section 12.
- Soil samples were submitted to their respective laboratories as specified in Section 12.4.

Sampling of asbestos was undertaken as follows:

- Soil samples were submitted to their respective laboratories as specified in Section 12.4.
- A minimum 10L sample from each sample location was recovered;
- Each sample (minimum of 10 L) was screened through a 7mm sieve and the material retained on the sieve examined for any bonded ACM and / or suspect material and forwarded to the laboratory for analysis if any suspected ACM is encountered;
- If visible FA material is present or suspected, the soil should be wetted to minimise the release of fibres;
- Identified bonded ACM and FA should be weighed for each sample; and
- One wetted 500ml sample from each sampling location was submitted for laboratory analysis for AF.

## **11.0 GROUNDWATER INVESTIGATION**

#### **11.1 Groundwater Assessment**

Benviron Group installed two groundwater monitoring well on the 24<sup>th</sup> & 30<sup>th</sup> July 2019 as part of the DSI. Samples were recovered from one (1) groundwater well labelled as GW2 at the time of sampling. GW1 was dry at the time of sampling. The schedule of analysis is provided below:

SAMPLE ID	SAMPLING DATE	HEAVY METALS	TRH	BTEX	PAH	РСВ	TRH	Phenol	OPP/COP	TRH C6-C10 & BTEXN
Benviron Group DSI										
GW2	08.08.2019	х	х	х	х	х	х	х	х	
GWD1	08.08.2019	х	х	х	х	х	х	х	х	
GWSS1	08.08.2019	х	х	х	х	х	х	х	х	
TS1	-									х
TB1	-									х

Table 9: Sampling Information – Groundwater

The location of the groundwater well is shown in **Figure 2** – Site Features, Borehole Locations and Exceedance Plan and details of the boreholes are presented in **Appendix G** – Borehole Logs.

Refer to **Appendix I** – Field Record Forms.

## **11.2 Groundwater Methodology**

Groundwater monitoring wells were constructed on the 24<sup>th</sup> & 30<sup>th</sup> July 2019 by adopting the following methodology:

- 50mm diameter, Class 18PVC threaded and flush joined casing and 0.45 machine-slotted screens were used;
- Coarse, washed sand and gravel was placed in the annulus surrounding the piping to a height of the screen;
- Bentonite pellets were placed in the annulus to form an impermeable plug near the top of the well to prevent surface runoff from entering directly into the well;
- A PVC cap was placed on the casing;
- 100mm diameter stainless steel flushed covers were used for all well finishes and concreted onto the ground surface.

## Table 10: Summary of Well Construction Details

Well ID	Total	Screening	Surface Level	Water	Comment
	Depth	(m)	(RL)	Bearing	
BH2 /GW1	12.5	6.5-12.5	31.54	NA	Dry- Current
BH3 /GW2	11.7	5.7-11.7	19.98	Silty Clay	Current

Notes:

1. RLs was taken from the closest point on the plan provided in Appendix F.

The following works were carried out upon completion of the well installations:

• The wells were developed by removing at least three well volumes until groundwater parameters reached equilibrium and no further turbidity improvements were observed.

Drilling and installation of the monitoring wells was carried out on the 24<sup>th</sup> & 30<sup>th</sup> July 2019, using a combination of solid stem auguring, under supervision of Benviron Group.

## **11.3 Groundwater Sample Collection**

Groundwater sampling was undertaken on the 8<sup>th</sup> August 2019. Prior to sampling, the resting water level was recorded within the well while checking for the presence of phase separated hydrocarbon.

Sampling was completed using a low flow peristaltic pump – a low flow/minimum drawdown sampling technique used to minimise any disturbance to the aquifer.

Field measured parameters were collected using a certified and calibrated In-situ YSI water quality meter. Samples were collected when field measured parameters (pH, electrical conductivity, redox potential, dissolved oxygen and temperature) had stabilised. The samples were placed into appropriate laboratory supplied bottles and preserved on ice. The peri pump and other sampling equipment were decontaminated before and after use to avoid possible cross contamination. All samples collected were preserved on ice and couriered directly to the laboratory under COC documentation.

### **11.4 Groundwater Observations**

Well ID	Well Depth	Surface Level RL	Groundwater Depth Measured (m BGL)	Groundwater Level (RL)	PSH Depth
BH2 /GW1	12.5	31.54	NA	NA	NA
BH3 /GW2	11.7	19.98	7.5	12.48	None

### Table 11: Groundwater Elevations & Observations

Notes:

2. RLs were taken from the closest point on the plan provided in Appendix F.

# **12.0 QUALITY ASSURANCE / QUALITY CONTROL**

# 12.1 General QA/QC

The frequency required for each field quality assurance / quality control (QA/QC) sample is presented in the table below.

## Table 12: QA/QCs Frequencies

	Intra Lab	Inter Lab	Rinsate	Spikes	Blanks
Sampling	1 in 20	1 in 20	1/day	1/day	1/day
Frequency					

During the contamination assessment the integrity of data collected is considered vital. With the assessment of the site, a number of measures were taken to ensure the quality of the data. These are as follows:

## **12.2 Sample Containers**

Soil samples collected during the investigation were placed immediately into laboratory prepared glass jars with Teflon lid inserts. Standard identification labels were adhered to each individual container and labelled according to depth, date, sampling team and media collected.

### 12.3 Decontamination

All equipment used in the sampling program was decontaminated prior to use and between samples to prevent cross contamination. Decontamination of equipment involved the following procedures:

- Cleaning equipment in potable water to remove gross contamination;
- Cleaning in a solution of Decon 90;
- Rinsing in clean demineralised water then wiping with clean lint free cloths;

Benviron Group also adopted a sampling gradient of lowest to highest potential contamination to minimise the impact of cross contamination. This gradient was determined from the historical review and the on-site inspection that was carried out prior to sampling.

Although Benviron Group maintains consistent sampling procedures, a rinsate sample is obtained to ensure false positive samples are not generated and that decontamination procedures are effective in preventing cross contamination. The Rinsate water is collected after being in contact generally with the trowel used for sampling. Analytical results that target the contaminants of concern are compared to a blank sample, which is taken directly from the rinsate water container supplied by the laboratory.

A rinsate sample was not collected as the samples were taken either directly from the push tube / split spoon sampler or U50 tube and therefore the chance for cross-contamination was minimal.
## **12.4** Sample Tracking, Identification and Holding Times

All samples were forwarded to Envirolab and ALS Environmental under recognised chain of custodies with clear identification outlining the date, location, sampler and sample ID. All samples were recorded by the laboratory as meeting their respective holding times. The sample tracking system is considered adequate for the purposes of sample collection.

#### **12.5** Sample Transport

All samples were packed into an esky with ice from the time of collection. A trip blank and trip spike are collected where appropriate. These were transported under chain of custody from the site to Envirolab Pty Ltd and ALS Environmental, both NATA registered laboratories. During the project, the laboratory reported that all the samples arrived intact and were analysed within holding times for the respective analytes.

Samples were kept below 4°C at all times, soil samples submitted for asbestos analysis are not required to be kept below 4°C.

## 12.6 Trip Spike

Trip Spike samples were obtained from the laboratory prior to conducting field sampling where volatile substances are suspected. Benviron Group QA/QC procedures for the collection of environmental samples involves the collection of trip blanks, trip spikes and duplicate samples both intra and inter laboratory.

#### 12.7 Trip Blank

A trip blank accompanied the sampling for the sampling process and is not separated from the sample collection and transportation process. The purpose of the trip blank is to identify whether cross-contamination is occurring during the sample collection and transport process.

#### **12.8** Field Duplicate Samples

The tables below list the duplicate soil samples collected with their corresponding primary samples.

Primary Sample	Sample Depth (m BGL)	Intra Duplicate	Inter Duplicate	Date Sampled
BH1	0.1-0.2	D1	SS1	31.7.2019
BH22	0.2-0.3	D2	SS2	30.7.2019
TP1	0.2-0.3	D3	SS3	24.7.2019

Table 13: Soil Field Duplicate Samples

Table 14: Groundwater Field Duplicate Samples

Primary Sample	Screen Zone	Intra Duplicate	Inter Duplicate	Date Sampled
	(m bgl)			
BH3/GW2	5.7-11.7	GWD1	GWSS1	8.8.2019

Field duplicate samples for soil were prepared in the field through the following process:

- A larger than normal quantity of soil is recovered from the sample location selected for duplication.
- Two Portions of the sub-sample are immediately transferred, one for an intralaboratory duplicate and another as a sample.
- Samples are placed into a labelled, laboratory supplied 250ml glass jar and sealed with an airtight, Teflon screw top lid. The fully filled jars are labelled as the sample and duplicate and immediately placed in a chilled esky.

Soil Intra-Laboratory duplicate samples were sent to Envirolab Pty Ltd while Inter-Laboratory duplicate samples were sent to ALS Environmental.

A summary of the test results with the Relative Percentage Difference (RPD) is presented in the following tables.

The comparisons between the duplicates and original samples indicate acceptable RPDs when they comply with criteria which are commonly set at:

- less than 30% for inorganics and 50% for organics
- greater than five (5) times the laboratory limit of recording (LOR)
- greater than 50% of the relevant health investigation level (HIL) concentration.

The tables, below, give details of intra laboratory and inter laboratory duplicates.

	BH1	ENVIROLAB	RELATIVE PERCENTAGE
ANALYTE	0.1-0.2	D1	DIFFERENCE
	ma/ka	ma/ka	%
HEAVY METALS			
Arsenic	<4	<4	-
Cadmium	<0.4	<0.4	-
Chromium	5	5	0
Copper	5	5	0
Lead	8	8	0
Mercury	0.1	<0.1	-
Nickel	3	3	0
Zinc	7	7	0
TRH			
C10-C14	<50	<50	-
C15-C28	<100	<100	-
C29-C36	<100	<100	-
BTEX			
Benzene	<0.2	<0.2	-
Toulene	<0.5	<0.5	-
Ethylbenzene	<1	<1	-
Xylenes - Total	<3	<3	-
POLYCYCLIC HYDROCARBONS (PAH)			
Benzo(a)pyrene	<0.05	<0.05	-
Total PAH	<0.05	<0.05	-
ORGANOCHLORINE PESTICIDES			
Heptachlor	<0.1	<0.1	-
Aldrin	<0.1	<0.1	-
Dieldrin	<0.1	<0.1	-
DDD	<0.1	<0.1	-
DDE	<0.1	<0.1	-
DDT	<0.1	<0.1	-
Chlordane (trans & cis)	<0.1	<0.1	-
POLYCHLORINATED BIPHENYLS			
Total PCB	<0.1	<0.1	-

# Table 15: Intra-lab Soil Sample D1 RPDs

	BH22	ENVIROLAB	RELATIVE PERCENTAGE
ANALYTE	0.2-0.3	D2	DIFFERENCE
	mg/kg	mg/kg	%
HEAVY METALS			
Arsenic	<4	<4	-
Cadmium	<0.4	<0.4	-
Chromium	11	12	9
Copper	16	17	6
Lead	6	5	18
Mercury	<0.1	<0.1	-
Nickel	8	10	22
Zinc	10	11	10
TRH			
C10-C14	<50	<50	-
C15-C28	<100	<100	-
C29-C36	<100	<100	-
BTEX			
Benzene	<0.2	<0.2	-
Toulene	<0.5	<0.5	-
Ethylbenzene	<1	<1	-
Xylenes - Total	<3	<3	-
POLYCYCLIC HYDROCARBONS (PAH)			
Benzo(a)pyrene	<0.05	<0.05	-
Total PAH	<0.05	<0.05	-
ORGANOCHLORINE PESTICIDES			
Heptachlor	<0.1	<0.1	-
Aldrin	<0.1	<0.1	-
Dieldrin	<0.1	<0.1	-
DDD	<0.1	<0.1	-
DDE	<0.1	<0.1	-
DDT	<0.1	<0.1	-
Chlordane (trans & cis)	<0.1	<0.1	-
POLYCHLORINATED BIPHENYLS			
Total PCB	<0.1	<0.1	-

# Table 16: Intra-lab Soil Sample D2 RPDs

	TP1	ENVIROLAB	RELATIVE PERCENTAGE
ANALYTE	0.2-0.3	D3	DIFFERENCE
	mg/kg	mg/kg	%
HEAVY METALS			
Arsenic	<4	<4	-
Cadmium	<0.4	<.4	-
Chromium	3	3	0
Copper	5	4	22
Lead	6	5	18
Mercury	<0.1	<0.1	-
Nickel	<1	<1	-
Zinc	6	5	18
TRH			
C10-C14	<50	<50	-
C15-C28	<100	<100	-
C29-C36	<100	<100	-
BTEX			
Benzene	<0.2	<0.2	-
Toulene	<0.5	<0.5	-
Ethylbenzene	<1	<1	-
Xylenes - Total	<3	<3	-
POLYCYCLIC HYDROCARBONS (PAH)			
Benzo(a)pyrene	<0.05	<0.05	-
Total PAH	<0.05	<0.05	-
ORGANOCHLORINE PESTICIDES			
Heptachlor	<0.1	<0.1	-
Aldrin	<0.1	<0.1	-
Dieldrin	<0.1	<0.1	-
DDD	<0.1	<0.1	-
DDE	<0.1	<0.1	-
DDT	<0.1	<0.1	-
Chlordane (trans & cis)	<0.1	<0.1	-
POLYCHLORINATED BIPHENYLS			
Total PCB	<0.1	<0.1	-

# Table 17: Intra-lab Soil Sample D3 RPDs

ANALYTE	Envirolab GW2 ug/l	DUPLICATE GWD1 ug/l	RELATIVE PERCENTAGE DIFFERENCE %
HEAVY METALS			
Arsenic	<1	<1	-
Cadmium	<0.1	<0.1	-
Chromium	<1	<1	-
Copper	<1	<1	-
Lead	<1	<1	-
Mercury	<0.05	<0.05	-
Nickel	2	2	0
Zinc	12	12	0
TRH			
C6-C10 (F1)	<10	<10	-
C10-C16 (F2)	<50	<50	-
BTEX			
Benzene	<1	<1	-
Toulene	<1	<1	-
Ethylbenzene	<1	<1	-
Xylenes - Total	<2	<2	-
POLYCYCLIC HYDROCARBONS (PAH)			
Benzo(a)pyrene	<0.1	<0.1	-
Naphthalene	<0.2	<0.2	-
Phenol			
Total Phenol	<0.05	< 0.05	-

# Table 18: Intra-lab Groundwater Sample GWD1 RPDs

The comparisons between the intra-laboratory duplicates and corresponding original samples for soil and groundwater indicated acceptable RPD.

	BH1	ALS	RELATIVE PERCENTAGE
ANALYTE	0.1-0.2	SS1	DIFFERENCE
	mg/kg	mg/kg	%
HEAVY METALS			
Arsenic	<4	<5	-
Cadmium	<0.4	<1	-
Chromium	5	6	18
Copper	5	6	18
Lead	8	9	12
Mercury	0.1	<0.1	-
Nickel	3	2	40
Zinc	7	<5	-
TRH			
C10-C14	<50	<50	-
C15-C28	<100	<100	-
C29-C36	<100	<100	-
втех			
Benzene	<0.2	<0.2	-
Toulene	<0.5	<0.5	-
Ethylbenzene	<1	<0.5	-
Xylenes - Total	<3	<0.2	-
POLYCYCLIC HYDROCARBONS (PAH)			
Benzo(a)pyrene	<0.05	<0.5	-
Total PAH	<0.05	<0.5	-
ORGANOCHLORINE PESTICIDES			
Heptachlor	<0.1	<0.1	-
Aldrin	<0.1	<0.1	-
Dieldrin	<0.1	<0.1	-
DDD	<0.1	<0.1	-
DDE	<0.1	<0.1	-
DDT	<0.1	<0.1	-
Chlordane (trans & cis)	<0.1	<0.1	-
POLYCHLORINATED BIPHENYLS			
Total PCB	<0.1	<0.1	-

# Table 19: Inter-lab Soil Sample SS1 RPDs

	BH22	ALS	RELATIVE PERCENTAGE
ANALYTE	0.2-0.3	SS2	DIFFERENCE
	mg/kg	mg/kg	%
HEAVY METALS			
Arsenic	<4	<5	-
Cadmium	<0.4	<1	-
Chromium	11	7	44
Copper	16	17	6
Lead	6	5	18
Mercury	<0.1	<0.1	-
Nickel	8	7	13
Zinc	10	66	147
TRH			
C10-C14	<50	<50	-
C15-C28	<100	<100	-
C29-C36	<100	<100	-
втех			
Benzene	<0.2	<0.2	-
Toulene	<0.5	<0.5	-
Ethylbenzene	<1	<0.5	-
Xylenes - Total	<3	<0.5	-
POLYCYCLIC HYDROCARBONS (PAH)			
Benzo(a)pyrene	<0.05	<0.5	-
Total PAH	<0.05	<0.5	-
ORGANOCHLORINE PESTICIDES			
Heptachlor	<0.1	<0.1	-
Aldrin	<0.1	<0.1	-
Dieldrin	<0.1	<0.1	-
DDD	<0.1	<0.1	-
DDE	<0.1	<0.1	-
DDT	<0.1	<0.1	-
Chlordane (trans & cis)	<0.1	<0.1	-
POLYCHLORINATED BIPHENYLS			
Total PCB	<0.1	<0.1	-

# Table 20: Inter-lab Soil Sample SS2 RPDs

	TP1	ALS	RELATIVE PERCENTAGE
ANALYTE	0.2-0.3	SS3	DIFFERENCE
	mg/kg	mg/kg	%
HEAVY METALS			
Arsenic	<4	<5	-
Cadmium	<0.4	<1	-
Chromium	3	2	40
Copper	5	<5	-
Lead	6	5	18
Mercury	<0.1	<0.1	-
Nickel	<1	<2	-
Zinc	6	<5	-
TRH			
C10-C14	<50	<50	-
C15-C28	<100	<100	-
C29-C36	<100	<100	-
BTEX			
Benzene	<0.2	<0.2	-
Toulene	<0.5	<0.5	-
Ethylbenzene	<1	<0.5	-
Xylenes - Total	<3	<0.5	-
POLYCYCLIC HYDROCARBONS (PAH)			
Benzo(a)pyrene	<0.05	<0.5	-
Total PAH	<0.05	<0.5	-
ORGANOCHLORINE PESTICIDES			
Heptachlor	<0.1	<0.1	-
Aldrin	<0.1	<0.1	-
Dieldrin	<0.1	<0.1	-
DDD	<0.1	<0.1	-
DDE	<0.1	<0.1	-
DDT	<0.1	<0.1	-
Chlordane (trans & cis)	<0.1	<0.1	-
POLYCHLORINATED BIPHENYLS			
Total PCB	<0.1	<0.1	-

# Table 21: Inter-lab Soil Sample SS3 RPDs

	Envirolab	ALS	RELATIVE PERCENTAGE
ANALYTE	GW2	GWSS1	DIFFERENCE
	ug/l	ug/l	%
HEAVY METALS			
Arsenic	<1	<1	-
Cadmium	<0.1	<0.1	-
Chromium	<1	<1	-
Copper	<1	<1	-
Lead	<1	<1	-
Mercury	<0.05	<0.1	-
Nickel	2	2	0
Zinc	12	13	8
TRH			
C6-C10 (F1)	<10	<20	-
C10-C16 (F2)	<50	<100	-
ВТЕХ			
Benzene	<1	<1	-
Toulene	<1	<2	-
Ethylbenzene	<1	<2	-
Xylenes - Total	<2	<2	-
POLYCYCLIC HYDROCARBONS (PAH)			
Benzo(a)pyrene	<0.1	<0.1	-
Naphthalene	<0.2	<0.1	-
voc			
Chloroform	<0.05	<0.05	-

## Table 22: Inter-lab Groundwater Sample GWSS1 RPDs

The comparisons between the inter-laboratory duplicates and corresponding original samples for soil and groundwater indicated generally acceptable RPD overall, with the exception of the concentration of zinc for soil SS2 which exceeded the DQOs for this project, however these exceedances are not considered significant because they are most likely due to the heterogeneity of the sample or low concentrations within the sample.

Field duplicates provide an indication of the whole investigation process, including the sampling process, sample preparation and analysis. The accuracy of the data is

considered to be adequate due to the effect on confidence intervals with low concentrations in the samples and their duplicates.

#### 12.9 Trip Spike and Trip Blank Results

Trip Spike samples were obtained from the laboratory prior to conducting field sampling where volatile substances are suspected. Trip spike and trip blank samples were collected to assess the effect of sample handling on volatile concentrations in the samples collected and the results are listed in the tables below:

ANALYTE	TS1 Trip Spike % Soil (mg/kg) 24.7.2019	ANALYTE	TS Trip Spike % Soil (mg/kg) 23.08.2019
BTEX		BTEX	
Benzene	96%	Benzene	87%
Toluene	103%	Toluene	89%
Ethyl Benzene	99%	Ethyl Benzene	107%
O-Xylenes	100%	O-Xylenes	108%
M & P Xylenes	100%	M & P Xylenes	108%
ANALYTE	TS2 Trip Spike % Soil (mg/kg) 30.7.2019	ANALYTE	TS3 Trip Spike % Soil (mg/kg) 31.7.2019
ANALYTE	TS2 Trip Spike % Soil (mg/kg) 30.7.2019	ANALYTE	TS3 Trip Spike % Soil (mg/kg) 31.7.2019
ANALYTE BTEX Benzene	<b>TS2 Trip Spike %</b> Soil (mg/kg) 30.7.2019 79%	ANALYTE BTEX Benzene	TS3 Trip Spike %   Soil   (mg/kg)   31.7.2019   95%
ANALYTE BTEX Benzene Toluene	TS2 Trip Spike %   Soil   (mg/kg)   30.7.2019   79%   86%	ANALYTE BTEX Benzene Toluene	TS3 Trip Spike %   Soil   (mg/kg)   31.7.2019   95%   91%
ANALYTE BTEX Benzene Toluene Ethyl Benzene	TS2 Trip Spike %   Soil   (mg/kg)   30.7.2019   79%   86%   76%	ANALYTE BTEX Benzene Toluene Ethyl Benzene	TS3 Trip Spike %   Soil   (mg/kg)   31.7.2019   95%   91%   91%
ANALYTE BTEX Benzene Toluene Ethyl Benzene O-Xylenes	TS2 Trip Spike %   Soil   (mg/kg)   30.7.2019   79%   86%   76%   73%	ANALYTE BTEX Benzene Toluene Ethyl Benzene O-Xylenes	TS3 Trip Spike %   Soil   (mg/kg)   31.7.2019   95%   91%   91%   90%

## Table 23: Trip Spike

ANALYTE	TS1 Trip Spike % water (ug/L) 8.8.2019		
BTEX			
Benzene	118%		
Toluene	112%		
Ethyl Benzene	107%		
O-Xylenes	109%		
M & P Xylenes	104%		

Results discussed in Section 12.11

ANALYTE	Trip Blank Soil (TB1) mg/kg	ANALYTE	Trip Blank Soil (TB) mg/kg
	24.7.2019		23.08.2019
TRH		TRH	
C6-C10	<25	C6-C10	<25
BTEX		втех	
Naphthalene	<1	Naphthalene	<1
Benzene	<02	Benzene	<0.2
Toluene	<0.5	Toluene	<.5
Ethyl Benzene	<1	Ethyl Benzene	<1
Total Xylenes	<3	Total Xylenes	<3
ANALYTE	Trip Blank Soil (TB2) mg/kg 30.7.2019	ANALYTE	Trip Blank Soil (TB3) mg/kg 31.7.2019
TRH		TRH	
C6-C10	<25	C6-C10	<25
BTEX		BTEX	
Naphthalene	<1	Naphthalene	<1
Benzene	<0.2	Benzene	<0.2
Toluene	<.5	Toluene	<.5
Ethyl Benzene	<1	Ethyl Benzene	<1
Total Xylenes	<3	Total Xylenes	<3

## Table 24: Trip Blank

ANALYTE	Trip Blank Water (TB1) ug/L 8.8.2019
TRH	
C6-C10	<10
BTEX	
Naphthalene	<1
Benzene	<1
Toluene	<1
Ethyl Benzene	<1
Total Xylenes	<2

Results discussed in Section 12.11

#### 12.10 Laboratory QA/QC

The integrity of analytical data provides the second step in the QA/QC process for total data compliance. The data validation techniques adopted by Benviron Group are based upon techniques published by the US EPA and in line with methods and guidelines adopted by the NSW EPA and outlined in the NEPM, 2013.

Descriptions are provided of the specific mechanisms used in the assessment of accuracy, precision and useability of analytical data within the project.

Refer to **Appendix H**- NATA Laboratory Test Results.

# 12.11 QA/QC Results

The QA/QC results for soil collected at the site are summarised in the table below:

## Table 25: QA/QC Results Summary

Data Quality Indicator	Results	DQI Met
Completeness		
Soil & Groundwater		
Data from critical samples is considered	Data is considered valid	Yes
valid		
Satisfactory frequency / result for QC	The QC results are considered adequate	Yes
samples	for the purpose of the investigation	
Field documentation completed	Field records are complete	Yes
Boreholes logs & COCs completed and	Logs, COCs and holding times have been	Yes
holding times complied with	completed and complied with	
Comparability		
Soil & Groundwater		
Standard operating procedures used	Yes	Yes
Consistent field conditions, sampling	Sampling was conducted by one Benviron	Yes
staff and laboratory analysis	Group scientist operating under the	
	SOPs. The laboratories remained	
	consistent throughout the investigation	
Same analytical methods used	All analytical methods used between	Yes
	laboratories were based on the	
	USEPA/APHA methods	
Limit of reporting appropriate and	The LORs were the same within each	Yes
consistent	laboratory but differed between the	
	primary and secondary laboratories. The	
	LORs were considered appropriate based	
	on the results.	

Data Quality Indicator	Results	DQI Met
Representativeness		
Soil & Groundwater		
Sampling appropriate for media and	All sampling was conducted in	Yes
analytes	accordance with Benviron Group SOPs.	
Samples adequately preserved	The majority of samples collected were	Yes
	received by laboratories at the correct	
	temperature. Where relevant, samples	
	were stored in acid-preserved containers	
	supplied by laboratories.	
Precision		
Soil & Groundwater		
SOPs appropriate and complied with in	The recovery of field duplicates was	Yes
relation to field duplicates	conducted in accordance with Benviron	
	Group SOPs s to allow for the assessment	
	of field precision.	
RPDs of the field duplicates within	An RPD of >50% was identified in one	Partial
control limits	split sample analysed for zinc and was	
	likely due to the heterogeneity of the	
	sample and/or the low concentrations in	
	the sample. Given that the majority of	
	RPDs for the remaining analytes were	
	<50%, the data set was considered to be	
	adequately precise.	
RPDs of the laboratory duplicates	The RPDs of the laboratory duplicates	Yes
within control limits	were within the control limits.	

Data Quality Indicator	Results	DQI Met
Accuracy		
Soil & Groundwater		
SOPs appropriate and complied with in	Yes	Yes
relation to field blanks		
Rinsate Blanks, trip blanks & laboratory	Laboratory blanks & trip blanks were free	Yes
blanks free of contaminants	of contaminants.	
Surrogate spikes within control limits	Yes	Yes
Laboratory control spikes within control	Laboratory Control Spike recoveries were	Yes
limits	within control limits	
Matrix Spike recoveries within control	Matrix spike recoveries were within	Partial
limits	control limits with the exception of	
	laboratory certificate ES1925239 for the	
	water matrix. Matrix spike recoveries	
	were less than lower control limit for	
	copper in sample ES192521101 /	
	GWSS1. This was considered a minor	
	non-conformance.	
Trip spike recoveries within control	Yes	Yes
limits		

## 12.12 QA/QC Evaluation / Conclusion

In summary, the findings of the QA/QC evaluation indicated the following:

- Data Completeness The data set is considered complete.
- Data Comparability The data set is considered comparable.
- Data Representativeness The data set is considered representable.
- Data Precision The following non-conformance was identified with regards to data precision:

- An RPD of >50% was identified in one split sample analysed for zinc and was likely due to the heterogeneity of the sample and/or the low concentrations in the sample. Given that the majority of RPDs for the remaining analytes were <50%, the data set was considered to be adequately precise.
- Data Accuracy The following non-conformance was identified with regards to data accuracy:
  - Matrix spike recoveries were within control limits with the exception of laboratory certificate ES1925239 for the water matrix. Matrix spike recoveries were less than lower control limit for copper in sample ES1925211--01 / GWSS1. This was considered a non-conformance.

It is therefore considered that the data is sufficiently reliable and that the results can be used for the purpose of this project.

## **13.0 SITE ASSESSMENT CRITERIA**

#### 13.1 SOILS

## 13.1.1 Health Investigation Levels (HILs)

To assess the contamination status of soils at a site, the NSW EPA refers to the document entitled National Environmental Protection (Assessment of Site Contamination) Measure (NEPM) (Amendment 2013).

The site is currently occupied by one rural residential property in the northwestern corner, four small greenhouse structures located along the eastern boundary, one large greenhouse structure along Gugandi Road on the eastern boundary, the remainder of the site is covered with trees, grasses and driveway /pathways. The site is proposed to be subdivided into multiple residential lots including landscaping areas including common gardens & a recreation / gathering area and new roads. The site is proposed to be subdivided into multiple residential lots including landscaping areas & new roads.

The site will be assessed against the NEPM exposure scenario 'Residential A' Health Investigation Levels of the above-mentioned guidelines and specifically refers to the following:

HIL 'A' Residential with garden / accessible soil (home grown produce <10% fruit and vegetable intake (no poultry), also includes childcare centres, preschools and primary schools.

The soil regulatory guidelines are presented in the table below.

# Table 26: Health Investigation Levels (HIL) Criteria for Soil Contaminants

simple sustainable solutions	Residential A	Reference
Heavy Metals		
Arsenic	100	NEPM 2013 - Table 1(A)1 HILs
Beryllium	60	NEPM 2013 - Table 1(A)1 HILs
Boron	4500	NEPM 2013 - Table 1(A)1 HILs
Cadmium	20	NEPM 2013 - Table 1(A)1 HILs
Chromium (VI)	100	NEPM 2013 - Table 1(A)1 HILs
Cobalt	100	NEPM 2013 - Table 1(A)1 HILs
Copper	6000	NEPM 2013 - Table 1(A)1 HILs
Lead	300	NEPM 2013 - Table 1(A)1 HILs
Manganese	3800	NEPM 2013 - Table 1(A)1 HILs
Mercury (Inorganic)	40	NEPM 2013 - Table 1(A)1 HILs
Methyl Mercury	10	NEPM 2013 - Table 1(A)1 HILs
Nickel	400	NEPM 2013 - Table 1(A)1 HILs
Selenium	200	NEPM 2013 - Table 1(A)1 HILs
Zinc	7400	NEPM 2013 - Table 1(A)1 HILs
Cyanide (Free)	250	NEPM 2013 - Table 1(A)1 HILs
Polycyclic Aromatic Hydrocarbor	ns (PAHs)	
Carcinogenic PAHs (as Bap TEQ)	3	NEPM 2013 - Table 1(A)1 HILs
Total PAHs	300	NEPM 2013 - Table 1(A)1 HILs
Organochlorine Pesticides		
DDT + DDE + DDD	240	NEPM 2013 - Table 1(A)1 HILs
Aldrin + Dieldrin	6	NEPM 2013 - Table 1(A)1 HILs
Chlordane	50	NEPM 2013 - Table 1(A)1 HILs
Endosulfan	270	NEPM 2013 - Table 1(A)1 HILs
Heptachlor	6	NEPM 2013 - Table 1(A)1 HILs
нсв	10	NEPM 2013 - Table 1(A)1 HILs
Phenols	-	
Phenols	3000	NEPM 2013 - Table 1(A)1 HILs
Pentachlorophenol	100	NEPM 2013 - Table 1(A)1 HILs
Cresols	400	NEPM 2013 - Table 1(A)1 HILs
Polychlorinated Biphenyls (PCBs	)	
PCBs	1	NEPM 2013 - Table 1(A)1 HILs
Other Pesticides		
Atrazine	320	NEPM 2013 - Table 1(A)1 HILs
Chlorpyrifos	160	NEPM 2013 - Table 1(A)1 HILs
Bifenthrin	600	NEPM 2013 - Table 1(A)1 HILs
Herbicides		
2.4.5-T	600	NEPM 2013 - Table 1(A)1 HILs
2.4-D	900	NEPM 2013 - Table 1(A)1 Hills
MCPA	600	NEPM 2013 - Table 1(A)1 HII s
МСРВ	600	NEPM 2013 - Table 1(A)1 Hills
Mecoprop	600	NEPM 2013 - Table 1(A)1 Hills
Picloram	4500	NEPM 2013 - Table 1(A)1 Hills
Other Organics	1000	
PDBE (Br1-Br9)	1	NEPM 2013 - Table 1(A)1 Hills

Note - All values are in mg/kg

## **13.1.2** Health Screening Levels (HSLs)

The HSLs are applicable to generic land uses such as residential, commercial/industrial or recreational/public open space and different soil types between the ground surface and soils >4 metres below ground level. The HILs have been applied to assess human health risks via the inhalation and direct contact pathways of exposure.

It should be noted that HSL D can be used in lieu of HSL B for buildings that comprise car parks or commercial properties on the ground floor.

For assessing TRH and BTEX contamination at sites used for sensitive land use, such as residential, the NEPM refers to the Health Screening Levels (HSLs) "HSL A and HSLB".

For selection of the health screening criteria an assessment of the in-situ soil profile should be undertaken. The soil profile consisted of predominantly Silty, Sand & Clay.

Benviron « group»	HSL A & HSL B	HSLA& HSLB	HSL A & HSL B	HSL A & HSL B	Soil Saturation Concentration (Csat)	Reference
		1111 to <2111	2m to <4m	4111+		
CLAY	490	NI	NII	NI	620	NERM 2013 Table 1(A) 2 HSL
Ethylbonzono	400 NI				69	NEPM 2013 - Table $I(A)$ 3 HSLs
	110	1NL 210			220	NEPM 2013 - Table $I(A)$ 3 HSLs
Norhtholono	- 110 - E	510			10	NEDM 2013 - Table 1(A) 3 HSLS
Reprinaiene	5				10	NEPM 2013 - Table 1(A) 3 HSLS
	0.7	1	2	200	430	NEPM 2013 - Table 1(A) 3 HSLS
	50	90	150	290	850	NEPM 2013 - Table 1(A) 3 HSLS
FZ CAND	280	NL	NL	NL	560	NEPM 2013 - Table 1(A) 3 HSLs
SAND	100	000	240	E 40	500	
Toluene	160	220	310	540	560	
Ethylbenzene	55	NL	NL	NL 170	64	NEPM 2013 - Table 1(A) 3 HSLs
xylenes	40	60	95	170	300	NEPM 2013 - Table 1(A) 3 HSLs
Naphthalene	3	NL	NL	NL	9	NEPM 2013 - Table 1(A) 3 HSLs
Benzene	0.5	0.5	0.5	0.5	360	NEPM 2013 - Table 1(A) 3 HSLs
F1	45	70	110	200	950	NEPM 2013 - Table 1(A) 3 HSLs
F2	110	240	440	NL	560	NEPM 2013 - Table 1(A) 3 HSLs
SILT						
Toluene	390	NL	NL	NL	640	NEPM 2013 - Table 1(A) 3 HSLs
Ethylbenzene	NL	NL	NL	NL	69	NEPM 2013 - Table 1(A) 3 HSLs
Xylenes	95	210	NL	NL	350	NEPM 2013 - Table 1(A) 3 HSLs
Naphthalene	4	NL	NL	NL	10	NEPM 2013 - Table 1(A) 3 HSLs
Benzene	0.6	0.7	1	2	440	NEPM 2013 - Table 1(A) 3 HSLs

100

NL

910

570

NEPM 2013 - Table 1(A) 3 HSLs

NEPM 2013 - Table 1(A) 3 HSLs

## Table 27: Health Screening Levels (HSL) Criteria

Note - All values are in mg/kg

100

NL

65

NL

40

230

## 13.1.3 (EILs) and (ESLs)

F1

F2

#### Ecological Investigation Levels (EILs) -

The NEPM 2013 states that "Ecological investigation levels (EILs) for the protection of terrestrial ecosystems have been derived for common contaminants in soil based on a species sensitivity distribution (SSD) model developed for Australian conditions. EILs have been derived for As, Cu, CrIII, DDT, naphthalene, Ni, Pb and Zn

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Insufficient data was available to derive ACLs for arsenic (As), DDT, lead (Pb) and naphthalene. As a result, the derived EILs are generic to all soils and are presented as total soil contaminant concentrations in Tables 1B (4) and 1B (5) within the NEPM 2013.

For the purposes of EIL derivation, a contaminant incorporated in soil for at least two years is considered to be aged for the purpose of EIL derivation. The majority of contaminated sites are likely to be affected by aged contamination. Fresh contamination is usually associated with current industrial activity and chemical spills".

The following process describes the method for calculation of site specific EILs.

# A. EILs for Ni, Cr III, Cu, Zn and Pb aged contamination (>2 years)

Steps 1–4 below describe the process for deriving site-specific EILs for the above elements using Tables 1B (1) – 1B (4), which can be found at the end of the NEPM 2013.

- Measure or analyse the soil properties relevant to the potential contaminant of concern (pH, CEC, organic carbon, clay content). Sufficient samples need to be taken for these determinations to obtain representative values for each soil type in which the contaminant occurs.
- Establish the sample ACL for the appropriate land use and with consideration of the soil-specific pH, clay content or CEC. The ACL for Cu may be determined by pH or CEC and the lower of the determined values should be selected for EIL calculation. Note that the ACL for Pb is taken directly from Table 1(B) 4.
- 3. Calculate the contaminant ABC in soil for the particular contaminant and location from a suitable reference site measurement or other appropriate method.

4. Calculate the EIL by summing the ACL and ABC:

$$EIL = ABC + ACL$$

#### B. EILs for As, DDT and naphthalene

EILs for aged contamination for DDT and naphthalene are not available and the adopted EIL is based on fresh contamination taken directly from Table 1B (5). The EILs for As, DDT and naphthalene are generic i.e. they are not dependent on soil type and are taken directly from Table 1B (5). Only EILs for fresh contamination are available for As, DDT and naphthalene due to the absence of suitable data for aged contaminants.

#### Ecological Screening Levels (ESLs) -

Ecological screening levels (ESLs) are presented based on a review of Canadian guidance for petroleum hydrocarbons in soil and application of the Australian methodology (Schedule B5b) to derive Tier 1 ESLs for BTEX, benzo(a)pyrene and F1 and F2 (Warne 2010a, 2010b)

The Canadian Council of the Ministers of the Environment (CCME) has adopted riskbased TPH standards for human health and ecological aspects for various land uses in the *Canada-wide standard for petroleum hydrocarbons (PHC) in soil* (CCME 2008) (CWS PHC). The standards established soil values including ecologically based criteria for sites affected by TPH contamination for coarse- and fine-grained soil types.

# Table 28: Ecological Investigation Levels (EIL) and Ecological Screening Levels (ESL)

**Criteria** 

Environ &	Contaminant Age/Soil Texture Age/Soil Age/Soil Conservation value		Urban residential and open public spaces	Commercial and industrial	Reference				
		Ecological Inv	estigation Levels (El	Ls)					
Heavy Metals									
Arsenic	Fresh	20	50	80	NEPM 2013 - Table 1(B) 1-5 EILs				
	Aged	40	100	160	NEPM 2013 - Table 1(B) 1-5 EILs				
Chromium (III)	Fresh Aged	Site Speci	fic Calculation Requ	ired	NEPM 2013 - Table 1(B) 1-5 EILs NEPM 2013 - Table 1(B) 1-5 EILs				
Copper	Fresh Aged	Site Speci	fic Calculation Requ	ired	NEPM 2013 - Table 1(B) 1-5 EILs NEPM 2013 - Table 1(B) 1-5 EILs				
Lead	Fresh	110	270	440	NEPM 2013 - Table 1(B) 1-5 EILs				
	Aged	470	1100	1800	NEPM 2013 - Table 1(B) 1-5 EILs				
Nickel	Fresh	Site Speci	fic Calculation Regu	ired	NEPM 2013 - Table 1(B) 1-5 EILs				
	Aged	one opeci	ne calculation requ	lieu	NEPM 2013 - Table 1(B) 1-5 EILs				
Zinc	Fresh Aged	Site Speci	fic Calculation Requ	ired	NEPM 2013 - Table 1(B) 1-5 EILs NEPM 2013 - Table 1(B) 1-5 EILs				
Polycyclic Aromatic Hyd	rocarbons (P	AHs)							
Naphthalene	Fresh	10	170	370	NEPM 2013 - Table 1(B) 1-5 EILs				
	Aged	10	170	370	NEPM 2013 - Table 1(B) 1-5 EILs				
Organochlorine Pesticid	es								
DDT	Fresh	3	180	640	NEPM 2013 - Table 1(B) 1-5 EILs				
	Aged	3	180	640	NEPM 2013 - Table 1(B) 1-5 EILs				
	ECC	logical Screening Leve	eis (ESLS) and Mar	agement Limits	NEDM 2012 Table 1/D) 6 7 Ellio				
$FT(C_6-C_{10})$	Eino	105*	180*	215*	NEPM 2013 - Table 1(B) 6-7 EILS				
	Cooreo	125	700	215	NEPM 2013 - Table 1(B) 6-7 EILs				
(Management / imite)	Eino		700	700	NEPM 2013 - Table 1(B) 6-7 EILS				
	Cooreo	-	800	800	NEPM 2013 - Table 1(B) 6-7 EILs				
F2 (-0 <sub>10</sub> -0 <sub>16</sub> )	Fine	25* 120* 170*		NEPM 2013 - Table 1(B) 6-7 EILs NEPM 2013 - Table 1(B) 6-7 EILs					
F2 (>C <sub>10</sub> -C <sub>16</sub> )	Coarse		1000	1000	NEPM 2013 - Table 1(B) 6-7 EILs				
(Management Limits)	Fine	-	1000	1000	NEPM 2013 - Table 1(B) 6-7 EILs				
F3 (>C <sub>16</sub> -C <sub>34</sub> )	Coarse	-	300	1700	NEPM 2013 - Table 1(B) 6-7 EILs				
	Fine	-	1300	2500	NEPM 2013 - Table 1(B) 6-7 EILs				
F3 (>C <sub>16</sub> -C <sub>34</sub> )	Coarse		2500	3500	NEPM 2013 - Table 1(B) 6-7 EILs				
(Management Limits)	Fine	-	3500	5000	NEPM 2013 - Table 1(B) 6-7 EILs				
F4 (>C <sub>34</sub> -C <sub>40</sub> )	Coarse	-	2800	3300	NEPM 2013 - Table 1(B) 6-7 EILs				
	Fine	-	5600	6600	NEPM 2013 - Table 1(B) 6-7 EILs				
F4 (>C <sub>34</sub> -C <sub>40</sub> )	Coarse		10000	10000	NEPM 2013 - Table 1(B) 6-7 EILs				
(Management Limits)	Fine	-	10000	10000	NEPM 2013 - Table 1(B) 6-7 EILs				
Benzene	Coarse	10	50	75	NEPM 2013 - Table 1(B) 6-7 EILs				
	Fine	10	65	95	NEPM 2013 - Table 1(B) 6-7 EILs				
Toluene	Coarse	10	85	135	NEPM 2013 - Table 1(B) 6-7 EILs				
	Fine	65	105	135	NEPM 2013 - Table 1(B) 6-7 ElLs				
Ethylbenzene	Coarse	1.5	70	165	NEPM 2013 - Table 1(B) 6-7 ElLs				
Vulanaa	Fine	40	125	100	NEPN 2013 - Table 1(B) 0-7 EILS				
Aylenes	Fine	10	105	95	NEPM 2013 - Table 1(B) 6-7 ElLs				
Benzo(a)pyrepo	Coareo	0.7	45	0.7	NEPM 2013 - Table 1(B) 6-7 EILS				
Denzo(a)pyrene	Fine	0.7	0.7	0.7	NEPM 2013 - Table 1(B) 6-7 FILS				
M - 4		0.1	0.1	0.1					

1

2

3 4

5

6

7

8

9

Urban residential/public open space is broadly equivalent to the HIL-A, HIL-B and HIL-C land use scenarios in Table 1A(1) Footnote 1 and as described in Schedule B7.

Aged values are applicable to arsenic contamination present in soil for at least two years. For fresh contamination refer to Schedule B5c.

Insufficient data was available to calculate aged values for DDT and naphthalene, consequently the values for fresh contamination should be used.

Insufficient data was available to calculate ACLs for As, DDT and naphthalene. The EIL should be taken directly from Table 1B(5).

ESLs are of low reliability except where indicated by \* which indicates that the ESL is of moderate reliability.

'-' indicates that insufficient data was available to derive a value.

To obtain F1, subtract the sum of BTEX concentrations from C6-C10 fraction and subtract naphthalene from >C10-C16 to obtain F2.

Management limits are applied after consideration of relevant ESLs and HSLs

Separate management limits for BTEX and naphthalene are not available hence these should not be subtracted from the relevant fractions to obtain F1 and F2.

## 13.2 Asbestos

Health screening for asbestos in soil, which are based on scenario-specific likely exposure levels, are adopted from the WA DoH guidelines and are referred in Table 7 in Schedule B1. The following health screening levels for asbestos can be seen below:

	Health Screening Levels (w/w)							
Form of Asbestos	Residential A Residential B Recreational C Commercial/Industrial I							
Bonded ACM	0.01%	0.04%	0.02%	0.05%				
FA and AF (Friable		0.001%						
Asbestos)	0.00176							
All forms of		No visible ashestes for surface soil						
asbestos	No visible asbestos for surface soil							

#### Table 29: Health Screening Levels for Asbestos

## **13.3** Aesthetic Considerations

Schedule B1 in NEPC (2013) requires the consideration of aesthetic issues arising from soils and groundwater within the site. The following assessment criteria were adopted when considering aesthetics:

- no persistently malodourous soils or extracted groundwater;
- no persistent hydrocarbon sheen on surface water;
- no staining or discolouration in soils, taking into consideration the natural state of the soil; and
- no large or frequently occurring anthropogenic materials present (to the extent practicable).

## 13.4 Groundwater

The NSW DECC has endorsed the use of the Groundwater Investigation Levels (GILs) given in the 1999 NEPM 'Schedule B(1) Guideline on the Investigation Levels for Soil and Groundwater' (Amendment 2013) and the water quality trigger levels given in the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC & ARMCANZ, 2000). These Guidelines provide criteria for:

• Aquatic ecosystems – both marine and fresh waters

The NEPM advises that 'when assessing groundwater contamination, the GILs are to be applied at the point of extraction and as response levels at the point of use, or where there is a likelihood of an adverse environmental effect at the point of discharge'.

For assessing groundwater quality, it is first necessary to assess the potential uses of groundwater downgradient of the site being assessed.

Potential uses of groundwater downgradient of the site include:

- Discharge to water bodies sustaining aquatic ecosystems particularly Fresh Water.
- Extraction of groundwater by local users.

The threshold concentrations presented in the ANZECC (2000) Fresh and Marine Waters Quality Guidelines are considered applicable for the protection of aquatic ecosystems of the receiving waters. As these guidelines apply to receiving waters, it is generally conservative to apply these to groundwater discharging to receiving waters. It is important to note that these are not threshold values at which an environmental problem is likely to occur if exceeded, rather, if the trigger values are exceeded, then further action is required which may include either further site-specific investigations to assess whether or not there is an actual problem or management / remedial action should be undertaken.

It is considered that *Fresh water trigger* values are applicable for investigating chemical concentrations in groundwater at the site. The nearest watercourse is Narara Creek, a tributary / drainage line connect to Narara Creek is located approximate 100m to the east of the site. It is understood that the NSW EPA policy is that the trigger values for the protection of 95% of aquatic ecosystems should be used as groundwater assessment criteria when considering moderately or highly disturbed receiving environments. The receiving waters for groundwater at the site are considered to be moderately disturbed ecosystems and the ANZECC (2000) 95% protection values are therefore considered appropriate groundwater assessment criteria for the site.

# 14.0 RESULTS

#### SOIL

The laboratory certificates are presented in **Appendix H** – NATA Accredited Laboratory Certificates.

A summary of the results together with the assessment criteria adopted are provided in **Appendix K** – Summary Tables.

#### 14.1 HEAVY METALS

#### 14.1.1 Heath Investigation Levels

As indicated in Table K1 all the heavy metals were below the respective LOR and/or the Health Investigation Level (HIL) for a residential development, that being the HIL 'A'.

## 14.1.2 Ecological Investigation Levels

The EILs for Copper, Zinc, Lead, Nickel and Chromium III were derived by adding the Ambient Background Concentration (ABC) to the Added Contaminant Limits (ACL), as per the following formula:

EIL = ABC + ACL

The ABC for the site has been determined by recovering a sample from an appropriate reference point, that being:

- BH7 (0.2-0.3m)
- BH7 (0.6-0.7m)
- BH30 (0.2-0.3m)
- BH30 (0.6-0.7m)

The soil samples collected from BH7 & BH30 were analysed for pH, CEC & %CLAY to provide the background parameters for the soil on the site. The more conservative background parameter from BH30 were adopted as the EIL criteria.

As shown in Table K1 all of the locations were below the site derived EILs.

## 14.2 TRH, BTEX, NAPHTHALENE &/OR BENZO (A) PYRENE

## 14.2.1 Heath Screening Levels & Management Limits

As indicated in Table K1, the F1 ( $C_6$ - $C_{10}$ ), F2 (> $C_{10}$ - $C_{16}$ ), benzene, toluene, ethyl benzene, xylenes and naphthalene concentrations were below the HSL 'A' & HSL 'B' for a Clay, Silt & Sand soil profile with a source depth of "Om to <1m" & "1m to <2m".

As shown in Table K1, the F1 ( $C_6$ - $C_{10}$ ), F2 (> $C_{10}$ - $C_{16}$ ), F3 ( $C_{16}$ - $C_{34}$ ), F4 ( $C_{34}$ - $C_{40}$ ), concentrations were below the Management Limits for a fine & coarse-grained soil texture in a "residential parkland and public open space".

#### 14.2.2 Ecological Screening Levels

As indicated in Table K1, the F1 ( $C_6$ - $C_{10}$ ), F2 (> $C_{10}$ - $C_{16}$ ), F3 ( $C_{16}$ - $C_{34}$ ), F4 ( $C_{34}$ - $C_{40}$ ), benzene, toluene, ethyl benzene, xylenes and benzo(a)pyrene concentrations were below the ESL for a fine & coarse grained soil texture in an "urban residential and public open space".

#### 14.3 PAH, OCP, OPP & PCB

#### 14.3.1 Heath Investigation Levels

As indicated in Table K1, the concentrations of the benzo(a)pyrene (as TEQ), PAH, OCP, OPP & PCB were below the Health Investigation Level (HIL) for a residential development, that being the HIL 'A' and/or the limit of reporting (LOR).

#### 14.3.2 EILs & ESLs

As indicated in Table K1, the concentrations of arsenic, naphthalene and DDT were below the EILs & ESLs for urban residential and public open space.

#### 14.4 Carbamates

As indicated in Table K1, the concentrations of Carbamates were below the limit of reporting (LOR).

#### 14.5 Asbestos

As shown in Table K1, no asbestos was detected in the soil samples tested.

#### 14.6 Acid Sulphate Soil Field Testing

The results of field pH tests are presented in Table 30 below.

Comulo	Donth (m)	р	н	рН		Change in pH (pH <sub>f</sub>	Effervescence
Sample	Depth (m)	H <sub>2</sub> O	Soil pH <sub>f</sub>	H <sub>2</sub> O <sub>2</sub>	Soil pH <sub>fox</sub>	– pH <sub>fox</sub> )	<b>Reaction Rate</b>
BH2	0.2-0.3	-	5.8	-	3.2	2.6	Moderate
BH2	0.9-1.0	-	4.7	-	4.0	0.7	Moderate
BH4	0.2-0.3	-	5.9	-	3.3	2.6	Moderate
BH4	0.6-0.7	-	5.0	-	4.6	0.4	Moderate
BH13	0.2-0.3	-	5.5	-	3.4	1.1	High
BH13	0.8-0.9	-	5.7	-	4.4	1.3	High
BH15	0.2-0.3	-	5.7	-	3.9	1.8	Moderate
BH15	0.7-0.8	-	5.7	-	5.0	0.7	Vigorous
BH19	0.2-0.3	-	6.2	-	3.2	3	Moderate
BH19	0.8-0.9	-	5.5	-	4.1	1.4	Moderate

#### Table 30: Summary of field test results

Notes:

- > pH<sub>f</sub> refers to pH field (soil and distilled H<sub>2</sub>O).
- > pH<sub>fox</sub> refers to pH field oxidised (soil and peroxide).
- > Change in pH refers to pH field minus pH field oxidised.

To investigate the pH of the soils (pH<sub>f</sub>) water was added to the soil samples.  $pH_f$  values of the investigated samples were not below 4. This indicates the soils from which the samples were collected did <u>**not**</u> contain *actual ASS*.

To investigate the presence of PASS, 30% peroxide (H<sub>2</sub>O<sub>2</sub>) was added to soil samples and the resulting pH of the mixture was measured (field test protocols are presented in Appendix D of the ASSMAC (1998) Field pH and peroxide test protocol). The pH of the soil peroxide solution (pH<sub>fox</sub>) <u>did not</u> decreased below 3 in any of the samples. The pH did drop more than 2 pH unit in three samples. However, this was consistent with fill material and the pH of the samples did not fall below the above limits. Therefore, it is confirmed that no further laboratory investigation is warranted at this stage.

#### GROUNDWATER

The laboratory certificates are presented in **Appendix H** – NATA Accredited Laboratory Certificates.

A summary of the results together with the assessment criteria adopted are provided in **Appendix K** – Summary Tables.

#### 14.7 HEAVY METALS

As indicated in Table K2, dissolved zinc was detected at concentrations above the respective groundwater investigation level for the 95% protection of freshwater aquatic ecosystems in GW2 and associated field duplicates.

The remaining metals concentrations were either below the laboratory limits of reporting (LOR) or their respective assessment criteria.

#### 14.8 TRH & BTEXN

As shown In Table K2, the BTEXN concentrations were either less than the laboratory limit of reporting (LOR) and/or below the assessment criteria.

As indicated in Table K2, the TRH F1 ( $C_6$ - $C_{10}$ ), F2 (> $C_{10}$ - $C_{16}$ ), benzene, toluene, ethyl benzene, xylenes and naphthalene concentrations were below the HSL 'A' & HSL 'B' for a Clay profile with a source depth of "2m to <4m".

#### 14.9 PAH

As indicated in Table K2, the PAH concentrations were either less than the laboratory limit of reporting (LOR) and/or below the assessment criteria.

#### 14.10 Phenol, OCP & OPP

As indicated in Table K2, the Total Phenol, OCP & OPP concentrations were either less than the laboratory limit of reporting (LOR) and/or below the assessment criteria.
# **15.0 UPDATED CONCEPTUAL SITE MODEL (CSM)**

# **Chemical of Concern:**

Minor levels of dissolved zinc metals were detected marginally above groundwater investigation levels. However, these excursions were considered to be background levels and therefore of limited concerns.

# Potential for Migration

Contaminants generally migrate from site via a combination of windblown dusts, rainwater infiltration, groundwater migration and surface water runoff. The potential for contaminants to migrate is a combination of:

- The nature of the contaminants (solid/liquid and mobility characteristics);
- The extent of the contaminants (isolated or widespread);
- The location of the contaminants (surface soils or at depth); and
- The site topography, geology, hydrology and hydrogeology.

The redevelopment works at site will created minimal unsealed ground surfaces and therefore, there is a low risk for migration of contaminants via wind-blown dust. Likewise, rainfall infiltration at the site is not expected due to the proposed sealed surfaces across the site based on the proposed development.

# Potential Exposure Pathways (Transport of Chemicals of Concern)

Potential exposure pathways include:

- Dermal;
- Ingestion; and
- Inhalation.

The potential for ingestion of soil is considered a potential exposure pathway based on the proposed at grade development. There is no risk for ingestion of contaminants via groundwater removed from monitoring wells as no monitoring wells will remain on the site post remediation works.

Based on the health screening limits (HSLs) for both soil and groundwater observed during the DSI; dermal and inhalation exposure pathways by potentially contaminated soil, groundwater and vapour is considered a low risk.

# **Receptors**

# <u>Human:</u>

The nearest watercourse is Narara Creek, a tributary / drainage line connect to Narara Creek is located 200m to the southwestern area of the site. located 200m south west of the site.

# **Ecological**

The ecological receptors would be surface water and benthic organisms in Narara Creek Gully / tributary. This assumes that the any contaminations can be transported offsite in groundwater via interconnected fractures in the clay/bedrock to Narara Creek.

# 16.0 DISCUSSION

# 16.1 SOILS

The soil data revealed the following:

- The laboratory results for all soil samples were below the adopted detection limits and/or the relevant guideline criteria.
- No asbestos was detected in the soil sample analysed.

The following known/potential contamination source areas identified in the CSM were considered of low risk:

- Historical uses & current uses rural residential & agricultural;
- Where pesticides were potentially utilised laboratory results indicate no issues;
- Carpark areas / driveways where leaks and spills from cars may have occurred preliminary laboratory results indicate no issues; and
- Degrading building features can be managed during demolition works.

Based on the investigation including the previous site history, underground services plans, soil & groundwater investigation results & site inspection; the potential for significant soil and/or groundwater impact is considered low.

Any soil requiring removal from the site, as part of future site works, should be classified in accordance with the "Waste Classification Guidelines, Part 1: Classifying Waste" NSW EPA (2014).

Reference should be made to Figure 2 for a copy of the site plans.

# **16.2 GROUNDWATER QUALITY**

The groundwater monitoring undertaken by Benviron Group has no concerns with TRH, BTEXN, PAH, OCP, OPP & Phenol in relation to the adopted guidelines.

Minor levels of dissolved zinc were detected marginally above groundwater investigation levels. However, these excursions were considered to be background levels and therefore of limited concerns. Benviron Group has extensive contaminated land experience in the Sydney Basin, which has indicated a common pattern of groundwater to be impacted by heavy metals. This is likely to be associated with progressive development and an increase in population growth and/or density.

# 16.3 DUTY TO REPORT

Under Section 60 of the Contaminated Land Management Act 1997, the owner of the land is required to notify contamination in circumstances as indicated in the NSW EPA (2015) *Guidelines on Duty to Report Contamination under the Contaminated Land Management Act 1997*.

Sites that are significantly impacted by soil, groundwater and ground gases are likely to require notification to the NSW EPA under section 60 of the CLM Act. A decision process for use by site owners or responsible persons considering reporting contamination under section 60 is provided in Appendix 1 (Figure 1) of the aforementioned guidelines.

# **17.0 CONCLUSION AND RECOMMENDATION**

The site is proposed to be subdivided into multiple residential lots including landscaping areas including common gardens & a recreation / gathering area and new roads. Based on the results of the investigation, the site is considered *suitable* for the proposed development, subject to the following;

 Any soil requiring removal from the site, as part of future site works, should be classified in accordance with the "Waste Classification Guidelines, Part 1: Classifying Waste" NSW EPA (2014).

If during any potential site works, significant odours and / or evidence of gross contamination (including asbestos) not previously detected are encountered, or any other significant unexpected occurrence, site works should cease in that area, at least temporarily, and the environmental consultant should be notified immediately to set up a response to this unexpected occurrence.

Thank you for the opportunity of undertaking this work. We would be pleased to provide further information on any aspects of this report.

# **18.0 LIMITATIONS**

To the best of our knowledge information contained in this report is accurate at the date of issue, however, subsurface conditions, including groundwater levels and contaminant concentrations, can change in a limited time. This should be borne in mind if the report is used after a protracted delay.

There is always some disparity in subsurface conditions across a site that cannot be fully defined by investigation. Hence it is unlikely that measurements and values obtained from sampling and testing during environmental works carried out at a site will characterise the extremes of conditions that exist within the site.

There is no investigation that is thorough enough to preclude the presence of material that presently or in the future, may be considered hazardous at the site. Since regulatory criteria are constantly changing, concentrations of contaminants presently considered low may, in the future, fall under different regulatory standards that require remediation.

Opinions expressed herein are judgements and are based on our understanding and interpretation of current regulatory standards and should not be construed as legal opinions.

# REFERENCES

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- NSW EPA "Sampling Design Guidelines" (1995). NSW Environment Protection Authority, Sydney.
- Ramboll Environ (2016), Site Audit report, Stage 1, Research Road, Narara NSW, Reference AS121784, dated 29<sup>th</sup> June 2016.
- US EPA "Regional Screening Level (RSL) Summary Tables" (2016). United States Environment Protection Authority.

# FIGURE 1: SITE LOCATION



# FIGURE 2: SITE FEATURES, BOREHOLE LOCATIONS & EXCEEDANCE PLAN



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BH33 BH3/GW2 P1	
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# **Vipac Engineers & Scientists**

# Narara Ecovillage Co-operative Ltd

Sewage Treatment Plant

# Noise and Vibration Management Plan

29N-13-0156-TRP-472221-0

16 Dec 2013

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Narara Ecovillage Co-operative Ltd

ViPAC

Sewage Treatment Plant

Noise and Vibration Management Plan

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	INTRODUCTION GLOSSARY OF TERMS



# **1 INTRODUCTION**

Vipac Engineers and Scientists Ltd (Vipac) was commissioned by Narara Ecovillage Co-operative Ltd to undertake a Construction Noise and Vibration Impact Assessment associated with the Proposed Sewage Treatment Plant (STP) at 25 Research Road, Narara, NSW.

This Noise Management Plan has been prepared in accordance with the following guidance documents:

- Environmental Protection Authority (EPA) Office of Environment and Heritage (OEH) NSW "Interim Construction Noise Guideline";
- EPA (OEH) NSW "Industrial Noise Policy";
- AS 2436-2010 "Guide to Noise Construction, Maintenance and Demolition Sites";

The steps for managing noise impacts from construction are as follows:

- Identify the location of the proposed works.
- Identify the sensitive receiver locations with respect to proposed works.
- Define noise management levels for the sensitive locations.
- Describe the nature of the works to be undertaken and their expected duration.
- Predict levels of noise and vibration from construction work at the identified sensitive receivers.
- Provide reasonable and feasible mitigation and management strategies where the noise management levels are exceeded.

# 2 GLOSSARY OF TERMS

A list of commonly used acoustical terms (and their definition) used in this report is provided below in **Table 1**, as an aid to readers of the report.

Term	Definition
L <sub>eq,1hr</sub>	Equivalent Continuous Noise Level - which, lasting for as long as a given noise event has the same amount of acoustic energy as the given event for the period of an hour.
L <sub>A10,1 hr</sub>	The noise level, which is equalled or exceeded for 10% of the measurement period of one hour.
L <sub>A90,T</sub>	The noise level, which is equalled or exceeded for 90% of a given measurement period, T. $L_{A90,T}$ is used in Australia as the descriptor for background noise.
L <sub>Aeq,T</sub>	The equivalent continuous A-weighted sound pressure level that has the same mean square pressure level as a sound that varies over time, for a given time period. It can be considered as the average sound pressure level over the measurement period and is commonly used as a descriptor for ambient noise.
L <sub>n</sub>	The Sound Pressure levels that is equalled or exceeded for n% of the interval time period. Commonly used noise intervals are $L_1$ , $L_{10}$ , $L_{90}$ and $L_{99}$ %
LA10,18hrs	The $L_{10}$ noise level for the time period extending from 6am to midnight.

#### **Table 1: Definition of Acoustical Terms**



# **3 PROJECT DESCRIPTION**

#### 3.1 Site Location

The proposed sewage treatment plant (STP) is located at Lot 13 DP 1126998 Research Road, Narara, NSW, approximately 6-kilometers northwest of Gosford, NSW. The site location of the proposed sewage treatment plant and surrounding noise sensitive receptors is illustrated in *Figure 1*.

There are a number of noise sensitive receptors located to the North-East and South-East of the proposed STP, situated within a 300-metre radius of the proposed STP that may potentially be impacted by the construction activities of proposed STP.



Figure 1: Locality Plan of Proposed STP and Noise Sensitive Receptors

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#### 3.2 Noise Sensitive Receivers

A list of the nearest potentially affected noise sensitive receivers located in the vicinity of the site of the proposed sewage treatment plant (STP) is provided below in *Table 2*. The distance for each of the sensitive receptors is calculated from the boundary of proposed STP to the property boundary of noise sensitive receivers.

ID	Property	Location
R1	3 Nursery Street, Narara	Approximately 220m to the North East of the STP
R2	2 Nursery Street, Narara	Approximately 260m to the North East of the STP
R3	1 Nursery Street, Narara	Approximately 320m to the North East of the STP
R4	16 Nursery Street, Narara	Approximately 260m to the South East of the STP
R5	Lot 10 Monarchy Way, Narara	Approximately 150m to the South East of the STP
R6	Lot 8 & 9 Monarchy Way, Narara	Approximately 170m to the South East of the STP
R7	Lot 6 & 7 Monarchy Way, Narara	Approximately 200m to the South East of the STP
R8	Lot 3 & 4 Monarchy Way, Narara	Approximately 210m to the South East of the STP
R9	Lot 1 & 2 Monarchy Way, Narara	Approximately 250m to the South of the STP
R10	Lot 21 Monarchy Way, Narara	Approximately 200m to the South East of the STP

Table 2:	Noise	Sensitive	Receivers
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#### 3.3 Construction Methodology

Typical construction activities consist of the following stages:

- Excavation
- Construction

The following is the typical construction equipment that will be used during the construction activities of each stage:

- Excavation Excavator and trucks for removals]
- Construction Mobile crane, material hoist, concrete mixer and concrete pump, delivery trucks and general construction tools such as drill, nail gun, electric saw, etc.

### 4 CONSTRUCTION NOISE GUIDELINES

### 4.1 NSW EPA (OEH) "Interim Construction Noise Guideline"

The NSW Interim Construction Noise Guideline was developed by the NSW - OEH and contains detailed procedures for the assessment and management of construction noise impacts.

The Guideline presents two ways of assessing construction noise impacts – the quantitative method, which is generally suited to longer-term construction, and the qualitative method, which is generally suited to short-term works (usually not more than 3 weeks) such as infrastructure maintenance.

It is expected that the length of the construction works will be more than 3 weeks and therefore, a quantitative method has been used for this assessment.



#### 4.1.1 Residences and Other Sensitive Land Uses

**Table 3** sets out the management levels for noise at residences and sensitive land uses, respectively. Restrictions to the hours of construction may apply to activities that generate noise at residences above the 'highly noise affected' noise management level.

#### Table 3: Noise at residence using Quantitative Assessment

Recommended Hours	Time of Day	Management level LAeq(15min)
	Monday to Friday - 7 am to 6pm	Noise affected RBL <sup>2</sup> + 10dB
Recommended standard hours	Saturday - 8am to 1 pm No Work on Sundays or Public holidays	Highly noise affected <sup>3</sup> 75dB
Outside recommended standard hours		Noise affected RBL <sup>2</sup> + 5dB

When assessing construction noise it should be noted that several types of plant and equipment can be particularly annoying to nearby residents. In those instances a +5dB penalty is applied to the predicted noise level. A list of typical plant and equipment commonly used on construction projects is provided below:

- Use of 'beeper' style reversing or movement alarms, particularly at night time
- Use of power saws, such as used for cutting timber, rail lines, masonry, road pavement or steel work
- Grinding metal, concrete or masonry
- Rock drilling
- Line drilling
- Vibratory rolling
- Rail tamping and regulating
- Bitumen milling or profiling
- Jack hammering, rock hammering it rock breaking'
- Impact piling

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Noise levels apply at the boundary that is most exposed to construction noise and at a height of 1.5 m above ground level. If the property boundary is more than 30m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30m of the residence. Noise levels may be higher at upper floors of the noise-affected residence.

<sup>2</sup> RBL is the Rating Background Level as defined in the OEH Industrial Noise Policy.

<sup>3</sup> LAeq 15-minute ≥ 75 dB is highly likely to generate strong community reactions and should be avoided.



#### 4.1.2 Assessing Impacts

The process of predicting noise is summarised in Figure 2.



Figure 2: Prediction and Assessment of impacts- Quantitative method



#### 4.2 Sleep Disturbance Assessment Approach

The NSW Construction Noise Guideline also recommends that when construction works extend for more than two consecutive nights, the analysis should cover maximum noise levels, and the extent that they exceed the Rating Background Level (RBL). Guidance indicating the potential for sleep disturbance is set out in the NSW Environmental Criteria for Road and Traffic Noise (EPA 1999), and is summarised as follows:

"OEH reviewed research on sleep disturbance in the NSW Environmental Criteria for Road Traffic Noise (ECRTN) (EPA, 1999). This review concluded that the range of results is sufficiently diverse that it was not reasonable to issue new noise criteria for sleep disturbance.

From the research, OEH recognised that current sleep disturbance criterion of an LA1, (1 minute) not exceeding the LA90, (15 minute) by more than 15 dB(A) is not ideal. Nevertheless, as there is insufficient evidence to determine what should replace it, OEH will continue to use it as a guide to identify the likelihood of sleep disturbance.

This means that where the criterion is met, sleep disturbance is not likely, but where it is not met, a more detailed analysis is required.

The detailed analysis should cover the maximum noise level or LA1, (1 minute), that is, the extent to which the maximum noise level exceeds the background level and the number of times this happens during the night-time period. Some guidance on possible impact is contained in the review of research results in the appendices to the ECRTN. Other factors that may be important in assessing the extent of impacts on sleep include:

- How often high noise events will occur
- Time of day (normally between 10pm and 7am)
- Whether there are times of day when there is a clear change in the noise environment (such as during early morning shoulder periods).

The LA1, (1 minute) descriptor is meant to represent a maximum noise level measured under 'fast' time response. DECCW will accept analysis based on either LA1, (1 minute) or LA(Max).

It should be noted that the OEH refers to the Office of Environment and Heritage, and DECCW refers to the Department of Environment, Climate Change and Water.

#### **5 CONSTRUCTION VIBRATION CRITERIA**

The effects of construction vibration upon buildings can be separated into three main categories:

- Perceptibility of the occupants to the vibration, and the possibility of them being disturbed or annoyed;
- Vulnerability of the building structures to vibration induced damaged;
- Vulnerability of the contents of the building that includes types of equipment, activities and processes.

#### 5.1 Human Response to Vibration

Humans are very sensitive to vibration, and they can be disturbed, annoyed, and have their work activities interfered with if the levels are too high. The OEH "Assessing Vibration – Technical Guidelines" and British Standard 6472 provide guidance on human response to vibration in buildings. These guidelines set down base vibration levels at which there would be minimal interference to occupants.

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BS 6841 also sets out guidance on the effects to physical health from sustained exposure to vibration. However it is unlikely that such levels would be encountered from construction or demolition activities. The frequency weighting to be applied to the vibration levels are obtained from BS 6841.

The vibration criteria and guidelines relating to human response are summarised below.

#### 5.1.1 OEH ASSESSING VIBRATION: A Technical Guideline

The OEH technical guideline for assessing vibration provides evaluation methods to assess the human response from continuous, impulsive and intermittent vibration in buildings from 1Hz to 80Hz which is based on British Standard 6472:1992 "Evaluation of the Human Exposure to Vibration in Building (1Hz to 80Hz)".

For continuous and impulsive vibration, assessment of impact should be considered on the basis of weighted RMS acceleration values. For intermittent vibration, assessment of impact should be considered on the basis of vibration dose values (VDV).

The OEH guidelines also include a section on mitigation when the predicted vibration value exceeds the criteria. Vibration mitigation may be achieved by way of:

- Controlling the vibration at the source, using the application of Best Management Practice (BMP) and Best Available Technology Economically Achievable (BATEA).
- Controlling the transmission of vibration.
- Controlling the vibration at the receiver

#### 5.1.2 British Standard 6472:2008- Evaluation of Human Exposure to Vibration in Buildings

BS6472:1992 was updated in 2008 by BS6472:2008 Parts 1 and 2. BS6472:2008 Part 1 sets out vibration levels at which minimal comment is likely to be provoked from the occupants of a building subject to vibration (BS6472:2008 Part 2 relates to Blast-induced vibration). BS 6472 takes into account the fact that humans perceive vertical vibrations to a greater extent than horizontal vibrations, although the effect is reversed at very low frequencies, below 4 Hz.

The evaluation of building vibration with respect to annoyance and comfort for occupants, over all weighted values of vibration is the preferred method of evaluation.

Continuous vibration would be generated for typical construction work. The curves in *Figure 3* represent the magnitudes of continuous vibration in buildings for Z-axis acceleration, below which adverse comments or complaints are rare. Multiplication factors are applied to the base level curve to define criteria for residential or office spaces. There are similar curves for x and y-axis.



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Figure 3: BS 6472 building vibration levels. Z-axis.

The Vibration Dose Value in BS 6472 is a concept used to evaluate the cumulative effects of bursts of both intermittent vibration and impulsive vibrations. Vibration Dose Value or the VDV represents a single value amount used to quantify the level of vibration.

The recommended VDV levels outlined in the OEH Vibration Guidelines (based on the BS6472:1992 Standard) which specifies levels of VDV expressed in daytime, night-time and typical human response are presented in *Table 4*. *Table 5* presents levels of VDV expressed in daytime, night-time and typical human response, based on the updated BS6472:2008 Part 1.

Table 4: Acceptable vibration dose values for intermittent vibration in var	ious buildings (m/s'''')

Location	Dayt	ime <sup>1</sup>	Night-time		
	Preferred Value m/s <sup>1.75</sup>	Maximum Value m/s <sup>1.75</sup>	Preferred Value m/s <sup>1.75</sup>	Maximum Value m/s <sup>1.75</sup>	
Critical areas <sup>2</sup>	0.1	0.2	0.1	0.2	
Residences	0.2	0.4	0.13	0.26	
Offices, schools, educational institutions and places of worship	0.4	0.8	0.4	0.8	
Workshops	0.8	1.6	0.8	1.6	

Note 1: Daytime is 07:00 am to 10:00 pm and night-time is 10:00 pm to 07:00 am.

Note 2: Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. These criteria are only indicative, and there may be a need to assess intermittent values against the continuous or impulsive criteria for critical cases.



# Table 5: Vibration dose value ranges which might result in various probabilities of adverse comment within various buildings (m/s<sup>1.75</sup>)

Place and time	Low probability of adverse comment m/s <sup>1.75 Note 1</sup>	Adverse comment possible m/s <sup>1.75</sup>	Adverse comment probable m/s <sup>1.75 Note 2</sup>
Residential buildings 16h day	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Residential buildings 8h night	0.1 to 0.2	0.2 to 0.4	0.4 to 0.8
Office buildings 16h day	0.4 to 0.8	0.8 to 1.6	1.6 to 3.2
Workshop buildings 16h day	0.8 to 1.6	1.6 to 3.2	3.2 to 6.4

Note 1: Below these ranges, adverse comment is not expected.

Note 2: Above these ranges, adverse comment is very likely.

Vibration frequency was assessed in the range from 8Hz - 80 Hz, as predominant frequencies are known to be above 8Hz. Vibration levels below the low probability of adverse comment range presented in *Table 5* correspond to a low probability of disturbance to building occupants. Adverse comment or complaints may be expected when the VDV approaches the higher range levels in the possible and probable categories. Values up to the maximum level in *Table 4* can only be used where all reasonable and feasible measures have been implemented and they can be justified.

Criteria for exposure to continuous and impulsive vibration with regard to PPV levels expressed in daytime and night-time (outlined in the OEH Vibration Guidelines) are provided in **Table 6**.

	Time	Peak Particle velocity (mm/s) for z-axis vibration Frequency range 8Hz-80Hz		
Place		Exposure to continuous vibration (16h day, 8h night)	Impulsive vibration excitation with up to three occurrences	
Critical working areas (e.g. hospital operating theatres, precision laboratories)	Day	0.14 to 0.28	0.14 to 0.28	
	Night	0.14 to 0.28	0.14 to 0.28	
Residential	Day	0.28 to 0.56	8.6 to 17.0	
	Night	0.2 to 0.4	2.8 to 5.6	
Office	Day	0.56 to 1.1	18.0 to 36.0	
	Night	0.56 to 1.1	18.0 to 36.0	
Workshops	Day	1.1 to 2.2	18.0 to 36.0	
	Night	1.1 to 2.2	18.0 to 36.0	

#### Table 6: Peak Particle velocity for z-axis



#### 5.2 Structural Response to Vibration

The response of a building to vibration is affected by several factors that include its type of foundation; the underlying ground conditions, its construction and the condition of the building.

BS 7385: Part 2-1993 provides guide values for building damage, as well as guidance on vibration measurement and data analysis. The German Standard DIN 4150: Part 3-1999 also provides guidelines for evaluating the effects of vibration on structures.

#### 5.2.1 German Standard DIN 4150-3:1999 – Structural Vibration – Effects of Vibration on Structures

The German standard DIN 4150-3 Structural Vibration Part 3: Effects on buildings and structures is commonly used in Australia to evaluate the effects of vibration on structures primarily used for static loading.

Short-term vibration is defined as vibration which does not occur often enough to cause structural fatigue and which does not produce resonance in the structure being evaluated.

**Table 7** below provides guideline limits for short-term vibration to ensure that damage reducing the serviceability of a building will not occur provided vibration levels do not exceed these limits. This is also shown graphically in *Figure 4*. Vibration at the foundation is taken as the maximum absolute value in the x, y, and z directions, and vibration at the highest floor is the maximum of the in plane components.

	Guideline values for velocity in mm/s			
Type of structure	Vibration at the foundation at a frequency of			Vibration at
	1Hz to 10Hz	10 to 50Hz	50 to 100Hz (and above)	highest floor at all frequencies
Buildings for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40
Dwellings and buildings of similar design and/or occupancy	5	5 to 15	15 to 20	15
Structures that because of their particular sensitivity to vibration, cannot be classified as above and are of great intrinsic value (e.g. listed buildings under preservation order)	3	3 to 8	8 to 10	8

#### Table 7: DIN4150-3 Vibration Limits





Figure 4: DIN 4150-3 Vibration Limits

# 5.2.2 British Standard 7385 Part 2 – 1993 Guidelines

The limits for transient vibration, above which cosmetic damage could occur to buildings, are given in *Table 8* and shown graphically in *Figure 5*.

These guide values however relate predominantly to transient vibration that does not give rise to resonant responses in structures. The guide values in *Table 8* should be reduced by up to 50%, in the case of dynamic loading caused by continuous vibration. The values presented in BS 7385-2 are frequency dependent levels that are judged to give a minimal risk of vibration-induced damage.

	,	inago
Type of building	Peak component particle ve predomin	locity in frequency range of ant pulse
	4 Hz to 15 Hz	15 Hz and above
Reinforced framed structures, Industrial and heavy commercial buildings	50 mm/s at 4 l	Hz and above
Un-reinforced or light framed structures, Residential or light commercial type buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above
Note 1: Values referred to are at the base of the building		
Note 2: For the residential buildings group, at frequencies t should not be exceeded	below 4 Hz, a maximum displacer	nent of 0.6mm (zero to peak)

# Table 8: Transient vibration guide values for cosmetic damage





Figure 5: Transient Vibration Guide for Cosmetic Damage

# 5.2.3 Construction Vibration Assessment Criteria Summary

A comparison of the above criteria is shown in *Figure 6*. PPV values have been used for the human disturbance values, in order to compare against building damage guide values.

The human disturbance criterion from BS6472 for continuous vibration is significantly lower than the various threshold damage levels from DIN4150 and BS7385. This is due to humans being able to perceive vibration levels that are well below those that could cause any risk to damage to a building or its contents.

The values in DIN4150 are levels that if complied with, damage will not occur. If levels are exceeded damage will not necessarily occur, however if they are significantly exceeded, then further investigations will be required.

The values specified in BS7385 are the lowest vibration levels above which damage has been credibly demonstrated. This is the basis on which the values are much higher than those of DIN4150.





Figure 6: Human Disturbance and Building Damage Guide Values

Based on the above, the following criterion is deemed most appropriate and is recommended for use in this assessment:

- When the adjacent building subject to vibration is occupied, continuous vibration levels from BS 6472 will be used to assess human perception. Human perception occurs at lower thresholds than that for building damage and during occupied periods will be the limiting criteria.
- When it is un-occupied, vibration levels from DIN4150 will be used to protect the building from cosmetic damage.



# 6 CONSTRUCTION NOISE & VIBRATION GOALS

A noise survey was carried out to measure the current ambient noise levels in the vicinity of the proposed STP. The results of unattended measurements are shown in **Table 9**. The noise limits for construction on the site have been determined in accordance with the interim construction noise guideline.

Period	Descriptor	L1	L2			
	L <sub>Aeq</sub>	46	47			
Day (7am- 6pm)	LA90	38 37				
	RBL <sup>1</sup>	37	34			
	L <sub>Aeq</sub>	51	53			
Evening (6pm-10pm)	L <sub>A90</sub>	38	36			
	RBL <sup>1</sup>	34	31			
	LAeq	41	41			
Night (10pm-7am)	LA90	32	35			
	RBL <sup>1</sup>	27	30			

#### Table 9: Existing Noise levels, dB(A)

Table 10 and Table 11 provide a summary of noise and vibration management levels criterion at the sensitive receivers.

Descharters	Burlad	N	ML	Highly affected		
Receiver type	Period	L1	L2	Noise Level		
	Day - (RBL+10)	47	44			
	Day - (RBL+5) (or outside standard hours)	42	39			
Residential	Evening - (RBL+5) (or outside standard hours)	39	36	75		
	Night (RBL+5) (or outside standard hours)	32	35			
Commercial	When in use		70			

#### **Table 10: Construction Noise Management Levels**

In absence of the proposed construction hours for the proposed STP, Vipac has assessed the construction noise impact during day, evening and night periods, in the event that partial operations need to be conducted outside of standard construction hours.

<sup>&</sup>lt;sup>1</sup> RBL is the median of the overall assessment background noise level calculated using OEH Industrial Noise Policy methodology as defined in the glossary of acoustic terms.



Receiver	Туре	Human Perception and c	cosmetic damage criteria
	.,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	Human Perception (mm/s)	Cosmetic Damage (mm/s)
R1-R4	Residential	0.28 - 0.56	5
C1	Commercial	0.56 - 1.1	5

#### Table 11: Human perception and cosmetic damage criteria (minimum value)

### 7 CONSTRUCTION NOISE ASSESSMENT

#### 7.1 Plant and Equipment

**Table 12** details the proposed construction plant and equipment and the corresponding acoustic power produced by each item. The total predicted sound power levels for each of the construction phases is also presented. The typical sound levels of the plant and equipment were extracted from *"Australian Standard AS 2436-2010, Appendix A", "British Standard BS 5228-1:2009 - Code of practice for noise and vibration control on construction and open sites- Part 1: Noise"* and *"Vipac database".* 

Plant & Equipment	Quantity	Sound Power Level (LWA)	Predicted Sound Pressure Levels (dB(A)) at various distances per equipment (metres)								
		dв	10	20	60	150	200	250	300		
Tracked excavator (103kW)	1	103	75	69	59	51	49	47	45		
Mobile Crane (70 tonne)	1	98	70	64	54	46	44	42	40		
Trucks	1	102	74	68	58	50	48	46	44		
Mobile Concrete Line Pump	1	103	75	69	59	51	49	47	45		
Hand-held Electric Drill	1	94	66	60	50	42	40	38	36		
Hand-held Electric Grinder	1	103	75	69	59	51	49	47	45		
Hoist	1	93	65	59	49	41	39	37	35		
Circular Saw	1	113	85	79	69	61	59	57	55		

#### **Table 12: Construction activities and Sound Powel Levels**

#### 7.2 Predicted Construction Noise Levels

The predicted noise levels have been calculated using the SoundPLAN computational noise modelling software package. The use of the SoundPLAN software and referenced modelling methodology is accepted for use in the state of NSW by the Office of Environment and Heritage (OEH) for environmental noise modelling purposes. Vipac have undertaken numerous noise modelling and impact assessments previously for a range of projects, including mining and industrial projects using SoundPLAN.

Noise levels are expressed as external  $L_{Aeq,15 minutes}$  at the nearest boundary of the receiver properties. The predicted levels are presented in *Table 13* for each of the construction stages. The results presented in bold red font represent exceedances of the applicable noise assessment goal.

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**Table 13: Predicted Noise Levels** 

Receptor ID	Period	Critaria	Noise	Predicted Noise	Evel (LAeq) dB
Reference			level	Excavation	Construction
	Chandard Llaura	Highly Noise Affected	75	36	46
		Noise Affected (RBL+10dB)	47	36	46
R1	2	Noise Affected Day (RBL + 5dB)	42	36	46
	Uutside Standard	Noise Affected Evening (RBL + 5dB)	39	36	46
		Noise Affected Night (RBL + 5dB)	32	36	46
	Standard Llaura	Highly Noise Affected	75	35	45
		Noise Affected (RBL+10dB)	47	35	45
R2		Noise Affected Day (RBL + 5dB)	42	35	45
	Outside Standard	Noise Affected Evening (RBL + 5dB)	39	35	45
		Noise Affected Night (RBL + 5dB)	32	35	45
	Standard Hours	Highly Noise Affected	75	33	44
		Noise Affected (RBL+10dB)	47	33	44
R3		Noise Affected Day (RBL + 5dB)	42	33	44
	Hours	Noise Affected Evening (RBL + 5dB)	39	33	44
		Noise Affected Night (RBL + 5dB)	32	33	44
	Standard Hours	Highly Noise Affected	75	35	45
		Noise Affected (RBL+10dB)	47	35	45
R4	Outside Standard	Noise Affected Day (RBL + 5dB)	42	35	45
	Hours	Noise Affected Evening (RBL + 5dB)	39	35	45
		Noise Affected Night (RBL + 5dB)	32	35	45
	Standard Houre	Highly Noise Affected	75	37	45
		Noise Affected (RBL+10dB)	44	37	45
R5		Noise Affected Day (RBL + 5dB)	39	37	45
	Hours	Noise Affected Evening (RBL + 5dB)	36	37	45
		Noise Affected Night (RBL + 5dB)	35	37	45

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Receptor ID	Period	Criteria	Noise	Predicted Noise	Level (L <sub>Aeq</sub> ) dB
Keterence			level	Excavation	Construction
	Standard Llaura	Highly Noise Affected	75	35	43
		Noise Affected (RBL+10dB)	44	35	43
R6		Noise Affected Day (RBL + 5dB)	39	35	43
	Uutside Standard Hours	Noise Affected Evening (RBL + 5dB)	36	35	43
		Noise Affected Night (RBL + 5dB)	35	35	43
		Highly Noise Affected	75	34	42
	Standard Hours	Noise Affected (RBL+10dB)	44	34	42
R7		Noise Affected Day (RBL + 5dB)	39	34	42
-	Hours	Noise Affected Evening (RBL + 5dB)	36	34	42
		Noise Affected Night (RBL + 5dB)	35	34	42
	Standard Hours	Highly Noise Affected	75	32	39
	Stalidald Flouis	Noise Affected (RBL+10dB)	44	32	39
R8		Noise Affected Day (RBL + 5dB)	39	32	39
	Hours	Noise Affected Evening (RBL + 5dB)	36	32	39
		Noise Affected Night (RBL + 5dB)	35	32	39
	Standard Hours	Highly Noise Affected	75	32	38
		Noise Affected (RBL+10dB)	44	32	38
R9		Noise Affected Day (RBL + 5dB)	39	32	38
	Hours	Noise Affected Evening (RBL + 5dB)	36	32	38
		Noise Affected Night (RBL + 5dB)	35	32	38
	Standard Hours	Highly Noise Affected	75	36	43
		Noise Affected (RBL+10dB)	44	36	43
R10		Noise Affected Day (RBL + 5dB)	39	36	43
	Hours	Noise Affected Evening (RBL + 5dB)	36	36	43
		Noise Affected Night (RBL + 5dB)	35	36	43

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#### 7.3 Sleep Disturbance

For construction activities, the  $L_1$  sound pressure level of a known  $L_{eq}$  (ambient noise level) is typically 10dB higher than the  $L_{eq}$  level, ( $L_1$  refers to the 1 percentile noise level, i.e. the noise level that is exceeded for 1% over a given measurement period and  $L_{eq}$  refers to the equivalent (or average) noise level over a given measurement period). It is on this basis (i.e. the relationship of an  $L_1$  noise level being approximately 10dB greater than the  $L_{eq}$  noise level for a given noise source) that the  $L_1$  noise emission level of the proposed construction equipment has been estimated. Vipac have assessed sleep disturbance by using the criteria of RBL+15dB. It should also be noted that the assessment has been completed for all activities. The results presented in bold red font represent exceedances of the sleep disturbance criteria.

	Predicted Nois						
Location ID	Excavation	Construction	Sleep Disturbance RBL+15dB				
R1	46	56					
R2	45	55					
R3	43	54	42				
R4	45	55					
R5	47	55					
R6	45	53					
R7	44	52					
R8	42	49	45				
R9	42	48					
R10	46	53					

#### Table 14: Stage 1- Sleep disturbance assessment

#### 7.3.1 Discussion

The noise levels during the initial site excavation/earthworks stage are predicted to be within noise management levels (for standard construction hours and outside standard construction hours) and also within the highly noise affected levels at all noise sensitive receivers. However, the predicted initial site excavation/earthworks noise levels would be elevated above the sleep disturbance criteria at most of the noise sensitive receivers, in the unlikely event that such works were undertaken during night-time hours.

Predicted noise levels during the construction stage are within the noise management levels (standard construction hours) and highly noise affected levels at all noise sensitive receivers with the exception of residential area R5. The excursion at R5 is primarily attributable to the circular saw activity. In order to reduce the noise impact at R5, any circular saw activity that may be required at the construction site should be carried out away from the noise sensitive receivers. The majority of the noise sensitive receivers are predicted to exceed the noise management level outside construction hours and would potentially cause sleep disturbance at all of the receivers, in the unlikely event that construction work was to be undertaken during night-time hours or outside of standard construction hours.

Overall, the noise impact assessment indicates that the predicted construction noise levels at all noise sensitive receivers will be within the Noise Management Levels and the Noise-Affected Levels of the NSW Interim Construction Guideline for construction work undertaken during standard construction hours. However, the predicted noise levels are predicted to exceed the Noise Management Levels for construction work undertaken outside of standard construction hours, in the unlikely event that work is undertaken outside of standard construction hours.



In the event that any construction work is required to be undertaken outside of standard construction hours, there is a potential that such activity would cause sleep disturbance at all noise sensitive receivers during the site preparation/excavation and construction stages. As such, a site specific noise management plan adopting reasonable and feasible mitigation and management measures should be adopted as detailed in **Section 8**.

#### 7.4 Construction Vibration Assessment

Vibration may also be generated as a result of construction work and has been considered both in respect of potential damage of buildings and potential annoyance to the occupants.

In many cases, it is the occupants/residents fear of building damage that enhances the potential annoyance. The most common form of vibration measurement is peak particle velocity (PPV) in mm/s. In respect to building damage, a vibration level limit and frequency is normally specified. However, in respect of potential annoyance to receivers, a combination of vibration level frequency and duration is more appropriate. This is normally termed as a dose value.

Most excavation activities will produce low and mid frequency vibrations. The nearest receiver (R10) to the excavation area/proposed development is approximately 150-metres. At this distance the excavation equipment would be unlikely to have an impact on the building at R10.

Hence, it is Vipac's opinion that the potential vibration impact that is likely to be generated by the construction activities associated with the proposed STP will not cause damage to the properties at the sensitive receptors located in the surrounding area.

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Noise and Vibration Management Plan

Sewage Treatment Plant

Narara Ecovillage Co-operative Ltd

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Project info-line and Construction response line	Notification	General	activities	Use and Siting	Enclosures				Substitution			onent	
A 24-hour construction response line should be provided as a contact point for any complaints regarding the construction work. A project info line should also be provided as a dedicated contact point for any project enquires. A Transport Project representative should respond to complaints within 2 hours.	A letter should be distributed to local residents in advance of the works to notify them of the nature and estimated timescales for completion of the proposed works. Thereafter a newsletter should be distributed to the local community by letter on a 2 weekly basis.	A Community Involvement Plan should be implemented to engage with government agencies, relevant councils, landowners, community members and other stakeholders to provide a single consultation framework.	During resurfacing / paving works consideration should be given to taking pavers off site for cutting where practical.	Where practical fixed plant should be positioned as far away as possible from sensitive receivers.	Utilise partial enclosure for cutting of kerbs and pavers.	Vipac recommends that all plant and equipment be certified prior to use.	Where possible mains power should be utilised for temporary traffic signals / work area lighting. Where this is not feasible silenced generator sets are to be used instead.	Construction equipment with the most effective mufflers, enclosures and low-noise tool bits and blades must be procured and utilised for the project.	Use less noise-intensive equipment where reasonable and feasible.	Equipment must be inspected on a regular basis and maintained as necessary, to ensure it is in good working order. This must include inspections of the condition and performance of mufflers.	Ensure there is no unnecessary shouting or loud stereos/radios on-site. There must be no dropping of materials from heights, throwing of metal items, or slamming of doors.	Details	Construction Noise and Vibration Management Plan

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Noise and Vibration Management Plan

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Monitoring RequirementsNoiseAttended mo	Complaints management Complaints management Complaint is and if justifie Where three work elemer mitigation me	Component	0
nitoring should also be undertaken in response to complaints made by the community in order to validate the source(s) giving rise to complaint(s).	ing any complaint regarding construction activities, the nominated member of staff must investigate the ne complaint. The aim will be to initiate an immediate investigation no later than two hours after the made. Where practicable a visit should be made to the complainant to verify the nature of the complaint d appropriate action should be taken to cease or amend the activity causing the complaint. or more substantiated complaints of a similar nature are received (from at least two complainants), the nt must be reviewed in order to consider whether the work methods can be changed or if additional ethods can be employed in order to prevent or reduce the likelihood of further complaints being made.	Details	Construction Noise and Vibration Management Plan

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# 9 COMMUNITY ENQUIRIES MAANAGEMENT

As part of the management plan, the community should be informed and consulted regarding the work activities, duration and details. An effective system should also be put in place to handle the complaints. The following details outlined herein are an example of what should be incorporated into a Community Relations Plan and include recommendations for complaints handling:

#### Notification before and during construction:

- Provide, reasonably ahead of time, information to the community regarding the construction work, duration, what is being done to minimise noise etc. For work to be undertaken outside of standard construction hours, inform affected residents between 5 and 14 days before commencement.
- To provide information to the neighbours, methods such as letterbox drops, meetings, individual contacts or setting up a website can be used.
- Maintain good communication between the community and project staff.
- Appoint a community liaison officer where required.
- Consider having a regular newsletter with site news, significant project events and timing of different activities.
- Facilitate contact with people to ensure that everyone can see that the site manager understands potential issues, that a planned approach is in place and that there is an ongoing commitment to minimise noise.

### **Complaints handling:**

- Provide a readily accessible contact point for example a 24-hour toll-free information and complaints line.
- Give complaints a fair hearing.
- Have a documented complaints process including an escalation procedure so that if a complaint is not satisfied there is a clear path to follow.
- · Call back as soon as possible to inform people of the actions to be taken.
- Provide a quick response to complaints with complaint handling staff having both a good knowledge
  of the project and ready access to information.
- Implement all feasible and reasonable measures to address the source of complaint.
- Keep a register of complaints including details such as date time description of the complaint, time of verbal response and timeframe for written response where appropriate.
- If the complaint is justified, remedial actions to be taken to remove the cause. In some cases noise
  measurements and noise monitoring may be required.

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Figure 7: Complaint Handling Procedure



# 10 OUT OF HOURS WORK PROCEDURE (OOHW)

# 10.1 OOHW Justification & approval

All proposed OOHW requires a full justification as to why the works are required to be undertaken outside of standard construction hours. There are however a number of reasons why works can only be undertaken out of hours and these include, but are not limited to:

- Ensuring the safety of construction personnel;
- Ensuring road user and public safety;
- Minimising disruption to road network users/ pedestrians;
- Minimising disruption to essential utility services.

Where it is considered possible (safe and reasonable) for works to be undertaken during standard hours, OOHW proposals should not be further actioned.

Approval for OOHW shall be given by the Construction Manager (CM).

## 10.2 OOHW Noise Assessment

A noise assessment for OOHW and a CNVMP should be prepared to assess the extent of noise impact that the proposed OOH construction activities may have upon the community/residential receivers.

The assessment should be undertaken by an appropriately qualified person experienced in assessing the impacts of noise from construction works.

As part of the assessment process:

- The level of noise impact will be evaluated and classified;
- Any exceedance of the construction noise management levels will be identified;
- · Appropriate noise management and mitigation measures will be determined where applicable;

#### 10.3 OOHW Community Notifications

Notification to specific impacted noise-sensitive receivers should be provided prior to the OOHW.

Any additional management measures identified for the works that require community notification are to be undertaken.

#### 10.4 Approval of OOHW and Implementation of OOHW Conditions

On receipt of the approval, any specific conditions that relate to the OOHW are to be:

- · Actioned for implementation (such as any additional notification to the community);
- Tool-boxed to relevant workforce and site personnel before each shift to introduce/reinforce works restrictions, management measures and expected workforce behaviour.
- Implemented during works and to be monitored.

### 10.5 OOHW Enquiries/Complaints Management

All complaints are to be managed by the project team as outlined in Section 9 of this report.

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