VEOLIA

Section 4

Network Operator

WATER TECHNOLOGIES

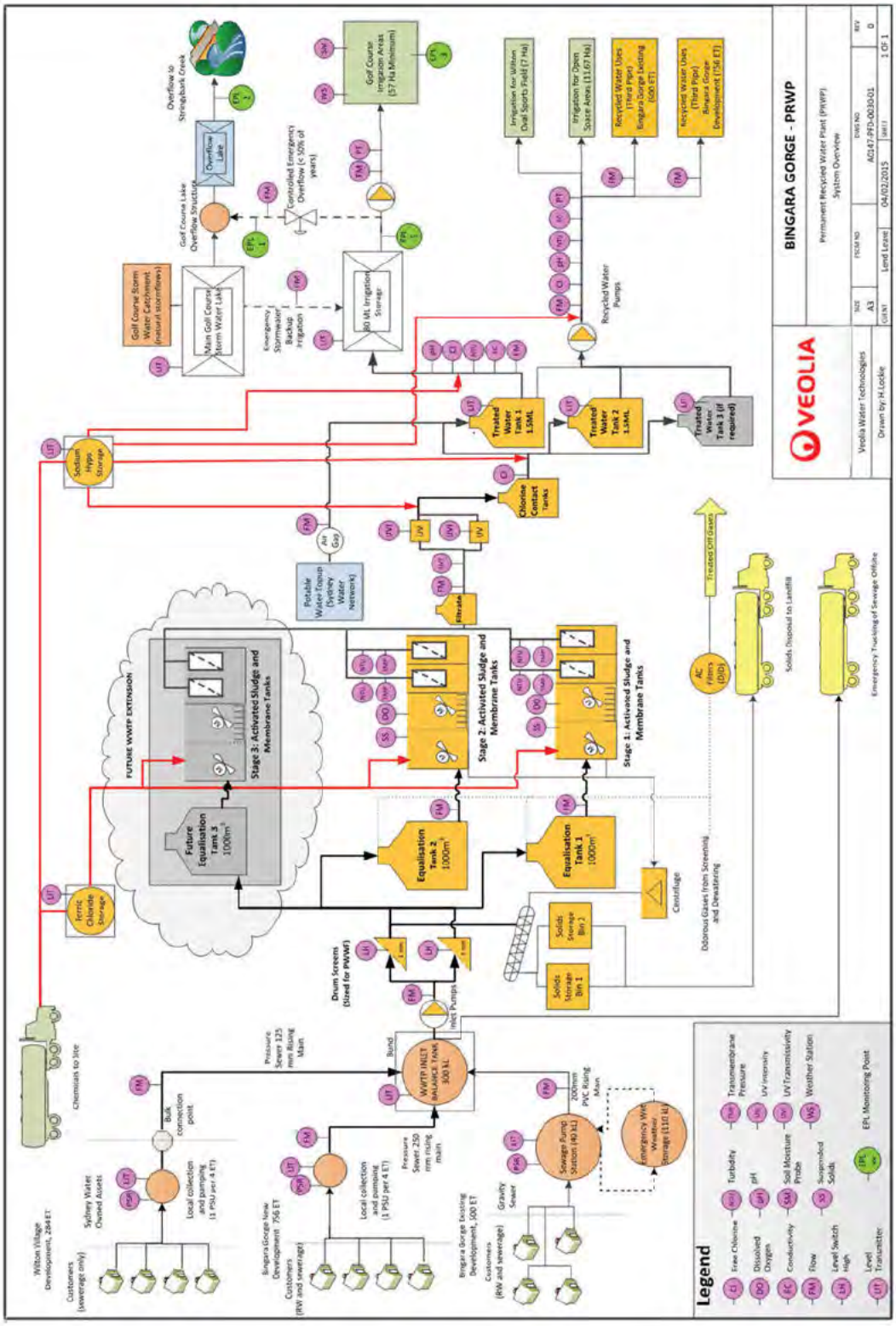
VEOLIA

4.2.1

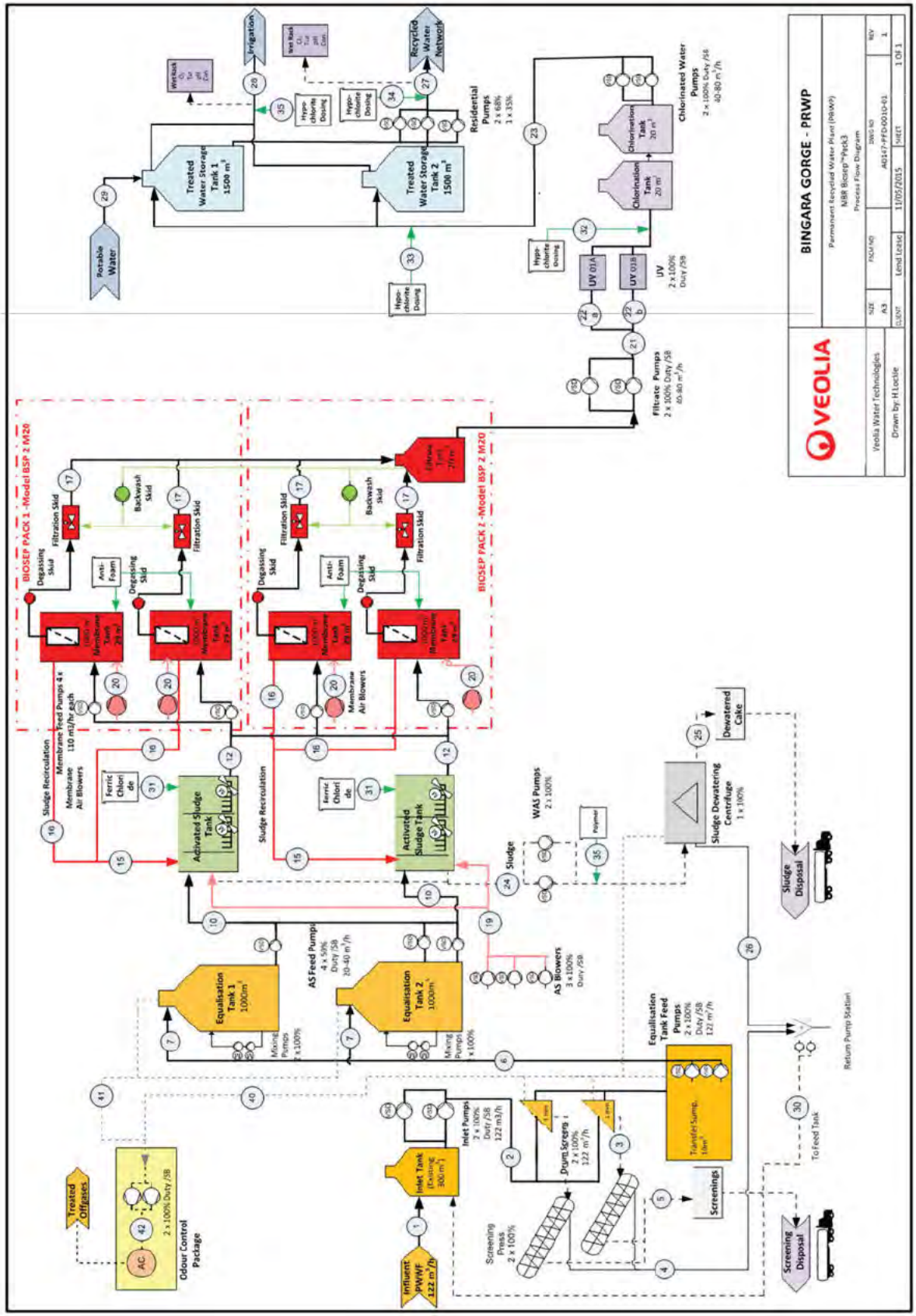
Process Flow Diagram

WATER TECHNOLOGIES

18.1 Appendix A: Overall System PFD and EPL Monitoring Points


BINGARA GORGE - PRWP
Permanent Recycled Water Plant (PRWP)
System Overview
VEOLIA
Veolia Water Technologies
Drawn by: H Locke
Land Lease
04/02/2015
AG47-PFD-0030-01
Golf Course Irrigation Areas (37 Ha Minimum)
Irrigation for Wilton Oval Sports Field (7 Ha)
Irrigation for Open Space Areas (11.67 Ha)
Recycled Water Uses (Third Pipe) Bingara Gorge Existing (600 ET)
Recycled Water Uses (Third Pipe) Bingara Gorge Development (756 ET)
Overflow to Stringybark Creek
Overflow Lake
Golf Course Lake Overflow Structure
Controlled Emergency Overflow (< 50% of years)
Golf Course Storm Water Catchment (natural stormflows)
Main Golf Course Storm Water Lake
Emergency Stormwater Backup Irrigation
80 ML Irrigation Storage
Recycled Water Pumps
Treated Water Tank 1 1.5ML
Treated Water Tank 2 1.5ML
Treated Water Tank 3 (if required)
Sodium Hypo Storage
Chlorine Contact Tanks
Air Gap
Potable Water Topup (Sydney Water Network)
Filtrate
Treated Off Gases
AC Films (DOS)
Solids Disposal to Landfill
Emergency Trucking of Sewage Offsite
FUTURE WWTP EXTENSION
Stage 3: Activated Sludge and Membrane Tanks
Future Equalisation Tank 3 1000m³
Stage 2: Activated Sludge and Membrane Tanks
Stage 1: Activated Sludge and Membrane Tanks
Equalisation Tank 2 1000m³
Equalisation Tank 1 1000m³
Centrifuge
Odorous Gases from Screening and Dewatering
Solids Storage Bin 2
Solids Storage Bin 1
Ferric Chloride Storage
Drum Screens (Sized for PWWF)
Inlet Pumps
Chemicals to Site
Bulk connection point
WWTP INLET BALANCE TANK 300 kL
Bund
Pressure Sewer 125 mm Rising Main
Pressure Sewer 250 mm rising main
200mm PVC Rising Main
Sewage Pump Station (40 kL)
Emergency Wet Weather Storage (110 kL)
Gravity Sewer
Local collection and pumping (1 PSU per 4 ET)
Sydney Water Owned Assets
Wilton Village Development, 264 ET
Customers (sewerage only)
Bingara Gorge New Development 756 ET
Customers (RW and sewerage)
Bingara Gorge Existing Development, 500 ET
Customers (RW and sewerage)
Legend
Free Chlorine
Dissolved Oxygen
Conductivity
Flow
Level Switch High
Level Transmitter
Turbidity
pH
Soil Moisture Probe
Suspended Solids
EPL Monitoring Point
Transmembrane Pressure
UV Intensity
UV Transmissivity
Weather Station

18.3 Appendix C: PFD Bingara PRWP (Permanent Plant)


BINGARA GORGE - PRWP
Permanent Recycled Water Plant (PRWP)
MBR Biosep™Pack3
Process Flow Diagram
VEOLIA
Veolia Water Technologies
Drawn by H Lockie
Lend Lease
11/05/2015
A0147-PFD-0010-01
1 OF 1
BIOSEP PACK 1 -Model BSP 2 M20
BIOSEP PACK 2 -Model BSP 2 M20
Irrigation
Recycled Water Network
Potable Water
Treated Water Storage Tank 1 1500 m³
Treated Water Storage Tank 2 1500 m³
Residential Pumps 2 x 68% 1 x 35%
Chlorinated Water Pumps 2 x 100% Duty /SB 40-80 m³/h
Chlorination Tank 20 m³
Hypo-chlorite Dosing
UV 01A
UV 01B
UV 2 x 100% Duty /SB
Filtrate Pumps 2 x 100% Duty /SB 40-80 m³/h
Filtrate Tank 70 m³
Filtration Skid
Backwash Skid
Degassing Skid
Anti-Foam
Membrane Tank 29 m³
Membrane Feed Pumps 4 x 110 m3/hr each
Membrane Air Blowers
Sludge Recirculation
Ferric Chloride
Activated Sludge Tank
WAS Pumps 2 x 100%
Polymer
Sludge Dewatering Centrifuge 1 x 100%
Dewatered Cake
Sludge Disposal
AS Feed Pumps 4 x 50% Duty /SB 20-40 m³/h
Equalisation Tank 1 1000m³
Equalisation Tank 2 1000m³
Mixing Pumps 2 x 100%
AS Blowers 3 x 100% Duty /SB
Equalisation Tank Feed Pumps 2 x 100% Duty /SB 122 m³/h
Transfer Sump 10m³
Return Pump Station
To Feed Tank
Inlet Pumps 2 x 100% Duty /SB 122 m3/h
Inlet Tank (Existing 300 m³)
Drum Screens 2 x 100% 122 m³/h
Screenings
Screening Presses 2 x 100%
Screening Disposal
Influent PWWF 122 m³/h
Odour Control Package 2 x 100% Duty /SB
Treated Offgases

VEOLIA *Veolia Water Technologies (Australia) Pty Ltd - NSW*

Filename: Bingara MDP 230307.xlsm — Software Tool Version 34300 - Beta Release

Project Name:	Bingarra Gorge MBR	**Rev:**	1
Project Number:	A0147	**Date:**	11-May-15
Document Title:	Mass Balance		
Doc. Number: Veolia Customer		**Prepared by:**	HL
		Checked by:	AJL
Issue:		**Approved by:**	HR

Stream				1		2	3	4	5	6	7	8	9	10	11	12	13	14	15
Stream description			Influent (Stage 1)	Influent (Stage 1 and 2)	Influent (Stage 3)	WWTP Inlet Feed Tank to Screens (from existing tank)	Screenings to Conveyor	Screening Drainage	Screenings to Bin	Equalisation Tank Feed (from transfer sump)	Eq. Tank 1 (or 2) Feed	Equalisation Tank Mixing Pumps (Tank 1 or 2)	Activated Sludge Feed Tank	Activated Sludge Feed Tank 1 or 2 Feed	Membrane Tank Feed (total)	Membrane Tank Feed (per Biomap Unit)	Membrane Tank Feed (per Membrane Tank)	Sludge Recirculation (total)	Sludge Recirculation AS1 (or AS2)
Flow	ADWF	m3/h	21.50	42.99	69.25	42.99	0.43	0.41	0.02	42.99	21.50	120.00	42.99	21.50	386.95	193.47	96.74	343.96	171.98
	Diurnal Peak	m3/h	25.80	61.38	98.86	61.38	0.61	0.60	0.01	61.38	30.69	120.00	61.38	30.69	429.64	214.82	107.41	368.26	184.13
	PWWF	m3/h	61.00	122.00	178.64	122.00	1.22	1.20	0.02	122.00	61.00	120.00	80.00	40.00	448.26	224.13	112.06	368.26	184.13
	Inst. Max	m3/h	70	140	205.00	122.00	1.22	1.20	0.02	122	122	120	80.00	80.00	480.00	240.00	120.00	400.00	200.00
Load	Average	kg/day	181	361	582	361	62	12	50	312	156	870	312	4540	81724	40862	20431	78422	39211
	Maximum	kg/day	217	516	831	516	88	18	71	445	222	1242	445	7365	103113	51556	25778	106059	53029
Concentration	Average	mg/L	350	350	350	350	6000	1250	120000	302	302	302	302	8800	8800	8800	8800	9500	9500
	Max (if applicable)	mg/L	500	500	500	500	6000	1224	240000	302	302	431	302	10000	10000	10000	10000	12000	12000

Stream			16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Stream description			Sludge Recirculation (per membrane tank)	Filtrate (per membrane tank)	Filtrate (total)	Aeration to ASP	Aeration (to membranes)	UV Feed (Total)	UV Feed (per train)	Chlorinated Water	WAS	Dewatered Cake	Dewatering Centrate	Residential Network Pumps	Irrigation Pond Discharge	Potable Water Top-up (To Recycled Water)	Return Pumps
Flow	ADWF	m3/h	85.99	10.39	41.58	504.00	200	41.58	20.79	41.58	1.42	0.09	1.33	31.25	10.33	0.00	1.74
	Diurnal Peak	m3/h	92.06	15.34	61.38	604.80	300	61.38	30.69	61.38	9.92	0.13	9.78	61.38	61.38	0.00	10.38
	PWWF	m3/h	92.06	20.00	80.00	504.00	300	80.00	40.00	80.00	10	0.13	9.78	61.38	80.00	-18.62	10.98
	Inst. Max	m3/h	100.00	40.00	80.00	660	300	80.00	40	80.00	10	0.20	9.78	162.00	80	-49	56.00
Load	Average	kg/day	19605	0.00	0.00			0.00	0.00	0	340	330	10				
	Maximum	kg/day	26515	0.02	0.07			0.07	0.04	0	510	495	15				
Concentration	Average	mg/L	9500	0.00	0.00			0.00	0.00	0	10000	150000	7680				
	Max (if applicable)	mg/L	17000	0.05	0.05			0.05	0.03	0	12000	150000	11523				

Chemicals

Stream			31	32	33	34	35	36	
Stream description			Ferric Chloride	Hypochlorite to Chlorination	Hypochlorite to Inlet TWS	Hypochlorite to Reticulation Network	Hypochlorite to Irrigation Storage	Polymer	
Flow	ADWF	L/h	6.07	2.35	1.11	0.28	0.28	0.04	m3/h
	Diurnal Peak	L/h	8.67	3.36	1.58	0.40	0.40	0.04	m3/h
	PWWF	L/h	8.67	7.20	1.11	1.11	1.11	0.04	m3/h
	Inst. Max	L/h	20.00	20.00	20.00	10.00	10.00	0.06	m3/h

Odorous Gases

40	41	42
Concentrated Gases	Dilute Gases (equalisation Tanks)	Total Foul Air Gas
434	5333	5767
434	5333	5767
434	5333	5767
434	5333	5767

4.2.4

Interconnection Point
Potable Water Top-Up

DATE PLOTTED: 12 June 2015 2:58 PM BY : FRANK KOLENDA

XREF's: xNA82013043-52 Title; xNA82013043-52 Survey; xNA82013043-52 Services; xNA82013043-52 Base xNA82013043-52 D-BASE
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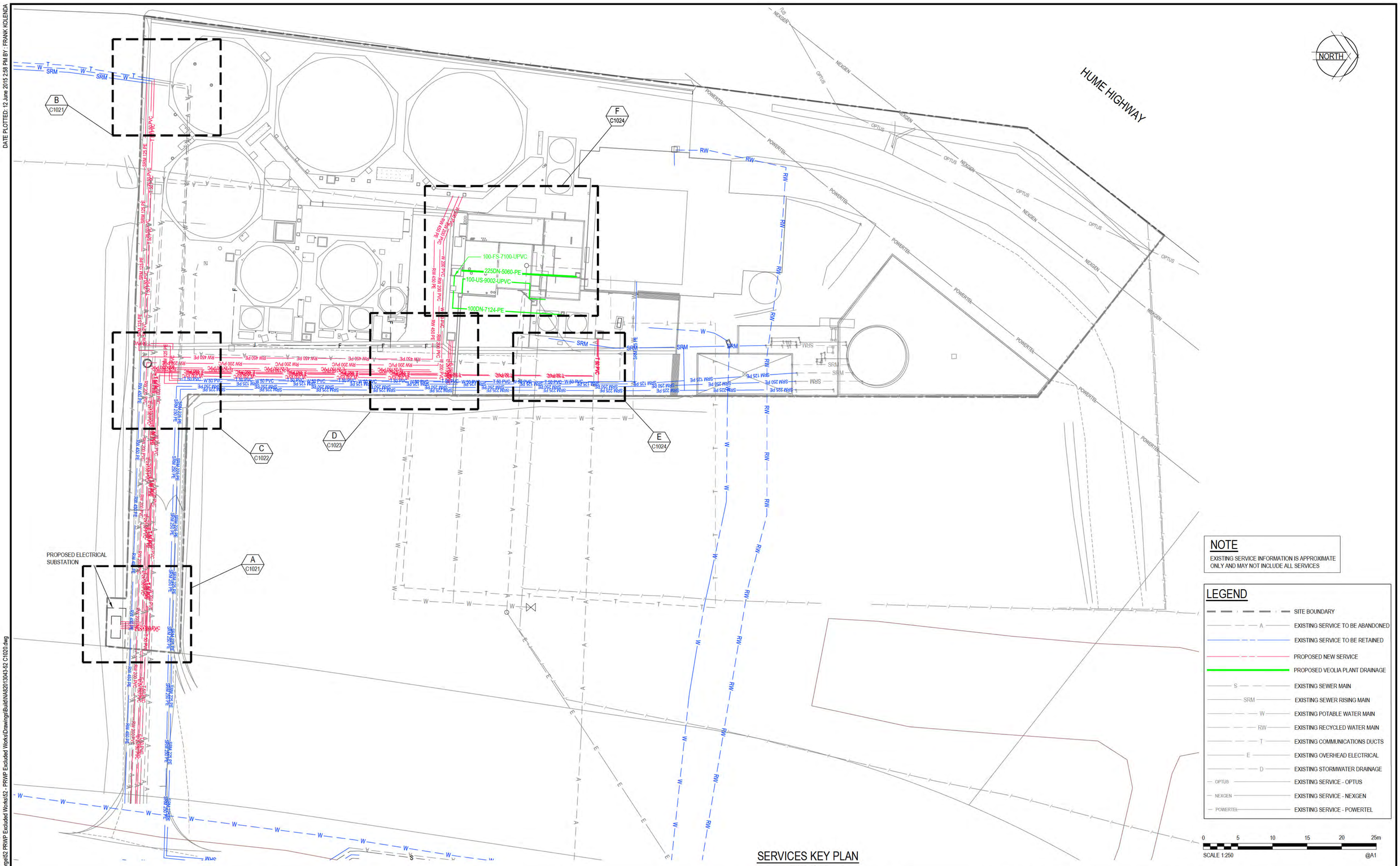

NOTE

EXISTING SERVICE INFORMATION IS APPROXIMATE ONLY AND MAY NOT INCLUDE ALL SERVICES

LEGEND

- SITE BOUNDARY
- A — EXISTING SERVICE TO BE ABANDONED
- EXISTING SERVICE TO BE RETAINED
- PROPOSED NEW SERVICE
- PROPOSED VEOLIA PLANT DRAINAGE
- S — EXISTING SEWER MAIN
- SRM — EXISTING SEWER RISING MAIN
- W — EXISTING POTABLE WATER MAIN
- RW — EXISTING RECYCLED WATER MAIN
- T — EXISTING COMMUNICATIONS DUCTS
- E — EXISTING OVERHEAD ELECTRICAL
- D — EXISTING STORMWATER DRAINAGE
- OPTUS — EXISTING SERVICE - OPTUS
- NEXGEN — EXISTING SERVICE - NEXGEN
- POWERTEL — EXISTING SERVICE - POWERTEL

0 5 10 15 20 25m

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SERVICES KEY PLAN

SCALE 1:250

Rev.	Date	Description	Des.	Verif.	Appd.
1	12/06/2015	ISSUED FOR TENDER	DAC	MBK	PCC

Cardno (NSW/ACT) Pty Ltd | ABN 95 001 145 035
Level 1, 47 Burelli Street
Wollongong NSW 2500
Tel: 02 4228 4133 Fax: 02 4228 6811
Web: www.cardno.com.au

		Date
Drawn	DAC	9/06/2015
Checked	JMA	12/06/2015
Designed	DAC	9/06/2015
Verified	MBK	12/06/2015
Approved	PCC	12/06/2015

Client: LEND LEASE COMMUNITIES (WILTON) PTY LTD

Project: BINGARA GORGE
PERMANENT RECYCLED WATER PLANT CIVIL WORKS

Title: SERVICES KEY PLAN

Status: FOR TENDER ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

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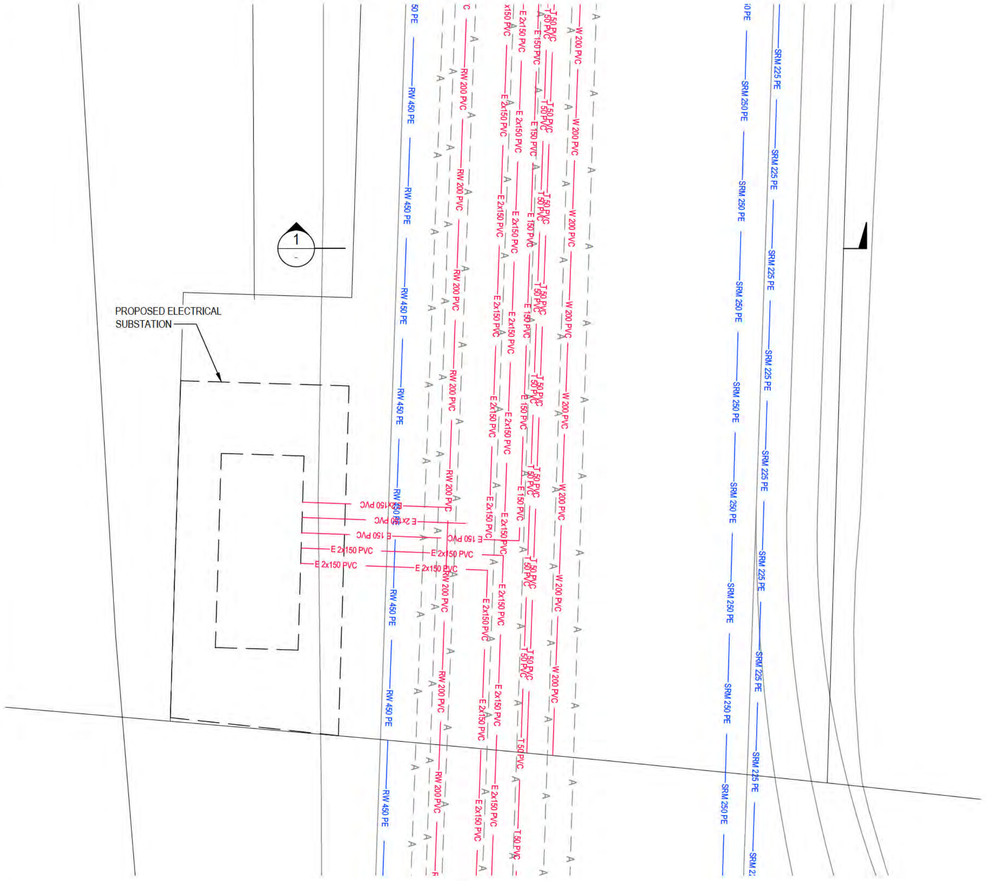
Revision: 1



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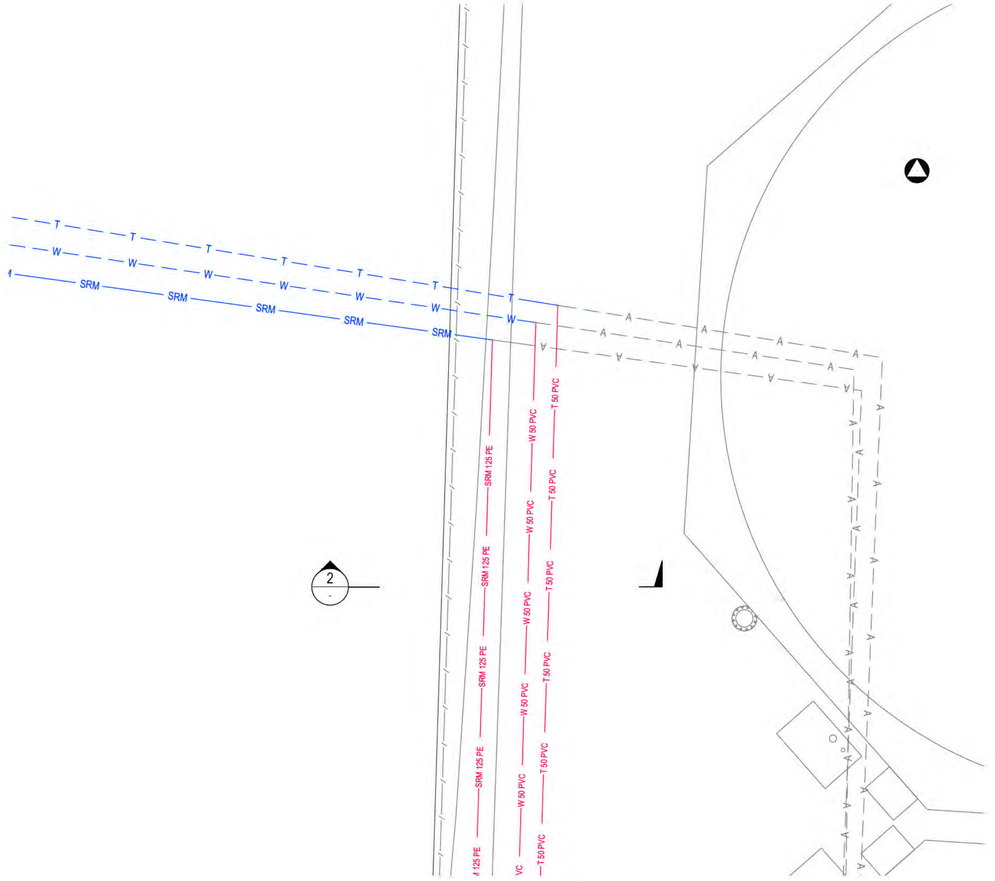

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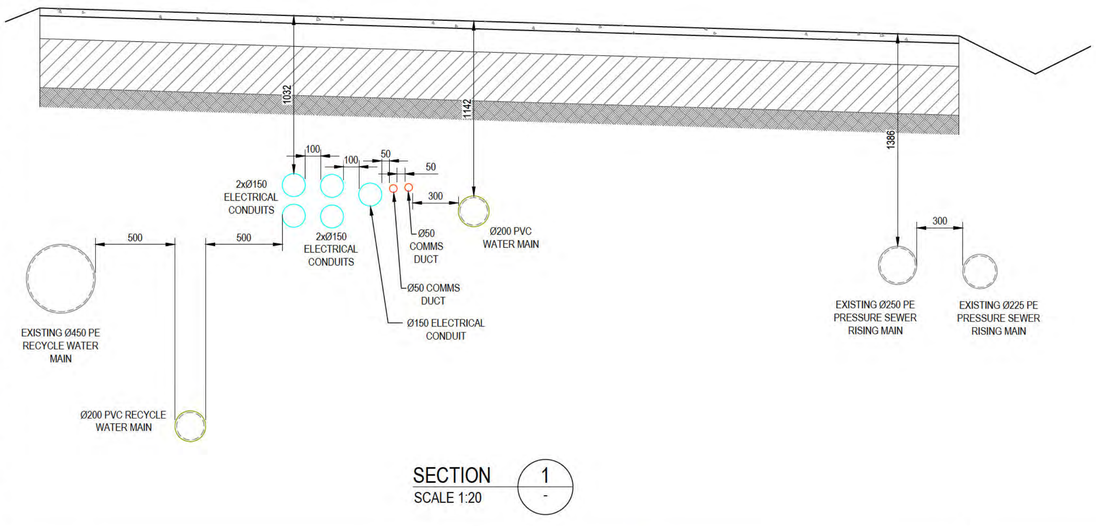

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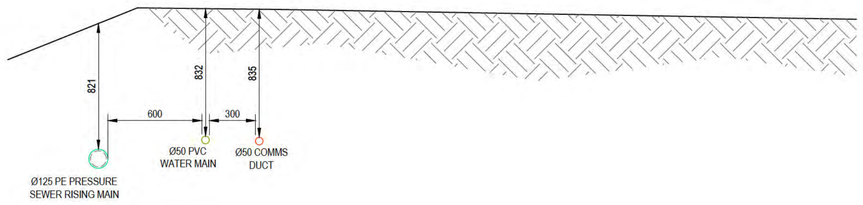

SECTION 2
SCALE 1:20
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NOTE

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LEGEND

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- A — EXISTING SERVICE TO BE ABANDONED
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- D — EXISTING STORMWATER DRAINAGE
- OPTUS — EXISTING SERVICE - OPTUS
- NEXGEN — EXISTING SERVICE - NEXGEN
- POWERTEL — EXISTING SERVICE - POWERTEL

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SCALE 1:20 @A1

0 1 2 3 4 5m
SCALE 1:50 @A1

Rev.	Date	Description	Des.	Verif.	Appd.
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Approved		
	PCC	12/06/2015

Client: LEND LEASE COMMUNITIES (WILTON) PTY LTD

Project: BINGARA GORGE
PERMANENT RECYCLED WATER PLANT CIVIL WORKS

Title: DETAIL AND SECTION PLAN
SHEET 1 OF 4

Status: FOR TENDER ONLY
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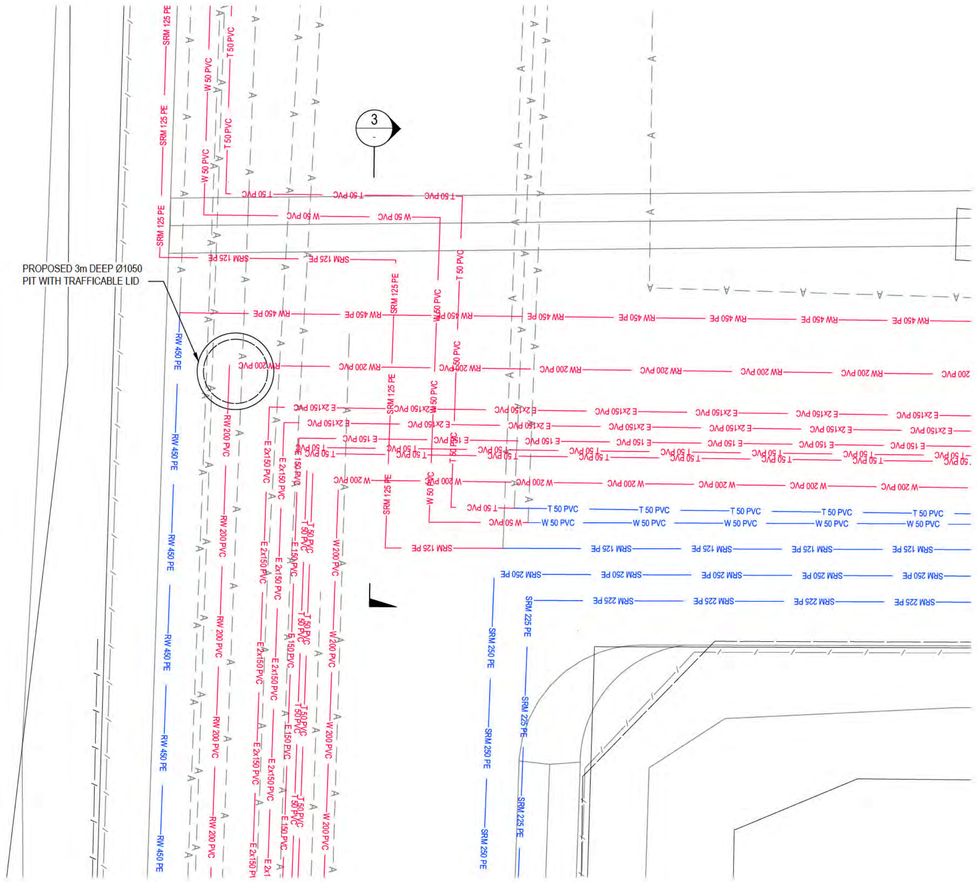

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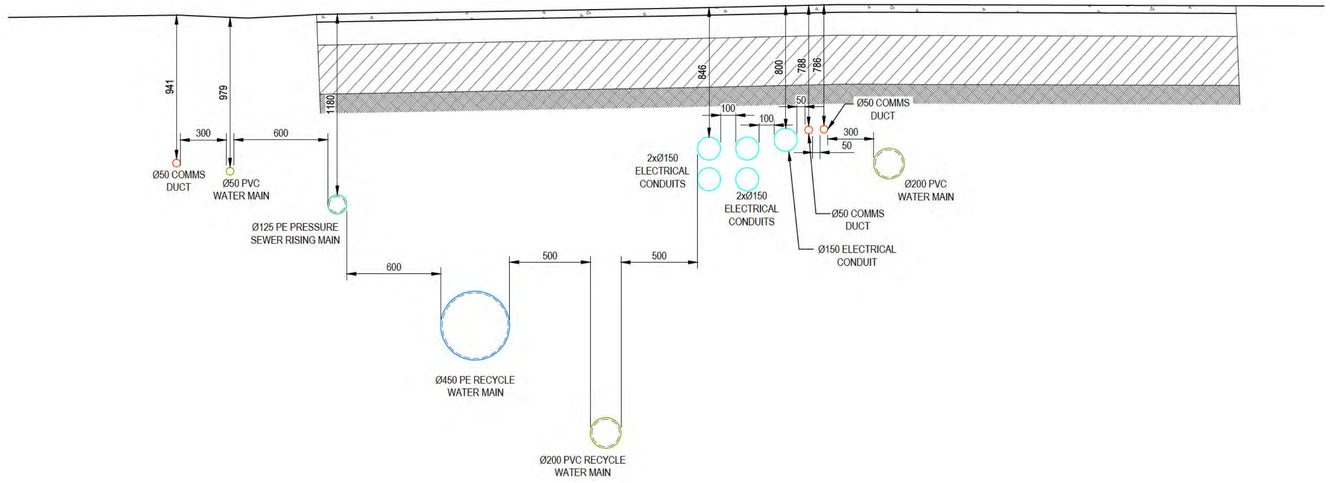

SECTION 3
SCALE 1:20
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NORTH

NOTE
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LEGEND

- SITE BOUNDARY
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- NEXGEN — EXISTING SERVICE - NEXGEN
- POWERTEL — EXISTING SERVICE - POWERTEL

0 0.5 1 1.5 2m
SCALE 1:20 @A1

0 1 2 3 4 5m
SCALE 1:50 @A1

Rev.	Date	Description	Des.	Verif.	Appd.
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Designed	DAC	9/06/2015
Verified	MBK	12/06/2015
Approved	PCC	12/06/2015

Client: LEND LEASE COMMUNITIES (WILTON) PTY LTD
Project: BINGARA GORGE
PERMANENT RECYCLED WATER PLANT CIVIL WORKS
Title: DETAIL AND SECTION PLAN
SHEET 2 OF 4

Status: FOR TENDER ONLY
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AHD	AS SHOWN	A1

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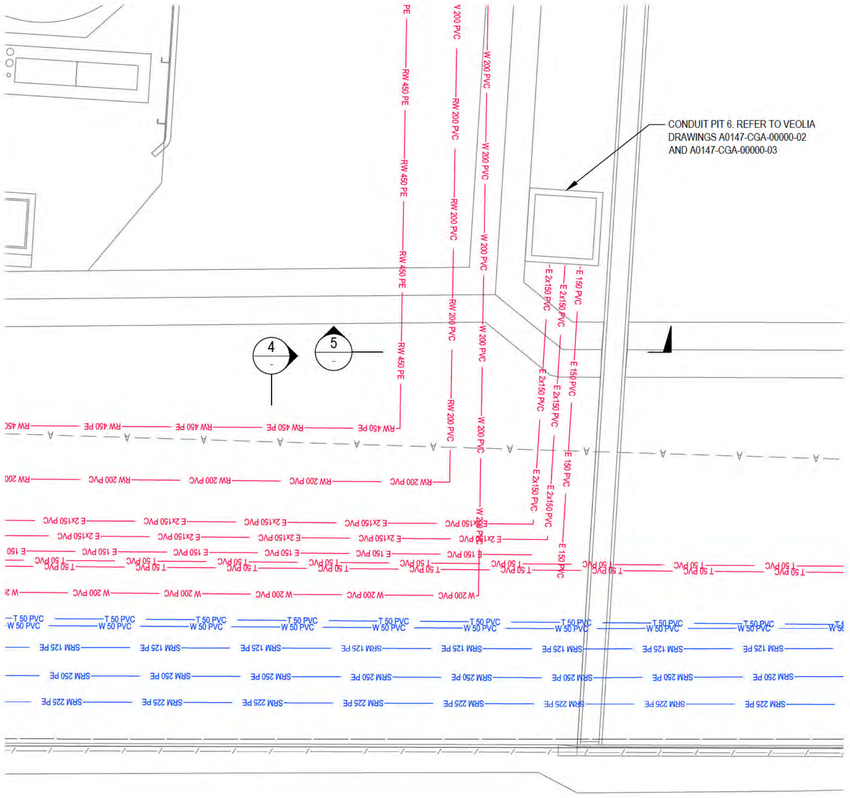
Revision: 1



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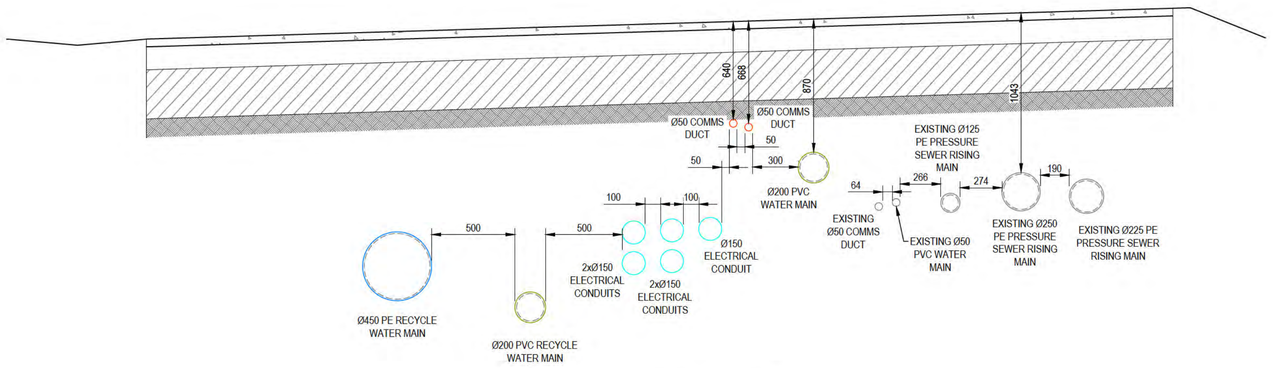

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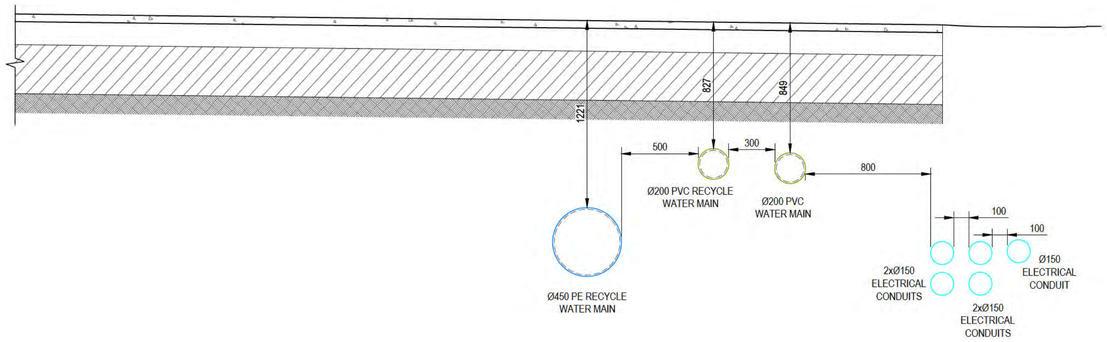

SECTION 5 / -
SCALE 1:20

NORTH

NOTE

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- OPTUS — EXISTING SERVICE - OPTUS
- NEXGEN — EXISTING SERVICE - NEXGEN
- POWERTEL — EXISTING SERVICE - POWERTEL

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SCALE 1:20 @A1

0 1 2 3 4 5m
SCALE 1:50 @A1

Rev.	Date	Description	Des.	Verif.	Appd.
1	12/06/2015	ISSUED FOR TENDER	DAC	MBK	PCC

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Designed	DAC	9/06/2015
Verified	MBK	12/06/2015
Approved	PCC	12/06/2015

Client: LEND LEASE COMMUNITIES (WILTON) PTY LTD

Project: BINGARA GORGE
PERMANENT RECYCLED WATER PLANT CIVIL WORKS

Title: DETAIL AND SECTION PLAN
SHEET 3 OF 4

Status: FOR TENDER ONLY
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AHD		AS SHOWN	A1

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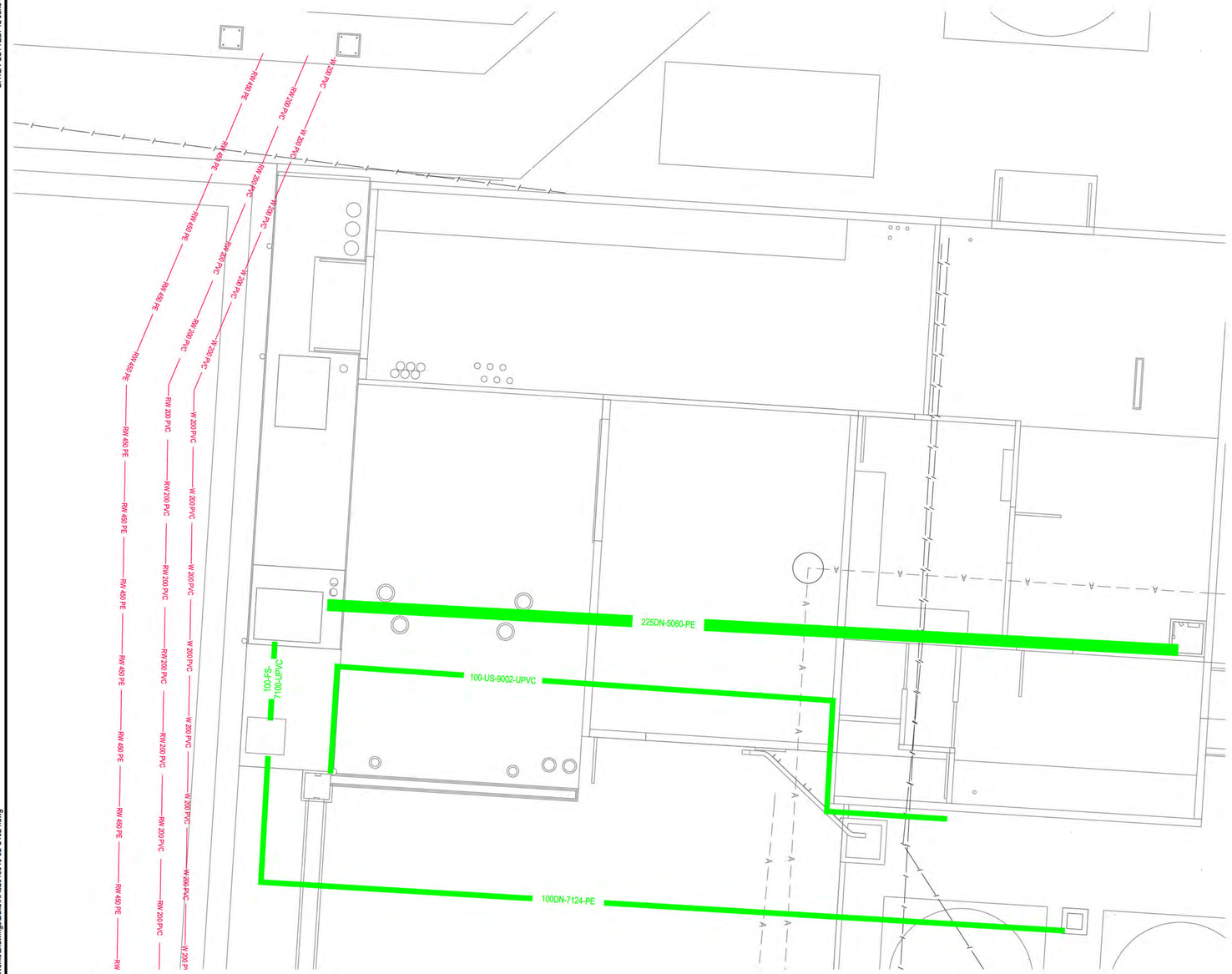
Revision: 1



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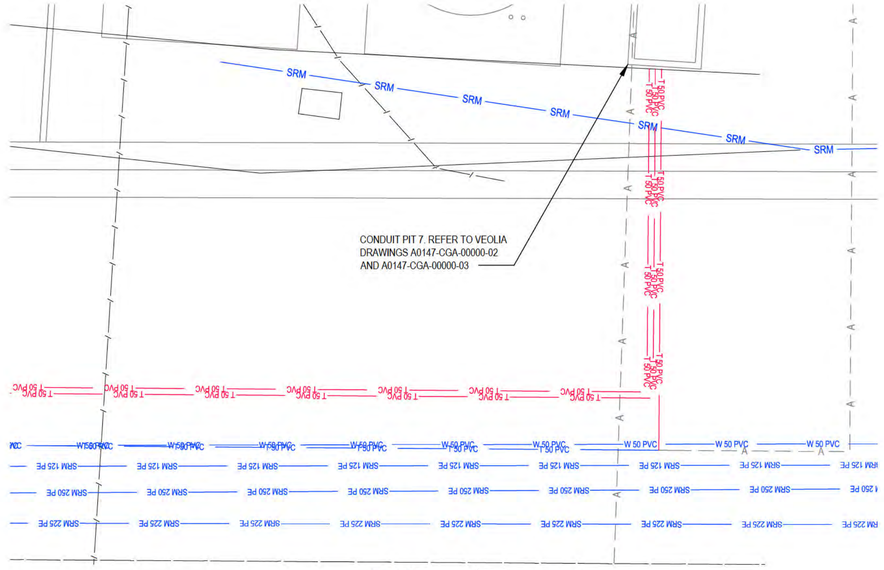

DETAIL E
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NOTE

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- NEXGEN — EXISTING SERVICE - NEXGEN
- POWERTEL — EXISTING SERVICE - POWERTEL

0 1 2 3 4 5m
SCALE 1:50 @A1

Rev.	Date	Description	Des.	Verif.	Appd.
1	12/06/2015	ISSUED FOR TENDER	DAC	MBK	PCC

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Checked	JMA	12/06/2015
Designed	DAC	9/06/2015
Verified	MBK	12/06/2015
Approved	PCC	12/06/2015

Client: LEND LEASE COMMUNITIES (WILTON) PTY LTD

Project: BINGARA GORGE
PERMANENT RECYCLED WATER PLANT CIVIL WORKS

Title: DETAIL AND SECTION PLAN
SHEET 4 OF 4

Status: FOR TENDER ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

DATUM	Scale	Size
AHD	AS SHOWN	A1

Drawing Number: NA82013043-52 C1024
Revision: 1

TK6010A/B
TREATED WATER TANKS
CAPACITY : 1500m³

PU6030A/B
HIGH FLOW RESIDENTIAL PUMPS 2x68%
FLOW @ PRESSURE : 110m³/h @ 400kPa

PU6031A
LOW FLOW RESIDENTIAL PUMP 1x35%
FLOW @ PRESSURE : 57m³/h @ 400kPa

PU6020
SAMPLE PUMP
FLOW @ PRESSURE : 0.8m³/h @ 235kPa

FROM POTABLE WATER NETWORK
150 - PW-6010-uPVC
TP 4
25 6000.02
RPZ 25 6000.03
25 6000.04
PI 6021
PAL 6022
PS 6022
15 6000.09
25 - PW-6015-uPVC
SERVICES POTABLE WATER
25 - PW-6017-uPVC
25 - PW-1010-uPVC
25 7010.01
25 7020.01
7010
SAFETY SHOWER & EYE WASH
7020
SAFETY SHOWER & EYE WASH
A0147-P&ID-5000-01
FROM CHLORINATED WATER PUMPS
150 - DE-6011-uPVC
150 6010.11
FIT 6031
LAHH 6001
LSH 6001
NOTE 1
NOTE 2
150x15
15 6000.06
15x12
A0147-P&ID-7200-01
FROM CHLORINE DOSING PUMPS
12 - HS-7218-PE HOSE
225 - RW-6013-PE
280 RW-6031-PE
280x225
225x150
150 - RW-6014-uPVC
150 6010.14
LALL 6020
LSL 6020
50 6010.13
100x50
TK6010A
TREATED WATER TANK A
N1 N2 N3 N4 N5 N6 N7 N8 M1 M2
V1 300 V2 300
750
600
25 6010.10
LAH 6002
LAL 6002
LIT 6002
400x200
200 FC6010A
200 6010.12
225 - RW-6012-PE
PAH 6007
PAL 6007
PIT 6007
225x15
15 6030.01
A0147-P&ID-7200-01
TO HYPO. DOSING PUMPS
FAL 6008
FIT 6008
200 6030.02
TP 2
RECYCLED WATER (LILAC) NETWORK
225 - RW-6017-PE
MIX6040
INLINE STATIC MIXER
225x50
50x25
25 6000.13
25 - FI-6027-uPVC
A0147-P&ID-8500-03
TO BTF
50 6000.07
50 - RW-6019-uPVC
A0147-P&ID-1000-01
TO SCREENS/DEWATERING
50x25
25 6030.08
25x15
15 - DN-6028-PE
A0147-P&ID-7000-01
TO WET RACK
(PU6031B FUTURE)
VSD
PI 6025
225x100
100 6030.31
100x80
80
FC6031AS
FC6031AD
80x50
80 6030.32
80 6030.33
225x80
PU6031A
LOW FLOW RESIDENTIAL PUMP A
RO
225x80
80 6030.05
80 - RW-6018-uPVC
225x150
225 - RW-6012-PE
225 - RW-6017-PE
PI 6023
225x150
150 6030.11
150x100
100
150x80
FC6030AS
FC6030AD
150 6039.12
150 6030.13
PU6030A
HIGH FLOW RESIDENTIAL PUMP A
NOTE 2
PI 6024
225x150
150 6030.21
FC6030BS
FC6030BD
150 6030.22
150 6030.23
PU6030B
HIGH FLOW RESIDENTIAL PUMP B
PE PVC
PVC PE
NOTE 1
NOTE 2
A0147-P&ID-7200-01
TO HYPO. DOSING PUMPS
NOTES:
1. STAGE 2 CONNECTION.
2. STAGE 3 CONNECTION.
3. FLOW METER WATER SEAL & SIPHON BREAKER
LAHH 6003
LSH 6003
150 - DE-6021-uPVC
150 6010.21
TK6010B
TREATED WATER TANK B (STAGE 2)
225 - RW-6023-PE
225 - RW-6032-PE
280 RW-6033-PE
LALL 6009
LSL 6009
50 6010.23
100x50
LAH 6004
LAL 6004
LIT 6004
225x150
150 6010.24
150 - RW-6024-uPVC
400x225
200 6010.22
225 - RW-6022-PE
NOTE 1
25 6000.12
225x15
NOTE 3
TP 3
225 - RW-6000-PE
IRRIGATION LAGOON
225 - RW-6032-PE
MIX6000
INLINE STATIC MIXER
225x15
15 6000.08
15x12
FIT 6019
FSL 6019
PVC PE
200x40
40 - RW-6020-PVC
PI 6018
15 6020.01
PVC PE
15 - DN-6029-PE
A0147-P&ID-7000-01
TO WET RACK
40 6020.21
40x32
32x25
25 6020.22
25 6020.23
25x15
15 - RW-6009-uPVC
40 6000.14
PU6020
SAMPLE PUMP
A0147-P&ID-7200-01
FROM CHLORINE DOSING PUMPS
12 - HS-7220-PE HOSE
A0147-P&ID-7200-01
FROM CHLORINE DOSING PUMPS
12 - HS-7219-PE HOSE

DRAWING CURRENT STATUS
ISSUED FOR CONSTRUCTION

REV	REVISION	DRAWN	CHECKED	APPROVED	REVISION DATE
2	UPDATED TO DCN A0147-007	LS	CVG	AJL	11/09/2015
B	UPDATED TO DCN A0147-001	LS	CVG	AJL	04/09/2015
A	ISSUED FOR CONSTRUCTION	LS/HL	CVG	AJL	22/05/2015
1	ISSUED FOR HAZOP	MG/HL	LS	AJL	27/02/2015
0	ISSUED FOR REVIEW	LS	HR	AJL	16/01/2015

DO NOT SCALE THIS DRAWING
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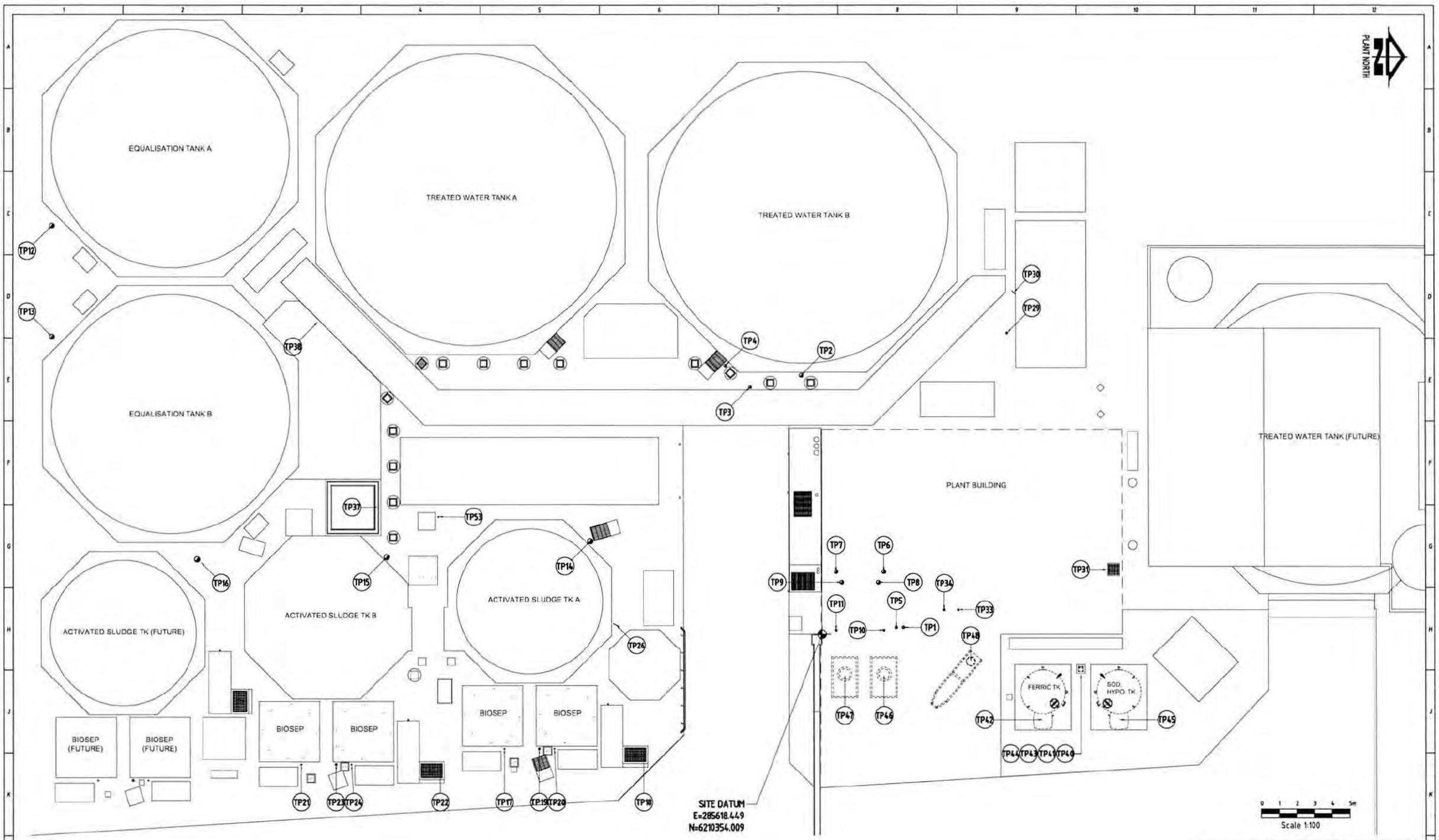
THIRD ANGLE PROJECTION

Veolia Water Solutions & Technologies (Australia) Pty Ltd
(A.B.N. 35 055 254 803)
Level 3
1 Innovation Road
Macquarie Park, NSW, 2113
Sydney, Australia.
Web: www.veoliawaterst.com.au
Email: systems@veoliawater.com
Tel: 61 2 8514 3200
Fax: 61 2 8514 3222

VEOLIA

DRAWN	LS
DATE	11/09/2015
CHECKED	CVG
DATE	11/09/15
APPROVED	AJL
DATE	14/09/15
REF DRAWING No.	
CUSTOMER	LEND LEASE
TITLE	PROCESS & INSTRUMENTATION DIAGRAM PERMANENT RECYCLED WATER PLANT (PRWP) TREATED WATER TANKS AND SAFETY SHOWERS
PROJECT REF	BINGARA GORGE - PRWP
LOCATION	WILTON NSW
PROJECT No.	A0147
ESTIMATE No.	
AREA	
SCALE	N.T.S
SHEET	01 OF 01
SIZE	A1
DRAWING No.	A0147-P&ID-6000-01
REVISION	2

PLOTTED 11/9/15 - 3:38pm
FILE-NO A0147-P&ID-6000-01D



NOTES:
1. TERMINATION POINTS TABLE REFER TO A0147-OGA-0000-02
2. UNDER GROUND PIPEWORK ROUTES OMITTED FOR CLARITY

PLAN

DRAWING CURRENT STATUS

ISSUED FOR CONSTRUCTION

REV	REVISION	DRAWN	CHECKED	APPROVED	REVISION DATE
0	ISSUED FOR CONSTRUCTION	PM	CVG	AJL	15/09/2015

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IF IN DOUBT ASK
THIRD ANGLE PROJECTION

Veolia Water Solutions & Technologies
(Australia) Pty Ltd
(A.B.N. 35 155 254 003)
Level 4, Bay Centre,
65 Pirrama Road
Pyrmont, NSW, 2009
Sydney, Australia.
Web: www.veoliawaterst.com.au
Email: enquiries@veoliawater.com
Tel: 61 2 8572 0400
Fax: 61 2 8572 0410

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DRAWN	PM	DATE	15/09/2015
CHECKED	CVG	DATE	15/9/15
APPROVED	AJL	DATE	15/9/15
REF DRAWING No.			

CUSTOMER: LEND LEASE
TITLE: OVERALL GENERAL ARRANGEMENT
PIPING INTERFACE SCHEDULE
TERMINATION POINTS LOCATION - SITE PLAN
PROJECT REF: BINGARA GORGE - PRWP
LOCATION: WILTON NSW

PROJECT No.	ESTIMATE No.	AREA
A0147		00
SCALE	SHEET OF	SIZE
1:100	01 03	A1
DRAWING No.		REVISION
A0147-OGA-0000-01		0

TP	SIZE	DESCRIPTION	CONNECTION	E	N	RL
1	225	INLET FROM PU0100B PUMP	PE TABLE E	285618.341	6210358.625	200.900
2	225	RECYCLED WATER NETWORK	PE TABLE E	285603.781	6210353.787	201.254
3	225	OVERFLOW TO IRRIGATION LAGOON	PE TABLE E	285604.263	6210350.844	201.254
4	250	FROM POTABLE WATER NETWORK	PE TABLE E	285602.964	6210349.529	201.354
5	160	TO FEED TANKS	PE TABLE E	285618.316	6210358.226	200.900
6	225	DRUM SCREEN "A" OVERFLOW	PE TABLE E	285615.124	6210357.727	200.900
7	225	DRUM SCREEN "B" OVERFLOW	PE TABLE E	285614.953	6210355.032	200.900
8	225	DRUM SCREEN "A" DRAIN	PE TABLE E	285615.708	6210357.374	200.900
9	225	DRUM SCREEN "B" DRAIN	PE TABLE E	285615.577	6210355.308	200.900
10	110	SCREW PRESS "A" DRAIN	PE TABLE E	285618.437	6210357.517	200.900
11	110	SCREW PRESS "B" DRAIN	PE TABLE E	285618.266	6210354.822	200.900
12	280	EQ. TK "A" O/D	PE TABLE E	285592.648	6210311.994	201.454
13	280	EQ. TK "B" O/D	PE TABLE E	285598.916	6210311.596	201.454
14	315	ACT. SLUDGE TK. "A" OVERFLOW	PE TABLE E	285612.352	6210341.246	201.655
15	315	ACT. SLUDGE TK. "B" OVERFLOW	PE TABLE E	285612.523	6210329.712	201.655
16	315	ACT. SLUDGE TK. "FUTURE" OVERFLOW	PE TABLE E	2856613.114	6210318.876	201.636
17	50	TRAIN A BIOSEP A FILTRATION SKID DRAIN	UPVC PLAIN END	285623.814	6210335.662	201.580
18	100	TRAIN A BACKWASH SKID BUND DRAIN	BUND DRAIN	285624.376	6210343.504	201.657
19	100	TRAIN A BIOSEP A/B DRAIN	UPVC TABLE E	285623.938	6210337.628	201.586
20	50	TRAIN A BIOSEP B FILTRATION SKID DRAIN	UPVC PLAIN END	285623.993	6210338.496	201.586
21	50	TRAIN B BIOSEP A FILTRATION SKID DRAIN	UPVC PLAIN END	285623.984	6210324.128	201.580
22	100	TRAIN B BACKWASH SKID BUND DRAIN	UPVC TABLE E	285624.546	6210331.970	201.227
23	100	TRAIN B BIOSEP A/B DRAIN	UPVC TABLE E	285624.109	6210326.094	201.586
24	50	TRAIN B BIOSEP B FILTRATION SKID DRAIN	UPVC PLAIN END	285624.164	6210326.963	201.580
26	315	FILTRATE TK OVERFLOW	PE TABLE E	285617.184	6210342.395	201.706
29	110	CONTACT TANK "A" DRAIN	PE TABLE E	285602.128	6210365.572	200.750
30	225	CONTACT TANK "B" OVERFLOW	PE TABLE E	285593.864	6210366.102	200.977
31	100	WET RACK DRAIN	DRAIN TO PIT	285615.962	6210370.700	200.450
33	110	CENTRIFUGE CONCENTRATE OUTLET	PE TABLE E	285617.548	6210361.799	200.900
34	110	CENTRIFUGE CONVERYOR DRAIN	PE TABLE E	285617.498	6210361.001	200.900
37	100	BIO TRICKLING FILTER BUND DRAIN	BUND DRAIN	285609.794	6210329.326	201.185
38	50	ODOUR CONTROL SYSTEM DRAIN	150 SUMP & GRATE	285599.027	6210326.680	201.269
40	32	FERRIC TANK SUPPLY DRAIN	DRAIN TO PIT	285621.489	6210368.369	200.874
41	90	FERRIC TANK OVERFLOW	DRAIN TO PIT	285621.266	6210368.409	200.874
42	50	FERRIC SUPPLY FROM TANKER	QUICK CPLG	REF TK DRG	REF TK DRG	REF TK DRG
43	90	SOD. HYPO. TANK OVERFLOW	DRAIN TO PIT	285621.279	6210368.609	200.874
44	32	SOD. HYPO. SUPPLY DRAIN	DRAIN TO PIT	285621.505	6210368.620	200.874
45	50	SOD. HYPO. SUPPLY FROM TANKER	QUICK CPLG	REF TK DRG	REF TK DRG	REF TK DRG
46	600	SCREENING BIN "A"	CUSTOM FLANGE	285620.745	6210357.509	N/A
47	600	SCREENING BIN "B"	CUSTOM FLANGE	285620.745	6210355.284	N/A
48	400	DEWATERING SOLIDS BIN	CUSTOM FLANGE	285620.021	6210362.427	203.14
53	50	WET AIR RECEIVER DRAIN	UPVC PLAIN END	285610.438	6210332.773	201.494

DRAWING CURRENT STATUS

ISSUED FOR CONSTRUCTION

REV	REVISION	DRAWN	CHECKED	APPROVED	REVISION DATE
0	ISSUED FOR CONSTRUCTION	PM	CVG	AJL	15/09/2015

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THIRD ANGLE PROJECTION

Veolia Water Solutions & Technologies
(Australia) Pty Ltd
(A.B.N. 35 055 254 003)
Level 4, Bay Centre,
65 Pirrama Road
Pyrmont, NSW, 2009
Sydney, Australia.
Web: www.veoliawaterst.com.au
E-mail: stems@veoliawater.com
Tel: 61 2 8572 8400
Fax: 61 2 8572 8418

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DRAWN	PM	DATE	15/09/2015
CHECKED	CVG	DATE	15/9/15
APPROVED	AJL	DATE	15/9/15
REF DRAWING No.			

CUSTOMER: LEND LEASE
TITLE: OVERALL GENERAL ARRANGEMENT
PIPING INTERFACE SCHEDULE
TERMINATION POINTS TABLE
PROJECT REF: BINGARA GORGE - PRWP
LOCATION: WILTON NSW

PROJECT No.	A0147	ESTIMATE No.	
AREA	00	SCALE	N.T.S
SHEET	02 OF 03	SIZE	A1
DRAWING No.	A0147-OGA-0000-02	REVISION	0

4.2.8

Recycled Water Demand

[1] SF = Sanitary Flow

[2] GWI = Groundwater infiltration

[3] SWI = Annual stormwater infiltration

[4] Gravity PWWF is approximately 6 x ADWF based on current peak flow information (based on trucking volumes) from the catchment

As indicated above in Table 6.1, the Average Dry Weather Flow (ADWF) in the Bingara Scheme is estimated to be 450 kL/day during Stage 1 and increases up to 945 kL/day at Ultimate development of 2000 ET.

The Peak Wet Weather Flow (PWWF) is based on:

- A peaking factor of 6 x ADWF in terms of instantaneous flow from the gravity catchment has been allowed, as this is the current peaking factor observed in the gravity catchment based on available information of pump outs, and there is significant storage in the catchment to buffer instantaneous peaks (see Section 9.3); and
- A peaking factor of 1.5 x ADWF from the pressure catchment as this is the maximum design capacity of the system.

With allowances for stormwater infiltration to the sewerage systems, the total annual flow is estimated to increase to approximately 550 kL/day (200 ML/year) during stage 1 and up to approximately 1100 kL/day (400 ML/year) at the Ultimate development of 2000 ET.

The relative impact of the additional stormwater and groundwater infiltration on the gravity sewerage catchment is most pronounced during the early stages of development when there is less pressure sewer network.

6 Recycled Water Demands

The proposed Bingara Scheme will supply Class A+ recycled water for the following uses:

- Golf Course Irrigation Network
- The Lilac Recycled Water Supply Network
- Irrigation of public open space, streetscapes and Wilton Oval
- Recycled water usage on customer premises.

An overview of the above recycled water demands is outlined below.

6.1 Golf Course Irrigation Demands

The Bingara Gorge master planned subdivision includes an 18-hole golf course. This golf course will have a large ongoing irrigation water demand. Irrigation of the golf course using recycled water also provides the dual benefit of maximising beneficial reuse of wastewater produced onsite to avoid excessive discharges to the Nepean River.

The 18-hole golf course has its own dedicated irrigation network supplied with recycled water from the wet weather storage pond. The available irrigation areas supplied from the golf course irrigation network is summarised below in Table 3.

The irrigation demand for the golf course has been estimated based on a peak day irrigation rate of 5 mm/day. These irrigation rates have been supported by daily water balance modelling in MEDLI (Department of Natural Resources, 1998). The model was based on irrigation occurring when a 5mm soil water deficit was achieved. The model indicated that the irrigation demand of the golf course will not be achieved by treated effluent alone and will need to be supplemented with stormwater or potable water.

Table 3: Golf course irrigation area and estimated irrigation demand

Zone	Area (ha)	Peak Demand	
		Rate[1] (mm/d)	Demand (kL/day)
Total Golf Course Irrigation Network	**46.7**	**5**	**2335**

[1] Peak irrigation rate based on Specifications for Bingara Gorge Golf Course Irrigation & Water Transfer Systems (Paul F. Jones & Associates Pty Ltd, Sep 2011). Higher irrigation demands may apply during short term periods of extreme evapotranspiration demand.

6.2 Class A + Recycled Water Demands

6.2.1 Recycled Water uses on Customer Premises

The recycled water demands on private property have been estimated based on the Water Supply Code of Australia - Sydney Water Edition; WSA 03-2011-3.1 (WSAA, 2012). In the Bingara Scheme, Class A+ recycled water from the lilac recycled water network can be reused on customer premises for the following uses:

- Toilet flushing
- Irrigation
- Outdoor cleaning and washdown, including bin and car washing
- Hard plumbed laundry washing machine cold water (voluntary)

Note: There will be no supply of recycled water to Sydney Water customers in the existing Wilton Village. The only supply of recycled water to Wilton Village will be for irrigation of Wilton Oval as discussed below in Section 6.2.2. Recycled water demands were calculated based on the water demand loading rates for dual water systems in the Water Supply Code of Australia - Sydney Water Edition; WSA 03-2011-3.1 (WSAA, 2012). The adopted water demand loading rates are outlined below in Table 7.2.

Table 7.2: Property specific water demand criteria for dual water systems

Land Use	Units	Potable Water[1]		Recycled Water[1]		%Recycled Water	
		ADD[2]	MDD[3]	ADD	MDD	ADD	MDD
Residential	kL/ET/day	0.5	0.8	0.25[4] (0.35)	1.15[4] (1.6)	33%	59%
Commercial	kL/net Ha/day	10	20	10.52	21	51%	51%
School	kL/500 students/day	45	90	45	90	50%	50%
Childcare	kL/500 students/day	45	90	45	90	50%	50%
Golf Club	kL/ET/day	0.5	0.8	0.35	1.6	41%	67%
Industrial	kL/net Ha/day	12.5	20	6.25	10	33%	33%

[1] Water demands as per Water Supply Code of Australia - Sydney Water Edition; WSA 03-2011-3.1 (WSAA, 2012).

[2] ADD = Average Day Demand.

[3] MDD = Maximum Day Demand.

[4] 0.25 kL/ET/day ADD excludes reuse for laundry washing machine cold water as this has not been mandated across the Bingara Scheme. Values in brackets indicate recycled water demands with laundry washing machine cold water reuse.

The supply of Class A+ recycled water into the lilac recycled water network will commence following commissioning and performance proving of the Bingara PRWP. Prior to this, recycled water network will continue to be supplied with potable water from the Sydney Water network.

The estimated demands for recycled water at each stage of the Bingara Scheme are outlined below in Table 4. It can be seen from Table 4 that there is no recycled water supply to the existing Sydney Water customers inside Wilton Village. The only recycled water supply to Wilton Village will be Class A+ recycled water for irrigation of Wilton Oval.

Table 4: Estimated recycled water demands for each stage

				Recycled Water Demand (kL/day)			
	Land Use	Size		With Laundry Reuse		No Laundry Reuse	
		No	Units	ADD	MDD	ADD	MDD
Stage 1	BG Residential Lots	525	Lots	184	840	131	604
	Primary School	400	Pupils	36.0	72.0	36.6	72
	Childcare Centre	80	Children	7.2	14.4	7.2	14.4
	Golf/Country Club	400	Visitors	11.7	53.3	11.7	53.3

	Commercial	1.03	ha	10.8	21.6	10.8	21.6
	Light Industry	0	ha	0	0	0	0
	Total Stage 1- 900 ET			**250**	**1001**	**197**	**765**
Stage 2	BG Residential Lots	1165	Lots	407.8	1864.0	291.3	1339.8
	Primary School	400	Pupils	36.0	72.0	36.6	72
	Childcare Centre	80	Children	7.2	14.4	7.2	14.4
	Golf/Country Club	400	Visitors	11.7	53.3	11.7	53.3
	Commercial	1.03	ha	10.8	21.6	10.8	21.6
	Light Industry	0	ha	0	0	0	0
	Total Stage 2- 1540 ET			**473.5**	**2025.4**	**357.0**	**1501.1**
Ultimate	BG Residential Lots	1520	Lots	532.0	2432.0	380.0	1748.0
	Primary School	400	Pupils	36.0	72.0	36.0	72.0
	Childcare Centre	80	Children	7.2	14.4	7.2	14.4
	Golf/Country Club	400	Visitors	11.7	53.3	11.7	53.3
	Commercial	1.03	ha	10.8	21.6	10.8	21.6
	Light Industry	4.2	ha	26.3	42.0	26.3	42.0
	Total Ultimate- 2000 ET			**624.0**	**2635.4**	**472.0**	**1951.4**

The recycled water demands in Table 4 are presented for two scenarios, with and without reuse for laundry washing machine cold water (laundry reuse). Laundry reuse has not been mandated in the Bingara Gorge development by Lend Lease Communities; hence laundry reuse is regarded as optional for customers inside the Bingara Scheme.

As recommended in the Water Supply Code of Australia - Sydney Water Edition; WSA 03-2011-3.1 (WSAA, 2012), allowance has been made for laundry reuse in both the recycled water supply system and in the surplus effluent irrigation system proposed for the site. In operation the actual volume of recycled water reused onsite will fall somewhere in between the two values presented in Table 4 based on the actual number of customers that elect to undertake laundry reuse of recycled water.

6.2.2 Public Open Space Irrigation Demands

Table 5: Public open space irrigation areas and estimated irrigation demand

Zone	Total Open Space	Assumed Irrigation	Peak Demand	
			Rate	Demand

	(ha)	Area (ha)	(mm/d)	(kL/d)
BG Open Space & Parks	13.1	3.7	5	185.0
Wilton Oval Sports Field	7.00	2.5	5	125.0
Total Open Space Irrigation	**20.1**	**6.2**		**310.0**

It can be seen from Table 7.4 there is a total of approximately 20.1 ha of open space and parklands provided within the Bingara Scheme boundary. It has been assumed that out of the total available area, approximately 6.2 ha would be suitable for irrigation following allowances for internal irrigation constraints like stormwater management, footpaths, shelters, picnic tables etc.

The irrigation demands for public open space and parklands has been estimated based on a peak day irrigation rate of 5 mm/day. These irrigation rates have been supported by daily water balance modelling in MEDLI (Department of Natural Resources, 1998). The model was based on irrigation occurring when a 5mm soil water deficit was achieved.

The demand for recycled water for irrigation of open space and park areas is estimated to be up to approximately 310 kL/day on a peak day. Higher irrigation rates may apply during short term periods of peak evapotranspiration demand.

6.2.3 Salinity Management

An evaluation has been conducted of the most appropriate mechanism for management of salinity, sodium adsorption ratio and other dissolved salt parameters to ensure that levels will not result in adverse effects to the environment and vegetation in irrigation water provided to the golf course, public spaces and recycled water customers. Total dissolved solids (TDS) has been selected as the most appropriate parameter for assessment of this as data is available at the existing Bingara temporary plant to provide a basis for assessment.

Based on the available data for the existing Bingara temporary plant the influent TDS is consistently less than 620 mg/ and has a median of approximately 560 mg/L. These values have been adopted for analysis of the expected TDS with the input from the lilac network returns.

No correlation is observed between TDS and COD in the influent to the plant and it is therefore assumed that where infiltration occurs, this is relatively similar in TDS of wastewater. The current TDS measured at the inlet to the temporary plant has therefore been adopted as a basis of design.

The measured TDS in wastewater to the plant is expected to be slightly below the TDS of recycled water provided following implementation of the recycled water network, with return of some TDS to the plant. The level of TDS increase will depend on the uptake of laundries in the catchment with a higher uptake of laundries resulting in greater return of TDS to the Bingara PRWP from the network.

After a short period of operation the TDS in the network will reach a steady state where the discharge to irrigation is equal to the input in each recycled water cycle through the system.

An evaluation has therefore been conducted on the steady state TDS of the recycled water in the system based on the following scenarios:

- 0% uptake of laundry connections to recycled water
- 30% uptake of laundry connections to recycled water
- 100% uptake of laundry connections to recycled water

This demonstrates that even at 100% uptake of laundry connections (a very unlikely scenario), the TDS will be maintained at < 1000 mg/L. This is considered acceptable even for more sensitive users (e.g. the golf course.)

To ensure no adverse effects of recycled water on plants the approach will be to monitor and inform users of the total dissolved solids (TDS), electrical conductivity (EC), Sodium Adsorption Ratio (SAR), Phosphorous and other levels, and inform users of appropriate planting strategies for the provided recycled water.

Table 7.4: Expected TDS with Laundry Uptake at Bingara PRWP

Scenario	0% Uptake of Laundry Connections		30% Uptake of Laundry Connections		100% Uptake of Laundry Connections	
	Median TDS	Maximum TDS	Median TDS	Maximum TDS	Median TDS	Maximum TDS
TDS mg/L	713	785	737	811	800	882

7 Sewerage Collection System

7.1 Overview

The Bingara scheme includes collection of wastewater as follows:

VEOLIA

4.2.10

Risk Assessments

WATER TECHNOLOGIES

4.2.10(a)

Risk Assessment
Recycled Water

WATER TECHNOLOGIES

8 Element 3 - Preventive Measures for Recycled Water Management

Components:
▪ Preventive measures and multiple barriers ▪ Critical control points

8.1 Preventive Measures and Multiple Barriers

Summary actions:
▪ Identify existing preventive measures system-wide for each significant hazard or hazardous event, and estimate the residual risk. ▪ Identify alternative or additional preventive measures that are required to ensure risks are reduced to acceptable levels. ▪ Document the preventive measures and strategies, addressing each significant risk.

This section provides an overview of preventative measures provided to ensure that the risk of hazards associated with the system is low. Each of these risks and preventative measures have been addressed in the HACCP discussed in Section 7.3.2 and presented in the Retail Supply Management Plan (RSMP) for the Bingara Scheme.

8.1.1 Water treatment

The treatment process design has been developed with the following objectives:

- To easily achieve the required treated water quality for proposed use
- To ensure surety can be provided in achieving log removal requirements as required by the Department of Health and IPART, with multi-barrier disinfection with pre-validated unit processes
- To provide automated response at CCP to ensure that water quality is within specification at all times.
- To be easy to operate
- To be efficient and cost effective to maintain and operate
- To provide a safe and clean environment in which our maintenance and operations staff will work
- To have a responsible approach to odour and noise prevention

An overview of the Bingara PRWP process is provided in Section 7.2.1.2. This includes a multi-stage treatment process with adequate redundancy and control in design to minimize the risk of recycled water not meeting requirements.

The Multi-Barrier approach to treatment and disinfection, and the implementation of CCP ensures that the risk of pathogens at levels above the acceptable requirements for the intended applications is very low. An overview of the adequacy of CCP in meeting objectives for virus removal, and therefore meeting objectives across other pathogens (as viruses are the limiting pathogen in terms of removal requirements) is provided in Section 8.2.

8.1.2 Treated Water Storage

There are two 1.5 ML treated water storage to be installed at the BIngara PRWP at completion of Stage 2, with space allowed for an additional storage at Stage 3 if this is deemed necessary. Storage provides security in supply to the recycled network and the capacity to confirm water quality is acceptable prior to discharge (via pumps) to the recycled water lilac network.

Protection and maintenance of the treated water storage tanks includes:

Treated Water Tank Protection
The Treated Water Tanks are covered and have vermin screens on vents to prevent contamination.

Light
The Treatment section of the Infrastructure post-membranes (the first stage of disinfection) is housed within covered tanks and/or inside buildings. Treated water storage tanks are also covered. Therefore there is no risk of algal growth within the plant.

Drainage
All chemicals on site are stored within a bunded area.

The treatment infrastructure is designed to drain all chemical and sludge waste to a common sump.

There is no risk of contamination of treated water with drainage/chemicals as the treated water tanks are fully sealed.

Backflow prevention on potable line to TW Storage
The potable water emergency top up will be provided using a 300 mm (minimum) air gap above the top water level in the recycled water tank to prevent backflow.

8.1.3 Lagoon Storage Protection

Two lagoon storages are provided, a 60 ML HDPE lined lagoon and a 20 ML clay lined lagoon. This storage is used for controlled irrigation of the Bingara Gorge golf course. At an ADWF of 0.9 ML/day (as expected at Stage 2 development), this provides approximately 88 days of storage. MEDLI modelling has been undertaken (see the Sewage Management Plan) to ensure that irrigation application rates and nutrient application rates are suitable for the golf course.

The storage is sized to reduce overflow events to less than 50% of years, based on analysis with MEDLI modelling (see the Sewage Management Plan for details.) The large volume of treated water storage also guarantees supply to the golf course during high demand periods.

Lagoons are constructed to avoid runoff entering the lagoon, restricting the lagoon catchment to rainfall direct to the lagoon surface and treated wastewater.

The storage lagoon will be fenced and located within the golf course grounds.

The design, construction, operation and safety management of the Storage Lagoon is the responsibility of Lend Lease Communities (Wilton) named as an authorised person in the Network Operator's Licence. It is a given in this Plan that the design and construction of the storage lagoon will meet all necessary standards and codes of practice to assure structural, environmental and water retaining integrity.

VWS will assist in the monitoring of the lagoon, with weekly monitoring for E Coli and Algae.

If a high level of bird life is observed at the lagoon it will be managed with preventative measures such as netting of the surface.

8.1.4 Recycled Water (Lilac) Network Protection

Recycled water network protection to ensure that recycled water quality is managed includes the following:

Pipework Design

The following applies to the Lilac network to minimise risk of contamination:

- Pipe work is installed in Aquatherm lilac pipe with labels identifying recycled water.
- Design of the Recycled Water Network is in line with SWC and Australian Plumbing standards minimising cross connection risk.
- Backflow prevention uses reduced pressure zone devices, and registered air gaps between the potable water and the recycled water systems in accordance with AS 3500.1 Section 4.
- Signage on all accessible valves.

Residual Chlorination

- Residual chlorination is provided on discharge of recycled water network pumps and irrigation overflow. This ensures that a residual is available in recycled water supplies to prevent pathogen growth in the network.
- The residual chlorination requirement will be adjusted based on seasonal variation in decay to ensure that a preset minimum is maintained at the most extreme points in the network.

8.1.5 Restrictions on Usage by Customers

Restrictions on usage by customers of water from the Recycled Water (lilac) network will apply under this Licence.

Customer contracts will be specific regarding health and safety when using treated water; additionally education programs will be developed for reminding the community as well as the provision of adequate signage and the like, once a Permanent Treatment Plant is in place (and recycled water provision to the lilac network commences.)

Usage for golf course irrigation will be relatively unrestricted (in terms of scheduling and buffer requirements) as the treatment standard will now achieve a higher standard of water (suitable for third pipe irrigation) than under the current scheme operation.

8.2 Critical Control Points

Summary actions

- Assess preventive measures throughout the recycled water system to identify critical control points.
- Establish mechanisms for operational control.
- Document the critical control points, critical limits and target criteria.

8.2.1 Definition of CCP

A CCP is defined as an activity, procedure or process where control can be

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Risk Criteria: As per Tables 2.5, 2.6 & 2.7: Australian Guidelines for Water Recycling: Managing Health and Environmental Risks-phase 1 (2006)

Scheme Component	Hazard	Hazardous Event	Impact	Control Strategy	Mitigated Risk				
					Likelihood		Consequence		Risk
Golf Course Irrigation storage dam	Vector borne diseases	Vermin/mosquito invasion of irrigation storage	Potential spread of diseases	1. Steep batters to minimise potential for mosquito growth. 2. Regular inspection for evidence of vermin access, e.g. mosquito larvae, bird nests etc.	C	Possible	3	Moderate	High
	Unintended contact with recycled water	Human access into storage	Potential spread of disease. Potential drowning.	1. Wet weather storage is fenced with appropriate warning signage. 2. Safe egress point from storage. 3. Wire rope along top of bank to prevent slippage into the pond.	B	Unlikely	3	Major	Moderate
	Blue green algae	Blue green algae outbreak in storage	Inhalation or contact with blue green algae toxins	1. Low nutrient concentrations in MBR effluent (TP < 0.3 mg/L, TN < 10 mg/L) 2. Ongoing monitoring for early detection of algae outbreaks. Algae speciation will be undertaken if outbreak occurs. 3. Aerator mixing of pond will be undertaken if algae outbreak occurs. 4. If frequent outbreaks occur a permanent aerator mixer will be installed into the pond.	B	Unlikely	2	Minor	Low
	Leakage to groundwater	Leakage to groundwater	Contamination of groundwater	1. HDPE / clay lined storages. 2. Groundwater monitoring if required	B	Unlikely	3	Moderate	Moderate
	Stormwater inputs	Stormwater runoff into storage during rain events	Increased potential for overflow	1. Designed to avoid inputs from stormwater runoff (except off the banks of the dam). 2. Precautionary and emergency discharges of recycled water from the wet weather storage in less than 50% of years into a tributary adjacent to Stringybark Creek if required in extreme wet weather.	A	Rare	1	Insignificant	Low
	Uncontrolled overflow	Uncontrolled overflow from the wet weather storage during extended wet weather	Public health risk or contamination of waterways	1. To avoid emergency overflows, precautionary discharges into a tributary gully adjacent to Stringybark Creek of up to 25% of the daily flow out of the main golf course stormwater lake can occur when wet weather storage > 75% full & main golf course stormwater lake is overflowing. 2. The proposed wet weather discharge point is the overflow structure in the main stormwater lake at the golf course and allows for dilution of recycled water with stormwater before entering the natural environment. 3. The recycled water in the wet weather storage is highly treated ("Class A+") and contains relatively low concentration of BOD, turbidity, and nutrients, faecal coliforms hence the discharge poses minimal threat to the downstream environment and minimal public health risks. NOTE: Suitable for unrestricted irrigation of open spaces. 4. Proposed discharge is modelled to occur infrequently in less than 50% of years based on historic data. 5. Monitoring and inspection of water quality monitoring downstream of the discharge location to be implemented if determined necessary following overflow.	A	Rare	2	Minor	Low
	Dam wall failure	Dam wall failure	Surface runoff and flooding	1. Design of dam walls with overflow weir for controlled overflow in unlikely event. 2. Scour protection in the unlikely event of uncontrolled overflow. 3. Continuous online monitoring of storage water level with of emergency discharge as required to avoid uncontrolled overflow (start to discharge prior to flood condition).	B	Unlikely	2	Minor	Low

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Scheme Component	Hazard	Hazardous Event	Impact	Control Strategy	Mitigated Risk				
					Likelihood		Consequence		Risk
Waste Water Treatment Plant	Trace contaminants in MBR effluent feed water	Trace contaminants following MBR treatment	Potential impacts on recycled water uses	1. Majority residential catchment hence there is a low likelihood of significant trace contaminants being present in recycled water. Refer to sewerage wastewater generation risk assessment table. 2. Customer supply contracts, recycled water use agreements and ongoing awareness and education through information provided with rates notices and via the LL and VWS websites. 3. Detailed annual recycled water quality monitoring for trace contaminants. 4. If contaminants are detected a source control investigation will be undertaken through analysis of trade waste and raw wastewater data and SPS and PSU pump data. 5. Refer to controls in sewerage risk assessment.	B	Unlikely	2	Minor	Low
	Poor water quality from MBR	MBR blower failure, shock loads, membrane failure etc.	Poor quality to downstream disinfection (UV and chlorine)	1. Continuous online monitoring and alarms on critical MBR process parameters MLSS, DO, Permeate Turbidity, transmembrane pressure. 2. Shutdown of plant on MBR permeate turbidity of 0.5 NTU (required to claim virus log removal value of 1) with operator attention required to rectify and restart plant as this is a CCP. (Shut down of plant includes shutdown of recycled water pumps to residential network.)	B	Unlikely	2	Minor	Low
	Pathogen break through from MBR membranes	Rupture of membrane fibres	Non-compliant recycled water	1. Use USEPA accredited microfiltration membranes. 2. Continuous online monitoring of MBR permeate turbidity with alarms and automatic shutdown (CCP as below) 3. Continuous online monitoring and alarms on transmembrane pressure. 4. Membrane chemical cleaning in line with manufacturer requirements to maximise membrane life. 5. Design flux, TMP and other process parameters as per manufacturer recommendations to maximise membrane life. **CCP1 :** turbidity does not exceed any of the following: 0.2 NTU more than 5% of the time within a 24-hour period and 0.5 NTU at any time. **Response:** If CCP not met (checked as above), membrane tanks taken out of service until problem rectified (as above)	B	Unlikely	2	Minor	Low
	Inadequate pathogen inactivation due to low UV dose	Inadequate UV dose caused by lamp failure, reactor fouling, high flow, poor feed water quality	Non-compliant recycled water	1. Use USEPA accredited UV disinfection system. 2. Continuous online monitoring of UV intensity and UV lamp faults with alarms and automatic shutdown. 3. Continuous online monitoring of flow through the UV reactor with alarms and automatic shutdown. 4. UV unit to include self-cleaning functions. 5. Design and operation of UV unit as per manufacturer recommendations. 6. Replace UV lamps every 12 months. **Validation of Log Removals:** Validation based on compliance of unit with log-removal requirements at flow rate of 120 m3/h and UVT > 65% (expected to be suitable for Stage 3 flows) from USEPA (2006)Ultraviolet Disinfection GuidanceManual for LT2 ESWTR report Units provided: Duty/ Standby Xylem Wedeco LBX850e **CCP1:** Online monitoring that UVT > 65% **CCP2:** Online monitoring of UV intensity, checking that this matches requirement at the flow/UVT measured (flow paced adjustment) **Response:** If CCP not met (checked as above), filtrate pumps (feeding UV) are shutdown. Operator then initiates Duty/ Standby changeover of the UV units.	B	Unlikely	4	Major	High

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Hazard	Hazardous Event	Impact	Control Strategy	Mitigated Risk				
				Likelihood		Consequence		Risk
Inadequate pathogen die off due to low CT in chlorine contact tank	Inadequate CT due to low chlorine concentration, high flow, low level in CCT, high COD, high temperature, incorrect pH	Non-compliant recycled water	1. Chlorine contact tank designed with baffles with conservative assumption of baffling factor 0.3 in design (expect will achieve 0.5) 2. Continuous online monitoring of free chlorine residual, pH and temperature at outlet of the CCT with alarms and automatic shutdown. 3. Continuous online monitoring of flow and water level in the CCT with alarms and automatic shutdown. **Validation:** Measurement of a 2 mg/L chlorine residual on discharge from the chlorine contact tank (online measurement) CT of 18 mg.min/L selected for 4-log virus removal with free chlorine (considering residual ammonia/ organics.) Additional 13 mg/L allowed in chlorine dosing to achieve breakpoint under maximum ammonia /organic conditions. Total chlorine dose of 15 mg/L to achieve residual requirement (basis of design for chlorine dosing) **CCP1:** 2-3 mg/L Cl residual measured on outlet of chlorination tanks. **CCP2:** Flow to Chlorine contact tanks < 80 m3/h to ensure residence time is achieved	B	Unlikely	4	Major	High
High salt concentration	High salt concentration in recycled water	Non-compliant recycled water	1. Continuous online monitoring of EC/TDS in treated water to irrigation and recycled water network. 2. If there is persistent high TDS in MBR permeate then a source control investigation will be undertaken through review of catchment raw wastewater quality and trade waste data.	B	Unlikely	2	Minor	Low
Process chemicals	Spillage of chemicals used in the process	Potential OH&S and public health impacts. Potential environmental impacts.	1. Appropriate bunding and separation in chemical storage and delivery areas. 2. Standard operating procedures to be developed for use of all chemicals. 3. MSDS of all chemicals maintained onsite. 4. Emergency Response Plan for chemical spillages.	B	Unlikely	2	Minor	Low
Metals, organic chemicals and other potential trace contaminants	Presence of excessive amounts of metals, organic chemicals and other trace contaminants in treated water	Potential OH&S, public health and environmental impacts.	1. Prevention strategy based around Trade Waste Agreements, Residential Supply Agreements, ongoing awareness and education at each billing cycle. 2. Predominately residential catchment, hence the likelihood of significant levels of contaminants is low. 3. Detailed annual monitoring of treated recycled water quality for trace contaminants at NATA accredited laboratory. 4. If contaminants are detected a source control investigation will be undertaken through review of catchment raw wastewater and trade waste data.	C	Possible	2	Minor	Moderate
membrane chemical cleaning wastewater or UV acid clean wastewater	Management of chemical contaminated wastewater	Potential impacts on recycled water quality if inappropriately managed	1. Capacity to recirc from membrane tanks after cleaning to head of the plant 2. Low usage of chemicals in process, neutralization within process considered adequate. 3. Can wait till min level is reached in Equal Tank or WWTP balance tank before feeding plant after the CIP return. 4. If process impacts are observed on the MBR then offsite disposal of chemical wastewater will be undertaken by licensed waste contractor.	C	Possible	3	Moderate	High

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Scheme Component	Hazard	Hazardous Event	Impact	Scheme Component	Mitigated Risk				
					Hazard Likelihood		Consequence		Risk
Treated Water Storage Tanks	Vector borne diseases	Vermin access to recycled water storage tank	Non-compliant recycled water	1. Storage tank constructed to potable water standards with vermin screens on all tank openings and overflows. 2. Monitoring and inspection for evidence of vermin access as required 3. If observed contaminated water will be wasted, or if appropriate, chemical treatment of the storage	B	Unlikely	3	Moderate	Moderate
	Insufficient Recycled water	Low Levels in Recycled water tanks caused by: • Consecutive peak day demands for recycled water; • Recycled water demand > treatment capacity and onsite storage capacity; • Maintenance of the treatment plant ; • failure of treatment plant or automatic system down due to the detection of non-compliant recycled water.	Interruption of recycled water supply to customers	1. Continuous online tank level monitoring with emergency potable water back up from Sydney Water network initiated by a low level in the recycled water storage tank. Note: Until process proving is conducted on the permanent wastewater plant, all supply to the network will be potable water (as currently) 2. Automatic shutdown of open space irrigation systems during emergency backup periods to ensure open space irrigation does not occur (consuming large volume of recycled water) and customer recycled water supply is not interrupted. 3. Significant capacity provided for maintenance, including D/S (100% redundancy) in membrane system, D/S (100%) in UV system	B	Unlikely	1	Insignificant	Low
	Cross Connection	Cross connection with the Sydney Water potable water network	Contamination of potable water supply	1. The potable water emergency top up will be provided using a 300 mm (minimum) air gap above the top water level in the recycled water tank to avoid cross connection issues.	A	Rare	3	Moderate	Low

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Scheme Component	Hazard	Hazardous Event	Impact	Control Strategy	Mitigated Risk				
					Likelihood		Consequence		Risk
Treated Water Storage Tanks	Decay of free chlorine residual during storage	Loss of adequate free chlorine residual due to equipment failure, high temperature, long detention time or high COD	Non-compliant recycled water	1. Sodium hypochlorite dosing provided at inlet to treated water tank 2. Sodium hypo dosing and free chlorine residual monitoring provided on discharge from recycled water pumps to recycled water network 3. Sodium Hypo dosing and free chlorine residual monitoring provided on the outlet from treated water tank to irrigation (overflow discharge). 4. Sodium hypo dosing on recycled water supply to recycled water network is normally based on compound dosing control for a preset network supply chlorine residual (adjusted seasonally). This is a CCP. Limits of low, high at CCP alarm Limits of very low / very high at CCP shutdown the pumps until concern rectified. 5. Monitoring of free chlorine at furthest point in the network to inform chlorine residual setpoints for network supply (including based on seasonal variability) 6. Sodium hypo dosing on irrigation supply water to be a fixed rate when flow measured to irrigation (compound difficult to control due to intermittent discharge. High/Low level chlorine alarms will be set on the discharge to alert the operator to consider increase in the dosing setpoint. Achieving a residual in the irrigation storage not as critical and this is not a CCP.	B	Unlikely	3	Moderate	Moderate
	Blue green algae	Blue green algae growth in recycled water storage tank	Non-compliant recycled water	1. Low nutrient levels in water. 2. TW Storage tank covered to prevent sunlight access and algae growth. 3. Inspection and monitoring of recycled water storage tank.	A	Rare	2	Minor	Low
	Unintended contact with recycled water in storage	Human access to storage	Potential public health impacts	1. TW Storage located inside the fenced and secure WWTP site. 2. Warning signage around the perimeter of the site and on each storage tank. 3. CCTV recording at the WWTP site. 4. Lockable manhole access points.	B	Unlikely	2	Minor	Low
	Tank failure	Tank failure	Flooding, contamination of surface water	1. Tank constructed from steel panel tanks with civil/structural engineer certification for tank and footings. 2. Quality assurance in construction. 3. Bollard fence around tanks if there is a risk of vehicular or machinery damage.	B	Unlikely	2	Minor	Low
	Tank materials	Dissolution of trace metals into recycled water	Non-compliant recycled water	1. Ensure all tank materials are compatible for use with potable water. 2. Sampling and analysis of water for trace contaminants as deemed necessary.	A	Rare	2	Minor	Low
Recycled Water Supply System	Cross connections	Cross connection with the Sydney Water potable water network	Contamination of potable water supply	1. Only approved contractors or staff that have undergone induction can perform work on water utility infrastructure. 2. Potable water reticulation network designed, constructed and tested in accordance with WSAA and Sydney Water standards. 3. Recycled water reticulation networks to be designed, constructed and tested in accordance with WSAA standards. 4. Water pressure in recycled water network to be maintained a minimum of 50 kPa below pressure in the potable network. 5. Quality assurance, inspection and pressure testing during construction. 6. Ongoing monitoring of water pressure and electrical conductivity in both networks during operation to assist with detection of cross connections. 7. Unique pipe materials in each water network. Class A+ Recycled Water network will use lilac striped HDPE pipe. 8. Minimum pipe separation distances to be maintained in common trenches. 9. Identification tape and signage on all trenches. 10. Compliance audits will be undertaken prior to introducing recycled water to the network. 11. Penalties will apply for failure to comply with all plumbing regulations.	B	Unlikely	3	Moderate	Moderate

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		Cross connection with potable water line on private property	Potential use of recycled water for potable uses inside the affected property (up to say 6 EP)	1. All plumbing work on private property to be undertaken by Licensed plumber in compliance with AS3500 and the NSW Plumbing Code. 2. Plumbing inspection & approvals during house construction by Wollondilly Council. 3. Dual check valve to be located at the potable water connection point for each property on both potable and recycled water networks. 4. Residential Customer Supply Contracts outlining responsibilities under the scheme. 5. Ongoing customer awareness and education with information provided at each billing cycle and on the LL and VWS websites	C	Possible	3	Moderate	High

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Scheme Component	Hazard	Hazardous Event	Impact	Control Strategy	Mitigated Risk				
					Likelihood		Consequence		Risk
Recycled Water Supply System cont...	Unintended or inappropriate uses of recycled water	Unintended uses of recycled water like swimming pool top up, drinking from outdoor taps, ingestion from excessive spray drift etc.	Potential use of recycled water for potable uses	1. Residential customer supply contracts and recycled water use agreements. 2. Ongoing awareness and education with information provided at each billing cycle and on the VWS and LL websites. 3. Appropriate identification and signage to be installed by plumbing contractor and verified during construction and plumbing inspection.	B	Unlikely	3	Moderate	Moderate
	Loss of chlorine residual	Loss of chlorine residual due to long detention time, high temperature, high COD	Non-compliant recycled water	1. As above under degradation in TWS, chlorine residual in supply to the recycled network is a CCP. 2. Chlorine dosing regime will be calibrated for each season to ensure the minimum required free chlorine residual is maintained at the furthest point in the reticulation system. 3. Adjustment of residual at RW network chlorine CCP will also account for expansion of the RW network 4. Sampling regime of free chlorine throughout the reticulation system and in select private dwellings.	B	Unlikely	3	Moderate	Moderate
	Pipe breakage	Pipe breakage due to excavation or machinery that leads to surface runoff of recycled water	Potential contamination of surface waters	1. PE100 PN16 HDPE pipe with welded joints and fittings. 2. Quality assurance and pressure testing during construction. 3. Above ground signage and identification tape in all trenches. 4. Register all work as executed plans with dial before you dig service Customer fault reporting and response procedures in customer service. 5. Emergency Response Plan for main breaks.	B	Unlikely	2	Minor	Low
Indoor uses on private lots for toilet flushing and washing machine cold water	Pathogens	Unintended uses	Potential public health impacts	1. Class A+ recycled water 2. Voluntary laundry washing machine cold water supply to be hard plumbed. 3. Residential customer supply contracts and recycled water use agreements. 4. Ongoing awareness and education with information provided at each billing cycle and on the LL and VWS websites 5. Appropriate identification and signage to be installed by plumbing contractor and verified during construction and plumbing inspection.	B	Unlikely	1	Minor	Low
outdoor recycled water uses on private lots, i.e. irrigation and wash-down	Pathogens	Human contact and ingestion of spray drift or surface runoff	Potential public health impacts	1. Customer supply contracts, recycled water use agreements and ongoing customer education and awareness. 2. Appropriate signage 3. Class A+ recycled water	B	Unlikely	1	Insignificant	Low
	Nutrients	Excessive nutrient loads in irrigation	Potential contamination of soil and groundwater	1. Recycled water contains low nutrients of TN<10 mg/L & TP<0.3mg/L and under normal irrigation rates and recycled water availability should not result in excessive nutrient impacts. 2. Soil monitoring will be undertaken as required. 3. If required customers will be advised to reduce irrigation rates or other management measure as per the recycled water supply agreement.	B	Unlikely	2	Minor	Low
	Salinity	Irrigation with high salt recycled water	Reduction in plant growth and poor appearance	1. System will maintain TDS at < 1000 mg/L via regular purge of water to irrigation. 2. Irrigation at 1000 mg/L TDS is unlikely to result in vegetation impacts, except for some specific species that may have very low tolerance to salt. 3. Customer supply contracts and recycled water use agreements will advise customers not to irrigate specific plants with very low tolerance to salt.	A	Rare	2	Minor	Low

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					Likelihood		Consequence		Risk
Outdoor recycled water uses on private lots and for puiblic open space irrigation, i.e. irrigation of gardens, irrigation of public spaces and outside wash-down cont...	SAR	Irrigation with high SAR recycled water	Potential impacts on soil structure	1. Soil monitoring of Exchangeable Sodium Percent will be undertaken as required 2. If required customers will be required to reduce irrigation rates or undertake a gypsum application based on the recycled water use agreement. 3. If required the SAR of the recycled water supply will be reduced to <5 through by addition of calcium and magnesium and/or by reducing sodium inputs.	B	Unlikely	2	Minor	Low
	pH	Irrigation with low or high pH recycled water	Long term pH impacts on soil	1. pH expected between 6.5 and 8.5 as per potable water standards. 2. Continuous online monitoring and alarms at RW pump discharge Very high / very low pH will shutdown RW pumps. 3. Ability for temporary dosing of lime to activated sludge tanks to correct pH 3. Future implementation of pH correction if deemed necessary	B	Unlikely	2	Minor	Low
		wash-down with high or low pH recycled water	Potential corrosion of private assets		B	Unlikely	2	Minor	Low
	Chlorine	Irrigation using recycled water with high chlorine concentration	Potential impacts on vegetation and soil microorganisms	1. Maximum free residual chlorine concentration of 2 mg/L. 2. As discussed above: - CCP on recycled water chlorine, as discussed above, with shutdown on very high/very low. - Seasonal adjustment of residual requirements to ensure appropriate dosing for level in the network.	B	Unlikely	2	Minor	Low
	Trace metals, organic chemicals and other potential trace contaminants	Trace contaminants present during irrigation	Potential impacts on soil and vegetation	1. Majority residential catchment hence there is a low likelihood of significant trace contaminants being present in recycled water. 2. Recycled water quality monitoring for trace contaminants as required 3. If contaminants are detected a source control investigation will be undertaken through analysis of trade waste and raw wastewater data.	B	Unlikely	3	Moderate	Moderate
Open Space Irrigation System (including Wilton Oval)	Unintended uses or human contact with recycled water	Unintended uses or human contact with recycled water	Potential health impacts	1. Irrigation management plans to be developed for irrigation on any open public space area 2. Irrigation of high quality "Class A+" recycled water only 3. No above ground taps or fixtures in public open space irrigation areas. 4. Appropriate warning signage in all open space irrigation areas. 5. Lockable irrigation valves pits and controllers etc. 6. Irrigation controllers with rain sensor override to prevent irrigation during rainfall.	B	Unlikely	3	Moderate	Moderate

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Scheme Component	Hazard	Hazardous Event	Impact	Control Strategy	Mitigated Risk				
					Likelihood		Consequence		Risk
Open Space Irrigation System (including Wilton Oval) cont...	Spray drift during irrigation	Spray drift onto sensitive receptor	Potential ingestion of recycled water	1. Irrigation of high quality "Class A+" recycled water only – not of concern 2. Signage 3. Education / Irrigation management plan	B	Unlikely	2	Insignificant	Low
	Irrigation during wet weather or over-irrigation	Irrigation during wet weather resulting in surface runoff or deep percolation of effluent	Contamination of surface and/or groundwater	1. Irrigation management plan that restricts irrigation to outside rainfall events. 2. Site based storm water runoff and environmental controls.	A	Rare	2	Minor	Low
	Stormwater runon	Stormwater runon	Stormwater running onto irrigation areas from up gradient	1. Stormwater diversion drains to divert all up gradient stormwater runoff around effluent irrigation areas. 2. Appropriate buffers to waterways, ponds, stormwater drains. 3. Irrigation controls as per above and irrigation management plan.	A	Rare	2	Minor	Low
	Irrigation rates and scheduling	Inappropriate irrigation scheduling	Increased risk of surface and ground water contamination	Irrigation scheduling will use programmable irrigation controllers to control irrigation frequency, time and duration. Irrigation rates will be calibrated to ensure no ponding. 2. Irrigation rates will be seasonally adjusted in the irrigation controller to match seasonal irrigation demand. 3. Low long term average irrigation rate of approximately 0.9 mm/day (3.2 ML/ha/year), hence low risk of groundwater contamination. 4. Geotechnical investigation indicated that no groundwater was encountered within 20 m of the surface. 5. The primary rock type intersected during bore construction was recorded to be sandstone which minimises percolation of effluent to deep groundwater. 6. High quality effluent with low nutrients and pathogens (reducing impact if this does occur) 7. There is only one registered groundwater bore within close proximity to the site and a further 17 registered groundwater bores within 3 to 5 km of the site. Water bearing zones were recorded at depths of between 26 m and 194 m below ground level.	B	Unlikely	2	Minor	Low
	Nitrogen	Excessive nitrogen load resulting in leaching of nitrate from irrigation areas	Contamination of groundwater	1. Irrigation of recycled water with total nitrogen concentration of median <10mg/L. 2. MEDLI modelling indicates all nitrogen applied in irrigation is taken up by vegetation. 3. MEDLI modelling indicates negligible nitrate concentration in deep drainage.	B	Unlikely	2	Minor	Low
	Phosphorus	Excessive phosphorous load resulting in leaching of phosphate from irrigation area	Contamination of groundwater	1. Irrigation of recycled water with total phosphorus concentration of median <0.3 mg/L and low average irrigation rates of around 0.9 mm/day (3.2 ML/ha/year). 2. MEDLI modelling indicates the majority of phosphorus applied in irrigation is taken up by vegetation. 3. MEDLI modelling indicates negligible phosphate concentration in deep drainage. 4. MEDLI modelling predicted Phosphorus adsorption into soil at a low rate of 0.3 kg/ha/year. 5. Critical P-sorption life of the soil is conservatively estimated to be >6000 years based on an assumed critical P-sorption capacity of 2000 kg/ha.	B	Unlikely	2	Minor	Low
	Effluent Salinity	Impacts on plant growth due to salinity	Reduction in plant growth and water and nutrient uptake rates	1. TDS to be limited to 1000 mg/L with regular purge from the system for irrigation. This is not expected to have any impact on the health of plants, provided appropriate planting selections are made. 2. Landscape design processes will ensure appropriate vegetation is selected in public open space irrigation areas.	B	Unlikely	2	Minor	Low
	Effluent SAR	Long term sodicity impacts on soil	Soil dispersion, reduction in permeability	1. Soil testing indicates loam top soils are generally non-sodic to slightly-sodic with Exchangeable Sodium Percentage (ESP) ranging from 2% to 5%. Deeper clay soils are sodic to highly-sodic with ESP ranging from 7% to 23%. 2. Gypsum/Lime application during construction to increase soil calcium and reduce ESP. 3. soil testing and Gypsum/Lime application to increase soil pH and soil calcium concentrations and reduce ESP if required	B	Unlikely	2	Minor	Low

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Client: Lend Lease Communities
Title: Recycled Water HACCP for IPART Application
Author: HL
Date (Revision): 28/03/2015 (for HACCP)
Risk Criteria: As per Tables 2.5, 2.6 & 2.7: Australian Guidelines for Water Recycling: Managing Health and Environmental Risks-phase 1 (2006)

Hazard	Hazardous Event	Impact	Control Strategy	Mitigated Risk				
				Likelihood		Consequence		Risk
Metals and trace contaminants	Trace contaminants is irrigation supply resulting in long term accumulation in irrigation area	Contamination of soil and groundwater	1. Source catchment is >90% domestic wastewater hence the likelihood of trace contaminants is low. 2. Customer awareness campaigns, supply contracts, trade waste agreements and recycled water use agreements will further reduce the likelihood of contaminants. 3. Acceptable irrigation rates adjusted based on climatic and soil conditions. 4. Detailed monitoring of effluent quality for trace contaminant will be undertaken as required for trace contaminants 5. Soil monitoring in open space irrigation areas will be undertaken as required if build-up or increase in contaminants is deemed possible in a particular area. 6. If contaminants are detected then an investigation into the likely source will be undertaken and trade waste/source controls implemented.	B	Unlikely	2	Minor	Low
Recycled water	Pipe breakage	Potential contamination of surface or groundwater	1. Visual inspection to identify boggy areas or erosion etc. 2. Fault and main break reporting system through customer service processes. 3. Contact numbers on VWS and LL website 4. If Sydney water contacted first they will manage the problem immediately and refer on to LL/VWS for repairs.	B	Unlikely	2	Minor	Low
Odour	Odour released during irrigation	Odour impacts on nearby residents	1. Irrigation of high quality "Class A+" recycled water with low BOD reduces the likelihood of any odour issues.	A	Rare	2	Minor	Low

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Scheme Component	Hazard	Hazardous Event	Impact	Control Strategy	Mitigated Risk				
					Likelihood		Consequence		Risk
Golf Course Irrigation network	Use of recycled water for irrigation	Use of recycled water for irrigation	Potential health or environmental impacts resulting from the use of recycled water	1. The Golf Course Irrigation Network is under the control of and owned by the Bingara Gorge Golf Club. A Golf Course management plan will be developed by the Golf Course as a DA requirement for the golf course. An irrigation management plan will be included as part of the overall management plan and will address issues specific to irrigation with recycled water. 2. A recycled water use agreement will be implemented with the golf course. 3. VWS staff will work with golf course staff during operation to assist with achieving sustainable outcomes for the scheme in terms of irrigation scheduling and the ongoing review of environmental monitoring results.	B	Unlikely	3	Moderate	Moderate
	Cross connection with potable networks	Cross connection between golf course irrigation network and potable networks	Contamination of other water supplies	The following cross connection controls will be included in the Golf Course Irrigation Management plan to be developed: 1. The golf course irrigation network is a completely independent network and has no direct connection to the potable networks. 2. Unique pipe materials. Golf Course Irrigation Network to use Lilac PVC or PE pipe. 3. Golf course Irrigation Network pipes to be laid in their own separate trench with identification tape and above ground signage. 4. Only approved, trained and supervised plumbing contractors are permitted to work on reticulation systems. 5. Golf course irrigation network is in separate footprint and isolated from the other water networks (with the exception of some road crossings).	B	Unlikely	3	Moderate	Moderate
	Unintended uses or human contact with recycled water	Unintended uses or human contact with recycled water	Potential health impacts	1. High quality "Class A+" area therefore no requirement for restricted irrigation only 2. Irrigation management plan to be developed including soil moisture probes and weather station override on irrigation controllers to prevent irrigation during rainfall, high wind or elevated soil moisture.	A	Rare	3	Moderate	Low

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Scheme Component	Hazard	Hazardous Event	Impact	Control Strategy	Mitigated Risk				
					Likelihood		Consequence		Risk
Golf Course Irrigation network cont...	Irrigation during wet weather	Irrigation during wet weather resulting in surface runoff or deep percolation of effluent	Contamination of surface and/or groundwater	1. Soil moisture probes and weather station override on irrigation controllers to prevent irrigation during rainfall, high wind or elevated soil moisture.	A	Rare	2	Minor	Low
	Dry Weather	Irrigation demand during dry weather exceeds available water	Insufficient irrigation water for golf course	1. Approximately three quarters of the irrigation demands are supplied by recycled water (approximately 320 mm/year). The remaining irrigation demands are supplied from the onsite storm water lake. 2. In an extreme dry event when the golf course stormwater ponds are empty, the golf course would implement irrigation demand management measures to minimise demand. .	A	Rare	3	Moderate	Low
	Irrigation rates and scheduling	Inappropriate irrigation scheduling	Increased risk of surface and ground water contamination	1. Irrigation scheduling will use programmable irrigation controllers to control irrigation frequency, time and duration. 2. Irrigation rates will be seasonally adjusted in the irrigation controller to match seasonal irrigation demand. 3. Monitoring of irrigation flows to each major irrigation zone and monitoring of the volumes of recycled water and stormwater reused. 4. Environmental monitoring of soil, groundwater, onsite stormwater ponds and downstream waterways to detect any contamination. 5. Details of irrigation rates, scheduling and environmental monitoring will be included in the golf course irrigation management plan to be developed. 6. VWS staff will work with golf course staff during operation to assist with achieving sustainable outcomes for the scheme in terms of irrigation scheduling and the ongoing review of environmental monitoring results.	B	Unlikely	2	Minor	Low
	Recycled water	Surface runoff during irrigation	Potential contamination of surface water	1. All golf course irrigation areas to use irrigation scheduling controls to control the time, frequency and duration of irrigation events. 2. Soil moisture probes and weather station override on irrigation controllers to prevent irrigation during rainfall or elevated soil moisture. 3. Golf Course stormwater drains to the storm water lake. 4. Irrigation rates will be seasonally adjusted in the irrigation controller to match seasonal irrigation demand. 5. Monitoring of irrigation flows to each major irrigation zone and monitoring of the volumes of recycled water and stormwater reused. 6. Environmental monitoring of soil, groundwater, onsite stormwater ponds and downstream waterways to detect any contamination. 7. Details of irrigation rates, scheduling and environmental monitoring will be included in the golf course irrigation management plan to be developed.	B	Unlikely	2	Minor	Low
	Nitrogen	Excessive nitrogen load resulting in leaching of nitrate from irrigation areas	Contamination of groundwater	1. Irrigation of recycled water with total nitrogen concentration of 10 mg/L. 2. Environmental monitoring of groundwater to detect any contamination. 3. Details of irrigation rates, scheduling and environmental monitoring will be included in the golf course irrigation management plan to be developed. 4. MEDLI modelling indicates all nitrogen applied in irrigation is taken up by vegetation. 5. MEDLI modelling indicates negligible nitrate concentration in deep drainage. 6. Low average irrigation rates, adjusted seasonally.	B	Unlikely	2	Minor	Low

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Scheme Component	Hazard	Hazardous Event	Impact	Control Strategy	Mitigated Risk				
					Likelihood		Consequence		Risk
Golf Course Irrigation network cont...	Phosphorus	Excessive phosphorous load resulting in leaching of phosphate from irrigation area	Contamination of groundwater	1. Irrigation of recycled water with total phosphorus concentration of 0.3 mg/L. 2. Low average irrigation rates of approximately 0.9 mm/day. 3. Environmental monitoring of groundwater to detect any contamination. 4. Details of irrigation rates, scheduling and environmental monitoring will be included in the golf course irrigation management plan to be developed. 5. MEDLI modelling indicates the majority of phosphorus applied in irrigation is taken up by vegetation. 6. MEDLI modelling indicates negligible phosphate concentration in deep drainage. 7. MEDLI modelling predicted Phosphorus adsorption into soil at a low rate of 0.3 kg/ha/year. 8. Critical P-sorption life of the soil is conservatively estimated to be >6000 years based on an assumed critical P-sorption capacity of 2000 kg/ha.	B	Unlikely	2	Minor	Low
	Effluent Salinity	Impacts on plant growth due to salinity	Reduction in plant growth and water and nutrient uptake rates	1. MEDLI modelling indicated no impacts on plant growth due to salinity based on a conservative effluent TDS of 1000 mg/L. 2. If salinity is an issue, Golf Course to dilute recycled water with stormwater.	B	Unlikely	2	Minor	Low
	Effluent SAR	Long term sodicity impacts on soil	Soil dispersion, reduction in permeability	1. Soil testing indicates loam top soils are generally non-sodic to slightly-sodic with Exchangeable Sodium Percentage (ESP) ranging from 2% to 5%. Deeper clay soils are sodic to highly-sodic with ESP ranging from 7% to 23%. 2. Gypsum/Lime application during golf course construction to increase soil calcium and reduce ESP. 3. Annual soil testing and Gypsum/Lime application to increase soil pH and soil calcium concentrations and reduce ESP. 4. Soil moisture probes to control irrigation scheduling to minimise percolation into deeper soil layers. 5. If required the irrigation water SAR will be adjusted through addition of calcium/magnesium or reduction in sodium inputs to maintain effluent SAR<5.	B	Unlikely	2	Minor	Low
	Metals and trace contaminants	Trace contaminants in irrigation supply resulting in long term accumulation in irrigation area	Contamination of soil and groundwater	1. Source catchment is >90% domestic wastewater hence the likelihood of trace contaminants is low. 2. Customer awareness campaigns, supply contracts, trade waste agreements and recycled water use agreements will further reduce the likelihood of contaminants. 3. Monitoring of effluent quality for trace contaminant will be undertaken as required. 4. Soil monitoring in golf course irrigation areas as deemed to be at risk will identify any Build-up or increase in contaminants. 5. If contaminants are detected then an investigation into the likely source will be undertaken and trade waste/source controls implemented. 6. Details of irrigation rates, scheduling and environmental monitoring will be included in the golf course irrigation management plan to be developed.	B	Unlikely	2	Minor	Low
	Recycled water	Pipe breakage	Potential contamination of surface or groundwater	1. Visual inspection to identify boggy areas or erosion etc. 2. Golf course stormwater drains to natural stormwater ponds. 3. Environmental monitoring of soil, groundwater, onsite stormwater ponds and downstream waterways to detect any contamination. 4. Details of irrigation rates and environmental monitoring will be included in the golf course irrigation management plan to be developed.	B	Unlikely	2	Minor	Low
	Odour	Odour released during irrigation	Odour impacts on nearby residents	1. Irrigation of high quality "Class A+" recycled water with low BOD 2. Algae control in the wet weather storage 3. Irrigation at night time only. 4. Details of irrigation rates and environmental monitoring will be included in the golf course irrigation management plan to be developed.	A	Rare	2	Minor	Low

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Scheme Component	Hazard	Hazardous Event	Impact	Control Strategy	Mitigated Risk				
					Likelihood		Consequence		Risk
Golf Course Irrigation network cont...	Stormwater runon	Stormwater running onto irrigation areas from up gradient	Water logging of irrigation area	1. Stormwater diversion drains to divert all up gradient stormwater runoff around golf course effluent irrigation areas and into stormwater ponds. 2. Appropriate buffers to waterways, ponds, stormwater drains and SEPP14 wetlands 3. Irrigation of effluent to areas used for stormwater management to be avoided (includes waterways, major drains, stormwater ponds, treatment basins and vegetated swales). 4. Details of irrigation rates and environmental monitoring will be included in the golf course irrigation management plan to be developed. 5. VWS staff will work with golf course staff during operation to assist with achieving sustainable outcomes for the scheme in terms of irrigation scheduling and the ongoing review of environmental monitoring results.	A	Rare	2	Minor	Low
	Percolation to groundwater	Excessive percolation of effluent to groundwater	Contamination of groundwater	1. Low average irrigation rates, adjusted seasonally. 2. Geotechnical investigation indicated that no groundwater was encountered within 20 m of the surface. 3. The primary rock type intersected during bore construction was recorded to be sandstone which minimises percolation of effluent to groundwater. 4. Irrigation only of high quality "Class A+" recycled water with low nutrients, suitable for relatively unrestricted irrigation. 5. Environmental monitoring of groundwater to detect any contamination. 6. Details of irrigation rates and environmental monitoring will be included in the golf course irrigation management plan to be developed.	B	Unlikely	2	Minor	Low

4.2.10(b)

Risk Assessment
Non-technical

Non Technical Risk Assessment
Bingara Gorge PWTP

Context And category	Adverse Event	Potential Immediate Consequence	Consequence (Penultimate Risk)	Likelihood (Risk of) of Occurrence	Consequence of Occurrence (Risk Outcome)	Risk Rating	Risk Evaluation: Acceptable Outcome (Y/N)	Example Risk Treatment to Avert an Adverse Event	Example Risk Treatment to mitigate impact of Adverse Event	Residual Likelihood of occurrence	Residual Consequence	Residual Risk Rating (Significance)	Risk Treatment Adequate (Y/N)	Responsibility Prevention at D&C By	Responsibility Mitigate impact By
External															
Access & security	Flood, extreme rain event	No access	Loss of production	Possible	Major	High	N	VWS has no influence over rain event. These will occur	D&C good stormwater management & drainage & ability to run infrastructure remotely. Implement EPRP	Unchanged	Reduced	Low	Y	Not applicable	LL & VWS
Access & security	Lightning	Safety of personnel & plant	Injury or plant failure	Possible	Major	V High	N	VWS has no influence over lightning event. These will occur	Install adequate lightning and surge current protection	Unchanged	Reduced	Low	Y	Not applicable	LL & VWS
Access & security	Bush fire	No access	Loss of production	Possible	Moderate	High	N	VWS has no influence over bush fire event. These may occur	Design and install adequate fire detection and protection	Unchanged	Reduced	Low	Y	Not applicable	LL & VWS
Access & security	Earthquake	Infrastructure damage	Loss of production	Rare event	Major	High	N	VWS has no influence over earthquake event. These may occur	D&C to earthquake standards. Implement EPRP.	Unchanged	Reduced	Low	Y	Not applicable	VWS
Access & security	Road accident restricting access	No access	Loss of production	Possible	Moderate	High	N	VWS has no influence over third party drivers on main or approach roads.	Construct good access roads into and within Bingara Gorge development	Unchanged	Reduced	Low	Y	Not applicable	LL
Access & security	Vandalism or other risk to Treatment Infrastructure	Infrastructure damage	Loss of production	Possible	Major	V High	N	Security fencing; intruder security alarm with back to base notification	Have sufficient insurance spares for critical equipment	Unlikely	Minor/Moderate	Low	Y	VWS	LL
Utilities, suppliers	Power supply failure	Plant stoppage	Loss of production	Possible	Major	V High	N	VWS has no influence over third party power supply	UPS for PLC. Hire emergency generator if long term event	Unchanged	Minor/Moderate	Low	Y	VWS	LL
Utilities, suppliers	Third party excavation cause damage	Service interruption	Customer complaint	Possible	Major	V High	N	Strict rules on dial before you dig; heavy penalties; visible routes	Emergency call out to repair	Lessened	Minor/Moderate	Low	Y	LL	VWS
Legal & regulatory	WICA licence breach	VWS must consult IPART	Loss of licence	Rare event	Severe	High	N	Have in place excellent contract administration and infrastructure management	Take whatever action is required applicable to the matter to rectify breach	Lessened	Minor/Moderate	Low	Y	LL	VWS
Legal & regulatory	Change in law for licence holder	VWS must consult IPART	Licence amendment	Possible	Moderate	High	N	VWS has no influence over change in law. These may occur	Negotiate sensibly with IPART and DLL	No change	Reduced	Low	Y	Not applicable	LL & VWS
Consumer customer	Illegal discharge of contaminants	Process upset	Loss of production	Possible	Major	V High	N	Customer contracts and other documentation including penalties highlighting as illegal	Sufficient surge capacity in sewage storage to dilute contaminants and procedures to handle various	Reduced	Reduced	Low	Y	LL & VWS	LL & VWS
Consumer customer	Illegal connection of recycle to potable water piping	Consumer Health issue	Consumer fined	Possible	Severe	V High	N	Customer contracts and other documentation including penalties highlighting as illegal	Refer offenders to counselling and medical practitioners	Reduced	Reduced	Low	Y	LL & VWS	LL & VWS
Stakeholder	Community complaint eg odour (relates to internal context public health)	PR and rectification costs	Loss of reputation or litigation	Possible	Severe	V High	N	Infrastructure design to have eg adequate odour control. Operate, maintain and monitor treatment infrastructure to high standard. Refer IOPs. Have in place Codes for Complaints Handling and Debt collection incl associated requirements	Implement Odour Release Plan or EPRP as applicable. Immediate route cause analysis and corrective action. Engage Odour consultant to further investigate. Consult community to alleviate concerns & abate reputation issues arising	Reduced	Reduced	Medium	Y	LL & VWS	LL & VWS
Stakeholder	Shire council complaint eg odour (refer to internal context public health)	PR and rectification costs	Loss of reputation or litigation	Possible	Severe	V High	N	Refer above	Refer above	Refer above	Refer above	Refer above	Refer above	Refer above	Refer above
Stakeholder	Facilities mgt complaint eg odour (refer to internal context public health)	PR and rectification costs	Loss of reputation or litigation	Possible	Severe	V High	N	Refer above	Refer above	Refer above	Refer above	Refer above	Refer above	Refer above	Refer above
Stakeholder	Golf course complaint eg odour (relates to internal context public health)	PR and rectification costs	Loss of reputation or litigation	Possible	Severe	V High	N	Refer above	Refer above	Refer above	Refer above	Refer above	Refer above	Refer above	Refer above
Stakeholder	Possibility of any perceived or actual threat to customers or public health as a result of the company's operations	PR and rectification costs	Loss of reputation or litigation	Possible	Severe	V High	N	Have in place excellent communications and marketing material in place for customers including emergency contact information	Implement that section of EPRP	Reduced	Reduced	Medium	Y	LL & VWS	LL & VWS
Internal															

Non Technical Risk Assessment
Bingara Gorge PWTP

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Public Health	Sewage odour (sewage itself)	Fines & rectification costs	Fines & loss of reputation	Possible	Severe	V High	N	Infrastructure design to have adequate odour control to DECC standards. Operate, maintain & monitor treatment infrastructure to high standard. Refer IOPs	Follow standard procedure in O&M manual for determining cause and corrective action. Engage odour consultant if needed.	Reduced	Reduced	Medium	Y	LL & VWS	VWS
Public Health	Recycle water odour (product water)	Fines & rectification costs	Fines & loss of reputation	Possible	Severe	V High	N	Infrastructure design to have adequate odour control to DECC standards. Operate, maintain & monitor treatment infrastructure to high standard. Refer IOPs.	Follow standard procedure in O&M manual for determining cause and corrective action. Engage odour consultant if needed.	Reduced	Reduced	Medium	Y	VWS	VWS
Public Health	Treatment Infrastructure odour (sewerage and treatment facilities)	Fines & rectification costs	Fines & loss of reputation	Possible	Severe	V High	N	Infrastructure design to have adequate odour control to DECC standards. Operate, maintain & monitor treatment infrastructure to high standard. Refer IOPs.	Follow standard procedure in O&M manual for determining cause and corrective action. Engage odour consultant if needed.	Reduced	Reduced	Medium	Y	LL & VWS	VWS
Public Health	Recycle water quality below specification;	Potential for health issues	Fines and litigation	Unlikely	Severe	V High	N	Infrastructure design to be specific for producing odourless and colourless treated water	Follow standard procedure in O&M manual for determining cause and corrective action.	Reduced	Reduced	Medium	Y	VWS	VWS
OHS	Work related illness	WorkCover reporting	Loss of reputation	Possible	Major	V High	N	Have in place stringent OHS Management Plan and enforce it in behavioural based awareness manner	Follow Incident response and management procedure. Report to relevant authorities depending on severity	Reduced	Reduced	Medium	Y	VWS	VWS
OHS	Work related injury	WorkCover reporting	Loss of reputation	Possible	Major	V High	N	Have in place stringent OHS Management Plan and enforce it in behavioural based awareness manner	Follow Incident response and management procedure. Report to relevant authorities depending on severity	Reduced	Reduced	Medium	Y	VWS	VWS
OHS	Inadequate supply of Personal Protection Equipment (PPE)	Unable to do certain works	Loss of production	Rare event	Major	High	N	Robust inventory management system in place	Operate remotely. Source alternate supplies from nearest supplier	Rare event	Minor-moderate	Low	Y	VWS	VWS
OHS	Inadequate resources	Staff shortage	Plant failure	possible	moderate	High	N	Train and practice our documented EPRP regularly	Recognise any poor management and replace responsible person	Rare Event	Moderate	Low	Y	VWS	VWS
Environmental	Chemical spill	Environmental pollution	Fines and litigation	Rare event	Severe	High	N	Permanent bunding; established procedures; available spill kits; adequate training	Follow procedures including source isolation.	Rare event	Moderate	Low	Y	VWS	VWS
Environmental	Operational noise.	Community complaint	Fines & loss of reputation	Unlikely	Major	High	N	Design and build to meet or better minimum noise levels; monitor noise	ID and isolate the offending equipment; determine root cause and rectify. Implement community consultation if needed	unchanged	Moderate	Low-medium	Y	VWS	VWS
Environmental	Excessive birdlife on storage pond	Pollution of treated water	Retreatment	Possible	Severe	V High	N	Possibly install netting; limit bird life by way of removal	Relocate birds; potentially may need to have VWS re-treat effluent	unchanged	Moderate	Low-medium	Y	LL	LL
Environmental	Excessive aquatic plants/algae in storage pond	Pollution of treated water	Retreatment	Possible	Severe	V High	N	Pond maintenance program	Concerted eradication	unchanged	Moderate	Low-medium	Y	LL	LL
Environmental	High numbers of mosquitoes	Mosquito borne diseases	Fines & loss of reputation	Possible	Severe	V High	N	Pond Maintenance program including spraying	Concerted eradication	unchanged	Moderate	Low-medium	Y	LL	LL
Environmental	Integrity of storage pond breached	Flooding of environment	Loss of treated water	Rare event	Severe	High	N	Pond design integrity and maintenance program	Implement DLL EPRP	unchanged	Moderate	Low-medium	Y	LL	LL
Note while the above environmental concerns related to the storage pond are documented, the management and care of the storage pond is not in VWS scope. Nonetheless here could be a perception that VWS is at fault which could impact on VWS reputation.															
IT systems & coms	Loss of telephone, fax and/or mobile phone communication for more than a day	Plant interruption	Loss of production	Possible	Major	V High	N	No real control over third party supplier of these services; however, have in place adequate supplier services agreement	Ensure 24 site attendance rather than remote monitoring	unchanged	lessened	Low-medium	Y	VWS	VWS
IT systems & coms	Server and internet failure	Plant interruption	Loss of production	Possible	Major	V High	N	Robust back up; disaster recovery plan in place	Implement normal recovery or disaster recovery if needed	unchanged	lessened	Low-medium	Y	VWS	VWS
IT systems & coms	Loss of PLC/SCADA system	Plant interruption	Loss of production	Possible	Major	V High	N	Have critical spares available eg PLC cards, back up program and the like.	Attend site, determine cause and rectify	unchanged	lessened	Low-medium	Y	VWS	VWS
Contractual	Material breach (eg unable to meet obligations)	Litigation	Loss of contract	Rare event	Severe	High	N	Understand contract before signing and properly administer by competent personnel	Meet with DLL and authorities to mitigate negative outcomes	unchanged	lessened	Low-medium	Y	VWS	VWS

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Contractual	Change in law	Contract amendment	Increase costs	Possible	Moderate	High	N	Potential for amending contract in equitable way	Meet with DLL and authorities to amend contract equitably	unchanged	lessened	Low-medium	Y	VWS	VWS
Financial	Bankruptcy by VWS	Breach of contract	Loss of contract	Rare event	Severe	High	N	VWS Corporate Governance at the highest of levels	Internal and external audits	unchanged	lessened	Low-medium	Y	VWS	VWS
Financial	VWS losing money on job	Work to contract	Loss of reputation	Rare event	Severe	High	N	All contingencies covered prior to signing contract	If due to change in law or variations, negotiate accordingly; Veolia never walks away	unchanged	lessened	Low-medium	Y	VWS	VWS
VWS compliance	IMS - loss of certification	Not a material breach	Loss of reputation	Unlikely	Moderate	Medium	N	VWS compliance group performs its duties	Regain certification with urgency to mitigate loss of reputation	lessened	lessened	Low	Y	VWS	VWS
VWS compliance	Failure to submit reports on time – contract, EPA, Work cover	Potential breach	Penalties	Unlikely	Severe	V High	N	VWS to have in place organisation and sufficient resources to ensure this does not occur	Increase resources and work overtime to mitigate this possibility	lessened	lessened	Low	Y	VWS	VWS
VWS compliance	Not keeping licences up to date (driver, trade, confined space and the like)	Potential breach	Penalties	Unlikely	Major	High	N	VWS administration in Solutions Group to properly manage this	Replace any unqualified resource with qualified	unchanged	lessened	Low-medium	Y	VWS	VWS
VWS compliance	Contract non-compliance - reporting requirements	Potential breach	Penalties	Unlikely	Major	High	N	Understand contract before signing and properly administer by competent personnel	Identify and rectify in timely manner	unchanged	lessened	Low-medium	Y	VWS	VWS
Organisational	Loss of key staff due to resignation	Dearth of supervision	Multiple	Unlikely	Severe	V High	N	Have in place succession or support duties plan	Call-out if needed	unchanged	lessened	Low-medium	Y	VWS	VWS

4.2.11

12 elements of the framework in AGWR

5 Methodology

VWS methodology for ensuring recycled water quality has been categorised accordingly to the 12 elements of the Australian Guidelines for Water Recycling (AGWR1) to which it refers:

- Element 1 – Commitment to responsible use and management of recycled water
- Element 2 – Assessment of the recycled water system
- Element 3 – Preventive measures for recycled water management
- Element 4 – Operational procedures and process controls
- Element 5 – Verification of recycled water quality and environmental performance
- Element 6 – Management of incidents and emergencies
- Element 7 – Operator, contractor and end user awareness and training
- Element 8 – Community Involvement and awareness
- Element 9 – Validation, research and development
- Element 10 – Documentation and reporting
- Element 11 – Evaluation and audit
- Element 12 – Review and continuous improvement

The following areas are addressed in other plans to some extent and cross-referencing is used in some instances to minimize duplication:

- Element 4 – Operational procedures and process controls; addressed to some extent in the IOP
- Element 6 – Management of incidents and emergencies; addressed to some extent in the RSMP
- Element 7 – Operator, contractor and end user awareness and training; addressed to some extent in the IOP
- Elements 10, 11 and 12 – addressed to some extent in all Plans as required under regulation and VWS certification.

6 Element 1: Commitment to responsible use and management of recycled water quality

Components:

- Responsible use of Recycled Water
- Regulatory and formal requirements
- Partnerships and engagement of stakeholders
- Recycled water policy

6.1 Responsible Use of Recycled Water

Summary of actions:

- Involve agencies (i.e. stakeholders) with responsibilities and expertise in protection of public and environmental health.
- Ensure that design, management and regulation of recycled water schemes is undertaken by agencies and operators with sufficient expertise.

6.1.2 Agencies and Involvement

A list of Stakeholders is provided in Section 4, namely those persons, entities and authorities that have an interest in the Bingara PRWP and its supply of recycled water. Stakeholders are listed in Section 10 above.

VWS has good working relationships with all agency-stakeholders involved that have been established through operation of the Bingara TRWP. These relationships will be maintained with ongoing clear lines of communication to all parties.

The appropriate mechanisms of consultation, application and approval for design and construction, and operation are being followed with adherence to all legal and commercial requirements, in particular as guided by the following authorities:

- Wollondilly Shire Council
- Independent Pricing and Regulatory Tribunal (IPART)
- Minister of Water
- Department of Health
- Department of Health Office of Environment & Heritage
- Environment Protection Authority (EPA)

This includes meeting with agencies (e.g. the EPA) as necessary to confirm requirements and flag mitigation measures for potential concerns prior to licence application submittal.

6.1.3 Partnerships and Involvement

VWS is working cooperatively with all stakeholders and agencies detailed in the above sections to common ends in terms of ensuring quality and security of recycled water supply. This includes adherence to all licence requirements and accommodation of reporting requirements and meeting requests for information as required. It is the intention of VWS to ensure that all partners are adequately involved to be satisfied the Bingara Scheme is being operated in line with public and environmental health requirements.

Under contract and Regulation VWS will develop formal communication with its stakeholders. VWS will actively develop mechanisms for gaining commitment and involvement from stakeholders. This will include regular meetings with key parties and establishment of working groups, as might be required.

The key partner that VWS is involved with contractually is Lend Lease Communities (Wilton), with clear guidelines in the Operations and Maintenance contract for communication requirements.

The key agency to which VWS will report prior to, and during, the construction phase of the project is Wollondilly Shire Council.

Key agencies to which VWS will regularly report as part of compliance verification during operations are as follows:

- IPART (under the WICA licence); and
- EPA (under the Environment Protection Licence (EPL).)

All compliance and review requirements of the above agencies will be adhered to in their entirety.

Involvement of customers as stakeholders is discussed in Section 9.11.

6.1.4 Expertise of VWS

VWS has the relevant qualification, competences, and experience in water recycling and is committed to responsible use of recycled water.

VWS has over 20 years of experience in the field of reuse with participation in over 100 reuse projects worldwide, ranging from partial potable substitution (Western Corridor, QLD), to golf course irrigation (Brampton Island reuse plant, QLD) to reuse for industry (Illawarra Wastewater Strategy (NSW) and Kwinana (WA). VWS is the design and build contractor for the Rosehill Camellia Recycled Water Project, NSW.

VWS has won many awards for innovative and successful water reuse solutions in USA, Australia and South Africa: our most recent award being for Masterfoods recycling plant in NSW. This was the GWI (Global Water Intelligence) award for innovation awarded in May 2010.

Network Operators and Retail supplier's Licences that have been granted to VWS by IPART for current operations include:

- The following licences for the Bingara TRWP:
  - Network Operator's licence No 10_012
  - Retail Supplier's licence No 10_13R

- The following licences are current for the Darling Quarter water industry infrastructure:
  - Network Operator's licence No 10_008
  - Retail Supplier's licence No 10_009R

The above demonstrates that VWS has the capability, expertise and capacity to convey and treat sewage and to produce and retail recycled water for potable water replacement in a third pipe system to meet all regulations and condition. Furthermore VWS understands the procedures and requirements of IPART to ensure ongoing update and compliance with regulations.

6.2 Regulatory and Formal Requirements

Summary of actions:

- Identify and document all relevant regulatory and formal requirements.
- Identify governance of recycled water schemes for individual agencies, designers, installers, operators, maintainers, owners and users of recycled water.
- Ensure that responsibilities are understood and communicated to designers, installers, maintainers, operations employees, contractors and end users.
- Review requirements periodically, to reflect any changes.

6.2.1 Governance

This plan is developed and will be updated to fulfil the requirements of the Australian Guidelines for Water Recycling (AGWR) and the following regulation:

Federal, state and territory, and local government legislation and regulations:

- Water Industry Competition Act 2006
- Water Industry Competition (General) Regulation 2008
- Water Industry Competition (Access to Infrastructure Services) Regulation 2007
- NSW Local Government Act 1993 – Section 68 requires approval from the local council for water supply, sewerage and stormwater drainage work as well as the installation and operation of a Sewage management system, including private recycled water schemes that process sewage.
- NSW Local Government (General) Regulation 2005 - Provides detail on the approval as well as the broad performance standards and other criteria for the operation of a recycled water scheme.
- NSW Environmental Planning and Assessment Act 1979 – Defines and regulates planning and development within NSW and sets out the development approval process and approvals required.
- NSW Environmental Planning and Assessment Regulation 2000
- NSW Public Health Act 1991 – NSW Health has responsibilities under the Act for monitoring and managing public health risks and improving public health through regulation, health promotion and other public health measures. NSW Health plays a key role in setting water quality compliance values for recycled water and must be informed of any incident that poses a risk to public health.
- NSW Protection of the Environment Operations (POEO) Act 1997 – States that it is an offence to pollute waters, or permit waters to be polluted except where that pollution occurs in compliance with an environment protection licence. Other offences relating to land, air (including odour) and noise pollution are covered in the POEO Act.
- NSW Work Health and Safety Act 2011 – Applies to employers where workplaces use recycled water and also to supplies of recycled water to workplaces.
- NSW Plumbing and Drainage Code (AS/NZS 3500) - This code provides the framework for plumbing work involving recycled water.

Operating licences and agreements:

- The Environment Protection Licence for the Bingara scheme has been issued to an alternate party (Wilton Water Pty Ltd) and is currently in the process of being transferred to VWS. The Network Licence for operation of the Bingara PRWP is currently under application. Upon issue of licence, this will be adhered to in its entirety, including all required updates and compliance audits.

Industry standards and codes of practice

- Applicable Australian and International standards for design and construction
- Customer complaint code of conduct
- Debt recovery code of conduct

6.2.2 Contractual and Regulatory Requirements

The Stakeholder table in Section 11 outlines the responsibilities and duties of each individual stakeholder.

The governance and summary contract arrangements are shown in Figure 2 below. Key aspects of governance are as follows:

- IPART determines the maximum prices that can be charged for certain retail energy, water and transport services in New South Wales. In addition to regulation of price, IPART also ensure under the WICA Act that adequate planning is in place to provide assurance on the adequacy of sewage systems quality of water being provided to consumers as being fit for purpose.
- Lend Lease Communities (Wilton) Pty. Limited (ABN 31 110 022 976) is the proposed Authorised person on the New Retail Supplier's Licence.
- Lend Lease Communities (Wilton) Pty. Limited (ABN 31 110 022 976) is the proposed Authorised person on the New Operator's Licence.
- VWS has signed Contracts with Lend Lease Communities (Wilton) for the design, construction, and commissioning of the Wastewater Treatment Infrastructure.
- VWS has signed Contracts with Lend Lease Communities (Wilton) for the Operation and Maintenance of the Bingara Scheme.

All roles and responsibilities from inception through to operations and maintenance will be clearly communicated to stakeholders, including all operations staff and the customers of the third pipe scheme.

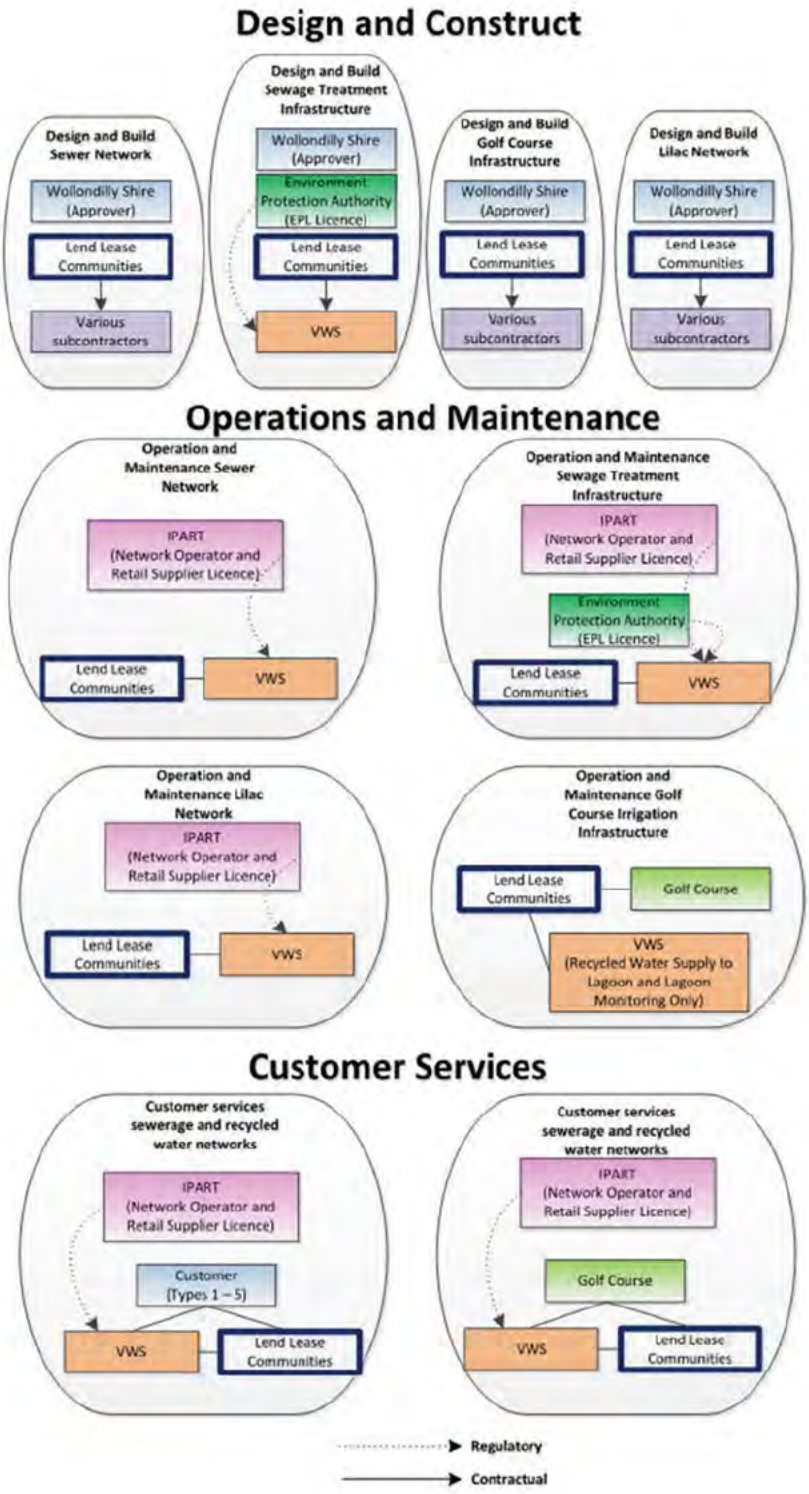

Figure 2: Contractual and Regulatory Framework

6.3 Recycled Water Policy

Summary Actions:

- Develop a recycled water policy, endorsed by senior managers, to be implemented within an organisation or by participating agencies.
- Ensure that the policy is visible and is communicated, understood and implemented by employees and contractors

VWS has developed a water policy (covering recycled water) that has been championed and signed off on by VWS Managing Director. This is attached in Appendix D.

Veolia Water Solutions & Technologies (VWS) is committed to helping its customers and society to prepare for their future water needs. This includes building the water services of tomorrow and managing these on a long-term basis. For each challenge we build on our field-proven experience to offer economically, environmentally and socially sustainable solutions. To this end VWS provides recycled water management systems to commercial, municipal and industrial customers that:

- Recognise and comply with all relevant legislation, codes and guidelines,
- Protect public and environmental health,
- Show a commitment to responsible use of recycled water,
- Have been developed using a risk management approach,
- Use the latest technology available in the market place and within the VWS portfolio, and adopt a multiple barrier approach to recycled water management,
- Are built on the wealth of knowledge within VWS on recycled water management,
- Are regularly improved and updated as technology and management systems are improved and refined within the VWS group,
- Promote clear and targeted two way communication and education with all stakeholders, customers, employees, users of recycled water and the wider community in relation to recycled water schemes,
- Include regular and reliable monitoring of critical control points and reliable and effective reporting through plant start-up, verification and ongoing operation,
- Include risk management and incident response capability during design, construction and operation of the recycled water schemes,
- Will be efficiently operated, with a focus on reducing operating costs, carbon footprint and impact on environment,
- Will be well maintained and offer a clean and safe working environment for operating and maintenance staff,
- Have clearly defined interfaces, roles and responsibilities for all scheme stakeholders, and
- Are consistent with the Australian Guidelines for Water Recycling and cover the 12-elements of the framework for recycled water quality management and use.

Achievement of our commitment is facilitated through our Corporate Governance principles and practices and the application of our BSI Global certified Integrated Management System which is founded on the relevant Australian and International standards for Occupational Health & Safety (AS/NZS 4801:2001), Environmental (AS/NZS ISO 14001:2004) and Quality (AS/NZS ISO

9001:2008) Management Systems.

The VWS Water Quality Policy is highly visible by the way of display with VWS other corporate policies is available to all employees, understood and implemented for all recycle water projects and contracts. The policy will be made available to our stakeholders via VWS internet webpage.

7 Element 2 - Assessment of the recycled water system

Components:

- Intended uses and source of recycled water
- Recycled water system analysis
- Assessment of water quality data
- Hazard Identification and risk assessment

7.1 Source of Recycled Water, Intended Uses, Receiving Environments & Routes of Exposure

Summary actions:

- Identify source of water.
- Identify intended uses, routes of exposure, receiving environments, endpoints and effects.
- Consider inadvertent or unauthorised uses.

7.1.1 Source of Water (Untreated): Municipal Sewage

There are to be three sources of raw wastewater to the Bingara PRWP:

- Gravity sewer catchment, discharging to the Bingara PRWP via a 200 mm PVC Sewerage Rising Main from the existing gravity SPS;
- Bingara Pressure sewer catchment, discharging to the Bingara PRWP via a 250 mm Pressure Sewer Main from the Bingara Gorge pressure sewer network;
- Wilton Pressure sewer catchment, 125 mm Pressure Sewer Main from Wilton Village pressure sewer network.

The catchment area has been identified as residential, commercial and retail, with no industrial loading. Customers will be required to adhere to customer contracts wherein they are not permitted to discharge to the sewer toxic or other materials detrimental to sewage management. This will mitigate the risk of raw sewage being of non-municipal nature.

The range of potential sewage characteristics is outlined in Table 3 below. The assessment is based on a period of composite sampling of raw sewage at the existing Bingara TRWP and from the Wilton catchment in February/March of 2015. The ranges are provided to indicate potential variation in concentrations (see Section 7.2.4 for details) based on available information. Ongoing monitoring will occur as required to develop an understanding of the influent characteristics, and potential changes, as the catchment is built out. Contingency measures have been allowed in the design (e.g. addition of acetic acid dosing) if this is required to be installed as an extension of the current design and construct contract.

It should be noted that the TDS has been assumed to be higher than the current monitoring data indicates based on the expectation that there will be a recycle of TDS back to the Bingara PRWP following commencement of supply to the Recycled Water network.

This risk of adverse effects on the treatment process due to illegal discharges of prohibited substances to the sewer is being minimised through community consultation, customer contracts clearly identifying prohibited substances and publication of this information on the dedicated website. Such community

engagement will be increased as necessary to ensure the quality of recycled water for third pipe supply is maintained.

One risk identified is the potential illegal discharge of chlorinated water from the local swimming pool. The procedure associated with swimming pool discharge is clearly outlined in the customer contract, and the dilution of incoming wastewater from different sources in the WWTP inlet balance tank and equalisation tanks ensures that there is minimum risk of pH fluctuation impacting process performance.

Table 3: Raw Sewage Characteristics

Parameter	Units	Expected Raw Sewage
Oil & Grease	mg/L	≤50
Ammonia NH3-N	mg/L	30 –70
BOD5	mg/L	150 – 350
COD	mg/L	500 – 950
pH		6 – 8
SS	mg/L	250 – 550
TN	mg/L	50 – 95
TP	mg/L	8 – 15
Conductivity	µS/cm	<1800
TDS	mg/L	<1000

7.1.2 Source of Water (Treated): Recycled Water

The source of water for Recycled Water usage is treated municipal sewage. The log removal requirements to achieve recycled water of acceptable quality, and additional quality requirements for recycled water are summarised in Table 4. The quality targets are based on the following:

- Third pipe supply requirements for toilets, laundries and gardens where there is an expectation of human contact with recycled water (non-potable contact);
- Nutrient reduction requirements for optimum use of water for irrigation (with MEDLI modelling conducted to confirm this is acceptable); and
- Controlled overflow of treated water from the irrigation storage lagoon to the creek as required (less than 50% of years, as detailed in the Sewage Management Plan.)

Details on quality assurance for Recycled Water in terms of log removals are provided in Section 8.2 with reference to the Critical Control Points (CCP).

Contamination via components not listed in this table is to be mitigated based on raw sewage quality management, as above.

Table 4: Recycled Water Quality Targets

Monitoring Stream/Point	Parameter	Value
Treated Water	TSS	<5 mg/L
Treated Water	COD	<50 mg/L
Treated Water	BOD_5	<10 mg/L

Treated Water	TKN	<5 mg/L
Treated Water	TN	<10 mg/L
Treated Water	TP	<0.4 mg/L
Treated Water	Log Removal Bacteria	≥ 5
Treated Water	Log Removal Viruses	≥ 6.5
Treated Water	Log Removal Protazoa	≥ 5

7.1.3 Recycled Water End Uses

The end uses of the recycled water produced at the Bingara PRWP are as follows:

- Private / commercial customers within the lilac network.
- Irrigation of public open spaces within the lilac network.
- Golf Course irrigation from the irrigation storage lagoon adjacent to the golf course.

Each of these relationships are being be regulated and controlled through Customer Contracts, which are a Tri-Party type between Lend Lease Communities (Wilton) Pty Ltd, VWS and the individual customer.

Customers Contracts include clauses on the obligation for safe use of recycled water within their property boundaries. Instructions are issued to customers and available on the VWS website (www.myrecycledwater.com.au).

Currently, the lilac network is provided with potable water. Prior to the Bingara PRWP supplying recycled water to the lilac network, all customers will be clearly informed of the change in supply from potable to non-potable water, although appropriate practices with regards to use of water from the lilac network are already being encouraged.

7.1.4 Receiving Environments

During extended wet weather controlled environmental discharges of treated wastewater will occur when the irrigation storage is greater than 75% full and the main golf course storm water lake is overflowing. Water quality will be assured over this period via mixing with stormwater, as detailed in the Sewage Management Plan. Based on MEDLI modelling, this is expected occur in less than 50% of years, as detailed in the Sewage Management Plan.

All irrigated areas will be managed (e.g. with scheduled irrigation) to ensure that water-logging and runoff does not result as a consequence of recycled water usage.

Soil moisture and quality will be monitored as necessary to identify any concerns with the quality of recycled water in terms of environmental and public health.

7.1.5 Routes of Exposure and Inadvertent Use of Recycled Water

Routes of exposure include inappropriate use of recycled water from the golf course lagoon or in the lilac network.

Mechanisms to minimise the risk of exposure include the following (as evaluated at the HACCP for the overall Bingara Scheme):

- For the Golf Course Irrigation Storage and Irrigation:
  - Wet weather storage is fenced with appropriate warning signage.
  - Safe egress point from storage.

- Wire rope along top of bank to prevent slippage into the pond.
- Irrigation controllers with rain sensor override to prevent irrigation during rainfall.
- Irrigation of high quality recycled water only, suitable for unrestricted irrigation.

- For the Treated Water Tanks Onsite:
  - TW Storage located inside the fenced and secure WWTP site and covered with a locked ladder to top of tank.
  - Warning signage around the perimeter of the site and on each storage tank.
  - CCTV recording at the WWTP site.
  - Lockable manhole access points.

- For the Lilac network recycled water:
  - Residential customer supply contracts and recycled water use agreements.
  - Ongoing awareness and education with information provided at each billing cycle and on the VWS and LL websites.
  - Appropriate identification and signage to be installed by plumbing contractor and verified during construction and plumbing inspection. Including all network to be lilac in colour with clear label s at appropriate points.
  - Irrigation of high quality recycled water only, suitable for unrestricted irrigation based on the AGRW.
  - No above ground taps or fixtures in public open space irrigation areas.
  - Appropriate warning signage in all open space irrigation areas.
  - Lockable irrigation valves pits and controllers etc.
  - Irrigation controllers with rain sensor override to prevent irrigation during rainfall.

- Cross connections
  - Only approved contractors or staff that have undergone induction can perform work on infrastructure.
  - Potable water reticulation network designed, constructed and tested in accordance with WSAA and Sydney Water standards.
  - Recycled water reticulation networks to be designed, constructed and tested in accordance with WSAA standards.
  - Water pressure in recycled water network to be designed for a minimum of 50 kPa below the available static head in the potable network.
  - Quality assurance, inspection and pressure testing during construction.
  - Ongoing monitoring of water pressure and electrical conductivity in both networks during operation to assist with detection of cross connections.
  - Unique pipe materials in each water network, including use of lilac striped HDPE pipe for recycled water.
  - Minimum pipe separation distances to be maintained in common trenches.
  - Identification tape and signage on all trenches.
  - Compliance audits will be undertaken prior to introducing recycled water to the network.
  - Penalties will apply for failure to comply with all plumbing regulations.

7.2 Recycled Water System Analysis

Summary actions:

- Assemble pertinent information and document key characteristics of the recycled water system to be considered.
- Assemble a team with appropriate knowledge and expertise.

- Construct a flow diagram of the recycled water system from the source to the application or receiving environments.
- Periodically review the recycled water system analysis.

7.2.1 System Overview

7.2.1.1 Sewage Collection and Conveyance

The Bingara scheme includes collection and conveyance of wastewater to the Bingara PRWP as follows:

- Existing gravity sewerage catchment already constructed to service existing development draining to one sewage pump station (SPS) –
    - This will be serviced by a 200 mm PVC Sewerage Rising Main from the existing gravity SPS
- Future pressure sewer network for all new connections in Bingara Gorge, including:
    - Bingara Gorge: Up to 4 lots drain by gravity to each pressure sewer pump unit (PSU), design and construct by Lend Lease Communities (Wilton)
        - This will be serviced by a 250 mm Pressure Sewer Main from the Bingara Gorge pressure sewer network
    - Wilton Village: One PSU per lot, design and construct by Sydney Water Corporation.
        - This will be serviced by a 125 mm Pressure Sewer Main from Wilton Village pressure sewer network.

7.2.1.2 Bingara PRWP

The Bingara PRWP process has been designed with two separate treatment trains to enable implementation of Stage 1 and Stage 2 works in sequence, for ease of construction and commissioning. There is also provision for a Stage 3 installation if required, depending on growth in the catchment.

From the existing WWTP Inlet Balance Tank the wastewater will be fed by Inlet Pumps to the Inlet Screens. The WWTP Inlet Balance Tank and Inlet Pumps are provided by Lend Lease Communities.

The inlet pumps and screens are sized to manage Peak Wet Weather Flows (PWWF) from the gravity sewer (assumed to have a PWWF of 6 x ADWF) and pressure sewer (assumed to have a PWWF of 1.5 x ADWF with minimal infiltration.) All inlet works will be fully operational at Stage 1 to ensure adequate Duty/Standby provision in screening.

From the screens, screened wastewater will discharge via gravity to a transfer sump and is pumped to the Equalisation Tanks. These tanks provide effective storage of around 3-days during peak wet weather events to attenuate flows to the plant. One equalization tank will be installed prior to Stage 1 works to provide flow balancing to the existing temporary plant. There will be provision during initial operation for connection of one equalization tank via temporary pipework to the Bingara TRWP. This will be removed following completion of Stage 1 works for the Bingara PRWP.

From the equalization tanks, screened wastewater will be pumped to the activated sludge system. All wastewater will be treated with Veolia's standard BioSep 2 M20 MBR's with modification specific to the application at Bingara. Each MBR

system has a three-stage activated sludge tank (incorporating a de-aeration zone for recirculated sludge, a swing/anoxic zone for feed and an aerated zone) and two membrane tanks. Each MBR process train has a peak design capacity of 80 m3/hour (or 1.92 ML/d), providing 100% redundancy in the system at design flows. The MBR provides disinfection to some extent with log-reduction of pathogens across the membranes.

The activated sludge and membrane tanks will be installed in stages, with Stage 2 a duplication and doubling of capacity compared to the Stage 1 installation. At both stages, adequate redundancy is available based on the two-train configuration of each Biosep unit.

The disinfection uses a multiple barrier approach to achieve log reduction targets outlined in the Australian Guidelines for Water Recycling (2006) using Microfiltration membranes (in the MBR described above), Ultraviolet disinfection, chlorine contact tank and residual chlorination.

MBR effluent is transferred to filtrate tanks, and then pumped to the UV-system for initial disinfection. Following UV-disinfection, treated water is discharged to the chlorine contact tanks for chlorination prior to transfer to the treated water storage. Chlorine dosing points are provided at the inlet to the chlorine contact tanks, the inlet to the treated water storage, and on each of the distribution lines from the treated water storage.

Odour treatment will be achieved with extraction via fans from the following sources of foul air:

- Inlet screens
- Centrifuge
- Dewatered biosolids and screenings skips
- Transfer pump station
- Return pump station

And the following source of dilute foul air:

- Equalisation tanks

Concentrated odorous gases will be treated in an odour treatment facility designed to maintain <500 OU in treated air at the outlet.

A centrifuge is provided for sludge dewatering. Waste Activated Sludge (WAS) from the activated sludge tanks will be pumped to a centrifuge for dewatering. Following dewatering, sludge is transferred via a conveyor to a completely covered and sealed skip bin.

7.2.1.3 Recycled Water Distribution

There are two recycled water distribution lines from the treated water tanks at the Bingara PRWP. One distribution line provides recycled water to the network, based on maintaining a present pressure in the network (below the pressure in the drinking water supply). Overflow from the treated water tanks is to the golf course irrigation storage lagoon. The expectation is that the treated water tanks will fill as recycled water usage is not equal to sewage inflows, and this will provide continuous transfer to the golf course. The ability to utilize stormwater at the golf course provides security in supply for irrigation in the event that additional water is required in the lilac network.

The Bingara Scheme PFD is provided in Appendix A, including monitoring points. The Bingara PRWP Process Flow Diagram (PFD) is provided in Appendix C. Piping and Instrumentation Diagrams (P&IDs) and GA's are provided in the

Appendix of the Site Analysis Plan.

As additional works are built, the process diagrams will be continuously updated to ensure that these are in-line with existing infrastructure.

7.2.2 Team with Appropriate Knowledge and Expertise

The members of the design team are listed below. Importantly the entire team and processes selected have the support and backing of VWS in Australia and our expertise and research and development capabilities worldwide.

Table 5: VWS Roles and Responsibilities

Phase	Responsible Person	Title
Project Management	Hugh Robinson	Project Manager
Design management		
Process	Hannah Lockie	Process Engineer
Electrical	Tom Lappalainen	Electrical Engineer
Civil	Lend Lease Communities	Authoriser
Mechanical	Michael Reid	Mechanical Engineer
Procurement	Hugh Robinson	Project Manager
Commissioning and Performance Test Management	Hannah Lockie	Process Engineer
Installation management	TBC	Project Engineer
O&M		
WHSEQ	Grant McNay	General Manager Services
O&M management	Jed Lindley	Operations manager
O&M	Chow Leong and Various service engineers	Service engineers

7.2.3 Assessment of water and sewage quality data

Summary actions:

- Assemble historical data about sewage, grey water or stormwater quality, as well as data from treatment plants and of recycled water supplied to users; identify gaps and assess reliability of data.
- Assess data (using tools such as control charts and trends analysis), to identify trends and potential problems.

7.2.4 Historical Data and Gaps

The housing development is largely new with the ratio of pressure sewer to gravity sewer changing with development, and therefore an expectation that there will be a change in influent characteristics over time. This will be assessed with ongoing monitoring.

A period of sampling was conducted in February/March of 2015 for influent to the existing Bingara TRWP. The data is summarised in Table 6. The design is considered robust to handle variation in influent parameters and contingency measures are available if required (e.g. acetic acid dosing for additional carbon), if these are required to meet effluent quality targets.

Temporary chemical dosing systems will also be considered if necessary to meet immediate requirements for treatment.

Table 6: Data available of raw wastewater characteristics at Bingara TRWP

Monitoring Year		2012/13			2015		
Monitoring Date		10th Nov 2011 - 7th July 2012			19th Jan - 10th Feb		
Days of Composite Sampling		32			12		
		Min	Median	Max	Min	Median	Max
COD	mg/L	90	366	866	158	597	940
BOD	mg/L	23	161	240	82	164	364
TSS	mg/L	20	102	412	144	312	495
TN	mg/L	18.2	66	132	52.7	61	74.4
NH3-N	mg/L	9.04	53	128	31.4	42.4	57.1
TP	mg/L	2.32	10	26.4	9.03	11	15.7
TDS	mg/L	340	427	532	394	560	612

7.2.5 Assess Data and Trending

Development of data and trending will be implemented at the beginning of operation to enable assessment of performance.

A number of critical parameters are monitored online and will be logged automatically in SCADA to enable generation of periodic reports on performance. See Section 9.8.2 for details of online monitoring.

7.3 Hazard identification and risk assessment

Summary actions:

- Define the approach to hazard identification and risk assessment, considering both public and ecological health.
- Periodically review and update the hazard identification and risk assessment to incorporate any changes.
- Identify and document hazards and hazardous events for each component of

the recycled water system.

- Estimate the level of risk for each identified hazard or hazardous event.
- Consider inadvertent and unauthorised use or discharge.
- Determine significant risks and document priorities for risk management.
- Evaluate the major sources of uncertainty associated with each hazard and hazardous event and consider actions to reduce uncertainty.

7.3.1 Approach to Hazard Identification and Risk Assessment

VWS is committed to good Risk Management (RM) principles and methodologies by application of the policies and procedures contained in its BSI Global certified integrated management system (IMS) and applied at every stage of project delivery from tendering through project management, contract management, design, procurement, construction, commissioning, operations, servicing and maintenance.

VWS utilise methodology provided by AS/NZS ISO 31000:2009 Risk management; Principles and Guidelines and related standards for managing disruption related risk and operational continuity. The stepwise approach and methodology are in line with the methodology under Element 2 in AGWR1 and summarised below:

- Define categories of adverse events and circumstances (risks) both external and internal
- Identify adverse events and circumstances for each category
- Consider the probability (likelihood) of each adverse event or circumstance occurring
- Consider the consequence of each adverse event or circumstance should these occur
- Evaluate the likelihood and consequence of each adverse event or circumstance and decide whether treatment is necessary to reduce the likelihood or to mitigate the consequence or both
- Decide on an appropriate risk treatment
- Repeat the evaluation process following risk treatment selected to assure that the risk treatment provides sufficient mitigation and control
- Repeat the process if necessary to arrive at an acceptable risk treatment
- Put the risk treatment in place, then manage and monitor.

The risk matrix below ranks the likelihood of an adverse event or circumstance occurring increasing from rare, to unlikely, possible, likely to almost certain; and the consequence of such event or circumstance increasing from insignificant to minor, moderate, major or severe as the case may be.

Likelihood or Probability	Consequence or Impact (Risk outcome)				
	Insignificant -1	Minor - 2	Moderate - 3	Major - 4	Severe - 5
Almost Certain - 5	Low	Medium	High	Very High	Very High
Likely - 4	Low	Medium	High	Very High	Very High
Possible - 3	Low	Medium	High	Very High	Very High
Unlikely - 2	Low	Low	Medium	High	Very High
Rare event - 1	Low	Low	Low	High	High

The priority of the actions and controls put in place shall be proportional to the level of risk identified in order that the residual risk becomes acceptable. This can be described qualitatively as follows noting that with the 5x5 matrix and 4 Risk Ratings, there is some crossover in the ratings and therefore cross over in our qualitative assessment:

Qualitative assessment rating of controls

Qualitative Residual Risk Rating	Qualitative Residual Risk Rating	Qualitative Residual Risk Rating
Low-medium	1-3	Best practice unless noted otherwise
Medium	4	Adequate unless noted otherwise
High-Very High	4-25	Inadequate

The higher the residual risk rating the greater the significance of that risk and the higher priority given to its prevention and or mitigation as applicable. Once VWS puts in place actions and controls to mitigate the consequence of an adverse event, VWS then reassesses that mitigation to assure the controls in place reduce the residual risk rating to an acceptable level.

Risks that remain significant with implementation of preventative measures will be addressed in the Emergency Response Plans (ERP) for the Bingara Scheme, to be developed under the operations contract with Lend Lease Communities (Wilton).

7.3.2 HACCP

A HACCP was conducted on March 30th and 31st of 2015 for the Bingara PRWP, Sewer network and lilac network adopting the above procedure.

Details of the HACCP evaluation is provided in Appendix E.

A review of key risks and preventative measures is provided below in Section 8.

8 Element 3 - Preventive Measures for Recycled Water Management

Components:
▪ Preventive measures and multiple barriers ▪ Critical control points

8.1 Preventive Measures and Multiple Barriers

Summary actions:
▪ Identify existing preventive measures system-wide for each significant hazard or hazardous event, and estimate the residual risk. ▪ Identify alternative or additional preventive measures that are required to ensure risks are reduced to acceptable levels. ▪ Document the preventive measures and strategies, addressing each significant risk.

This section provides an overview of preventative measures provided to ensure that the risk of hazards associated with the system is low. Each of these risks and preventative measures have been addressed in the HACCP discussed in Section 7.3.2 and presented in the Retail Supply Management Plan (RSMP) for the Bingara Scheme.

8.1.1 Water treatment

The treatment process design has been developed with the following objectives:

- To easily achieve the required treated water quality for proposed use
- To ensure surety can be provided in achieving log removal requirements as required by the Department of Health and IPART, with multi-barrier disinfection with pre-validated unit processes
- To provide automated response at CCP to ensure that water quality is within specification at all times.
- To be easy to operate
- To be efficient and cost effective to maintain and operate
- To provide a safe and clean environment in which our maintenance and operations staff will work
- To have a responsible approach to odour and noise prevention

An overview of the Bingara PRWP process is provided in Section 7.2.1.2. This includes a multi-stage treatment process with adequate redundancy and control in design to minimize the risk of recycled water not meeting requirements.

The Multi-Barrier approach to treatment and disinfection, and the implementation of CCP ensures that the risk of pathogens at levels above the acceptable requirements for the intended applications is very low. An overview of the adequacy of CCP in meeting objectives for virus removal, and therefore meeting objectives across other pathogens (as viruses are the limiting pathogen in terms of removal requirements) is provided in Section 8.2.

8.1.2 Treated Water Storage

There are two 1.5 ML treated water storage to be installed at the BIngara PRWP at completion of Stage 2, with space allowed for an additional storage at Stage 3 if this is deemed necessary. Storage provides security in supply to the recycled network and the capacity to confirm water quality is acceptable prior to discharge (via pumps) to the recycled water lilac network.

Protection and maintenance of the treated water storage tanks includes:

Treated Water Tank Protection
The Treated Water Tanks are covered and have vermin screens on vents to prevent contamination.

Light
The Treatment section of the Infrastructure post-membranes (the first stage of disinfection) is housed within covered tanks and/or inside buildings. Treated water storage tanks are also covered. Therefore there is no risk of algal growth within the plant.

Drainage
All chemicals on site are stored within a bunded area.

The treatment infrastructure is designed to drain all chemical and sludge waste to a common sump.

There is no risk of contamination of treated water with drainage/chemicals as the treated water tanks are fully sealed.

Backflow prevention on potable line to TW Storage
The potable water emergency top up will be provided using a 300 mm (minimum) air gap above the top water level in the recycled water tank to prevent backflow.

8.1.3 Lagoon Storage Protection

Two lagoon storages are provided, a 60 ML HDPE lined lagoon and a 20 ML clay lined lagoon. This storage is used for controlled irrigation of the Bingara Gorge golf course. At an ADWF of 0.9 ML/day (as expected at Stage 2 development), this provides approximately 88 days of storage. MEDLI modelling has been undertaken (see the Sewage Management Plan) to ensure that irrigation application rates and nutrient application rates are suitable for the golf course.

The storage is sized to reduce overflow events to less than 50% of years, based on analysis with MEDLI modelling (see the Sewage Management Plan for details.) The large volume of treated water storage also guarantees supply to the golf course during high demand periods.

Lagoons are constructed to avoid runoff entering the lagoon, restricting the lagoon catchment to rainfall direct to the lagoon surface and treated wastewater.

The storage lagoon will be fenced and located within the golf course grounds.

The design, construction, operation and safety management of the Storage Lagoon is the responsibility of Lend Lease Communities (Wilton) named as an authorised person in the Network Operator's Licence. It is a given in this Plan that the design and construction of the storage lagoon will meet all necessary standards and codes of practice to assure structural, environmental and water retaining integrity.

VWS will assist in the monitoring of the lagoon, with weekly monitoring for E Coli and Algae.

If a high level of bird life is observed at the lagoon it will be managed with preventative measures such as netting of the surface.

8.1.4 Recycled Water (Lilac) Network Protection

Recycled water network protection to ensure that recycled water quality is managed includes the following:

Pipework Design

The following applies to the Lilac network to minimise risk of contamination:

- Pipe work is installed in Aquatherm lilac pipe with labels identifying recycled water.
- Design of the Recycled Water Network is in line with SWC and Australian Plumbing standards minimising cross connection risk.
- Backflow prevention uses reduced pressure zone devices, and registered air gaps between the potable water and the recycled water systems in accordance with AS 3500.1 Section 4.
- Signage on all accessible valves.

Residual Chlorination

- Residual chlorination is provided on discharge of recycled water network pumps and irrigation overflow. This ensures that a residual is available in recycled water supplies to prevent pathogen growth in the network.
- The residual chlorination requirement will be adjusted based on seasonal variation in decay to ensure that a preset minimum is maintained at the most extreme points in the network.

8.1.5 Restrictions on Usage by Customers

Restrictions on usage by customers of water from the Recycled Water (lilac) network will apply under this Licence.

Customer contracts will be specific regarding health and safety when using treated water; additionally education programs will be developed for reminding the community as well as the provision of adequate signage and the like, once a Permanent Treatment Plant is in place (and recycled water provision to the lilac network commences.)

Usage for golf course irrigation will be relatively unrestricted (in terms of scheduling and buffer requirements) as the treatment standard will now achieve a higher standard of water (suitable for third pipe irrigation) than under the current scheme operation.

8.2 Critical Control Points

Summary actions

- Assess preventive measures throughout the recycled water system to identify critical control points.
- Establish mechanisms for operational control.
- Document the critical control points, critical limits and target criteria.

8.2.1 Definition of CCP

A CCP is defined as an activity, procedure or process where control can be

applied, and that is essential for preventing hazards that represent high risks or reducing these to acceptable levels.

CCPs require:

- Operational parameters that can be measured, and for which critical limits can be set to define effectiveness (e.g. chlorine residuals for disinfection)
- Operational parameters that can be monitored sufficiently frequently to reveal any failures in a timely manner (e.g. online and continuous monitoring of key treatment processes) — in some cases 'timely' may mean monitoring regularly rather than frequently (e.g. backflow prevention audits)
- Procedures for corrective action that can be implemented in response to deviation from critical limits.

8.2.2 Overview of Critical Control Points (CCP)

An overview of the online monitoring points at CCP to ensure recycled water quality is provided graphically in Figure 3 with a list of all CCP monitoring points provided in

Table 7.

CCP have been determined in-line with the requirement to ensure a multi-barrier approach to disinfection and that log removals for recycled water quality assurance are achieved.

Note that although the irrigation water will be monitored for a range of parameters, with alarms for excursion outside critical limits this is not considered a CCP as there are adequate measures upstream of this point to ensure that the supply to irrigation is fit for purpose. In the event that the RW Network CCP does not comply with limits, water supply would also be shutdown to the irrigation network via shutdown of the plant.

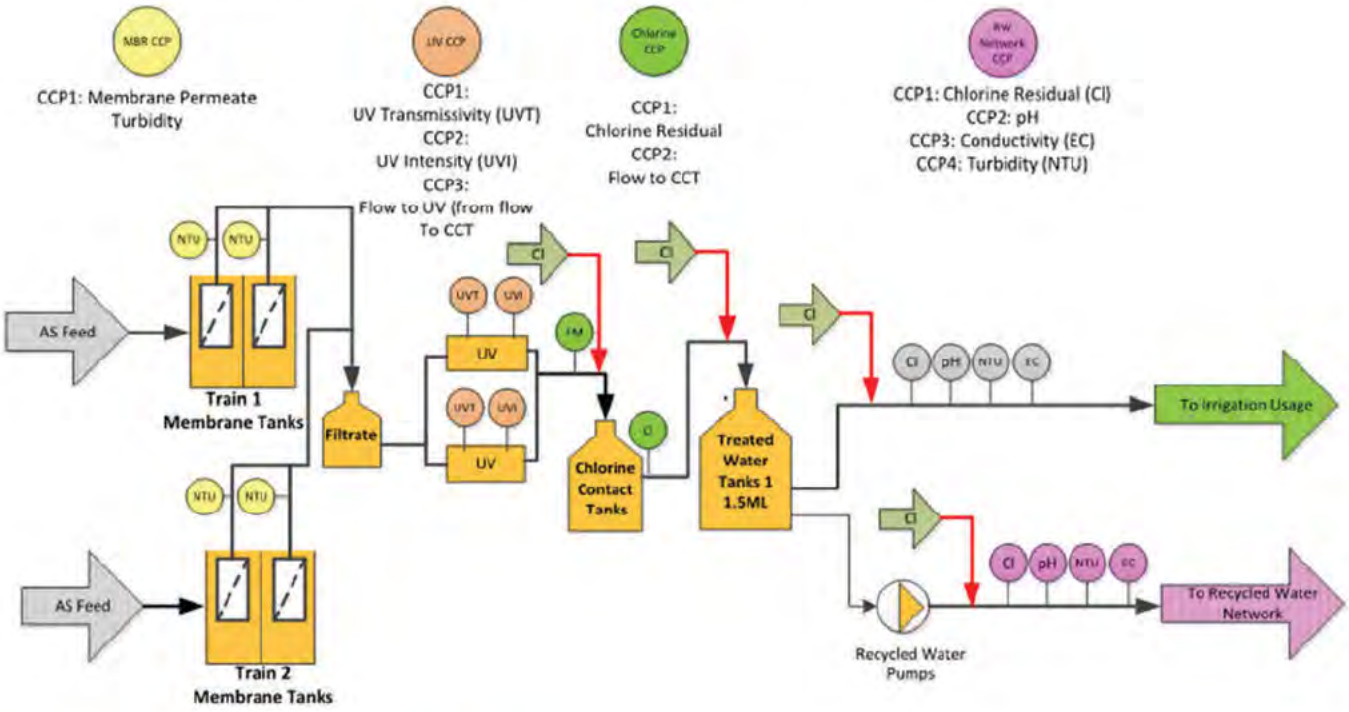

Figure 3: Overview of CCP monitoring for the Bingara PRWP

Table 7: Online Monitoring for the Bingara PRWP at CCP

System	Parameter	Measured by	Frequency
Membrane filtration	Turbidity	SCADA	Continuous
UV System	UV Transmissivity (UVT)	SCADA	Continuous
	UV Intensity (UVI)	SCADA	Continuous
Chlorination Tank Feed	Flow NOTE: Only included as this is a CCP, other flow meters not documented here	SCADA	Continuous
Chlorination System Outlet	Chlorine Residual	SCADA	Continuous
Recycled Water Network Supply	pH	SCADA	Continuous
	Chlorine Residual	SCADA	Continuous
	Turbidity	SCADA	Continuous
	Conductivity	SCADA	Continuous

8.2.3 CCP Log Removal Credits and Validation Requirements

An overview of the CCP requirements in terms of log-removals is provided in Table 8. It should be noted that this table only provides the basis for development of CCP based on microbial requirements and does not set the specific limits at each CCP.

CCP limits are discussed in Section 8.2.5 and 8.2.6.

Table 8: CCP Log Removal Credits, Validation Basis and Online Control Requirements

Critical control points	Log Removal Credits	Validation Basis and Online Control Requirements to achieve Log-Removal Credits
Membrane Permeate		
CCP 1: Permeate Turbidity	Virus – 1 Bacteria – 2 Protazoa – 2	Membranes provided: HYDRAsub / Sterapore SADF MBR (model 50M1000FF) Membranes certified under California Department of Health Title 22 Validation Report for membranes Pre-validated under Title 22 to achieve 1-log virus removal 100% frequency based on turbidity not exceeding any of the following: - 0.2 NTU more than 5% of the time within a 24-hour period; and - 0.5 NTU at any time.

Critical control points	Log Removal Credits	Validation Basis and Online Control Requirements to achieve Log-Removal Credits
UV System		
CCP1: UV Transmissivity (UVT) CCP2: UV Intensity (UVI) CCP3: Flow to UV	Virus – 1.5 Bacteria – 3 Protazoa – 3	UV Units provided: Duty/ Standby Xylem Wedeco LBX850e Validated according to USEPA (2006) Ultraviolet Disinfection Guidance Manual for LT2 ESWTR report Validation based on compliance of unit with log-removal requirements at flow rate (maximum) of 120 m3/h and UVT > 65%, provided the design UV intensity is adequate to achieve dose requirements at measured flow
Chlorination System		
CCP1: Residual Chlorine on CCT Outlet CCP2: Flow to Chlorine Contact	Virus – 4 Bacteria – 2 Protazoa – 0	Measurement of a 2 mg/L chlorine residual on discharge from the chlorine contact tank (online measurement) CT of 18 mg.min/L selected for 4-log virus removal with free chlorine (considering residual ammonia/ organics.) Requires measurement of: a) 2 mg/L chlorine residual minimum on discharge from CCT b) less than 80 m3/hr flow to the CCT
Recycled Water Network Supply	**No credits Claimed**	**No validation required**

8.2.4 Mechanisms for Operational Control at CCP

Supporting programs are taken by the operator to reduce the likelihood of failure of a control (barrier/critical process) or other management actions to reduce water quality hazard occurrence.

These actions or programs include but are not limited to:

- Monitoring and maintaining integrity of a barrier by periodic evaluation, tracking history and a pro-active replacement program.
- Regular verification and calibration of water quality analysers
- Maintenance programs suited to the criticality of each process, which may be more frequent than manufacturer direction.

O&M manuals in development will elaborate further on these aspects.

As per the CCP incident Response Plan (see Section 8.2.7) the response to CCP excursions, including outside alert limits, includes an evaluation of measures that

can be implemented to ensure that such excursions do not occur regularly or lead to non-conformances.

Each critical control monitoring parameter is trended on the SCADA system and alert and critical alarm set points are programmed to generate alarm that displays on the SCADA screens and can also be also relayed to mobile communication devices such as mobile phones.

The process manager and process engineers have defined reports that the SCADA system can generate on a regular basis which summarise information for review.

8.2.5 CCP Excursions

A CCP excursion is defined as the excursion of a critical alarm set point defined for the parameter being monitored at that point. All critical control/operational points are monitored by parameters that are measured online and alarms can be generated in real time using the supervisory control and data acquisition (SCADA) system.

In general, critical control points have the following limits:

- Alert limit:
  Response: A priority 2 alarm to the operator on duty. The duty operator follows the CCP response procedure and work instructions specific to that critical point to investigate and rectify the reason for the alert limit being triggered. No shutdown is initiated

- Shutdown limit:
  Response: A priority 1 alarm to the operator on duty as this indicates the necessary corrections to improve operation after initiation of the alert limit were not adhered to. The plant is shutdown if this limit is reached.

  Triggering an alert limit or shutdown limit (only) does not amount to a non-conformance as these limits may be set with the purpose of allowing an operator to rectify a potential problem before a non-conformance can occur. CCP alerts are recorded using the SCADA system historian and the duty operator's records of rectification actions in the operator's logbook.

- Critical limit:
  Response: A priority 1 alarm is issued via the SCADA system. The duty operator follows the CCP response procedure and work instructions specific to that critical point to investigate and rectify the reason for the critical alarm. Shutdown will be initiated (as it should have been under the shutdown limit for parameters with different critical / shutdown limits.)

  In most cases the rectification action may involve a switch to a back-up process unit but in some cases supply of recycled water may be stopped.

  Reaching a critical limit will be considered a non-conformance, and therefore it is preferable to have a difference between shutdown and critical limits where there is no automated response that will necessarily improve performance (e.g. on UV transmissivity).

All CCP alarms are reported as water treatment incidents using the VWS incident report form.

The corrective actions taken by the operator are recorded on the incident report form as well as in the operator's logbook. All CCP alarm events are reported to Lend Lease Communities (Wilton) as soon as practical using the VWS incident report form, and to the regulator if required. The CCP incident response procedure is outlined in Section 8.2.7.

8.2.6 CCP Limits Targets and Criteria

CCPs, operational response and control, critical limits and target criteria are summarised in Table 9 below.

Table 9: CCP Limit Targets and Criteria

Critical control point	Log Removals	Critical Limit	Shutdown Limit	Alert Limit	Monitoring	Corrective actions
Membrane Permeate						
CCP 1: Permeate Turbidity	Virus – 1 Bacteria – 2 Protazoa – 2	0.5	0.4	0.2	Turbidity (NTU) monitored on permeate from each membrane tank	Alarm to 24/7 service engineer on alert limit alarm. Automatic shutdown of membrane train on shutdown level alarm (no feed to or from relevant AS tank), remaining membrane tanks remain in service. Critical limit is a non-conformance, plant shutdown and reporting of incident as required.

Critical control point	Log Removals	Critical Limit	Shutdown Limit	Alert Limit	Monitoring	Corrective actions
UV System						
CCP1: UV Transmissivity (UVT)	Virus – 1.5 Bacteria – 3 Protazoa – 3	65	66	68	UVT (%) monitored on each UV Unit	Alarm to 24/7 service engineer on alert limit alarm. Automatic shutdown of plant on shutdown limit. Operations are required to assess cause of colour and determine if restart is possible or potable water backup is required.
CCP2: UV Intensity (UVI)	As above	To be adjusted automatically based on dose required for flow	To be adjusted automatically based on dose required for flow	To be adjusted automatically based on dose required for flow	UV intensity (mJ/cm2) monitored on each UV unit	The UVI will be automatically adjusted based on flow to the UV unit. The dosage limits for alarm, shutdown and non-conformance (critical limit) will be dependent on the flow during operation. Responses will be as follows: Alert limit – alarm. Shutdown limit- shutdown plant until Standby UV unit can be switched manually to the Duty unit. CCP – Shutdown Plant until Standby UV Unit can be switched manually to the Duty unit.

Critical control point	Log Removals	Critical Limit	Shutdown Limit	Alert Limit	Monitoring	Corrective actions
CCP3: Flow to UV	As above	80	80	No alarm	m^3/h flow to chlorine contact tanks	There is no alarm required for flow approaching 80 m^3/h as this should be corrected automatically be modification of pump operation. If flow exceeds 80 m^3/hr, shutdown and critical limit initiated (appropriate reporting etc.)
Chlorination System						
CCP1: Residual Chlorine on Chlorine Contact Tank Outlet	Virus – 4 Bacteria – 2 Protazoa – 0	<2 OR >3.4	<2.1 OR >3.2	<2.3 OR >2.8	mg/L Chlorine residual on tank outlet	Alarm to 24/7 service engineer on alert limit alarm. Automatic shutdown of plant on shutdown limit. Operations are required to assess cause of residual decline and determine if restart is possible.

Critical control point	Log Removals	Critical Limit	Shutdown Limit	Alert Limit	Monitoring	Corrective actions
CCP2: Flow to Chlorine Contact	As above	80	80	No alarm	m^3/h flow to chlorine contact tanks	As above, here is no alarm required for flow approaching $80m^3/h$ as this should be corrected automatically be modification of pump operation. If flow exceeds 80 m^3/hr, shutdown and critical limit initiated.
Recycled Water Network Supply						
pH	N/A	N/A	<6 OR >8	<6.5 OR >7.8	pH on discharge of recycled water network pumps	
Chlorine Residual	N/A	TBC	TBC	TBC	mg/L Chlorine residual	Seasonal limits to be set for chlorine residual
Turbidity	N/A	1	0.5	0.2	NTU	Operator to aim to rectify issue with taking problematic membrane trains out of service (if this is the cause). Other causes such as contamination of tanks to be investigated.
Conductivity	N/A	2000	2000	1500	$\mu S/cm^2$	Top up with potable water

Critical control point	Log Removals	Critical Limit	Shutdown Limit	Alert Limit	Monitoring	Corrective actions
						required

8.2.7 CCP Incident Responses

All critical control point alarm excursions are treated as incidents and are reported to Lend Lease Communities (Wilton). The overall response process for critical/quality point alarm non-conformance is show below:

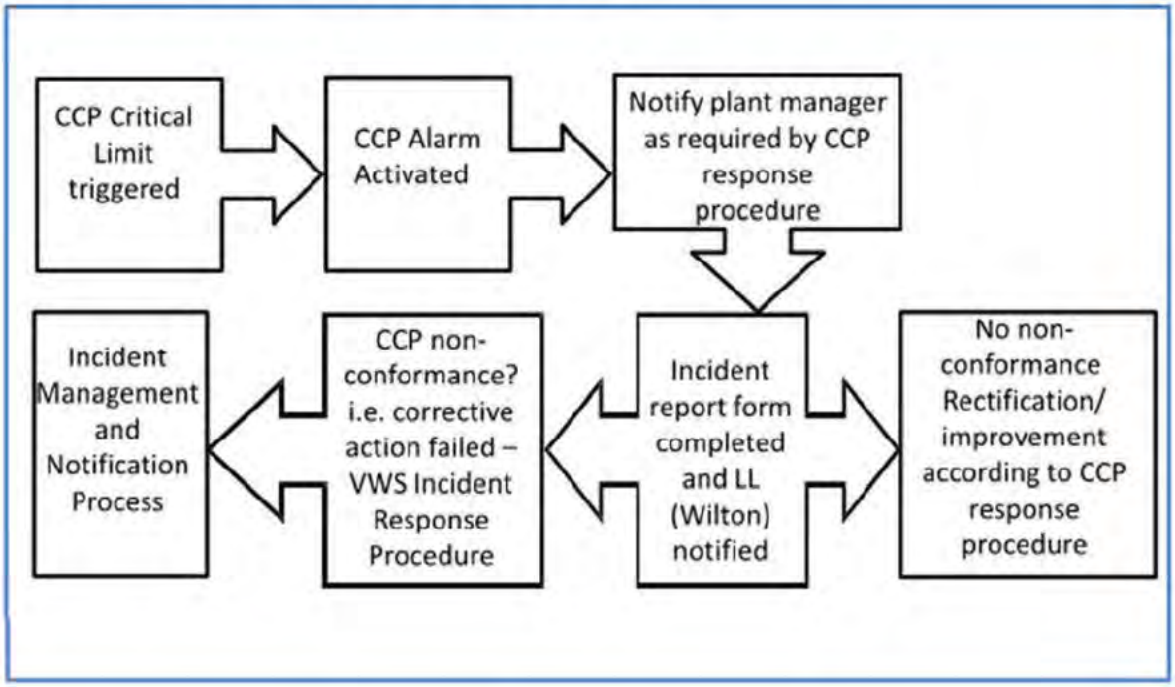

Figure 4: Procedure for CCP Incident Response

9 Element 4 - Operational procedures and process control

Components:

- Operational Procedures
- Operational Monitoring
- Operational Corrections
- Equipment Capability and Maintenance
- Materials and Chemicals

Summary Procedures

- Identify procedures required for all processes and activities applied within the whole recycled water system (source to use).
- Document all procedures and compile into an O&M manual

9.1.1 Identification and Documentation of Procedures

Operational Procedures and Monitoring will be developed into an Operation and Maintenance manual.

Section 1.0 Introduction
About This Manual
Infrastructure Overview
Occupational Health, Safety & Environment

Section 2.0 Treatment Processes
Process Description
Process Theory

Section 3.0 Control Philosophy
Overall Control Philosophy
Sub-systems Control Philosophy

Section 4.0 Plant Control System
Overall Control System
Local Operator Panel Displays

Section 5.0 Routine Operating Tasks
Routine Operating Tasks
Chemical Handling
Sub-Systems Units
Water Quality Monitoring
Sewage Quality Monitoring
Daily Log Sheet

Section 6.0 Process Troubleshooting
Inlet Screens and Screw Conveyors
Transfer Pumps
Equalisation Tanks
Activated Sludge Tanks
Activated Sludge Blowers
BioSep Systems
UV System
Chlorination System
Treated Water Tanks and Treated Water Supply
Sludge Dewatering
Solids Storage
Odour Control Unit

9.2 Operational Monitoring

Summary actions

- Develop monitoring protocols for operational performance of the recycled water supply system, including the selection of operational parameters and criteria, and the routine analysis of results.
- Document monitoring protocols into an operational monitoring plan.

Operational monitoring in terms of water quality compliance at the CCP is detailed under Section 8.2.

Operation monitoring in terms of additional performance measurements has been assessed via a HAZOP procedure to ensure that the P&ID cover all critical operation points, including:

- Online monitoring of level, flow and pressure and all relevant alarms.
- Alarms for all mechanical equipment and safe mechanisms for automatic shutdown.

Monitoring of all operating parameters are carried out on a continuous 24/7 basis by the plant PLC accessible remotely by VWS engineering staff. All service engineers are equipped with wireless access on their tablet PCs. The operator on-call will be immediately notified via SMS of any dial-out fault at the plant. In some instances, the capacity to dial-in and rectify a fault is available. However, VWS does not advocate the use of remote fault rectification unless absolutely

The Control Philosophy will include details on alarms that will dial-out, and waring alarms that may only be required to be displayed at the local PLC (if any). In addition, remote modification parameters will be selected during review of the Control Philosophy.

An overview of key operational monitoring is provided in Table 10.

Table 10: Key Operational Monitoring

Scheme Component	Operational Monitoring
Gravity Sewerage	SPS water level
	Pump Starts, Pump hours Run, Current Draw, Power Consumption
	Mechanical / Electrical Faults
	Rising Main Mag Flowmeter
Pressure Sewer	Pressure Sewer Unit (PSU) Water Level
	Pump starts, hours run, power consumption
	Mechanical / electrical faults
	Pressure sewer main mag flow meters

WWTP Inlet balance tank and Equalisation Tanks	Water level in tanks
	Flow meters out of tanks, as indicated
	Mechanical / electrical faults
Activated Sludge tanks and MBR	Water levels in all tanks
	Flow meters on feed / discharge lines
	Aeration blower air flow, VSD frequency and faults
	Dissolved oxygen
	Mixed liquor suspended solids
	Nitrate, ammonia, pH, ORP in activated sludge tanks
	Mechanical /Electrical faults
Membrane Tanks	Aeration blower air flow and faults
	MBR permeate turbidity (also a CCP)
	Transmembrane pressure
	Water levels in all tanks
	Dissolved oxygen
	Mechanical /Electrical faults
Process Chemicals	Pump dosage rates
	Level in chemical storage
	Mechanical /Electrical faults
UV System	UV intensity (also a CCP)
	UV transmissivity of water in UV (also a CCP)
	Lamp faults and Run hours
Chlorine Disinfection	Flow to chlorination (also a CCP)
	Chlorine residual after chlorine contact tanks (also a CCP)
	Treated water (on irrigation and recycled water lines) residual chlorine, turbidity, pH and conductivity measurement
Recycled water supply and storage	Levels in all tanks
	Treated water (on irrigation and recycled water lines) residual chlorine, turbidity, pH and conductivity measurement
	Residual chlorine in the network (sampling as required to capture seasonal variation)
	Recycled water supply pressure
	Flow rate to recycled water network
	Mechanical /Electrical faults
Odour Control System	Mechanical /Electrical faults (with fans)
Wet weather storage and supply	Water level
	Inflow from Bingara PRWP
	Outflow to golf course irrigation
	Pump starts, power draw, run time
	Mechanical /Electrical faults

9.4 Operational Corrections

Summary actions

- Establish & document procedures for corrective action where operational parameters are not met.
- Establish rapid communication systems to deal with unexpected events.

9.4.1 Procedures for Corrective Actions

As far as safely possible, corrective response to measurements will be automated, e.g. through the following:

- P&ID loop to increase chlorine dosing to maintain a chlorine residual.
- Automated Duty/Standby changeover of pumps where practical.
- Automated aeration control, including via:
  - DO-setpoints.
  - Veolia's proprietary Amonit software to more accurately control nitrogen removal with aeration.

These automated responses will be detailed in the Control Philosophy document.

A number of operational parameters will be used to indicate the requirement for maintenance of equipment. This includes:

- Frequent high level / cleaning measured on fine screening units.
- Turbidity increase in membrane permeate – indicates requirement to conduct a membrane repair campaign.
- High nitrate in AS tanks – potentially requirement to include an acetic acid dosing system for addition of adequate carbon for nitrogen removal.
- High mixed liquor concentration in AS Tanks – requirement to waste additional sludge to centrifuge to avoid membrane fouling.
- Pressure increase on discharge of activated sludge blowers – indicates requirement to clean fixed diffusers in activated sludge tanks.
- Decrease in UVT – indicates requirement to conduct membrane repair campaign (if associated with turbidity).
- Failure to meet residual chlorination requirements – indicates potentially high ammonia level in discharge from AS tanks and requirement to adjust control loop to increase aeration time "On".
- Failure to meet UV intensity requirements – indicates UV lamp cleaning requirements and/or lamp replacement.
- High conductivity on recycled water network supply – indicates requirement to investigate salinity management measures across the scheme.
- Low pH on recycled water network supply – indicates potential requirement for alkalinity addition to process.
- Low chlorine residual measured with sampling in the network – requirement to increase target chlorine residual from the treatment plant.
- Excessive use of chemicals (tracked with pumped volumes) – investigation required of reason for increase in chemical demands.

Details on the specific procedures of maintenance of process units will be provided in the O&M Manuals.

9.4.2 Rapid Communication System

Dial-out alarms and operator on-call rostering to cover 24/7 offsite monitoring will ensure that there is a rapid response to any faults and/or poor performance at the plant. This system is already in place for the Bingara TRWP and will be expanded / adjusted as required for the Bingara PRWP.

A series of emergency response plans have been developed for the Bingara TRWP and the recycled water network. These will expanded / adjusted as required for the Bingara PRWP.

9.5 Equipment Capability and Maintenance

Summary actions

- Ensure that equipment performs adequately and provides sufficient flexibility and process control.
- Establish a program for regular inspection & maintenance of all equipment, including monitoring.

9.5.1 Adequate performance and reliability

All Treatment Infrastructure equipment and devices were selected for reliability, flexibility and ease of operation and maintenance from prequalified reliable VWS suppliers (including our own Veolia proprietary equipment). In the development of the design and construction design and constructability reviews further support this assurance.

The design ensures:

- Online measuring devices monitor critical operational parameters continuously
- Automated responses to changes in water quality are alarmed to a service engineer (on call 24/7)
- Automated shutdown on Critical Control Points.
- Necessary redundancy in equipment supply and/or back up operational configurations to minimize unplanned plant shutdowns.
- Automatic adjustment of process parameters where appropriate (i.e. flow controlled chemical dosing, automatic cleaning of membranes when deterioration of performance is detected)
- A safe and clean environment is provided for our maintenance and operations staff to work in, including adequate bunding and safe chemical storage and handling equipment.

9.5.2 Regular Inspection and Maintenance

An O&M manual will be prepared for scheduling of daily, weekly, monthly, bi-annual and annual maintenance inspection and planned maintenance activities for the Bingara PRWP and the recycled water networks. These will be carried out under the O&M services agreement by VWS.

For the Bingara PRWP, a site log will be maintained for each site visit performed by a VWS engineer. The log contains relevant information on the tasks performed during the visit, including:

- All maintenance checks as per the O&M Manual (currently under development)
- Any other maintenance tasks performed
- All operating data manually collected
- A log of chemical usage and chemical deliveries required (intended to be used to review and optimize chemical usage, and ensure no shortfalls in supply)

9.6 Materials and Chemicals

Summary actions

- Ensure that only approved materials and chemicals are used.
- Establish documented procedures for evaluating chemicals, materials and suppliers.

9.6.1 Approved Materials and Chemicals

VWS only uses approved chemical suppliers, and provides some of the chemicals from its own in house chemical supply division. Continuity of supply is guaranteed with approved back up suppliers nominated and pre-checked.

Other chemicals such as paints and sealants that come into contact with water will be selected to assure no contamination occurs. This includes ensuring that equipment used post-membranes is all for potable water standard.

9.6.2 Evaluating Suppliers and Products

All products and materials used in the recycled infrastructure will comply with the standards and codes noted in the AGWR1

- AS/NZS 3500 (Plumbing and Drainage 2003)
- AS/NZS 4020 (Testing of Products for Use in Contact with Drinking Water 2005)
- WASS Sewerage Code Version 2.1 (WASS 2002a)
- WSAA Water Supply Code (Dual Water Supply Supplement Version 1.1) (WSAA 2002b) Refer to Element 5 for NATA testing of water for quality compliance.

All relevant suppliers will be required to comply with these requirements.

9.8 Recycled water quality monitoring

Summary actions

- Determine the characteristics to be monitored.
- Determine the points at which monitoring will be undertaken.
- Determine the frequency of monitoring

9.8.1 Overview

The characteristics of the recycled water will be monitored both online and via sampling. The characteristics to be monitored online and the online monitoring points are summarised in Section 9.8.2, and also detailed in the P&ID. The characteristics to be sampled and manually measured, and the frequency of sampling, is summarised in Section 9.8.5. The procedures for manual sampling and analysis are outlined in Section 9.8.3.

For key monitoring responses associated with CCP see Section 8.2.

9.8.2 Online Monitoring

An overview of all water quality monitoring (including CCP and other parameters) at the Bingara PRWP is provided in Table 11.

An overview of the online monitoring points at CCP to ensure recycled water quality is provided in Section 8.2.2.

Table 11: Online Water Monitoring for the Bingara PRWP

System	Parameter	Measured Units	Frequency
Activated Sludge Tanks	Mixed Liquor Suspended Solids	Each AS Tank (2)	Continuous
	Mixed Liquor Oxidation Reduction Potential (Anoxic Zone)	Each AS Tank Anoxic Zone (2)	Continuous
	Dissolved Oxygen (Aeration Zones)	Each AS Tank (2)	Continuous
	Nitrate	Each AS Tank (2)	Continuous
	Ammonia	Each AS Tank (2)	Continuous
Membrane filtration	Turbidity	Each Membrane Tank (4)	Continuous
UV System	UV Transmissivity (UVT)	Each UV Unit (2)	Continuous
	UV Intensity (UVI)	Each UV Unit (2)	Continuous
Chlorination System Outlet	Chlorine Residual	Outlet of Series Operated Chlorine Contact Tanks (1)	Continuous
Discharge from site treated water tank to irrigation	pH	Combined Overflow Line from TW Tanks	Continuous
	Chlorine Residual	Combined Overflow Line from TW Tanks	Continuous

	Turbidity	Combined Overflow Line from TW Tanks	Continuous
	Conductivity	Combined Overflow Line from TW Tanks	Continuous
Discharge of Recycled Water Network Pumps	pH	Discharge of Recycled Water Network Pumps	Continuous
	Chlorine Residual	Discharge of Recycled Water Network Pumps	Continuous
	Turbidity	Discharge of Recycled Water Network Pumps	Continuous
	Conductivity	Discharge of Recycled Water Network Pumps	Continuous

9.8.3 Procedures for Manual Sampling

Onsite sampling and analyses procedures will be developed taking into account best practice as outlined in the Standard Methods for the Examination of Water and Wastewater (21st edition APHA/AWWA) and AS/NZS 5667.1:1998 Water quality-Sampling.

External laboratory analyses are performed by laboratories that have obtained NATA certification for the method.

Where analyses use newly developed procedures or where the frequency of the analyses does not warrant NATA certification, the external laboratory is required to provide the method statement and a reference to an international standard method on which the method is based.

Manual sampling of raw water and treated recycled water quality as grab samples will be undertaken routinely. When necessary, periods of composite sampling will be undertaken to confirm that grab samples are adequately representative of water quality.

9.8.4 Treated Water Quality Targets

Key treated water quality objectives are summarised in Table 12. These targets are the basis of assessment of monitoring data that shall be collected as summarised in Section 9.8.5.

Table 12 Target effluent quality

Parameter	Units	Minimum	Mean	95%ile	Maximum
Biochemical Oxygen Demand	mg/L	N/A	NS	10	20
Suspended Solids	mg/L	N/A	NS	1	2
Turbidity	NTU	N/A	NS	0.5	1
Total Nitrogen	mg/L as N	N/A	10	NS	20

Total Phosphorus	mg/L as P	N/A	0.3	NS	2
pH	pH	6.5	NS	NS	8.5
Total Dissolved Solids	mg/L	N/A	N/A	1000	1500

9.8.5 Monitoring Parameters and Frequency

The regular monitoring that will be undertaken at the Bingara PRWP is summarised in Table 13.

Table 13: Treated Water Manual Sampling Under Normal Operation (at inlet to Treated Water Tanks)

Parameter	Measured by	Frequency
TSS	NATA Lab[1]	Once / Week
Conductivity	NATA Lab[1]	Once / Week
BOD	NATA Lab[1]	Once / Week
COD	NATA Lab[1]	Once / Week
Alkalinity as CaCO3	NATA Lab[1]	Once / Week
Ions (Ca, Mg, Na)	NATA Lab[1]	Once / Week
Total Kjeldahl Nitrogen (TKN)	NATA Lab[1]	Once / Week
Ammonium Nitrogen (NH4-N)	NATA Lab[1]	Once / Week
Nitrate/Nitrite Nitrogen (NOx-N)	NATA Lab[1]	Once / Week
Total Nitrogen (TN)	NATA Lab[1]	Once / Week
Total Phosphorus (TP)	NATA Lab[1]	Once / Week
E coli	NATA Lab[1]	Once / Week
Helminths	NATA Lab[1]	Once / Week
Coliphages	NATA Lab[1]	Once / Week
Clotridia	NATA Lab[1]	Once / Week
Ammonia	NATA Lab[1]	Once / Week

9.8.6 Operational Sampling of Lagoon

To ensure that there is no risk to public health, checks will be conducted from the treated water storage lagoon, as change in water quality may occur in the treated water storage lagoon, e.g. due to algae growth.

The lagoon has been in operation with a discharge of high nutrient and pathogen levels from the Bingara TRWP with no concerns. However, greater stringency has been applied to water quality requirements with the Bingara PRWP based on:

- Expectation that creek overflows will occur from the lagoon in 50% of years.
- Move to non-restricted irrigation to increase water usage on the golf course, based on the higher quality of water provided from the Bingara

PRWP this is considered acceptable.

A summary of the monitoring that will be undertaken at the lagoon during overflow events is provided in Section 9.9.2, under EPL monitoring point 5. Routine monitoring that will occur, including outside overflow periods, is provided in Table 14.

Table 14: Routine Irrigation Lagoon monitoring

Parameter	Value or Range	Sampling Frequency
E. Coli	<10cfu/100mL*	1 x grab sample per week
Algae Blooms	Visual**	Visual check daily (Mon – Fri)
TDS	<1000 mg/L	1x grab sample per week

*10cfu/100mL is a trigger point for investigation, as this may indicate that non-restricted irrigation should cease. However, a risk-based decision may be made to continue irrigation at up to 1000 cfu/100 mL, depending on additional controls put in place on irrigation (e.g. within existing buffer zones).

**The plant operator will inspect the water surface to see if there is any floating algae or change in colour. The daily operating log book will record whether any algae is present or not at the lagoon, and if so remedial actions will be undertaken in order to remove the algae growth (if required).

9.8.7 Operational Sampling of Residential Properties

Sampling will be undertaken as required at residential properties to verify that the chlorine residual provided at the extreme points in the network is sufficient.

The chlorine residual setpoint on the discharge of the recycled water network pumps will be adjusted as required seasonally to meet chlorine residual requirements in the network.

9.9 Application Site and Receiving Environment Monitoring

Summary actions

- Determine the characteristics to be monitored and the points at which monitoring will be undertaken.

9.9.1 Application Site Monitoring

The Golf course shall report any unusual condition associated with use of the recycled water application, including notifying VWS of any adverse effects on the grass or odour. This will generally be used as a guide to the impact on vegetation of recycled water applied elsewhere across the scheme for irrigation.

Should it become apparent at any time that further monitoring is required, this Plan and contract with Lend Lease Communities (Wilton) would be amended based on underlying parameters. Such monitoring may include:

- Soil chemistry,
- Plants, terrestrial and aquatic biota, and
- Groundwater.

This will be conducted at the discretion of VWS and Lend Lease Communities (Wilton) depending on any areas of suspected impact.

9.9.3 Environmental Monitoring

Discharge from the Irrigation Storage to the creek will be infrequent, with this undertaken in around 50% of years under a controlled release if the level in the irrigation storage exceeds 75% (to avoid an uncontrolled overflow). Environmental monitoring points are stipulated by the EPL licence and are shown graphically in Appendix A. These points are summarised in Table 15.

During overflow events, the flow at monitoring points 1 and 2 will also be monitored for flow to verify that the following EPL criteria is met at all times for a precautionary discharge to occur:

- Flow out of irrigation storage is less than 25% of the main flow out of the golf course storm water lake; and
- Main golf course storm water lake overflowing at more than 2 ML per day.

An emergency discharge will occur from the irrigation storage when the storage is greater than 97%. Operation will target minimising the risk of this occurring via precautionary discharges as above.

Table 15: EPL Environmental Monitoring Points

EPL Monitoring Point	Type of Monitoring/ Discharge Point	Description	Monitoring Requirements
1	Precautionary and Emergency Discharge	Recycled water precautionary discharge from the irrigation storage into lake structure to avoid uncontrolled overflow	Flow (via flow meter)
2	Discharge Event Monitoring	Combined discharge of irrigation storage discharge/overflow and stormwater from the golf course stormwater lake	Pollutant concentration, as per Table 17
3	Discharge to Land	Irrigation water for golf course	Based on assessment of vegetation health
5	Monitoring Effluent Discharge in Irrigation Storage Prior to Overflow /Use on Golf Course	Irrigation storage water	Pollutant concentration, as per Table 17

In the event that a discharge event occurs, environmental monitoring points will apply under the EPL as per Table 15. This will include flow monitoring at EPL monitoring points as per Table 16. It should be noted that measurement of flow at EPL monitoring point 2 is required to inform the percentage of overflow to the environment that is stormwater and the percentage that is irrigation storage overflow. This is a key parameter in controlling precautionary discharge.

Table 16: EPL Flow Monitoring Points

EPL Monitoring Point	Flow Monitoring (Yes/No)	Measurement Device	Limit
1	Yes	Flow Meter (on overflow)	2 ML/d
2	Yes	Level over weir at outlet to lake	N/A (used to check on storm flow relative to irrigation storage overflow)
3	No	N/A	N/A
5	No	Flow Meter (on irrigation to golf course)	3 ML/d

At EPL monitoring points 2 and 5, monitoring will be undertaken daily during environmental discharge events (only) of the parameters as summarized in Table 17. During other times, when water is used only for golf course irrigation, the frequency of monitoring will be as per the golf course irrigation plan.

Table 17: Pollutant Monitoring and Concentration Limits at Discharge Environmental Monitoring Points

Parameter	Units	50%ile Limit	100%ile Limit
BOD	mg/L	10	20
Faecal Coliforms	cfu/100 mL	10	
Total Nitrogen	mg/L		20
Total Phosphorus	mg/L		2
pH			6.5-7.5
TDS	mg/L		1500
TSS	mg/L	15	30
Turbidity	NTU		5

9.10 Documentation and Reliability

Summary actions

- Establish and document a sampling plan for each characteristic including location and frequency ensuring monitoring data is representative and reliable.

Key points of monitoring in the system include:

- Inlet to the Bingara PRWP
- Inlet to the treated water tanks at the Bingara PRWP
- Golf course irrigation lagoon

The above monitoring locations, sampling parameters and sampling frequency are detailed in Section 9.8 above.

Monitoring of the receiving environment and application site(s) will be conducted as determined necessary by environmental specialists to determine any change in soil / environmental water characteristics.

9.11 Satisfaction of Users of Recycled Water

Summary actions

- Establish an inquiry and response program for users of recycled water, including appropriate training of people responsible for the program.

9.11.1 Customer Education

All customers (residents) in Bingara Gorge, as a process of moving in, sign a Customer Contract, details of which are available on the website www.myrecycledwater.com.au).

As a part of this process, each customer signs to properly handle prohibited substances discharges. Further information is also provided to the customer within the dedicated website maintained for the purpose (www.myrecycledwater.com.au).

9.11.2 Customer Complaint Centre

As a part of its operation, VWS maintains a 24/7 customer service call centre with further details provided below. VWS also maintains current records of retail customers on its database; for all customer relations including financial management on behalf of Lend Lease.

All calls are handled promptly by a representative of VWS fully conversant with customer interactions procedure and duly recorded for action, follow-up and resolution.

Based on the details of the call, the issue is escalated and in co-ordination with Lend Lease, as necessary, actions are promptly carried out, within VWS organisation, to attend to complaints, faults or other matters.

If there is an operational issue as a result of the call, VWS operations staff, after carrying out an appropriate repair / replacement work, log details of the operation and contact the caller as necessary to keep the customer updated at all important stages of the repair / replacement / other actions process.

VWS Code of Practice for Complaints Handling is detailed in the Retail Supply Management Plan (RSMP) under the Retail Supplier's licence and the associated procedures will be implemented in the event of any complaints.

9.11.3 Reliability of Supply

The Golf Course has a backup from the stormwater lagoon adjacent to the irrigation storage, and supply of water to the golf course will be given a lower priority than assuring that adequate supply is provided to residences.

This will be managed as follows:

- Recycled water supply to the lilac network will be the first priority.
- If the level in the treated water tanks is not high enough, no overflow will occur to fill the irrigation storage lagoon.
- Stormwater will be used for golf course irrigation as required to meet demand.
- Irrigation of public spaces will be ceased if supply to residents cannot be met.

As a final backup to supply the lilac network, there is provision for top-up with potable water to the treated water tanks to manage any short-fall in demand due

to abnormally high demand.

9.11.4 Short-Term Evaluation of Results

Summary actions

- Establish procedures for the short-term review of monitoring data and satisfaction of users of recycled water.
- Develop reporting mechanism internally and externally, where required

VWS has developed procedures for short term review of data monitoring and satisfaction of users of recycled water and authorities. VWS has internal process expertise that will be involved in the regular review of data and responding to any concerns on water quality. This will include daily correspondence between process engineers and plant operators as required.

9.11.5 Corrective responses

Summary actions

- Establish and document procedures for corrective responses to non-conformance or feedback from users of recycled water.
- Established rapid communication systems to deal with unexpected events

As described in Section 9.11.2 there will be a customer complain centre to deal with any concerns from customers on recycled water quality and respond in a timely manner, as required.

Unexpected and emergency events will be managed in accordance with the Emergency Response Plans, developed for the Bingara TRWP, and intended to be modified / expanded for the Bingara PRWP.

Key parameters concerned with the safe and effective operation of the plant are detailed in other sections (under CCP, Section 8.2 and operational monitoring, Section 9.2.) Automated responses are provided as necessary to ensure that:

- Water quality is continuously met with automated response /shutdown of equipment;
- Automated corrective responses are provided as necessary; and
- Automated alarms are generated with the operator on call alerted immediately to provide a manual corrective action onsite as necessary.

Details of the required operator response to process conditions will be included in the O&M Manuals (under preparation).

10Element 6 - Management of incidents and emergencies

Components:
- Communication
- Incident and emergency response protocols

10.1 Communication

Summary actions
- 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

10.1.1 Communication protocols with relevant agencies and stakeholders

The EPRP, under development for the Bingara PRWP will contain a complete list of Agencies, Stakeholders and contact details of those who need to be advised and or be responsible for taking specific action in the event of an incident or emergency. The communication between agencies will be initiated by VWS on several levels as outlined below:

- Regulatory
- Contractual
- Operational
- Customer related

An overview of Stakeholders is provided in Section 4 and an overview of the key regulatory and contractual relationships is provided in Section 6.2.2. Details of relationship between stakeholders during management of emergencies will be provided in the EPRP for the Bingara PRWP.

10.1.2 Media response

Only trained and authorised personnel will be permitted to address or respond to the media. Depending on the incident or emergency the media handling could be by VWS or Lend Lease Communities (Wilton) or both.

In case of a media response by VWS, General Manager – Services will be responsible.

10.3 Incident and emergency response protocols

Summary actions

- Define potential incidents and emergencies and document procedures and response plans with involvement of relevant agencies.
- Train employees and regularly test emergency response plans.
- Investigate any incidents or emergencies and revise protocols as necessary

10.3.1 Potential Incidents and Emergencies

Critical potential incidents have been determined through a risk assessment and are summarized in Table 18. Response to these risks has been addressed in the emergency response plans for the Bingara TRWP, with these responses summarised below. The emergency response plan for the Bingara Scheme will be developed in full under the operations contract with Lend Lease Communities (Wilton).

Table 18: Most critical potential incidents

Type of emergency	Event / scenarios	Consequences
Human	Injury, illness Bomb threat	Medical treatment required Evacuation of building
Natural	Localised flooding Fire, Major Access Disruption, Extreme Weather, Earthquake, Fire, Subsidence and the like	Plant failure, local evacuation
Technological	Fire Power disruption Chemical spill Loss of containment UV / chlorination failure Illegal discharge of contaminants Loss of PLC/SCADA system; Significant Damage to Lilac Infrastructure Sewage Pumping Station Failure	Biological hazard, chemical hazard, fumes, odour Water specifications not met Pollution, contamination
Integrity Breach	Lagoon Integrity Breach	Biological hazard, contamination
Security Risks	High Security Risk, Threat to Human Life	Plant Failure, Fatalities, Epidemic risk

The key prevention measures to be undertaken by VWS for emergency prevention / management are as follows:

- Workplace fire protection and fire-fighting equipment installed
- Fire protection and fire-fighting equipment suitable for the types of risks at the workplace (e.g. foam or dry powder type extinguishers for fires that involve flammable liquids)
- Equipment regularly tested by a competent person
- Equipment kept clear of obstructions

- Workers educated on fire danger periods and total fire ban days
- Good house keeping
- Regular workplace inspections
- Workers inspect and can report any articles that are unusual, suspicious or unaccounted for
- Bomb threat checklist available for recording details of bomb threats
- Current safety data sheets available for all hazardous chemicals on site
- Hazardous chemicals labelled and stored in a safe manner
- Equipment available to initially respond to a hazardous chemical incident, such as absorbent material to contain a liquid spill
- Workers educated on health and hygiene practices
- Established Health monitoring and biological hazard processes
- PPE and first aid facilities
- Consultation with public health organisation as required
- First Aid kit installed
- Established Incident Management and Investigation Processes
- PPE available
- Site access controlled – site secured out of hours
- Tested and tagged electrical equipment
- Job cards, task lists and return times are communicated to a supervisor. Communication equipment such as mobile phones are utilized

10.3.2 Training

Preparedness is a continuous cycle of identification, mitigation, planning, training, resourcing and practice drills, followed by evaluation and improvement in order to prevent or mitigate the potential for, respond to, recover from, and mitigate the effects of those adverse events and circumstances that could potentially arise and be identified as emergencies.

All service personnel employed for onsite operations are trained in the handling of the emergencies identified in the relevant EPRP for the Bingara PRWP. This includes informing staff of changes and review of emergency response and incident protocols.

10.3.4 Investigations

Whenever an incident occurs, whether it is related to OHS, Environment, Quality Operations, Contractual or Regulatory and whether it is a serious occurrence involving harm or damage to the environment or property or a near miss, VWS responds to all incidents appropriately and take the necessary actions to restore safety and the like per protocols and then investigate and report accordingly followed by taking the preventative actions recommended in the report to avert a future occurrence. VWS' Incident response, investigation and reporting procedures are regularly audited to:

- AS/NZS 4801:2001 OHS Management Systems
- BS OHSAS 18001:2007 OHS Management Systems
- AS/NZS ISO 14001:2004 Environmental Management Systems
- AS/NZS ISO 9001:2008 Quality Management Systems

10.3.5 Notification

VWS commits to compliance with IPART's publication: Incident Notification by Private Sector Water Licensees (refer). This requirement is embodied into the EPRP.

11 Element 7 - Operator, contractor and end user awareness and training

Components:

- Operator, contractor and end user awareness and involvement
- Operator, contractor and end user training

This section addresses awareness and training for operators, contractors and end users of recycled water systems.

11.1 Operator, contractor and end user awareness and involvement

Summary actions

- Develop mechanisms and communication procedures to increase operator and end user awareness of, and participation in, water quality management and environmental protection.

11.1.1 Operators and contractors

All operators and contractors are properly inducted onto the site to ensure understanding and compliance of site OHS and Environmental rules and obligations. They are aware of:

- VWS water quality policy
- The principles of risk management
- Characteristics of the recycled water supply system
- Regulatory and legislative requirements
- Their roles and responsibilities, including requirements to complete:
  - Job specific Safe Work Method Statements (SWMSs) or Job Safety and Environmental Assessments, depending on the task.
  - Comply with site specific work procedures and general service procedures developed by VWS.
- How their actions can affect water quality, and public and environmental health.

11.1.2 End Users

Customers are made aware of their own obligations and water management by way of their contracts, website information and community consultation. As a minimum all end users shall be made aware of:

- Restrictions on use of recycled water
- Management requirements that are essential to ensure the sustainable use of recycled water
- Any practice that could threaten human or environmental health.

11.3 Operator, Contractor and End User Training

Summary actions

- Ensure that operators, contractors and end users maintain the appropriate experience and qualifications.
- Identify training needs and ensure resources are available to support training programs.
- Documents and maintain and of all the training sessions.

11.3.1 Appropriate qualifications and experience

VWS engages only persons qualified and experience to perform duties prescribed in their employment contract which also sets out their position description, duties, authorities and performance indicators.

Each employee attends a formal annual individual performance appraisal that also identifies their training requirements based on the requirements of their role and career goals.

All new employees are inducted according to the VWS Induction Policy which will provide employees with an understanding, among others, of:

- General environmental duty and obligations under relevant legislation;
- Quality, WH&S and environmental objectives and targets;
- Company policy;
- Applicable legislation;
- WH&S and environmental controls;
- Emergency response;
- Responsibilities
- Levels of authority.

Safety and emergency training is provided to all employees as well as standard Company training e.g. Manual Handling and Respect in the Workplace.

VWS engages only subcontractors that have been fully prequalified technically, contractually and commercially.

11.3.2 Competencies and training

VWS provides a dedicated services team having the necessary specialised skills and competencies to service the Treatment Infrastructure. These necessary skills and competencies are only achieved through specialised training and experience within and by VWS Australia.

Competency Module	Remarks
Basic Water System Awareness	
Closed Water Systems Treatment	
Boiler Systems Treatment	Indirectly applicable
Biological Treatment	
Carbon Filtration	Indirectly applicable

Competency Module	Remarks
Ultraviolet Disinfection	
Multimedia Filtration	
Reverse osmosis	Indirectly applicable
Chemical Dosing and Control	Including Chlorination Chemistry

VWS leverages the experience not only of its own service engineers but the process engineering knowledge and experience of its Australian and overseas professional experts in the process packages, including the BioSep units proposed for the Bingara PRWP.

11.3.3 End User Awareness Training

The end users of the recycled water are VWS' customers. Awareness will be provided in the form of communication:

- Customer Contracts
- Information Sessions
- Newsletters
- Web Page (www.myrecycledwater.com.au)

Awareness campaigns will be informed by communication during operation, facilitated by active engagement with end users as well as the 24/7 Customer Complaint Centre, as outlined in Section 9.11.

13Element 9 - Validation, Research and Development

Components:

- Validation process
- Design of equipment
- Investigative studies and research monitoring

13.1 Validation of processes

Summary of actions

- Validate processes and procedures to ensure they control hazards effectively.
- Revalidate processes when variations in conditions occur

Validation of the selected processes for disinfection is provided based on pre-validation of the selected processes, as summarised in Section 8.2.3.

There will be Plant Proving and Validation Period will be over an eight (8) week period and shall commence from the date of completion of the Performance Test.

The Bingara PRWP is to be validated over twelve (12) weeks of continuous operation ("validation period"). The twelve (12) weeks will comprise of the four (4) week Performance Test period and eight (8) week Plant Proving and Validation period.

Plant Proving and Validation can only be successfully completed following confirmation of Design log removals, recycled water quality requirements and acceptance by the relevant regulatory authorities, including IPART.

For each train, during the four week proof of performance period, effluent from the Bingara PRWP under process proving will be discharged to the Bingara TRWP for treatment and discharge to the irrigation storage lagoon as occurs currently. This period will be used for safe supply of water to irrigation, prior to proving the process equipment is suitable for supply to the Lilac Recycled Water Network.

Continuous monitoring at the CCP is provided to ensure that the criteria for the validation of the process to be maintained is met (i.e. that the process remains with the limits of its pre-validated performance.) The monitoring applied to ensure this occurs is summarised in Section 8.2.4 and 8.2.6.

Should any changes occur in the operational configuration of equipment occur, the design will be re-validated or modified to ensure that the log-removal requirements of the unit processes are achieved.

13.3 Design of Equipment

Summary of actions

- Validate the design of new equipment and infrastructure to ensure continuing reliability.

Design of equipment crucial to meeting the performance requirement of the system is based on pre-tested systems and pre-validated unit packages. The system has been designed with sufficient redundancy to ensure reliable operation, as summarised in the Infrastructure Operating Plan, Sewage Management Plan and as indicated on P&ID Drawings.

A Treatment Infrastructure Commissioning and Performance Proving Plan will be developed prior to commissioning to accurately test the installed infrastructure under the range of potential process and operational conditions. This will include testing of the control logic to ensure automated responses to equipment failure and abnormal operation is as intended.

To ensure ongoing reliability of the system, all manufacturers' procedures for maintenance will be adhered to and an annual maintenance report will be prepared to review the requirements for infrastructure renewal, with ongoing review as necessary throughout the year.

Operational monitoring data, summarised in Section 9.2, as well as visual inspections will be used to assess the performance of equipment over time and whether any degradation in performance has occurred requiring significant upgrade. Instrumentation has been provided to ensure the testing of the design intent of the equipment is possible, for example, monitoring of the blower discharge pressure to test the performance of the diffusers and fouling over time (indicating requirements for fixed-diffuser cleaning scheduling.)

13.4 Investigation of studies and research monitoring

Summary of actions

- Establish programs to increase understanding of recycled water supply system, and use this information to improve management of the recycled water supply system.

Investigation of studies and research monitoring by VWS will be carried out locally (in terms of the performance of the Bingara PRWP) and by VWS' R&D facilities in Europe where various works are performed in relation to recycle water production and reuse.

The use of third-pipe systems with a relatively large portion of the local community connected to the sewer also receiving third-pipe recycled water is an area that is still undergoing development. In addition, pressure sewer networks are not widespread throughout Australia as yet.

Local studies may therefore include the following:

- Baseline monitoring of parameters or contaminants to identify change in influent quality with the increase in the percentage of houses connected to both sewer networks (increasing the recirculation of recalcitrant contaminants around the network.)
- Research into public concerns and perceptions on recycled water usage in the community to optimise the mechanisms and content of end user engagement programs.
- Developing early-warning systems to improve the management of poor

water quality

- Examining chemical quality of sludge to detect any change from alternate catchments (e.g. increased metal concentrations).

14 Element 10 - Documentation and reporting

Components:

- Management of documentation and records
- Reporting

VWS is certified by BSI Global to the following standards noted in 12.6.2 for its integrated management system (IMS) in relation to all its business activities, products and services.

VWS is audited annually by BSI for continuing certification and every three years for recertification. Its current certification is valid until 28th July 2015 and will be updated following this. It follows that the requirements of this element can be met by VWS by complying its certified management systems and procedures.

14.1 Management of documentation and records

Summary of actions

- Document information pertinent to all aspects of recycled water quality management, and develop a document-control system to ensure versions are in use.
- Establish a records-management system and ensure that all employees are trained to complete records.
- Periodically review documentation and revise as necessary.

14.1.1 Document Control

A document-control system is established as part of the VWS O&M contract with Lend Lease Communities (Wilton) and its obligations under the Network Operator's Licence to ensure that only the most recent version of an appropriately approved document is in use. This is based on the VWS Document Control system that tracks all documents and ensures that revisions are based on a single source of information accessible to all employees.

Documentation associated with the Bingara PRWP includes:

- O&M Manuals
- Infrastructure Operational Plan
- Emergency Response Plans
- Sewage Management Plan
- As Constructed Drawings

14.1.2 Records Management

The records systems provide sufficient detail to provide assurance of operational control. Records include:

- The Infrastructure SCADA will provide the necessary operational records need for complying operations monitoring and reporting.

- Our maintenance records shall provide the complying information need for operational reliability.
- Audits and associated audit reports will provide conformance verification and any corrective actions required to ensure compliance.
- Incident reports including corrective actions, root cause analyses and preventative actions shall provide the necessary compliance records in this area.

14.1.3 Document Review

Documents will be periodically reviewed and revised to reflect changing circumstances.

Records of all activities are easily accessible electronically and paper as necessary and protected from loss noting VWS has in place a certified disaster recovery system for electronic records. Paper records shall be maintained in offices with fire (smoke) detection and protection (fire extinguishers as a minimum).

14.2 Reporting

Summary of actions

- Establish procedures for effective internal and external reporting.
- Produce an annual report aimed at users of recycled water, regulatory authorities and stakeholders.

14.2.1 Internal

VWS shall prepare operational reports as deemed necessary for internal QA purposes. These cover OHSE, Operations, Water Quality and Financials.

14.2.2 External

VWS shall prepare operational reports to Lend Lease Communities on an annual basis, as per the Operations Contract, covering OHSE, Operations and Water Quality in accordance with formats to be agreed to by Lend Lease Communities (Wilton).

14.2.3 IPART reporting

VWS shall prepare Annual reports to IPART or as otherwise directed for Lend Lease Communities (Wilton) in accordance with Network Operators' Reporting Manual under the Water Industry Competition Act 2006 Water — Reporting Manual.

16Element 11 - Evaluation and Audit

Components:

- Long-term evaluation of results
- Audit of recycled water quality management

Long-term evaluation of recycled water quality results and audit of recycled water quality management are required to determine whether original preventive strategies are effective and whether these are being implemented appropriately. This long-term evaluation allows performance to be measured against objectives and helps to identify opportunities for improvement.

16.1 Long Term Evaluation of Results

Summary actions

- Collect and evaluate long-term data to assess performance and identify problems.
- Document and report results.

Annually VWS will reviews the performance of the infrastructure by way of the following with a view to identifying problem areas and optimising future operations:

- Infrastructure Audit (condition of assets)
- Water Quality Data
  - Sampled Analysis Results Summary (including at the Bingara PRWP and for the receiving environment)
  - Logged Data Trends (available via SCADA)
- Audit reports, including updating of the Recycled Water Quality Plan

16.2 Audit of recycled water quality management

Summary actions

Establish processes for internal and external audits

16.3 Internal and external audits

16.3.1 Internal audits

All VWS personnel must perform their duties lawfully and in accordance with our certified integrated management system (IMS).

General Manager - Services is responsible for coordinating the national audit program which includes the following audit types:

- Certification audit,
- Legal / regulatory audit,
- System audit,
- Compliance / Surveillance audit.

In compliance with IPART audits pursuant to their Audit Guidelines, VWS shall regularly audit this Plan, its companion plans and the Service Agreement between VWS and Lend Lease Communities (Wilton) to ensure VWS is meeting its obligations under each.

16.3.2 External audits

These may be by Lend Lease Communities (Wilton) our customers and by IPART under WICA legislation.

Lend Lease Communities (Wilton) may prepare audits in line with the contractual obligations of VWS.

IPART will audit in accordance with its Audit Guideline, Water Licence Audits Water — Guidelines including the audit of this Plan. The Minister may at his discretion require IPART to audit more frequently than legislated.

Other audits will be carried out against the companion plans to this Water Quality Plan (refer Section 9).

The EPA will also conduct audits of the Bingara PRWP pursuant to the obligations of VWS under the EPL.

16.4 Audit results

Audits shall be documents by way of formal reports. A schedule of non-compliance events will be maintained by VWS and submitted as part of the annual report to IPART including the following;

- List of non-conformances
- Date or period of non-compliance
- Nature non-compliance including a list of customers who have been affected
- Reasons for non-compliance and root cause analysis
- Any remedial action required and actual/anticipated date of full compliance.

17 Element 12 - Review and Continuous Improvement -

Components:

- Review by senior managers
- Recycled water quality management improvement plan

VWS is committed to quality assurance across its business. This commitment is communicated through the VWS Quality and related Policies and the BSI Global certified VWS IMS.

17.2 Review by Senior Management

Summary actions

- Senior managers review the effectiveness of the management system & evaluate need for change.

Senior management (namely the General Manager -Services of VWS) will review the effectiveness of the recycled water quality management system and evaluate the need for change, by:

- Reviewing reports from audits, recycled water quality performance, environmental performance and previous management reviews
- Considering concerns of users of recycled water, regulators and other stakeholders
- Evaluating the suitability of the water quality policy, objectives and preventive strategies in relation to changing internal and external conditions such as:
  - Changes to legislation, expectations and requirements
  - Changes in the activities of the organisation
  - Advances in science and technology
  - Outcomes of recycled water quality incidents and emergencies
  - Reporting and communication.

The review by senior managers will be documented.

17.3 Recycled Water Quality Management Improvement Plan

Summary actions

- Develop a recycled water quality management improvement plan.
- Ensure that the plan is communicated and implemented, and that improvements are monitored for effectiveness.

17.3.1 Improvement plan development

Depending on joint discussion between VWS and Lend Lease Communities (Wilton), an improvement plan may be considered. Such a plan, if made, shall give consideration to the following which may or may not provide improvements, depending on performance to date as presented in reports and audits.

- Capital works
- Training
- Enhanced operational procedures
- Consultation programs
- Research and development
- Incident protocols
- Communication and reporting

17.3.2 Plan communication, implementation and monitoring

Once a plan is prepared, this will be formally communicated to the relevant stakeholders, implemented and monitored accordingly.

4.2.14

Environmental Study

Site Analysis Report

Bingara Gorge Waste Water Treatment Plant – EPL Variation

82015063-01/Report 001 Rev 1

Prepared for
Veolia Pty Ltd

May 2015

VEOLIA

Cardno
Shaping the Future

Contact Information

Cardno South Coast
Trading as Cardno (NSW/ACT) Pty Ltd
ABN 95 001 145 035

Level 1, 47 Burelli Street
PO Box 1285
Wollongong NSW 2500

Telephone: 02 4228 4133
Facsimile: 02 4228 6811
International: +61 2 4228 4133

southcoast@cardno.com.au
www.cardno.com.au

Author(s):

Rob McKinlay
Environmental Planner

Approved By:

Daniel Thompson
Project Manager

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1	14 May 2015	Final	RMK	DJT

Executive Summary

This Site Analysis Report has been prepared to inform the Veolia Water Solutions & Technologies (Veolia) application to vary Environment Protection Licence (EPL) 20335 associated with an Onsite Wastewater and water recycling scheme. The Waste Water Treatment Plant (WWTP) associated with the scheme has not yet been constructed, with a change of operator occurring in the period since the EPL was issues. Consequently, a variation to the EPL is required to address the revised WWTP.

This Report provides an overview of the site context, proposed variation and the associated environmental aspects. A number of detailed technical studies have been undertaken to inform the Site Analysis, which are cross referenced. Technical studies comprise:

> Plant and Civil Design

> Water Balance Assessment

> Combined Sewerage and Water Infrastructure Operating Plan

> Sewage Management Plan

> Stormwater and Services Review

> Odour Assessment

> Noise Assessment

The technical studies illustrate that subject to implementation of the identified management and mitigation measures there would not be an unacceptable impact on the surrounding environment as a result of plant emissions. Conversely the proposal will provide a wastewater treatment facility for the Bingara Gorge Residential subdivision and adjacent township of Wilton. Based on the conclusions of this Report it is recommended that the EPA approve the proposed EPL variation subject to the controls identified.

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Figures

Tables

Appendices

1 Introduction

1.1 Background

This Site Analysis Report has been prepared on behalf of Veolia Water Solutions & Technologies (Veolia) in relation to Environment Protection Licence (EPL) 20335 associated with an Onsite Wastewater and water recycling scheme at Condell Park Road, Wilton. An EPL is required for the Waste Water Treatment Plant (WWTP) subject to Schedule 1 of the *Protection of Environment Operations Act 1997* (POEO Act). The WWTP associated with the scheme has not yet been constructed, with a change of operator occurring in the period since the EPL was issued. Veolia propose to vary the design of the WWTP with an associated variation to the EPL required.

The WWTP is proposed to provide a sewage treatment service for the existing township of Wilton and the Bingara Gorge residential subdivision, as well as treated recycled water for landscape irrigation and use within dwellings for non-potable purposes within Bingara Gorge. The WWTP would service a total of 2,000 equivalent tenement (ET) in the ultimate scheme.

1.2 Structure of this Report

The structure of this report is as follows:

> **Section 1** – provides an overview of the site context and proposed development

> **Section 2** – identifies the legislative context of the proposed development

> **Section 3** – reviews the environmental impacts from the proposed development

> **Section 4** – summarises the report findings

This Report has been prepared based on the following technical inputs and plans:

> Civil drawings prepared by Cardno (2015) – **Appendix A**

> Process design drawings prepared by Veolia (2015) – **Appendix B**

> Combined Sewerage and Water Infrastructure Operating Plan prepared by Veolia (2015)– **Appendix C**

> MEDLI modelling outputs informing the Water Balance Assessment prepared by Cardno (2015) – **Appendix D**

> Sewage Management Plan prepared by Veolia (2015) – **Appendix E**

> Stormwater and Services Review prepared by Cardno (2015) – **Appendix F**

> Odour Assessment prepared by Pacific Environment (2015) – **Appendix G**

> Noise Assessment, prepared by Vipac (2015) – **Appendix H**

> Landscape Plans, prepared by Cardno (2015) – **Appendix I**

1.3 Subject Site Location & Surrounds

The WWTP site is located within the western portion of the industrial lands precinct of the Bingara Gorge residential development area, 60km south of Sydney (refer to **Figure 1-1**). The site is within the south west corner of the development area, immediately adjacent to the Hume Highway, which runs along the western boundary of the site.

The industrial lands precinct comprises industrial zoned land split into a number of lots to service future industrial uses. The site is bound by:

- To the *North* – by the Hume Highway to the north west and unconstructed industrial subdivision to the north east (Bingara Gorge Golf Course, future residential land and areas of existing bushland
- To the *East* – by unconstructed industrial subdivision and access road, with the Bingara Gorge Residential Subdivision beyond
- *To the South* – by unconstructed industrial subdivision with Condell Park Road further to the south and large lot rural land beyond
- *To the West* – by the Hume Highway.

The WWTP will be connected to the road network via an access handle leading to the internal industrial lands access road, which connects to Condell Park Road. Condell Park Road then connects to Pembroke Avenue, Picton Road and the Hume Highway providing access north to Sydney and south to Canberra.

1.4 Site Review

The site is has previously been cleared with bulk earthworks undertaken to make the site ready for future industrial land use. Consequently, potential impacts associated with contamination, ecology or heritage aspects have already been assessed across the site. The site was initially identified and approved for the construction and operation of a WWTP by DA ID993_05, issued on 18 May 2006 for Staged Development.

The site currently contains areas of cleared land, along with an interim WWTP and associated areas of hardstand approved subject to DA 010.2014.0042.001, issued on 8 October 2014.

DA 010.2014.0042.001 approved the staged construction of a Sewerage Treatment Plant (STP), Water Recycling Scheme and Sewer Rising Main. The stages of development comprised:

- Stage 1 – Installation of a water main, sewer main, sewer rising main from the treatment plant site, early commissioning works package and bulk earthworks.
- Stage 2 – STP Stage 1
- Stage 3 – STP Stage 2
- Stage 4 – STP Stage 3

The Stage 1 plant has been partially constructed with the following works undertaken:

- Redundancy tank and bund
- Truck fill slab with bund
- Flow monitoring slab
- Hardstand

The remaining Stage 1 plant items, along with the Stage 2 and 3 plant works are proposed to be modified in line with Veolia's plant design with no significant change in the general magnitude of works at each stage.

1.5 Development Overview

The proposed development comprises a WWTP serviced via the following infrastructure:

> Gravity sewerage systems, collection tank and transfer pump station

> Pressure sewerage system

> Lilac System

> Irrigation (golf course) storage lagoon

The development drawings are located at **Appendix A** (civil) and **Appendix B** (process). Operational details of the development are located in the Combined Sewerage and Water Infrastructure Operating Plan (Veolia, 2015) (Operations Plan) located at **Appendix C**. The Operations Plan has been prepared by Veolia to support an application for a NSW Network Operator's Licence associated with the WWTP and associated sewer and recycled water networks. The Operations Plan identifies the proposed operations comprising:

> Collection and conveyance of wastewater from Bingara Gorge Development, Bingara Gorge Existing catchment and Wilton Village (rising main from boundary of Sydney Water assets only) to the WWTP

> Treatment of wastewater at the WWTP to recycled water standard suitable for reuse within a household lilac pipework system

> Supply of recycled water services to lots in the Bingara Gorge Residential Subdivision

> Supply of recycled water services to lots in the existing Bingara Gorge catchment

> Provision of other services required for the operation, maintenance and repair of the infrastructure associated with wastewater conveyance, wastewater treatment and recycled water supply.

The Bingara Scheme is partially developed with an interim treatment plant in place, which will be expanded to:

> Accommodate additional residential and commercial tenements with connection to the network

> Treat additional wastewater on a daily basis and provide greater capacity to manage peak flows

> Upgrade the treatment standard provided for wastewater to increase recycled water usage, with provision of recycled water to the lilac network.

Veolia holds a Network Operator's Licence and a Retail Supplier's Licence for operation of the existing scheme. It should be noted that there is no EPL required under the existing operations as the volume of wastewater treated does not exceed the threshold volume at which this is required.

The scheme will service an estimated total of 2000 equivalent tenements (ET) from the three connected catchments, equating to treatment of an average dry weather flow (ADWF) up to approximately 1.5 ML/d, and peak wet weather flows up to 3.0 ML/d.

A comparison between the scope of operations within the existing Bingara Scheme (authorised to operate by IPART) and the proposed plant design with the required EPL amendments is provided in Table 1 of the Com*bined Sewerage and Water Infrastructure Operating Plan* at **Appendix C**.

The proposed modifications as identified in the Com*bined Sewerage and Water Infrastructure Operating Plan* facilitate the capacity to collect and treat a larger volume of wastewater to a higher standard to accommodate an increase in the number of customers serviced, and enable usage of recycled water in the lilac network to offset potable water usage through the scheme. Additional benefits offered by the Bingara Scheme upgrades include improving the quality of water provided to the golf course irrigation lagoon, minimising restrictions on irrigation water usage, increasing the volume that can be used on the golf course, and therefore reducing the requirements for environmental discharge (Veolia, 2015).

1.6 Civil Works

Refer to **Appendix A** for details of the civil engineering design drawings.

1.6.1.1 Bulk Earthworks

The bulk earthwork design is detailed on **Drawing C1005** of **Appendix A**. The bulk earthworks will consist of traditional cut and fill exercise. There is minimal earthworks required for the WWTP site as this was completed as part of Stage 1 of works approved under DA 010.2014.0042.001.

Bulk earthworks associated with the wet weather storage ponds were partially completed under Stage 1 of DA 010.2014.0042.001. The revised Veolia plant design requires less ponds than was approved under DA 010.2014.0042.001. The simplified pond layout is shown on **Drawing C1003** of **Appendix A.**

1.6.1.2 Roads

The proposal is serviced via an access handle from the access road servicing the industrial lands precinct. Roads are detailed in **Drawing C1003 and C1004** of **Appendix A**.

1.6.1.3 Utilities

The plant would be serviced via mains water and electricity, entering the site from Condell Park Road.

A Telstra service will be supplied to the development from the existing network within the Bingara Gorge Residential Subdivision.

1.6.1.4 Stormwater

The proposed stormwater reticulation works are detailed in **Drawing C1009** of **Appendix A** and described in the Stormwater and Services Review (Cardno, 2015) located at **Appendix B**.

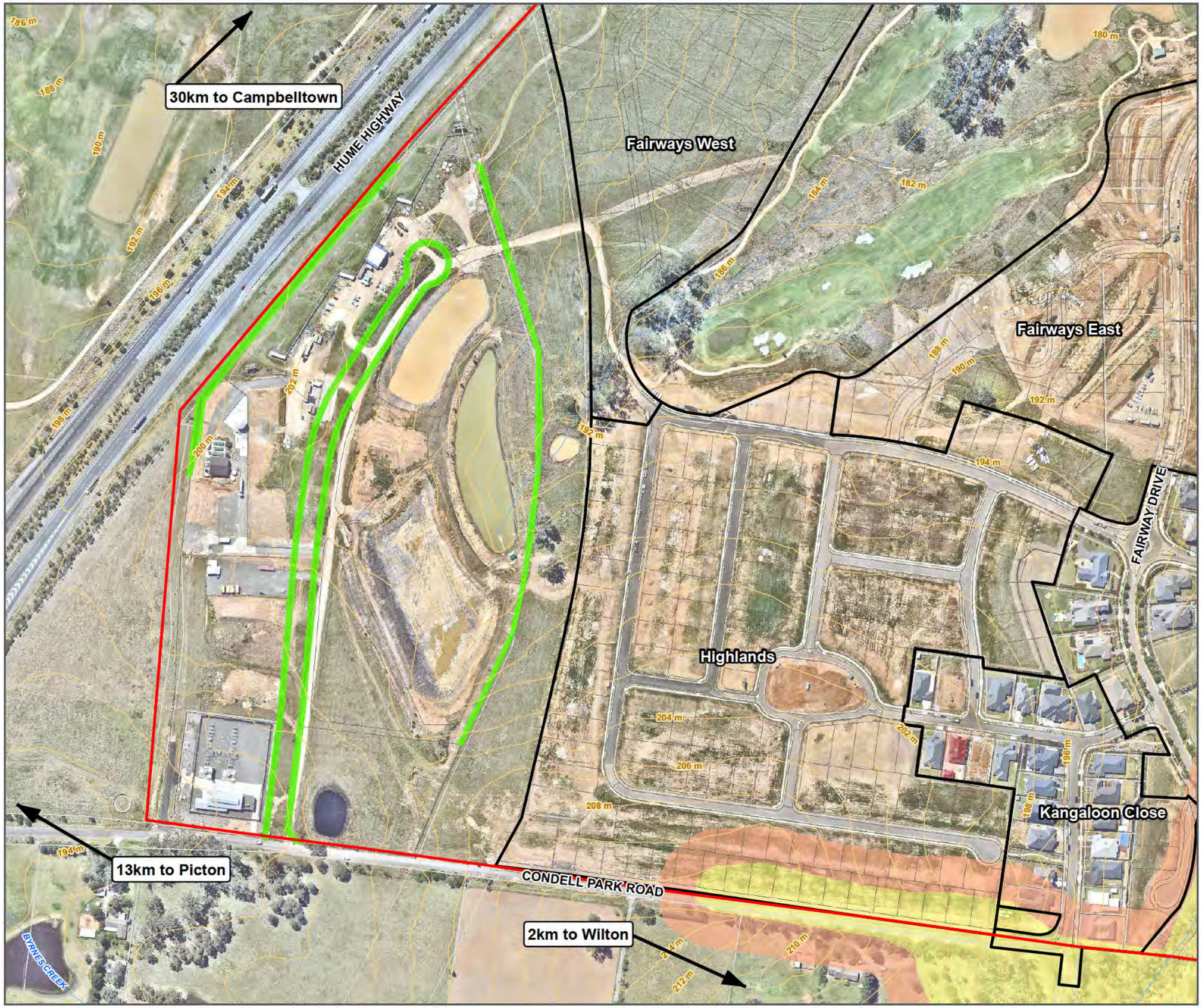
The key recommendations of the Stormwater and Services Review are as follows:

> An OSD system with an approximate 104m^3 storage volume. Orifice plate / choke pipe be incorporated into the design to effectively attenuate peak flows in the developed scenario

> A GPT unit, bio-retention basin and grassed buffer strips to be installed to provide stormwater treatment. Treatment devices to be assessed for suitability during detailed design. Other treatment options may need to be considered due to site constraints.

1.6.1.5 Landscaping

Landscape plans have been prepared for the site in accordance with the Wollondilly Shire Council Development Control Plan. The landscape plans are located at **Appendix I** and illustrate screening to the Hume Highway to the north and west, along with tree planting along the internal industrial lands access road to screen the plant from dwellings within the Bingara Gorge Residential Subdivision.



VEOLIA WATER
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Site Analysis Plan

BINGARA GORGE, NSW

Legend

- Bingara Gorge Development Area
- Watercourses (LPI)
- 2m Contours (LPI)
- Lot Layout
- Masterplan Release Areas
- Proposed Planting Areas

Bushfire Prone Land (RFS, 2014)

- Vegetation Buffer
- Vegetation Category 2

FIGURE 1-1

1:3,000 Scale at A3

Metres
0 20 40 60 80 100

N

Cardno

Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2015-05-04
Coordinate System: GDA 1994 MGA Zone 56
Project: 82015063_01
Map: 82015063-01-GS-001-SiteAnalysisPlan.mxd 02
Aerial imagery supplied by nearmap (October 2014)

2 Regulatory Framework

2.1 Protection of Environment Operations Act 1997

The *Protection of Environment Operations Act 1997* (POEO Act) Schedule 1 identifies activities that require an EPL. Clause 36 of Schedule 1 relates to sewage treatment, which includes:

> ***"the operation of sewage treatment systems (including the treatment works, pumping stations, sewage overflow structures and the reticulation system) that involve the discharge or likely discharge of wastes or by-products to land or waters".***

Subject to Section 58 an EPL may be varied by the regulatory authority. Section 58 (5) states that a licence is varied by notice in writing given to the holder of the licence. It is noted that the proposed variation is subject to assessment and public consultation under the Environmental Planning and Assessment Act 1979 (EP&A Act). Consequently, the EPA is not required to invite and consider public submissions before it varies the licence as identified by Section 58(6).

3 Environmental Impact Assessment

This section considers the existing environment and how the proposed works will be integrated into the existing environment to determine the level of potential impacts as a result of the proposed works.

3.1 Traffic & Access

3.1.1 Existing Environment

Access to the site will be via an access handle to the south eastern portion of the site that connects with the industrial lands internal access road. The on-site road network allows trucks to service the facility with a turning bay located at the northern extremity of the road adjacent to the activated sludge tank next to the existing plant and adjacent to the activated sludge tanks. The turning bays will allow delivery trucks to turn around prior to exiting the site.

Roads, car parking and access have been design in accordance with the relevant Australian Standards. Preliminary designs are included in **Appendix A**. Traffic movements to and from the site would be limited to operational staff and irregular delivery of chemicals for plant operation and dewatered sludge removal. The following is a summary of truck movements for operational purposes:

> Chemical (ferric, polymer and sodium hypochlorite) deliveries approximately once per week (at maximum demand) in tankers that are 12m L x 2.5 m W x 2.8 m H.;

> Dewatered biosolids removal approximately twice per week via a 10 m L x 2.5 m W x 2.8 m H vehicle; and

> Screenings removal approximately once per week via a 8.2m L x 2.5m W x 3.1m H vehicle.

Limited irregular movements would occur associated with plant maintenance, e.g. for membrane and major equipment repair once per 6-months where a crane will be required onsite to remove membranes from tanks to the concrete pad area. Due to the limited number of vehicle movements, mitigation and management measures would only be required during the construction phase.

3.1.2 Mitigation Measures

The following mitigation measures are proposed to ensure works do not significantly impact on the existing road network:

> The Construction Environmental Management Plan would include a Traffic Management Plan (TMP) to address traffic movements during construction. Measures within the TMP would include:

- Washing down of vehicles prior to leaving site where required
- Vehicle movements limited to standard construction hours
- Turning off engines when vehicles are not in use
- Traffic entering the site will be staggered to ensure roads are not blocked as a result of the proposed works.

3.2 Land Use Analysis & Suitability

3.2.1 Existing Environment

The historic use of the site is characterised by rural activities, primarily grazing. The site is located on land with a low gradient adjacent to the Hume Highway to the west. The land surrounding the site, associated with the industrial subdivision falls away to the south, east and north east, with treatment ponds and residential subdivision beyond.

The site area is cleared as a result of works associated with previously approved DA's. These DA's were associated with the industrial and sewage treatment uses proposed on site as discussed at **Section 1.4**. Consequently, the site is deemed appropriate for the proposal.

Major earthworks are not proposed to significantly change the site levels and water courses do not traverse the site. Consequently, the overall topographic form will remain unchanged.

Through the implementation of appropriate landscape planning as identified at **Appendix I** and through the use of a muted non-reflective colour scheme for the larger tank components of the plant, the proposal would not create significant impacts on the existing landscape features or the future use of the surrounding area. Furthermore, the site is identified for industrial purposes and would meet the demands of the existing and proposed residential development in the area. The proposed works will therefore, positively impact on the community, facilitating the residential precinct of Bingara Gorge and sustaining the township of Wilton.

3.2.2 Mitigation Measures

The following mitigation measures will ensure that land use and suitability impacts are to be minimised during the proposed works:

> Areas under construction will be fenced to ensure prevention of the general public entering areas of construction hazards

> Works will be managed to ensure that the usability of adjacent land parcels is not reduced as a result of the proposed works

> Implementation of landscape planting as a component of the construction works

> During the detailed design phase, lighting will be designed in accordance with the relevant Australian Standards including AS4282 Control of the Obtrusive Effects of Outdoor Lighting

> Construction lighting will be directed toward the construction site to minimise use of excessive lighting and potential spill.

3.3 Odour

The *Bingara Gorge Wastewater Treatment Plant Odour Assessment – Preliminary Layout* (2015) was undertaken by Pacific Environment. The Assessment is located at **Appendix G**. The Assessment intent was to establish the potential odour footprint from the proposed upgraded WWTP with and without the treatment tanks being covered to inform design considerations.

The Assessment included the following scope:

> Meteorological modelling

> Estimating emissions for the site based on Sydney Water odour emission rate database values

> Predicting the dispersion of odour using CALPUFF

> Comparing the predicted concentrations against the New South Wales odour criterion.

The Assessment found that emissions from the site were dominated by the odour control unit based on a conservative assessment. The predicted odour concentrations (Pacific Environment, 2015) identified that:

The site is expected to comply with the C99 1sec = 2ou criterion for both scenarios.

Covering the treatment tanks is unlikely to significantly change the odour footprint of the site due to the dominance of the odour control unit emissions.

The dispersion modelling of predicted odour emissions from the WWTP indicates that "the site would meet the most stringent of the NSW Criteria, namely C99 1 sec = 2 ou at nearby receptors, for both scenarios modelled" (Pacific Environment, 2015). Furthermore, should the preliminary layout, on which the Assessment was made undergo minor modification within the site with the odour sources being relocated

(i.e. treatment and treated water storage tanks), and minor modification in the location of the OCU, the C99 1 sec = 2 ou criterion would still be met at nearby sensitive locations. This is based on the very large buffer distance between the point at which the NSW Criteria are achieved and the nearby sensitive locations.

3.3.1 Mitigation Measures

The WWTP would satisfy the odour emissions criteria, with no further mitigation and management measures beyond the proposed design required.

3.4 Noise & Vibration

Vipac Engineers and Scientists Pty Ltd (Vipac) (2015) prepared the *Bingara Gorge Wastewater Treatment Plant Noise Impact Assessment* (Noise Assessment) based on the NSW Industrial Noise Policy (INP) and Australian Standard AS 1055-1997. The Noise Assessment is located at **Appendix H**. The Noise Assessment was undertaken to determine potential impacts of the revised WWTP design on sensitive receivers and updates the previous Vipac *Noise Impact Assessment* report (2013).

Potentially impacted receivers include three residences to the south comprising part of the existing Wilton Village, as well as two future stages of the Bingara Gorge Residential Subdivision being Highlands and Fairways. Background noise monitoring was undertaken at one location to establish the background levels, with modelling subsequently undertaken to establish the extent of potential impact.

Noise modelling was undertaken for both operating scenarios being Stage 1 and 2 operating concurrently and Stage 3 operations. The modelling examined neutral and worst case conditions during the day and night, with the difference in noise generation between the two operating scenarios considered negligible (approximately 1dB).

The predicted noise impact on sensitive receivers ranged from between 15 to 40 dB(A) dependent upon the criteria used (Vipac, 2015). Consequently, the noise generation fell below the applicable criteria during day, evening and night time. Consequently, Vipac are of the opinion that the WWTP is acceptable from a noise generation perspective (Vipac, 2015) with no mitigation required, other than that already incorporated into the design.

3.4.1 Mitigation Measures

The WWTP would satisfy the noise emissions criteria, with no further mitigation and management measures beyond the proposed design required.

3.5 Water Cycle

3.5.1 Water Balance

Water, nutrient and salt balance modelling of the proposed recycled water irrigation scheme was undertaken using the MEDLI model version 1.3 (Model for Effluent Disposal by Land Irrigation) developed by the Queensland Department of Natural Resources (Department of Natural Resources, 1998). MEDLI is a daily water, nutrient and salt balance model that uses derived site specific daily rainfall, pan evaporation, temperature and solar radiation data to simulate the water balance, plant growth and nutrient and salt transport in an irrigation system. MEDLI modelling was undertaken to demonstrate the proposed irrigation scheme will comply with the requirements outlined in the NSW Environmental Guidelines: Use of Effluent by Irrigation (NSW DEC, 2004).

Table 3-1 Estimated Wastewater Generation for the Wilton Water Scheme

WWTP Stage	Catchment	ET	EP	Average Dry Weather Flow (ADWF)				Total Annual Flow		
				SF[1] (L/EP/d)	GWI[2] (L/EP/d)	ADWF (L/EP/d)	ADWF (kL/day)	SWI[3]	kL/day	ML/year
Ultimate 2000 ET	Gravity	500	1500	150	30	180	270	30%	351	128
	Pressure	1500	4500	150	0	150	675	10%	742	271
	Total	2000	6000				945		1093	399

1. SF = Sanitary Flow
2. GWI = Groundwater infiltration
3. SWI = Annual stormwater infiltration

Table 3-2 Estimated Surplus Recycled Water for Irrigation at each Stage

ET	Wastewater Generation & Treatment (kL/d)				Recycled Water Demand (kL/d)	Surplus to Irrigation (kL/d)
	ADWF	Total Flow inc I&I1	MBR Losses	MBR Permeate		
2000	945	1093	18.9	1075	472	603

1. Inflow & infiltration assumed to be 30% for gravity sewer and 10% for pressure sewer.
2. Recycled water demand assumes no reuse for laundry washing machine cold water service.

MEDLI modelling was undertaken based on the modelling parameters and assumptions listed below in **Table 3.3.**

Table 3-3 MEDLI Modelling Parameters & Assumptions

Parameters	Ultimate – 2000 ET with recycling
Average Irrigation Flow	603 kL/day
Total Irrigation Area	52.7 ha (includes public open space irrigation areas) Average effluent irrigation rate approximately 1.1 mm/day or 4.17 ML/ha/year.
Climate data	Derived daily climate data for Wilton sourced from QLD Department of Science for the coordinates 34.25oS, 150.700E for the 56-year modelling period.
Time Period	100-year historic modelling period from 1/1/1959 to 31/12/2014 using a daily time step.
Soil type	The standard MEDLI soil type "low permeability red brown earth" was used with a total soil profile depth of 1500 mm across 4 soil layers
Crop type	Standard MEDLI crop type "temperate pasture"
Average Effluent Quality	Total Nitrogen – 10 mg/L Total Phosphorus – 1 mg/L (lowest possible input in MEDLI)
Wet Weather Storage	80 ML HDPE lined open dam
Irrigation scheduling	Irrigation scheduling based on soil water deficit. Irrigation Trigger: Soil Water Deficit > 5 mm Irrigation Amount: Drained Upper Limit + 1 mm

Details of the effluent irrigation areas and discharge areas and flows are provided in **Figures 3-1** and **3-2** below.

MEDLI modelling was undertaken based on the input parameters and performance targets presented above. A summary of average water balance results from MEDLI is provided below in **Table 3-4**.

Table 3-4 MEDLI Modelling Average Water Balance Results

Parameter	Ultimate – 2000 ET
Pond volume	80 ML (133 days)
Average volume	23 ML (29% full)
Effluent inflow	220.2 ML (603 kL/day)
Climate inputs	- 0.6 ML/year
Irrigation	217.4 ML/year
Pond overflow	2.14 ML/year
Volumetric % Reuse	>98.8 %
Average Overflow Event Statistics	3.7 events every 10 years 36.4 days in 10 years 9.7 days per event
Irrigation Area	52.7 ha (golf course and public open space areas)
Rainfall	907 mm/year
Irrigation	412 mm/year
Evapotranspiration	788 mm/year
Runoff	38.4 mm/year
Deep drainage	493 mm/year

Refer to **Appendix D** for the MEDLI Water Balance Model output file.

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Effluent Irrigation Areas

BINGARA GORGE, NSW

Legend

- Site Boundary
- Golf Course Irrigation Mains (Solo Water, 2011)
- Watercourses
- 10m Contours
- Employment Lands
- Golf Course Stormwater Ponds
- Golf Course Irrigation Areas (46.7ha)
- Open Space Irrigation Areas (6.2ha)
- Lot Layout
- Cadastre (LPI, 2014)

FIGURE 3-1

1:11,000 Scale at A3

Metres
0 100 200 300 400 500

N

Cardno

Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2015-05-04
Coordinate System: GDA 1994 MGA Zone 56
Project: 82015063_01
Map: 82015063-01-GS-002-EffluentIrrigationArea.mxd 02
All base data supplied by LPI unless otherwise stated.

VEOLIA WATER
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Emergency Discharge and Event Monitoring Locations

BINGARA GORGE, NSW

Recycled water precautionary and emergency discharge location into lake discharge structure

Upstream monitoring location

HUME HIGHWAY
ALLENS CREEK
STRINGYBARK CREEK
CLEMENTS CREEK
BYRNES CREEK
CONDELL PARK ROAD
FAIRWAY DRIVE
WHITE STREET
J.E.F FREY STREET
HORDERN STREET
BEATTY STREET
PEMBROKE PARADE
GOODWIN STREET
OXENBRIDGE AVENUE
HORNBY STREET WEST
SARAZEN CRESCENT
KIRKWOOD CHASE
PICTON ROAD
JANDERRA LANE
EMMA LANE
BROUGHTON STREET
TYSON ROAD
ALMOND STREET
CAMPSIE STREET

160 m
140 m
110 m
120 m
180 m
200 m
210 m
150 m
130 m
170 m
190 m
220 m

Legend

- Site Boundary
- Emergency Monitoring Locations
- Emergency Discharge Locations
- Golf Course Irrigation Mains (Solo Water, 2011)
- Watercourses
- 10m Contours
- Employment Lands
- Golf Course Stormwater Ponds
- Golf Course Irrigation Areas (46.7ha)
- Open Space Irrigation Areas (6.2ha)
- Lot Layout
- Cadastre (LPI, 2014)

Emergency Discharge Flow Path

- Along Stringybark Creek
- Along Tributary Gully

FIGURE 3-2

1:11,000 Scale at A3

Metres
0 100 200 300 400 500

N

Cardno

Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2015-05-04
Coordinate System: GDA 1994 MGA Zone 56
Project: 82015063_01
Map: 82015063-01-GS-003-EmergencyDischarge.mxd 02

3.5.2 Sewage Management Plan prepared by Veolia (2015)

Veolia prepared a *Sewage Management Plan* (2015), which provides an overview of the design of the sewage management, treatment and distribution system associated with the PRWP. The Management Plan located at **Appendix E** identifies the current temporary treatment plant function along with that of the proposed plant. The Management Plan also identifies discharge during wet weather operations, associated water quality and monitoring.

A monitoring regime is identified, along with operational management measures including customer service and complaints handling mechanisms, along with emergency response plans and incident reporting.

3.6 Waste

Veolia is acutely aware of their role and responsibility in the conservation of natural resources and impacts to the environment. Opportunities to minimise waste generation and maximise the use of existing resources on site will be implemented where possible.

Waste comprising scrap metal, masonry, packaging materials and plastics generated during the construction phase would be collected in sorted skip bins on-site and would be removed by a licensed contractor. General waste generated by contractors working on site will be collected and recycled where possible or disposed at a licensed waste facility.

A Site Waste Minimisation and Management Plan (SWMMP) will be developed as part of the proposed works to ensure waste is minimised and recycled where possible and that the appropriate measures are employed throughout the project to ensure that waste is disposed of in a legal manner.

Biosolids and screenings will be transferred via a licenced contractor to a suitable disposal facility. Solids storage bins onsite will be fully enclosed with odour extraction.

3.6.1 Mitigation Measures

The following mitigation measures will be utilised to minimise potential impacts associated with waste generation during development:

- Development and implementation of a SWMMP

3.7 Cumulative Impacts

Cumulative impacts relate to the compounding effects and interactions arising from both the individual environmental impacts interacting to exacerbate the overall impact and the interactions between developments proposed or operating within the locality or at a similar time. Together these impacts can affect the natural or built environment. Consideration of cumulative impacts ensures that environmental impacts from the proposal are not viewed in isolation from surrounding developments.

Consideration of the cumulative impacts is primarily achieved by each specific environmental assessment within this SEE, with, each assessment that has the potential to affect offsite locations undertaken in the context of the surrounds. This approach ensures that both on and off-site impacts are considered along with those in the surrounding environment.

Development within the wider Bingara Gorge Residential Subdivision is the primary contributor to cumulative impacts within the locality. Works within Bingara Gorge currently occurring are primarily to the east and northeast in the form of civil works for residential subdivision, as well as around the golf course club house and golf course. The master planning of the development has resulted in the cumulative impacts of the overall site being considered from the outset, with the Bingara Gorge Subdivision considered in its wider context.

The master planning of the Estate ensures that the final land form would not create an unacceptable cumulative impact. Cumulative impacts associated with the construction of the WWTP have been addressed through the staging of development and incorporation of mitigation and management measures identified within this Report into the contractors CEMP.

The staging of development ensures that extensive works are not being undertaken concurrently across the Bingara Gorge Subdivision, as this would have the potential to create impacts through cumulative noise generation and truck movements. The staging of works packages dilutes the potential impacts to an acceptable level as identified in the impact assessments undertaken.

This assessment has found that there are no anticipated cumulative impacts created by interactions between the WWTP construction and operation, and the wider subdivision works on account of the staging of works. Potential cumulative impacts associated with a number of on-site construction activities occurring concurrently are not anticipated subject to the incorporation of the mitigation measures including the use of erosion control measures to limit potential impacts from earthworks and transport off site, and the consideration of traffic noise as well as on-site construction noise when addressing the overall noise impact from the works, as identified in the individual impact assessment sections.

4 Conclusion

4.1 Conclusion

This Report has been prepared to support a variation to Environment Protection Licence (EPL) 20335 associated with an Onsite Wastewater and water recycling scheme at Condell Park Road, Wilton. Veolia propose to vary the design of the Waste Water Treatment Plant (WWTP) with an associated variation to the EPL required.

The analysis within this Report has been undertaken to inform the WWTP design to ensure that potential impacts on the environment are minimised during both construction and operation. A Water Balance Assessment has been undertaken, with these findings informing the design capacity of the Plant. The refinements have ensured that overflows are managed at acceptable levels in accordance with the previously approved EPL. Operational and Waste Water Management Plans have been prepared to address the Plant operation, with management and reporting regimes put in place to guide future operation.

The site is located between the Hume Highway to the west and the Bingara Gorge Residential Subdivision to the east. The proximity of the site to residential areas has been considered, with a noise and air quality assessment undertaken. These assessments found that the noise generated by the WWTP would not impact on the surrounding residential areas. Further, the odour generation from the WWTP does not exceed the level of the previously approved plant and complies with the applicable criteria.

In summary the assessments have found that the WWTP would not create an unacceptable impact to the environment, with an appropriate monitoring regime proposed to ensure these impacts are considered on a continuous basis. Consequently, it is considered that the proposed WWTP plant design, construction and operation is acceptable and that an EPL variation should be supported.

5 References

Pacific Environment (2015) Bingara Gorge Wastewater Treatment Plant Odour Assessment – Preliminary Layout

Vipac Engineers and Scientists Pty Ltd (2015) Bingara Gorge Wastewater Treatment Plant Noise Impact Assessment

Bingara Gorge Waste Water Treatment Plant – EPL Variation

APPENDIX A
CIVIL DRAWINGS

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VEOLIA WATER SOLUTIONS AND TECHNOLOGIES

PERMANENT RECYCLED WATER PLANT

COVER SHEET

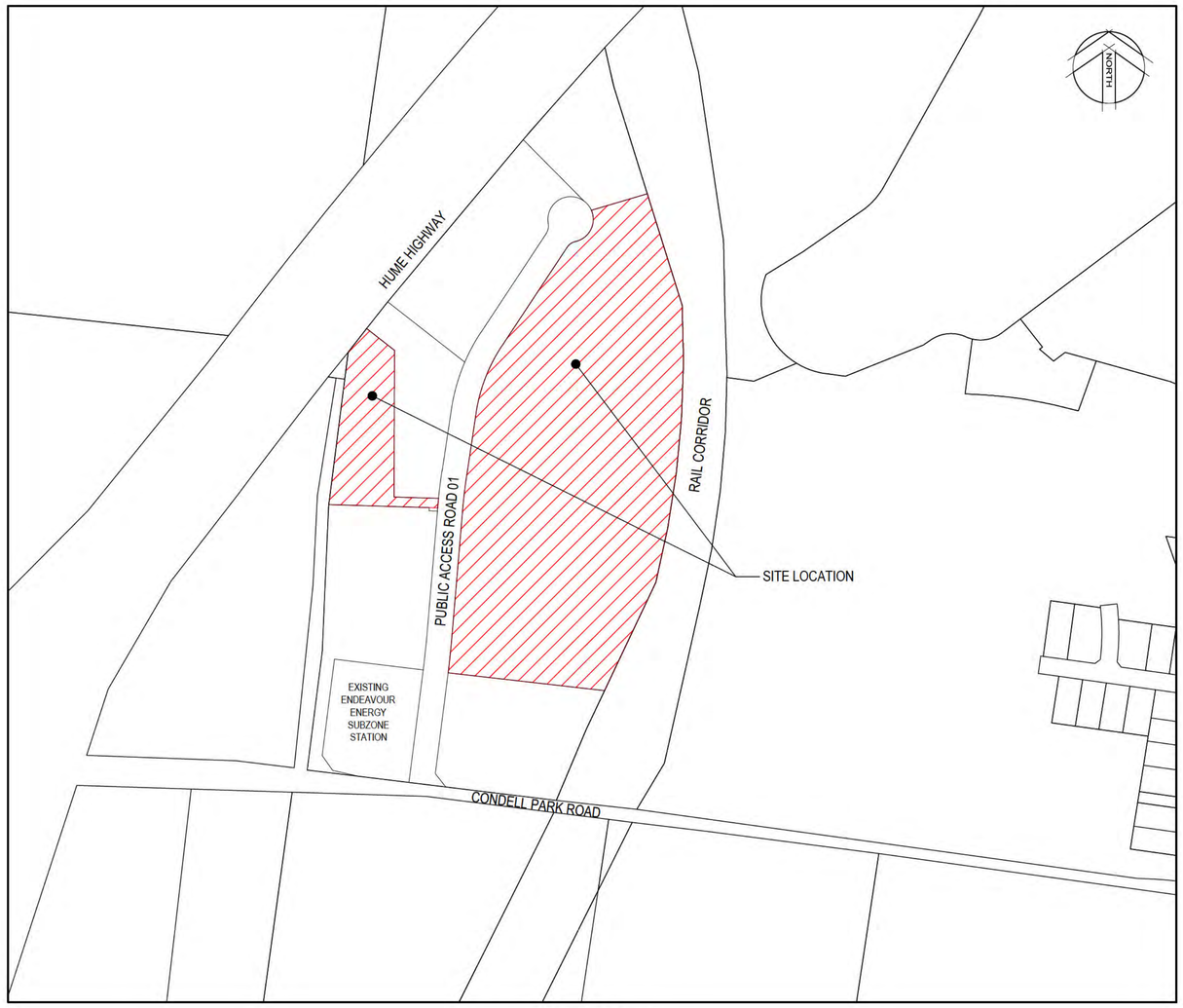
Rev.	Date	Description	Des.	Verif.	Appd.
1	8/05/2015	ISSUED FOR DA	FK	JMK	PCC

Drawn	FK	Date 28/04/2015
Checked	PCC	Date 8/05/2015
Designed	FK	Date 28/04/2015
Verified	JMK	Date 8/05/2015
Approved	PCC	Date 8/05/2015

Status: FOR APPROVAL
NOT TO BE USED FOR CONSTRUCTION PURPOSES

DATUM: AHD | Scale: NTS | Size: A1

Drawing Number: 82015063-002-C1000 | Revision: 1



LOCALITY PLAN
1:2500

DRAWING SCHEDULE

DWG NO.	SHEET DESCRIPTION	REV
82015063-002-C1000	COVER SHEET	1
82015063-002-C1001	DRAWING SCHEDULE AND LOCALITY PLAN	2
82015063-002-C1002	EXISTING SITE LAYOUT PLAN	1
82015063-002-C1003	PROPOSED SITE LAYOUT PLAN	1
82015063-002-C1004	WASTE WATER TREATMENT PLANT GENERAL ARRANGEMENT LAYOUT PLAN	1
82015063-002-C1005	BULK EARTHWORKS LAYOUT PLAN	1
82015063-002-C1006	WASTE WATER TREATMENT PLANT BUILDING LAYOUT PLAN	1
82015063-002-C1007	WASTE WATER TREATMENT PLANT BULIDING ELEVATIONS - SHEET 1 OF 2	1
82015063-002-C1008	WASTE WATER TREATMENT PLANT BULIDING ELEVATIONS - SHEET 2 OF 2	1
82015063-002-C1009	PROPOSED STORMWATER LAYOUT PLAN	2
82015063-002-C1010	TYPICAL POND CROSS SECTIONS	1
82015063-002-C1011	SOIL AND WATER MANAGEMENT PLAN	1

0 50 100 150 200 250m
SCALE 1:2500 (A1), 1:5000 (A3)

Rev.	Date	Description	Des.	Verif.	Appd.
2	8/05/2015	DRAWING SCHEDULE AMENDED	FK	JMK	PCC
1	8/05/2015	ISSUED FOR DA	FK	JMK	PCC

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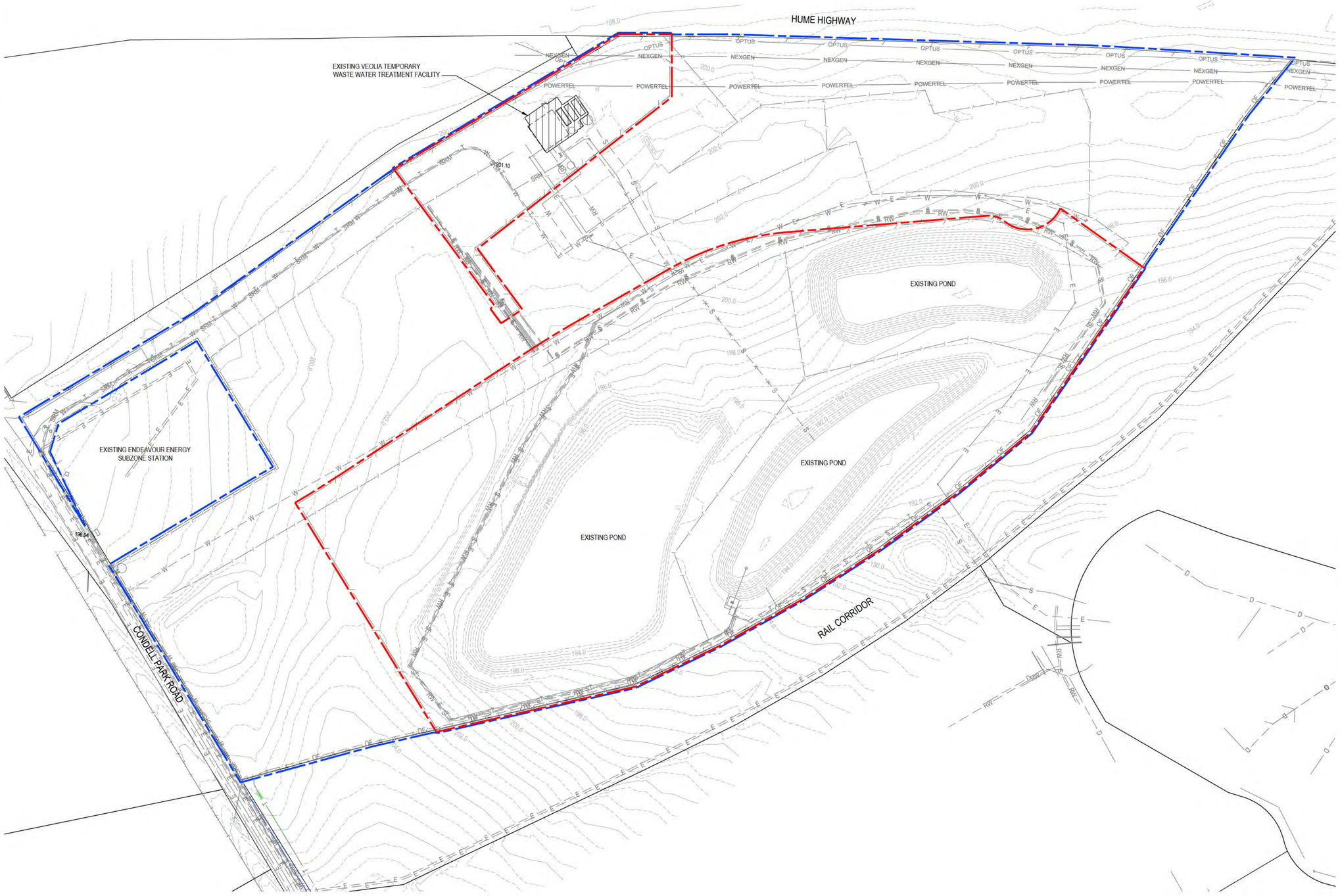
Checked	PCC	Date 8/05/2015
Designed	FK	Date 28/04/2015
Verified	JMK	Date 8/05/2015
Approved	PCC	8/05/2015

Client: VEOLIA WATER SOLUTIONS AND TECHNOLOGIES
Project: PERMANENT RECYCLED WATER PLANT
Title: DRAWING SCHEDULE AND LOCALITY PLAN
Status: FOR APPROVAL
NOT TO BE USED FOR CONSTRUCTION PURPOSES
DATUM: AHD | Scale: 1:1500 | Size: A1
Drawing Number: 82015063-002-C1001 | Revision: 2



EXISTING SITE LAYOUT PLAN

SCALE 1:1000

LEGEND:

- SITE BOUNDARY FOR WASTE WATER TREATMENT FACILITY AND ASSOCIATED TREATMENT PONDS WITHIN INDUSTRIAL LANDS.
- SITE BOUNDARY FOR INDUSTRIAL LANDS.
- 50.0 — EXISTING CONTOURS
- S — EXISTING SEWER MAIN
- SRM — EXISTING SEWER RISING MAIN
- W — EXISTING POTABLE WATER MAIN
- RW — EXISTING RECYCLED WATER MAIN
- T — EXISTING COMMUNICATIONS DUCTS
- OF — EXISTING COMMUNICATIONS DUCTS
- E — EXISTING ELECTRICAL
- D — STORMWATER DRAINAGE
- OPTUS — EXISTING SERVICE - OPTUS
- NEXGEN — EXISTING SERVICE - NEXGEN
- POWERTEL — EXISTING SERVICE - POWERTEL

NOTE:

EXISTING TREATMENT FACILITY DOES NOT FORM PART OF THIS DEVELOPMENT APPLICATION. THEY ARE APPROVED UNDER A PREVIOUS DA APPLICATION - No. ID993-05

0 20 40 60 80 100m

SCALE 1:1000 (A1), 1:2000 (A3)

Rev.	Date	Description	Des.	Verif.	Appd.
1	8/05/2015	ISSUED FOR DA	FK	JMK	PCC

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Designed	FK	Date 28/04/2015
Verified	JMK	Date 8/05/2015
Approved	PCC	8/05/2015

Client: VEOLIA WATER SOLUTIONS AND TECHNOLOGIES

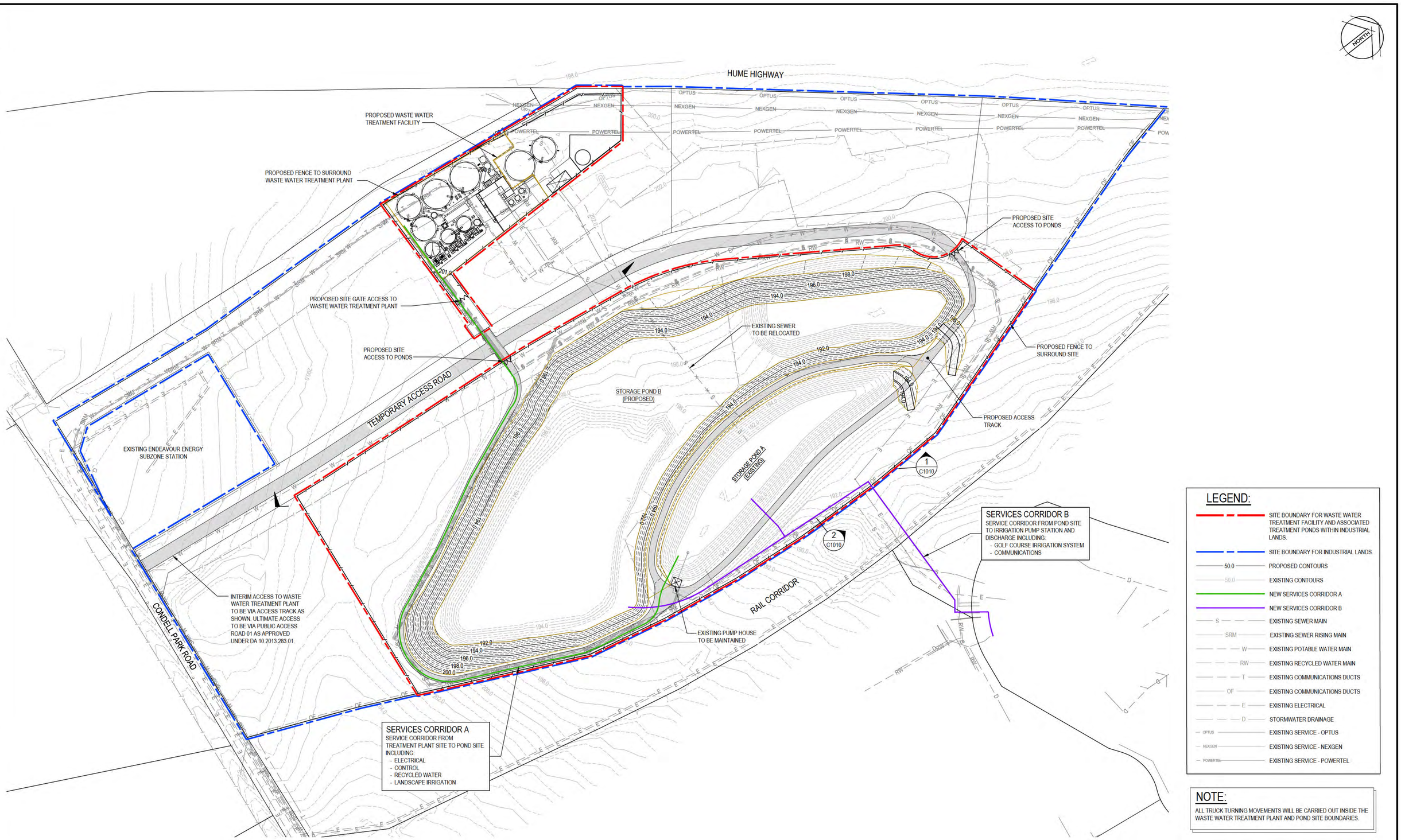
Project: PERMANENT RECYCLED WATER PLANT

Title: EXISTING SITE LAYOUT PLAN

Status: FOR APPROVAL
NOT TO BE USED FOR CONSTRUCTION PURPOSES

DATUM: AHD | Scale: 1:1000 | Size: A1

Drawing Number: 82015063-002-C1002 | Revision: 1



PROPOSED SITE LAYOUT PLAN

SCALE 1:1000

Rev.	Date	Description	Des.	Verif.	Appd.
1	8/05/2015	ISSUED FOR DA	FK	JMK	PCC

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Checked	PCC	8/05/2015
Designed	FK	28/04/2015
Verified	JMK	8/05/2015
Approved	PCC	8/05/2015

Client: VEOLIA WATER SOLUTIONS AND TECHNOLOGIES
Project: PERMANENT RECYCLED WATER PLANT
Title: PROPOSED SITE LAYOUT PLAN
Status: FOR APPROVAL
NOT TO BE USED FOR CONSTRUCTION PURPOSES
DATUM: AHD | Scale: 1:1000 | Size: A1
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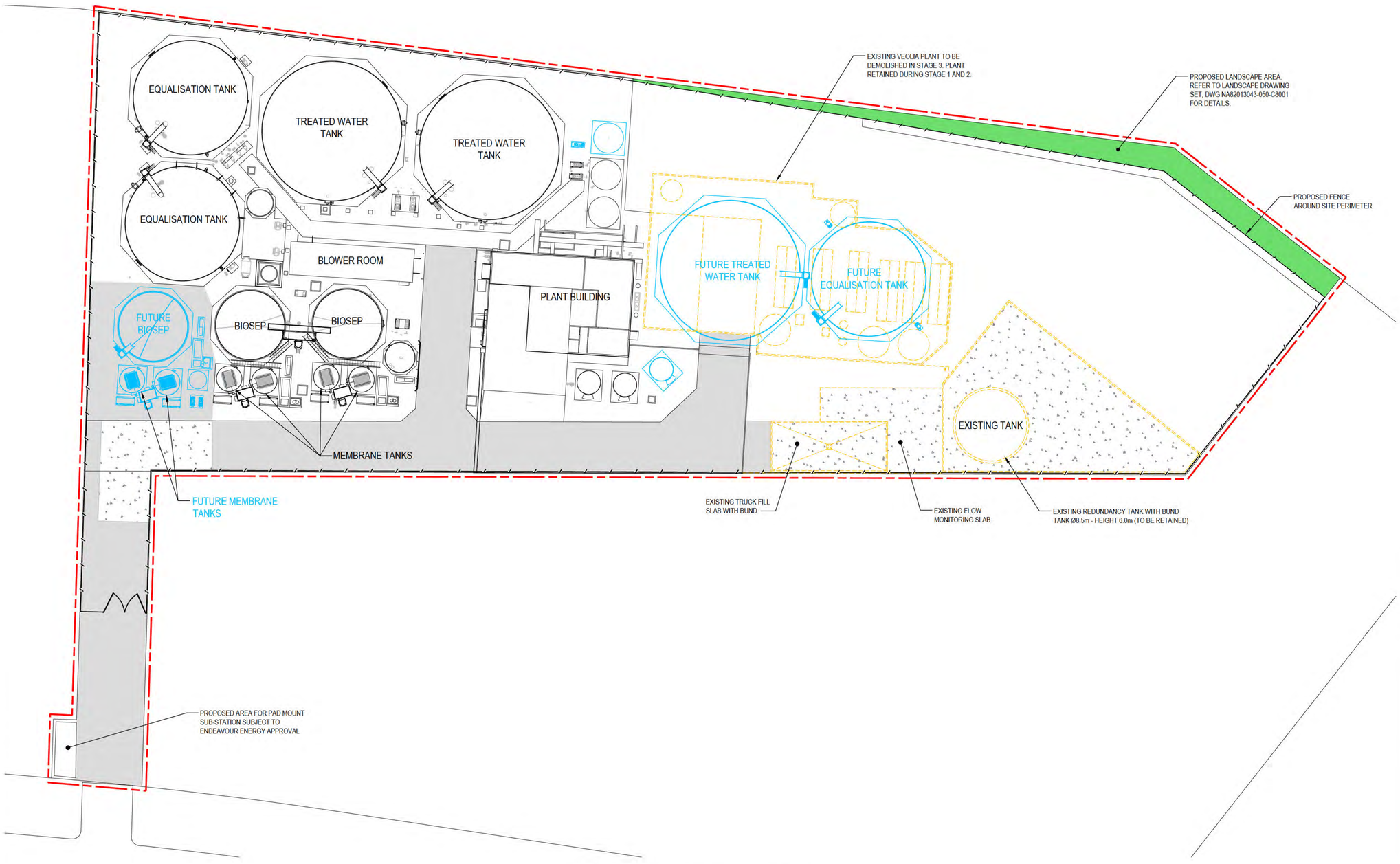

GENERAL ARRANGEMENT LAYOUT PLAN

SCALE 1:250

LEGEND

- SITE BOUNDARY
- PERMANENT 1.8m HIGH BLACK POST AND WIRE FENCE WITH 3 STRANDS OF BARBED WIRE
- PROPOSED BUILDING/STRUCTURE (STAGE 1 AND 2)
- PROPOSED BUILDING/STRUCTURE (STAGE 3)
- EXISTING BUILDING/STRUCTURE (TO BE RETAINED)
- EXISTING BUILDING/STRUCTURE (TO BE DEMOLISHED IN STAGE 3)
- PROPOSED HARDSTAND/ROAD PAVEMENT. DESIGN TO BE CONFIRMED
- EXISTING CONCRETE AREA
- LANDSCAPING AREA

0 5 10 15 20 25m

SCALE 1:250 (A1), 1:500 (A3)

Rev.	Date	Description	Des.	Verif.	Appd.
1	8/05/2015	ISSUED FOR DA	FK	JMK	PCC

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Drawn	FK	28/04/2015
Checked	PCC	8/05/2015
Designed	FK	28/04/2015
Verified	JMK	8/05/2015
Approved	PCC	8/05/2015

Client: VEOLIA WATER SOLUTIONS AND TECHNOLOGIES

Project: PERMANENT RECYCLED WATER PLANT

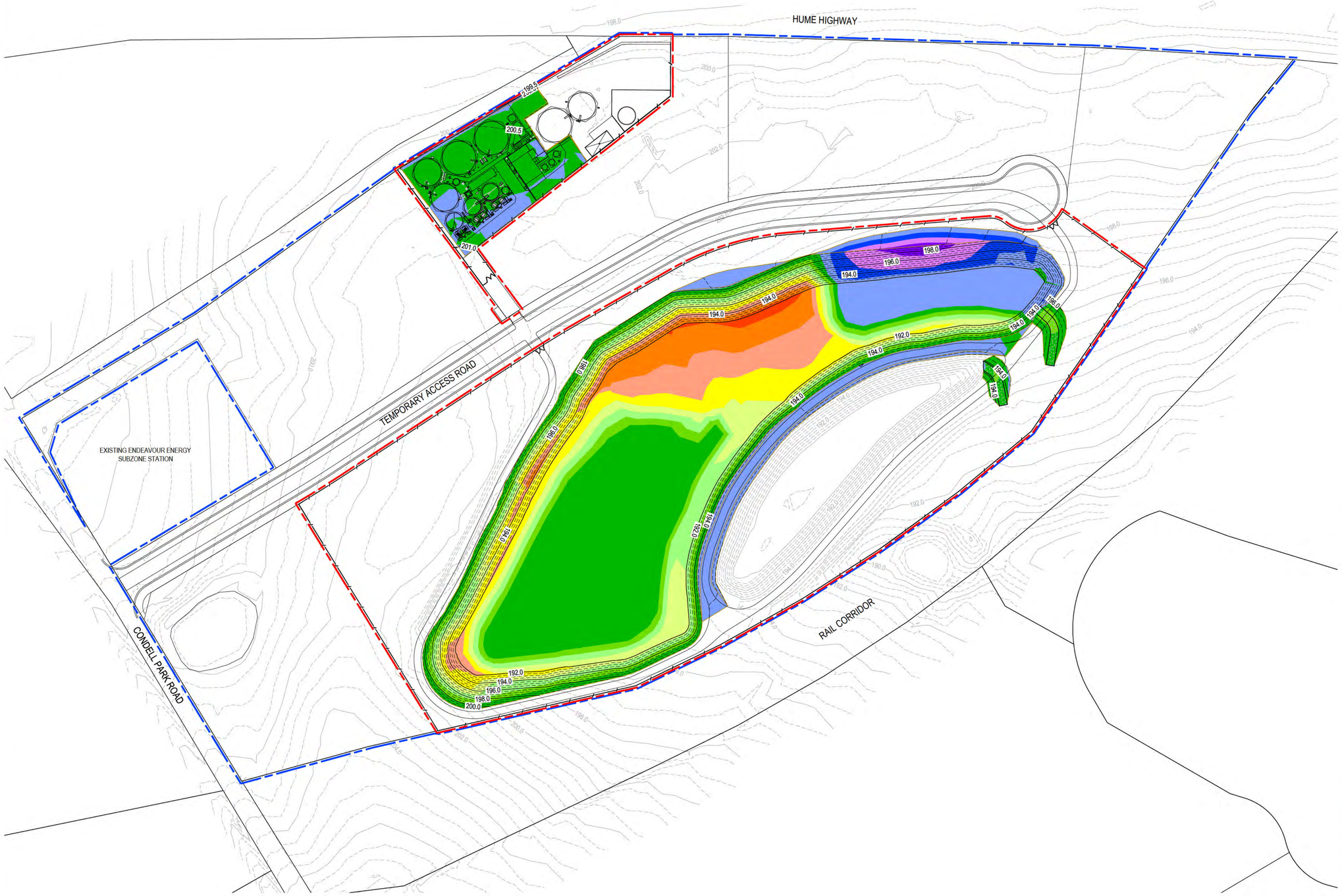
Title: WASTE WATER TREATMENT PLANT
GENERAL ARRANGEMENT LAYOUT PLAN

Status: FOR APPROVAL
NOT TO BE USED FOR CONSTRUCTION PURPOSES

DATUM		Scale	Size
AHD		1:250	A1

Drawing Number: 82015063-002-C1004

Revision: 1



ELEVATIONS LEGEND:

No.	MINIMUM ELEVATION (m)	MAXIMUM ELEVATION (m)	COLOUR
1	-7.412	-7.000	
2	-7.000	-6.000	
3	-6.000	-5.000	
4	-5.000	-4.000	
5	-4.000	-3.000	
6	-3.000	-2.000	
7	-2.000	-1.000	
8	-1.000	0.000	
9	0.000	1.000	
10	1.000	2.000	
11	2.000	3.000	
12	3.000	3.572	

CUT/FILL SUMMARY

NAME	CUT	FILL	NET
PROPOSED STORAGE POND 3	68355.10m^3	5080.62m^3	63274.48m^3 (CUT)

LEGEND:

- SITE BOUNDARY FOR WASTE WATER TREATMENT FACILITY AND ASSOCIATED TREATMENT PONDS WITHIN INDUSTRIAL LANDS.
- SITE BOUNDARY FOR INDUSTRIAL LANDS.
- 50.0 PROPOSED CONTOURS
- 50.0 EXISTING CONTOURS

BUL EARTHWORKS LAYOUT PLAN

SCALE 1:1000

0 20 40 60 80 100m

SCALE 1:1000 (A1), 1:2000 (A3)

Rev.	Date	Description	Des.	Verif.	Appd.
1	8/05/2015	ISSUED FOR DA	FK	JMK	PCC

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Checked	PCC	Date 8/05/2015
Designed	FK	Date 28/04/2015
Verified	JMK	Date 8/05/2015
Approved	PCC	8/05/2015

Client: VEOLIA WATER SOLUTIONS AND TECHNOLOGIES

Project: PERMANENT RECYCLED WATER PLANT

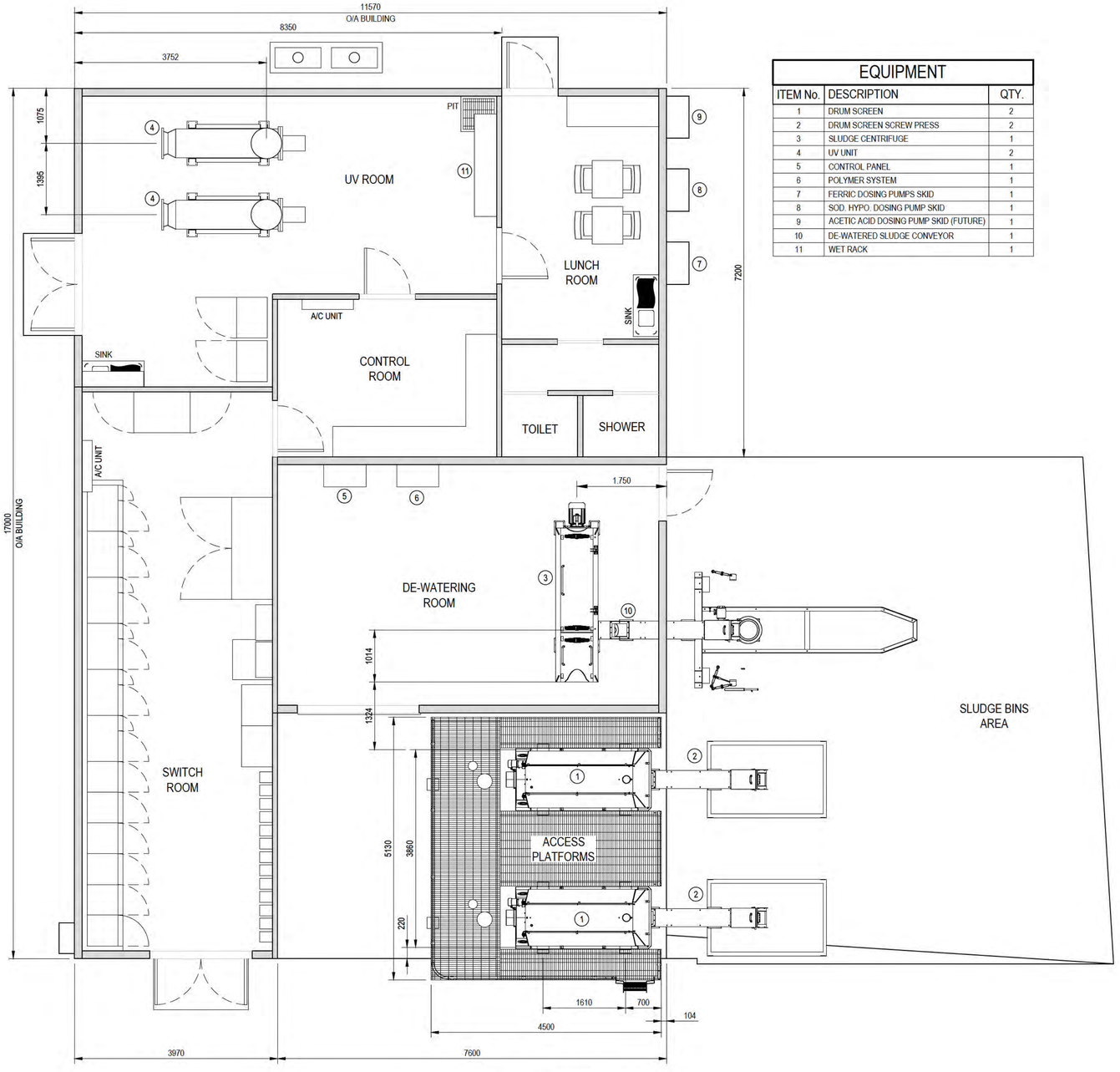
Title: BULK EARTHWORKS LAYOUT PLAN

Status: FOR APPROVAL
NOT TO BE USED FOR CONSTRUCTION PURPOSES

DATUM		Scale	Size
AHD		1:1000	A1

Drawing Number: 82015063-002-C1005

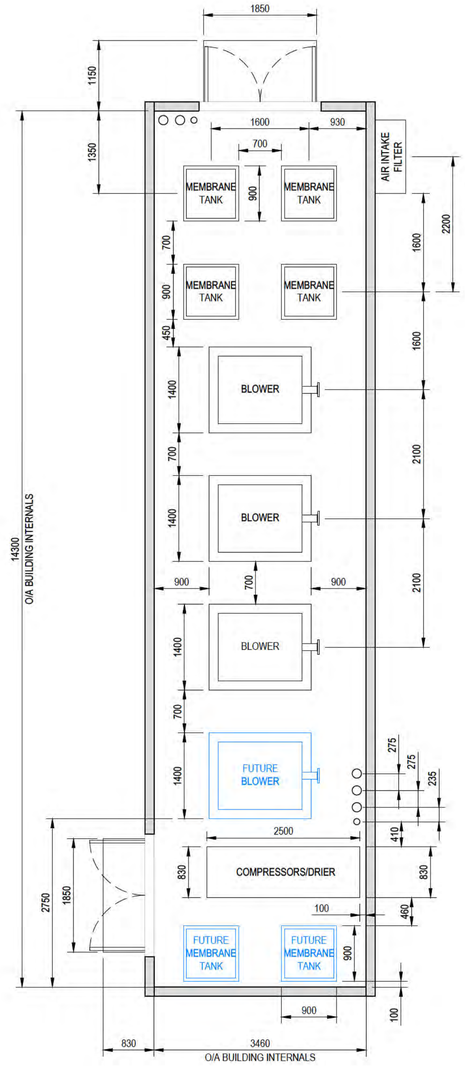
Revision: 1



PLANT BUILDING

EQUIPMENT

ITEM No.	DESCRIPTION	QTY.
1	DRUM SCREEN	2
2	DRUM SCREEN SCREW PRESS	2
3	SLUDGE CENTRIFUGE	1
4	UV UNIT	2
5	CONTROL PANEL	1
6	POLYMER SYSTEM	1
7	FERRIC DOSING PUMPS SKID	1
8	SOD. HYPO. DOSING PUMP SKID	1
9	ACETIC ACID DOSING PUMP SKID (FUTURE)	1
10	DE-WATERED SLUDGE CONVEYOR	1
11	WET RACK	1



BLOWER BUILDING

BUILDING LAYOUT PLAN
SCALE 1:50

0 1000 2000 3000 4000 5000mm
SCALE 1:50 (A1), 1:100 (A3)

Rev.	Date	Description	Des.	Verif.	Appd.
1	8/05/2015	ISSUED FOR DA	FK	JMK	PCC

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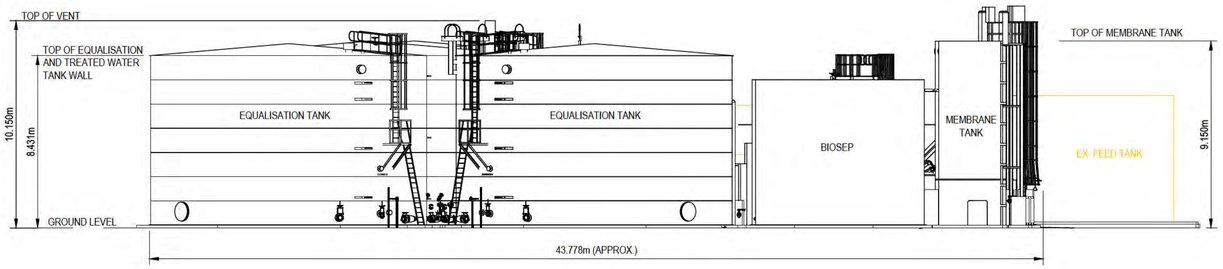
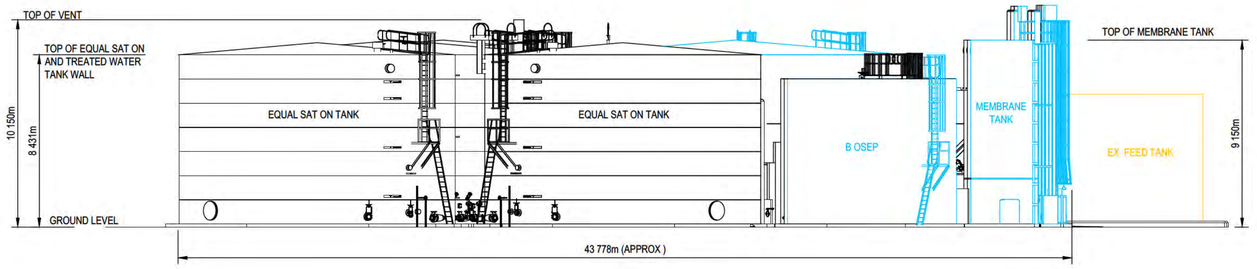
		Date
Drawn	FK	28/04/2015
Checked	PCC	8/05/2015
Designed	FK	28/04/2015
Verified	JMK	8/05/2015
Approved	PCC	8/05/2015

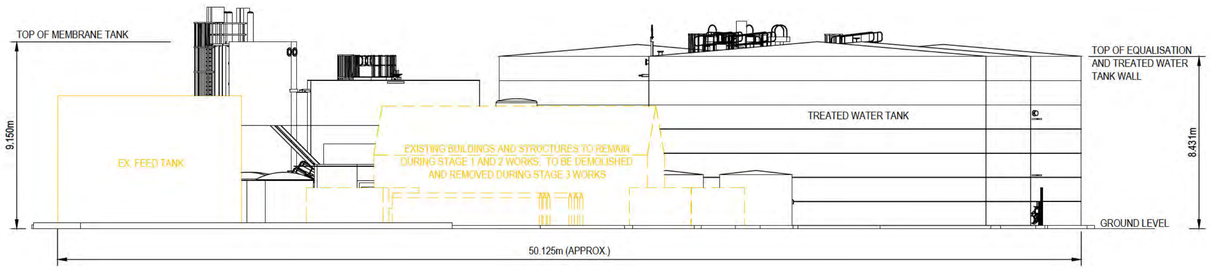
Client: VEOLIA WATER SOLUTIONS AND TECHNOLOGIES
Project: PERMANENT RECYCLED WATER PLANT
Title: WASTE WATER TREATMENT PLANT BUILDING LAYOUT PLAN
Status: FOR APPROVAL
NOT TO BE USED FOR CONSTRUCTION PURPOSES
DATUM: AHD | Scale: 1:50 | Size: A1
Drawing Number: 82015063-002-C1006 | Revision: 1



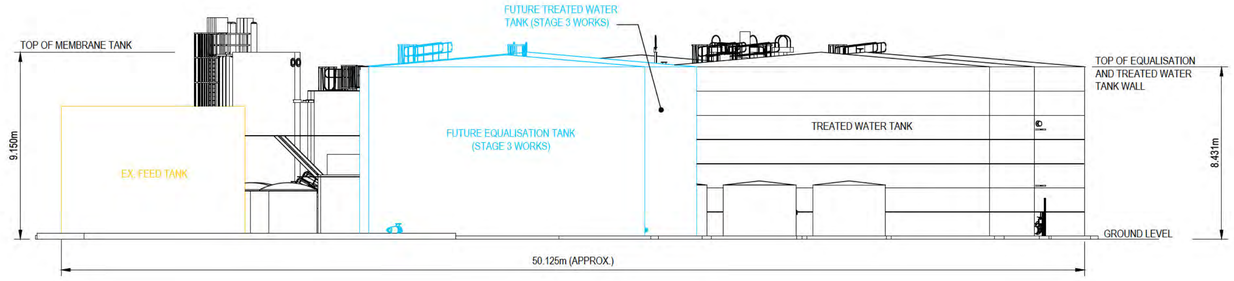
NORTH VIEW (STAGE 1 & 2)
SCALE 1:150



NORTH VIEW (STAGE 3)
SCALE 1:150



SOUTH VIEW (STAGE 1 & 2)
SCALE 1:150



SOUTH VIEW (STAGE 3)
SCALE 1:150

0 5 10 15m
SCALE 1:150 (A1), 1:300 (A3)

Rev.	Date	Description	Des.	Verif.	Appd.
1	8/05/2015	ISSUED FOR DA	FK	JMK	PCC

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Designed	FK	Date 28/04/2015
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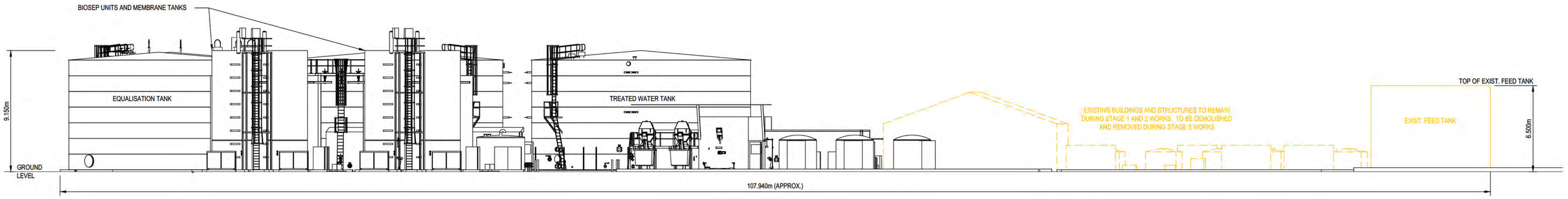
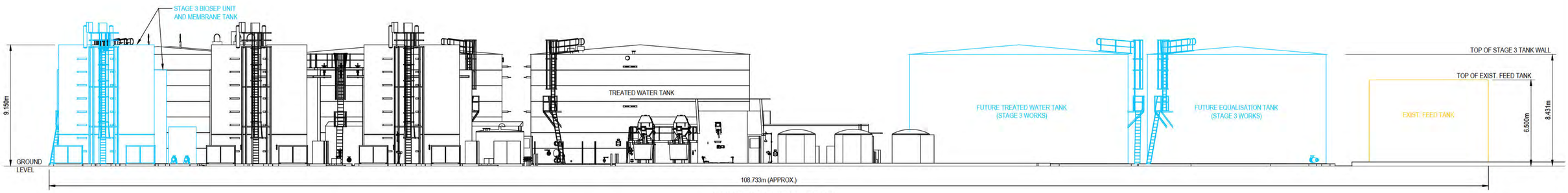
Approved	PCC	8/05/2015

Client: VEOLIA WATER SOLUTIONS AND TECHNOLOGIES
Project: PERMANENT RECYCLED WATER PLANT
Status: FOR APPROVAL
NOT TO BE USED FOR CONSTRUCTION PURPOSES
Title: WASTE WATER TREATMENT PLANT BUILDING ELEVATIONS - SHEET 1 OF 2
DATUM: AHD | Scale: 1:150 | Size: A1
Drawing Number: 82015063-002-C1007 | Revision: 1



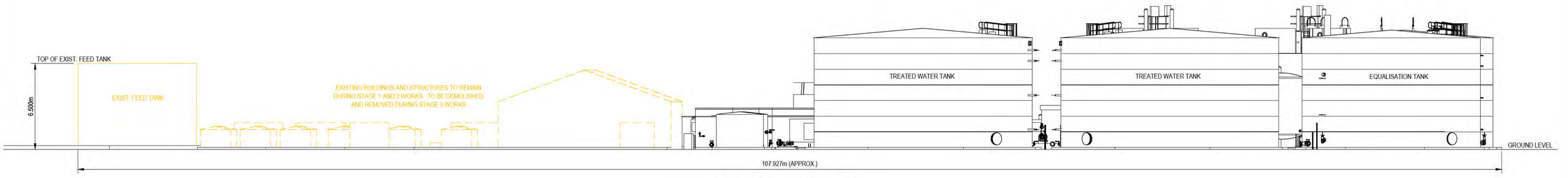
WEST VIEW (STAGE 1 & 2)

SCALE 1:150



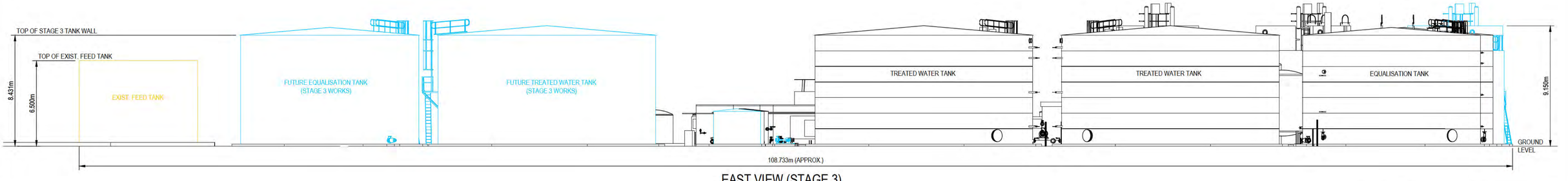
WEST VIEW (STAGE 3)

SCALE 1:150



EAST VIEW (STAGE 1 & 2)

SCALE 1:150



EAST VIEW (STAGE 3)

SCALE 1:150

0 5 10 15m

SCALE 1:150 (A1), 1:300 (A3)

Rev.	Date	Description	Des.	Verif.	Appd.
1	8/05/2015	ISSUED FOR DA	FK	JMK	PCC

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Checked	PCC	Date 8/05/2015
Designed	FK	Date 28/04/2015
Verified	JMK	Date 8/05/2015
Approved	PCC	8/05/2015

Client: VEOLIA WATER SOLUTIONS AND TECHNOLOGIES

Project: PERMANENT RECYCLED WATER PLANT

Title: WASTE WATER TREATMENT PLANT
BUILDING ELEVATIONS - SHEET 2 OF 2

Status: FOR APPROVAL
NOT TO BE USED FOR CONSTRUCTION PURPOSES

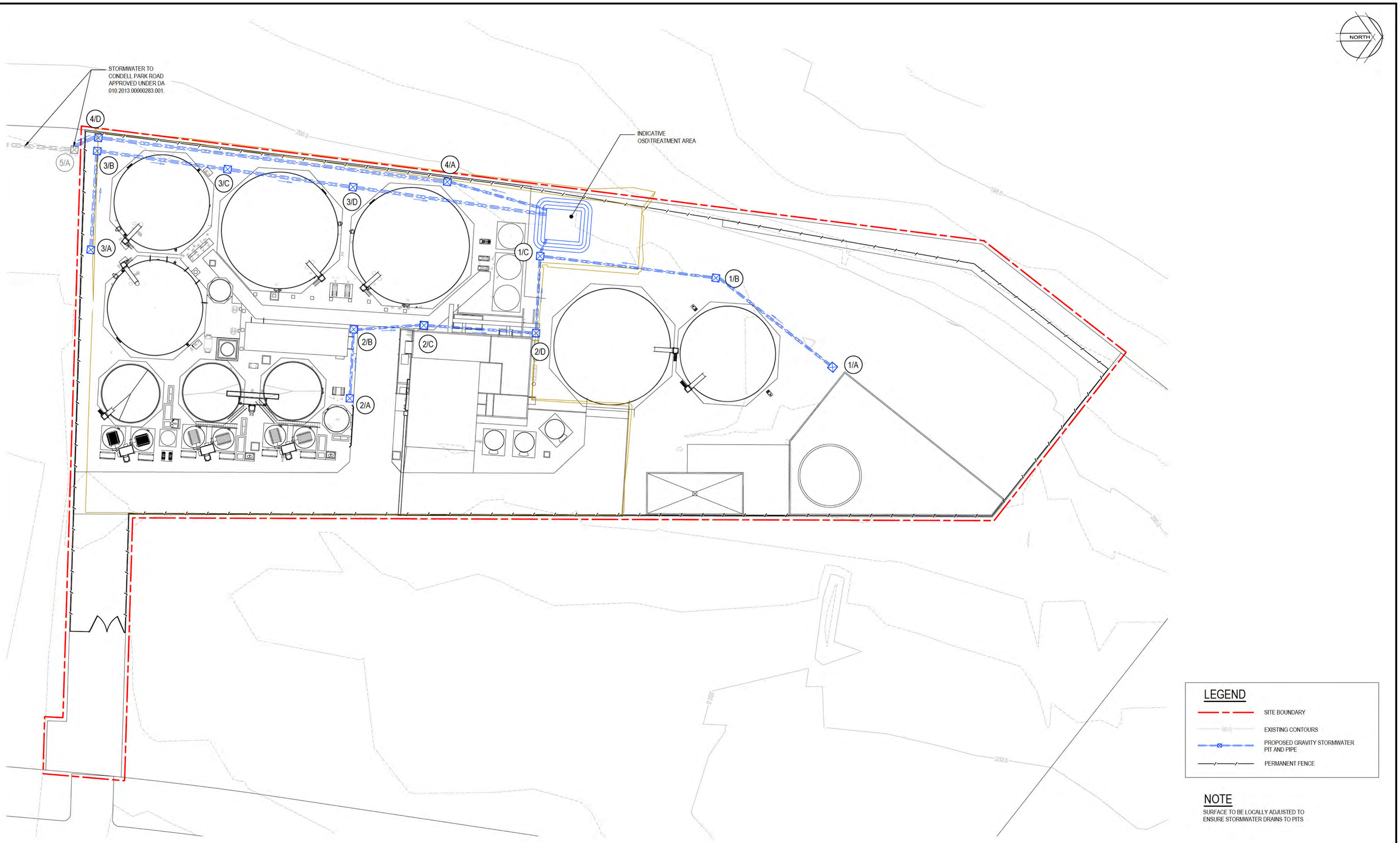
DATUM	Scale	Size
AHD	1:150	A1

Drawing Number: 82015063-002-C1008

Revision: 1

DATE PLOTTED: 12 May 2015 11:49 AM BY : FRANK KOLENDA

XREFs: X-82015063-002-T_BLOCK; X-82015063-002-D-BASE; X-82015063-002-D-LOT BOUNDARIES; X-82015063-002-D-STORMWATER; X-82015063-002-E-CONTOURS
CAD File: U:\FY15\063-02_Bingara WWTP - EIS\02_Bingara WWTP - EIS\Drawings\Build\82015063-002-C1009.dwg



CONCEPTUAL DRAINAGE LAYOUT PLAN

SCALE 1:250

Rev.	Date	Description	Des.	Verif.	Appd.
2	8/05/2015	AMENDMENTS TO DRAINAGE	FK	JMK	PCC
1	8/05/2015	ISSUED FOR DA	FK	JMK	PCC

Cardno
Shaping the Future
Cardno (NSW/ACT) Pty Ltd | ABN 95 001 145 035
Level 1, 47 Burelli Street
Wollongong NSW 2500
Tel: 02 4228 4133 Fax: 02 4228 6811
Web: www.cardno.com.au

Drawn	FK	Date 28/04/2015
Checked	PCC	Date 8/05/2015
Designed	FK	Date 28/04/2015
Verified	JMK	Date 8/05/2015
Approved	PCC	8/05/2015

Client: VEOLIA WATER SOLUTIONS AND TECHNOLOGIES

Project: PERMANENT RECYCLED WATER PLANT

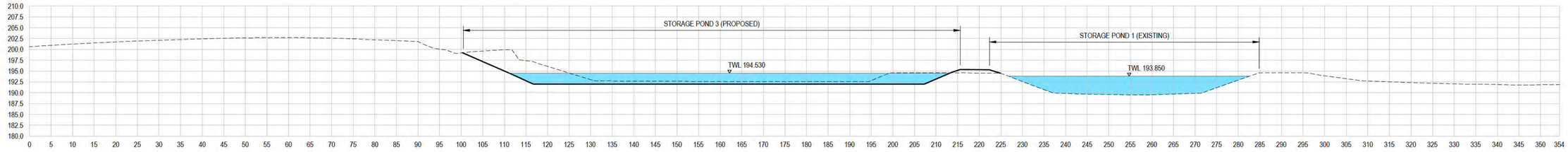
Title: PROPOSED STORMWATER LAYOUT PLAN

Status: FOR APPROVAL
NOT TO BE USED FOR CONSTRUCTION PURPOSES

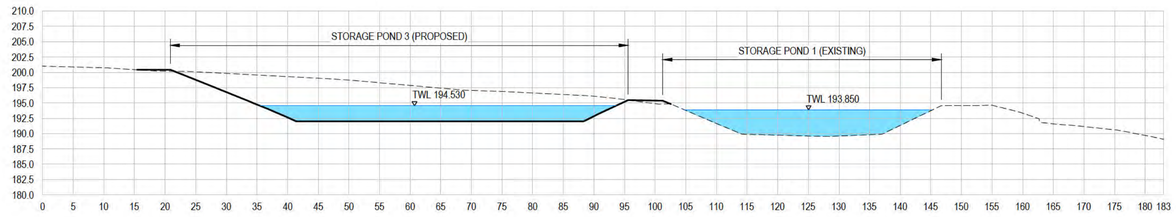
DATUM	Scale	Size
AHD	1:250	A1

Drawing Number: 82015063-002-C1009

Revision: 2



SECTION 1
SCALE 1:500 — C1003



SECTION 2
SCALE 1:500 — C1003

0 10 20 30 40 50m
SCALE 1:500 (A1), 1:1000 (A3)

Rev.	Date	Description	Des.	Verif.	Appd.
1	8/05/2015	ISSUED FOR DA	FK	JMK	PCC

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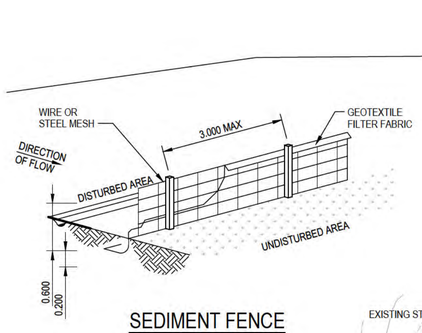
Tel: 02 4228 4133 Fax: 02 4228 6811
Web: www.cardno.com.au

		Date
Drawn	FK	28/04/2015
Checked	PCC	8/05/2015
Designed	FK	28/04/2015
Verified	JMK	8/05/2015
Approved	PCC	8/05/2015

Client: VEOLIA WATER SOLUTIONS AND TECHNOLOGIES
Project: PERMANENT RECYCLED WATER PLANT
Title: TYPICAL POD CROSS SECTIONS
Status: FOR APPROVAL
NOT TO BE USED FOR CONSTRUCTION PURPOSES
DATUM: AHD | Scale: 1:500 | Size: A1
Drawing Number: 82015063-002-C1010 | Revision: 1



SEDIMENT FENCE
SCALE: NTS

SOIL AND WATER MANAGEMENT PLAN
SCALE 1:1000

SHAKE DOWN PAD
SCALE: N.T.S.

SOIL AND WATER MANAGEMENT NOTES

1. PERMANENT BATTERS TO BE TOPSOILED (MIN 0.100m) AND HYDROSEEDED WITH APPROVED SEED MIX.
2. ALL FOOTPATHS AND DISTURBED AREAS TO BE HYDROSEEDED IMMEDIATELY UPON COMPLETION WITH SEED MIX APPROVED BY DEPT LAND AND WATER CONSERVATION.
3. TOPSOIL TO BE STOCKPILED AS SHOWN, WITH SEDIMENT FENCE PLACED DOWNSTREAM TO PREVENT LOSS OF MATERIAL ALL DISTURBED AREAS ARE TO BE SEEDED WITH AN APPROVED SEED MIX.
4. SEEDED AREAS TO BE REGULARLY WATERED TO PROMOTE RAPID GROWTH.
5. ANY REVEGETATED AREAS WHICH FAIL TO ESTABLISH WITHIN THREE MONTHS MUST BE RE-SOWN.
6. ALL SOIL AND WATER MANAGEMENT DEVICES TO BE CHECKED AND MAINTAINED WEEKLY AND AFTER EACH STORM EVENT TO ENSURE OPERATION AND PERFORMANCE.
7. ANY INCIDENTS ON SITE LIKELY TO CAUSE POLLUTION TO BE REPORTED IMMEDIATELY TO THE SUPERINTENDENT.
8. DUST SUPPRESSION EQUIPMENT TO BE AVAILABLE AT ALL TIMES (INCLUDING WEEKENDS, ROSTER DAYS AND PUBLIC HOLIDAYS) TO REDUCE THE EMISSION OF DUST FROM THE SITE.
9. SEDIMENT CONTROL MEASURES TO BE REMOVED WHEN REVEGETATION IS COMPLETE.
10. HAULAGE VEHICLES TO REMAIN ON SEALED ROADS OR DEFINED TRACKS AT ALL TIMES WITHIN THE SITE.
11. BITUMEN DEFLECTORS TO BE PLACED ACROSS ROAD SHOULDER IF FINAL SEAL IS NOT TO BE PLACED IMMEDIATELY.
12. EARTHWORKS AND TRENCHING TO BE STAGED TO KEEP WORK AREAS TO A MANAGEABLE SIZE
13. EXCAVATED MATERIAL FROM TRENCHES TO BE STOCKPILED UPHILL OF TRENCH UNTIL BACKFILLING
14. PUBLIC ROADS TO BE KEPT CLEAR OF DEBRIS AT ALL TIMES.
15. CONTRACTOR TO PROVIDE SHAKER PAD FOR VEHICLES ENTERING/LEAVING SITE.

LEGEND:

- SITE BOUNDARY FOR WASTE WATER TREATMENT FACILITY AND ASSOCIATED TREATMENT PONDS WITHIN INDUSTRIAL LANDS.
- 50.0 — PROPOSED CONTOURS
- 50.0 — EXISTING CONTOURS
- SEDIMENT CONTROL BARRIER (REFER DETAIL)
- PROPOSED STOCKPILE LOCATION
- PROPOSED SHAKE DOWN FACILITY (REFER DETAIL)

0 20 40 60 80 100m
SCALE 1:1000 (A1), 1:2000 (A3)

Rev.	Date	Description	Des.	Verif.	Appd.
1	8/05/2015	ISSUED FOR DA	FK	JMK	PCC

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Level 1, 47 Burelli Street
Wollongong NSW 2500
Tel: 02 4228 4133 Fax: 02 4228 6811
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Drawn	FK	Date 28/04/2015
Checked	PCC	Date 8/05/2015
Designed	FK	Date 28/04/2015
Verified	JMK	Date 8/05/2015
Approved	PCC	8/05/2015

Client: VEOLIA WATER SOLUTIONS AND TECHNOLOGIES
Project: PERMANENT RECYCLED WATER PLANT
Title: SOIL AND WATER MANAGEMENT PLAN
Status: FOR APPROVAL
NOT TO BE USED FOR CONSTRUCTION PURPOSES
DATUM: AHD | Scale: 1:1000 | Size: A1
Drawing Number: 82015063-002-C1011 | Revision: 1

Bingara Gorge Waste Water Treatment Plant – EPL Variation

APPENDIX B
PLANT DESIGN DRAWINGS

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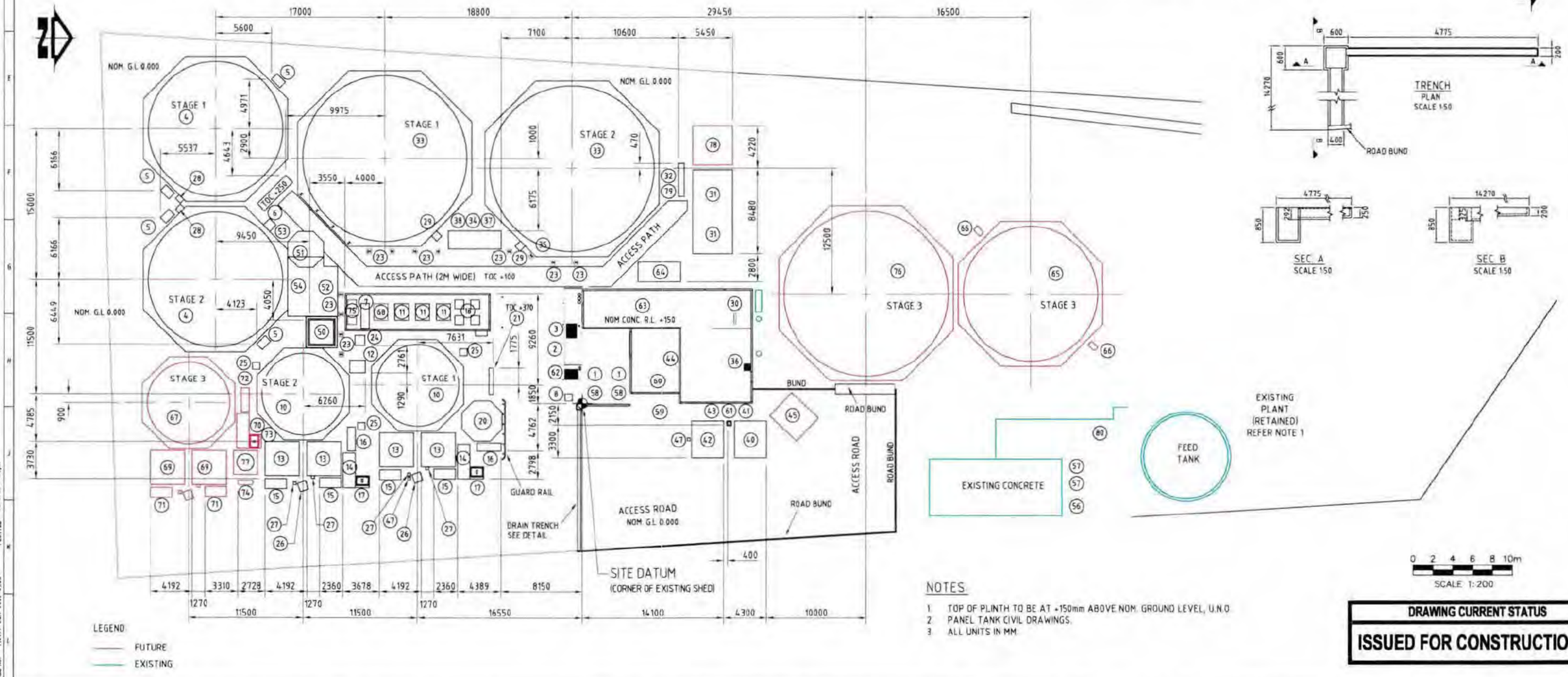
ITEM	EQUIPMENT	QTY	OPERATING LOAD EACH (kgs)	PLINTH DIMENSIONS
1	INLET DRUM SCREEN PLATFORM	1	7500	N/A
2	TRANSFER & RETURN SUMP	1	N/A	REF. A0147-CGA-0010-04
3	EQUALISATION TANK FEED PUMP	2	166	N/A
4	EQUALISATION TANK	2	1040000	STD-TF13.50-002(NOTE 2)
5	EQUALISATION TANK MIXING PUMP	4	170	1200x800
6	ACTIVATED SLUDGE FEED PUMP	4	90	4000x1000
7	COMPRESSORS & DRIER	3	TBA	REF.A0147-CGA-0020-01
8	DRUM SCREEN PLATFORM LANDING	1	TBA	750x700
9				
10	ACTIVATED SLUDGE TANK	2	345000	STD-TF08.25-102(NOTE 2)
11	ACTIVATED SLUDGE BLOWER	3	370	REF.A0147-CGA-0020-01
12	WAS PUMP	2	110	1585x1250
13	BIOSEP	4	4x47200	3430x3430
14	BACKWASH SKID	2		3485x1250
15	FILTRATION SKID	4		2160x995
16	BIOSEP PANEL	2		2400x800
17	BIOSEP CHEMICAL BUND	2		REF.A0147-CGA-0020-03
18	MEMBRANE TANK BLOWER	4	510	REF.A0147-CGA-0020-01
19				
20	FILTRATE TANK	1	30000	TBA

ITEM	EQUIPMENT	QTY	OPERATING LOAD EACH (kgs)	PLINTH DIMENSIONS
21	FILTRATE PUMP	2	142	2700x450
22				
23	PIPE SUPPORT FOOTING	12	1600	450x450
24	AIR RECEIVER	1	TBA	1000x1000
25	AS TANK PLATFORM LANDING	3	TBA	750x700
26	BIOSEP PLATFORM LANDING	2	TBA	900x850
27	BIOSEP PLATFORM FOOTING	4	TBA	300x300
28	EQ. TANKS PLATFORM LANDING	2	TBA	700x530
29	TREATED TANKS PLATFORM LANDING	2	TBA	750x700
30	UV UNIT	2	1010	N/A
31	CHLORINATION CONTACT TANK	2	25480	8300x4000
32	CHLORINATED WATER PUMP	2	142	3300x600
33	TREATED WATER STORAGE TANK	2	1550000	STD-TF16.50-102(NOTE 2)
34	RESIDENTIAL PUMP HOLD	2	1400	5300X1800
35	SAMPLE PUMP	1	27	N/A
36	WET RACK	1	200	N/A
37	RESIDENTIAL PUMP	1	HOLD	N/A
38	RESIDENTIAL PUMP (FUTURE)	1		N/A
39				
40	SOD. HYPO. STORAGE TANK	1	12300	3700x3200

ITEM	EQUIPMENT	QTY	OPERATING LOAD EACH (kgs)	PLINTH DIMENSIONS
41	SOD. HYPO. DOSING PUMP SKID	2	215	N/A
42	FERRIC STORAGE TANK	1	15250	3700x3200
43	FERRIC DOSING PUMPS SKID	1	215	N/A
44	POLYMER SYSTEM	1		N/A
45	ACETIC ACID STORAGE TANK (FUTURE)	1	11350	3700x3200
46				
47	SAFETY SHOWER & EYE WASH	2	50	300x300
48				
49				
50	ODOUR REMOVAL 1	1		
51	ODOUR REMOVAL 2	1		
52	EXTRACTION FAN HOLD	2		
53	DISCHARGE VENT	1		
54	MOISTURE FILTER	1		
55				
56	MACERATOR (EXISTING)	1	EXISTING	EXISTING
57	FEED PUMPS	2	EXISTING	EXISTING
58	DRUM SCREENS SCREW PRESS	2	TBA	N/A
59	DEWATERED SLUDGE CONVEYOR	1	TBA	N/A
60	SLUDGE CENTRIFUGE PLATFORM	1	3700	N/A

ITEM	EQUIPMENT	QTY	OPERATING LOAD EACH (kgs)	PLINTH DIMENSIONS
61	DRAIN PIT	1		300x300x300 (INTERNALS)
62	RETURN PUMP	2	90	N/A
63	SWITCHBOARD	1		9200x800
64	GENERATOR	1	TBA	4200x2000 HOLD
65	EQUALISATION TANK (FUTURE)	1		14500x14500
66	EQ. TANK MIXING PUMP (FUTURE)	2		1200x800
67	ACTIVATED SLUDGE TANK (FUTURE)	1		9280x9280
68	ACTIVATED SLUDGE BLOWER (FUTURE)	1		REF.A0147-CGA-0020-01
69	BIOSEP (FUTURE)	2		3430x3430
70	BACKWASH SKID (FUTURE)	1		3485x1250
71	FILTRATION SKID (FUTURE)	2		2160x995
72	BIOSEP PANEL (FUTURE)	1		2400x800
73	BIOSEP CHEMICAL BUND (FUTURE)	1		REF.A0147-CGA-0020-03
74	FILTRATE PUMP (FUTURE)	2		1500x450
75	MEMB. TANK BLOWER (FUTURE)	2		REF.A0147-CGA-0020-01
76	TREATED WATER STORAGE TANK (FUTURE)	1		TBA
77	FILTRATE TANK (FUTURE)	1		2400x2400
78	CHLORINATION CONTACT TANK (FUTURE)	1		4000x3900
79	CHLORINATED WATER PUMP (FUTURE)	1		N/A
80	FEED PUMP (FUTURE)	1		TBA



TRENCH
PLAN
SCALE 1:50

SEC A
SCALE 1:50

SEC B
SCALE 1:50

NOTES

1. TOP OF PLINTH TO BE AT +150mm ABOVE NOM. GROUND LEVEL, U.N.O.
2. PANEL TANK CIVIL DRAWINGS.
3. ALL UNITS IN MM.

0 2 4 6 8 10m
SCALE 1:200

DRAWING CURRENT STATUS

ISSUED FOR CONSTRUCTION

REV	REVISION	DRAWN	CHECKED	APPROVED	REVISION DATE
D	ISSUED FOR CONSTRUCTION	FM	CVG	AJL	5/05/2015
C	ISSUED FOR REVIEW	FM	CVG	AJL	14/04/2015
B	ISSUED FOR REVIEW	MG	CVG	AL	26/03/2015
A	ISSUED FOR REVIEW	MG	CVG	HL	17/03/2015

DO NOT SCALE THIS DRAWING
IF IN DOUBT ASK
THIRD ANGLE PROJECTION

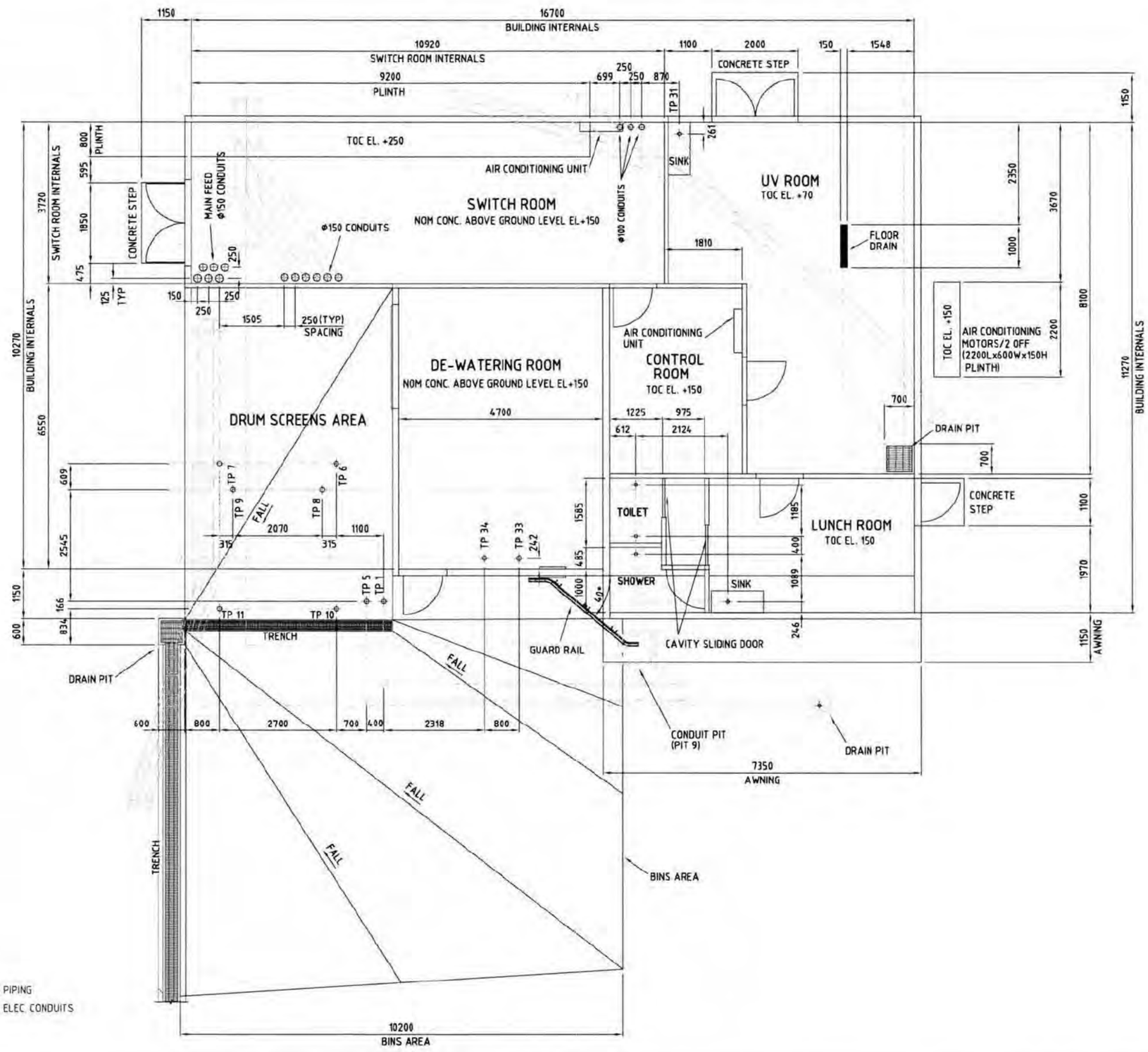
Veolia Water Solutions & Technologies
(Australia) Pty Ltd
(A.B.N. 35 055 254 013)
Level 4, Bay Centre,
65 Pirrama Road
Pyrmont, NSW, 2009
Sydney, Australia
Web: www.veoliawaterst.com.au
Email: systems@veoliawater.com
Tel: 61 2 8572 8600
Fax: 61 2 8572 8610

VEOLIA

DRAWN	FM	DATE	5/05/2015
CHECKED	AJL PFA CA	DATE	5/05/2015
APPROVED	AJL	DATE	5/05/2015
REF DRAWING No.			

CUSTOMER: LEND LEASE
TITLE: CIVIL GENERAL ARRANGEMENT OVERALL SITE PLAN CIVIL GUIDANCE STAGES 1 AND 2
PROJECT REF: BINGARA GORGE - PRWP
LOCATION: WILTON NSW

PROJECT No.	A0147	ESTIMATE No.	
AREA	00		
SCALE	1:200	SHEET	01 OF 01
SIZE	A1		
DRAWING No.	A0147-CGA-0000-01	REVISION	0



LEGEND:

---- U/G PIPING

—·— U/G ELEC. CONDUITS

NOTES:

1. REFER TO A0147-CGA-0000-01 FOR OVERALL CIVIL SITE PLAN.
2. REFER TO A0147-CGA-0010-02 FOR ELEVATION AND ISO VIEWS.
3. ROOF IS NOT SHOWN FOR CLARITY.
4. REFER TO A0147-CGA-0010-03 FOR DETAILS OF DRAINAGE.
5. CHEMICAL STORAGE NOT SHOWN.

0m 1m 2m 3m 4m 5m

SCALE 1:50

DRAWING CURRENT STATUS

ISSUED FOR CONSTRUCTION

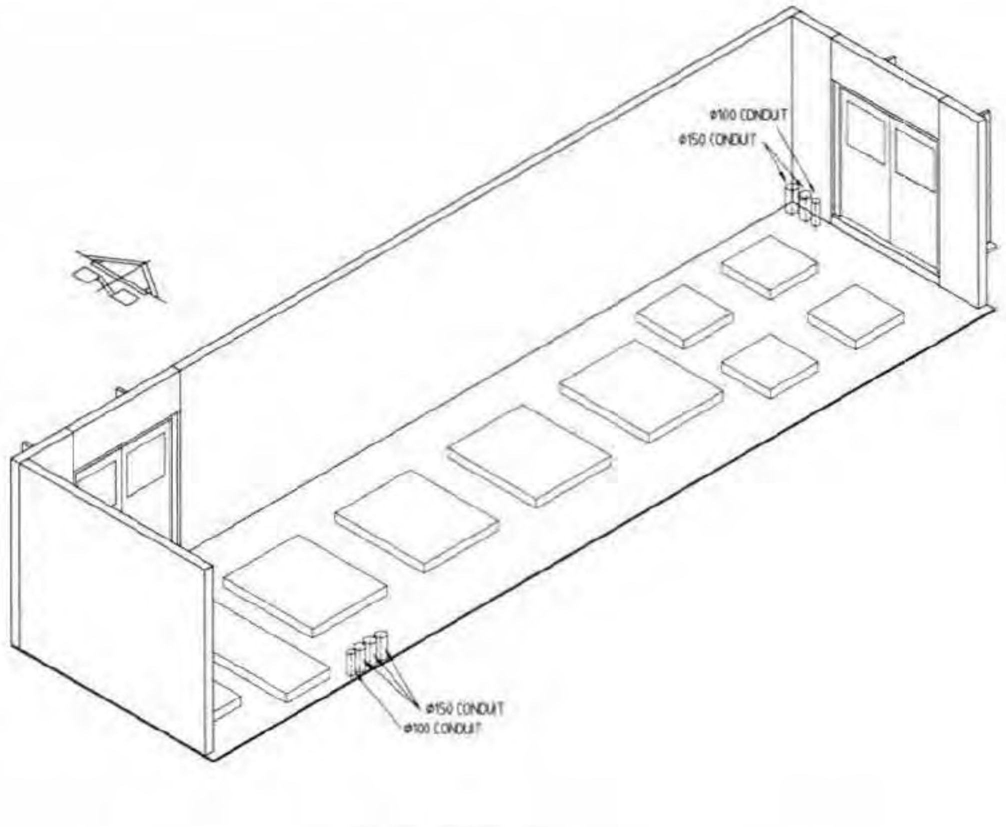
REV	REVISION	DRAWN	CHECKED	APPROVED	REVISION DATE
0	ISSUED FOR CONSTRUCTION	FM	CVG	AJL	4/05/2015
A	ISSUED FOR REVIEW	MG	CVG	AL	20/03/2015

DO NOT SCALE THIS DRAWING
IF IN DOUBT ASK
THIRD ANGLE PROJECTION

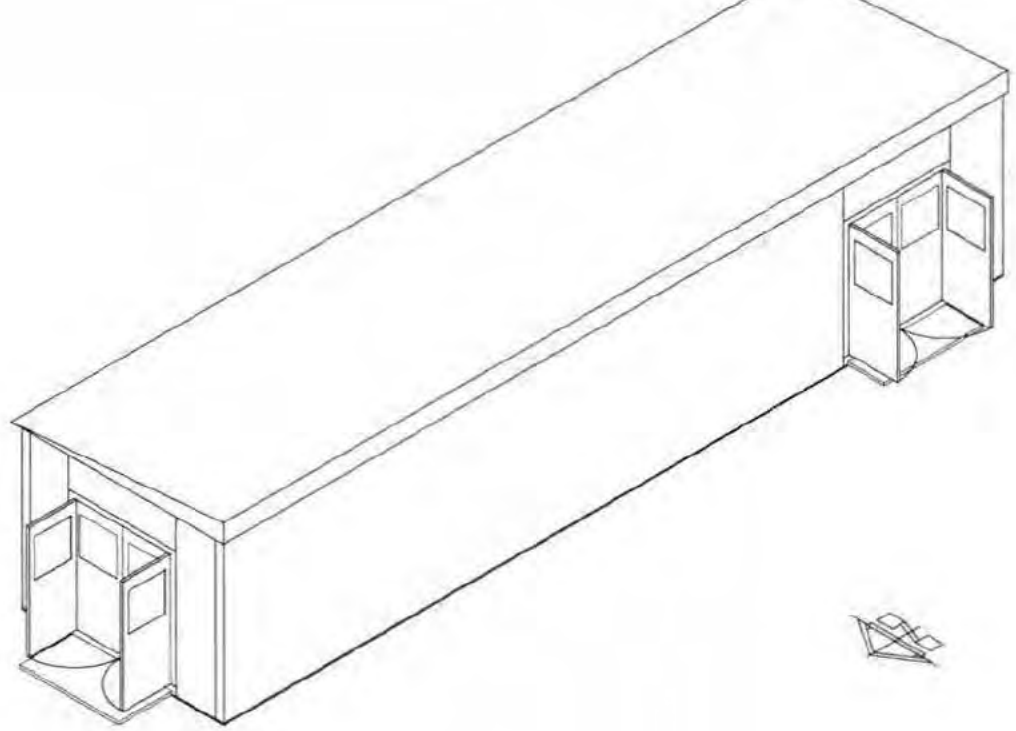
Veolia Water Solutions & Technologies (Australia) Pty Ltd
(A.B.N. 35 095 254 003)
Level 4, Bay Centre,
65 Pirrama Road
Pyrmont, NSW, 2009
Australia.
Web: www.veoliawaterst.com.au
Email: systems@veoliawater.com
Tel: 61 2 8572 0400
Fax: 61 2 8572 0410

VEOLIA

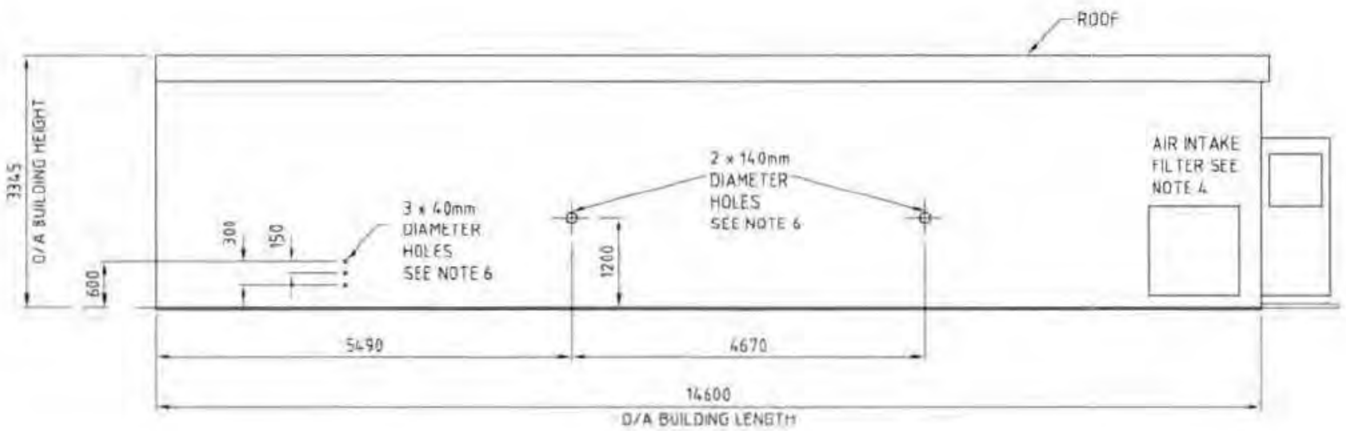
DRAWN: FM	DATE: 4/05/2015	CUSTOMER: LEND LEASE	PROJECT No.: A0147
CHECKED: CVG	DATE: 4/05/2015	TITLE: CIVIL GENERAL ARRANGEMENT PROCESS BUILDING PLAN VIEW	SCALE: 1:50
APPROVED: AJL	DATE: 4/05/2015		SHEET: 01 OF 03
REF DRAWING No.		PROJECT REF: BINGARA GORGE - PRWP	LOCATION: WILTON NSW
			DRAWING No.: A0147-CGA-0010-01
			ESTIMATE No.
			AREA: 10
			SIZE: A1
			REVISION: 0



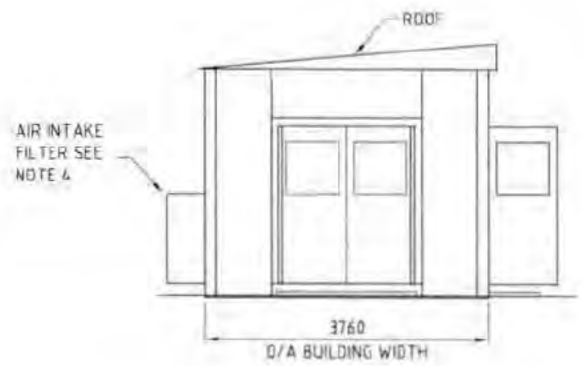
ISOMETRIC VIEW
(OUTER WALL, ROOF AND AWNING OMITTED FOR CLARITY)



ISOMETRIC VIEW



EAST ELEVATION



NORTH ELEVATION

0m 1m 2m 3m 4m 5m
SCALE 1:50

NOTES:

1. REFER TO A0147-CGA-0000-01 FOR OVERALL CIVIL SITE PLAN.
2. REFER TO A0147-CGA-0020-01 FOR PLAN VIEW.
3. ROOF IS IN CONCEPT ONLY. CIVIL DESIGNER TO SELECT APPROPRIATE ARRANGEMENT.
4. NOMINAL SIZE - CIVIL DESIGNER TO CONFIRM SIZE.
5. ROOF DRAINAGE NOT SHOWN - BY CIVIL DESIGNER.
6. ALL WALL PENETRATIONS TO BE CONFIRMED AT SITE PRIOR TO DRILLING WALLS.

DRAWING CURRENT STATUS

ISSUED FOR CONSTRUCTION

REV	REVISION	DRAWN	CHECKED	APPROVED	REVISION DATE
0	ISSUED FOR CONSTRUCTION	NJ	CVG	AL	4/05/2015
A	ISSUED FOR REVIEW	MG	CVG	AL	20/03/2015

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THIRD ANGLE PROJECTION

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(A.B.N. 35 055 254 003)
Level 4, Bay Centre,
65 Pirrama Road
Pyrmont, NSW, 2009
Sydney, Australia
www.veoliawaterst.com.au
systems@veoliawater.com
Tel: 61 2 8572 0400
Fax: 61 2 8572 0410

VEOLIA

DRAWN: NJ	DATE: 1/05/2015	CUSTOMER: LEND LEASE	PROJECT No: A0147
CHECKED: CVG	DATE: 4/5/15	TITLE: CIVIL GENERAL ARRANGEMENT BLOWERS BUILDING ELEVATIONS & ISO VIEWS	SCALE: N.T.S; SHEET 02 OF 03; SIZE A1
APPROVED: AL	DATE: 4/5/15		DRAWING No: A0147-CGA-0020-02
REF DRAWING No:		PROJECT REF: BINGARA GORGE - PRWP; LOCATION: WILTON NSW	REVISION: 0

Bingara Gorge Waste Water Treatment Plant – EPL Variation

APPENDIX C
INFRASTRUCTURE OPERATING PLAN

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Bingara Gorge Waste Water Treatment Plant – EPL Variation

APPENDIX D
WATER BALANCE ASSESSMENT

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****

SUMMARY OUTPUT
MEDLI Version 1.30

Data Set: Bingara Gorge 3
Run Date: 29/04/15 Time:14:33:41.98
****

GENERAL INFORMATION
****
Title: Bingara Gorge 2
Subject: Stormwater Infiltration Ignored
Client: Lend lease
User: Lynn Morrissey
Time: Wed Apr 29 14:30:08 2015
Comments: [no entry]

RUN PERIOD
****

Starting Date 1/ 1/1959
Ending Date 31/12/2014
Run Length 56 years 0 days

CLIMATE INFORMATION
****

Enterprise site: Bingara Gorge -34.3 deg S 150.7 deg E
Weather station: WILTON_34.25S_150.70E

ANNUAL TOTALS	10 Percentile	50 percentile	90 Percentile
Rainfall mm/year	534.	912.	1326.
Pan Evap mm/year	1255.	1387.	1533.

MONTHLY	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rainfall (mm)	86	111	98	76	65	84	44	61	47	73	89	76	906
Pan Evap (mm)	180	142	127	92	65	52	59	84	111	139	157	184	1389
Ave Max Temp DegC	27	27	25	22	19	16	15	17	20	22	24	26	21
Ave Min Temp DegC	16	16	15	12	9	6	5	6	8	10	13	15	10
Rad (MJ/m2/day)	21	19	17	14	11	9	10	14	17	20	21	22	16

MONTHLY IRRIGATION
****

Irrigation (mm)	45	34	33	29	26	21	24	34	37	41	38	50	412

SOIL PROPERTIES
****

Soil type: Low Perm Red Brown Earth

SOIL WATER PROPERTIES

		Layer 1	Layer 2	Layer 3	Layer 4
Bulk Density	(g/cm3)	1.4	1.5	1.5	1.5
Porosity	(mm/layer)	46.4	218.9	271.7	129.1
Saturated Water Content	(mm/layer)	46.0	217.5	268.8	128.4
Drained Upper Limit	(mm/layer)	25.7	160.0	203.4	96.9
Lower Storage Limit	(mm/layer)	8.6	100.5	153.6	78.6
Air Dry Moisture Content	(mm/layer)	4.3			
Layer Thickness	(mm)	100.0	500.0	600.0	300.0

		Profile	Max Rootzone
Total Saturated Water Content	(mm)	660.7	263.5
Total Drained Upper Limit	(mm)	486.0	185.7
Total Lower Storage Limit	(mm)	341.3	109.1
Total Air Dry Moisture Content	(mm)	5.7	4.8
Total Depth	(mm)	1500.0	600.0

Maximum Plant Available Water Capacity		76.6
Saturated Hydraulic Conductivity		
At Surface	(mm/hr)	20.0
Limiting	(mm/hr)	0.5

RUNOFF

Runoff curve No II	75.0

SOIL EVAPORATION

CONA	(mm/day^0.5)	4.0
URITCH	(mm)	10.0

AVERAGE WASTE STREAM
****

Other waste stream
(All values relate to influent after any screening and recycling, if applicable).

Inflow Volume	(ML/year)	220.2
Nitrogen	(tonne/year)	2.2
Phosphorus	(tonne/year)	0.2
Salinity	(tonne/year)	109.9
Nitrogen Concentration	(mg/L)	10.0
Phosphorus Concentration	(mg/L)	1.0
Salinity	(mg/L)	499.0
Salinity	(dS/m)	0.8

WASTE STREAM DETAILS (for last inflow event):

Nitrogen Concentration	(mg/L)	10.0
Phosphorus Concentration	(mg/L)	1.0

TDS Concentration	(mg/L)	499.0
Salinity	(dS/m)	0.8

IRRIGATION WATER
****

Irrigation triggered on a soil water deficit of (mm): 5.0
Irrigating upto upper storage limit + 1 mm

AREA

Total Irrigation Area	(ha)	52.7

VOLUMES

Total Irrigation	(ML/year)	217.4
Minimum Volume Irrigated by Pump	(ML/ha/day)	0.0
Maximum Volume Irrigated by Pump	(ML/ha/day)	7.6
Maximum Vol. Available For Shandying	(ML/yr)	0.0

IRRIGATION CONCENTRATIONS

Average salinity of Irrigation	(dS/m)	0.8
Average salinity of Irrigation	(mg/L)	500.7
Average Nitrogen Conc of Irrigation		
Before ammonia loss	(mg/L)	7.7
After ammonia loss	(mg/L)	6.4
Average Phosphorus Conc of Irrigation	(mg/L)	1.0

FRESH WATER USAGE
****

Irrigation (shandying) water	(ML/yr)	0.00
Avg volume of fresh water used	(ML/yr)	0.00
Annual allocation	(ML/yr)	N/A

POND INFORMATION
****

POND GEOMETRY

		Pond 1
Final pond volume	(ML)	18.9
Final liquid volume	(ML)	18.9
Final sludge volume	(ML)	0.0
Average pond volume	(ML)	22.7
Average active volume	(ML)	22.7

Maximum pond volume	(ML)	80.0
Minimum allowable pond volume	(ML)	5.3
Average pond depth	(m)	1.7
Pond depth at outlet	(m)	6.0
Maximum water surface area	(m2 x1000)	13.3
Pond catchment area	(m2 x1000)	13.6
Pond footprint length	(m)	188.4
Pond footprint width	(m)	72.4

POND WATER BALANCE

Inflow of Effluent to pond system	(ML/yr)	220.2
Recycle Volume from pond system	(ML/yr)	0.0
Rain water added to pond system	(ML/yr)	12.4
Evaporation loss from pond system	(ML/yr)	13.0
Seepage loss from pond system	(ML/yr)	0.5
Irrigation from last pond	(ML/yr)	217.4
Volume of overtopping	(ML/yr)	2.1
Sludge accumulated	(ML/yr)	0.0
Sludge accumulated	(t DM/yr)	0.0
Sludge removed	(ML/yr)	0.0
No of desludging events every 10 years		0.0
Increase in pond water volume	(ML/yr)	-0.4

OVERTOPPING EVENTS

Volume of overtopping (ML/yr)	2.14
No. of days pond overtops per 10 years	36.43
Average Length of overtopping events (days)	9.71
% Reuse	98.81

No. of overtopping events every 10 years

> 0.000 ML	3.75
> 0.005 ML*	3.75
> 1.000 ML	3.21
> 2.000 ML	2.86
> 5.000 ML	1.96
> 10.000 ML	0.71
> 20.000 ML	0.00
> 50.000 ML	0.00

* Volume equivalent to 1 mm depth of water

>>> NO-IRRIGATION EVENTS <<<

%Days rain prevents irrigation		27.5
%Days water demand too small to trigger irr.		38.6
No. periods/year without irrigable effluent		0.0
Average Length of such periods	(days)	0.0

POND NITROGEN BALANCE

Nitrogen Added by Effluent	(tonne/yr)	2.2	Irrig. from pond (ML/yr)	217.4
Nitrogen removed by Irrigation	(tonne/yr)	1.7		
Nitrogen removed by Volatilisation	(tonne/yr)	0.5		
Nitrogen removed by Seepage	(tonne/yr)	0.0		

Nitrogen accumulated in Sludge	(tonne/yr)	0.0
Nitrogen lost by Overtopping	(tonne/yr)	0.0
Nitrogen involved in Recycling	(tonne/yr)	0.0
Increase in pond Nitrogen	(tonne/yr)	0.0

POND PHOSPHORUS BALANCE

Phosphorus Added by Effluent	(tonne/yr)	0.2	Irrig. from pond (ML/yr)	217.4
Phosphorus removed by Irrigation	(tonne/yr)	0.2		
Phosphorus removed by Seepage	(tonne/yr)	0.0		
Phosphorus accumulated in Sludge	(tonne/yr)	0.0		
Phosphorus lost by Overtopping	(tonne/yr)	0.0		
Phosphorus involved in Recycling	(tonne/yr)	0.0		
Increase in pond Phosphorus	(tonne/yr)	0.0		

POND SALINITY BALANCE

Salinity Added by Effluent	(tonne/yr)	109.9
Salinity removed by Irrigation	(tonne/yr)	108.9
Salinity removed by Seepage	(tonne/yr)	0.2
Salinity lost by Overtopping	(tonne/yr)	1.0
Salinity involved in Recycling	(tonne/yr)	0.0
Increase in pond Salinity	(tonne/yr)	-0.2

POND CONCENTRATIONS

		Pond 1
Average Nitrogen Conc of Pond Liquid	(mg/L)	7.4
Average Phosphorus Conc of Pond Liquid	(mg/L)	1.0
Average TDS Conc of Pond Liquid	(mg/L)	487.5
Average Salinity of Pond Liquid	(dS/m)	0.8
Average Potassium Conc of Pond Liquid	(mg/L)	0.0
(On final day of simulation)		
Nitrogen Conc of Pond Liquid	(mg/L)	7.6
Phosphorus Conc of Pond Liquid	(mg/L)	1.0
TDS Conc of Pond Liquid	(mg/L)	498.8
EC of Pond Liquid	(dS/m)	0.8
Potassium Conc of Pond Liquid	(mg/L)	0.0

REMOVED SLUDGE - NUTRIENT & SALT CONCENTRATIONS

Nitrogen in removed Sludge (db)	(kg/tonne)	0.0
Phosphorus in removed Sludge (db)	(kg/tonne)	0.0
Salt in removed Sludge (db)	(kg/tonne)	0.0
Potassium in removed Sludge (db)	(kg/tonne)	0.0

REMOVED SLUDGE - NUTRIENT & SALT MASSES

Nitrogen in removed Sludge	(tonne/yr)	0.0
Phosphorus in removed Sludge	(tonne/yr)	0.0
Salt in removed Sludge (mass bal.)	(tonne/yr)	0.0
Salt in removed Sludge	(tonne/yr)	0.0
Potm. in removed Sludge (mass bal.)	(tonne/yr	0.0

Potassium in removed Sludge (tonne/yr) 0.0

LAND DISPOSAL AREA
****

WATER BALANCE

(Initial soil water assumed to be at field capacity)
(Irrigated up to 34.11% of field capacity)

Rainfall	(mm/year)	906.8	Irrigation Area	(ha)	52.7
Irrigation	(mm/year)	412.6			
Soil Evaporation	(mm/year)	153.7			
Transpiration	(mm/year)	634.2			
Runoff	(mm/year)	38.4			
Drainage	(mm/year)	492.9			
Change in soil moisture	(mm/year)	0.1			

ANNUAL TOTALS

Year	Rain (mm)	Irrig (mm)	Sevap (mm)	Trans (mm)	Runoff (mm)	Drain (mm)	Change (mm)
1959	1104.0	434.4	192.6	623.5	14.6	713.9	-6.3
1960	1014.0	419.9	200.7	586.1	5.4	634.2	7.5
1961	1239.0	389.6	202.6	601.2	81.5	733.4	9.8
1962	1051.0	410.2	38.3	660.6	7.7	761.1	-6.3
1963	1669.0	343.0	37.2	645.8	74.9	1263.5	-9.4
1964	1023.0	519.7	43.3	740.1	395.8	424.8	-61.4
1965	445.0	403.3	42.5	569.7	0.0	227.9	8.2
1966	715.0	400.1	40.2	622.2	39.5	359.6	53.6
1967	911.0	428.2	40.1	699.0	11.8	598.1	-9.7
1968	463.0	404.3	216.0	591.5	0.0	85.1	-25.3
1969	1307.0	331.9	39.8	667.4	41.7	858.2	31.8
1970	771.0	481.4	45.8	796.9	1.1	357.3	51.2
1971	782.0	429.5	44.9	762.4	0.0	447.7	-43.6
1972	962.0	416.8	44.1	774.5	6.5	609.4	-55.6
1973	974.0	369.9	229.2	631.3	1.9	421.1	60.4
1974	1376.0	375.0	39.0	653.2	45.4	1022.1	-8.7
1975	1011.0	455.8	43.2	741.3	68.3	624.7	-10.7
1976	1244.0	424.0	42.5	758.1	1.6	875.6	-9.8
1977	677.0	407.0	233.6	618.6	8.8	274.6	-51.6
1978	1395.0	427.6	42.9	745.2	168.5	820.3	45.6
1979	359.0	398.0	419.1	358.7	0.0	25.7	-46.4
1980	480.0	399.8	396.1	408.8	1.1	56.6	17.2
1981	984.0	404.6	356.8	582.5	5.3	362.0	82.0
1982	453.0	411.5	334.4	502.7	0.3	125.6	-98.5
1983	903.0	414.7	326.8	484.3	48.2	400.1	58.3
1984	1122.0	417.1	42.7	749.4	18.1	689.2	39.8
1985	989.0	346.4	42.0	682.4	0.0	640.3	-29.4
1986	995.0	491.7	43.6	759.9	201.0	521.9	-39.8
1987	1021.0	369.9	42.4	696.2	77.7	504.3	70.3
1988	1345.0	440.8	42.5	724.2	222.1	810.1	-13.0

1989	1031.0	411.4	40.4	685.6	0.9	729.2	-13.7
1990	1413.0	382.2	76.8	656.8	131.5	932.4	-2.4
1991	904.0	441.9	622.8	367.6	80.1	282.5	-7.1
1992	811.0	404.3	174.2	665.0	8.9	344.1	23.1
1993	700.0	424.3	261.1	600.6	0.0	309.8	-47.2
1994	551.0	403.8	57.3	700.1	1.2	181.9	14.2
1995	954.0	415.0	296.9	628.5	34.9	399.1	9.6
1996	806.0	415.7	42.8	736.5	1.1	441.7	-0.3
1997	702.0	409.6	42.9	769.7	5.2	335.6	-41.8
1998	992.0	370.4	41.0	671.6	90.8	508.0	51.1
1999	1019.0	349.4	37.0	638.4	34.1	602.3	56.6
2000	674.0	470.8	38.8	703.3	0.0	463.0	-60.3
2001	710.0	472.7	287.6	612.6	0.0	323.9	-41.5
2002	603.0	406.7	43.5	694.4	1.1	289.4	-18.7
2003	703.0	410.9	283.5	571.5	0.3	210.0	48.6
2004	733.0	411.9	42.3	782.8	0.1	323.6	-4.0
2005	816.0	408.7	39.8	630.3	7.1	531.8	15.5
2006	516.0	410.3	522.6	265.5	0.5	207.7	-69.9
2007	1165.0	397.3	319.3	488.6	66.7	615.4	72.3
2008	875.0	420.8	37.9	692.1	28.1	541.6	-3.9
2009	654.0	435.2	348.6	555.5	0.0	178.0	7.1
2010	1000.0	395.8	351.6	528.5	1.6	512.0	2.0
2011	913.0	420.5	274.5	531.4	12.6	517.5	-2.4
2012	899.0	383.9	37.6	629.1	4.5	612.1	-0.3
2013	1017.0	477.1	342.9	573.3	91.1	492.5	-5.7
2014	834.0	388.6	40.8	697.2	1.9	466.5	16.1

NUTRIENT BALANCE

NITROGEN

Total N irrigated from ponds	(kg/ha/year)	31.7	% of Total as ammonium		80.0
Nitrogn lost by ammonia volat.	(kg/ha/year)	5.1	Deep Drainage (mm/year)		492.9
Nitrogen added in irrigation	(kg/ha/year)	26.6			
Nitrogen added in seed	(kg/ha/year)	0.7			
Nitrogen removed by crop	(kg/ha/year)	84.9			
Denitrification	(kg/ha/year)	0.3			
Leached NO3-N	(kg/ha/year)	0.5			
Change in soil organic-N	(kg/ha/year)	-57.4			
Change in soil solution NH4-N	(kg/ha/year)	0.0			
Change in soil solution NO3-N	(kg/ha/year)	-1.0			
Change in adsorbed NH4-N	(kg/ha/year)	0.0			
Initial soil organic-N	(kg/ha)	3520.0			
Final soil organic-N	(kg/ha)	304.3			
Initial soil inorganic-N	(kg/ha)	55.3			
Final soil inorganic-N	(kg/ha)	0.0			
Average N03-N conc in the root zone	(mg/L)	0.0			
Average N03-N conc below root zone	(mg/L)	0.1			
Average N03-N conc of deep drainage	(mg/L)	0.1			

PHOSPHORUS

Phosphorus added in irrigatn	(kg/ha/year)	4.2	% of Total as phosphate	100.0
Phosphorus added in seed	(kg/ha/year)	0.1		
Phosphorus removed by crop	(kg/ha/year)	3.5		
Leached PO4-P	(kg/ha/year)	0.0		
Change in dissolved PO4-P	(kg/ha/year)	0.0		
Change in adsorbed PO4-P	(kg/ha/year)	0.6		
Average P04-P conc in the root zone	(mg/L)	0.0		
Average P04-P conc below root zone	(mg/L)	0.0		

SOIL P STORAGE LIFE

Year	YearNo.	Tot P stored kg/ha	P leached in year kg/ha
1959	1	1951.4	0.1
1960	2	1960.5	0.1
1961	3	1958.5	0.1
1962	4	1960.8	0.1
1963	5	1963.0	0.1
1964	6	1971.2	0.0
1965	7	1968.3	0.0
1966	8	1970.1	0.0
1967	9	1971.3	0.1
1968	10	1978.7	0.0
1969	11	1974.0	0.1
1970	12	1974.9	0.0
1971	13	1975.6	0.0
1972	14	1981.6	0.1
1973	15	1976.8	0.0
1974	16	1976.4	0.1
1975	17	1977.1	0.1
1976	18	1982.7	0.1
1977	19	1978.5	0.0
1978	20	1978.7	0.1
1979	21	1980.2	0.0
1980	22	1987.3	0.0
1981	23	1983.0	0.0
1982	24	1983.4	0.0
1983	25	1984.2	0.0
1984	26	1988.5	0.1
1985	27	1982.8	0.1
1986	28	1982.8	0.1
1987	29	1982.6	0.1
1988	30	1987.9	0.1
1989	31	1982.2	0.1
1990	32	1982.1	0.1
1991	33	1983.9	0.0
1992	34	1989.8	0.0
1993	35	1984.0	0.0
1994	36	1983.7	0.0
1995	37	1984.1	0.0
1996	38	1989.0	0.0
1997	39	1983.2	0.0

1998	40	1983.0	0.1
1999	41	1982.7	0.1
2000	42	1988.1	0.0
2001	43	1983.7	0.0
2002	44	1983.5	0.0
2003	45	1984.2	0.0
2004	46	1989.3	0.0
2005	47	1983.4	0.1
2006	48	1984.7	0.0
2007	49	1985.4	0.1
2008	50	1989.5	0.1
2009	51	1984.5	0.0
2010	52	1984.9	0.1
2011	53	1984.6	0.1
2012	54	1988.8	0.1
2013	55	1984.4	0.0
2014	56	1984.0	0.0

PLANT

Plant species: Ryegrass pasture

PLANT WATER USE

Irrigation	(mm/year)	413.	Totl Irrigation Area(ha)	52.7
Pan coefficient	(%)	1.0		
Maximum crop coefficient	(%)	0.8		
Average Plant Cover	(%)	61.		
Average Plant Total Cover	(%)	86.		
Average Plant Rootdepth	(mm)	527.		
Average Plant Available Water Capacity	(mm)	77.		
Average Plant Available Water	(mm)	65.		
Yield produced per unit transp.	(kg/ha/mm)	12.		

PLANT NUTRIENT UPTAKE

Dry Matter Yield (Shoots)	(kg/ha/yr)	7650.			
Net nitrogen removed by plant	(kg/ha/yr)	84.	Shoot Concn	(%DM)	1.10
Net phosphorus removed by plant	(kg/ha/yr)	3.	Shoot Concn	(%DM)	0.05

AVERAGE MONTHLY GROWTH STRESS (0=no stress, 1=full stress)

Month	Yield kg/ha	Nitr	Temp	Water Defic	Water Logging
1	767.	0.6	0.2	0.1	0.0
2	614.	0.5	0.2	0.1	0.0
3	685.	0.6	0.1	0.1	0.0
4	562.	0.6	0.0	0.1	0.0

5	469.	0.6	0.0	0.0	0.0
6	416.	0.6	0.1	0.0	0.0
7	513.	0.6	0.2	0.0	0.0
8	612.	0.6	0.1	0.0	0.0
9	687.	0.6	0.0	0.0	0.0
10	761.	0.7	0.0	0.0	0.0
11	744.	0.6	0.1	0.1	0.0
12	821.	0.6	0.2	0.1	0.0

>>> NO-PLANT EVENTS <<<

%Days due to temperature stress	0.2
%Days due to scorching	0.2
%Days due to water stress	1.3
%Days due to nitrogen stress	0.1
No. of forced harvests per year	0.7
No. of normal harvests per year	1.8

SALINITY

Salt tolerance - plant species: tolerant

Average EC of Irrigation Water (dS/m)	0.8	Irrigation	(mm/year)	412.6
Average EC of Rainwater (dS/m x10)	0.3	Rainfall	(mm/year)	906.8
Average EC of Infiltrated water (dS/m)	0.3			
Av. water-upt-weightd rootzone EC(dS/m s.e.)	0.2			
EC soil soln (FC) at base of rootzone (dS/m)	0.8	Deep Drainage	(mm/year)	492.9
Reduction in Crop yield due to Salinity (%)	0.0			
Percentage of yrs that crop yld falls below 90% of potential because of soil salinity	0.0			

Period	ECrootzone sat ext (dS/m)	ECbase in situ (dS/m)	Rel Yield (%)
1959 - 1968	0.20	0.60	100.
1960 - 1969	0.19	0.58	100.
1961 - 1970	0.20	0.61	100.
1962 - 1971	0.21	0.65	100.
1963 - 1972	0.22	0.67	100.
1964 - 1973	0.24	0.80	100.
1965 - 1974	0.22	0.69	100.
1966 - 1975	0.21	0.65	100.
1967 - 1976	0.19	0.59	100.
1968 - 1977	0.20	0.62	100.
1969 - 1978	0.18	0.56	100.
1970 - 1979	0.21	0.65	100.
1971 - 1980	0.22	0.68	100.
1972 - 1981	0.22	0.68	100.
1973 - 1982	0.23	0.75	100.
1974 - 1983	0.24	0.76	100.

1975 - 1984	0.25	0.83	100.
1976 - 1985	0.24	0.81	100.
1977 - 1986	0.26	0.89	100.
1978 - 1987	0.25	0.83	100.
1979 - 1988	0.25	0.84	100.
1980 - 1989	0.22	0.72	100.
1981 - 1990	0.20	0.61	100.
1982 - 1991	0.20	0.62	100.
1983 - 1992	0.19	0.60	100.
1984 - 1993	0.20	0.61	100.
1985 - 1994	0.21	0.66	100.
1986 - 1995	0.22	0.70	100.
1987 - 1996	0.22	0.71	100.
1988 - 1997	0.23	0.74	100.
1989 - 1998	0.23	0.78	100.
1990 - 1999	0.23	0.77	100.
1991 - 2000	0.26	0.90	100.
1992 - 2001	0.26	0.89	100.
1993 - 2002	0.26	0.91	100.
1994 - 2003	0.27	0.93	100.
1995 - 2004	0.26	0.89	100.
1996 - 2005	0.25	0.86	100.
1997 - 2006	0.27	0.91	100.
1998 - 2007	0.25	0.85	100.
1999 - 2008	0.26	0.85	100.
2000 - 2009	0.28	0.98	100.
2001 - 2010	0.27	0.94	100.
2002 - 2011	0.26	0.88	100.
2003 - 2012	0.24	0.81	100.
2004 - 2013	0.24	0.77	100.
2005 - 2014	0.23	0.74	100.

GROUNDWATER
****

Average Groundwater Recharge (m3/day) 711.0
Average Nitrate-N Conc of Recharge (mg/L) 0.1

Thickness of the Aquifer (m) 10.0
Distance (m) from Irrigation Area to where
Nitrate-N Conc in Groundwater is Calculated 1020.0

Concentration of NITRATE-N in Groundwater (mg/L)

Year	Depth Below Water Table Surface 0.0 m	5.0 m	9.0 m
1963	0.0	0.0	0.0
1968	0.1	0.1	0.1
1973	0.1	0.1	0.1
1978	0.1	0.1	0.1
1983	0.1	0.1	0.1

	1988	0.1	0.1	0.1
	1993	0.1	0.1	0.1
	1998	0.1	0.1	0.1
	2003	0.1	0.1	0.1
	2008	0.1	0.1	0.1
	2013	0.1	0.1	0.1
Last	2014	0.1	0.1	0.1

ACKNOWLEDGMENTS
****
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UNCONDITIONAL FINISH

Bingara Gorge Waste Water Treatment Plant – EPL Variation

APPENDIX E

WASTE WATER MANAGEMENT PLAN

Cardno
Shaping the Future

Bingara Gorge Waste Water Treatment Plant – EPL Variation

APPENDIX F
STORMWATER AND SERVICES REVIEW

Cardno
Shaping the Future

Stormwater & Services Report

Insert project name

NA82013045-01 / Report 001 Ver 1

Prepared for
Veolia Pty Ltd

May 2015

Cardno
Shaping the Future

Contact Information

Cardno South Coast
Trading as Cardno (NSW/ACT) Pty Ltd
ABN 95 001 145 035

Level 1, 47 Burelli Street
WOLLONGONG NSW 2500
PO Box 1285
WOLLONGONG NSW 2500

Telephone: 02 4228 4133
Facsimile: 02 4228 6811

www.cardno.com.au

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1	DA Application to Council	JMK		12/05/2015

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1. Introduction

Cardno South Coast has been commissioned by Veolia Pty Ltd to complete a civil, stormwater & service design and associated report for the proposed Wastewater Treatment Plant at the Bingara Gorge industrial lands for development approval purposes. It is proposed to construct a process building, storage tanks, pavement, stormwater drainage infrastructure and associated services utilities as part of the scope of works for the Wastewater Treatment Plant.

This stormwater design employs the principals of Water Sensitive Urban Design (WSUD), with a focus on reducing pollutant export and managing storm flows while improving the visual aesthetics of the urban landscape as a part of the greater concept of Ecologically Sustainable Development. Stormwater quality modelling has been undertaken using the MUSIC 5.0 program as a part of the WSUD treatment train selection process. The water quality improvement devices chosen for the development will reduce post development stormwater pollutant loads in accordance with the objectives in the *Bingara Gorge: Flooding, Stormwater and Water Quality Management Strategy Report (J. Wyndham Prince, Sept 2013).*

The DRAINS stormwater modelling program has been used to determine the peak stormwater flow rates for all Average Recurrence Interval (ARI) storm events up to and including the Q100 ARI event for the post development site. DRAINS has been utilised to establish the increase in peak stormwater flow rates for all ARI storm events and the On-site Detention (OSD) storage volumes required to attenuate these flows back to existing rates.

2. Site Description

The subject site is located at the western extent of Condell Park Road, Bingara Gorge. The subject site is approximately 6,700m^2 and is bounded by the ARTC rail corridor to the east and the Hume Highway to the north.

The site is currently a small wastewater treatment facility, with existing infrastructure consisting of a single wastewater treatment process building (approximately 700m^2 of roof area), formed driveways and storage areas. The remaining site is vacant and clear of any development consisting of grasses. **Figure 1** shows the location of the site and the existing infrastructure.

Site topography is characterised by a small hilltop plateau in the central area of the site. The plateau area has relatively flat grades with slopes between 0% and 3% which gradually increases towards the site perimeter from between 3% and 5%. The site slopes towards the ARTC Rail Corridor to the eastern boundary and the Hume Highway to the west.

Figure 1 – Site Location

3. Site Access & Bulk Earthworks

Access to the subject site will be achieved via a temporary access track that will run from Condell Park Road to the site boundary of the wastewater treatment facility and associated ponds.

A Category F Commercial/Industrial road is proposed to follow the same alignment as the temporary access track. This is currently pending approval under DA number 2013.0283.

The bulk earthworks consist of approximately 44,000 cubic metres cut and 17,300 cubic metres fill. There will be 26,400 cubic metres of excess fill which will be used elsewhere on the Bingara Gorge site. The earthworks will be carried out in stages as per the civil design staging plan.

4. Site Services

The following services will be provided to the site, by the service providers listed below when the main access road in constructed as per pending DA approval 2013.0283.

Service	**Service Provider**
Gas	Jemena
Telecommunications	Telstra
Electricity	Endeavour Energy
Water	Sydney Water
Recycled Water	SoloWater
Sewer	SoloWater

There are existing services located in Condell Park Road and applications will be made to these service providers at detailed design stage.

There are existing services connected to the existing Veolia sewerage treatment plant. These services will be used temporarily for this proposed development.

5. Minor Drainage System

The minor drainage system has been designed for the 10 year ARI design storm spectrum in accordance with Wollondilly Shire Council's (WSC) Specification D5: Stormwater Drainage Design, and the Institution of Engineer's publication *Australian Rainfall and Runoff* (1987). Peak runoff volumes have been calculated using DRAINS stormwater modelling software.

DRAINS is based around the ILSAX hydrological model (loss and routing model). It uses a loss model involving depression storages and the Horton infiltration model for pervious areas, and the time-area method as a routing model to convert rainfall hyetographs to runoff hydrographs.

Peak runoff volumes have been calculated using the DRAINS stormwater modelling software. Interallotment drainage systems have been designed using DRAINS.

6. Major Drainage System

The major drainage system has been designed for the 100 year ARI design storm spectrum in accordance with Wollondilly Shire Council's (WSC) Specification D5: Stormwater Drainage Design, and the Institution of Engineer's publication *Australian Rainfall and Runoff* (1987). Peak runoff volumes have been calculated using DRAINS stormwater modelling software.

Overflows from pits will flow towards the Hume Highway to the west of the site.

All overflow paths meet the V*D requirements safety requirements.

7. Onsite Detention

To meet the objectives of WCC's DCP 2009 OSD will be incorporated into the Site to:

Ensure peak flows discharging from the residential subdivision are kept to pre-development levels

To achieve the Site Storage Requirements (SSR's) for OSD, it is proposed to construct an underground OSD tank receiving flows from pavement and roof areas. These flows will be attenuated to predevelopment rates for all storm events from the 5 year to 100 year ARI events.

The computer model DRAINS was used for hydrologic modelling of the site. DRAINS is an advanced storage-routing model that allows simulation of complex catchment behaviour including storages and diversion of flows. The model is considered effective in determining the minimum storage requirements necessary to achieve no increase in the existing peak flows for events up to the 1% AEP (100 year ARI).

In preparing the DRAINS model, a catchment breakdown of the site was developed such that flows from roof and pavement areas directed to the pipe drainage network are attenuated by the underground OSD tank. Some areas of the site are not able to be efficiently collected by the pipe drainage network and are excluded from the OSD calculation. The flows collected from the roof and pavement areas will receive further attenuation to offset the areas that are not able to be detained. Post development conditions were calculated assuming a 100% impervious fraction. These adopted impervious percentages for the post-development lad use are conservative and consistent with those prescribed in WSC's Stormwater Specification.

Table 1 - Comparison of Peak Flows for the Existing & Developed Scenarios (with OSD)

Catchment	Area [ha]	Scenario	% Impervious	Q5 [m^3/s]	Q10 [m^3/s]	Q20 [m^3/s]	Q50 [m^3/s]	Q100 [m^3/s]	Total SSR [m^3]
WWTP	0.67	Existing	10	0.144	0.183	0.233	0.265	0.303	104
		Developed	100	0.144	0.163	0.185	0.197	0.302	

The results demonstrate that by incorporating 104m^3 of OSD volume into the development, peak flows discharging from the post-developed site can be maintained to at or below the pre-development flow rates. Significant OSD capacity is provided for the roof areas and pavement areas surrounding the proposed process building thereby offsetting the need for OSD for the small areas to the north that are not attenuated. Modelling and results demonstrate that attenuation provided is sufficient in achieving a net reduction in peak flows at the outflow of the site in the developed scenario.

An orifice plate has been sized for the underground OSD system. The orifice plate will be 210mm in diameter at the invert of the underground OSD system limiting flows from the tank to 94 L/sec. A 300mm diameter overflow pipe will be installed at the obvert of the tank and will discharge overflows during the 1 in 100 year and 1 in 50 year event.

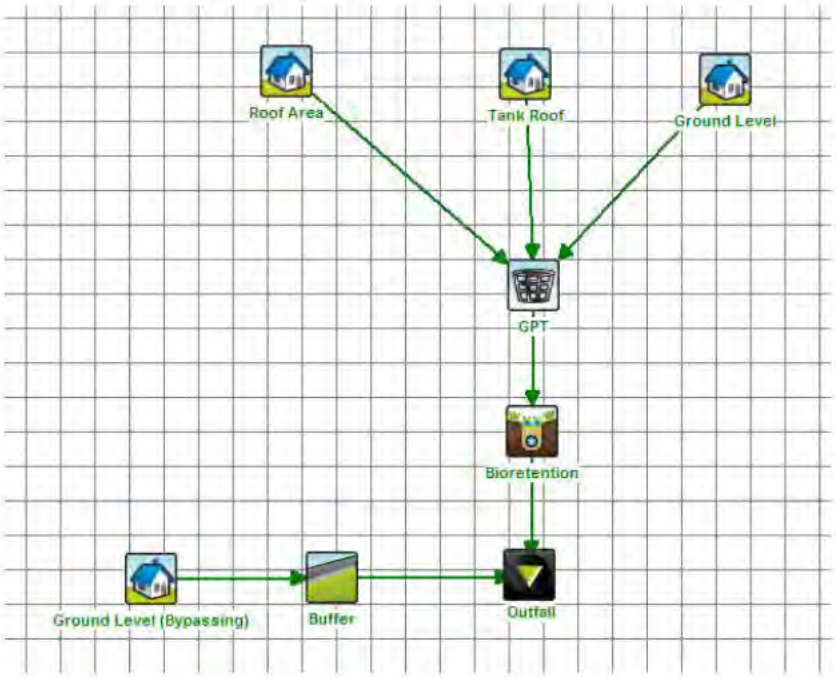
8. Water Quality

In recent years there have been an increasing number of initiatives to manage the urban water cycle in a more sustainable way. A WSUD treatment system consisting of Gross Pollutant Trap (GPT), Bio-retention basin and grassed buffer strips will provide the primary treatment of stormwater before it is discharged from the site.

The stormwater quality analysis for this study was undertaken using the Model for Urban Stormwater Improvement Conceptualisation (MUSIC) Version 5. The model accounts for the portion of the site that will

bypass the proposed GPT and bio-retention basin by providing treatment via a grassed buffer strip. The MUSIC configuration is shown in **Figure 2**.

Figure 2 – MUSIC Model Layout for the WWTP Post Development Site



The adopted annual pollutant loading rates and rainfall runoff parameters used in the modelling are consistent with the published values in the NSW Draft MUSIC Modelling Guidelines (2010) issued by the Sydney Metropolitan Catchment Management Authority.

A 6 minute rainfall data set from Parramatta covering the years 1984-1994 was adopted for the stormwater quality modelling. The Parramatta annual rainfall is 963mm/year and provides a higher average annual rainfall than Bingara Gorge of 805mm/year, providing a conservative modelling approach. **Table 2** provides a summary of the pollutant concentrations for the WWTP.

Table 2 - Summary of Pollutant Concentrations – WWTP Site

Pollutant	Total Catchment Loads (kg/yr)	Total Residual Load from Catchment (kg/yr)	Total Reduction Achieved	Reduction Required	Objective Achieved
TSS	767	146	80.9%	80%	Yes
TP	1.38	0.657	52.5%	45%	Yes
TN	12.3	6.23	49.3%	45%	Yes

The MUSIC modelling demonstrates that the proposed treatment train consisting of a GPT, bio-retention basin and grassed buffer strip will result in total suspended solids, total phosphorus and total nitrogen reductions being above the Upper Nepean River Catchment guideline values.

Based on the stormwater quality modelling results, the following parameters can be applied to the WWTP site.

- Bio-retention basin - 60m^2
- Buffer Strip – Area equivalent to 2.5% of contributing catchment, i.e. 56 square metres required and a buffer strip of 63 square metres is provided
- An alternative system may be considered at the detailed design stage, provided the required water quality targets are achieved.

9. Conclusion & Recommendations

The Stormwater Management Plan for the Wastewater Treatment Plant has been prepared to support a development application for the site.

The SWMP for the development of the site has been prepared in accordance with WSC's Specification D5: Stormwater Drainage Design. Stormwater runoff is to be conveyed using a pit and pipe drainage system which operates within the proposed site.

OSD has been incorporated into the drainage design via and underground OSD tank with a 104m^3 storage capacity. The drainage design is such that there are no adverse effects to adjoining properties or upon the land as a result of stormwater run-off.

The stormwater treatment developed for the site provides reductions in post development stormwater runoff pollutant concentrations entering the inter-allotment drainage design proposed for the Bingara Gorge Industrial Lands. To achieve these improvements stormwater flows from the site are directed to a WSUD treatment system comprising a GPT, bio-retention basin and grassed buffer strips rather than direct discharge off site. Constructability issues on site may require the use of other stormwater treatment options.

It is recommended that:

> An OSD system with an approximate 104m^3 storage volume. Orifice plate / choke pipe be incorporated into the design to effectively attenuate peak flows in the developed scenario

> A GPT unit, bio-retention basin and grassed buffer strips to be installed to provide stormwater treatment. Treatment devices to be assessed for suitability during detailed design. Other treatment options may need to be considered due to site constraints.

10. References

Australian Rainfall & Runoff 1987 (ARR87)

Wollondilly Shire Council Specification D5: Stormwater Drainage Design

DRAINS

Department of Housing Design Manual

Bingara Gorge: Flooding, Stormwater and Water Quality Management Strategy Report

Bingara Gorge Waste Water Treatment Plant – EPL Variation

APPENDIX G
ODOUR ASSESSMENT

Cardno
Shaping the Future

Report

BINGARA GORGE WASTEWATER TREATMENT PLANT ODOUR ASSESSMENT – PRELIMINARY LAYOUT

VEOLIA

Job ID. 20074

23 March 2015

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Pacific Environment Operations Pty Ltd: ABN 86 127 101 642

BRISBANE
Level 1, 59 Melbourne Street, South Brisbane Qld 4101
PO Box 3306, South Brisbane Qld 4101
Ph: +61 7 3004 6400
Fax: +61 7 3844 5858

Unit 1, 22 Varley Street
Yeerongpilly, Qld 4105
Ph: +61 7 3004 6460

ADELAIDE
35 Edward Street, Norwood SA 5067
PO Box 3187, Norwood SA 5067
Ph: +61 8 8332 0960
Fax: +61 7 3844 5858

SYDNEY
Suite 1, Level 1, 146 Arthur Street
North Sydney, NSW 2060
Ph: +61 2 9870 0900
Fax: +61 2 9870 0999

MELBOURNE
Level 10, 224 Queen Street
Melbourne Vic 3000
Ph: +61 3 9036 2637
Fax: +61 2 9870 0999

PERTH
Level 1, Suite 3
34 Queen Street, Perth WA 6000
Ph: +61 8 9481 4961
Fax: +61 2 9870 0999

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CONTENTS

List of Figures

1 INTRODUCTION

Veolia engaged Pacific Environment to perform an odour assessment relating to a proposed expansion of the Bingara Gorge Wastewater Treatment Plant (WWTP). The subject site is shown in Figure 1-1 and the proposed site and plant layout is shown in Figure 1-2. The plant layout is indicative, and has been used to provide an indication of the potential range of odour impact for the site.

The nearest potential sensitive locations can be seen to the east of the subject site in in Figure 1-1. These are the residential allotments and are shown as yellow rectangles.

1.1 Background

Bingara Gorge is a Master planned community with a total site area of 450 hectares. When complete, Bingara Gorge will feature a series of individual villages surrounded by bushland centred around an 18 hole championship golf course.

The WWTP will service the community and will expand the current capacity of the existing WWTP on the site. It proposed to consist of:

- one feed tank (covered)
- three equalisation tanks (covered)
- three treatment tanks (anoxic/aerobic)
- three treated water storage tanks (uncovered)
- a centrifuge with odour extraction
- a dewatered sludge skip with odour extraction
- odour control units:
- one treating air from the equalisation tanks, transfer sumps, dewatering units, screening units, solids conveyers and solids handling skips.
- one from the feed tank (Carbon Filter).

1.2 Objectives of the Study

The objective of the study was to determine the potential odour footprint from the proposed upgraded WWTP with and without the treatment tanks being covered.

1.3 Scope of Work

The scope of work included:

- Modelling meteorology for the site using recognised methods.
- Estimating emissions for the site based on Sydney Water odour emission rate database values.
- Predicting the dispersion of odour using CALPUFF.
- Comparing the predicted concentrations against the New South Wales odour criterion.
- Preparing a report.

Figure 1-1: Subject Site

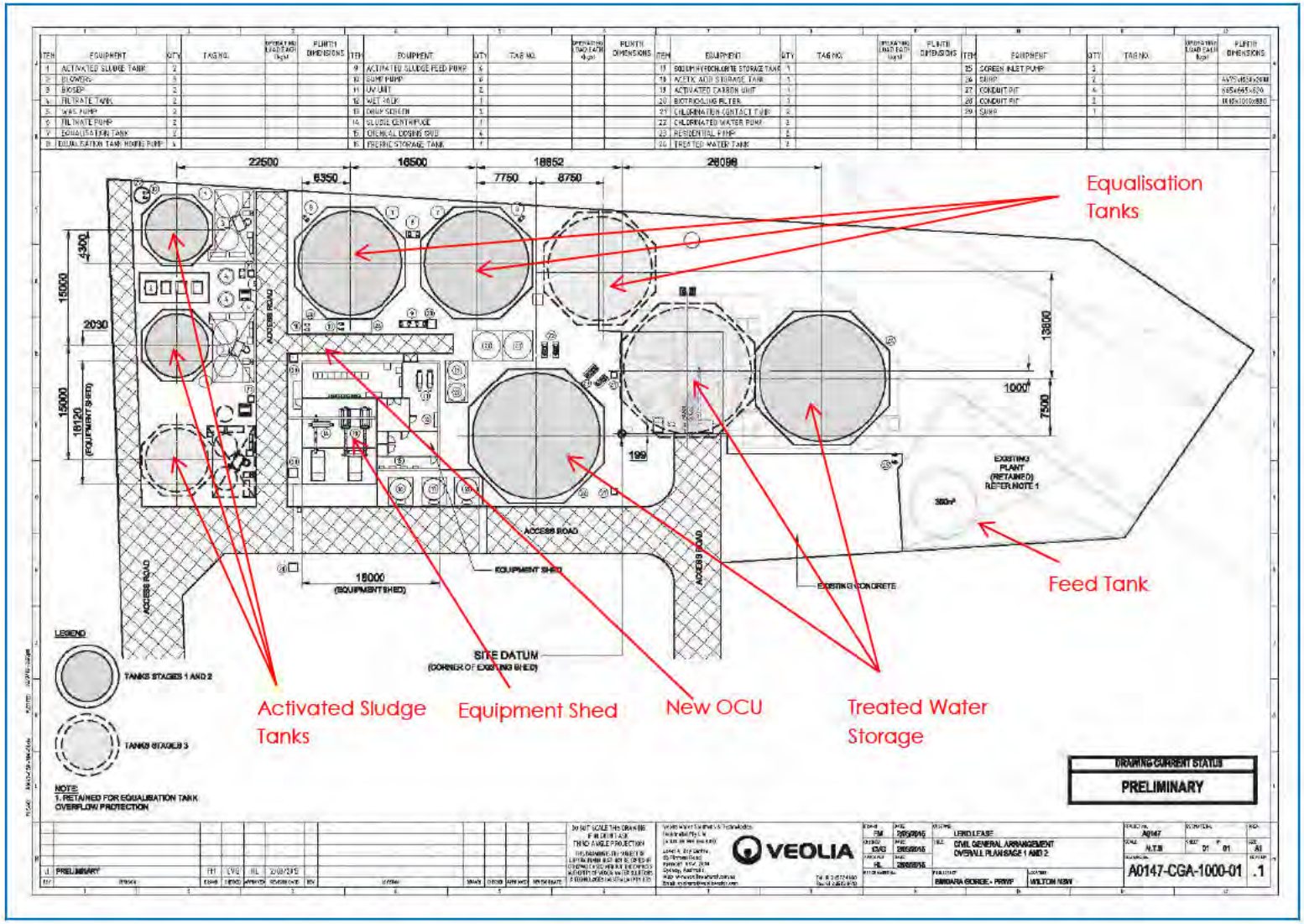


Figure 1-2: Preliminary WWTP Layout

2 ODOUR ASSESSMENT CRITERIA

2.1 Introduction

The determination of air quality assessment criteria for odour (i.e. the setting of suitable odour impact assessment criteria) and the use of the assessment criteria (i.e. evaluation of impacts) are recognised as challenging areas in air quality assessments. The topic has received considerable attention in recent years and the procedures and guidelines for assessing odour impacts using dispersion models have been refined considerably. However, there is still debate in the scientific community about appropriate odour criteria in odour impact assessments with dispersion modelling.

The NSW EPA have developed odour assessment criteria and defined the way in which they should be applied with dispersion models to assess the likelihood of nuisance impact arising from odour emissions.

There are two topics that need to be considered in evaluation of suitable assessment criteria:

- What "level of exposure" to odour is considered acceptable to meet current community standards in NSW?
- How can dispersion models be used to determine if a source of odour meets the criteria which are based on the adopted acceptable level of exposure?

The term "level of exposure" has been used to reflect the fact that odour impacts are determined by several factors, the most important of which are (the so-called FIDOL factors):

- The **F**requency of the exposure.
- The **I**ntensity of the odour.
- The **D**uration of the odour episodes.
- The **O**ffensiveness of the odour.
- The **L**ocation of the source.

In determining the offensiveness of an odour it needs to be recognised that for most odours the context in which an odour is perceived is also relevant. Some odours, for example the smell of sewage, hydrogen sulfide, butyric acid, landfill gas etc., are likely to be judged offensive regardless of the context in which they occur. Other odours such as the smell of jet fuel may be acceptable at an airport, but not in a house, and diesel exhaust odour may be acceptable near a busy road, but not in a restaurant.

In summary, whether or not an individual considers an odour to be a nuisance will depend on the FIDOL factors outlined above and although it is possible to derive formulae for assessing odour annoyance in a community, the response of any individual to an odour is still unpredictable. Odour assessment criteria need to take account of these factors.

2.1.1 Complex Mixtures of Odorous Air Pollutants

The Approved Methods (NSW EPA, 2005) include a ground-level concentration (glc) criterion for complex mixtures of odorous air pollutants. They have been refined by the NSW EPA to take account of population density in the area. Table 2-1 lists the odour glc criterion which applies to the 99th percentile of predicted result concentrations (not to be exceeded more than 1% of the time), for different population sizes/densities at a defined averaging time.

Table 2-1: Odour Performance Criteria for the Assessment of Odour

Population of affected community	Criterion for complex mixtures of odorous air pollutants (ou)
≤ ~2	7
~10	6
~30	5
~125	4
~500	3
Urban (2000) and/or schools and hospitals	2

The different odour criteria are based on considerations of risk of odour impact rather than differences in odour acceptability between urban and rural areas. For a given odour intensity there will be a wide range of responses in the population exposed to the odour. In a more densely populated area there will be a greater risk that some individuals within the community will find the odour more unacceptable than in a sparsely populated area.

Given the potential number of sensitive receptors which may be located in the community around the WWTP, we have adopted the most stringent EPA criterion of $C_{99\ 1\ sec}$ = 2 ou.

2.2 Peak-to-mean Ratios

It is common practice to use dispersion models to determine compliance with odour criteria. This introduces a complication with the NSW EPA criteria for the concentration averaging period of 1 second, since Gaussian dispersion models are only able to directly predict concentrations over an averaging period of one hour. The human nose, however, responds to odours over periods of the order of a second or so. During a 3-minute period, odour levels can fluctuate significantly above and below the mean depending on the nature of the source.

To determine the ratio more rigorously between the one-second peak concentrations and three-minute and longer period average concentrations (referred to as the peak-to-mean ratio) that might be predicted by a Gaussian dispersion model, the EPA commissioned a study by (Katestone Scientific, 1995; Katestone Scientific, 1998). This study recommended peak-to-mean ratios for a range of circumstances. The ratio is also dependent on atmospheric stability and the distance from the source. For this assessment we have assumed a peak-to-mean ratio of 2.3 (to convert from 1 hour averaging periods to 1 second) for all stability classes as all sources are treated as point sources. A summary of the factors is provided in Table 2-2.

Table 2-2: Factors for estimating peak concentrations on flat terrain

Source Type	Pasquil-Gifford stability class	Near field P/M60*	Far field P/M60
Area	A, B, C, D	2.5	2.3
	E, F	2.3	1.9
Line	A – F	6	6
Surface point	A, B, C	12	4
	D, E, F	25	7
Tall wake-free point	A, B, C	17	3
	D, E, F	35	6
Wake-affected point	A – F	2.3	2.3
Volume	A – F	2.3	2.3

*Ratio of peak 1-second average concentrations to mean 1-hour average concentrations

The EPA Approved Methods take account of this peaking factor and the criteria shown in Table 2-1 are based on nose-response time, which is effectively assumed to be 1 second.

3 STUDY APPROACH AND METHODOLOGY

To assess the potential odour impacts associated with the proposed plant expansion, we performed dispersion modelling. This is described below.

3.1 Odour Emissions Estimation

3.1.1 Odour Sources Modelled

There are a number of processes on the site which have the potential to emit odour. These include:

- feed tank
- three equalisation tanks
- three treatment tanks (anoxic/aerobic)
- three treated water storage tanks
- certifuge;
- dewatered sludge skip;
- odour control unit (OCU)
- carbon filtration unit.

Each source is discussed further below with regard for its potential to emit to air.

3.1.1.1 Feed Tank

The feed tank is located towards the northern end of the site. It has a volume of 300 m^3 and holds raw sewage. It is understood that the tank will be covered, with odorous air drawn from the tank being treated using an activated carbon unit. This is discussed further in Section 3.1.1.8.

3.1.1.2 Equalisation Tanks

There will be three equalisation tanks on the site. These will be covered, and the extracted air will be treated using an odour control unit on the site. In line with the Sydney Water (2011) requirements, we have adopted a maximum outlet concentration of 500 ou for the odour control unit.

It is assumed that the covers on the tanks will be 100% efficient.

3.1.1.3 Treatment Tanks

There will be three activated sludge treatment tanks on site, which will consist of both aerobic and anoxic zones. The surface area for the aerobic zone for each tank was modelled at 33 m^2 per tank, and the anoxic zones were modelled with a surface area of 25 m^2 per tank.

The tanks were modelled as both covered and uncovered to assess whether tank covering would be required. When covered, it was assumed that the covers were 100% efficient. Comment with regard to the assumed efficiency of the tank covers is provided below in Section 3.1.2.

3.1.1.4 Treated Water Storage Tanks

Three treated water storage tanks were included in the assessment, each with a surface area of 219 m^2. The tanks will be used to store fully treated effluent and were not covered.

If they were to be covered, the odour emissions from the site would be lower.

3.1.1.5 Equipment Shed

There is an equipment shed on site which will hold the centrifuge. We have assumed that odour from the centrifuge and screening area will be extracted and treated in the main OCU. This does not include the full extraction of the shed.

3.1.1.6 Dewatered Sludge Skip

It is proposed that the dewatered sludge generated by the site will be kept in a skip. For the purposes of the modelling we assumed that the sludge skip would be kept covered, with odorous air drawn out of the skip and treated in the OCU.

3.1.1.7 Odour Control Unit

It has been assumed that the odour control unit used to treat odour from the site will meet the minimum requirements of *Odour Control Unit Standard Specification* (Sydney Water, 2011) with a maximum discharge concentration of 500 ou. The height of the discharge stack was assumed to be 10 m with a diameter of 0.3 m. The modelled exhaust exit velocity was 15 m/s and the exit temperature was set to be ambient, which is conservative as this excludes thermal buoyancy in the modelling.

We note that the emission rate for the odour control unit was based on a design airflow of 18,000 m^3/hr, which is greater than the flow from the 0.3 m diameter stack with a velocity of 15 m/s (equivalent to an air flow rate of 3,817 m^3/hr). Using the design airflow for the emissions estimation achieves a realistic upper odour emission rate combined with a conservative assessment of momentum flux.

3.1.1.8 Carbon Filtration Unit

The carbon filtration unit was located near the feed tank. It is assumed that the carbon filter unit treats 1,000 m^3/hr (0.3 m^3/s). The size of the unit is unknown, however it was assumed that it holds sufficient carbon of a suitable quality to treat the typical loadings on the plant for an extended period.

Although activated carbon is highly efficient in removing sulfide based odours, for conservatism we have assumed an outlet concentration of 500 ou based on the requirements of Sydney Water (2011) for odour control units. It is assumed that the cover over the feed tank will be 100% efficient.

3.1.2 Emission Rate Data

As odour sampling was not performed for this assessment, odour emission rate data were taken from a number of sources. These included:

- the Sydney Water odour emission rate database (including New South Wales sites and Queensland sites including Cairns and Luggage Point)
- data recently collected by Pacific Environment for sites at Hervey Bay (Qld), Murwillumbah (Northern NSW) and Redcliffe (Qld) and also data held for a site in Tasmania.

To analyse the odour emissions data, we put all data into a single dataset grouped by source type. We then extracted the 70th percentile emission rate value for each source type. It is our experience that the 70th percentile typically provides an upper representative range of potential emissions. The alternative of using maximum emission rate values, is often unrealistic.

The emission rate data used in the modelling is shown in Table 3-1 for the area sources and Table 3-2 for the point sources.

Table 3-1: Area Source Emission Rate Data

Source	Odour Emission Rate ou/(m²/s)	Area per source (m²)	Odour Emission Rate ou/(ou/s)	Source	Notes
Activated Sludge Tank	0.25	33	8.3 (aerobic zone)	Odour database. 70th percentile for Activated sludge Aerobic zones	Odour emission rate for each section calculated and added together, then source modelled as one large source per tank
	0.89	25	22.3 (anoxic zone)	Odour database. 70th percentile for Activated sludge Anoxic zones	
Treated Water Tanks	0.11	219	24.1	70th percentile for Sydney water database	Emission rate per tank

Table 3-2: Point Source Emission Rate Data

Source	Airflow (m³/hr)	Exit Concentration	Odour emission rate (ou/s)	Notes
New Odour Control Unit	18,000	500	2,500	Assumed maximum concentration of 500 ou in line with upper limit for OCUs in Sydney Water (2011)
Activated Carbon Unit	1,000	500	139	

The assumptions used in the modelling are as follows:

- Covers were assumed 100% efficient when in use.
- Equipment building contains centrifuge, air is removed and treated.
- Dewatered sludge skip is kept inside the equipment building, air is removed and filtered.
- Odour control unit have a maximum outlet concentration of 500 ou.

3.2 Dispersion Modelling

Dispersion modelling was used to determine the ground level odour concentration for the area surrounding the WWTP.

The dispersion modelling methodology used in this assessment is shown in Figure 3-1 and is discussed further below.

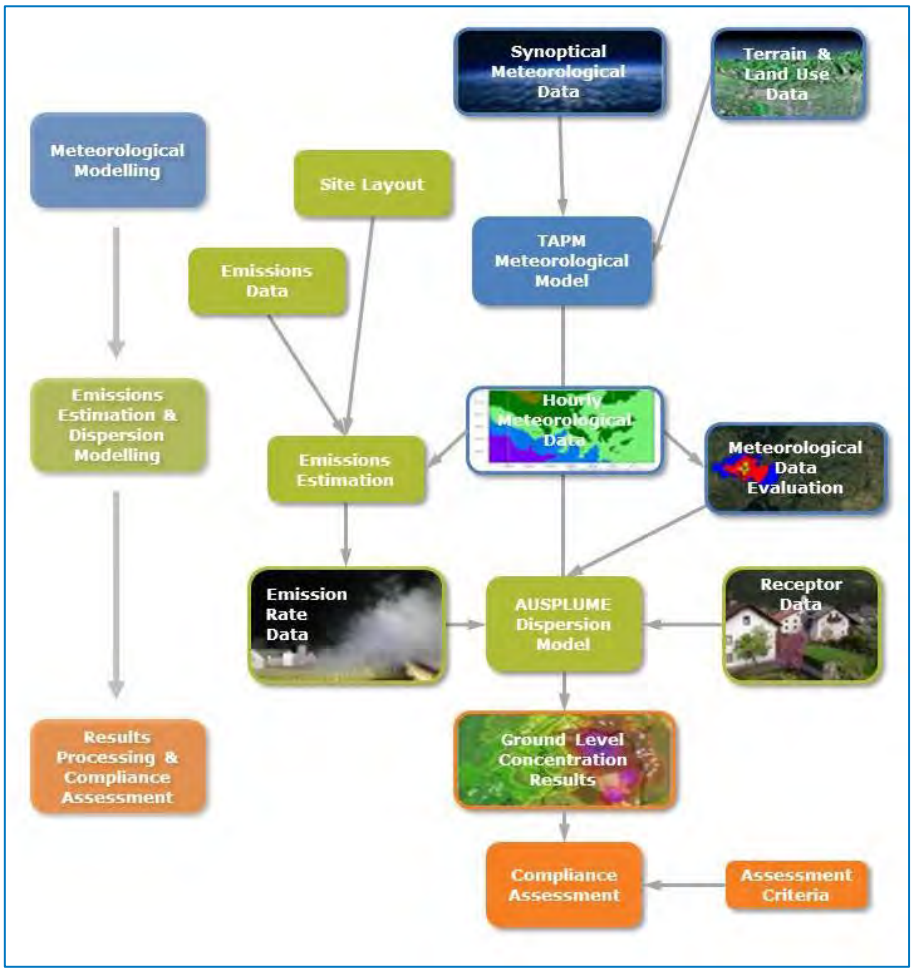


Figure 3-1: Modelling Methodology Used in this Study

3.2.1 TAPM

The closest weather station with readily available data is located approximately 20 km away in an area with different land use and terrain. This means that the data may not be representative of the WWTP location. Considering this we modelled wind patterns in the area using The Air Pollution Model (TAPM) using the 'No Observation' approach outlined in NSW OEH (2011). This method makes use of prognostic meteorological data from TAPM for the study.

TAPM (version 4), is a three-dimensional meteorological and air pollution model developed by the CSIRO Division of Atmospheric Research. The Technical Paper by Hurley (2008a) describes technical details of the model equations, parameterisations, and numerical methods. A summary of some verification studies using TAPM is also given in Hurley *et al*. (2008b). The model predicts airflow important to local scale air pollution, such as sea breezes and terrain-induced flows, against a background of larger scale meteorology provided by synoptic analyses.

The modelling was centred on 34°13.5'S and 150°40.5'E and was configured with a 30 x 30 grid, with an outer spacing of 30 km and 25 vertical levels. In total, four domains were set up with grid spacing of 30 km, 10 km, 3 km and 1 km. This setup is consistent with good practice and the guidance prepared by DEC NSW (2005).

Australian synoptic data for the year 2008 was used. We selected this year as it is representative of long term trends in south eastern Queensland. Surface data was taken from the TAPM v4 database. To

enable the model to spin up, the modelling started on 29 December 2007 and finished on 1 January 2009.

We used TAPM-generated data in the No Observation approach detailed in the *Generic Guidance and Optimum Model Settings for the CALPUFF modelling system for inclusion into the 'Approved methods for the Modeling and Assessment of Air Pollutants in NSW* (NSW OEH, 2011). As noted above, this method was selected due to the distance to the nearest weather station.

3.2.2 CALMET

CALMET is the meteorological pre-processor to CALPUFF and includes a wind field generator containing objective analysis and parameterised treatments of slope flows, terrain effects, and terrain blocking effects. The pre-processor uses the meteorological inputs in combination with land use and geophysical information for the modelling domain to predict a gridded three dimensional meteorological field (containing data on wind components, air temperature, relative humidity, mixing height, and other micro meteorological variables) for the domain used in the CALPUFF dispersion model.

CALMET uses the meteorological data input in combination with land use and geophysical information to predict a gridded meteorological field for the modelling domain. The gridded TAPM generated data were processed in CALMET with fine terrain resolution (100 m grid point spacing) for an outer domain of approximately and an inner domain of approximately 10 km x 10 km domain (with an outer domain of 400 m). This step further resolved the effects of smaller scale terrain features on the wind field.

3.2.3 CALPUFF

CALPUFF is a multi layer, multi species, non-steady state puff dispersion model that can simulate the effects of time and space varying meteorological conditions on pollutant transport, transformation and removal. The model contains algorithms for near source effects such as building downwash, partial plume penetration, sub-grid scale interactions as well as longer range effects such as pollutant removal, chemical transformation, vertical wind shear and coastal interaction effects. The model employs dispersion equations based on a Gaussian distribution of pollutants across released puffs and takes into account the complex arrangement of emissions from point, area, volume and line sources.

In addition to the three-dimensional meteorological data output from CALMET; CALPUFF requires the following input data:

- emission data and plant layout
- receptor information.

CALPUFF is a US EPA regulatory model for long-range transport or for modelling in regions of complex meteorology. It is the preferred dispersion model for use in coastal and complex terrain situations in Australia. Detailed description of CALPUFF is provided in the user manual (TRC, 2006).

The receptor grid for the dispersion modelling of concentration was, as for the meteorological modelling, at a grid spacing of 100 m with additional discrete receptors representing the nearest houses to the site.

As noted above, each source was modelled as either a point or area source using the emission rate data detailed in Section 3.1.

4 METEOROLOGICAL DATA USED IN THE ASSESSMENT

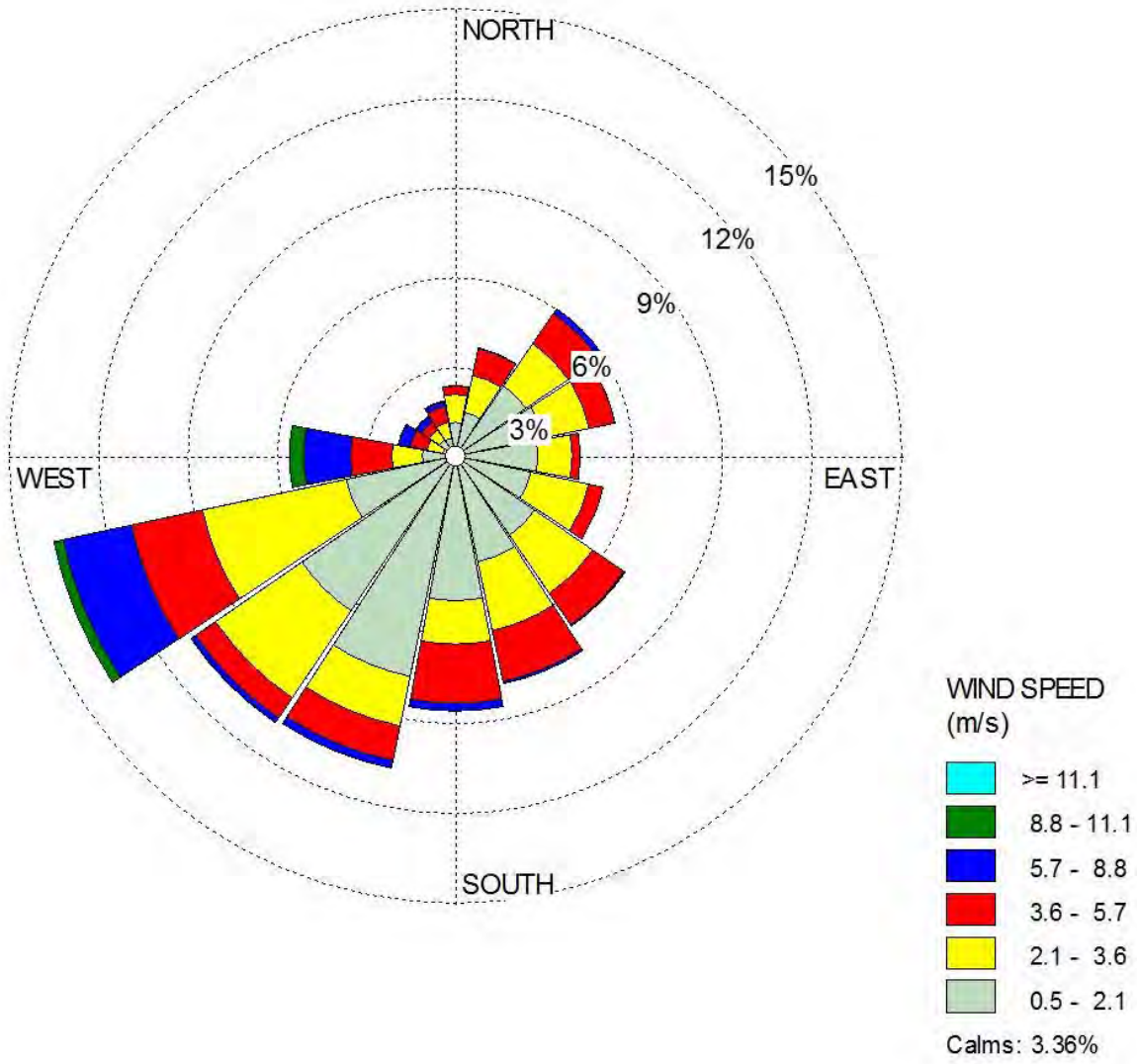
The primary meteorological parameters involved in modelling plume dispersion from WWTPs are wind direction, wind speed, turbulence (atmospheric stability) and mixing height (depth of turbulent layer). The meteorological data used in the dispersion modelling are evaluated below.

4.1 Wind

The wind roses show the frequency of occurrence of winds by direction and strength. The bars correspond to the 16 compass points (north, north-north-east, north-east etc). The bar at the top of each wind rose diagram represents winds blowing from the north (i.e. northerly winds), and so on. The length of the bar represents the frequency of occurrence of winds from that direction, and the colour and width of the bar sections correspond to wind speed categories, as per the legend. Thus it is possible to visualise how often winds of a certain direction and strength occur over any period of time.

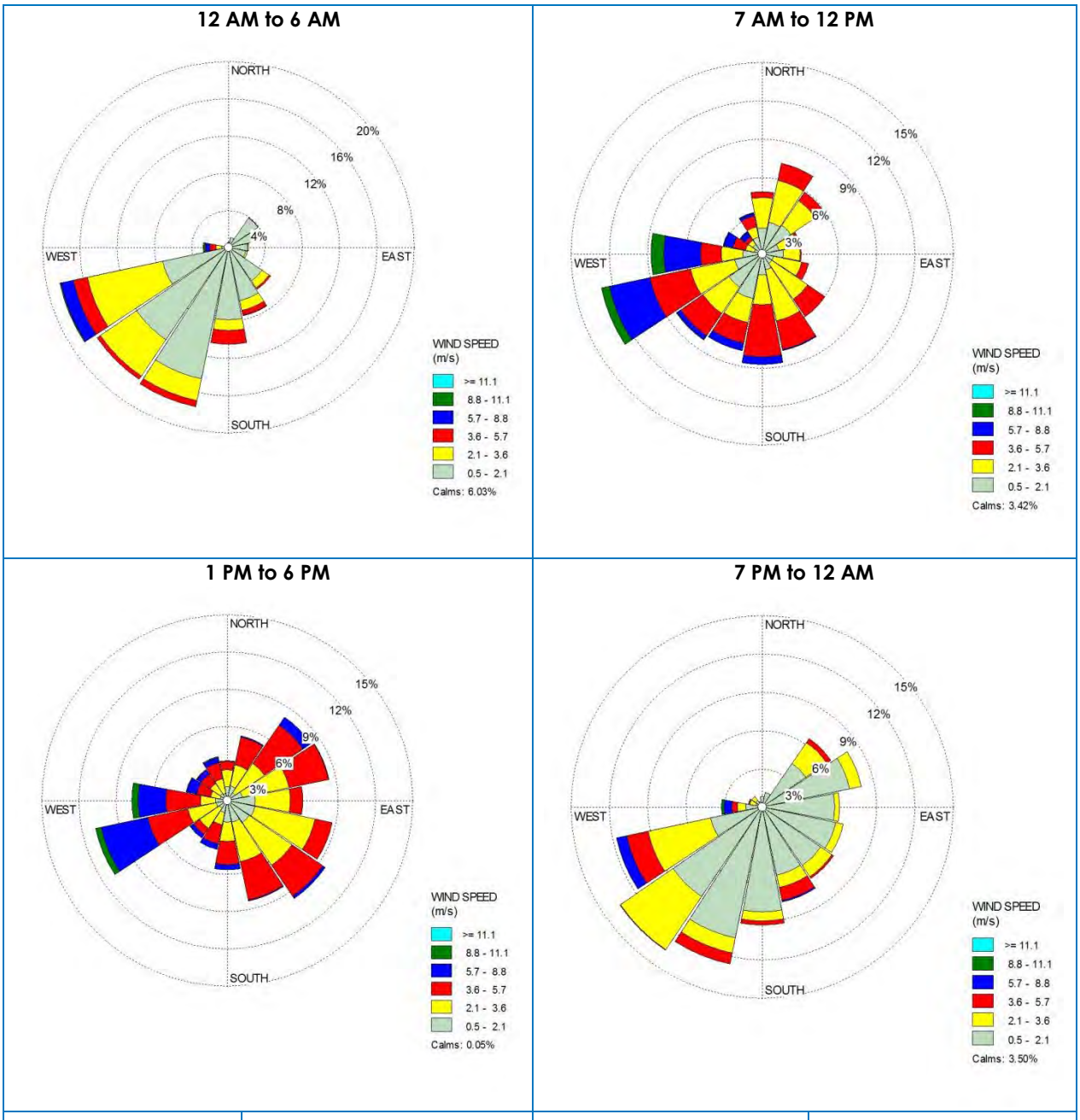
The wind roses plotted from data extracted from CALMET is presented in Figure 4-1 and Figure 4-2. The annual wind rose (Figure 4-1) shows that the prevailing wind direction is from a west-southerly direction which is a reflection of the terrain in the area. In the early morning and at night, the winds are typically from the south west, reflecting terrain-induced flow. During the day, the wind speed increases and is from the east, representing a combination of common synoptic-scale influences and the sea breeze effect.

Overall the wind data show a high frequency of calm to light winds (up to 3 m/s), occurring 69% of the time. The frequency of light winds generated by TAPM is high compared to typical sites in southern Queensland and may be significantly higher than the actual frequency. Hence the wind data should lead to a conservative estimate of impacts (given that light winds are least favourable for odour dispersion).



Location:	Data Period:	Data Type:
WWTP site	2008	CALMET extract
Calm winds:	**Average wind speed:**	**Plot:**
3.4%	2.6 m/s	G. Galvin

Figure 4-1: Wind rose for the site



Time of day	Average wind speed (m/s)	Calm winds frequency %	WIND SPEED (m/s)
12 AM to 6 AM	1.8	6.0	>= 11.1 8.8 - 11.1 5.7 - 8.8 3.6 - 5.7 2.1 - 3.6 0.1 - 2.1
7 AM to 12 PM	3.1	3.4	
1 PM to 6 PM	3.6	0.1	
7 PM to 12 AM	1.8	3.5	

Location:	Data Period:	Data Type:	Plot:
WWTP site	2008	CALMET extract	G. Galvin

Figure 4-2: Time of day wind roses for the WWTP site

The wind speed frequency is shown in Figure 4-3.

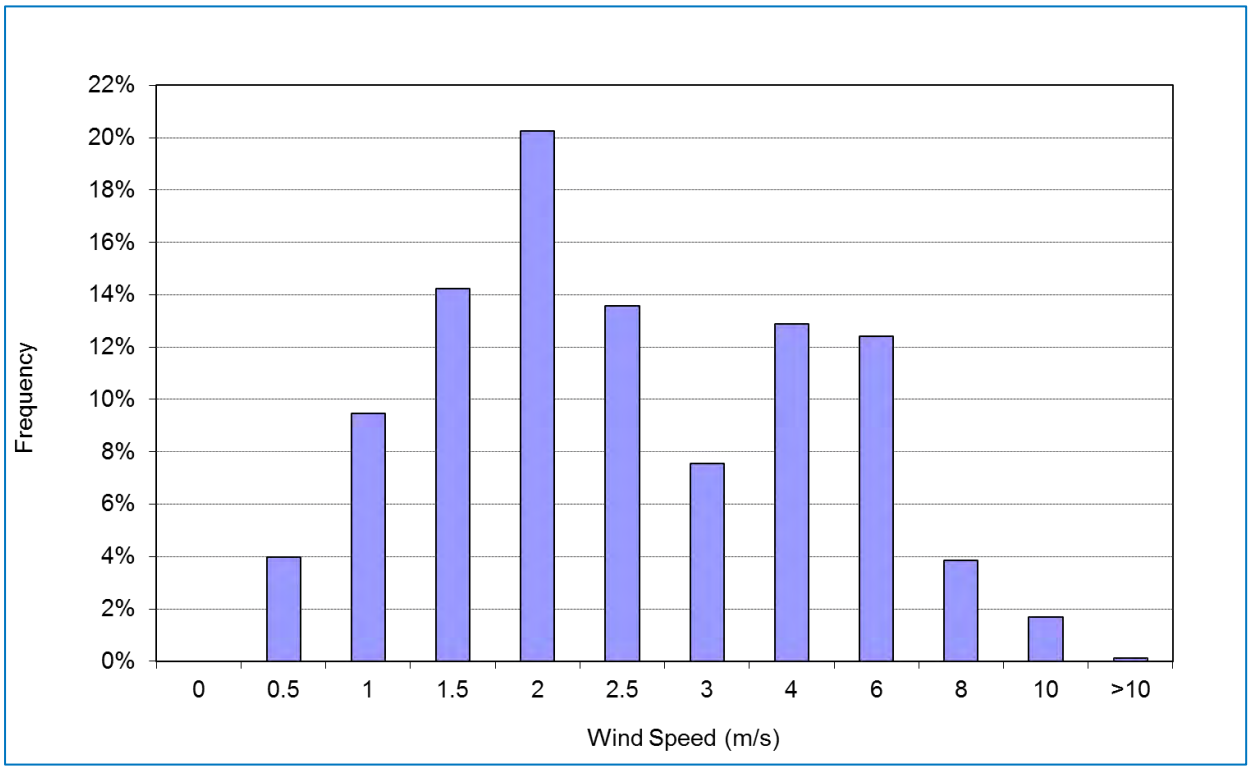


Figure 4-3: Wind Speed Frequency (hourly average)

4.2 Stability

Atmospheric turbulence is an important factor in plume dispersion. Turbulence acts to increase the cross-sectional area of the plume due to random motions, thus diluting or diffusing a plume. As turbulence increases, the rate of plume dilution or diffusion increases. Weak turbulence limits plume diffusion and is a critical factor in causing high plume concentrations downwind of a source, particularly when combined with very low wind speeds.

Turbulence is related to the vertical temperature gradient, the condition of which determines what is known as stability, or thermal stability. For traditional dispersion modelling using Gaussian plume models, categories of atmospheric stability are used in conjunction with other meteorological data to describe atmospheric conditions and thus dispersion.

The most well-known stability classification is the Pasquill-Gifford scheme[a], which denotes stability classes from A to F. Class A is described as highly unstable and occurs in association with strong surface heating and light winds, leading to intense convective turbulence and much enhanced plume dilution. At the other extreme, class F denotes very stable conditions associated with strong temperature inversions and light winds, which commonly occur under clear skies at night and in early mornings. Under these conditions plumes can remain relatively undiluted for considerable distances downwind.

Intermediate stability classes grade from moderately unstable (B), through neutral (D) to slightly stable (E). Whilst classes A and F are strongly associated with clear skies, class D is linked to windy and/or cloudy weather, and short periods around sunset and sunrise when surface heating or cooling is small. As a general rule, unstable (or convective) conditions dominate during the daytime and stable flows are dominant at night. This diurnal pattern is most pronounced when there is relatively little cloud cover and light to moderate winds.

The frequency distributions of stability classes in the CALMET meteorological file are presented in Figure 4-4. The data shows a typical frequency of occurrence of Neutral and Calm stability for inland locations.

[a] A more accurate turbulence scheme within CALPUFF, based on micrometeorological parameters was used for the modelling.

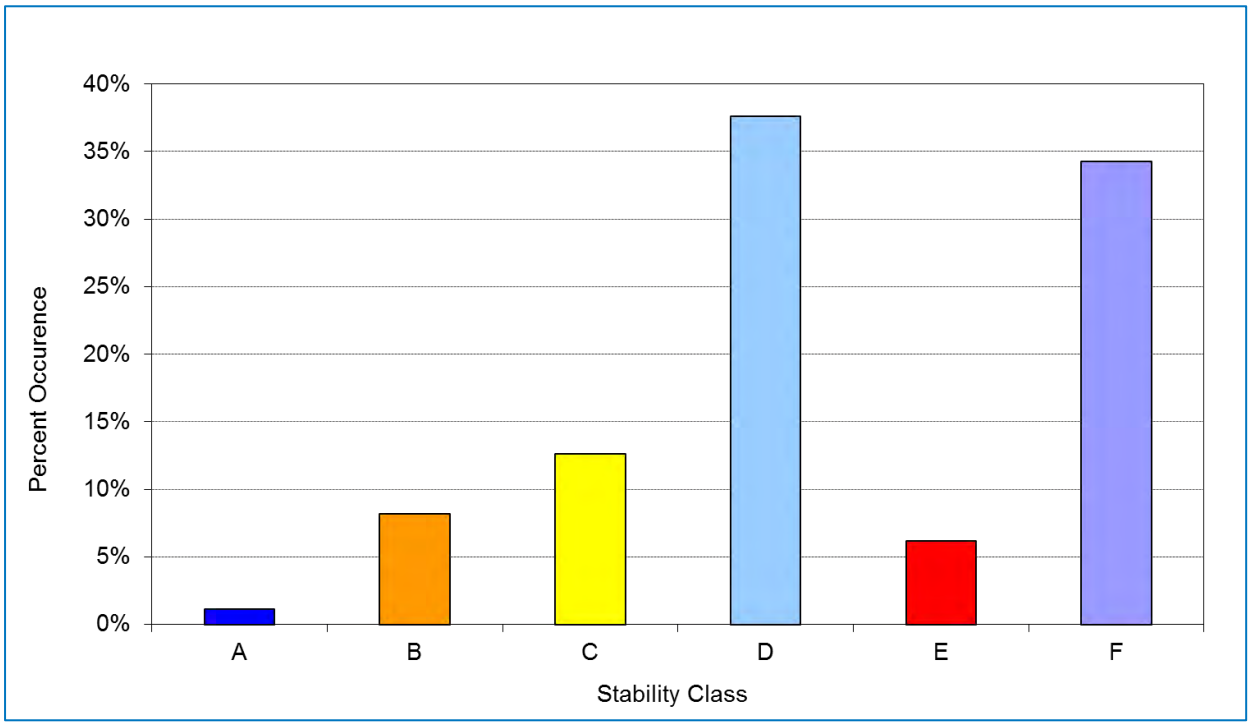


Figure 4-4: Frequency distribution of the estimated stability classes at the WWTP site

4.3 Mixing Height

Mixing height is the depth of the atmospheric mixing layer beneath an elevated temperature inversion. It is an important parameter in air pollution meteorology as vertical diffusion or mixing of a plume is generally considered to be limited by the mixing height. This is because the air above this layer tends to be stable, with restricted vertical motions.

The estimated diurnal variation of mixing height at the site is presented in Figure Figure 4-5. The diurnal cycle is clear in this figure. At night, mixing height is normally relatively low. After sunrise, it increases in response to convective mixing due to solar heating of the earth's surface. The estimated mixing height behaviour is consistent with expectations.

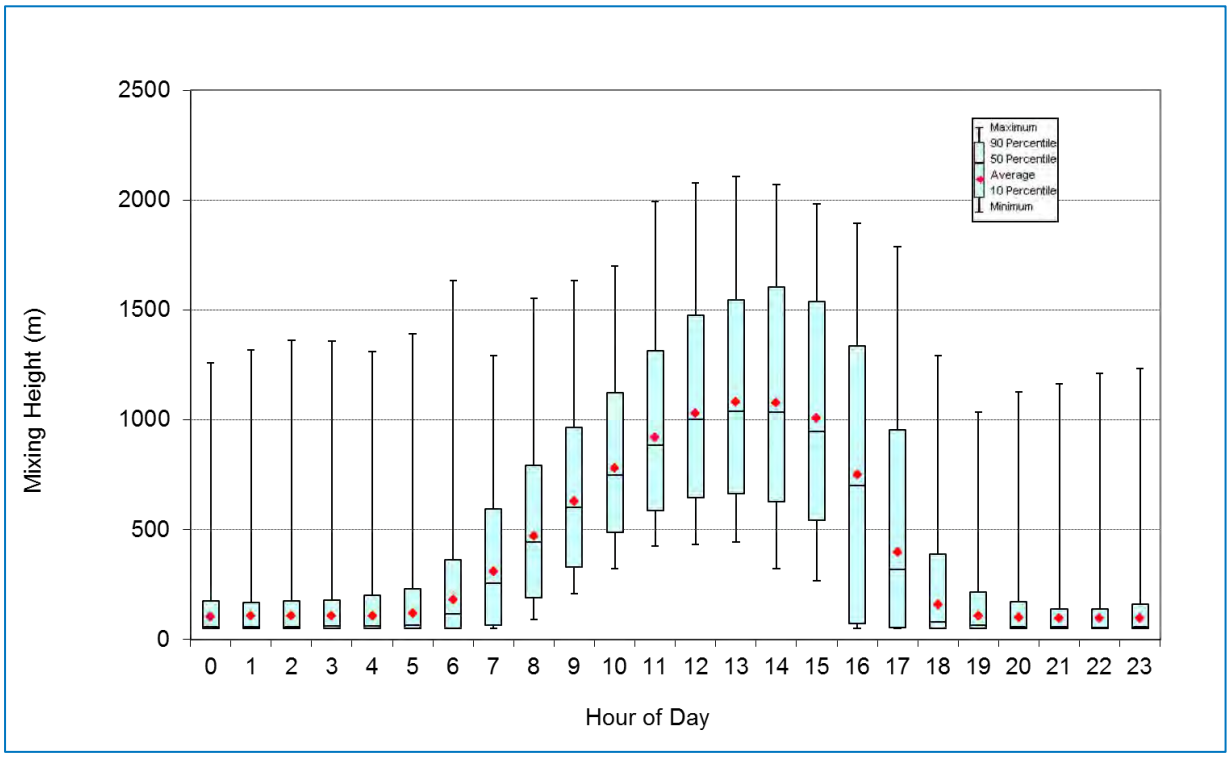


Figure 4-5: Estimated mixing heights at the WWTP site

5 RESULTS

The results from the dispersion modelling are shown below (including peak-to-mean conversion) as follows[b]:

- Figure 5-1 WWTP as proposed – Uncovered treatment tanks
- Figure 5-2 WWTP as proposed – Covered treatment tanks

For clarity, both scenarios have been shown together in Figure 5-3.

Species:	Location:	Scenario:	Percentile:	Averaging Time:
Odour	Bingara Gorge	WWTP with Covered Treatment Tanks	99th	1 sec (incl P/M)
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
CALPUFF v6.42	ou	2 ou Green line	2008 CALMET-Generated	G. Galvin

Figure 5-1: Model Results – Preliminary Layout with Uncovered Treatment Tanks

[b] The white squares are used to indicate the location of the area sources. The larger squares are the location of the treated water tanks, the smaller squares are the locations of the treatment tanks.

Species:	Location:	Scenario:	Percentile:	Averaging Time:
Odour	Bingara Gorge	WWTP with Uncovered Treatment Tanks	99th	1 sec (incl P/M)
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
CALPUFF v6.42	ou	2 ou Red line	2008 CALMET-Generated	G. Galvin

Figure 5-2: Model Results – Preliminary Layout with Covered Treatment Tanks

Species:	Location:	Scenario:	Percentile:	Averaging Time:
Odour	Bingara Gorge	WWTP with Covered Treatment Tanks (red line) Uncovered (green line) Treatment Tanks	99th	1 sec (incl P/M)
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
CALPUFF v6.42	ou	2 ou Green line	2008 CALMET-Generated	G. Galvin

Figure 5-3: Model Results – Preliminary Layout – Both Scenarios

6 DISCUSSION

The model results, based on the odour emission rate data in Table 3-1 and Table 3-2 are shown in Figure 5-1 to Figure 5-3. The emission rate data shown in Table 3-1 and Table 3-2 indicated that for the area source emissions, the odour emission rate from the holding tanks were similar to that from the treatment tanks. This would be expected as the treatment tanks have a smaller area, but a higher emission rate, compared to the treated water tanks, which are larger, but have a lower emission rate.

Overall, the emissions from the site were dominated by the odour control unit. This was expected due to the conservative maximum outlet concentration of 500 ou in combination with the design airflow of 18,000 m^3/hr. In reality, the airflows may be lower, and the outlet concentration will be less. Therefore, the assessment can be regarded as conservative.

The predicted odour concentrations as shown in Figure 5-1 to Figure 5-3 showed:

- The site is expected to comply with the $C_{99\ 1sec}$ = 2ou criterion for both scenarios.
- Covering the treatment tanks is unlikely to significantly change the footprint of the site due to the dominance of the odour control unit emissions.

Given that the layout modelled is preliminary, if the odour control unit emissions were to decrease, the odour impact footprint of the site would also decrease, and still be in compliance. Moreover, if the layout of the treatment tanks or treated water tanks were to change with the OCU remaining in the same position, the site footprint would be unlikely to change due to the magnitude of emissions from the OCU, compared to the emissions from the rest of the site.

7 CONCLUSIONS

The odour emissions used in this assessment were based on the 70th percentile emission rate values of data held by Pacific Environment which included both the Sydney Water database values and other data held by Pacific Environment. The use of upper range of emissions data (like the 70th percentile) means that the emission rates should cover a wide range of possible emission conditions which is conservative.

Dispersion modelling using CALPUFF of predicted odour emissions from the WWTP indicates that the site would meet the most stringent of the NSW Criteria, namely $C_{99\ 1\ sec}$ = 2 ou at nearby receptors, for both scenarios modelled.

The modelling indicated that if sources on the site were to be moved (i.e. treatment and treated water storage tanks), but the OCU were to remain in the same place, the $C_{99\ 1\ sec}$ = 2 ou criterion would still be met at nearby sensitive locations.

8 REFERENCES

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Bingara Gorge Waste Water Treatment Plant – EPL Variation

APPENDIX H
NOISE ASSESSMENT

Cardno
Shaping the Future

Vipac Engineers & Scientists Ltd.
4/5 Leo Lewis Close, Toronto, NSW 2283, Australia
PO Box 306, Toronto, NSW 2283, Australia
t. +61 2 4950 5833 | **f.** +61 2 4950 4276 | **e.** huntervalley@vipac.com.au
w. www.vipac.com.au | A.B.N. 33 005 453 627 | A.C.N. 005 453 627

Vipac Engineers & Scientists

Cardno

Bingara Gorge Wastewater Treatment Plant

Noise Impact Assessment

29N-15-0037-TRP-472739-1

12 May 2015

Report Title: Noise Impact Assessment **Job Title: Bingara Gorge Wastewater Treatment Plant**	
DOCUMENT NO: 29N-15-0037-TRP-472739-1 **PREPARED FOR:** Cardno Level 1, 47 Burelli Street Wollongong, New South Wales, 2500, Australia **CONTACT:** Daniel Thompson **Tel:** +61 2 4231 9603 **Fax:** +61 2 4228 6811	**REPORT CODE:** TRP **PREPARED BY:** Vipac Engineers & Scientists Ltd. 4/5 Leo Lewis Close, Toronto, NSW 2283, Australia **Tel:** +61 2 4950 5833 **Fax:** +61 2 4950 4276

PREPARED BY: Author:	 Lynne Tan **Project Engineer**	Date: 12 May 2015
REVIEWED BY: Reviewer:	 Darragh Kingston **Manager, Hunter Valley/Newcastle** **Team Leader, Acoustic**	Date: 12 May 2015
AUTHORISED BY:	 Darragh Kingston **Manager, Hunter Valley/Newcastle** **Team Leader, Acoustic**	Date: 12 May 2015

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KEYWORDS:

EXECUTIVE SUMMARY

Vipac Engineers and Scientists Ltd (Vipac) was engaged by Cardno on behalf of Veolia to carry out the acoustic assessment of a Proposed Wastewater Treatment Plant (WWTP) at Condell Park Road, Bingara Gorge, Wilton NSW.

The following standards and guidelines were used for this assessment:

- NSW Environmental Protection Agency (EPA) (Office of Environmental and Heritage (OEH)) *Industrial Noise Policy* (INP),
- Australian Standard AS 1055-1997- "*Acoustics Description and Measurement of Environmental Noise, Part 1- General Procedure*".

A noise impact assessment has been undertaken to determine the potential noise impact on noise sensitive receptors in the surrounding area, for the revised design for the proposed Wastewater Treatment Plant, which includes the effects of a new proposed WWTP layout plan and the proposed equipment associated the new design for the proposed WWTP.

The acoustic impact of the proposed Wastewater Treatment Plant is predicted to be within the applicable noise criteria during day, evening and night time criteria for all development/operational stages of the WWTP.

It is therefore Vipac's professional opinion that the proposed Wastewater Treatment Plant (stages 1 - 3) is acceptable from an acoustic point of view.

TABLE OF CONTENTS

1 INTRODUCTION

Vipac Engineers and Scientists Ltd (Vipac) was engaged by Cardno on behalf of Veolia to carry out the acoustic assessment of a Proposed Wastewater Treatment Plant (WWTP) at Condell Park Road, Bingara Gorge, Wilton NSW.

The following standards and guidelines were used for this assessment:

- NSW Environmental Protection Authority (EPA) (Office of Environmental and Heritage (OEH)) *Industrial Noise Policy* (INP),
- Australian Standard AS 1055-1997- "*Acoustics Description and Measurement of Environmental Noise, Part 1- General Procedure*".

The original Noise Impact Assessment report (29N-13-0131-TRP-342369-0, dated 13/12/13) was finalised in December 2013 and submitted as Appendix H with the EIS for the proposed WWTP. Subsequently the NSW EPA issued a notice regarding the EPA's General Terms of Approval (Notice No. 1520584) for the proposed WWTP, dated 21/05/2014. The notice issued by the EPA included a request for clarification on a number of items relating to the Noise Impact Assessment. An amended Noise Impact Assessment report (29N-13-0131-TRP-342369-1) has been prepared in response to the clarification sought by the EPA.

This document presents the findings of a revised operational noise impact assessment, which includes the effects of a new proposed WWTP layout plan and the proposed equipment associated the new design for the proposed WWTP.

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.

Table 1: Definition of Acoustical Terms

Term	Definition
$L_{eq,1hr}$	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.
$L_{A10,1\ hr}$	The noise level, which is equalled or exceeded for 10% of the measurement period of one hour.
$L_{A90,T}$	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.
$L_{Aeq,T}$	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_n	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}%
$L_{A10,18hrs}$	The L_{10} noise level for the time period extending from 6am to midnight.

3 PROJECT DESCRIPTION

3.1 SITE LOCATION

The Bingara Scheme is located at the Lend Lease Communities Bingara Gorge residential development site near the village of Wilton in NSW. The site is located near the intersection of the Hume Highway and Picton Road, approximately 85 km south west of Sydney CBD.

There are three existing receivers (Wilton Village) and future residences (Stage A and Stage B of Bingara Gorge Residential Subdivision) located within a 500-metres radius of the proposed WWTP that may potentially be impacted by the WWTP operations. The Sydney Skydivers base at Wilton Airport Strip is located to the northwest of the proposed WWTP but this is not considered as a noise sensitive receptor. The site location of the proposed Bingara Scheme and surrounding noise sensitive receptors is illustrated in ***Figure 1***.

Figure 1: Locality Plan of Proposed WWTP and Noise Sensitive Receivers

3.2 NOISE SENSITIVE RECEIVERS

A list of the nearest potentially affected noise sensitive receivers to the Wastewater Treatment Plant (WWTP) is provided below in ***Table 2***. The distance is calculated from the boundary of proposed WWTP to the property boundary of noise sensitive receivers.

Table 2: Noise Sensitive Receivers

ID	Property	Location
R1	Wilton Village 1	Approximately 310m to the South of the WWTP
R2	Wilton Village 2	Approximately 260m to the South of the WWTP
R3	Wilton Village 3	Approximately 350m to the South West of the WWTP
R4	Future residence at Stage A	Approximately 260m to the East of the Pump Station
R5	Future residence at Stage B	Approximately 230m to the North-East of the Pump Station

The nearest existing noise sensitive receivers to the proposed WWTP are represented by the assessment locations R1, R2 and R3, illustrated on ***Figure 1***. The proposed future residential dwellings that are to be constructed in the vicinity of the proposed WWTP are represented by the assessment locations R4 and R5, illustrated on ***Figure 1***.

3.3 PROPOSED WASTEWATER TREATMENT PLANT

The proposed Wastewater Treatment Plant will provide sewerage and recycled water services to the Lend Lease Communities of the Bingara Gorge development at Wilton and also to the existing Sydney Water customers in Wilton Village.

The new wastewater treatment plant will be constructed in stages in line with the progressive development of the area. Construction Stage 1 and 2 will be completed in the near future (end of 2015), with Stage 3 design and construction to be initiated as required to service population growth. Details of the wastewater treatment plant and staging are provided in the Sewage Management Plan.

Appendix A shows the layout plan of the proposed Wastewater Treatment Plant for all stages and ***Appendix B*** shows the layout plan of the treatment plant and the evaporation and wet weather storage ponds.

4 EXISTING NOISE ENVIRONMENT

Vipac installed noise logging equipment at one location to measure baseline environmental noise levels at a representative location in the vicinity of the proposed wastewater treatment plant. The location of the monitoring point is listed in ***Table 3*** and shown in ***Figure 1***.

The primary aim of the noise logging survey was to determine the existing environmental noise levels of the potentially affected area and to enable an assessment of the potential noise impacts on the receiving environment.

Table 3: Monitoring Locations

Loc.	Date	Location / Address	Instrument	Serial No.
L1	21/11/13 - 28/11/13	Condell Park Road, Wilton	LD 870	0181

The instrument was programmed to accumulate noise data continuously over sampling periods of 15-minutes for the entire monitoring period. Internal software then calculates and stores the Ln percentile noise levels for each sampling period, which can later be retrieved for detailed analysis.

The instrument was calibrated using a Rion NC-73 calibrator immediately before and after monitoring and showed a maximum error of 0.5 dB.

Table 4 presents a summary of the current ambient noise levels at the site. The results of the noise logging survey over the full duration of the baseline noise monitoring period are provided in ***Appendix C***.

Table 4: Summary of current ambient noise levels - dB(A)

Period	L_{A10}	L_{Aeq}	L_{A90}
Day	57	55	46
Evening	56	53	45
Night	56	53	46

Construction activities were operating during day time period at the Bingara Gorge Subdivision (Stage A) when the noise monitoring was conducted. This is not considered to be representative of a typical activity in the surrounding area and therefore, it is our opinion that the ambient noise levels during day time was not suitable for determining the intrusiveness level. To be conservative, it was recommended to use the evening intrusiveness level as the daytime limit.

The overall ambient noise level in the area (monitoring location L1) was dominated by continuous insect and cricket noise and road traffic noise from the Hume Motorway. Construction noise from Bingara George Subdivision was audible at the monitoring location but was not considered to be a dominant source in the overall ambient noise environment, due to the level of road traffic noise and noise from insects and crickets around the monitoring position. During the site visit, the Vipac Engineer also walked to the end of the cul-de-sac at the western end of Condell Park Road and it was noted that road traffic noise from the Hume Motorway and the off ramp from the motorway became more dominant in the vicinity of the residential property R1, illustrated on ***Figure 1***.

5 CRITERIA

THE EPA (OEH) INP sets limits on the noise that may be generated by the WWTP during the operational stage. These limits are dependent upon the existing noise levels at the site and are designed to ensure changes to the existing noise environment are minimised and deal with the intrusiveness of the noise and the amenity of the environment. The most stringent of the limits is taken as the limiting criterion for the noise source.

The intrusiveness noise criterion requires that the $L_{Aeq,15minutes}$ for the noise source, measured at the most sensitive receiver under worst-case conditions, should not exceed the Rated Background Level (RBL) by more than 5dB, represented as follows:

- $L_{Aeq,15minutes}$ < RBL+ 5dB

Noise levels at nearby noise sensitive receptors (located in the surrounding area) associated with the operational phase of the WWTP should not exceed the Project Specific Noise Levels detailed in ***Table 5.***

The rating background level (RBL) is the overall single figure background level representing each assessment period (day/evening/night) and it is determined by calculating the median value of all the daytime, evening and night-time background levels from the monitoring surveys for each period respectively, as recorded by the noise logger during the course of the baseline survey.

The background ($L_{A90,\ 15\ minute}$) noise levels recorded during the survey ranged between 39 - 53 dB(A) during the daytime period, 37 – 56 dB(A) during the evening period, and ranged between 35 – 56 dB(A) during the night-time period. The rating background levels (RBL) for each period varies depending on the background noise level recorded during the day, evening and night-time periods of the noise logging survey. It is acknowledged that the upper ranges of the background noise levels recorded during the evening and night-time period are relatively high, however, it is considered likely that a significant contributor to the elevated noise levels was due insect noise in the area, and also the influence of road traffic noise from the Hume Motorway.

Table 5: Project Specific Noise Levels at Noise Sensitive Receptors dB(A)

Location	Period	L_{Aeq}	RBL	Recommended Acceptable [1] L_{Aeq}	Intrusiveness Criteria Level	Project Specific Noise Level
R1-R5	Day	55	46	55	51	51
	Evening	53	45	45	50	50
	Night	53	46	40	51	51

[1] Recommended Acceptable L_{Aeq} noise level for residence in Suburban area from Table 2.1 in the EPA Industrial Noise Policy.

6 NOISE MODELLING

Noise modelling has been performed 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®.

6.1 GEOGRAPHICAL DATA

Table 6 below lists the drawings received and used in the noise model.

Table 6: Drawings used

Drawing Title	Description	Received Date
H10053_BG IPART BASE_June13 131121.dxf	Existing Ground elevations and future allotment layout plan of Bingara Gorge Subdivision	27/11/2013
ACAD-E-SURFACE.dxf	Ground Elevation of the proposed WWTP	29/11/2013
ACAD-D-SURFACE.dxf	Modified ground elevation of the proposed WWTP	29/11/2013
A0147-CGA-0000-01 (Rev C)	Civil General Arrangement Overall Site Plan Civil Guidance	14/04/2015
A0147-EGA-0000-02 (Rev A)	Plant General Arrangement Overall Plan	10/04/2015
A0147-EGA-0000-03 (Rev A)	Plant General Arrangement Elevation Views	10/04/2015
A0147-EGA-0000-04 (Rev A)	Plant General Arrangement Elevation Views	10/04/2015
A0147-EGA-0010-01 (Rev A)	Equipment General Arrangement Process Building Plan View	17/04/2015

6.2 NOISE SOURCES

A list of equipment that will be used in the proposed Wastewater Treatment Plant for each stage was provided to Vipac by Cardno. Vipac has identified a number of "noisy" sources, which will potentially impact on the noise sensitive receivers and is listed in ***Appendix D***. The noise emission levels for plant and equipment incorporated into the noise prediction model are also listed in ***Appendix D***.

Vipac has conservatively assumed that the façade of plant room, blower room and pump station will provide a reduction of 10dB. All of the noise sources associated with the Irrigation storage area will be located in the pump station with the exception of the floating transfer pumps, which will be positioned on the irrigation storage pond.

6.3 NOISE MODELLING SCENARIO

Vipac has been advised by Cardno that Stage 1 and 2 of the proposed WWTP will be operating concurrently and Stage 3 operations will be installed at a later stage depending on the future master plan approval.

Hence, two acoustic modelling scenarios were assessed within the SoundPLAN noise modelling package, one scenario for Stage 1 and 2 operations of the proposed WWTP and the second scenario with all stages (Stage 1, 2 and 3) of the proposed WWTP in operation. The operations associated with each of the operational/development scenarios of the WWTP and operational hours of equipment are detailed in ***Appendix E***. Noise modelling was also undertaken for neutral and worst-case weather conditions for two scenarios of the WWTP. The neutral and worst-case conditions that were considered in the noise modelling predictions are described below in ***Section 6.4.***

6.4 WEATHER CONDITIONS

Four acoustic modelling scenarios were run for each of the three WWTP stages within the SoundPLAN program using CONCOWE algorithms under both neutral and worst case weather conditions for the day and night periods. It should be noted that sound will propagate further through the atmosphere under certain weather conditions dependent on air pressure variations, wind speed and direction variations, temperature inversions etc. The 'worst-case' weather conditions chosen were those highly conducive to the propagation of sound.

Table 7 presents the weather parameters used in the CONCOWE calculations based on annual data from the Bureau of Meteorology (BoM) Weather Station at Campbell Town

Table 7: Sound Plan Weather Parameters

Parameter	Day		Evening/Night	
	Neutral	Worst-Case	Neutral	Worst-Case
Pasquill Stability Category	B	D	D	F
Wind Speed (m/s)	0	3	0	3
Humidity (%)	50	50	70	70
Temperature (deg Celsius)	15	15	10	10
Met Category	3	5	4	6

6.5 WWTP OPERATIONAL PHASE – PREDICTED NOISE LEVELS

Noise prediction modelling has been carried out to assess the potential impact associated with the proposed Wastewater Treatment Plant on the existing noise environment at the nearest noise sensitive receptors located in proximity to the site. The predicted noise levels representative of the operational phase of each stage for both neutral conditions and worst-case conditions during day and night time are presented in ***Table 8*** and ***Table 9***.

Table 8: Proposed WWTP Operations (Stage 1+2) - Predicted Noise Impact

Receiver	Day Time (Criteria - L_{Aeq} 46dBA)		Night Time (Criteria - L_{Aeq} 40dBA)	
	Neutral	Worst	Neutral	Worst
R1 - Wilton Village 1	15	22	18	22
R2 - Wilton Village 2	16	22	19	22
R3 - Wilton Village 3	22	29	25	29
R4 - Stage A	38	40	39	40
R5 - Stage B	22	29	25	29

Table 9: Proposed WWTP Operations (Stage 1+2+3) - Predicted Noise Impact

Receiver	Day Time (Criteria - L_{Aeq} 46dBA)		Night Time (Criteria - L_{Aeq} 40dBA)	
	Neutral	Worst	Neutral	Worst
R1 -Wilton Village 1	16	23	19	23
R2 -Wilton Village 2	17	23	19	23
R3 -Wilton Village 3	22	29	25	29
R4 - Stage A	38	40	39	40
R5 -Stage B	22	29	25	29

Noise prediction modelling has been undertaken for each of the two operational stages taking into consideration two scenarios considering both the neutral and worst-case conditions during day time and night time. The difference between the predicted noise levels for each stage was negligible, at approximately 1dB. The slight difference in the predicted noise levels is primarily due to the operations of the floating pump at the wet weather storage pond during Stage 1, which is the dominant noise source.

The predicted noise impact from the proposed Wastewater Treatment Plant on the noise sensitive receivers ranged between 15 to 40dB(A), falling below the applicable criteria during day, evening and night time.

Appendix F and ***Appendix G*** provide the noise contour maps associated with the acoustic modelled scenarios.

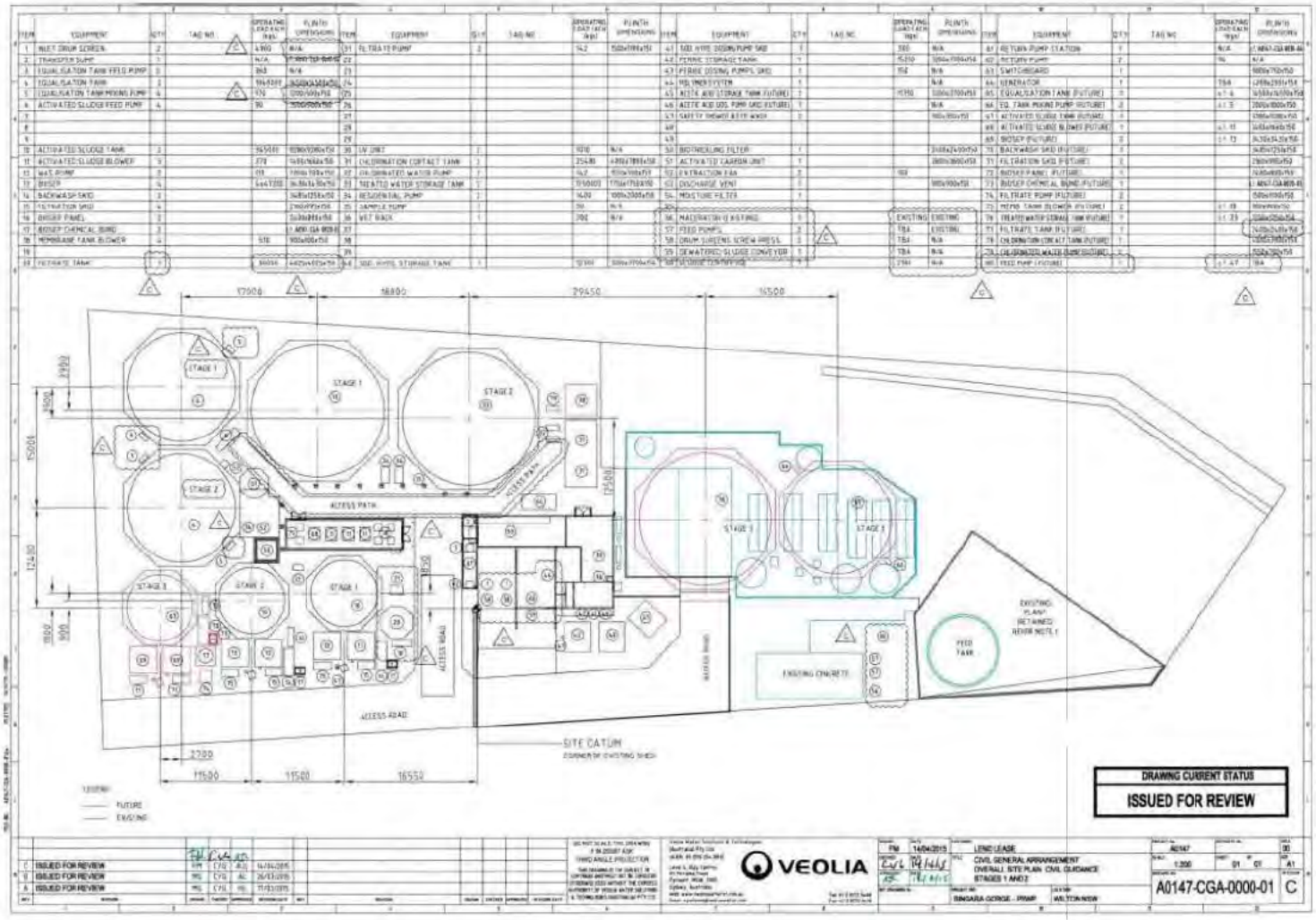
7 CONCLUSION

A noise impact assessment has been undertaken to determine the potential noise impact of the proposed Wastewater Treatment Plant operations on noise sensitive receptors in the surrounding area.

The acoustic impact of the proposed Wastewater Treatment Plant is predicted to be within the applicable noise criteria during day, evening and night time criteria for all development/operational stages of the WWTP.

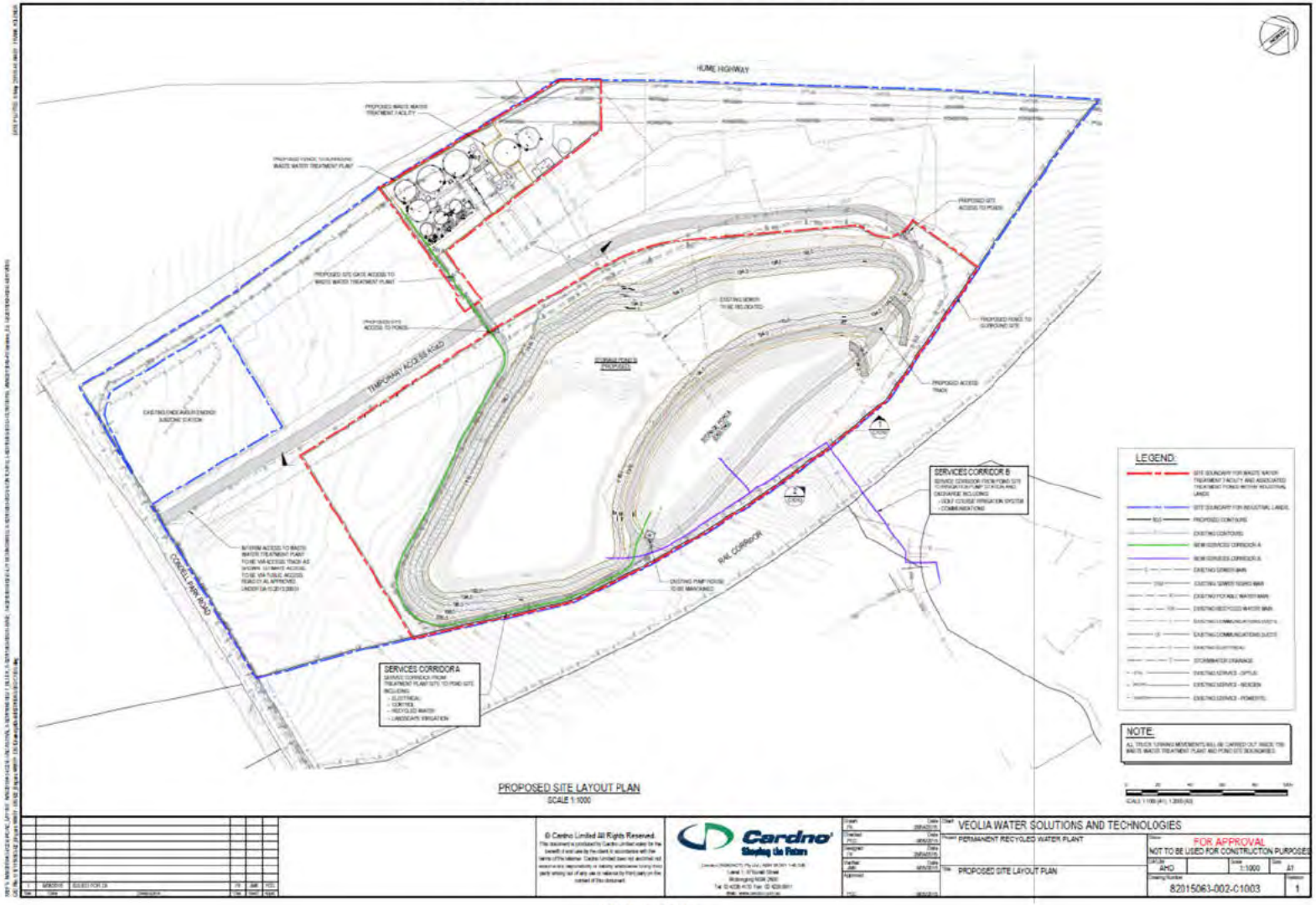
It is therefore Vipac's professional opinion that the proposed Wastewater Treatment Plant (Stages 1 - 3) is acceptable from an acoustic point of view.

Appendix A EQUIPMENT LOCATION



12 May 2015

Appendix B SITE LAYOUT PLAN



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Appendix C NOISE LOGGING SURVEY- MEASUREMENT RESULTS

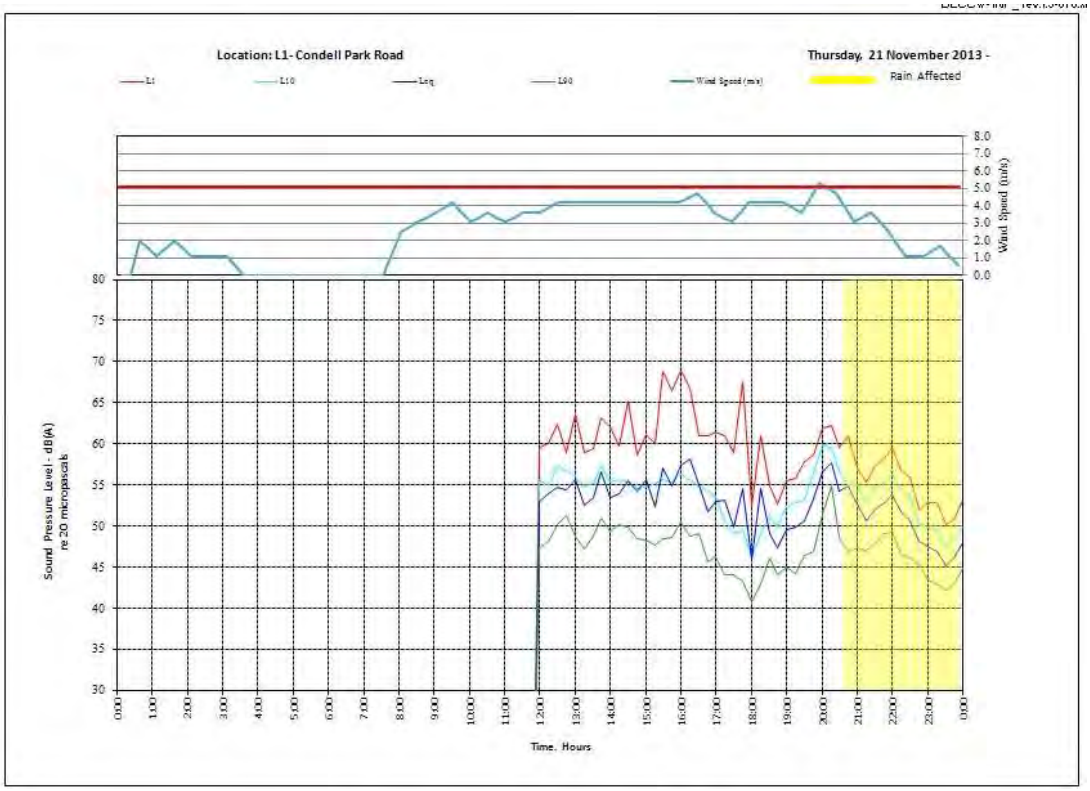


Figure 2: Unattended Noise Results – Day 1

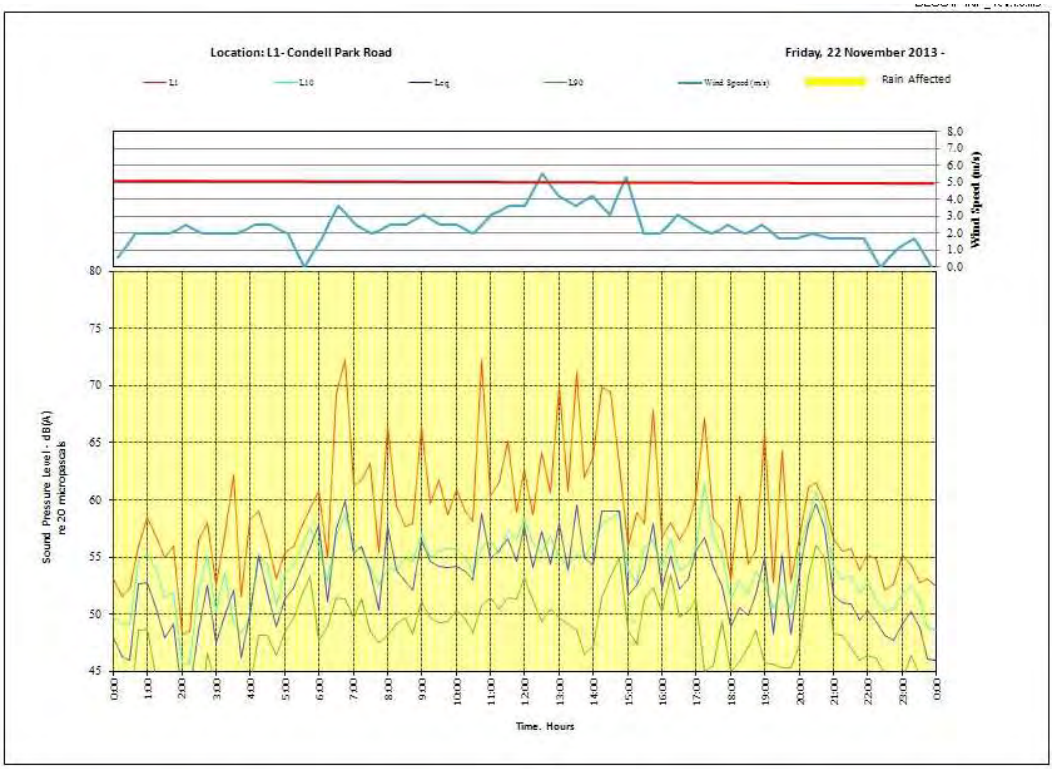


Figure 3: Unattended Noise Results – Day 2

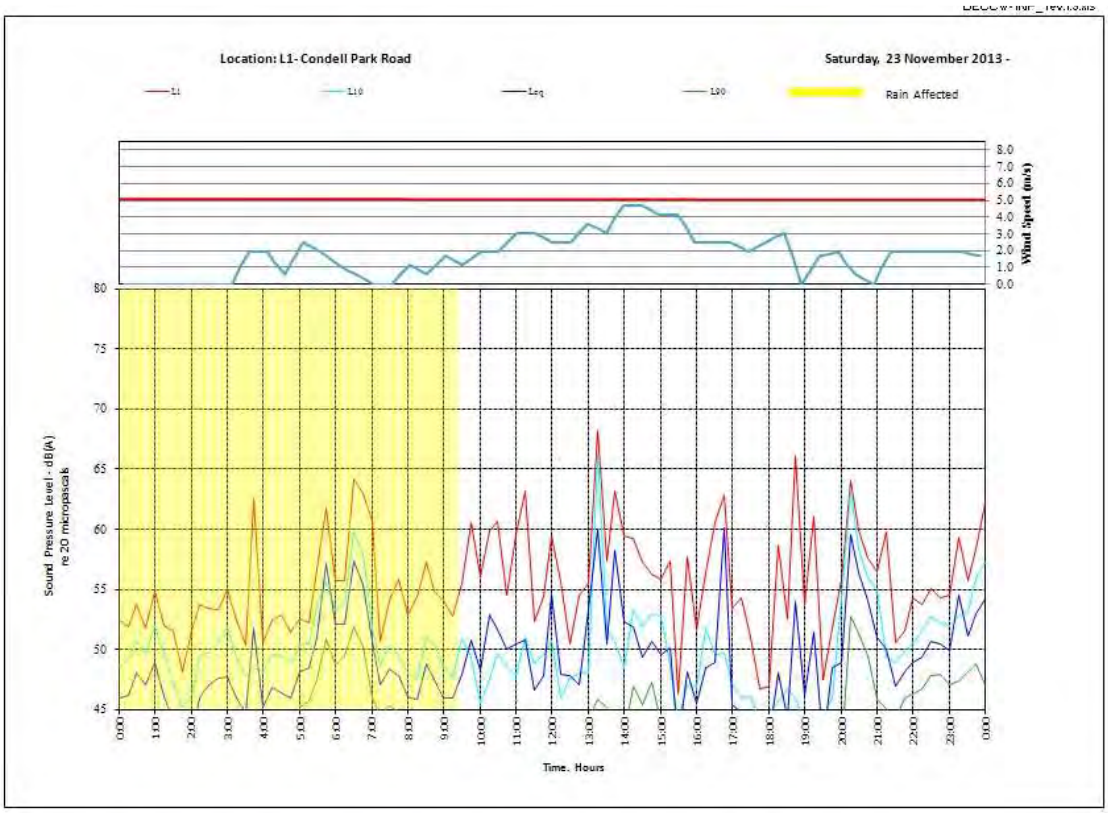


Figure 4: Unattended Noise Results – Day 3

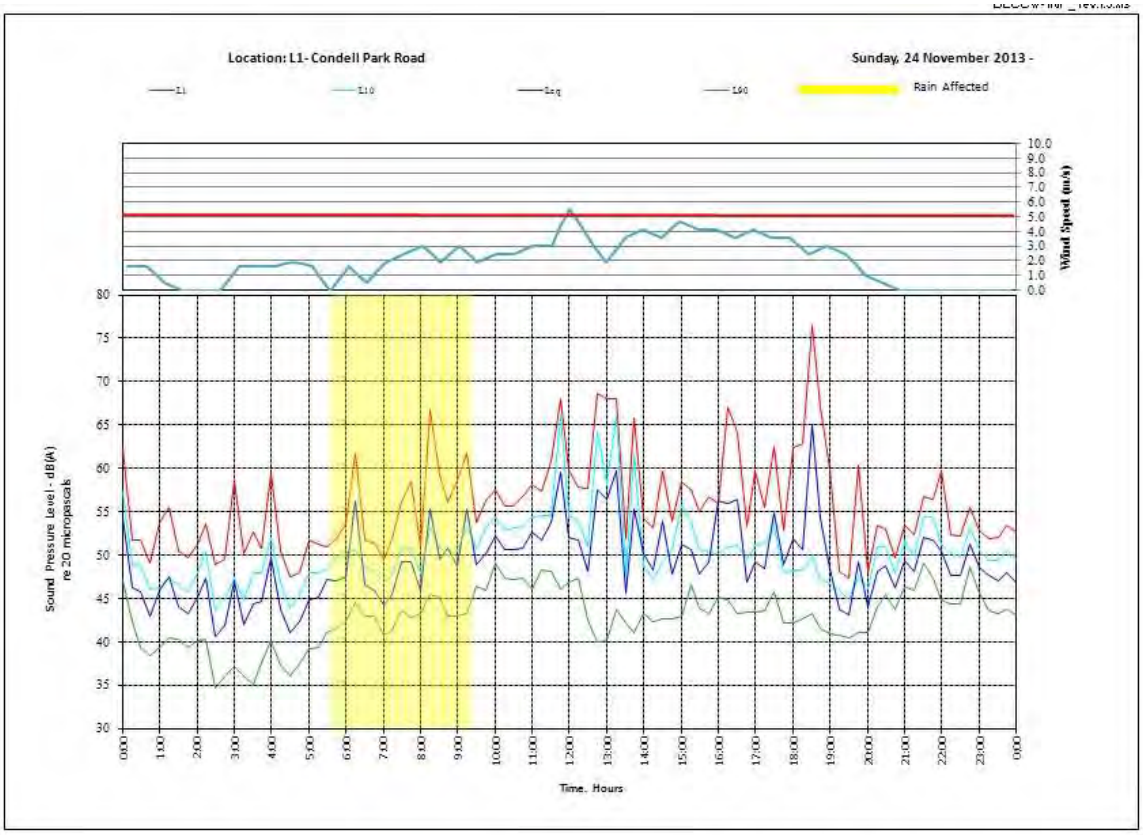


Figure 5: Unattended Noise Results – Day 4

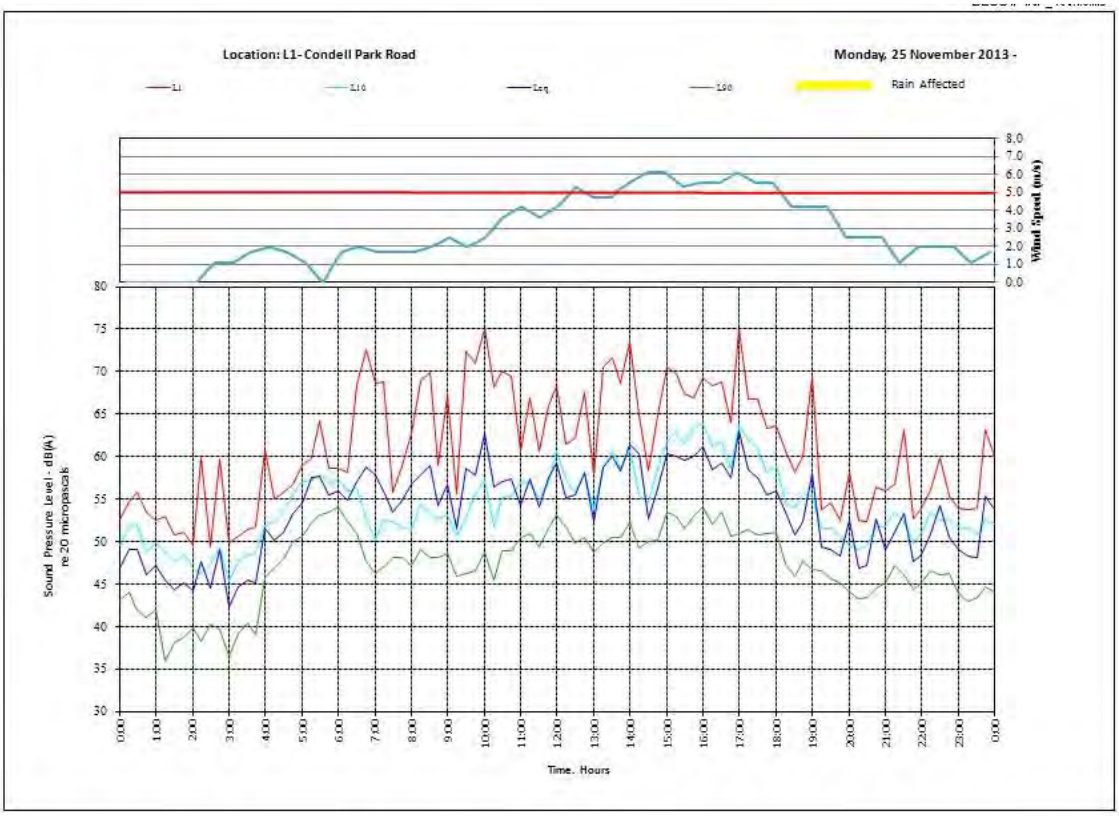


Figure 6: Unattended Noise Results – Day 5

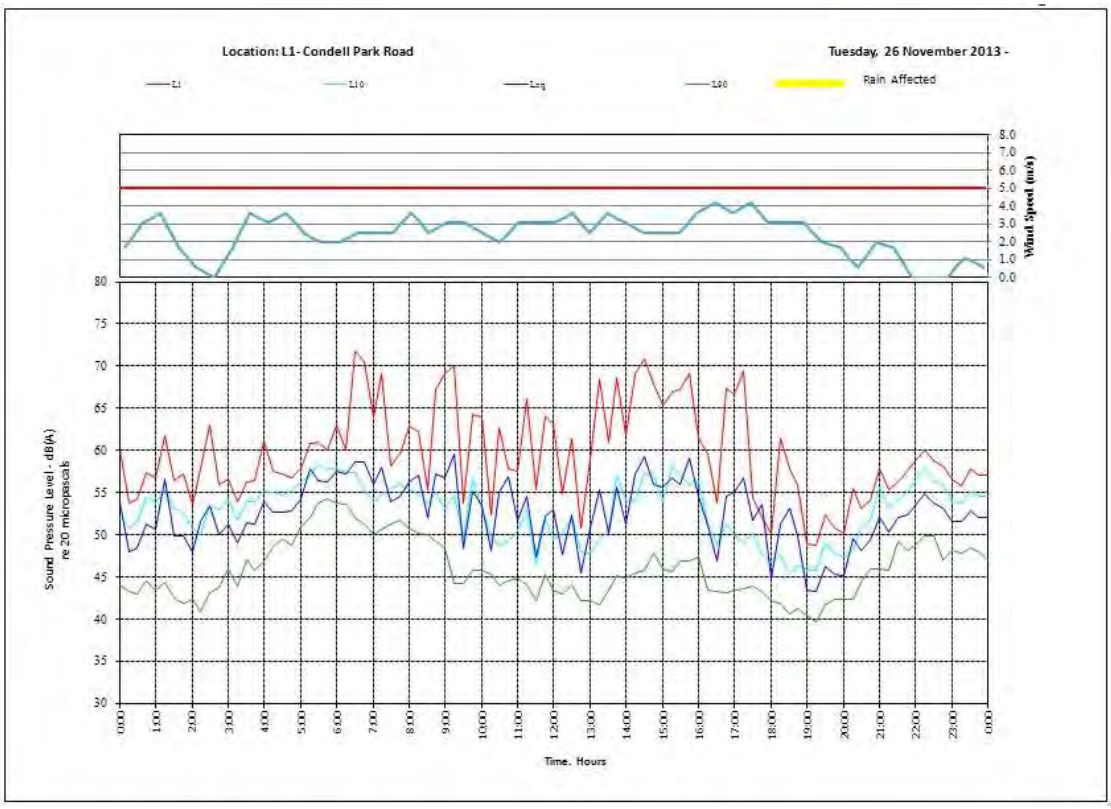


Figure 7: Unattended Noise Results – Day 6

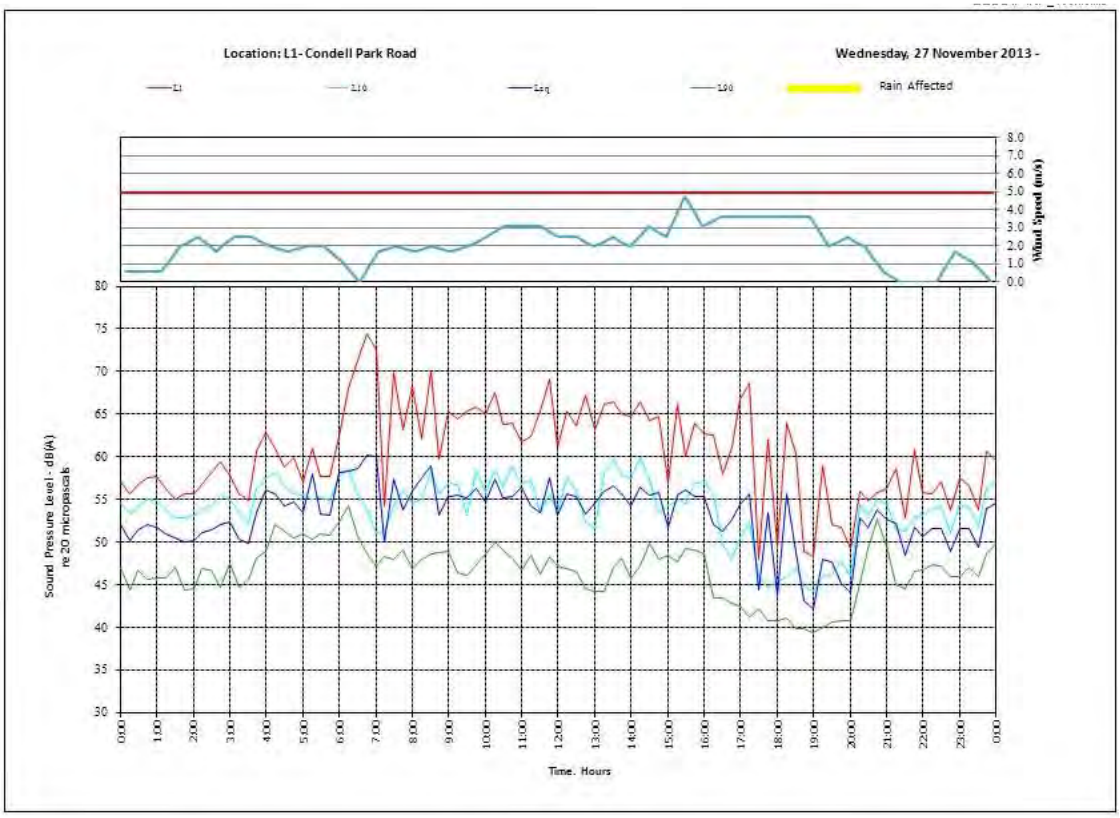


Figure 8: Unattended Noise Results – Day 7

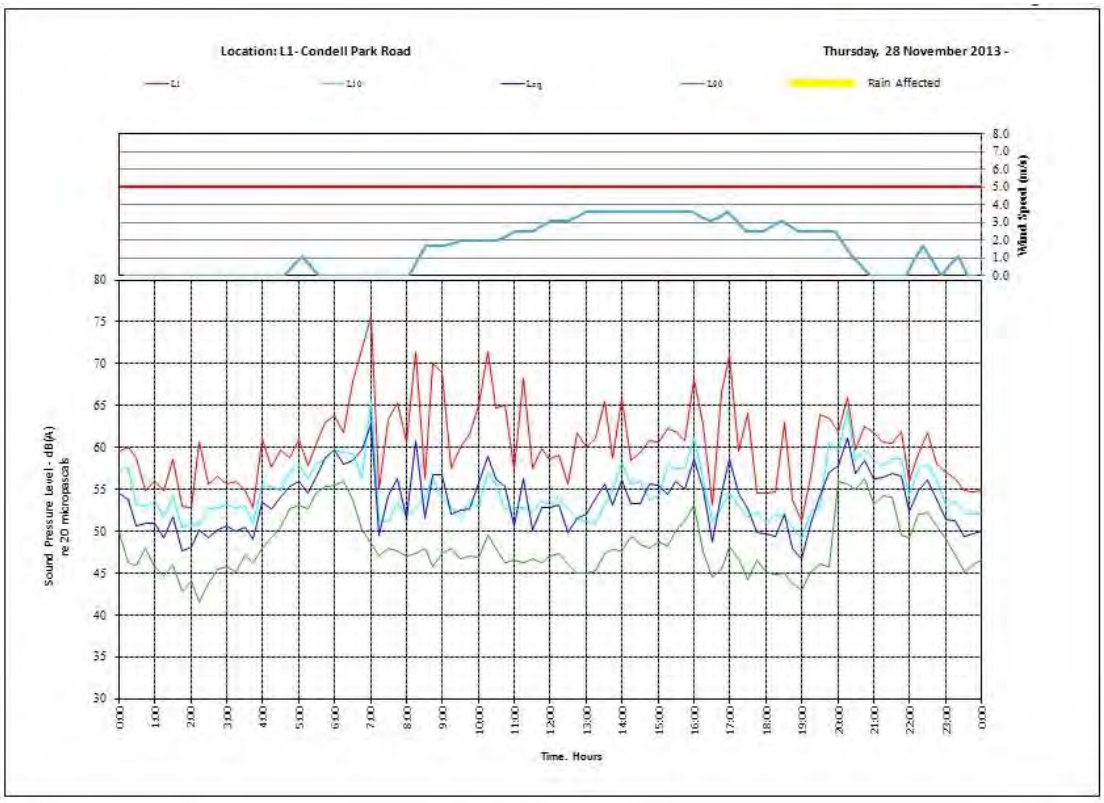


Figure 9: Unattended Noise Results – Day 8

Appendix D LIST OF EQUIPMENT ASSOCIATED WITH SOUND POWER LEVELS

Noise Source	Item No	Sound Power Level (dBA)
Screen Feed Pumps	57	74
Macerator	56	78
Return Pumps	61	78
Equalisation Tank Feed Pumps	3	78
Equalisation Tank Mixing Pumps	5	78
AS Feed Pumps	6	78
Membrane Tank Feed Pump	Underneath 13	78
Filtrate Pumps	21	68
Chlorinated Water Pumps	32	68
Residential Pumps – Base	34	81
Backwash Pump	14	73
Ferric Dosing Pumps	43	68
Sodium Hypo Dosing Pumps (to Chlorination Tanks)	41	68
Sodium Hypo Dosing Pumps (to pre-treated water tanks)	41	68
Sodium Hypo Dosing Pumps (to Residential Network)	41	68
Sodium Hypo Dosing Pumps (to Irrigation Network)	41	68
Polymer Dosing System	44	68
WAS Pumps	12	76
BioSep Acid Dosing Pump	14	68
BioSep Bleach Dosing Pump	14	68
Sample Pump	35	78
Inlet Drum Screen	1	83
Drum Screen Screw Press	Adjacent to 1	83
Solids Bins	Outside Bldg eastern wall	83
AS Blowers	11	81
Odour Fans	52	83
Membrane Tank Blowers	18	83
Centrifuge – Main Drive	60	88
Dewatered sludge conveyor	Adjacent to 60	83
Compressors	Adjacent to Blowers	78
Air Drier	Adjacent to Blowers	73
Reverse Cycle Air Conditioners	outside Bldg Northern Wall	73
Activated Sludge Tank	10	66
BioSep Membrane Tanks	13	66
Screen Feed Pumps	57	78
Equalisation Tank Feed Pumps	3 (additional)	78
Equalisation Tank Mixing Pumps	66	78
Membrane Tank Feed Pump	Underneath 69	78
Activated Sludge Tank	67	66
BioSep Membrane Tanks	69	66
Filtrate Pumps	74	68
Backwash Pump	70	73
Chlorinated Water Pumps	79	68
BioSep Acid Dosing Pump	73	68
BioSep Bleach Dosing Pump	73	68
AS Blowers	68	81
Membrane Tank Blowers	75	83
Floating Transfer pumps	Storage Pond	85
Brine Transfer Pump	Pump Station	79

Appendix E LIST OF EQUIPMENT ASSOCIATED WITH EACH STAGES AND OPERATION HOURS

Noise Source	Item No/Location	No of Units/ Duty	Operating Time			Operational Stages		
			Day 8am- 5pm	Evening 5pm-10pm	Night 10pm-8am	Stage 1	Stage 2	Stage 3
Screen Feed Pumps	57	1	X	X	X	X	X	X
Macerator	56	1	X	X	X	X	X	X
Return Pumps	61	1	X				X	X
Equalisation Tank Feed Pumps	3	1	X	X	X		X	X
Equalisation Tank Mixing Pumps	5	4	X	X	X		X	X
AS Feed Pumps	6	2	X	X	X	X	X	X
Membrane Tank Feed Pump	Underneath 13	4	X	X	X		X	X
Filtrate Pumps	21	1	X	X	X		X	X
Chlorinated Water Pumps	32	1	X	X	X		X	X
Residential Pumps - Base	34	1	X	X	X		X	X
Backwash Pump	14	1	X	X	X		X	X
Ferric Dosing Pumps	43	1	X	X	X		X	X
Sodium Hypo Dosing Pumps (to Chlorination Tanks)	41	1	X	X	X		X	X
Sodium Hypo Dosing Pumps (pre-treated water tanks)	41	1	X	X	X		X	X
Sodium Hypo Dosing Pumps (to Residential Network)	41	1	X	X	X		X	X
Sodium Hypo Dosing Pumps (to Irrigation Network)	41	1	X	X	X		X	X
Polymer Dosing System	44	1	X				X	X
WAS Pumps	12	1	X				X	X
BioSep Acid Dosing Pump	14	1	X	X	X		X	X
BioSep Bleach Dosing Pump	14	1	X	X	X		X	X
Sample Pump	35	1	X	X	X		X	X
Inlet Drum Screen	1	2	X	X	X		X	X
Drum Screen Screw Press	Adjacent to 1	1	X	X	X		X	X
Solids Bins	Outside Bldg eastern wall	1	X				X	X
AS Blowers	11	2	X	X	X		X	X
Odour Fans	52	1	X	X	X	X	X	X
Membrane Tank Blowers	18	4	X	X	X		X	X
Centrifuge - Main Drive	60	1	X				X	X
Dewatered sludge conveyor	Adjacent to 60	1	X				X	X
Compressors	Adjacent to Blowers	1	X	X	X	X	X	X
Air Drier	Adjacent to Blowers	1	X	X	X	X	X	X

Noise Source	Item No/Location	No of Units/ Duty	Operating Time			Operational Stages		
			Day 8am- 5pm	Evening 5pm-10pm	Night 10pm-8am	Stage 1	Stage 2	Stage 3
Reverse Cycle Air Conditioners	outside Bldg Northern Wall	2	X	X	X		X	X
Activated Sludge Tank	10	2	X	X	X		X	X
BioSep Membrane Tanks	13	4	X	X	X		X	X
Screen Feed Pumps	57	1	X	X	X			X
Equalisation Tank Feed Pumps	3 (additional)	1	X	X	X			X
Equalisation Tank Mixing Pumps	66	2	X	X	X			X
Membrane Tank Feed Pump	Underneath 69	1	X	X	X			X
Activated Sludge Tank	67	2	X	X	X			X
BioSep Membrane Tanks	69	4	X	X	X			X
Filtrate Pumps	74	2	X	X	X			X
Backwash Pump	70	1	X	X	X			X
Chlorinated Water Pumps	79	1	X	X	X			X
BioSep Acid Dosing Pump	73	1	X	X	X			X
BioSep Bleach Dosing Pump	73	1	X	X	X			X
AS Blowers	68	1	X	X	X			X
Membrane Tank Blowers	75	2	X	X	X			X
Floating Transfer pumps	Storage Pond	2	X	X	X	X	X	X
Brine Transfer Pump	Pump Station	2	X	X	X	X	X	X

Appendix F : NOISE CONTOUR MAPS (STAGE 1 AND 2)

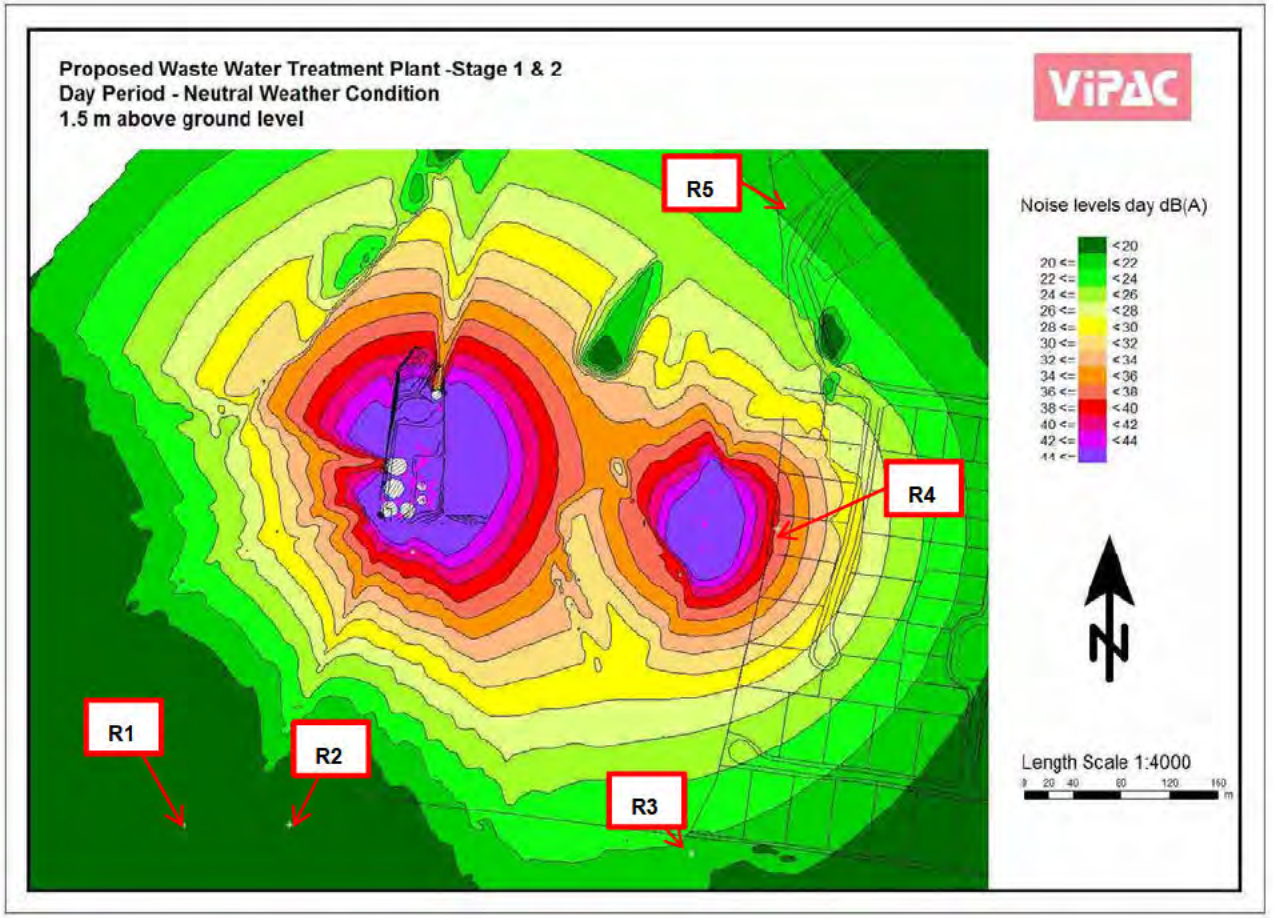


Figure 10: Proposed WWTP (Stage 1 and 2) – Day Period, Neutral Weather Conditions

12 May 2015

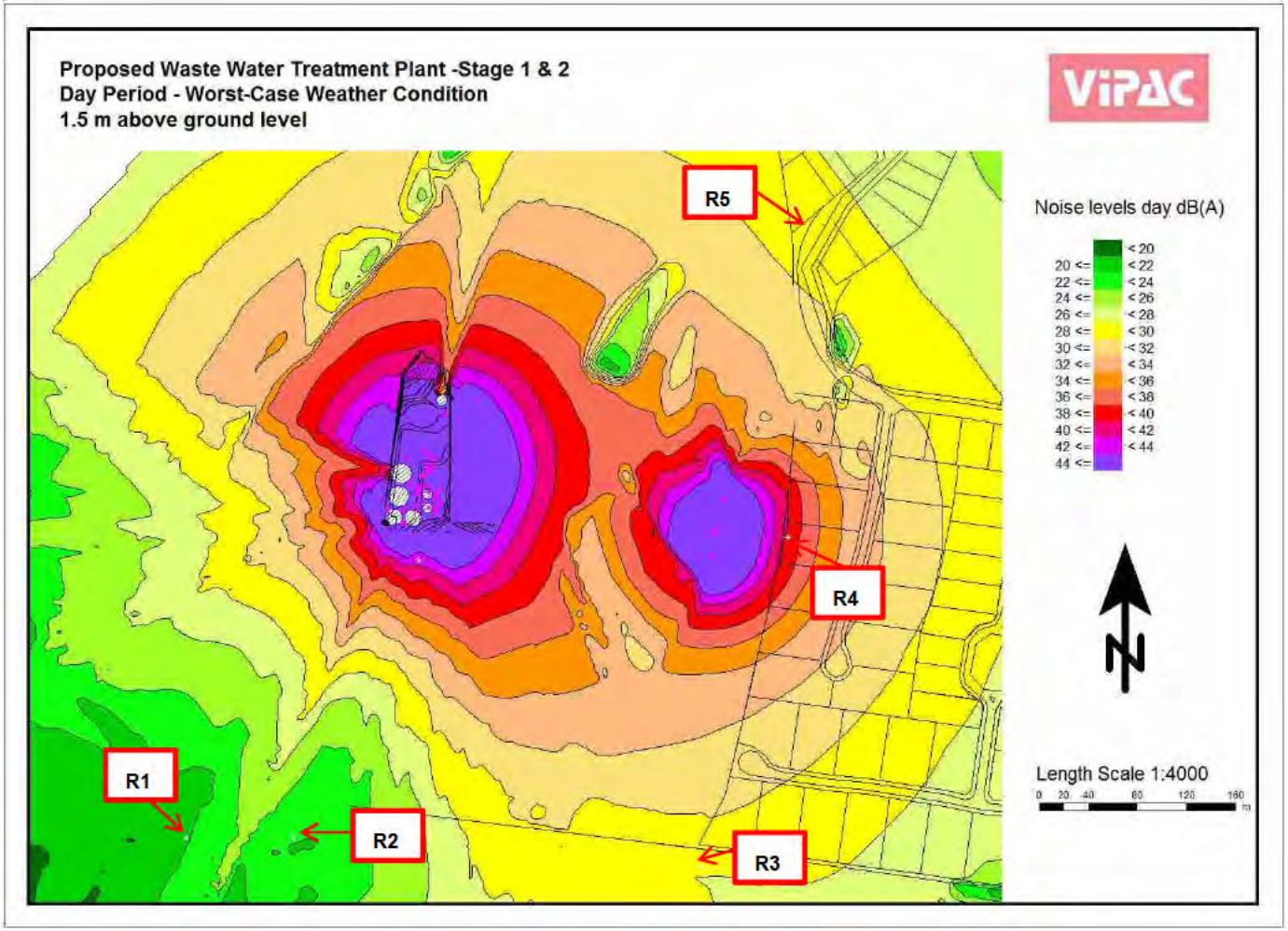


Figure 11: Proposed WWTP (Stage 1 and 2) – Day Period, Worst Case Weather Conditions

12 May 2015

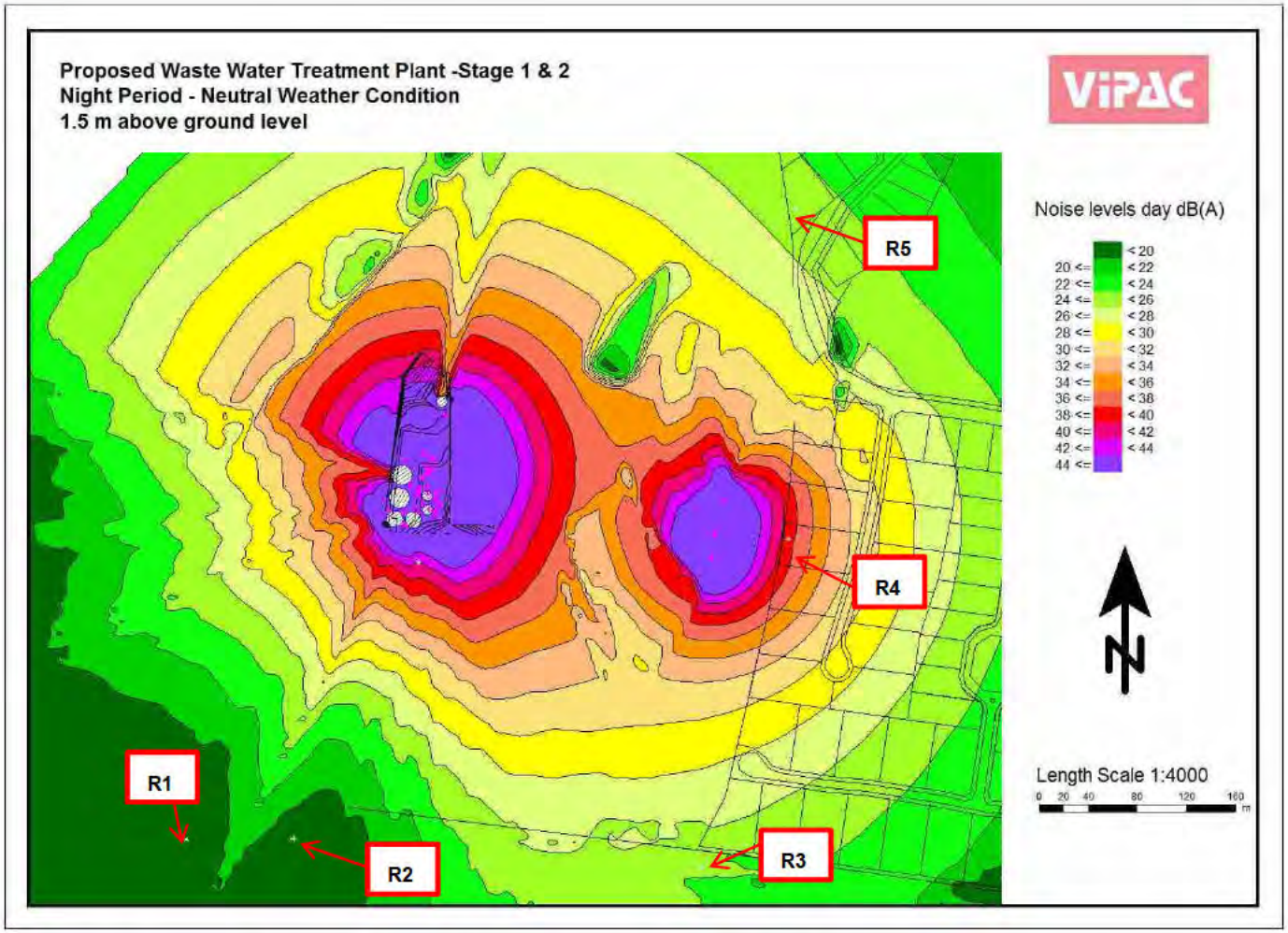


Figure 12: Proposed WWTP (Stage 1 and 2) – Night Period, Neutral Weather Conditions

12 May 2015

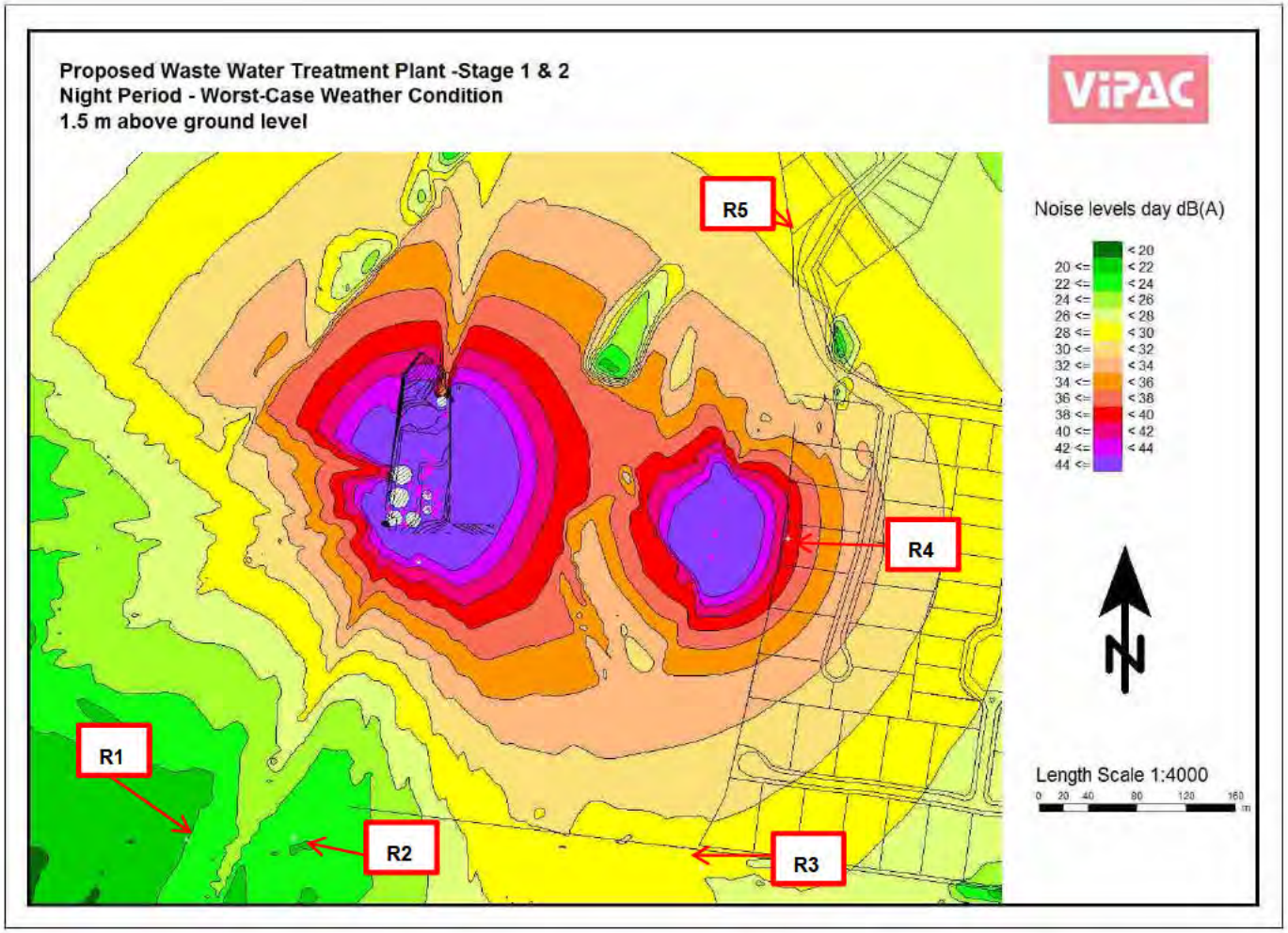


Figure 13: Proposed WWTP (Stage 1 and 2) – Night Period, Worst Case Weather Conditions

12 May 2015

Appendix G : NOISE CONTOUR MAPS (STAGE 1, 2 AND 3)

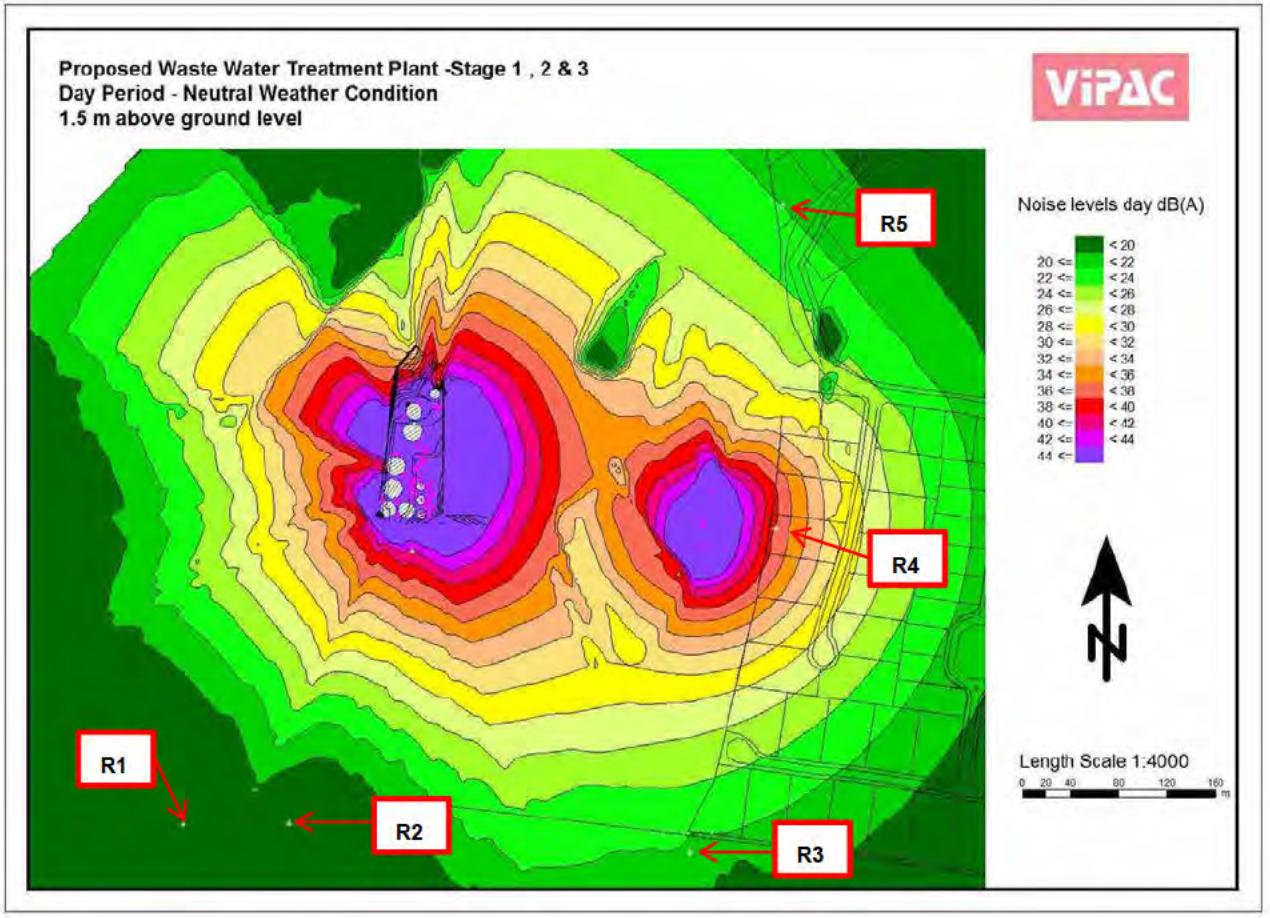


Figure 14: Proposed WWTP (Stage 1, 2 and 3) – Day Period, Neutral Weather Conditions

12 May 2015

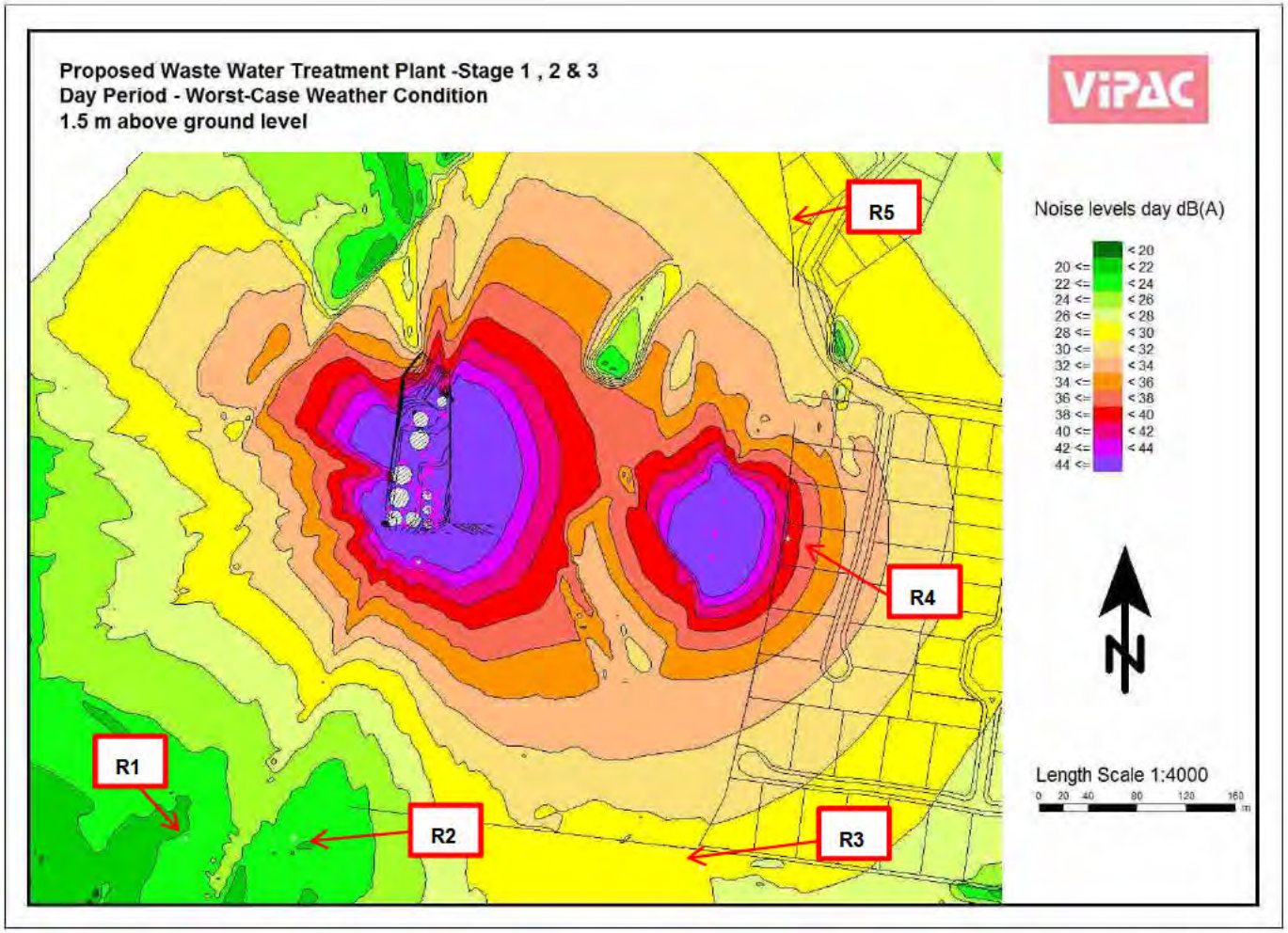


Figure 15: Proposed WWTP (Stage 1, 2 and 3) – Day Period, Worst Case Weather Conditions

12 May 2015

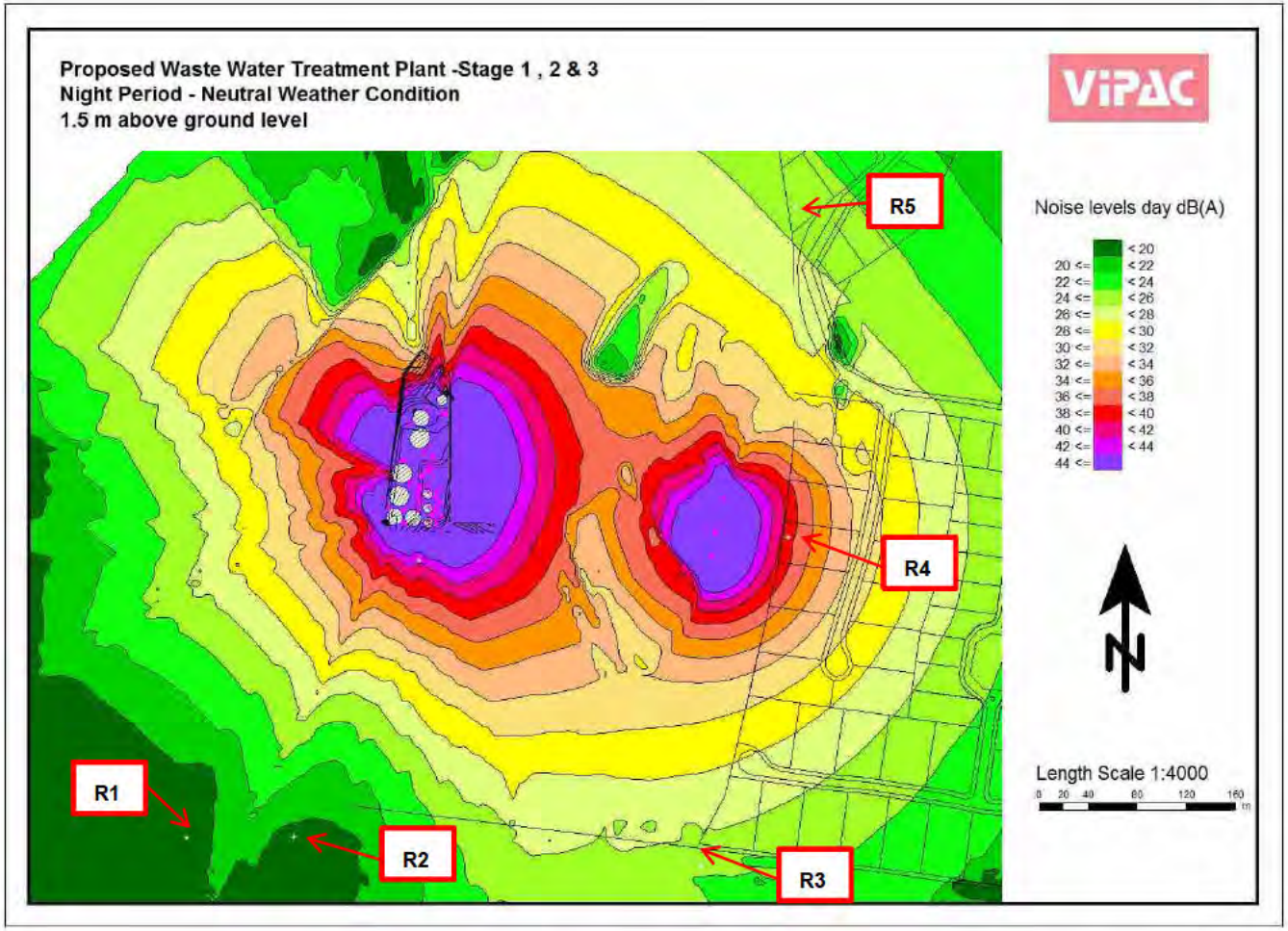


Figure 16: Proposed WWTP (Stage 1, 2 and 3) – Night Period, Neutral Weather Conditions

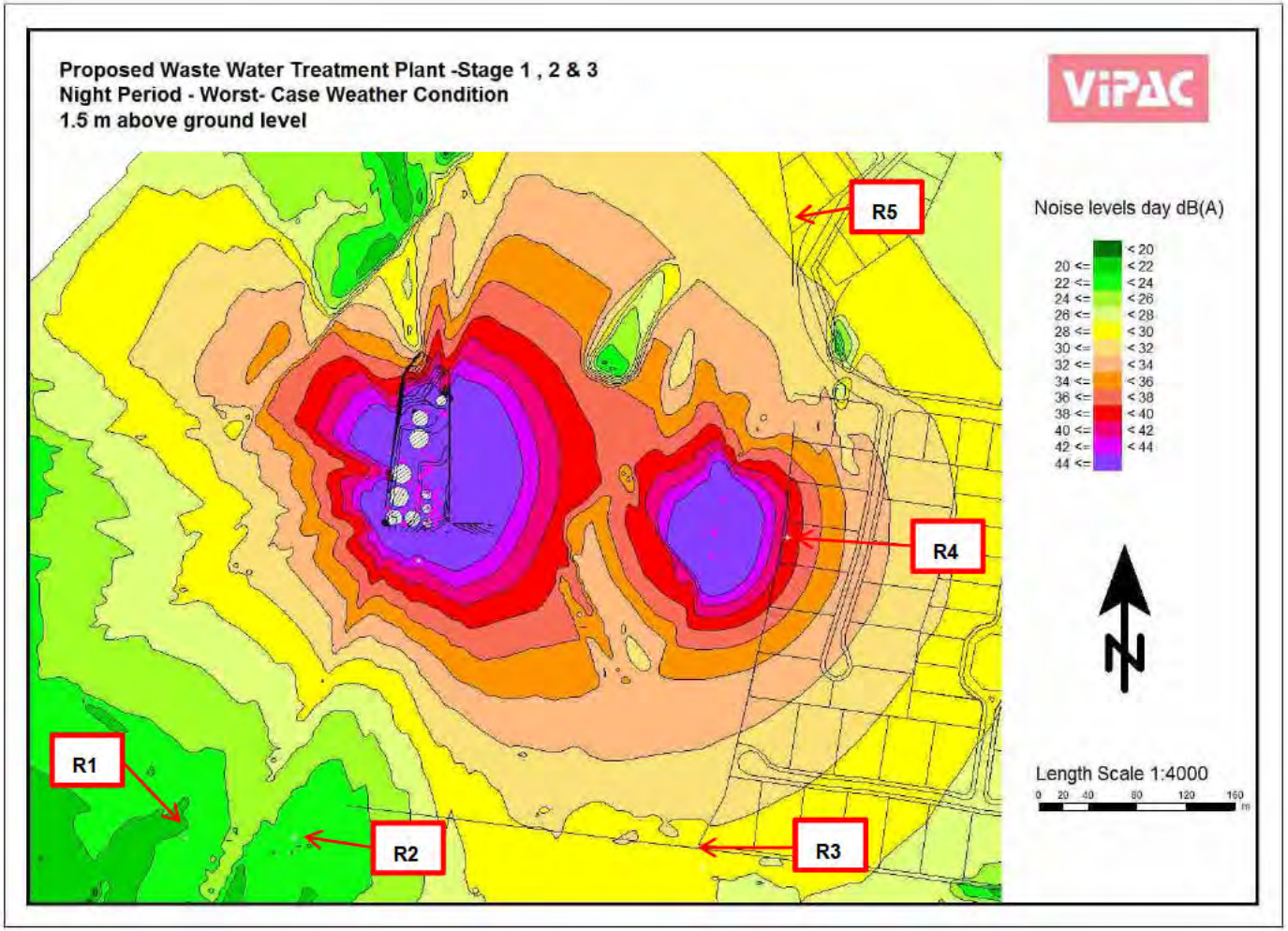


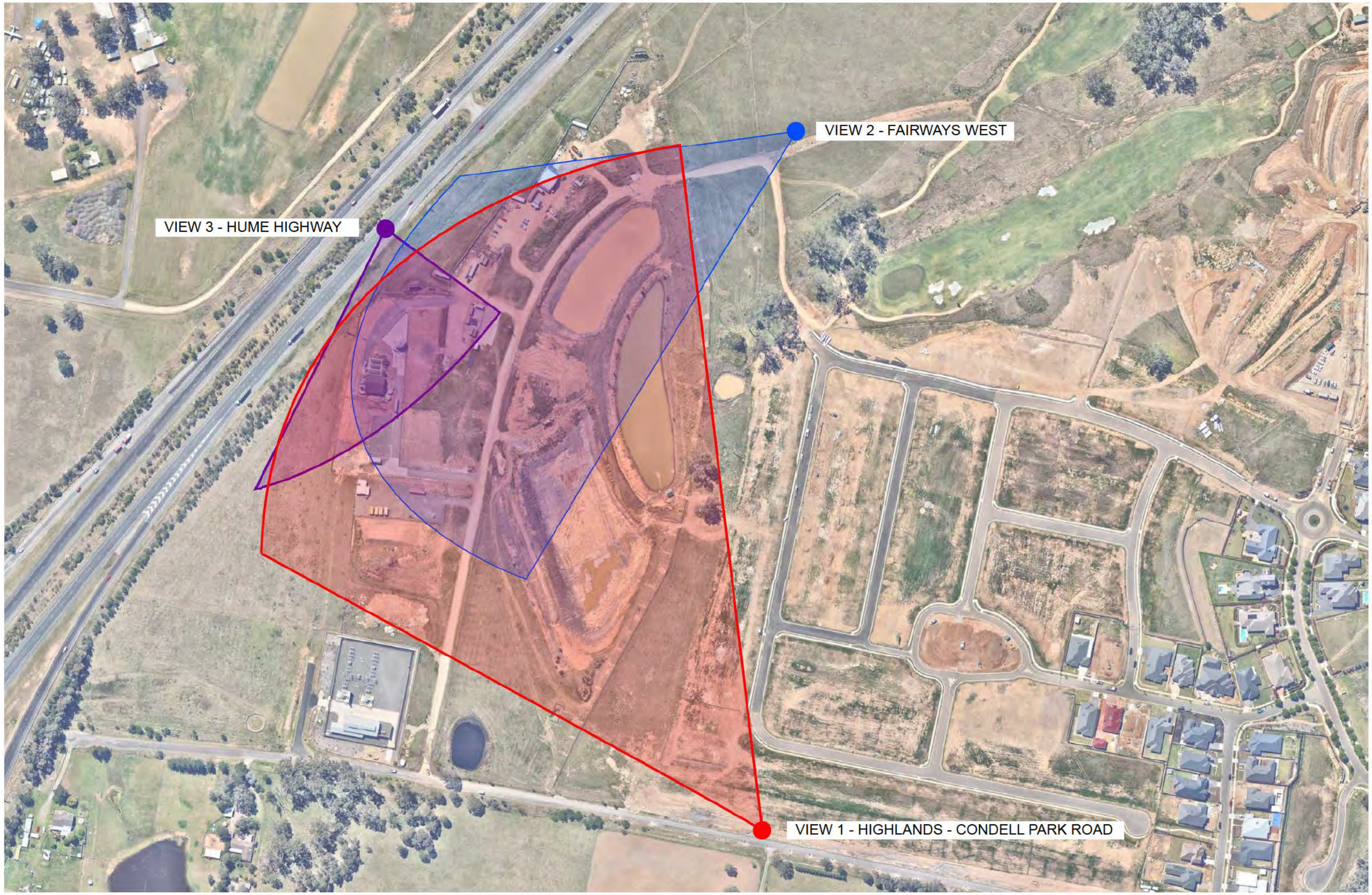
Figure 17: Proposed WWTP (Stage 1, 2 and 3) – Night Period, Worst-Case Weather Conditions

12 May 2015

Bingara Gorge Waste Water Treatment Plant – EPL Variation

Appendix I
LANDSCAPE PLANS

Cardno
Shaping the Future



Cardno

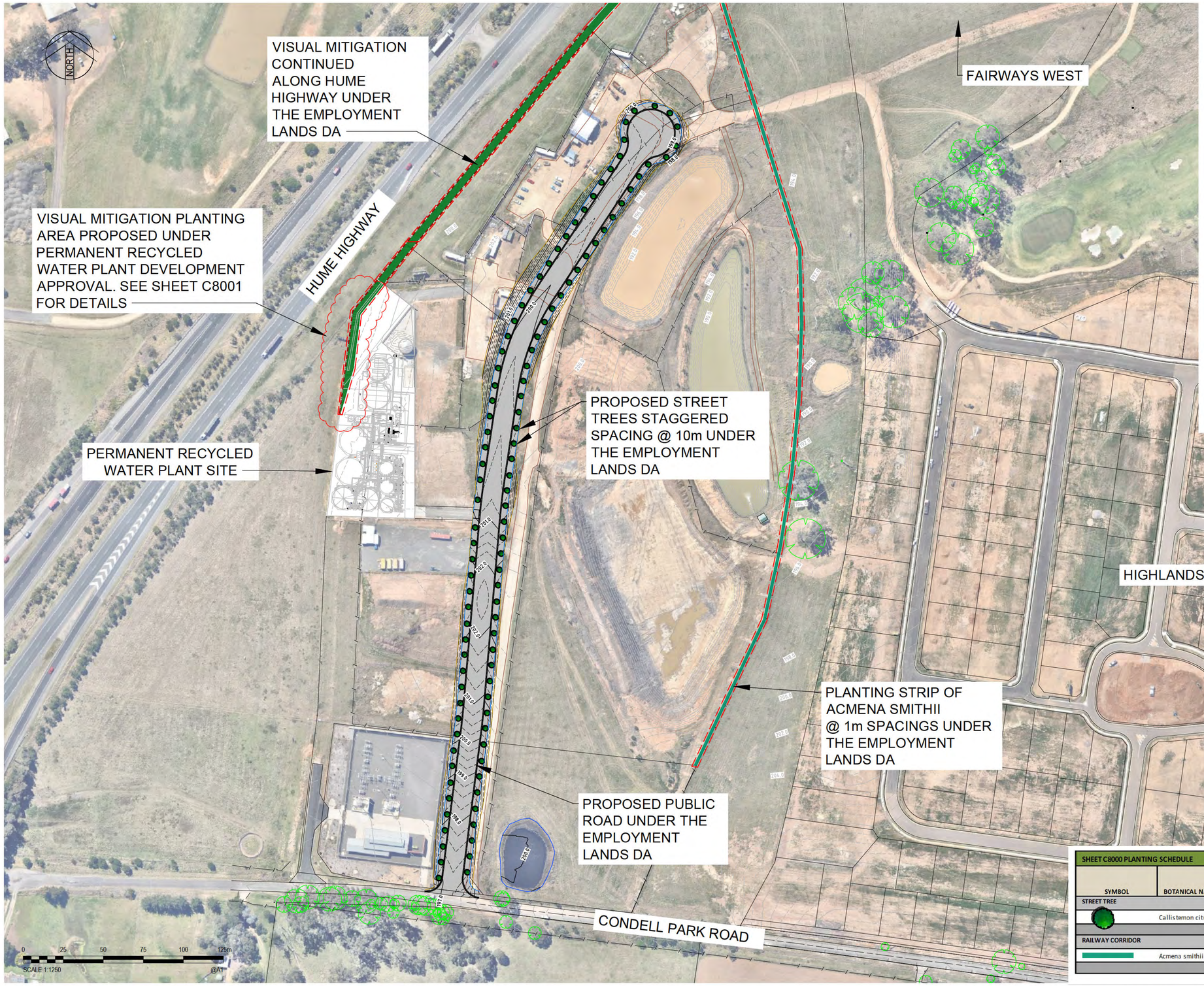
0 25 50 75 125m

BINGARA GORGE | **VISUAL ASSESSMENT** | VIEW LOCATION KEY MAP

+61 2 4231 9600 | www.cardno.com.au | Level 1, 47 Burelli Street, Wollongong, 2500 NSW Australia

date: 6/3/2015 | NA82013043 | revision: 1


SYDNEY
SKYDIVERS



LEGEND

- LIMIT OF WORKS
- EXISTING VEGETATION
- TEMPORARY FENCE
- PROPOSED VISUAL MITIGATION PLANTING AREA (Refer to Planting Schedule and Notes page C8001)
- PROPOSED STREET TREE PLANTING (Refer to Planting Schedule and Notes per this page)
- 100 X 25 H4 WOODEN PLANTER AREA EDGE

NOTES

1. In order to read this plan please print as an A1 sheet, not an A3.
2. All planting areas are to have a base of imported topsoil with organic additives to a minimum depth of 200mm.
3. Excavation of existing material may be necessary to reach subsoil levels to allow for topsoil placement. Excess excavated material (spoil) is to be removed from site.
4. Excavations are to be finished with an even surface and uniform depth.
5. The Low Shrub species are to be sporadically interplanted together.
6. Proposed Tree locations and spacings are as per the plan.
7. All landscape works are to be maintained and nurtured.
8. Tree root barriers are to be installed around the edge of all planter areas that intersect with paved surfaces along the streetscape.
9. Stake and add wind protectors to all trees as required.
10. During summer, trees and all planting is to be watered regularly to ensure stress-free growth and survival.
11. This landscape plan has been co-ordinated with all other engineering plans produced by Cardno.
12. Planting that is shown within the treatment plant site is included in the proposed DA. All planting outside of the site (as noted) is included under the Employment Lands DA (010.2013.00000283.001)

SHEET C8000 PLANTING SCHEDULE

SYMBOL	BOTANICAL NAME	COMMON NAME	MATURE HEIGHT (m)	MATURE WIDTH (m)	SPACING (m)	SIZE	QUANITITY
STREET TREE							
	Callistemon citrinus	Lemon Scented Bottlebrush	4	3	10m	100L	103
					TOTAL PLANTS		103
RAILWAY CORRIDOR							
	Acmena smithii	Lilly Pilly	12	5	1m	25L	TBC

Rev.	Date	Description	Des.	Venf.	Appd.
4	06/05/15	DA ANNOTATIONS	MJW	MJW	JK
3	28/04/2015	CLIENT COMMENTS	CFN	MJW	JK
2	9/4/2015	UPDATED	CFN	MJW	JK
1	12/03/2015	CONCEPT PLAN	CFN	MJW	

REVISION IN PROGRESS

Lend Lease

CHECK PRINT ONLY

PRELIMINARY ☐ FINAL ☐	INITIAL	DATE	INITIAL	DATE
MARKUP				
BACKDRAFTED / CORRECTED				
CONFIRMED				
SELF CHECK				

		Date
Drawn	CFN	12/03/2015
Checked	MJW	12/03/2015
Designed	CFN	12/03/2015
Verified	MJW	12/03/2015
Approved	JK	9/4/2015

Client: LEND LEASE

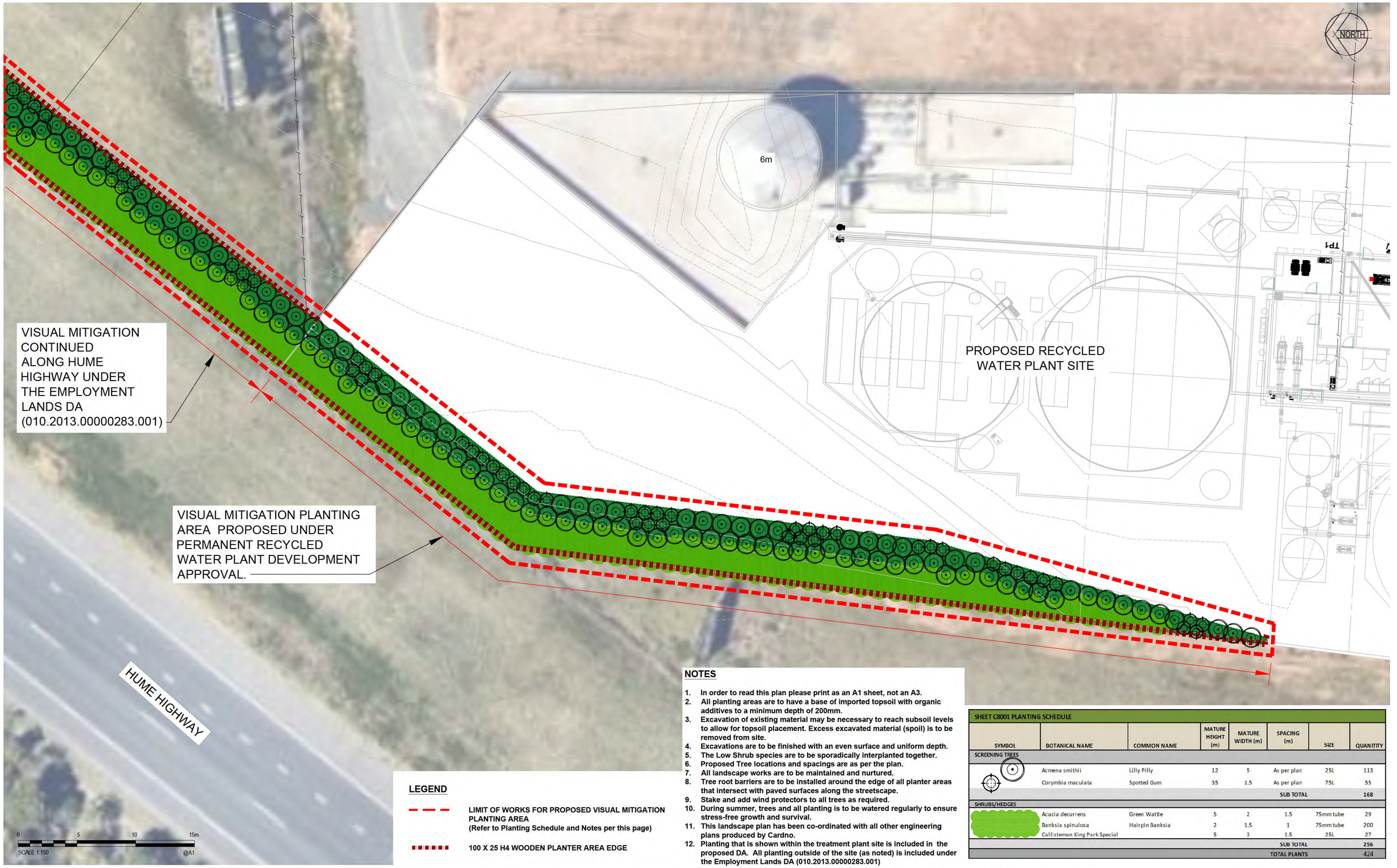
Project: BINGARA GORGE
PERMANENT RECYCLED WATER PLANT

Title: LANDSCAPE PLAN
CONCEPT VISUAL MITIGATION PLAN

Status: FOR APPROVAL
NOT TO BE USED FOR CONSTRUCTION PURPOSES

DATUM | Scale: 1:1250 | Size: A1

Drawing Number: NA82013043-050-C8000 | Revision: 4



LEGEND

- LIMIT OF WORKS FOR PROPOSED VISUAL MITIGATION PLANTING AREA (Refer to Planting Schedule and Notes per this page)
- 100 X 25 H4 WOODEN PLANTER AREA EDGE

NOTES

1. In order to read this plan please print as an A1 sheet, not an A3.
2. All planting areas are to have a base of imported topsoil with organic additives to a minimum depth of 200mm.
3. Excavation of existing material may be necessary to reach subsoil levels to allow for topsoil placement. Excess excavated material (spoil) is to be removed from site.
4. Excavations are to be finished with an even surface and uniform depth.
5. The Low Shrub species are to be sporadically interplanted together.
6. Proposed Tree locations and spacings are as per the plan.
7. All landscape works are to be maintained and nurtured.
8. Tree root barriers are to be installed around the edge of all planter areas that intersect with paved surfaces along the streetscape.
9. Stake and add wind protectors to all trees as required.
10. During summer, trees and all planting is to be watered regularly to ensure stress-free growth and survival.
11. This landscape plan has been co-ordinated with all other engineering plans produced by Cardno.
12. Planting that is shown within the treatment plant site is included in the proposed DA. All planting outside of the site (as noted) is included under the Employment Lands DA (010.2013.00000283.001)

SHEET C8001 PLANTING SCHEDULE

SYMBOL	BOTANICAL NAME	COMMON NAME	MATURE HEIGHT (m)	MATURE WIDTH (m)	SPACING (m)	SIZE	QUANTITY
SCREENING TREES							
	Acmena smithii	Lilly Pilly	12	5	As per plan	25L	113
	Corymbia maculata	Spotted Gum	35	1.5	As per plan	75L	55
					SUB TOTAL		168
SHRUBS/HEDGES							
	Acacia decurrens	Green Wattle	5	2	1.5	75mm tube	29
	Banksia spinulosa	Hairpin Banksia	2	1.5	1	75mm tube	200
	Callistemon King Park Special		5	3	1.5	25L	27
					SUB TOTAL		256
					TOTAL PLANTS		424

Rev.	Date	Description	Des.	Verif.	Appd.
4	06/05/15	DA ANNOTATION	MJW	MJW	JK
3	28/04/2015	CLIENT COMMENTS	CFN	MJW	JK
2	9/4/2015	UPDATED	CFN	MJW	JK
1	12/03/2015	CONCEPT PLAN	CFN	MJW	

Lend Lease

Cardno® Shaping the Future
Cardno (NSW/ACT) Pty Ltd | ABN 95 001 145 035
Level 1, 47 Burelli Street
Wollongong NSW 2500
Tel: 02 4228 4133 Fax: 02 4228 6811
Web: www.cardno.com.au

Drawn	CFN	Date 12/03/2015
Checked	MJW	Date 12/03/2015
Designed	CFN	Date 12/03/2015
Verified	MJW	Date 12/03/2015
Approved	JK	9/4/2015

Client: LEND LEASE
Project: BINGARA GORGE PERMANENT RECYCLED WATER PLANT
Title: LANDSCAPE PLAN CONCEPT VISUAL MITIGATION PLAN

Status: FOR APPROVAL
NOT TO BE USED FOR CONSTRUCTION PURPOSES
DATUM | Scale 1:150 | Size A1
Drawing Number: NA82013043-050-C8001 | Revision 4

4.2.15

Waste Management

11.7 Discharge Event Monitoring

Monitoring will be undertaken during all discharge events to demonstrate no significant impacts on the downstream environment are occurring.

For every discharge event the following monitoring will be undertaken:

- Visual inspection of the discharge by the operator to ensure it is functioning correctly, achieving adequate mixing and not contributing to soil erosion or other visual impacts
- Recycled water quality monitoring from the wet weather storage
- Detection of stormwater lake overflow
- Monitoring of the discharge flow rate
- Water quality monitoring downstream of the discharge location, as deemed necessary based on key environmental indicators.

12 Ancillary Issues

12.1 Waste Management

12.1.1 Screenings

All incoming wastewater passes through a fine screen. The screen will never be bypassed. Overflows from the screen will be returned to the WWTP feed tank via the drainage sump outside the WWTP building.

An alarm will be activated if a high level is reached in the screens. This will give the operator time to close the inlet of the screens prior to overflow occurring.

Screenings are dewatered via a combined screenings conveyor/press. Dewatered screenings are disposed in a storage bin for transport offsite at an approved landfill facility.

All incoming wastewater is macerated to ensure efficient screening performance.

12.1.2 Waste Activated Sludge

The Activated Sludge process produces a Waste Activated Sludge (WAS) or biosolids stream of 1 – 3.5% of the flow rate. The estimated volume and weight of WAS produced at each stage is outlined in Table 23.

Sludge wasting is conducted on a timer basis, with the operator able to select the start time and duration of sludge wasting. Each activated sludge tank is fitted with an MLSS sensor. This will allow the operator to monitor and adjust wasting as required. In general, the activated sludge MLSS will be controlled at < 13,000 mg/L, to ensure that the MLSS in the membrane tanks does not exceed 15,000 mg/L.

Sludge will be pumped directly from the activated sludge tanks to the dewatering centrifuge. To reduce complexity in control and pumping, sludge dewatering will occur from each activated sludge tank over a separate interval.

Initially, the sludge will be pumped to a holding tank inside the new building from where it is periodically removed from the site by a licensed liquid waste transport contractor.

During construction of Stage 2, a dewatering centrifuge will be installed. This will allow all WAS to be thickened to reduce the total volume requiring disposal.

Table 23: Expected Sludge Generation

Pollutant	Waste Activated Sludge (WAS)			Dewatered Sludge (WAS)		
	WAS Volume (m^3/day)	MLSS (mg/L)	Dry Weight (kg/day)	Volume (m^3/day)	%DS Minimum	Dry Weight (kg/day)[1]
Stage 1	13.08	13,000	170	1.13	15	170
Stage 2	26.15	13,000	340	2.27	15	340
Ultimate Development	39.23	13,000	510	3.40	15	510

[1] Assumes no loss in dewatering, in reality will be lower

12.2 Chemicals Management

The following water treatment chemicals will be used in the Bingara PRWP:

- Ferric chloride for phosphorus removal
- Acetic Acid as a supplementary carbon source for MLSS control and denitrification (if this is required – to be installed at a later stage as an extension of the VWS current scope.)
- Citric acid for membrane cleaning.
- Sodium hypochlorite for disinfection and membrane cleaning.

All chemicals used in the scheme will be managed based on best practice strategy, including:

- Online continuous monitoring of chemical dosing provided from pumps.
- Control of chemical dosing as required to minimise consumption.
- All chemicals delivered to the site in an appropriate road bund area to minimise environmental risk.
- Separation of strong acid (ferric chloride) and strong base (sodium hypochlorite.)
- Material Safety Data Sheets will be maintained onsite for all chemicals;
- Spill response kits will be maintained onsite for all chemicals;
- Procedures to control the acceptance of chemicals to the site to ensure only the correct chemicals are unloaded;
- Emergency response procedures for chemical spills;

4.3.7

Wet Weather Operations

>75% full (>60 ML)	Precautionary discharge	Undertake precautionary discharge as per Section 11.2.
>97% full (>77.5ML)	Emergency discharge	Undertake emergency discharge as per Section 11.2.

The level set points shown above in Table 19 are preliminary. The control system will be programmed with adjustable level set points so the scheme can be optimised during operation to maximise the availability of recycled water and minimise the potential for discharge to the environment.

11 Wet Weather Operations

11.1 Overview

The Bingara Scheme has been designed to ensure effective operation during dry weather with a target of zero dry weather over flows or discharges. The scheme includes a centralised control system that will monitor, report and alarm system performance, faults and potential overflows.

However, like all sewerage schemes, during periods of extended wet weather the scheme will be required to discharge to the environment in a controlled manner. The discharges are required in order to minimise the public health and environmental risks associated with uncontrolled overflows.

The previous design that received development and EPA approval allowed for discharge of raw sewage in the sewer network. This has not been considered here due to the environmental and reputational risks associated. Instead, discharge to environment will only be permitted from the irrigation storage lagoon.

This discharge will be via precautionary and emergency discharges of recycled water (treated to a standard suitable for unrestricted reuse) from the wet weather storage in less than 50% of years into a tributary of Stringybark Creek;

11.2 Minimising Discharges

The potential for recycled water discharges to the environment have been minimised through implementation of the following best practice measures:

- Wastewater reuse and recycling is maximised in the scheme through the supply of Class A+ recycled water to customers for toilet flushing, laundry and outdoor recycled water uses
- Irrigation of the Bingara Gorge golf course with recycled water with Class A+ water, reducing restriction on irrigation and increasing the volume of water that can be used (by providing a higher level of treatment.
- The irrigation area and 80 ML irrigation storage provided for the scheme has been modelled to achieve an average storage overflow frequency in less than 50% of years, as required by the NSW Environmental Guidelines: Use of Effluent by Irrigation (NSW Department of Environment and Conservation, Oct 2004)

- Pressure sewerage network to service all future development to minimise stormwater and groundwater infiltration and hence minimise the annual volume of surplus recycled water requiring management
- Precautionary discharge events during conditions of high creek flow are proposed to minimise emergency discharge during dry periods when less dilution with stormwater can be achieved at the discharge location.
- Selecting a discharge location that maximises the flow path, land contact and dilution with stormwater prior to entering Stringybark Creek.

With implementation of the wastewater minimisation and water recycling initiatives, the Bingara Scheme will still require an emergency discharge that will be used following periods of extended wet weather and low irrigation demand. These discharges are expected to occur infrequently and the system will be managed during operation to minimise environmental and public health risks. An overview of the proposed emergency discharge is provided below.

11.3 Discharge Triggers

As outlined in Table 20 it is proposed to undertake precautionary and emergency discharges from the wet weather storage to minimise the risk of uncontrolled overflows from the storage during wet weather. Triggers for precautionary and emergency discharge events are described below in Table 20.

Table 20: Triggers for precautionary and emergency discharge events

Discharge Event	Trigger	Limits
Precautionary Discharge	1. Wet weather storage >75% full; 2. Main golf course stormwater lake overflowing at >2 ML/day	1. Discharge up to 25% of the daily flow out of the main golf course stormwater lake. 2. Maximum discharge of 2 ML/day.
Emergency Discharge	1. Wet weather storage >97% full	1. Discharge the daily volume of surplus recycled water to ensure uncontrolled overflows from the wet weather storage do not occur.

Precautionary discharge during periods of high stream flow are used to minimise the risk of emergency discharges, however emergency discharges may still be required under certain conditions. The wet weather storage also includes a 0.5 metre freeboard provided over and above the 100% full level that will be utilised under emergency situations.

11.4 Discharge Location & Receiving Environment

The proposed discharge location is the stormwater overflow structure from the main golf course Stormwater Lake (see Appendix B). This discharge location was selected to maximise dilution of recycled water with stormwater before entering the natural environment.

Details of the proposed discharge location and downstream environment are outlined below in Table 21.

Table 21: Infrequent (<50% of years) treated effluent discharge location and receiving environment

Coordinates	Address	Description of Receiving Environment
286629.9 E, 6210991.3 N	Greenbridge Drive, Bingara Gorge	Precautionary and emergency discharges will be released from the golf course irrigation system into the main golf course stormwater lake overflow structure. From the discharge location the recycled water/stormwater mixture will flow approximately 100 metres through the golf course stormwater swale and overland flow system before discharging into a vegetated natural gully that forms a tributary to Stringybark Creek. Once the water reaches the vegetated natural gully it would flow for a further 650 metres before discharging into Stringybark Creek. Water would then flow a further 1.6 km along Stringybark Creek before discharging to the Allens Creek. Allens Creek flows into the Nepean River approximately 4.5 km further downstream.

11.5 Environmental Values

The environmental values of the downstream environment in Stringybark Creek relate to the protection of aquatic ecosystems and primary contact recreation. The water quality objectives adopted for Stringybark Creek from the National Water Quality Management Strategy: An Introduction to the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (Australian and New Zealand Environment and Conservation Council (ANZECC); Agriculture and Resource Management Council of Australia and New Zealand, 2000) are based on requirements for a “slightly disturbed Low Land River”, as follows:

- Total Nitrogen: < 500 µg/L (0.5 mg/L)
- Total Phosphorus: <50 µg/L (0.05 mg/L)
- Faecal Coliform: <150 cfu/100 mL

It is not expected based on the relatively low discharge volumes per year, and low discharge frequency, that the above water quality objectives for Stringybark Creek will be impacted. In particular this risk will be minimised via the high quality of treatment at the Bingara PRWP and ensuring that adequate dilution with stormwater occurs during controlled overflow periods.

11.6 Discharge Water Quality

The proposed recycled water to be discharged to the environment is Class A+ treated recycled water from the wet weather storage.

This water contains relatively low concentration of BOD, turbidity and nutrients and pathogens; however dilution with catchment stormwater flows is still required to achieve water quality objectives during discharge events.

The Class A+ treated discharge water complies with the microbiological water quality objectives without dilution as this water has undergone multiple barrier disinfection processes with MBR membrane microfiltration and ultraviolet irradiation; hence the discharge poses minimal public health risks in the downstream environment. Nutrient limits (nitrogen and phosphorus) are achieved via dilution with storm flow over these periods.

The approximate discharge water quality and estimates of the downstream concentrations are outlined below in Table 22. The concentrations were estimated based 5 to 1 dilution with stormwater at the discharge location and as the tributary enters Stringybark Creek.

The data in Table 22 demonstrates that the quality of water in Stringybark Creek downstream of the tributary gully will comply with the water quality target concentrations for nutrients and Faecal Coliform in the ANZECC Guidelines (Australian and New Zealand Environment and Conservation Council (ANZECC); Agriculture and Resource Management Council of Australia and New Zealand, 2000).

Table 22: Precautionary discharge water and estimated downstream concentrations

Pollutant	**Discharge Limits**[1]	**Estimated Downstream Concentration**	
		In tributary gully downstream of stormwater lake[2]	**Where tributary gully enters Stringybank Creek**[3]
Biochemical Oxygen Demand	<10 mg/L	<2 mg/L	<0.4 mg/L
Suspended Solids	<10 mg/L	<2 mg/L	<0.4 mg/L
Total Nitrogen	<10 mg/L	<2 mg/L	<0.4 mg/L
Total Phosphorus	<0.5 mg/L	<0.1 mg/L	<0.02 mg/L
Total Dissolved Solids	<1500 mg/L	<300 mg/L	<60 mg/L
Faecal Coliform	<10 cfu/100 mL	<2 cfu/100 mL	<1 cfu/100 mL

[1] Measured in the wet weather storage.

[2] Assumes a daily discharge up to 25% of daily overflow volume from main stormwater pond.

[3] Assumes additional mixing of 25% where the tributary gully meets Stringybark Creek, based on proportioning of stormwater catchment areas. Stringybark Creek total catchment area of 538 ha, tributary gully catchment area of 118 ha.

Given the high quality water, dilution achieved and that the proposed discharge will occur infrequently in less than 50% of years, the strategy is not expected to result in significant impacts on the receiving environment nor compromise environmental values of primary contact recreation or protection of aquatic ecosystems in the downstream natural environment.

11.7 Discharge Event Monitoring

Monitoring will be undertaken during all discharge events to demonstrate no significant impacts on the downstream environment are occurring.

For every discharge event the following monitoring will be undertaken:

- Visual inspection of the discharge by the operator to ensure it is functioning correctly, achieving adequate mixing and not contributing to soil erosion or other visual impacts
- Recycled water quality monitoring from the wet weather storage
- Detection of stormwater lake overflow
- Monitoring of the discharge flow rate
- Water quality monitoring downstream of the discharge location, as deemed necessary based on key environmental indicators.

12 Ancillary Issues

12.1 Waste Management

12.1.1 Screenings

All incoming wastewater passes through a fine screen. The screen will never be bypassed. Overflows from the screen will be returned to the WWTP feed tank via the drainage sump outside the WWTP building.

An alarm will be activated if a high level is reached in the screens. This will give the operator time to close the inlet of the screens prior to overflow occurring.

Screenings are dewatered via a combined screenings conveyor/press. Dewatered screenings are disposed in a storage bin for transport offsite at an approved landfill facility.

All incoming wastewater is macerated to ensure efficient screening performance.

12.1.2 Waste Activated Sludge

The Activated Sludge process produces a Waste Activated Sludge (WAS) or biosolids stream of 1 – 3.5% of the flow rate. The estimated volume and weight of WAS produced at each stage is outlined in Table 23.

Sludge wasting is conducted on a timer basis, with the operator able to select the start time and duration of sludge wasting. Each activated sludge tank is fitted with an MLSS sensor. This will allow the operator to monitor and adjust wasting as required. In general, the activated sludge MLSS will be controlled at < 13,000 mg/L, to ensure that the MLSS in the membrane tanks does not exceed 15,000 mg/L.

Sludge will be pumped directly from the activated sludge tanks to the dewatering centrifuge. To reduce complexity in control and pumping, sludge dewatering will occur from each activated sludge tank over a separate interval.

Initially, the sludge will be pumped to a holding tank inside the new building from where it is periodically removed from the site by a licensed liquid waste transport contractor.

4.3.9

Risk Assessment
Sewerage

Project: Bingara Wastewater Management
Client: Lend Lease Communities
Title: Sewerage HACCP for IPART Application
Author: HL
Date (Revision): 27/03/2015
Risk Criteria: As per Tables 2.5, 2.6 & 2.7: Australian Guidelines for Water Recycling: Managing Health and Environmental Risks-phase 1 (2006)

Scheme Component	Hazard	Hazardous Event	Impact	Control Strategy	Mitigated Risk				
					Likelihood		Consequence		Risk
Wastewater generation	Excessive wastewater generation	Peak population or excessive water usage	Build-up of raw wastewater in the inlet balance tank, SPS and PSUs. Potential overflow to the environment. Inadequate treatment capacity	1. Water demand management strategy including minimum 3-star rated water efficient fixtures and appliances as required by BASIX. 2. Education, encouragement and empowerment of customers to move towards best practice water efficiency with 5-star fixtures and appliances and smart water metering. 3. Pressure sewerage collection system on all new lots to minimise infiltration of groundwater and stormwater. 4. Ongoing monitoring and management of the gravity sewerage network to minimise groundwater & stormwater infiltration 5. Continuous online monitoring of pump starts and run hours on each Pressure Sewer Unit (PSU) and the gravity sewerage pump station (SPS) to allow abnormal flows to be detected by the central control system. 6. Trade waste agreements and waste minimisation plans will be required for non-residential customers (if relevant) 7. All non-residential customers will have their own dedicated PSU to enable direct monitoring of trade waste discharges through the central control system (if relevant) 8. Customer contracts and access agreements that outline the responsibilities of the customer with regard to appropriate water usage and waste disposal practices. 9. Ongoing awareness and communication with existing customers through additional information provided at each billing cycle & the Lend Lease Bingara Gorge website (https://www.bingaragorgeonline.com.au/Recycled-Water/default.aspx) and the existing VWS website (http://www.myrecycledwater.com.au/) 10. Treatment infrastructure sized assuming 625 L/EP/day, equivalent of ~200L/EP/day (including infiltration, etc.) This is above the 180L/EP/day expected based on experience elsewhere. 11. WWTP inlet balance tank ~330 kL 12. Inlet feed pumps and screens are sized for 205 m3/h which is equivalent of 6 x ADWF for the gravity sewer and 1.5 x ADWF for the pressure sewer at Stage 3. This allows capacity for screening of peak wet weather flows for transfer to the equalization tank storage. 13. Inlet screens are sized for Stage 3 PWWF (205 m3/h) at Stage 2 (where PWWF is only expected to be 122 m3/h). This will allow for assessment of the requirement to increase flow attenuation in the network prior to population growth, with significant additional capacity provided during Stage 2 for wet weather flows. 14. Equalisation Tank Storage of 2 ML at Stage 2 and 3 ML at Stage 3 for future growth. MBR units are sized for 2 x ADWF and therefore, the effective storage capacity of the Equalisation Tanks (in terms of difference between screen and MBR capacity) is 48 hours, allowing for even the most extreme storm event, including at Stage 3. 15. Road tanker pump out from individual PSUs and inlet balance tank if required (as is occurring currently under the VWS operations license to prevent overflow)	A	Rare	4	Major	High
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	1. Customer supply contracts and recycled water use agreement will be developed with each customer and will include obligations and education regarding appropriate substances to be disposed of to sewerage & substances that must be avoided (with fines applicable to discharge of banned substances.) 2. Ongoing customer awareness campaigns & information provided with each water bill & through the Lend Lease Bingara Gorge website (https://www.bingaragorgeonline.com.au/Recycled-Water/default.aspx) and the existing VWS website (http://www.myrecycledwater.com.au/) 3. Ability for LL to install online water quality monitoring probes (e.g. TDS, pH, TOC etc.) into pressure sewer pump wells to detect suspected inappropriate trade waste practices (if deemed necessary based on abnormal influent at the Bingara PWRP.	B	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	1. Predominately residential sewerage catchment with non-residential customers account for 10% of all wastewater generated. 2. 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. 3. Each non-residential customer in the pressure sewer catchment will have its own low pressure sewage pump station to enable monitoring of customer specific compliance with trade waste agreements. 4. Ability to install online water quality monitoring probes (e.g. TDS, pH, TOC etc.) into pressure sewer pump wells to detect suspected inappropriate trade waste practices. 5. Effluent compliance monitoring at the WWTP discharge 6. Soil monitoring as required if determined a risk of poor quality/risk to plants	B	Unlikely	3	Moderate	Moderate

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Scheme Component	Hazard	Hazardous Event	Impact	Control Strategy	Mitigated Risk				
					Likelihood		Consequence		Risk
	Shock load of chemical or other contaminants	Poor chemical or trade waste management practices resulting in shock load of contaminants on MBR	Potential biomass die off and reduction in MBR effluent quality Impact on membranes and other equipment Chemicals may also be an OHS hazard Impact on reuse potential	1. Concentrations of parameters unlikely to be above critical values for biomass activity 2. Continuous online monitoring of MLSS, DO, pH, EC and other process parameters at the BIngara PWRP to detect potential impacts on the treatment process (in bioreactors and on effluent) 3. If contaminants detected, an investigation will be undertaken into the source of contamination. This may involve review of Pressure Sewer Unit (PSU) operational data, water usage data, trade waste agreements etc. 4. Additional online water quality monitoring probes can be installed into suspect PSUs for tracing persistent sources of contamination if required. 5. Road tanker pump out of contaminated water from the WWTP inlet balance tank if required. 6. 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	A	Rare	3	Minor	Low
	Gross pollutants in raw wastewater	Poor solid waste management practices resulting in sewer blockage and overflow	Potential sewer blockage and overflow	1. Low pressure sewerage system with grinder pumps will macerate sewage prior to entering the pipe network. 2. Appropriately designed gravity network designed to achieve self-cleansing velocities. 3. Sewer/pump blockage Emergency Response Plan will be developed for the scheme and will include steps for identification of route cause and preventative actions. 4. Where multiple blockages have occurred at the same location, specific customer awareness/education will be implemented or compliance notices issued. 5. Maintenance regime will be developed for the pressure sewer network. 6. VWS will be on call with equipment for clearing blockages. 7. Gravity catchment flows are macerated prior to entering the WWTP inlet balance tank.	C	Possible	2	Minor	Moderate

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Scheme Component	Hazard	Hazardous Event	Impact	Control Strategy	Mitigated Risk				
					Likelihood		Consequence		Risk
Low Pressure Sewerage Collection System	Inflow and infiltration to the sewerage network	Inflow and infiltration to the sewerage network	Potential overflow from inlet balance tank if combined inflows exceed capacity of the inlet screens/pumps	1. Low pressure sewerage system constructed with PE100, PN16 HDPE with welded joints and fittings. 2. D/S pumps in the majority of PSU 3. Contractor induction and education. 4. Inspection and quality assurance during construction. 5. Pump starts/runtime at each PSU to detect sources of inflow. 6. WWTP Inlet Balance tank provides buffer and emergency storage. 7. More than 24 hrs storage capacity in each PSU. 8. Inlet feed pumps and screens are sized for 205 m3/h which is equivalent of 6 x ADWF for the gravity sewer and 1.5 x ADWF for the pressure sewer at Stage 3. This allows capacity for screening of peak wet weather flows for transfer to the equalization tank storage. 9. Inlet screens are sized for Stage 3 PWWF (205 m3/h) at Stage 2 (where PWWF is only expected to be 122 m3/h). This will allow for assessment of the requirement to increase flow attenuation in the network prior to population growth, with significant additional capacity provided during Stage 2 for wet weather flows. 10. Equalisation tank storage 2 ML stage 2 11. Tanker in emergency situation	C	Unlikely	2	Minor	Low
	Inflow and infiltration upstream of Pressure Sewer Unit (PSU)	Inflow and infiltration upstream of Pressure Sewer Unit (PSU)	Potential overflow from PSU	1. Plumbing inspection of all household plumbing installation prior to connection. 2. Customer contract required that do not connect rainwater to the PSU 3. Reports on PSU levels, runtimes, including during rainfall, to assist in detecting infiltration. 4. Customer education and rectification noticeswill be provided if required. 5. Solvent welded joints in gravity sub sewers.	C	Possible	2	Minor	Moderate
	Blockages upstream of Pressure Sewer Unit (PSU)	Blockages upstream of Pressure Sewer Unit (PSU)	Overflow from household and customer complaints	1. Induction and awareness training for pressure sewer contractors working in the scheme. 2. Upstream pipes designed and constructed to AS3500 plumbing code with 1:60 grade for self cleansing. 3. level monitoring and pump start/runtime at each PSU to identify sources of blockages. Customer education and rectification notices will be provided if required. 4. VWS on call with cleaning equipment for removing blockages. 5. Contractors called in for removing blockages if necessary.	C	Possible	2	Minor	Moderate
	peak flow above 1.5 x ADWF	Excessive peak inflows	Potential overflow from inlet balance tank if combined inflows exceed capacity of Inlet Screens	1. PSU pump operation centrally controlled at the treatment plant to individual pump stations. 2. Capacity to switch off PSU (to be automated if necessary) *See additional controls for excessive inflows above.*	A	Rare	2	Minor	Low
	Pressure main break	Pressure main failure or breakage due to unapproved excavation activity	Discharge of raw sewage to the environment	1. All mains constructed with PE100, PN16 HDPE pipe with welded joints and fittings. 2. All mains are pressure tested and certified during construction. 3. Pressure sewer mains are generally located at the bottom of a common services trench, hence other pipes will be damaged from poor excavation practices before the pressure sewer. 4. Signage and identification tape to be installed above all pressure mains. 5. All sewer pipe locations registered with dial before you dig service. 6. Customer Service Centre and fault reporting with maximum response times for operations staff. 7. Sewer spill Emergency Response Plan and clean-up procedures will be developed.	B	Unlikely	2	Minor	Low
	Leakage from PSU wet well	Failure of PSU wet well resulting in subsurface leakage	Discharge of raw sewage to groundwater	1. Clean water static pressure test of each wet well during construction. 2. Wet well designed to include allowances for all structural loads including hydrostatic and soil pressures. 3. PSUs out of trafficked areas.	B	Unlikely	2	Minor	Low
	Pump Failure	Pump failure by power surge, blockage, loss of suction etc.	Potential discharge of raw sewage to the environment	1. All pumps in the scheme are monitored and an alarm raised if any abnormality is detected. Monitoring includes: wet well water level, pump fault detection, power system fault detection, number of starts and run hours for both the duty and standby pumps (where D/S), current draw in operation and during start up and energy consumption. 2. Duty and standby pumps in each PSU in the Bingara Gorge pressure sewerage catchment. 3. Fail safe in electrical system so pump can operate during control system failure. 4. High quality robust pumps with long design life. 5. Standard pumps with spare pumps maintained onsite for quick changeover if required.	B	Unlikely	3	Minor	Low

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Scheme Component	Hazard	Hazardous Event	Impact	Control Strategy	Mitigated Risk				
					Likelihood		Consequence		Risk
Low Pressure Sewerage Collection System cont...	Power failure	Extended power failure across pressure sewer network	Potential discharge of raw sewage to the environment	1. 24 hours storage is provided in all PSUs. 2. Road tanker pump out from individual PSUs if required. 3. Water usage low during power failure – therefore actual storage in this circumstance is greater.	B	Unlikely	2	Minor	Low
Gravity Sewerage Collection System	Inflow and infiltration to the gravity sewerage network	Inflow and infiltration to the gravity sewerage network	Potential overflow from SPS or inlet balance tank if combined inflows exceed capacity of Inlet Pumps/Screens	1. Inlet balance tank at WWTP provides buffer and emergency storage. 2. Audit of the gravity sewer network will be undertaken to repair existing damage. 3. Operational monitoring of the SPS flows and wet well water level with high level alarms. 4. 150 kL emergency storage in SPS wet well, 110 kL emergency storage tank and upstream reticulation network. 5. Emergency truck pump out from inlet balance tank if required. 6. Total of >24 hours storage in PSU scheme (can switch off the PSUs if required via control panel at WWTP) 7. Inlet feed pumps and screens are sized for 205 m3/h which is equivalent of 6 x ADWF for the gravity sewer and 1.5 x ADWF for the pressure sewer at Stage 3. This allows capacity for screening of peak wet weather flows for transfer to the equalization tank storage. 8. Inlet screens are sized for Stage 3 PWWF (205 m3/h) at Stage 2 (where PWWF is only expected to be 122 m3/h). This will allow for assessment of the requirement to increase flow attenuation in the network prior to population growth, with significant additional capacity provided during Stage 2 for wet weather flows.	C	Unlikely	2	Moderate	Moderate
	Blockages upstream of SPS	Blockages upstream of SPS	Potential overflow from sewer	1. Upstream pipes designed and constructed to WSAA code to achieve self-cleansing. 2. VWS on call with cleaning equipment for removing blockages. 3. Maintenance access designed into the sewerage network. 4. Customer Service Centre and fault reporting with maximum response times for operations staff. 5. Sewer spill Emergency Response Plan and clean-up procedures.	C	Possible	2	Minor	Moderate
	Overflow event	Overflow from SPS	Public health or environmental risk following an overflow event	1. The occurrence of all overflow events will be detected by the control system based on water level monitoring in the SPS wet well. 2. SPS and rising main to be upgraded as required to meet current and future flows (major limitation is currently rising main which is under construction) 3. D/S pumps in SPS 4. Generator installed to power SPS pumps 5. Capacity to Tanker – no overflow intended to occur under any circumstance from the SPS.	C	Rare	2	Moderate	Low
Gravity Sewerage Collection System	High peak diurnal flows	Excessive peak inflows	Potential overflow from SPS or inlet balance tank if combined inflows exceed capacity of Inlet Pumps/Screens	1. Inlet screens sized to manage PWWF which is well above peak diurnal expectations. 2. Equalisation Tank Storage of 2 ML at Stage 2 and 3 ML at Stage 3 for future growth allows the equivalent of > 16 hours storage at PWWF at Stage 3. 3. MBR units are sized for 2 x ADWF and therefore, the effective storage capacity of the Equalisation Tanks (in terms of difference between screen and MBR capacity) is 48 hours, allowing for even the most extreme storm event, including at Stage 3. This is more than adequate capacity for diurnal variation in flows. 4. Equalisation tanks with 2 ML able to flatten diurnal variation to membranes to be negligible. 5. Membranes sized for 2xADWF (with D/S), adequate for peak flow with Equalisation Tank volume, and more than adequate for diurnal variation.	A	Rare	2	Minor	Low

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Scheme Component	Hazard	Hazardous Event	Impact	Control Strategy	Mitigated Risk				
					Likelihood		Consequence		Risk
Gravity Sewerage Collection System	Gravity main break	Gravity main failure or breakage due to unapproved excavation activity	Discharge of raw sewage to the environment	1. Signage and identification tape to be installed above all gravity mains. 2. All sewer pipe locations registered with dial before you dig service. 3. Customer Service Centre and fault reporting with maximum response times for operations staff. 1. Sewer spill Emergency Response Plan and clean-up procedures	B	Unlikely	2	Minor	Low
	Leakage from SPS wet well	Failure of SPS wet well resulting in subsurface leakage	Discharge of raw sewage to groundwater	1. SPS wet well designed to include allowances for all structural loads including hydrostatic and soil pressures.	B	Rare	2	Minor	Low

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Scheme Component	Hazard	Hazardous Event	Impact	Control Strategy	Mitigated Risk				
					Likelihood		Consequence		Risk
Gravity Sewerage Collection System	Pump Failure	Pump failure by power surge, blockage, loss of suction etc.	Potential discharge of raw sewage to the environment	1. All pumps in the scheme (including SPS) are monitored and an alarm raised if any abnormality is detected. Monitoring includes: wet well water level, pump fault detection, power system fault detection, number of starts and run hours for both the duty and standby pumps, current draw in operation and during start up and energy consumption. 2. Duty and standby pumps in SPS.	B	Unlikely	3	Moderate	Moderate
	Power failure	Extended power failure at SPS	Potential discharge of raw sewage to the environment	1. Standby power generator provided at SPS. 2. 150 kL emergency storage in SPS wet well, 110 kL emergency storage tank and upstream reticulation network. 3. WWTP Inlet balance tank provides storage for peak inflows that could occur if a control system failure and power failure occur simultaneously. 4. Emergency bunded road tanker pump out from inlet balance tank if required.	B	Rare	2	Minor	Low
Wastewater Treatment - Inlet Balance Tank, Equalisation Tanks, Activated Sludge Tanks, Membrane Tanks, UV Disinfection, Chlorination, Treated Water Storage	Structural failures of raw sewage/ process tanks and pipes	Tank failure	Discharge of process water to environment	1. Steel panel tanks / FRP membrane tanks with appropriately designed footings. 2. Quality assurance during tank manufacture and installation.	A	Rare	3	Moderate	Low
	Process tank overflows	Blockage or fault causing overflow of process tanks	Discharge of process water to environment	1. Screening system to remove gross solids and avoid blockages. 2. Overflows on all tanks back to a centralized return pump station. 3. Return pump station to inlet balance tank to ensure screening of all overflows 4. Overflow from return pump station to transfer pump station (transfer to equalization tanks) 5. Automated pump shutdowns on high levels in process tanks. - Overflow in AS tank – - shutdown AS feed pumps and accumulate feed in equalization tanks - Overflow in Equalisation tank – shutdown Transfer Pumps and WWTP inlet pups, accumulate flows in WWTP inlet tanks until such time as issue can be rectified. 6 pump out from the return pump station possible if required in extreme operating conditions	B	Unlikely	2	Minor	Low
	Mechanical/ electrical items	Failure of mechanical electrical items	Non-compliant recycled water	1. Fault detection on all critical mechanical electrical components. 2. Continuous online water quality monitoring of critical process parameters, e.g. DO, pH, MLSS, transmembrane pressure, turbidity, UV intensity. 3. Duty/Standby provision for critical equipment (redundancy strategy verified during HAZOP of P&ID) 4. Dial-out alarms for operators to initiate changeover of D/S status of equipment as required.	C	Possible	2	Minor	Moderate
	Power blackouts	Extended power blackout	Loss of treatment capacity	1. Generator backup of treatment plant 2. Generator backup of SPS 3. No sewage inflow during power blackout as pressure sewer system will also be down 4. Wastewater will Build-up in 24 hours emergency storage at each PSU. 5. Road tanker pump out from each PSU if required. 6. Battery backup of alarm systems.	C	Possible	2	Minor	Moderate
	Blockage of inlet screening unit	Blockage of screening unit caused by excessive solids in raw wastewater	Overflow of screens to the return pump station to return flows to WWTP inlet balance tank	1. Only macerated sewage will enter the plant. 2. Water level monitoring and high level alarm (dial-out) in screening units. 3. If screening blockage occurs undertake investigation into source of gross solids and implement preventative actions.to NOTE: Overflow of screens is to return pump station for transfer to head of the plant.	B	Unlikely	2	Minor	Low

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Scheme Component	Hazard	Hazardous Event	Impact	Control Strategy	Mitigated Risk				
					Likelihood		Consequence		Risk
Wastewater Treatment - Inlet Balance Tank, Equalisation Tanks, Activated Sludge Tanks, Membrane Tanks, UV Disinfection, Chlorination, Treated Water Storage	Pollutant overload	Excessive BOD or ammonia load	Non-compliant recycled water	1. Continuous online monitoring of MBR process DO, MLSS, ORP, ammonia and nitrate with alarms. 2. Ammonit (Veolia proprietary) control of aeration to achieve required performance. 3. Variable speed drive aeration system to match air supply with inflow and DO set point based on Ammonit selection. Reserve capacity is designed into the aeration system. 4. If process impacts due to high pollutant loads are observed a source control investigation will be undertaken using raw wastewater, trade waste data and pressure sewer pump data.	B	Unlikely	3	Moderate	Moderate
	Membrane CIP waste	Return of chemical laden CIP waste through MBR	Potential upset of treatment process and biomass die off	1. MBR inline CIP concentrations below critical level for biomass die off. 2. Return of CIP waste to transfer sump and back to head of plant for dilution with feed. After CIP, filtrate valve will be closed to ensure this occurs. 3. Capacity after CIP return to WWTP inlet balance to have additional storage time in the WWTP inlet balance tank to provide greater dilution with raw sewage. 4. If operational problems are experienced MBR CIP waste will be trucked off site to nearest approved facility.	B	Unlikely	3	Moderate	Moderate
	Process chemicals	Spillage of process chemicals	Potential release of chemicals to the environment Potential OH&S impacts	1. Appropriate bunding and separation of chemicals in chemical storage and delivery area with space allowed between sodium hypochlorite tank and ferric chloride storage 2. Standard operating procedures for the transport, receipt and use of chemicals.	A	Rare	2	Minor	Low
	Waste activated sludge	Inadequate sludge wastage rates	High MLSS in MBR, decline in effluent quality & increased membrane fouling	1. Continuous online monitoring of MLSS, DO, turbidity and TMP with alarms. 2. Installation of sludge dewatering system at Stage 2. Transfer of WAS as required (operator initiated) to dewatering as required. Reduced requirement for biosolids transport offsite, making the MLSS relatively easy to control in bioreactors.	B	Unlikely	3	Moderate	Moderate
	Membrane failure	Membrane failure resulting in carryover of human pathogens	Non-compliant recycled water	1. Continuous online monitoring of membrane permeate turbidity and transmembrane pressure. 2. Log 1 removal guaranteed by automated shutdown of membranes if turbidity reaches 0.5 NTU (see CCP below) 3. If event occurs, identify and isolate failed membrane module and if required replace failed membrane module. 4. MBR membrane tank capacity = 4 x ADWF with flow through process limited to 2 xADWF. Provides for shutdown of up to two membrane tanks at a time if required. Full operation of activated sludge enabled over this time with returns to the alternate activated sludge trains. 5. Multi-barrier approach provides assurance that UV unit and chlorine will achieve LRV. If concern, multi-dosing points for chlorine provided (inlet to CCT, outlet to CCT and on the supplies to recycled water network and irrigation) 6. If considered that shutdown process ineffective to guarantee 1 log removal, shutdown on recycled water pumps to network may be initiated. In this event, testing of treated water storage water quality prior to restarting supply of recycled water to the network. 7. Undertake monitoring of pond water quality to ensure compliance for water out of plant. 8. Chemical treatment of pond water can be undertaken if necessary. 9. An Emergency Response Plan will be developed for MBR membrane failure. 10. Preventative scheduled maintenance of membranes to reduce likelihood of failure. **CCP1 :** turbidity does not exceed any of the following: 0.2 NTU more than 5% of the time within a 24-hour period and 0.5 NTU at any time. **Response:** If CCP not met (checked as above), membrane tanks taken out of service until problem rectified (as above)	B	Unlikely	3	Moderate	Moderate

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					Likelihood		Consequence		Risk
Wastewater Treatment - Inlet Balance Tank, Membrane Bioreactor + UV Disinfection cont...	UV failure	Inadequate UV dose due to lamp failure, reactor fouling, high flow or high turbidity	Non-compliant recycled water	1. Continuous online monitoring of UV transmissivity and flow to UV units for adjustment of UV intensity (dose) provided 2. Continuous online monitoring UV intensity, and adjustment of intensity based on measured flow and transmissivity 3. Monitoring of upstream permeate turbidity and shutdown of membrane tank on turbidity exceeding 0.5 NTU. 4. Continuous online monitoring of lamp failure. 5. If Low UV dose is recorded filtrate pumps shutdown and operator initiates changeover duty/standby of UV units. investigate and rectify. 6. Shut off recycled water pumps and supply network via potable water supply 7. Testing of treated water storage water quality to ensure compliance before provision to network. Option of drain down of treated water storage to pond if adequate for irrigation, but not RW network. Following drain down, tanks would be refilled with potable water. 8. Undertake monitoring of pond water quality to ensure compliance. 9. Chemical treatment of pond water can be undertaken if necessary. 10. An Emergency Response Plan will be developed for UV lamp failure. 11. Scheduled UV unit cleaning. **Validation of Log Removals:** Validation based on compliance of unit with log-removal requirements at flow rate of 120 m3/h and UVT > 65% (expected to be suitable for Stage 3 flows) from USEPA (2006)Ultraviolet Disinfection GuidanceManual for LT2 ESWTR report Units provided: Duty/ Standby Xylem Wedeco LBX850e **CCP1:** Online monitoring that UVT > 65% **CCP2:** Online monitoring of UV intensity, checking that this matches requirement at the flow/UVT measured (flow paced adjustment) **Response:** If CCP not met (checked as above), filtrate pumps (feeding UV) are shutdown. Operator then initiates Duty/ Standby changeover of the UV units.	B	Unlikely	3	Moderate	Moderate

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Scheme Component	Hazard	Hazardous Event	Impact	Control Strategy	Mitigated Risk				
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	Chlorine Dose Inadequate at CCT inlet	Inadequate chlorine dose to achieve LRV	Non-compliant recycled water	1. Chlorine contact tanks operated in series with 30 mins (at peak flow) total storage, and 9 minutes effective storage, assuming baffling factor of 0.3 2. Continuous online monitoring residual chlorine at the outlet of the chlorine contact tanks 3. Provision for either flow paced dosing or compound dosing (based on residual measured) at inlet to chlorine contact tanks 4. If low residual chlorine is recorded at any point in system (based on alarms selected for CCP) investigate and rectify. 5. Ability to dose additional chlorination on inlet to the TW storage tanks if inadequate residual measured on chlorine contact tank outlet – in general, dose will be adjusted to make up shortfall (e.g. if measure 1 mg/L on chlorine contact tank outlet will dose additional 1 mg/L at inlet to TW storage tanks). 6. Ability to dose additional chlorine on recycled water supply line (to lilac network) if inadequate residual measured on this line. 7. Ability to dose additional chlorine on overflow from TW tanks to irrigation pond if inadequate residual measured on this line. 8. If chlorine inadequate on RW supply to network, shut off recycled water pumps and supply network via potable water supply 9. If shutdown initiated, testing of treated water storage water quality to ensure compliance before provision to network. Option of drain down of treated water storage to pond if adequate for irrigation, but not RW network. Following drain down, tanks would be refilled with potable water. 10. Undertake monitoring of pond water quality to ensure compliance. 11. An Emergency Response Plan will be developed for chlorination failure. 12. Regular checks of chlorine dosing pump calibration and ensure that degradation of sodium hypochlorite accounted for in PLC inputs (operator able to adjust strength of solution) 13. Regular checks of residual chlorine measurement instrumentation **Validation:** Measurement of a 2 mg/L chlorine residual on discharge from the chlorine contact tank (online measurement) CT of 18 mg.min/L selected for 4-log virus removal with free chlorine (considering residual ammonia/ organics.) Additional 13 mg/L allowed in chlorine dosing to achieve breakpoint under maximum ammonia /organic conditions. Total chlorine dose of 15 mg/L to achieve residual requirement (basis of design for chlorine dosing) **CCP1:** 2-3 mg/L Cl residual measured on outlet of chlorination tanks. **CCP2:** Flow to Chlorine contact tanks < 80 m3/h to ensure residence time is achieved	B	Unlikely	3	Moderate	Moderate
Wastewater Treatment - Inlet Balance Tank, Membrane Bioreactor + UV Disinfection cont...	Chlorine Dose Inadequate in supply to RW network	Inadequate chlorine dose to achieve residual in the network	Non-compliant recycled water	1. Sodium hypochlorite dosing provided at inlet to treated water tank available (if required) 2. Sodium hypo dosing and free chlorine residual monitoring provided on discharge from recycled water pumps to recycled water network 3. Sodium Hypo dosing and free chlorine residual monitoring provided on the outlet from treated water tank to irrigation (overflow discharge) 4. Sodium hypo dosing on recycled water supply to recycled water network is normally based on compound dosing control for a preset network supply chlorine residual (adjusted seasonally). This is a CCP. 5. Limits of low, high at CCP alarm 6. Limits of very low / very high at CCP shutdown the pumps until concern rectified. 7. Monitoring of free chlorine at furthest point in the network to inform chlorine residual setpoints for network supply (including based on seasonal variability) 8. **CCP1:** 0.5 mg/L Cl residual measured on chlorine supply to RW network for residual disinfection	B	Unlikely	3	Moderate	Moderate

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	Sabotage/ vandalism	Sabotage/vandalism	Potential loss of treatment function	1. Lockable site with 6-foot secure fencing. 2. Lockable shed for all treatment equipment. 3. Remotely accessible CCTV system at WWTP site. 4. Community awareness and involvement in the local water scheme.	B	Unlikely	3	Moderate	Moderate
Wastewater Treatment - Inlet Balance Tank, Membrane Bioreactor + UV Disinfection cont...	Noise	Excessive noise generation	Noise complaints for nearby residents	1. All sewage pumps in the gravity and pressure sewer networks are submersible pumps located below ground level in an enclosed chamber. 2. A 250 metre buffer from the WWTP to the nearest residential dwelling. 3. WWTP building located adjacent to the Hume Hwy, which is impacted by background traffic noise. 4. Blowers located in acoustic enclosures and in a separate building 5. Screens and centrifuge located in a building and fully enclosed. 6. Equipment specifications and design of custom noise enclosures will be undertaken to ensure compliance with the NSW Industrial Noise Policy of background noise plus 5 dBA at nearest residential dwelling. 7. All planned construction and routine maintenance works will be undertaken during standard permissible hours. 8. All emergency works will be undertaken to minimise noise impacts on residents. 9. 24 hour customer service call centre for fielding all noise and other complaints. All complaints are recorded, reviewed and acted upon	A	Rare	2	Minor	Low
	Odour	Excessive odour generation	Odour complaints by nearby residents	1. Ventilation stacks provided on all house connections to ensure gravity sewers are well ventilated. 2. All gravity sewers designed to achieve self-cleansing velocity to avoid accumulation and breakdown of solids in the network. 3. Minimum of 250 m buffer between the WWTP site and residential dwellings. 4. Passively ventilated McBerns activated carbon filters will be used on all air valves in the pressure sewer network and gravity SPS rising main. 5. Inlet structure to enable the rising mains to discharge into the bottom of the WWTP inlet balance tank below the bottom water level to minimise release of gases inside the tank. 6. Actively ventilated McBerns activated carbon filter on the WWTP inlet balance tank. 7. Equalisation tank off-gases to be treated with activated carbon with a discharge stack at 10m to promote dispersion of offgases. 8. Dewatering and screenings solids skips to be fully enclosed. 9. Transfer sump, return sump, dewatering, screening offgases to be treated in odour control unit with a discharge stack at 10m to promote dispersion of offgases. 10. The incoming pressure sewer mains will be injected with metals salts if required for odour control 11. WWTP building has automatic indoor air quality monitoring for temperature, oxygen, hydrogen sulphide and methane, with automatic operation of an evaporative air conditioning unit to maintain ventilation and air quality. 12. 24 hour customer service call centre for fielding all odour and other complaints. All complaints are	A	Rare	2	Minor	Low
	Sludge Spillage	Spillage of sludge	Potential OH&S and public health impacts. Potential environmental impacts.	1. Sludge skips within containment 2. Contractor suitable for waste collection for biosolids transport offsite. 3. O&M procedures for sludge clean up to prevent hose off to environment or operator contact.	C	Possible	2	Minor	Moderate
	Aesthetics	Excessive visual impacts	Complaints from nearby residents	4. All pressure sewer units (PSU) are located below ground. The only visible infrastructure is the lid and power turret for each PSU. 5. There will be approximately 4 lots connected to each PSU, which results in a lower visual impact compared to a standard pressure sewer model where there is one PSU for every lot. 6. Minimum of 250 metre buffer between the WWTP site and residential dwellings. 7. Maximum tank height of 9 m across site 8. Odour stack at 10 m height. 9. Maximum ladder height of 10.5 m across site 10. The WWTP building is located in a future industrial area with buildings of similar construction and visual appearance. 11. The scheme uses onsite recycled water storage with variable speed drive booster pump sets, hence there is no need to construct an elevated reservoir on a hill near the site to provide service pressures to the scheme	A	Rare	2	Minor	Low

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					Likelihood		Consequence		Risk
	Indoor air quality	Contamination of indoor air with harmful sewer gases	OH&S impacts	1. Air conditioner/ventilation system operation 2. Dewatering and screening equipment ducted to odour control facility 3. Equipment isolated in appropriate rooms (e.g. all screening / dewatering equipment in a single location, isolated from UV units and control panel)	B	Unlikely	3	Moderate	Moderate