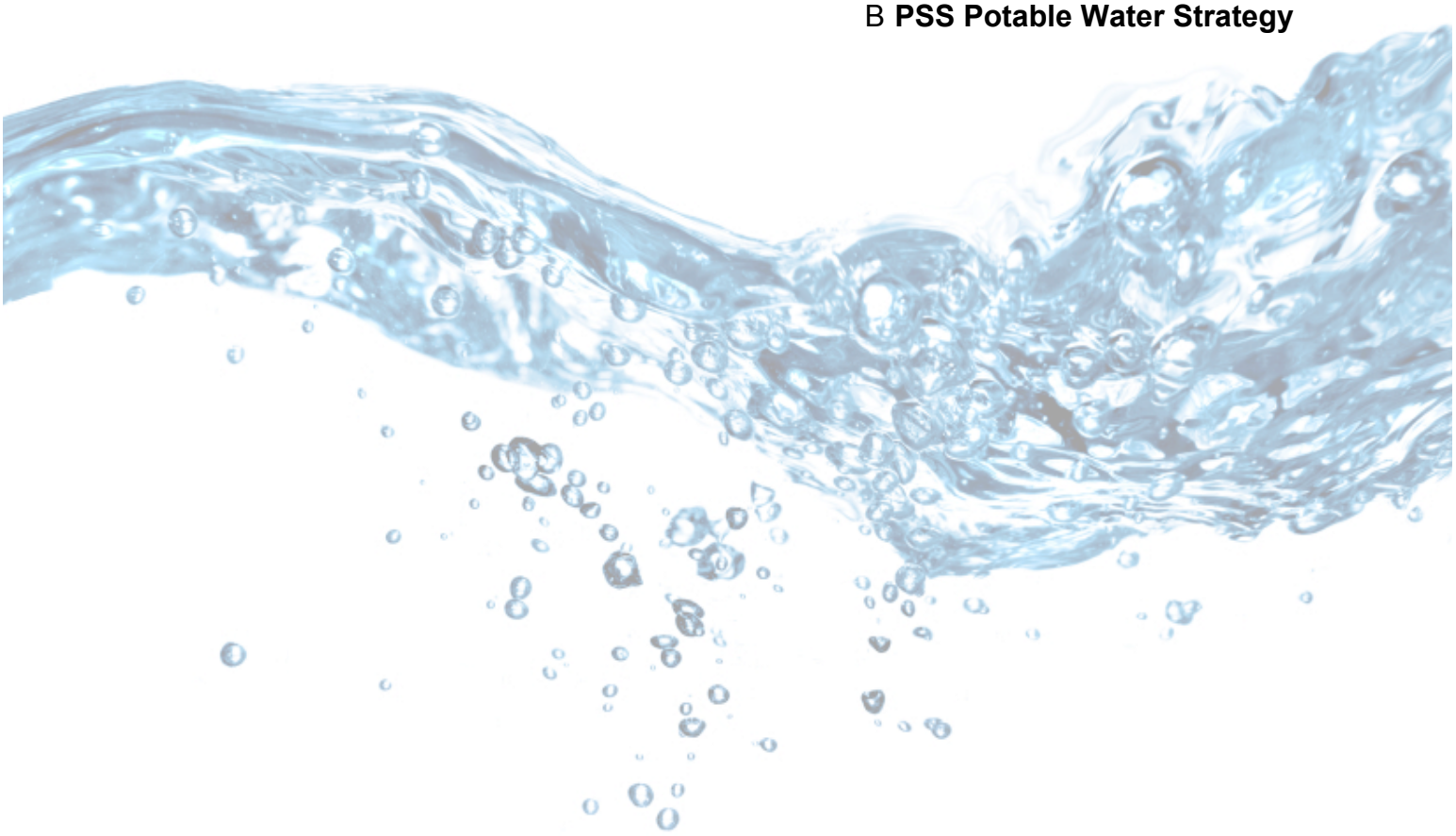
Appendix 4.1.6 **Bulk Supply Agreement**

A **Wyong Council Letter**
B **PSS Potable Water Strategy**



Wyong Shire Council
CENTRAL COAST

LD/Luke Drury
Our Ref D0328644

24 June 2013

Mr Wayne Williamson
Project Director
Solo Water
1-19 Hill Street
SUNSHINE BEACH QLD 4567

Dear Mr Williamson

Technical feasibility of potable water supply to Catherine Hill Bay

As discussed at Council's offices on 27 February 2013, Council's Water and Sewerage staff have assessed the proposal to supply bulk potable water to Catherine Hill Bay Water Utility Pty Ltd for the purposes of supplying approximately 650 residential dwellings at Catherine Hill Bay.

The proposal is technically feasible, with a suitable connection point within the Wyong Local Government Area to be determined at a later date. It is also noted that the associated commercial arrangements are yet to be discussed between Wyong Shire Council and Catherine Hill Bay Water Utility Pty Ltd.

The intent of this letter is to inform the Independent Pricing and Regulatory Tribunal (IPART) that Wyong Council is a feasible supply source of potable water for Catherine Hill Bay Water Utitlity's proposal to service Catherine Hill Bay.

If you would like to discuss this matter further, feel free to contact Luke Drury on 4350 5109.

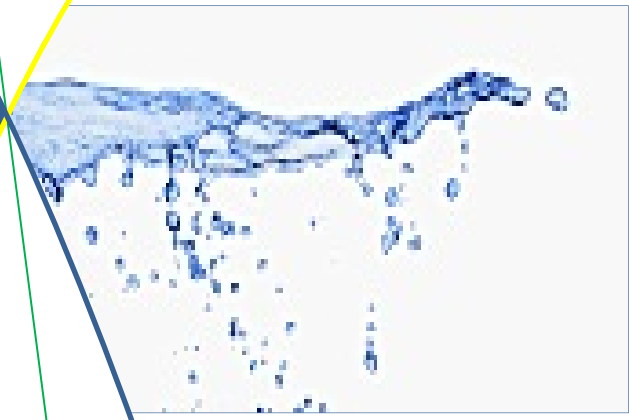
Yours faithfully

Daryl Mann
Manager
Water and Sewerage

WATER SUPPLY

SUMMARY SERVICING STRATEGY

Catherine Hill Bay



Prepared For

Solo Water

April 2013

Design Engineering Consultants
P.S. Solutions
ABN 57 097 164 899

PS SOLUTIONS PTY LTD

Document Information

Prepared for	Solo Water
Project Name	Catherine Hill Bay
File Reference	xxxxxxxxx
Job Reference	CHB
Date	12 Dec 2012

Contact Information

Pressure System Solutions Pty Ltd
A B N 57 097 164 899
1/47-51 Lorraine Street
Peakhurst NSW 2210
Sydney Australia
T: +61 2 9584 1177
F: +61 2 9584 1477

E: admin@pssolutions.net.au

PO Box 630 Jannali NSW 2226

Document Control

Version	Date	Issue	Author	Review / Approved
A	12.12.12	First Issue	CJR	SMW
B	15.04.13	Revised to Kanangra Drive Strategy	CJR	SMW

Document ID:
J:\700-Projects\800-Preliminary-Tender\Catherine Hill Bay\Water Service Main\Water Servicing Strategy\CHB Water Servicing Strategy 150413.docx

CONTENTS

1. GENERAL 1
2. DESCRIPTION OF WATER SERVICING STRATEGY 1
3. LOCATION OF CONNECTION AND METERING 2
4. CATHERINE HILL BAY WATER RETICULATION 2
5. WATER SUPPLY DESIGN CRITERIA 2
6. CATHERINE HILL BAY WATER DEMAND 3
7. HYDRAULIC MODELLING 3

ATTACHMENT 1 - WATER SERVICE MAIN MASTER PLAN 4
ATTACHMENT 2 - HYDRAULIC MODEL OUTPUTS 5

1. GENERAL

This strategy has been prepared for Solo Water. This document is a summary of the technical information for the water servicing strategy for Catherine Hill Bay (CHB), to be provided as supporting information for the CHB water servicing IPART Application.

This strategy encompasses the supply of potable water from the existing Wyong Council reservoir at Kanangra Drive Central Coast to the Catherine Hill Bay community.

2. DESCRIPTION OF WATER SERVICING STRATEGY

The proposed strategy is to service Catherine Hill Bay via a private water utilities transfer main extending from the existing Wyong Council reservoir at Kanangra Drive Central Coast to the Catherine Hill Bay Township.

The transfer main is to serve as the filling main for the proposed CHB Storage Reservoir on Montefiore Street Catherine Hill Bay. The water supply main is approximately 6,300m length.

The transfer main consists of two new sections of main, and the reactivation of an existing water main.

The first section of transfer main from the existing Kanangra Drive Reservoir is a proposed new 200mm HDPE 1.5 km long located in Kanangra Drive road reserve.

The transfer main then connects to an existing section of water main located in an existing NPWS/RFS fire trail. The main is 200mm HDPE. The existing main supplied water to a former coal main located on the proposed Catherine Hill Bay development site. The existing section to be reused will be pressure tested and disinfected before being returned to service.

The final section of transfer main is a new 200mm service located on the new development site extending from the existing water main to the proposed CHB Storage Reservoir on Montefiore Street Catherine Hill Bay

Refer to attached Water Service Main Masterplan for Catherine Hill Bay showing the proposed water transfer main location.

To transfer the water to Catherine Hill Bay a pumping station is required. A new water pumping station is to be constructed on the Kanangra Drive reservoir site pumping to a proposed new 0.5ML CHB Storage Reservoir on Montefiore Street at the Catherine Hill Bay development location. The new water pumping station is to be owned and operated by the private water utility.

Service isolation valves, scour valves and air valves shall be located within the main in accordance with WSA-03 minimum requirements and as required.

The Catherine Hill Bay reservoir shall be sized in accordance with private water utility licensing requirements.

3. LOCATION OF CONNECTION AND METERING

The connection to the Wyong Council system is proposed to be at the outlet distribution pipework at the Kanangra Reservoir. The water transfer pumps are proposed to be located adjacent to the connection to the Wyong Council system.

A Wyong Council bulk water meter is proposed to be located at the Kanangra Reservoir on the outlet of the water pumps. An easement will be required for the private water utility asset located on Wyong Council property.

4. CATHERINE HILL BAY WATER RETICULATION

The water reticulation system servicing Catherine Hill Bay shall extend from the Catherine Hill Bay reservoir and servicing the supply area included in the private water utility license.

The water service mains shall include fire fighting allowance in accordance with WSA-03.

5. WATER SUPPLY DESIGN CRITERIA

The water supply demand calculations for Catherine Hill Bay are based on the WSA 03-2002, using an average daily residential demand of 0.5 kL/d.

Catherine Hill Water Supply Design Criteria

WSA 2002	Table 2.1	Newcastle Peak Hour Demand Rate
1000m2 lots	L/s/100 Lots	2.9

Catherine Hill Bay		
Lots	651	Lots
p/lot	2.1	p/lot (preliminary only for determination of WSA Peaking factors)
Average Daily Flow	0.5	kL/d

6. CATHERINE HILL BAY WATER DEMAND

The number of house (ET) to be supplied from the Catherine Hill Bay Water system = 651.

Catherine Hill Bay project Water Demand

Peak Hour Demand Rate		
WSA peak hour factor	2.9	Factor
Calculated L/s Flow	19	L/s
Design Flow for Pumps	**23.3**	**L/s**
Peak Day Demand (Trunk main to balance tank)		
Average Day Demand	326	kL/d
population	1367	pop
WSA Factor for Population below 2000	2	PDD Factor
Peak Day Demand	**651**	**kL/d**
Peak Hour Demand (Distribution main from Balance Tank)		
Average Hour Demand (Peak day)	7.5	L/s
WSA Factor for Population below 2000	5	PHD Factor
Peak Hour Demand	**38**	**L/s**

7. HYDRAULIC MODELLING

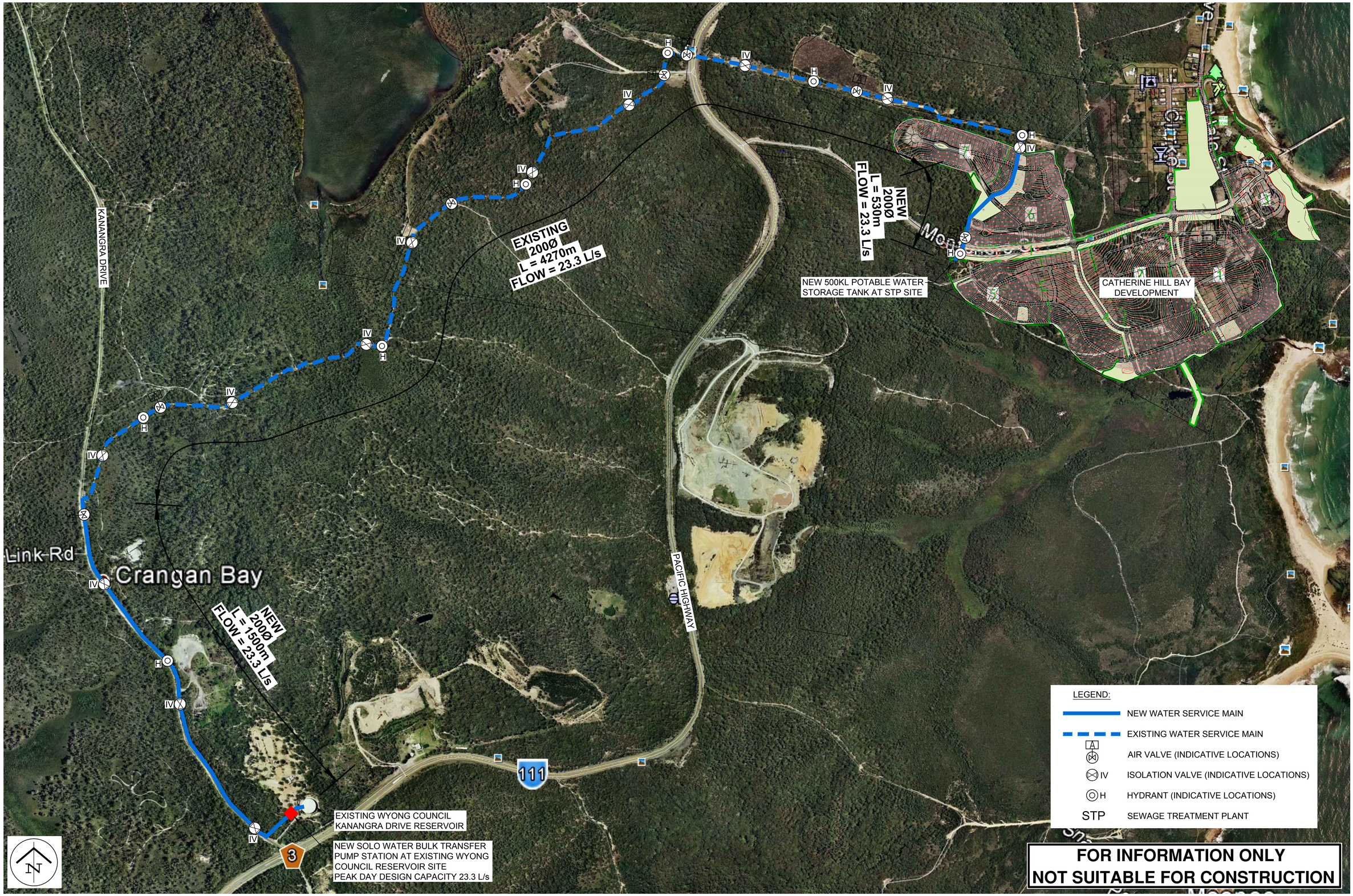
The rising main from the pressure system at Kanangra Drive Reservoir to the Catherine Hill Bay reservoir was modelled using Pipes software. The profile from Kanangra Drive reservoir to Catherine Hill Bay was based on preliminary geographical data.

Survey and geotechnical investigations will be conducted at the detail design phase of the project.

The hydraulic model nodal plan and design plans are attached.

Water Supply System Hydraulic Model Pipe Outputs
Design Parameters:
K = 0.06
Material = 200mm HDPE
Transfer Main Length = 6.3 km
Head loss = 0.7m / 100m

ATTACHMENT 1 - WATER SERVICE MAIN MASTER PLAN



Saved: 17.04.2013, By: kgao
J:\700-Projects\800-Preliminary-Tender\Catherine Hill Bay\Water Service Main\Catherine Hill Bay_Bulk Water Main.dwg

Date: 17/04/2013

Drawing No: SK003

Rev: A

Scale: 0 100 200 300m
SCALE 1:6000 AT A1

CATHERINE HILL BAY
WATER SERVICE MAIN MASTER PLAN

Solo Water

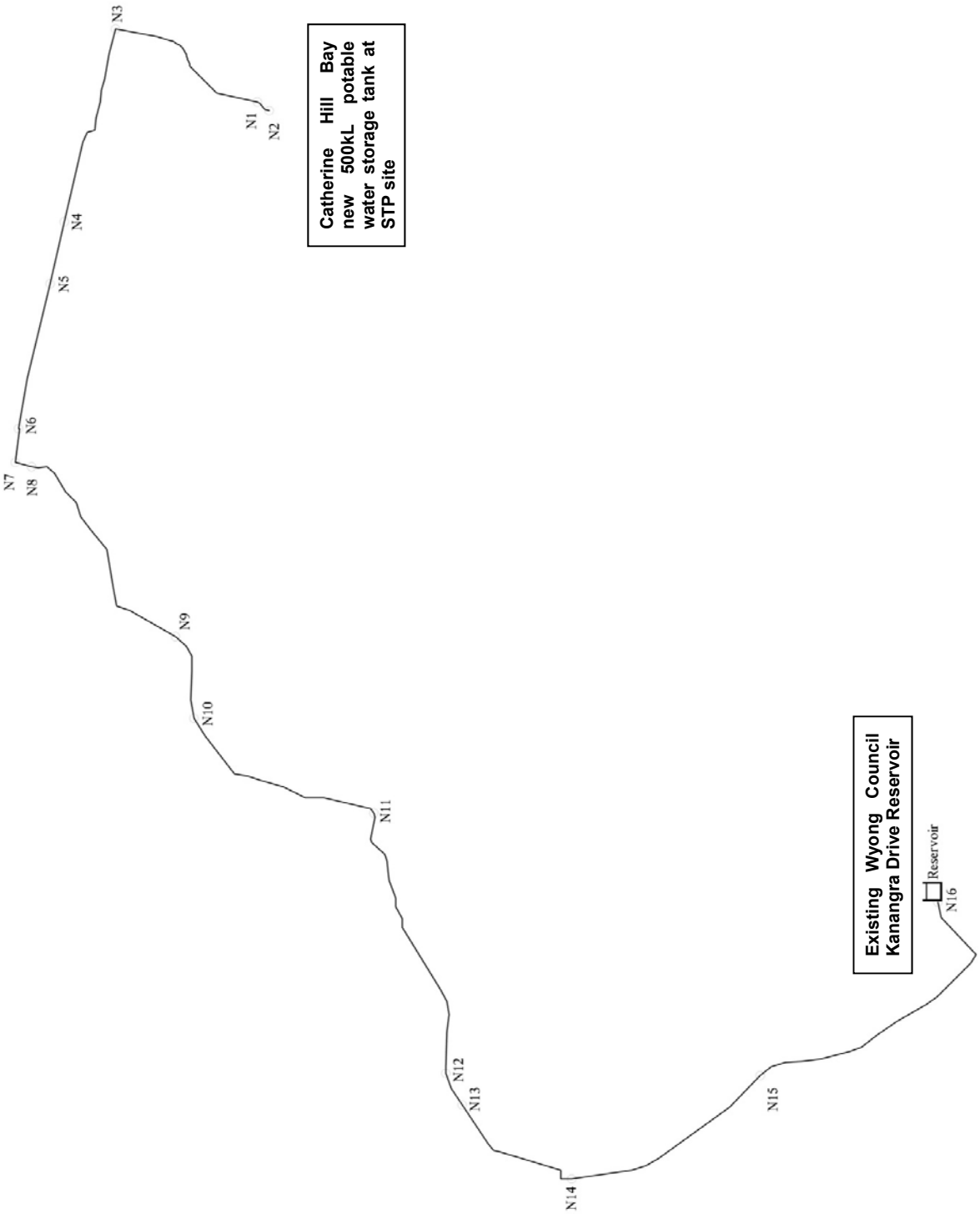
Pressure System Solutions Pty Ltd
PLANNING, DESIGN & IMPLEMENTATION OF WATER & WASTEWATER
Our Understanding and Experience Provides Certainty
PO Box 630 Jannali NSW 2226
www.pssolutions.net.au
T: +61 2 9584 1177
F: +61 2 9584 1477

ATTACHMENT 2 - HYDRAULIC MODEL OUTPUTS

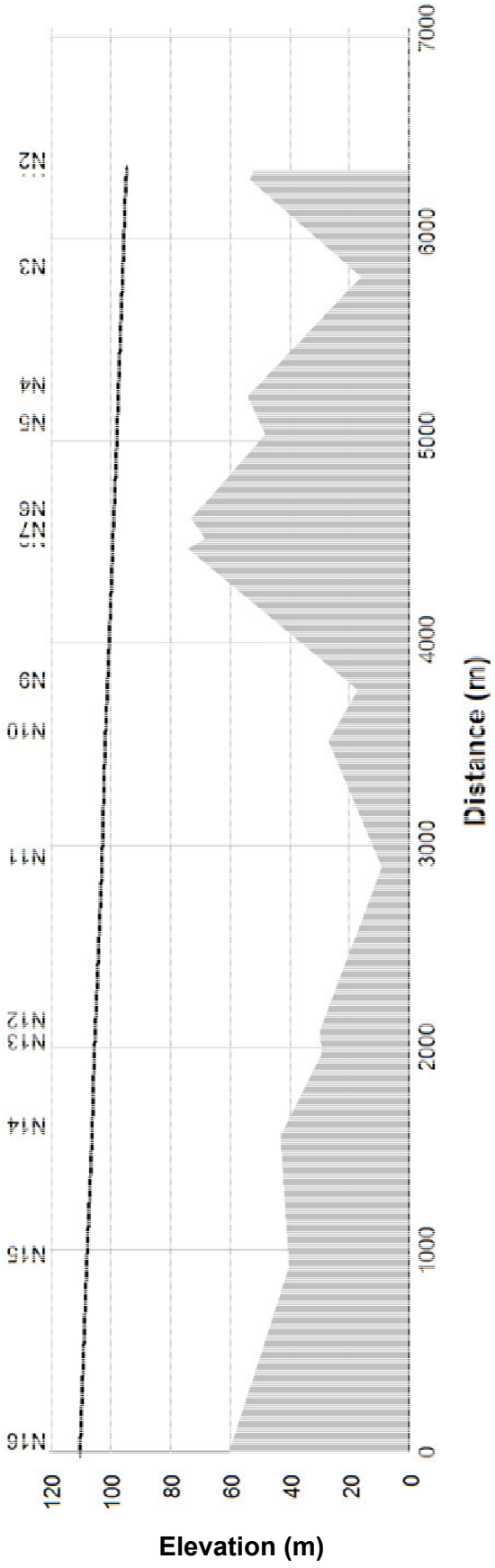
Hydraulic Model Pipe Results

Pipe		Flow (L/s)	Headloss (m/km)	Length (m)	Pipe Size (mm)
From	To				
N2	N1	23.3	2.44	45	200
N1	N3	23.3	2.45	481	200
N3	N4	23.3	2.45	584	200
N4	N5	23.3	2.47	182	200
N5	N6	23.3	2.44	422	200
N6	N7	23.3	2.45	98	200
N7	N8	23.3	2.65	49	200
N8	N9	23.3	2.45	694	200
N9	N10	23.3	2.46	252	200
N10	N11	23.3	2.44	615	200
N11	N12	23.3	2.45	811	200
N12	N13	23.3	2.45	102	200
N13	N14	23.3	2.46	411	200
N14	N15	23.3	2.44	634	200
N15	N16	23.3	2.45	918	200

Pipe Location: Easement Option: Water main model nodes



Functional Long Section



Appendix 4.1.9 **Drinking Water Preliminary Risk Assessment**

Project: Catherine Hill Bay Water Utility
Client: Rose Group
Title: Drinking Water Preliminary Risk Assessment for IPART Application
Author: BI
Date (Revision): 10/07/2013 (Revision B)
Risk Criteria: As per Tables 3.1, 3.2 & 3.3: Australia Drinking Water Guidelines 6 (2011)

Scheme Component	Hazard	Hazardous Event	Impact	Unmitigated Risk					Control Strategy	Mitigated Risk				
				Likelihood		Consequence		Risk		Likelihood		Consequence		Risk
Bulk Water Supply	Contaminants in bulk water source	Contaminants detected in Wyong Shire Councils monitoring systems	Supply of non-compliant potable water	C	Possible	4	Major	Very High	1. Bulk water agreement from Wyong Shire Council guarantees bulk water supply will be compliant with the Australian Drinking Water Guidelines. Wyong Shire Council is responsible for all upstream water quality, treatment and catchment management issues. 2. Develop notification and communication protocols with Wyong Shire Council to ensure Catherine Bay Water Utility is notified of all water quality events in a timely manner.	D	Unlikely	3	Moderate	Moderate
Potable Water Transfer Pump Station	Oil and pump lubricants	Water supply contaminated with oil/lubricant from failed pump seal	Supply of non-compliant potable water	C	Possible	2	Minor	Moderate	1. Appropriate pump selection and design. 2. Routine inspection and maintenance of transfer pump station	D	Unlikely	2	Minor	Low
	Transfer Pump Station Failure	Mechanical, electrical or control system failure or power outage	Loss of supply capacity	C	Possible	4	Major	Very High	1. Multiple pump set with standby capacity 2. 24 hours storage provided in onsite potable water storage tank	D	Unlikely	4	Major	High
Potable Water Transfer Pipeline	Microbiological contamination	Water main break	Supply of non-compliant potable water	C	Possible	4	Major	Very High	1. Design, construction, pressure testing and commissioning of the transfer main to WSAA Standards. 2. Emergency Response Plan to be developed for water main breaks will include water main sterilisation procedure	D	Unlikely	3	Moderate	Moderate
	Microbiological contamination	Cross contamination due to poor maintenance practices	Supply of non-compliant potable water	C	Possible	4	Major	Very High	1. Standard operating and maintenance procedures will be developed for the scheme. Procedures will include water main flushing, hygiene and disinfection requirements. 2. Separate tools to be used on water and sewerage systems.	D	Unlikely	3	Moderate	Moderate
	Microbiological contamination	Backflow and cross connections	Supply of non-compliant potable water	C	Possible	2	Minor	Moderate	1. No direct connections to the transfer pipeline. The only connection point to the pipeline is the onsite potable water and fire storage tank via a 300 mm air gap.	D	Unlikely	2	Minor	Low
	Sedimentation in pipeline	Excessive sedimentation in pipeline during off peak periods	Taste, odour and colour complaints	C	Possible	2	Minor	Moderate	1. Undertake routine flushing of the water transfer main 2. Customer taste and odour complaint monitoring system with Customer Service.	B	Likely	1	Insignificant	Moderate
	Pipeline breakage	Major pipeline breakage	Localised flooding, soil erosion, loss of supply	C	Possible	4	Major	Very High	1. Existing 200 mm HDPE main to be cleaned, air scoured, pressure tested, repaired and disinfected. Any non-compliant sections of main will be replaced. 2. Construction quality assurance. 3. Flow monitoring at each end of the pipeline to detect flow differential. 4. 24 hours storage provided in onsite potable water storage tank. 5. Emergency Response Plan for water main breaks. 6. Frequent inspection along water main corridor to detect leaks and breaks.	B	Likely	3	Moderate	High
	Pipeline leakage	Minor leaks	Water wastage	B	Likely	2	Minor	High	1. Use VSD controlled transfer pump station to minimise operating pressure during low flows. Pumps will only ramp up to maximum pressure when pumping peak flows. 2. Flow meters and pressure sensors on the transfer pipeline for monitoring of "midnight flows" for identification of leaks. 3. Walk over and visual inspection along water main corridor to identify leaks. 4. Use leak detection equipment if required.	B	Likely	1	Insignificant	Moderate
Onsite Potable Water Storage Tank	Microbiological contamination	Vermin, animal and mosquito access to storage	Supply of non-compliant potable water	B	Likely	4	Major	Very High	1. Sealed tank designed to potable water storage standards with screens on all tank openings. 2. Ongoing inspection & maintenance program	D	Unlikely	4	Major	High
	Material compatibility	Dissolution of tank materials into potable water supply	Supply of non-compliant potable water	C	Possible	4	Major	Very High	1. Tank constructed to potable water storage standards using materials compatible with potable water supply 2. Metallic tanks to use food grade HDPE liner.	D	Unlikely	3	Moderate	Moderate
	Cross connection	Backflow into water transfer main	Supply of non-compliant potable water	C	Possible	3	Moderate	High	1. Connection of transfer main uses an Air gap above the high water overflow level in the tank.	E	Rare	3	Moderate	Moderate
Recirculation & Chlorine Dosing	Chlorine residual	Inadequate chlorine residual (low or high)	Supply of non-compliant potable water	C	Possible	4	Major	Very High	1. Continuous online monitoring of free chlorine residual with alarms for low and high concentrations. 2. Duty and standby chlorine dosing pumps. 3. Fault detection and alarms on dosing pumps.	D	Unlikely	4	Major	High

Project: Catherine Hill Bay Water Utility
Client: Rose Group
Title: Drinking Water Preliminary Risk Assessment for IPART Application
Author: BI
Date (Revision): 10/07/2013 (Revision B)
Risk Criteria: As per Tables 3.1, 3.2 & 3.3: Australia Drinking Water Guidelines 6 (2011)

Scheme Component	Hazard	Hazardous Event	Impact	Unmitigated Risk					Control Strategy	Mitigated Risk				
				Likelihood		Consequence		Risk		Likelihood		Consequence		Risk
Potable Water Supply Booster Pump Station	Pump seals and lubricants	Water supply contaminated from failed pump seal	Supply of non-compliant potable water	C	Possible	2	Minor	Moderate	1. Appropriate pump selection and design. 2. Routine inspection and maintenance of transfer pump station.	D	Unlikely	2	Minor	Low
	Low pressure	Water pressure in potable network below that in the recycled water networks	Increased risk of backflow if a cross connection occurs	B	Likely	4	Major	Very High	1. Duty of drinking water supply booster pump station to be set a minimum of 50 kPa above duty of the non-potable water booster pump station. 2. Monitoring of water pressure differential between the drinking water recycled water networks.	C	Possible	4	Major	Very High
	Booster pump station failure	Mechanical, electrical or control system failure or power outage	Loss of supply capacity	C	Possible	4	Major	Very High	1. VSD pressure booster pump set with standby capacity. 2. Routine inspection and maintenance of booster pump station. 3. Standby emergency diesel pump with automatic changeover	C	Possible	4	Major	Very High
Potable Water Reticulation System	Class A+ recycled water network	Cross connection with the Class A+ recycled water network	Supply of non-compliant potable water	C	Possible	4	Major	Very High	Cross connection controls including: 1. Reticulation networks designed, constructed and commissioned to WSAA standards. 2. Unique pipe colour and materials. Potable uses blue PVC pipe. Class A+ recycled water network uses lilac striped HDPE pipe. 3. Identification and labelling and minimum separation distances in common trenches. 4. Only approved Solo Water contractors can undertake work on the reticulation networks. 5. Potable water network to operate a minimum of 50 kPa above that in the recycled water network. 6. Routine monitoring of potable water quality 7. Monitoring of pressure and salinity differential between the drinking and non-potable water networks	B	Likely	3	Moderate	High
	Sedimentation and slime growth	Excessive sedimentation in reticulation system during off peak periods	Taste, odour and colour complaints	B	Likely	1	Insignificant	Moderate	1. Routine monitoring and water main flushing program 2. Monitoring of taste and odour complaints through customer service processes	C	Possible	1	Insignificant	Low
	Microbiological contamination	Water main break	Supply of non-compliant potable water	C	Possible	4	Major	Very High	1. Design, construction, pressure testing and commissioning to WSAA Standards. 2. Emergency Response Plan for water main breaks will include water main sterilisation procedure	D	Unlikely	3	Moderate	Moderate
	Microbiological contamination	Cross contamination due to poor maintenance practices	Supply of non-compliant potable water	C	Possible	4	Major	Very High	1. Standard operating and maintenance procedures will be developed for the scheme. Procedures will include hygiene and disinfection requirements. 2. Separate tools to be used on water and sewerage systems.	D	Unlikely	3	Moderate	Moderate
	Microbiological contamination	Backflow and cross connections	Supply of non-compliant potable water	C	Possible	2	Minor	Moderate	1. No direct connections to the transfer pipeline. The only connection point to the pipeline is the onsite potable water and fire storage tank via an air gap.	D	Unlikely	2	Minor	Low
	Reticulation pipe breakage	Major breakage	Localised flooding, soil erosion, loss of supply	C	Possible	3	Moderate	High	1. Design, construction, pressure testing and commissioning to WSAA Standards. 2. Emergency Response Plan for water main breaks will include water main sterilisation procedure	C	Possible	3	Moderate	High
	Reticulation pipe leakage	Minor leaks	Water wastage	C	Possible	2	Minor	Moderate	1. Use VSD controlled booster pump station to minimise operating pressure during low flows. 2. Flow meters and pressure sensors on reticulation network for monitoring of "midnight flows" for identification of leaks. 3. Walk over and visual inspection along water main corridor to identify leaks. 4. Use leak detection equipment if required.	C	Possible	1	Insignificant	Low
	Fire hydrants on potable water network	Reduction in water pressure in potable network during fire flows	Increased risk of backflow if a cross connection occurs	B	Likely	4	Major	Very High	1. Cross connection controls. 2. Network design to minimise pressure losses during fire flow. 3. Use VSD controlled transfer pump station to maintain pressure during fire flows.	C	Possible	3	Moderate	High
Customer Consumption and Private Water Systems	Onsite Class A+ recycled water pipes	Cross connection on private land	Supply of non-compliant potable water	B	Likely	4	Major	Very High	1. Domestic plumbing systems installed and tested for compliance with AS3500 and the NSW Code of Practice for Plumbing and Drainage by licensed plumbing contractors. 2. Catherine Hill Bay Water Utility to provide induction, training and compliance auditing for all domestic plumbing contractors. 3. Dual check valve for backflow prevention at all connection points.	C	Possible	4	Major	Very High
	Excessive water use	Poor user behaviour	Excessive water use, Potential overload of onsite water systems	C	Possible	3	Moderate	High	1. Customer supply and trade waste agreement will outline expected water consumptions rates. 2. Ongoing customer awareness and education 3. Smart water meters at all connection points to provide feedback on water use	C	Possible	3	Moderate	High
	Leaks	Leaks in onsite water systems	Water wastage	B	Likely	1	Insignificant	Moderate	1. Smart water meters at all connection points to enable detection of leaks by residents	C	Possible	1	Insignificant	Low

DRINKING WATER
QUALITATIVE ENVIRONMENTAL AND PUBLIC HEALTH RISK ASSESSMENT CRITERIA

From tables 3.1, 3.2 & 3.3 on Page 3-8 of the Australian Drinking Water Guidelines (2011)

Qualitative measures of likelihood

Level	Descriptor	Example Description from ADWG
A	Almost certain	Is expected to occur in most circumstances
B	Likely	Will probably occur in most circumstances
C	Possible	Might occur or should occur at some time
D	Unlikely	Could occur at some time
E	Rare	May occur only in exceptional circumstances

Qualitative measures of consequence or impact

Level	Descriptor	Example description from ADWG
1	Insignificant	Insignificant impact, little disruption to normal operation, low increase in normal operation costs
2	Minor	Minor impact for small population, some manageable operation disruption, some increase in operating costs
3	Moderate	Minor impact for large population, significant modification to normal operation but manageable, operation costs increased, increased monitoring
4	Major	Major impact for small population, systems significantly compromised and abnormal operation if at all, high level of monitoring required
5	Catastrophic	Major impact for large population, complete failure of system

Qualitative risk analysis matrix: Level of risk

		Consequences				
Likelihood		1	2	3	4	5
		Insignificant	Minor	Moderate	Major	Catastrophic
A	Almost certain	Moderate	High	Very High	Very High	Very High
B	Likely	Moderate	High	High	Very High	Very High
C	Possible	Low	Moderate	High	Very High	Very high
D	Unlikely	Low	Low	Moderate	High	Very high
E	Rare	Low	Low	Moderate	High	High

Solo Water

Appendix 4.1.10 **A Preliminary Drinking Water Quality Management Plan**

Preliminary Drinking Water Quality Management Plan

for the

Catherine Hill Bay Water Utility, at Catherine Hill Bay Residential Subdivision

April 2013

Prepared for: Wayne Williamson
Solo Water Pty Ltd

Project Number: H10052
Project Name: Catherine Hill Bay
Report Number: H10052_R6A

harvest
water management consultants pty ltd

164 Rivergum Drive
Burpengary Qld 4505
0488 427 878
office@harvestwmc.com.au
www.harvestwmc.com.au

DOCUMENT CONTROL

Report Number: H10052_R6

ISSUE	STATUS	DATE	ISSUE DETAILS	AUTHOR	APPROVED
A	Preliminary	10/07/2013	FOR IPART LICENSE APPLICATION	ES	BRADLEY IRWIN MIEAust, CPEng, NPER

COMMERCIAL IN CONFIDENCE

DISCLAIMER

This report has been written for exclusive use by Solo Water Pty Ltd for the Solo Water Catherine Hill Bay Water Utility based on the agreement with Harvest Water Management Consultants Pty Ltd.

The investigation was carried out based on the specific requirements of Solo Water Pty Ltd and may not be applicable outside of this specific scope. Therefore the information in this report shall not be relied upon by any third party without further input from Harvest Water Management Consultants Pty Ltd.

The investigation has been undertaken based on information provided by others. Harvest Water Management Consultants Pty Ltd accepts no responsibility for the accuracy of information provided by others. The accuracy of the investigation and report is dependent on the accuracy of this information.

Preliminary Drinking Water Quality Management Plan

for the

Catherine Hill Bay Water Utility, at Catherine Hill Bay Residential Subdivision

Table of Contents

1 Introduction 1
1.1 Background 1
1.2 Scheme Overview 1
1.3 Plan framework 2
2 Drinking Water Quality Management Framework 3
2.1 Element 1 – Commitment to drinking water quality management 3
2.1.1 Drinking Water Quality Management Policy 3
2.1.2 Regulatory and Formal Requirements 4
2.1.3 Engaging Stakeholders 4
2.2 Element 2 – Assessment of the Drinking Water Supply System 6
2.2.1 Water Supply System Analysis 6
2.2.2 Assessment of Water Quality Data 8
2.2.3 Hazard Identification and Risk Assessment 9
2.3 Element 3 – Preventive Measures for Drinking Water Quality Management 10
2.3.1 Preventative Measures and Multiple Barriers 10
2.3.2 Critical Control Points 10
2.4 Element 4 – Operational Procedures and Process Controls 13
2.4.1 Operational Procedures 13
2.4.2 Operational Monitoring 13
2.4.3 Corrective Actions 15
2.4.4 Equipment Capability and Maintenance 17
2.4.5 Materials and Chemicals 17
2.5 Element 5 – Verification of Drinking Water Quality 18
2.5.1 Drinking Water Quality Monitoring 18
2.5.2 Consumer Satisfaction 19
2.5.3 Short Term Evaluation of Results 19
2.5.4 Corrective Action 20
2.6 Element 6 – Management of Incidents and Emergencies 21
2.6.1 Communication 21
2.6.2 Incident and Emergency Response Plans 22
2.7 Element 7 – Employee Awareness and Training 25

2.7.1 Employee Awareness and Involvement 25
2.7.2 Employee Training 25
2.8 Element 8 – Community Involvement and Awareness 26
2.8.1 Community Consultation 26
2.8.2 Communication 26
2.9 Element 9 – Research and Development 27
2.9.1 Investigative Studies and Research Monitoring 27
2.9.2 Validation and Processes 27
2.9.3 Design of Equipment 27
2.10 Element 10 – Documentation and Reporting 28
2.10.1 Management of Documentation and Records 28
2.10.2 Reporting 28
2.11 Element 11 – Evaluation and Audit 29
2.11.1 Long Term Evaluation Results 29
2.11.2 Audit of Drinking Water Quality Management 29
2.12 Element 12 – Review and Continuous Improvement 30
2.12.1 Review by Executive Management 30
2.12.2 Drinking Water Quality Management Improvement Plan 30
3 Bibliography 31

List of Figures

Figure 1.1: 12-Element framework for management of drinking water quality (ADWG: 2011) 2
Figure 2.1: Critical control point decision tree (Source: AGWR, 2006) 11

List of Tables

Table 2.1: Preliminary Regulatory and Formal Requirements summary 4
Table 2.2: Preliminary Stakeholder Register 5
Table 2.3: Description of drinking water supply system. 6
Table 2.4: Preliminary Critical Control Points and Limits 12
Table 2.5: Summary of operational and maintenance procedures to be developed. 13
Table 2.6: Summary of Preliminary Operational Monitoring. 14
Table 2.7: Preliminary corrective actions for potential operational non-compliances. 15
Table 2.8: Preliminary verification monitoring program. 18
Table 2.9: Preliminary corrective actions for non-compliance with verification monitoring. 20
Table 2.10: Preliminary Emergency Contact List. 21
Table 2.11: Overview of Emergency Response Plans to be developed 22

1 Introduction

1.1 Background

Solo Water has entered into an agreement with the Rose Property Group to provide an integrated water, sewerage, recycled water and retail service provider solution for the approved residential subdivision at Catherine Hill Bay. The provision of private water services is permitted under the Water Industry Competition Act (WICA) (New South Wales Government, 2006) and is administered by the NSW Independent Pricing and Regulatory Tribunal (IPART) (NSW Independent Pricing and Regulatory Tribunal, 2013).

The proposed Catherine Hill Bay Water Utility Scheme will be 100% owned, operated and maintained by Catherine Hill Bay Water Utility Pty Ltd (CHBWU) (a subsidiary of Solo Water) and funding of the scheme will be provided through rating of individual customers in the scheme as is the case with conventional water authorities. The CHBWU will take on all risks associated with the scheme and will operate the scheme in accordance with the license issued by IPART and the detailed management plans to be developed during detailed design of the scheme.

This preliminary Drinking Water Quality Management Plan report has been prepared to address Question 4.1.10 in the IPART application as follows:

> *Describe how the 12 elements of the framework for the management of drinking water quality, as detailed in the Australian Drinking Water Guidelines (ADWG), have been addressed and will be implemented and maintained. Provide evidence of the applicant corporation's capacity to implement the 12 elements of the framework in the ADWG in Appendix 4.1.10.*

This Preliminary Drinking Water Quality Management Plan will be updated and finalised during detailed design following approval of the IPART network operator license. The final plan will be informed by detailed design and specific requirements included on the IPART licence.

1.2 Scheme Overview

The proposed CHBWU scheme is located inside the approved footprint of the Catherine Hill Bay residential subdivision at Montefiore Street, Catherine Hill Bay, New South Wales. The site is located at the southern end of the Lake Macquarie City Council region.

The CHBWU will supply potable and non-potable water to approximately 470 connections in the scheme under a dual reticulation arrangement. Potable water for the scheme will be sourced by the CHBWU under a bulk potable water supply agreement with Wyong Shire Council. The scope of this agreement will include guarantees and reliability in terms of flow, pressure and water quality at the connection point.

The bulk water connection point for the scheme will be the existing Wyong Council Kanangra Drive Reservoir located approximately 6 km west of the CHBWU site. Potable water will be delivered to the scheme via a bulk transfer pump station and transfer pipeline owned, operated and maintained by the CHBWU.

The new transfer pump station will be located at the existing Kanangra Drive reservoir site and will pressurise approximately 6.5 km of 200 mm HDPE transfer main that runs along an existing services corridor and Class 1 fire trail and discharges into the CHBWU onsite potable water storage tank located at the CHWBU scheme wastewater treatment plant site.

The onsite potable water storage tank provides approximately 24 hours storage at peak demand. The tank will be designed to prevent animal/mosquito access and constructed from materials compatible for use in a potable water system.

The storage tank includes a recirculation loop with chlorine monitoring and dosing system to maintain appropriate free residual chlorine concentrations. The chlorine system will be continuously monitored with alarms to ensure chlorine residuals are always maintained within appropriate limits.

Potable water supply to customers in the scheme is provided through a potable water reticulation network pressurised by a variable speed drive booster pump station. An emergency standby diesel pump with automatic changeover is used to pressurise the reticulation network during periods of power outage.

The potable water reticulation network will be designed and constructed in accordance with Water Services Association Australia (WSAA) standards and will include appropriate isolation valves, scour valves, air valves, flushing points, fire hydrants and water quality monitoring points.

Water pressure in the potable network will maintained a minimum of 50 kPa above the pressure in the recycled water network to minimise the potential for backflow if a cross connection was to occur. Additional monitoring for detection of cross connections will also be undertaken including monitoring of water pressure and salinity differential between the two water networks. All customer connection points will require a dual check valve to protect the potable water network in the event of a cross connection on private land.

A Process Flow Diagram (PFD) of the potable water scheme is provided in Appendix A.

1.3 Plan framework

The Australian Drinking Water Guidelines (ADWG) (National Health and Medical Research Council; Natural Resource Management Ministerial Council, 2011) provides a 12-element framework developed to guide the design of a structured and systematic approach for the management of drinking water quality from catchment to consumer, to assure its safety and reliability. The 12-element framework is outlined below in Figure 1.1.

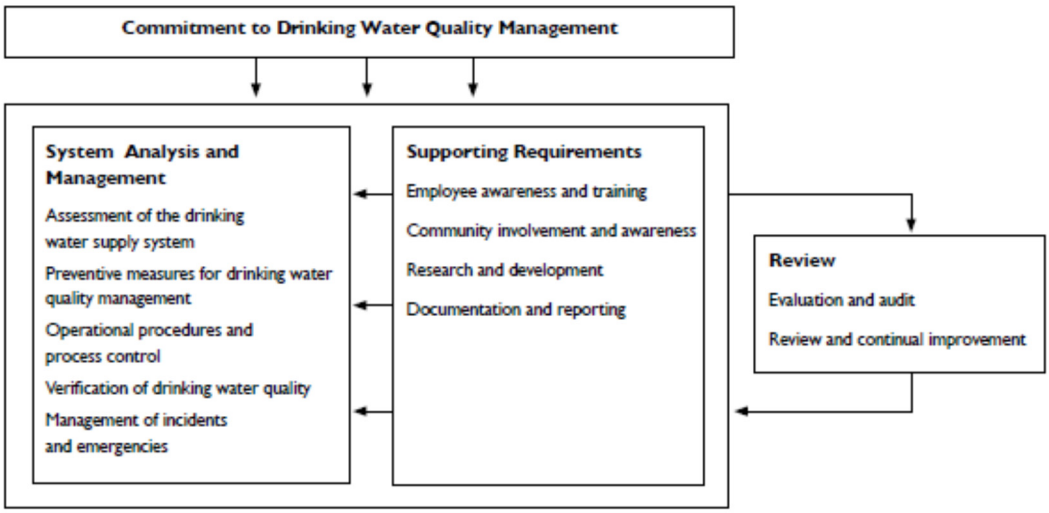


Figure 1.1: 12-Element framework for management of drinking water quality (ADWG: 2011)

The following selections in this report outline how the CHBWU scheme will address its requirements against each element of the framework.

2 Drinking Water Quality Management Framework

2.1 Element 1 – Commitment to drinking water quality management

2.1.1 Drinking Water Quality Management Policy

- Formulate a drinking water quality policy, endorsed by senior executive, to be implemented throughout the organisation.
- Ensure that the policy is visible and is communicated, understood and implemented by employees.

Solo Water has developed a draft drinking water quality policy that will be applied across all Solo Water schemes including the CHBWU scheme. This policy will be endorsed by senior management, senior staff and operators and will be implemented throughout the organisation.

The drinking water quality policy will be communicated to the public and relevant stakeholders via the Solo Water and CHBWU websites and other forums.

The draft drinking water quality policy that applies to all Solo Water Schemes is provided below:

"Solo Water is committed to managing its water supply effectively to provide a safe, reliable and high-quality drinking water supply that consistently meets the requirements of the Australian Drinking Water Guidelines, our customers and regulatory agencies.

To achieve this, in partnerships with stakeholders and relevant agencies, Solo Water will:

- *Create a positive culture within the organisation that promotes a proactive and transparent approach to drinking water quality management;*
- *Manage water quality at all points in the supply chain from source water to the consumer;*
- *Use a risk-based approach to identify and control potential threats to drinking water quality;*
- *Integrate the needs and expectations of our customers, stakeholders, regulators and employees into our planning;*
- *Establish robust systems for the regular monitoring of drinking water quality and implement effective communication and reporting mechanisms to provide relevant and timely information to customers, stakeholders and regulatory agencies;*
- *Develop appropriate contingency planning and incident response capabilities;*
- *Provide appropriate training to staff and contractors involved with managing drinking water quality*
- *Participate in appropriate research and development activities to ensure continued understanding of drinking water quality issues and performance;*
- *Continuously improve our practices by assessing performance against corporate commitments, stakeholder expectations and key performance indicators.*

Solo Water will implement and maintain a drinking water quality management system consistent with the Australian Drinking Water Guidelines to manage effectively the risks to drinking water quality."

All managers and employees involved in the supply of drinking water are responsible for understanding, implementing, maintaining and continuously improving the drinking water quality management system.

2.1.2 Regulatory and Formal Requirements

- Identify and document all relevant regulatory and formal requirements.
- Ensure responsibilities are understood and communicated to employees.
- Review requirements periodically to reflect any changes.

For each new scheme, Solo Water will undertake a review of regulatory and formal requirements and these will be integrated into the Drinking Water Quality Management Plan. The preliminary regulatory and formal requirements identified for the CHBWU Scheme are included below in Table 2.1.

Table 2.1: Preliminary Regulatory and Formal Requirements summary

Regulatory or Formal Requirement	Relevance to Drinking Water Quality
NSW Public Health Act 2010 and Regulation 2012	Protection of public health
NSW Health Drinking Water Monitoring Program	Framework for water quality monitoring, response and communication protocols
Australian Drinking Water Guidelines 2011	Framework and guidance for provision of safe drinking water, including water quality targets
NSW Code of practice Plumbing and Drainage 2006 and AS3500 (2003)	Requirements for private water systems located downstream of the water meter.
Protection of the Environment Operations Act 1997	Environment and protection including licensed discharges.
Independent Pricing and Regulatory Tribunal (IPART) licence requirements	IPART administers the licensing of private water utilities in NSW under the Water Industry and Competition Act
Water Industry and Competition Act 2006	
Fluoridation of Public Water Supplies Act 1957	Sets out the requirements for fluoridation of public water supplies. (NOTE: All water is fluoridated by the bulk water supplier)
NSW Code of practice for fluoridation of Public Water Supplies 2011	

2.1.3 Engaging Stakeholders

- Identify all stakeholders who could affect, or be affected by, decisions or activities of the drinking water supplier.
- Develop appropriate mechanisms and documentation for stakeholder commitment and involvement.
- Regularly update the list of relevant agencies.

Solo Water has undertaken a preliminary review of stakeholders related to the CHBWU Scheme which is outlined in the preliminary stakeholder register in Table 2.2 below. A more detailed review of stakeholders related to the CHBWU Scheme will be undertaken and the register updated as the scheme is implemented.

Table 2.2: Preliminary Stakeholder Register

Stakeholder	Relevance
Customers connected to the CHBWU Scheme network	Direct consumers of the water supply
Wyong Shire Council	Bulk potable water supplier
Independent Pricing and Regulatory Tribunal (IPART)	IPART administers the licensing of private water utilities in NSW under the Water Industry Competition Act
Department of Health	Provides regulatory requirements and guidelines Water quality incident notification requirements
Lake Macquarie City Council	Local council in the development area

Additional stakeholders not listed above may be identified in the future e.g. local residents groups, environmental groups and other non-government organisations.

2.2 Element 2 – Assessment of the Drinking Water Supply System

2.2.1 Water Supply System Analysis

- Assemble a team with appropriate knowledge and expertise.
- Construct a flow diagram of the water supply system from catchment to consumer.
- Assemble pertinent information and document key characteristics of the water supply system to be considered.
- Periodically review the water supply system analysis.

Preliminary assessment of the drinking water supply system has been undertaken for the purposes of the IPART application. More detailed assessment will occur during detailed design of the system following approval of the IPART license.

The preliminary assessment was undertaken internally with experienced Solo Water staff and consultants. The assessment team documented a preliminary process flow diagram and written description of the water supply scheme to allow hazard identification and risk assessment of the proposal. The process flow diagram of the drinking water supply system is included in Appendix A. The description of the drinking water supply system is provided below in Table 2.3.

Table 2.3: Description of drinking water supply system.

Drinking Water Infrastructure	Description
Bulk Potable Water Source	The bulk water source for the CHBWU scheme is verified potable water sourced from Wyong Shire Council under a bulk supply agreement. A bulk water connection point will be provided by Wyong Council at the existing Kanangra Drive Reservoir site for connection of the CHBWU bulk water transfer pump station. Wyong Shire Council are responsible for all aspects of asset management and drinking water quality management upstream of this connection point. Communication protocols will be put in place with the Wyong Shire Council to ensure any water quality issues are communicated to CHBWU in a timely manner.
Potable Water Transfer Pump Station	The potable water transfer pump station will be located at the Wyong Shire Council Kanangra Drive Reservoir site. The transfer pump station will use variable speed drive pumps and controllers to maintain water levels in the Catherine Hill Bay onsite potable water storage. The transfer pump station will have a peak design capacity of 23.3 L/s based on standard potable water design flows. Average flow through the station will be in the order of 5 L/s. Further details can be found in PS Solutions report: Water Supply Summary Servicing Strategy Catherine Hill Bay (PS Solutions Pty Ltd, April 2013).

Drinking Water Infrastructure	Description
Potable Water Transfer Pipeline	There is an existing 200 mm HDPE drinking water transfer main that runs approximately 6 km from the Kanangra Drive reservoir to the Catherine Hill Bay site that had previously been used to supply drinking water to the former coal loading facility at the site. The existing main runs along a National Parks and Wildlife Service (NPWS) category 1 essential fire trail corridor and terminates at the proposed subdivision site. A water main maintenance and access easement is being sort along the length of this water main corridor with the NPWS/RFS. A new connection from Kanangra Drive Reservoir running along Kanangra Drive Road Reserve will be connected into the existing main as shown on the plan. A plan showing the bulk water transfer system is provided in Appendix A. The existing water main will be extended from its current termination point within the site and connected to the onsite potable water storage tank located on Montefiore Street Waste Water Treatment Plant (WWTP) site. Condition assessment, pressure testing, detailed survey, cleaning and disinfection of this main will be undertaken during detailed design and any faulty sections of pipe replaced.
Onsite Potable Water Storage Tank	A 1.2 ML potable water storage tank will be provided on site. The 1.2 ML tank provides approximately 1-day storage at peak day potable water demands and includes 0.5ML dedicated emergency fire storage and backup of the non-potable water system. The tank will be a steel panel tank with internal polymer lining suitable for contact with potable water.
Chlorine Monitoring and Dosing System	The potable water storage tank will include a recirculation loop with a continuous online monitoring and dosing system for maintenance of chlorine residual. The chlorine monitoring and dosing system will be controlled through the direct digital control system. Alarms will be activated for high and low free chlorine concentrations.
Potable Water Supply Pressure Booster Pump Station	Customer water pressure and flow in the CHBWU scheme will be controlled by a pressure booster VSD pump station set. The pump set will use multiple pumps controlled by variable speed drive to maintain the pressure set point in the downstream reticulation system across a wide range of flows. Pressure set point of the potable water pumps will be maintained a minimum of 50 kPa above that in the recycled water supply networks.
Potable Water Reticulation Network	The potable water reticulation network will be designed and constructed in accordance with Water Services Association Australia (WSAA) standards. The reticulation system will be constructed in line with staging of the residential development. The potable water reticulation mains will use different pipe material and colour to that in the recycled water network to reduce the potential for cross connection. The potable water mains will use blue PVC pipe and the non-potable water network will use lilac striped HDPE pipe.
Customer connection points	Customer connection points will be provided to each allotment. Each customer connection point will include a dual check valve for backflow prevention, isolation valving and a smart water meter.

Drinking Water Infrastructure	Description
Potable water uses	The drinking water system will be used to supply all potable water demands within the CHBWU Scheme area. Approved potable water uses include: • Drinking; • All bathroom taps including the shower, bath tub, basins and vanity units; • All kitchen taps including the kitchen sink and dishwasher; • The hot water service supplied to all areas of the house; • The laundry sink; • Pool and spa top-up; • Fire hydrants and fire fighting; • All other potable uses not specifically mentioned above.
Integrated online monitoring, control and alarm system	Continuous online monitoring, control and alarms for the potable water infrastructure is centrally managed using the direct digital control system. The control system allows the infrastructure to operate unattended and automatically reports issues requiring operator attention. Online monitoring probes are manually calibrated and checked by operations staff on a routine basis to ensure all probes are recording accurate readings. All critical alarm systems have a battery backup to ensure faults are reported during power outages. The control system is designed to automatically recover following power outage.

2.2.2 Assessment of Water Quality Data

- Assemble historical data from source waters, treatment plants and finished water supplied to consumers (over time and following specific events).
- List and examine exceedances.
- Assess data using tools such as control charts and trends analysis to identify trends and potential problems.

Given the source water for the CHBWU scheme is verified potable water purchased under a bulk supply agreement from Wyong Shire Council, no detailed evaluation of catchment and raw water quality data has been undertaken for the CHBWU scheme.

During detailed design (following approval of the IPART license) operational potable water quality monitoring data from Kanangra Drive Reservoir will be sourced from Wyong Council to inform the design of the chlorine dosing system and to provide information on other background water quality parameters, e.g. TDS, alkalinity, total organic carbon etc.

Once the scheme is operational, water quality monitoring inside the CHBWU scheme boundary will be undertaken and this data used to review and improve the system on an ongoing basis.

2.2.3 Hazard Identification and Risk Assessment

- Define the approach and methodology to be used for hazard identification and risk assessment.
- Identify and document hazards, sources and hazardous events for each component of the water supply system.
- Estimate the level of risk for each identified hazard or hazardous event.
- Evaluate the major sources of uncertainty associated with each hazard and hazardous event and consider actions to reduce uncertainty.
- Determine significant risks and document priorities for risk management.
- Periodically review and update the hazard identification and risk assessment to incorporate any changes.

Preliminary hazard identification and risk assessment of the proposed CHBWU scheme was undertaken internally with an experienced team of Solo Water staff and consultants. The risk assessment was undertaken based on the framework presented in the ADWG (2011) and ISO 31000 (2009). An overview of the preliminary risk assessment process undertaken for the CHBWU scheme is described below:

1. Define the risk assessment criteria to be used and the context of the risk assessment. The risk assessment was undertaken based on the qualitative risk criteria presented in the ADWG (2011), refer to Appendix C;
2. Review the process flow diagram and description of the water supply system;
3. Divide the process flow diagram into a number of individual scheme components, e.g. bulk water transfer pump station;
4. Identify a number of potential hazards and hazardous events for each scheme component;
5. Assess the unmitigated risk by estimating the likelihood and consequence of each hazard and hazardous event occurring;
6. Document the risk control strategy for each risk;
7. Assess the mitigated risk using the risk assessment criteria from the ADWG (2011;
8. Identify the significant risks of the water supply system.

A copy of the preliminary drinking water risk assessment table for the CHBWU Scheme is provided in Appendix C.

Given the water source for the scheme is verified potable water purchased under a bulk supply agreement with Wyong Shire Council, there are minimal hazards associated with the raw water source, catchment management and water treatment. The majority of hazards relate to protection of the distribution system from contamination, and management of chlorine residual in the transfer pipeline, onsite storage tank and reticulation system.

Once the scheme is constructed, operational water quality monitoring data will also be used to inform the assessment of the scheme. Further risk assessment of the scheme will be undertaken on an ongoing basis and when any future changes to drinking water infrastructure or operational procedures are undertaken.

2.3 Element 3 – Preventive Measures for Drinking Water Quality Management

2.3.1 Preventative Measures and Multiple Barriers

- Identify existing preventive measures from catchment to consumer for each significant hazard or hazardous event and estimate the residual risk.
- Evaluate alternative or additional preventive measures where improvement is required.
- Document the preventive measures and strategies into a plan addressing each significant risk.

During the preliminary risk assessment workshop, risk control strategies were developed for each risk and assessment of the mitigated risk was undertaken. The risk control strategies for each risk are presented in the preliminary drinking water risk assessment table in Appendix C. The risk control strategies will be incorporated into the design of the scheme and the management plans yet to be documented.

Given the scheme water source is potable water supplied under a bulk supply agreement with Wyong Shire Council, specific source or catchment management controls are not required. However a communication protocol will be developed with Wyong Shire Council to ensure any water quality incidents identified by Wyong Shire Council through monitoring upstream of the bulk supply point, are communicated to the CHBWU in a timely manner so that appropriate actions can be taken.

The main preventative measure incorporated into the design of the drinking water scheme is the recirculation, chlorine residual monitoring and chlorine dosing system to be installed on the onsite potable water tank. This system will automatically monitor and control chlorine residual concentrations within the desired range and automatically raise an alarm for any deviation outside of acceptable limits.

Preventative maintenance measures will be developed for all assets to minimise the potential for failure and/or contamination of the water supply. (Further details can be found in the Solo Water Catherine Hill Bay Water Utility Preliminary Infrastructure Operating Plan, Solo Water: 2013).

Preventative measures will also be developed to maintain quality in the reticulation system, including water main flushing regimes, water main sterilisation, response procedures for water main breaks etc.

Additional preventive measures may be identified in future during detailed design or following review of operational performance. Where continuous improvement actions are identified they shall be assessed and included in the improvement plan for implementation as outlined in Section 2.12.2.

2.3.2 Critical Control Points

- Assess preventive measures from catchment to consumer to identify critical control points.
- Establish mechanisms for operational control.
- Document the critical control points, critical limits and target criteria.

All high and very high risks identified in the risk assessment process presented above underwent a further assessment to identify the Critical Control Points (CCPs). CCPs were identified based on the decision tree presented below in Figure 2.1 that was sourced from the Australian Guidelines for Water Recycling (AGWR: 2006) (Natural Resource Management Ministerial Council; Environment Protection and Heritage Council; Australian Health Ministers Conference, 2006)).

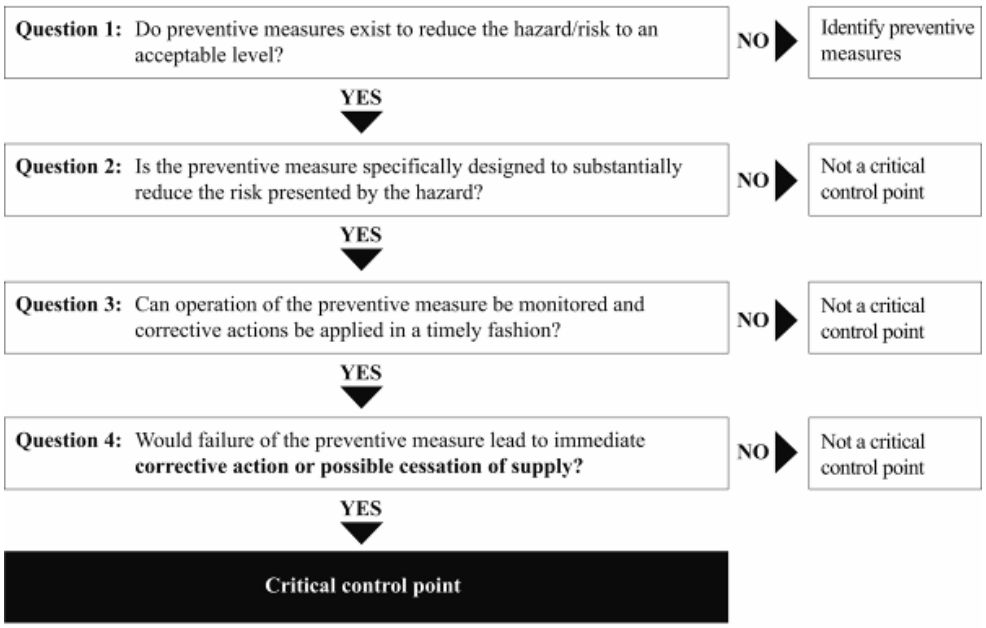


Figure 2.1: Critical control point decision tree (Source: AGWR, 2006)

Following assessment of significant risks using the above CCP decision tree, two critical control points were identified, these were:

- Chlorine residual in the potable water storage tank;
- Water pressure differential between the potable and recycled water networks.

The CCP for chlorine residual will be managed through a recirculation loop on the potable water storage tank. The recirculation system will include chlorine dosing with sodium hypochlorite and continuous online monitoring of pH and free chlorine residual. The system will automatically raise alarms for low and high pH or free chlorine concentrations.

The CCP for cross connection will be managed with a cross connection detection procedure. The procedure will be automated through the control system to occur during low demand periods at around 1 am each night. The preliminary automated cross connection detection procedure developed for the scheme involves (subject to variation during detailed design):

1. Continuous online monitoring of water pressure in both the recycled water and potable water networks at a strategic location in the reticulation system (lowest RL and furthest distance from the supply pump station);
2. Switching off recycled water supply pump so the only pressure in the recycled water network is provided by static head;
3. Ramping up the VSD potable water supply pump to its maximum operating pressure;
4. Monitoring change in water pressure in both networks throughout the test. A potential cross connection will be detected and alarms will be raised if:
    a) Water pressure in the recycled water network increases above the baseline static head when the potable water pump ramps up, or
    b) If there is no pressure differential between the potable and recycled water networks.

Preliminary details of the operational limits and critical limits for each CCP are outlined below in Table 2.4. Additional CCPs may be identified during detailed design.

Table 2.4: Preliminary Critical Control Points and Limits

Critical Control Point	Hazard(s) of Concern	Location of Measurement	Operational Monitoring	Target	Operational Limit Range	Critical Limits
Chlorine residual	Micro-biological Human pathogens	Potable water supply storage tank - recirculation loop	Free chlorine residual (continuous online)	0.75 mg/L*	0.6 to 2 mg/L	0.4 to 3 mg/L
			pH (continuous online)	pH 7 to 7.5	pH 7 to 8	pH 6.5 to 8.5
Water pressure differential across potable and recycled networks	Cross connection	Strategic location in both networks (lowest RL and furthest point from supply pump)	Water pressure differential (continuous online) Nightly cross connection detection procedure	> 50 kPa differential	< 50 kPa differential	No pressure differential

* Target chlorine concentration will be assessed further during design and operation to ensure the minimum chlorine residual is maintained at the furthest point in the network. This will be informed by monitoring of the seasonal chlorine decay throughout the network.

2.4 Element 4 – Operational Procedures and Process Controls

2.4.1 Operational Procedures

- Identify procedures required for processes and activities from catchment to consumer.
- Document all procedures and compile into an operations manual.

Process controls and operational procedures will be developed to address specific hazards and preventative measures identified in the risk assessment processes. All process controls and operational procedures will be documented in the Operations and Maintenance (O & M) Manual to be developed for the scheme. A summary of the specific operational plans to be developed for each component of the drinking water supply system is outlined below in Table 2.5.

Table 2.5: Summary of operational and maintenance procedures to be developed.

Scheme Component		Operation and Maintenance Plans and Procedures^
Potable Water	Bulk water transfer system	Bulk water pump station O & M manual Bulk water pipeline inspection regime
	Potable water storages	Potable water storage inspection & maintenance regime Site security requirements (Fencing & CCTV will be used at the WWTP site)
	Chlorine monitoring and dosing system	Chlorine monitoring and dosing system O & M manual Online monitoring sensor and probe calibration regime and register
	Potable water supply booster pump station	Potable water supply booster pump station O & M manual Emergency standby diesel pump O & M Manual
	Potable water reticulation	Potable water main flushing regime Water main sterilisation procedures Worker hygiene procedures for work on a potable water system Water network valves maintenance regimes Fire hydrant pressure and flow test procedures Potential cross connection detection procedure Backflow and cross connection prevention guidelines
Monitoring & control system	Sensors and probes	Online monitoring sensor and probe calibration regime
	Communication systems	Online monitoring sensor and probe calibration regime and register Communication and telemetry systems O & M manual

^ To be developed during detailed design.

2.4.2 Operational Monitoring

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

The drinking water system will operate autonomously with continuous online monitoring and control with alarms on all critical operational parameters. The control system also includes mechanical/ electrical fault detection and all alarms are provided with battery backup to ensure alarms can be raised during a power outage.

The preliminary operational monitoring parameters and criteria are included below in Table 2.6.

Table 2.6: Summary of Preliminary Operational Monitoring.

Scheme Component		Operational Monitoring	Data Source
Potable Water	Bulk water transfer pump system	Pump hours run and number of starts	Online monitoring & control system
		VSD frequency	
		Flow and pressure	
		Electricity consumption	
		Power outages	
		Pump and electrical failures	
		Control system failures or loss of connection	
	Bulk water transfer pipeline	Flow metre at each end of the pipeline	Online monitoring & control system
		Visual inspection for main breaks	Inspection checklists
	Potable water storage	Water level	Online monitoring & control system
		Potable water quality verification monitoring	Potable water quality monitoring data base
		Visual inspection to check tank integrity or evidence of vermin/mosquito invasion	Inspection checklists
	Chlorine monitoring and dosing system	Free chlorine residual	Online monitoring & control system
		pH	
		Level in Sodium Hypochlorite chemical storage tank	
		Chlorine dosing pump failure	
	Potable water supply booster pump station	Pump hours run and number of starts	Online monitoring & control system
		VSD frequency	
		Flow and pressure	
		Electricity consumption	
		Power outages	
		Pump and electrical failures	
		Emergency diesel pump switch over	
	Potable water reticulation system	Potable water quality verification monitoring	Potable water quality monitoring data base
		Water pressure differential in the potable and recycled water networks	Online monitoring & control system
		Electrical conductivity differential in the potable and recycled water networks	
		Cross connection detection procedure	
		Flow monitoring	
		Visual inspection for main breaks	Inspection checklists

2.4.3 Corrective Actions

- Establish and document procedures for corrective action to control excursions in operational parameters.
- Establish rapid communication systems to deal with unexpected events.

A summary of the preliminary corrective actions for potential non-compliance events are outlined below in Table 2.7. The corrective actions outlined below will be formalised into the O & M documentation for the scheme during detailed design.

Following any incident or non-compliance events an incident reporting and continuous improvement procedure will be implemented that outlines the route cause, corrective actions taken and preventative measures required to minimise the potential for reoccurrence of the incident. All incident reports are reviewed by the Operations Manager as they arise and appropriate continuous improvement actions taken.

Table 2.7: Preliminary corrective actions for potential operational non-compliances.

Potential Non-Compliance Event	Preliminary Corrective Actions
Low chlorine residual detected	1. Increase chlorine dosing set point; 2. Consider supplementary chlorine dosing using chlorine tablets; 3. Review control system logs, calibration records and inspect chlorine dosing system for evidence of faults and if required rectify any faults; 4. Advise the Operations Manager; 5. Undertake additional water quality monitoring in the potable water tank and throughout the network; 6. Consider flushing pipes or emptying the potable water tank to remove non-compliant water from the system; 7. If critical limits are reached, consider turning off potable water supply and consult emergency response procedures; 8. Implement incident reporting and continuous improvement procedure.
Potable water storage tank integrity breach or evidence of vermin access	1. Remove the source of contamination, e.g. birds nest; 2. Consider emptying, cleaning and sterilising the tank to remove any contaminated water; 3. Review chlorine residual monitoring data and trends to ensure adequate chlorine residual is being maintained; 4. Consider increasing the set point for chlorine dosing or increasing the chlorine dose manually using chlorine tablets; 5. Advise the Operations Manager; 6. Undertake repairs of the tank; 7. Undertake additional water quality monitoring in the potable water storage tank and reticulation system to ensure water quality compliance; 8. Implement incident reporting and continuous improvement procedure.

Potential Non-Compliance Event	Preliminary Corrective Actions
Potential cross connection detected or no pressure differential between water networks	1. Turn off Advanced Water Treatment Plant and use potable water backup in the recycled water supply network until it can be demonstrated there is no cross connection; 2. Consider flushing the potable and recycled water networks to ensure only potable water is being used; 3. Undertake detailed investigations on the reticulation systems to determine if an actual cross connection exists and identify its location; 4. Isolate the impacted area and advise affected customers; 5. Undertake appropriate repairs to the networks to remove the cross connection; 6. Undertake water main sterilisation procedure in the area of rectification works; 7. Undertake detailed assessment to ensure the cross connection has been removed; 8. Undertake detailed water quality monitoring for Bacteria, Viruses and Protozoa across both water networks to demonstrate water quality compliance; 9. Once it is confirmed there is no cross connection and water quality compliance is demonstrated, the Advanced Water Treatment Plant can be brought back online to fill the recycled water storage tank; 10. Implement incident reporting and continuous improvement procedure.
Suspected non-compliant plumbing installations on private property	1. Advise affected customer of the potential fault observed and issue a rectification notice requiring the home owner to provide a written certification of the private plumbing installation to AS3500 by a licensed plumber approved by the CHBWU; 2. Advise Lake Macquarie City Council (as the entity responsible for undertaking plumbing inspections) of the potential issue; 3. Review the licensed plumber report; 4. Implement incident reporting and continuous improvement procedure.
Water main break	1. Isolate the break by closing network isolation valves; 2. Advise affected customers and the call centre of the break or water outage; 3. Undertake appropriate repairs to the water main; Note: Tools and equipment used for maintenance and repair work on the sewerage network cannot be used on the potable water network; 4. Following completion of rectification work, implement the water main sterilisation procedure to ensure microbiological quality of the network is not compromised; 5. Undertake potable water quality monitoring in the network to verify water quality compliance; 6. Undertake restoration works for any damage to the environment or property caused by the break, e.g. soil erosion; 7. Advise the call centre of the status of the event once rectified; 8. Implement incident reporting and continuous improvement procedure.

2.4.4 Equipment Capability and Maintenance

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

All equipment and infrastructure used for the supply of drinking water will be conservatively designed and operated and maintained in an appropriate manner to ensure reliable operation.

Detailed O & M plans will be developed for each component of the water supply scheme during detailed design. An overview of the O & M plans to be developed during detailed design is provided above in Table 2.5.

The ongoing maintenance requirements for each asset will be managed using Pronto Asset Information System software to ensure compliance with routine maintenance activities can be tracked. Additional information regarding the operation and maintenance of infrastructure is provided in the Preliminary Infrastructure Operating Plan for the Catherine Hill Bay Water Utility (Solo Water, 2013).

Maintenance procedures will include the following:

- Daily, weekly, monthly and annual maintenance and inspection checklists;
- Manual testing and calibration procedures for online water quality monitoring probes;
- Chemical delivery, storage and use procedures;
- Drinking water system hygiene and maintenance procedures to prevent contamination of the water distribution system during maintenance activities, e.g. main breaks, house connections, flushing etc.;
- Procedure for routine flushing of mains via flushing points.

2.4.5 Materials and Chemicals

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

Detailed procedures for evaluating chemicals, materials and suppliers will be developed and documented in the Operations and Maintenance Manual including chemical delivery and use procedures to ensure safe chemical use and storage.

The potable water storage tank and reticulation system will be constructed to potable water storage standards using materials compatible with potable water supply.

The proposed potable water storage tank will be a steel panel tank with a food grade HDPE liner and the reticulation pipe will use blue PVC potable water pipe. This strategy should avoid issues associated with corrosion and dissolution of metals into the drinking water system. Customers will be encouraged to use plastic pipe over copper pipe in household plumbing installations to avoid potential impacts caused by the corrosion of copper pipe.

2.5 Element 5 – Verification of Drinking Water Quality

2.5.1 Drinking Water Quality Monitoring

- Determine the characteristics to be monitored in the distribution system and in water as supplied to the consumer.
- Establish and document a sampling plan for each characteristic, including the location and frequency of sampling.
- Ensure monitoring data are representative and reliable.

Verification monitoring will generally be via drinking water quality monitoring in the reticulation system as well as monitoring of customer complaints and customer satisfaction (see section 2.5.2).

Given the bulk water source is verified potable water from Wyong Shire Council, verification monitoring undertaken by the CHBWU will focus on compliance with microbiological criteria in the Australian Drinking Water Guidelines. Detailed assessment for chemical contaminants is only likely to be undertaken once per year as this would be undertaken as a matter of routine by Wyong Shire Council. Any non-compliance detected in the bulk water supply verification monitoring will be communicated to Wyong Shire Council for rectification.

A preliminary verification monitoring schedule is included in Table 2.8 below.

Table 2.8: Preliminary verification monitoring program.

Frequency	Monitoring Locations	Preliminary Monitoring Parameters
Weekly	Potable water storage tank Strategic locations in the network, including the furthest point in the network (to be confirmed during detailed design and will change as the development is built out)	Routine weekly testing will be undertaken primarily to verify microbiological quality of the network using the following parameters: • E. Coli; • Total Coliform; • Heterotrophic Plate Count; • Temperature; • Free residual chlorine; • Total chlorine; • pH; • Turbidity; • Total dissolved solids (or electrical conductivity).
Annually during peak demand period	Potable water storage tank Strategic locations in the network, including the furthest point in the network (to be confirmed during detailed design and will change as the development is built out)	More detailed analysis will be undertaken once per year during the peak demand month. Detailed annual testing will include the following parameters: • Cations and anions, including fluoride • Disinfection by-products including trihalomethanes • Metals and inorganics • Pesticides & organic toxicants

2.5.2 Consumer Satisfaction

- Establish a consumer complaint and response program, including appropriate training of employees.

Monitoring of customer satisfaction will be undertaken for the CHBWU scheme by monitoring and acting on customer feedback and complaints through the customer service call centre. The customer service call centre for the CHBWU scheme will be operated by Unitywater under a subcontract service provider agreement with Solo Water.

All customer complaints will be investigated. A preliminary overview of the process for monitoring and investigation of customer complaints is outlined below:

1. Unitywater customer service call centre staff receives a call from a CHBWU customer or member of the public;
2. Unitywater customer service call centre staff records a log of the call including complaint number, customer contact details, time of call, time(s) of incident and description of the query or concern into the Customer Service Management Database;
3. Unitywater customer service call centre staff contacts the CHBWU site operator and provides appropriate information regarding the complaint for action. This information may also be emailed for a written record;
4. The CHBWU site operator investigates the complaint, if required contacts the complainant, and takes appropriate action to rectify any issues.
5. If significant issues are identified the CHBWU operator will escalate the complaint to the Solo Water Operations Manager.
6. The CHBWU site operator contacts the Unitywater call centre to close out the complaint advising the issues, what action was taken, what time if any future rectification works are required;
7. Unitywater call centre operator closes out the complaint in the Customer Service Management Database by entering all information provided by CHBWU staff and advising the customer appropriately;
8. Customer service statistics, response times, KPIs etc. can be extracted from the data stored in the Customer Service Management Database at the Unitywater call centre. Regular reports will be provided to CHBWU and the Solo Water and CHBWU staff.

Unitywater and CHBWU staff will receive ongoing training to ensure this customer complaint process is appropriately implemented. CHBWU Scheme staff will be trained to log any customer complaints or feedback that they receive via other means (e.g. in person) to the Unitywater call centre to ensure the details are recorded and can be tracked and monitored.

2.5.3 Short Term Evaluation of Results

- Establish procedures for the daily review of drinking water quality monitoring data and consumer satisfaction.
- Develop reporting mechanisms internally, and externally, where required.

All water quality verification monitoring data will be reviewed immediately upon receipt by the site operator. All non-compliant data is to be identified, escalated to the operations manager and acted upon immediately. All data will be stored in the Potable Water Quality Monitoring Database to allow long term analysis and trending. The results of all monitoring data will be reported to Solo Water management through monthly, quarterly and annual reporting protocols.

All customer complaints will be investigated and acted upon in the shortest possible time. Customer complaints and issues will be reported to Solo Water management through monthly, quarterly and annual reporting protocols.

2.5.4 Corrective Action

- Establish and document procedures for corrective action in response to non-conformance or consumer feedback.
- Establish rapid communication systems to deal with unexpected events.

Every non-compliance event identified through verification monitoring and every customer complaint will be investigated immediately to identify the root cause of the non-compliance.

For water quality non-compliances, the NSW Health Drinking Water Monitoring Program (NSW Department of Health, 2005) provides response protocols for the management of physical, chemical and microbiological quality of drinking water. A summary flow chart outlining the response protocols for the management of microbiological quality of drinking water can be seen in Appendix D and the response protocols for the management of physical and chemical quality of drinking water can be seen in Appendix E.

The preliminary corrective actions for response to non-conformance events are outlined below in Table 2.9.

Table 2.9: Preliminary corrective actions for non-compliance with verification monitoring.

Potential Non-Compliance Event	Preliminary Corrective Actions
Non-compliant potable water verification monitoring result	1. Review monitoring data immediately upon receipt of results. 2. For all non-compliances immediately advise the Solo Water Operations Manager. 3. If non-compliance relates to microbiological quality (e.g. detection of E. Coli or Coliform bacteria) implement the NSW *Health Response Protocols for Microbiological Quality* outlined in Appendix D. 4. If non-compliance relates to physical or chemical quality, implement the *NSW Health Response Protocols for Physical and Chemical Quality* outlined in Appendix E. 5. Implement incident reporting and continuous improvement procedure.
Customer Complaints	1. CHBWU operations staff receives customer complaint via Unitywater call centre. 2. Investigate the complaint and rectify. 3. For significant issues immediately advise the Solo Water Operations Manager. 4. Once the issue is rectified, advise the Unitywater call centre. 5. Implement incident reporting and continuous improvement procedure.

Following any incident or non-compliance event an incident reporting and continuous improvement procedure will be implemented that outlines the route cause, corrective actions taken and preventative measures required to minimise the potential for reoccurrence of the incident. All incident reports are reviewed by the Operations Manager as they arise and appropriate continuous improvement actions taken.

2.6 Element 6 – Management of Incidents and Emergencies

2.6.1 Communication

- Define communication protocols with the involvement of relevant agencies and prepare a contact list of key people, agencies and businesses.
- Develop a public and media communications strategy.

In the event of any significant water quality incident or emergency events, prompt communication and notification of the event is essential for minimising the potential impacts. A preliminary contact list of key people, agencies and businesses that may need to be contacted in an emergency event is outlined below in Table 2.10.

In addition to this, specific emergency response plans will be developed for a range of potential incident/emergencies identified through risk assessment processes, as outlined below in Table 2.11.

Table 2.10: Preliminary Emergency Contact List.

Contact	Incident/Emergency and Communication strategy
Solo Water staff Site Operator Operations Manager Solo Water Executive	In the event of any emergency, the site operator should immediately notify the Operations Manager who will notify Solo Water executive and external contacts and government departments as required below.
Wyong Shire Council Phone: (02) 4350 5555 Fax: (02) 4351 2098	For any bulk supply water quality issues contact Wyong Shire Council. A more detailed communication protocol will be developed in conjunction with Wyong Shire council before the scheme becomes operational.
NSW Health In NSW calling 1300 066 055 will direct you to your local Public Health Unit.	Where a risk to public health is suspected based on routine monitoring for microbiological indicators and chemical contaminants contact the local NSW Public Health Unit. NSW Health will implement existing protocols and communication strategies in the event of an emergency and can provide assistance with communicating important information to the public via the media.
Lake Macquarie City Council Phone: (02) 4921 0333 Fax: (02) 4958 7257	Where a risk to public health is suspected contact Lake Macquarie City Council public health section.
Unitywater 24hr Call Centre Ph: 1300 086 489	Unitywater call centre staff will be kept up to date on the status of an emergency event so they can relay information to any customers that phone the call centre.
Customers Database of customer contact details	A number of communication strategies will be used to convey emergency information to customers depending on the event, including: 1. The CHBWU website will be updated about the emergency event; 2. The Unitywater call centre staff will be updated about the emergency event; 3. Customers may be directly contacted by mail, phone or by door knocking; 4. A notice will be placed on the notice board at the treatment plant site; 5. Operations staff may drive around with a recorded loud speaker message alerting customers to the emergency event; 6. For serious events, NSW Health will provide assistance to coordinate a communication strategy and provide alerts via various media (radio, TV).

2.6.2 Incident and Emergency Response Plans

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

Emergency Response Plans will be developed for all potential events identified in the risk assessment processes and as updated through detailed design and operation. A number of emergency events that were identified in the risk assessment and the steps to be included in the Emergency Response Plans are outlined below in Table 2.11.

Table 2.11: Overview of Emergency Response Plans to be developed

Scheme Component	Incident or Emergency	Steps to be included in Emergency Response Plan
Bulk water supply	Notification received from Wyong Council regarding non-compliant water quality in the bulk water supply from Kanangra Drive Reservoir	1. Liaise with Wyong Council and maintain open ongoing communications. 2. Consider the need to turn off the bulk water transfer pump station to prevent transfer of non-compliant water into the CHBWU scheme. 3. Consider the need to increase chlorine dosing in the CHBWU onsite potable water storage tank. 4. Undertake additional potable water quality monitoring in the CHBWU onsite potable water storage tank and reticulation system. 5. If non-compliance detected and relates to microbiological quality (e.g. detection of E. Coli or coliform bacteria) follow steps outlined in flowchart in Appendix D. 6. If non-compliance detected and relates to physical or chemical quality (e.g. exceedence of guideline value) follow steps outlined in flowchart in Appendix E. 7. Consider carting water from alternate water source location if more than 24hr disruption to supply likely.
Chlorine monitoring and dosing system	Low chlorine residual	1. Increase chlorine dosing set point; 2. Consider supplementary chlorine dosing using chlorine tablets; 3. Review control system logs, calibration records and inspect chlorine dosing system for evidence of faults and if required rectify any faults; 4. Advise the Operations Manager; 5. Undertake additional water quality monitoring in the potable water tank and throughout the network; 6. Consider flushing pipes and/or emptying the potable water tank to remove non-compliant water from the system; 7. If non-compliant microbiological water quality detected (e.g. detection of E. Coli or coliform bacteria) follows steps outlined in flowchart in Appendix D. 8. Implement incident reporting and continuous improvement procedure.

Scheme Component	Incident or Emergency	Steps to be included in Emergency Response Plan
Potable water storage tank	Contamination or vermin access	1. Remove the source of contamination, e.g. birds nest; 2. Consider emptying, cleaning and sterilising the tank to remove any contaminated water; 3. Review chlorine residual monitoring data and trends to ensure adequate chlorine residual is being maintained; 4. Consider increasing the set point for chlorine dosing or increasing the chlorine dose using chlorine tablets; 5. Advise the Operations Manager; 6. Undertake repairs of the tank; 7. Undertake additional water quality monitoring in the potable water storage tank and reticulation system to ensure water quality compliance; 8. If non-compliant microbiological water quality detected (e.g. detection of E. Coli or coliform bacteria) follows steps outlined in flowchart in Appendix D. 9. If non-compliance detected and relates to physical or chemical quality (e.g. exceedence of guideline value) follows steps outlined in flowchart in Appendix E. 10. Implement incident reporting and continuous improvement procedure.
Chlorine monitoring and dosing system	Low chlorine residual	1. Increase chlorine dosing set point; 2. Consider supplementary chlorine dosing using chlorine tablets; 3. Review control system logs, calibration records and inspect chlorine dosing system for evidence of faults and if required rectify any faults; 4. Advise the Operations Manager; 5. Undertake additional water quality monitoring in the potable water tank and throughout the network; 6. Consider flushing pipes and/or emptying the potable water tank to remove non-compliant water from the system; 7. If non-compliant microbiological water quality detected (e.g. detection of E. Coli or coliform bacteria) follows steps outlined in flowchart in Appendix D. 8. Implement incident reporting and continuous improvement procedure.
Potable water reticulation	Cross connection detected on private property	1. Advise affected customer of the potential fault observed and issue a rectification notice requiring the home owner to provide a written certification of the private plumbing installation to AS3500 by a licensed plumber approved by the CHBWU; 2. Advise Lake Macquarie City Council (as the entity responsible for undertaking plumbing inspections) of the potential issue; 3. Review the licensed plumber report and status of repairs; 4. Implement incident reporting and continuous improvement procedure.

Scheme Component	Incident or Emergency	Steps to be included in Emergency Response Plan
	Cross connection detected in CHBWU reticulation network	1. Turn off Advanced Water Treatment Plant and use potable water backup in the recycled water supply network until it can be demonstrated there is no cross connection; 2. Consider flushing the potable and recycled water networks to ensure only potable water is being used; 3. Undertake detailed investigations on the reticulation systems to determine if an actual cross connection exists and identify its location; 4. Isolate the impacted area and advise any affected customers; 5. Undertake appropriate repairs to the networks to remove the cross connection; 6. Undertake water main sterilisation procedure in the area of rectification works; 7. Undertake detailed assessment to ensure the cross connection has been removed; 8. Undertake detailed water quality monitoring for Bacteria, Viruses and Protozoa across both water networks to demonstrate water quality compliance; 9. Once it is confirmed there is no cross connection and water quality compliance is demonstrated, the Advanced Water Treatment Plant can be brought back online to fill the recycled water storage tank; 10. Implement incident reporting and continuous improvement procedure.

2.7 Element 7 – Employee Awareness and Training

2.7.1 Employee Awareness and Involvement

- Develop mechanisms and communication procedures to increase employees' awareness of and participation in drinking water quality management.

All managers, employees and contractors involved with drinking water quality management will undergo induction and ongoing awareness training for relevant aspects of the Drinking Water Quality Management System relating to their areas of work. This induction will aim to develop awareness and encourage participation and ownership of drinking water quality management.

Employee involvement in drinking water quality management will be encouraged through the following processes and mechanisms:

- General awareness training at the employee/contractor induction stage;
- Specific training to employees/contractors regarding their specific work duties;
- The Incident Review and Continuous Improvement Process that requires all staff involved in an incident to contribute to development of continuous improvement strategies and measures to prevent reoccurrence of the same incident;
- General Continuous Improvement Requests can be made through the system by any staff member at any time through completing the Continuous Improvement Request form;
- Relevant employees and contractors will be consulted for any future changes and updates to the system processes and procedures that may occur.

2.7.2 Employee Training

- Ensure that employees, including contractors, maintain the appropriate experience and qualifications.
- Identify training needs and ensure resources are available to support training programs.
- Document training and maintain records of all employee training.

All managers, employees and contractors involved with the scheme will have appropriate experience and qualifications to undertake the specific job for which they are responsible. Job specific training will be provided to employees and contractors for implementation of operation, maintenance, corrective action and emergency response procedures required for drinking water quality management.

External domestic plumbing contractors and Council plumbing inspectors involved in installation and certification of household plumbing system will be required to undergo a Solo Water induction and awareness training for cross connection controls and back flow prevention. A plumbing guideline will be developed to inform plumbing contractors of appropriate requirement for work within a dual reticulation area.

A formal training and induction database will be developed and maintained for the management of training and induction requirements for all staff and contractors involved with the CHBWU scheme. This database will be developed during detailed design and shall be reviewed annually for compliance.

2.8 Element 8 – Community Involvement and Awareness

2.8.1 Community Consultation

- Assess requirements for effective community involvement.
- Develop a comprehensive strategy for community consultation.

Once the Catherine Hill Bay Utility Scheme is operational, it will be important to keep customers informed about how the scheme works and community involvement will be encouraged. A community consultation strategy will be developed for any major upgrades to the water treatment process in the future to ensure all concerns of the community, particularly social and environmental concerns, are taken into account.

All customers of the CHBWU Scheme will be provided information about the scheme via information packs and the Customer Supply Agreement that they will be required to comply with. Customers will also be provided with smart water meters which will empower them to make informed decisions about their water use by providing them information about their water use and any leaks. A community consultation strategy will be developed prior to any major system changes once the scheme becomes operational.

2.8.2 Communication

- Develop an active two-way communication program to inform consumers and promote awareness of drinking water quality issues.

Community involvement in the CHBWU drinking water scheme will be encouraged. The following mechanisms will be available for community communication and to promote awareness of drinking water quality issues:

- Direct communication of water quality incidents and alerts (see section 2.6.1);
- CHBWU Scheme website updated with recent information including water quality monitoring results;
- Customer supply agreements with all residential customers of the CHBWU Scheme;
- Commercial and trade waste agreements with any commercial customers of the CHBWU Scheme;
- Customer information packs distributed to all dwellings in the scheme;
- Ongoing customer awareness and education;
- Customer service systems for managing customer complaints and reporting of failures (see section 2.5.2 for details about the Unitywater call centre process);
- Smart water meters for customer feedback on water usage and leaks;
- Direct communication with the local operator (because the scheme is small with onsite assets and a local operator, it is likely that residents will be able to directly communicate with the local operator). Note: the operator will log any significant issues with the Unitywater call centre to ensure records are kept;
- Community consultation for all major system changes once the scheme becomes operational.

2.9 Element 9 – Research and Development

2.9.1 Investigative Studies and Research Monitoring

- Establish programs to increase understanding of the water supply system.
- Use information to improve management of the water supply system.

Research and development will be undertaken as required to address identified deficiencies or uncertainties in the drinking water system. Given the relatively small size of the scheme and bulk water source is verified potable water from Wyong Shire Council, significant research and development into catchment management and water treatment techniques is not required.

Solo Water and CHBWU staff and contractors will remain up to date with industry research and technology through their involvement with industry bodies including the NSW Water Directorate, Water Services Association of Australia, Australian Water Association and the Institute of Engineers and their attendance at industry seminars and conferences.

2.9.2 Validation and Processes

- Validate processes and procedures to ensure that they are effective in controlling hazards.
- Revalidate processes periodically or when variations in conditions occur.

Ongoing validation and improvement of the research will be undertaken for the scheme to improve knowledge and understanding of the scheme during the early stages of operation:

- Refinement of the chlorine dosing regime and chlorine residual critical limits at the onsite storage. Refinement of operational and critical limits for chlorine residual will be based on operational data to ensure adequate chlorine residual is maintained throughout the entire water network across the range of climatic and operational conditions experienced in the scheme;
- Refinement of water main flushing regime across the range of climatic and operational conditions experienced in the scheme to minimise water wastage whilst still complying with water quality requirements and customer expectations for taste and odour;
- Validation and testing of the adequacy of the automated cross connection detection procedure.

Other research and development activities will be identified based on operational performance and issues identified through operational monitoring.

2.9.3 Design of Equipment

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

Design of all equipment for the scheme is undertaken using appropriately qualified water engineering professionals from within Solo Water or its contractors and consultants.

All new assets and equipment created for any Solo Water scheme are developed under a new asset creation process that includes design review, audit, quality assurance and handover procedures. The new asset creation process is outlined in the Solo Water Preliminary Infrastructure Operating Plan for the CHBWU (Solo Water, 2013).

2.10 Element 10 – Documentation and Reporting

2.10.1 Management of Documentation and Records

- Document information pertinent to all aspects of drinking water quality management.
- Develop a document control system to ensure current versions are in use.
- Establish a record management system and ensure that employees are trained to fill out records
- Periodically review documentation and revise as necessary.

Solo Water's parent company Solo Waste Recovery have a fully accredited ISO 9001 quality system that includes records management and document control procedures that will be adopted for all Solo Water schemes including the CHBWU. Employees will be trained in the appropriate records management and document control procedures. The system ensures all staff can only access the latest controlled version of each document through the corporate computer network.

In addition Solo Water will maintain several information databases applicable to drinking water quality including:

- Continuous online monitoring and control system which logs monitoring and control data including chlorine residual monitoring, dosing, system pressure etc.;
- Customer service database managed by Unitywater which will store customer complaints, CHBWU actions, response times and feedback etc.;
- Pronto asset management software for managing routine maintenance and generation of asset failure statistics;
- The potable water quality monitoring database which will store all of the potable water quality monitoring results.

All monitoring data will be kept for the life of the scheme and periodic reviews will be undertaken of the records management and documentation systems.

2.10.2 Reporting

- Establish procedures for effective internal and external reporting.
- Produce an annual report made available to consumers, regulatory authorities and stakeholders.

Internal reports will be produced for the CHBWU scheme on a monthly, quarterly and annual basis by the Solo Water Operations Manager with input from all Site Operators. These reports will provide a summary to Solo Water management of performance and adequacy of the scheme against key performance indicators, and will include:

- Potable water quality monitoring data and assessment against compliance;
- Customer complaints, issues, compliments, actions taken and response times;
- Performance against a range of key performance indicators and service standards;
- Information on any non-compliances, corrective actions, incidents and emergency events that occurred during the period;
- Recommendations for continuous improvement actions to be implemented and monitoring progress of implementation of required actions.

The annual reports and water quality monitoring results will be made available to customers, government departments and other stakeholders through the CHBWU and Solo Water websites. Additional external reporting requirements to NSW Health and IPART etc will be documented following receipt of the IPART license.

2.11 Element 11 – Evaluation and Audit

2.11.1 Long Term Evaluation Results

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

The Solo Water Operation Manager will undertake ongoing review and evaluation of monitoring results and operational performance data against ADWG values, key performance indicators, service standards and other benchmarking indicators, e.g. NSW Water Supply and Sewerage Benchmarking Reports.

2.11.2 Audit of Drinking Water Quality Management

- Establish processes for internal and external audits.
- Document and communicate audit results.

Internal and external audit of the Drinking Water Quality system will be undertaken as required by the Solo Waste Recovery ISO9001 Quality Assurance system. Any additional external audit requirements required by IPART and other government departments will be included following receipt of the IPART license.

Record keeping and reporting systems will be maintained to allow audit processes to occur as they are required.

2.12 Element 12 – Review and Continuous Improvement

2.12.1 Review by Executive Management

- Senior executive review of the effectiveness of the management system.
- Evaluate the need for change.

The Solo Water executive team will receive quarterly and annual reports from the Operations Manager regarding the performance of all Solo Water Schemes including the CHBWU Scheme. These reports include recommendations for continuous improvement made by Operations staff and the Operations Manager.

Executive review and continuous improvement processes include:

- Review of significant issues, incidents or events they may be escalated from time to time; *NOTE: Following any significant incidents or events, executive management will be involved in the incident review and continuous improvement process to ensure adequate resources can be allocated to address any significant issues that may arise.*
- Review of the quarterly and annual reports prepared by the Operations Manager;
- Internal and external audit results and recommendations;
- Approval of funding and resource allocation for projects/actions to be included on the continuous improvement program each year based on recommendations in annual reports;
- Monitoring of progress of implementation of the continuous improvement program;
- Providing input as to how the system may be impacted by future organisational change being planned by executive management in order to allow sufficient time for integration and implementation or any change processes.

2.12.2 Drinking Water Quality Management Improvement Plan

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

A drinking water quality management continuous improvement program will be maintained on an ongoing basis. This program will include all continuous improvement actions to be implemented from review of operational data and incident reports. Executive Management will monitor the progress of implementation.

System deficiencies will be identified through continuous improvement requests and recommendations outlined in the quarterly and annual reporting process. From this information, a drinking water quality management improvement plan will be compiled which will include a program for implementation of improvements. For each improvement within the program, responsibility will be assigned, budgets allocated and a program schedule set with deadlines that are monitored.

The initial drinking water quality improvement plan for the CHBWU scheme will be developed during detailed design and will be communicated to all relevant staff and monitored for effectiveness and progress of implementation.

3 Bibliography

AS/NZS (Standards Australia/Standards New Zealand). (2009). *ISO 31000 Risk management - Principles and guidelines.*

National Health and Medical Research Council; Natural Resource Management Ministerial Council. (2011). *Australian Drinking Water Guidelines 6.* Australian Government.

Natural Resource Management Ministerial Council; Environment Protection and Heritage Council; Australian Health Ministers Conference. (2006). *Australian Guidelines for Water Recycling: Managing Health and Environmental Risks (Phase 1).* National Water Quality Management Strategy. Australian Government.

New South Wales Government. (2006). *Water Industry Competition Act.*

NSW Department of Health. (2005). *Drinking Water Monitoring Program.*

NSW Independent Pricing and Regulatory Tribunal. (2013). *IPART*. Retrieved from http://www.ipart.nsw.gov.au/

PS Solutions Pty Ltd. (April 2013). *Water Supply Summary Servicing Strategy Catherine Hill Bay.*

Solo Water. (2013). *Infrastructure Operating Plan for the Catherine Hill Bay Water Utility.*

List of Appendices

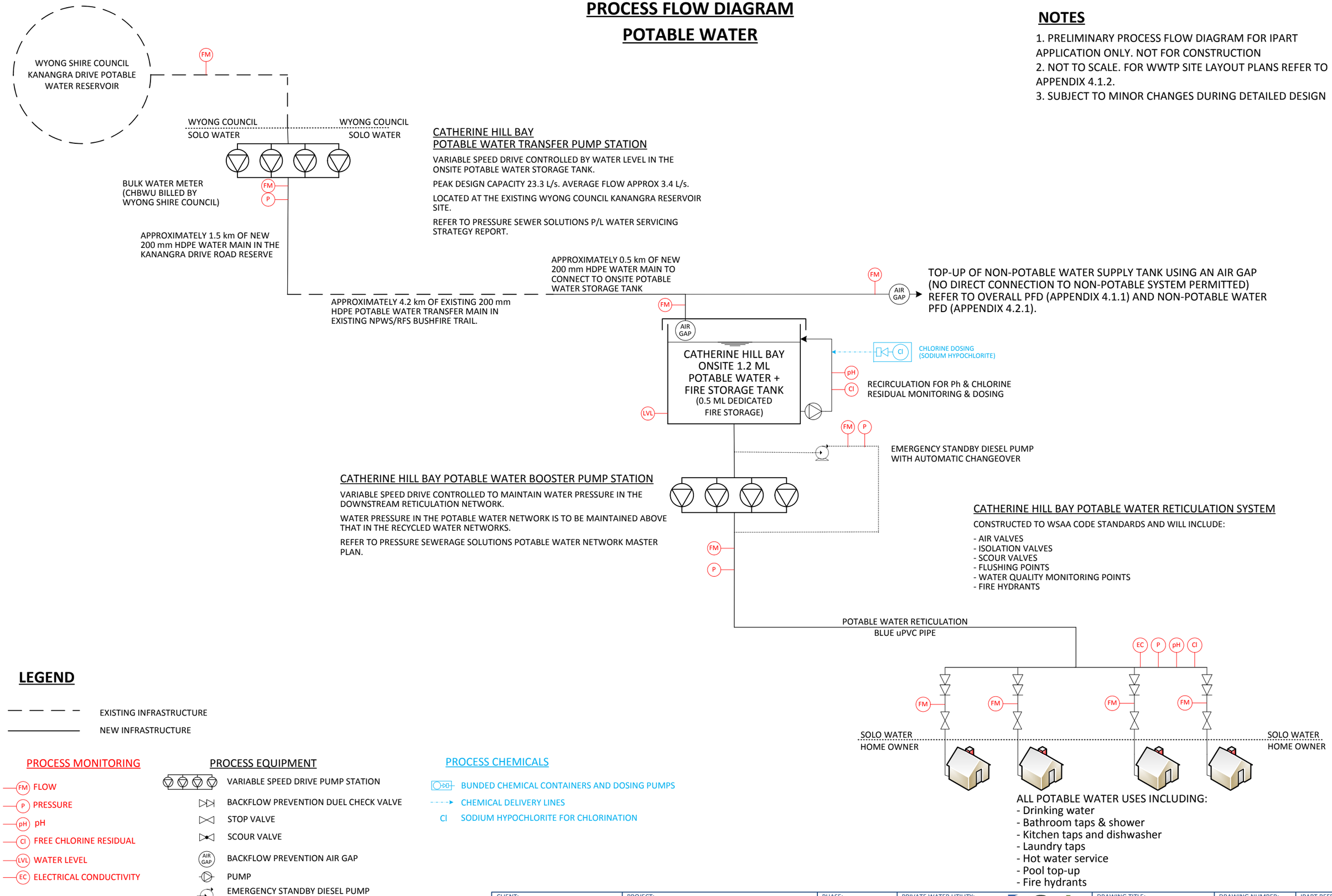
Appendix A Process Flow Diagram – Catherine Hill Bay Potable Water II
Appendix B Bulk Water Main Layout Plan..... III
Appendix C Drinking Water System Preliminary Risk Assessment..... IV
Appendix D NSW Health Response Protocols – Microbiological Drinking Water Quality V
Appendix E NSW Health Response Protocols – Physical and Chemical Drinking Water Quality VI

Appendix A
Process Flow Diagram – Catherine Hill Bay Potable Water

PROCESS FLOW DIAGRAM
POTABLE WATER

NOTES

1. PRELIMINARY PROCESS FLOW DIAGRAM FOR IPART APPLICATION ONLY. NOT FOR CONSTRUCTION
2. NOT TO SCALE. FOR WWTP SITE LAYOUT PLANS REFER TO APPENDIX 4.1.2.
3. SUBJECT TO MINOR CHANGES DURING DETAILED DESIGN



CATHERINE HILL BAY POTABLE WATER TRANSFER PUMP STATION

VARIABLE SPEED DRIVE CONTROLLED BY WATER LEVEL IN THE ONSITE POTABLE WATER STORAGE TANK.

PEAK DESIGN CAPACITY 23.3 L/s. AVERAGE FLOW APPROX 3.4 L/s.

LOCATED AT THE EXISTING WYONG COUNCIL KANANGRA RESERVOIR SITE.

REFER TO PRESSURE SEWER SOLUTIONS P/L WATER SERVICING STRATEGY REPORT.

CATHERINE HILL BAY POTABLE WATER BOOSTER PUMP STATION

VARIABLE SPEED DRIVE CONTROLLED TO MAINTAIN WATER PRESSURE IN THE DOWNSTREAM RETICULATION NETWORK.

WATER PRESSURE IN THE POTABLE WATER NETWORK IS TO BE MAINTAINED ABOVE THAT IN THE RECYCLED WATER NETWORKS.

REFER TO PRESSURE SEWERAGE SOLUTIONS POTABLE WATER NETWORK MASTER PLAN.

CATHERINE HILL BAY POTABLE WATER RETICULATION SYSTEM

CONSTRUCTED TO WSAA CODE STANDARDS AND WILL INCLUDE:

- AIR VALVES
- ISOLATION VALVES
- SCOUR VALVES
- FLUSHING POINTS
- WATER QUALITY MONITORING POINTS
- FIRE HYDRANTS

ALL POTABLE WATER USES INCLUDING:
- Drinking water
- Bathroom taps & shower
- Kitchen taps and dishwasher
- Laundry taps
- Hot water service
- Pool top-up
- Fire hydrants

LEGEND

EXISTING INFRASTRUCTURE

NEW INFRASTRUCTURE

PROCESS MONITORING

- FM FLOW
- P PRESSURE
- pH pH
- Cl FREE CHLORINE RESIDUAL
- LVL WATER LEVEL
- EC ELECTRICAL CONDUCTIVITY

PROCESS EQUIPMENT

- VARIABLE SPEED DRIVE PUMP STATION
- BACKFLOW PREVENTION DUEL CHECK VALVE
- STOP VALVE
- SCOUR VALVE
- AIR GAP BACKFLOW PREVENTION AIR GAP
- PUMP
- EMERGENCY STANDBY DIESEL PUMP WITH AUTOMATIC CHANGEOVER

PROCESS CHEMICALS

- BUNDED CHEMICAL CONTAINERS AND DOSING PUMPS
- CHEMICAL DELIVERY LINES
- Cl SODIUM HYPOCHLORITE FOR CHLORINATION

CLIENT:	PROJECT:	PHASE:	PRIVATE WATER UTILITY:	DRAWING TITLE:	DRAWING NUMBER:	IPART REFERENCE:
ROSE PROPERTY GROUP PTY LTD	CATHERINE HILL BAY RESIDENTIAL SUBDIVISION MONTEFIORE STREET, CATHERINE HILL BAY	IPART LICENSE APPLICATION	CATHERINE HILL BAY WATER UTILITY PTY LTD	PROCESS FLOW DIAGRAM POTABLE WATER	H10052_P02C	APPENDIX 4.1.1
					DATE: 05/07/2013	

Appendix B
Bulk Water Main Layout Plan

EXISTING 4.2 km X 200 mm HDPE WATER MAIN IN EXISTING NPWS/RFS FIRE TRAIL.

EXISTING 200 mm HDPE WATER MAIN PASSES UNDER THE PACIFIC HWY IN EXISTING COMMON SERVICES CULVERT.

EXISTING 4.2 km X 200 mm HDPE WATER MAIN IN EXISTING NPWS/RFS FIRE TRAIL.

CONNECT NEW MAIN INTO EXISTING MAIN.

NEW 0.6 km X 200 mm HDPE WATER MAIN TO CONNECT TO 0.5 ML POTABLE WATER STORAGE TANK

NEW 0.5 ML POTABLE WATER STORAGE TANK AT WWTP SITE

EXISTING 4.2 km X 200 mm HDPE WATER MAIN IN EXISTING NPWS/RFS FIRE TRAIL.

EXISTING 4.2 km X 200 mm HDPE WATER MAIN IN EXISTING NPWS/RFS FIRE TRAIL.

THE EXISTING 200 mm WATER MAIN WILL BE DISCONNECTED FROM THE EXISTING 400 mm WYONG COUNCIL TRUNK WATER MAIN AND CONNECTED TO THE NEW 200 mm MAIN FROM THE TRANSFER PUMP STATION AT KANANGRA DRIVE RESERVOIR.

NEW 1.5 km X 200 mm HDPE WATER MAIN IN KANANGRA DRIVE ROAD RESERVE FROM NEW TRANSFER PUMP STATION.

NEW SOLO WATER BULK TRANSFER PUMP STATION AT EXISTING WYONG COUNCIL RESERVOIR SITE PEAK DAY DESIGN CAPACITY 23.3 L/s.

EXISTING WYONG COUNCIL KANANGRA DRIVE RESERVOIR

PACIFIC HWY

WATTAGAN CR

NOTES:
1. CONCEPT FOR IPART APPLICATION ONLY NOT FOR CONSTRUCTION.
2. ALIGNMENT OF BACKGROUND AERIAL PHOTO IS APPROXIMATE ONLY. IMAGE SOURCED FROM GOOGLE EARTH PRO.
3. THE EXISTING WATER MAIN WAS USED TO SUPPLY WATER TO THE FORMER COAL MINE LOCATED ON THE SUBDIVISION SITE.
4. THE EXISTING WATER MAIN RUNS ALONG AN EXISTING NPWS/RFS CLASS 1 FIRE TRAIL. SOLO WATER IS ENTERING AN AGREEMENT WITH NPWS FOR ACCESS AND MAINTENANCE OF THE WATER MAIN AND FIRE TRAIL.
5. FOLLOWING THE COMPLETION OF NEW WORKS THE ENTIRE TRANSFER MAIN WILL BE PRESSURE TESTED AND DISINFECTED BEFORE BEING RETURNED TO SERVICE.
6. REFER TO PRESSURE SEWER SOLUTIONS PTY LTD WATER SERVICING STRATEGY REPORT FOR DETAILS ON HYDRAULIC DESIGN.

ISSUE	DATE	ISSUE DETAILS
A	8/4/2013	IPART LICENSE APPLICATION

harvest
water management consultants pty ltd
184 Rivergum Drive
Burpengary, Qld 4505
0488 427 878
brad@harvestwmc.com.au
www.harvestwmc.com.au
ABN: 54140 844 047

CLIENT: SOLO WATER CATHERINE HILL BAY WATER UTILITY

PROJECT: CATHERINE HILL BAY RESIDENTIAL SUBDIVISION ROSE PROPERTY GROUP

Solo Water

SITE: MONTEFIORE ROAD, CATHERINE HILL BAY

DESIGN: BI | DRAWN: BI | APPROVED: BI

Bradley Irwin RPEQ (10637) CPENG NPER Environmental Engineer

Signed on behalf of Harvest Water Management Consultants Pty Ltd | DATE

DRAWING TITLE: BULK WATER TRANSFER MAIN LAYOUT PLAN

PROJECT NO.: H10052

SCALE: 1:10,000 at A3 (0 100 200 300 400 500)

DWG TYPE: CONCEPT ONLY NOT FOR CONSTRUCTION

DWG NO.: P05

ISSUE: A

Appendix C
Drinking Water System Preliminary Risk Assessment

Note: Drinking Water Risk Assessment table from IPART application – Appendix 4.1.9

Project: Catherine Hill Bay Water Utility
Client: Rose Group
Title: Drinking Water Preliminary Risk Assessment for IPART Application
Author: BI
Date (Revision): 10/07/2013 (Revision B)
Risk Criteria: As per Tables 3.1, 3.2 & 3.3: Australia Drinking Water Guidelines 6 (2011)

Scheme Component	Hazard	Hazardous Event	Impact	Unmitigated Risk					Control Strategy	Mitigated Risk				
				Likelihood		Consequence		Risk		Likelihood		Consequence		Risk
Bulk Water Supply	Contaminants in bulk water source	Contaminants detected in Wyong Shire Councils monitoring systems	Supply of non-compliant potable water	C	Possible	4	Major	Very High	1. Bulk water agreement from Wyong Shire Council guarantees bulk water supply will be compliant with the Australian Drinking Water Guidelines. Wyong Shire Council is responsible for all upstream water quality, treatment and catchment management issues. 2. Develop notification and communication protocols with Wyong Shire Council to ensure Catherine Bay Water Utility is notified of all water quality events in a timely manner.	D	Unlikely	3	Moderate	Moderate
Potable Water Transfer Pump Station	Oil and pump lubricants	Water supply contaminated with oil/lubricant from failed pump seal	Supply of non-compliant potable water	C	Possible	2	Minor	Moderate	1. Appropriate pump selection and design. 2. Routine inspection and maintenance of transfer pump station	D	Unlikely	2	Minor	Low
	Transfer Pump Station Failure	Mechanical, electrical or control system failure or power outage	Loss of supply capacity	C	Possible	4	Major	Very High	1. Multiple pump set with standby capacity 2. 24 hours storage provided in onsite potable water storage tank	D	Unlikely	4	Major	High
Potable Water Transfer Pipeline	Microbiological contamination	Water main break	Supply of non-compliant potable water	C	Possible	4	Major	Very High	1. Design, construction, pressure testing and commissioning of the transfer main to WSAA Standards. 2. Emergency Response Plan to be developed for water main breaks will include water main sterilisation procedure	D	Unlikely	3	Moderate	Moderate
	Microbiological contamination	Cross contamination due to poor maintenance practices	Supply of non-compliant potable water	C	Possible	4	Major	Very High	1. Standard operating and maintenance procedures will be developed for the scheme. Procedures will include water main flushing, hygiene and disinfection requirements. 2. Separate tools to be used on water and sewerage systems.	D	Unlikely	3	Moderate	Moderate
	Microbiological contamination	Backflow and cross connections	Supply of non-compliant potable water	C	Possible	2	Minor	Moderate	1. No direct connections to the transfer pipeline. The only connection point to the pipeline is the onsite potable water and fire storage tank via a 300 mm air gap.	D	Unlikely	2	Minor	Low
	Sedimentation in pipeline	Excessive sedimentation in pipeline during off peak periods	Taste, odour and colour complaints	C	Possible	2	Minor	Moderate	1. Undertake routine flushing of the water transfer main 2. Customer taste and odour complaint monitoring system with Customer Service.	B	Likely	1	Insignificant	Moderate
	Pipeline breakage	Major pipeline breakage	Localised flooding, soil erosion, loss of supply	C	Possible	4	Major	Very High	1. Existing 200 mm HDPE main to be cleaned, air scoured, pressure tested, repaired and disinfected. Any non-compliant sections of main will be replaced. 2. Construction quality assurance. 3. Flow monitoring at each end of the pipeline to detect flow differential. 4. 24 hours storage provided in onsite potable water storage tank. 5. Emergency Response Plan for water main breaks. 6. Frequent inspection along water main corridor to detect leaks and breaks.	B	Likely	3	Moderate	High
	Pipeline leakage	Minor leaks	Water wastage	B	Likely	2	Minor	High	1. Use VSD controlled transfer pump station to minimise operating pressure during low flows. Pumps will only ramp up to maximum pressure when pumping peak flows. 2. Flow meters and pressure sensors on the transfer pipeline for monitoring of "midnight flows" for identification of leaks. 3. Walk over and visual inspection along water main corridor to identify leaks. 4. Use leak detection equipment if required.	B	Likely	1	Insignificant	Moderate
Onsite Potable Water Storage Tank	Microbiological contamination	Vermin, animal and mosquito access to storage	Supply of non-compliant potable water	B	Likely	4	Major	Very High	1. Sealed tank designed to potable water storage standards with screens on all tank openings. 2. Ongoing inspection & maintenance program	D	Unlikely	4	Major	High
	Material compatibility	Dissolution of tank materials into potable water supply	Supply of non-compliant potable water	C	Possible	4	Major	Very High	1. Tank constructed to potable water storage standards using materials compatible with potable water supply 2. Metallic tanks to use food grade HDPE liner.	D	Unlikely	3	Moderate	Moderate
	Cross connection	Backflow into water transfer main	Supply of non-compliant potable water	C	Possible	3	Moderate	High	1. Connection of transfer main uses an Air gap above the high water overflow level in the tank.	E	Rare	3	Moderate	Moderate
Recirculation & Chlorine Dosing	Chlorine residual	Inadequate chlorine residual (low or high)	Supply of non-compliant potable water	C	Possible	4	Major	Very High	1. Continuous online monitoring of free chlorine residual with alarms for low and high concentrations. 2. Duty and standby chlorine dosing pumps. 3. Fault detection and alarms on dosing pumps.	D	Unlikely	4	Major	High

Project: Catherine Hill Bay Water Utility
Client: Rose Group
Title: Drinking Water Preliminary Risk Assessment for IPART Application
Author: BI
Date (Revision): 10/07/2013 (Revision B)
Risk Criteria: As per Tables 3.1, 3.2 & 3.3: Australia Drinking Water Guidelines 6 (2011)

Scheme Component	Hazard	Hazardous Event	Impact	Unmitigated Risk					Control Strategy	Mitigated Risk				
				Likelihood		Consequence		Risk		Likelihood		Consequence		Risk
Potable Water Supply Booster Pump Station	Pump seals and lubricants	Water supply contaminated from failed pump seal	Supply of non-compliant potable water	C	Possible	2	Minor	Moderate	1. Appropriate pump selection and design. 2. Routine inspection and maintenance of transfer pump station.	D	Unlikely	2	Minor	Low
	Low pressure	Water pressure in potable network below that in the recycled water networks	Increased risk of backflow if a cross connection occurs	B	Likely	4	Major	Very High	1. Duty of drinking water supply booster pump station to be set a minimum of 50 kPa above duty of the non-potable water booster pump station. 2. Monitoring of water pressure differential between the drinking water recycled water networks.	C	Possible	4	Major	Very High
	Booster pump station failure	Mechanical, electrical or control system failure or power outage	Loss of supply capacity	C	Possible	4	Major	Very High	1. VSD pressure booster pump set with standby capacity. 2. Routine inspection and maintenance of booster pump station. 3. Standby emergency diesel pump with automatic changeover	C	Possible	4	Major	Very High
Potable Water Reticulation System	Class A+ recycled water network	Cross connection with the Class A+ recycled water network	Supply of non-compliant potable water	C	Possible	4	Major	Very High	Cross connection controls including: 1. Reticulation networks designed, constructed and commissioned to WSAA standards. 2. Unique pipe colour and materials. Potable uses blue PVC pipe. Class A+ recycled water network uses lilac striped HDPE pipe. 3. Identification and labelling and minimum separation distances in common trenches. 4. Only approved Solo Water contractors can undertake work on the reticulation networks. 5. Potable water network to operate a minimum of 50 kPa above that in the recycled water network. 6. Routine monitoring of potable water quality 7. Monitoring of pressure and salinity differential between the drinking and non-potable water networks	B	Likely	3	Moderate	High
	Sedimentation and slime growth	Excessive sedimentation in reticulation system during off peak periods	Taste, odour and colour complaints	B	Likely	1	Insignificant	Moderate	1. Routine monitoring and water main flushing program 2. Monitoring of taste and odour complaints through customer service processes	C	Possible	1	Insignificant	Low
	Microbiological contamination	Water main break	Supply of non-compliant potable water	C	Possible	4	Major	Very High	1. Design, construction, pressure testing and commissioning to WSAA Standards. 2. Emergency Response Plan for water main breaks will include water main sterilisation procedure	D	Unlikely	3	Moderate	Moderate
	Microbiological contamination	Cross contamination due to poor maintenance practices	Supply of non-compliant potable water	C	Possible	4	Major	Very High	1. Standard operating and maintenance procedures will be developed for the scheme. Procedures will include hygiene and disinfection requirements. 2. Separate tools to be used on water and sewerage systems.	D	Unlikely	3	Moderate	Moderate
	Microbiological contamination	Backflow and cross connections	Supply of non-compliant potable water	C	Possible	2	Minor	Moderate	1. No direct connections to the transfer pipeline. The only connection point to the pipeline is the onsite potable water and fire storage tank via an air gap.	D	Unlikely	2	Minor	Low
	Reticulation pipe breakage	Major breakage	Localised flooding, soil erosion, loss of supply	C	Possible	3	Moderate	High	1. Design, construction, pressure testing and commissioning to WSAA Standards. 2. Emergency Response Plan for water main breaks will include water main sterilisation procedure	C	Possible	3	Moderate	High
	Reticulation pipe leakage	Minor leaks	Water wastage	C	Possible	2	Minor	Moderate	1. Use VSD controlled booster pump station to minimise operating pressure during low flows. 2. Flow meters and pressure sensors on reticulation network for monitoring of "midnight flows" for identification of leaks. 3. Walk over and visual inspection along water main corridor to identify leaks. 4. Use leak detection equipment if required.	C	Possible	1	Insignificant	Low
	Fire hydrants on potable water network	Reduction in water pressure in potable network during fire flows	Increased risk of backflow if a cross connection occurs	B	Likely	4	Major	Very High	1. Cross connection controls. 2. Network design to minimise pressure losses during fire flow. 3. Use VSD controlled transfer pump station to maintain pressure during fire flows.	C	Possible	3	Moderate	High
Customer Consumption and Private Water Systems	Onsite Class A+ recycled water pipes	Cross connection on private land	Supply of non-compliant potable water	B	Likely	4	Major	Very High	1. Domestic plumbing systems installed and tested for compliance with AS3500 and the NSW Code of Practice for Plumbing and Drainage by licensed plumbing contractors. 2. Catherine Hill Bay Water Utility to provide induction, training and compliance auditing for all domestic plumbing contractors. 3. Dual check valve for backflow prevention at all connection points.	C	Possible	4	Major	Very High
	Excessive water use	Poor user behaviour	Excessive water use, Potential overload of onsite water systems	C	Possible	3	Moderate	High	1. Customer supply and trade waste agreement will outline expected water consumptions rates. 2. Ongoing customer awareness and education 3. Smart water meters at all connection points to provide feedback on water use	C	Possible	3	Moderate	High
	Leaks	Leaks in onsite water systems	Water wastage	B	Likely	1	Insignificant	Moderate	1. Smart water meters at all connection points to enable detection of leaks by residents	C	Possible	1	Insignificant	Low

DRINKING WATER
QUALITATIVE ENVIRONMENTAL AND PUBLIC HEALTH RISK ASSESSMENT CRITERIA

From tables 3.1, 3.2 & 3.3 on Page 3-8 of the Australian Drinking Water Guidelines (2011)

Qualitative measures of likelihood

Level	Descriptor	Example Description from ADWG
A	Almost certain	Is expected to occur in most circumstances
B	Likely	Will probably occur in most circumstances
C	Possible	Might occur or should occur at some time
D	Unlikely	Could occur at some time
E	Rare	May occur only in exceptional circumstances

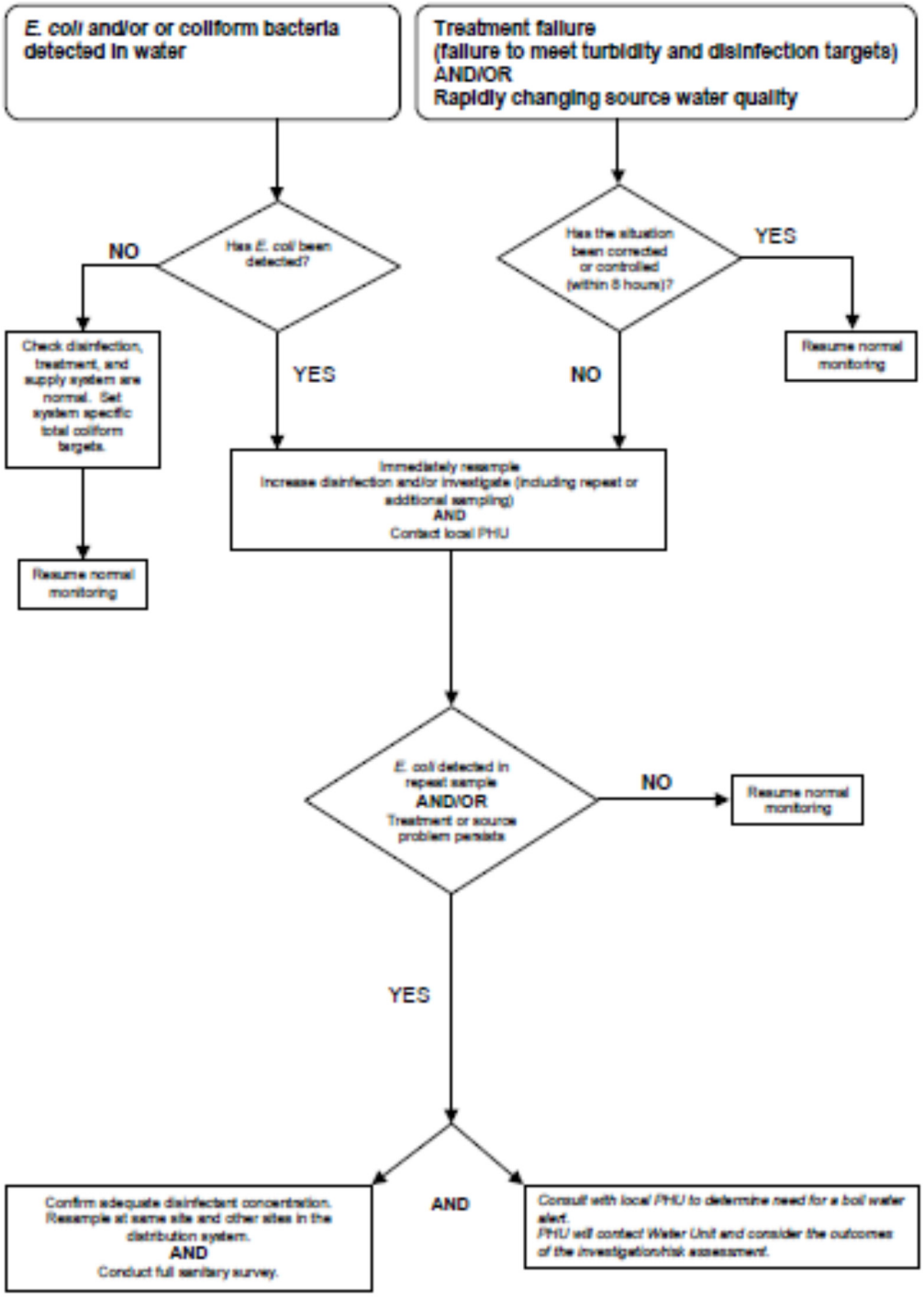
Qualitative measures of consequence or impact

Level	Descriptor	Example description from ADWG
1	Insignificant	Insignificant impact, little disruption to normal operation, low increase in normal operation costs
2	Minor	Minor impact for small population, some manageable operation disruption, some increase in operating costs
3	Moderate	Minor impact for large population, significant modification to normal operation but manageable, operation costs increased, increased monitoring
4	Major	Major impact for small population, systems significantly compromised and abnormal operation if at all, high level of monitoring required
5	Catastrophic	Major impact for large population, complete failure of system

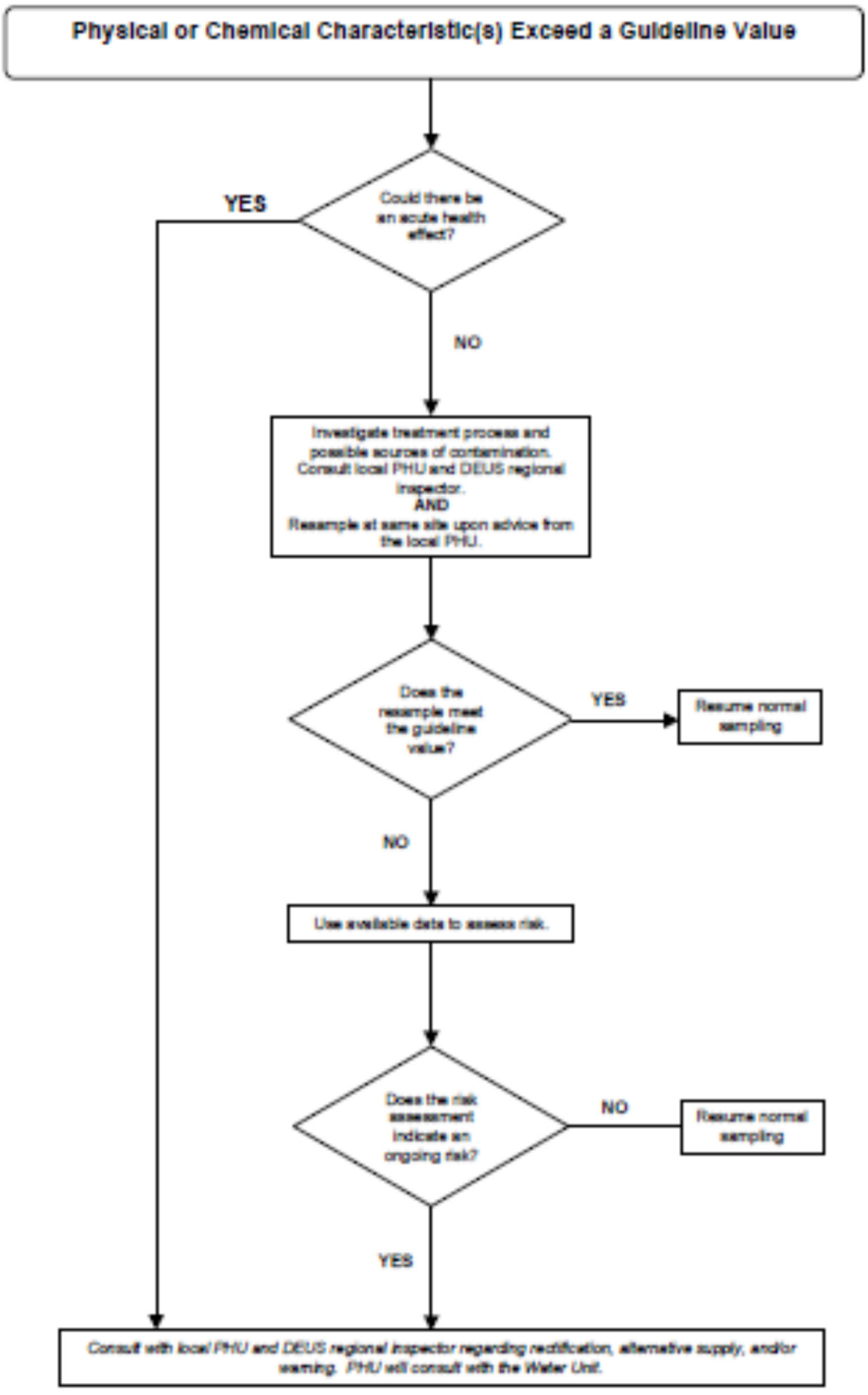
Qualitative risk analysis matrix: Level of risk

		Consequences				
Likelihood		1	2	3	4	5
		Insignificant	Minor	Moderate	Major	Catastrophic
A	Almost certain	Moderate	High	Very High	Very High	Very High
B	Likely	Moderate	High	High	Very High	Very High
C	Possible	Low	Moderate	High	Very High	Very high
D	Unlikely	Low	Low	Moderate	High	Very high
E	Rare	Low	Low	Moderate	High	High

Appendix D
NSW Health Response Protocols – Microbiological Drinking Water Quality



Appendix E
NSW Health Response Protocols – Physical and Chemical Drinking Water Quality



Solo Water

Appendix 4.1.12 **Preliminary Infrastructure Operations Plan (IOP)**

Preliminary
Infrastructure Operating Plan

for the

Catherine Hill Bay Water Utility, at
Catherine Hill Bay Residential Subdivision

July 2013

Prepared for: Wayne Williamson
Solo Water Pty Ltd

Project Number: H10052
Project Name: Catherine Hill Bay
Report Number: H10052_R5A

harvest
water management consultants pty ltd

164 Rivergum Drive
Burpengary Qld 4505
0488 427 878
office@harvestwmc.com.au
www.harvestwmc.com.au

DOCUMENT CONTROL

Report Number: H10052_R5

ISSUE	STATUS	DATE	ISSUE DETAILS	AUTHOR	APPROVED
A	DRAFT	12/07/2013	FOR IPART LICENSE APPLICATION	ES, BI	BRADLEY IRWIN MIEAust, CPEng, NPER

COMMERCIAL IN CONFIDENCE

The information contained in this report, including intellectual property in concepts, designs, drawings and documents created by Harvest Water Management Consultants Pty Ltd remain the property of this company.

This report may contain commercially sensitive information that could be of benefit to our competitors and therefore must only be used by the person to whom it is provided for the stated purpose in which it is provided. The information must not be provided to any third person without prior written approval of Harvest Water Management Consultants Pty Ltd.

DISCLAIMER

This report has been written for exclusive use by Solo Water Pty Ltd for the Catherine Hill Bay Water Utility based on the agreement with Harvest Water Management Consultants Pty Ltd.

The investigation was carried out based on the specific requirements of Solo Water Pty Ltd and may not be applicable outside of this specific scope. Therefore the information in this report shall not be relied upon by any third party without further input from Harvest Water Management Consultants Pty Ltd.

The investigation has been undertaken based on information provided by others. Harvest Water Management Consultants Pty Ltd accepts no responsibility for the accuracy of information provided by others. The accuracy of the investigation and report is dependent on the accuracy of this information.

Preliminary Infrastructure Operating Plan

for the

Catherine Hill Bay Water Utility, at Catherine Hill Bay Residential Subdivision

Table of Contents

1 Introduction 1
1.1 Plan framework 1
2 Infrastructure Description 2
2.1 Overview of Solo Water Standard Model 2
2.2 Solo Water Schemes 2
2.2.1 Catherine Hill Bay Water Utility Scheme 2
3 Levels of Service 4
4 Corporate Asset Management Systems 5
4.1 Asset Management System Software 5
4.2 Finance System 5
4.3 Geographical Information System 5
5 Risk Management 6
6 Asset Lifecycle Management 7
6.1 Creation or Renewal of Assets 7
6.2 Operation and Maintenance of Assets 8
6.2.1 Routine Operation & Maintenance 8
6.2.2 Non-Routine Maintenance 10
6.3 Asset Monitoring and Condition Assessment 10
6.4 Contingency Planning and Emergency Response Plans 17
6.5 Asset Renewal and Replacement 19
6.6 Asset Disposal 20
7 Financial Summary 21
7.1 Financial Overview 21
7.1.1 Capital Funding 21
7.1.2 Operation and Maintenance Funding 21
7.1.3 Renewal Funding 21
7.2 Financial Projections of Solo Water Schemes 21
7.2.1 Catherine Hill Bay Financial Projection 21
8 Plan Review and Continuous Improvement 22
8.1 Infrastructure Operating Plan Review 22
8.2 Improvement & Implementation Plan 22
Appendices 23

List of Tables

Table 2.1: Catherine Hill Bay Water Utility Scheme Infrastructure Overview 2
Table 6.1: Overview of asset creation/renewal process for new Solo Water schemes..... 7
Table 6.2: Overview of Operation and Maintenance plans & Procedures to be developed 9
Table 6.3: Infrastructure monitoring and condition assessment methodology. 11
Table 6.4: Contingency planning and Emergency Response Plans 17

1 Introduction

This preliminary Infrastructure Operating Plan (IOP) has been prepared for the proposed Catherine Hill Bay Water Utility (CHBWU) scheme to support the Network Operator License application to IPART being made under the Water Industry Competition Act (WIC Act). The proposed CHBWU will provide water, wastewater and recycled water services to 470 connections inside the approved residential subdivision located at Montefiore Road, Catherine Hill Bay, New South Wales.

The proposed CHBWU scheme is currently in the concept design and regulatory approval stage. Following approval of the Network Operator License from IPART, development of the detailed design and documentation of the detailed operation, maintenance and emergency response plans for the proposed scheme will commence. At this stage the detailed design and management plans will be audited by an IPART approved auditor prior to construction.

Given the project is in its early stages, this IOP has been designed as a road map to highlight the various operating and maintenance plans, asset management systems, monitoring systems and emergency response plans required for the scheme.

1.1 Plan framework

Key elements of this Preliminary Infrastructure Operating Plan are:

- Description of proposed infrastructure
- Levels of service
- Infrastructure risk assessment
- Asset Life cycle management
- Financial summary
- Improvement/implementation plan

2 Infrastructure Description

2.1 Overview of Solo Water Standard Model

Solo Water has developed a standardised approached to integrated water and wastewater management for sites in remote areas. The infrastructure requirements are similar across different Solo Water Schemes, however based on the site specific opportunities and constraints, some of the specific arrangements and details may vary slightly across each scheme. The use of common infrastructure elements allows simpler and more efficient asset management strategies to be employed.

The Solo Water integrated water and wastewater scheme includes the following general components:

- Bulk water supply connection to an existing water utility for sourcing potable water;
- Onsite potable water storage tank with chlorine monitoring and dosing;
- Variable Speed drive potable water supply booster pump station;
- Pressure sewerage collection system using fusions welded HDPE pipe;
- A standard Solo Water Membrane Bioreactor with capacity of 300 kL/day for production of irrigation quality recycled water;
- Wet weather storage for storing recycled water during wet periods;
- An Advanced Water Treatment Plant for production of high quality recycled water suitable for supply to individual houses in a dual reticulation system for toilet, laundry and outdoor non-potable uses;
- Onsite recycled water storage tank with chlorine monitoring and dosing;
- Variable Speed drive recycled water supply booster pump station.
- Potable and recycled water networks with cross connection monitoring and control measures.

A description of how the above standard model has been adapted to the various Solo Water schemes is outlined below.

2.2 Solo Water Schemes

2.2.1 Catherine Hill Bay Water Utility Scheme

An overview of the specific infrastructure proposed for the Catherine Hill Bay Water Utility scheme based on the standard Solo Water model is outline below in Table 2.1.

Table 2.1: Catherine Hill Bay Water Utility Scheme Infrastructure Overview

Scheme Component	Asset	Description
Potable Water	Bulk water transfer pump station	Variable speed drive pump station sized 23.3 L/sec
	Bulk water transfer pipeline	6.5 km x 200 mm HDPE pipeline

Scheme Component	Asset	Description
Potable Water cont…	Onsite potable water storage	1.2 ML HDPE lined steel panel tank
	Potable water supply booster pump station	Variable speed drive booster pump station
	Emergency diesel pump	Diesel pump with automatic changeover
	Reticulation system	Approximately 7 km of blue PVC potable water reticulation pipe Scour valves, air valves, flushing points, isolation valves, fire hydrants etc to WSAA standards
	Potable water customer connections	470 connections with smart water metre, dual check valve and isolation valves
Waste Water	Sewerage customer connections	470 localised gravity connections Up to 4 houses per pressure sewer pump station.
	Pressure sewer pump stations	Approximately 120 to 150 pressure sewer pump stations
	Pressure sewer mains	Approximately 7 km of brown stripe PN 16 fusion welded HDPE pressure sewer pipe
	Membrane Bioreactor (MBR)	1 x Solo Water MBR Train Peak Treatment Capacity: 330kL/day Average Flow: 215 kL/day (inc 15 kL/day AWTP return flows)
	Wet weather storage	10 ML HDPE lined wet weather storage dam
	Irrigation System	Stage 1 Temporary: 10.75 ha temporary, restricted access irrigation area supplied with MBR effluent Ultimate: 8.3 ha public open space irrigation system supplied with Class A+ recycled water from the AWTP
Recycled Water	Advanced water treatment plant (AWTP)	Class A+ recycled water production: 200 kL/day Treatment train includes Ultrafiltration membranes, Side Stream Reverse Osmosis, Ultraviolet disinfection, Chlorine contact tank and residual chlorination.
	Reverse osmosis reject evaporation system	1 x 500 m^2 HDPE lined vetiver grass evaporation wetland 2 x 2000 m^2 HDPE lined saline evaporation ponds.
	Recycled Water Storages	850 kL HDPE lined steel panel tank
	Recycled water supply booster pump station	Variable speed drive booster pump station
	Emergency diesel pump	Diesel pump with automatic changeover
	Reticulation system	Approximately 7 km of lilac striped PN16 fusion welded HDPE recycled water reticulation pipe Scour valves, air valves, flushing points, isolation valves, fire hydrants etc to WSAA standards
	Recycled water customer connection points	470 connections with smart water metre, dual check valve and isolation valves

3 Levels of Service

The draft standards of service for Solo Water schemes are outlined in the Solo Water document "*Customer Charter and Standard Terms and Conditions for Provision of Water and Wastewater Services*" (refer to IPART Application Appendix 5.1.7). The levels of service will be reviewed annually and updated. An extract from this document is provided below.

"Reliability of supply

Obligation to provide reliable services

SW will enter into and ensure continuity of a maintenance agreement with a suitably qualified practitioner who will develop and implement plans, systems and processes to manage its delivery of a reliable service.

Unplanned interruptions — response

SW will comply with the following standards:

- *The number of customers who will receive an unplanned water and/or waste water service interruption will be kept to a practical minimum;*
- *On average, SW will attend urgent water and waste water failures within 180 minutes;*
- *SW or its agent will restore unplanned water and waste water service supply within 24 hours where practical and parts are available;*
- *SW or its agent will keep a stock of most common consumable parts to assist with the speedy resolution of service failure.*

SW will:

- *Minimise the impact of unplanned interruptions to services (including restoration as soon as possible, and the provision of information); and*
- *Provide customers with access to drinking water in the event of major or long-term unplanned interruptions to water services.*

Bursts, leaks, blockages and spills

In the event of a burst, leak or blockage in its system, SW or its agent will;-

- *Promptly attend the site upon notification;*
- *Take action to rectify the situation, taking into account the potential or actual impact on*
    - *Customers;*
    - *Others affected by the failure;*
    - *Property; and*
    - *The environment.*
- *Provide information about any unplanned interruption to a service through a notice affixed to its external customer notice board, which advises customers of the estimated duration of any interruption.*
- *Ensure that, in the event of a waste water spill on a customer's property damage and inconvenience to customers and others affected is minimised; and*
- *Ensure that a waste water spill is promptly contained, cleaned up and the affected area disinfected."*

4 Corporate Asset Management Systems

Solo Water's parent company Solo Waste Recovery (SWR) is an established company providing solid and liquid waste management services to councils, residents and commercial customers. SWR has a number of existing corporate systems that all new Solo Water schemes will be integrated with, including:

- Asset information system using the Pronto software package
- Financial management system using the Pronto software package
- ISO 9001 Quality Assurance System
- ISO 14001 Environmental Management System
- AS4801 OH&S Management System

4.1 Asset Management System Software

Solo Water's parent company Solo Waste Recovery (SWR) has an operational asset management system that manages a significant portfolio of mobile and fixed assets. The SWR asset management system uses the "Pronto" suite of software and provides integration of all corporate systems and functions.

As new Solo Water schemes are constructed asset information and maintenance requirements will be populated into Pronto asset management software. The Pronto asset management software will be used to coordinate routine maintenance tasks and monitor compliance with maintenance schedules.

Standard procedures will be developed for the registration of new assets into the Pronto asset management system software.

4.2 Finance System

Solo Water's parent company Solo Waste Recovery uses the Pronto suite of software for managing company finance and projections. The finance system integrates with the asset management module to allow simplified projections and cash flow forecasting for renewals and future capital expenditure.

4.3 Geographical Information System

All assets produced under the various Solo Water schemes will be stored in a Geographical Information System (GIS) to allow efficient access to spatial and asset information by operations and customer service staff.

Solo Water will use the GIS software package MapInfo (subject to change) across all schemes. Solo Water head office will maintain a master GIS database that will be used for all schemes. Access to the master GIS database will be given to site operators so that GIS data can be viewed in the field through remote devices and using the computer in the main control room at the WWTP building in each scheme.

Standard procedures will be developed for the registration of new assets into the GIS system based on digital work as executed survey data.

5 Risk Management

Risk management processes and procedures are used to inform the design, operation, maintenance, management and renewal of assets for all Solo Water schemes. A risk register will be developed and maintained for all Solo Water schemes to enable ongoing monitoring, review and continuous improvement of risk management strategies over time.

For the Catherine Hill Bay Water Utility scheme a preliminary risk assessment of the water, wastewater and recycled water scheme has been undertaken based on the risk management framework outlined in ISO31000 (2009). The risk assessment was undertaken to identify the key risks for the scheme in relation to both the failure of assets and loss of supply capability, as well as risks relating to public health and environmental impacts. The preliminary risk assessment tables are provided in Appendix A of this report.

The key risks identified in Appendix A have been used to inform the concept design prepared for the IPART application. The risk assessment was undertaken for each major type of asset and for each key risk, high level risk management strategies have been developed. Given the early stage of the project the risk management strategies focus on identifying the key documents and plans to be developed during detailed design of the scheme, including:

- Operation & Maintenance Manuals for each scheme component
    - Normal operating conditions
    - Preventative maintenance and inspection programs
- Emergency Response Plans
    - Documented plans designed to minimise the impact on customers and the environment due to failure of key scheme components
- Monitoring and Condition Assessment
    - Ongoing monitoring and reporting of key risks and asset condition

The risk assessments will be updated during detailed design based on more accurate and available information. The risk assessment will also be updated during operation based on the actual performance of the scheme.

Based on the above and the preliminary risk assessment tables presented in Appendix A an overview of the Asset Lifecycle Management process has been developed for all Solo Water schemes including the Catherine Hill Bay Water Utility Scheme. An overview of the asset lifecycle management process and requirements for the CHBWU scheme are outlined below.

6 Asset Lifecycle Management

Solo Water manages potable water, sewerage and recycled water assets across the entire asset management life cycle from asset creation to asset disposal, as outlined below.

6.1 Creation or Renewal of Assets

All new assets created by for new Solo Water schemes or for renewals or replacement of existing infrastructure are developed under a project management framework.

Each new scheme or major renewal is treated as an individual project. A project management plan is developed to ensure the design, construction, commissioning and handover of assets to Solo Water is undertaken in an appropriate manner to ensure all assets are fit for purpose. All new assets created for Solo Water schemes will generally be created in line with the following framework:

Table 6.1: Overview of asset creation/renewal process for new Solo Water schemes

New Asset Creation	Overview of Typical Asset Creation Process for New or Renewed Solo Water Assets
Scope, demand, operational requirements, design requirements, concept design and planning approvals	The scope and operational requirements for the project are determined based on the type of project being investigated or asset being constructed. An overall concept design for the new integrated water, wastewater and recycled water scheme or asset is developed and submitted for regulatory approval. It is during this stage the design and performance requirements of the new asset or scheme are determined in consultation with relevant stakeholders. Review of operational data and projected demands should be used to inform this process where possible. For renewal projects assessment of existing and ultimate demand and performance against service standards is undertaken to determine the sizing and design requirements. In general the following approvals are to be obtained for each Solo Water scheme: • IPART Network Operator License Application; • Approvals and environmental assessment under the Environmental Planning and Assessment Act and other associated planning legislation; • Environmental Protection Licenses from the Environmental Protection Agency for schemes above 2500 EP, or approval of local government for schemes < 2500 EP.
Detailed Design & Management Plan Documentation	Solo Water and its network of associated consultants is responsible for detailed design of the following critical scheme components: • Pressure sewerage network and property connection points; • Wastewater treatment plant including the Membrane Bioreactor and Advanced Water Treatment Plant; • Potable water, non-potable water and irrigation supply networks and booster pumping stations; • Online monitoring and control system that integrates operation of the entire scheme; • Input to the landscape and irrigation system design for areas to be irrigated with recycled water. Detailed design of landscaped and open space areas is generally undertaken by the developer in consultation with Solo Water. At this stage the detailed operation and maintenance and other management plans are documented for the specific components of the scheme. All design work undertaken by others must be approved by Solo Water prior to construction.

New Asset Creation	Overview of Typical Asset Creation Process for New or Renewed Solo Water Assets
Design Audit	As required by the IPART licenses all detailed designs and management plans will be audited by an IPART approved auditor.
Construction & Quality Assurance	Solo Water is responsible for the construction and commissioning of the following critical scheme components: • Pressure sewer pump stations and property connection points; • Membrane bioreactor; • Advanced water treatment plant; • Water storages; • Potable water supply variable speed drive booster pump station; • Recycled water supply variable speed drive booster pump station; • Irrigation water variable speed drive supply booster pump station; • Online monitoring and control systems. The land developer's civil contractor is generally responsible for construction of the following scheme components: • Pressure sewer mains in the road reserve; • Potable and recycled water mains in the road reserve; • Landscaped areas and recycled water irrigation systems. All assets constructed by others are to be inspected and signed off by authorised Solo Water staff and consultants prior to being handed over to Solo Water.
Asset Handover & Registration	All assets handed over to Solo Water must be inspected and quality assured by Solo Water staff or approved contractors/consultants. The following information is required for new assets to be handed over to Solo Water: • Design and construction quality assurance sign off by approved persons; • Detailed Operation and Maintenance manuals; • Survey accurate Work As Executed drawings in an appropriate digital format for direct import into the corporate GIS system; • Appropriate asset information data for registration of all new assets into the Pronto Asset Management System software.
Operational Audit & Minister Approval	As required by the IPART licenses all schemes must undergo an Operational Audit and receive Minister's approval prior to supply of water or recycled water to customers.

6.2 Operation and Maintenance of Assets

6.2.1 Routine Operation & Maintenance

Routine maintenance of all assets will be undertaken based on operation and maintenance manuals developed during the detailed design phase. All maintenance requirements for individual pieces of equipment will be based on manufacturer recommendations. Detailed Operation and Maintenance (O & M) Manuals will be prepared for each major scheme component and/or equipment item during detailed design.

Routine maintenance requirements for all assets will be entered into the Pronto Asset Management software as new Solo Water assets are created. Routine maintenance schedules will be extracted from the software for distribution to the site operator at each scheme.

The Pronto Asset Management software will also be used to monitor compliance with the routine maintenance schedules and allow the Operations Manager to review performance against key performance indicators and the internal performance requirements for site operators.

Based on review of the infrastructure risk assessment tables presented in Appendix A the following detailed O & M manuals, plans, processes and procedures will be developed for the Catherine Hill Bay Water Utility during detailed design. Additional plans may be identified during future assessment and detailed design.

Table 6.2: Overview of Operation and Maintenance plans & Procedures to be developed

Scheme Component		Operation and Maintenance Plans and Procedures^
Potable Water	Bulk water transfer system	Bulk water pump station O & M manual Bulk water pipeline inspection regime
	Potable water storages	Potable water storage inspection & maintenance regime Site security requirements (Fencing & CCTV will be used at the WWTP site)
	Chlorine monitoring and dosing system	Chlorine monitoring and dosing system O & M manual
	Potable water supply booster pump station	Potable water supply booster pump station O & M manual Emergency standby diesel pump O & M Manual
	Potable water reticulation	Potable water main flushing regime Water main sterilisation procedures Worker hygiene procedures for works on a potable water system Water network valves maintenance regimes Fire hydrant pressure and flow test procedures Potential cross connection detection procedure Backflow and cross connection prevention guidelines
Waste water	Pressure sewer pump stations	Pressure sewer pump station O & M Manual
	Pressure sewer pipe lines	Pressure sewer main flushing regime Pressure sewer network valves maintenance regimes
	Odour control systems	Activated carbon filter replacement regime
	Membrane Bioreactor	MBR operation & maintenance manual Site security requirements (Fencing & CCTV will be used at the WWTP site)
	Wet weather storage	Wet weather storage inspection & maintenance regime
	Evaporation pond	Evaporation pond inspection and maintenance regime
Recycled Water	Advanced Water Treatment Plant (AWTP)	AWTP O & M Manual Site security requirements (Fencing & CCTV will be used at the WWTP site)

Scheme Component		Operation and Maintenance Plans and Procedures^
Recycled Water cont…	Recycled Water Storages	Recycled water storage inspection & maintenance regime
	Recycled water supply booster pump station	Recycled water supply booster pump station O & M manual Emergency standby diesel pump O & M Manual
	Recycled water reticulation network	Recycled water main flushing regime Recycled water main sterilisation procedures Worker hygiene procedures for works on a recycled water system
	Irrigation Systems	Irrigation system O & M Manual
Chemicals	Chemicals management	Chemical Material Safety Data Sheets Chemical delivery, storage and handling procedures Chemical storage and dosing system inspection and maintenance regime
Monitoring & control system	Sensors and probes	Online monitoring sensor and probe calibration regime
	Communication systems	Communication and telemetry systems O & M manual

^ To be developed during detailed design.

6.2.2 Non-Routine Maintenance

Non-routine maintenance will be undertaken as needed based on faults detected through the online monitoring and control system and the customer service call centre. The impacts of non-routine operations and maintenance activities on customers will be minimised as far as practicable.

6.3 Asset Monitoring and Condition Assessment

Asset monitoring and condition assessment will be undertaken for each asset and asset category.

All Solo Water schemes operate automatically using a continuous online monitoring and control system. The system records all online monitoring and control data, warnings, faults and alarms. This data will be used for the basis of system review and performance reporting to management and regulators as required by the IPART license and other relevant legislation.

Other systems that will be used to record, measure, monitor asset condition and operational performance are:

- Online monitoring and control system logs;
- Customer service call centre database;
- Pronto asset information system database;
- Geographical information system;
- Water quality compliance monitoring databases;
- Environmental monitoring databases;
- Incident reports;
- Field testing.

Based on review of the risk assessment tables presented in Appendix A the following detailed risk and asset monitoring processes and procedures will be developed for implementation at the

Catherine Hill Bay Water Utility to monitoring ongoing asset condition, scheme reliability and operational risk.

Table 6.3: Infrastructure monitoring and condition assessment methodology.

Scheme Component		Asset Monitoring and Asset Condition Indicators	Information Source
Potable Water	Bulk water transfer pump station	Pump and other component age and design life	Pronto asset information system database
		Compliance with routine maintenance schedule	
		Number of non-routine maintenance events	
		Pump hours run and number of starts	Online monitoring & control system logs Incident reports
		Pump energy consumption	
		Number of pump failures	
		Number of control system failures or loss of connection	
	Bulk water transfer pipeline	Pipeline and other component age & design life	Pronto asset information system database
		Compliance with routine maintenance schedule	
		Number of non-routine maintenance events	
		Transfer capacity & pipeline roughness	Field testing as required
		Number of breaks/failures	Customer service database Incident reports Online monitoring & control system logs
		Risk/consequence of failure	Asset risk assessment documentation
	Potable water storages	Tank and other component age & design life	Pronto asset information system database
		Compliance with routine maintenance schedule	
		Number of non-routine maintenance events	
		Number of tank low level events	Online monitoring & control system logs Incident reports Potable water quality monitoring database
		Number of potable water quality incidents	
	Chlorine monitoring and dosing system	Chlorine system component age & design life	Pronto asset information system database
		Compliance with routine maintenance schedule, including monitoring probe calibration records	Monitoring probe calibration records
		Number of non-routine maintenance events	
		Number of events with low or high chlorine residual	Online monitoring & control system logs Incident reports
		Number of events with low or high pH	
		Number of events with low level in chlorine storage	
		Number of chlorine dosing pump failures	
		Number of pH and chlorine monitoring system failures	
		Number of failed monitoring probe calibrations	Monitoring probe calibration records

Scheme Component		Asset Monitoring and Asset Condition Indicators	Information Source
Potable Water cont…	Potable water supply booster pump station	Pump and other component age and design life	Pronto asset information system database
		Compliance with routine maintenance schedule	
		Number of non-routine maintenance events	
		Pump hours run and number of starts	Online monitoring & control system logs Incident reports
		Pump energy consumption	
		Number of pump failures	
		Number of supply low pressure events	
		Number of emergency diesel pump cut in events	
	Potable water reticulation and supply	Pipeline and other component age and design life	Pronto asset information system database
		Compliance with routine maintenance schedule	
		Number of non-routine maintenance events	
		Network capacity	Field testing and network modelling as required
		Number of breaks/failures	Online monitoring & control system logs Incident reports Potable water quality monitoring database
		Risk/consequence of failure	
		Number of potable water quality events	
		Number of low water pressure events	
		System leakage and midnight flows	
		Number of customer taste, odour & colour complaints	Customer service call centre database
		Number of customer loss of water supply events	
		Number of customer events resolved in < 3 hours	
		Number of customer event resolved in > 3 hours	
Waste water	Pressure sewer pumps stations	Pump and other component age and design life	Pronto asset information system database
		Compliance with routine maintenance schedule	
		Number of non-routine maintenance events	
		Pump hours run and number of starts	Online monitoring & control system logs Incident reports
		Pump energy consumption	
		Number of pump failures	
		Number of high water level alarms	
		Number of impending overflow alarms	
		Number of control system failures or loss of connection/signal	
		Number of customer odour complaints	Customer service call centre database
		Number of customer loss of sewerage service events	
		Number of customer events resolved in < 3 hours	

Scheme Component		Asset Monitoring and Asset Condition Indicators	Information Source
Waste water cont…	Pressure sewer pumps stations cont…	Number of customer event resolved in > 3 hours	Customer service call centre database
	Pressure sewer network, e.g. pipelines, valves etc	Pipeline and other component age & design life	Pronto asset information system database
		Compliance with routine maintenance schedule	
		Number of non-routine maintenance events	
		Network capacity	Field testing and network modelling as required
		Number of pressure sewer main breaks/failures	Customer service call centre database Incident reports Online monitoring & control system logs
		Risk/consequence of failure	Asset risk assessment documentation
	Membrane bioreactor	WWTP component age and design life	Pronto asset information system database Monitoring probe calibration records
		Compliance with routine maintenance schedule including monitoring probe calibration records	
		Number of non-routine maintenance events	
		Effluent quality compliance	Effluent quality monitoring database
		Number of failed monitoring probe calibrations	Monitoring probe calibration records
		Number of monitoring system failures	Online monitoring & control system logs Incident reports
		Number of equipment failures	
		Number of critical warning alarms	
		Number of subcritical warning alarms	
	Odour control systems	Odour control system component age and design life	Pronto asset information system database
		Compliance with routine maintenance schedule	
		Number of non-routine maintenance events	
		Customer odour complaints	Customer service call centre database
	Effluent wet weather storage pond	Wet weather storage component age and design life	Pronto asset information system database
		Compliance with routine maintenance schedule	
		Number of non-routine maintenance events	
		Groundwater monitoring for leak detection	Groundwater quality monitoring database
		Number of high level events	Online monitoring & control system logs
		Number of algae events	Effluent quality monitoring database Incident reports

Scheme Component		Asset Monitoring and Asset Condition Indicators	Information Source
Recycled Water	Advanced Water Treatment Plant	AWTP component age and design life	Pronto asset information system database Monitoring probe calibration records
		Compliance with routine maintenance schedule including monitoring probe calibration records	
		Number of non-routine maintenance events	
		Recycled water quality compliance	Recycled water quality monitoring database
		Number of failed or inaccurate monitoring probe calibrations	Monitoring probe calibration records
		Number of monitoring system failures	Online monitoring & control system logs Incident reports
		Number of equipment failures	
		Number of critical warning alarms	
		Number of subcritical warning alarms	
	Saline evaporation ponds	Saline pond component age and design life	Pronto asset information system database
		Compliance with routine maintenance schedule	
		Number of non-routine maintenance events	
		Groundwater monitoring for leak detection	Groundwater quality monitoring database
		Number of high level events	Online monitoring & control system logs
	Recycled water storage tank	Tank and other component age & design life	Pronto asset information system database
		Compliance with routine maintenance schedule	
		Number of non-routine maintenance events	
		Number of tank low level events	Online monitoring & control system logs Incident reports Potable water quality monitoring database
		Number of recycled water quality incidents	
	Chlorine monitoring and dosing system	Chlorine system component age & design life	Pronto asset information system database
		Compliance with routine maintenance schedule, including monitoring probe calibration records	
		Number of non-routine maintenance events	Monitoring probe calibration records
		Number of events with low or high chlorine residual	Online monitoring & control system logs Incident reports
		Number of events with low or high pH	
		Number of events with low level in chlorine storage	
		Number of chlorine dosing pump failures	
		Number of pH and chlorine monitoring system failures	
		Number of failed or inaccurate probe calibrations	Monitoring probe calibration records

Scheme Component		Asset Monitoring and Asset Condition Indicators	Information Source
Recycled Water cont…	Recycled water supply booster pump station	Pump and other component age and design life	Pronto asset information system database
		Compliance with routine maintenance schedule	
		Number of non-routine maintenance events	
		Pump hours run and number of starts	Online monitoring & control system logs Incident reports
		Pump energy consumption	
		Number of pump failures	
		Number of low pressure events	
		Number of high pressure events	
		Number of emergency diesel pump cut in events	
	Recycled water reticulation and supply	Pipeline and other component age and design life	Pronto asset information system database
		Compliance with routine maintenance schedule	
		Number of non-routine maintenance events	
		Network capacity	Field testing and network modelling as required
		Number of breaks/failures	Online monitoring & control system logs Incident reports Potable water quality monitoring database
		Risk/consequence of failure	
		Number of water quality events	
		Number of low water pressure events	
		Number of high water pressure events	
		System leakage and midnight flows	
		Number of customer aesthetic complaints	Customer service call centre database
		Number of customer loss of water supply events	
		Number of customer events resolved in < 3 hours	
		Number of customer event resolved in > 3 hours	
	Open space irrigation systems	Irrigation system component age and design life	Pronto asset information system database
		Compliance with routine maintenance schedule, including soil moisture probe calibration	
		Number of non-routine maintenance events	
		Number of irrigation system breaks/failures	Online monitoring & control system logs
		Number of events with high flow to an irrigation zone	
		Number of events with high soil moisture alerts	
		Irrigation loading capacity of each irrigation zone	Review irrigation areas as required to verify actual loading capacity
		Surface water monitoring	Surface water monitoring database
		Groundwater monitoring	Groundwater monitoring database
		Soil monitoring	Soil monitoring database

Scheme Component		Asset Monitoring and Asset Condition Indicators	Information Source
Recycled Water cont…	Open space irrigation systems cont…	Number of customer complaints regarding irrigation practices, ponding water, odour etc	Customer service call centre database
		Number of customer complaints regarding poor landscape maintenance practices	

6.4 Contingency Planning and Emergency Response Plans

The preliminary risk assessment presented in Appendix A identified a number of possible emergency events where infrastructure failure has the potential to impact on service provision to customers. Contingency planning around these possible events has been included in the scheme design undertaken to date.

During detailed design specific Emergency Response Plans to outline the procedures to be implemented by operations staff to minimise the potential impacts on customers and the environment due to the failure of specific pieces of infrastructure. Ongoing training will be provided to operations staff to ensure they are competent in the requirements of the various Emergency Response Plans.

Based on review of the risk assessment tables presented in Appendix A the following detailed Emergency Response Plans have been identified to be developed and implemented at the CHBWU scheme.

Table 6.4: Contingency planning and Emergency Response Plans

Scheme Component		Infrastructure Risk	Contingency Planning	Emergency Response Plans (to be developed)^
Potable Water	Bulk water transfer system	Failure of bulk transfer system	24 hours storage in onsite potable water tank Water cartage from Kanangra Drive reservoir Electrical connection point for mobile generator provided on pump station electrical system	Emergency Response Plan for bulk water transfer system failure
	Potable water storage	Contamination or vermin access	Chlorine tablets stored on site	Emergency Response Plan for storage contamination or vermin access
		Tank failure		Emergency Response Plan for tank failure
	Chlorine monitoring and dosing system	Chlorine system failure Inadequate chlorine dose	Duty and standby chlorine dosing pumps Chlorine tablets stored on site	Emergency Response Plan for chlorination system failure or low chlorine alarm
	Potable water supply booster pump station	Pump failure Power outage	Booster pump set designed so one pump can fail while still delivering peak flow and pressure to the reticulation network Emergency standby diesel pump with automatic changeover	Emergency Response Plan for booster pump station failure
	Potable water reticulation	Cross connection	Water pressure control in potable and recycled water networks	Emergency Response plan for cross connections
		Reticulation pipe break	Isolation valves designed into the network as per WSAA Code.	Emergency Response Plan for water main break including sterilisation

Scheme Component		Infrastructure Risk	Contingency Planning	Emergency Response Plans (to be developed)^
Waste water	Pressure sewer pump stations	Pump failure Power failure Control system failure	Standard pumps with spare pumps and parts maintained on site Duty and standby pumps 24 hours storage in each pump station Fail safe for pump to operate during control system failure Road tanker pump-out from each pump station by licensed liquid waste contractor to nearest accepting licensed facility to avoid uncontrolled overflows	Emergency Response Plan for pressure sewer pump station failure or high level alarm Emergency Response Plan for scheme wide power outage
	Pressure sewer pipe lines	Pressure sewer main break	Isolation valves designed into the network as per WSAA Code.	Emergency Response Plan for pressure sewer main break including cleanup & disinfection procedures
	Membrane Bioreactor	Process failure Power outage Tank failure	Standard process pumps with spare pumps and parts maintained on site Electrical connection point for mobile generator provided on MBR electrical system Road tanker pump-out by licensed liquid waste contractor to nearest accepting licensed facility to avoid uncontrolled overflows	Emergency Response Plan for MBR process failure
	Wet weather storage	Algae growth	Potable water backup of recycled water tank if blue green algae outbreak occurs. Allowance to chlorinate effluent prior to entering the wet weather storage. Install aerator into pond if algae events are frequent.	Emergency Response Plan for algae growth in storage
		Structural integrity & leakage	Road tanker pump-out by licensed liquid waste contractor to nearest accepting licensed facility	Emergency Response Plan for pond leakage or wall failure
		High level overflow	Precautionary and emergency irrigation events to avoid uncontrolled storage overflows Road tanker pump-out by licensed liquid waste contractor to nearest accepting licensed facility to avoid uncontrolled overflows	Emergency Response Plan for high level in treated effluent wet weather storage.
Recycled Water	Advanced Water Treatment Plant	Process failure	Potable water back up of recycled water tank	Emergency Response Plan for AWTP failure
	Saline evaporation ponds	Structural integrity & leakage	Road tanker pump-out by licensed liquid waste contractor to nearest accepting licensed facility	Emergency Response Plan for pond leakage or wall failure
		High level overflow	0.5 metre freeboard Road tanker pump-out by licensed liquid waste contractor to nearest accepting licensed facility	Emergency Response Plan for saline evaporation pond high level

Scheme Component		Infrastructure Risk	Contingency Planning	Emergency Response Plans (to be developed)^
Recycled Water cont…	Recycled Water Storages	Contamination or vermin access	Chlorine tablets stored on site	Emergency Response Plan for vermin access to storage
		Tank failure		Emergency Response Plan for tank failure
	Chlorine monitoring and dosing system	Chlorine system failure Inadequate chlorine dose	Duty and standby chlorine dosing pumps Chlorine tablets stored on site	Emergency Response Plan for chlorination system failure or low chlorine alarm
	Recycled water supply booster pump station	Pump failure Power outage	Booster pump set designed so one pump can fail while still delivering peak flow and pressure to the reticulation network Emergency standby diesel pump with automatic changeover	Emergency Response Plan for booster pump station failure
	Recycled water reticulation network	Cross Connection	Water pressure control in potable and recycled water networks	Emergency Response Plan for cross connections
		Reticulation pipe break	Isolation valves designed into the network as per WSAA Code.	Emergency Response Plan for water main break including sterilisation
	Irrigation Systems	Irrigation pipe break	Isolation valves designed into the irrigation system for isolation of each irrigation zone	Emergency Response Plan for irrigation pipe break
Chemical	Chemicals management	Chemical spill	All chemicals storages located in a bunded & covered area	Emergency Response Plan for chemical spillage with cleanup procedures
Monitor-ing & control system	Sensors and probes	Sensor failure	Control system allows manual override of faulty sensor until new sensor installed	Emergency Response Plan for faulty monitoring sensor
	Communic-ation systems	Commun-ication system failure	Multiple path radio system with backup from Telstra Next G mobile phone network Fail safe to ensure pressure sewer units operate during control system failure	Emergency Response Plan for control system failure

^ To be developed during detailed design.

6.5 Asset Renewal and Replacement

The process for renewal and replacement of assets is informed by recommended design life of assets from equipment suppliers as well as review of operational performance and asset condition monitoring data.

The estimated design life assumed for significant Solo Water assets for future cash flow forecasting purpose is based on the following asset design life assumptions:

- Pipelines, tanks, buildings and civil works – 50 years
- Pressure sewer pumps – 15 to 20 years
- General sewage and water pumps – 5 to 10 years
- MBR and AWTP process pumps – 5 years

- Electrical switchboards and control panels – 10 years
- Monitoring and control system components and sensors etc – 10 years
- Membranes – 7 years

The life of assets will be maximised through proactive preventative maintenance strategies. As assets approach the end of their design life additional condition asset assessment will be undertaken.

6.6 Asset Disposal

There are currently no assets identified to require decommissioning or disposal. As assets approach the end of their design life and/or are identified to require decommissioning and disposal an asset disposal plan will be developed for each specific asset. During development of the asset disposal plan consideration will be given to maximise the reuse and recycling of asset materials where possible and appropriate.

7 Financial Summary

7.1 Financial Overview

7.1.1 Capital Funding

All new Solo Water schemes are funded through capital contributions by the land developer for which the scheme is being provided.

7.1.2 Operation and Maintenance Funding

Funding for operation, maintenance and renewal of assets is provided from rated customers within the scheme.

During early stages of the development build out when there is insufficient customers to make the scheme self funded, the scheme is subsidised by the developer. Following this 100% of the costs of the scheme are recovered from rated customers through potable water, sewerage and recycled water rates.

Annual funding for operation and maintenance is estimated to be 10% of annual revenue. This will be increased as required in the future and/or as the age of assets increases.

7.1.3 Renewal Funding

Future renewal and replacement of assets under the scheme is funded from a sinking fund for each scheme. Contributions to the sinking fund are made from annual revenue until money in the sinking fund reaches a total of 4% of the total capital cost of the scheme.

Following the withdrawal of funds from the sinking fund to undertake renewal and replacement of an asset, the sinking fund is topped up that year to ensure 4% of total capital cost is always available in the sinking fund.

7.2 Financial Projections of Solo Water Schemes

Financial projections for each Solo Water scheme are provided below to demonstrate that there is adequate cash flow in each scheme to ensure funding for operation, maintenance and renewal of assets on an ongoing basis.

7.2.1 Catherine Hill Bay Financial Projection

Financial modelling and cash flow forecasting for the Solo Water Catherine Hill Bay Water Utility Scheme has been undertaken to ensure the scheme is self-funding, including all O & M and sinking fund costs. A summary of the financial modelling results is presented in the IPART retail licence application in Appendix 7.3.1.

8 Plan Review and Continuous Improvement

8.1 Infrastructure Operating Plan Review

This document will be reviewed and updated on an ongoing basis. During operation this will be the responsibility of the Operations Manager who will be responsible for overseeing all operation and maintenance activities undertaken by the site based operators at all Solo Water schemes.

Following approval of the IPART license for the CHBWU detailed design and management plan documentation will occur. This will allow the more detailed management plans identified in the above sections to be documented, including the O & M Manuals and Emergency Response Plans etc.

During operation this plan will be reviewed annually or more frequently if there are significant changes to infrastructure, management plans or business systems. The plan will also be updated as each new Solo Water scheme is developed.

Each time the document is reviewed an improvement plan is developed to further progress the asset management systems and processes within Solo Water and the CHBWU. The preliminary improvement/implementation plan is outlined below.

8.2 Improvement & Implementation Plan

Following approval of the IPART license for the CHBWU scheme:

- Undertake detailed design of the various scheme components of the CHBWU scheme;
- Document the detailed operation and maintenance manuals for each scheme component based on the actual equipment and materials used in the design;
- Document the detailed Emergency Response Plans with contact details for each major scheme component.

Prior to construction of assets:

- Formalise procedures for the capture of work as executed data from new assets into the corporate GIS;
- Formalise procedures for capturing new asset data into the Pronto Asset Information and Finance systems;
- Planning and design of the corporate data management systems and databases to allow easy access to data for performance assessment and reporting, e.g. customer service call centre database, effluent quality database, online monitoring system database.

Prior to operation of assets:

- Formalise and integrate all required operational and emergency procedures etc into one integrated system of work for operation staff that incorporates the requirements of all business systems, including Asset Management, OHS, Quality, Environmental, Risk Management;
- Training of staff to ensure competency in the requirements of the corporate systems.

Appendices

Appendix A: Preliminary Risk Assessment Tables I

Appendix A:
Preliminary Risk Assessment Tables

1. Drinking Water Preliminary Risk Assessment (IPART Appendix 4.1.9)
2. Non-Potable Water Preliminary Risk Assessment (IPART Appendix 4.2.10)
3. Sewerage Preliminary Risk Assessment (IPART Appendix 4.3.9)

Project: Catherine Hill Bay Water Utility
Client: Rose Group
Title: Drinking Water Preliminary Risk Assessment for IPART Application
Author: BI
Date (Revision): 10/07/2013 (Revision B)
Risk Criteria: As per Tables 3.1, 3.2 & 3.3: Australia Drinking Water Guidelines 6 (2011)

Scheme Component	Hazard	Hazardous Event	Impact	Unmitigated Risk					Control Strategy	Mitigated Risk				
				Likelihood		Consequence		Risk		Likelihood		Consequence		Risk
Bulk Water Supply	Contaminants in bulk water source	Contaminants detected in Wyong Shire Councils monitoring systems	Supply of non-compliant potable water	C	Possible	4	Major	Very High	1. Bulk water agreement from Wyong Shire Council guarantees bulk water supply will be compliant with the Australian Drinking Water Guidelines. Wyong Shire Council is responsible for all upstream water quality, treatment and catchment management issues. 2. Develop notification and communication protocols with Wyong Shire Council to ensure Catherine Bay Water Utility is notified of all water quality events in a timely manner.	D	Unlikely	3	Moderate	Moderate
Potable Water Transfer Pump Station	Oil and pump lubricants	Water supply contaminated with oil/lubricant from failed pump seal	Supply of non-compliant potable water	C	Possible	2	Minor	Moderate	1. Appropriate pump selection and design. 2. Routine inspection and maintenance of transfer pump station	D	Unlikely	2	Minor	Low
	Transfer Pump Station Failure	Mechanical, electrical or control system failure or power outage	Loss of supply capacity	C	Possible	4	Major	Very High	1. Multiple pump set with standby capacity 2. 24 hours storage provided in onsite potable water storage tank	D	Unlikely	4	Major	High
Potable Water Transfer Pipeline	Microbiological contamination	Water main break	Supply of non-compliant potable water	C	Possible	4	Major	Very High	1. Design, construction, pressure testing and commissioning of the transfer main to WSAA Standards. 2. Emergency Response Plan to be developed for water main breaks will include water main sterilisation procedure	D	Unlikely	3	Moderate	Moderate
	Microbiological contamination	Cross contamination due to poor maintenance practices	Supply of non-compliant potable water	C	Possible	4	Major	Very High	1. Standard operating and maintenance procedures will be developed for the scheme. Procedures will include water main flushing, hygiene and disinfection requirements. 2. Separate tools to be used on water and sewerage systems.	D	Unlikely	3	Moderate	Moderate
	Microbiological contamination	Backflow and cross connections	Supply of non-compliant potable water	C	Possible	2	Minor	Moderate	1. No direct connections to the transfer pipeline. The only connection point to the pipeline is the onsite potable water and fire storage tank via a 300 mm air gap.	D	Unlikely	2	Minor	Low
	Sedimentation in pipeline	Excessive sedimentation in pipeline during off peak periods	Taste, odour and colour complaints	C	Possible	2	Minor	Moderate	1. Undertake routine flushing of the water transfer main 2. Customer taste and odour complaint monitoring system with Customer Service.	B	Likely	1	Insignificant	Moderate
	Pipeline breakage	Major pipeline breakage	Localised flooding, soil erosion, loss of supply	C	Possible	4	Major	Very High	1. Existing 200 mm HDPE main to be cleaned, air scoured, pressure tested, repaired and disinfected. Any non-compliant sections of main will be replaced. 2. Construction quality assurance. 3. Flow monitoring at each end of the pipeline to detect flow differential. 4. 24 hours storage provided in onsite potable water storage tank. 5. Emergency Response Plan for water main breaks. 6. Frequent inspection along water main corridor to detect leaks and breaks.	B	Likely	3	Moderate	High
	Pipeline leakage	Minor leaks	Water wastage	B	Likely	2	Minor	High	1. Use VSD controlled transfer pump station to minimise operating pressure during low flows. Pumps will only ramp up to maximum pressure when pumping peak flows. 2. Flow meters and pressure sensors on the transfer pipeline for monitoring of "midnight flows" for identification of leaks. 3. Walk over and visual inspection along water main corridor to identify leaks. 4. Use leak detection equipment if required.	B	Likely	1	Insignificant	Moderate
Onsite Potable Water Storage Tank	Microbiological contamination	Vermin, animal and mosquito access to storage	Supply of non-compliant potable water	B	Likely	4	Major	Very High	1. Sealed tank designed to potable water storage standards with screens on all tank openings. 2. Ongoing inspection & maintenance program	D	Unlikely	4	Major	High
	Material compatibility	Dissolution of tank materials into potable water supply	Supply of non-compliant potable water	C	Possible	4	Major	Very High	1. Tank constructed to potable water storage standards using materials compatible with potable water supply 2. Metallic tanks to use food grade HDPE liner.	D	Unlikely	3	Moderate	Moderate
	Cross connection	Backflow into water transfer main	Supply of non-compliant potable water	C	Possible	3	Moderate	High	1. Connection of transfer main uses an Air gap above the high water overflow level in the tank.	E	Rare	3	Moderate	Moderate
Recirculation & Chlorine Dosing	Chlorine residual	Inadequate chlorine residual (low or high)	Supply of non-compliant potable water	C	Possible	4	Major	Very High	1. Continuous online monitoring of free chlorine residual with alarms for low and high concentrations. 2. Duty and standby chlorine dosing pumps. 3. Fault detection and alarms on dosing pumps.	D	Unlikely	4	Major	High

Project: Catherine Hill Bay Water Utility
Client: Rose Group
Title: Drinking Water Preliminary Risk Assessment for IPART Application
Author: BI
Date (Revision): 10/07/2013 (Revision B)
Risk Criteria: As per Tables 3.1, 3.2 & 3.3: Australia Drinking Water Guidelines 6 (2011)

Scheme Component	Hazard	Hazardous Event	Impact	Unmitigated Risk					Control Strategy	Mitigated Risk				
				Likelihood		Consequence		Risk		Likelihood		Consequence		Risk
Potable Water Supply Booster Pump Station	Pump seals and lubricants	Water supply contaminated from failed pump seal	Supply of non-compliant potable water	C	Possible	2	Minor	Moderate	1. Appropriate pump selection and design. 2. Routine inspection and maintenance of transfer pump station.	D	Unlikely	2	Minor	Low
	Low pressure	Water pressure in potable network below that in the recycled water networks	Increased risk of backflow if a cross connection occurs	B	Likely	4	Major	Very High	1. Duty of drinking water supply booster pump station to be set a minimum of 50 kPa above duty of the non-potable water booster pump station. 2. Monitoring of water pressure differential between the drinking water recycled water networks.	C	Possible	4	Major	Very High
	Booster pump station failure	Mechanical, electrical or control system failure or power outage	Loss of supply capacity	C	Possible	4	Major	Very High	1. VSD pressure booster pump set with standby capacity. 2. Routine inspection and maintenance of booster pump station. 3. Standby emergency diesel pump with automatic changeover	C	Possible	4	Major	Very High
Potable Water Reticulation System	Class A+ recycled water network	Cross connection with the Class A+ recycled water network	Supply of non-compliant potable water	C	Possible	4	Major	Very High	Cross connection controls including: 1. Reticulation networks designed, constructed and commissioned to WSAA standards. 2. Unique pipe colour and materials. Potable uses blue PVC pipe. Class A+ recycled water network uses lilac striped HDPE pipe. 3. Identification and labelling and minimum separation distances in common trenches. 4. Only approved Solo Water contractors can undertake work on the reticulation networks. 5. Potable water network to operate a minimum of 50 kPa above that in the recycled water network. 6. Routine monitoring of potable water quality 7. Monitoring of pressure and salinity differential between the drinking and non-potable water networks	B	Likely	3	Moderate	High
	Sedimentation and slime growth	Excessive sedimentation in reticulation system during off peak periods	Taste, odour and colour complaints	B	Likely	1	Insignificant	Moderate	1. Routine monitoring and water main flushing program 2. Monitoring of taste and odour complaints through customer service processes	C	Possible	1	Insignificant	Low
	Microbiological contamination	Water main break	Supply of non-compliant potable water	C	Possible	4	Major	Very High	1. Design, construction, pressure testing and commissioning to WSAA Standards. 2. Emergency Response Plan for water main breaks will include water main sterilisation procedure	D	Unlikely	3	Moderate	Moderate
	Microbiological contamination	Cross contamination due to poor maintenance practices	Supply of non-compliant potable water	C	Possible	4	Major	Very High	1. Standard operating and maintenance procedures will be developed for the scheme. Procedures will include hygiene and disinfection requirements. 2. Separate tools to be used on water and sewerage systems.	D	Unlikely	3	Moderate	Moderate
	Microbiological contamination	Backflow and cross connections	Supply of non-compliant potable water	C	Possible	2	Minor	Moderate	1. No direct connections to the transfer pipeline. The only connection point to the pipeline is the onsite potable water and fire storage tank via an air gap.	D	Unlikely	2	Minor	Low
	Reticulation pipe breakage	Major breakage	Localised flooding, soil erosion, loss of supply	C	Possible	3	Moderate	High	1. Design, construction, pressure testing and commissioning to WSAA Standards. 2. Emergency Response Plan for water main breaks will include water main sterilisation procedure	C	Possible	3	Moderate	High
	Reticulation pipe leakage	Minor leaks	Water wastage	C	Possible	2	Minor	Moderate	1. Use VSD controlled booster pump station to minimise operating pressure during low flows. 2. Flow meters and pressure sensors on reticulation network for monitoring of "midnight flows" for identification of leaks. 3. Walk over and visual inspection along water main corridor to identify leaks. 4. Use leak detection equipment if required.	C	Possible	1	Insignificant	Low
	Fire hydrants on potable water network	Reduction in water pressure in potable network during fire flows	Increased risk of backflow if a cross connection occurs	B	Likely	4	Major	Very High	1. Cross connection controls. 2. Network design to minimise pressure losses during fire flow. 3. Use VSD controlled transfer pump station to maintain pressure during fire flows.	C	Possible	3	Moderate	High
Customer Consumption and Private Water Systems	Onsite Class A+ recycled water pipes	Cross connection on private land	Supply of non-compliant potable water	B	Likely	4	Major	Very High	1. Domestic plumbing systems installed and tested for compliance with AS3500 and the NSW Code of Practice for Plumbing and Drainage by licensed plumbing contractors. 2. Catherine Hill Bay Water Utility to provide induction, training and compliance auditing for all domestic plumbing contractors. 3. Dual check valve for backflow prevention at all connection points.	C	Possible	4	Major	Very High
	Excessive water use	Poor user behaviour	Excessive water use, Potential overload of onsite water systems	C	Possible	3	Moderate	High	1. Customer supply and trade waste agreement will outline expected water consumptions rates. 2. Ongoing customer awareness and education 3. Smart water meters at all connection points to provide feedback on water use	C	Possible	3	Moderate	High
	Leaks	Leaks in onsite water systems	Water wastage	B	Likely	1	Insignificant	Moderate	1. Smart water meters at all connection points to enable detection of leaks by residents	C	Possible	1	Insignificant	Low

DRINKING WATER
QUALITATIVE ENVIRONMENTAL AND PUBLIC HEALTH RISK ASSESSMENT CRITERIA

From tables 3.1, 3.2 & 3.3 on Page 3-8 of the Australian Drinking Water Guidelines (2011)

Qualitative measures of likelihood

Level	Descriptor	Example Description from ADWG
A	Almost certain	Is expected to occur in most circumstances
B	Likely	Will probably occur in most circumstances
C	Possible	Might occur or should occur at some time
D	Unlikely	Could occur at some time
E	Rare	May occur only in exceptional circumstances

Qualitative measures of consequence or impact

Level	Descriptor	Example description from ADWG
1	Insignificant	Insignificant impact, little disruption to normal operation, low increase in normal operation costs
2	Minor	Minor impact for small population, some manageable operation disruption, some increase in operating costs
3	Moderate	Minor impact for large population, significant modification to normal operation but manageable, operation costs increased, increased monitoring
4	Major	Major impact for small population, systems significantly compromised and abnormal operation if at all, high level of monitoring required
5	Catastrophic	Major impact for large population, complete failure of system

Qualitative risk analysis matrix: Level of risk

		Consequences				
Likelihood		1	2	3	4	5
		Insignificant	Minor	Moderate	Major	Catastrophic
A	Almost certain	Moderate	High	Very High	Very High	Very High
B	Likely	Moderate	High	High	Very High	Very High
C	Possible	Low	Moderate	High	Very High	Very high
D	Unlikely	Low	Low	Moderate	High	Very high
E	Rare	Low	Low	Moderate	High	High

Project: Catherine Hill Bay Water Utility
Client: Rose Group
Title: Non-Potable Water Preliminary Risk Assessment for IPART Application
Author: BI
Date (Revision): 10/07/2013 (Revision B)
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	Unmitigated Risk					Control Strategy	Mitigated Risk				
				Likelihood		Consequence		Risk		Likelihood		Consequence		Risk
MBR treated source water	Trace contaminants in MBR effluent feed water	Trace contaminants following MBR treatment	Potential impacts on recycled water uses	C	Possible	2	Minor	Moderate	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 CHB Water Utility Website. 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. 5. If required additional treatment will be provided in the AWTP using reverse osmosis, activated carbon or ion exchange.	B	Unlikely	2	Minor	Low
	Poor water quality from MBR	MBR blower failure, shock loads, membrane failure etc	Poor quality feed water to AWTP	D	Likely	3	Moderate	High	1. Continuous online monitoring and alarms on critical MBR process parameters MLSS, DO, Permeate Turbidity, UV Intensity, transmembrane pressure. 2. Shut down AWTP if MBR produces poor quality effluent.	B	Unlikely	2	Minor	Low
Wet weather storage dam	Contamination of wet weather storage	Contaminants in wet weather storage going to AWTP during high demand	Poor quality feed water to AWTP	D	Likely	3	Moderate	High	During certain high demand situations the AWTP will take water from the wet weather storage. 1. Regular inspection for evidence of vermin access, e.g. mosquito larvae, bird nests etc or early detection of algae outbreaks. 2. UF prefilter on supply line from wet weather storage into AWTP. 3. Emergency response plan for algae outbreak which will include chemical treatment and/or aeration/mixing of pond. 4. If contamination detected, shut off supply from wet weather storage to AWTP. Note: Potable water top up available if recycled water storage tank levels get too low.	B	Unlikely	3	Moderate	Moderate
Advanced Water Treatment Plant	Pathogen break through from UF membranes	Rupture of membrane fibres	Non-compliant recycled water	D	Likely	4	Major	Very high	1. Use USEPA accredited ultrafiltration membranes. 2. Membrane integrity testing by air pressure decay as per manufacturer requirements. 3. Continuous online monitoring of UF permeate turbidity with alarms and automatic shutdown. 4. Continuous online monitoring and alarms on transmembrane pressure. 5. High quality MBR permeate as feed water. 6. Membrane chemical cleaning in line with manufacturer requirements to maximise membrane life. 7. Design flux, TMP and other process parameters as per manufacturer recommendations to maximise membrane life.	B	Unlikely	4	Major	High
	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	D	Likely	4	Major	Very high	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.	B	Unlikely	4	Major	High
	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	D	Likely	4	Major	Very high	1. Chlorine contact tank designed to USEPA standards. 2. Continuous online monitoring of free chlorine residual and pH 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.	B	Unlikely	4	Major	High
	High salt concentration	High salt concentration in feed water	Non-compliant recycled water	C	Possible	2	Minor	Moderate	1. Continuous online monitoring and control of EC/TDS in blended product water. The ratio of UF permeate diverted to the RO automatically increases as feed water EC/TDS increases. 2. Continuous online monitoring of feed water MBR permeate EC/TDS with alarms. 3. If there is persistent high TDS in MBR permeate feed water 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 AWTP process	Potential OH&S and public health impacts. Potential environmental impacts in receiving environment	D	Likely	3		High	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

Project: Catherine Hill Bay Water Utility
Client: Rose Group
Title: Non-Potable Water Preliminary Risk Assessment for IPART Application
Author: BI
Date (Revision): 10/07/2013 (Revision B)
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	Unmitigated Risk					Control Strategy	Mitigated Risk				
				Likelihood		Consequence		Risk		Likelihood		Consequence		Risk
Advanced Water Treatment Plant continued…	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.	C	Possible	2	Minor	Moderate	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 laboratory. 4. If contaminants are detected a source control investigation will be undertaken through review of catchment raw wastewater and trade waste data. 5. If required additional treatment will be provided in the AWTP through activated additional RO treatment, carbon adsorption and/or ion exchange processes.	C	Possible	2	Minor	Moderate
	UF membrane chemical cleaning wastewater or UV acid clean wastewater	Management of chemical contaminated wastewater	Potential impacts on the MBR treatment process if inappropriately managed	E	Almost certain	4	Major	Very high	1. Temporary storage or all chemical contaminated wastewater from UF membrane and/or UV disinfection unit cleaning. 2. Neutralisation of all chemical contaminated wastewater before controlled trickle feed back to the MBR inlet balance tank. 3. 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
Non-Potable Water Storage Tank	Vector borne diseases	Vermin or mosquito access to recycled water storage tank	Non-compliant recycled water	E	Almost certain	3	Moderate	High	1. Storage tank constructed to potable water standards with mosquito screens on all tank openings and overflows. 2. Regular monitoring and inspection for evidence of vermin or mosquito access. 3. If observed contaminated water will be wasted or if appropriate chemical treatment of the storage will be undertaken by addition of chlorine tablets, hydrogen peroxide or similar.	B	Unlikely	3	Moderate	Moderate
	Overflows	Tank overflow due to failure of level controls	Overflow to the environment	C	Possible	2	Minor	Moderate	1. Storage tank overflows directly to the wet weather storage or inlet balance tank.	B	Unlikely	1	Insignificant	Low
	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	D	Likely	3	Moderate	High	1. Recirculation system with free chlorine monitoring and sodium hypochlorite dosing and alarms on the recycled water storage tank. 2. If required chlorine tablets can be manually applied to the storage.	B	Unlikely	3	Moderate	Moderate
	Blue green algae	Blue green algae growth in non-potable water storage tank	Non-compliant recycled water	B	Unlikely	2	Minor	Low	1. Storage tank covered to prevent sunlight access and algae growth. 2. Regular inspection and monitoring of non-potable water storage tank.	A	Rare	2	Minor	Low
	Unintended contact with recycled water in storage	Human access to storage	Potential public health impacts	D	Likely	2	Minor	Moderate	1. 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	C	Possible	2	Minor	Moderate	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	C	Possible	2	Minor	Moderate	1. Ensure all tank materials are compatible for use with potable water. 2. Metallic tanks to be lined with a food grade polymer liner to avoid dissolution of metals.	A	Rare	2	Minor	Low
Non-Potable Water Supply System	Cross connections	Cross connection with the CHB Water Utility potable water network	Contamination of potable water supply for up to 470 ET	D	Likely	4	Major	Very high	1. Only approved contractors or staff that have undergone CHB Water Utility induction can perform work on water utility infrastructure. 2. Potable and non-potable reticulation networks to be designed, constructed and tested in accordance with WSAA standards. 3. Water pressure in non-potable network to be maintained a minimum of 50 kPa below pressure in the potable network. 4. Quality assurance, inspection and pressure testing during construction. 5. Ongoing monitoring of water pressure and electrical conductivity in both networks during operation to assist with detection of cross connections. 6. Unique pipe materials in each water network. Potable network will use blue PVC and the non-potable will use lilac striped HDPE pipe. 7. Minimum pipe separation distances to be maintained in common trenches. Potable water pipework to be located above non-potable water pipework. 8. Identification tape and signage on all trenches. 9. Potable water is used in the non-potable water network until Stage 2 when the AWTP is constructed. Compliance audits will be undertaken prior to introducing recycled water to the network. 10. Conservative AWTP log reduction targets based on Table 3.7 in AGWR (2006).	B	Unlikely	4	Major	High

Project: Catherine Hill Bay Water Utility
Client: Rose Group
Title: Non-Potable Water Preliminary Risk Assessment for IPART Application
Author: BI
Date (Revision): 10/07/2013 (Revision B)
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	Unmitigated Risk					Control Strategy	Mitigated Risk				
				Likelihood		Consequence		Risk		Likelihood		Consequence		Risk
Non-Potable Water Supply System continued…	Cross connections continued…	Cross connection with potable water line on private property	Potential use of non-potable water for potable uses inside the affected property (up to say 6 EP)	D	Likely	3	Moderate	High	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 during house construction. 3. Dual check valve to be located at the potable water connection point for each property. 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 CHB Water Utility website. 6. Conservative AWTP log reduction target based on Table 3.7 in AGWR (2006).	C	Possible	3	Moderate	High
	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 non-potable water for potable uses	E	Almost certain	3	Moderate	High	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 CHB Water Utility website. 3. Appropriate identification and signage to be installed by plumbing contractor and verified during construction and plumbing inspection. 4. Appropriate pricing levels so non-potable water is not significantly lower in cost than potable water. 5. Flow monitoring to detect larger than normal flows 6. Conservative AWTP log reduction targets based on Table 3.7 in AGWR (2006).	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	D	Likely	3	Moderate	High	1. 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. 2. Weekly monitoring 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	C	Possible	2	Minor	Moderate	1. 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 and on the CHB Water Utility GIS. 5. Pressure and flow monitoring in the network to assist with detecting pipe breaks. 6. Visual inspection for wet, green, boggy areas or signs of soil erosion. 7. Customer fault reporting and response procedures in customer service. 8. Emergency Response Plan for main breaks. 9. All stormwater at the site is treated using bioretention basins in the stormwater treatment train.	B	Unlikely	2	Minor	Low
	Minor pipe leaks	Minor leaks from pipe joints and fittings	Potential contamination of groundwater	D	Likely	2	Minor	Moderate	1. PN16 HDPE pipe with welded joints and fittings. 2. Quality assurance and pressure testing during construction. 3. Visual inspection for green, wet and boggy areas. 4. Monitor flows throughout the network to identify water losses. 5. Use leak detection systems if required.	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	E	Almost certain	3	Moderate	High	1. Class A+ recycled water with conservative log reduction targets. 2. 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 CHB Water Utility website. 5. Appropriate identification and signage to be installed by plumbing contractor and verified during construction and plumbing inspection. 6. Appropriate pricing levels so non-potable water is not significantly lower in cost than potable water. 7. Flow monitoring to detect larger than normal flows.	B	Unlikely	3	Moderate	Moderate
Uncontrolled outdoor non-potable uses on private lots, i.e. irrigation and washdown	Pathogens	Human contact and ingestion of spray drift or surface runoff	Potential public health impacts	C	Possible	2	Minor	Moderate	1. Conservative AWTP log reduction target based on Table 3.7 in AGWR (2006). 2. Customer supply contracts, recycled water use agreements and ongoing customer education and awareness.	B	Unlikely	1	Insignificant	Low
	Nutrients	Excessive nutrient loads in irrigation	Potential contamination of soil and groundwater	C	Possible	2	Minor	Moderate	1. AWTP treated recycled water contains low nutrients of TN<7 mg/L & TP<0.25 mg/L and under normal irrigation rates and recycled water availability should not result in excessive nutrient impacts. 2. Detailed soil monitoring will be undertaken annually on private land on the 3 biggest users of non-potable water in the scheme based on customer non-potable water meter readings. 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

Project: Catherine Hill Bay Water Utility
Client: Rose Group
Title: Non-Potable Water Preliminary Risk Assessment for IPART Application
Author: BI
Date (Revision): 10/07/2013 (Revision B)
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	Unmitigated Risk					Control Strategy	Mitigated Risk				
				Likelihood		Consequence		Risk		Likelihood		Consequence		Risk
Uncontrolled outdoor non-potable uses on private lots, i.e. irrigation and washdown continued…	Salinity	Irrigation with high salt recycled water	Reduction in plant growth and poor appearance	C	Possible	2	Minor	Moderate	1. The AWTP includes a side stream reverse osmosis process to maintain salt concentrations at around 500 mg/L TDS as per potable water standards. 2. Irrigation at 500 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
		Washdown using high salt recycled water	Corrosion of customer private assets	C	Possible	2	Minor	Moderate	1. The AWTP includes a side stream reverse osmosis process to maintain salt concentrations at around 500 mg/L TDS as per potable water standards.	A	Rare	2	Minor	Low
	SAR	Irrigation with high SAR recycled water	Potential impacts on soil structure	C	Possible	2	Minor	Moderate	1. Sandy soil profile hence the sodicity issues should not be significant. 2. Annual soil monitoring of Exchangeable Sodium Percent will be undertaken on the 3 biggest recycled water users based on customer non-potable water metre records. 3. If required customers will be required to reduce irrigation rates or undertake a gypsum application based on the recycled water use agreement. 4. 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	D	Likely	2	Minor	Moderate	1. Maintain pH between 6.5 and 8.5 as per potable water standards. 2. Continuous online monitoring, control and alarms on pH correction system.	B	Unlikely	2	Minor	Low
		Washdown with high or low pH recycled water	Potential corrosion of private assets	D	Likely	2	Minor	Moderate		B	Unlikely	2	Minor	Low
	Chlorine	Irrigation using recycled water with high chlorine concentration	Potential impacts on vegetation and soil microorganisms	D	Likely	2	Minor	Moderate	1. Maximum free residual chlorine concentration of 2 mg/L. 2. Develop site specific chlorine dosing regimes across all seasons.	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	C	Possible	3	Moderate	High	1. Majority residential catchment hence there is a low likelihood of significant trace contaminants being present in recycled water. 2. Customer supply contracts, recycled water use agreements and ongoing awareness and education through information provided with rates notices and via the CHB Water Utility Website. 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. 5. If required additional treatment in the AWTP will be provided using reverse osmosis, activated carbon or ion exchange.	B	Unlikely	3	Moderate	Moderate
Stage 2 ultimate Public Open Space Irrigation System	Cross connection with potable network	Cross connection between open space irrigation network and potable water networks	Contamination of potable water supplies	D	Likely	5	Catastrophic	Very high	Cross connection control plan will be developed for the scheme and will include the following requirements for the Open Space Irrigation Network: 1. Water pressure in Open Space Irrigation Network to be maintained a minimum of 50 kPa pressure below the pressure in the potable network. 2. Unique pipe materials. Open Space Irrigation Network is to use Lilac PVC pipe. 3. Only approved, trained and supervised plumbing contractors are permitted to work on reticulation systems. 4. Monitoring of pressure and salinity differential between potable and non-potable water networks	B	Unlikely	3	Moderate	Moderate
	Unintended uses or human contact with recycled water	Unintended uses or human contact with recycled water	Potential health impacts	D	Likely	3	Moderate	High	1. Irrigation of high quality "Class A+" recycled water only 2. No above ground taps or fixtures in public open space irrigation areas. 3. Appropriate warning signage in all open space irrigation areas. 4. Lockable irrigation valves pits and controllers etc. 5. Soil moisture probes and weather station override on irrigation controllers to prevent irrigation during rainfall, high wind or elevated soil moisture. 6. Surface sprinklers with spray drift control including sprinkler nozzles that operate under low pressure with a large droplet size and low throw height.	A	Rare	3	Moderate	Low
	Spray drift during irrigation	Spray drift onto sensitive receptor	Potential ingestion of recycled water	E	Almost certain	3	Moderate	High	1. Irrigation of high quality "Class A+" recycled water only 2. Soil moisture probes and weather station override on irrigation controllers to prevent irrigation during rainfall, high wind or elevated soil moisture. 3. Surface sprinklers with spray drift control including sprinkler nozzles that operate under low pressure with a large droplet size and low throw height.	A	Rare	2	Minor	Low
	Irrigation during wet weather	Irrigation during wet weather resulting in surface runoff or deep percolation of effluent	Contamination of surface and/or groundwaters	E	Almost certain	3	Moderate	High	1. A 10 ML wet weather storage dam and a 0.85 ML recycled water storage tank provides sufficient storage during wet weather. 2. 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

Project: Catherine Hill Bay Water Utility
Client: Rose Group
Title: Non-Potable Water Preliminary Risk Assessment for IPART Application
Author: BI
Date (Revision): 10/07/2013 (Revision B)
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	Unmitigated Risk					Control Strategy	Mitigated Risk				
				Likelihood		Consequence		Risk		Likelihood		Consequence		Risk
Stage 2 ultimate Public Open Space Irrigation System continued…	Irrigation rates and scheduling	Inappropriate irrigation scheduling	Increased risk of surface and ground water contamination	C	Possible	2	Minor	Moderate	1. 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.	B	Unlikely	2	Minor	Low
	Recycled water	Surface runoff during irrigation	Potential contamination of surface water	C	Possible	3	Moderate	High	1. All 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. Site based storm water run off and environmental controls.	B	Unlikely	2	Minor	Low
	Nitrogen	Excessive nitrogen load resulting in leaching of nitrate from irrigation areas	Contamination of groundwater	C	Possible	3	Moderate	High	1. Irrigation of "Class A+" recycled water with total nitrogen concentration of 7 mg/L and low average irrigation rates of around 0.9 mm/day. 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	C	Possible	3	Moderate	High	1. Irrigation of "Class A+" recycled water with total phosphorus concentration of 0.25 mg/L and low average irrigation rates of around 0.9 mm/day. 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 >166 years based on P-sorption capacity of holocene sand.	B	Unlikely	2	Minor	Low
	Effluent Salinity	Impacts on plant growth due to salinity	Reduction in plant growth and water and nutrient uptake rates	C	Possible	2	Minor	Moderate	1. MEDLI modelling indicated no impacts on plant growth due to salinity based on a conservative effluent TDS of 1500 mg/L. 2. Landscape design processes will ensure appropriate vegetation is selected in temporary irrigation areas that can tolerate the required salt concentrations. 3. The natural sandy top soil profile and relatively high rainfall at the site will assist with flushing of salt through the soil profile to minimise potential salinity impacts on vegetation.	B	Unlikely	3	Moderate	Moderate
	Effluent SAR	Long term sodicity impacts on soil	Soil dispersion, reduction in permeability	C	Possible	2	Minor	Moderate	1. Topsoil profile is dominated by sand, hence the likelihood of sodicity impacts is low. 2. Detail geotechnical testing to be undertaken for each development stage will avoid areas with high clay content and Exchangeable Sodium Percentage (ESP). 3. Ongoing monitoring of soil cations will detect changes in soil ESP over time. 4. If required gypsum/lime application to irrigation areas will be undertaken. 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 is irrigation supply resulting in long term accumulation in irrigation area	Contamination of soil and groundwater	C	Possible	2	Minor	Moderate	1. Source catchment is >99% 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 events occurring. 3. Detailed monitoring of effluent quality for trace contaminant will be undertaken annually using a NATA accredited laboratory. 4. Soil monitoring in open space irrigation area 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. If required additional treatment processes can be installed, e.g. BAC, ion exchange.	B	Unlikely	2	Minor	Low
	Recycled water	Pipe breakage	Potential contamination of surface or groundwater	C	Possible	2	Minor	Moderate	1. Flow and pressure monitoring in the irrigation supply system. 2. Visual inspection to identify boggy areas or erosion etc. 3. Fault and main break reporting system through customer service processes.	B	Unlikely	2	Minor	Low
	Odour	Odour released during irrigation	Odour impacts on nearby residents	B	Unlikely	2	Minor	Low	1. Irrigation of high quality "Class A+" recycled water with low BOD	A	Rare	2	Minor	Low
	Stormwater runon	Stormwater running onto irrigation areas from upgradient	Water logging of irrigation area	D	Likely	2	Minor	Moderate	1. Stormwater diversion drains to divert all upgradient stormwater runoff around effluent irrigation areas. 2. Appropriate buffers to waterways, ponds, stormwater drains and SEPP14 wetlands	A	Rare	2	Minor	Low
	Percolation to groundwater	Excessive percolation of effluent to groundwater	Contamination of groundwater	C	Possible	3	Moderate	High	1. Low long term average irrigation rate of approximately 0.9 mm/day, hence low risk of groundwater contamination. 2. Minimal presence of groundwater within 3 metres of ground surface is geotechnical investigation. 3. High quality effluent with low nutrients. 4. MEDLI modelling indicates negligible concentrations of nutrients in deep drainage for conservative sandy soil profile. 5. A minimum of 600mm sandy loam topsoil cover will be provided on irrigation areas if there is potential for seasonal high water table.	B	Unlikely	2	Minor	Low

NON-POTABLE WATER

QUALITATIVE ENVIRONMENTAL AND PUBLIC HEALTH RISK ASSESSMENT CRITERIA

From tables 2.5, 2.6 and 2.7 on Page 39 of the Australian Guidelines for Water Recycling Managing Health & Environmental Risks Phase 1 (2006)

Qualitative measures of likelihood

Level	Descriptor	Example Description from AGWR
A	Rare	May occur only in exceptional circumstances. May occur once in 100 years
B	Unlikely	Could occur within 20 years or in unusual circumstances
C	Possible	Might occur or should be expected to occur within a 5- to 10-year period
D	Likely	Will probably occur within a 1-to 5-year period
E	Almost certain	Is expected to occur with a probability of multiple occurrences within a year

Qualitative measures of consequence or impact

Level	Descriptor	Example Description from AGWR
1	Insignificant	Insignificant impact or not detectable
2	Minor	Health — Minor impact for small population Environment — Potentially harmful to local ecosystem with local impacts contained to site
3	Moderate	Health — Minor impact for large population Environment — Potentially harmful to regional ecosystem with local impacts primarily contained to on-site
4	Major	Health — Major impact for small population Environment — Potentially lethal to local ecosystem; predominantly local, but potential for off-site impacts
5	Catastrophic	Health — Major impact for large population Environment — Potentially lethal to regional ecosystem or threatened species; widespread on-site and off-site impacts

Qualitative risk analysis matrix: Level of risk

		Consequences				
Likelihood		1	2	3	4	5
		Insignificant	Minor	Moderate	Major	Catastrophic
A	Rare	Low	Low	Low	High	High
B	Unlikely	Low	Low	Moderate	High	Very high
C	Possible	Low	Moderate	High	Very high	Very high
D	Likely	Low	Moderate	High	Very high	Very high
E	Almost certain	Low	Moderate	High	Very high	Very high

Project: Catherine Hill Bay Water Utility
Client: Rose Group
Title: Sewerage Preliminary Risk Assessment for IPART Application
Author: BI
Date (Revision): 10/07/2013 (Revision B)
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	Unmitigated Risk					Control Strategy	Mitigated Risk				
				Likelihood		Consequence		Risk		Likelihood		Consequence		Risk
Wastewater generation	Trace contaminants in domestic wastewater	Poor household chemical use and disposal practices resulting in excessive contaminant levels in recycled water	Potential environmental impacts on effluent irrigation areas	C	Possible	2	Minor	Moderate	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 and substances that should be avoided. 2. Ongoing customer awareness campaigns and information provided with each water bill and through the CHB Water Utility website.	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	D	Likely	2	Minor	Moderate	1. Predominately residential sewerage catchment with non-residential customers account for less than 1% of all wastewater generated. 2. Trade waste agreement will be developed with each non-residential customers to ensure wastewater is pretreated to domestic standards before discharge into the sewerage system. 3. Each non-residential customer will have its own low pressure sewage pump station to enable monitoring compliance of trade waste agreements.	B	Unlikely	2	Minor	Low
	Shock load of chemical	Poor chemical or trade waste management practices resulting in shock load of contaminants on MBR	Potential biomass die off and reduction in MBR effluent quality. Chemicals may also be an OHS hazard.	A	Rare	2	Minor	Low	1. Continuous online monitoring of MLSS, DO, pH, EC and other process parameters to detect potential impacts on the treatment process. 2. 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 agreement etc. 3. Additional online water quality monitoring probes can be installed into suspect PSUs for tracing persistent sources of contamination if required. 4. Road tanker pump out of contaminated water from the inlet balance tank if required.	B	Unlikely	1	Insignificant	Low
	Gross pollutants in raw wastewater	Poor solid waste management practices resulting sewer blockage and overflow.	Potential sewer blockage and overflow	E	Almost certain	2	Minor	Moderate	1. Low pressure sewerage system with grinder pumps will macerate sewage prior to entering the pipe network. 2. Appropriately designed network with self cleansing velocities and high head pumps will minimise the potential for network blockage. 3. Sewer/pump blockage Emergency Response Plan will be developed for the scheme and will include step for identification of route cause and preventative actions. Where multiple blockages have occurred on the same pump station, specific customer awareness/education will be implemented or compliance notices issued. 4. Flushing and maintenance regime will be developed for the pressure sewer network.	C	Possible	2	Minor	Moderate
	Excessive wastewater generation	Peak tourist population or excessive water usage	Build up of raw wastewater in the inlet balance tank and PSUs. Potential overflow to the environment.	C	Possible	2	Minor	Moderate	1. Water demand management strategy including mandatory best practice water efficient fixtures, smart water metres, customer awareness. 2. MBR capacity based on treatment of average daily flows plus 10% contingency at 2.8 EP/ET. 3. Flow and level monitoring at each pump unit to detect sources of inflow. 4. Road tanker pumpout from individual PSUs if required.	B	Unlikely	1	Insignificant	Low
Low Pressure Sewerage Collection System	Inflow and infiltration to the sewerage network	Inflow and infiltration to the sewerage network	Potential overflow from PSU or inlet balance tank if combined inflows exceed capacity of MBR	D	Likely	2	Minor	Moderate	1. Low pressure sewerage system constructed with PN16 HDPE with welded joints and fittings. 2. Contractor induction and education. 3. Inspection and quality assurance during construction. 4. Flow and level monitoring at each pump unit to detect sources of inflow. 5. PSU pump operation centrally controlled by the Direct Digital Control System. PSUs with high water level are given pumping priority. 6. Road tanker pumpout from individual pump units if required.	C	Possible	2	Minor	Moderate
	Inflow and infiltration upstream of Pressure Sewer Unit (PSU)	Inflow and infiltration upstream of Pressure Sewer Unit (PSU)	Potential overflow from PSU or inlet balance tank if combined inflows exceed capacity of MBR	E	Almost certain	2	Minor	Moderate	1. Plumbing inspection of all household plumbing installation prior to connection. 2. Induction and awareness training for all domestic plumbing contractors working in the scheme. 3. Flow and level monitoring at each PSU to identify sources of inflow. Customer education and rectification notices will be provided if required. 4. Road tanker pumpout from individual PSUs if required.	C	Possible	2	Minor	Moderate
	High peak diurnal flows	Excessive peak inflows	Potential overflow from PSU or inlet balance tank if combined inflows exceed capacity of MBR	C	Possible	2	Minor	Moderate	1. Inlet balance tank at WWTP provides buffer storage for diurnal flows. 2. Storage capacity in each PSU provides buffer storage for diurnal flows. 3. PSU pump operation centrally controlled by the Direct Digital Control System. PSUs with high water level are given pumping priority in the control system. 4. Road tanker pumpout from individual pump units if required.	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	C	Possible	3	Moderate	High	1. All mains constructed with 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. Flow monitoring at the WWTP will identify major variations in daily flow. 7. Customer Service Centre and fault reporting with maximum response times for operations staff. 8. Sewer spill Emergency Response Plan and cleanup procedures will be developed. 9. Pressure and flow monitoring in the pressure sewer network.	B	Unlikely	2	Minor	Low

Project: Catherine Hill Bay Water Utility
Client: Rose Group
Title: Sewerage Preliminary Risk Assessment for IPART Application
Author: BI
Date (Revision): 10/07/2013 (Revision B)
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	Unmitigated Risk					Control Strategy	Mitigated Risk				
				Likelihood		Consequence		Risk		Likelihood		Consequence		Risk
Low Pressure Sewerage Collection System continued..	Leakage from PSU wet well	Failure of PSU wet well resulting in subsurface leakage	Discharge of raw sewage to groundwater	C	Possible	2	Minor	Moderate	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. Timber bollards or fencing around all PSUs to prevent vehicle access. 4. Water level and flow monitoring at each PSU.	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	D	Likely	3	Moderate	High	1. Duty and standby pumps in each PSU. 2. Fail safe in electrical system so pump can operate with failed network connections. 3. High quality robust pumps with long design life. Likely supplier is E-One. 4. Standard pumps with spare pumps maintained onsite for quick changeover if required.	B	Unlikely	3	Moderate	Moderate
	Power failure	Extended power failure across pressure sewer network	Potential discharge of raw sewage to the environment	E	Almost certain	3	Moderate	High	1. 24 hours emergency storage is provided in all PSUs. 2. Low pressure sewer network start up and recovery process is included in Direct Digital Control System logic to avoid excessive simultaneous pump operation. 3. Road tanker pump out from individual PSUs if required.	B	Unlikely	2	Minor	Low
Wastewater Treatment - Membrane Bioreactor + UV Disinfection	Structural failures of tanks and pipes	Tank failure	Discharge of process water to environment	C	Possible	3	Moderate	High	1. Stainless steel 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	C	Possible	2	Minor	Moderate	1. All process tanks gravity overflow back to inlet balance tank. 2. Screening system on inlet to MBR to remove gross solids.	B	Unlikely	2	Minor	Low
	Mechanical/ electrical items	Failure of mechanical electrical items	Non-compliant recycled water	E	Almost certain	3	Moderate	High	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	C	Possible	2	Minor	Moderate
	Power blackouts	Extended power blackout	Loss of treatment capacity	E	Almost certain	3	Moderate	High	1. No sewage inflow to MBR during power blackout as pressure sewer system will also be down 2. Wastewater will build up in 24 hours emergency storage at each PSU. 3. Road tanker pump out from each PSU if required. 4. Electrical connection point for mobile power generator to power MBR if required.	C	Possible	2	Minor	Moderate
	Blockage of inlet screening unit	Blockage of screening unit caused by excessive solids in raw wastewater	Carryover of solids to MBR with reduced treatment performance and increased risk of membrane failure	C	Possible	2	Minor	Moderate	1. Only grinder pump macerated sewage will enter the plant. 2. Water level monitoring and high level alarm in screening unit. 3. If screening blockage occurs undertake investigation into source of gross solids and implement preventative actions.	B	Unlikely	2	Minor	Low
	Hydraulic overload during diurnal peak flows	Excessive sewerage flows	Build up of raw wastewater in the inlet balance tank and PSUs. Potential overflow to the environment.	C	Possible	2	Minor	Moderate	1. When peak capacity of the MBR is exceeded the inlet balance tank provides buffer storage for diurnal flows. 2. 24 hour storage capacity in each PSU can also provide buffer storage in extreme events. 3. PSU pump operation centrally controlled by the Direct Digital Control System. PSUs with high water level are given pumping priority through the control system logic. 4. Road tanker pump out from individual PSUs if required during operation.	B	Unlikely	2	Minor	Low
	Pollutant overload	Excessive BOD or ammonia load	Non-compliant recycled water	C	Possible	3	Moderate	High	1. Continuous online monitoring of MBR process DO, MLSS, pH with alarms. 2. Variable speed drive aeration system to match air supply with inflow. Reserve capacity is designed into the aeration system. 3. If process impacts due to high pollutant loads are observed a source control investigation will be undertaken using raw wastewater and trade waste 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	D	Likely	3	Moderate	High	1. MBR CIP waste is stored and neutralised prior to return to the inlet balance tank. 2. 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.	C	Possible	3	Moderate	High	1. Appropriate bunding and separation of chemicals in chemical storage and delivery area. 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.	E	Almost certain	3	Moderate	High	1. Continuous online monitoring of MLSS, DO and TMP with alarms. 2. When MLSS reaches maximum set point sludge is pumped from the bottom of the MBR tank to a sludge holding tank before offsite disposal to approved facility.	B	Unlikely	3	Moderate	Moderate
	Membrane failure	Membrane failure resulting in carryover of human pathogens	Non-compliant recycled water	D	Likely	4	Major	Very high	1. Continuous online monitoring of membrane permeate turbidity and transmembrane pressure. 2. If event occurs, identify and isolate failed membrane module and if required replace failed membrane module. 3. Shut off irrigation supply pump and undertake monitoring of pond water quality to ensure compliance. 4. Chemical treatment of pond water can be undertaken if necessary. 5. An Emergency Response Plan will be developed for MBR membrane failure.	B	Unlikely	4	Major	High

Project: Catherine Hill Bay Water Utility
Client: Rose Group
Title: Sewerage Preliminary Risk Assessment for IPART Application
Author: BI
Date (Revision): 10/07/2013 (Revision B)
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	Unmitigated Risk					Control Strategy	Mitigated Risk				
				Likelihood		Consequence		Risk		Likelihood		Consequence		Risk
Wastewater Treatment - Membrane Bioreactor + UV Disinfection continued…	UV failure	Inadequate UV dose due to lamp failure, reactor fouling, high flow or high turbidity	Non-compliant recycled water	E	Almost certain	3	Moderate	High	1. Continuous online monitoring UV intensity, flow, upstream permeate turbidity and lamp failure. 2. If Low UV dose is recorded investigate and rectify. 3. Shut off irrigation supply pump and undertake monitoring of pond water quality to ensure compliance. 4. Chemical treatment of pond water can be undertaken if necessary. 5. An Emergency Response Plan will be developed for UV lamp failure.	C	Possible	3	Moderate	High
	Sabotage/ vandalism	Sabotage/vandalism	Potential loss of treatment function	C	Possible	4	Major	Very high	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
	Noise	Excessive noise generation	Noise complaints for nearby residents	C	Possible	2	Minor	Moderate	1. All treatment equipment is located inside the WWTP building. 2. 100 metre buffer to the nearest residential dwelling. 3. Noisy equipment items will be enclosed in purpose built noise enclosures or insulated plant room. 4. Equipment specification and design will ensure compliance with NSW Industrial Noise Policy of 5 dBA above background noise level at the nearest residential dwelling. 5. WWTP building located on Montefiore Road, which is impacted by background traffic noise. 6. Noise complaint management system through customer service processes.	A	Rare	2	Minor	Low
	Odour	Excessive odour generation	Odour complaints by nearby residents	C	Possible	2	Minor	Moderate	1. All treatment tanks are located inside the WWTP building. 2. 100 metre buffer to the nearest residential dwelling. 3. All treatment tanks are sealed with passive ventilation through Mcberns activated carbon filters located on the roof of the WWTP building. 4. WWTP building includes deodorising sprayers for use if required. 5. Odour complaint management system through customer service processes.	A	Rare	2	Minor	Low
	Aesthetics	Excessive visual impacts	Complaints from nearby residents	C	Possible	2	Minor	Moderate	1. All treatment equipment is located inside the WWTP building. 2. 100 metre buffer to the nearest residential dwelling. 3. Vegetation screening around the WWTP site.	A	Rare	2	Minor	Low
	Indoor air quality inside MBR shed	Contamination of indoor air with harmful sewer gases	OH&S impacts	B	Unlikely	4	Major	High	1. All treatment tanks are sealed and externally ventilated. 2. Continuous online monitoring of indoor air quality for oxygen, hydrogen sulphide and methane gas inside the WWTP building, with automated air conditioner/ventilation system operation and alarm systems.	B	Unlikely	3	Moderate	Moderate
Wet Weather Storage	Vector borne diseases	Vermin/mosquito invasion of wet weather storage	Potential spread of diseases	D	Likely	3	Moderate	High	1. Steep batters to minimise potential for mosquito growth. 2. Regular inspection for evidence 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.	D	Likely	2	Minor	Moderate	1. Wet weather storage is fenced with appropriate warning signage. 2. Remote CCTV system used at WWTP site. 3. Safe egress point from storage.	A	Rare	3	Moderate	Low
	Blue green algae	Blue green algae outbreak in storage	Inhalation or contact with blue green algae toxins	D	Likely	3	Moderate	High	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. Chemical treatment and/or aeration/mixing of pond will be undertaken if algae outbreak occurs. 4. If frequent outbreaks occur a permanent aeration/mixer will be installed into the pond.	B	Unlikely	2	Minor	Low
	Leakage to groundwater	Leakage to groundwater	Contamination of groundwater	C	Possible	3	Moderate	High	1. HDPE lined storage. 2. Continuous online monitoring of pond water level to detect leaks. 3. Groundwater monitoring	B	Unlikely	3	Moderate	Moderate
	Stormwater inputs	Stormwater runoff into storage during rain events	Increased potential for overflow	D	Likely	2	Minor	Moderate	1. Turkey nested dam to avoid inputs from stormwater runoff.	A	Rare	1	Insignificant	Low
	Uncontrolled overflow	Uncontrolled overflow from the wet weather storage during extended wet weather	Stormwater contamination	D	Likely	3	Moderate	High	1. MEDLI modelling indicates the 10 ML did not overflow based on 100-years of historic climate data. 2. Continuous online monitoring of storage water level with automatic scheduling of emergency irrigation events to irrigation areas will be undertaken as required to avoid uncontrolled overflow. 3. Removal of excess water by road tanker pump out if required.	A	Rare	2	Minor	Low
	Dam wall failure	Dam wall failure	Surface runoff and flooding	C	Possible	4	Major	Very high	1. Design of dam walls with scour protection in the unlikely event of uncontrolled overflow. 2. MEDLI modelling predicts the storage will not overflow based on historic rainfall data. 3. Continuous online monitoring of storage water level with automatic scheduling of emergency irrigation events as required to avoid uncontrolled overflow.	B	Unlikely	2	Minor	Low

Project: Catherine Hill Bay Water Utility
Client: Rose Group
Title: Sewerage Preliminary Risk Assessment for IPART Application
Author: BI
Date (Revision): 10/07/2013 (Revision B)
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	Unmitigated Risk					Control Strategy	Mitigated Risk				
				Likelihood		Consequence		Risk		Likelihood		Consequence		Risk
Stage 1 temporary, restricted access Irrigation System	Cross connection with potable or non-potable water networks	Cross connection between temporary irrigation network and other water networks	Contamination of other water supplies	C	Possible	5	Catastrophic	Very high	Temporary irrigation management plan will be developed for the scheme and will include the following cross connection controls: 1. Temporary irrigation system to operate under low pressure. 2. Unique pipe materials. Temporary Irrigation Network is to use Lilac striped HDPE pipe. 3. Temporary 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.	B	Unlikely	3	Moderate	Moderate
	Unintended uses or human contact with recycled water	Unintended uses or human contact with recycled water	Potential health impacts	D	Likely	3	Moderate	High	Log reduction targets for the temporary irrigation system will be achieved with the following site based controls: 1. Secure, restrictive access temporary irrigation areas including warning signs, identification and labelling. 2. Surface sprinklers with spray drift control including sprinkler nozzles that operate under low pressure with a large droplet size and low throw height. 3. A minimum 30 m buffer distance between the edge of the temporary irrigation areas and the closest dwelling. 4. No above ground taps or fixtures in temporary irrigation areas. 5. Lockable irrigation valves pits and controllers etc. 6. Soil moisture probes and weather station override on irrigation controllers to prevent irrigation during rainfall, high wind or elevated soil moisture. 7. Irrigation at night time only under normal conditions. 8. Non-irrigated, vegetated buffer strips down gradient of the temporary irrigation areas.	A	Rare	3	Moderate	Low
	Spray drift during irrigation	Spray drift onto sensitive receptor	Potential ingestion of recycled water	E	Almost certain	3	Moderate	High	1. Weather station override on irrigation controllers to prevent irrigation during high wind. 2. Surface sprinklers with spray drift control including sprinkler nozzles that operate under low pressure with a large droplet size and low throw height. 3. A minimum 30 m buffer distance between the edge of the temporary irrigation areas and the closest dwelling.	A	Rare	2	Minor	Low
	Irrigation during wet weather	Irrigation during wet weather resulting in surface runoff or deep percolation of effluent	Contamination of surface and/or groundwaters	E	Almost certain	3	Moderate	High	1. 10 ML wet weather storage provides approximately 100 days storage at average irrigation rates. 2. Soil moisture probes and weather station override on irrigation controllers to prevent irrigation during rainfall, high wind or elevated soil moisture. 3. Non-irrigated, vegetated buffer strips down gradient of the temporary irrigation areas.	A	Rare	2	Minor	Low
	Irrigation rates and scheduling	Inappropriate irrigation scheduling	Increased risk of surface and ground water contamination	C	Possible	2	Minor	Moderate	1. 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.	B	Unlikely	2	Minor	Low
	Recycled water	Surface runoff during irrigation	Potential contamination of surface water	C	Possible	3	Moderate	High	1. All temporary 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. Site based storm water run off and environmental controls. 4. Non-irrigated, vegetated buffer strips down gradient of the temporary irrigation areas.	B	Unlikely	2	Minor	Low
	Nitrogen	Excessive nitrogen load resulting in leaching of nitrate from irrigation areas	Contamination of groundwater	C	Possible	3	Moderate	High	1. Irrigation of "Class A" recycled water with total nitrogen concentration of 10 mg/L and low average irrigation rates of around 0.9 mm/day. 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	C	Possible	3	Moderate	High	1. Irrigation of "Class A" recycled water with total phosphorus concentration of 0.3 mg/L and low average irrigation rates of around 0.9 mm/day. 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 >166 years based on P-sorption capacity of holocene sand.	B	Unlikely	2	Minor	Low
	Effluent Salinity	Impacts on plant growth due to salinity	Reduction in plant growth and water and nutrient uptake rates	C	Possible	2	Minor	Moderate	1. MEDLI modelling indicated no impacts on plant growth due to salinity based on a conservative effluent TDS of 1500 mg/L. 2. Landscape design processes will ensure appropriate vegetation is selected in temporary irrigation areas that can tolerate the required salt concentrations. 3. The natural sandy top soil profile and relatively high rainfall at the site will assist with flushing of salt through the soil profile to minimise potential salinity impacts on vegetation.	B	Unlikely	3	Moderate	Moderate

Project: Catherine Hill Bay Water Utility
Client: Rose Group
Title: Sewerage Preliminary Risk Assessment for IPART Application
Author: BI
Date (Revision): 10/07/2013 (Revision B)
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	Unmitigated Risk					Control Strategy	Mitigated Risk				
				Likelihood		Consequence		Risk		Likelihood		Consequence		Risk
Stage 1 temporary, restricted access Irrigation System continued...	Effluent SAR	Long term sodicity impacts on soil	Soil dispersion, reduction in permeability	C	Possible	2	Minor	Moderate	1. Topsoil profile is dominated by sand, hence the likelihood of sodicity impacts is low. 2. Detail geotechnical testing to be undertaken for each development stage will avoid areas with high clay content and Exchangeable Sodium Percentage (ESP). 3. Ongoing monitoring of soil cations will detect changes in soil ESP over time. 4. If required gypsum/lime application to irrigation areas will be undertaken. 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	C	Possible	2	Minor	Moderate	1. Source catchment is >99% 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 events occurring. 3. Detailed monitoring of effluent quality for trace contaminant will be undertaken annually using a NATA accredited laboratory. 4. Soil monitoring in temporary irrigation area 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. If required additional treatment processes can be installed, e.g. BAC, ion exchange.	B	Unlikely	2	Minor	Low
	Recycled water	Pipe breakage	Potential contamination of surface or groundwater	C	Possible	2	Minor	Moderate	1. Flow and pressure monitoring in the temporary irrigation supply system. 2. Visual inspection to identify boggy areas or erosion etc.	B	Unlikely	2	Minor	Low
	Odour	Odour released during irrigation	Odour impacts on nearby residents	B	Unlikely	2	Minor	Low	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. A minimum 30 m buffer distance between the edge of the temporary irrigation areas and the closest dwelling.	A	Rare	2	Minor	Low
	Stormwater runon	Stormwater running onto irrigation areas from upgradient	Water logging of irrigation area	D	Likely	2	Minor	Moderate	1. Stormwater diversion drains to divert all upgradient stormwater runoff around temporary effluent irrigation areas. 2. Appropriate buffers to waterways, ponds, stormwater drains and SEPP14 wetlands	A	Rare	2	Minor	Low
	Percolation to groundwater	Excessive percolation of effluent to groundwater	Contamination of groundwater	C	Possible	3	Moderate	High	1. Low long term average irrigation rate of approximately 0.9 mm/day, hence low risk of groundwater contamination. 2. Minimal presence of groundwater within 3 metres of ground surface in geotechnical investigation. 3. Irrigation of high quality "Class A" recycled water with low nutrients. 4. MEDLI modelling indicates negligible concentrations of nutrients in deep drainage for conservative sandy soil profile. 5. A minimum of 600mm sandy loam topsoil cover will be provided on irrigation areas if there is potential for seasonal high water table.	B	Unlikely	2	Minor	Low

SEWERAGE

QUALITATIVE ENVIRONMENTAL AND PUBLIC HEALTH RISK ASSESSMENT CRITERIA

From tables 2.5, 2.6 and 2.7 on Page 39 of the Australian Guidelines for Water Recycling Managing Health & Environmental Risks Phase 1 (2006)

Qualitative measures of likelihood

Level	Descriptor	Example Description from AGWR
A	Rare	May occur only in exceptional circumstances. May occur once in 100 years
B	Unlikely	Could occur within 20 years or in unusual circumstances
C	Possible	Might occur or should be expected to occur within a 5- to 10-year period
D	Likely	Will probably occur within a 1-to 5-year period
E	Almost certain	Is expected to occur with a probability of multiple occurrences within a year

Qualitative measures of consequence or impact

Level	Descriptor	Example Description from AGWR
1	Insignificant	Insignificant impact or not detectable
2	Minor	Health — Minor impact for small population Environment — Potentially harmful to local ecosystem with local impacts contained to site
3	Moderate	Health — Minor impact for large population Environment — Potentially harmful to regional ecosystem with local impacts primarily contained to on-site
4	Major	Health — Major impact for small population Environment — Potentially lethal to local ecosystem; predominantly local, but potential for off-site impacts
5	Catastrophic	Health — Major impact for large population Environment — Potentially lethal to regional ecosystem or threatened species; widespread on-site and off-site impacts

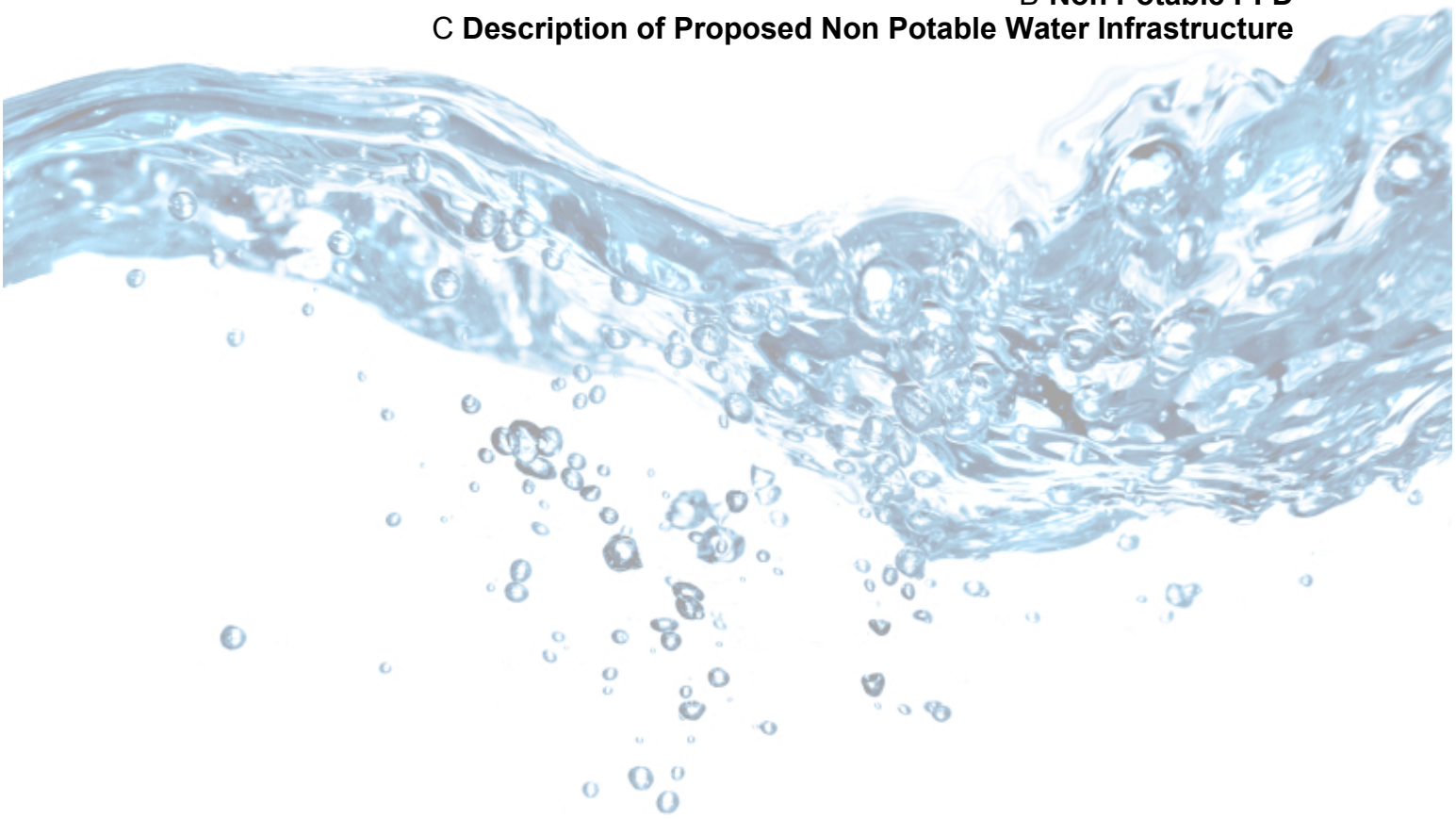
Qualitative risk analysis matrix: Level of risk

		Consequences				
Likelihood		1	2	3	4	5
		Insignificant	Minor	Moderate	Major	Catastrophic
A	Rare	Low	Low	Low	High	High
B	Unlikely	Low	Low	Moderate	High	Very high
C	Possible	Low	Moderate	High	Very high	Very high
D	Likely	Low	Moderate	High	Very high	Very high
E	Almost certain	Low	Moderate	High	Very high	Very high

Solo Water

Appendix 4.2.1 **Non Potable Water**

A **Overall PFD**
B **Non Potable PFD**
C **Description of Proposed Non Potable Water Infrastructure**



PROCESS FLOW DIAGRAM OVERALL

WYONG COUNCIL KANANGRA DRIVE RESERVOIR

WYONG COUNCIL | SOLO WATER

TOTAL WATER DEMAND:
ADD: 337.1 kL/d
PDD: 987.8 kL/d
PDD FLOW: 12.5 L/s in 22 hours
FIRE FLOW: 10.0 L/s
TOTAL PEAK FLOW 22.5 L/s

EMERGENCY BACKUP

POTABLE
ADD: 151.3 kL/d
PDD: 179.0 kL/d
2.3 L/s IN 22 hrs

FIRE:
10 L/s

AIR GAP

NON-POTABLE
ADD: 185.7 kL/d
PDD: 808.8 kL/d
10.2 L/s IN 22 hrs

AIR GAP

1.2 ML POTABLE WATER + FIRE STORAGE (0.5ML DEDICATED FIRE STORAGE)

0.85 ML RECYCLED WATER STORAGE

185.7 kL/d

BULK POTABLE WATER TRANSFER SYSTEM

TRANSFER PIPELINE

- TOTAL PIPELINE 6.3 km x DN 200 mm HDPE
- 4.2 km EXISTING HDPE MAIN IN NPWS/RFS CLASS 1 FIRE TRAIL
- 1.5 km OF NEW HDPE MAIN TO CONNECT KANANGRA DR RESERVOIR TO THE EXISTING MAIN
- 0.6 km OF NEW HDPE MAIN TO CONNECT THE EXISTING MAIN TO ONSITE POTABLE WATER STORAGE TANK (REFER TO BULK WATER MAIN LAYOUT PLAN IN APPENDIX 4.1.3)

NEW TRANSFER PUMP STATION

- LOCATED AT THE EXISTING WYONG COUNCIL KANANGRA DR RESERVOIR SITE
- VARIABLE SPEED DRIVE BOOSTER PUMP SET WITH BUILT IN STANDBY CAPACITY
- PEAK DESIGN FLOW 23.3 L/s

POTABLE WATER RETICULATION NETWORK
ADD: 151.3 kL/day
PDD: 179.0 kL/day

CATHERINE HILL BAY DEVELOPMENT LOTS
470 ET

RECYCLED WATER RETICULATION NETWORK
ADD: 185.7 kL/day
PDD: 808.8 kL/day

ADD: 118.4 kL/day
PDD: 472.4 kL/day

AWTP
(WWTP Stage 2)
RECYCLED WATER
CLASS A+
PRODUCTION: 185.7 kL/d

PUMP ROOM

CONTROL ROOM

CHEMICALS

MBR
(WWTP Stage 1)
PEAK CAPACITY 300 kL/day)

HIGH & LOW DEMAND

10 ML WET WEATHER STORAGE

209.2 kL/d

209.2 kL/d

213.2 kL/day

UF RETENATE 15.8 kL/day

AVG: 39.2 kL/day
PEAK: 196.2 kL/day

IRRIGATION OF OPEN SPACE AREAS
IRRIGATION AREA: 4.9 ha

AVG: 28.1 kL/day
PEAK: 140.2 kL/day

IRRIGATION OF LANDSCAPED ROAD BUFFERS
IRRIGATION AREA: 3.5 ha

RO REJECT

7.7 kL/day
4700 mg/L TDS

500 m² RO REJECT EVAPO-TRANSPIRATION WETLAND. SALT TOLERANT VETIVER GRASS

6.2 kL/day
5600 mg/L TDS

2000 m² RO REJECT EVAPORATION POND No. 1

2000 m² RO REJECT EVAPORATION POND No. 2

MISTING SPRAYERS

MISTING SPRAYERS

OFFSITE DISPOSAL OF SALT RESIDUE/SURPLUS BRINE TO APPROVED FACILITY USING LICENSED WASTE CONTRACTOR

4 kL/day MBR WASTE SLUDGE

197.4 kL/day

OFFSITE DISPOSAL TO APPROVED FACILITY USING LICENSED WASTE TRANSPORT CONTRACTOR

PRESSURE SEWER NETWORK

197.4 kL/day

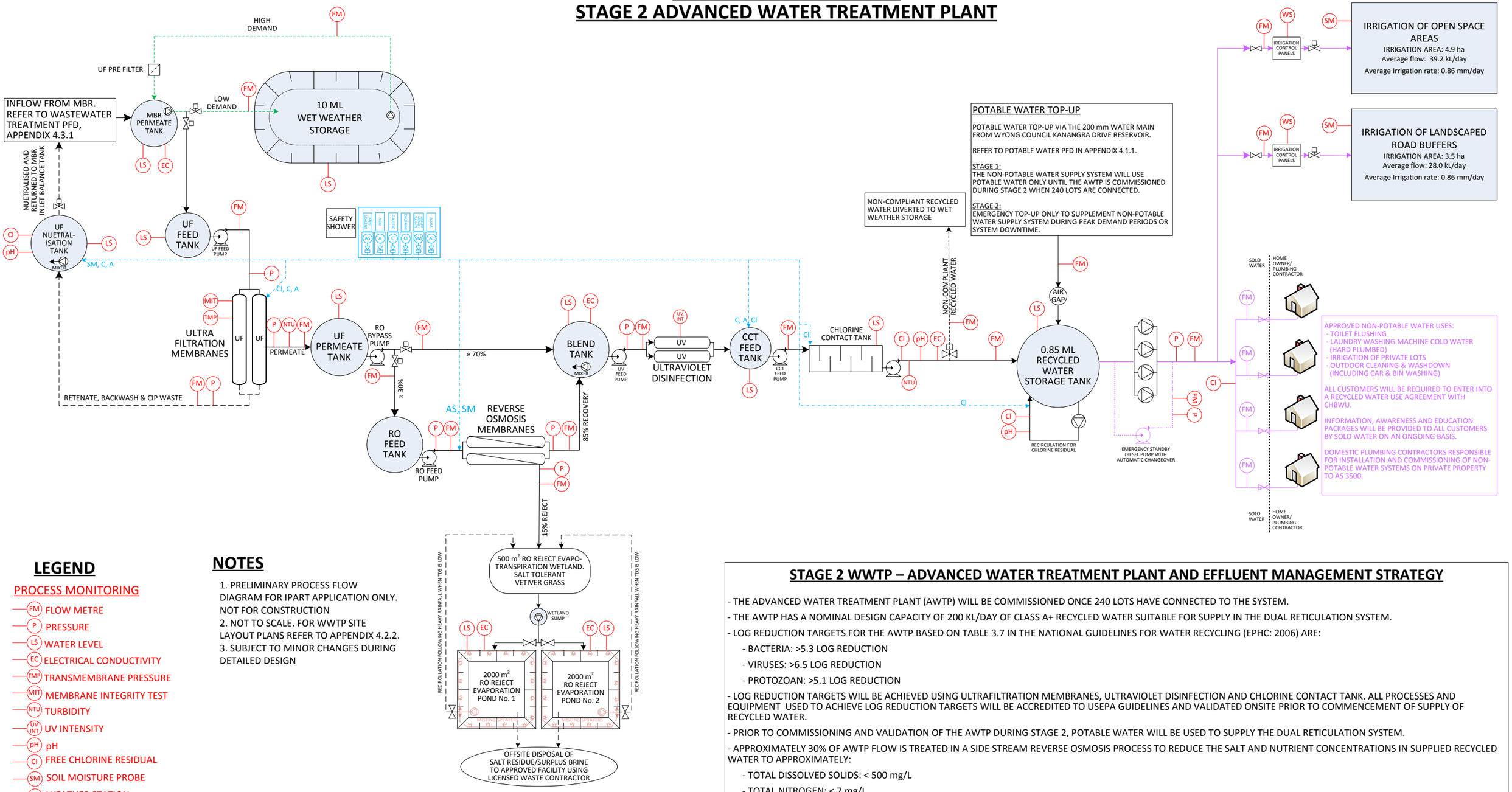
STAGE 1 TEMPORARY IRRIGATION AREA
(up to 240 lots or 100 kL/day)
IRRIGATION AREA: 10.8 ha

LEGEND

- POTABLE WATER PRESSURE BOOSTER PUMP SET WITH VARIABLE SPEED DRIVE
- NON-POTABLE WATER PRESSURE BOOSTER PUMP SET WITH VARIABLE SPEED DRIVE
- EMERGENCY STANDBY DEISEL PUMP WITH AUTOMATIC CHANGEOVER
- EMERGENCY STANDBY DEISEL PUMP WITH AUTOMATIC CHANGEOVER
- POTABLE WATER
- CLASS A+ RECYCLED WATER
- MBR + UV PERMEATE
- STAGE 1 TEMPORARY IRRIGATION
- REVERSE OSMOSIS REJECT
- UF RETENATE
- MBR WASTE SLUDGE
- PRESSURE SEWER

CLIENT:	PROJECT:	PHASE:	PRIVATE WATER UTILITY:	DRAWING TITLE:	DRAWING NUMBER:	IPART REFERENCE:
ROSE PROPERTY GROUP PTY LTD	CATHERINE HILL BAY RESIDENTIAL SUBDIVISION MONTEFIORE STREET, CATHERINE HILL BAY	IPART LICENSE APPLICATION	CATHERINE HILL BAY WATER UTILITY PTY LTD	PROCESS FLOW DIAGRAM OVERALL	H10052_P01C	APPENDIX 4.1.1
					DATE: 05/07/2013	

PROCESS FLOW DIAGRAM
STAGE 2 ADVANCED WATER TREATMENT PLANT



LEGEND

PROCESS MONITORING

- FM FLOW METRE
- P PRESSURE
- LS WATER LEVEL
- EC ELECTRICAL CONDUCTIVITY
- TMP TRANSMEMBRANE PRESSURE
- MIT MEMBRANE INTEGRITY TEST
- NTU TURBIDITY
- UV INT UV INTENSITY
- pH pH
- CI FREE CHLORINE RESIDUAL
- SM SOIL MOISTURE PROBE
- WS WEATHER STATION

PROCESS EQUIPMENT

- ADVANCED WATER TREATMENT PLANT PROCESS TANKS
- ULTRAFILTRATION MEMBRANE SKID
  NOMINAL MEMBRANE PORE SIZE 0.03 UM
  INTEGRITY TESTING BY PRESSURE DECAY
  USEPA ACCREDITED MEMBRANES SUPPLIED BY X-FLOW
- BRACKISH WATER REVERSE OSMOSIS SKID
- ULTRAVIOLET DISINFECTION SYSTEM
  SELF CLEANING SYSTEM WITH UV INTENSITY MONITORING
  NOMINAL UV DOSE OF 85 J/m2 @ UV TRANSMISSION OF 60%
  USEPA ACCREDITED UV DISINFECTION SYSTEM SUPPLIED BY ORICA
- CHLORINE CONTACT TANK
  CONTACT TANK WILL BE DESIGNED TO USEPA GUIDELINES TO ACHIEVE CT VALUES FOR THE REQUIRED LOG REMOVAL TARGETS.

- SUBMERSIBLE PUMP
- DRY-MOUNTED PUMP
- MIXING PUMP
- MOTORISED VALVE
- MANUAL VALVE
- EVAPORATION MISTING SPRAYERS
- UF PRE FILTER

PROCESS CHEMICALS

- BUNDED CHEMICAL STORAGE AREA
- BUNDED CHEMICAL CONTAINERS AND DOSING PUMPS
- CHEMICAL DELIVERY LINES
- AS REVERSE OSMOSIS MEMBRANE ANTISCALENT
- CI SODIUM HYPOCHLORITE FOR CHLORINATION
- SM SODIUM METABISULPHIDE DOSING FOR DECHLORINATION
- C SODIUM HYDROXIDE (CAUSTIC) FOR pH CORRECTION AND MEMBRANE CLEANING
- A HYDROCHLORIC ACID FOR pH CORRECTION AND MEMBRANE CLEANING

NOTES

1. PRELIMINARY PROCESS FLOW DIAGRAM FOR IPART APPLICATION ONLY. NOT FOR CONSTRUCTION
2. NOT TO SCALE. FOR WWTP SITE LAYOUT PLANS REFER TO APPENDIX 4.2.2.
3. SUBJECT TO MINOR CHANGES DURING DETAILED DESIGN

STAGE 2 WWTP – ADVANCED WATER TREATMENT PLANT AND EFFLUENT MANAGEMENT STRATEGY

- THE ADVANCED WATER TREATMENT PLANT (AWTP) WILL BE COMMISSIONED ONCE 240 LOTS HAVE CONNECTED TO THE SYSTEM.
- THE AWTP HAS A NOMINAL DESIGN CAPACITY OF 200 KL/DAY OF CLASS A+ RECYCLED WATER SUITABLE FOR SUPPLY IN THE DUAL RETICULATION SYSTEM.
- LOG REDUCTION TARGETS FOR THE AWTP BASED ON TABLE 3.7 IN THE NATIONAL GUIDELINES FOR WATER RECYCLING (EPHC: 2006) ARE:
  - BACTERIA: >5.3 LOG REDUCTION
  - VIRUSES: >6.5 LOG REDUCTION
  - PROTOZOAN: >5.1 LOG REDUCTION
- LOG REDUCTION TARGETS WILL BE ACHIEVED USING ULTRAFILTRATION MEMBRANES, ULTRAVIOLET DISINFECTION AND CHLORINE CONTACT TANK. ALL PROCESSES AND EQUIPMENT USED TO ACHIEVE LOG REDUCTION TARGETS WILL BE ACCREDITED TO USEPA GUIDELINES AND VALIDATED ONSITE PRIOR TO COMMENCEMENT OF SUPPLY OF RECYCLED WATER.
- PRIOR TO COMMISSIONING AND VALIDATION OF THE AWTP DURING STAGE 2, POTABLE WATER WILL BE USED TO SUPPLY THE DUAL RETICULATION SYSTEM.
- APPROXIMATELY 30% OF AWTP FLOW IS TREATED IN A SIDE STREAM REVERSE OSMOSIS PROCESS TO REDUCE THE SALT AND NUTRIENT CONCENTRATIONS IN SUPPLIED RECYCLED WATER TO APPROXIMATELY:
  - TOTAL DISSOLVED SOLIDS: < 500 mg/L
  - TOTAL NITROGEN: < 7 mg/L
  - TOTAL PHOSPHORUS: < 0.25 mg/L
- OPERATION OF THE AWTP IS FULLY AUTOMATED AND INTEGRATED WITH THE OPERATION OF THE MBR & DUAL RETICULATION SYSTEM USING THE DIRECT DIGITAL CONTROL SYSTEM.
- ALL ONLINE MONITORING, CONTROL AND ALARM SYSTEMS CAN BE REMOTELY ACCESSED THROUGH THE INTERNET. ALL DATA IS LOGGED FOR REVIEW AND TROUBLE SHOOTING.
- THE AWTP IS DESIGNED TO AUTOMATICALLY SHUT DOWN IF NON-COMPLIANT RECYCLED WATER IS DETECTED THROUGH CONTINUOUS ONLINE MONITORING.
- THE NON-POTABLE WATER STORAGE TANK PROVIDES APPROXIMATELY 1-DAY STORAGE AT PEAK RECYCLED WATER DEMANDS. THE DUAL RETICULATION SYSTEM WILL BE SUPPLEMENTED BY A POTABLE WATER TOP-UP DURING PERIODS OF EXTENDED PEAK DEMAND OR SYSTEM FAILURE.
- A RECYCLED WATER MANAGEMENT PLAN (RWMP) WILL BE DEVELOPED FOR THE SCHEME DURING DETAILED DESIGN. THE RWMP WILL THE OUTLINE RISK ASSESSMENT, CRITICAL CONTROL POINTS, MONITORING AND VALIDATION REQUIREMENTS FOR THE SCHEME.
- SURPLUS CLASS A+ RECYCLED WATER NOT REUSED ON PRIVATE LOTS (APPROXIMATELY 40% OR 67 KL/DAY) WILL BE MANAGED BY IRRIGATION OF 4.9 HA OF OPEN SPACE AREAS AND 3.5 HA OF LANDSCAPED ROAD BUFFERS

CLIENT:	PROJECT:	PHASE:	PRIVATE WATER UTILITY:	DRAWING TITLE:	DRAWING NUMBER:	IPART REFERENCE:
ROSE PROPERTY GROUP PTY LTD	CATHERINE HILL BAY RESIDENTIAL SUBDIVISION MONTEFIORE STREET, CATHERINE HILL BAY	IPART LICENSE APPLICATION	CATHERINE HILL BAY WATER UTILITY PTY LTD	PROCESS FLOW DIAGRAM NON-POTABLE WATER	H10052_P03B DATE: 05/07/2013	APPENDIX 4.2.1

Description of proposed non-potable water infrastructure

<table>
<tr><th>Non-Potable Water Infrastructure</th><th>Description</th></tr>
<tr><td>Non-potable water source and wastewater minimisation</td><td>
During Stage 1 only potable water is used to supply the non-potable water reticulation system until the Advanced Water Treatment Plant (AWTP) is constructed in Stage 2. The AWTP is described in further detail below.

Stage 2 source water for the AWTP once constructed will be “Class A” Membrane Bioreactor (MBR) + Ultraviolet disinfection (UV) treated effluent from the permeate tank or from the 10 ML wet weather storage during periods of high demand.

The raw wastewater source for the CHBWU scheme is domestic wastewater collected from a predominately residential catchment. Residential customer supply agreements and trade waste agreements will be entered into with each customer resulting in a low risk of trace contaminants being present in recycled water.

For more details about the MBR+UV process and wet weather storage refer Appendix 4.3.1.
</td></tr>
<tr><td>Advanced Water Treatment Plant (AWTP)</td><td>
Once the AWTP is commissioned in Stage 2, 100% of MBR+UV effluent is treated in the AWTP to produce “Class A+” recycled water suitable for supply in the dual reticulation system. The AWTP has nominal capacity of 200 kL/day designed to treat all wastewater produced in the scheme. The proposed AWTP is a multiple barrier treatment system with the following unit processes:
• Ultrafiltration membranes;
• Ultraviolet disinfection;
• Chlorine contact tank; and
• Side stream reverse osmosis for salinity control.

All treatment equipment used in the AWTP for pathogen control will be accredited to USEPA standards by the manufacturer. Design, commissioning, validation and operation of equipment will be undertaken in compliance with manufacturer and USEPA accreditation requirements.

The Solo Water AWTP received approval by the Victorian Department of Health and Safety (DHS) in 2008 (WA65106) for the log reduction targets outlined below. The AWTP log reductions approved by Victorian DHS exceed the required log reduction targets outlined in the National Guidelines for Water Recycling (AGWR: 2006) as summarised in the following table.
<table>
<tr><th></th><th>Log Reduction Target
(from Table 3.7 AGWR: 2006)</th><th>Log Reduction Claimed
(Victorian DHS Approval: 2008)</th></tr>
<tr><td>Bacteria</td><td>> 5.3 log reduction</td><td>> 8 log reduction</td></tr>
<tr><td>Viruses</td><td>> 6.5 log reduction</td><td>> 7.5 log reduction</td></tr>
<tr><td>Protozoan</td><td>> 5.1 log reduction</td><td>> 6.5 log reduction</td></tr>
</table>
In addition to the above log reduction targets the AWTP is expected to achieve the following recycled water quality targets:
• Turbidity <1 NTU
• BOD <5mg/L
• SS <5mg/L
• pH 6.5-8.5
• TN <7mg/L
• TP <0.25mg/L
• TDS <500mg/L
</td></tr>
</table>

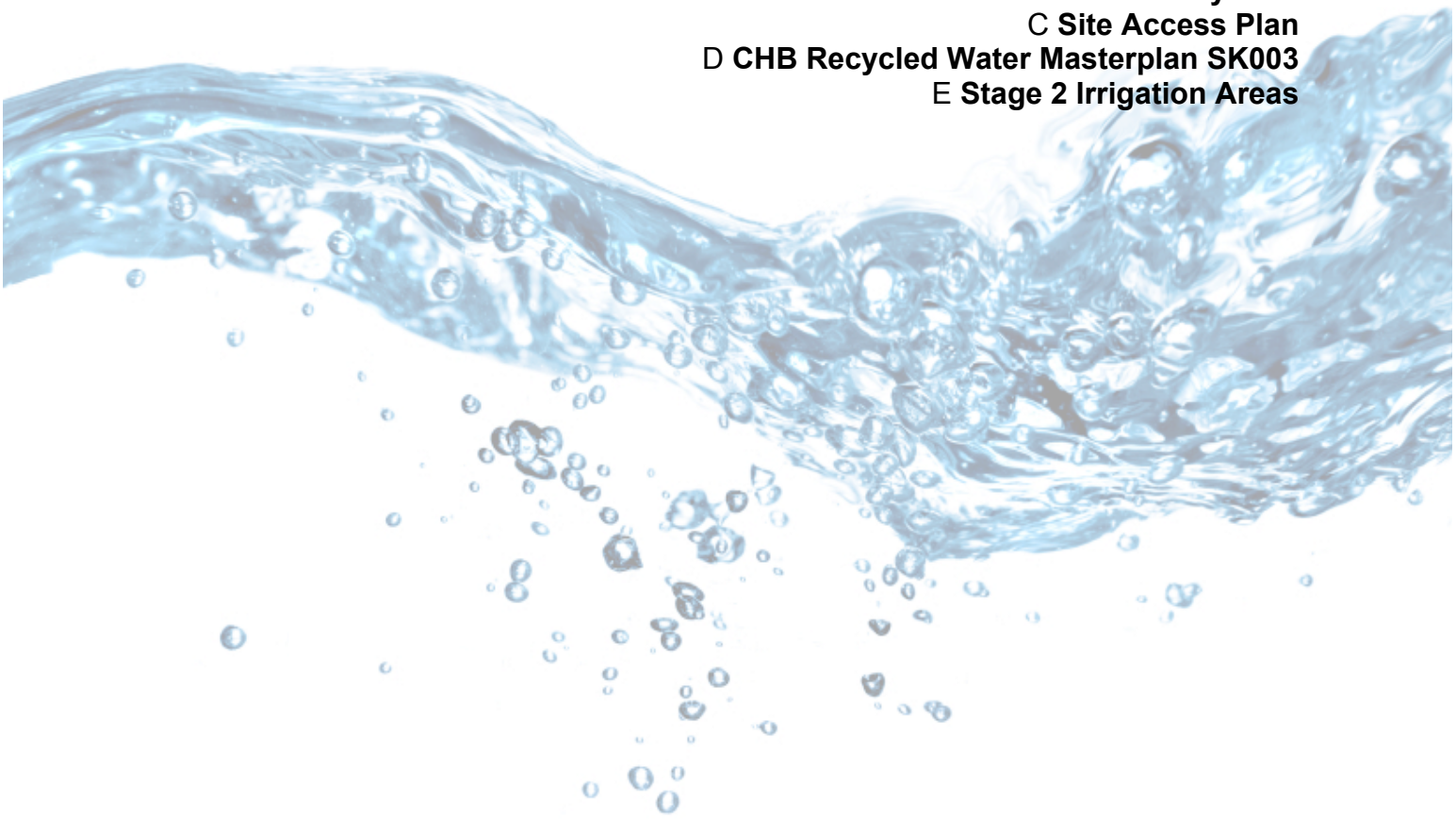
Non-Potable Water Infrastructure	Description
Ultrafiltration membranes	The Solo Water AWTP uses USEPA accredited Ultrafiltration membranes supplied by X-Flow. The system will be skid mounted for easy installation and maintenance. The membranes will operate under an inside→out cross flow arrangement and will include (subject to detailed design): • Continuous online monitoring of permeate turbidity with alarms and automatic shutdown; • Direct membrane integrity testing via air pressure decay with alarms and automatic shutdown; • Continuous online monitoring and alarms on trans-membrane pressure and flux with alarms; • Automatically scheduled chemical cleaning regimes; The UF system is continuously monitored and controlled using the Direct Digital Control System and is designed to raise an alarm and/or automatically shut down if high turbidity or loss of membrane integrity is detected.
Ultraviolet disinfection	The Solo Water AWTP uses an USEPA accredited UV Disinfection system supplied by Orica. Typical details of the UV disinfection system include (subject to detailed design): • Design UV dose of 85 J/m2 at a UV Transmission of 60%; • Continuous online monitoring of UV intensity with alarms and automatic shutdown; • Continuous online monitoring of lamp failure and run time with alarms and automatic shutdown; • Continuous online monitoring of UV reactor flow with alarms and automatic shutdown; • Self cleaning functions on the UV reactor and lamps; The UV system is continuously monitored and controlled using the Direct Digital Control System and is designed to raise an alarm and/or automatically shut down if low UV Intensity, high flow or lamp fault is detected.
Chlorine contact tank	The Solo Water AWTP uses a Chlorine Contact Tank (CCT) designed to USEPA standards. Typical details of the CCT include (subject to detailed design): • Continuous online monitoring of free chlorine residual, pH and temperature at the outlet of the CCT; • Continuous online monitoring of flow and water level in the CCT for detention time control; • Automatically controlled chemical dosing systems for pH correction and chlorine dosing; • Baffled tank designed to maximise plug flow and mixing in the reactor. The CCT is continuously monitored and controlled using the Direct Digital Control System and is designed to raise an alarm and/or automatically shut down if low free chlorine residual or low detention time is detected.
Reverse Osmosis	The AWTP also includes a side stream Reverse Osmosis (RO) process for salinity control in the dual reticulation system. Approximately 30% of UF membrane permeate will be treated using a skid mounted RO membrane system. RO treated water is then blended back with the 70% RO bypass water in a mixing tank. Typical details of the RO system include (subject to detailed design): • Continuous online monitoring of TDS/EC in the feed water and blended water tank; • The split of flow to the RO is automatically controlled to maintain TDS in the blended water tank at around 500 mg/L; • Maximise RO recovery rate of 85% to minimise RO reject waste volumes; The RO is used for salinity control and no pathogen log reduction credits are claimed for the RO unit.

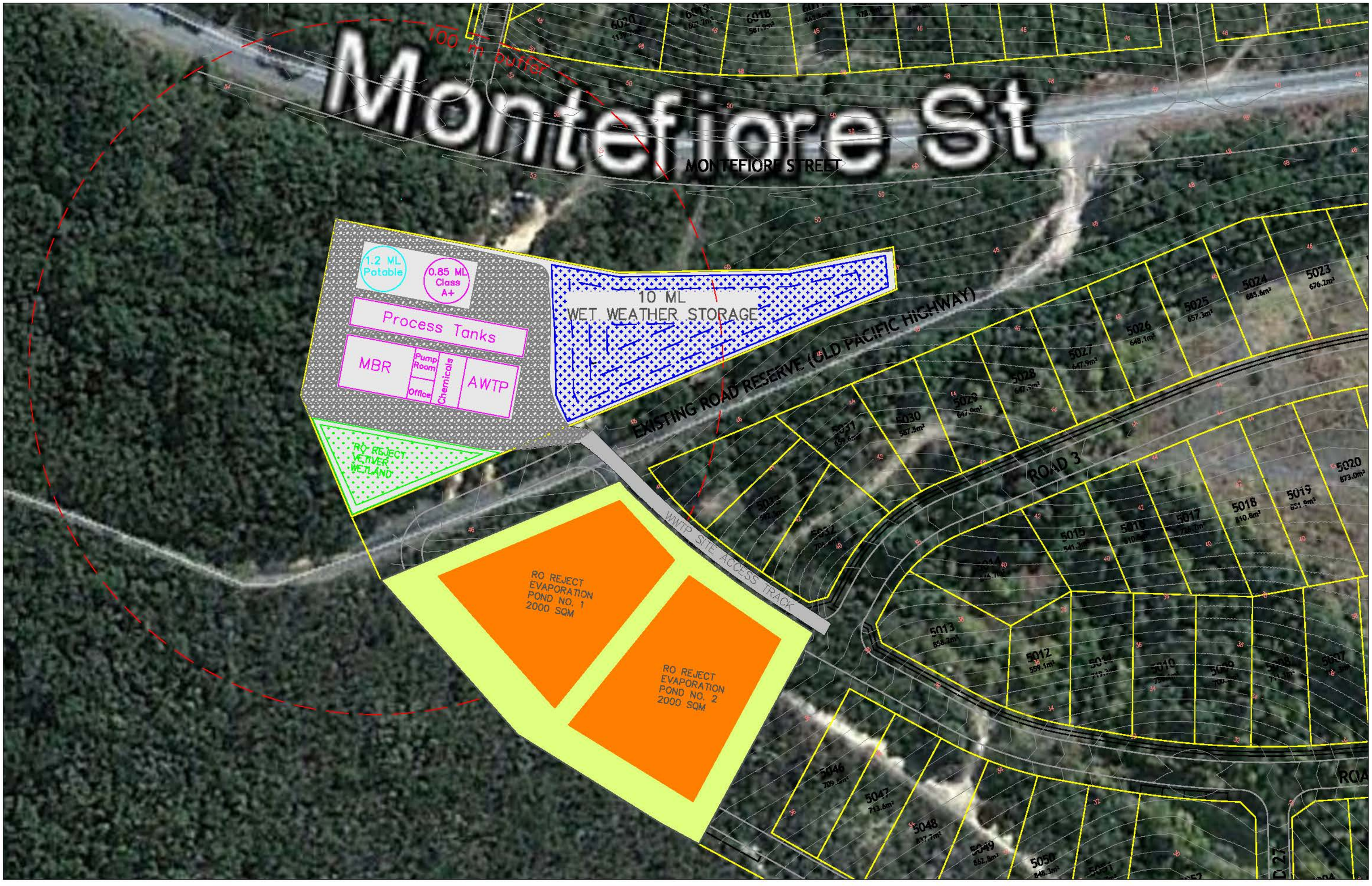
Non-Potable Water Infrastructure	Description
RO Reject Wetland and Evaporation ponds	RO reject wastewater from the RO process will be managed using: • Trade waste and residential customer supply contracts with limits and advice on salt disposal and selection of appropriate cleaning chemicals; • Maximum recovery rate for the RO unit at 85%; • 500 m^2 of subsurface flow wetland planted with salt tolerant Monto Vetiver Grass; • 2 x 2000 m^2 evaporation ponds with black HDPE liner and spray misting system to maximise evaporation rates.
Non-Potable Water Storage Tank	Compliant AWTP treated non-potable water will be stored in a 0.85 ML non-potable water storage tank. This tank provides around 3 days storage at average flows or approximately 1 day storage during periods of peak irrigation demand. The non-potable water storage tank will include: • Recirculation loop with continuous online monitoring of pH and free chlorine residual with automated dosing system to prevent loss of chlorine residual during storage; • Level sensors to start/stop the AWTP and for emergency top-up from the potable water system if the AWTP is shut down; • Potable water top-up to be via a 300 mm air gap above the high level overflow level for cross connection control; • Non-potable water tanks designed to potable water standards to restrict vermin & mosquito access and for compatible tank materials to prevent contamination during storage.
Non-Potable water reticulation system	During Stage 1 only potable water is used to supply the non-potable water reticulation system until the AWTP is constructed in Stage 2. During Stage 2, non-potable water from the non-potable water storage tank is supplied to customers using the non-potable water reticulation system. Pressure to the reticulation network is provided using a variable speed pressure booster pump set with standby diesel pumps as backup for use during power outages. The non-potable water reticulation system will include (subject to detailed design): • Pressure booster pump set to maintain pressure in the downstream network a minimum of 50 kPa below pressure in the potable water network across a wide range of flows; • Emergency standby diesel pumps with automatic changeover will be used to supply flow and pressure during power outage; • Non-potable water reticulation pipe in the common services trench to be laid below potable water pipes with appropriate identification labelling and separation distances; • Sampling points throughout the network and at the furthest point in the network for collection of non-potable water samples to enable verification monitoring; • Monitoring of pressure and salinity differential between the drinking and non-potable water networks will be undertaken to assist with detecting cross connections. • Different pipe material and colour to that in the potable water network to reduce the potential for cross connection. The potable water mains will use blue PVC pipe and the non-potable water network will use lilac striped HDPE pipe.
Non-Potable water uses	The intended uses of non-potable water supplied from the dual reticulation system are: • Toilet flushing • Laundry washing machine cold water supply (hard plumbed) • Irrigation of private lots • Outdoor cleaning and wash down (including car and bin washing) • Open space irrigation areas

Non-Potable Water Infrastructure	Description
Stage 2 (ultimate) Open Space Irrigation	Following construction of the AWTP in stage 2, the surplus "Class A+" not reused on private lots will be managed by open space irrigation areas that will consist of 3.5 ha of landscaped road buffers and 4.9 ha of open space areas. The average open space irrigation flow rate will be approximately 67.3 kL/day with low average irrigation rates of <0.9 mm/day. All irrigation water will be stored in a 0.85 ML recycled water storage tank. The use of "Class A+" water for irrigation minimises the health and environmental risks associated with irrigation of effluent. An Irrigation Management Plan will be developed for the ultimate open space irrigation scheme that will outline site specific irrigation controls and will include (but not limited to): • Irrigation of high quality "Class A+" recycled water. • Irrigation scheduling controls to control the time, frequency and duration of irrigation events. • Soil moisture probes and weather station override on irrigation controllers to prevent irrigation during rainfall, high wind or elevated soil moisture content. • Site based storm water runoff and environmental controls. • Surface sprinklers with spray drift control including sprinkler nozzles that operate under low pressure with a large droplet size and low throw height. • Monitoring to detect any potential impacts.
Integrated online monitoring, control and alarm system	Continuous online monitoring, control and alarms for the non-potable water infrastructure is centrally managed using the direct digital control system. The control system allows the infrastructure to operate unattended and automatically reports issues requiring operator attention. Online monitoring probes are manually calibrated and checked by operations staff on a routine basis to ensure all probes are recording accurate readings. All critical alarm system have a battery backup to ensure faults are reported during power failure. The control system is designed to automatically recover following power outage.

Appendix 4.2.3 **Water Infrastructure**

A **WWTP Site Layout P10A**
B **Site Locality Plan**
C **Site Access Plan**
D **CHB Recycled Water Masterplan SK003**
E **Stage 2 Irrigation Areas**





ISSUE	DATE	ISSUE DETAILS
C	10/7/13	ADJUSTED RO REJECT POND & ADDED WWTP SITE ACCESS TRACK
B	15/5/13	ADJUSTED RO REJECT POND
A	30/3/13	WWTP LAYOUT FOR IPART APPLICATION

harvest
water management consultants pty ltd
184 Rivergum Drive
Burpengary, Qld 4505
0488 427 878
office@harvestwmc.com.au
www.harvestwmc.com.au
ABN: 54140 844 047

CLIENT: SOLO WATER – CATHERINE HILL BAY WATER UTILITY

PROJECT: CATHERINE HILL BAY RESIDENTIAL SUBDIVISION ROSE GROUP

SITE: MONTEFIORE ROAD CATHERINE HILL BAY NSW

DESIGN: BI | DRAWN: BI | APPROVED: BI

Bradley Irwin RPEQ (10837) CPENG NPER Environmental Engineer

SIGNED: _____ DATE: _____
for and on behalf of Harvest Water Management Consultants Pty Ltd

DRAWING TITLE: WASTEWATER TREATMENT PLANT SITE LAYOUT

PROJECT NO.: H10052

SCALE: 1:1000 at A3 (0, 10, 20, 30, 40, 50)

DWG TYPE: CONCEPT ONLY NOT FOR CONSTRUCTION

DWG NO.: P10

ISSUE: C

ISSUE	DATE	ISSUE DETAILS
C	10/7/13	ADJUSTED RO REJECT POND & ADDED WWTP SITE ACCESS TRACK
B	15/5/13	ADJUSTED RO REJECT POND
A	26/3/13	WWTP LAYOUT FOR IPART APPLICATION

harvest
water management consultants pty ltd
164 Rivergum Drive
Burpengary, Qld 4505
0488 427 878
brad@harvestwmc.com.au
www.harvestwmc.com.au
ABN: 54140 844 047

CLIENT: SOLO WATER – CATHERINE HILL BAY WATER UTILITY

PROJECT: CATHERINE HILL BAY RESIDENTIAL SUBDIVISION ROSE GROUP

SITE: MONTEFIORE ROAD CATHERINE HILL BAY NSW

DESIGN	DRAWN	APPROVED
BI	BI	BI

Bradley Irwin RPEQ (10837) CPENG NPER
Environmental Engineer
Signed on behalf of Harvest Water Management Consultants Pty Ltd

DRAWING TITLE: WASTEWATER TREATMENT PLANT SITE LAYOUT AND OVERALL SITE

SCALE: 1:4000 at A3 (0, 40, 80, 120, 160, 200)

DWG TYPE: PRELIMINARY

PROJECT NO.: H10052

DWG NO.: P10.1

ISSUE: C

211688 CHB SK 07_B

WWTP SITE

Pt.5040
7340.2m²

EXISTING ROAD RESERVE (OLD PACIFIC HIGHWAY)

PROPOSED RETAINING WALL
(MAX. HEIGHT 1.8m)

MAX. 1:4

EVAPORATION BASIN
SURFACE AREA=2003m²
DEPTH=1.0m

PROPOSED RETAINING WALL
(MAX. HEIGHT 1.0m)

MAX. 1:5

MAX. 1:5

Pt.5040
7226.4m²

EVAPORATION BASIN
SURFACE AREA=2015m²
DEPTH=1.0m

PROPOSED RETAINING WALL
(MAX. HEIGHT 2.8m)

MAX. 1:3

MAX. 1:3

MAX. 1:3

PROPOSED RETAINING WALL
(MAX. HEIGHT 2.8m)

PROPOSED RETAINING WALL
(MAX. HEIGHT 2.8m)

WWTP SITE ACCESS TRACK

1.00

1.00

8m WIDE PAVEMENT

8m WIDE PAVEMENT

6m WIDE PAVEMENT

5032
828.6m²

5033
1164.8m²

5031
659.6m²

5030
587.5m²

5029
647.9m²

5028
647.9m²

5027
647.9m²

5026
648.1m²

5025
657.3m²

5024
685.6m²

5023
676.2m²

5022
621.2m²

4006
622.2m²

5014
846.7m²

5015
541.3m²

5016
610.5m²

5017
726.7m²

5018
810.8m²

5019
851.9m²

5020
873.0m²

5021
634.2m²

4007
652.5m²

4008
683.9m²

4009
645.4m²

5013
858.2m²

5012
559.1m²

5011
719.3m²

5010
758.1m²

5009
700.2m²

5008
741.1m²

5007
761.3m²

5006
852.8m²

5005
662.0m²

5034
881.8m²

5035
713.6m²

5036
837.7m²

5037
862.8m²

5038
848.3m²

5039
752.7m²

5041
1796.2m²

5004
795.8m²

5003
727.4m²

5002
734.0m²

5001
735.4m²

NATIONAL PARK

M.C.A.

100mm AT FULL SIZE

REV.	DATE	AMENDMENT	DESIGN	DRAWN	CHECKED	APPROVED
A	11/6/13	FOR INFORMATION ONLY	J.Y.	A.M.	N.D.	
B	9/7/13	FOR INFORMATION ONLY	J.Y.	J.D.	N.D.	

DESIGN FILE S:\

SCALES
0 10 20 A1 / A3
1:500 / 1:1000

ALL DIMENSIONS ARE IN METRES. DO NOT SCALE

adw johnson
Central Coast
2 Bounty Close,
P.O. Box 3717,
Tuggerah N.S.W. 2259
Phone: (02) 4305 4300
Fax: (02) 4305 4399
email: coast@adwjohnson.com.au
www.adwjohnson.com.au
ABN 62 129 445 398

CLIENT
COASTAL HAMLETS
Pty. Ltd.

PROPERTY DESCRIPTION
PLAN OF SUBDIVISION
OF LOTS 100,101,102,103 AND 106 IN D.P. 1129872,
LOT 1 D.P.1151628, LOT 1 D.P.1141989, AND
LOT 1 D.P.1129299.

SURVEYED –
DATUM A.H.D.

PROJECT
CATHERINE HILL BAY

PLAN TITLE
PROPOSED EVAPORATION BASINS
WITH ULTIMATE ROAD CONFIGURATION

PROJECT No.	DISCIPLINE	NUMBER	REV.
211688 –	SK –	07	B

Plotted By: jeremyd Plot Date: 09/07/13 – 12:25 Cad File: S:\211688\Drawings\ENG\WASTE BASIN SKETCH\211688 CHB SK 07_B.dwg

Saved: 04.04.2013, By: kgao
J:\700-Projects\800-Preliminary-Tender\Catherine Hill Bay\Drawings\Street Mains\Catherine Hill Bay_SK003 Recycled Water Masterplan.dwg

Date: 04/04/2013

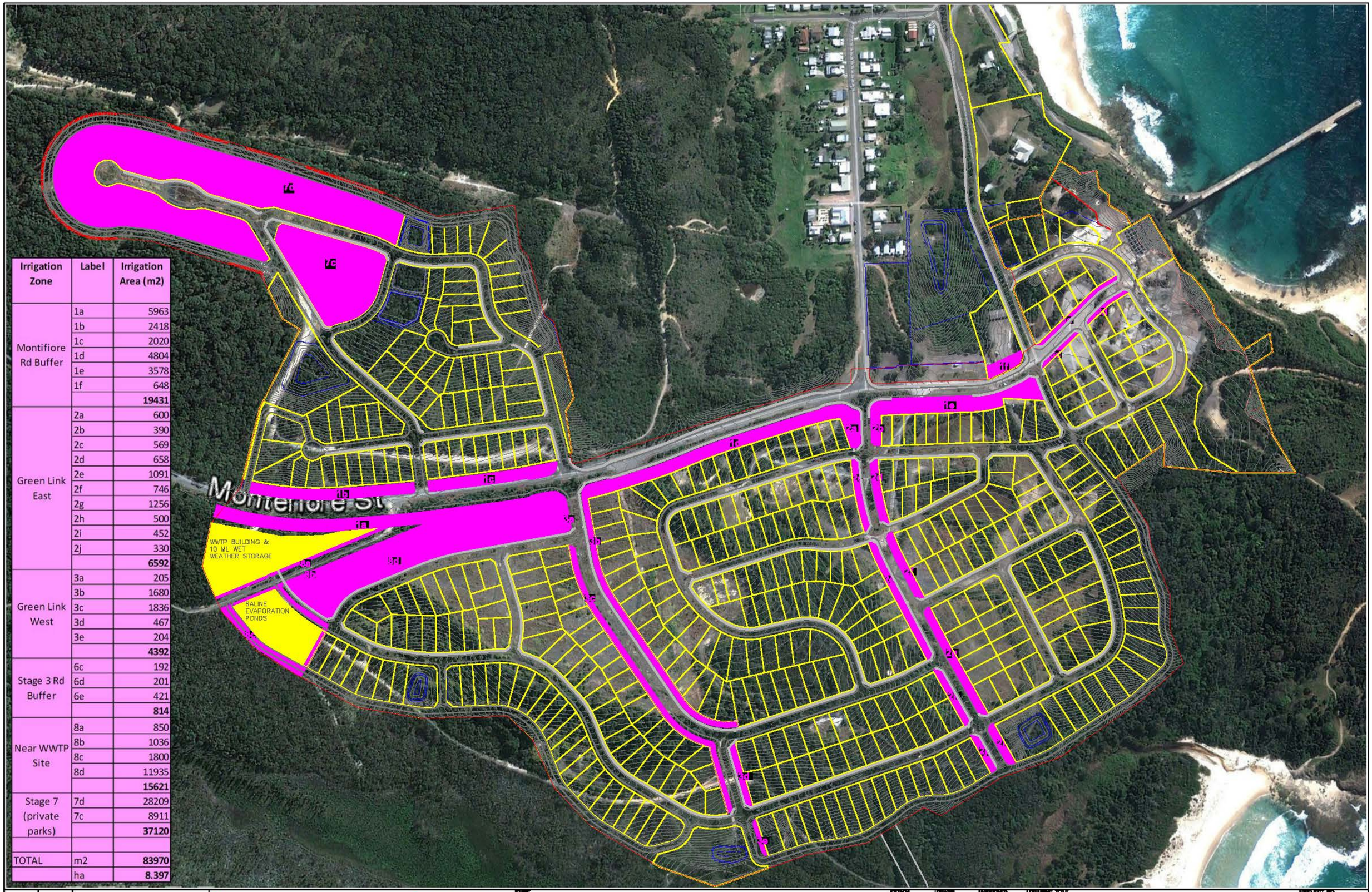
Drawing No: SK003

Rev: A

Scale: 0 20 40 60 80 100m
SCALE 1:2000 AT A1

CATHERINE HILL BAY RECYCLED WATER SCHEME
MASTER PLAN

Solo Water
Pressure System Solutions Pty Ltd
PLANNING, DESIGN & IMPLEMENTATION OF WATER & WASTEWATER
Our Understanding and Experience Provides Certainty
PO Box 630 Jannali NSW 2226
www.pssolutions.net.au
T: +61 2 9584 1177
F: +61 2 9584 1477



Irrigation Zone	Label	Irrigation Area (m2)
Montifiore Rd Buffer	1a	5963
	1b	2418
	1c	2020
	1d	4804
	1e	3578
	1f	648
		19431
Green Link East	2a	600
	2b	390
	2c	569
	2d	658
	2e	1091
	2f	746
	2g	1256
	2h	500
	2i	452
	2j	330
		6592
Green Link West	3a	205
	3b	1680
	3c	1836
	3d	467
	3e	204
		4392
Stage 3 Rd Buffer	6c	192
	6d	201
	6e	421
		814
Near WWTP Site	8a	850
	8b	1036
	8c	1800
	8d	11935
		15621
Stage 7 (private parks)	7d	28209
	7c	8911
		37120
TOTAL	m2	**83970**
	ha	**8.397**

ISSUE	DATE	ISSUE DETAILS
C	6/7/2013	REVISED IRRIGATION AREAS FOR PART APPLICATION
B	26/6/2013	REVISED IRRIGATION AREAS FOR DISCUSSION
A	13/3/2013	FOR LMCC COMMENT

harvest
water management consultants pty ltd
184 Rivergum Drive
Burpengary, Qld 4505
0488 427 878
brad@harvestwmc.com.au
www.harvestwmc.com.au
ABN: 54140 844 047

CLIENT: SOLO WATER – CATHERINE HILL BAY WATER UTILITY

PROJECT: CATHERINE HILL BAY RESIDENTIAL SUBDIVISION ROSE GROUP

SITE: MONTEFIORE ROAD CATHERINE HILL BAY NSW

DESIGN: BI | DRAWN: BI | APPROVED: BI

Bradley Irwin RPEQ (10837) CPENG NPER Environmental Engineer

Signed for and on behalf of Harvest Water Management Consultants Pty Ltd | Date

DRAWING TITLE: 8.3 ha OPEN SPACE EFFLUENT IRRIGATION AREAS WWTP STAGE 2 – 470 LOTS WITH RECYCLING

PROJECT NO.: H10052

SCALE: 1:4000 at A3 (0, 40, 80, 120, 160, 200)

DWG TYPE: CONCEPT NOT FOR CONSTRUCTION

DWG NO.: P09–2

ISSUE: C