

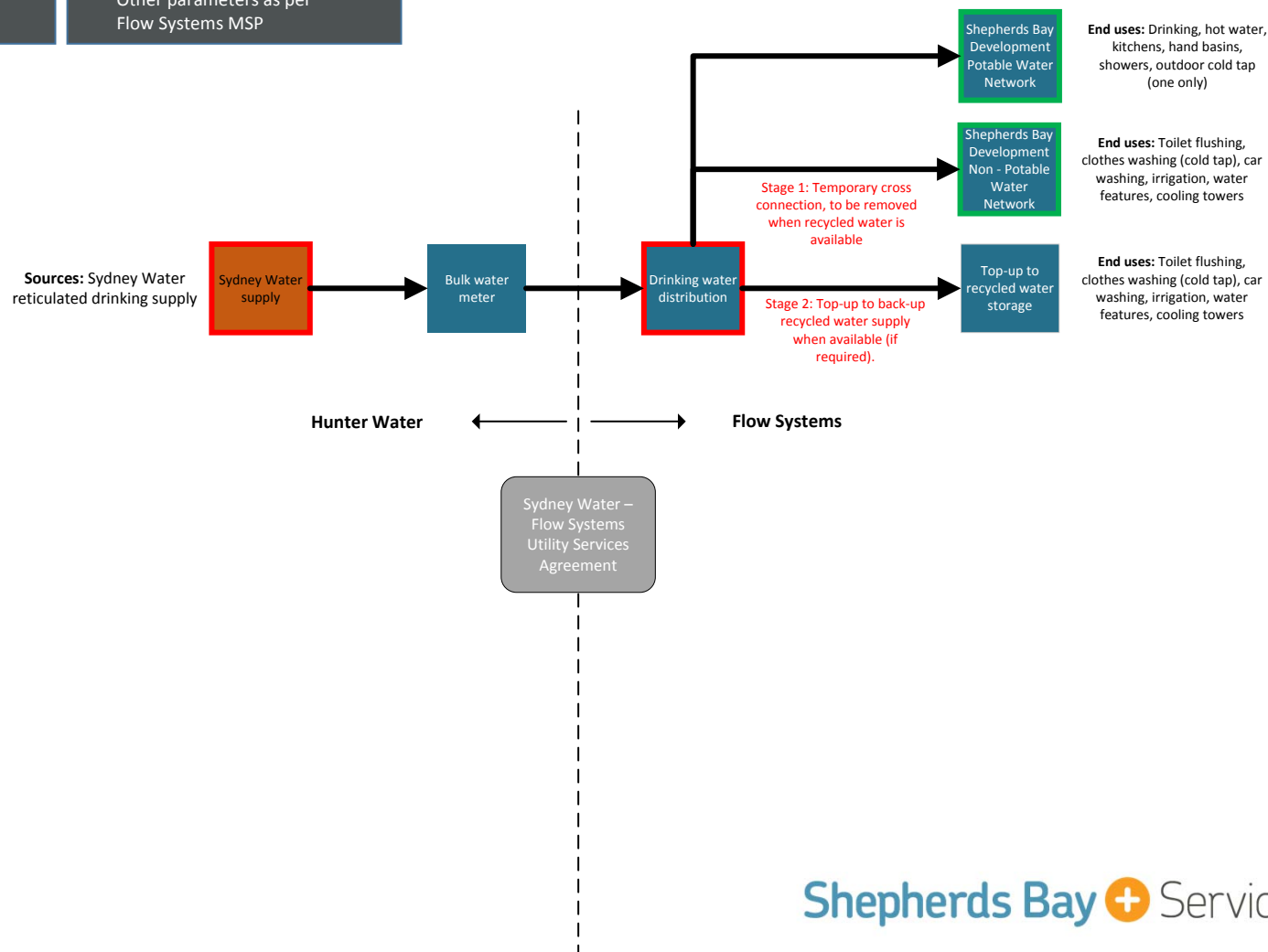
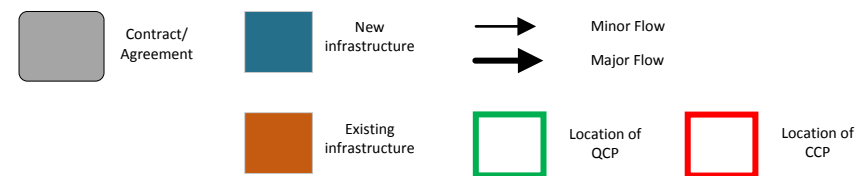
Appendix 4.1.1(a) Process Flow Diagram (Drinking Water)

Quality Control Points (QCP) for Water Quality

Bulk water meter
Free Chlorine
pH
Drinking Water Distribution
Turbidity
Pressure

Critical Control Points (CCP) for Water Quality

Drinking Water Supply
Turbidity
pH
Free Chlorine
Other parameters as per Flow Systems MSP

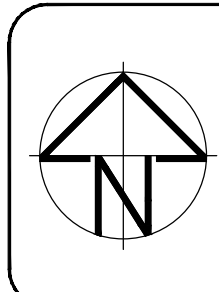


Shepherds Bay + Services

Appendix 4.1.1(c) Drinking Water Reticulation Masterplan

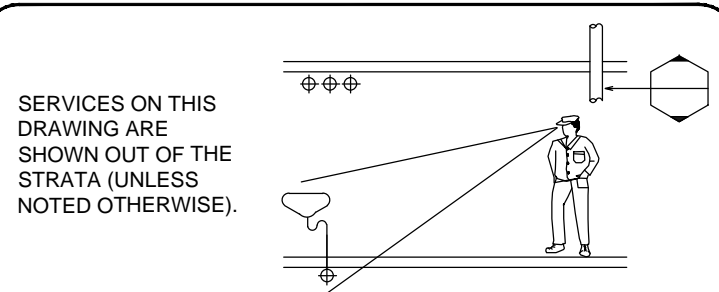


LEGEND	
SRM	SEWER RISING MAIN
SRW	SEWER RISING WATER
RWM	RECYCLED WATER MAIN
CW	COLD WATER MAIN
ES	EXISTING SEWER
AS	SHEPHERDS BAY SERVICES AREA OF OPERATION



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01	AUTHORITY INFORMATION ISSUE		02/08/16



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PROJECT	SHEPHERDS BAY
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DRAWING TITLE	WATER SERVICING MASTER PLAN
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CHECKED	TN
No IN SET	- OF -
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PROJECT No	5954
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REVISION	01

Appendix 4.1.3(a) Scheme Lot and DP References

Shepherds Bay Services
- Area of Operations



Image courtesy of Six Maps

See over for detail

Image courtesy of Six Maps



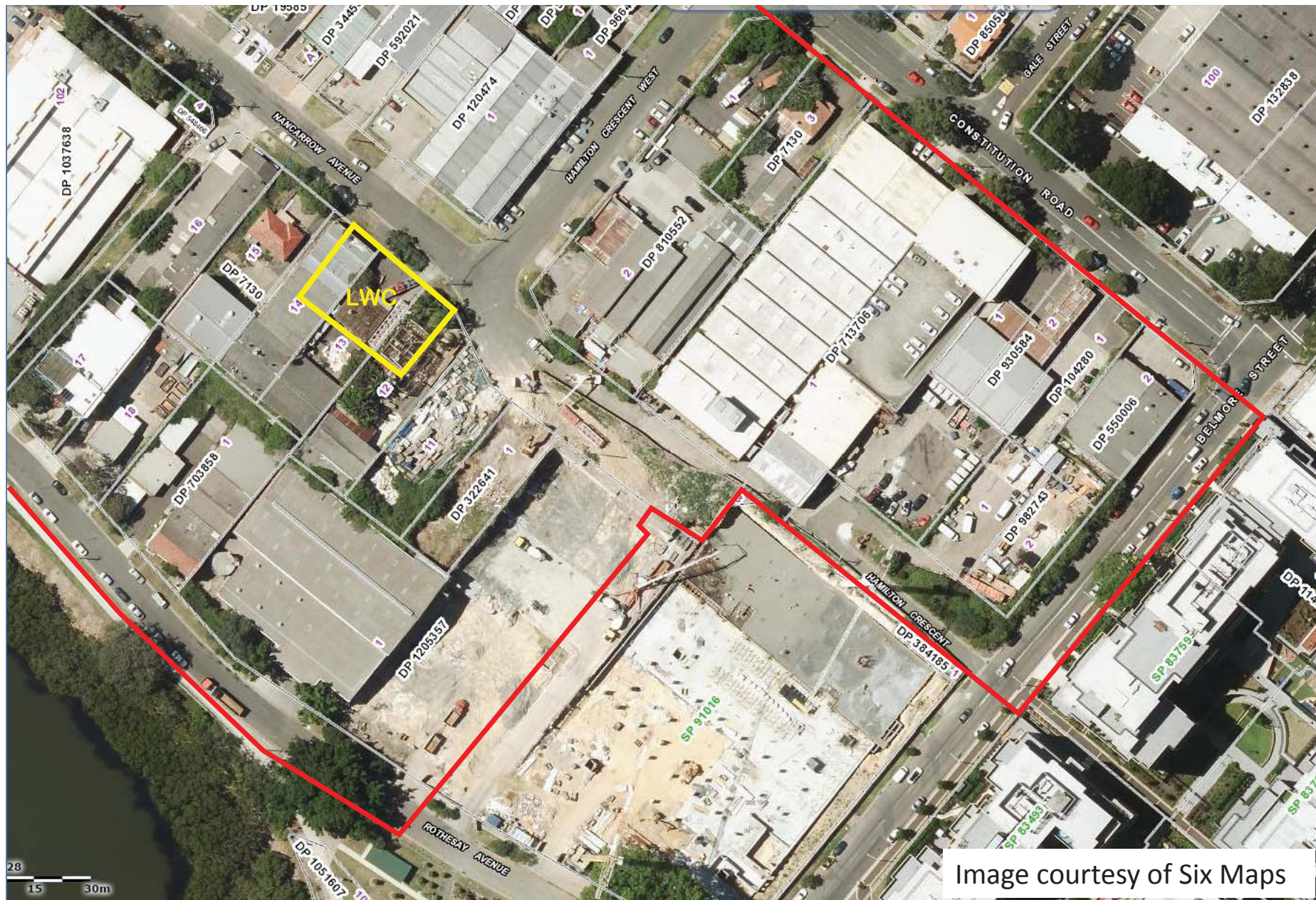


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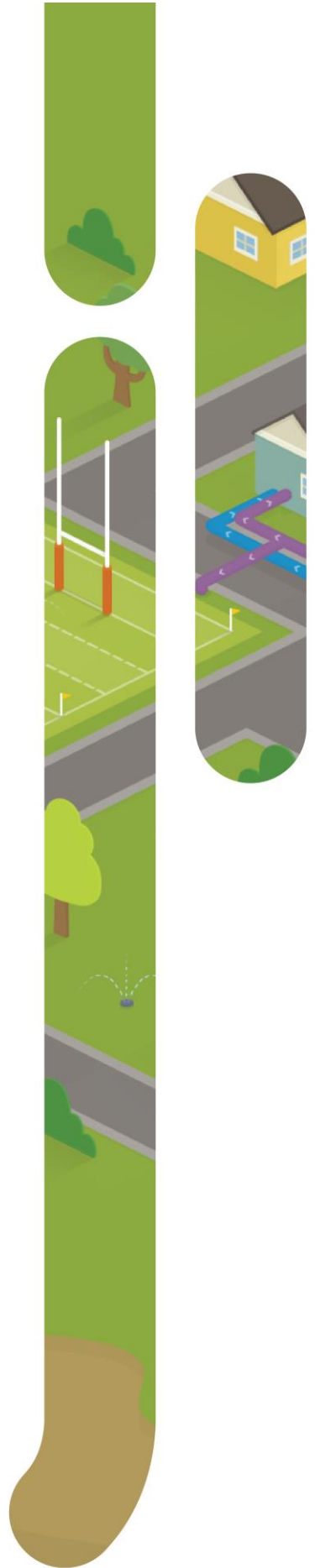
Appendix 4.1.6(a) Shepherd's Bay Water Servicing Strategy Executive Summary



Shepherds Bay

Preliminary Water, Wastewater and Recycled Water Assessment

July 2016



Executive Summary

Introduction

The Shepherds Bay Development covers approximately 35 hectares and is undergoing a fundamental change from an industrial area to a high density residential area. The development comprises of 9 residential building as well as commercial and retail areas. The development is part of a proposed residential urban renewal project located on the northern shores of the Parramatta River in Meadowbank, Sydney. The area is being developed by Holdmark Property Group.

When completed, the Shepherds Bay Development will be a truly sustainable water community with high quality water efficient fixtures and fittings and reduction of potable water use through an onsite Local Water Centre (LWC, a water recycling facility), generating recycled water to service 8 stages of the development. This report excludes Stage 1 building assessment.

A water balance assessment for the development has been undertaken by Kinesis and is provided in Appendix D. This Preliminary Water, Wastewater and Recycled Water Assessment however is based on total demands determined from Water Supply Code of Australia, Sydney Water Edition.

Growth and demands

Based on the apartment numbers, size and occupancy rates, the total population for the development is estimated at 2,931. The expected maximum day water demand is about 1.2 ML/d and recycled water demand is 0.7 ML/d. This assumes >140 units per net hectare (dual reticulation). Where data is available, Sydney Water uses an evidence based approach. The demands determined in this report is conservative and could be revised once Growth Servicing Strategy values are provided by Sydney Water. The evidence based approach is likely to see a reduction in the total demand and could be comparable to the demands adopted in the Kinesis report.

The wastewater flow is expected to be about 450 kL/d based on a consumption rate of 150 L/p/d.

Servicing Strategy

The strategy is based on the information provided by Sydney Water namely Feasibility letter, Notice of Requirements (NOR), case numbers 152348V2, 152349, 152350 and 152351. The strategy for the development includes:

Potable water – The development will be serviced by a new DN200 main along Nancarrow Avenue. As part of the initial development application 152348V2, Sydney Water instructed Holdmark to amplify approximately 720 metres of main to a DN200 providing a frontage to the development site.

Wastewater– Wastewater will be collected from the 8 stages of the development and treated onsite at the LWC. Each pair of stages 2&3, 4&5, 6&7 and 8&9, will have a 10 kL storage and transfer pump station that will pump wastewater to the LWC at Stage 3. Each pump station will have an overflow that will divert excess flows to the closest Sydney Water wastewater main in the event of pump failure. The LWC will have a bypass arrangement prior to the flow balancing tank (FBT). This bypass will have the ability to divert flows if required to the existing 300 mm main on Rothesay Ave.

The internal pumps and rising main to the 'delivery point' will be owned and maintained by the Owners Corporation. Shepherds Bay Services will own and operated the assets beyond the delivery point.

Recycled water – Recycled water will be supplied from the LWC to the 8 stages of the development for the following uses:

- Toilet and washing machine
- Car washing bays
- Irrigation including open space irrigation

During the initial stage prior to the LWC operation, potable water top up to the recycled network will be required. Once construction is completed, potable water top will be provided to the recycled water storage tank.

The recycled water assets will be owned and operated by Flow Systems subsidiary Flow Systems Operations Pty Ltd or its nominee.

Local Water Centre - The LWC will incorporate a combined membrane bioreactor and ultrafiltration system and will operate 24 hours a day. The LWC is proposed to be in operation by 2020. The LWC will be owned and operated by Flow Systems subsidiary Flow Systems Operations Pty Ltd or its nominee. Typical ownership and scheme schematics are provided in Appendix A.

Figure 1 below shows the servicing strategy for the site.

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Appendix 4.1.9(a) Preliminary Risk Assessment Overview

Preliminary Risk Assessment Overview

Purpose

The purpose of undertaking the preliminary risk assessment was to:

- Identify potential risks that may impact the safe and reliable operation of the facility (and associated components), specifically focussed on risks associated with the following:
 - o Potential impacts to public health and/or water quality
 - o Environmental impacts including noise, odour and general environmental impacts
 - o Operational reliability and process performance
 - o Financial viability
 - o Customer Service
- Identify early, potential risk mitigation/control measures that can be incorporated in the design, construction and operation of the facility in order to sufficiently mitigate these risks.
- Facilitate further dialogue with all key stakeholders to ensure all key risks associated with the project are identified and effectively controlled.

Methodology

The risk assessment approach adopted for conducting the preliminary risk assessment for the project was consistent with the recommendations in the Australian Guidelines for Recycled Water Management (AGRW). The process included the following activities:

- **Risk Identification** – The identification of a range of risk related to the project (*what might happen?*)
- **Risk Categorisation** – The categorisation of the risks into various types to aid understanding and to provide context
- **Risk Assessment** – determination of the likelihood and consequence of the unmitigated/uncontrolled risk, see Attachment A for details of the assessment criteria (*what is the likelihood and impact/consequence?*)
- **Managing the Risk / Risk Mitigation** – the identification of appropriate controls to be further developed and implemented as appropriate should the project be approved to proceed (*what can be done to stop it happening?*)
- **Post Mitigation Risk Assessment** – the reassessment of the risk following implementation of appropriate controls to ensure that the risk is sufficiently mitigated (*how effective do we anticipate the controls to be?*)

Outcomes

Identification

In undertaking the preliminary risk assessment a total of 98 key risks were identified across the following areas:

Area	Descriptions
The Catchment	Risks associated with the catchment area including consideration of items such as contamination, volume changes, public health incidents, storage requirements, illegal discharge to sewers etc.
The Sewer Network	Risks associated with the network itself including blockages, pipe or equipment failure, loss of power etc.
Local Water Centre	Consideration of the potential risks associated with the operation of the treatment facility including tank and/or equipment failure, odour, noise, process risks, capacity, power failure, telemetry, vandalism, operator error, flooding etc.
Recycled Water Reticulation and use	Risks associated with the transfer of recycled water from the facility to the users and covered areas such as equipment failure, demand, unauthorised usage, water quality, power failure etc.
Potable Water Distribution	Risks associated with the storage and distribution of potable water to users and considered areas such as equipment failure, demand, unauthorised usage, water quality, security, power failure, etc.
Management	General operations management issues risks that may impact operational reliability or supply surety.

Risks have been summarised at Attachment B as the detailed preliminary risk assessment contains information that is commercial in confidence.

ATTACHMENT A: RISK ASSESSMENT QUALITATIVE CRITERIA

QUALITATIVE MEASURES OF LIKELIHOOD		
Level	Descriptor	Example description
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		
Level	Descriptor	Example description
1	Insignificant	Insignificant impact or non-detectable.
2	Minor	Health - Minor impact for small population.
		Environment - Potentially harmful to local ecosystem with local impacts contained to site.
		Financial - Cost of event and / or rectification is less than \$10K.
3	Moderate	Health - Minor impact for large population.
		Environment - Potentially harmful to regional ecosystem with local impacts primarily contained to site.
		Financial - Cost of event and / or rectification is greater than \$10K but less than \$100K.
4	Major	Health - Major impact for small population.
		Environment - Potentially lethal impact to local ecosystem, predominantly local, but potential for off-site impacts.
		Financial - Cost of event and / or rectification is greater than \$100K but less than \$1,000K.
5	Catastrophic	Health - Major impact for large population.
		Environment - Potentially lethal to regional ecosystem or threatened species; widespread on-site and off-site impacts.
		Financial - Cost of event and / or rectification is greater than \$1,000K.

QUALITATIVE RISK ESTIMATION					
Likelihood	Consequence				
	1- Insignificant	2 - Minor	3 - Moderate	4 - Major	5 - 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

ATTACHMENT B: PRELIMINARY RISK ASSESSMENT SUMMARY

Item	Component	Potential Hazard	Pre-mitigation Risk	Controls	Post-mitigation (Residual) Risk
1	Catchment	Low flow in reticulation generates odour	High	<ul style="list-style-type: none"> Regular flushing of reticulation Interim, staged servicing strategy 	Moderate
		Out of specification feed water for treatment process	High	<ul style="list-style-type: none"> Testing and monitoring Disinfection barriers Education of customer base Utility approval of new connections Buffering tank 	Low
2	Sewage Local Water Centre	Sewage overflow in community	Very High	<ul style="list-style-type: none"> Monitoring Ability to isolate reticulation built into design Registration on DBYD Allow adequate storage in collection tanks 	High
		Sewage overflow at household	Very High	<ul style="list-style-type: none"> Installation of pumps by authorised personnel Monitoring of network Proactive maintenance regime Plumbing checks for infiltration prior to occupancy 	High
		Odour	Very High	<ul style="list-style-type: none"> Design to minimise air entrainment Odour control on air valves Regular replacement of cartridges 	High
3	Recycled Water Local Water Centre	Inability to treat water due to process unit failure	High	<ul style="list-style-type: none"> Duty / standby of equipment Inlet and product water buffer storage Spares of critical equipment on site Monitoring and controls Proactive maintenance regime Experienced operators Maintain Asset Protection Zones Maintain access around LWC for fire fighting Access to water for fire fighting Located above 1 in 100 year flood level Backup generator 	Low
		Product water out of specification due to process failure	Very High	<ul style="list-style-type: none"> Production shut down Duty / standby of equipment Inlet and product water buffer storage Monitoring and controls Proactive maintenance regime Experienced operators 	Moderate
		Noise and odour	Very High	<ul style="list-style-type: none"> Odour and noise modelling at planning phase Odour scrubbing Noise mitigation in building design 	High
		Environmental spill from tank rupture	Low	<ul style="list-style-type: none"> Quality assurance processes in construction Isolation from stormwater drainage Experienced construction contractors and operators Monitoring of tank levels 	Low
4	Recycled water reticulation and use	Compromise of public health through consumption of recycled water	Very High	<ul style="list-style-type: none"> Plumbing inspections prior to occupancy High treatment quality Education Signage in public areas 	Very High
		Interruption to household recycled water supply due to breakage in reticulation	High	<ul style="list-style-type: none"> Monitoring Ability to isolate reticulation built into design Registration on DBYD 	Low
		Recycled water supply exceeds demand	Moderate	<ul style="list-style-type: none"> Buffer storage System monitoring Evaluation of offsite uses as the development progresses 	Low
		Recycled water demand exceeds supply	Moderate	<ul style="list-style-type: none"> Buffer storage Top up with drinking water 	Low
5	Drinking Water Storage and Reticulation	Interruption to household drinking water supply due to breakage in reticulation	Very High	<ul style="list-style-type: none"> Monitoring Ability to isolate reticulation built into design Registration on DBYD 	High
		Compromise of public health due to poor water quality	Very High	<ul style="list-style-type: none"> Shepherd's Bay Water is distributing drinking water provided by Sydney Water under a Utility Services Agreement Monitoring in distribution network 	High
6	Management	Unable to provide services due to business failure	High	<ul style="list-style-type: none"> Ongoing auditing of the business in accordance with the network operator's licence Internal governance regime Water Industry Competition Act's Operator of Last Resort provisions and step in rights 	Moderate

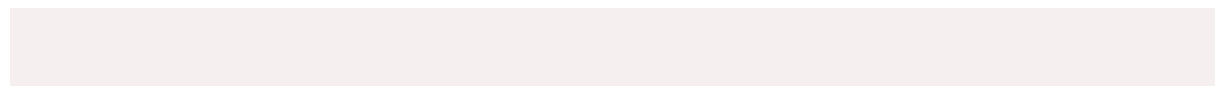
Appendix 4.1.10(a) Flow Systems Drinking Water Quality Plan (TOC)

Drinking Water Quality Plan (DWQP)



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30/1/15	2	Added AMP to: Figure 1 Table 1	Flow	Kirsten Evans	Andrew Horton
11/02/15	3	Added Acronyms Table	Flow	Laura Dixon	Andrew Horton



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Appendix 4.1.10(b) Shepherd's Bay Scheme Management Plan (TOC)

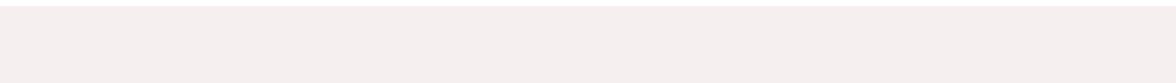
Shepherds Bay Scheme Management Plan (Scheme MP)

Shepherds Bay  **Plus**



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Appendix 4.1.12(a) Flow Systems Infrastructure Operating Plan (TOC)

Infrastructure Operating Plan (IOP)



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Appendix 4.2.1(a) Process Flow Diagram (Sewerage and Recycled Water)

Quality Control Points (QCP) for Water Quality

Bioreactor	Stabilisation
pH	pH
Dissolved oxygen	TDS
Temperature	
Flow	
Chlorine Residual	
Chlorine residual	
Reverse Osmosis	
TDS	

Critical Control Points (CCP) for Water Quality

Membranes
Permeate turbidity
UV
UV transmissivity
UV Intensity
Flow
Chlorine Contact
Chlorine residual
Flow

Unit Operation	Log Removal		
	Virus	Protozoa	Bacteria
MBR	≥2.5	≥4.0	≥4.0
UV	≥1.5	≥4.0	≥4.0
Chlorine	≥3.0	-	≥3.0
Design	≥7.0	≥8.0	≥11.0
Required	≥6.5	≥5.0	≥5.0
	✓	✓	✓

New infrastructure

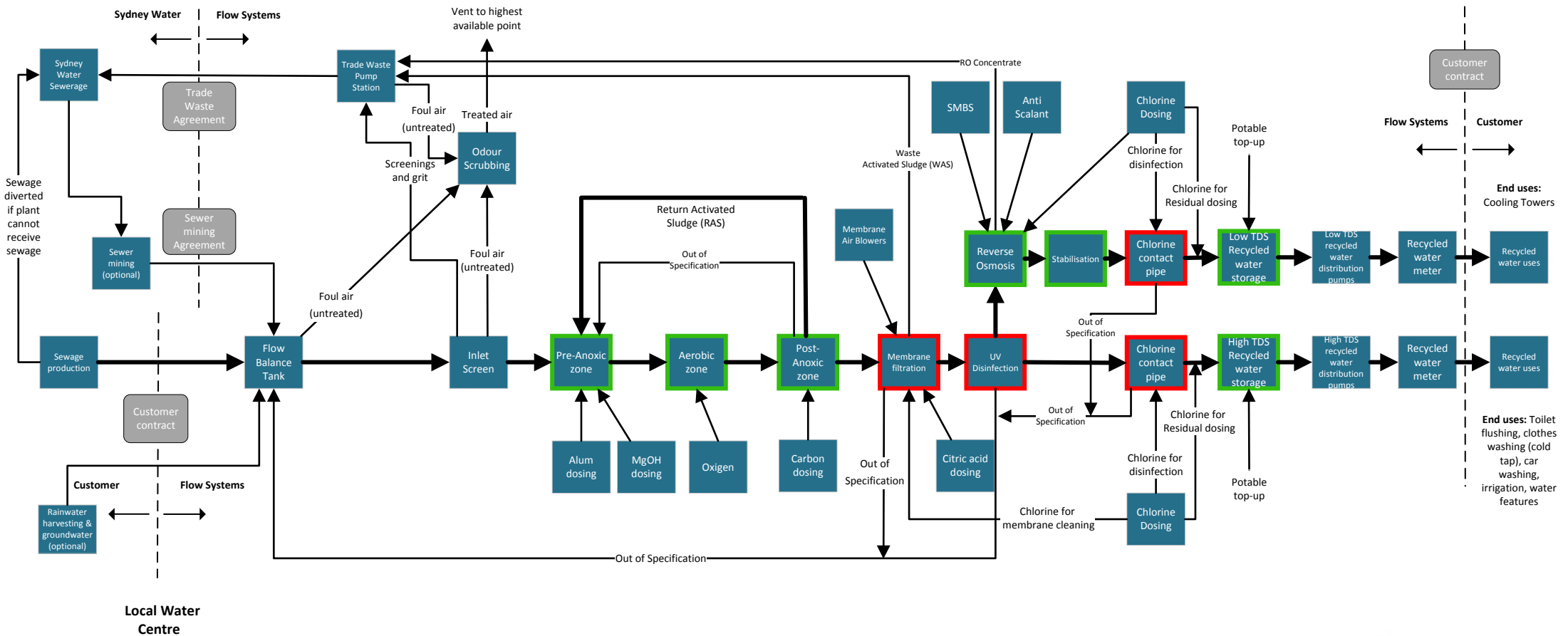
Minor Flow

Major Flow

Contract/Agreement

Location of QCP

Location of CCP

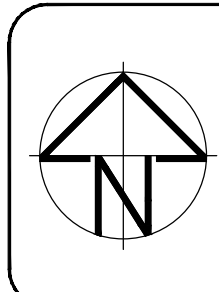


Appendix 4.2.1(b) Recycled Water Reticulation Masterplan



LEGEND

SRM	SRV	SEWER RISING MAIN
R	R	SEWER LINE
C	C	RECYCLED WATER
E	E	COLD WATER MAIN
S	S	EXISTING SEWER
S	S	SHEPHERD'S BAY SERVICES AREA OF OPERATION



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PROJECT	SHEPHERD'S BAY
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DRAWING TITLE	WATER SERVICING MASTER PLAN
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PROJECT No	5954	DRAWING No	FAI-100	REVISION	01				

Appendix 4.2.11(a) Flow Systems Recycled Water Quality Plan (TOC)

Recycled Water Quality Plan (RWQP)

Document Issue Record

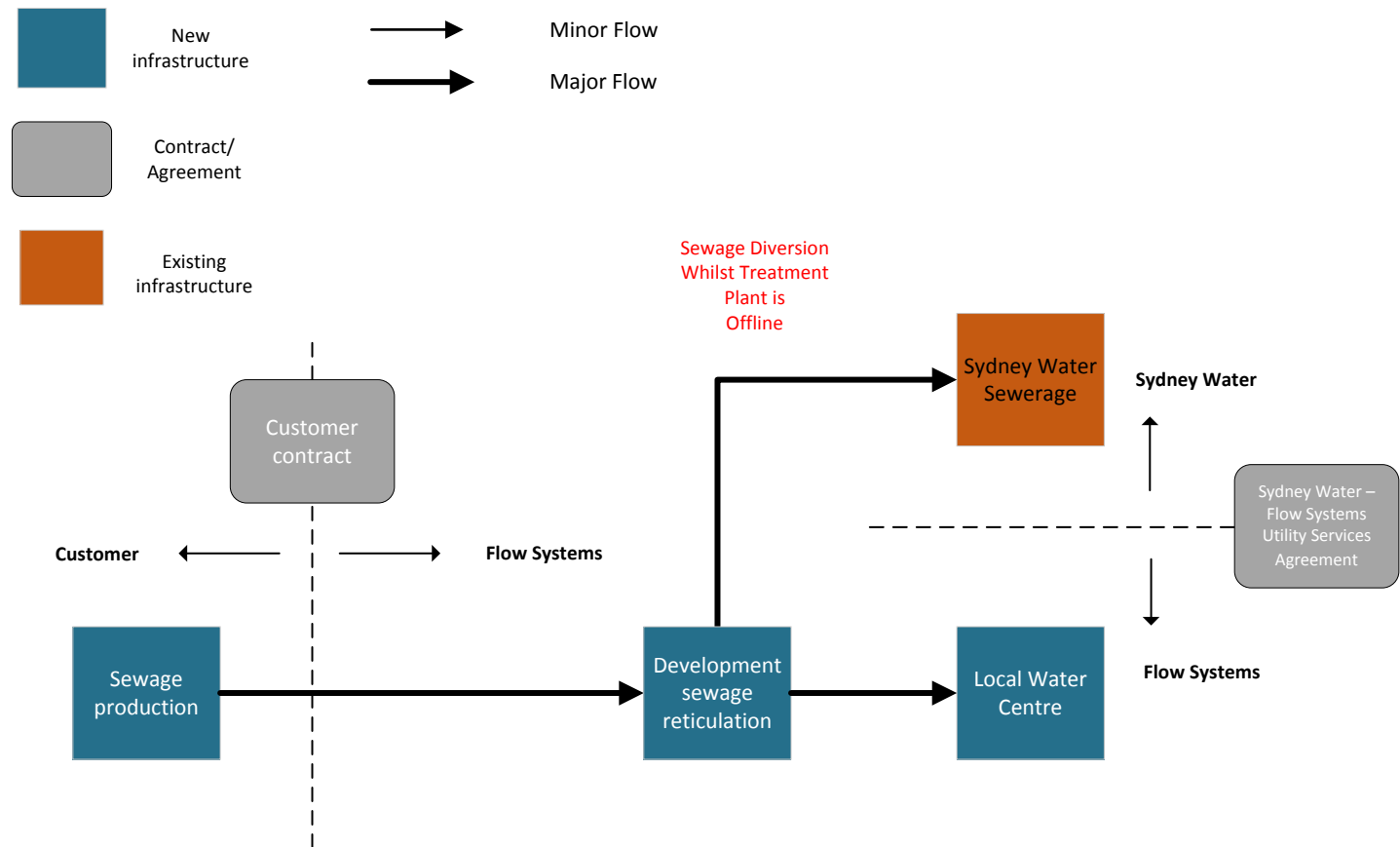
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24/10/14	1	First revision	Flow	Kirsten Evans	Andrew Horton
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Appendix 4.3.1(a) Process Flow Diagram (Interim Sewer)



Shepherds Bay + Services

flow
systems

Appendix 4.3.1(b) Sewerage Reticulation Masterplan



LEGEND

SRM	SRM	SEWER RISING MAIN
RWM	RWM	SEWER LINE
CWM	CWM	RECYCLED WATER
EW	EW	COLD WATER MAIN
ES	ES	EXISTING SEWER
OP	OP	SHEPHERDS BAY SERVICES AREA OF OPERATION

Appendix 4.3.10(a) Flow Systems Sewage Management Plan (TOC)

Sewage Management Plan (Sewage MP)



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