WITCHCLIFFE

VILLAGE SCALE WATER RECYCLING

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Director Engineering & Environment

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TME

Town Planning Management Engineering

Acknowledgements

- Redgate Estate Pty Ltd- Land Owners
- Aspen Group – Project Managers
- Shire of Augusta Margaret River
- United Utilities Australia (UUA) - proposed licensed service provider

The Village
Redgate Road

TME

Town Planning Management Engineering

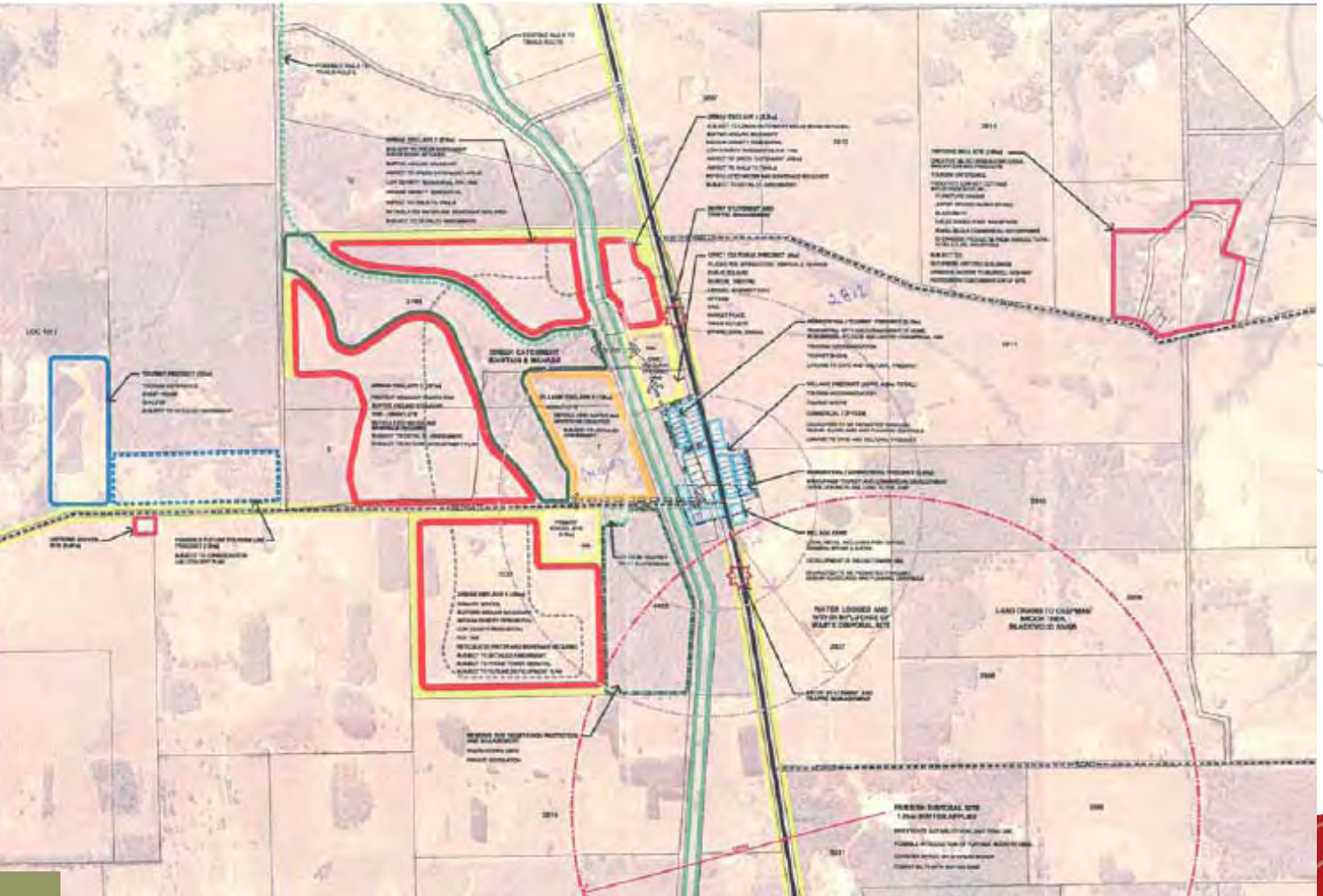
Witchcliffe

- Sustainable water services
- Rain tanks to each residence
- Pressure sewer collection systems
- Waste Water Treatment Plant delivering Class A+ non potable water
- **Land is now zoned**
- **Subdivision approvals in place for stage 1**
- Planners – Roberts Day
- Engineers – TME
- Environmental - RPS

Witchcliffe Village Strategy

- Provides a vision for the future growth of the Witchcliffe town site until 2028 and defines a footprint for the expansion of the town site based on the Leeuwin-Naturaliste Ridge State Planning Policy 6.1 (1998) LNRSSP.
- Vision is to “create a vibrant rural village within a forest and farm setting, with respect for the physical, environmental and landscape of the area, diversity in lifestyle choice and facilities, a strong sense of belonging, nurturing and celebrating local talent and industry, providing tourism experiences and promoting human spirit.”
- The Strategy sets out a number of objectives to achieve this vision. Central to these is the notion of expanding Witchcliffe using alternative servicing methods.

Witchcliffe Planning Context



Land Ownership

Redgate Estate Pty Ltd own Lot 2 and Sussex Location 2183 Redgate Road which comprises approximately 111 hectares of land with a potential yield of 504 residential lots. The land is and currently zoned Future Development Zone and has an approved Structure Plan in place and subdivision approval for a first stage of 50 lots.

Redgate Developments Pty Ltd also has an area of approximately 52 hectares at Lot 1032 Redgate Road also zoned Future Development that will yield approximately 228 lots.

Approx 44 existing townsite lots with total expansion of approx 845 lots

Structure Plan Area

Lot 2 and Sussex Location 2183 Redgate Road

Lot 2 and Sussex Location 2183 Redgate Road

Stage One Location

Servicing Coordination

- Multiple land owners, developers and existing residents
- Public workshops
- Coordinated servicing approach
- Cooperation between land owners and consultant teams
- All striving for innovative and leading edge development

General servicing required for development

Clearing- clear blue gums and retain native

Earthworks- minimise earthworks and retain landform

Site works- walls minimal use

Water supply-alternate methods

Sewer- alternate methods

Roadworks- alternate methods and form

Stormwater/ WSUD- state of the art methods- extensive use of bioretention systems

Power- Western Power and Green Power

Telstra- NBN ???

Water and Sewer

Traditional servicing approach would be by water main and sewer main to and from Margaret River (8km away)

Witchcliffe not in license area of Water Corporation

Alternate suppliers now permitted and encouraged by ERA

New future for Western Australia for water and sewer

Witchcliffe and Gracetown are leading the way

Breaking significant new ground in WA

Proposed toilet connected to recycled water

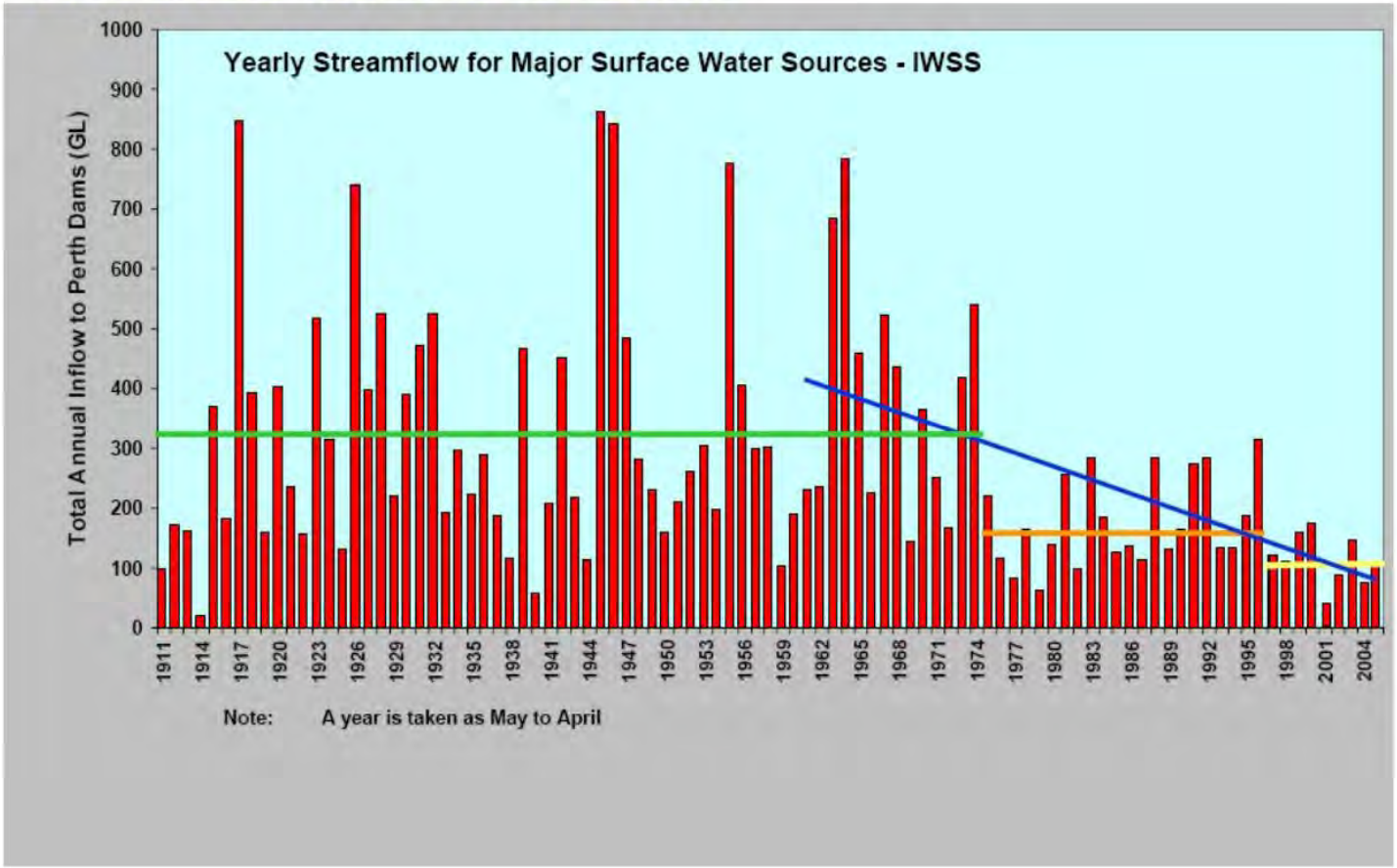
External hose bib tap

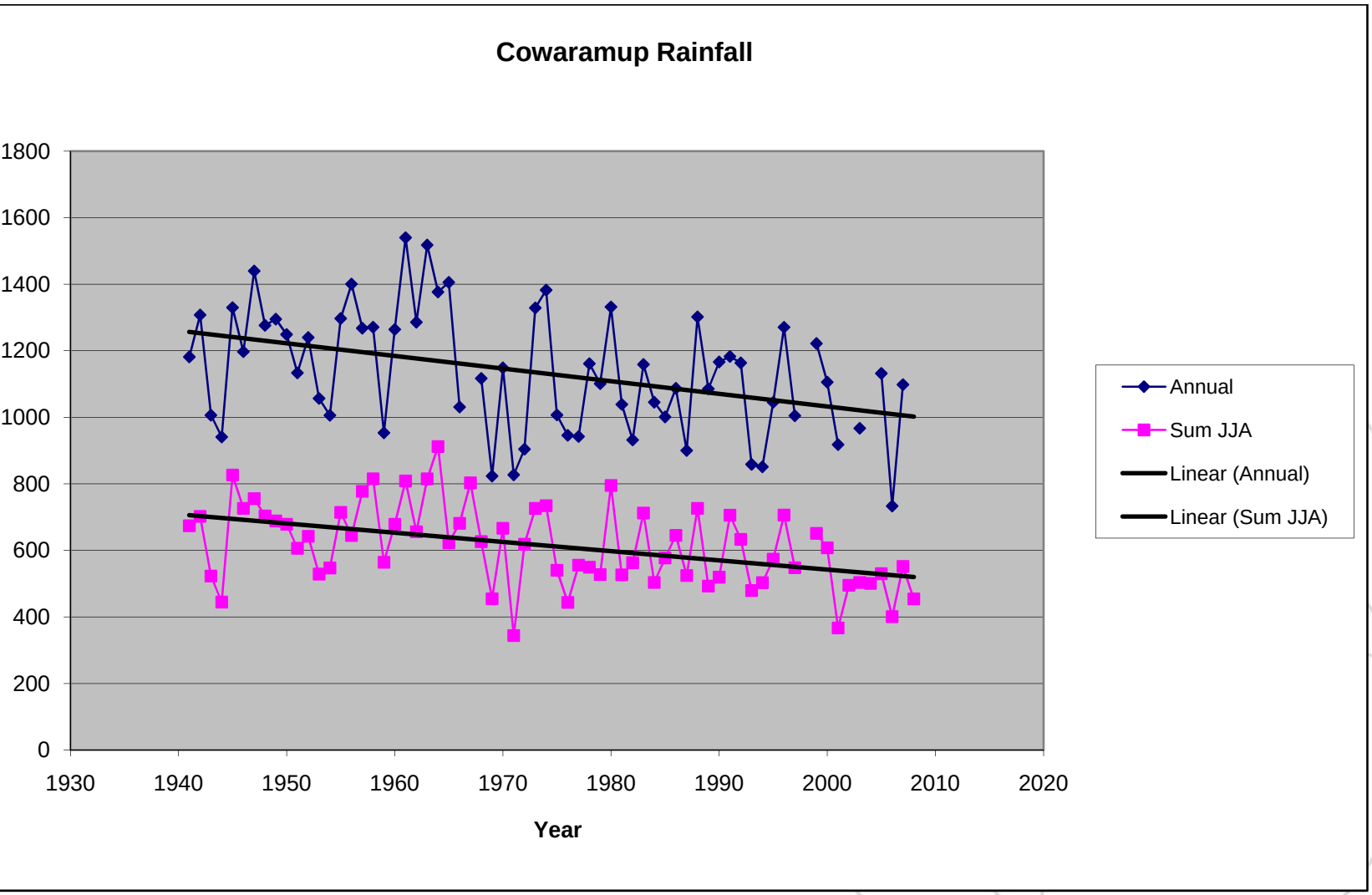
Recycled water main and property service

Recycled water main and drinking water main

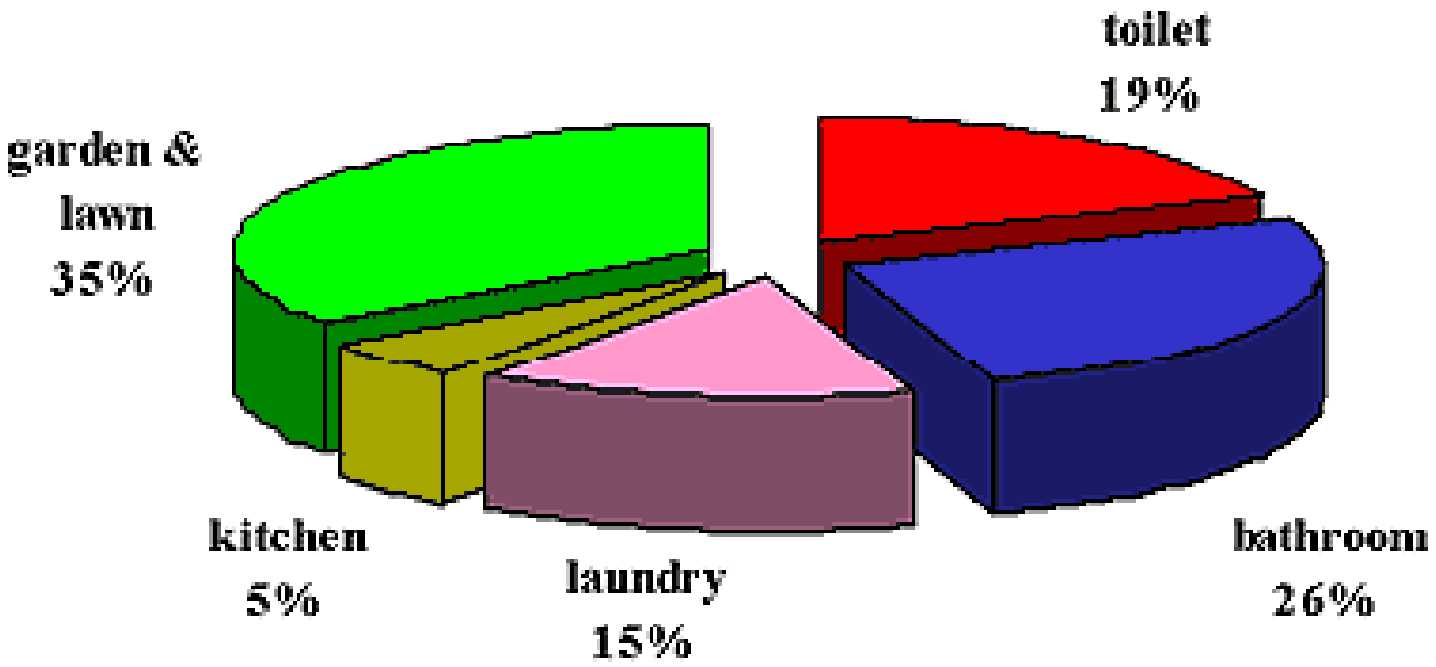
Reasons for Change

Reduced Inflows to Dams



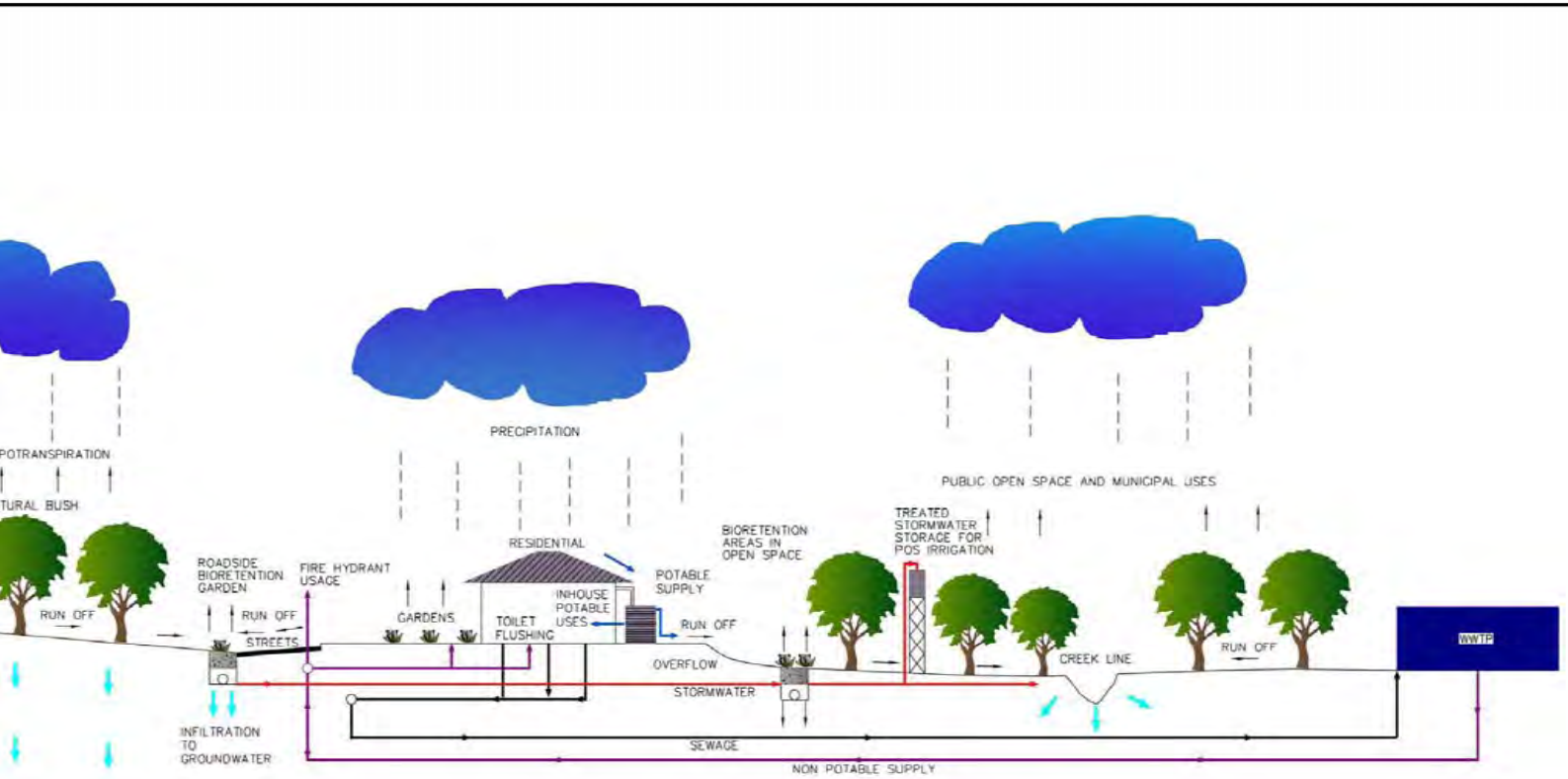

Cowaramup Rainfall
1800
1600
1400
1200
1000
800
600
400
200
0
1930
1940
1950
1960
1970
1980
1990
2000
2010
2020
Year
Annual
Sum JJA
Linear (Annual)
Linear (Sum JJA)

Average family home consumption



Proposed Water and Sewer Strategy for Witchcliffe

- Rainwater tanks to each lot to provide potable water supply for inside homes- drinking, showers
- Sewer effluent from each lot collected and conveyed to a proposed Water Recycling Plant (WRP) at Davis Road tip site
- Effluent treated to class A+ (fit for purpose) standard and become a non potable water supply
- Treated water returned to each lot for non potable uses such as toilet flushing and gardens (exclude laundry initially)
- Non Potable Water also used in fire hydrants through development
- Stormwater for lots and roads treated and captured together with shallow groundwater from subsoil systems for use on POS areas



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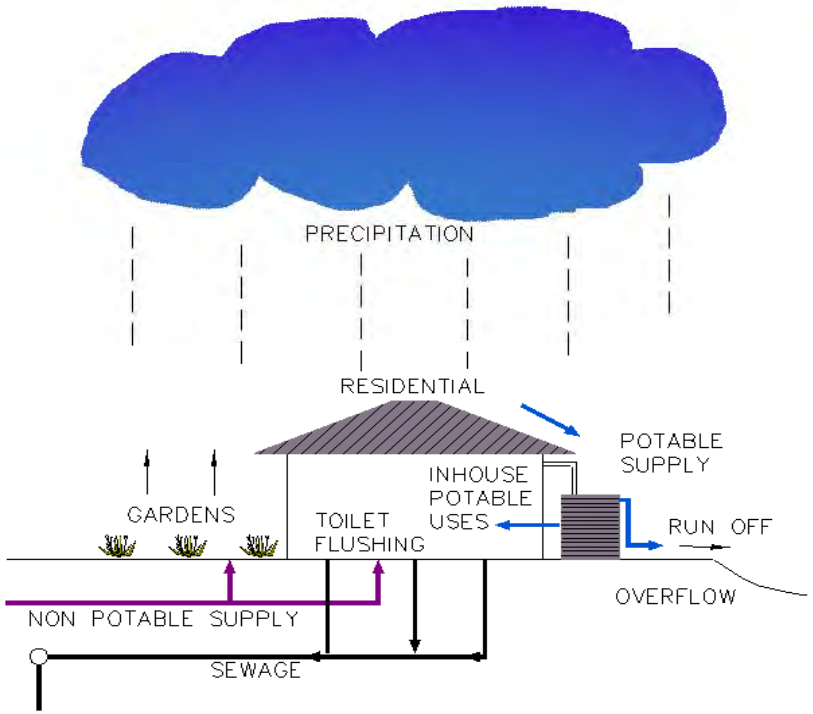
LEGEND

SEWAGE

Household water balance

Water balance modelling using historic rainfall/climate change

Varying occupancies, roof areas



Household water balance

The State Water Strategy -approx 100,000 litres/p/yr consumed

Approx 50% is for external use. Thus 50,000 litres/p/yr used externally (137 litres/p/day average).

Based on an average occupancy of 2.6 persons/lot and 122 l/p/d availability a non potable demand of approximately 310 l/house /day can be supplied for gardens.(approximately 90% of the State Water Strategy targets)

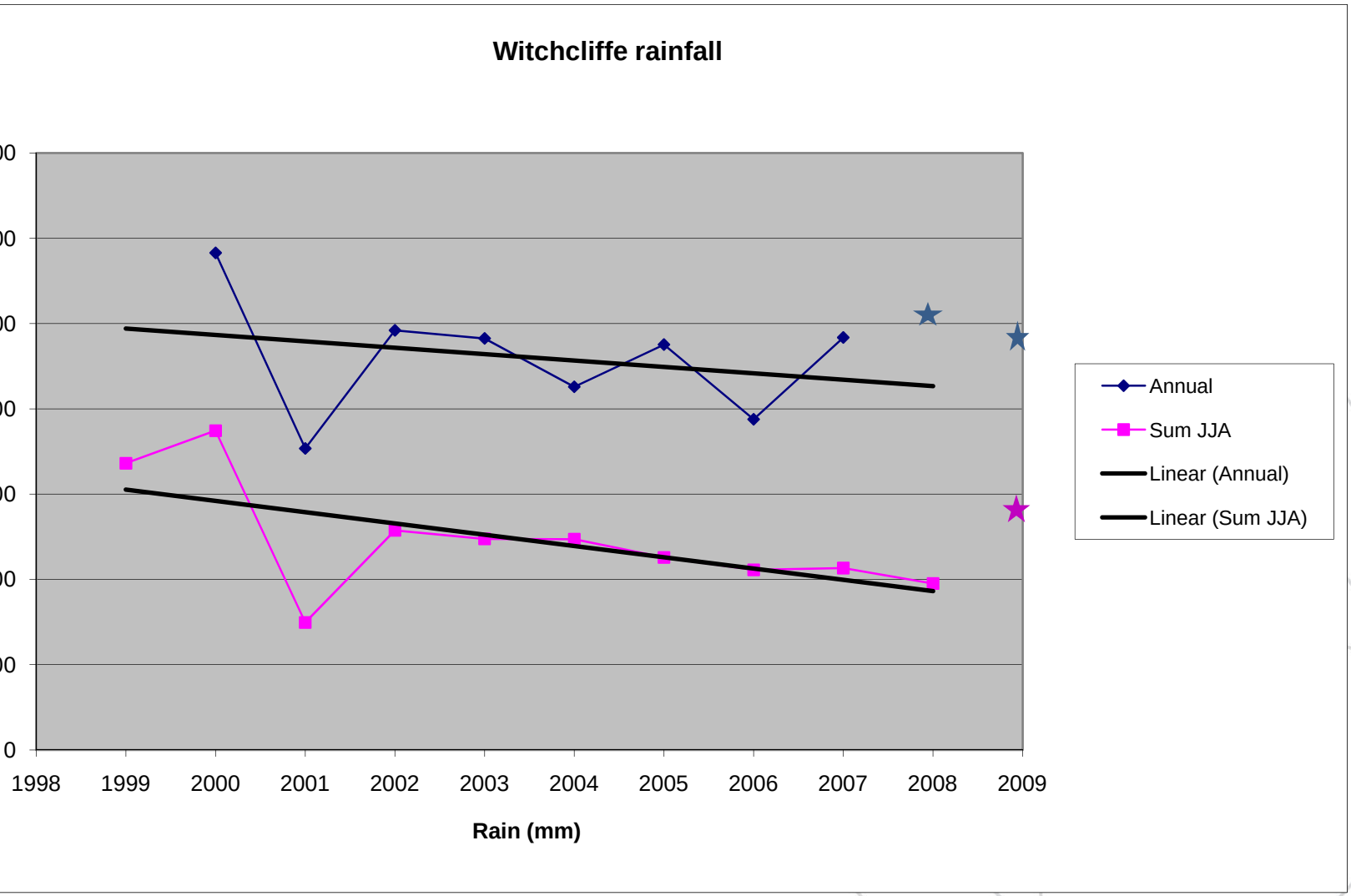
Non Potable water will be used inside houses in toilets only and outside the houses for garden irrigation

Non potable usage in the houses is limited to toilets. With low flush toilets the demand is 33 l/p/day. This results in a daily demand for toilets of 85.8 /day

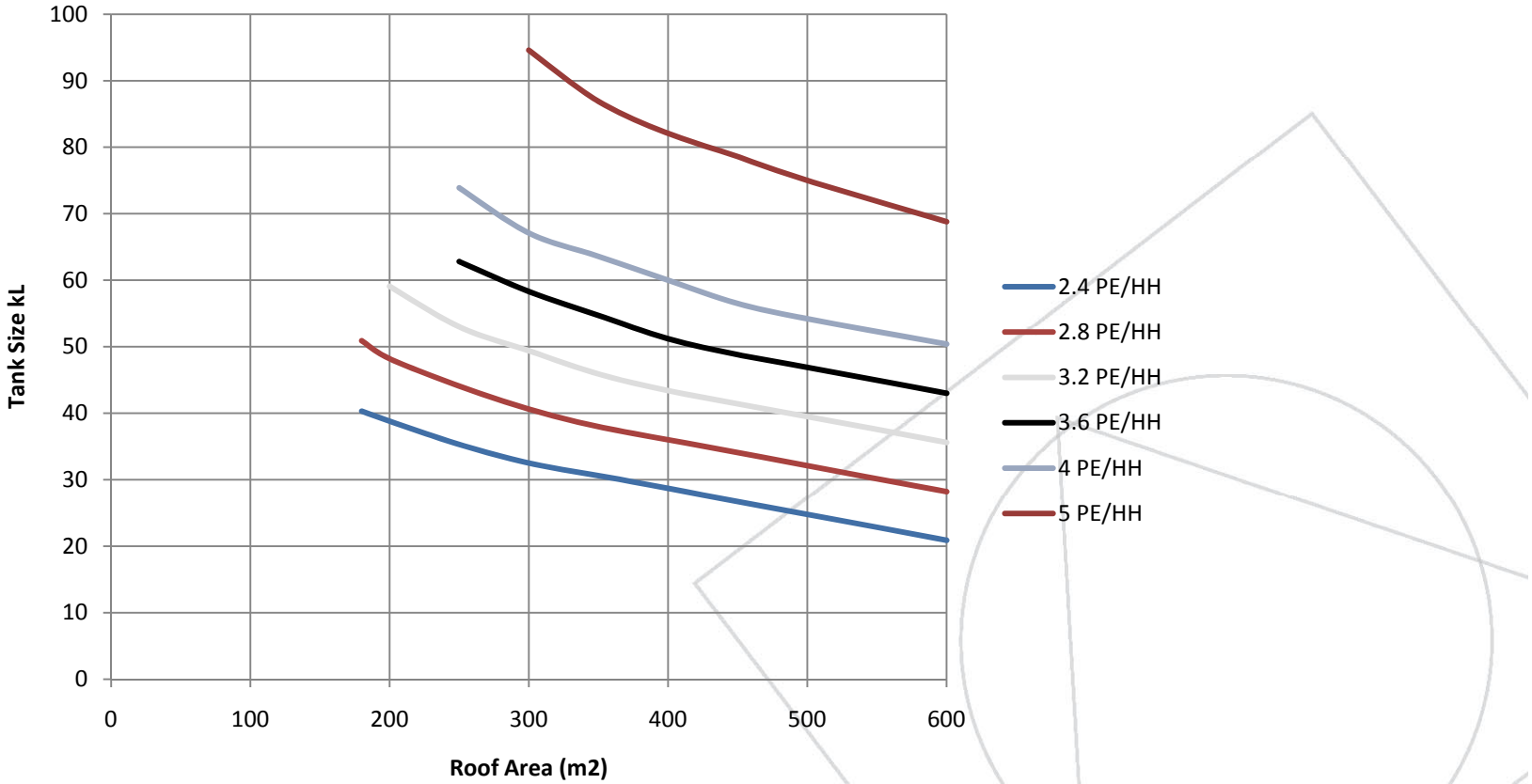
Non Potable water used on the gardens will be restricted to the water that can be provided back to each house. (approx 225 l/day)

Household water balance

- Without a major winter storage the non potable water available for irrigation demands will be the same as the in house potable demand
- Under average rainfall conditions (last 5 years average) and using the maximum non potable supply available it will be possible to irrigate with sub surface irrigation approximately 145 m2 of lawn per household.
- This is based on subsurface irrigation of grass and meeting 40% of the evaporation with irrigation after rainfall is deducted.
- Alternatively native gardens and / or vegetable gardens could be used as long as they stay within the daily non potable water allocation available.
- Use of native plantings will be encouraged for each household


Witchcliffe rainfall
00
00
00
00
00
00
0
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
Rain (mm)
Annual
Sum JJA
Linear (Annual)
Linear (Sum JJA)

Witchcliffe Rain Tank Sizes Last 5 years Average Rain (2003 – 2007) (122L/p/day))



Witchcliffe Sewer Collection System

Propose low pressure sewer system

Reduces the need for this

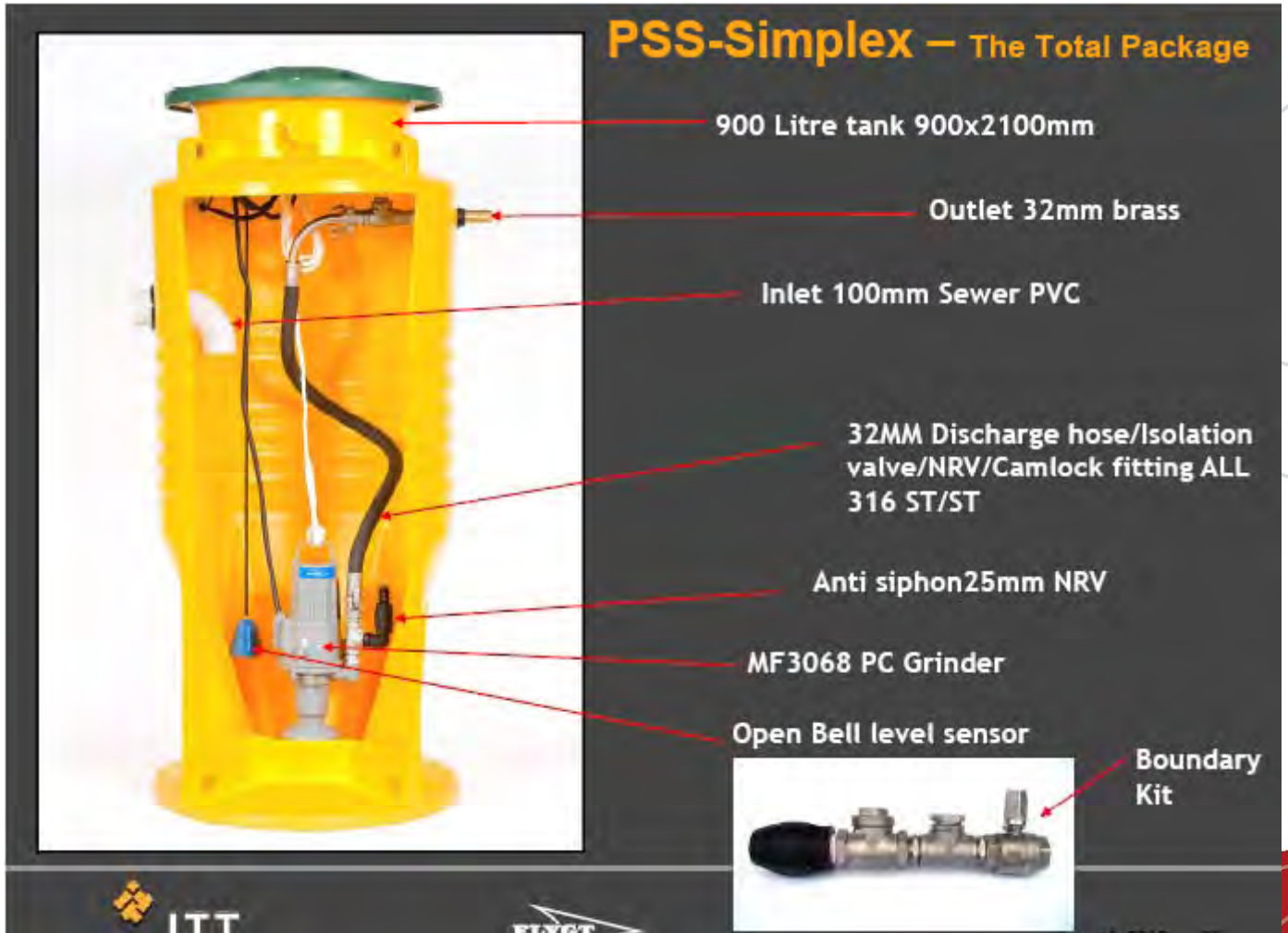
Watertight design and absence of manholes eliminates external flows into the system

Particularly good in backlog areas

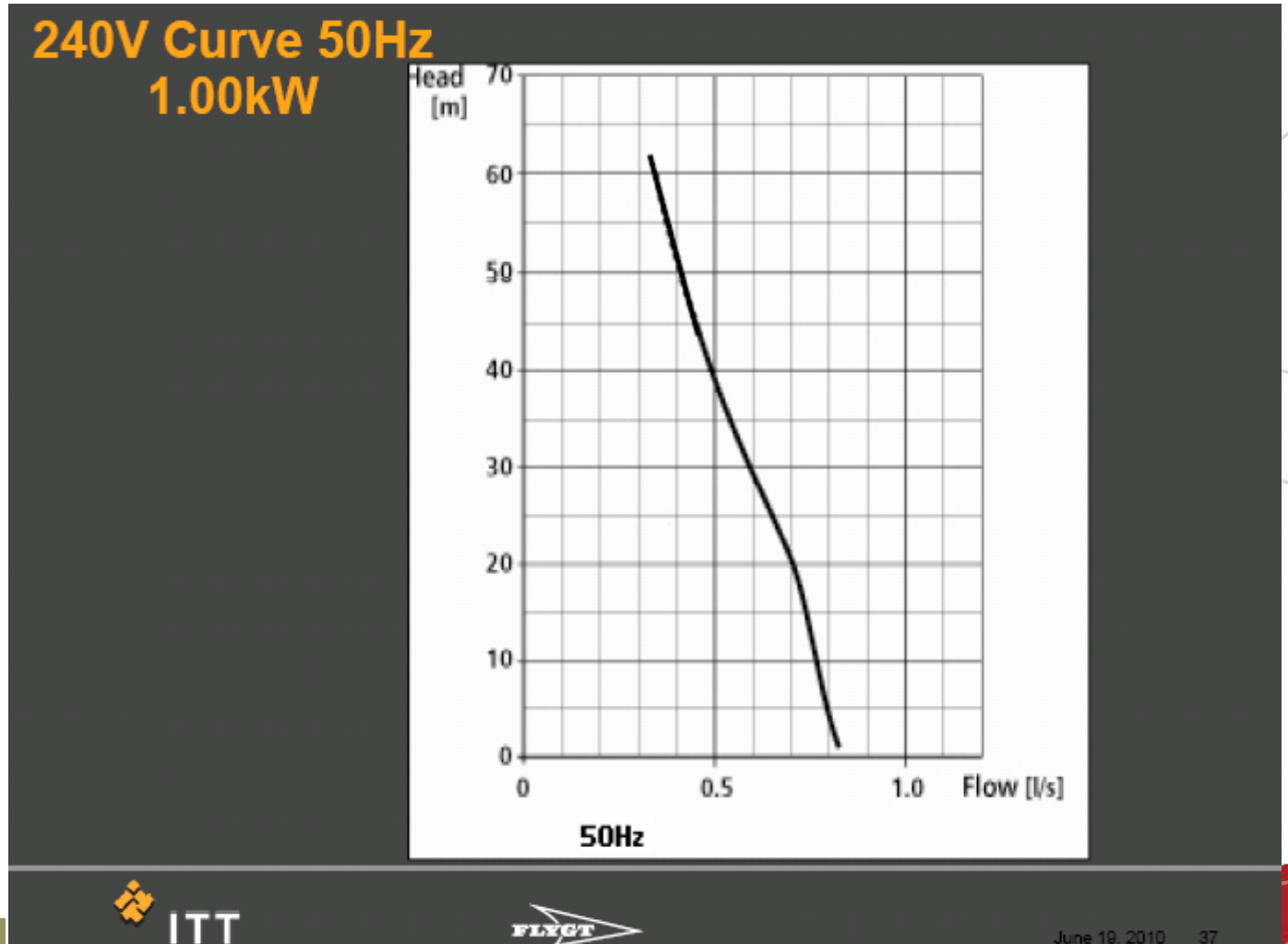
Low Pressure Sewer System

- Differ from conventional sewer systems in that they break down large solids in a lot scale pump station before they are transported through the collection system
- Watertight design and absence of manholes eliminates external flows into the system
- South East Water installed the first pressure sewer system (PSS) in Australia at Tooradin in 2001. Now have 800 units installed.
- Particularly good in backlog areas
- Water Corporation have used in limited parts of backlog areas

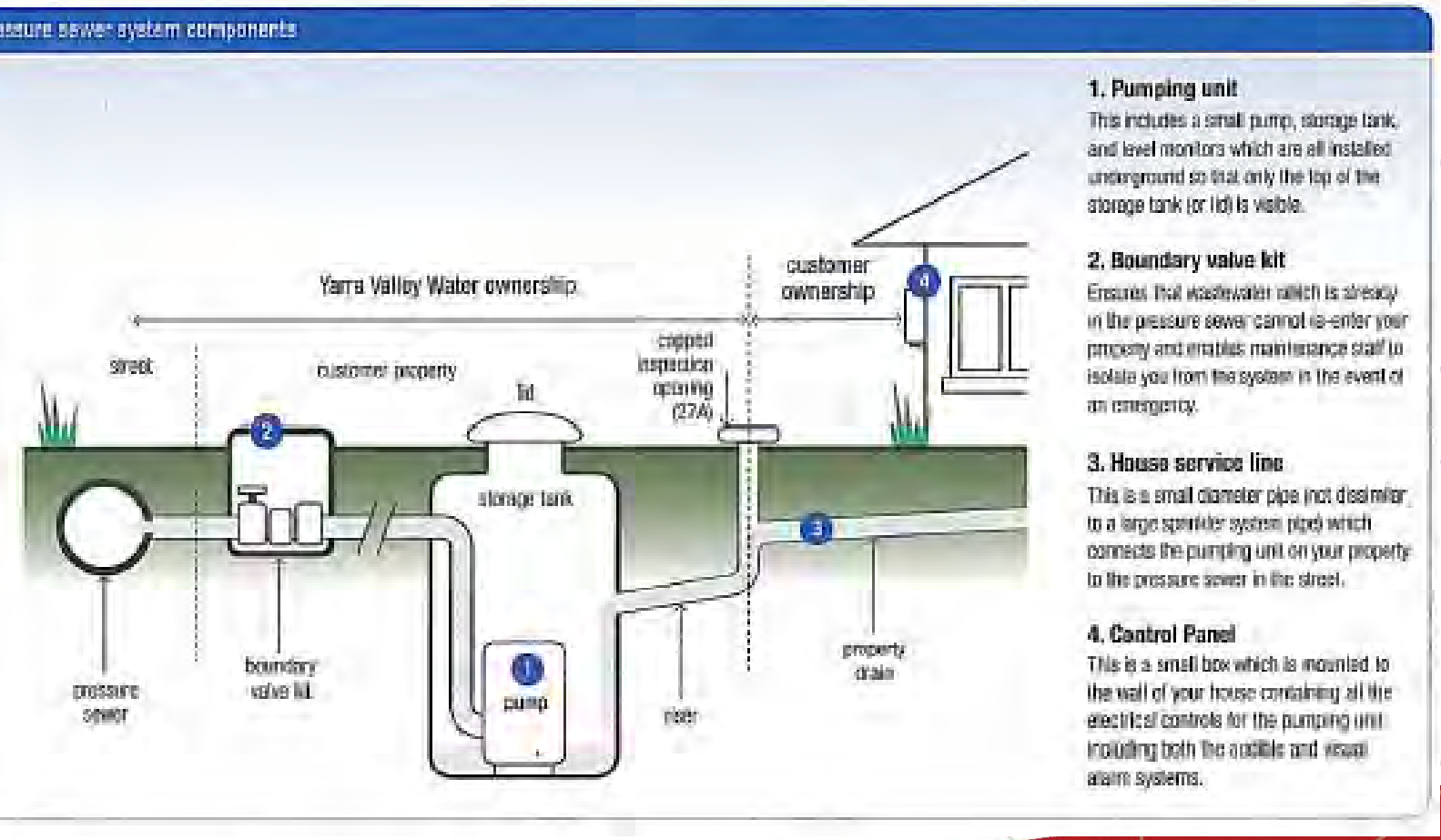
Example Pressure Sewer System



Example Pump Curve



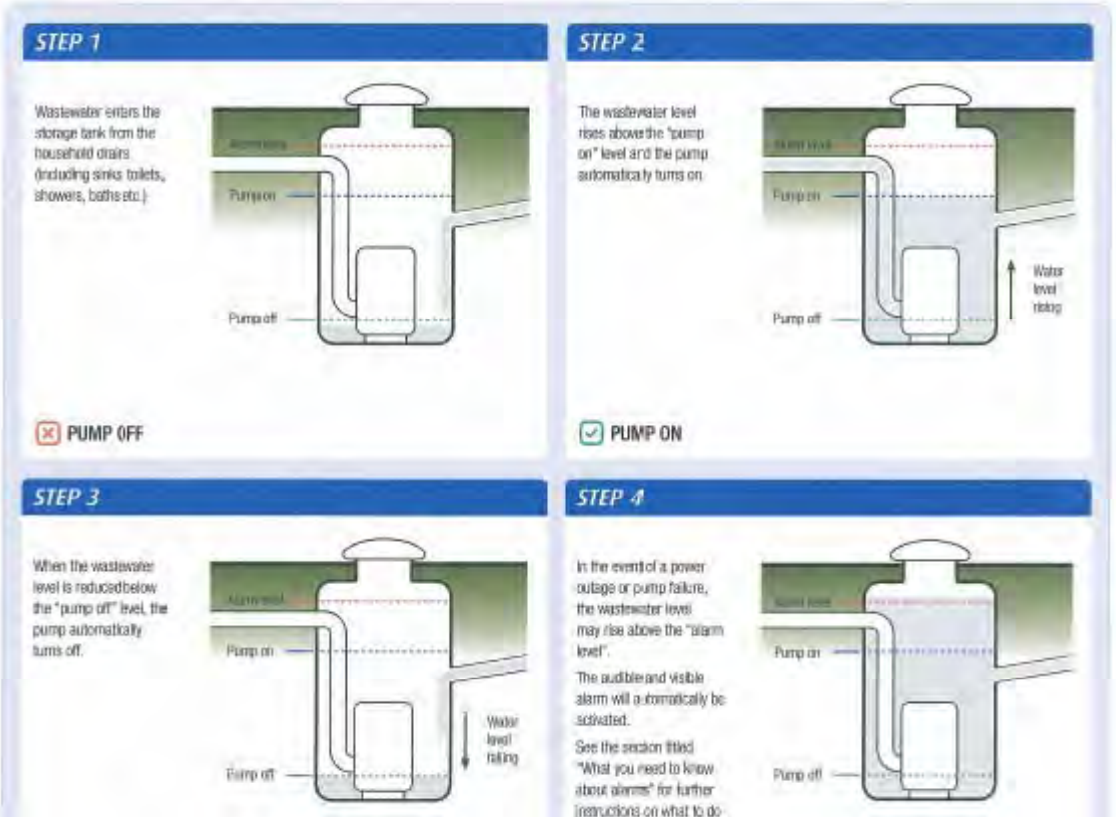
Gembrook System - Victoria



Gembrook System - Victoria

How do pressure sewer systems work?

The main component of the pressure sewer system is the pumping unit which is installed on your property. The pumping unit works in the following way:



Gembrook Example - Victoria

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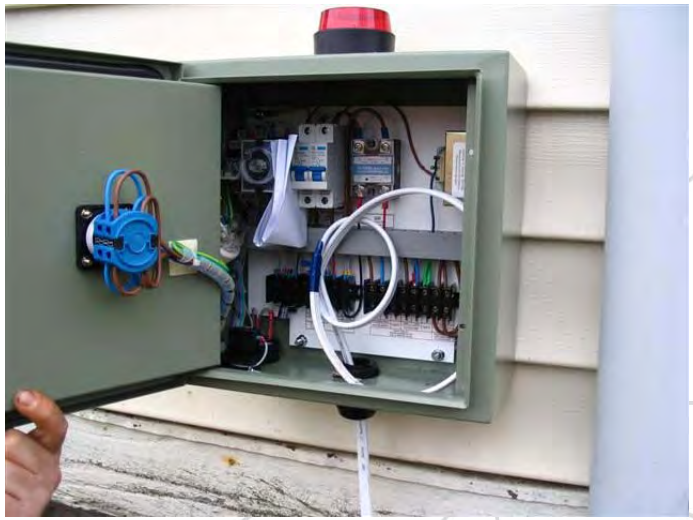
Gembrook Example - Victoria



Gembrook Example - Victoria

Gembrook Example - Victoria

Proposed WRP site

WRP flows

United Utilities Australia have assessed the scheme and determined flow parameters for design of the WWTW

Average daily inflow (design maximum, during holidays) 260 kL/d

Average daily inflow (design minimum, during winter) 220 kL/d

Peak factor 3.0x ?

Minimum Flow factor 0.25x

Length of Peak 2.0 hours

Example Package Plant (100 kL/d)

Image courtesy of UUA

WRP concept

Water Recycling Plant (WRP) concept developed by Wayne Bagg of UUA consists of:

- Inlet works comprising fine screenings and grit removal
- Inflow balancing tank
- Activated sludge reactor
- External hollow- fibre ultrafiltration system
- Disinfection by ultraviolet light irradiation and chlorination (> 6.5 log removal of pathogens)
- Continuous online monitoring of recycled water quality
- Chemical dosing for alkalinity control and TP removal
- Biofilter odour scrubber- all process units will be covered
- Waste activated sludge dewatered for off site disposal

Water Quality Targets- source Wayne Bagg UUA

Water Quality Targets

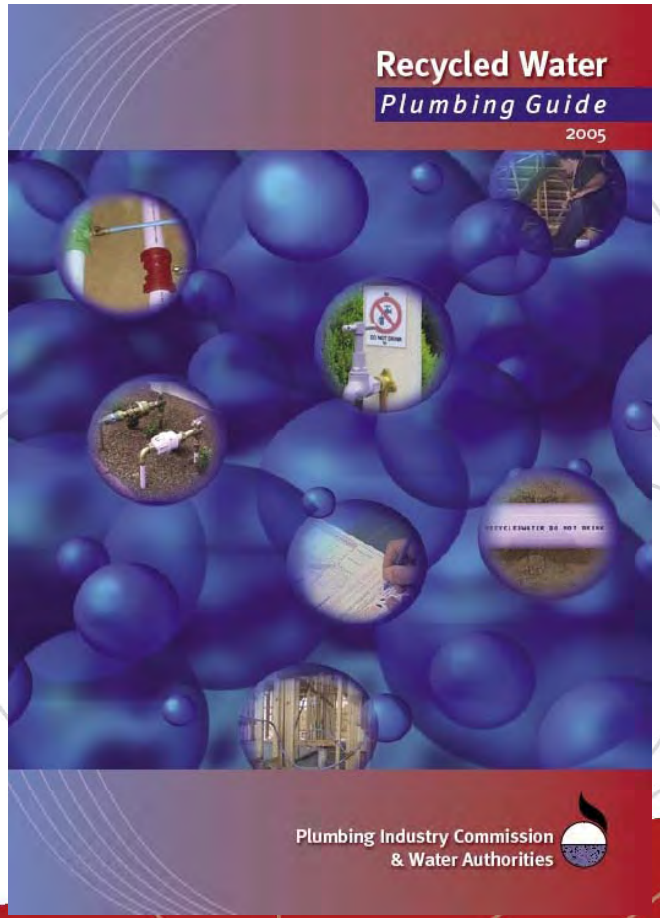
Based on 'fit for purpose' study from *Australian Recycled Water Guidelines, Phase 1.*

Parameter	Units	Value	Relevant Unit Process
BOD	mg/L	<5.0	Secondary treatment
NH_4^+	mg/L	<0.5	Complete nitrification during secondary treatment
NO_x	mg/L	<0.01	Full biological nitrification/denitrification during secondary treatment
TN	mgN/L	<5.0	Secondary treatment incorporating biological nitrogen removal
TP	mgP/L	<0.1	Secondary treatment incorporating biological and chemical phosphorus removal
TSS	mgSS/L	<0.2	Ultrafiltration
Total Alkalinity	mg/L (as $CaCO_3$)	>100	Chemical conditioning of inflow to RWTP
Turbidity	NTU	<0.5	Secondary treatment and ultrafiltration
E. Coli	TFC/ml	<1.0	Disinfection via ultraviolet light and chlorination
Chlorine Residual	mg/L	>1.0	Chlorination by dosing with hypochlorite solution

Example Non Potable Water System

Conveyance Systems for Non Potable Water

- Once treated in a treatment plant the non potable water needs to be returned to each of the houses for reuse in toilets and in gardens
- Purple “third pipe” systems are used
- Australian standards are developed for these pipes
- Commonly used in eastern states
- All fittings and pipes are purple
- Garden fittings and pipes are also purple
- System would be owned and operated by a licensed provider (UUA)



Non Potable Water System

Proposed toilet connected to recycled water

External hose bib tap

Non Potable Water System

Recycled water main and property service

Recycled water main and drinking water main

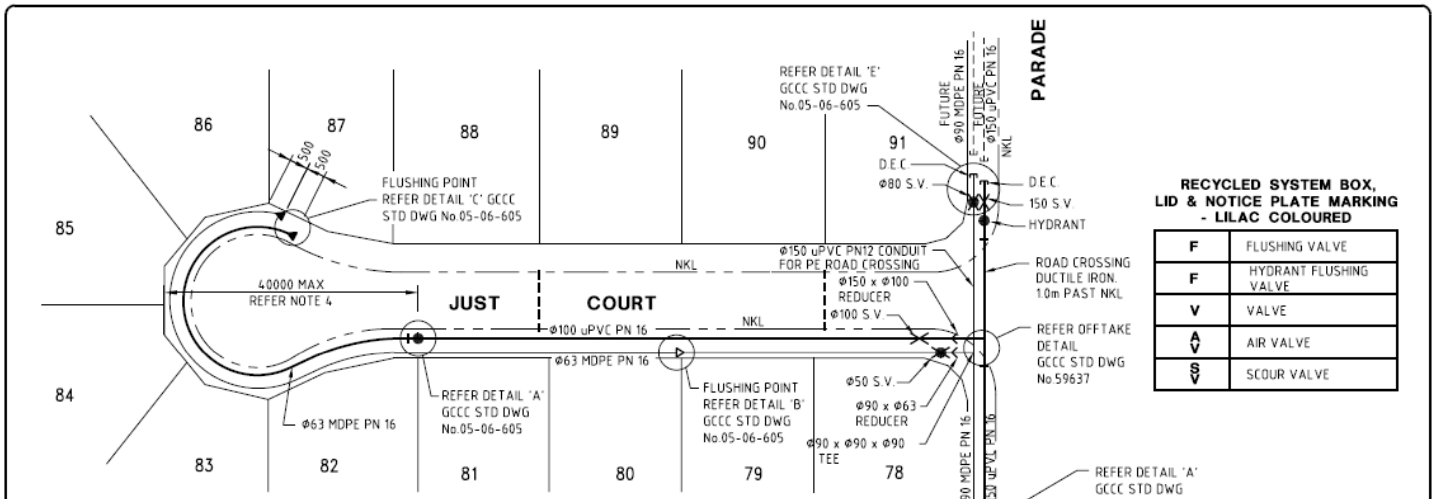
Non Potable Water System

Recycled water and drinking water meter assemblies

Non Potable Water System

External hose bib taps with prohibition sign and removable handle

Non Potable Water System



RECYCLED SYSTEM BOX, LID & NOTICE PLATE MARKING - LILAC COLOURED

F	FLUSHING VALVE
F	HYDRANT FLUSHING VALVE
V	VALVE
A V	AIR VALVE
S V	SCOUR VALVE

TYPICAL LAYOUT PLAN

NOTES:

1. FOR TYPICAL FOOTPATH VERGE ALLOCATIONS FOR PUBLIC UTILITES REFER TO G.C.C.C. STD. DWG. NO. 05-02-005.
2. FOR PVC/ DI MAINS THE MAXIMUM DISTANCE BETWEEN POTABLE SYSTEM HYDRANTS SHALL BE 80m.
3. FOR PVC/ DI MAINS THE MAXIMUM DISTANCE BETWEEN RECYCLED SYSTEM FLUSHING HYDRANTS SHALL BE 80m.
4. POTABLE SYSTEM HYDRANTS MAY BE PROVIDED 40m FROM THE CUL-DE-SAC END. WHERE PROVIDED, A FLUSHING POINT SHALL BE PROVIDED AT THE POLY SYSTEM MAIN END.
5. FOR PE MAINS FLUSHING POINTS SHALL BE PROVIDED AT THE PERMANENT ENDS OF ALL RECYCLED SYSTEM MAINS.
6. FOR PE MAINS FLUSHING POINTS SHALL BE PROVIDED AT 150m MAXIMUM SPACING ALONG THE RECYCLED MAIN AT THE PROLONGATION OF COMMON BOUNDRIES.
7. POTABLE SYSTEM STOP VALVES SHALL BE PROVIDED AT ALL BRANCHES, TEES & CROSSES AND SECTION VALVES SHALL BE GENERAL SPACED AT MULTIPLES OF 50 PROPERTY BLOCKS IN ACCORDANCE WITH THE DETAILS SHOWN ABOVE.
8. RECYCLED SYSTEM STOP VALVES SHALL BE SPACED AT MAXIMUM MULTIPLES OF 50 PROPERTY BLOCKS AND AT A MINIMUM OF ONE PER ROAD AT THE BRANCH OFFTAKE.
9. POTABLE END RECYCLED SYSTEM SECTION VALVES SHALL BE SPACED AT MULTIPLES OF 100 PROPERTY BLOCKS.
10. PRIOR TO COMMENCING WORK ON SITE THE CONTRACTOR SHALL DETERMINE THE LOCATION OF ALL EXISTING UTILITIES.
11. THE CONTRACTOR SHALL ENSURE THAT THE WORKS ARE CARRIED OUT IN ACCORDANCE WITH THE REQUIREMENTS OF THE CURRENT ENVIRONMENTAL PROTECTION ACT.
12. FOR POTABLE AND RECYCLED WATER SERVICE TYPICAL INSTALLATION DETAILS REFER G.C.C.C STD DWG. No. 05-06-602
13. ALTERNATIVE FITTINGS ARE SHOWN ON G.C.C.C. STD. DWG. No. 05-06-602.
14. DIMENSIONS ARE IN MILLIMETRES UNLESS SHOWN OTHERWISE

LEGEND

100Φ u.P.V.C. CL 16	WATER MAIN POTABLE
90Φ u.P.V.C. CL 16	WATER MAIN RECYCLED
	FIRE HYDRANT
	SERVICE CONDUIT
SV	STOP VALVE FL-FL
PVC D.I.C.L.	PIPE MATERIAL CHANGED
SV	STOP VALVE FOR PE
150 100	REDUCER PIPE
DEC	DEAD END CAP
NKL	NOMINAL KERB LINE
	FLUSHING POINT E.O.L.
	FLUSHING POINT ONLINE

Gold Coast City Council

THIS DRAWING IS NOT TO BE AMENDED WITHOUT REFERENCE TO STANDARDS COMMITTEE

CONTROLLED DOCUMENT

DO NOT SCALE TAKE FIGURED DIMENSIONS ONLY

DRAWN BY TECHNICAL SERVICES BRANCH

PASSED: 15/07/04

APPROVED: 26/02/04

No.	AMENDMENT	APPROVED	DATE	ISSUED

STANDARD DRAWING

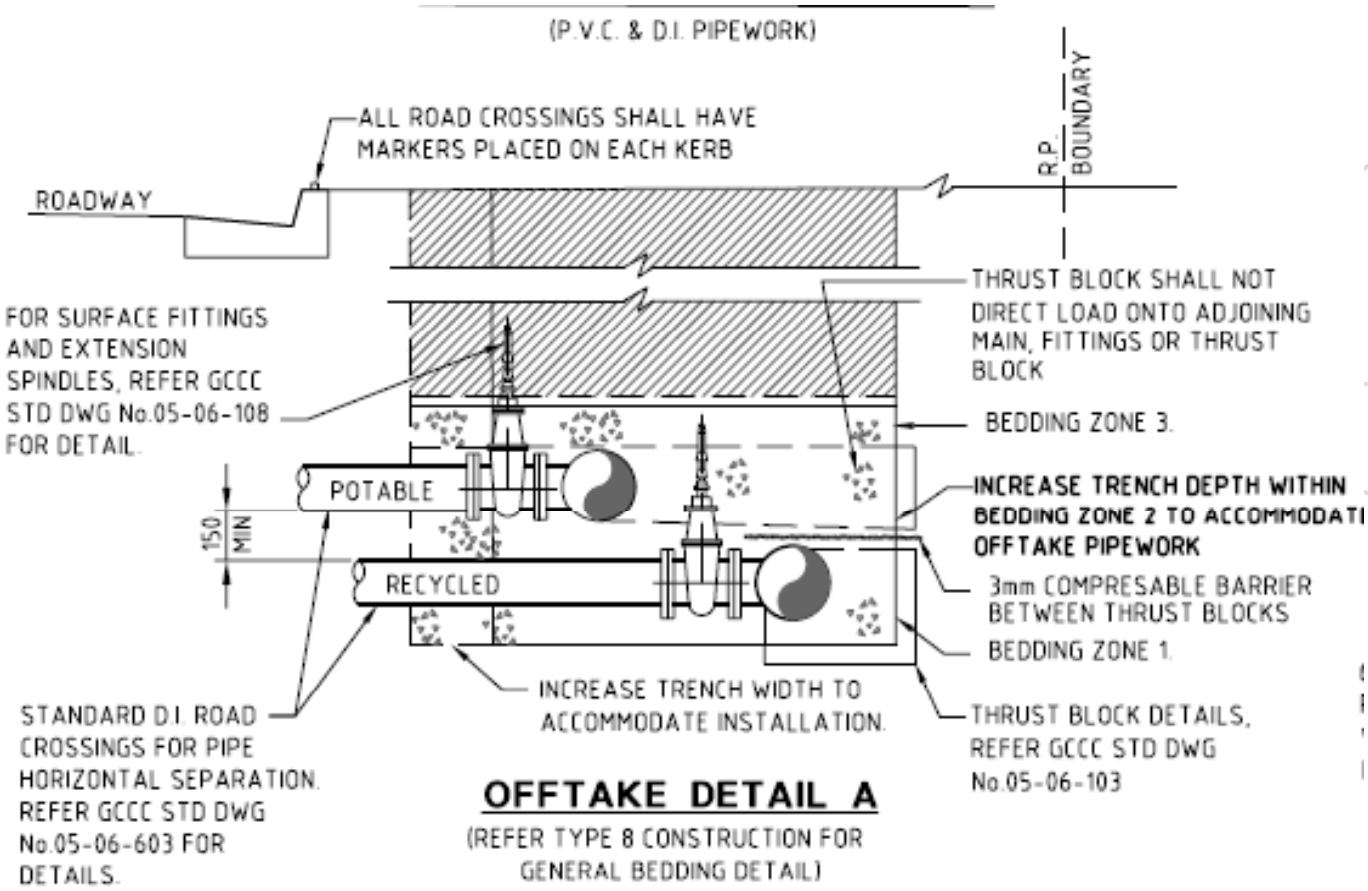
DUAL WATER RETICULATION SYSTEM
TYPICAL ARRANGEMENT DETAILS

MICROFILMED

STANDARD DRAWING No. 05-06-601

ISSUE 2005 EDITION

Non Potable Water System



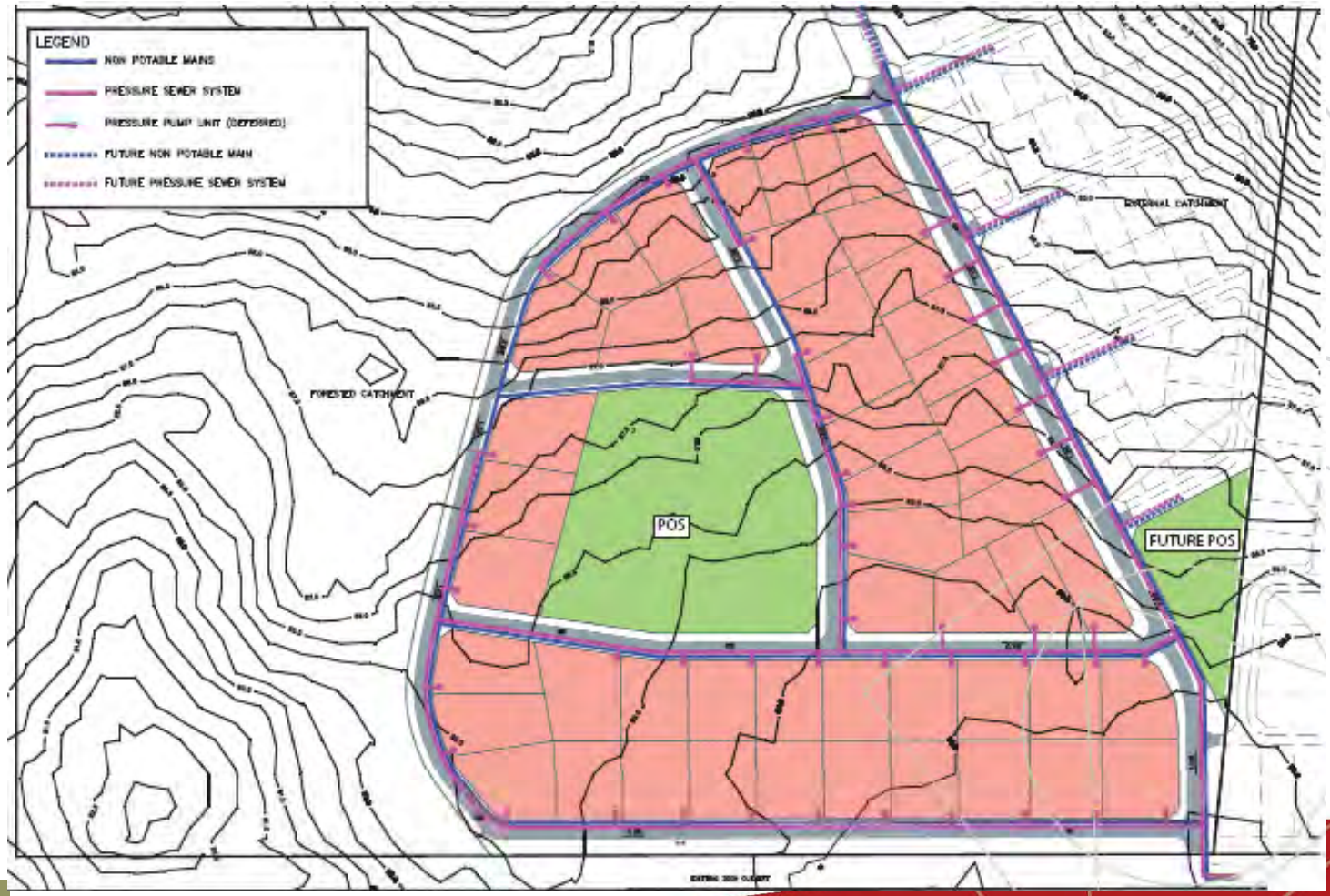
Non Potable Water System

USES FOR CLASS A+ RECYCLED WATER IN PIMPAMA COOMERA

Class A+ recycled water is Queensland's highest quality recycled water not intended for drinking. The following table lists those activities Class A+ recycled water can and should not be used for:

CLASS A+ RECYCLED WATER CAN BE USED FOR:	CLASS A+ RECYCLED WATER SHOULD NOT BE USED FOR:
■ Toilet flushing ■ Garden watering and irrigation ■ Filling ornamental ponds ■ Car washing ■ Fire fighting ■ Construction and building purposes ■ Dust suppression ■ Irrigation of food crops ■ External household cleaning	■ Drinking ■ Cooking or other kitchen purposes ■ Personal washing ■ Evaporative coolers ■ Clothes washing

Pipe System layouts



System Operation

United Utilities Australia selected as preferred operator for the developers

Same operator as proposed for Gracetown

Extensive discussions currently underway with UUA, Shire and developers

Agreements being drafted

Proposed that Shire would own the system and that UUA would operate system under an operating license from ERA

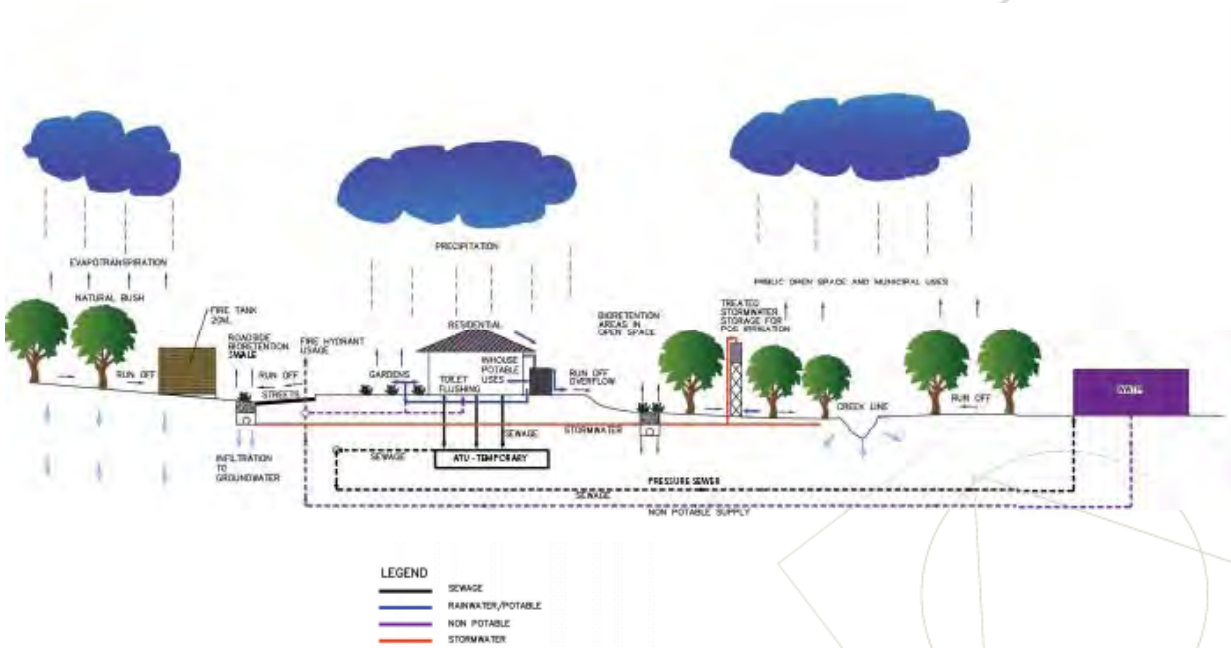
Business case and capital and operating cost assessments currently being finalised

Staging Strategy

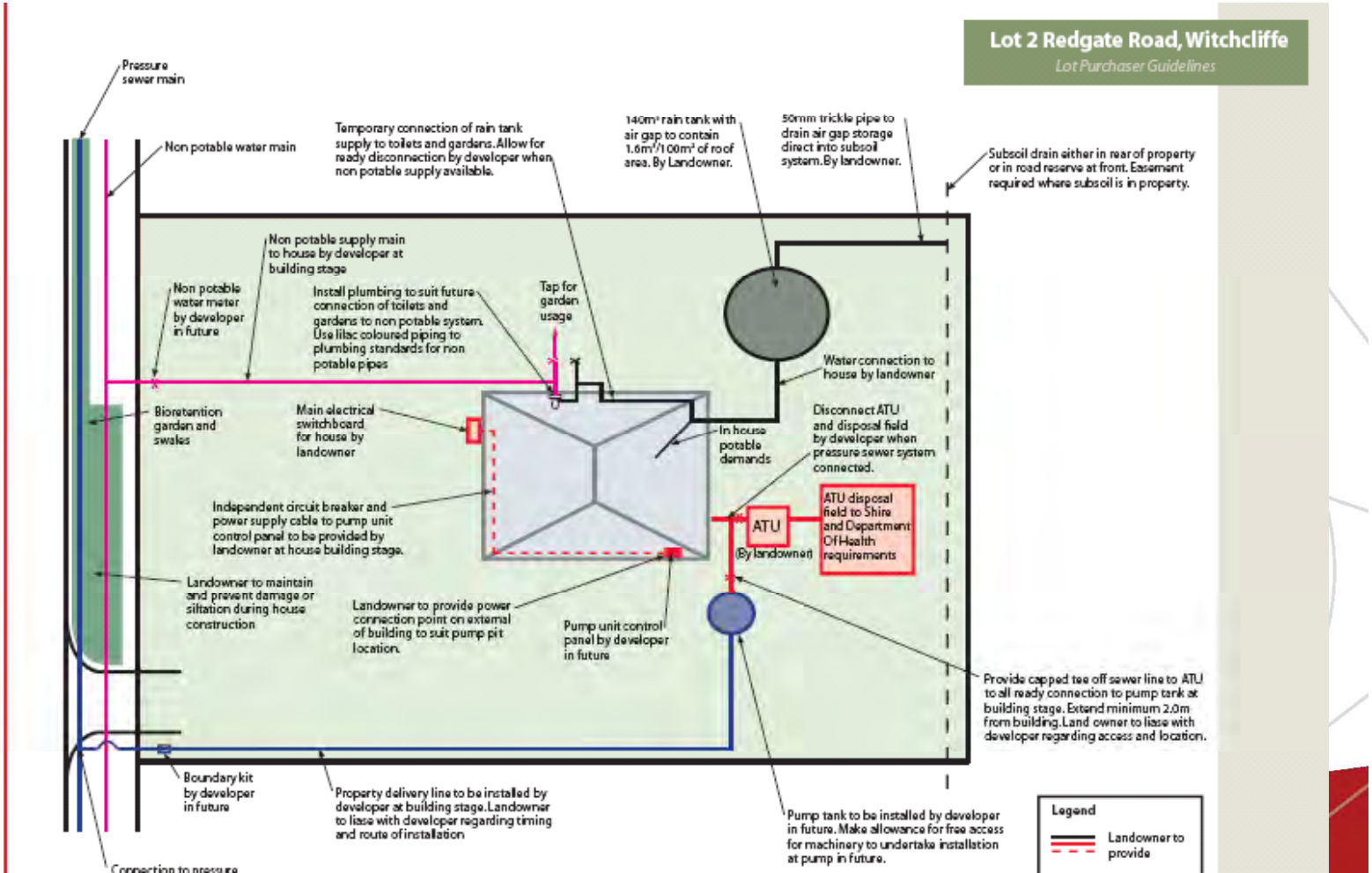
Insufficient flows initially to commission treatment plant (30% load)

Release initial stages of lots (approx 2000 m^2 each) with ATU's and larger rainwater tanks (as initially no non potable supply to reduce demand)

When sufficient flows generated complete treatment plant and connect all houses to pressure sewer and non potable schemes



Lot Purchaser Guidelines



WSUD

Lot 2 Redgate Road, Witchcliffe

Urban Water Management Plan

07183

Febuary 2010

Key Elements

Figure 4 - Key Elements Plan

Environmental Issues

Figure 5 - Identified Weeds And Foreshore Condition

SOURCE: CCG

Figure 6 - Environmental Plan

Water Dependent Ecosystems

8. DRAINAGE MANAGEMENT OVERVIEW

The aim of the drainage management for the Witchcliffe development is to both control peak flow rates to predevelopment levels and to improve the water quality of the runoff from the site.

The flows from the 1:1 year ARI 1 hour event will be captured and treated in a series of bioretention swales throughout the site to reduce nutrients and sediments in the stormwater.

A minimum of 2% bioretention area (1120 m2) is required to be supplied to treat the stormwater from the development site. A total area of 1200 m2 is being provided. (2.14% of equivalent impervious area).

The flows from the 1:5 year ARI and 1:100 year ARI events will be captured in the same bioretention swale system and then any excess flows will be conveyed by a pit and pipe system to a series of landscaped detention basins where flow peaks will be reduced to the predevelopment levels before discharge to the site. No flows will be retained in these basins other than natural soakage so that the downstream creek system is not restricted in receiving its environmental flows.

All flows calculated are based on returning the site hydrology to that which occurred prior to the plantation of Bluegums being established.

The upstream flows from the rural catchment south of Redgate Road (catchment A1 in Fig 10) are not being treated as they will be catered for when that land is developed in the future but the flow volumes are being catered for in the system hydraulics.

Figures 14 to 16 show the schematic designs for the stormwater treatment and conveyance system that have been agreed with the Shire and Figure 17 shows the expected nutrient removal performance of the bioretention swale system based on an area of 2% of the equivalent impervious area of the development.

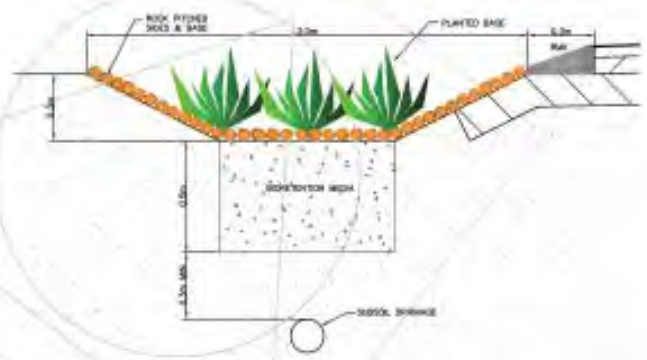


Figure 14 - Typical Vegetated Bioretention Swale

All flows from the development are assumed to be captured within the stage one boundary and are then treated and conveyed to the outlet of the A2 catchment (Fig 10).

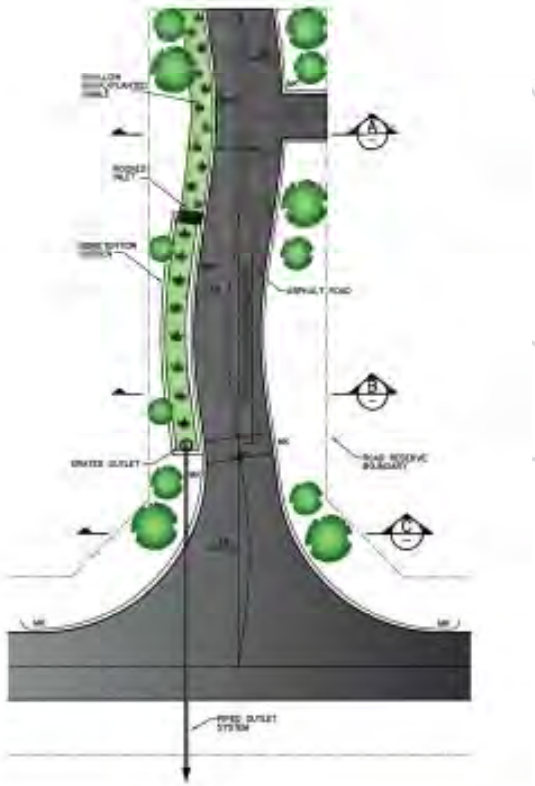


Figure 15 - Typical Road Detail

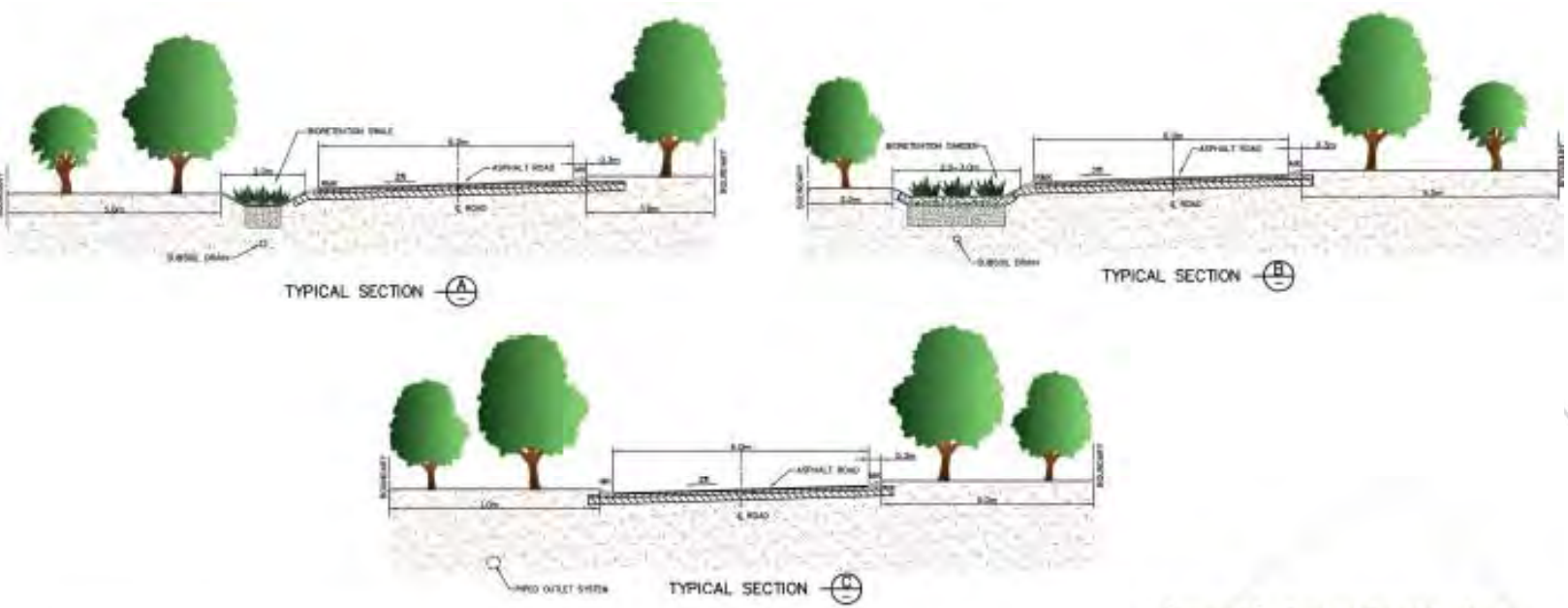
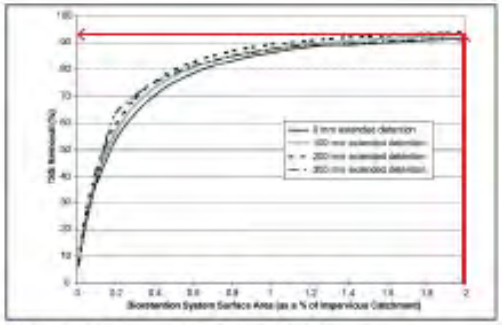
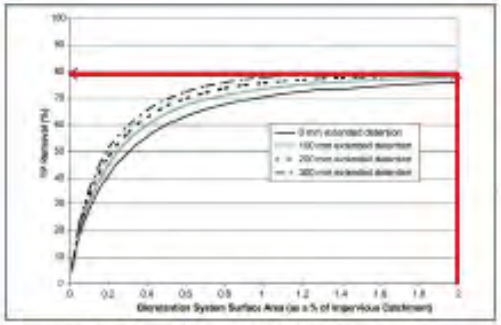


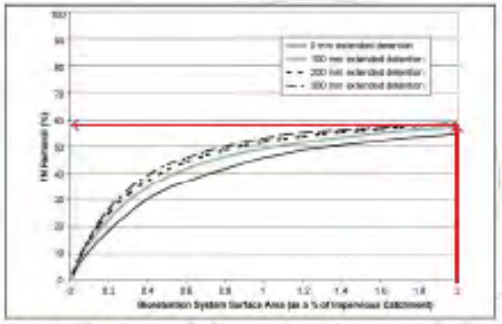
Figure 16 - Typical Road Sections



Bioretention System TSS removal performance



Bioretention System TP removal performance



Bioretention System TN removal performance

Figure 17 - Bioretention Removal Performance

1 in 1 year

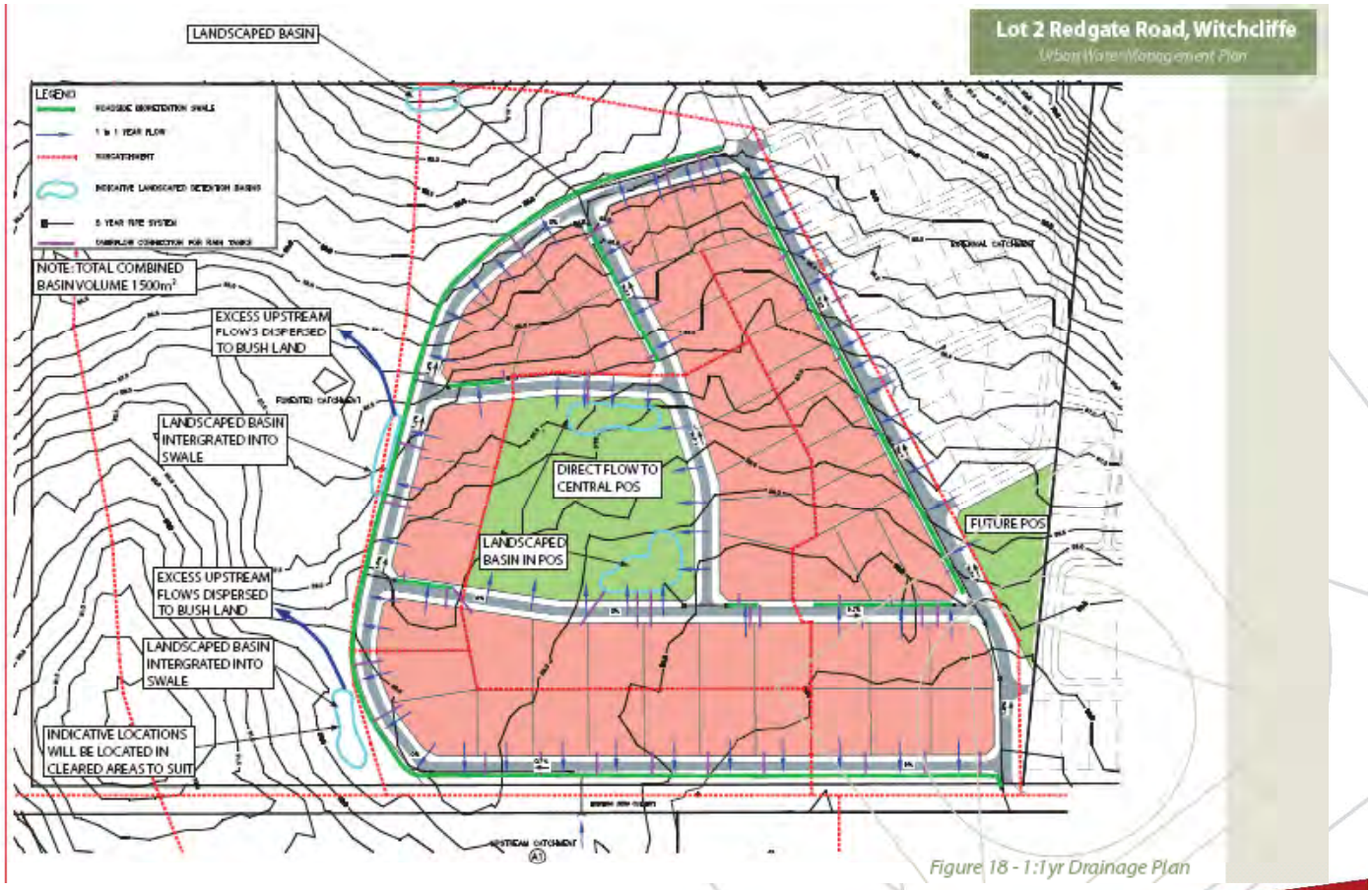


Figure 18 - 1:1yr Drainage Plan

1 in 5 year

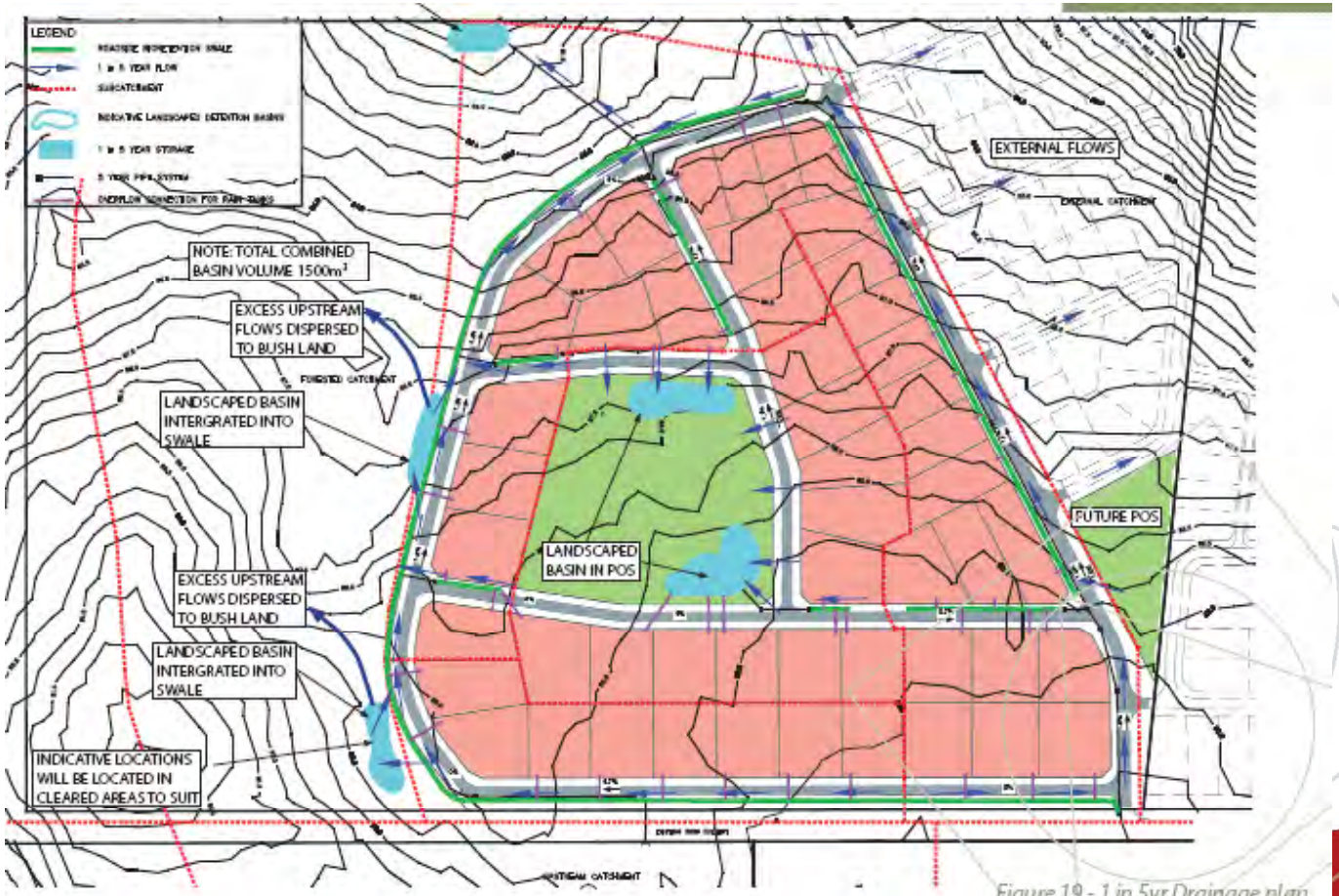
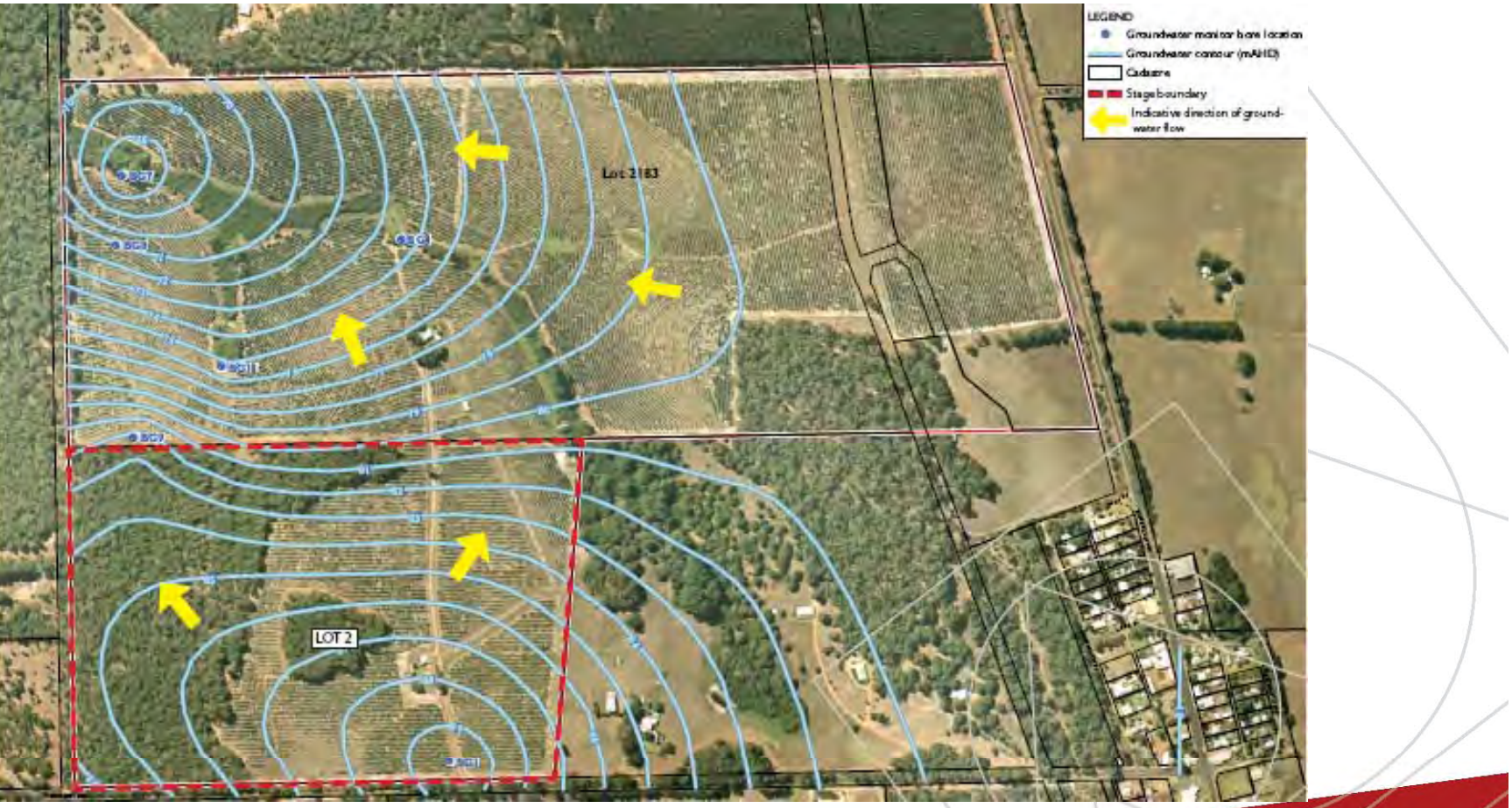
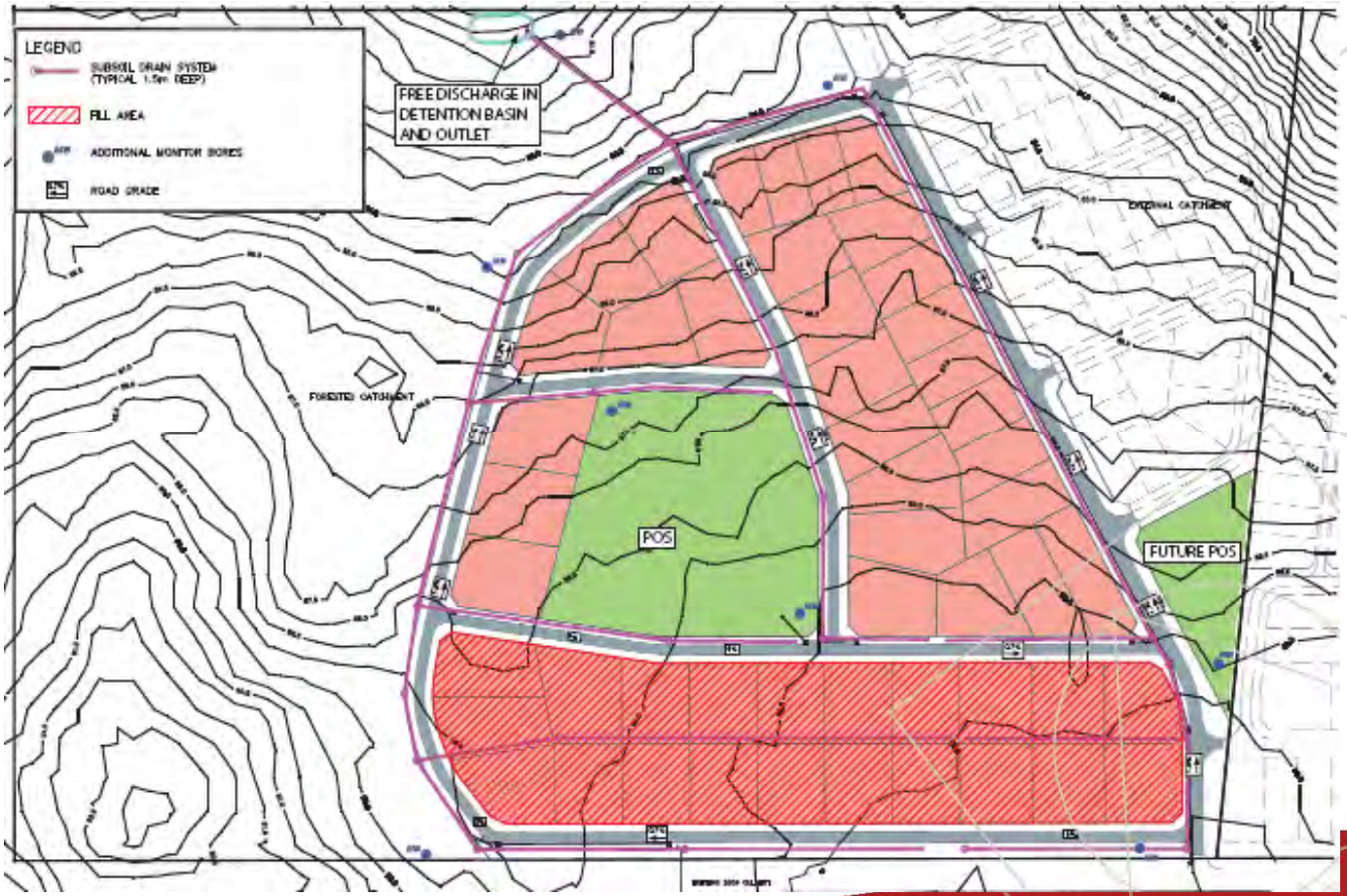


Figure 19 - 1 in 5yr Drainage plan

Groundwater



Subsoil System



Erosion and Sediment Control

14. EROSION AND SEDIMENT CONTROL PLAN

General Requirements

As identified in the Boodjidup Brook Action Plan and as required by the Shire of Augusta Margaret River and Erosion and Sediment Control Plan should be established and implemented at the time of development.

The following measures are recommended and should be adopted at the development stage for Lot 2.

Limiting Area of Disturbance

During construction minimum site disturbance for the shortest possible time will be the key in limiting the areas for sediment generation.

Movement of vehicles in areas outside the development area should be minimised so as to limit the area of disturbance.

Any ruts or bare areas that develop should be immediately restored and protected from further scour with hay bale filters.

Diversion and Control of Runoff

At the commencement of construction the flow diversion and dissipation drain that takes flows from the catchment south of Redgate Road should be installed as earkly as possible so that in the event of a rainfall event flows from the upstream catchment do not disturb the development site.

Infrastructure Service Trenches

For this development it is proposed that all service trenches be reinstated and compacted after laying of services as soon as possible so as to minimise the generation of possible sediment. Special care will also be taken in location of excavated spoil and in disposal of surplus spoil.

Stabilised Site Access

To prevent the egress of sediment from the site it would be proposed to construct stabilised site access points at the main entry to the development off Redgate Road.

This would be simply an area of metal aggregate placed over the entry to trap any sediment prior to leaving the site.

A similar arrangement could be used at any hardstand areas on the site for contractor facilities.

Sediment and Silt Traps

At each of the entry points to the piped drainage system sediment traps would be installed.

In addition temporary silt fences may be required to the bioretention swales to prevent silt entry prior to stabilisation of the site and planting of the bioretention swales.

Temporary Silt fences would also be installed at the outlets from the flow dissipation drains and the detention basins at the end of the system.

Vegetative Stabilisation

At completion of all earthworks the exposed areas and fill areas will be stabilised with hydromulch or native seeding to promote rapid revegetation of exposed surfaces.

Firebreaks

It is preferable for firebreaks to follow contours but this is not always possible.

In this instance however some of the firebreaks will travel down the slope and so it would be recommended that regular cross drains / compacted trafficable buds should be provided to divert water away from the firebreaks and to minimise erosion.

Blue gum Plantation

In areas where the Blue gums have been cleared but development will not be proceeding in the first stage of development the tree stumps will be allowed to coppice and regrow. It has been advised that if left this way the trees could grow to 4 to 6 m within 2 years and will substantially reduce the amount of runoff and subsequent erosion in their area. These trees could be then left for later reharvesting or clearing should development of the area proceed prior to harvesting size.

Residential Building Stage

At the residential building stage the property developer has little control over activities on site or on the sediment that can be generated form the site.

However there are a number of guidelines that can be given to the purchasers of the lots by the Shire to minimise sediment generation from the sites. The developer of the land could also make this information available to purchasers of the land.

In the Shire of Augusta Margaret River there is the "Guidelines for Erosion and Sediment Control at Building Sites in Western Australia" that can be utilised

Measures that could be undertaken at building stage include:

- Sensible site planning
- Diversion of upslope water (where appropriate Stabilised site entry/ exit point
- Silt fences to protect Bioretention gardens
- Minimisation of site disturbance and duration of disturbance
- Installation of sediment controls along the lower edge of the site
- Appropriate location and protection of stockpiles
- Early connection of roof downpipes
- Trap onsite runoff from toil, paint and concrete washing and brick, tile and concrete cutting

Erosion and Sediment Control

- All hard waste be stored onsite in a way that prevents material loss by wind or water
- When travelling to and from site, secure load to prevent wind blown litter and sediment
- Immediate removal of accidental spills of materials
- Continual monitoring and maintenance of all control measures
- Compaction of backfilled of trenches
- Revegetation and stabilisation of the site

Inspection and Maintenance

Successful implementation of an Erosion and Sediment Control Plan will require regular inspection and maintenance of the installed systems and measures.

It is proposed that the Contractor would inspect and repair all works daily and that a minimum of weekly audit inspections would be undertaken by the construction phase engineer.

Emergency Stabilisation of Erosion

For this site a clear path of communication will be established between the engineer, contractor and the local authority to ensure that any emergency situations can be dealt with promptly. Sources of required materials such as hay bales will be predetermined and incorporated into the contingency arrangements.

Silt Fence On Building Site

Typical Signage

Litter Control To Building Site And Fence To Swale

Future

Witchcliffe is breaking new ground- Redgate Estates are pioneering the way- Stage 1 commencing shortly

System proposed is new for WA- will be one of first implemented fully

Similar systems have been common in Eastern States for many years

This system will be the benchmark for future developments in WA

Will aid in reducing demand on Water Resources into the future