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Brimbin

Integrated Water Cycle Management Strategy

301015-02225 – EN-REP-0001

July 2013

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BRIMBIN
INTEGRATED WATER CYCLE MANAGEMENT STRATEGY

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Front Cover: *Part of the site of the proposed new town of Brimbin (source: Manning River Times, 13 March 2013)*

PROJECT 301015-02225 - BRIMBIN

REV	DESCRIPTION	ORIG	REVIEW	WORLEY-PARSONS APPROVAL	DATE	CLIENT APPROVAL	DATE
0	FINAL	TM	DS	DS	12-Jul-2013		

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EXECUTIVE SUMMARY

Background

This report outlines an Integrated Water Cycle Management (IWCM) strategy for a proposed residential and industrial development at Brimbin, approximately 10 kilometres north of Taree. This study is intended to accompany a rezoning application for the Brimbin site.

The objective of this study is to address the requirements of MidCoast Water (MCW) in assessing a rezoning application for the Brimbin development precinct. This will involve preparing high level concepts for the provision of water supply, sewerage and recycled water infrastructure to the site, which will be considered in a manner that will satisfy IWCM objectives.

This study also includes a high level assessment of the cost and technical feasibility of providing water supply and sewerage infrastructure to the Brimbin development precinct. Potential staging of this infrastructure will also be determined based on likely rates of development.

Proposed Development

The overall development of the Brimbin site would incorporate residential development with schools, neighbourhood centres, retail and commercial areas, employment lands (light to general industry), landscape and recreational areas. This will also include all associated infrastructure including water supply and sewerage, roads, drainage, electricity, gas, telecommunications and transport routes.

The total area of the proposed Brimbin development precinct is approximately 3,800 hectares (refer to Brimbin Structure Plan (July 2013) contained in **Appendix 1)**. Of this total area, approximately 1,500 hectares is identified as being non-developable (e.g. conservation, riparian corridors, lakes). The remaining area (approximately 2,300 hectares) is intended to comprise residential, commercial, industrial, primary production, environmental living and private recreation development. The Brimbin Structure Plan (July 2013) has been adopted to estimate the ultimate potable water demand, sewerage loadings and recycled water demand for the site.

The major part of the proposed Brimbin development is approximately 874 hectares designated for residential development including low density, medium density, seniors living and large lot residential (approximately 4000 m^2 per lot) development. It is anticipated that the residential development yield of the Brimbin site would be up to 8000 dwellings, which is consistent with projections contained in the *Mid-North Coast Regional Strategy* (NSW Department of Planning, 2009).

Other major components of the proposed development requiring water and wastewater services include:

- approximately 740 hectares of Environmental Living (Zone E4) proposed in the eastern most portion of the site adjacent to the Lansdowne River, the majority of which would be for private conservation.

- approximately 400 hectares of Primary Production (Zone RU4), which would be designated for small scale rural and primary production.
- approximately 112 hectares of General Industrial (Zone IN1), consisting of light to general industrial development that would generate employment opportunities for future residents of Brimbin and surrounding areas.
- approximately 26 hectares of retail, commercial and civic land.

It is anticipated that the development would occur at an average rate of 300 residential lots per year, with other non-residential development to be staged progressively in proportion to residential development. It is anticipated that ultimate development of the site could take up to 30 years.

Water Demand and Sewage Loadings

Projected water demands and sewage loadings were prepared based on anticipated lot yields within the Brimbin development precinct and a design household equivalent tenement (ET) from MCW. The purpose of this assessment was to determine ultimate design criteria and infrastructure capacity requirements for the site.

The residential development area is expected to yield up to 8000 ET, consisting of general residential development (7020 ET), medium density and seniors living development (810 ET) and a large lot residential area with lots up to 4 ha each (170 ET).

Non-residential development areas are expected to yield up to 1,123 ET, of which the major component is 112 hectares of 'employment lands' (784 ET). Other non-residential development includes commercial, retail, educational and private recreation areas.

The design flows for future development areas were estimated based on MCW benchmark water demand breakdown, demand reduction factors to allow for uptake of water saving devices within residential areas, and allowance for recycled water demand for toilet flushing and outdoor irrigation in new residential areas. These design flows were utilised to estimate the extent of potable water, sewerage and recycled water infrastructure required to service ultimate development of the Brimbin site.

Integrated Water Cycle Management

The key goals of implementing an IWCM strategy for the Brimbin development precinct are:

- Minimising potable water demand within the development.
- Minimising the net volume of effluent disposal required for the site and therefore minimising effluent discharge into downstream waterways (i.e. Dawson and Manning Rivers).
- Maximising potential for water reuse and recycling within the development.

There are a number of constraints and opportunities posed by potential development of the Brimbin site in relation to water cycle management. One of the major opportunities for development of the site is the provision of a dual reticulation recycled water supply to the site, which would satisfy the requirements of state legislation (BASIX) and reduce future potable water consumption by around 50%. The major issues surrounding potential development of the site include the scale of the development and the need for significant upgrades to the existing MCW water supply and sewerage systems.

Effluent Management Options Assessment

One of the major limitations to potential future development of the Brimbin site is capacity to dispose of effluent generated by development of the site. In addition to consideration of water cycle management options for Brimbin, various effluent management options have been assessed to reduce or offset the effluent disposal capacity required for the site.

Based on a preliminary review of a series of effluent management options, three options were identified for further assessment:

- **Option 1** – Dual reticulation recycled water supply for internal and external reuse within Brimbin residential areas.
- **Option 2** – Recycled water supply to Brimbin for agricultural and open space irrigation.
- **Option 3** – Expansion of the Taree Effluent Management Scheme (TEMS) to cater for effluent from Brimbin.

Following a preliminary triple bottom line analysis of these three options, the preferred effluent management option is provision of a reticulated recycled water system for new residential areas and areas designated for Primary Production within the Brimbin site. This system would include a recycled water treatment facility at Dawson STP, a recycled water pumping station and rising main system and a network of distribution mains and reticulation pipework throughout the Brimbin site.

This system would satisfy BASIX requirements for new residential areas and would provide sufficient capacity to dispose of all of the effluent generated from the site in dry weather. Wet weather flows would continue to be managed by existing means at Dawson STP including storage in effluent holding ponds.

Preliminary Options Assessment

The IWCM strategy outlines a preliminary assessment of options for provision of water supply sewerage and recycled water to the Brimbin site. This qualitative assessment summarised a number of benefits and disadvantages associated with each option. Further to this qualitative assessment, the selected options for the purposes of preparing the IWCM strategy and satisfying the requirements of MCW are described below:

Potable Water Supply:	Connection to the MCW water supply system.
Sewerage:	Connection to the MCW sewerage system, including sewage treatment at Dawson Sewage Treatment Plant (STP).
Recycled Water Supply:	Provision of a reticulated recycled water supply system for internal and external reuse, including a recycled water treatment facility at Dawson STP. The system would provide recycled water treated to a level suitable for unrestricted public access.

Preliminary Water Cycle Management Option

Further to the consideration of various options for water supply, sewerage and recycled water servicing of Brimbin, the selected water cycle management options for the Brimbin development precinct are discussed in **Section 6** of this report. These have been selected based on a preliminary options assessment and may be subject to further consideration and optimisation at later stages of the project.

A brief summary of the selected water cycle management option for the Brimbin site is included below.

Potable Water

Significant upgrades to the existing Irkanda to Harrington water supply system will be required to service the Brimbin development site with potable water. WorleyParsons has undertaken conceptual analysis of the Irkanda supply system using a WaterCAD model to determine the likely extent of upgrades that would be required to cater for ultimate development of Brimbin. Based on a review of previous studies and WaterCAD model results, the likely extent of water supply upgrades required to service ultimate development of the Brimbin site is presented in **Figure 1** and generally described below.

Initial Stages

Servicing of initial stages of the development could be achieved by providing an extension off an existing DN150 main in Lansdowne Road into the site. The number of lots that can be serviced off this existing main would need to be confirmed by MidCoast Water. In order to satisfy minimum pressure requirements, it is likely that the initial stages of development would need to be located below RL 40m AHD. Servicing initial stages off the existing DN150 main in Lansdowne Road is assumed on the basis that initial stages of the development are located in close vicinity to the existing main.

Phase 1 (up to 3000 ET)

Further development would require a new trunk water main to be constructed off the existing DN375 main between Irkanda Reservoir and Harrington. It is anticipated that the new main would need to be a DN300 main, approximately 6,800 metres in length, capable of supplying approximately 3000 ET.

The main would generally follow the alignment of the existing Lansdowne Road and terminate at the northern extent of the proposed 'employment lands' within the site.

Phase 2 (up to ultimate development)

Development beyond approximately 3000 ET would require an additional trunk main to be constructed between Irkanda Reservoir and at least one new potable water reservoir to be constructed at a high point in the north of the site. The new trunk main would be approximately 9,700 metres of DN375 pipe. The ultimate potable water storage capacity required for Brimbin would be around 7.5 ML. A booster pump station would also be required to lift water to the new reservoir.

Sewerage

The area encompassing the Brimbin development precinct is not currently serviced by a reticulated sewerage system. The nearest sewage treatment plant to the site is Dawson STP, which is located approximately 6 kilometres south of the Brimbin site on the northern side of the Dawson River. Dawson STP currently services the entire Taree Sewerage Scheme. The majority of effluent from Dawson STP discharges into the Manning River near Cundletown via an effluent pumping station and DN450 effluent main.

The likely extent of sewerage system upgrades required to service ultimate development of the Brimbin site is presented in **Figure 2** and generally described below.

Initial Stages

It is proposed to construct sewage transfer infrastructure to connect the Brimbin site to Dawson STP prior to construction of lots within the development site. Interim measures, such as tankering sewage to Dawson STP or supplementing sewage flows from other sources may be required until the site has sufficient sewage loading to minimise sewage detention times within the transfer infrastructure.

Upgrade of Dawson STP

MCW have advised there is sufficient space within the existing footprint of Dawson STP to allow for future upgrades to cater for growth within the catchment, including Brimbin. This would include augmentation and/or replication of existing units including inlet works, secondary clarifiers, maturation ponds, UV disinfection and biosolids handling.

Phase 1 (up to 4000 ET)

In order to transfer sewage from Brimbin to Dawson STP, a network of sewage rising mains and pumping stations will need to be constructed. A DN300 rising main, approximately 4,400m in length, would be constructed via Lansdowne Road and along the western boundary of the existing railway corridor to Brimbin STP. This main would transfer sewage from the southern and eastern portions of the site, including residential and non-residential development.

Phase 2 (up to ultimate development)

An additional DN300 rising main, approximately 5,400m in length, would be constructed via Brimbin Road and the existing electricity easement which is aligned in a north-easterly direction and traverses the Brimbin site. This main would transfer sewage from the western and northern portions of the site.

Reticulation

Given the proximity of the site to a number of watercourses including Dawson and Manning Rivers, it would be necessary to adopt a sewerage reticulation system with a low risk of overflow and exfiltration. It is assumed that a leak tight gravity sewerage system would be adopted within the development site to minimise inflow and infiltration, hence reducing the volume of stormwater that would enter the sewerage system. In addition, suitable provision for emergency storage would also be made to minimise the risk of sewage overflow into downstream waters.

Recycled Water

The recycled water strategy to service Brimbin would consist of constructing trunk infrastructure to transfer recycled water from a treatment facility at Dawson STP to the development site. The recycled water strategy is generally described below and presented in **Figure 3**.

Initial Stages

It is likely that the construction of recycled water infrastructure would be deferred until there are a sufficient number of residential lots that would connect to the system. The optimum timing of construction, commissioning and connection of a recycled water supply system to Brimbin would be subject to further detailed studies.

Recycled Water Treatment Facility

In order for a reticulated recycled water system to be implemented for Brimbin, upgrades to the treatment processes at Dawson STP will be required, including an additional treatment facility that would produce effluent of a standard suitable for unrestricted public access. This system would nominally include membrane filtration and chlorination in order to treat the current plant effluent to the required standard.

The ultimate design flow for the treatment facility would be approximately 4.5 ML/day, which is equivalent to the ultimate peak day recycled water demand. In order to defer capital expenditure it is proposed that upgrades to the STP for recycled water treatment be undertaken in stages.

Recycled Water Transfer and Storage

Ultimate development of the Brimbin site could be serviced off a single DN300 recycled water main. Based on a preliminary assessment of ultimate recycled water demand, this trunk main would be approximately 8,200 metres in length and would be constructed between Dawson STP and the north-western extent of the site. At least two recycled water pumping stations would need to be constructed to transfer recycled water from Dawson STP into the site, and ultimately to a recycled water reservoir.

Preliminary Infrastructure Costs

A preliminary estimate of the order of cost has been prepared for the selected water, sewerage and recycled water servicing option. Costs would be classified as either developer funded internal works or lead-in works. Lead-in works would be funded by MCW and would be recovered as a portion of the overall headworks charges, which are determined and periodically reviewed by MCW.

The preliminary cost estimates for lead-in works to service the Brimbin site with potable water, sewerage and recycled water are summarised below:

- Potable Water $13,780,000
- Sewerage $7,310,000
- Recycled Water $15,270,000

- **TOTAL** **$36,360,000**

Conclusion

The selected water supply, sewerage and recycled water servicing options would satisfy the objectives of IWCM for the Brimbin development site, in that potable water demand would be minimised and water recycling opportunities would be maximised throughout the life of the development.

1 INTRODUCTION

WorleyParsons has been engaged by Roche Group to prepare an Integrated Water Cycle Management (IWCM) Strategy for a proposed residential and industrial development at Brimbin, approximately 10 kilometres north of Taree. A locality plan of the site is presented below in **Figure 1**.

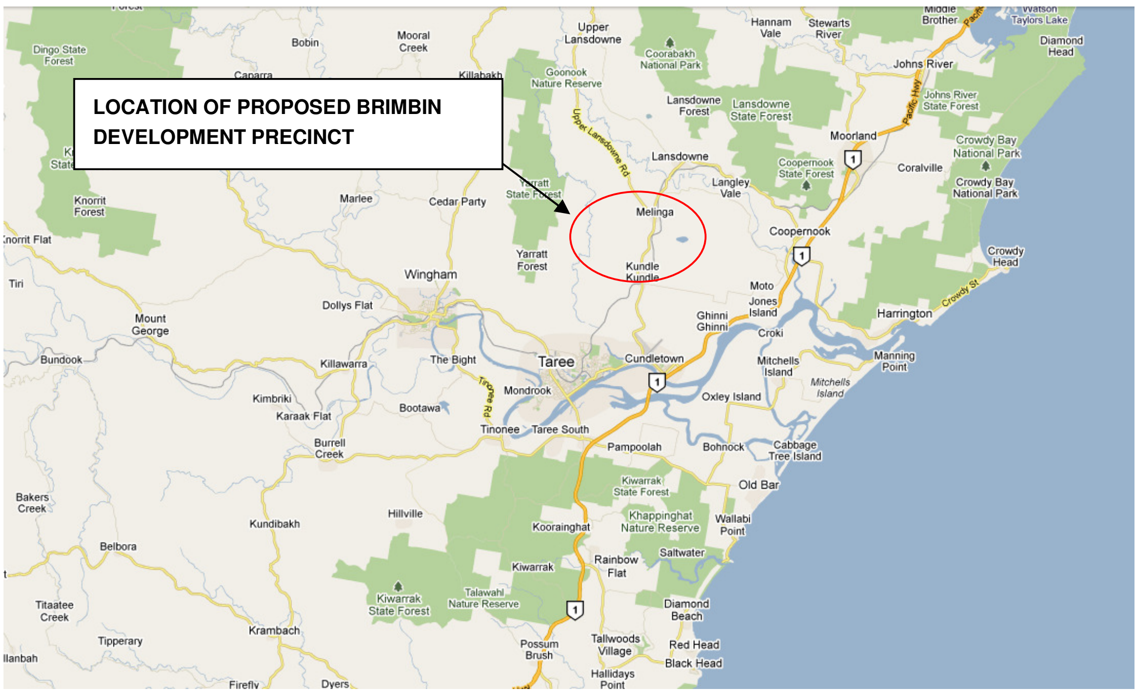


Figure 1: Locality Plan of Brimbin and surrounds **(Source: Google Maps)**

This study is intended to accompany a rezoning application for the Brimbin site. It will also assist Greater Taree City Council (GTCC) and MidCoast Water (MCW) in assessing the rezoning application, particularly regarding water management issues related to potential development of the site.

1.1 Background

The total area of the proposed Brimbin development precinct is approximately 3,800 hectares. Of this total area, approximately 1,500 hectares is identified as being non-developable (e.g. conservation, riparian corridors, lakes). The remaining area (approximately 2,300 hectares) is intended to comprise residential, commercial, industrial, rural, environmental living and open space development. The Brimbin Structure Plan (July 2013), contained in **Appendix 1**, presents the proposed ultimate development composition for the site.

MCW prepared an initial scope of works which broadly identifies the issues that need to be addressed as part of the rezoning for the Brimbin site (refer to **Appendix 2**). The scope of works is defined in two broad categories, namely:

1. An integrated water cycle management (IWCM) strategy
2. Water supply and wastewater servicing strategies

The purpose of the IWCM study and servicing strategies is to consider a full range of water cycle management issues related to potential development of the site and to determine the most appropriate solution for providing water supply, sewerage and recycled water services to the site. Stormwater management within the site will also be considered in the context of providing these services.

1.2 Site Description and Current Landuse

The Brimbin site is located to the north of existing urban development at Taree. The site is generally bound by existing rural land holdings to the north, Lansdowne River to the east, Brimbin Road and Kundle Kundle Road to the south and Dawson River to the west. The site is also approximately bisected by Lansdowne Road and the North Coast Railway Line.

Approximately half of the site is currently used for agricultural purposes, primarily consisting of cleared grazing lands. The remaining half of the site consists of dense native vegetation including forested areas, estuarine wetlands and riparian vegetation.

Under the Greater Taree Local Environmental Plan (LEP) 2010, the site consists of portions of land zoned as RU 1 (Primary Production), RU 4 (Rural Small Holdings) and E2 (Environmental Conservation).

1.3 Study Objectives

The objective of this study is to address the requirements of MidCoast Water in assessing a rezoning application for the Brimbin development precinct (refer to correspondence in **Appendix 2**). This report contains an assessment of the following:

- An urban water balance, including potential potable and recycled water demand and sewage generation in the proposed Brimbin development precinct.
- An options assessment for offsets to water supply and effluent generation, including triple bottom line (TBL) analysis.
- Integration of a preferred water supply and sewerage servicing option with stormwater management objectives for the site.
- Infrastructure concept plans for ultimate development of the site.

- Preliminary determination of headworks capacity for water supply and sewerage servicing of the site.

This study also includes a high level assessment of the cost and technical feasibility of providing water supply, sewerage and recycled water infrastructure to the Brimbin development precinct. Potential staging of this infrastructure will also be determined based on likely rates of development.

2 PROPOSED DEVELOPMENT

2.1 Types of Development

The overall development of the Brimbin site would incorporate residential development with schools, neighbourhood centres, retail and commercial areas, employment lands (light to general industry), landscape and recreational areas. This will also include all associated infrastructure including water supply and sewerage, roads, drainage, electricity, gas, telecommunications and transport routes.

Table 2-1 includes the proposed development composition based on the Brimbin Structure Plan (refer to **Appendix 1**). The development composition is presented by the land use zones described in the *Greater Taree Local Environmental Plan 2010*.

Table 2-1 Proposed development composition based on Brimbin Structure Plan

Development Type by LEP Zoning	Area (hectares)
Developable Areas	
R1 – General Residential (includes 746 ha of residential development, the remainder consists of private recreation, riparian corridors and open space)	1162
B4 – Mixed Use (includes 54 ha of medium density / seniors housing, the remainder consists of mixed-use centre, high school, central lake and riparian corridors)	115
IN1 – General Industrial	112
RU4 – Primary Production Small Lots	400
R5 – Large Lot Residential	74
E4 – Environmental Living	740
TOTAL DEVELOPABLE AREA	**2603**
Non-Developable Areas	
E1 – National Parks and Wildlife	984
E2 – Environmental Conservation	158
SP2 – Infrastructure (re-aligned freight rail)	18
TOTAL NON- DEVELOPABLE AREA	**1160**
TOTAL SITE AREA	**3763**

The major part of the proposed Brimbin development is approximately 874 hectares designated for residential development including low density, medium density, seniors living and large lot residential (approximately 4000 m^2 per lot) development. Of the 874 hectares designated for residential development, 746 hectares would be zoned R1 – General Residential, 54 hectares would be zoned B4 – Mixed Use and 74 hectares would be zoned R5 – Large Lot Residential. It is anticipated that the residential development yield of the Brimbin site would be up to 8000 dwellings, which is consistent with projections contained in the *Mid-North Coast Regional Strategy* (NSW Department of Planning, 2009).

Another major component of the proposed development is approximately 112 hectares of General Industrial land, which would consist of light to general industrial development that would generate employment opportunities for future residents of Brimbin and surrounding areas. A further 26 hectares would be assigned for retail, commercial and civic development.

Up to 400 hectares of developable area is designated for Primary Production with some potential for future employment development.

A further 740 hectares of land in the eastern portion of the Brimbin development precinct has been designated for 'Environmental Living', the majority of which would be for private conservation. It is unlikely that this portion of the site would be connected to reticulated water and sewerage in the future, given:

- the relative isolation of this portion of the site from the majority of the proposed development;
- the distance to any existing or potential future water supply and sewerage infrastructure; and
- the proposed dwelling density being around one lot per 10 hectares.

It is likely that on-site rainwater tanks and on-site wastewater treatment systems would be the most appropriate form of servicing for this portion of the site.

2.2 Staging and Rate of Development

Due to the proximity to existing infrastructure and urban development at Taree, staging of the proposed residential development at Brimbin is expected to commence from the southern portion of the site adjacent to Lansdowne Road. Non-residential development would commence within close proximity to the recreational lake and Lansdowne Road. The development would then generally proceed towards the north and north-west.

It is anticipated that the development would occur at an average rate of 300 residential lots per year, with other non-residential development to be staged progressively in proportion to residential development.

Given the extent of the site, the rate of development is almost certain to change throughout the life of the development. Based on the initial assumption of an average of 300 residential lots per year, ultimate development of the site could take up to 30 years.

3 WATER DEMAND AND SEWAGE LOADINGS

Projected water demands and sewage loadings have been prepared based on anticipated lot yields within the Brimbin development precinct and a design household equivalent tenement (ET) from MCW. The purpose of this assessment is to determine ultimate design criteria and infrastructure capacity requirements for the site.

As discussed in **Section 2.1**, up to 740 hectares of the site is proposed to be rezoned as Environmental Living (Zone E4). Due to the relative isolation of this portion of the site from the majority of the proposed development, the distance to any existing or potential future water supply and sewerage infrastructure and the proposed dwelling density, it is considered appropriate that this part of the site would not be serviced by reticulated water supply and sewerage. Therefore, the proposed Environmental Living zone has not been further considered in the calculation of ultimate residential development yield, potential water demand or sewage generation.

3.1 Projected Development Yield

3.1.1 Residential

For the purposes of estimating projected sewage loadings within the Brimbin development precinct, an equivalent population (EP) of 2.2 EP per ET will be adopted for future residential development. This is consistent with MCW's future loading forecasts within the Dawson STP catchment.

The current Brimbin Structure Plan (refer to **Appendix 1**) includes allowance for up to 874 hectares of various types of residential development. In addition to the general residential areas (low density), the Brimbin Structure Plan also includes allowance for other residential development including medium density residential, designated seniors living and large lot rural residential development (approximately 4000 m^2 per lot). The total ultimate residential development is expected to yield up to 8000 ET.

A summary of the anticipated ultimate residential development yield within Brimbin, based on the Brimbin Structure Plan (May 2013), is included in **Table 3-1**.

Table 3-1 Ultimate Residential Development Yield

Development Type	Area (ha)	ET per ha	Ultimate ET
General Residential (R1)	746	9.4	7020
Medium Density / Seniors Housing (B4)	54	15.0	810
Large Lot Residential (R5) [1]	74	2.3	170
TOTAL	**874**	**-**	**8000** [2]

1. Average lot size in large lot residential area approximately 4000 m^2 each with a yield of approximately 170 lots in this area.

2. The projected number of residential lots within Brimbin (8000) is consistent with the Mid North Coast Regional Strategy projections for the site.

As discussed in **Section 2.2**, the rate of development is expected to occur at an average of 300 residential lots per year, meaning that ultimate development may take up to 30 years.

3.1.2 Non-Residential

As previously discussed, a major component of the proposed Brimbin development is 112 hectares assigned as 'employment lands', which would include uses such as bulky goods retailing, warehouses, distribution centres and general industrial uses. Additional non-residential development will include a retail centre, schools, commercial precincts, neighbourhood shops and recreational areas.

A summary of the anticipated ultimate non-residential development yield within Brimbin, based on the Brimbin Structure Plan, is included in **Table 3-2**.

Table 3-2 Ultimate Non-Residential Development Yield

Development Type	Area (ha)	ET per ha	Ultimate ET
General Industrial	112	7	784
Mixed-Use Centre (commercial and retail)	26	5	130
Schools (Primary and Secondary)	15	7	105
Private Recreation (e.g. golf course)	52	2	104
TOTAL	**205**	**-**	**1123**

It is noted that the non-residential demand component of the projected development yield is equivalent to approximately 15% of the total projected demand. In comparison, MCW estimates that the existing non-residential loading at the Dawson Sewage Treatment Plant is between 20% and 35% of the total load.

3.2 Design Water Demand and Sewage Generation

MCW have advised that a typical design water demand per ET for their area of operation (including Brimbin) is 205 kL/ET/year. This is equivalent to 255 L/EP/day (assuming 2.2 EP per ET). MCW have advised that this figure is seasonally variable, in that:

- 30% of total annual demand occurs in summer months.
- 25% of total annual demand occurs in spring and autumn months.
- 20% of total annual demand occurs in winter months.

MCW have provided a breakdown of water usage in a typical household. This breakdown will be used to estimate sewage generation and potential recycled water demand within a typical household. The adopted proportion of total internal and external household water usage is included in **Table 3-3**.

Table 3-3 Breakdown of design water demand (MidCoast Water)

Area of Usage	Percentage breakdown	MCW Design Demand (L/EP/day)	Percentage Hot Water demand	Hot Water Demand (L/EP/day)
Outdoor	27%	69	0%	0
Toilet	12%	31	0%	0
Laundry	22%	56	30%	17
Bathroom	29%	74	50%	37
Kitchen	5%	13	50%	6
Other	5%	13	0%	0
TOTAL	**100%**	**255**	**-**	**60**

MCW have advised that their design water demand of 205 kL/ET/year has taken into account some uptake of water efficient devices in existing dwellings.

For the Brimbin site, actual water demand and sewage generation would be expected to be less than the MCW design demand for new development areas due to the uptake of additional water saving devices to satisfy BASIX requirements, water restrictions and heightened awareness of the general public to minimise water usage.

For the purposes of estimation of potable and recycled water demand in new development areas, the following assumptions on water demand reduction compared to the MCW benchmark have been adopted.

- 20% reduction for water saving shower heads (2 star rated)
- 35% reduction for dual flush toilets
- 15% reduction for water efficient washing machines (2 star rated)
- 20% reduction for water efficient kitchen taps (2 star rated)

It is noted that these reductions represent approximately half of the total reduction in water usage for each of the respective uses (i.e. the MCW design water demand already accounts for the other half of the water demand reduction).

A comparison between the benchmark water demand and reduced water demand with the assumed demand reductions is included in **Table 3-4**.

Table 3-4 Comparison between MCW design demand and reduced water demand

Area of Usage	MCW Design Demand (L/EP/day)	Reduced Demand (L/EP/day)
Outdoor	69	69
Toilet	31	20
Laundry	56	48
Bathroom	74	59
Kitchen	13	10
Other	13	13
TOTAL	**256**	**219**

The reduced demand presented in **Table 3-4** (219 L/EP/day) represents a 15% decrease compared to MCW design demand, which is consistent with MCW's objective of offsetting effluent generation and potable water supply.

The statutory BASIX requirement is for a 40% reduction in potable water use compared to existing state averages for all new residential dwellings. This would result in a potable water demand of 156 L/EP/day. As the reduced demand represents a greater demand than that under the BASIX requirement, it is conservative in terms of determining ultimate infrastructure capacity. The further 25% reduction in potable water use to meet BASIX requirements would be made up by utilising alternative water sources such as dual reticulation recycled water or rainwater harvested in on-site tanks.

3.3 Potential Recycled Water Demand

The potential recycled water use in future development areas such as Brimbin would be based on the reduced water demand (including the MCW outdoor demand) and sewage generation including provision for water demand reduction.

It is assumed that recycled water would be used within the Brimbin development precinct for internal and external use in residential areas, including:

- Toilet flushing (20 L/EP/day)
- Outdoor irrigation (69 L/EP/day)

These assumptions would mean that recycled water could comprise as much as 40% of total household water demand based on the average MCW design outdoor demand. The actual daily recycled water demand within the site will vary depending on a number of factors such as rainfall, temperature and soil moisture conditions.

Based on the benchmark water demand, adopted water demand reduction and recycled water usage assumptions, the design flows that have been adopted for sewage generation, potable water demand and recycled water demand are summarised in **Table 3-5**.

Table 3-5 Design flows for future development areas

Area of Usage	Adopted Demand (L/EP/day)	Wastewater to Sewer (L/EP/day)	Potable Water Demand (L/EP/day)	Recycled Water Demand (L/EP/day)
Outdoor	69	0	0	69
Toilet	20	20	0	20
Laundry	48	48	48	0
Bathroom	59	59	59	0
Kitchen	10	10	10	0
Other	13	13	7	6
TOTAL	**219**	**150**	**124**	**95**

It is noted that based on the MCW design water demand shown in **Table** 3-4 and the likely potable water demand shown in **Table 3-5**, the reduction in potable water demand as a result of demand reduction measures and a recycled water system could be up to 52% compared to existing average consumption. This will also better the current BASIX requirement of 156 L/EP/day potable water demand.

The use of dual reticulation recycled water would reduce the average volume of effluent generation from the Brimbin site from 150 L/EP/day to 55 L/EP/day. This substantially reduces the environmental impact of the development on the overall health of the receiving waters. It would also reduce any increases in operational costs associated with the existing MCW effluent disposal system.

3.4 Ultimate Loadings and Design Criteria

The estimation of ultimate potable water demands, sewage production and recycled water demands within the Brimbin development precinct are based on the design flows presented in **Table 3-5** and the following assumptions:

- Recycled water would be supplied to all new residential areas within the Brimbin development precinct. Allowance for recycled water supply to existing nearby townships (including Taree) and other potential development areas are not included in this study.
- No allowance has been made in this report for supply of recycled water to non-residential areas. Whilst it is very likely that non-residential users will utilise recycled water, estimation of the demand is highly dependent upon specific industries. Consequently it is considered

conservative to ignore this demand, both in terms of potable water infrastructure and effluent disposal. It is likely that the decision to provide recycled water to non-residential areas would be made at either the subdivision or development application phase of development of the site.

- Projected recycled water demand is based on internal and external reuse including connection to toilets and outdoor taps.
- An average daily demand for outdoor recycled water usage of 69 L/EP/day (refer **Table 3-5**) has been adopted. This figure would vary day to day depending on climatic conditions (i.e. temperature and rainfall), which would impact upon the total daily recycled water demand.
- New sewerage systems (including conventional gravity sewerage) would be designed and constructed to ensure minimal inflow and infiltration. This would reduce the storm allowance required to be considered in the design of sewage transportation and treatment infrastructure.

3.4.1 Potable Water

The aforementioned design criteria have been utilised to estimate the extent of potable water infrastructure required to service ultimate development of the Brimbin site. Potable water demands for residential and non-residential development are summarised in **Table 3-6** and **Table 3-7** respectively.

For the purpose of this study, potable water infrastructure has conservatively been sized based on the reduced water demand without consideration for recycled water supply. As shown in **Table 3-6**, recycled water use would reduce potable water demand by around half, which would also reduce the scale of potable water infrastructure upgrades.

Table 3-6 Potable Water Design Criteria – Residential

	Units	Potable Water Demand	
		without RW supply	with RW supply
Ultimate Residential Development	ET	8000	8000
Potable Water Demand	L/EP/day	219	123
Persons per equivalent tenement	EP / ET	2.2	2.2
Average Day Demand	kL/ET/day	0.48	0.27
Average Day Demand (Ultimate)	ML/day	3.8	2.2
Peak Day Factor	-	*2.25*	*2.25*
Peak Day Demand	kL/ET/day	1.80	1.17
Peak Day Demand (Ultimate)	ML/day	14.4	9.4
Peak Instantaneous Demand (Ultimate)	L/s/ET	0.07	0.046
Peak Instantaneous Demand (Ultimate)	L/s	560	368

Table 3-7 Potable Water Design Criteria – Non-Residential

	Units	Potable Water Demand
Ultimate Non-Residential Development	ha	205
Average Day Demand (light industry)	kL/ha/day	11.5
Average Day Demand	ML/day	2.36
Peak Day Factor	-	1.2
Peak Day Demand (Ultimate)	ML/day	2.83
Peak Hour Factor		1.3
Peak Hour Demand (Ultimate)	L/s	43

3.4.2 Sewerage

Ultimate sewage loadings have been estimated based on the aforementioned design criteria and are summarised in **Table 3-8**.

Table 3-8 Sewerage Design Criteria – Residential and Non-Residential

	Units	Sewage Loadings		
		Residential	Non-Residential	TOTAL
Ultimate Development	ET	8000	1123	9123
Wastewater to sewer	L/EP/day	150	150	150
Persons per equivalent tenement	EP / ET	2.2	2.2	2.2
Average Dry Weather Flow (Ultimate)	L/s	30.6	4.3	34.9
Average Dry Weather Flow (Ultimate)	ML/day	2.6	0.4	3.0
Peak to average flow	-	2	2	2
Peak Dry Weather Flow (Ultimate)	L/s	61	9	70
Storm Allowance	L/s/ET	0.035	0.035	0.035
Peak Wet Weather Flow (Ultimate)	L/s	341	48	389

3.4.3 Recycled Water

Potential recycled water demands for ultimate residential development and Primary Production areas are summarised in **Table 3-9** and **Table 3-10** respectively.

Table 3-9 Recycled Water Design Criteria – Residential

	Units	Recycled Water Demand	
		excluding laundry	Including laundry
Ultimate Standard Residential Development [1]	ET	8000	8000
Recycled Water Demand	L/EP/day	95	143
Persons per equivalent tenement	EP / ET	2.2	2.2
Average Day Demand	kL/ET/day	0.21	0.31
Average Day Demand (Ultimate)	ML/day	1.67	2.51
Peak Day Factor	-	*6.0*	*4.0*
Peak Day Demand	kL/ET/day	1.26	1.26
Peak Day Demand (Ultimate)	ML/day	10.08	10.08
Peak Day Demand (Ultimate)	L/s	117	117
Peak Instantaneous Demand	L/s/ET	0.049	0.049
Peak Instantaneous Demand (Ultimate)	L/s	392	392

1. Includes proposed medium density and seniors living development areas. Whilst the majority of recycled water demand is for outdoor uses, which would be less for medium density and seniors living, inclusion of these development types is conservative in terms of estimating required infrastructure capacity.

Table 3-10 Recycled Water Design Criteria – Primary Production

	Units	Recycled Water Demand
Ultimate Primary Production Area [1]	Ha	400
Adopted Irrigation Application Rate [2]	ML/ha/yr	1.9
Annual irrigation rate	ML/yr	760
Adopted peak recycled water demand [3]	L/s/ha	0.88
Peak recycled water demand	L/s	352

1. Based on the Brimbin Structure Plan (refer to **Appendix 1**).
2. Based on the average irrigation application rate across the TEMS in 2009/10, although subject to confirmation through further studies.
3. Based on the peak flows for irrigation areas within the TEMS, although subject to confirmation.

4 INTEGRATED WATER CYCLE MANAGEMENT

4.1 Objectives

IWCM involves the integration of water supply and sewerage services with other urban services, including roads and stormwater drainage, to maximise benefits to local water utilities and the environment in general.

Water use in developed countries like Australia is high and demand continues to grow with an increasing population. This growth in demand is putting pressure on potable water supplies and resulting in the need to use all available water resources in a more sustainable and integrated manner. Examples of integration of water resources include using a proportion of stormwater and/or recycled water to supplement the water supply, reducing potable water demand and increasing opportunities for water reuse and recycling. The Brimbin development will need to adopt one or all of these water cycle integration measures to satisfy a number of key objectives.

The key goals of implementing an IWCM strategy for the Brimbin development precinct are:

- Minimising potable water demand within the development.
- Minimising the net volume of effluent disposal required for the site and therefore pollutant discharge into downstream water (i.e. Dawson and Manning Rivers).
- Maximising potential for water reuse and recycling within the development.

4.2 Major Issues and Opportunities

The Brimbin development would provide the following potential opportunities in terms of water supply, sewerage and water cycle management:

- Given the scale of the development, there are opportunities to provide infrastructure in a number of stages and therefore take advantage of future improvements in technologies and regulatory changes (e.g. on-site treatment systems, use of rainwater tanks for potable water supply).
- Water recycling, whether it is in the form of rainwater tanks or a reticulated recycled water system, would satisfy the requirement under state legislation (BASIX) of a 40% reduction in potable water consumption compared to existing average consumption. Furthermore, reticulated recycled water could provide a reduction in potable water usage of around 50% and reduces potential increases in effluent disposal volume as a result of urban development.
- The supply of recycled water would reduce the extent and cost of future upgrades that would be required to the existing trunk potable water supply system that services Taree and surrounding townships.

- Reticulated recycled water systems are generally being required in new major development areas in Australia and a system to service the Brimbin site would be one of the first within the MCW area of operation. The system could become a centre piece for the community and encourage support and education for sustainable water management.

There are a number of issues which will affect the formulation of an IWCM strategy for the Brimbin development. These issues are outlined below.

- The size of ultimate development would be roughly equivalent to the size of the existing township of Taree. If the development were to be connected to the existing MCW water supply and sewerage systems, significant upgrades would be required to these systems.
- State legislation (BASIX) requires each new dwelling to achieve a minimum 40% reduction in potable water use compared to the average consumption across NSW (BASIX, 2010). This could be achieved by either:
    - Connecting residential areas to a reticulated recycled water system; or
    - Providing rainwater tanks on each residential lot that would be used for outdoor irrigation and toilet flushing.
- Market acceptability may pose a challenge to the supply of water from recycled water and/or rainwater tanks for uses such as in laundries and hot water systems.
- The distance between the Brimbin site and the nearest point of connection to existing sewerage infrastructure (Dawson Sewage Treatment Plant (STP)) will result in relatively high construction and operation costs.
- Large storages would be required for recycled water to cater for peak irrigation demand during summer periods unless there are demand management practices in place.
- Depending on the effluent disposal volume available within the Dawson STP catchment, excess recycled water may need to be discharged to Dawson and/or Manning Rivers, resulting in an increase in nutrient and runoff load. Any increases in the volume of effluent disposal and pollutant discharge (suspended solids, phosphorus and nitrogen) as a result of development would be subject to licensing and regulatory approval.
- Any sewerage system at Brimbin would increase the risk of sewage and/or effluent overflow to downstream waters.

4.3 Preliminary Options Assessment

There are a number of potential water supply, sewerage and recycled water servicing options available which would satisfy the requirements of MCW in preparing an IWCM strategy. A summary of these options is included in the following sections.

4.3.1 Potable Water

There are two potential options that have been considered for the provision of potable water to the Brimbin site. These are:

- Connection to the MCW potable water supply system.
- Provision of on-site rainwater tanks to supply potable water.

A summary of the benefits and disadvantages of these two options is included in **Table 4-1**.

Table 4-1 Potable Water Servicing Options

IWCM Option	Benefits	Disadvantages
Connection to the MCW water supply system	• Most conventional and accepted option. • Very low risk of issues associated with water quality and security of supply.	• Would require significant upgrades to the existing system, including supply mains, storage and possibly headworks.
Provision of on-site rainwater tanks to supply potable water	• Avoids the need for significant upgrades to the MCW system. • May provide a proportion of on-site stormwater detention requirements.	• Security of supply would not be guaranteed 100% of the time (i.e. during extreme dry weather). • NSW Health does not currently endorse the use of rainwater tanks for potable water supply in urban areas. • Responsibility and cost associated with maintenance and replacement of tanks would be the borne by the property owner.

The use of on-site rainwater tanks for potable water supply in urban areas is currently not endorsed by NSW Health due to concerns regarding water quality. Therefore, this option has not been further considered at this stage of the project. The selected option for water supply servicing of Brimbin would be connection to the MCW supply system. This option presents the lowest risk to the developer and is widely accepted as the most suitable option by authorities and the general public.

Given the scale of the development, upgrades to the MCW water supply system would need to be staged over the period of the development (assumed to be around 30 years). The staging of water supply infrastructure would not preclude the consideration of on-site rainwater tanks for potable water supply in the future.

4.3.2 Sewerage

Two potential options for the provision of sewerage to the Brimbin site have been considered. These are:

- Connection to the MCW sewerage system, including sewage treatment at Dawson STP.
- Construction of on-site water reclamation plants (WRPs) for sewage treatment.

A summary of the benefits and disadvantages of these two options is included in **Table 4-2**.

Table 4-2 Sewerage Servicing Options

IWCM Option	Benefits	Disadvantages
Connection to the MCW sewerage system	• Ability to utilise existing sewage treatment and effluent disposal infrastructure.	• Distance to the nearest existing MCW sewerage infrastructure (approx. 5km to Dawson STP), resulting in relatively high capital costs. • Would require long term upgrades to Dawson STP.
Construction of on-site water reclamation plants (WRPs)	• Minimises the capital and operating costs associated with longer distance of sewage transfer to Dawson STP. • Potential to produce effluent of a higher quality than existing processes at Dawson STP. • Avoids the need for upgrade of Dawson STP.	• Would require rigorous environmental assessment and approval processes. • Dependent on the availability of a suitable location for on-site STPs. • Additional operating costs for MCW or a private operator. • Need to provide discharge to local waterway for wet weather and/or periods of low irrigation demand.

Connection to the MCW sewerage system presents the least risk and most conventional sewerage servicing option for the Brimbin development. However, the distance between Brimbin and Dawson STP would require capital investment to provide sewage transfer infrastructure including pumping stations and rising mains. Capital costs could be deferred for initial stages of the development by providing temporary on-site sewage treatment plants with on-site disposal or by providing a tankering service.

Considering the potential difficulty in gaining approval for a permanent on-site STP, and the dependence on a suitable location, this option has not been considered any further at this stage of the project. Therefore, the selected option for provision of sewerage services to the Brimbin development precinct would be connection to the MCW sewerage system.

Sewerage infrastructure would be staged over the development period which would allow for the uptake of improved treatment technologies in the future. Similar to potable water supply infrastructure, the selected sewerage servicing option would not preclude the consideration of alternative options in the future, including on-site WRPs.

4.3.3 Recycled Water

MCW have advised that one of the major constraints to development at Brimbin is the capacity of effluent disposal at Dawson STP. Due to the environmental sensitivity of Dawson River, the majority of effluent from Dawson STP is currently pumped to the Manning River via a 6km long DN450 effluent main. Any increases in effluent disposal into the Dawson and/or Manning Rivers would be subject to regulatory approval and licensing, which poses a significant challenge to various authorities.

For the purposes of this study and to satisfy the overarching objectives of IWCM, it is assumed that any IWCM option adopted for the Brimbin site would include a water reuse and recycling component, whether it is in the form of a reticulated recycled water supply and treatment system and/or rainwater tanks.

Three potential options for recycled water servicing of the Brimbin site have been considered. These are:

- A reticulated recycled water supply system for internal and external reuse, including a recycled water treatment facility at Dawson STP. This system would need to provide recycled water treated to a level suitable for unrestricted public access.
- A reticulated recycled water system for internal and external reuse, supplied by on-site WRPs.
- Internal and external reuse of roof runoff collected in rainwater tanks for non-potable uses.

A summary of the benefits and disadvantages of these options is included in **Table 4-3**.

Table 4-3 Recycled Water Servicing Options

IWCM Option	Benefits	Disadvantages
A reticulated recycled water system for internal and external reuse, utilising existing and additional treatment facilities at Dawson STP	• Would maximise the offset of potable water use and meet potable water reduction requirements (BASIX) for new development areas. • Treatment facility could be incorporated into existing treatment process at Dawson STP. • Recycled water supply would be available immediately from Dawson STP (current loading approximately 23,000 EP) • Minimise overall effluent discharge from Dawson STP	• Recycled water transfer between Dawson STP and the Brimbin site, resulting in high operating costs.
A reticulated recycled water system for internal and external reuse, supplied by on-site water reclamation plants	• Would maximise the offset of potable water use and meet potable water reduction requirements (BASIX) for new development areas. • Treatment process would be fully integrated with on-site sewage treatment. • Lower capital and operating cost for delivering recycled water compared to a treatment facility at Dawson STP. • Minimise overall effluent discharge from Dawson STP	• Would require rigorous environmental assessment and approval processes. • Dependent on the availability of a suitable location for on-site STPs. • Additional operating costs for MCW or a private operator. • Recycled water supply not available until sufficient development is connected to an on-site system.

IWCM Option	Benefits	Disadvantages
Internal and external reuse of roof runoff collected in rainwater tanks (approximately 4 kL per lot)	• Provides a "free" source of water (i.e. not subject to water usage charges). • Provides limited on-site stormwater detention. • Less operating costs and energy use compared to a reticulated recycled water system.	• Provides less potable water reduction compared to a reticulated recycled water system. • Does not provide minimisation of effluent disposal capacity. • Responsibility and cost associated with maintenance and replacement of tanks would be the borne by the property owner.

A reticulated recycled water supply would offset a proportion of effluent generated by development at Brimbin. This would in turn reduce the volume of effluent disposal capacity required as a result of the development. MCW have indicated that effluent management is one of the most important considerations in formulating an IWCM for the site. Therefore, in terms of effluent management, reticulated recycled water would be advantageous in comparison to rainwater tanks.

One of the drawbacks of reticulated recycled water is the capital and ongoing costs associated with duplication of infrastructure. This cost is typically passed onto residents in the form of recycled water usage and service charges. In Sydney the price of recycled water ($1.609/kL) is currently calculated at 80% of the potable water charge ($2.012/kL) (Sydney Water, 2011). In comparison, recycled water collected in rainwater tanks would not be subject to usage and service charges, although there are ongoing costs associated with maintenance of rainwater tanks (e.g. tank cleaning, pump maintenance).

Rainwater tanks are advantageous in overall IWCM terms as they contribute to development wide stormwater management objectives, particularly control of stormwater quality and quantity within the site. Provision of rainwater tanks on individual lots would offer some on-site stormwater detention (OSD) capacity and would minimise the volume of stormwater pollutants discharged to downstream waters. A Stormwater Management Strategy prepared for the Brimbin site (WorleyParsons, 2013) does not include provision of rainwater tanks within residential areas. Instead, detention basins incorporating stormwater treatment measures across the catchment have been adopted in lieu of rainwater tanks in the Strategy. Greater Taree City Council (GTCC) has responded that their preference would be for the bulk of OSD to be in designated detention areas to minimise restrictions on titles, easements and covenants in relation to private OSD facilities (GTCC, April 2011).

The selection of a preferred recycled water servicing option (reticulated recycled water or rainwater tanks) would be influenced by the selection of a preferred effluent management strategy for development at Brimbin. A detailed assessment of various effluent management options is included in **Section 5**.

5 PRELIMINARY EFFLUENT MANAGEMENT OPTIONS

5.1 Background

One of the major limitations to potential future development of the Brimbin site is capacity to dispose of effluent from Dawson STP generated by development of the site. As part of the water cycle management options for Brimbin, there is a need to consider various effluent management options to reduce or offset the effluent disposal capacity required for the site.

This section outlines a preliminary assessment of various effluent management options that may be adopted for Brimbin.

5.2 Performance Objectives

The following performance objectives are applicable to the preferred effluent management option for Brimbin:

- Provide sufficient capacity to dispose of 100% of effluent generated from the Brimbin site in dry weather.
- Existing 76 ML effluent holding ponds and additional buffer storage at Dawson STP could be utilised to manage wet weather flows.
- Minimise the volume of effluent to be disposed of by installing leak tight gravity sewerage, hence reducing inflow and infiltration and lessening peak wet weather flows to Dawson STP.
- Ensure Dawson STP does not exceed the flow and load based license conditions stipulated within its Environment Protection License (EPL).

5.3 Existing Effluent Management Systems

There are currently three means of effluent disposal at Dawson STP:

1. Discharge via the Taree Effluent Management Scheme (TEMS).
2. Discharge via a DN450 effluent main which outlets into the Manning River at Phillip Street, Chatham.
3. Discharge directly to Dawson River via effluent holding ponds located adjacent to the river.

The TEMS commenced operation in 2009 and is providing beneficial reuse of effluent from Dawson STP on farms at Cundletown and Dumaresq Island. In 2009/10, approximately 380 ML of effluent from Dawson STP was used to irrigate 200 hectares of farmland. This represented approximately 25% of the total effluent discharged from Dawson STP in that period (HydroScience, 2010).

In addition to the TEMS, approximately 30 ML per year of reclaimed effluent is used for irrigation of a 10 hectare hardwood farm located in the buffer zone of the STP. Additional effluent reuse on farms near the STP also occurs on a relatively minor scale.

The existing effluent disposal capacity at Dawson STP is limited by the following:

- The capacity of the existing pump station at Dawson STP that delivers effluent to the TEMS is limited to 175 L/s. The pump station is currently able to deliver up to 7 ML/day at 12 hours pumping per day. The peak demand at the irrigation areas within the TEMS is estimated to be approximately 240 L/s (HydroScience, 2010). Therefore, the existing transfer system from Dawson STP is unable to meet peak demands at the irrigation areas at Cundletown and Dumaresq Island.
- The TEMS currently delivers effluent to ten rural properties in Cundletown and Dumaresq Island with a total irrigation area of 200 hectares. In 2009/10 the total quantity of effluent supplied to the TEMS was approximately 380 ML, equivalent to 1.9 ML/ha/yr. This equated to 25% of the total outflow from Dawson STP. The remaining 75% was released into the Manning River at Chatham or via the effluent holding ponds adjacent to Dawson River.
- An Environment Protection Licence (EPL) for Dawson STP (License No. 2531) prescribes a number of effluent volume and pollutant mass limits related to discharge of effluent. MCW is required under Section 55 of the *Protection of the Environment Operations (POEO) Act 1997* to ensure that effluent discharge from Dawson STP does not exceed these licence conditions. It is noted that the TEMS is not included within this EPL.

Under the 'business-as-usual' scenario of effluent management within the Dawson STP catchment, the effluent disposal capacity at Dawson STP would need to be increased to cater for development at Brimbin. This would require one or a combination of the following to be implemented:

- Increasing the capacity of the existing 76 ML effluent holding ponds at Dawson STP.
- Upsizing the effluent pump station and rising main that delivers recycled water to the TEMS.
- Amending the EPL for Dawson STP to allow for a greater discharge to Dawson River (subject to regulatory approval).

5.4 Merit Assessment

There are a number of options available to manage effluent generated by development at Brimbin. These options are listed below:

- Dual reticulation of recycled water to Brimbin residential areas.
- Recycled water supply for open space and agricultural areas within Brimbin.
- Expansion of the existing TEMS.
- Increasing wet weather storage at Dawson STP.

- Potable reuse.

Based on a preliminary review of the aforementioned effluent management options, three options have been identified for further assessment:

- **Option 1** – Reduce net effluent volume via implementation of a recycled water supply for internal and external reuse within Brimbin residential and employment areas.
- **Option 2** – Reduce net effluent volume via implementation of a recycled water supply to Brimbin for agricultural and open space irrigation.
- **Option 3** – Increase non river effluent disposal via expansion of the TEMS to cater for effluent from Brimbin.

A brief merit assessment is presented below for other effluent management options that could be considered for Brimbin. For various reasons, these options have been ruled out for further consideration at this stage.

5.4.1 Wet Weather Storage at Dawson STP

Increasing wet weather storage capacity at Dawson STP would allow for storage of greater volumes of effluent during periods of wet weather and would minimise overflow into Dawson River.

The existing effluent holding ponds at Dawson STP have a total capacity of 76 ML, which is equivalent to approximately 19 days of effluent storage at existing ADWF. This would reduce to approximately 11 days of effluent storage once ultimate development of Brimbin is reached.

Increasing wet weather storage should not be considered in isolation from the other effluent management options. Increased storage capacity could provide flexibility to store more effluent prior to overflow. However, exact storage requirements to minimise wet weather overflow to a level acceptable under the current EPL could not be quantified without establishing transfer rates from the STP or available areas for irrigation within the TEMS or elsewhere.

5.4.2 Direct Discharge to Dawson River

It is considered that any release of untreated wastewater directly into the Dawson River would have significant environmental implications and raise community concern. Direct discharge to downstream waters is also contradictory to current effluent management practices at Dawson STP and other sewerage schemes operated by MCW.

This option is likely to result in significant impacts on ecosystems within the Dawson and Manning Rivers. Significant community concern and regulatory controls with such a proposal would also be expected. This option has not been further considered.

5.4.3 Transfer to nearby sewerage system

Dawson STP is the main sewage treatment facility for Taree and is likely to remain so for the foreseeable future. In addition to Dawson STP, the following smaller treatment plants are operated by MCW in the region:

- Wingham (approximately 14km from Brimbin)
- Old Bar (approximately 17km from Brimbin)
- Harrington (approximately 19km from Brimbin).
- Minor schemes at Lansdowne (approximately 6km from Brimbin) and Coopernook (approximately 10km from Brimbin).

These STPs are considerably smaller than Dawson STP and would not have sufficient capacity to cater for sewage generated by development at Brimbin without significant upgrades. In addition, the distance of these STPs from Brimbin further precludes them as viable alternatives.

Given the lack of a nearby sewerage scheme capable of accepting effluent from Brimbin, this option has not been further considered,

5.4.4 Potable Reuse

MCW has developed a Sustainable Water Cycle Management Plan (SWCMP) that identifies potable reuse of recycled water as a future sustainable opportunity. Whilst the SWCMP describes this option as a suitable source substitution to cater for demand growth, this future option would also provide a highly effective and weather independent effluent management option, involving the transfer of effluent from a sewage treatment facility directly to the intake of a drinking water treatment facility, effectively creating a “closed loop” water supply and sewage treatment scheme.

Some of the issues associated with potable reuse include those briefly described below:

- This method of reuse requires more complex, costly and energy intensive levels of treatment compared to other effluent disposal options.
- Such a scheme would require long distance transfer of treated effluent to return into the urban water cycle.
- There is yet to be widespread public acceptance of potable reuse given the concepts and technologies are still relatively new.
- The regulatory framework within NSW has not been firmly established and the political climate of such schemes remains untested.

Potable reuse is currently the most extreme case of water recycling and is currently only likely to be adopted in situations where water supplies are at a critical level. There are a number of technical, regulatory and social challenges that would need to be overcome before potable reuse is seen as a viable water management solution. As such, potable reuse has not been further considered within this report.

5.5 Effluent Management Options Assessment

5.5.1 Option 1 – Dual Reticulation

This option would involve installation of a dual reticulation recycled water scheme within the Brimbin development site. This would deliver high quality recycled water for outdoor irrigation and toilet flushing in residential areas.

The scheme would require construction of additional treatment facilities at Dawson STP, including membrane filtration and chlorination units, to produce recycled water to a quality suitable for reuse in residential areas. These units would be installed to further treat effluent from the existing treatment processes at Dawson STP.

Recycled water would be delivered from Dawson STP to Brimbin via one or more recycled water pumping stations and rising mains. At least one recycled water reservoir would also be required within the site to meet peak demands (during dry weather).

5.5.2 Option 2 – Agricultural and Open Space Irrigation

This option would involve supply of recycled water to areas within the Brimbin site designated as Primary Production. The total area designated for Primary Production within the Brimbin Structure Plan (July 2013) (refer to **Appendix 1**) is approximately 400 hectares. Other public or private open space areas such as golf courses could be included under this option, however as the total area of such spaces is relatively small compared to the area available for Primary Production they have not been considered. Furthermore, other recycled water servicing options such as stormwater harvesting may be more suitable for such public and private open space areas.

Additional treatment processes, including sand filtration and chlorination, would be required at Dawson STP to produce recycled water to a quality suitable for unrestricted access. Recycled water would be delivered to areas designated as Primary Production via one or more pumping stations and rising mains. Under this option it is assumed that on-site storage of recycled water would not be provided. Instead, the existing 76 ML effluent holding ponds at Dawson STP would be used for storage.

Based on the projected ultimate development yield of the site, the projected ADWF generated at Brimbin would be approximately 3 ML/day, which equates to approximately 1100 ML/year. The actual effluent volume requiring disposal would be greater than this, accounting for wet weather flows. Nonetheless, the average annual irrigation rate across the area designated as Primary Production would need to be at least 3.0 ML/ha/yr in order to discharge the projected ultimate ADWF generated by Brimbin.

Typical application rates for the land designated for Primary Production at Brimbin could be in the vicinity of 3 to 4 ML/ha/yr on average. Further detailed site assessments, including soil testing and preparation of a detailed water balance for the site, would need to be undertaken to determine likely irrigation application rates. However, it is likely that the majority of effluent generated by development at Brimbin could be used for irrigation of areas designated as Primary Production.

It is noted that the annual irrigation application rate across the 200 hectares of farmland within the TEMS was approximately 1.9 ML/ha/yr in 2009/10 (HydroScience, 2010).

5.5.3 Option 3 – Expansion of TEMS

This option would involve expanding the existing TEMS by connecting additional rural properties to Dawson STP. This is likely to require construction of a new effluent pumping station and rising main, as the existing transfer system does not have sufficient capacity to supply the optimal expected maximum irrigation demands at the ten properties currently within the TEMS.

As previously mentioned, the ultimate ADWF generated by development at Brimbin is projected to be approximately 3 ML/day, equivalent to approximately 1100 ML/year. Based on the 2009/10 application rate of 1.9 ML/ha/yr (HydroScience, 2010), an additional 595 hectares of irrigation area would be required to cater for all of the dry weather effluent generated by Brimbin.

There is little opportunity to provide the required additional irrigation area near the existing TEMS at Cundletown and Dumaresq Island. MCW have advised that there are a number of potential areas for expansion of the TEMS located to the west of Coopernook. A preliminary environmental assessment undertaken for the TEMS identified a number of properties near Coopernook as having potential for inclusion within the TEMS. The total area considered in this assessment was in the order of 550 hectares. For the purposes of this study, it is assumed that any expansion of the TEMS would occur in the areas previously identified by MCW to the west of Coopernook.

5.6 Triple Bottom Line Assessment

5.6.1 Preliminary Cost Estimates

Preliminary capital and operating cost estimates for each of the three effluent management options is presented in **Table 5-1**. Detailed estimates and NPV analyses are included in **Appendix 4**.

Table 5-1 Preliminary Estimates for Effluent Management Options

Effluent Management Option	Cost ($,000)		
	Capital	Operating (per year)	NPV (30 yrs. @ 7%)
Option 1	56,810	322.5	35,281
Option 2	64,780	83.1	32,794
Option 3	101,160	43.1	49,795

Other than upgrades required to achieve water quality requirements for various end uses, these estimates do not include upgrades to primary and secondary treatment processes at Dawson STP because they would be common to all options.

Option 1 presents the lowest estimated capital cost of the three options presented above. Both Options 2 and 3 would necessitate rainwater tanks within the proposed Brimbin residential development areas to satisfy BASIX requirements, hence the estimates for Options 2 and 3 include supply and installation of rainwater tanks on residential lots (approximately $5000 per lot). The estimates for Options 2 and 3 also include indicative capital costs for provision of recycled water to agricultural areas (approximately $100,000 per irrigated hectare), including reticulation, distribution networks and recycled water storage. The cost of Option 3 is significantly greater than Option 2 due to the greater area assumed to be required to expand the TEMS to cater for all effluent from the Brimbin site.

5.6.2 Non-Cost Factors

A qualitative assessment of various criteria pertinent to the selection of a preferred effluent management option is summarised in **Table 5-2**.

Table 5-2 Summary of Shortlisted Effluent Management Options

	Option 1	Option 2	Option 3
Effluent Disposal Capacity			
Dry Weather	Would provide disposal capacity for approximately 60% of effluent on average. Future adoption of connection of recycled water to laundries would further increase effluent disposal capacity.	On the basis of an average irrigation application rate of 5.2 ML/ha/yr and irrigation area of 230 ha, there would be sufficient area to dispose of 100% of effluent generated in dry weather. Actual application rate would need to be confirmed by further studies to determine feasibility of this option.	On the basis of an average irrigation application rate of 1.9 ML/ha/yr and irrigation area of 595 ha, there would be sufficient area to dispose of 100% of effluent generated in dry weather. Further studies would be required to determine whether this area is available for long-term effluent disposal.
Wet Weather	Provides some effluent disposal capacity through use for toilet flushing.	Little to no disposal capacity during wet weather.	Little to no disposal capacity during wet weather.
Development Considerations			
Ability to meet BASIX requirements	Would reduce potable water demand to a level that would satisfy BASIX requirements.	Would not satisfy BASIX requirements (i.e. rainwater tanks would be required in residential areas).	Would not satisfy BASIX requirements (i.e. rainwater tanks would be required in residential areas).
Future land zoning / tenure	Future rezoning of residential areas to higher density residential may reduce effluent disposal capacity, however unlikely within the next 30 years.	If Primary Production land were to be rezoned in the future some infrastructure may become redundant (e.g. irrigation pipework). Trunk recycled water infrastructure could be retained for recycled water supply or modified for sewage transfer.	Ongoing capacity depends on the future zoning of the land. Potential rezoning poses a risk to future effluent disposal capacity.
Infrastructure Considerations			
Recycled Water Treatment	Treatment to level for unrestricted access within residential areas.	Treatment to level for unrestricted access within primary production areas.	Existing treatment process (suitable for restricted access) could be maintained.

	Option 1	**Option 2**	**Option 3**
Transfer and reticulation	Recycled water main and pumping station required between Dawson STP and Brimbin (approx. 8km). Dual reticulation for all residential areas.	Recycled water main and pumping station required between Dawson STP and Brimbin (approx. 8km). Connected to irrigation network within primary production areas.	Recycled water main and pumping station required to Coopernook (approx. 15km).

One of the major benefits of Option 1 over Options 2 and 3 is that it would minimise potable water demand within the development site and achieve the requirements of BASIX for demand reduction. New residential development areas would be provided with a secure supply of recycled water for outdoor irrigation and toilet flushing, with potential for future connection to laundries.

One of the major disadvantages of Options 2 and 3 is the lack of demand for recycled water (i.e. lack of effluent disposal capacity) during wet weather. There is typically no demand for recycled water for agricultural and open space irrigation during and following rainfall. This poses a problem for effluent disposal, particularly during periods of heavy and prolonged rainfall. Option 1 is the only option that would provide some form of wet weather effluent disposal capacity, albeit a relatively small component of ADWF (20 L/EP/day, equivalent to approximately 13% of ADWF) through use of recycled water for toilet flushing. It is also noted that the volume of wet weather effluent disposal capacity could be increased if recycled water were to be connected to laundries for clothes washing.

Another disadvantage of Option 2 is that there is an existing farm dam located on the Brimbin site. This dam has an area of approximately 30 hectares at top water level and would be capable of supplying the vast majority of demand for irrigation within the site. If recycled water was supplied for open space and agricultural reuse it would need to be used in preference to the existing farm dam, which is a free source of water.

It is unlikely that any of the options presented above would have sufficient capacity to dispose of all effluent generated by development at Brimbin. Although the potential recycled water demand within residential areas is equivalent to approximately 60% of ADWF, it would be much less than this during and after wet weather.

Based on the total available area for agricultural and open space irrigation (approximately 340 hectares), Option 2 may utilise a larger proportion of ADWF than Option 1 (subject to further studies on likely irrigation demands). Similarly, Option 3 has the potential to utilise a large proportion of ADWF, if there is sufficient available area to expand the TEMS. It is assumed that there would be little, if any, demand for recycled water during wet weather for both Option 2 and Option 3.

5.7 Ultimate Effluent Disposal Capacity

5.7.1 Dry Weather Flows

Table 5-3 summarises the projected ultimate dry weather effluent volume generated at Brimbin and the potential available dry weather effluent disposal capacity under Options 1 and 2 presented in **Section 5.5**.

Table 5-3 Ultimate effluent generation and disposal capacity at Brimbin

	Total Effluent	
	Volume Generated	**Disposal Capacity**
Projected Ultimate ADWF generated at Brimbin ➢ Ultimate Development = 9123 ET ➢ Ultimate ADWF = 9123 ET x 2.2 EP/ET x 150 L/EP/day	**= 1100 ML/yr**	
less potential effluent demand under Option 1 ➢ Residential Reuse = 8000 ET x 2.2 EP/ET x 95 L/EP/day		= 610 ML/yr
less potential effluent demand under Option 2 ➢ Primary Production Reuse = 400 ha x 1.9 ML/ha/yr [1]		= 760 ML/yr
Total Effluent Disposal Capacity		**= 1370 ML/yr**
Therefore, excess dry weather effluent disposal capacity		**= 270 ML/yr**

1. For the purpose of estimating effluent disposal capacity, it has been conservatively assumed that the average irrigation application rate across the Brimbin site is equivalent to the average rate across the TEMS in 2009/10. As noted previously, it is likely that irrigation application rates in Brimbin would be greater than this.

Based on the projected effluent volumes generated at Brimbin and the potential effluent disposal capacity under Options 1 and 2, there would be sufficient capacity to dispose of all dry weather effluent generated by ultimate development at Brimbin.

5.7.2 Wet Weather Flows

Increases in effluent volume generated during wet weather are difficult to predict as they are highly dependent on rainfall intensity, frequency and duration in any given year. Historical sewage inflow data to Dawson STP suggests that wet weather flows to the STP result in a total annual increase in inflow of up to 75% above dry weather baseline (20th percentile) inflow. In the case of ultimate development of Brimbin, such an increase would result in an effluent volume generated due to wet weather of approximately 800 ML/yr (in addition to 1100 ML/yr dry weather effluent volume).

The current EPL for Dawson STP permits discharge of up to 20,000 kL/day via the effluent holding ponds adjacent to Dawson River and up to 22,750 kL/day via the effluent disposal main which transfers effluent to Manning River at Chatham. The highest recorded inflow to Dawson STP in the period between July 2002 and March 2010 was just less than 40,000 kL in one day, which is within the limits imposed by the EPL.

The availability of sufficient wet weather effluent disposal capacity would need to be assessed at a later stage of the development and continually monitored by MCW against the EPL for Dawson STP. Measures that would be implemented to ensure sufficient wet weather effluent disposal capacity include the following:

- Installing leak tight sewerage reticulation within the Brimbin site to minimise inflow and infiltration as much as possible.
- Utilising part or all of the buffer storage volume at Dawson STP, including the 76 ML effluent holding ponds that were constructed as part of the TEMS.

5.8 Preferred Effluent Management Option

Based on a preliminary review of a series of options for effluent management to cater for future development at Brimbin, the preferred option is outlined below:

- Provide a reticulated recycled water network for new residential areas at Brimbin, including a recycled water pumping station at Dawson STP, a rising main between the STP and Brimbin, and distribution mains and reticulation pipework throughout the Brimbin site. This network will satisfy BASIX requirements for the development, replacing the need for rainwater tanks on individual lots.
- Provide a recycled water treatment facility at Dawson STP, including membrane filtration, UV disinfection and chlorination to satisfy water quality requirements for dual reticulation.
- Provide connections off the distribution mains to supply recycled water to areas designated as Primary Production within the Brimbin site.

Further to this IWCM Strategy, it is recommended that additional studies be undertaken to confirm the suitability of the areas designated as Primary Production for irrigation with recycled water and to determine likely agricultural and open space irrigation demands using recycled water.

6 PRELIMINARY WATER CYCLE MANAGEMENT APPROACH

Further to the consideration of various options for potable water, sewerage, recycled water and stormwater management at Brimbin, this section summarises the selected water cycle management approach for the Brimbin development precinct. These have been selected based on a preliminary options assessment and may be subject to further consideration at later stages of the project.

6.1 Potable Water

6.1.1 Existing System

The Brimbin development precinct is located within the existing Irkanda to Harrington water supply system. This system includes potable water reservoirs at Coopernook (0.45 ML, TWL 57.4m), Lansdowne (0.59 ML, TWL 35.2m) and Harrington (2.27 ML, TWL 37.8m). These are supplied through a trunk watermain system under gravity from the Irkanda Bulk Storage Reservoir (7 ML, TWL 85.5m), to the north of Taree.

Existing industrial and residential properties in the township of Kundle Kundle, near the Brimbin site, are serviced by a DN150 water main located along Lansdowne Road. This main is supplied by a DN375 line that extends from Irkanda Reservoir to the Manning River near Harrington. In addition, there are a series of DN100 mains connected to the DN375 main that service rural properties off Kundle Kundle Road and Innes Lane.

6.1.2 Development Servicing

Significant upgrades to the existing Irkanda to Harrington water supply system will be required to service the Brimbin development site with potable water.

Previous studies have addressed the need to upgrade the existing water supply system to service the Brimbin site, including:

- Hunter Water Engineering, *Brimbin Development Water Supply Strategy*, January 2000
- Connell Wagner, *Brimbin Local Environmental Study*, February 2004
- MidCoast Water, *The Manning District Water Supply Scheme Strategy Report*, November 2005

WorleyParsons has reviewed these studies to determine the likely extent of upgrades that would be required to cater for ultimate development of Brimbin. Furthermore, a conceptual analysis of the Irkanda supply system has been undertaken using a WaterCAD model developed by MidCoast Water (refer to **Appendix 3**). It is noted that the model is not calibrated, nor does it allow for growth within other parts of the system, and is therefore of limited use. It cannot be relied upon to determine the exact extent of upgrades required and the number of lots that can be serviced off existing water supply infrastructure. Further detailed analysis of the system will be required at later stages of the project.

Based on a review of previous studies and WaterCAD model results, the likely extent of water supply upgrades required to service ultimate development of the Brimbin site is presented in **Figure 1** and discussed in the following sections.

6.1.2.1 Initial Stages

Servicing of initial stages of the development could be achieved by providing at least two extensions off an existing DN150 main in Lansdowne Road into the site. MCW have advised that around 180 ET could currently be serviced off this existing main, based on empirical potable water demands. However, MCW's risk profile does not permit greater than 25 ET off a single directional feed, such as the one located in Lansdowne Road. Dual feed servicing would be required off the existing DN150 main with suitable valving arrangements and suitable separation of the main extensions into the site.

In order to satisfy minimum pressure requirements, it is likely that the initial stages of development would need to be located below RL 40m AHD. If development were to commence far from this main or at an elevation greater than RL 40m AHD then an alternative servicing option may need to be considered.

6.1.2.2 Trunk Mains

Further development would require a new trunk water main to be constructed off the existing DN375 main between Irkanda Reservoir and Harrington. It is anticipated that the new main would need to be a DN300 main, approximately 6,800 metres in length, capable of supplying approximately 3000 ET. The main would generally follow the alignment of the existing Lansdowne Road (although it is understood Roche Group intends to realign a section of the road as part of the development) and terminate at the northern extent of the proposed 'employment lands' within the site.

Development beyond approximately 3000 ET would require an additional trunk main to be constructed between Irkanda Reservoir and the site. The new trunk main would be approximately 9,700 metres of DN375 pipe. A new potable water reservoir would be constructed at a high point in the north of the site.

6.1.2.3 Capacity of Irkanda Reservoir

The existing Irkanda Reservoir, which has a capacity of 7 ML, is the main supply reservoir for the Irkanda to Harrington system, including the townships of Lansdowne, Coopernook and some rural residential properties surrounding Brimbin. Ultimate development of Brimbin would require construction of a new on-site reservoir and would increase the demand from Irkanda Reservoir.

The water supply modelling results suggest that ultimate development of Brimbin could be accommodated by modifying the operating levels of Irkanda Reservoir. The current top and bottom operating water levels are 85.6m and 83.9m respectively. The storage volume between these operating levels only represents around 8% of the total reservoir volume. If the bottom water level were to be lowered by 1 metre to 82.9m this would provide additional operational capacity and could accommodate ultimate development at Brimbin. It would also satisfy MCW operational criteria of operating the reservoir above the two-thirds top water level. These results do not take into account additional growth within the water supply catchment and would need to be confirmed by MidCoast Water operations staff at subsequent stages of the project.

Based on the likely rate of development of Brimbin (approximately 300 lots per year) and the use of recycled water within the site, any modification or upgrades to Irkanda Reservoir as a result of development at Brimbin are not expected to be required within the first 10 years of development. However, this assessment does not include the demands from other development areas within the water supply catchment.

Further water supply modelling would be required to confirm that there is sufficient capacity at Irkanda Reservoir to cater for ultimate development at Brimbin.

6.1.2.4 New Potable Water Reservoir and Booster Pump Station

At least one new potable water reservoir would need to be constructed at a high point in the north of the site (approximately RL 75m AHD). Based on the likely ultimate water demands presented in **Table 3-6** and **Table 3-7**, the ultimate potable water storage capacity required for Brimbin would be around 10 ML. A booster pump station would also be required to lift the supply from Irkanda Reservoir to the new reservoir.

6.1.2.5 Distribution Mains and Reticulation

A network of potable water reticulation mains would be constructed progressively throughout the development of the site.

6.2 Sewerage

6.2.1 Existing System

The area encompassing the Brimbin development precinct is not currently serviced by a reticulated sewerage system. On-site sewerage systems such as septic tanks are utilised within existing development on and adjacent to the Brimbin site.

The nearest sewage treatment plant (STP) to the site is Dawson STP, which is located approximately 6 kilometres south of the Brimbin site on the northern side of Dawson River. Dawson STP was commissioned in 1986 and currently services the entire Taree Sewerage Scheme. The majority of effluent from Dawson STP discharges into the Manning River near Cundletown via an effluent pumping station and DN450 effluent main. Dawson STP consists of the following treatment units:

- Primary treatment consisting of screening and grit removal.

- Secondary treatment consisting of a balancing tank, oxidation ditch and two secondary clarifiers.
- Four maturation ponds for flow balancing and preliminary disinfection.
- UV disinfection
- Four sludge lagoons and a centrifuge for biosolids dewatering.

The most recent augmentation of Dawson STP in 2000 increased its capacity to 30,000 EP. The plant currently services approximately 23,500 EP. MCW have advised that growth within the Dawson STP catchment is expected to be around 0.8% per year, however this does not take into account any development of Brimbin. Based on MCW's growth projection without allowance for Brimbin, the STP is expected to reach capacity by 2038. Development of Brimbin would bring forward the need to upgrade the STP.

6.2.2 Development Servicing

A preliminary sewerage servicing strategy for ultimate development of the site is presented in **Figure 2** and discussed in the following sections.

6.2.2.1 Initial Stages

It is proposed to construct sewage transfer infrastructure to connect the Brimbin site to Dawson STP prior to construction of lots within the development site. Interim measures, such as tankering sewage to Dawson STP or supplementing sewage flows from other sources may be required until the site has sufficient sewage loading to minimise sewage detention times within the transfer infrastructure.

6.2.2.2 Dawson STP

Development within the Brimbin precinct was not included in the most recent servicing strategy prepared by MCW in 2003 for the Dawson STP catchment. Allowing for the anticipated rate of development within Brimbin (around 300 lots per year), this would increase overall growth within the Dawson STP catchment to around 3.8% per year. At this rate of growth, Dawson STP would reach its current 30,000 EP capacity approximately 6 years following the commencement of development at Brimbin.

MCW have advised there is sufficient space within the existing footprint of Dawson STP to allow for future upgrades to cater for growth within the catchment, including Brimbin. This would include augmentation and/or replication of existing units including inlet works, secondary clarifiers, maturation ponds, UV disinfection and biosolids handling.

6.2.2.3 Transfer System

In order to transfer sewage from Brimbin to Dawson STP, a network of sewage rising mains and pumping stations will need to be constructed. Due to the size of the ultimate development, it would be necessary to construct more than one pumping station and rising main to Dawson STP. Based on a preliminary assessment, two possible routes for sewage transfer mains have been considered:

Phase 1 (up to 4000 lots)

A DN300 rising main, approximately 4,400m in length, would be constructed via Lansdowne Road and along the western boundary of the existing railway corridor to Brimbin STP. This main would transfer sewage from the southern and eastern portions of the site, including residential and non-residential development.

Phase 2 (up to ultimate development)

An additional DN300 rising main, approximately 5,400m in length, would be constructed via Brimbin Road and the existing electricity easement which is aligned in a north-easterly direction and traverses the Brimbin site. This main would transfer sewage from the western and northern portions of the site.

The Brimbin Structure Plan (July 2013) indicates that a road may be constructed between Brimbin Road and the proposed development via the existing easement. It would be preferable to construct any water and sewerage infrastructure within this road reserve.

Based on the topography along this pipeline route it may be possible to construct a significant portion of the line (about 2,500m) as a gravity sewer. This would minimise the required pump station capacity and power consumption but would result in additional construction costs. For the purpose of this assessment and to prepare initial cost estimates, it has been assumed that the main would be a pressure main for its entire length.

6.2.2.4 RETICULATION

There are a number of types of sewerage reticulation systems that could be adopted, including conventional gravity, low pressure and vacuum. In line with MCW's sewerage servicing policy, conventional gravity sewerage would be adopted in preference to low pressure or vacuum systems.

Given the proximity of the site to a number of watercourses including the Dawson and Manning Rivers, it would be necessary to adopt a sewerage reticulation system with a low risk of overflow and exfiltration. A leak tight gravity sewerage system at Brimbin would be preferable to minimise inflow and infiltration, hence reducing the volume of stormwater that would enter the sewerage system. In addition, suitable provision for emergency storage would also be made to minimise the risk of sewage overflow into downstream waters.

The sewerage reticulation system would discharge to one or more sewage pumping stations that would transfer sewage to Dawson STP. A sewerage reticulation layout, including the location of sewage pumping stations, would be prepared once a Masterplan is developed for the site.

6.3 Recycled Water

6.3.1 Existing System

As previously mentioned, the Taree Effluent Management Scheme (TEMS) was commissioned in 2009 and is currently supplying effluent for irrigation to 200 hectares of farmland at Cundletown and Dumaresq Island. The current treatment train at Dawson STP produces effluent of a standard for restricted public access.

6.3.2 Development Servicing

For the purposes of estimating ultimate infrastructure capacity, it has been assumed that a recycled water supply system for the Brimbin site would include provision to service all residential development types and areas designated as Primary Production in the Brimbin Structure Plan (July 2013). It is acknowledged that there may be potential to connect recycled water to other non-residential development areas. However, because the types of non-residential development are not yet known and the potential recycled water demand cannot be easily quantified, no allowance has been made for recycled water demand for non-residential development. In addition, there may be potential for connection to other areas outside the Brimbin site, which have also not been allowed for.

The average day, maximum day and peak instantaneous demands shown in **Table 3-9** have been used to determine the ultimate capacity of key components of the proposed recycled water system to service Brimbin.

The recycled water strategy to service Brimbin would consist of constructing trunk infrastructure to transfer recycled water from a treatment facility at Dawson STP to the development site. The trunk infrastructure would nominally include the following components:

- A recycled water treatment facility at Dawson STP to produce recycled water of a standard suitable for unrestricted public access and internal reuse.
- Recycled water pumping stations at the Dawson STP site.
- A recycled water reservoir at the highest point within the Brimbin residential development area.
- Rising mains from the treatment facility at Dawson STP to the proposed recycled water reservoir.
- Distribution mains from the reservoir to residential and primary production areas within the site.

The recycled water strategy is generally described in the following sections and presented in **Figure 3**.

6.3.2.1 Staging

It is possible that the construction of recycled water infrastructure would be deferred until there are a sufficient number of residential lots that would connect to the system. This may result in the recycled water reticulation system being initially supplied with potable water. The optimum timing of construction, commissioning and connection of a recycled water supply system to Brimbin would be subject to further detailed studies.

6.3.2.2 Recycled Water Treatment Facility

In order for a reticulated recycled water system to be implemented for Brimbin, upgrades to the treatment processes at Dawson STP will be required, including an additional treatment facility that would produce effluent of a standard suitable for unrestricted public access. This system would nominally include membrane filtration and chlorination in addition to the current treatment units at the plant.

It is likely that the recycled water treatment system for the TEMS and a dual reticulation supply for Brimbin would operate as a single treatment train, with effluent for the TEMS being drawn out of the treatment train prior to membrane filtration.

The ultimate design flow for the treatment facility would be approximately 4.5 ML/day, which is equivalent to the ultimate peak day recycled water demand. In order to defer capital expenditure it is proposed that upgrades to the STP for recycled water treatment be undertaken in stages.

6.3.2.3 Transfer Systems

Based on a preliminary assessment of ultimate recycled water demand, the Brimbin site could be serviced off a single DN300 recycled water main, approximately 8,200 metres in length between Dawson STP and the north-western extent of the site. It is proposed to construct the main along the existing electricity easement from Brimbin Road into the site, parallel to potable water and sewerage transfer pipelines.

A recycled water pumping station would need to be constructed to transfer recycled water from Dawson STP into the site, and ultimately to a recycled water reservoir. The pumping station would be ultimately sized to transfer up to peak day demand assuming 24 hours per day pumping.

6.3.2.4 Recycled Water Storage

A recycled water storage reservoir would be constructed along with the pumping stations and transfer main. It is likely to be located at a high point within the Brimbin development precinct. For the purposes of this study, it has been assumed that it would be located adjacent to the future potable water reservoir located along the northern boundary of the site to the west of Lansdowne Road.

Recycled water storage would be sized to hold up to peak day demand with an allowance for reserve storage, resulting in a total storage volume of approximately 7 ML.

6.3.2.5 Distribution Mains

Trunk recycled water distribution mains would be constructed from the recycled water reservoir into each of the residential development precincts. It is assumed that the distribution mains would be laid in shared trenches with potable water distribution mains. A preliminary layout of the distribution mains is shown on **Figure 3**. This layout is indicative only and would need to be confirmed following finalisation of subdivision layouts for each development area.

6.4 Stormwater Management

6.4.1 Existing Site

The majority of the site is currently undeveloped with very little impervious surface area. The site contains two major internal catchments that ultimately discharge into Dawson and Manning Rivers. There are three major creek systems within the site:

- An unnamed creek in the western portion of the site, which generally drains in a south-west to westerly direction and discharges into Dawson River.
- An unnamed creek that straddles the northern boundary of the site and generally drains in a westerly direction and discharges into Dawson River at the north-western corner of the site.
- Pontobark Creek, which generally drains in a south to south-easterly direction and discharges into Dickensons Creek and the Manning River floodplain.

There are also a number of other minor catchments that drain towards the Brimbin site boundary and towards either Dawson River or Manning River.

6.4.2 Development Servicing

Development of the site will increase the impervious area on the site, which will increase peak flow rates through the site and ultimately into downstream waters. In order to satisfy stormwater quality and quantity management objectives for the site, a series of detention basins and stormwater treatment devices (gross pollutant traps, bio-retention swales, bio-retention basins and constructed wetlands) will be constructed throughout the development. A Stormwater Management Strategy has been prepared for the site (WorleyParsons, 2013) and is currently pending review by GTCC.

As outlined in **Section 5**, dual reticulation has been preferred as a means of reducing potable water consumption in residential areas in lieu of rainwater tanks. There would not be a need for both rainwater tanks and reticulated recycled water supply in residential areas. Hence, rainwater tanks have not been included within the Stormwater Management Strategy.

Stormwater runoff through the site would be managed via a series of detention basins. These basins would provide attenuation of runoff to ensure that post-development peak flow rates are no greater than existing peak flow rates throughout the site.

6.5 Operation and Maintenance

MCW would generally be responsible for the operation and maintenance of the potable water, recycled water and sewage treatment systems. The operation and maintenance costs for these systems would be recovered through residents.

Maintenance of stormwater detention and treatment measures would be the responsibility of either GTCC or the developer.

7 PRELIMINARY INFRASTRUCTURE COSTS

A preliminary estimate of the order of cost has been prepared for the selected water, sewerage and recycled water servicing option presented in **Section 6**. This preliminary estimate is based on WorleyParsons experience and judgement as a firm of practising professional engineers familiar with the construction industry. The estimate cannot be guaranteed as we have no control over Contractor's prices, market forces and competitive bids from Tenderers. The estimate may exclude items which should be considered in a cost plan. The preliminary estimate by WorleyParsons is not to be relied upon in any way due to constant changes in market prices and limited available information on the civil construction industry. If a reliable cost estimate is required, then WorleyParsons would be able to engage an appropriately qualified Quantity Surveyor to prepare an estimate to a greater level of certainty.

7.1 Staging

Each of the components of the water supply and sewerage systems would be staged according to their necessity based on the rate of development of the site. For the purposes of estimating staging requirements and present worth of infrastructure, it has been assumed that Brimbin would be developed over a period of 30 years with an average of 300 standard residential lots released each year. It has also been assumed that non-residential development would occur within the same timeframe and at a rate proportional to residential development.

7.2 Capital Cost Estimates

The preliminary capital cost of water and sewerage infrastructure to service the Brimbin development precinct has been estimated based on the Hunter Water Estimating Guidelines (September 2008) and other limited information. Detailed investigation and design will be required at later stages of the project to confirm these estimates.

The costs of lead-in works to service the Brimbin site would be classified into two categories:

1. Internal works (developer funded).
2. Lead-in works (to be funded by MCW and recovered through developer charges).

It is noted that no allowance has been made for any modifications or upgrades that may be required to existing MCW infrastructure, including Irkanda Reservoir or sewage treatment process units at Dawson STP.

Cost estimates for internal works would be developed throughout the development of the site by Roche Group. Preliminary cost estimates for lead-in works are presented in **Table 7-1**.

Table 7-1 Preliminary Capital Cost Estimate – Lead-in Works

System Component	Estimated Capital Cost	Timing (Year No.)
Potable Water		
DN250 main from Irkanda trunk main to Brimbin (6,800 m)	$3,180,000	1
DN300 main from Irkanda reservoir to Brimbin (9,700 m)	$5,720,000	10
10 ML reservoir and 50kW pump station	$4,880,000	10
Sub-Total for Potable Water	***$13,780,000***	
Sewage Transportation and Treatment		
Pump Station for eastern lots (90 L/s)	$950,000	1
DN300 Rising Main via Lansdowne Rd (4,400 m)	$2,440,000	1
Pump Station for western lots (90 L/s)	$950,000	15
DN300 Rising Main via electricity easement (5,400 m)	$2,970,000	15
Sub-Total for Sewerage	***$7,310,000***	
Recycled Water		
Treatment Facility - Stage 1	$3,970,000	2
Transfer main via Brimbin Rd (8,200 m)	$3,530,000	2
Pumping Stations – 30 L/s	$820,000	2
7 ML Reservoir	$3,410,000	2
Treatment Facility - Stage 2	$1,770,000	11
Treatment Facility - Stage 3	$1,770,000	21
Sub-Total	***$15,270,000***	
TOTAL PRELIMINARY CAPITAL COST ESTIMATE FOR LEAD-IN WORKS	**$36,360,000**	

7.3 Net Present Value

In order to estimate life cycle costs and the present worth of the infrastructure required to service ultimate development, a net present value (NPV) analysis has been used.

As previously discussed, it is anticipated that around 300 residential lots would be released per year, meaning that ultimate development of the site would take around 30 years. For the purpose of preparing an NPV analysis, it has been assumed that ultimate development of the site would occur over a period of 30 years and that infrastructure would be staged accordingly. The NPV has been prepared over a 30 year period and considers all infrastructure costs that would be incurred throughout the period of development.

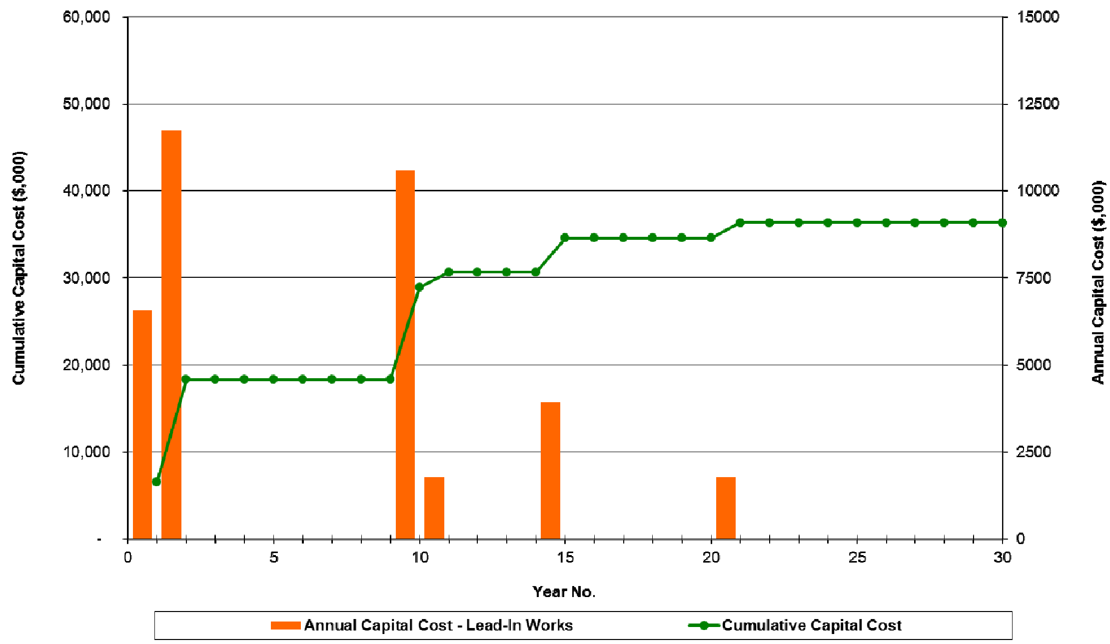
The NPV analysis for the capital and operating cost of lead-in works for the selected water, sewerage and recycled water servicing option, prepared for a 30 year period (i.e. up to 2040) and at a 7% discount rate, is presented in **Table 7-2**.

Table 7-2 Net Present Value – Water, Sewerage and Recycled Water Infrastructure

Item	Total Capital Cost (lead-in works only) ($M)	Net Present Value (including capital and O&M costs of lead-in works only) 30 years @ 7% ($M)
Potable Water	13.8	8.9
Sewerage	7.3	4.9
Recycled Water	15.3	12.3
TOTAL	**36.4**	**26.2**

The estimated annual and cumulative capital cost for water supply, sewerage and recycled water infrastructure for ultimate development of Brimbin is shown in **Chart 1**.

Chart 1 Preliminary estimate of annual and cumulative capital costs



8 CONCLUSION

8.1 Development Servicing

Given the findings of this investigation into the constraints and opportunities of the Brimbin site in relation to integrated water cycle management, the following servicing options have been considered for this study. It is stressed that the selected options should not preclude the consideration of alternative options in the future to allow for improvements in technologies and changes in regulatory requirements.

POTABLE WATER

The selected water supply servicing option involves connection to the MCW system. This would require significant upgrades to the existing system, which would be staged over the development period. Staging of water supply infrastructure also provides an opportunity to consider alternative supply options in the future.

SEWERAGE

The selected sewerage servicing option involves construction of a low pressure reticulation system and transfer for treatment at Dawson STP. Dawson STP would require significant upgrades to cater for development at Brimbin; however upgrades could be staged over the development period. Similar to the water supply servicing option, staging of sewerage infrastructure would leave open the possibility to adopt future improvements in technologies and alternative servicing options, such as on-site water reclamation.

RECYCLED WATER

In order to satisfy the objectives of minimising potable water use in new development areas and maximising the potential for water reuse and recycling, it is proposed that residential development at Brimbin is connected a reticulated recycled water system. The system would supply recycled water of a quality suitable for internal and external non-potable reuse.

STORMWATER MANAGEMENT

Stormwater runoff through the site would be managed via a series of detention basins. These basins would provide attenuation of runoff to ensure that post-development peak flow rates are no greater than existing peak flow rates. There would not be a need for both rainwater tanks and reticulated recycled water supply in residential areas, hence rainwater tanks have not been considered as part of the preferred stormwater management strategy for the site.

8.2 Satisfying IWCM Objectives

The selected water supply, sewerage and recycled water servicing options would satisfy the objectives of IWCM for the Brimbin site, in that potable water demand would be minimised and water recycling opportunities would be maximised for the life of the development.

9 REFERENCES

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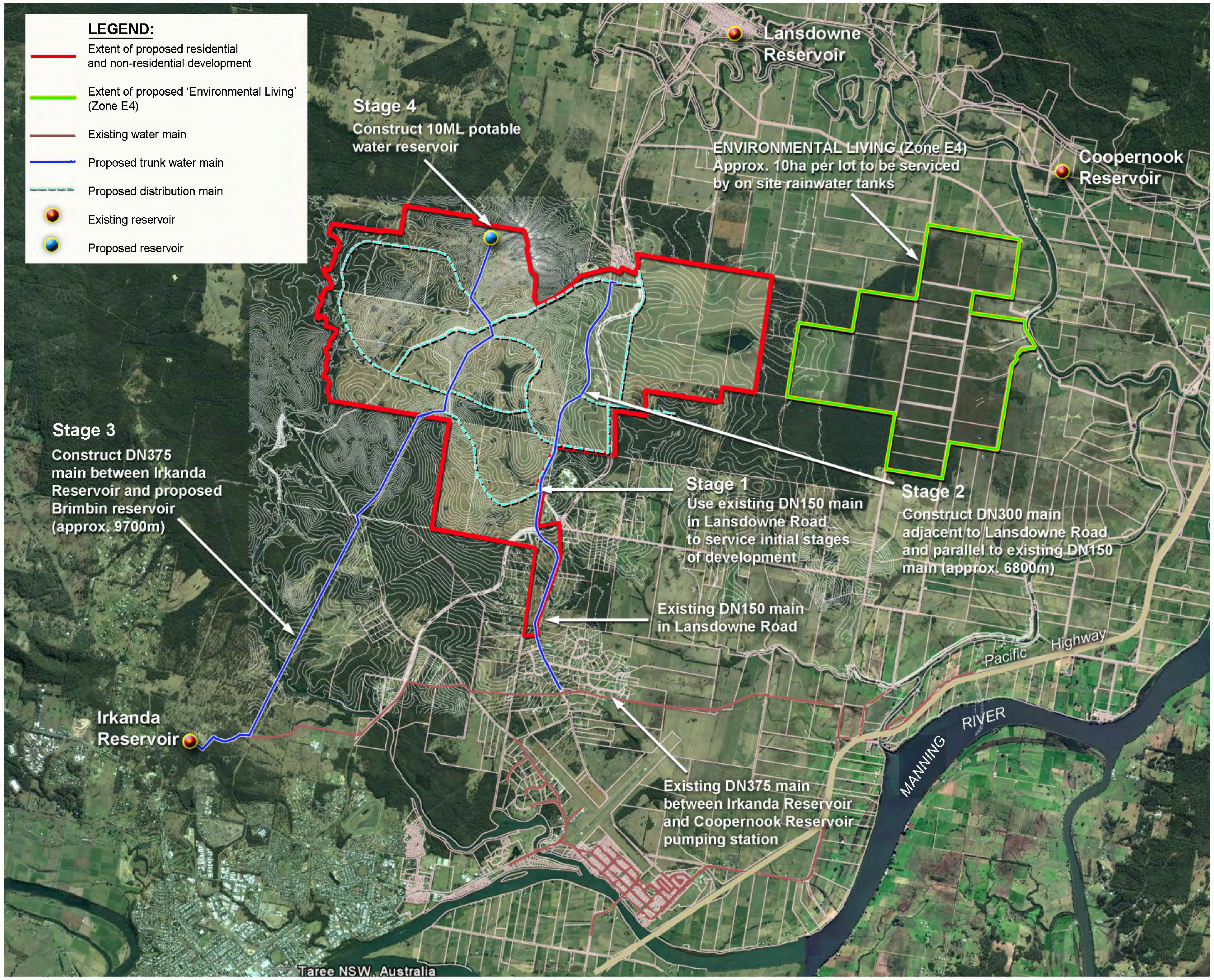
Figures



WorleyParsons
resources & energy

EcoNomics

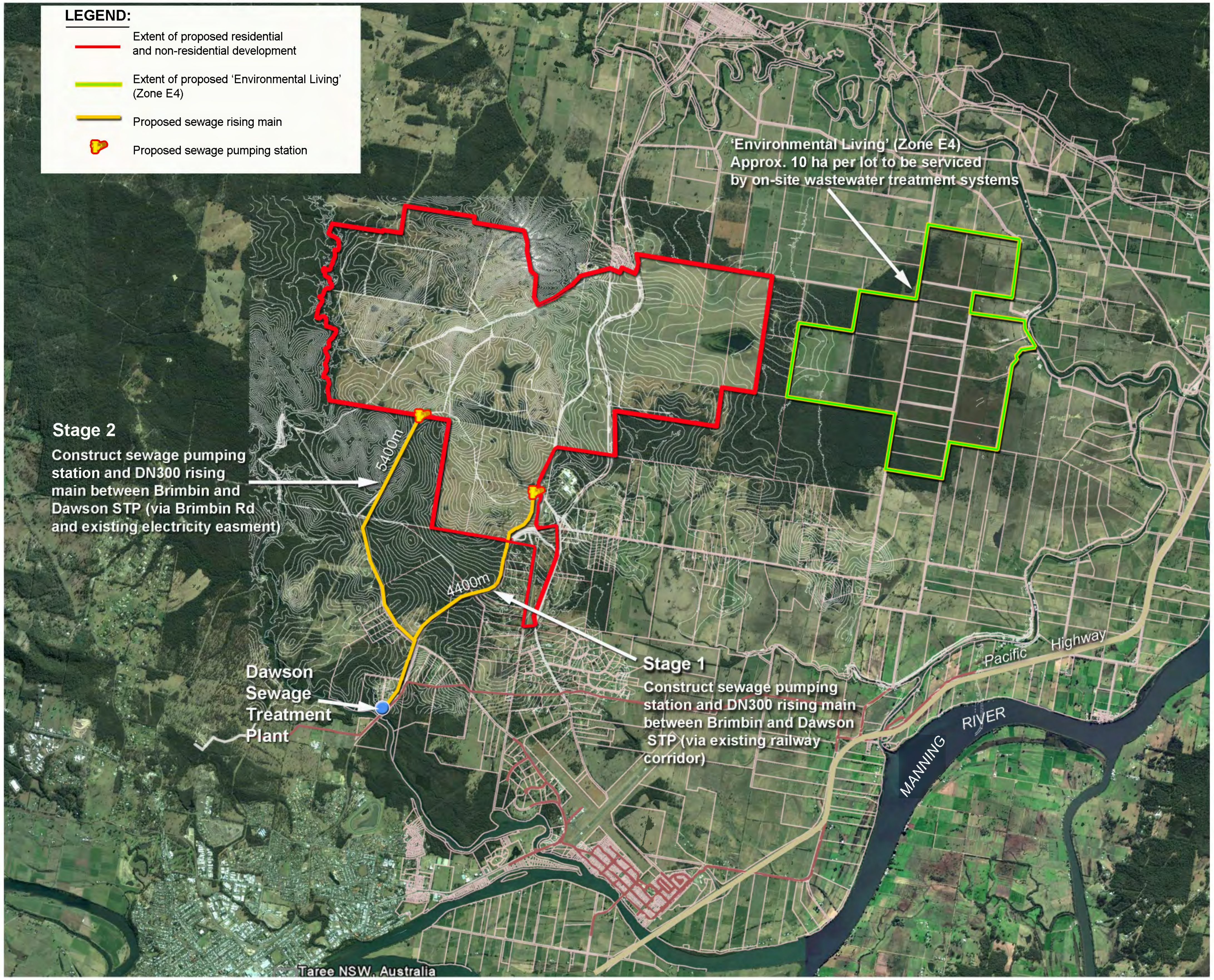
Source:

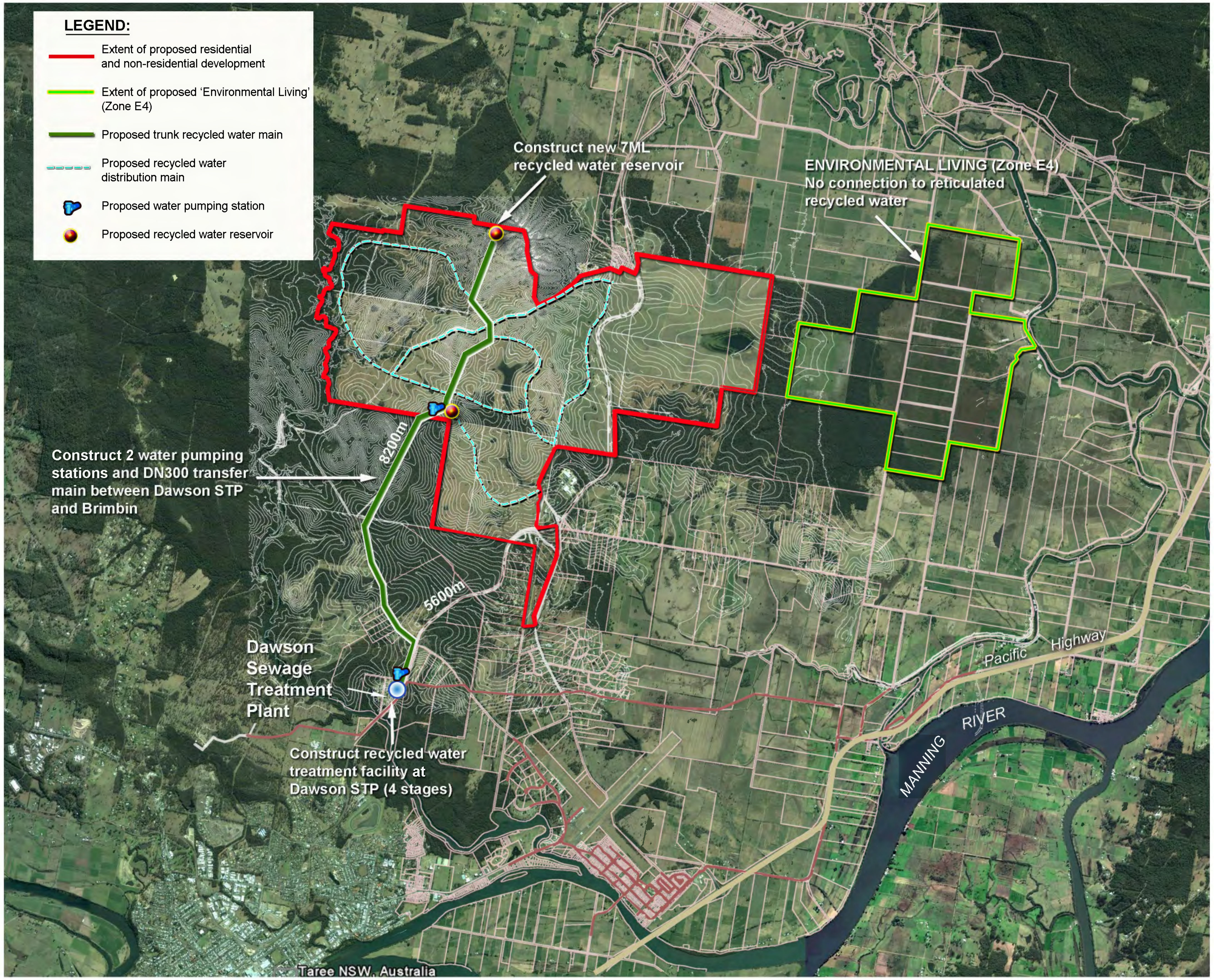
File Identity: 301015-02225 FIG1_PotableWaterServicingStrategy.jpg

Date Modified: 21/05/2013

Brimbin Integrated Water Cycle Management Strategy
Potable Water Servicing Strategy

FIGURE 1


LEGEND:
Extent of proposed residential and non-residential development
Extent of proposed 'Environmental Living' (Zone E4)
Proposed sewage rising main
Proposed sewage pumping station
'Environmental Living' (Zone E4) Approx. 10 ha per lot to be serviced by on-site wastewater treatment systems
Stage 2
Construct sewage pumping station and DN300 rising main between Brimbin and Dawson STP (via Brimbin Rd and existing electricity easment)
5400m
4400m
Stage 1
Construct sewage pumping station and DN300 rising main between Brimbin and Dawson STP (via existing railway corridor)
Dawson Sewage Treatment Plant
Pacific Highway
MANNING RIVER
Taree NSW, Australia



WorleyParsons
resources & energy

EcoNomics

Source:

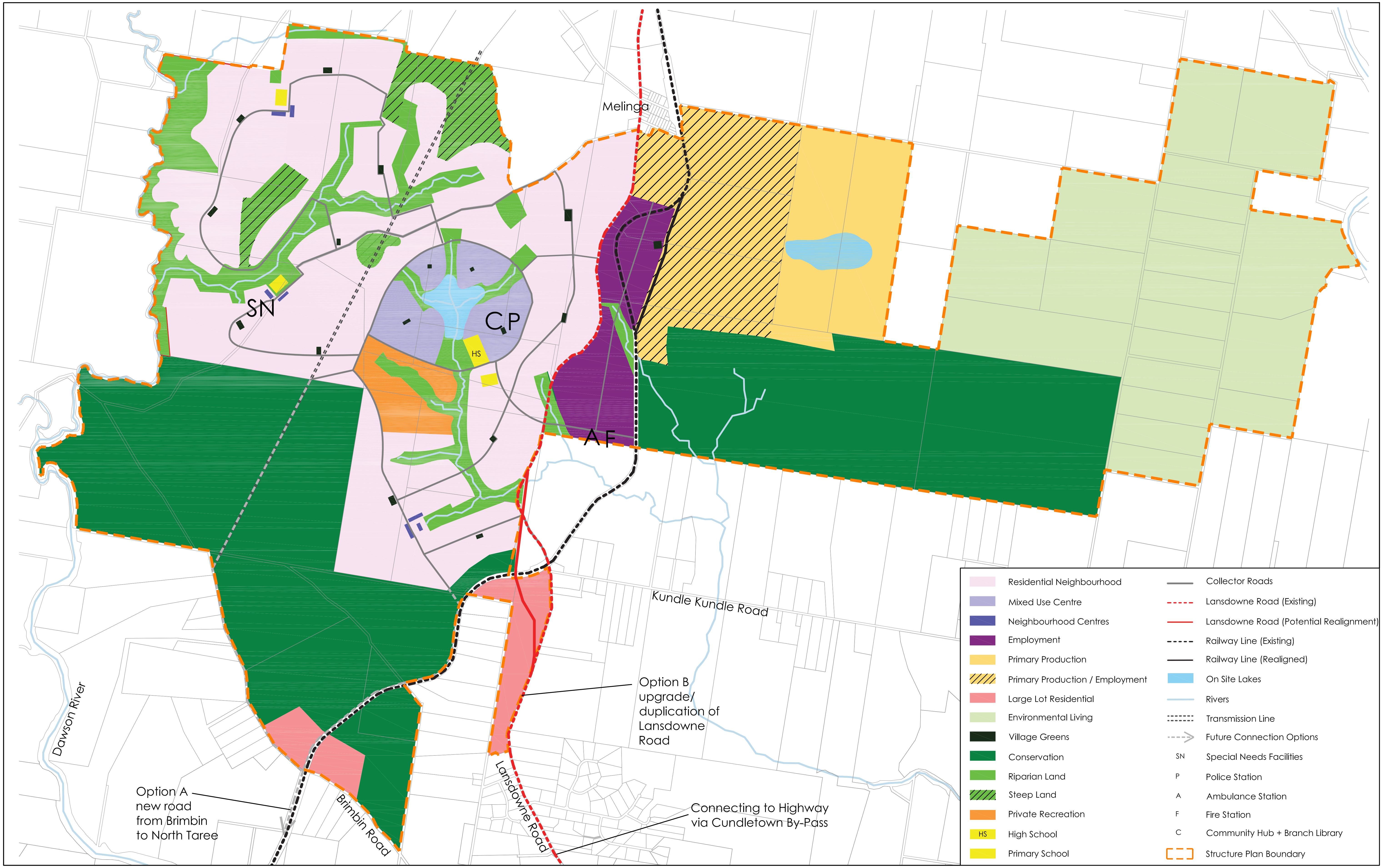
File Identity: 301015-02225 FIG3_RecycledWaterServicingStrategy.jpg

Date Modified: 23/05/2013

Brimbin Integrated Water Cycle Management Strategy
Recycled Water Servicing Strategy

FIGURE 3

Appendix 1 Brimbin Structure Plan (Roberts Day, July 2013)



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ROCHE GROUP

BRIMBIN STRUCTURE PLAN
JULY 2013

0 metres 300 600 900 1200 1500

SCALE 1:30,000 **SHEET** A3

Brimbin New Town
PROJECT

Roche Group
CLIENT

RCH TAR RD1201
DRAWING NUMBER

REVISION	DESCRIPTION	YYMMDD	DRAWN	APPR'D
G	Annotations	130710	SG	SG
F	Riparian Zone	130524	SG	SG
E	Correct Boundary	130520	SG	SG
D	Alts to Enviro Living	130304	SG	SG
C	Alts to Conservation	120723	SG	SG
B	Staging Plan	120312	JS	AK
A	Structure Plan	111017	JS	SG

Appendix 2 Letter from MidCoast Water to Roche Group

MIDCOAST WATER

Forster Office:
16 Breese Parade
Locked Bag 4000
Forster NSW 2428

Telephone: 02 6591 7543
Fax: 02 6591 7555

4th May 2010

Roche Group Pty Ltd
via email:

Attention: Mr Wes Gardner

RE: IWCM, WATER & SEWERAGE SERVICING STRATEGIES FOR BRIMBIN

I've prepared an initial scope of works for the strategies that MCW will require you to prepare as part of the rezoning for the Brimbin Masterplan. The primary purpose of the strategies developed during the masterplanning and rezoning process is to identify if and how the proposed development can be provided with services, and any staging of the infrastructure required to provide these services.

INTEGRATED WATER CYCLE MANAGEMENT (IWCM) PLAN
MidCoast Water will require the preparation of an IWCM plan for the proposed development. The IWCM is to consider the urban water cycle within the site, identify methods to reduce or offset demand for potable water and effluent generation and integrate with the stormwater management proposed for the site. The IWCM should contain, as a minimum, the following components:

1. An urban water balance with sensitivity analysis for yield & climate changes.
2. Options assessment for offsets to water supply & effluent generation
3. Site analysis for compatibility & integration with stormwater management
4. Infrastructure concept plans for the ultimate development
5. Headworks capacity determination.

WATER SUPPLY & SEWERAGE SERVICING STRATEGIES
These strategies build upon the infrastructure concept plans within the IWCM. They are to detail the infrastructure required for the ultimate development and importantly the staging of the provision of this infrastructure to reflect the staged development of the estate, including any interim infrastructure provision to be utilised for the initial stage(s).

Please give me a call on (02) 6591 7543 should you have any questions.

Yours faithfully

DAVID MCKELLAR
Development Engineer

Appendix 3 Water Supply Modelling Report

1. INTRODUCTION

The following report summarises water supply modelling of the Irkanda water supply system that has been undertaken for the purposes of determining infrastructure upgrades that are likely to be required as a result of development at Brimbin.

Water supply modelling has been undertaken using the Bentley WaterCAD software package. The model was originally setup by MidCoast Water and provided to WorleyParsons for the purpose of modelling the system including upgrades to cater for Brimbin. Two model scenarios have been analysed:

1. Existing system (based on MidCoast Water model as provided)
2. Post-development at Brimbin (based on MidCoast Water model setup of the existing system but including ultimate development at Brimbin)

2. EXISTING SYSTEM COMPONENTS

A schematic of the existing Irkanda water supply model developed by MidCoast Water is presented in **Figure A3.1**. The existing model has been used as received from MCW. No assessment has been made as to its accuracy, nor has any form of checking or calibration been undertaken. In addition, the model is based on existing conditions. No assessment of the impact of water demand change in other parts of the water supply network has been undertaken.

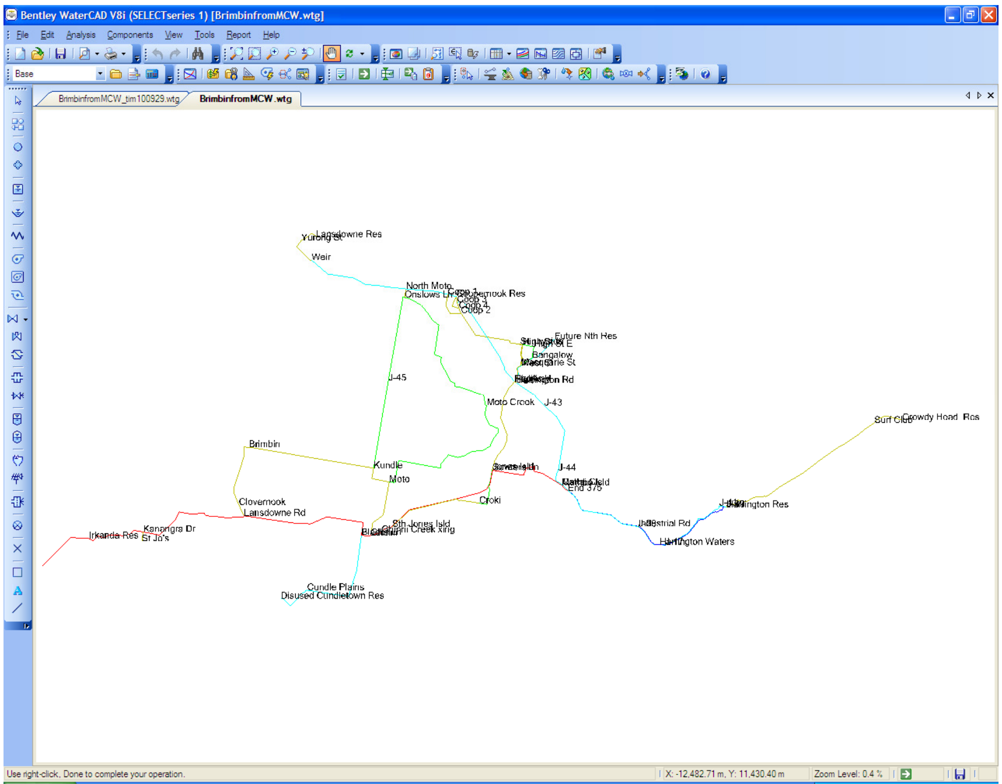


Figure A3.1 Existing Water Supply Model

3. PROPOSED SYSTEM UPGRADES

Additions to the water supply model that have been included to simulate the future development scenario are presented in **Table A3-4** and **Table A3-5**.

Table A3-4 Proposed Junctions and Peak Hour Demands at Brimbin

Label	Elevation (m)	Peak Hour Demand (L/s)
Brimbin-Stage1	30.00	7
Brimbin-Stage2	68.00	66
Brimbin-Stage3	65.00	122

Table A3-5 Proposed Pipes at Brimbin

Start Node	Stop Node	Length (m)	Diameter (mm)	Material
Brimbin	Brimbin-Stage1	1,500.20	152.4	Ductile Iron
Lansdowne Rd	PMP-2	6,048.27	300.0	Ductile Iron
PMP-2	Brimbin-Stage2	884.85	300.0	Ductile Iron
Irkanda Reservoir	PMP-3	7,779.81	375.0	Ductile Iron
PMP-3	Brimbin-Stage3	2,009.40	375.0	Ductile Iron

In addition to the pipes and junctions inserted into the model, two booster pumps were included to ensure minimum pressure requirements could be achieved for Stages 2 and 3 of the Brimbin development.

A schematic of the proposed water supply model including the additions presented in **Table A3-4** and **Table A3-5** is shown in **Figure A3.2**.

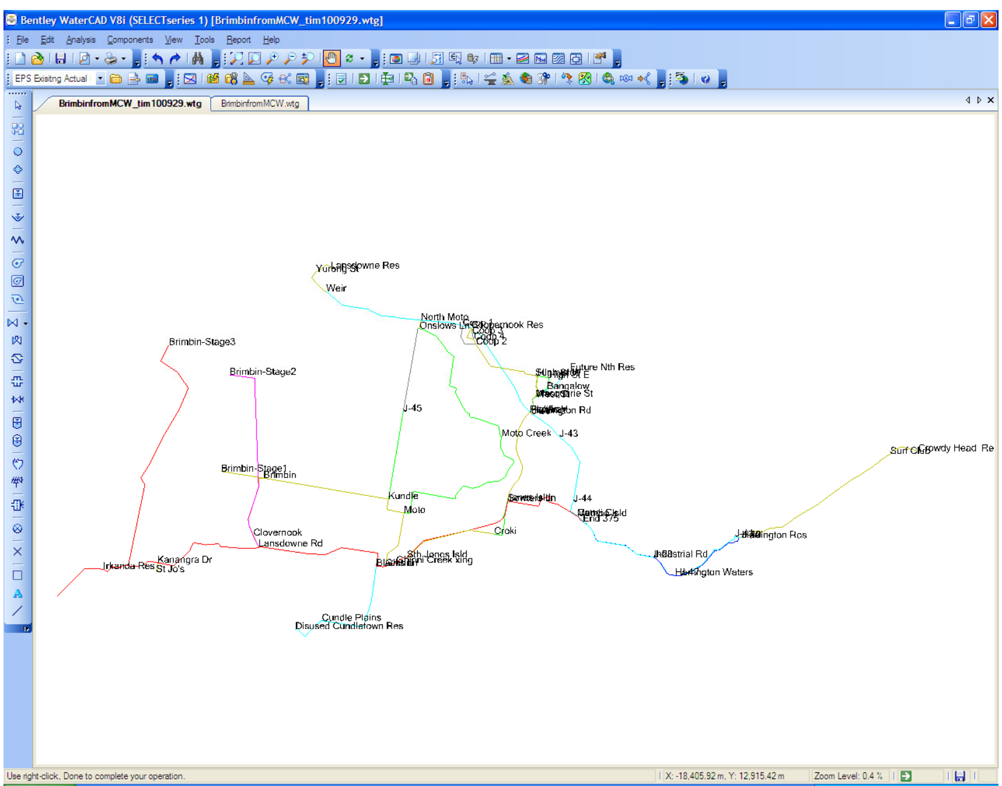


Figure A3.2 Proposed Water Supply Model

4. MODELLING RESULTS

The existing and proposed model scenarios were run in an extended period simulation (EPS) mode over a period of two days using a diurnal pattern developed by MidCoast Water. The following points should be noted as exclusions and assumptions associated with the modelling:

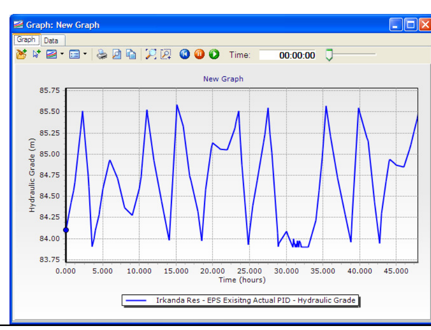
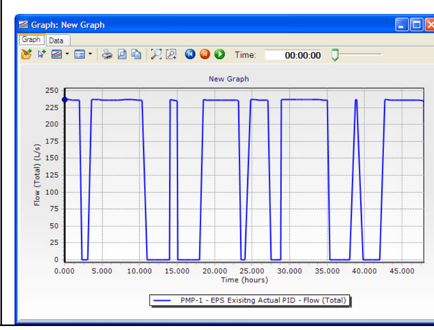
- Allowance has only been made for development in Brimbin. Existing peak day and peak hour demands have been adopted for both the existing and post-development modelling scenarios.
- Modelling of peak week and extreme week has not been undertaken as part of this analysis.

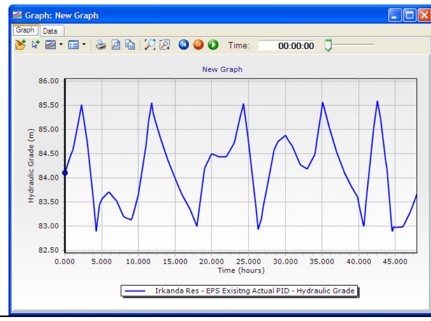
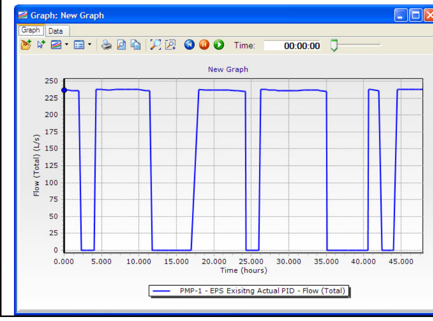
The following sections summarise key issues identified with the existing water supply system based on modelling results and upgrades that may be required to cater for ultimate development of Brimbin.

OPERATING LEVELS AT IRKANDA RESERVOIR

The initial model results demonstrated that the current operating capacity of Irkanda Reservoir would not be sufficient to cater for ultimate development at Brimbin due to the significant increase in peak hour demand. It should be noted that the current operating volume of Irkanda Reservoir only utilises around 10% of the total reservoir volume (refer to **Table A3-1**). The model was run under an alternate scenario with the bottom operating level of Irkanda Reservoir lowered from 83.9m to 82.9m. A comparison of the hydraulic grade line at Irkanda Reservoir and flow rates from the Kolodong Booster Pump Station under two different operating scenarios is shown in **Table A3-6**.

Table A3-6 Comparison of operating scenarios at Irkanda Reservoir

	Hydraulic Grade Line at Irkanda Reservoir, including ultimate development at Brimbin	Flow Rates from Booster Pump Station between Kolodong Reservoir and Irkanda Reservoir
Current Operating Scenario TOL = 85.6m BOL = 83.9m Depth = 1.7m		

	Hydraulic Grade Line at Irkanda Reservoir, including ultimate development at Brimbin	Flow Rates from Booster Pump Station between Kolodong Reservoir and Irkanda Reservoir
Modified Operating Scenario TOL = 85.6m BOL = 82.9m Depth = 2.7m		

In order to cater for ultimate development at Brimbin, the results of hydraulic modelling suggest that the bottom operating level at Irkanda Reservoir would need to be lowered to 82.9m. This would increase the operating volume of the reservoir to around 17% of the total reservoir volume.

Further analysis of the water supply system has been undertaken on the basis of the modified operating scenario at Irkanda Reservoir.

AREAS OF LOW WATER PRESSURE

Analysis of the existing water supply system suggests that low water pressures are currently experienced during periods of peak day demand at Coopernook and the area surrounding Harrington Reservoir. The minimum pressures at these locations in both the existing and proposed development scenarios are summarised in **Table A3-7**.

Table A3-7 Minimum pressures at various locations with low water pressure

Label	Elevation (m)	Minimum Pressure (kPa)	
		Existing Scenario	Including Brimbin
Coop 1	49.00	6.0	12.4
Coop 2	49.00	6.1	12.1
Coop 3	49.00	5.9	11.9
Coop 4	49.00	6.1	12.0
J39 (nr Harrington Reservoir)	23.00	134.5	134.5
J40 (nr Harrington Reservoir)	23.00	134.5	134.5

The results demonstrate that development at Brimbin would have no impact on minimum pressure at these locations. It is noted that the minimum pressures at Coopernook are significantly lower than typical design requirements (200 kPa). A water supply strategy prepared for the Manning Water Supply Scheme (MidCoast Water, 2005) raised the need for upgrades to water supply infrastructure at Coopernook.

COMPARISON OF WATER PRESSURE UNDER EXISTING AND POST-DEVELOPMENT SCENARIOS

The minimum pressure head at key locations within the Irkanda water supply system junction was analysed under existing and post-development scenarios to determine whether development at Brimbin would have any impact on the existing water supply system. The water supply system including ultimate development of Brimbin has been analysed at the three proposed junctions shown in **Table A3-4** and at three locations within the existing system:

- Brimbin (near the UGL Rail site off Lansdowne Road)
- Coopernook 1
- Harrington Waters

The pressure head at each of these junctions over the two day simulation period is presented in **Figure A3-3**.

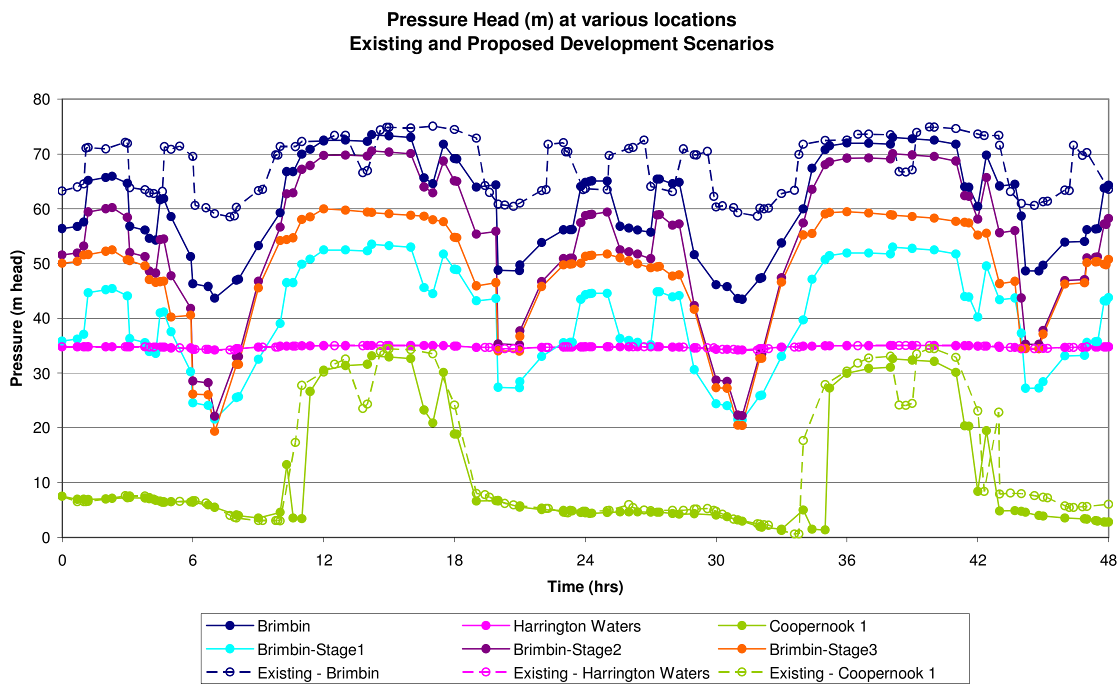


Figure A3-3 Comparison of pressure head under existing and proposed scenarios

The model results suggest that there would be no significant change to water pressure at Harrington Waters and Coopernook. There would be a decrease in minimum pressure of around 10 metres at the junction near Lansdowne Road during peak periods, however minimum pressures requirements would still be satisfied.

5. SUMMARY

The results of water supply modelling indicate that ultimate development of Brimbin can be accommodated within the existing water supply system, subject to upgrades and modifications to the existing system. These upgrades and modifications are summarised below.

Stage 1 of Brimbin (up to approximately 180 ET, subject to confirmation from MCW):

- Extension of the existing DN150 main in Lansdowne Road into the Brimbin development site to service lots below RL 30m AHD (approximately 1500 metres).

Stage 2 of Brimbin (up to 3000 ET):

- Construction of a new DN300 main off the existing DN375 Irkanda trunk water main at Lansdowne Road (approximately 6900 metres) and a booster pump station with a duty of around 70 L/s @ 50m. The new main and booster pump station would be capable of servicing lots up to RL 68m AHD.

Stage 3 of Brimbin (up to ultimate development)

- Construction of a new DN375 main between Irkanda Reservoir and the Brimbin development site (approximately 9,800 metres) and a booster pump station with a duty of around 100 L/s @ 35m. The new main and booster pump station would be capable of servicing lots up to RL 65m AHD.
- Lowering of the bottom operating level at Irkanda Reservoir from 83.9m to 82.9m.

The suggested upgrades and modifications to the existing water supply system to accommodate development at Brimbin are based on preliminary modelling and likely development yields at Brimbin. Further detailed analysis of the system would need to be undertaken at later stages of the project.

Appendix 4 Preliminary Infrastructure Cost Estimates

BRIMBIN
INTEGRATED WATER CYCLE MANAGEMENT STRATEGY

Preliminary Cost Estimate

LEAD-IN WORKS

Potable Water		
DN300 main from Irkanda trunk main to Brimbin (6,800 m)	$3,180,000	1
DN375 main from Irkanda reservoir to Brimbin (9,700 m)	$5,720,000	10
10ML Reservoir and 50kW pump station	$4,880,000	10
Sub-Total for Potable Water Lead-In Works	***$13,780,000***	
Sewerage Transportation and Treatment		
Pump Station for eastern lots (90 l/s)	$950,000	1
DN300 Rising Main via Lansdowne Rd (4,400 m)	$2,440,000	1
Pump Station for western lots (90 l/s)	$950,000	15
DN300 Rising Main via electricity easement (5,400 m)	$2,970,000	15
Sub-Total for Sewerage Lead-In Works	***$7,310,000***	
Recycled Water		
Treatment Facility - Stage 1	$3,970,000	2
DN300 main via Brimbin Rd (8,200 m)	$3,530,000	2
Pumping Stations - 2 x 30 l/s	$820,000	2
7 ML Reservoir	$3,410,000	2
Treatment Facility - Stage 2	$1,770,000	11
Treatment Facility - Stage 3	$1,770,000	21
Sub-Total for Recycled Water Lead-In Works	***$15,270,000***	
TOTAL FOR LEAD-IN WORKS	**$36,360,000**	

BRIMBIN INTEGRATED WATER CYCLE MANAGEMENT STRATEGY

DN300 main from Irkanda trunk main to Brimbin — October 2011

General Assumptions and Exclusions

Estimate prepared using Hunter Water Estimating Guidelines (September 2008)

Potable water main would 6800 metres, based on preliminary route assessment

The pipe size, length and pressure class are based on preliminary assessment and would be subject to further detailed design

Preliminary Cost Estimate	Unit	Rate	Quantity	Amount
Supply and install trenched pipe section (assume DN300 DICL)	m	205	6800	1,394,000
Supply and install directional drilled pipe section (assume steel CL)	m	3500	100	350,000
Additional allowance for terrain (25% of total length)	m	50	1700	85,000
			Sub-total	*1,829,000*
Establishment Cost	item			20,000
			Sub-total	*1,849,000*
Change in CPI (September 2008 to June 2011)		177.6	7.1%	130,400
Total Estimated Contract Award Sum (CAS)				**1,979,400**
			say	**1,980,000**
Design (including survey and geotechnical)	10%	CAS		237,600
Pre-construction Project Management	12%	Design		28,512
			Sub-total	*266,112*
Pre-construction contingency	30%	(Design + PM)		79,834
Total Pre-Construction Cost				**345,946**
Construction Management	10%	CAS		198,000
Construction Contingency Allowances	30%	(CAS + CM)		653,400
Total Construction Cost				**2,831,400**
TOTAL PRELIMINARY PROJECT ESTIMATE				**3,177,346**
			say	**3,180,000**

BRIMBIN INTEGRATED WATER CYCLE MANAGEMENT STRATEGY

DN375 main from Irkanda Reservoir to Brimbin — October 2011

General Assumptions and Exclusions

Estimate prepared using Hunter Water Estimating Guidelines (September 2008)

Potable water main would 9700 metres, based on preliminary route assessment

The pipe size, length and pressure class are based on preliminary assessment and would be subject to further detailed design

Preliminary Cost Estimate	Unit	Rate	Quantity	Amount
Supply and install trenched pipe section (assume DN375 DICL)	m	250	9700	2,425,000
Supply and install directional drilled pipe section (assume steel CL)	m	3000	200	600,000
Additional allowance for terrain (25% of total length)	m	50	2425	121,250
			Sub-total	*3,146,250*
Establishment Cost	item			20,000
			Sub-total	*3,166,250*
Change in CPI (September 2008 to June 2011)		177.6	7.1%	223,298
			Total Estimated Contract Award Sum (CAS)	**3,389,548**
			say	**3,390,000**
Design (including survey and geotechnical)	10%	CAS		339,000
Pre-construction Project Management	12%	Design		40,680
			Sub-total	*379,680*
Pre-construction contingency	30%	(Design + PM)		113,904
			Total Pre-Construction Cost	**493,584**
Construction Management	10%	CAS		339,000
Construction Contingency Allowances	40%	(CAS + CM)		1,491,600
			Total Construction Cost	**5,220,600**
			TOTAL PRELIMINARY PROJECT ESTIMATE	**5,714,184**
			say	**5,720,000**

BRIMBIN INTEGRATED WATER CYCLE MANAGEMENT STRATEGY

7.5 ML Reservoir and 50kW booster pump station — October 2011

General Assumptions and Exclusions

Estimate prepared using Hunter Water Estimating Guidelines (September 2008)

The pipe size, length and pressure class are based on preliminary assessment and would be subject to further detailed design

Preliminary Cost Estimate	Unit	Rate	Quantity	Amount
Supply and install 10ML reservoir	item			2,400,000
Supply and install lead-in mains to reservoir	m	250	100	25,000
Supply and install water pump station (50kW)	item			250,000
			Sub-total	*2,675,000*
Establishment Cost	item			20,000
			Sub-total	*2,695,000*
Change in CPI (September 2008 to June 2011)		177.6	7.1%	190,063
			Total Estimated Contract Award Sum (CAS)	**2,885,063**
			say	**2,890,000**
Design (including survey and geotechnical)	10%	CAS		289,000
Pre-construction Project Management	12%	Design		34,680
			Sub-total	*323,680*
Pre-construction contingency	30%	(Design + PM)		97,104
			Total Pre-Construction Cost	**420,784**
Construction Management	10%	CAS		289,000
Construction Contingency Allowances	40%	(CAS + CM)		1,271,600
			Total Construction Cost	**4,450,600**
			TOTAL PRELIMINARY PROJECT ESTIMATE	**4,871,384**
			say	**4,880,000**

BRIMBIN INTEGRATED WATER CYCLE MANAGEMENT STRATEGY

Sewage Pumping Station (eastern lots) — October 2011

General Assumptions and Exclusions

Estimate prepared using Hunter Water Estimating Guidelines (September 2008)
Pumps would be designed to transfer PWWF for half of development, with a pump duty of 90 L/s @ 50 m
Station would include one duty and one standby pump, with a total power rating of 75kW

Preliminary Cost Estimate	Unit	Rate	Quantity	Amount
Civil Cost	item			311,250
Pumps	item			53,100
Electrical Switchboard	item			82,050
Telemetry	item			43,000
			Sub-total	*489,400*
Establishment & Disestablishment Cost				20,000
			Sub-total	*509,400*
Change in CPI (September 2008 to June 2011)		177.6	7.1%	35,925
			Total Estimated Contract Award Sum (CAS)	**545,325**
			say	**550,000**
Design (including survey and geotechnical)	12%	CAS		66,000
Pre-construction Project Management	12%	Design		7,920
			Sub-total	*73,920*
Pre-construction contingency	30%	(Design + PM)		22,176
			Total Pre-Construction Cost	**96,096**
Construction Management	10%	CAS		55,000
Construction Contingency Allowances	40%	(CAS + CM)		242,000
			Total Construction Cost	**847,000**
			TOTAL PRELIMINARY PROJECT ESTIMATE	**943,096**
			say	**950,000**

BRIMBIN INTEGRATED WATER CYCLE MANAGEMENT STRATEGY

Sewage rising main between Brimbin STP and eastern lots (via Lansdowne Rd)

October 2011

General Assumptions and Exclusions

- Estimate prepared using Hunter Water Estimating Guidelines (September 2008)
- Sewage transfer main would 4400 metres, based on preliminary route assessment
- Pipe would be DN300, based on design pumping rate
- The pipe size, length and pressure class are based on preliminary assessment and would be subject to further detailed design

Preliminary Cost Estimate	Unit	Rate	Quantity	Amount
Supply and install trenched pipe section (assume DICL)	m	270	4400	1,188,000
Supply and install directional drilled pipe section (assume steel CL)	m	3500	0	0
Additional allowance for terrain	m	50	2200	110,000
			Sub-total	*1,298,000*
Establishment Cost	item			20,000
			Sub-total	*1,318,000*
Change in CPI (September 2008 to June 2011)		177.6	7.1%	92,951
			Total Estimated Contract Award Sum (CAS)	**1,410,951**
			say	**1,420,000**
Design (including survey and geotechnical)	10%	CAS		170,400
Pre-construction Project Management	12%	Design		20,448
			Sub-total	*190,848*
Pre-construction contingency	30%	(Design + PM)		57,254
			Total Pre-Construction Cost	**248,102**
Construction Management	10%	CAS		142,000
Construction Contingency Allowances	40%	(CAS + CM)		624,800
			Total Construction Cost	**2,186,800**
			TOTAL PRELIMINARY PROJECT ESTIMATE	**2,434,902**
			say	**2,440,000**

BRIMBIN INTEGRATED WATER CYCLE MANAGEMENT STRATEGY

Sewage Pumping Station (western lots) **October 2011**

General Assumptions and Exclusions

Estimate prepared using Hunter Water Estimating Guidelines (September 2008)
Pumps would be designed to transfer PWWF for half of development, with a pump duty of 90 L/s @ 50 m
Station would include one duty and one standby pump, with a total power rating of 75kW

Preliminary Cost Estimate	Unit	Rate	Quantity	Amount
Civil Cost	item			311,250
Pumps	item			53,100
Electrical Switchboard	item			82,050
Telemetry	item			43,000
			Sub-total	*489,400*
Establishment & Disestablishment Cost				20,000
			Sub-total	*509,400*
Change in CPI (September 2008 to June 2011)		177.6	7.1%	35,925
			Total Estimated Contract Award Sum (CAS)	**545,325**
			say	**550,000**
Design (including survey and geotechnical)	12% CAS			66,000
Pre-construction Project Management	12% Design			7,920
			Sub-total	*73,920*
Pre-construction contingency	30% (Design + PM)			22,176
			Total Pre-Construction Cost	**96,096**
Construction Management	10% CAS			55,000
Construction Contingency Allowances	40% (CAS + CM)			242,000
			Total Construction Cost	**847,000**
			TOTAL PRELIMINARY PROJECT ESTIMATE	**943,096**
			say	**950,000**

BRIMBIN INTEGRATED WATER CYCLE MANAGEMENT STRATEGY

Sewage rising main between Brimbin STP and northern lots (via electricity easement)

October 2011

General Assumptions and Exclusions

Estimate prepared using Hunter Water Estimating Guidelines (September 2008)

Sewage transfer main would 5400 metres, based on preliminary route assessment

Pipe would be DN300, based on design pumping rate

The pipe size, length and pressure class are based on preliminary assessment and would be subject to further detailed design

Preliminary Cost Estimate	Unit	Rate	Quantity	Amount
Supply and install trenched pipe section (assume DICL)	m	270	5400	1,458,000
Supply and install directional drilled pipe section under railway line (assume steel CL)	m	3500	0	0
Additional allowance for terrain	m	50	2700	135,000
			Sub-total	*1,593,000*
Establishment Cost	item			20,000
			Sub-total	*1,613,000*
Change in CPI (September 2008 to June 2011)		177.6	7.1%	113,756
			Total Estimated Contract Award Sum (CAS)	**1,726,756**
			say	**1,730,000**
Design (including survey and geotechnical)	10% CAS			207,600
Pre-construction Project Management	12% Design			24,912
			Sub-total	*232,512*
Pre-construction contingency	30% (Design + PM)			69,754
			Total Pre-Construction Cost	**302,266**
Construction Management	10% CAS			173,000
Construction Contingency Allowances	40% (CAS + CM)			761,200
			Total Construction Cost	**2,664,200**
			TOTAL PRELIMINARY PROJECT ESTIMATE	**2,966,466**
			say	**2,970,000**

BRIMBIN INTEGRATED WATER CYCLE MANAGEMENT STRATEGY

Recycled water treatment facility at Brimbin STP - Stage 1 — October 2011

General Assumptions and Exclusions

Treatment facility is designed to produce effluent for unrestricted public access (i.e. internal reuse)
Assumed that treatment would be installed in three stages, each approx. 1.5 ML/day treatment capacity

Preliminary Cost Estimate		Unit	Rate	Quantity		Amount
Construct 1.5 ML/day recycled water treatment (MBR + Chlorination)		item				2,250,000
(including membranes, in-line chlorine injection, PLC, SCADA, buildings)						
				Sub-total	*$*	*2,250,000*
Change in CPI (nil)					$	-
				Total Estimated Contract Award Sum (CAS)		**2,250,000**
				say		**2,250,000**
Preliminaries (OH&S, site establisment, erosion and sediment control)	12%	CAS				270,000
Design (including survey and geotechnical)	12%	CAS				270,000
Pre-construction Project Management	12%	Design				32,400
				Sub-total		*572,400*
Pre-construction contingency	30%	(Design + PM)				171,720
				Total Pre-Construction Cost		**744,120**
Construction Management	10%	CAS				225,000
Construction Contingency Allowances	30%	(CAS + CM)				742,500
				Total Construction Cost		**3,217,500**
				TOTAL PRELIMINARY PROJECT ESTIMATE		**3,961,620**
				say		**3,970,000**

BRIMBIN INTEGRATED WATER CYCLE MANAGEMENT STRATEGY

Recycled water treatment facility at Brimbin STP - Stage 1 — October 2011

General Assumptions and Exclusions

Treatment facility is designed to produce effluent for restricted public access (i.e. agricultural and open space reuse)
Assumed that treatment would be installed in three stages, each approx. 1.5 ML/day treatment capacity

Preliminary Cost Estimate	Unit	Rate	Quantity		Amount
Construct 1.5 ML/day recycled water treatment (sand filtration + chlorination) (including membranes, in-line chlorine injection, PLC, SCADA, buildings)	item				900,000
			Sub-total	*$*	*900,000*
Change in CPI (nil)				$	-
			Total Estimated Contract Award Sum (CAS)		**900,000**
			say		**900,000**
Preliminaries (OH&S, site establisment, erosion and sediment control)	12%	CAS			108,000
Design (including survey and geotechnical)	12%	CAS			108,000
Pre-construction Project Management	12%	Design			12,960
			Sub-total		*228,960*
Pre-construction contingency	30%	(Design + PM)			68,688
			Total Pre-Construction Cost		**297,648**
Construction Management	10%	CAS			90,000
Construction Contingency Allowances	30%	(CAS + CM)			297,000
			Total Construction Cost		**1,287,000**
			TOTAL PRELIMINARY PROJECT ESTIMATE		**1,584,648**
			say		**1,590,000**

BRIMBIN INTEGRATED WATER CYCLE MANAGEMENT STRATEGY

Recycled water main from Dawson STP to Proposed Reservoir — October 2011

General Assumptions and Exclusions

- Estimate prepared using Hunter Water Estimating Guidelines (September 2008)
- Recycled water main would 8200 metres, based on preliminary route assessment
- Pipe would be DN200, based on design pumping rate (maximum hour demand)
- The pipe size, length and pressure class are based on preliminary assessment and would be subject to further detailed design

Preliminary Cost Estimate	Unit	Rate	Quantity	Amount
Supply and install trenched pipe section (assume DICL)	m	210	8200	1,722,000
Supply and install directional drilled pipe section (assume steel CL)	m	3500	0	0
Additional allowance for terrain	m	50	4100	205,000
			Sub-total	*1,927,000*
Establishment Cost	item			20,000
			Sub-total	*1,947,000*
Change in CPI (September 2008 to June 2011)		177.6	7.1%	137,311
			Total Estimated Contract Award Sum (CAS)	**2,084,311**
			say	**2,090,000**
Design (including survey and geotechnical)	10%	CAS		209,000
Pre-construction Project Management	12%	Design		25,080
			Sub-total	*234,080*
Pre-construction contingency	30%	(Design + PM)		70,224
			Total Pre-Construction Cost	**304,304**
Construction Management	10%	CAS		209,000
Construction Contingency Allowances	40%	(CAS + CM)		919,600
			Total Construction Cost	**3,218,600**
			TOTAL PRELIMINARY PROJECT ESTIMATE	**3,522,904**
			say	**3,530,000**

BRIMBIN INTEGRATED WATER CYCLE MANAGEMENT STRATEGY

Recycled water main from Dawson STP to Coopernook for expansion of the Taree Effluent Management Scheme

October 2011

General Assumptions and Exclusions

Estimate prepared using Hunter Water Estimating Guidelines (September 2008)

Recycled water main would 15000 metres, based on preliminary route assessment

Pipe would be DN200, based on design pumping rate (maximum hour demand)

The pipe size, length and pressure class are based on preliminary assessment and would be subject to further detailed design

Preliminary Cost Estimate	Unit	Rate	Quantity	Amount
Supply and install trenched pipe section (assume DICL)	m	210	15000	3,150,000
Supply and install directional drilled pipe section (assume steel CL)	m	3500	200	700,000
Additional allowance for terrain	m	50	3750	187,500
			Sub-total	*4,037,500*
Establishment Cost	item			20,000
			Sub-total	*4,057,500*
Change in CPI (September 2008 to June 2011)		177.6	7.1%	286,153
			Total Estimated Contract Award Sum (CAS)	**4,343,653**
			say	**4,350,000**
Design (including survey and geotechnical)		10%	CAS	435,000
Pre-construction Project Management		12%	Design	52,200
			Sub-total	*487,200*
Pre-construction contingency		30%	(Design + PM)	146,160
			Total Pre-Construction Cost	**633,360**
Construction Management		10%	CAS	435,000
Construction Contingency Allowances		40%	(CAS + CM)	1,914,000
			Total Construction Cost	**6,699,000**
			TOTAL PRELIMINARY PROJECT ESTIMATE	**7,332,360**
			say	**7,340,000**

BRIMBIN INTEGRATED WATER CYCLE MANAGEMENT STRATEGY

Recycled Water Pumping Station **October 2011**

General Assumptions and Exclusions

Estimate prepared using Hunter Water Estimating Guidelines (September 2008)
Pumps would be designed to transfer up to maximum hour demand, with a pump duty of 30 L/s @ 60 m
Station would include one duty pump and one standby pump, with a total power rating of 25kW

Preliminary Cost Estimate	Unit	Rate	Quantity	Amount
Civil Cost (including pipework)	item			82,500
Pumps	item			17,715
Electrical Switchboard	item			52,260
Flowmeter	item			15,262
Strainer	item			7,813
Telemetry	item			30,400
			Sub-total	*205,950*
Establishment & Disestablishment Cost				8,000
			Sub-total	*213,950*
Change in CPI (September 2008 to June 2011)		177.6	7.1%	15,089
			Total Estimated Contract Award Sum (CAS)	**229,039**
			say	**230,000**
Design (including survey and geotechnical)	12% CAS			34,500
Pre-construction Project Management	12% Design			4,140
			Sub-total	*38,640*
Pre-construction contingency	30% (Design + PM)			11,592
			Total Pre-Construction Cost	**50,232**
Construction Management	10% CAS			23,000
Construction Contingency Allowances	40% (CAS + CM)			101,200
			Total Construction Cost	**354,200**
			TOTAL PRELIMINARY PROJECT ESTIMATE	**404,432**
			say	**410,000**

BRIMBIN INTEGRATED WATER CYCLE MANAGEMENT STRATEGY

Recycled Water Pumping Station — October 2011

General Assumptions and Exclusions

Estimate prepared using Hunter Water Estimating Guidelines (September 2008)
Pumps would be designed to transfer up to maximum hour demand, with a pump duty of 85 L/s @ 35 m
Station would include one duty pump and one standby pump, with a total power rating of 50kW

Preliminary Cost Estimate	**Unit**	**Rate**	**Quantity**	**Amount**
Civil Cost (including pipework)	item			163,365
Pumps	item			27,210
Electrical Switchboard	item			63,570
Flowmeter	item			21,936
Strainer	item			9,633
Telemetry	item			30,400
			Sub-total	*316,114*
Establishment & Disestablishment Cost				10,000
			Sub-total	*326,114*
Change in CPI (September 2008 to June 2011)		177.6	7.1%	22,999
			Total Estimated Contract Award Sum (CAS)	**349,113**
			say	**350,000**
Design (including survey and geotechnical)	12%	CAS		42,000
Pre-construction Project Management	12%	Design		5,040
			Sub-total	*47,040*
Pre-construction contingency	30%	(Design + PM)		14,112
			Total Pre-Construction Cost	**61,152**
Construction Management	10%	CAS		35,000
Construction Contingency Allowances	40%	(CAS + CM)		154,000
			Total Construction Cost	**539,000**
			TOTAL PRELIMINARY PROJECT ESTIMATE	**600,152**
			say	**610,000**

BRIMBIN INTEGRATED WATER CYCLE MANAGEMENT STRATEGY

Recycled Water Reservoir — October 2011

General Assumptions and Exclusions

Estimate prepared using historical data from Hunter Water (indexed to September 2007)

Preliminary Cost Estimate	Unit	Rate	Quantity	Amount
7 ML Reservoir	item			1,900,000
			Sub-total	*1,900,000*
Establishment & Disestablishment Cost				20,000
			Sub-total	*1,920,000*
Change in CPI (September 2008 to June 2011)		177.6	12.3%	236,812
Total Estimated Contract Award Sum (CAS)				**2,156,812**
			say	**2,160,000**
Design (including survey and geotechnical)	12% CAS			216,000
Pre-construction Project Management	12% Design			25,920
			Sub-total	*241,920*
Pre-construction contingency	30% (Design + PM)			72,576
Total Pre-Construction Cost				**314,496**
Construction Management	10% CAS			216,000
Construction Contingency Allowances	30% (CAS + CM)			712,800
Total Construction Cost				**3,085,612**
TOTAL PRELIMINARY PROJECT ESTIMATE				**3,400,108**
			say	**3,410,000**

BRIMBIN INTEGRATED WATER CYCLE MANAGEMENT STRATEGY

Recycled water treatment facility at Brimbin STP — October 2011

General Assumptions and Exclusions

Treatment facility is designed to produce effluent for unrestricted public access (i.e. internal reuse)
Assumed that treatment would be installed in three stages, each approx. 1.5 ML/day treatment capacity

Preliminary Cost Estimate	Unit	Rate	Quantity		Amount
Additional 1.5 ML/day recycled water treatment (MBR + Chlorination)	item				1,000,000
(including membranes, in-line chlorine injection, PLC, SCADA)					
			Sub-total	*$*	*1,000,000*
Change in CPI (nil)				$	-
Total Estimated Contract Award Sum (CAS)					**1,000,000**
				say	**1,000,000**
Preliminaries (OH&S, site establisment, erosion and sediment control)	12%	CAS			120,000
Design (including survey and geotechnical)	12%	CAS			120,000
Pre-construction Project Management	12%	Design			14,400
			Sub-total		*254,400*
Pre-construction contingency	30%	(Design + PM)			76,320
Total Pre-Construction Cost					**330,720**
Construction Management	10%	CAS			100,000
Construction Contingency Allowances	30%	(CAS + CM)			330,000
Total Construction Cost					**1,430,000**
TOTAL PRELIMINARY PROJECT ESTIMATE					**1,760,720**
				say	**1,770,000**

BRIMBIN INTEGRATED WATER CYCLE MANAGEMENT STRATEGY

Recycled water treatment facility at Brimbin STP — October 2011

General Assumptions and Exclusions

Treatment facility is designed to produce effluent for restricted public access (i.e. agricultural and open space reuse)
Assumed that treatment would be installed in three stages, each approx. 1.5 ML/day treatment capacity

Preliminary Cost Estimate	Unit	Rate	Quantity	Amount
Additional 1.5 ML/day recycled water treatment (sand filtration + chlorination) (including membranes, in-line chlorine injection, PLC, SCADA)	item			600,000
			Sub-total $	*600,000*
Change in CPI (nil)			$	-
Total Estimated Contract Award Sum (CAS)				**600,000**
			say	**600,000**
Preliminaries (OH&S, site establisment, erosion and sediment control)	12%	CAS		72,000
Design (including survey and geotechnical)	12%	CAS		72,000
Pre-construction Project Management	12%	Design		8,640
			Sub-total	*152,640*
Pre-construction contingency	30%	(Design + PM)		45,792
Total Pre-Construction Cost				**198,432**
Construction Management	10%	CAS		60,000
Construction Contingency Allowances	30%	(CAS + CM)		198,000
Total Construction Cost				**858,000**
TOTAL PRELIMINARY PROJECT ESTIMATE				**1,056,432**
			say	**1,060,000**

BRIMBIN INTEGRATED WATER CYCLE MANAGEMENT STRATEGY

EFFLUENT MANAGEMENT OPTION 1 - DUAL RETICULATION TO BRIMBIN RESIDENTIAL DEVELOPMENT AREA

	Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
		3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
Rate of		3%	7%	10%	13%	17%	20%	23%	27%	30%	33%
Development	Dwellings/year	296	296	296	296	296	296	296	296	296	296
Assumptions	Dwellings total	296	592	887	1,183	1,479	1,775	2,071	2,367	2,663	2,958

	Year	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
		3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
Rate of		37%	40%	43%	47%	50%	53%	57%	60%	63%	67%	70%	73%	77%	80%	83%	87%	90%	93%	97%	100%
Development	Dwellings/year	296	296	296	296	296	296	296	296	296	296	296	296	296	296	296	296	296	296	296	296
Assumptions	Dwellings total	3,254	3,550	3,846	4,142	4,437	4,733	5,029	5,325	5,621	5,917	6,212	6,508	6,804	7,100	7,396	7,692	7,987	8,283	8,579	8,875

CAPITAL COSTS ($ thousands)

DESCRIPTION	COST CALCULATION	INITIAL COSTS ($'000)	COSTS WITHIN FIRST 30 YRS	TIMING (Year No.)	PRESENT VALUE 4%	7%	YEAR 10%	1	2	3	4	5	6	7	8	9	10
Potable Water																	
DN300 main from Irkanda trunk main to Brimbin (6,800 m)		3180.0	3180.0	1	3180.0	3180.0	3180.0	3180.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DN375 main from Irkanda reservoir to Brimbin (9,700 m)		5720.0	5720.0	10	4018.8	3111.3	2425.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5720.0
7.5ML Reservoir and 50kW pump station		4880.0	4880.0	10	3428.6	2654.4	2069.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4880.0
Potable Water Distribution Mains (20,000 m)		6550.0	6550.0	ongoing	3926.4	2899.0	2264.0	218.3	218.3	218.3	218.3	218.3	218.3	218.3	218.3	218.3	218.3
Potable Water Reticulation		39136.0	39136.0	ongoing	23460.4	17321.2	13527.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5
	Sub-Total for Potable Water	59466.0	59466.0		38014.2	29165.8	23467.0	4702.9	1522.9	1522.9	1522.9	1522.9	1522.9	1522.9	1522.9	1522.9	12122.9
Sewerage																	
Pump Station for eastern lots (90 l/s)		950.0	950.0	1	950.0	950.0	950.0	950.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DN300 Rising Main via Lansdowne Rd (4,400 m)		2440.0	2440.0	1	2440.0	2440.0	2440.0	2440.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pump Station for western lots (90 l/s)		950.0	950.0	15	548.6	368.4	250.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DN300 Rising Main via electricity easement (5,400 m)		2970.0	2970.0	15	1715.1	1151.8	782.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Reticulation (leak tight gravity sewerage)		73380.0	73380.0	ongoing	43988.2	32477.2	25364.1	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0
	Sub-Total for Sewerage	80690.0	80690.0		49641.9	37387.4	29786.3	5836.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0
Recycled Water																	
Rainwater tanks in residential areas		0.0	0.0	ongoing	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Treatment Facility - Stage 1		3970.0	3970.0	2	3970.0	3970.0	3970.0	3970.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DN300 transfer main via Brimbin Rd (8,200 m)		3530.0	3530.0	2	3530.0	3530.0	3530.0	3530.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pumping Stations - 2 x 30 l/s		820.0	820.0	2	820.0	820.0	820.0	820.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7 ML Reservoir		3410.0	3410.0	2	3410.0	3410.0	3410.0	3410.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Treatment Facility - Stage 2		1770.0	1770.0	11	1195.7	899.8	682.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Treatment Facility - Stage 3		1770.0	1770.0	21	807.8	457.4	263.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Recycled Water Distribution Mains (20,000 m)		6550.0	6550.0	ongoing	3926.4	2899.0	2264.0	218.3	218.3	218.3	218.3	218.3	218.3	218.3	218.3	218.3	218.3
Recycled Water Reticulation		39136.0	39136.0	ongoing	23460.4	17321.2	13527.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5
	Sub-Total for Recycled Water	60956.0	60956.0		41120.4	33307.3	28467.0	13252.9	1522.9	1522.9	1522.9	1522.9	1522.9	1522.9	1522.9	1522.9	1522.9
TOTAL CAPITAL COSTS		**201112.0**	**201112.0**		**128776.4**	**99860.6**	**81720.3**	**23792**	**5492**	**5492**	**5492**	**5492**	**5492**	**5492**	**5492**	**5492**	**16092**
Lead-in Works		36360.0	36360.0		30014.7	26943.1	24773.2	18300.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10600.0
CUMULATIVE CAPITAL COSTS								23,792	29,283	34,775	40,267	45,759	51,250	56,742	62,234	67,726	83,817

DESCRIPTION	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Potable Water																				0.0
DN300 main from Irkanda trunk main to Brimbin (6,800 m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DN375 main from Irkanda reservoir to Brimbin (9,700 m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7.5ML Reservoir and 50kW pump station	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Potable Water Distribution Mains (20,000 m)	218.3	218.3	218.3	218.3	218.3	218.3	218.3	218.3	218.3	218.3	218.3	218.3	218.3	218.3	218.3	218.3	218.3	218.3	218.3	218.3
Potable Water Reticulation	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5
Sub-Total for Potable Water	1522.9	1522.9	1522.9	1522.9	1522.9	1522.9	1522.9	1522.9	1522.9	1522.9	1522.9	1522.9	1522.9	1522.9	1522.9	1522.9	1522.9	1522.9	1522.9	1522.9
Sewerage																				
Pump Station for eastern lots (90 l/s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DN300 Rising Main via Lansdowne Rd (4,400 m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pump Station for western lots (90 l/s)	0.0	0.0	0.0	0.0	950.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DN300 Rising Main via electricity easement (5,400 m)	0.0	0.0	0.0	0.0	2970.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Reticulation (leak tight gravity sewerage)	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0
Sub-Total for Sewerage	2446.0	2446.0	2446.0	2446.0	6366.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0
Recycled Water																				
Rainwater tanks in residential areas	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Treatment Facility - Stage 1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DN300 transfer main via Brimbin Rd (8,200 m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pumping Stations - 2 x 30 l/s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7 ML Reservoir	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Treatment Facility - Stage 2	1770.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Treatment Facility - Stage 3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1770.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Recycled Water Distribution Mains (20,000 m)	218.3	218.3	218.3	218.3	218.3	218.3	218.3	218.3	218.3	218.3	218.3	218.3	218.3	218.3	218.3	218.3	218.3	218.3	218.3	218.3
Recycled Water Reticulation	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5
Sub-Total for Recycled Water	3292.9	1522.9	1522.9	1522.9	1522.9	1522.9	1522.9	1522.9	1522.9	1522.9	3292.9	1522.9	1522.9	1522.9	1522.9	1522.9	1522.9	1522.9	1522.9	1522.9
TOTAL CAPITAL COSTS	**7262**	**5492**	**5492**	**5492**	**9412**	**5492**	**5492**	**5492**	**5492**	**5492**	**7262**	**5492**	**5492**	**5492**	**5492**	**5492**	**5492**	**5492**	**5492**	**5492**
Lead-in Works	1770.0	0.0	0.0	0.0	3920.0	0.0	0.0	0.0	0.0	0.0	1770.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CUMULATIVE CAPITAL COSTS	91,079	96,571	102,063	107,554	116,966	122,458	127,949	133,441	138,933	144,425	151,686	157,178	162,670	168,162	173,653	179,145	184,637	190,129	195,620	201,112

OPERATION & MAINTENANCE COSTS ($ thousands) 9435.00

DESCRIPTION	COST CALCULATION	O&M COSTS PER YR ($'000)			PRESENT VALUE 4%	7%	10%	YEAR 1	2	3	4	5	6	7	8	9	10
Water		0.00			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sewerage		0.00			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Recycled Water		322.5			5476.4	3958.9	3021.2	0.0	322.5	322.5	322.5	322.5	322.5	322.5	322.5	322.5	322.5
Total P Worth O&M Costs					5476.4	3958.9	3021.2	0.0	322.5	322.5	322.5	322.5	322.5	322.5	322.5	322.5	322.5
Total P Worth (Capital + O&M)					**134252.8**	**103819.5**	**84741.5**	23791.7	5814.2	5814.2	5814.2	5814.2	5814.2	5814.2	5814.2	5814.2	16414.2

DESCRIPTION	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sewerage	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Recycled Water	322.5	322.5	322.5	322.5	322.5	322.5	322.5	322.5	322.5	322.5	322.5	322.5	322.5	322.5	322.5	322.5	322.5	322.5	322.5	322.5
Total P Worth O&M Costs	322.5	322.5	322.5	322.5	322.5	322.5	322.5	322.5	322.5	322.5	322.5	322.5	322.5	322.5	322.5	322.5	322.5	322.5	322.5	322.5
Total P Worth (Capital + O&M)	7584.2	5814.2	5814.2	5814.2	9734.2	5814.2	5814.2	5814.2	5814.2	5814.2	7584.2	5814.2	5814.2	5814.2	5814.2	5814.2	5814.2	5814.2	5814.2	5814.2

Notes:

BRIMBIN INTEGRATED WATER CYCLE MANAGEMENT STRATEGY

EFFLUENT MANAGEMENT OPTION 2 - AGRICULTURAL AND OPEN SPACE REUSE WITHIN BRIMBIN DEVELOPMENT AREA

		2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
	Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
		3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
Rate of		3%	7%	10%	13%	17%	20%	23%	27%	30%	33%	37%	40%	43%	47%	50%
Development	Dwellings/year	296	296	296	296	296	296	296	296	296	296	296	296	296	296	296
Assumptions	Dwellings total	296	592	887	1,183	1,479	1,775	2,071	2,367	2,663	2,958	3,254	3,550	3,846	4,142	4,437

		2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
	Year	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
		3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
Rate of		53%	57%	60%	63%	67%	70%	73%	77%	80%	83%	87%	90%	93%	97%	100%
Development	Dwellings/year	296	296	296	296	296	296	296	296	296	296	296	296	296	296	296
Assumptions	Dwellings total	4,733	5,029	5,325	5,621	5,917	6,212	6,508	6,804	7,100	7,396	7,692	7,987	8,283	8,579	8,875

CAPITAL COSTS ($ thousands)

DESCRIPTION	COST CALCULATION	INITIAL COSTS	COSTS WITHIN	TIMING	PRESENT VALUE		YEAR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		($'000)	FIRST 30 YRS	(Year No.)	4%	7%	10%															
Potable Water																						
DN300 main from Irkanda trunk main to Brimbin (6,800 m)		3180.0	3180.0	1	3180.0	3180.0	3180.0	3180.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DN375 main from Irkanda reservoir to Brimbin (9,700 m)		5720.0	5720.0	10	4018.8	3111.3	2425.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5720.0	0.0	0.0	0.0	0.0	0.0
7.5ML Reservoir and 50kW pump station		4880.0	4880.0	10	3428.6	2654.4	2069.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4880.0	0.0	0.0	0.0	0.0	0.0
Potable Water Distribution Mains (20,000 m)		6550.0	6550.0	ongoing	3926.4	2899.0	2264.0	218.3	218.3	218.3	218.3	218.3	218.3	218.3	218.3	218.3	218.3	218.3	218.3	218.3	218.3	218.3
Potable Water Reticulation		39136.0	39136.0	ongoing	23460.4	17321.2	13527.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5
	Sub-Total for Potable Water	59466.0	59466.0		38014.2	29165.8	23467.0	4702.9	1522.9	1522.9	1522.9	1522.9	1522.9	1522.9	1522.9	1522.9	12122.9	1522.9	1522.9	1522.9	1522.9	1522.9
Sewerage																						
Pump Station for eastern lots (90 l/s)		950.0	950.0	1	950.0	950.0	950.0	950.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DN300 Rising Main via Lansdowne Rd (4,400 m)		2440.0	2440.0	1	2440.0	2440.0	2440.0	2440.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pump Station for western lots (90 l/s)		950.0	950.0	15	548.6	368.4	250.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	950.0
DN300 Rising Main via electricity easement (5,400 m)		2970.0	2970.0	15	1715.1	1151.8	782.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2970.0
Reticulation (leak tight gravity sewerage)		73380.0	73380.0	ongoing	43988.2	32477.2	25364.1	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0
	Sub-Total for Sewerage	80690.0	80690.0		49641.9	37387.4	29786.3	5836.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	6366.0
Recycled Water																						
Rainwater tanks in residential areas		32000.0	32000.0	ongoing	19182.6	14162.9	11060.9	1066.7	1066.7	1066.7	1066.7	1066.7	1066.7	1066.7	1066.7	1066.7	1066.7	1066.7	1066.7	1066.7	1066.7	1066.7
Treatment Facility - Stage 1		1590.0	1590.0	2	1590.0	1590.0	1590.0	1590.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DN300 transfer main via Brimbin Rd (8,200 m)		3530.0	3530.0	2	3530.0	3530.0	3530.0	3530.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pumping Stations - 85 l/s		610.0	610.0	2	610.0	610.0	610.0	610.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7 ML Reservoir		0.0	0.0	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Treatment Facility - Stage 2		1060.0	1060.0	11	716.1	538.9	408.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1060.0	0.0	0.0	0.0	0.0
Treatment Facility - Stage 3		1060.0	1060.0	21	483.8	273.9	157.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Recycled Water Distribution Mains (8,000 m)		2700.0	2700.0	ongoing	1618.5	1195.0	933.3	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0
Agricultural area reticulation / storage		22500.0	22500.0	ongoing	13487.8	9958.3	7777.2	750.0	750.0	750.0	750.0	750.0	750.0	750.0	750.0	750.0	750.0	750.0	750.0	750.0	750.0	750.0
	Sub-Total for Recycled Water	65050.0	65050.0		41218.8	31858.9	26067.6	7636.7	1906.7	1906.7	1906.7	1906.7	1906.7	1906.7	1906.7	1906.7	1906.7	2966.7	1906.7	1906.7	1906.7	1906.7
TOTAL CAPITAL COSTS		**205206.0**	**205206.0**		**128874.9**	**98412.1**	**79320.9**	**18176**	**5876**	**5876**	**5876**	**5876**	**5876**	**5876**	**5876**	**5876**	**16476**	**6936**	**5876**	**5876**	**5876**	**9796**
Lead-in Works		28940.0	28940.0		23211.0	20398.7	18393.9	12300.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10600.0	1060.0	0.0	0.0	0.0	3920.0
CUMULATIVE CAPITAL COSTS								18,176	24,051	29,927	35,802	41,678	47,553	53,429	59,304	65,180	81,655	88,591	94,466	100,342	106,217	116,013

DESCRIPTION	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Potable Water															0.0
DN300 main from Irkanda trunk main to Brimbin (6,800 m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DN375 main from Irkanda reservoir to Brimbin (9,700 m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7.5ML Reservoir and 50kW pump station	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Potable Water Distribution Mains (20,000 m)	218.3	218.3	218.3	218.3	218.3	218.3	218.3	218.3	218.3	218.3	218.3	218.3	218.3	218.3	218.3
Potable Water Reticulation	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5
Sub-Total for Potable Water	1522.9	1522.9	1522.9	1522.9	1522.9	1522.9	1522.9	1522.9	1522.9	1522.9	1522.9	1522.9	1522.9	1522.9	1522.9
Sewerage															
Pump Station for eastern lots (90 l/s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DN300 Rising Main via Lansdowne Rd (4,400 m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pump Station for western lots (90 l/s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DN300 Rising Main via electricity easement (5,400 m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Reticulation (leak tight gravity sewerage)	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0
Sub-Total for Sewerage	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0
Recycled Water															
Rainwater tanks in residential areas	1066.7	1066.7	1066.7	1066.7	1066.7	1066.7	1066.7	1066.7	1066.7	1066.7	1066.7	1066.7	1066.7	1066.7	1066.7
Treatment Facility - Stage 1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DN300 transfer main via Brimbin Rd (8,200 m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pumping Stations - 85 l/s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7 ML Reservoir	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Treatment Facility - Stage 2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Treatment Facility - Stage 3	0.0	0.0	0.0	0.0	0.0	1060.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Recycled Water Distribution Mains (8,000 m)	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0
Agricultural area reticulation / storage	750.0	750.0	750.0	750.0	750.0	750.0	750.0	750.0	750.0	750.0	750.0	750.0	750.0	750.0	750.0
Sub-Total for Recycled Water	1906.7	1906.7	1906.7	1906.7	1906.7	2966.7	1906.7	1906.7	1906.7	1906.7	1906.7	1906.7	1906.7	1906.7	1906.7
TOTAL CAPITAL COSTS	**5876**	**5876**	**5876**	**5876**	**5876**	**6936**	**5876**	**5876**	**5876**	**5876**	**5876**	**5876**	**5876**	**5876**	**5876**
Lead-in Works	0.0	0.0	0.0	0.0	0.0	1060.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CUMULATIVE CAPITAL COSTS	121,889	127,764	133,640	139,515	145,391	152,326	158,202	164,077	169,953	175,828	181,704	187,579	193,455	199,330	205,206

OPERATION & MAINTENANCE COSTS ($ thousands)

9435.00

DESCRIPTION	COST CALCULATION	O&M COSTS PER YR	PRESENT VALUE			YEAR 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		($'000)	4%	7%	10%															
Water		0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sewerage		0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Recycled Water		93.1	1581.9	1143.5	872.7	0.0	93.1	93.1	93.1	93.1	93.1	93.1	93.1	93.1	93.1	93.1	93.1	93.1	93.1	93.1
Total P Worth O&M Costs			1581.9	1143.5	872.7	0.0	93.1	93.1	93.1	93.1	93.1	93.1	93.1	93.1	93.1	93.1	93.1	93.1	93.1	93.1
Total P Worth (Capital + O&M)			**130456.8**	**99555.7**	**80193.6**	18175.5	5968.7	5968.7	5968.7	5968.7	5968.7	5968.7	5968.7	5968.7	16568.7	7028.7	5968.7	5968.7	5968.7	9888.7

DESCRIPTION	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sewerage	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Recycled Water	93.1	93.1	93.1	93.1	93.1	93.1	93.1	93.1	93.1	93.1	93.1	93.1	93.1	93.1	93.1
Total P Worth O&M Costs	93.1	93.1	93.1	93.1	93.1	93.1	93.1	93.1	93.1	93.1	93.1	93.1	93.1	93.1	93.1
Total P Worth (Capital + O&M)	5968.7	5968.7	5968.7	5968.7	5968.7	7028.7	5968.7	5968.7	5968.7	5968.7	5968.7	5968.7	5968.7	5968.7	5968.7

Notes:

BRIMBIN INTEGRATED WATER CYCLE MANAGEMENT STRATEGY

EFFLUENT MANAGEMENT OPTION 3 - EXPANSION OF TAREE EFFLUENT MANAGEMENT SCHEME

							Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
								3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
						Rate of		3%	7%	10%	13%	17%	20%	23%	27%	30%	33%	37%	40%	43%	47%	50%
						Development	Dwellings/year	296	296	296	296	296	296	296	296	296	296	296	296	296	296	296
						Assumptions	Dwellings total	296	592	887	1,183	1,479	1,775	2,071	2,367	2,663	2,958	3,254	3,550	3,846	4,142	4,437
CAPITAL COSTS ($ thousands)																						
DESCRIPTION	COST CALCULATION	INITIAL COSTS	COSTS WITHIN	TIMING	PRESENT VALUE		YEAR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		($'000)	FIRST 30 YRS	(Year No.)	4%	7%	10%															
Potable Water																						
DN300 main from Irkanda trunk main to Brimbin (6,800 m)		3180.0	3180.0	1	3180.0	3180.0	3180.0	3180.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DN375 main from Irkanda reservoir to Brimbin (9,700 m)		5720.0	5720.0	10	4018.8	3111.3	2425.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5720.0	0.0	0.0	0.0	0.0	0.0
7.5ML Reservoir and 50kW pump station		4880.0	4880.0	10	3428.6	2654.4	2069.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4880.0	0.0	0.0	0.0	0.0	0.0
Potable Water Distribution Mains (20,000 m)		6550.0	6550.0	ongoing	3926.4	2899.0	2264.0	218.3	218.3	218.3	218.3	218.3	218.3	218.3	218.3	218.3	218.3	218.3	218.3	218.3	218.3	218.3
Potable Water Reticulation		39136.0	39136.0	ongoing	23460.4	17321.2	13527.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5
	Sub-Total for Potable Water	59466.0	59466.0		38014.2	29165.8	23467.0	4702.9	1522.9	1522.9	1522.9	1522.9	1522.9	1522.9	1522.9	1522.9	12122.9	1522.9	1522.9	1522.9	1522.9	1522.9
Sewerage																						
Pump Station for eastern lots (90 l/s)		950.0	950.0	1	950.0	950.0	950.0	950.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DN300 Rising Main via Lansdowne Rd (4,400 m)		2440.0	2440.0	1	2440.0	2440.0	2440.0	2440.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pump Station for western lots (90 l/s)		950.0	950.0	15	548.6	368.4	250.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	950.0
DN300 Rising Main via electricity easement (5,400 m)		2970.0	2970.0	15	1715.1	1151.8	782.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2970.0
Reticulation (leak tight gravity sewerage)		73380.0	73380.0	ongoing	43988.2	32477.2	25364.1	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0
	Sub-Total for Sewerage	80690.0	80690.0		49641.9	37387.4	29786.3	5836.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	6366.0
Recycled Water																						
Rainwater tanks in residential areas		32000.0	32000.0		19182.6	14162.9	11060.9	1066.7	1066.7	1066.7	1066.7	1066.7	1066.7	1066.7	1066.7	1066.7	1066.7	1066.7	1066.7	1066.7	1066.7	1066.7
Treatment Facility - Stage 1		0.0	0.0	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DN375 transfer main to Coopernook (15,000 m)		7340.0	7340.0	2	7340.0	7340.0	7340.0	7340.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pumping Stations - 85 l/s		610.0	610.0	2	610.0	610.0	610.0	610.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Treatment Facility - Stage 2		0.0	0.0	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Treatment Facility - Stage 3		0.0	0.0	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Recycled Water Distribution Mains		0.0	0.0	ongoing	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Agricultural area reticulation / storage		61500.0	61500.0	ongoing	36866.6	27219.2	21257.7	2050.0	2050.0	2050.0	2050.0	2050.0	2050.0	2050.0	2050.0	2050.0	2050.0	2050.0	2050.0	2050.0	2050.0	2050.0
	Sub-Total for Recycled Water	101450.0	101450.0		63999.2	49332.1	40268.6	11066.7	3116.7	3116.7	3116.7	3116.7	3116.7	3116.7	3116.7	3116.7	3116.7	3116.7	3116.7	3116.7	3116.7	3116.7
TOTAL CAPITAL COSTS		**241606.0**	**241606.0**		**151655.3**	**115885.3**	**93521.9**	**21606**	**7086**	**7086**	**7086**	**7086**	**7086**	**7086**	**7086**	**7086**	**17686**	**7086**	**7086**	**7086**	**7086**	**11006**
Lead-in Works		29040.0	29040.0		24231.1	21805.9	20047.7	14520.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10600.0	0.0	0.0	0.0	0.0	3920.0
CUMULATIVE CAPITAL COSTS								21,606	28,691	35,777	42,862	49,948	57,033	64,119	71,204	78,290	95,975	103,061	110,146	117,232	124,317	135,323
OPERATION & MAINTENANCE COSTS ($ thousands)																						
		9435.00																				
DESCRIPTION	COST CALCULATION	O&M COSTS PER YR			PRESENT VALUE			YEAR 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		($'000)			4%	7%	10%															
Water		0.00			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sewerage		0.00			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Recycled Water		43.1			732.7	529.7	404.2	0.0	43.1	43.1	43.1	43.1	43.1	43.1	43.1	43.1	43.1	43.1	43.1	43.1	43.1	43.1
Total P Worth O&M Costs					732.7	529.7	404.2	0.0	43.1	43.1	43.1	43.1	43.1	43.1	43.1	43.1	43.1	43.1	43.1	43.1	43.1	43.1
Total P Worth (Capital + O&M)					**152388.0**	**116415.0**	**93926.1**	21605.5	7128.7	7128.7	7128.7	7128.7	7128.7	7128.7	7128.7	7128.7	17728.7	7128.7	7128.7	7128.7	7128.7	11048.7

	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
	53%	57%	60%	63%	67%	70%	73%	77%	80%	83%	87%	90%	93%	97%	100%
Dwellings/year	296	296	296	296	296	296	296	296	296	296	296	296	296	296	296
Dwellings total	4,733	5,029	5,325	5,621	5,917	6,212	6,508	6,804	7,100	7,396	7,692	7,987	8,283	8,579	8,875
DESCRIPTION	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Potable Water															0.0
DN300 main from Irkanda trunk main to Brimbin (6,800 m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DN375 main from Irkanda reservoir to Brimbin (9,700 m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7.5ML Reservoir and 50kW pump station	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Potable Water Distribution Mains (20,000 m)	218.3	218.3	218.3	218.3	218.3	218.3	218.3	218.3	218.3	218.3	218.3	218.3	218.3	218.3	218.3
Potable Water Reticulation	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5	1304.5
Sub-Total for Potable Water	1522.9	1522.9	1522.9	1522.9	1522.9	1522.9	1522.9	1522.9	1522.9	1522.9	1522.9	1522.9	1522.9	1522.9	1522.9
Sewerage															
Pump Station for eastern lots (90 l/s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DN300 Rising Main via Lansdowne Rd (4,400 m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pump Station for western lots (90 l/s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DN300 Rising Main via electricity easement (5,400 m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Reticulation (leak tight gravity sewerage)	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0
Sub-Total for Sewerage	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0	2446.0
Recycled Water															
Rainwater tanks in residential areas	1066.7	1066.7	1066.7	1066.7	1066.7	1066.7	1066.7	1066.7	1066.7	1066.7	1066.7	1066.7	1066.7	1066.7	1066.7
Treatment Facility - Stage 1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DN375 transfer main to Coopernook (15,000 m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pumping Stations - 85 l/s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Treatment Facility - Stage 2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Treatment Facility - Stage 3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Recycled Water Distribution Mains	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Agricultural area reticulation / storage	2050.0	2050.0	2050.0	2050.0	2050.0	2050.0	2050.0	2050.0	2050.0	2050.0	2050.0	2050.0	2050.0	2050.0	2050.0
Sub-Total for Recycled Water	3116.7	3116.7	3116.7	3116.7	3116.7	3116.7	3116.7	3116.7	3116.7	3116.7	3116.7	3116.7	3116.7	3116.7	3116.7
TOTAL CAPITAL COSTS	**7086**	**7086**	**7086**	**7086**	**7086**	**7086**	**7086**	**7086**	**7086**	**7086**	**7086**	**7086**	**7086**	**7086**	**7086**
Lead-in Works	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CUMULATIVE CAPITAL COSTS	142,409	149,494	156,580	163,665	170,751	177,836	184,922	192,007	199,093	206,178	213,264	220,349	227,435	234,520	241,606
DESCRIPTION (O&M)	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sewerage	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Recycled Water	43.1	43.1	43.1	43.1	43.1	43.1	43.1	43.1	43.1	43.1	43.1	43.1	43.1	43.1	43.1
Total P Worth O&M Costs	43.1	43.1	43.1	43.1	43.1	43.1	43.1	43.1	43.1	43.1	43.1	43.1	43.1	43.1	43.1
Total P Worth (Capital + O&M)	7128.7	7128.7	7128.7	7128.7	7128.7	7128.7	7128.7	7128.7	7128.7	7128.7	7128.7	7128.7	7128.7	7128.7	7128.7

Notes: