

Bathurst Effluent Reuse Scheme

Pre-Feasibility Report

Bathurst Regional Council

April 2006

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FINAL REPORT

Bathurst Regional Council

Bathurst Effluent Reuse Scheme *Pre-Feasibility Report*

April 2006

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EXECUTIVE SUMMARY

Bathurst Regional Council (BRC) wishes to develop an effluent reuse scheme that will make use of the treated effluent that currently discharges directly to the Macquarie River from the Bathurst Sewage Treatment Plant (STP). The principal reuse option is irrigation of sports fields, public facilities and agricultural land; however, it may be possible to incorporate non-potable water systems in future development areas. The main benefits of the scheme will be to reduce demand on potable and raw water supplies and to supply high quality reclaimed water for irrigation cheaper and with greater security of supply than current irrigation methods. BRC will seek government funding under the Water Smart Program for at least 50% of the cost of the scheme.

The quality of treated effluent currently being discharged is high and generally meets DEC and ANZECC guidelines for discharge to aquatic environments and for secondary contact. Some augmentation of the STP may be required in future to meet all DEC licence conditions. The STP is unlikely to require modifications for the reuse scheme other than a new pumping station. The scheme will comprise pumps, storages and pipelines to deliver reclaimed water to the property boundaries of potential users. Users will be required to meet health and safety provisions as well as environmental constraints as part of formal agreements for supply of reclaimed water.

A number of zones were identified as potential irrigation areas and options were assessed for various levels of reuse. From an economic perspective the optimum range of area to be irrigated is between 300 and 500ha which results in between 45% and 65% reuse of total treated effluent discharged from the STP. The corresponding capital cost was estimated to be between \$4.3M and \$6.8M. (For 100% reuse, approximately 900ha would need to be irrigated and the capital cost of the trunk distribution network would be approximately \$18M). Users will be charged a nominal amount for the reclaimed water that will meet some of the ongoing operation costs. Users will also be responsible for costs associated with storage and irrigation systems on their own properties.

Environmental and social impacts are expected to be minimal for all options and a number of social and environmental benefits were identified – the main benefits being improvement in potential for agricultural development, reduced demand on water supply infrastructure, improvements in environmental flows in rivers from increased dam releases, reduced demand for fertilisers, greater security of irrigation water supply, and meeting community expectations for more sustainable use and reuse of resources. There is also demonstrated community support for this project. A detailed Environmental Impact Assessment (EIA) will be required should funds become available to proceed with the scheme. This report discusses most of the issues expected to arise in the EIA process.

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1 BACKGROUND

1.1 INTRODUCTION

This Pre-feasibility Assessment Report has been prepared by Environmental Resources Management (ERM) on behalf of the Bathurst Regional Council (BRC). Its purpose is to assess the likely impacts associated with options for the reuse of treated effluent from the Bathurst Sewage Treatment Plant (STP).

The STP treats sewage from the city of Bathurst to tertiary standard and currently discharges between 7 and 11 ML/day (approximately 3,000 ML/annum) of treated effluent to the Macquarie River. BRC wishes to investigate environmentally sustainable options for reusing treated effluent (also referred to hereafter as reclaimed water) and will seek funding to implement cost-effective options.

1.2 STUDY AREA

1.2.1 Overview

Bathurst is the main commercial and administrative centre in the upper Macquarie River Valley and has a population of approximately 35,000 (30,307 in 2000 Census). It is located in a wide valley on the Macquarie River floodplain, approximately 207 km west of Sydney via the Great Western Highway as shown in *Figure 1.1*.

The existing STP is situated between Morisset Street and the Macquarie River, approximately 2.5 km north of the town centre, and is adjacent to the north-eastern corner of the residential zone and to agricultural land to the north (*Figure 1.1*). STP infrastructure is positioned approximately 185m from the nearest residential properties.

The study area for reuse options is limited only by reasonable expectations of pipeline and storage costs and has nominally been extended to a maximum distance of 30km from the STP as shown in *Figure 1.2*. Four potential Zones have been identified for effluent reuse – these are discussed in *Section 1.3*.

G:\GIS\Miscellaneous\Locality Map.wor 17.03.2006 Environmental Resources Management Australia Pty Ltd





1.2.2 Soils

Interpretation of the 1:250 000 Bathurst Soil Landscape Map (Kovacs, Murphy and Lawrie, 1989), shows the study area to be dominated by the Bathurst soil landscape. The Bathurst soil landscape occurs on upland areas in the vicinity of the Bathurst township and would be dominant in Zone 1. The Macquarie soil landscape occurs on the alluvial plains and terraces of the Macquarie, upper Belubula and Campbells Rivers and would dominate Zones 2, 3 and 4.

Bathurst Soil Landscape

The landscape is characterised by undulating to rolling hills with elevations of 650 to 850 m and slopes of 6 to 10%. Local relief varies from 30-70 m and the drainage patterns are convergent with drainage lines 500 to 1000 m apart.

The dominant soils have formed on the Bathurst Granite which is a medium to coarse grained and massive granodiorite and adamellites. The soils are non-calcic brown soils (Dr2.12, Dr2.22, Dr2.42) with yellow solodic soils (Dy3.42, Dy3.43) on the lower slopes and in drainage lines. Sands (Uc1) and mottled yellow solodic soils (Dy3.82, Dy3.83) also occur.

Constituent soils are described as moderately permeable to slowly permeable with a moderate to high available water holding capacity. The depth to bedrock is usually greater than 100 cm. Topsoil is slightly acid and fertility is described as moderate, typically deficient in nitrogen, phosphorus, molybdenum and on lower lying areas, calcium.

The soils are considered suitable for cropping (provided there is good erosion control) and grazing. They are also likely to be suitable for irrigation with reclaimed water.

The Macquarie Soil Landscape

The landscape is characterized by alluvial plains and terraces with local relief of less than 10m and slope gradients usually less than 3%. The landscape also includes back plains, swamps, channel benches, relict stream channels, flood outs, ox bows, levees and point bars. (These latter features would probably be excluded from any irrigation scheme).

The dominant soils have formed on alluvium which has been derived from the volcanics of the Molong Geanticline, volcanics and metasediments of the Hill End Trough, Tertiary basalts and associated volcanics from the Canobolas Complex.

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The soils are typically prairie soils (Um6.11, Um6.31, Um 6.14, Gn3.43, Gn 4.42, Db1.1) on the floodplain with some earthy loams (Um5.52), siliceous sands (Uc) and loams (Um), weisenboden (Ug 5.11, Ug5.61, Ug 5.17) and black earths (Ug6.11). Black earths are dominant on the Campbell's river alluvium. Terraces have a variety of soils including red podzolic soils (Dr2.21) and red earths (Gn2.11) on upper levels and yellow podzolic soils (Dy3.13) and yellow solodic soils (Dy3.32, Dy3.43) on middle and lower levels.

Constituent soils are described as moderately permeable (Macquarie River) to moderately well drained (Campbell's River) with a high available water holding capacity. The depth to bedrock is usually greater than 150 cm. Topsoil is neutral to slightly alkaline and fertility is described as moderate to high. There are no known nutrient deficiencies on the Campbell's River black earths, but the Macquarie River soils are known to be deficient in nitrogen and phosphorus.

The soils are considered highly suitable for cropping. They are also likely to be suitable for irrigation with reclaimed water.

1.2.3 Groundwater

There are numerous bores in the Bathurst region, most of which are licensed for domestic or stock use, though some irrigation licenses exist. A phone questionnaire of some bore users conducted by Agsol, found that users were accessing water at a depth of approximately 35 to 40 m and that there were some quality issues. It also confirmed that standing water levels within the Bathurst soil landscape were below 10 m. Standing water levels below the Macquarie River soil landscape are likely to be above 10 m and can be as high as 3 to 4 m below the surface.

1.2.4 Surface Water

The study area is situated within the upper Macquarie River Catchment. The Macquarie River begins at the confluence of the Fish River and the Campbells River approximately 10 km south of Bathurst City. The Macquarie River services a major agricultural production area in western NSW, supplies potable water to Bathurst's and irrigation water to farmers and includes the Macquarie Marshes which are an internationally renowned breeding habitat for wetland bird species. Tertiary treated effluent discharges from the Bathurst STP into the upper Macquarie River.

The major water storage for Bathurst is Ben Chifley dam located on the Campbell's River, 22 km upstream of Bathurst. Water released from the dam flows down the Campbell's River into the Macquarie River. Subsequent to raising of the dam wall in 2002, it now has a capacity of 30,800 ML, which proved sufficient to meet potable and irrigator needs without the need for water restrictions during the major drought of 2002-2003. State government policy stipulates that no new irrigation licenses be released within the Bathurst region. There is, however, potential for transfer of water entitlement under the "duality of ownership" system or permanent transfer by outright sale of a water entitlement.

Raw water for park watering and industrial uses is supplied by the 1,700ML Winburndale Dam which is located on the Winburndale Rivulet, east of Bathurst. Water is transported by an old wood stave pipeline between the dam and the city. It is understood that flows in the Winburndale Rivulet have been affected by the dam, particularly during dry periods.

1.3 OUTLINE OF THE PROPOSAL

BRC is proposing to construct pipelines and storage facilities to provide irrigation water to potential users such as farmers, the Bathurst Golf Course, Council playing fields and gardens, educational and sports centres and potentially to developers of future residential areas. The existing STP will be modified only to the extent required to supply reclaimed water to standards appropriate to the intended uses.

Four potential areas have been identified for possible distribution of reclaimed water (refer *Figure 1.2*):

- **Zone 1**: incorporates the south-western side of the Macquarie River, extending from the STP via the Golf Course and Agricultural Station to Bathurst TAFE, St Stanislaus College and South Bathurst Public School. The primary source of irrigation water for this zone is currently Winburndale raw water which incurs a high usage charge; more water would be used on these properties if a cheaper source was available.
- **Zone 2**: located on the eastern side of the Macquarie River, extending predominantly along the floodplain, incorporating agricultural land, the Greenacres Turf Farm, Tyers Park Racecourse, Bathurst Showground and Sportsground. The primary source of irrigation water for this zone is currently licensed river water and bore water. Bore water generates high electricity costs for big users such as the Tyers Park Race Course. There is likely to be interest from current and potential irrigators in this area.

- Zone 3: comprises agricultural land up to 10km north and north-east of the STP and adjacent rises from Kelso to White Rock. The primary source of irrigation water for this zone is currently licensed extractions of river water; which draws on Ben Chifley dam releases and the primary source of Bathurst's potable water supply. There is likely to be substantial interest in irrigating additional farm lands between Kelso and White Rock if an alternative water source was available at a cost effective price.
- **Zone 4**: the far southern zone along the Campbell's River, comprising agricultural land up to 30km south of the STP between White Rock and The Lagoon. The current source of irrigation water is the same as for Zone 3.

Reclaimed water storages are proposed in each of the four zones but the main storage is proposed to be within the centre of Tyers Park Racecourse in Zone 2. This storage would have an initial capacity of 140ML for Zone 2 and could be expanded to 290ML if Zones 2 and 3 are to be irrigated. Secondary storages capable of providing 2 to 5 days supply will be located in Zone1, Zone 3 and Zone 4. The abandoned Boundary Rd Quarry has been identified as a potential storage for Zone 1 with approximately 10ML capacity. It is likely the storages for Zones 3 and 4 totalling 150ML each will need to be on private property.

Even if all zones are supplied with reclaimed water it will still be necessary to release reclaimed water into the Macquarie River during wet weather flows and when all storages are full.

Most irrigation sites would need a small storage to balance inflows from the main reclaimed water pipeline. It is proposed that the user/property owner will be responsible for the construction and cost of any on-site storage. Reclaimed water will be provided via offtakes from the main pipelines to property boundaries only. Restrictions will be placed on the methods of irrigation to ensure environmental and health and safety requirements are met.

1.4 STRATEGIC CONTEXT

BRC's primary objective for the effluent reuse scheme is to reduce overall demands on potable and raw water so that pressure on supply infrastructure, especially during droughts will be reduced. More water will also be available for release from dams as environmental flows. The importance of the scheme derives from the potential realisation of this objective and from the benefits it may generate. The potential benefits are outlined in *Section 5.4*.

BRC will seek funding from the Federal Government under the Country Towns Water Supply and Sewerage Program and the Water Smart Program.

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1.5 **REPORT FUNCTION AND STRUCTURE**

1.5.1 *Purpose of the Report*

This report provides an assessment of the issues and the potential benefits and costs associated with the effluent reuse options. It has been prepared to assist BRC in its planning and in its applications for funding. The report also identifies some of the environmental safeguards and mitigation measures that are likely to be required in relation to the works and which would need to be assessed in the Environmental Impact Assessment (EIA).

1.5.2 Document Structure

The report has been divided into four parts as described below and is supplemented by technical appendices which provide technical and economic information. This structure reflects the likely format of the EIA.

Part A – The Proposal

Part A provides the background to the proposal and introduces options in a strategic context. It also includes a discussion on the need for the proposal, incorporating project alternatives and a general description of the preferred option.

Part B – Planning Framework, Issues Identification and Socio-Economic Considerations.

Part B provides an overview of potential planning and approval requirements as well as possible issues requiring consideration in the EIA including socioeconomic factors.

Part C – Options and Environmental Issues

Part C discusses the likely options, construction and operation issues, potential environmental impacts and mitigation measures that may be available to minimise adverse environmental impacts and maximise benefits to the community.

Part D – Project Justification

Part D outlines approximate costs and provides justification for the various effluent reuse options in the context of ecologically sustainable development.

Part A The Proposal

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2 PROJECT NEED AND ALTERNATIVES

2.1 EXISTING SYSTEMS

2.1.1 *Water*

The raw water supply for Bathurst is currently provided by pumping from a weir on the Macquarie River near Waterworks Lane. This weir captures water released from Ben Chifley Dam. Raw water is pumped to the water treatment plant located near Waterworks Lane and treated water is then pumped to 15 storage tanks at elevated sites around the city to service the potable water distribution network. Some of the raw water is pumped to separate raw water storage tanks to provide irrigation water for a number of users, including the Golf Course, Bathurst Agricultural Station and several schools and sports facilities.

2.1.2 Sewerage

Approximately 98% of Bathurst is sewered by gravity to 14 sewage pumping stations, which pump to the existing Sewage Treatment Plant (STP). The existing plant treats sewage to tertiary standard and discharges between 7 and 11 ML/day of treated effluent directly into the Macquarie River. The variability of discharge volumes reflects the changes in non-permanent population (up to 35% of the total population). No seasonal trends are apparent.

The STP is located on a floodplain. It is protected by a levee constructed to RL650.4, which is approximately equivalent to the 1 in 100 year Average Recurrence Interval (ARI) flood level. Some of the pumps are also affected by lesser floods.

Design Flows

The design average dry weather flow (ADWF) for the existing STP is 10.7ML/d based on the peak load in 2005. The flow does not vary significantly between the winter ADWF and the summer ADWF. The population of Bathurst is expected to increase by 1% per annum in the medium term, however, the STP has capacity (with minor modifications) to treat additional flows.

A summary of current flows is given in *Table 2.1*. A detailed analysis of future flow rates, taking into account irrigator's needs for a reliable supply of reclaimed water, will be needed at a later date to confirm optimum irrigation area/storage size relationships.

Annual and Peak Flows	Flow ML/d		
Average Dry Weather Flow (ADWF) for 2005	10.7		
	(0.011L/s per ET)		
Peak Dry Weather Flow (PDWF)	ADWF x r		
	(approximately 1.4 x ADWF)		
Average Wet Weather Flow (AWWF)	1.1 x ADWF		
Peak Wet Weather Flow (PWWF)	PDWF + SA		
$r = \sqrt{(1.74+56/T^{0.4})}$ for T>30 (where T = No. tenements ultimately to be connected)			

The plant has been designed to receive and treat all flows from 900 to 1,000 L/s (78 to 86 ML/d).

History and Description of Sewage Treatment Plant

In the early years of settlement the people of Bathurst installed cesspits at individual dwellings to collect and store human wastes. The first organised disposal system consisted of the cesspits being emptied at night, and the waste being carted to a disposal area where it was buried. The cesspit system was unsanitary and contributed to the spread of diseases such as typhoid. Leakage from the pits could easily enter subsurface water, and since the town's water supply system comprised mainly wells and bores, this contaminated the drinking water. Cesspits were therefore gradually replaced by "earth closets" and fully sealed pans. These were emptied more frequently than the cesspits, and "night carts" became a regular feature of life in the town. In recent years, with increasing awareness of sewage system effects on the environment, technology has advanced with the introduction of reticulated pipework systems collecting sewage from both domestic and industrial sources, transfer of collected sewerage to a central treatment facility, and state of the art treatment technology to ensure that discharges to streams and disposal of by-product wastes do not threaten the environment.

Surveys for the first sewerage system began in 1910, and the treatment plant was completed in 1915. The original treatment plant consisted of huge underground septic tanks. Liquid overflow (effluent) passed through rubble filters and into the Macquarie River. Between 1928 and 1930 the septic tank plant was converted to a more complex system, which used the existing tanks in combination with a "trickling filter" and some experimental process units known as "Imhoff tanks". These additions ensured that the sewerage was more thoroughly treated. The updated plant also included facilities for drying the solid waste (sludge) and for chlorinating the effluent before discharge to the river. In 1965, a major upgrading of the sewerage system was completed. It included the construction of a conventional "trickling filter" treatment plant, and abandonment of the old septic tank plant completely. The first experimental intermittently decanted extended aeration (IDEA) tank was built in 1976, with a further four being added in 1982. At that time a new inlet works, sludge lagoons and effluent ponds were also constructed. Further experiments were carried out between 1990 and 1993 to further develop IDEA technology to biologically remove phosphorus. In 1998 two 17,500 IDEA Bio-P tanks were completed and successfully commissioned. This was a significant technological milestone as the new treatment plant produces effluent well within EPA standards. Alum dosing was commenced in 2002 to further reduce nutrient loads and improve the final effluent quality.

The Intermittently Decanted System Extended Aeration (IDEA) System (The '*Bathurst*' *Box)*

During the 1970's the Public Works Department was experimenting with an "intermittently decanted extended aeration" process. Bathurst City Council agreed to participate in the experiment and the prototype of a 4,000 person treatment unit was built at the sewerage treatment plant. The process became known as the "Bathurst Box". The advantage of the intermittent aeration process is that sewerage which has simply been screened for rags and had grit removed, can be biologically stabilised and the solids settled in a single tank. There is no need for separate settling tanks. Periodic aeration of the sewage encourages the growth of bacteria which break down the organic material to produce water, new cells and inoffensive by-products such as water carbon dioxide and nitrate salts. The aeration is stopped regularly, and the sludge and micro organisms settle so that when a trough is lowered into the tank contents, it "decants" clear, treated liquid. One added advantage of stopping the aeration is that it promotes certain bacteria which convert nitrates into nitrogen gas, so that the nutrient nitrogen is largely removed from the sewage. The sludge is pumped out periodically to retain the ideal proportions of raw sewage and active bacteria. Effluent from the tanks is disinfected in shallow ponds. Four extra units were built in 1982. These units incorporated "diffused aeration" systems in lieu of surface aeration units, which forced air through tiny holes in pipes laid on the bottom of the tanks. The process removes 90% or more of the solids and organic matter from the raw sewerage. It also reduces the content of undesirable nutrients, including nitrogen and phosphorus, which encourage the growth of algae in the water downstream of the discharge point.

IDEA with Biological Phosphorus Removal ("BIO-P")

Testing the liquid discharge from the existing aeration tanks has shown that, under the right conditions, bacteria which can take up large amounts of phosphorus can be encouraged to grow in the treatment unit. A pilot plant run at Bathurst from 1990 to 1993 proved that by cultivating these bacteria, very low levels of phosphorus can be achieved in the effluent. To prove the theory and develop the technology, the original "Bathurst Box" was converted into a full-scale trial plant. A number of extra chambers constructed in front of the existing tank allow oxygen in the sewerage to be severely reduced. Mixing fresh water sewage with recycled fluid from the aeration tank in this environment encourages the presence of phosphorus-hungry bacteria. The sewerage is than passed through the aerated zone, where bacteria multiply in the presence of oxygen, using large amounts of phosphorus. The normal nitrogen conversion processes also take place and the sludge when settled and removed is rich in phosphorus. Large proportions of both nutrients are removed by natural processes from liquid effluent, without the use of costly chemicals. The speeds and operating times of the electrical motors driving the aerators, pumps and decant trough are adjustable, which allows fine tuning of the process to achieve optimum performance. An additional sedimentation tank was built as part of the trial plant. This allows raw sewage to be stored and partially fermented to reduce the oxygen content of the sewage before it is discharged to the inlet chambers. This assists the start of the Bio-P removal process. As a result of increased nutrient removal larger quantities of sludge are required to be removed. To facilitate handling and removal, a sludge dewatering belt press was constructed to reduce wet sludge to a 'cake' which contains approximately 11% solids. This cake is then transported off site for disposal. The trial plant is world first. Its great advantage is that it does not need separate settling tanks, as required by other Bio-P processes developed elsewhere. Additionally, existing intermittent extended aeration units, which are common throughout NSW, can be simply converted at a low cost. Following successful completion of the trial plant, two 17,500 EP IDEA Bio-P tanks were constructed and commissioned in 1998, complete with upgraded inlet works, new effluent ponds and a UV plant for disinfection of effluent prior to discharge to the Macquarie River.

Inlet Works

Sewage contains varying quantities of floating and suspended solids, some of considerable size. Materials such as rags, pieces of wood, metal, plastic, or rubble enter sewers and eventually reach the treatment plant. These need to be removed as their presence interferes with subsequent treatment processes and mechanical equipment. In 1998, following commissioning of the two 17,500 EP IDEA Bio-P tanks, upgrading works were carried out with the replacement of the inlet works screens to further improve the performance of the treatment plant. Two new "step screens" were installed complete with screening, washing and dewatering facilities including bagging unit for simple and efficient disposal. In 2001 a new grit removal system was installed to remove and wash fine particles, sand and grit. This also assists in improving the efficiency of the remainder of the treatment process.

Sludge Handling Facilities

The problem of disposing of sludge produced by the plant increases as the size of the town increases. The old-sand filled drying beds allow water from the sludge to drain away so that the dried sludge can be scraped off the surface. When they became inadequate, they were supplemented by sludge lagoons, which store the sludge while it settles and thickens. The lagoons are drained one at a time to dry and allow removal of sludge. With the increased sludge loading on the plant the sludge lagoons became incapable of handling the demands required. In 1993 an alternative sludge handling plant was installed comprising of a sludge dewatering belt press. The belt enables wet

sludge to be reduced to a 'cake' which contains approximately 11% solids which can be loaded onto a truck and disposed off site. With increasing volumes of sludge produced from the IDEA Bio-P process, further works were carried out to improve the efficiency and capacity of the sludge handling facilities. These works included:

- Dissolved Air Flotation (DAF) unit
- Conversion of the Water Activated Sludge (WAS) tank to a sludge thickening tank which will store thickened sludge from the DAF unit.
- Installation of an additional belt filter press.
- Construction of a conveyor and sludge storage hopper for efficient loading and disposal from the plant.

Outlet Works Ultraviolet Disinfection as an Alternative to Chlorination

To comply with good environmental practices and EPA requirements, sewage effluent is required to be disinfected to kill disease-causing micro organisms that the effluent may contain. The method commonly adopted for disinfection of sewage effluent is injection of chlorine to kill bacteria. As an alternative to chlorination, Ultraviolet irradiation is effective in killing all types of bacteria and viruses. The advantages of UV disinfection include ready automation, no dangerous chemical handling, short retention time, low maintenance and no ill effect from overdoses. As part of the construction works associated with the two 17,500 EP IDEA Bio-P tanks, a fully automated UV plant was constructed to disinfect all sewage effluent prior to discharge to the Macquarie River. In 1997, CRC for Waste Management and Pollution Control (WMPC) Ltd approved a research and development project proposed by the Department of Public Works and Services (DPWSA), Advanced Waste Management Centre (AWMC) of the University of Queensland, DLWC and the CSIRO. The objective of the project is to develop and demonstrate a cost-effective Biological Nutrient Removal (BNR) retrofitting for intermittent decanted extended aeration (IDEA) plants. Given Bathurst Council's background and experience in trialling IDEA systems with Bio-P removal, the Bathurst Wastewater Treatment Works was chosen as an ideal site for full scale demonstrations. The project is being conducted in two phases, with the first phase comprising intensive sampling and testing to collect background data required for comparing plant performance before and after plant retrofitting. Results of the intensive testing showed exceptionally low total phosphorus levels in the effluent ranging from 0.14 and 0.22 mg per litre. The second phase is to demonstrate the technology over an extended period and to further optimise the design and operation of the process. Participating Organisations are:

- Department of Public Works and Services DPWS (Project Leader)
- University of Queensland AWMC
- Department of Land & Water Conservation DLWC
- CSIRO

Council has constructed an effluent reuse scheme to save using potable (town) water and also save money. The scheme utilises treated effluent, which is pumped through a 10-micron automatic backwash filter then through Ultra Violet disinfection. The effluent is then chlorinated and stored for use as wash down and irrigation water around the site. The systems performance is checked daily for optimum performance.

An additional side stream is further treated through a series of three filters; namely a 30, 5 and 0.5 micron filter with additional UV sterilisation as well. The 5 micron filter is an activated carbon filter, which removes any organics, which may be present. The treated water is expected to meet the Australian Drinking Water Quality Guidelines. Management of treatment plant bio-solid by-product biosolids generated at the Wastewater Treatment Works are currently being transported to "Willow Vale" at Evans Plains. The owners of this property beneficially reuse this product on the property, improving soil structure, moisture holding capacity, crop yields and crop quality. It has also been successfully used to rehabilitate eroded areas. The biosolids have greatly improved the soil structure, increased the level of organics in the soil, improved crop yields and provided a return to the environment.

Raw sewage enters the plant via 1 existing rising main connected to a single influent pipe. The inlet works comprise 2 automatic (5 mm) step screens. The screens are equipped with a screw conveyor, washing system and press zone to dewater and transfer the screenings to a sealed continuous bagging unit.

Each step screen is isolated for maintenance purposes using stainless steel penstocks. When the step screen is isolated, the flow will build up behind the upstream penstock until it overflows and passes into the inlet works pump station. The sewage will then flow to a vortex grit trap before discharging to the flow splitter box. The grit trap system is fully enclosed and comprises a grit separator, shaftless screen grit classifier and continuous bag filling system for disposal to collection bins.

The inlet works, including the inlet channel, screens and grit removal facilities is covered and an odour control system extracts and treats foul air from this area of the plant.

Power

The existing power supply to the STP may require an upgrade if sewage inflows increase significantly in future. The STP is currently supplied by 11kV overhead power lines leading to a pole mounted 1,000 kVA transformer on the western side of the site.

Biological Issues

A Sequencing Batch Reactor (SBR) system provides biological nutrient removal. The SBR is a single tank configuration divided into four compartments comprising three cells located at the front and a large aeration tank. There are four operating IDEA tanks located at the STP. Each tank is fitted with a stainless steel decanter for effluent withdrawal. EATs 1, 6 &7 are fitted with surface aerators and EATs 2, 3, 4 & 5 are fitted with fine bubble diffused aeration systems supported by aeration blowers. All tanks have associated pipework, returned activated sludge (RAS) and waste activated sludge (WAS) pumps for activated sludge return and waste respectively. EAT 1 is also fitted with a prefermentor.

From the inlet works, the screened and degritted sewage is pumped to a divider tower where the flow is distributed to the four tanks in operation. The amount of flow to each tank can be adjusted by moving the stainless steel dividers in the top of the tower. The SBR basins are designed as an intermittent aerobic and anoxic reactor so as to maintain simultaneous nitrification and denitrification (SND) to achieve a total nitrogen concentration of less than 10 mg/L. There is a three-cell bioselector at the front of the tank to provide suitable biological conditions in the system to optimise Biological Nutrient Removal (BNR). A mixer is located in each of the three cells.

The SBR process is designed to operate at a mixed liquor suspended solids (MLSS) concentration of 3,000 - 5,000 mg/L. Minimum design sludge age is 20 days.

Chemical Addition

Alum dosing for the reduction of phosphorus achieves appropriate nutrient removal. The design allows for multi-point dosing with points located at the flow splitter and in the decanters of Tanks 6 & 7.

Alkalinity buffering is not required under normal operating conditions. However, at high alum dose rates, for example as a result of loss of biological phosphorus removal activity, supplementary alkalinity buffering will be required. There are currently no caustic systems in place at the STP. The alum dosing system has a maximum storage capacity of 50,000 L and is contained within a bunded area, with emergency shower and drainage included in the design. An additional 4,000 L capacity tank will soon be installed.

Effluent Equalisation and Disinfection

Effluent is decanted from the IDEA tanks into two 50ML catch ponds to enable balancing of intermittently decanted effluent, and reduction of the required sizing of downstream processes and pipework. Effluent is pumped from the catch ponds to the UV disinfection facility.

The disinfection of effluent takes place within an enclosed UV system to achieve faecal coliform levels of less than 200 cfu/100mL. Disinfected effluent flows by gravity to the Macquarie River. In future some or all of the treated effluent may be pumped to proposed reclaimed water storages. From there, the reclaimed water may be used for irrigation or other non-potable uses. Excess treated effluent will continue to be released to the Macquarie River as necessary.

Sludge Disposal

The quality of sludge produced has been classified as Restricted Use 2 under the NSW EPA Biosolids Classification framework (1997). This means that the minimum quality grades of the sludge (biosolids) is Contaminant grade C and Stabilisation grade B. The permissible land application options for sludge of this quality is agricultural, forestry, soil and site rehabilitation, landfill disposal and surface land disposal within the boundaries of a STP site.

The sludge produced at the STP is currently being transported to an agricultural property at Evans Plains and it is expected that this will continue into the foreseeable future. Transportation is by BRC staff. Additional sludge is likely to be produced when reclaimed water storages are periodically cleaned.

Effluent Quality

The typical quality of treated effluent and the quality requirements specified in DEC, ANZECC and ARMCANZ guidelines is presented in *Table 2.2*.

Table 2.2 shows that the treated effluent meets requirements for use in general agriculture and on recreational areas. It is preferred that public access be excluded during and immediately after irrigation and/or that irrigation of publicly accessible places be done at night. The data also suggest that the water may meet requirements for irrigation of public open spaces and for fresh vegetable production. If reclaimed water is to be used for future multihousing developments, it would need to be of a higher quality which could require a substantial upgrade of current treatment processes.

Table 2.2Typical Quality of Treated Effluent at Bathurst STP

Parameter	Unit	Discharge ¹	Current	DEC D	ischarge	Irrigation
			licence	Stan	dards	Waters ²
			(90 th %ile)	General	Sensitive	
				Waters	Waters	
pН		7.4-8.8	6.5-8.5	6.5 - 8.5	6.5 - 8.5	6-8.5
BOD ₅	mg/L	<20	20	15	10	
Suspended solids	mg/L	<25	25	20	15	
N as ammonia	mg/L	-	-	5	1.0 - 2.0	
N as nitrate	mg/L	-	-			
Total Nitrogen	mg/L	1.7-7	15	15	10	25-125 ³
Total Phosphorus	mg/L	0.35-1.6	1	1.0	0.3 - 0.5	$0.8 - 12^3$
Total oil and grease	mg/L	<10	10	10	2.0	
Faecal coliforms	cfu/100mL	Generally 1-97		<1504		<1000
		(<200)				

¹ Source: Bathurst Regional Council

² Source: ANZECC and ARMCANZ (2000)

³ Short term (up to 20 years) trigger value guidelines. Require specific site assessment.

⁴ ANZECC 2000 Guideline for primary contact activities (<1000 cfu/100mL for secondary contact)

Effluent quality generally meets all relevant standards and is considered suitable for discharge to the Macquarie River. Some upgrades to the STP and its treatment processes may be required in the near future to reduce suspended solids – especially in summer when algal blooms can occur. Chlorine dosing can be introduced at the balance storage(s) wherever irrigation is proposed in locations where public access is not restricted.

2.2 Issues and Deficiencies

Occasionally, during high water demand periods combined with dry weather, negligible flows occur in the Macquarie River between the weir and the STP discharge point and flow in the river below this point is 100% treated effluent. This is considered to be undesirable both from an environmental perspective and from a social perception perspective.

Discharge of treated effluent to the Macquarie River compensates for the reduction in natural river flows that result from irrigation and potable water demands. Reducing this discharge may require additional releases from Ben Chifley Dam for environmental flows; however, it is expected that the reduction in raw water demand will exceed these additional releases. This potential requirement will be assessed in the EIA phase. There are environmental benefits that result from more "natural" flows being reinstated to the river and, provided these releases do not exceed the reduction in raw water demand that results from effluent reuse, there are potential advantages to the community in terms of cost and security of supply.

The cost of raw water is high compared to other cities in Australia (approximately \$0.65/kL) and losses between Ben Chifley Dam and the weir may be as high as 30% based on similar situations in NSW. A separate study may be undertaken on the feasibility of constructing a raw water pipeline directly from the Dam to the water treatment plant. This study will need to consider potential changes to raw water demand that may result from the use of reclaimed water instead of raw water for irrigation and other purposes. It is desirable to reduce raw water demand from both an economic and an environmental standpoint, provided dam releases are used to maintain environmental flows in the river.

The current costs to farmers and to the environment of pumping water from the river for irrigation are considerable. Provided reclaimed water can be provided to users at or below these current costs most irrigators are expected to support such a scheme. The greater reliability of supply is also a very significant advantage.

If a sufficient amount of treated effluent is reused, there are likely to be opportunities to reduce or withhold chemical phosphorus removal treatment, especially during the peak irrigation season. Stripping of phosphorous from treated effluent is an expensive process so reducing this treatment would result in cost savings at the STP.

Most irrigators currently use fertilisers which add to river nutrient loads via runoff, seepage and spray drift. Also, stripping of phosphorous from treated effluent adds salts and other chemical residues to the receiving waters. It would be desirable from an environmental perspective to reduce or even eliminate both problems by using reclaimed water treated to a standard where nutrient levels are suitable for irrigation. Economic advantages would also result from the reduced cost of fertilisers on each property irrigated by reclaimed water.

2.3 PROJECT OPTIONS AND ALTERNATIVES

2.3.1 Irrigation Options

A number of options are available for reusing treated effluent (reclaimed water) including:

- irrigation of private agricultural properties that currently use the raw water supply, licensed river extractions and groundwater bores;
- irrigation of private properties that do not currently irrigate;
- irrigation of the golf course, racecourse, playing fields and other facilities managed by educational and research institutions;

- irrigation of Council managed grounds, playing fields and gardens;
- supply of reclaimed water for non-potable water systems mandated in future residential developments, most likely to be centred between the Tyers Park area and Kelso; and
- supply of reclaimed water to existing residential areas retrofitted with nonpotable distribution networks.

A prioritisation for selection of areas to receive the reclaimed water cannot be determined at this stage.

Typical relationships between percentage reuse, irrigation area and storage capacity required for a total annual flow of 3,000 ML/yr are summarised in *Table 2.3*. These values are indicative only and cannot be directly applied to the Bathurst region. Extensive investigation will be required as part of the EIA process to determine more accurate values.

Area Irrigated (ha)	Discharge to River (ML/yr)	Irrigation Use (ML/yr)	Reuse (%)	Storage Required (ML)
70	2735	265	8.8	2
	2700	300	10.0	10
	2685	315	10.5	15
	2665	335	11.1	25
	2650	350	11.6	50
300	2400	600	20	10
	1800	1200	40	20
	1700	1300	43	100
	1650	1350	45	150
	1610	1390	46	250
900	1800	1200	30	20
	1380	1620	54	100
	1200	1800	60	150
	900	2100	70	250
	300	2700	90	600

Table 2.3Typical Irrigation-Storage-Reuse Relationship

2.3.2 Project Options

The four zones identified in *Section 1.3* include properties and sites that fall into most of the irrigation categories listed above. The project options represent the progressive introduction of each of the four zones to the effluent reuse scheme. These can be compared against the "Do Nothing" option on the basis of quantity of effluent reused and the marginal benefit of each ML of effluent reused. These options are summarised in *Table 2.4*.

PARAMETER	OPTION 1	OPTION 2	OPTION 3	OPTION 4
	Zone 1 Only	Zones 1 and 2	Zones 1, 2 and 3	All Zones
Irrigable Land (ha)	70	300	600	900
Storage Proposed (ML)	10	150	360	600
Approximate Reuse (%)	11	45	70	90
Average Flow (L/s)	9	39	78	116
Length of Pipeline (km)	8.3	15.8	25.8	65.8

An alternate way of considering the effluent reuse options is as follows:

- Zero reuse whereby the current regime of direct discharge to the Macquarie River is maintained (the "do nothing" option).
- Partial reuse whereby a small to moderate proportion of effluent is reused for irrigation and excess water is discharged into the Macquarie River (Options 1, 2 and 3). This approach requires smaller storage and irrigation areas than a maximum reuse scheme. It is estimated that on average, up to 1,500ML/annum could be reclaimed without provision of substantial storage. If approach is adopted, most of the daily effluent production would be reclaimed during the warm summer months, and most direct discharges to the Macquarie River would be in the cold winter months and/or during prolonged wet periods. If the land area under irrigation is greater than 300ha, the provision of more substantial storage would be needed, to increase the level of reuse and consequently reduce discharges.
- Full or 'Maximum' reuse (Option 4) this option corresponds to criteria set by the NSW DEC and is defined as a 50 percentile overflow case, i.e. an overflow of treated effluent from storage once every second year on average. This means that on average, in every second year 92% of effluent is used for irrigation and 8% is discharged and in every other year there is 100% reuse. A large total storage volume will be required for this option to store reclaimed water during non-growing or low demand periods.

2.3.3 *Pipeline Options*

Pipelines can be constructed above or below ground and can be constructed within a number of corridors and alignments. As a simplification based on reasonable expectations it has been assumed that most pipelines will be below ground, installed using continuous trenching techniques and will be located within existing road reserves wherever practical.

Taking into account estimates of reasonable peak demand, it is proposed that four basic pipe sizes be considered in the scheme:

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- A 200mm diameter pipe will be needed to cater for high flow between the STP and the main Tyers Park balance storage in Tyers Park.
- 150mm diameter pipe will be required for Zone 2, Zone 3 and the first half of Zone 4.
- A 100mm diameter pipe will be required to service Zone 1 and the second half of Zone 4.
- 75mm diameter pipe and meter will be sufficient for most offtakes.

Choice of pipe material is yet to be finalised but is expected to be HDPE.

2.3.4 *Pumping Options*

A variety of pump configurations and pump types will be required for the scheme, dependent on which reuse option is implemented and the timing of when each zone is included. A reclaimed water pumping station will be needed at the STP for all options. A second pumping station will be required at the Tyers Park balance storage for Options 2, 3 and 4. Each pumping station is expected to consist of up to four pumps installed progressively as additional zones are added to the system. The proposed pump requirements for each option are as follows:

Option 1:

A Pumping Station would be constructed at the STP with one "Type 1" pump (9L/s at up to 160m head capacity). A pump should not be required at the balance storage as its elevation is sufficient to supply the system by gravity. The existing STP power supply is assumed to be capable of supplying power to this pump. The pumping station would be constructed with sufficient space to install additional pumps for future development of other options. The control panel would also have capacity for expansion.

Option 2:

Two additional, "Type 2" pumps (40L/s at 10m head capacity) would be installed in the STP Pumping Station to pump reclaimed water to the Tyers Park balance storage. It is likely an additional transformer will be required to supply power to this pumping station. A Pumping Station would be constructed at the Tyers Park balance storage, including controls, new power supply and pipework and valves for expansion for future options. One "Type 3" pump (30L/s at 20m head) would be installed to supply reclaimed water to Zone 2 only. The pumping station would be constructed with sufficient space to install additional pumps for future development of other options. The control panel would also have capacity for expansion.

Option 3:

A third "Type 2" pump would be installed at the STP pumping station as a standby pump for Option 3 and to satisfy design flows for Option 4 should it be adopted. One "Type 4" pump (40L/s at 20m head) would be installed with additional pipework, control panel modifications and valves at the Tyers Park Pumping Station to supply reclaimed water to Zone 3 only. Another "Type 4" pump would be installed at the storage facility in Zone 3, along with required controls and power supply.

Option 4:

Two "Type 5" pumps (20L/s at up to 100m head) would be installed at the Tyers Park Pumping Station to supply reclaimed water to Zone 4. Because of the potential length of the Zone 4 pipeline, two additional "Type 4" pumps with controls and electricity supplies will also be required at the intermediate balance storage and 'end-of-line' balance storage.

Multiple pumps at pumping stations will reduce the risk of adverse impacts resulting from pump failure. It may also be desirable to provide backup generators to minimise potential impacts from extended power failures.

2.3.5 Storage Options

The proposed storage options for each reuse option are as follows:

Option 1:

A 10ML storage facility would be constructed in Zone 1. This can be a new tank; however, it is proposed to convert the disused quarry adjacent to the existing water storage reservoir on Boundary Road. This is likely to require concrete lining. This option provides an additional social and environmental benefit by adaptive reuse of a disused facility and offsets potential cost required to remediate the quarry.

Option 2:

A storage facility of 140ML capacity will be constructed in Zone 2. The preferred site is in the centre of the Tyers Park Racecourse. This storage would form a pond approximately 190m x 190m x 4m deep. Additional storage can also be constructed on adjacent irrigation properties to reduce the size of the main storage.

Option 3:

The storage facility in Zone 2 would be expanded to a capacity of 290ML with dimensions of approximately 400m x 190m x 4m deep. An additional balance storage with 60ML capacity would also be constructed in Zone 3.

Option 4:

A storage facility of 120ML capacity would be constructed at the southern limit of the pipeline in Zone 4. An intermediate storage facility of 120ML capacity would also be required, located at approximately the half way point along the Zone 4 pipeline.

2.3.6 *Power Supply Options*

If significant quantities of recycled water are to be pumped to irrigation areas, new power supply will be required to service the new pumping stations as well as booster pumps and pumps at other balance storages. The proposed arrangement for new electrical works is to install pole-mounted transformers as close as possible to the new pumps. Underground cables would be used to connect the transformers to the pumps.

2.4 OVERVIEW OF OPERATIONS

The proposed arrangement for supplying reclaimed water to any combination of the four zones will comprise:

- one or two new pumping stations capable of meeting peak irrigation demands to each of the four zones (depending on preferred option and staging);
- a main pipeline in each zone with offtakes to boundaries of each property to be irrigated;
- at least one large system balance storage; and
- individual storages and irrigation systems on each property (provided by property owners.

BRC can supply an agreed quantity of reclaimed water of agreed and acceptable quality to the boundary of any potential user. A key to the attractiveness of the scheme to most potential users will be the reliability of supply. The responsibility for on-site storage, distribution and irrigation or other uses will be with the property owners. There will be conditions placed on the use of reclaimed water such as health and safety requirements and methods of irrigation (maintaining soil moisture deficit etc.), to prevent reclaimed water leaving the property, impacting on receiving waters or creating any hazard to public health. Mechanisms for water 'sharing' must be put in place where there is more than one user for a reclaimed water irrigation scheme. Reclaimed water quality will be continually monitored at the STP and at balance storages. Water quality and soil conditions will also be periodically tested at individual properties and areas of use.

For Zone 1 where irrigation of sports fields, parks and gardens may occur and public access is unrestricted a requirement of <10 cfu/100mL may apply. This can be achieved by additional UV treatment and/or chlorination either at the STP or at the balance storage. This requirement will not apply to agricultural properties in Zones 2, 3 & 4 but some restrictions on wind drift of spray irrigation will be imposed in the supply agreements.

The proposed reclaimed water supply system for each zone is shown in *Figures Figure 2.1*, Figure 2.2 and *Figure 2.3*.






2.5 WATER SHARING ARRANGEMENTS – ISSUES AND OPTIONS

2.5.1 Issues

Provider Issues

- 1. The aim for the reclaimed water provider is to maximise water use.
- 2. The commercial driver for the provider is to save/reduce load based licensing costs (Approx. \$50,000 pa) and sewage treatment processes associated with discharges to waters. (Current DEC guidelines suggest that these potential savings are maximised if the provider can demonstrate that the scheme meets the requirement for 100% reuse in 50% of years).
- 3. The user demand for water will vary annually and seasonally and is unlikely to ever equal any 'average' or 'median' demand.
- 4. A reclaimed water scheme cannot be designed to meet peak demand, but rather, a certain level of demand on any one day.
- 5. Water balance investigations, incorporating available supply (based on estimates of population, wastewater production etc), must be undertaken to determine the amount of land area and storage required to achieve a supply rate that meets a certain identified level of demand.
- 6. System design must ensure that available water is divided in an equitable manner; to cope with variability in available supply e.g. homeowner adoption of water saving strategies could significantly reduce water production.
- 7. If the water supply is increasing over time, a mechanism must be available to ensure extra land and/or storage is provided to minimise discharges and associated costs.
- 8. The scheme must be cost effective to operate.

User Issues

- 1. The supply of water must be sufficiently reliable to warrant user expenditure on irrigation equipment, balance pond, pumps etc associated with the scheme.
- 2. The user must to be assured that when there is insufficient water to meet demand, the resource is being shared equitably between users
- 3. The user must be able to understand and be in agreement with how their allocation is determined.

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Water Sharing - A Case Study

The Shoalhaven reclaimed water irrigation scheme (SRWIS) is a successful example of water sharing arrangements in NSW. In this scheme, a median annual volumetric requirement for each user is determined and expressed as a proportion of total annual available reclaimed water. This percentage figure then constitutes their daily allocation entitlement. If the reclaimed water supply rate falls below predictions, the concept of sharing comes into play.

The water distribution system for the SRWIS has been designed to deliver daily an estimated 'reasonable peak demand' quantity of reclaimed water to each property on a 'shared basis'. Over a 24 hour period, a special valve delivers reclaimed water at a prescribed rate to a balancing pond which can hold at least one day's `reasonable peak demand' irrigation needs. If the balance pond is full, a float valve prevents additional water entering the storage. Any water pumped through the distribution pipe but not taken up by the various property balance ponds is returned to the storage.

Each property's balance pond is metered and the meter is read quarterly. A customised computer program enables the provider to generate water usage and how this usage compares with other users on per unit area basis (modified further for crop type) for each user. This enables rapid identification of irrigators who are using too much or too little water. Usage is then discussed with the operator and if he/she consistently fails to meet usage requirements, his/her share can be reduced. The SRWIS scheme is not designed to achieve the EPA standard of 100% reuse in 50% of years.

2.5.2 Reasonable Peak Demand

It is not possible to design a scheme that will always meet plant water requirements without having large discharges to receiving waters and/or storage facilities during periods of low plant water requirements. It is necessary to size any distribution pipe employed in a reclaimed water irrigation scheme to accommodate `reasonable peak demand'. This reflects the fact that it is not feasible to size a pipe for unusual occasions when there is high peak supply and demand. Water balances can be employed to determine a peak demand that meets most situations and the distribution pipe is sized accordingly.

2.5.3 Contractual Agreements

Good contractual agreements are needed to avoid the realisation of tangible and intangible risks associated with reclaimed water and subsequent legal and financial risks. Tangible risks could impact on human, animal and crop health and the environment. A perception of these risks can lead to intangible risks such as unreasonable perceptions by an uninformed community that reclaimed water harms food products and/or the environment. In addition other nations could impose bans on the import of products grown in contact with reclaimed water for real or political reasons.

To reduce associate risks, the contractual agreements should cover issues such as:

- ensuring guidelines are followed;
- identifying alternatives for discharge or storage and further treatment of reclaimed water if it is unsuitable for reuse e.g. due to plant failure;
- ensuring staff and contractors receive appropriate training to understand risks and legal requirements;
- archiving reclaimed water records so that they can be accessed at a later date if necessary;
- providing clear, accurate and comprehensive information to consumers on limitations or restrictions on reclaimed water uses and other relevant issues;
- development, implementation and audit of a quality assurance program that describes procedures for monitoring, reporting, record keeping and auditing reclaimed water activities; and
- development of reclaimed water management protocols which ensure that appropriate contractual arrangements are in place and that the responsibilities of the respective parties are clearly set out.

In the development of the SRWIS, the then Department of Land and Water Conservation invested in substantial technical and legal advice to develop appropriate contractual arrangements with end users. These have been used as a model by Sydney Water, Byron Shire and other NSW Councils and could be applied to the Bathurst scheme. Based on this model, clauses that should be included in contractual agreements for the Bathurst scheme include:

- 1. Cost penalties for early exit. The value of these should be sufficient to avoid 'low commitment' users but not so high that they frighten 'high commitment' users.
- 2. Clauses compelling users to irrigate a certain amount of reclaimed water in any one year (to avoid increased discharges) and penalties for not doing this. Penalties may be financial or involve a reduction or loss of their share.
- 3. Clauses which ensure that the user takes responsibility for using the reclaimed water in an environmentally responsible manner (e.g. avoiding over-irrigation or application of excessive fertiliser in addition to that received in reclaimed water). The penalties outlined in point 2 could be enforced for non-compliance. The individual environmental management plan is the mechanism for achieving this requirement.

2.6 PROJECT TIMING

The proposed works for Option 1 could probably be constructed within 6 to 12 months of completion of environmental studies and approval finalisation. Options 2 and 3 will require at least 12 months to construct, given the additional requirements for pumping and storage.

Assuming funding is secured prior to December 2006 and the environmental assessment and approvals process will require approximately 6 months; construction could commence in mid-2007 and be completed before late-2008.

2.7 CONSIDERATIONS FOR STAGING

The initial stage in implementing an effluent reuse scheme will be the studies required to confirm feasibility, define preferred options and meet statutory planning requirements. Several factors must be considered in determining an appropriate operating scheme for an effluent reuse scheme, including:

- sufficient land availability and wet weather storage,
- reclaimed water quantity and quality,
- environmental and social impacts,
- costs to users (compared to existing costs),
- capital costs of pipelines, pumps and storages,
- operation and maintenance costs,
- funding and economic costs/benefits to the community, and
- suitability of the land to be irrigated without damaging the wider environment.

To firm up any potential irrigation scheme, it is recommended that the proponent:

- 1. Prepares a 'formal expression of interest' to identify all potential users in irrigation zones of interest
- 2. Undertakes water balances on feasible schemes to determine the likely average level of reuse, peak daily demand at potential sites and the need for and size of any wet weather storage.

If the proposed irrigation scheme is still feasible, the next steps will be to undertake an environmental assessment process which will include (from a reuse perspective) obtaining a memorandum of understanding from potential users, soil survey of individual properties to assess land capability and area of suitable land, assessment of the capacity of current and/or proposed irrigation systems and detailed water and nutrient balances.

Where there are multiple users, critical issues need to be addressed including rules for allocating reclaimed water between users, establishing a price structure and addressing the concept of 'tradeable rights'. It is important that all stakeholders are kept informed of progress during any scheme development.

It is recommended that potential users form a reference group which has input into the scheme development and devising of contractual arrangements.

Construction staging will predominantly be a function of funding. It is expected that Zone 1 can be developed as a complete system as the initial stage of construction. Zones 3 to 4 can be developed progressively following construction of the main balance storage in Tyers Park.

Part B

Planning Framework, Issues Identification, and Socio-Economic Considerations

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3 PLANNING AND REGULATORY FRAMEWORK

This chapter outlines the statutory considerations and the environmental determination process that are likely to apply to the proposed reclaimed water system.

Environment Protection and Biodiversity Conservation Act

The *Environment Protection and Biodiversity Conservation Act, 1999 (EPBC Act)* prescribes the Commonwealth's role in environmental assessment, biodiversity conservation and the management of matters of national environmental significance (NES).

Under the *EPBC Act*, any action that has, or is likely to have, a significant impact on a matter of NES may progress only with the approval of the Commonwealth Minister for the Environment. An action is defined as a project, development, undertaking, activity (or series of activities), or alteration to any of these. Matters of NES include:

- World Heritage properties;
- Ramsar wetlands of international importance;
- listed threatened species and communities;
- internationally protected migratory species;
- Commonwealth marine areas; and
- nuclear actions.

It is generally the responsibility of the proponent of a proposed development, to determine whether the proposal, or action, has the potential to impact upon a matter of NES and constitute the need for a referral to the Commonwealth for determination.

At this stage of the assessment, no elements of the proposed development are expected to potentially impact upon matters of NES; however these works must be more closely assessed before this can be confirmed.

3.1 Environmental Planning and Assessment Act

3.1.1 Environmental Impact Assessment Requirements under Part 5 of the EP&A Act

Consideration of Impact on the Environment

The effluent reuse scheme will need to be assessed in accordance with the *Environmental Planning and Assessment Act, 1979 (EP&A Act)* and the *Environmental Planning and Assessment Regulation, 2000.* The *EP&A Act* institutes a system for environmental planning and assessment, including approvals and environmental impact assessment for proposed developments.

The *EP&A Act* contains two parts, which impose the requirements for environmental assessment of developments. Part 4 of the *EP&A Act* provides for the control of 'development', which requires development consent or is prohibited under an environmental planning instrument. Where a project does not require development consent, the environmental impacts must be assessed as an 'activity' under Part 5 of the *EP&A Act*. Part 4 and Part 5 are mutually exclusive in that Part 5 only applies to 'activities'. The term 'activity' as defined in Part 5 is to exclude 'development for which development consent is required' or which is prohibited under Part 4.

The *EP&A Act* also establishes environmental planning instruments including State Environmental Planning Policies (SEPPs), Regional Environmental Plans (REPs) and Local Environmental Plans (LEPs). The proposed works are located within the Bathurst Regional Council boundaries and fall under the provision of the Bathurst Local Environment Plan (LEP). The STP site is zoned Special Uses (5a) under the Bathurst LEP. Sewerage systems can be defined as utility undertakings, which are permissible with development consent within each zone of the Bathurst LEP.

Bathurst LEP adopts Clause 35 and Schedule 1 of the *Environmental Planning and Assessment Model Provisions, 1980 (Model Provisions)* which provides exemptions to certain public utility undertakings from the need for development consent. Clause 2(a) of Schedule 1 exempts public utility development at or below the surface of the ground level from requiring consent.

The effluent reuse systems consist of a network of pipelines and treated effluent storages, located at or below the surface of the ground and do not require consent under Clause 2 (a) of Schedule 1 of the Model Provisions.

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The proposal is likely to be assessed under the provisions of Part 5 of the *EP&A Act.* BRC is responsible for the operation and management of sewerage systems throughout the region and will be the proponent for the proposal. BRC must determine whether the activity is likely to have a significant effect on the environment and therefore require an Environmental Impact Statement under section 112 of the *EP&A Act*.

Initial investigations have identified several environmental issues associated with the proposal, which have the potential for significant impacts and it is likely an EIS will need to be prepared.

BRC as the proponent for the works would be required to consult with the Director General of Planning, NSW for issues to be considered in the preparation of each EIS. Approvals would be required from BRC and the Department of Environment and Conservation.

3.1.2 Requirement to Prepare an SIS

Development applications that require consent from a council or any other statutory authority are required to be assessed in accordance with Section 5A of the *EP&A Act*, as amended by the *Threatened Species Conservation Act*, 1995 (*TSC Act*), and *Fisheries Management Act*, 1995.

The *TSC Act* lists a number of factors to be taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats. Schedules 1 and 2 of the *TSC Act* lists species, populations or ecological communities of native flora and fauna considered to be threatened in New South Wales.

If a development may potentially affect any flora or fauna species, populations or ecological community listed by the *TSC Act*, an Eight-Part Test is required. The Eight-Part Test, referred to in Section 94(2) of the *TSC Act* and Section 5A of the *EP&A Act*, determines whether the proposed works represent a significant impact. If a significant impact is determined, a Species Impact Statement (SIS) and licence is required under the *TSC Act*.

An SIS is not expected to be required for the proposed development but a flora and fauna assessment will need to be undertaken as a part of the EIA process to confirm this expectation.

3.1.3 Regional Planning Instruments

Refer to BRC's Planning Instruments

3.1.4 State Planning Instruments

State Environmental Planning Policy (SEPP) No. 4 – Development Without Consent

SEPP No. 4 – Development Without Consent, permits certain categories of development, which would otherwise require development consent, to be carried out without the need for that consent.

The proposed works are expected to be undertaken without the requirement for development consent from Council and will therefore require assessment under the provisions of Part 5 of the *EP&A Act*.

SEPP No. 33 - Hazardous and Offensive Development

SEPP 33 aims to identify potentially hazardous or offensive developments and in determining whether a development is a hazardous or offensive industry, aims to ensure that any measures proposed to be employed to reduce the impact of the development are taken into account.

A DEC licence for water protection is expected to be required under Section 120 of the *PoEO Act, 1997* as a part of the approval process.

SEPP 44 – Koala Habitat Protection

SEPP 44 aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for koalas to ensure a permanent free-living population over their present range and reverse the current trend of koala population decline.

A flora and fauna survey will need to be undertaken as a part of the EIA process for the proposal but at this stage pipeline routes are not expected to encroach on potential koala habitat.

SEPP 55 - Remediation of Land

SEPP 55 introduced state-wide planning controls for the remediation of contaminated land and states that land must not be developed if it is unsuitable for a proposed use because it is contaminated. If the land is unsuitable, remediation must take place before the land is developed.

It is not known at this stage if potentially contaminated land may be effected by the proposed works.

3.2 OTHER LEGISLATIVE CONSIDERATIONS

National Parks and Wildlife Act, 1974

Under Section 90 of the *National Parks and Wildlife Act,* 1974, consent is required to knowingly destroy, deface or damage or knowingly cause or permit destruction or defacement of or damage to, a relic or Aboriginal Place.

Archaeological investigations will need to be undertaken as a part of the EIA process. It is not possible at this stage to confirm if sites of significance are likely to be encountered. Both the social (Aboriginal) and scientific (Archaeological) significance of the potential pipeline routes may be significant depending on the preferred routes.

Protection of the Environment Operations Act, 1997

The existing sewerage system is licensed by DEC (formerly the Environment Protection Authority) under the *Protection of the Environment Operations Act* (*PoEO Act*) 1997. The proposed works may require modifications to the existing license and as such the proposal would require concurrence from the DEC.

Heritage Act, 1977

The *Heritage Act, 1977* was introduced to conserve the environmental heritage of NSW. Environmental heritage is defined as including buildings, works, relics or places which are of historic, scientific, cultural, social, archaeological, architectural, natural or aesthetic significance to the state.

The *Heritage Act*, 1977 provides for the making of a variety of orders and permits to protect items of environmental heritage, including items classified as 'relics'. The definition of a European relic under the *Heritage Act*, 1977 states that a European relic:

"... means any deposit, object or material evidence:

- (a) which relates to settlement of the area that comprises New South Wales, not being aboriginal settlement; and
- (b) which is 50 or more years old."

If any European relic is disturbed, an excavation permit is required under Section 140 of the *Heritage Act*, 1977. A historic heritage study will be required as a part of the EIA. It is not possible to predict the likelihood of heritage items being encountered but given new works are likely to be within previously disturbed areas the likelihood can be assumed to be low.

Rivers and Foreshore Improvement Act 1948

The *Rivers and Foreshores Improvement (RFI) Act, 1948* regulates construction activities in close proximity to waterways. An excavation permit is generally required from DNR (formerly DIPNR), for any excavation to be carried out on protected land, specifically any land within 40 m of a waterway.

Local councils may be exempt from the need to obtain an excavation permit under Section 22H of the *RFI Act*.

Water Act 1912

Part 8 of the *Water Act 1912* (166C matters for general consideration and 167 Applications for Approval) outlines the approval procedures to the Ministerial Corporation for applications to undertake controlled works which may affect floodplains, wetlands, water flows and flow rates.

An assessment of the impacts of the proposed works to the floodplain as will be required as part of the EIA.

3.3 RECLAIMED WATER MANAGEMENT SYSTEM

The proposed works involve irrigation using reclaimed water. A number of considerations about re-use of treated wastewater will need to be taken into account when determining the proposal. Its reuse is governed by State Legislation; however, Council and end-users may be liable under Common Law and under the Trade Practices Act for use of a wastewater product that causes harm.

The statutory matters that must be included in an EIS of the whole scheme under clauses 229 and 230 of the EP&A Regulations related to reclaimed water irrigation are as follows:

- Australian and New Zealand Environment and Conservation Council (ANZECC) National Water Quality Management Strategy;
- DEC (2004) Environmental Guidelines Use of Effluent By Irrigation;
- National Health and Medical Research Council, Agriculture and Resource Management Council of Australia and New Zealand and Australian and New Zealand Environment and Conservation Council (ANZECC, ARMCANZ, NH&MRC) (2000) Guidelines for Sewerage Systems - Reclaimed Water -National water quality management strategy; and
- DIPNR soil and landscape issues.

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4 ISSUES IDENTIFICATION

This chapter explains the approach which will be required in the EIA to identify and address the environmental issues associated with the proposal. It suggests typical requirements of Government departments and the likely consultation process with local Aboriginal communities and the local community in general.

4.1 GOVERNMENT CONSULTATION

NSW State legislation requirements are implemented by a number of government agencies including the Department of Environment and Conservation (DEC), NSW Health, Department of Infrastructure (DOI), Department of Natural Resources (DNR), and the Department of Energy, Utilities and Sustainability (DEUS). Consultation with Government agencies is expected to involve representatives of these organisations as well as advising organizations such as the Department of Primary Industries (DPI).

A summary of typical requirements of each agency for projects of this nature is presented in *Table 4.1, Table 4.2, Table 4.3, Table 4.4, Table 4.5 and Table 4.6.* Additional requirements can also be expected.

At this stage there appears no statutory impediments to a reclaimed water scheme at Bathurst, provided water supplied meets water quality guidelines for land use types participating in the scheme, and appropriate buffers are provided between irrigation areas and any residence, property boundary, designated drainage area or SEPP 14 wetland.

Strategic

- Existing sewage management practices;
- Objectives of the proposal;
- Population of areas served by the proposal including an analysis of future growth, strategy for serving that growth, and load projections;
- Alternatives to preferred strategy and their evaluation including alternative STP sites and reclaimed water management options;
- Water management strategies implemented or proposed by Council;
- Potential for land use conflicts with adjacent land uses;
- Construction and operation costs and means of funding; and
- Proposal's benefits.

Scheme Operation

- Odour impacts and mitigation measures;
- Biosolids management;
- Management of overflows of treated or partially treated sewage from the STP & system;
- Wet weather treated effluent storage requirements;
- Contingency plans;
- Describe how effluent will be managed when it cannot be used for irrigation.

Planning and other Policies

- Bathurst LEP;
- Healthy Rivers Commission requirements;
- State Environmental Planning Policy No.33 Hazardous and Offensive Development;
- Relevant ANZECC National Water Quality Management Strategy Guidelines;
- DLWC's Soil and Landscape Issues in EIA Technical Publication No.34;
- Environment Protection Authority's *Guidelines for the Utilisation of Treated Effluent by Irrigation;*
- NSW Fisheries Fish Passage Requirements for Waterway Crossing;
- DLWC Environment Guide for Management of Local Government Water Supply, Sewerage, and Drainage Services; and
- State Groundwater Policy.

Construction

- The extent of clearing;
- Trunk and reticulation system construction;
- Methods for crossing rivers and creeks;
- Locations of use and works compounds and storage areas;
- Identification of partial or complete road closures, their duration, and related management methods;
- Identification of the temporary use of public reserves including the area occupied and duration of occupation;
- Soil and water management;
- Measures to control the weed African Lovegrass during construction; and
- A construction program. This should include the specific identification if the duration of activities in residential areas.

Water Quality

- Public health, and environmental impacts on waterways and receiving waters;
- Measures to manage any treated effluent storage dam, eg algal blooms, odours.

Effluent Reuse

- Estimated quantity and quality of treated effluent to be reused;
- Level of demand and evidence of uptake of treated effluent;
- Location for reuse of treated effluent and long term availability of these sites;

Strategic

- Impacts of treated effluent on land uses including impacts on groundwater and soil quality and long term sustainability of such sites;
- Management responsibility; and
- Any health impacts resulting from effluent reuse.

Flora and Fauna

An assessment of impacts to flora and fauna, particularly critical habitats, threatened species, populations, ecological communities, and their habitats listed under the *Threatened Species Conservation Act 1995* and the *Fisheries Management Act 1997*.

General

- Impacts on waterbirds;
- Flooding issues with the STP site and the effluent management system; and
- Indigenous and non-indigenous cultural heritage values affected by the proposal;

Consultation

Consultation will be required with all relevant local, State and Commonwealth government authorities, service providers and community groups. These include:

- Department of Environment and Conservation;
- NSW Health;
- Southern Rivers Catchment Management Authority;
- Department of Primary Industry (formerly NSW Fisheries and NSW Agriculture);
- Department of Lands;
- Relevant local Aboriginal Groups;
- Roads and Traffic Authority; and
- Residents.

General

Details of the Proposal

- Description of proposed development and its components;
- Incorporation of ESD principles;
- Incorporation of cleaner production initiatives;
- All phases of the project cycle construction & operation; and
- Construction timetabling and mitigation measures.

Strategic and Planning Issues

- Relation of proposal to relevant strategic plans where they exist; and
- Management control plan (MCP).

Community

Consultation on communities concerns and preferences.

Sewerage Scheme Operation

- Design capacity of the new system
- Projected quality and quantity of the effluent
- Projected annual mass load of pollutants to be irrigated
- Odour impacts and mitigation measures;
- Biosolids management;
- Management of overflows of treated or partially treated sewage from the STP & system;
- Wet weather treated effluent storage requirements;
- Contingency plans;
- Describe how effluent will be managed when it cannot be used for irrigation.

Modelling and monitoring

- Post construction monitoring and compliance with environmental requirements; and
- Air, noise and water modelling.
- Water budget, incorporating plant evapotranspiration (accounting for type of crop to be grown), rainfall, percolation, runoff and reclaimed water application rates.

Air

Guidelines/requirements

- NSW EPA, 2001a, Draft Policy: Assessment and Management of Odour from Stationary Sources in NSW;
- NSW EPA, 2001b, Technical Notes: Draft Policy: Assessment and Management of Odour from Stationary Sources in NSW; and
- NSW EPA, 2001c, Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in NSW.

Issues to be addressed:

- Relevant meteorological data, mitigation measures, plume dispersion and receptors; and
- Air monitoring programs.

Water

- Sustainability and compliance with the environmental performance objectives of the DEC's *Guideline "The Utilisation of Treated Effluent by Irrigation" (Draft, 1995);*
- Effluent quality as listed *in "Guidelines for Sewerage Systems; Use of Reclaimed Water"* (ARMCANZ, November 2000) or as per advice provided by NSW Health;
- Discharges of partially or fully treated sewage to waters from the sewage treatment system (including sewage treatment plant, pumping stations and reticulation system) and potential impacts on the environment and public health;
- Options to replace high value water used for urban and industrial and other purposes with treated effluent, consistent with Target 17 of the State Water Management Outcomes Plan;
- Consistency with any relevant Statement of Joint Intent (SoJI) established by the Healthy Rivers Commission;
- Achievement or protection of the River Flow Objectives (RFOs) and WQO's;
- Sewage and effluent management should take a triple bottom line approach;
- Options for reuse of treated wastewater;

General

• Discharges are to be designed to achieve the best environmental outcomes.

Effluent Irrigation

- Environmental and public health performance objectives of "The Utilisation of Treated Effluent by Irrigation", (NSW EPA, 1995 (Draft));
- Effluent quality, site selection, minimum land requirements, loading rates (hydraulic, organic and nutrients) and operational/management systems;
- Site drainage and existing surface water management, local catchments and receiving waterways, groundwater and the hydrological catchment and existing potential sources of water pollution;
- Proximity of the irrigation area to the groundwater table, wells, water courses or other surface waters, dwellings, public areas and public roads, as may be applicable
- Effluent characteristics and water and nutrient balance.
- Constraints on the proposed effluent irrigation areas and suitability for irrigation activities of soil depth and types, topography, buffers to waterways, susceptibility to flooding
- Effluent irrigation methodology including proposed application rates, associated resting periods, effluent irrigation management such as cropping and harvesting practices, and system controls including timers, alarms, distribution safeguards, runoff collection provisions and maintenance programs.

Sewerage Treatment Plant

- Changes to existing STP functions and operations;
- Sludge management generated by new reuse system;
- Chemicals or fuels on site and their storage;
- Flooding of the site; and
- Stormwater management controls during construction and operation phases.

Noise

- Compliance with the NSW EPA Industrial Noise Policy;
- Noise from the construction and operation of the facility and equipment;

Compliance with:

- EPA Environmental Noise Management Series: NSW Industrial Noise Policy, January 2000.
- EPA Environmental Noise Management Series: Environmental Criteria for Road Traffic Noise, May 1999.
- Chapter 171 Noise Control Guideline, Construction Site Noise, EPA Environmental Noise Control Manual, 1994.
- Noise emissions from both construction and operation; and
- Identification of all receptors.

Waste

- Characterisation of all wastes in accordance with the EPA environmental guideline, "Assessment, Classification and Management of Non-liquid Wastes;
- Waste tracking and control and compliance with the EPA environmental guideline, "Assessment, Classification and Management of Non-liquid Wastes";
- Environmental impacts associated with waste management;
- Beneficial use of STP residuals on land in accordance with the EPA's Guideline "Use and Disposal of Biosolids Products" (1997); and
- Maximisation of waste reuse and proper storage of wastes.

Flora and Fauna

• Critical habitats, threatened species, populations, ecological communities, and their habitats listed under the *Threatened Species Conservation Act* 1995 and the Fisheries Management Act 1997.

Aboriginal Heritage

• Indigenous and non-indigenous cultural heritage values affected by the proposal.

Siting of STPs on Crown reserves

- Aesthetic, recreational, cultural heritage (indigenous and non-indigenous), and natural heritage values of the reserves;
- Siting of works in consultation with the relevant Trust Board;
- Buffer zones for maintaining public safety, security, vegetative screening, noise reduction, landscaping and fencing;
- Potential impacts on any Endangered Ecological Communities & options for ameliorating or avoiding such impacts; and
- Benefits to the Trust & wider community with regard to each Crown reserve.

Disposal/Re-use of Reclaimed Water (and biosolids) on Crown lands

- Community benefits, utilisation of reclaimed water and/or biosolids for income generating/saving activities, demand for various uses by community groups;
- Arrangements with private landholders for re-use of reclaimed water (and biosolids);
- Disposal of reclaimed water into nearby waterways, and other options for re-use, including recycling for domestic use (eg water for household flushing toilets); and
- Potential environmental and social impacts associated with the release of reclaimed water on Crown lands (reserves and creek beds) including potential impacts on terrestrial and aquatic weed growth, potential algal blooms, human health and safety, and aquatic and terrestrial flora and fauna.

Proposed works on Crown Land.

- Acquisition of Crown lands including easements required for all roading and piping; and adequate buffer zones;
- Licences to apply reclaimed water to Crown lands, including disposal of effluent into creek systems where the bed is Crown land.

Table 4.4 Expected Department of Primary Industries (DPI) DG's Requirements

Water Balance

- Water budgets covering wet and dry conditions and calculations on wet weather storage and land requirements
- Environmental impact on surface and groundwater
- Operational Environmental Management Plan
- Flood analysis

Nutrient Balance

• Fate of nutrients, especially N and P and long-term sustainability of the system.

Soil Capability

• Soil surface and profile, percolation, BD, nutrient levels, sodicity, salinity and cation exchange capacity.

Appropriate land uses

- Principles and practices for sustainable farm management.
- Management practices on the irrigated properties including, vegetation cover or pasture/ crop mix, method of nutrient removal and irrigation rate and volume.

Land Use conflicts

• Potential conflicts between neighbouring properties to the effluent irrigation areas.

Table 4.5Expected NSW Fisheries DG's Requirements

General

- Adjacent aquatic environments and their regional significance;
- Interactions and prediction of impacts of proposal on these aquatic systems;
- Mitigation measures to avoid impacts on aquatic environments;
- Monitoring programs with feedback mechanisms to improve on-going management of aquatic environments;
- Analysis of options;
- Distribution and treatment points and failsafe measures;
- Performance of system in wet and dry conditions; and
- Waterway crossings;

Table 4.6Expected NSW Department of Health's DG's requirements

General

- Methods of sewage treatment and disposal including predicted quality and quantity and fate of biosolids and screenings;
- Land use zoning and potential to impact water sources in catchment;
- Odour impacts and mitigation measures;
- Additional chemical treatments proposed and the potential impact on the quality of the final reclaimed water.
- Design features of the total System to prevent overflows and measures for detecting and alerting DEC and the NSW Department of Health;
- Reclaimed water quality, method of disposal and management practices
- Meteorological data including wind, rainfall, evapotranspiration;
- Geotechnical characteristics of irrigation land;
- Water use from local ground and surface water especially any potential consumption uses;
- Operational Environmental Management Plans including management of storage dams;
- Alternative storage arrangements if system fails; and
- Ability of system to ensure no contamination of potable water;

4.2 COMMUNITY CONSULTATION

No formal community consultation has been undertaken as part of this preliminary assessment. Informal discussions to gauge the potential level of interest have been undertaken with representatives from nine potential user groups (refer *Annex C*). These included the Simplot food processing factory, Bathurst Golf Club, Golden West Race Course at Tyers Park, DPI's Agricultural Research Station, Bathurst TAFE, Greenacres Turf Farm, Mr. McSpedden and potential developers of future residential areas at Blackdown Estate and Sundown Farm. Seven of these groups expressed interest in using the resource to a combined estimated volume in excess of 1,650ML per annum. The Simplot factory and properties that currently irrigate with effluent from this factory are unlikely to be interested in using reclaimed water as their demands are already fully satisfied.

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5 SOCIO-ECONOMIC ASSESSMENT

A detailed social assessment has not been made for this report and economic assessment has been limited to rudimentary costing of capital works and approximate operating costs. This chapter discusses components of the proposed effluent reuse scheme that will require assessment during the EIA process in relation to community impacts.

5.1 INTRODUCTION

The socio-economic impacts assessment will need to:

- assess the social and economic conditions of the site area and its surrounds;
- predict the impact of the scheme;
- describe the benefits of the scheme; and
- address issues raised by the community as part of an on-going community consultation program.

There are several environmental factors relating to the scheme that have the potential to impact on individuals and the wider community, including changes in land use, air quality, potential health issues, and the cost and quality of water.

5.2 EXISTING SOCIOECONOMIC PROFILE

5.2.1 Site Context

The BRC Local Government Area is 3,815 km2.

5.2.2 Population

The estimated resident population of Bathurst is 34,720 (May 2004) and is growing at approximately 1% per annum

5.2.3 Demographic Profile

Refer to The Bathurst Region Statistical Profile, 2005 prepared by BRC.

5.3 CONTRIBUTION TO THE LOCAL COMMUNITY

The project will generate significant expenditure in the Bathurst region, which will greatly benefit the local community. BRC will be looking to use local business where possible. For example, it is anticipated that approximately 75 per cent of workers and contractors will be drawn from the local workforce.

BRC will also be looking to create opportunities for the local community, such as apprenticeships and traineeships both directly and indirectly through local subcontractors. Other benefits to local firms include OHS training and upskilling, IT training, and Operator tickets and training.

BRC will commit to using local labour and suppliers, provided that they are cost effective and meet the Program's requirements. Opportunities will arise for the construction of trunk infrastructure, the supply, installation and maintenance of pumping equipment and the installation of irrigation systems on individual properties. A small number of additional Council staff are expected to be required in the longer term for administration, operation and maintenance of the system.

5.4 POTENTIAL IMPACTS AND BENEFITS

The following sections look at potential impacts and benefits associated with the proposal. They relate to:

- Land use changes;
- Air quality;
- Public health;
- Ecology and Heritage;
- Water quality and reliability of supply;
- User costs; and
- Employment.

Land Use Changes

The availability of reclaimed water for irrigation to any property along the supply pipelines may induce farmers to irrigate parts of their properties that are currently used for grazing or other purposes. While this is likely to have a net positive impact, increasing potential wealth in the community, it will be essential to carefully control irrigation to prevent negative impacts on the environment.

Air Quality

Odour impacts are anticipated to be well below normal criteria and should not cause any discomfort to sensitive receptors, such as residents. The reclaimed water will be treated to a level that is unlikely to create odours. Irrigation methods will be mandated that preclude the emission of particulate matter from the irrigation system. The irrigation areas will not be used by the public or by livestock whilst irrigation is occurring.

Public Health

No public health issues are expected from the ongoing operation of the STP, provided all regulatory requirements continue to be met. The area is fenced and public access to the site is restricted.

Previous health related reports on the STP have not highlighted any significant health effects to either STP employees or surrounding communities and other sensitive receptors.

For the proposed effluent reuse scheme, public health issues cover both human health and animal health risks. Humans are potentially at risk of infection from exposure to pathogens, which can be found within reclaimed water. Reclaimed water can be ingested or absorbed through skin or wounds. Direct ingestion of reclaimed water is most likely to occur if someone mistakenly drinks water from a tap or valve in the irrigation system. This risk will be minimised (for the general public) by:

- a very high level of sewage treatment including UV disinfection;
- secure taps and fittings with prominent warning signage;
- limited public access to irrigation areas during irrigation;
- fencing of all reclaimed water storages; and
- a community education program.

Irrigation/farm workers are the group likely to have the most exposure to reclaimed water-borne pathogens. Handling of irrigation equipment may pose some minor risk of reclaimed water (and any residual pathogens) entering the blood stream via cuts and wounds, however, due to the multiple barrier approach involving membrane filtration and UV disinfection, the risk is considered extremely low. Health and safety procedures will be proscribed to all future users of reclaimed water, and training of workers will be a key element of these procedures.

The main risks to animals (both domestic and wild) are skin infections from grazing recently irrigated pastures. The reclaimed water is expected to have a very low concentration of potential pathogens and will be monitored to ensure that pathogen concentrations do not exceed any current guideline.

Ecology and Heritage

No significant impacts to the ecology of the area are expected as a result of the upgrade of the proposed effluent reuse scheme. Some improvements in environmental flows in the Macquarie River are possible if some of the raw water that is replaced by reclaimed water is released as environmental flows from the dams. This needs to be investigated in more detail during the EIA.

The pipeline routes are expected to be within road reserves or in cleared properties with no significant ecological or heritage impacts. However, should the eventual preferred routes encroach on river flats or on potential aboriginal sites or potential heritage sites, detailed investigations will be required.

Water Quality and Reliability of Supply

Current irrigation practices involve pumping from the river or in a few instances from boreholes. The quality of river water is variable and occasions arise when insufficient river water is available. The use of reclaimed water will provide virtually 100% reliability of supply and uniform water quality. Since the drought conditions which emerged in 2001, there has been increasing interest by potential irrigators in obtaining reclaimed water to combat the unreliability of supply of other types of water.

Depending on whether the opportunity to eliminate nutrient stripping and chlorination from the sewage treatment process is implemented, reclaimed water can contain sufficient nutrients to significantly reduce requirements (and cost) for fertilisers on properties to be irrigated.

User Costs

Current users of raw water pay approximately \$0.65/kL and irrigators that pump from the river or from boreholes attract costs equivalent to \$0.05 to \$0.20/kL depending on the scale of their irrigation systems. It is difficult to make clear recommendations on a 'pricing' strategy as the value of reclaimed water to the Australian community is rapidly changing, however, it is anticipated that a nominal charge (say \$0.10/kL) will be applied to users of reclaimed water. Capital costs of on-site storages, distribution networks and irrigation equipment will be borne by the user.

A 1998 Public Works study found that the value of reclaimed water varied with the economic value of the crop (e.g. more valuable for wine grapes than beef cattle grazing pastures) and also varied with the distribution costs. At that time the value of reclaimed water varied from less than \$0.02/kL (for beef grazing) to over \$1/kL for high value horticultural crops. The inherent 'reliability' of reclaimed water would also have a value, which would be proportional to water scarcity. These factors should be given consideration in development of a pricing strategy.

Up until the late 1980s, charges were not usually imposed upon the end users of reclaimed water, as STP owners were saving money by producing water for irrigation rather than discharge to inland waters, which would need to be of a higher quality. However, there are now documented examples of community willingness to pay for reclaimed water, for instance the SRWIS, Virginia Pipeline scheme in South Australia and the Grampian-Wimmera-Mallee Water scheme in Victoria.

If a user pays system is implemented, it may be possible to incorporate a scheme equivalent to that used for water licenses, whereby temporary or permanent transfers of reclaimed water could occur. However, this may not be feasible if farmers object to individuals profiting from the sale of a right that was initially acquired at no cost or if it could stop the reclaimed water being used for a higher use in the future (such as replacement of a potable water supply). Any tradeable rights scheme would need to take into account the following differences between a reclaimed water scheme and the situation in regulated rivers:

- Supply of reclaimed water for irrigation is expected to be much more reliable than in the regulated river systems, which would render severe water shortages unlikely.
- Only enough irrigators are to join the scheme at any stage to ensure supply can be provided at the agreed level of reliability.
- The supply of reclaimed water is expected to increase with time so it would be possible to obtain an allocation or increase in allocation without transferred it from an existing user.

- It is not expected that there would be a well developed "transfer market" among irrigators in the initial stage of operation.
- Major objectives of the scheme are to maximise beneficial reuse and minimise discharges. These objectives could be compromised if irrigators acquired additional water entitlements to provide a higher level of security of supply.

Employment

Construction works are expected to take 6 to 12 months offering only short term employment benefits. Ongoing operations and maintenance will employ only 2 or 3 additional BRC employees.

5.5 CONCLUSION

The Bathurst STP will cater for the predicted increase in population and has been designed to cope with increased flows for the foreseeable future.

Economically, the reclaimed water reuse scheme will provide opportunities for the local workforce to participate in construction and ongoing operations, as well as providing the associated construction materials where appropriate. There is potential for reduction of sewage treatment costs to BRC and thus to the community and for reduction of irrigator costs of irrigation water supply and fertiliser.

Socially, the reuse of a resource rather than releasing it into the river will be viewed positively. Construction impacts, such as noise and traffic will be short term and operational impacts will be minor. Potential health impacts are expected to be the main focus of public concern. Overall, the socio-economic impacts are considered minor and manageable.

It can be concluded that there are likely to be net benefits for the community resulting from the effluent reuse scheme.

Part C

Environmental Issues

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6 ENVIRONMENTAL ISSUES

6.1 POTENTIAL ENVIRONMENTAL IMPACTS

Potential adverse environmental impacts associated with irrigation with reclaimed water include:

- Soil: risk of adverse physical and/or chemical changes, which could lead to a reduction in fertility and the soil's potential to grow pastures, crops and trees. The principal risk would be from irrigation leading to waterlogging, a rise in water tables and/or soil sodicity salinity increases. Additionally, irrigation may increase the soil erosion risk and pathogens and other contaminants in reclaimed water could render the soil toxic to soil micro-organisms or plant growth.
- **Surface and groundwaters:** water, nutrients, organics and chemicals not immobilised by a healthy plant soil system could leak to surface and groundwater resources.
- **Catchment conditions:** irrigation could generate additional runoff and/or percolation leading to a change in catchment hydrology.
- **Biota:** pathogens and other contaminants in reclaimed water could impact on health of biota and altered water regime could alter the biotic composition to suit the new conditions.

6.2 MITIGATION MEASURES

As fundamental of this study, the suitability of the land to be irrigated without causing environmental degradation will be assessed. Areas deemed to be unsuitable will be avoided, thus minimising the likelihood of adverse environmental impacts. Site selection will incorporate consideration of:

- i. **Topography** slope should be sufficiently minor to avoid risk of excess runoff and erosion (*Annex A*). Presence of drainage lines creates an erosion and seasonal waterlogging risk.
- ii. **Soil depth and type –** determines characteristics relevant to an irrigation regime, including water holding capacity and permeability (Annex *B*).
- iii. **Rock outcrop** surface rock outcrop over 5% interferes with irrigation and cultivation machinery and increases risk of erosion.

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- iv. **Proximity to groundwater, wells, surface water, dwellings, public areas and public roads** – address contamination risk e.g. groundwater should not be above 3m.
- v. **Flood potential –** frequent flooding would limit irrigation opportunities.
- vi. **Geology –** presence of geological discontinuities might permit direct discharge of reclaimed water into groundwater.
- vii. **Buffer zones** buffer zones of at least 20 m are generally recommended where the site is adjacent to public roads; a 50 m zone is required for dwellings and at least 250 m from any natural watercourse, wetland or well used for a domestic water supply.
- viii. **Vegetation** types of crop, pasture or other vegetation and their ultimate use, if applicable, including required nutrient and salinity levels. Groundcover is essential in mitigating erosion risk.

Continual monitoring of reclaimed water quality will take place at the STP and balance storages, incorporating assessment against current standards for the recipient land uses. A contingency plan will come into play should water quality fail to meet these standards and this will ensure water being used for irrigation is of a sufficiently high quality to avoid realisation of environmental risks.

Runoff or waterlogging resulting from irrigation practises will be avoided by ensuring excess reclaimed water application does not occur. This will be achieved by abstaining from irrigating during or immediately after wet weather; soil moisture monitoring; and retention of a small soil water deficit following irrigation to act as a buffer should rainfall occur.

6.3 MONITORING

Reclaimed water quality will be continually monitored at the STP and at balance storages. Water quality and soil conditions will also be periodically tested at individual properties and areas of use

Part D Project Justification

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7 PREFERRED OPTIONS

Some combination of the four zones identified in Section 1.3 must be selected for initial design and costing of a reclaimed water transportation network. Based on the previous sections, it can be concluded that:

Zone 1 is well worth further consideration. More than 330 ML/annum of reclaimed water could be used, replacing the raw water and potable water currently used for irrigation in this area. There are opportunities to store water in the abandoned quarry. The main constraints relate to disruption of residential streets during installation of the pipeline and the head required (approximately 150m) to pump reclaimed water to the balance storage.

Zone 2 is well worth further investigation. It appears that more than 1,200 ML/annum of reclaimed water could be readily used. The reclaimed water would replace existing uses of bore water and potentially river water extractions. Representatives of the Golden West Race Club at Tyers Park have indicated that they would consider proposals to store reclaimed water in the centre of the racecourse. This zone is very close to the STP and to areas that may be subdivided for housing in the future where reclaimed water could also be used. Any irrigation pipeline could easily be extended to agricultural land to the north-west and southeast along the Macquarie River floodplain. The main constraints relate to the need to cross the Macquarie River which may require directional boring.

Zone 3 and the Macquarie River floodplain to the north and west of Tyers Race track is an obvious extension to any irrigation scheme in Zone 2. This scheme would allow reclaimed water to be used in new subdivisions in the Kelso area as well as on numerous agricultural properties on the Macquarie river floodplain. This area has the potential to take most available reclaimed water; it is important that the scheme services an area where demand is significantly higher than the supply.

Development of Zone 4 appears less desirable at this stage as there is likely to be sufficient uptake on the three identified schemes above. Consideration of Cost per % of Effluent Reuse versus Area of Irrigation indicates an optimum area of irrigation would be between 300 and 500 ha resulting in between 45% and 68% reuse. Option 4 is therefore unlikely to be cost effective unless potential users are prepared to pay a premium for access to reclaimed water.

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8 COSTS

8.1 CAPITAL COSTS

Capital costs for the project would include provision of pipework (including supply, delivery, trenching, installation and backfilling); metered offtakes to property boundaries of users; pumping stations (including structure, pumps, valves, pipework, power supply and controls); and reclaimed water balance storage facilities. Additional pumps will be required at balance storage ponds in Zones 3 and 4. Allowance has been made for the cost of directional boring as the likely method for crossing the Macquarie River.

Project capital costs are expected to range between \$1.5 million and \$18 million, dependent on which zones are serviced with reclaimed water. It should be noted that costs have been based on the assumption that construction would proceed in the order of Zone 1, Zone 2, Zone 3 and then Zone 4. The cost of infrastructure utilised by multiple zones has mostly been allocated to the first zone that requires it.

Table 8.1 provides a summary of capital cost estimated for the zones and options described in this report. *Figure 8.1* shows comparisons of costs used to determine the optimum configuration.

8.2 **OPERATION AND MAINTENANCE COSTS**

Ongoing or future costs may include modifications to STP treatment requirements (although options for reducing phosphorous stripping are likely to result in a net saving in treatment costs) and additional offtake construction costs in the event of future users joining the scheme. Operational costs will generally include electricity usage; monitoring; and administration costs associated with management of contractual agreements etc. Maintenance costs will be associated with servicing and repairs to pumps, valves, controls, meters and leaking pipes. Proposed reclaimed water use charges will contribute to meeting these costs but are not expected to fully cover all ongoing costs until sufficient users are signed up to the scheme. At this stage there is insufficient data to estimate ongoing costs.

8.3 OTHER COSTS

All on-site irrigation costs including buffer storage, pipes, pumps, power supply, irrigation systems and drainage are expected to be borne by the user. The cost of the offtake to the property boundary will be part of the initial construction cost, but costs of offtakes constructed after initial construction may need to be shared by the future users.

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				ZON	E 1	JOZ	VE 2	ΟZ	NE 3	Z	NE 4
ltem	Details	Rate	Unit	Quantity	Cost	Quantity	Cost	Quantity	Cost	Quantity	Cost
		(\$)			(\$)		(\$)		(\$)		(\$)
Pipes (HDPE) ¹	200mm	201	٤	ı	ı	1,940	389,940	ı	I	I	1
	150mm	155	E		1	2,180	337,900	10,000	1,550,000	20,000	3,100,000
	100mm	109	E	7,450	812,050	1,310	142,790		1	20,000	2,180,000
Extended offtake piping ¹	¹ 75mm	20	E	885	61,950	2,040	142,800	'	I	ı	'
Offtakes ²		2,475	each	12	29,700	13	32,175	20	49,500	80	198,000
Directional boring	(for Macquarie River Crossing)	·	Item	•		~	25,000			·	
STP Pumping Station ³	pump: Type 1 (9L/s @ 150m head)	13,900	each	~	13,900	•	I	ı	I	ı	'
	Type 2 (40L/s @ 10m head)	10,400	each	•	•	7	20,800	~	10,400	•	'
	building, valves & pipework	23,000	ltem	0.5	11,500	0.5	11,500	'	I	•	ı
	Transformer & elec supply	11,000	ltem	•	I		11,000	•	1	•	ı
	controls	10,000	ltem	0.7	7,000	0.3	3,000		ı	•	ı
Tyer's Pumping Station ³	³ pump: Type 3 (30L/s @ 20m head)	11,500	each		ı	~	11,500	'	I	ı	ı
	Type 4 (40⊔/s @ 20m head)	15,000	each	•	I	•	1	~	15,000	•	ı
	Type 5 (20L/s @ 100m head)	29,700	each	•	1	•	I	'	I	2	59,400
	building, valves & pipework	23,000	Item	•	I	0.5	11,500	0.3	6,900	0.2	4,600
	Transformer & elec supply	11,000	ltem	•	I		11,000	'	ı	·	ı
	controls	10,000	ltem	•	I	0.7	7,000	0.2	2,000	0.1	1,000
Type 4 Pump	(incl.controls + elec.)	20,000	each	•	I	•	ı	~	20,000	2	40,000
Storage Construction/ E>	expansion (excludes land acquisition)	ı	ltem		300,000		1,050,000		1,575,000		1,800,000
Design & Other @ 10%					123,610		220,791		322,880		738,300
Contingencies @ 15%					203,957		364,304		532,752		1,218,195
TOTAL COST (\$)					1,563,667 1 563,667		2,793,000 1 356 666		4,084,432 8 4 4 1 0 0 8		9,339,495 17 780 603
	61 CO31 (\$)				1,000,0001		4,330,000		0,441,030		11,100,033
¹ Includes supply, deliver	rry, trenching, installation and backfilling										
² Includes t-intersection,	, bend, 5mx75mm diam. HDPE pipe, but	terfly valve	e and 9	06×006×00	0mm conci	ete pit & π	neter				
³ Pumping station infrast	tructure is expanded as additional zones	are irrigat	ed as s	hown							
		,									

Table 8.1Cost Estimates



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9 BENEFITS

9.1 Environmental Benefits

Implementation of an effluent reuse scheme could have a number of environmental benefits, including:

- Environmental flows in the Macquarie River could be supplied by "natural" water supplied from the catchment dams rather than by treated effluent, possibly leading to an improvement in water quality;
- Increase in environmental flows in the Campbells River and Macquarie River as use of dam releases for irrigation is reduced;
- Decrease in discharge of treated effluent into natural waterways where it could potentially degrade water quality, primarily by contributing to eutrophication or algal blooms.
- Reduced discharge and energy expenditure associated with possible reduction in nutrient removal processes at the STP;
- Reduced reliance and demand on raw water supplies, enabling more sustainable water management;
- Reuse of a valuable resource (reclaimed water) that would otherwise be discarded and wasted;
- Options for incorporation of non-potable water supplies to new residential areas in accordance with BASIX objectives.

9.2 SOCIAL BENEFITS

Potential social benefits associated with the use of reclaimed water for irrigation include:

- Public satisfaction at participating in an innovative sustainable 'environmentally friendly' effluent re-use scheme;
- Reduced drought-time stress to farmers caused by water shortages and associated reductions in production/ income;
- Development of more productive agricultural land associated with increased irrigation potential, thus increasing regional job opportunities and prosperity.

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9.3 ECONOMIC BENEFITS

Economic benefits of the effluent reuse scheme would include:

- Provision of a new water source, thereby increasing land capability;
- Very reliable water supply for irrigators which facilitates greater certainty in farming practises, particularly during drought conditions;
- Reduced treatment costs to BRC for removing nutrients from sewage;
- Reduced fertiliser costs to irrigators on occasions where reclaimed water fully or partially meets crop nitrogen and phosphate requirements;
- Development of more productive agricultural land associated with increased irrigation potential, thus increasing regional job opportunities and prosperity.

10 IMPACTS

10.1 INTRODUCTION

The *EP&A Regulation* requires that an EIS include:

"the reasons for justifying carrying out the development or activity in the manner proposed, having regard to biophysical, economic and social considerations and the principles of ecologically sustainable development."

This pre-feasibility study has not investigated issues in sufficient detail to satisfy the requirements for producing an EIS. However, the following sections provide an overview of preliminary assessments having regard to the biophysical, social and economic considerations.

10.2 BIOPHYSICAL CONSIDERATIONS

10.2.1 Water resources and land capability

There are no expected changes to treated effluent quality for discharges to the Macquarie River. There may be some changes in the quality of reclaimed water used for irrigation, primarily in relation to nutrient removal. Faecal coliform levels are not expected to change. A sustainable irrigation scheme has been developed to use the reclaimed water at various properties in and around Bathurst. Desktop assessments of soil maps have found that soils at the proposed irrigation sites have the capacity to immobilise nutrients and have a low risk of salinity.

The implementation of the irrigation scheme is not expected to cause significant soil disturbance and as such there is a low risk of potential impacts to downstream water quality. The main reclaimed water storage will be lined, preventing loss of reclaimed water to the Macquarie River through seepage and optimising irrigation across changes in seasonal demand. The proposed scheme is expected to bring several major benefits to water quality in the region, the details of which are included in *Section 9*. Irrigation of the playing fields and agricultural properties will optimise the reuse of reclaimed water within the context of the land area and storage requirements for the scheme.

Irrigation scheduling will ensure that reclaimed water is not applied to the land during or immediately following wet weather. The soil moisture will be monitored as part of the operation of the scheme and a small soil water deficit will be retained following irrigation. Excess reclaimed water will not be applied to the land, ensuring that no runoff will occur as a direct result of the irrigation practices. Direct releases of treated effluent to the Macquarie River will be reduced by at least 50% (depending on the final option selected) so that the volume in comparison to the total annual flow in the river will be reduced. Currently, the treated effluent comprises a small percentage of the total annual flow in the Macquarie River but occasionally comprises 100% of daily flows. Implementation of any of the options will require compensatory discharges from dams to maintain environmental flows.

Total nutrient loads expected to be allowed in reclaimed water represent a very small proportion of the total catchment loads. Total Phosphorous loads in reclaimed water would represent a maximum of 0.18%. Total Nitrogen loads would represent a maximum of 0.47% of the total catchment loads for the ultimate scheme (Option 3).

10.2.2 Soil erosion

No soil erosion issues are anticipated for the completed schemes. Heavy machinery and equipment used in construction may result in stripping and compaction of the soil profile, increasing the risk of sediment laden run-off and potentially reducing infiltration. Increased run off could impact soils down slope of construction works if these soils are prone to water erosion. This will be a temporary situation and will be mitigated by appropriate erosion and sediment control measures.

10.2.3Flora and Fauna

No threatened or regionally significant flora or fauna species or vegetation communities have been identified in this limited assessment. The potential impacts of the proposal on threatened species and the potential to utilise effected areas as habitat must be addressed in Eight Part Tests.

Potential impacts from the construction phase of the proposal may include sedimentation of aquatic and riparian environments, including the Macquarie River and its tributaries and anabranches.

The potential impact of a large new storage in the area on foraging habitat available for bird species will need to be investigated. There may be impacts on migratory bird species utilising this area, and a referral to the Commonwealth Minister for the Environment may need to be submitted under the *EPBC Act*, 1999.

10.3 SOCIAL CONSIDERATIONS

10.3.1 Heritage

The study area is significant to the course and patterning of the local area, as the land boundaries surrounding the study area represent the original subdivision of land stemming from the 1850s. The study area possesses no known items of heritage significance that will be affected by the proposed works and has already undergone extensive disturbance related to farming and other activities.

The construction of pipelines and storages will disturb a ground surface that has been extensively disturbed over the past 150 years. However, archaeological potential for both Aboriginal and historical heritage cannot be confirmed without a detailed study of the final route(s) selected.

10.3.2 Noise and Vibration

Ground vibrations from even the most severe potential construction activities are unlikely to produce detectable vibration at distances of 300m (the distance to the nearest receiver).

Traffic noise generated during the peak construction period is expected to be within the DEC's road traffic noise criterion.

Sprinkler systems used for the irrigation of reclaimed water will not exceed the criterion of 35dB(A) at any location. However, when considered cumulatively with potential noise levels from pumping stations it is expected that a more detailed review will be required during the EIA process.

10.3.3 Air Quality

During construction there is the possibility of particulate matter being generated from various activities, but appropriate site management practices, set down in the EMP will ensure all impacts are appropriately mitigated.

Numerous studies have concluded that, based on current information, the potential does not exist for disease to be spread via aerosols from STPs.

The operation of the reclaimed water management system (irrigation and other non-potable uses) is not anticipated to give rise to air quality issues.

10.3.4 Visual

Pipelines will be buried and will therefore have no visual impacts. Clearing of vegetation along pipeline routes will be minimal. Storages may need to be appropriately landscaped to satisfy community expectations.

10.3.5 Traffic and Transport

Traffic impacts associated with the construction phase are expected to be minimal. Transport of construction materials will be spread throughout the day within standard working hours or during appropriate low volume periods.

10.4 ECONOMIC CONSIDERATIONS

Analyses of the cost of effluent reuse in relation to the area irrigated, indicates that the optimal economic solution would be to irrigate a land area of between 300 and 500 ha with reclaimed water (refer *Figure 8.1*. Implementation of most of Option 3 (i.e. Zones 1 and 2 plus partial irrigation of Zone 3) is the preferred option on a simple economic basis. Depending on the availability of funds for a scheme within this 'optimum zone', the project would incur capital costs of between \$4.3 million and \$6.8 million and enable reuse of between 45% and 65% of reclaimed water.

Option 4 incurs significant extra costs associated with the relatively long length of the main pipeline. Option 4 at total cost of \$17.8 million (nearly double the cost of Option 3) may be prohibitively expensive.

Joint funding is being sought by BRC from the Federal Government under the Country Towns Water Supply and Sewerage Program. The wider economic impact to the Australian community is beyond the scope of this report. However, economic impacts on the local Bathurst community will be limited to the proportion of rates required to cover BRC's proportion of capital costs, which will be offset by potential additional income generated in the region by improved agricultural productivity.

11 ECOLOGICALLY SUSTAINABLE DEVELOPMENT

11.1 INTRODUCTION

The broadest meaning of ESD is:

"using, conserving and enhancing the community's resources so that the ecological processes, on which life depends, are maintained and the total quality of life, now and in the future, can be increased" (Commonwealth of Australia 1992).

The main thrust behind ESD is that current and future generations should leave a natural environment that functions as well or better than the one inherited. Each of the principles of ESD are considered in the following sections.

11.2 PRECAUTIONARY PRINCIPLE

Interpretation

According to the *Protection of the Environment Administration Act, 1991*, the precautionary principle means that if there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

This principle was developed in response to one of the great difficulties of interpreting scientific data. The scientific method produces results based on confidence limits. These are controlled by the scope of data acquisition, interpretation methods and general understanding within a particular scientific discipline of particular phenomena. This has been used as a way of validating a lack of response to a potential threat of serious or irreversible environmental degradation.

In the application of this principle:

- careful application should always be undertaken to avoid serious or irreversible environmental damage; and
- an assessment of consequences of various options should be undertaken in formulating a proposal.

ESD requires that uncertainty and the associated risk level be considered in decision making.

Justification

The environmental consequences of the proposed scheme have been assessed on a preliminary basis only. All predictions contain a degree of uncertainty, which reflects the variable nature of the environment.

The proposed works are not expected to result in serious or irreversible damage. The proposal will complement an existing efficient sewage treatment system, and make reclaimed water available for other uses, thus reducing demand on raw water and on water pumped directly from the Macquarie River.

11.3 Social Equity Including Intergenerational Equity

Interpretation

Social equity involves value concepts of justice and fairness so that the basic needs of all sectors of society are met and there is a fair distribution of costs and benefits to improve the wellbeing and welfare of the community, population or society. Social equity does not imply equality but there should be equal access to opportunities for improved welfare, with a bias towards benefiting the least well-off sectors of society.

Social equity includes intergenerational equity, which requires that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.

Justification

The proposal appears to be consistent with the principles of social equity and inter-generational equity through the efficient use of a resource that provides a number of benefits to society.

The proposal will reduce demand on natural resources, increase reuse of a potential resource currently being released into the environment and improve the potential extent and efficiency of farming and other agricultural activities.

11.4 CONSERVATION OF BIOLOGICAL DIVERSITY AND MAINTENANCE OF ECOLOGICAL INTEGRITY

Interpretation

Biological diversity refers to the diversity of genes, species, populations, communities and ecosystems, and the linkages between them. Biological resources provide food, medicines, fibres and industrial products. They are also responsible for vital ecological services such as maintaining soil fertility and the supply of clean and fresh water. Maintaining biological diversity safeguards life support functions and can be considered a minimal requirement for intergenerational equity.

Justification

The proposal is expected to have a beneficial effect on receiving water quality through the maintenance of environmental flows by release of natural river water from dams rather than using treated effluent. The proposed reuse scheme requires a dedicated main storage to be constructed. Construction of the reclaimed water storage, which will be lined, will provide habitat to aquatic bird species. The storage will be maintained to enhance these habitat qualities.

11.5 IMPROVED VALUATION AND PRICING OF ENVIRONMENTAL RESOURCES

Interpretation

The environment has conventionally been considered a free resource, with the true cost to the environment not factored into cost of production or use of that resource.

This principle involves placing a monetary or social value on the environment that ultimately increases its value so as to decrease future exploitation.

Pollution and future exploitation can be controlled under the polluter pays principle, whereby polluters who degrade the natural environment are responsible and accountable for returning it to its previous condition.

Justification

The formalisation of the reclaimed water reuse scheme has acknowledged the value of reclaimed water as a commodity as well as the fact that it will aid in the rehabilitation of local waterways and prevent potential health risks associated with effluent discharges. Nutrient rich reclaimed water will also reduce the requirement for application of fertiliser to irrigated land.

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Annex A

Topographic Requirements For Irrigation Of Land With Effluent

Property		Limitation	Restrictive feature			
	Nil or slight	Moderate	Severe			
Slope %				Excess runoff and erosion risk		
	< 1	1-3	>3-			
surface/underground						
sprinkler	< 6	6-12	>12			
Trickle/micro spray	< 10	10-20	>20			
Flooding	none or rare	occasional	frequent	Limited irrigation		
				opportunities		
Landform	crests, convex	concave slopes	drainage	Erosion and seasonal		
	slopes, plains	and foot slopes	lines	waterlogging risk		
Surface rock outcrop %	nil	0-5	>5	Interferes with irrigation and		
				cultivation machinery,		
				increases risk of runoff		

Source: Hardie & Hird (1998)

Annex B

Soil Requirements For Irrigation Of Land With Effluent

Property		Limitation		Restrictive feature
	nil or slight	moderate	severe	
ESP (0-40 cm)	<5	5-10	>10	Structural degradation and waterlogging ^F
ESP (40-100 cm)	<10	>10	-	Structural degradation and waterlogging
ECe dS/m (0-70 cm)	<2	2-4	>4	Excess salt restricts plant growth
ECe dS/m (70-100 cm)	<4	4-8	>8	Potential seasonal groundwater rise
Depth to seasonal HWT m ^G	>3A	0.5-3 ^A	<0.5	Wetness, risk to groundwater
Depth impervious bedrock (pap m	>1	0.5-1	<0.5	Restricts plant growth, excess
Ks. mm/hr. 0-100 cm	20-80	5-20	<5	Excess runoff, waterlogging,
-, , , ,		>80	_	risk to groundwater
AWC mm/m	>100	<100	-	Little plant available water in reserve, risk to groundwater
Bulk density (g/cm ³ , 0-				Restricts root growth
70 cm)				Ū.
sandy loam	<1.8	>1.8	-	
loam and clay loam	<1.6	>1.6	-	
clay	<1.4	>1.4	-	
Soil pH (CaCl ₂) topsoil	6.0-7.5	3.5 ^B -6.0	<3.5 ^B	Reduces optimum plant growth
		>7.5	-	
CEC cmol+/kg	>15	3 ^c -15	<3 ^C	Unable to 'hold' plant nutrients
EAT (0-100 cm)	4,5,6,7	2,3	1,8	Poor structure
P sorption kg/ha	>6000D	2000-6000E	<2000 ^E	Unable to immobilise any excess P

Source: Hardie and Hird (1998)

ESP Exchangeable Sodium Percentage

ECe effective electrical conductivity

EAT Emerson aggregate test HWT high water table

CEC cation exchange capacity Ks saturated hydraulic conductivity

А Often impossible to excavate to 3 m, hence local knowledge and lack of evidence of water table to sampling depth ((1 m) is used.

В Where effluent is alkaline or lime is available, opportunities exist to raise the pH. If acid soil is present, land levelling may not be appropriate. ^C adding soil amendments such as biosolids or liming agents could overcome this.

D Assuming the sorption strength is higher than 20% of the sorption capacity. If this is not the case, a higher sorption capacity is required to immobilise excess P.

Е These limitations exist only if there is a sensitive groundwater source.

F Overcome by gypsum application.

G Quality and potential impacts on groundwater should also be considered.

Annex C

Consultation

Persons/ Organisations Interviewed during the Preliminary Assessment of Reclaimed Water Irrigation Potential for Bathurst

Zone	Major landholder	Distance from STP (lum)	Elevatio n from STP	Potential irrigatio n area	Existing/ proposed irrigation	Source of existing irrigation	Potential average use of	Interest in new reclaimed water scheme	
		(KM)	(m)	(na)	land use		d water (ML)		
1	Simplot	<0.5	<10	<100	Maize	Water recycled on site, River license	400	No	Sufficient water recycled on site
1	Golf club	2.5	80	26	Turf-golf course, fairways	Raw water supply	130	Yes	Has balance pond
1	Bathurst Agricultur al Station	3.5	80	10	Orchard	Raw water supply, Bore	40	Yes	May provide storage opportuni ties
1	Bathurst TAFE	4.5	80	<5	Play-ground, turf	Raw water supply	<20	?	
2	Greenacres Turf farm	1.5	<10	60	Turf supplies (45 ha), Lucerne (15ha)	River license (300 ML/annu m)	300	Yes	
	Golden West Race course	1.5	<10	12	Turf-Race Course	Bore water	60	Yes	Would consider storage but would need to approach Board
Nort h weste rn exten sion	Blackdown Estate	2	20	>5	Garden /lucerne	Water recycled on site, Site dams	>20	Not e	established
3	Sunbright farm	4.5	40	50	Orchard	Site dams Bore	>100	Not es consid p subdi	stablished – lered to be a otential vision area
4	McSpedde n	15	30	450	Lucerne, maize, vegetables, pasture	River license (120 ha)	>1000	Yes	

NB. Simplot managers believed that some of their maize suppliers on the Macquarie River floodplain may be interested in taking reclaimed water from the Bathurst STP.

Mr McSpedden suggested that there would be many farmers between Kelso and White Rock that would be interested as there are large areas of suitable irrigation land that do not have irrigation licences. He believed that the supply of reclaimed water from Bathurst would all be used before any pipeline reached the Lagoon area. He would also be prepared to form part of a 'reference' group that could be formed to detail specific reclaimed water irrigation schemes.

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