



WAGGA WAGGA WATER TREATMENT PLANT AUGMENATION PRELIMINARY ENVIRONMENTAL ASSESSMENT

Report Number DC 13186

Date November 2013

Prepared for
Riverina Water County Council



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Document Control

Issue / Revision	Author	Reviewer	Date of Issue
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Foreword

This Preliminary Environmental Assessment (PEA) has been prepared by NSW Public Works on behalf of Riverina Water County Council (RWCC). The report provides a preliminary environmental assessment of the proposal to upgrade the Wagga Wagga Water Treatment Plant (WTP) in Wagga Wagga in the Riverina district of southern NSW. The PEA has been prepared to support the application for Director General's Requirements under Part 4, Division 4.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The proposed works are considered to be State significant development pursuant to Schedule 1 of State Environment Planning Policy (State and Regional Development) 2011, as the capital investment value of the project is expected to exceed \$30 million.

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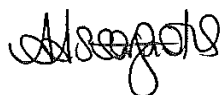
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List of Abbreviations

AHD	Australian Height Datum
AHIMS	Aboriginal Heritage Information Management System
CEMP	Construction Environmental Management Plan
CMA	Catchment Management Authority
CWS	Clear Water Storage
DECCW	Department of Environment, Climate Change and Water
DGR	Director General's requirements
DPI	Department of Primary Industries
EIS	Environmental impact statement
EP&A Act	Environmental Planning and Assessment Act 1979
EP&A Regulation	Environmental Planning and Assessment Regulation 2000
EPA	Environment Protection Authority, now part of OEH
EPBC Act	Environment Protection and Biodiversity Conservation 1999
EPL	Environment Protection Licence
ISEPP	<i>State Environmental Planning Policy (Infrastructure) 2007</i>
LALC	Local Aboriginal Land Council
LEP	Local Environmental Plan
LGA	Local Government Area
ML	Mega litres
NOW	NSW Office of Water
NPW Act	National Parks and Wildlife Act 1974
NTU	nephelometric turbidity unit
OEH	Office of Environment and Heritage
POEO Act	Protection of the Environment Operations Act 1997
REF	Review of Environmental Factors
RWCC	Riverina Water County Council
SEPP	State Environmental Planning Policy
SRD SEPP	State and Regional Development State Environmental Planning Policy
SWMP	Soil And Water Management Plan
TMP	Traffic Management Plan
TSC Act	<i>Threatened Species Conservation Act 1995</i>
WTP	Water Treatment Plant
WM Act	<i>Water Management Act</i>

1 Introduction

This section provides a brief description of the proposal, the background to the proposal and an overview of the proposed WTP site.

1.1 Background to the Proposal

The Wagga Wagga WTP is located off the Sturt Highway (Hammond Avenue) (Lot 2, DP 540063) in Wagga Wagga. Wagga Wagga City is located in the Riverina region of southern New South Wales, about 450 kilometres south-west of Sydney (refer to Figure 1-1). The treatment plant site covers an area of 8.43 ha. Figure 1-1 and Figure 1-3 show aerial photographs of the existing Wagga Wagga WTP.

The Wagga Wagga WTP is owned and operated by Riverina Water County Council (RWCC). The WTP in conjunction with the West Wagga Wagga WTP, North Wagga Wagga WTP and smaller bore systems, supplies reticulated water to the City of Wagga Wagga and the Shires of Lockhart, Greater Hume, Urana. Raw water for the WTP is sourced from the Murrumbidgee River and East Wagga Wagga Borefield. River water is drawn by means of seven pumps, with pump capacities ranging from 60 to 180 L/s. The WTP is able to produce up to 44 ML/d of potable water from the Murrumbidgee River under typical river conditions.

The Wagga Wagga WTP was built in stages, commencing in the 1930's with the construction of Clarifier 1, Filters 1 and 2, and Clear Water Storage 1. The final filter (Filter 6) was constructed in the early 1960's. A new wash-water and sludge handling plant was commissioned in 2006.

A Raw Water Quality Risk Assessment Workshop undertaken in February 2012 identified microbial pathogens and turbidity as the key risks associated with the operation of the Wagga Wagga WTP. The raw water quality in the Murrumbidgee River at Wagga Wagga can deteriorate significantly with turbidities in excess of 1000 NTU (nephelometric turbidity unit) following heavy rain in the region. The Wagga Wagga WTP is unable to treat raw water with turbidity level in excess of 100 NTU, and during these conditions raw water is sourced from the East Wagga Wagga Borefield. However as the regional demand increases the existing water treatment system will be unable to rely solely on the East Wagga Wagga Borefield for raw water and the Murrumbidgee River source will need to be utilised during high turbidity events.

Riverina Water is therefore proposing to upgrade the existing Wagga Wagga WTP in order to treat poor quality water and to maintain a secure production of 55 ML/d from the Murrumbidgee River.



Figure 1-1 Wagga Wagga Location Map

1.2 Site Overview

Wagga Wagga City constitutes both rural and urban areas, with commercial, industrial and military landuses. Most of the population is concentrated in the urban areas with rural land used primarily for wheat-growing, dairy farming, mixed farming and sheep grazing (id, 2013).

All works to upgrade the Wagga Wagga WTP would be undertaken within the existing site boundary (See Figure 1-3 below). The WTP is located in the urban area of East Wagga Wagga to the east of the main town centre. The site also houses the RWCC administration office and depot. Photographs of the site are provided in Appendix A.

The Wagga Wagga WTP lies on the banks of the Murrumbidgee River. The site is bounded by the Murrumbidgee River to the north, the Easts Riverview Holiday (caravan) Park to the east and Marshalls Creek which forms the western and southern boundaries of the site.

Surrounding landuses are mostly light industrial and includes the newly upgraded electrical substation (owned by Essential Energy). The nearest residential development is within 75 m

of the western site boundary. A recreational walking path runs along the Murrumbidgee River and Marshalls Creek to the west of the site.

The site and surrounds contain little native vegetation which is confined to a narrow riparian strip along the Murrumbidgee River and Marshalls Creek (see Figure 1-3). Limited landscaped vegetation is located within the WTP site. No Aboriginal sites have been recorded at the site or within 1 km of the site boundary.

The Wagga Wagga WTP site is listed as having local heritage significance under the Wagga Wagga LEP. The listing relates to a number of the existing structures at the site being the “Riverside Residence” and the original pump house building (see Figure 1-4 and Plate 1 and 2, Appendix A).

1.2.1 Land Ownership

The site is owned by RWCC.

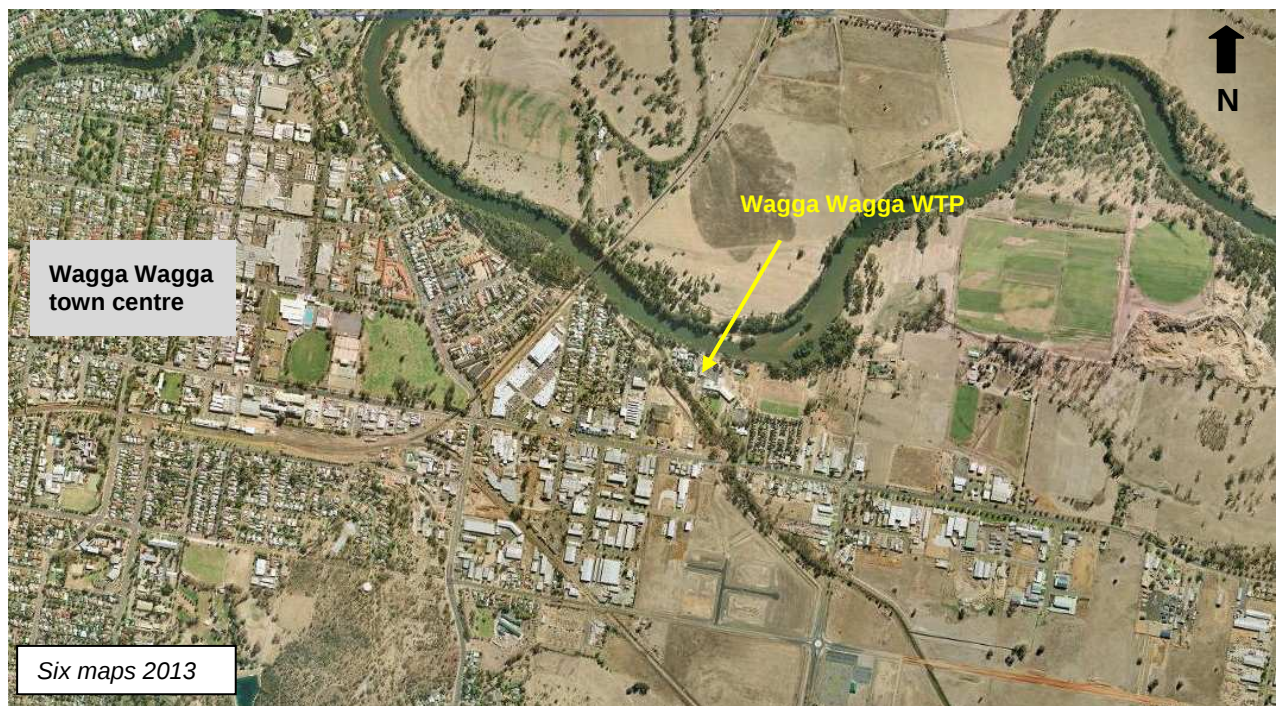


Figure 1-2 Wagga Wagga WTP locality map



Figure 1-3 Aerial Photo of Wagga Wagga WTP and surrounding landuses

1.3 Existing WTP Infrastructure and Treatment Process

The existing Wagga Wagga WTP has the following key process units, which are shown in Figure 1-4:

- Aeration of East Wagga Wagga Bores;
- Murrumbidgee River raw water pumping station;
- Alum and activated silica dosing at inlet to flocculators;
- Two upflow clarifiers;
- Four banks of pressure monosand filters;
- Dosing of lime, fluoride and chlorine;
- Clear water storage and pumping;
- Wash water handling system;
- Sludge dewatering infrastructure including centrifuges.

The river water treatment train at Wagga Wagga WTP was built in stages, commencing in the 1930's with the construction of Clarifier 1, Filters 1 and 2, and Clear Water Storage (CWS) 1. Filters 3 and 4 were constructed in the late 1930's, followed by Clarifier 2, CWS 2

and Filter 5 in the early 1950's. Filter 6 was constructed in the early 1960's. A new washwater and sludge handling plant was commissioned in 2006.

The existing WTP has a hydraulic capacity of 44 ML/d. River water is drawn by means of seven pumps, six of which are vertical turbine type located in two deep machinery wells, and the seventh is a submersible unit immersed directly in the river. The capacities of these raw water pumps range from 60 to 180 L/s.

1.3.1 Raw Water Treatment Process

Raw river water is pumped into the two flocculators located at the centre of the two circular upflow clarifiers. Alum and activated silica are dosed at the inlet to the flocculators for coagulation and subsequent flocculation. Settled water from the clarifiers is filtered by four banks of pressure sand filters. Backwash water for one filter cell is generated from the filtered water from the other three or five cells in the filter, through a rotating master valve arrangement.

Filtered water gravitates to two clear water storage tanks, with CWS 1 being the original tank constructed in the 1930s, and CWS 2 located underneath Clarifier 2. Filtered water is dosed with hydrated lime for pH correction, chlorine for disinfection, and sodium silicofluoride for fluoridation before being pumped to the town reservoirs.

A schematic of the existing treatment process is provided in Appendix C.

1.3.2 Borewater Treatment Process

The East Wagga Wagga Borefield consists of three bores with capacities ranging from 60 to 110 L/s. Water from the bores is pumped to the WTP and aerated in order to release Carbon Dioxide (CO₂) and Hydrogen Sulphide. Aeration is achieved as water cascades through timber baffling in the towers and is then collected in a concrete basin. Aeration raises the pH of the water from about 6.6 to about 7.3. Bore water is fluoridated and chlorinated just prior to aeration to assist in the release of Hydrogen Sulphide, preserve bacteriological quality, and prevent algal growth in the collecting basin. Water from the Aeration Tank gravitates to CWS 2 located underneath Clarifier 2. This water is then mixed with the filtered river water in the Clear Water Storage tanks.



Figure 1-4 Existing Infrastructure

Note aerial taken during December 2010 floods

2 Scope of the Proposed Works

2.1 Description of the Proposal

A feasibility study on the upgrade of the Wagga Wagga WTP has been undertaken (HWA, 2012) which has identified the preferred option as augmenting the WTP with a 55 ML/d Clarification and Dual Media Filtration process. The upgrade will increase the capacity of the plant to 55 ML/d and secure this capacity under raw water turbidities up to 300 NTU.

Inclined Plates settlers or Reactivator Clarifiers have been shortlisted as the preferred clarification options. Preliminary WTP layouts for the two preferred options are provided in Appendix B and schematics of the treatment process provided in Appendix C.

The scope of works for the proposed upgrade broadly includes the following:

- New raw water pumping station including new intake and infiltration well to be located to the east of the existing raw water pumping station;
- New alum dosing system and static mixer;
- Polymer dosing system;
- Inclined Plate Sedimentation Tanks, or Reactivator Clarifiers;
- Dual Media Filters including backwash pumps and blowers;
- New chlorine storage and dosing system;
- Clear Water System upgrade, including new 3 ML CWS and pumping station;
- Backwash system for filters including of air scour and backwash pumps;
- Use of existing Clarifiers as filter washwater batch settlers;
- Mechanical dewatering upgrade including the provision of two additional centrifuges;
- Switchrooms;
- Addition of automation and control infrastructure;
- General site services and miscellaneous items.

The proposed works would be contained within the existing WTP site and would not encroach into neighbouring land lots.

2.1.1 Retention of Existing Infrastructure

The following existing infrastructure will be retained and utilised for a different function as part of the upgraded treatment plant;

- Clarifiers 1 & 2 to be converted and used as filter backwash wastewater batch settling tanks;
- Balance tank to be utilised as the sludge holding tank for the centrifuges; and
- Existing two centrifuges would be retained and used in conjunction with two new centrifuges.

2.1.2 Capital Investment Value

A feasibility report for the proposed upgrade of Wagga Wagga WTP was prepared by Hunter Water Australia in October 2012. The report provided a cost analysis of a number of options. The cost estimate for the two preferred options is provided in Table 2-1 below and more detailed costings provided in Appendix D.

Table 2-1 Cost Estimate of preferred options

Wagga Wagga WTP Options	Total Capital Cost Estimate
Option 1: Inclined Plates 55 ML/d	\$37,889,000
Option 2: Reactivator Clarifiers 55 ML/d	\$38,599,000

3 Statutory Considerations

This section identifies the relevant environmental planning instruments, legislation, policies and strategic planning documents relevant to the proposal.

3.1 Local Environmental Planning Instruments

3.1.1 Wagga Wagga Local Environmental Plan 2010

All works proposed as part of the upgrade of the Wagga Wagga WTP would be undertaken on land zoned IN2 Light Industrial under the Wagga Wagga Local Environmental Plan 2010 (Wagga Wagga LEP).

The objectives of the IN2 Light Industrial zone are to

- To provide a wide range of light industrial, warehouse and related land uses.
- To encourage employment opportunities and to support the viability of centres.
- To minimise any adverse effect of industry on other land uses.
- To enable other land uses that provide facilities or services to meet the day to day needs of workers in the area.
- To support and protect industrial land for industrial uses.

Development for the purposes of water treatment facilities is not prohibited under IN2 Light Industrial land zoning and the proposed works are therefore permissible with development consent. The upgrade works would be confined to the existing Wagga Wagga WTP site. The augmentation of the Wagga Wagga WTP is not inconsistent with the objectives of the IN2 land zoning.

Clause 5.12(1) of the Wagga Wagga LEP states that the LEP does not restrict or prohibit, or enable the restriction or prohibition of, the carrying out of any development, by or on behalf of a public authority, that is permitted to be carried out with or without development consent, or that is exempt development, under State Environmental Planning Policy (Infrastructure) 2007 (see 3.2.1 below).

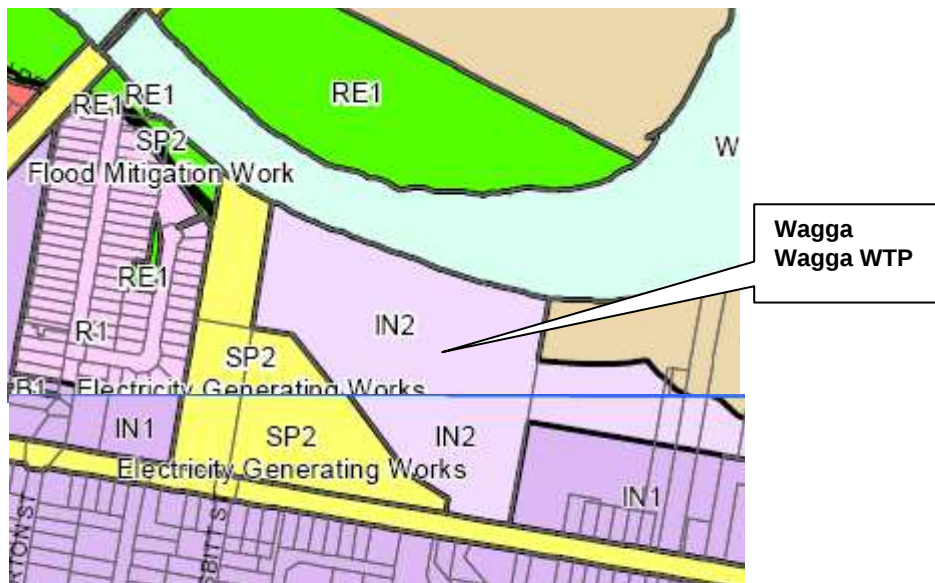


Figure 3-1 Land Zoning – Wagga Wagga LEP 2010

Other applicable clauses under the Wagga Wagga LEP 2010

Heritage

The Wagga Wagga WTP is listed under Schedule 5 of the Wagga Wagga LEP. The listing relates primarily to the “Riverside Residence” and the original pump house building (see Figure 1 4 and Plates 1 and 2, Appendix A). These structures would be retained. The heritage provisions applicable to the proposal are provided in clause 5.10 of the LEP. A Historic Heritage Assessment would be undertaken to assess any potential impacts the proposal may have on the heritage significance of the site.

Riparian Lands

Clause 7.5 of the Wagga Wagga LEP is concerned with riparian lands and waterways and requires the consent authority to consider:

- (a) any potential adverse impact on; water quality within the waterway, aquatic and riparian habitats and ecosystems, stability of the bed, shore and banks of the waterway, the free passage of fish and other aquatic organisms within or along the waterway, habitat of any threatened species, population or ecological community,
- (b) whether or not it is likely that the development will increase water extraction from the waterway for domestic or stock use and the potential impact of any extraction on the waterway,
- (c) proposed measures to ameliorate any potential adverse impact.

Development consent must not be granted unless the consent authority is satisfied that:

- (a) the development is designed, sited and managed to avoid any potential adverse environmental impact, or
- (b) if a potential adverse impact cannot be avoided, the development:
 - (i) is designed and sited so as to have minimum adverse impact, and
 - (ii) incorporates effective measures so as to have minimal adverse impact, and
 - (iii) mitigates any adverse impact through the restoration of any existing disturbed area on the land.

These issues will be addressed as part of the preparation of the EIS.

3.2 State Environmental Planning Policies

3.2.1 State Environmental Planning Policy (Infrastructure) 2007

State Environmental Planning Policy (Infrastructure) 2007 (ISEPP) aims to assist in the effective delivery of public infrastructure by improving certainty and regulatory efficiency. The ISEPP provides clear definition of environmental assessment and approval process for public infrastructure and services facilities.

Division 24 of the ISEPP details the planning provisions in relation to Water Supply Systems, which includes water treatment facilities. Clause 125(3) lists the land zones where development for the purpose of water treatment facilities may be carried out by or on behalf of a public authority without consent. Zone IN2 Light Industrial is not included under clause 125(3). Therefore the provisions under the ISEPP are not applicable to the works and proposed development cannot proceed without development consent.

3.2.2 State Environmental Planning Policy State and Regional Development

The State Environmental Planning Policy (State and Regional Development) 2011 (SRD SEPP) declares certain types of development and infrastructure to be of State and regional significance. Clause 8 of SRD SEPP declares a development to be State significant development where a development is not permitted without consent (i.e. permitted with consent under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act)) and is listed in Schedule 1 or 2 of the SRD SEP.

Schedule 1 of the SRD SEPP includes:

- (1) Development for the purpose of water storage or water treatment facilities (not including desalination plants) that has a capital investment value of more than \$30 million.

The proposed upgrade of the Wagga Wagga WTP is expected to have a capital investment value of more than \$30 million (cost estimates are provided in Appendix D) and is therefore considered to meet the criteria for State significant development.

3.3 NSW Statutes

3.3.1 Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* (EP&A Act) provides a framework for environmental planning and assessment in NSW. Section 89C of the Act enables certain developments to be declared "State significant development" by means of a State Environmental Planning Policy (SEPP) or by order of the Minister for Planning and Infrastructure.

As discussed in Section 3.2.2 above, the proposal falls within the requirements of Schedule 1 of SRD SEPP as the capital investment value of the proposed WTP upgrade is predicted to exceed \$30 million. The proposal would therefore need to be assessed under Part 4 Division 4.1 of the EP&A Act. The Minister (for Planning and Infrastructure) is the consent authority for State significant development (the Minister however may delegate the consent authority function to the Planning Assessment Commission, the Director-General or to any other public authority).

An Environmental Impact Statement (EIS) would need to be prepared in accordance with Schedule 2 of the *Environmental Planning & Assessment Regulation 2000*, which details the format and content for an EIS. The EIS would include the Director-General's Requirements for the development.

The Minister (or the Minister's delegate) would need to take into consideration the matters listed under section 79C of the EP&A Act when determining the development application.

Section 89J lists the approvals and legislation that are not applicable to State significant development.

3.3.2 Protection of the Environment Operations Act 1997

The NSW Environmental Protection Authority is responsible for the administration of the *Protection of the Environment Operations Act 1997* (POEO Act). The POEO Act regulates air, noise, land and water pollution. Activities listed under Schedule 1 of the POEO Act are scheduled activities which require an environment protection licence (EPL).

RWCC currently holds an EPL (number 614) to discharge supernatant from the WTP to Marshalls Creek. The licence authorises up to 1000 kL to be discharged per day. It is understood that once the WTP is augmented supernatant will no longer need to be discharged to the Creek (or will be discharged at a greatly reduced volume). The EPL may need to be varied under section 56 of the POEO Act.

Section 120 of the POEO Act makes it an offence to pollute waters. The construction of the upgraded WTP can be carried out without causing water pollution and therefore a licence would not be required. The Environment Protection Authority (EPA) is the Appropriate Regulatory Authority as the work is being undertaken by a public authority.

3.3.3 Protection of the Environment Operations (Waste) Regulation 2005

The *Protection of the Environment Operations (Waste) Regulation 2005* sets out the provisions with regards to non-licensed waste activities and non-licensed waste transporting, in relation to the way in which waste must be stored, transported, and the reporting and record-keeping requirements. The disposal of construction waste would be required to comply with this regulation.

3.3.4 Local Government Act 1993

Section 60 of the *Local Government Act 1993* (LG Act) states that approval is required from NSW Office of Water (NOW) to construct or extend water treatment works. Approval would therefore be required under Section 60 of the LG Act for the works.

3.3.5 Water Management Act 2000

RWCC currently holds a water access licence issued under the *Water Management Act 2000* (WM Act) to extract 7805 ML/year from the Murrumbidgee River (Water Access Licence 40AL400024). RWCC also has a 1000 ML high security licence number 40AL405344. The Murrumbidgee River is subject to the *Water Sharing Plan for the Murrumbidgee Regulated River Water Source 2003* which sets the rules for the management of water access licences, water allocation accounts, the extraction of water, the operation of dams and the management of water flows in the Murrumbidgee regulated river catchment. Typically RCWW use less than 50% of their water allocation and do not intend on increasing their extraction limit any further as part of the upgrade of the Wagga Wagga WTP.

Section 90 (2) of the WM Act provides for a water supply work approval which authorises its holder to construct and use a specified water supply work at a specified location. This includes work (such as a water pump or water bore) that is constructed or used for the purpose of taking water from a water source. However State significant development proposals are exempt from the requirement to gain approval from NOW and therefore no approval would be required to construct the new raw water pumping station as part of the WTP upgrade.

Controlled activity approvals are required when a work is constructed within waterways under Section 91E of the *Water Management Act 2000* (WM Act). However public authorities are exempt from the requirement to obtain such an approval (Clause 38 of the *Water Management (General) Regulation 2011*). Therefore RWCC is not required to obtain an approval under this Act for the works within waterways, such as for the new raw water intake.

Nevertheless, the works would be required to be constructed in accordance with the NSW Office of Water guidelines for the installation of instream structures and the protection of riparian zones.

3.3.6 National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act 1974* (NPW Act) provides for the statutory protection of Aboriginal cultural heritage places, objects and features. One of the objects of the NPW Act is the conservation of places, objects and features of significance to Aboriginal people (Section 2A). The NPW Act provides for the management of both Aboriginal Objects and Aboriginal Places.

Aboriginal Objects and Aboriginal Places are protected under Part 6 of the NPW Act and there are legislative penalties if a person harms or desecrates an Aboriginal Place or Object (s. 86). Harm to an Aboriginal Place or Object includes any act or omission that destroys,

defaces or damages the object or place, or, in relation to an Aboriginal object, moves the object from the land on which it had been situated.

A review of the OEH Aboriginal Heritage Information Management System (AHIMS) database did not identify any Aboriginal sites in the vicinity of the WTP site. A cultural heritage assessment would be undertaken as part of the EIS to determine whether the proposal would impact on items of Aboriginal cultural heritage sites and whether further assessment would be required.

It is noted that an Aboriginal Heritage Impact Permit (AHIP) under the Section 90 of the NPW Act is not required for State significant development.

3.3.7 Threatened Species Conservation Act 1995

The *Threatened Species Conservation Act 1995* (TSC Act) protects species of threatened flora and fauna, endangered populations and endangered ecological communities and their habitats in NSW.

The impacts of any works that may affect 'threatened species', as listed in the TSC Act, must be properly assessed. Impacts can include the destruction of threatened species habitat or potential habitat and the threatening ecological communities.

It is not expected that the works would impact on threatened species, their habitat or endangered ecological communities, however this would be confirmed as part of the EIS.

3.3.8 Fisheries Management Act 1994

The objectives of the *Fisheries Management Act 1994* (FM Act 1994) are to conserve, develop and share the fishery resources of the State for the benefit of present and future generations. The FM Act is administered by the Department of Primary Industries, Fisheries (DPI Fisheries).

A permit is required for any proposed dredging and reclamation works in 'waterland' undertaken by a local authority, in accordance with Section 200 of the FM Act. The works would require excavation within the Murrumbidgee River as part of the construction of the new raw water pumping station and therefore a permit under Section 200 would be required (it is noted that although Section 89J of the EP&A Act removes the requirement for persons not being public or local authorities to gain a permit under Section 201, the same does not apply to local authorities under Section 200).

The works are not expected to block fish passage and no approval under Section 219 of the FM Act would be required. There may be the requirement to relocate existing large woody debris or snags from the Murrumbidgee River and this would require approval from DPI Fisheries (which is considered to constitute dredging under Section 200 of the FM Act).

The installation of instream structures, the degradation of native riparian vegetation along New South Wales water courses and the removal of large woody debris from New South Wales rivers and streams is listed as a key threatening process under the Schedule 6 of the FM Act. The key threatening processes associated with the proposal and any potential impacts to threatened species, populations or endangered ecological communities, as listed in the FM Act would need to be assessed as part of the EIS.

3.4 Commonwealth Statutes

3.4.1 Environment Protection and Biodiversity Conservation Act 1999

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides for Commonwealth involvement in development assessment and approval in circumstances where there exist 'matters of national environmental significance'. Matters of national environmental significance include:

- World Heritage properties;
- National Heritage places;
- Ramsar Wetlands;
- Nationally threatened species and ecological communities;
- Migratory species;
- Commonwealth marine areas;
- Great Barrier Reef Marine Park; and
- Nuclear actions (including uranium mining).

No matters of national environmental significance as listed under the EPBC Act are likely to be significantly impacted by the proposed works.

3.5 Relevant Policies, Guidelines and Standards

The following policies, guidelines and standards would need to be considered during the preparation of the EIS;

- Wagga Wagga Development Control Plan 2010
- *Water Sharing Plan for the Murrumbidgee Regulated River Water Source 2003*
- *Murrumbidgee Catchment Management Plan* (Murrumbidgee CMA 2008)
- *Policy and guidelines for fish habitat conservation and management 2013 update*, (DPI, 2013)
- *Guidelines for Controlled Activities: Riparian Corridors* (DWE, 2008)
- *Guidelines for Controlled Activities: Watercourse Crossings* (DWE, 2008)

3.6 Consultation

RWCC have undertaken the following initial consultation as part of the proposal;

Essential Energy

RWCC have been discussing relocation of the overhead powerlines through the WTP site (in order to optimise space for the new WTP) since 2005. In 2010 we obtained a Design Information Package for the relocation of sub transmission lines. Great Southern Electrical (GSE) have been engaged to undertake the design and approval process for reconstruction of the powerlines underground. Design approval was received in August 2013. While there has not been structured consultation, during the above process RWCC have provided various site plans of proposed new WTP layout to Essential Energy (formerly Country Energy).

Caravan Park

RWCC have had discussions with the neighbouring Caravan Park directors at a meeting held in Kiama NSW in September 2013. The main purpose of the meeting was to discuss the possibility of a second access to the WTP site through their property. At the same meeting the proposal to upgrade the Wagga WTP was raised.

Wagga Wagga City Council

There are four Wagga Wagga City Council representatives that make up RWCC. Wagga Wagga City Council adopted the IWCM plan that included recommendation to construct a new WTP.

3.6.1 Agency Consultation

Consultation with the following stakeholders would be recommended during the preparation of the EIS.

- Wagga Wagga Council
- NSW Office of Water
- Office of Environment and Heritage
- Environment Protection Authority
- Department of Primary Industries (Fisheries)
- Road and Maritime Services
- Murrumbidgee Catchment Management Authority (CMA)

4 Project Justification

4.1 Water Demands

The population of Wagga Wagga is increasing steadily. It is predicted that by 2031, the population of the Wagga Wagga City will be 77,968 persons, an increase of 18,305 persons (30.68%) from 2006 (id, 2013). This represents an average annual growth rate of 1.18% (id, 2013).

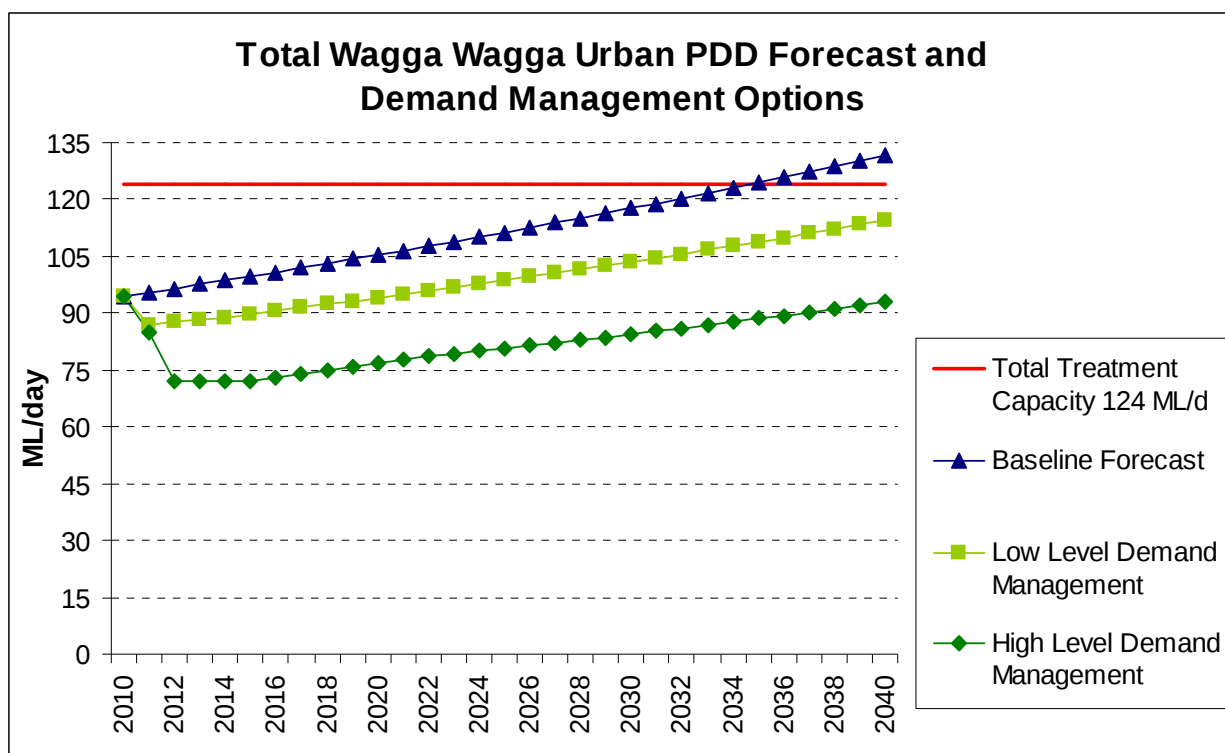
The Wagga Wagga WTP in combination with the East Wagga Wagga Borefield has a total capacity of 65 ML/day (HSC, 2010). Based on the results of the Integrated Water Cycle Management Strategy undertaken for the region (HSC, 2010), RWCC have adopted a demand of 115 ML/day for the year 2040, which is based on low level demand management (see Section 4.1.1 below).

The North, East and West Wagga Wagga Borefields can provide 60 ML/day. The upgraded Wagga Wagga WTP would therefore need to provide 55 ML/day to meet the adopted demand of 115 ML/day.

4.1.1 Demand Management

RWCC have implemented an ongoing program of demand management to reduce consumption through the more efficient use of water. This includes permanent restrictions on the use of fixed sprinklers and rebates for re-landscaping nature strips. RWCC are committed to undertaking additional works and programs to reduce water consumption as per the *Riverina Water County Council Demand Management Plan* (HSC 2012).

Figure 4-1 below shows the impact of the implementation of a low level demand management program (to be implemented by RWCC) on reducing water consumption.



Source: HydroScience 2012

Figure 4-1 Demand Management Impact on Water Consumption

4.2 Need for the Proposal

The Wagga Wagga WTP was originally constructed in 1930 with additional infrastructure added on a somewhat ad hoc basis ever since. The plant is ageing and much of the existing infrastructure components are nearing the end of their service life.

The Wagga Wagga WTP is currently constrained in its ability to meet current water demands as the plant is unable to treat raw water with turbidity levels greater than 100 NTU. The Murrumbidgee River is prone to high turbidity particularly during storm events. Monitoring data provided by RWCC shows that following storm events turbidity can remain between 500 - 1,500 NTU for some days. Under typical conditions however the turbidity of the river water varies between approximately 20 NTU and 40 NTU (HWA, 2012).

Periods of high river turbidity generally occur during periods of high rainfall when water demands are low and therefore these demands can currently be met by the East Wagga Wagga Borefield. However as water demands increase in line with the growing population borewater will be unable to satisfy the growing potable water demand. It is noted also that pumping from the borefield is subject to pumping limitations by the existing water access licences. The inability of the Wagga Wagga WTP to treat certain raw water parameters is restrictive and presents a high risk in the event that the East Wagga Wagga Borefield is taken offline.

RWCC have implemented demand management strategies which will reduce water consumption, however water demand will continue to grow in line with population growth, albeit at a reduced rate.

The upgrade of the existing Wagga Wagga WTP would ensure a secure production of up to 40 ML/d from the Murrumbidgee River in the short to medium term, and 55 ML/d by 2026. This would ensure the people of the Wagga Wagga Region have access to a safe and reliable potable water source for the long term.

4.3 Option Evaluation

4.3.1 Site Location Evaluation

The existing Wagga Wagga WTP site was the only site considered for the siting of the new WTP. The site is located in a predominately light industrial / commercial area and has been utilised for water treatment since 1930's. It is a largely disturbed site with suitable area to accommodate the new plant. Some existing water treatment infrastructure will be retained and incorporated into the design of the upgraded plant (see Section 4.3.2 below). The new WTP would be largely confined to the existing WTP footprint, thereby minimising the overall environmental impacts.

4.3.2 Use of Existing Infrastructure

An assessment of the existing infrastructure at the Wagga Wagga WTP was undertaken as part of the feasibility study for the proposal (HWA, 2012). As part of this assessment it was determined that it was not feasible to retain the majority of existing infrastructure for incorporation into the new treatment process due to the following;

- insufficient hydraulic capacity and size for the ultimate 55 ML/d upgrade,
- unreliability issues due to age and the condition,
- existing arrangements and pipework being very complex and requiring a convoluted pipework system to connect the existing infrastructure to new infrastructure,
- structural uncertainties of existing infrastructure, and
- cost of retro fitting not being favourable against the installation of new, modern and more reliable infrastructure.

However the following existing treatment components will be retained and utilised for a different function as part of the upgraded plant;

- Clarifiers 1 & 2 to be converted and used as filter backwash wastewater batch settling tanks,
- Balance tank to be utilised as the sludge holding tank for the centrifuges, and
- Existing two centrifuges would be retained and used in conjunction with two new centrifuges.

4.3.3 Treatment Option Evaluation

Three treatment technologies were evaluated as part of the feasibility report (HWA, 2012). A comparison matrix was developed to compare and assess the options to assist in identifying a preferred option.

A cost analysis of all three options was undertaken based on a combination of:

- Market pricing (at current exchange rate for overseas equipment);
- Benchmarking of recent projects;
- First principals estimating;
- Preliminary designs, sketches and scope of works.

The cost analysis determined that the total project cost for all three options was very similar as shown in Table 4-1 below.

Table 4-1 Cost Estimate for all three options

Wagga Wagga WTP Options	Total Project Cost Estimate
Option 1: Inclined Plates 55 ML/d	\$37,889,000
Option 2: Reactivator Clarifiers 55 ML/d	\$38,599,000
Option 3 Actiflo™ 55 ML/d	\$38,096,000

As all options were quite similar with regards to the capital and operating expenses and treatment technology and process, a non-financial comparison was undertaken. The highest scoring option when comparing non-financial criteria was the Inclined Plates option with an overall score of 80%. The Reactivator Clarifier was placed second with 77% and finally the Actiflo™ option was third with 62%.

RWCC is currently considering Options 1 and 2 as the preferred option in the Concept Design Phase.

5 Environmental Impact Identification and Assessment

This section briefly outlines the potential environmental impacts which may arise as a result of the construction and operation of the proposal. Preliminary mitigation measures are identified to manage and address the environmental impacts.

5.1 Preliminary Risk Assessment

A preliminary assessment was undertaken to identify key environmental risks associated with the construction and operation of the Wagga Wagga WTP. The key environmental aspects identified during the risk assessment are summarised in the Table 5-1. More details for each environmental aspect is provided in the preceding sections.

Table 5-1 Preliminary Risk Assessment

Environmental Issue	Environmental Aspect (or hazard)	Potential Environmental Impact	Level of Risk without Controls	Comment / Mitigation Measure
Surface Water	Excavation and ground disturbance Instream works for raw water intake	Sedimentation in waterway	Moderate	Instream silt curtains Sediment and erosion controls ensuring runoff diverting around the site.
Noise and Vibration	Operational noise	Disturbance to neighboring caravan park	Moderate to major	Noise assessment to quantify noise impacts Acoustic barriers or other controls to reduce impacts.
Traffic and access	Construction traffic entering and leaving site	Safety of other road users	Major	Traffic assessment to assist appropriate controls to reduce impact.
Flora and Fauna	Vegetation clearing and site disturbance	Disturbance / impact to native flora and fauna	Minor	Very little native vegetation on site.
Aboriginal Heritage	General site disturbance during construction	Disturbance / impact to items of Aboriginal cultural heritage	Minor	Low likelihood of Aboriginal sites being present.
Historical Heritage	General site disturbance during construction	Impact to items of historic heritage	Minor	Heritage items will not be directly impacted by the works.
Waste	Construction waste	Wastes leaving the site and impacting on surround land and water quality.	Moderate	Waste practices implemented to minimise waste generation and to manage waste generated.

5.2 Noise

Whilst the Wagga Wagga WTP currently generates noise through the operation of the treatment infrastructure (aerators) no noise complaints have been made due to the operation of the plant. A low level hum and some splash noise is audible on the adjacent walking track

(along Marshalls Creek) on the western boundary. The only sensitive noise receiver in the direct vicinity of the WTP is the caravan park located on the eastern boundary. Noise from the operation of the existing plant is not audible at the neighbouring caravan park.

Traffic along the Sturt Highway can be heard in some areas of the site.

Construction

Short term construction noise would be expected during the 14 month construction period. A noise assessment in accordance with the *Interim Construction Noise Guidelines* (DECC, 2009) would be undertaken to determine predicted construction noise and management strategies to reduce the impact of noise on surrounding sensitive receivers.

Operation

The upgraded WTP is likely to result in increased noise generation. Some of the new infrastructure components would be located closer to the eastern boundary which presents an increased risk that operational noise may be audible to the neighbouring caravan park.

Noise generated from the upgraded plant would be quantified through a noise assessment and appropriate mitigation measures developed, including the establishment of an appropriate day, evening and night time operating criteria for the upgraded plant.

5.2.1 Mitigation

- A Construction Noise Management Plan would be prepared which would identify site specific mitigation measures to reduce construction noise based on the construction method proposed.
- Consultation would be undertaken with neighbouring properties with regards to the construction program and likely noise impacts.
- An operational noise assessment would be undertaken to determine appropriate operational criteria with which the WTP would need to meet. The noise assessment would include recommendations (if required) to reduce noise emissions from the plant.
- Noise verification / monitoring would be undertaken post construction to ensure the operation of the WTP meets the established noise criteria.

5.3 Traffic and Access

The Wagga Wagga WTP is located on Hammond Avenue which forms part of the Sturt Highway. The Sturt Highway commences near Gundagai south west of Sydney and traverses due west terminating in South Australia. The Highway has a total length of approximately 950 km. The Sturt Highway is a classified road which is managed and financed by Roads and Maritime Services.

Hammond Avenue at the entrance to the WTP narrows from four lanes to one lane in each direction to cross Marshalls Creek. The speed limited is 60 km/hr in the vicinity of the WTP site. The road experiences moderate to high traffic volumes. According a traffic study undertaken for a development to the east of the WTP, traffic volume on Hammond Avenue is 16,000 vehicles per day (GDH, 2008). There is no sealed footpath along Hammond Avenue.

Construction

The construction workforce would vary according to the work being carried out at the site, the construction method and contractor's program. Indicative average numbers during the 14 month construction period would be in the order of 15-20 employees and an average of 5-10 truck movements per day. Particular operations are likely to require more frequent truck movements such as concreting works. A more accurate estimation of construction traffic would be undertaken as part of the EIS.

Given the high volume of traffic along Hammond Avenue, appropriate traffic controls would need to be implemented to minimise impacts to other road users. It is likely that restrictions would be placed on vehicles exiting the site, such as permitting one way egress only from the site during construction (ie no left turn on to Hammond Avenue) due to safety.

Whilst construction works may cause some inconvenience to local road users, impacts would be short-term.

Operation

Traffic levels to and from the site would be similar to the preconstruction levels.

5.3.1 Mitigation

A Traffic Management Plan (TMP) would be prepared for the construction works. The TMP would assess the safety of the entrance point to the WTP from Hammond Road and develop appropriate management measures to ensure the safety of other road users.

Consideration would be given to allowing one way egress only from the site during construction (ie no left turn on to Hammond Avenue).

5.4 Flora and Fauna

The Wagga Wagga WTP site is highly disturbed with limited habitat potential for native species. The riparian corridor along Marshalls Creek and the Murrumbidgee River is outside the boundary fence line.

A number of threatened flora and fauna species have been recorded in the Wagga Wagga LGA, however a search of the OEH Wildlife Atlas found that no threatened flora or fauna had been recorded in the vicinity of the WTP site.

It is considered unlikely that any riparian vegetation will require clearing, however it may be necessary to clear some landscaped species within the WTP grounds. The impact of any clearing would be assessed in a flora and fauna assessment, although the impact is predicted to be minimal.

The Murrumbidgee River forms part of the *Aquatic Ecological Community In The Natural Drainage System Of The Lower Murray River Catchment*, which is listed as an endangered ecological community under the FM Act. The impacts to this community would be assessed as part of the Flora and Fauna Assessment undertaken as part of the EIS. This would look specifically at the aquatic impacts associated with the construction and operation of the new raw water intake.

5.4.1 Mitigation

A Flora and Fauna Assessment of the works would be undertaken.

All recommendation measures resulting from the flora and fauna assessment would be implemented.

5.5 European Heritage

The Wagga Wagga WTP site is listed as having local heritage significance under the Wagga Wagga LEP. The listing relates to a number of the existing structures at the site these being the "Riverside Residence" and the original pump house building (see Figure 1 4 and Plate 1 and 2, Appendix A).

The Riverside Residence and original pump house building would not be impacted by the proposed upgrade. A Historic Heritage Assessment would be undertaken to assess the potential for the upgrade works to impact on the overall European heritage significance of the site.

5.5.1 Mitigation

A Historic Heritage Assessment of the works would be undertaken.

The heritage listed Riverside Residence and original pump house buildings would be retained.

5.6 Aboriginal Heritage

The Wagga Wagga WTP is located on the Murrumbidgee River floodplain. The site is flat with no elevated areas. A review of the AHIMS database has revealed that no Aboriginal heritage sites are located on the site or within 1 km of the site. Given the existing level of disturbance and the landscape characteristics, the site is considered to have very low archaeological sensitivity. It is not expected that proposal would impact on previously unrecorded Aboriginal items. However, an Aboriginal Cultural Heritage Impact Assessment of the works would be undertaken as part of the EIS.

5.6.1 Mitigation

An Aboriginal Cultural Heritage Impact Assessment of the works would be undertaken.

The construction works would comply with all the recommendations provided in the Aboriginal assessment.

5.7 Water Quality, Sediment and Erosion Control

Construction

The area of disturbance required during construction is predicted to be approximately 1.35 ha. Most of the construction works would be undertaken in locations away from the Murrumbidgee River and Marshalls Creek boundary fence lines. The site is very flat and sediment and erosion controls would be implemented to prevent runoff leaving the site.

There will be the requirement to install a new raw water intake structure to extract water from the Murrumbidgee River (see Appendix B for approximately location). This may require the construction of a cofferdam within the River to undertake the works. The new raw water intake would be located so as to avoid the clearing of mature riparian vegetation.

Operation

Supernatant from the sludge thickening process is currently discharged to Marshalls Creek. Under the upgraded plant supernatant would be UV disinfected before being returned to the treatment stream. No discharges from the upgraded Wagga Wagga WTP are therefore proposed.

Post construction, there will be no increase in water extraction from the Murrumbidgee River beyond the existing water access licence conditions.

5.7.1 Mitigation

A site specific Soil and Water Management Plan would be prepared to detail all appropriate controls to ensure sediment is not washed into the nearby Murrumbidgee River or Marshalls Creek.

Appropriate approvals would be obtained prior to undertaking the instream works.

Instream works to be undertaken in accordance with NOW and DPI Fisheries best practice guidelines.

5.8 Flooding

The Wagga Wagga WTP is located on the bank of the Murrumbidgee River and is prone to inundation during floods. Riverina Water is proposing to upgrade the existing flood levee

around the entire WTP site to provide 1 in 100 year flood protection. This would be undertaken as a separate project and constructed prior to the commencement of the upgrade works. All new infrastructure proposed as part of the WTP has been designed based on this assumption and therefore flooding of the site is considered to be unlikely.

5.9 Visual

The WTP is partially screened along the Marshalls Creek boundary and is set back from Hammond Avenue and therefore not generally visible to the public.

The upgraded WTP would be located closer to the eastern site boundary than the current plant. Whilst the lower portion of the eastern boundary (towards Hammond Avenue) contains a vegetative screen, the upper portion (near the Murrumbidgee River) does not. Screening vegetation would be planted along the entire boundary as part of the works.

Provided screening of the plant is undertaken, no impacts are predicted post construction.

5.9.1 Mitigation

Screening vegetation to be planted along all boundaries of the WTP.

5.10 Waste

Construction

There would be little with regards to construction waste as part of the upgrade works. Most of the redundant infrastructure and buildings will be retained post construction. A section of the existing builder's workshop would be removed to accommodate the new treatment equipment.

Waste likely to be generated as a result of the construction works would include;

- Excess spoil due to site levelling, construction of in-ground infrastructure (ie pipework, tanks etc), establishment of foundations. It is likely that most of the spoil resulting from the construction works would be reworked on site such as for backfill and internal road works.
- Redundant mechanical and electrical equipment including pumps, electrical cabinets, pipes.
- Miscellaneous waste such as from excess building materials and packaging.
- Some green (vegetation) waste from onsite clearing. There is little in the way of landscaped species at the site so green waste is expected to be minimal.
- General personnel waste from construction staff.

It is predicted that waste can be managed to ensure that no environmental impacts result.

Operation

As per the current practice at the Wagga Wagga WTP, dewatered sludge solids would be transported off site for disposal.

All supernatant resulting from the treatment stream would be disinfected and returned to the headworks of the plant for treatment.

5.10.1 Mitigation

The contractor undertaking the works would detail waste management procedures in a Waste Management Plan. The contractor is to assume responsibility for the appropriate disposal of any waste generated.

The Waste Management Plan is to include:

- details of (classification of waste in accordance with EPA guidelines), and the waste management action proposed for each type of waste;
- procedures that ensure the waste is transported to a lawful place; and
- a description of the roles and responsibilities of everyone who manages the waste, including the site supervisor and sub-contractors.

5.11 Odour / Air Quality

It is considered unlikely that odour would be generated from the operation of the the upgraded plant. The new WTP will be designed to ensure that any odour issues are minimised and meet best practice guidelines for operation. This includes, for example, ensuring that sludge (water treatment by-products) is managed to avoid any potential odour impacts particularly dewatering and during storage.

5.11.1 Mitigation

The plant would be designed and operated in accordance with best practice guidelines.

5.12 Chemical Usage

The Wagga Wagga WTP currently uses Chlorine Gas for disinfection purposes. Chlorine is listed as a dangerous good in the Australian Dangerous Goods Code (ADG Code) (class 2.3, toxic gas) and is classified as a hazardous substance by the National Occupational Health and Safety Commission (NOHSC). The plant also utilises alum (Aluminium Sulphate), silica, lime and fluoride in the treatment stream.

The type of chemicals used in the upgraded plant would be similarly to that currently used. However the upgraded WTP will have a greater treatment capacity and greater requirement for the storage and dosing of chemicals.

Chemical storage and dosing at the upgraded plant would include;

- Aluminium Sulphate;
- Soda ash;
- Polymer; and
- Liquid sodium hypochlorite.

5.12.1 Mitigation

A preliminary hazard analysis would be undertaken in accordance with current Department of Planning and Infrastructure guidelines including *Hazardous and Offensive Development Application Guidelines Applying SEPP 33* to assess the increased chemical storage and usage associated with the upgraded plant.

All WTP operators would have appropriate training and qualifications to handle the chemicals used at the plant.

Chemicals would be transported, stored, handled and dosed in accordance with all relevant legislation, Australian Standards and guidelines.

6 Conclusions and Recommendations

6.1 Summary of Recommendations

Further Studies

The following is a summary of further specialist studies required to support the EIS;

- Noise Impact Assessment
- Flora and Fauna Assessment
- Traffic Assessment
- Aboriginal and Historic Cultural Impact heritage assessment

6.2 Conclusion

Whilst some environmental impacts are expected during the construction and operation of the upgraded Wagga Wagga WTP, it is predicted that the through the implementation of appropriate mitigation measures that the impacts can be managed so as not to result in a significant impact on the environment.

7 References

DECC (2009) *Interim Construction Noise Guidelines*,

DECCW (2010) *Due Diligence Code of Practice for the Protection of Aboriginal Objects* in NSW

GHD (2008) *Report for Wagga Planning Studies Traffic Management - Hammond Avenue North*
September 2008

Hunter Water Australia (2012) *Upgrade of Wagga Wagga Water Treatment Plant Feasibility Study*
Report (Final)

HydroScience Consulting (2012) *Riverina Water County Council Demand Management Plan*
November 2012.

HydroScience Consulting (2010) *Joint Integrated Water Cycle Management Evaluation Study*

Id (2013) <http://forecast2.id.com.au/Default.aspx?id=304&pg=5520>

Appendix A – Site Photographs



Plate 1 – Original Pumphouse Building



Plate 2 – Original Pumphouse Building



Plate 3 – Raw water intake pipes



Plate 4 Murrumbidgee River



Plate 5 Murrumbidgee River



Plate 6 Murrumbidgee River boundary (to the left), bore water aeration plant in the background



Plate 6 Showing aeration plant and builders workshop



Plate 7 Showing sludge plant



Plate 8 Approximate location of new raw water intake



Plate 9 View of eastern site boundary showing caravan park



Plate 10 Builders workshop



Plate 11 Site entrance driveway



Plate 12 WTP entrance



Plate 13 Marshalls Creek



Plate 14 Marshalls Creek



Plate 14 View of WTP from Marshall Creek walking track

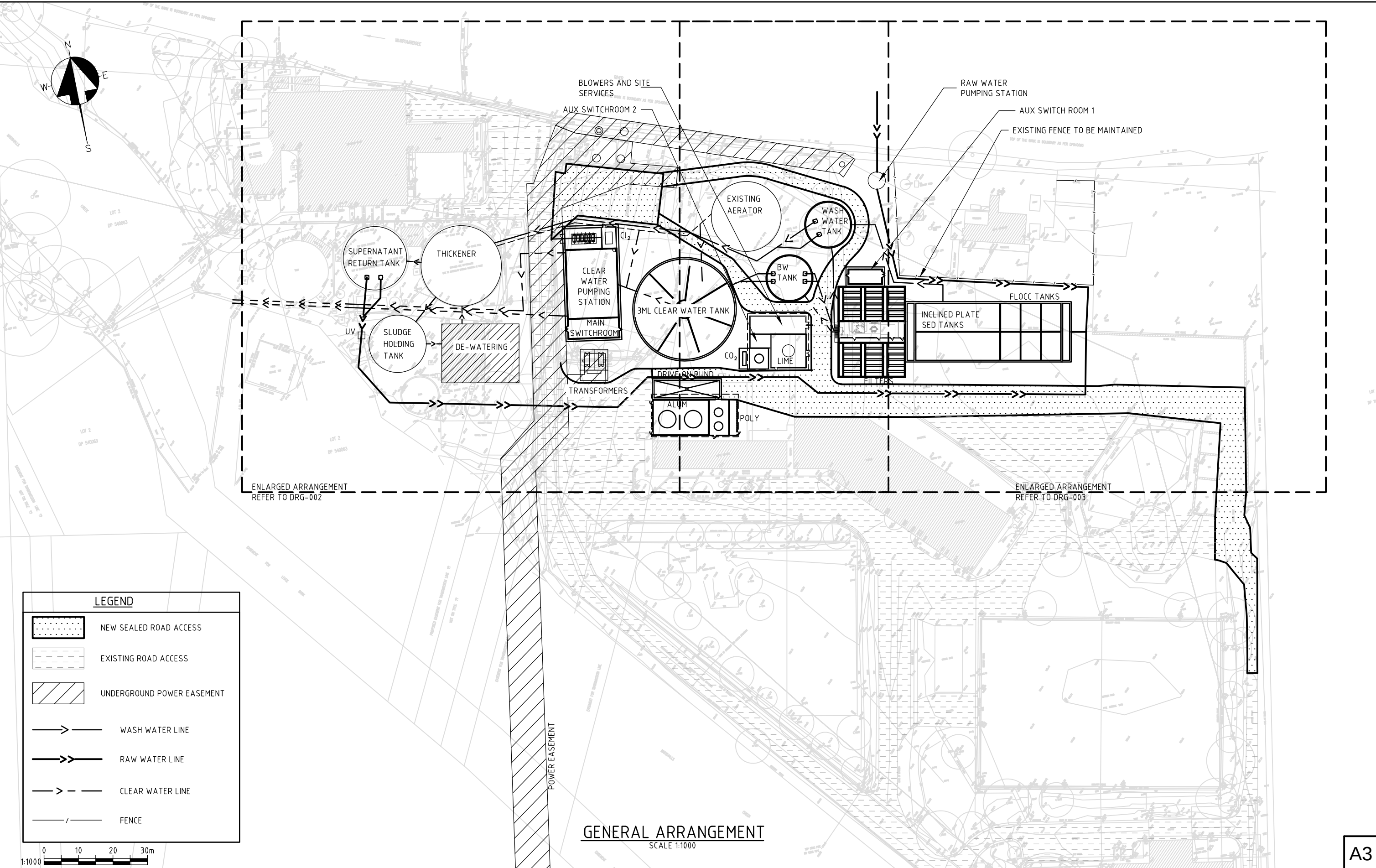


Plate 13 Marshall's Creek walking track



Plate 13 Western site boundary, showing clearwater tank in the background

Appendix B – Preliminary site layouts for the preferred WTP options

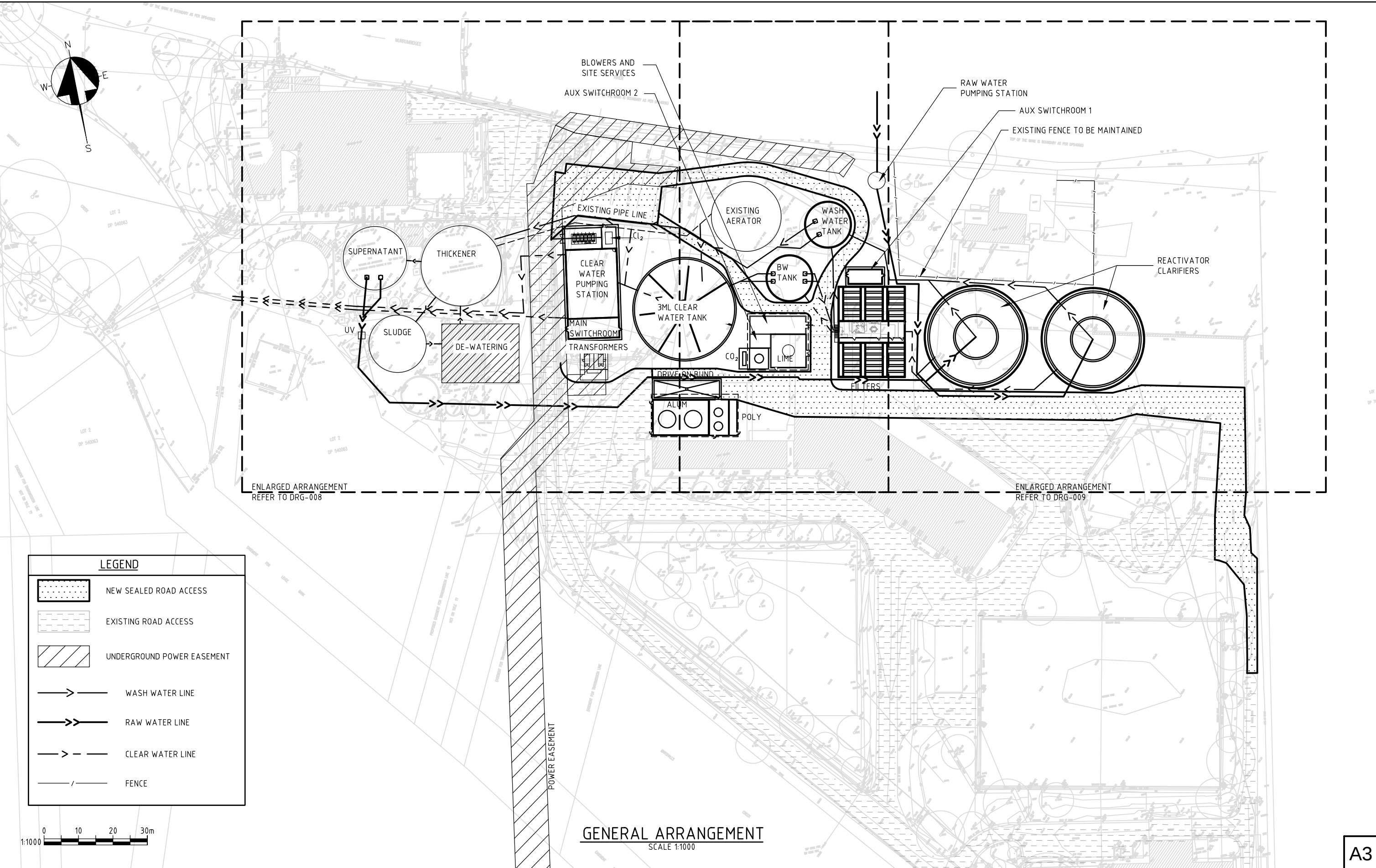


LEGEND

NEW SEALED ROAD ACCESS

EXISTING ROAD ACCESS

AMENDMENTS				Designed XXX		Checked XXX	HORIZONTAL Co-ordinate System - BM Adopted - East - North -	Hunter Water Australia Pty Ltd. ABN 19 080869905 19 SPIT ISLAND CLOSE STEEL RIVER, MAYFIELD WEST NSW 2304 PO Box 5007 HRMC NSW 2310 PH (02) 4941 5000 FAX (02) 4941 5011 Quality ISO 9001 ● ISO GLOBAL	RIVERINA WATER COUNTY COUNCIL WAGGA WAGGA WATER TREATMENT PLANT OPTION 1 INCLINED PLATES & DUAL MEDIA FILTERS + NEW CWT GENERAL ARRANGEMENT	Scale AS SHOWN at A3	Document No SKETCH- C -001
C	17.04.2012	REVISED DRAFT	KK	Drawn KK		Checked XXX				Status DRAFT	Version C
B	16.04.2012	REVISED DRAFT	KK	Approved XXX		-	VERTICAL Datum - BM Adopted - Reduced Level -				
A	30.03.2012	DRAFT	KK	HWA Project Number 3545		-					
Ver	Date	Description	Drawn								



AMENDMENTS				Designed XXX		Checked XXX		Hunter Water Australia Pty Ltd. ABN 19 080869905 19 SPIT ISLAND CLOSE STEEL RIVER, MAYFIELD WEST NSW 2504 PO Box 5007 HRMC NSW 2310 PH (02) 4941 5000 FAX (02) 4941 5011 Quality ISO 9001 • ISO GLOBAL	RIVERINA WATER COUNTY COUNCIL		Scale	Document No
				Drawn KK	Checked XXX			Hunter Water Australia	WAGGA WAGGA WATER TREATMENT PLANT		AS SHOWN	SKETCH- C - 007
C	17.04.2012	REVISED DRAFT	KK	Approved XXX					OPTION 3 REACTIVATOR CLARIFIERS & DUAL MEDIA FILTERS + NEW CWT		at A3	
B	16.04.2012	REVISED DRAFT	KK						GENERAL ARRANGEMENT		Status	
A	30.03.2012	DRAFT	KK	HWA Project Number 3545							DRAFT	Version
Ver	Date	Description	Drawn									C

Appendix C – Treatment Process Schematics

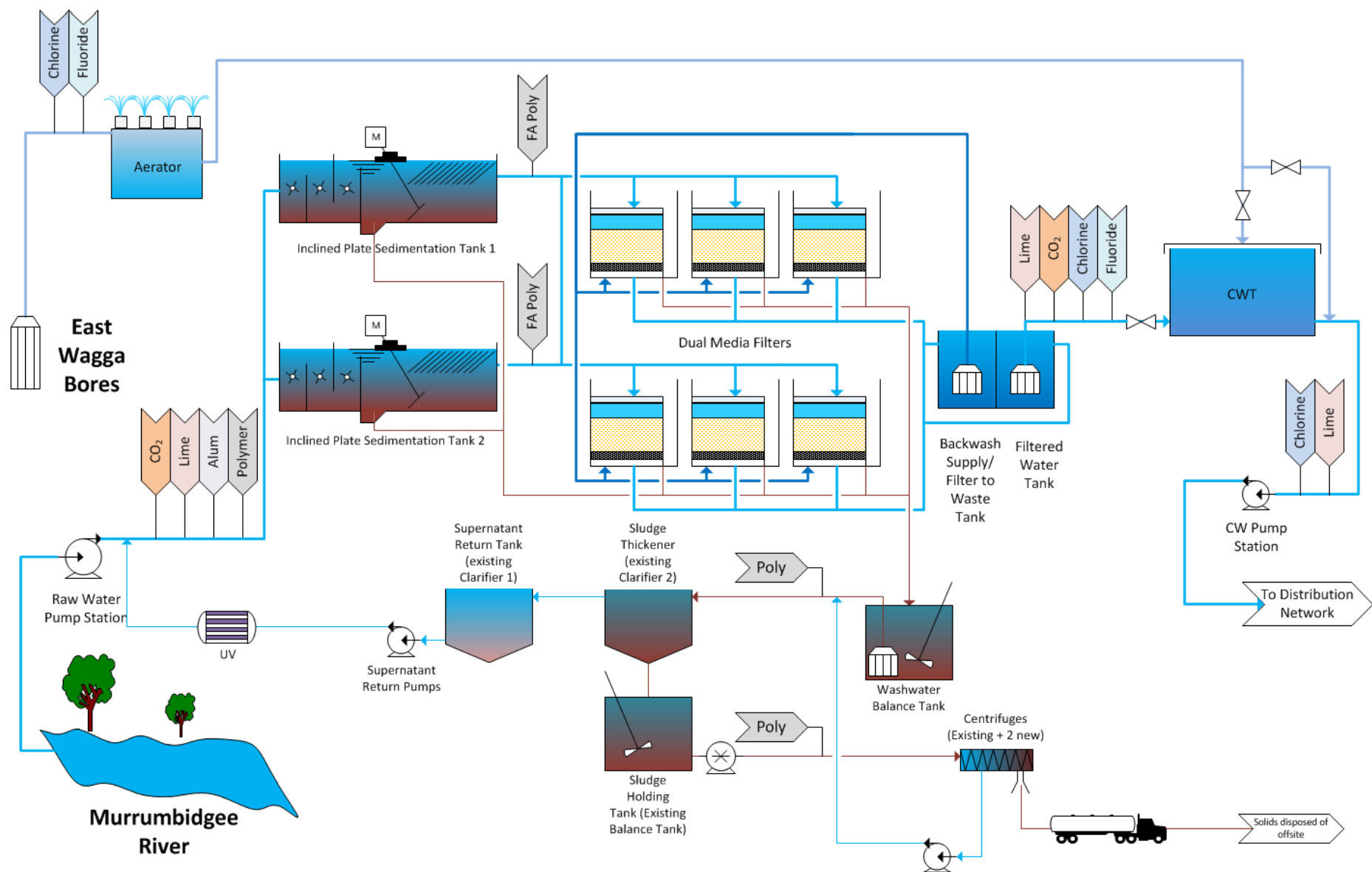


Figure 6-1: Inclined Plate and Dual Media Filter Option - Process Flow Diagram.

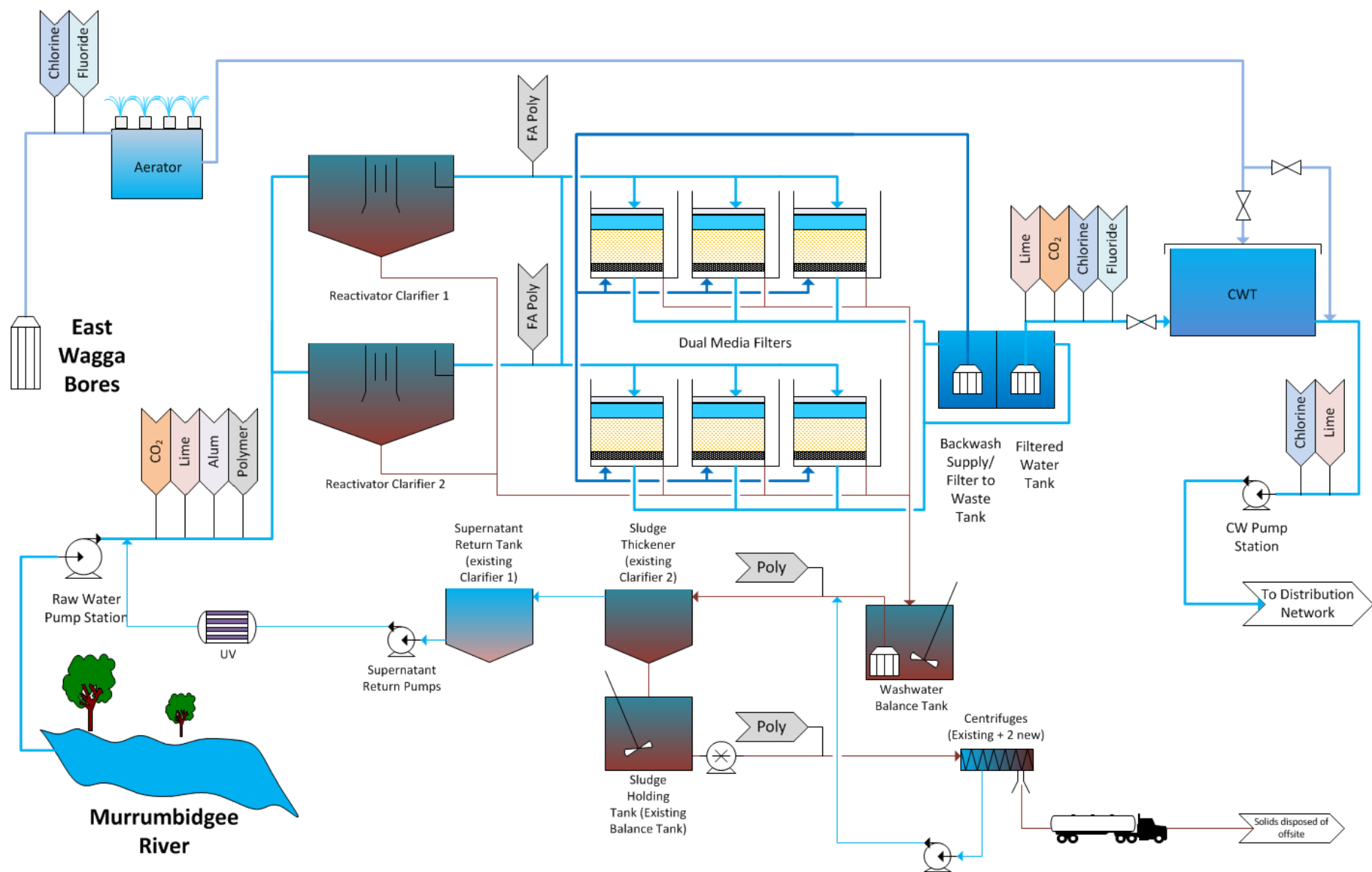


Figure 6-7 Reactivator Clarifier and Dual Media Filter Option - Process Flow Diagram.

Appendix D – Detailed cost estimates for the preferred WTP options

Option 1 Inclined Plates cost summary (HWA, 2012)

Wagga Wagga WTP - Option 1 - 55 MLD - Description	% of Cost	Total
Direct Costs		
Site Establishment (Based on 18 months)	2.7%	\$735,000
Raw Water Pumping	11.5%	\$3,145,000
Clear Water System	15.1%	\$4,107,000
Clear Water Storage baffling	0.4%	\$101,000
Chemical Dosing	10.5%	\$2,868,000
Clarification	12.1%	\$3,301,000
Filtration	19.4%	\$5,300,000
Backwash Storage (700kL)	1.6%	\$443,000
Washwater Storage (700kL)	1.7%	\$454,000
Process residuals	0.5%	\$125,000
Mechanical Dewatering	2.7%	\$733,000
Compressed Air System & Service Water Pumps	0.3%	\$85,000
Instrumentation	0.8%	\$227,000
General piping and valves between processes	6.7%	\$1,827,000
Curb & Guttering	2.6%	\$704,000
Site Power Supply	0.7%	\$200,000
Main Switchroom	1.4%	\$390,000
Control Room	0.9%	\$253,000
Site underground Conduit & Pits	0.6%	\$150,000
PLC/SCADA system	2.2%	\$600,000
Services	0.1%	\$18,000
Decommissioning and Demolition	0.7%	\$200,000
Subtotal		\$27,259,000
Indirect Costs		
Eng. Design (Total)	15%	\$4,089,000
Project Management & commissioning	12%	\$3,271,000
Contractor Profit	12%	\$3,271,000
Subtotal		\$10,631,000
Total Project Cost		\$37,889,000
Risk Analysis Output		
	P90	P50
Inherent Risk - Total Construction Estimate	\$38,478,000	\$36,787,000

Option 2 Reactivator Clarifiers cost summary (HWA, 2012)

Wagga Wagga WTP - Option 3 - 55 MLD - Description	% of Cost	Total
Direct Costs		
Site Establishment (Based on 18 months)	2.6%	\$735,000
Raw Water Pumping	11.3%	\$3,145,000
Clear Water System	14.8%	\$4,107,000
Clear Water Storage baffling	0.4%	\$101,000
Chemical Dosing	10.3%	\$2,869,000
Clarification	12.9%	\$3,579,000
Filtration	19.1%	\$5,300,000
Backwash Storage (700kL)	1.6%	\$443,000
Washwater Storage (700kL)	1.6%	\$454,000
Process residuals	0.7%	\$196,000
Mechanical Dewatering	2.4%	\$662,000
Compressed Air System & Service Water Pumps	0.3%	\$85,000
Instrumentation	0.8%	\$227,000
General piping and valves between processes	7.3%	\$2,034,000
Curb & Guttering	2.5%	\$704,000
Site Power Supply	0.7%	\$200,000
Main Switchroom	1.4%	\$390,000
Control Room	0.9%	\$253,000
Site underground Conduit & Pits	0.5%	\$150,000
PLC/SCADA system	2.2%	\$600,000
Services	0.1%	\$18,000
Decommissioning and Demolition	0.7%	\$200,000
Subtotal		\$27,769,000
Indirect Costs		
Eng. Design (Total)	15%	\$4,166,000
Project Management & commissioning	12%	\$3,333,000
Contractor Profit	12%	\$3,333,000
Subtotal		\$10,830,000
Total Project Cost		\$38,599,000
Risk Analysis Output		
	P90	P50
Inherent Risk - Total Construction Estimate	\$39,228,000	\$37,481,000