APPENDIX D

Revised ‘Wastewater Working Paper’ prepared by Jacobs.

New Grafton Correctional Centre

Infrastructure New South Wales

Wastewater Servicing Working Paper

Final | 6

10 November 2016

New Grafton Correctional Centre

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Terms and acronyms used in this document

Acronym	Definition
AGWR	Australian Guidelines for Water Recycling: Managing Health and Environmental Risks (Phase 1), 2006
EPA	NSW Environment Protection Authority
EPL	Environment Protection Licence
NGCC	New Grafton Correctional Centre
POEO	Protection of The Environment Operations
OWMS	Onsite wastewater management system
STP	Sewerage Treatment Plant
DBYD	Dial Before You Dig
DPE	Department of Planning and the Environment
EIS	Environmental Impact Statement
INSW	Infrastructure New South Wales
LGA	Local Government Area
NBN	National Broadband Network
NGCC	New Grafton Correctional Centre
NSW	New South Wales
OSD	On Site Detention
Project	Comprises the New Grafton Correctional Centre which will provide up to 1,700 new prison beds, within a maximum and minimum security correctional centre with relevant support services and facilities.
Project Site	Comprised of two properties Lot 26 DP 751376 and Lot 1 DP 1190399 and is located at 313 Avenue Road, Lavadia.
Proposal	Comprises the concept proposal and the Stage 1 works development application.
SEARs	Secretary's Environmental Assessment Requirements
SEPP	State Environmental Planning Policy
SSD	State Significant Development

Executive Summary

Infrastructure NSW (INSW) on behalf of Corrective Services NSW (CSNSW), a division of the Department of Justice, is seeking approval under Division 4.1, Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) for the concept proposal and Stage 1 Development Application (DA) for the New Grafton Correctional Centre (the Project). The concept proposal and the Stage 1 works application comprise the Proposal.

The Project satisfies the criteria of Schedule 1 of *State Environmental Planning Policy (State and Regional Development) 2011* as the capital investment value of the correctional centre as proposed exceeds $30 million. As such, the Project is declared to be as State Significant Development (SSD) under Division 4.1, Part 4 of the EP&A Act and the Minister for Planning is the consent authority for the application. The Secretary's Environmental Assessment Requirements (SEARs) for the Proposal were issued by the Department of Planning and Environment (DPE) on 21 December 2015.

The Project is located approximately 12.5 kilometres southeast of Grafton; within the Clarence Valley Local Government Area (LGA) at 313 Avenue Road, Lavadia (the Project Site). The Project Site includes two properties comprised of Lot 26 DP 751376 and Lot 1 DP 1190399 and is 195 hectares in size.

This study investigates a number of options for provision of wastewater services to the New Grafton Correctional Centre (NGCC). This assessment has identified that the Project Site would be serviced by an onsite wastewater management system as the closest existing wastewater system (Clarenza STP which is owned and operated by Clarence Valley Council) is too far away. An onsite wastewater management system would require construction of a wastewater treatment plant at the site, along with suitable conveyance infrastructure (pumps and pipes) to transfer the wastewater from the facilities to the wastewater treatment plant.

Three options were considered and the preferred option recommended by this assessment consists of onsite treatment of the sewage generated by the Project during operations. However this would not be confirmed until the Stage 2 of the Project. A portion of the treated effluent would be reused within the facility via a dual reticulation system (for compatible uses such as irrigation of playing fields, water for cooling towers and toilet/urinal flushing). The remainder of the treated effluent would be used for an agricultural irrigation scheme located on the remaining land at the site, including an irrigation storage dam. This would be established at the site to maximise reuse of effluent and, provided there is sufficient area available for irrigation and a suitable storage dam is constructed onsite, all remaining effluent can be reused. This would avoid any discharge of treated effluent to the environment. This approach maximises reuse by including irrigation of the remaining open spaces at the site, outside of the correctional facilities, in addition to the dual reticulation reuse system.

In order to determine the suitability of the site, and identify any specific areas or locations that are not suitable for effluent irrigation, a detailed site and soil study is required to be undertaken. In the absence of such information, a desktop level analysis has been undertaken on the possible scale of the irrigation area. For the analysis, an agricultural irrigation system with an irrigation area of 25 ha with a 20 ML storage dam is proposed. The Project Site has a total area of around 195 ha, of which 125 hectares is considered from the preliminary analysis to be suitable for effluent reuse, hence it is likely that suitable space is available for a 25 ha irrigation area, although placement within the asset protection zone would need to adhere to the requirements of the Bushfire Assessment Report. At this stage only a preliminary analysis of the site's soil characteristics has been undertaken, which indicated no severe impediment to effluent irrigation. However it is recommended that once the exact location is identified in the Stage 2 DA that further assessment, including a detailed soil suitability study be undertaken in accordance with the requirements of the *Environmental Guidelines: Use of Effluent by Irrigation* (NSW DEC, 2004). This would identify any areas on the site that are not suited to effluent irrigation, and would identify any mitigating factors, such as soil improvement and target nutrient concentrations in the recycled water, to manage potential impacts to the environment.

An indicative order of magnitude cost for the preferred option is estimated to be within a range of $14 million and $26 million.

The average inflow of wastewater to the onsite facility at ultimate capacity is 470 kilolitres per day (kL/d) which is equivalent to around 2,240 equivalent persons based on an adopted standard of 210 L/EP/d. Whilst this is

less than the threshold for scheduled activities under the *Protection of the Environment Operations Act 1997* (2,500 equivalent persons), it is recommended that an Environment Protection Licence be obtained for the wastewater system from the NSW Environment Protection Authority, which would make it the appropriate regulatory authority. This would allow discharge of any excess treated effluent to the environment.

This *Wastewater Working Paper* helps to fulfil some of the requirements under the Secretary's Environment Assessment Requirements (SEARs) No 12 issued for the Proposal in regards to the management of operational wastewater. Further assessment will be required as part of the Stage 2 DA once the preferred option for managing wastewater is identified.

1. Introduction

1.1 Background

Infrastructure NSW (INSW) on behalf of Corrective Services NSW, a division of the Department of Justice, is seeking approval under Division 4.1, Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) for the concept proposal and Stage 1 Development Application (DA) for the New Grafton Correctional Centre (the Project).

The Project satisfies the criteria of Schedule 1 of *State Environmental Planning Policy (State and Regional Development) 2011* as the capital investment value of the correctional centre exceeds $30 million. As such, the Project is declared to be a State Significant Development (SSD) under Division 4.1, Part 4 of the EP&A Act and the Minister for Planning is the consent authority for the application. The Secretary's Environmental Assessment Requirements (SEARs) for the Proposal were issued by the Department of Planning and Environment (DPE) on 21 December 2015.

1.2 Locality

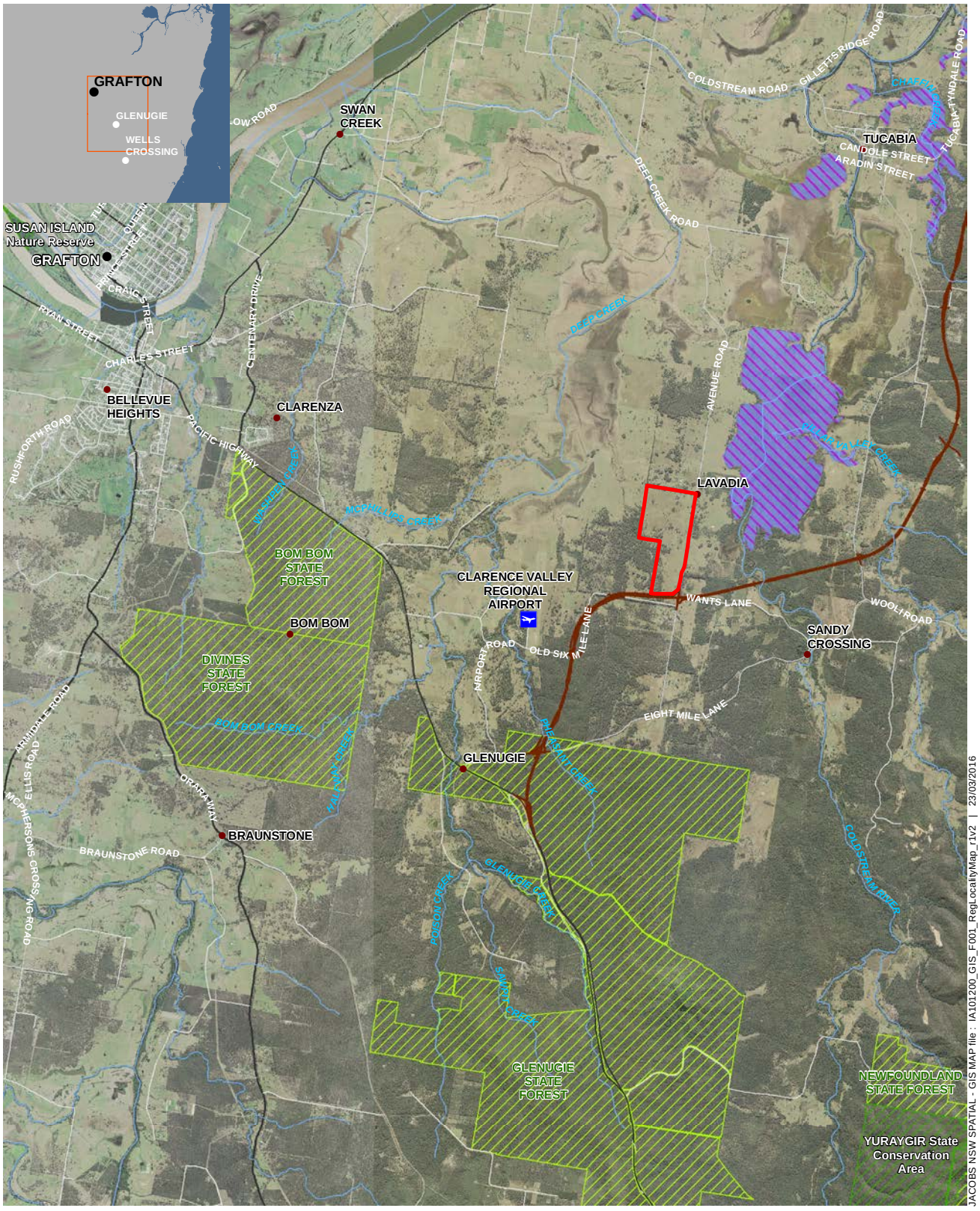
The Project is located approximately 12.5 kilometres southeast of Grafton; refer to **Figure 1-1**; within the Clarence Valley Local Government Area (LGA) at 313 Avenue Road, Lavadia (the Project Site). The Project Site is zoned RU2 - Rural Landscape under the *Clarence Valley Local Environmental Plan 2011.* Development for the purpose of a correctional centre is permissible with consent within the RU2 Rural Landscape zone.

The Project Site includes two properties comprised of Lot 26 DP 751376 and Lot 1 DP 1190399 and is 195 hectares in size (refer **Figure 1-2**). The site has historically been used for cattle grazing. In July 2015, development consent for a dwelling house in the southeast corner of Lot 1 DP 1190399 was granted by Council and construction of the house and adjacent shed is complete. The Project Site is bounded by Avenue Road (also recognised as Golden Mile Road) to the east, and Old Six Mile Lane to the south. Avenue Road connects to the Pacific Highway via Eight Mile Lane to the south and Old Six Mile Lane connects to the Pacific Highway to the west.

It is noted that the Grafton bypass portion of the upgraded Pacific Highway project (by Roads and Maritime Services) will, in addition to the reconfigured Old Six Mile Lane, form the southern boundary of the site once completed in approximately 2019. As part of that project, Avenue Road will pass over the Pacific Highway and the intersection of Avenue Road and Old Six Mile Road will be upgraded to improve local access, without direct connection to the highway.

1.3 Project description

The New Grafton Correctional Centre (NGCC) requires a staged development application that sets out a concept proposal for a new correctional centre at Grafton that provides maximum and minimum security facilities and includes a total of 1,700 beds. The concept proposal includes a maximum built form height of 12 metres (approximately three storeys) with a gross floor area of approximately 100,000 square metres. The staged development application also seeks concurrent Stage 1 approval for site clearance and preparatory works. **Table 1-1** provides a summary of the Proposal's key components and features.



Legend

- The Project
- Grafton Bypass (proposed)
- SEPP 14 Wetlands
- National Park Reserves
- State Forests

0 2 4 Km

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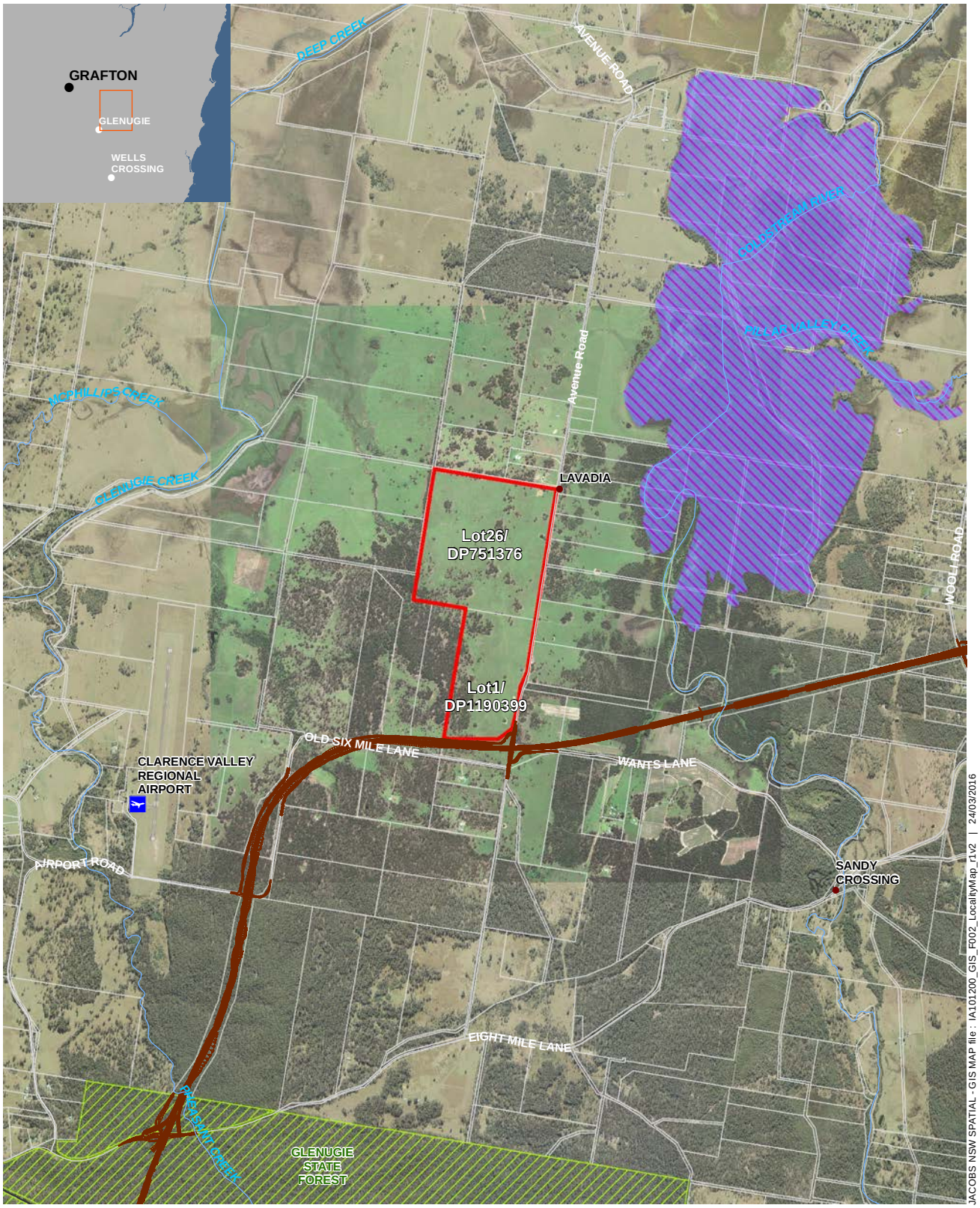
Data sources

Jacobs 2015
LPI 2015
NSW DPE 2015
RMS 2013 (W2B Alliance)

Figure 1-1 | Regional Locality



Legend

- The Project
- Grafton Bypass (proposed)
- SEPP 14 Wetlands
- State Forests

0 1 2 Km

1:50,000 @ A4

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Data sources

Jacobs 2015
LPI 2015
NSW DPE 2015
RMS 2013 (W2B Alliance)

Figure 1-2 | The Project

Table 1-1 Key Project Components

Stage	Description
Development summary	The staged SSD application seeks approval for: • A concept proposal for the New Grafton Correctional Centre. • First stage site clearance and preparatory works for the Project. • Together referred to as the Proposal.
Project Concept Proposal	The NGCC includes a maximum and minimum security correctional centre of 1,700 beds comprised of: • A maximum security section of 1,300 beds that will include: • 1000 beds for male inmates. • 300 beds for female inmates. • A minimum security section that will include: • 400 bed residential accommodation for male inmates. The building envelope including the configuration, location and number of building structures required for the Project would not be determined until the detailed design is completed as part of the Stage 2 works. Consequently, the Stage 2 construction works for the Project could occur anywhere within the development zone shown in **Figure 1-3**. The total footprint around both the maximum and minimum correctional centres, including the carpark, is around 45 ha. Features of the Project include the following: • The concept proposal includes a maximum built form height of 12 metres (approximately three storeys). • The gross floor area will be approximately 100,000 square metres. • A six metre high fence or wall will be constructed around the perimeter of the facility, with light and security camera poles up to 10 metres in height. • Store buildings, small ancillary facilities and a central energy plant will be located outside the perimeter walls / fences. • Internal access into and out of the correctional centre from Avenue Road will be provided. • Car parking for approximately 500 car spaces. • Other associated facilities include recreational oval, special accommodation units, health facilities, education and programs areas, administration, workshops, staff amenities, visitor facilities and utilities. • A 100-metre wide Asset Protection Zone (APZ) zone would be cleared around the correctional centre and associated facilities and car parking area in accordance with the *Rural Fires Act 1997* and requirements of the *Planning for Bush Fire Protection* (PBP; NSW Rural Fire Service [RFS], 2006). • A vegetation buffer outside the APZ would be provided along the northern, eastern and southern boundaries of the Project Site. The buffer would be 50 metres wide along the northern property boundary, 15 metres wide to the east along Avenue Road and 30 metres wide along the southern property boundary. • Fire access roads on the inside and the outside of the perimeter fence of the facility will be constructed to ensure safe operational access for emergency services personnel responding to a bushfire event. • Water, wastewater, power and communication utilities within the Project Site. • Landscaping of ground cover and /or shrubbery in areas to be defined.

Stage	Description
Stage 1 Site Clearance and Preparatory Works	Stage 1 (early works) DA, includes preparatory work within the cadastral boundaries of Lot 26 DP 751376 and Lot 1 DP 1190399. This would involve: • Vegetation clearance and biodiversity management activities. • Construction of access roads including fire access roads to the extent required to conduct Stage 1 works. • Construction of auxiliary facilities such as construction compound, construction staff parking facilities and stockpiles sites. • Temporary provision of water, power and communication services within the site to the extent required to conduct Stage 1 works. • Demolition of the existing house and sheds. • Bulk excavation and site stabilisation works. • Landscaping.
Value	The capital investment value for the Project is in excess of $30 million.
Project Site	• Located at 313 Avenue Road, Lavadia. • Lot 26 DP 751376. • Lot 1 DP 1190399. • Project Site is195 hectares (ha) in size.

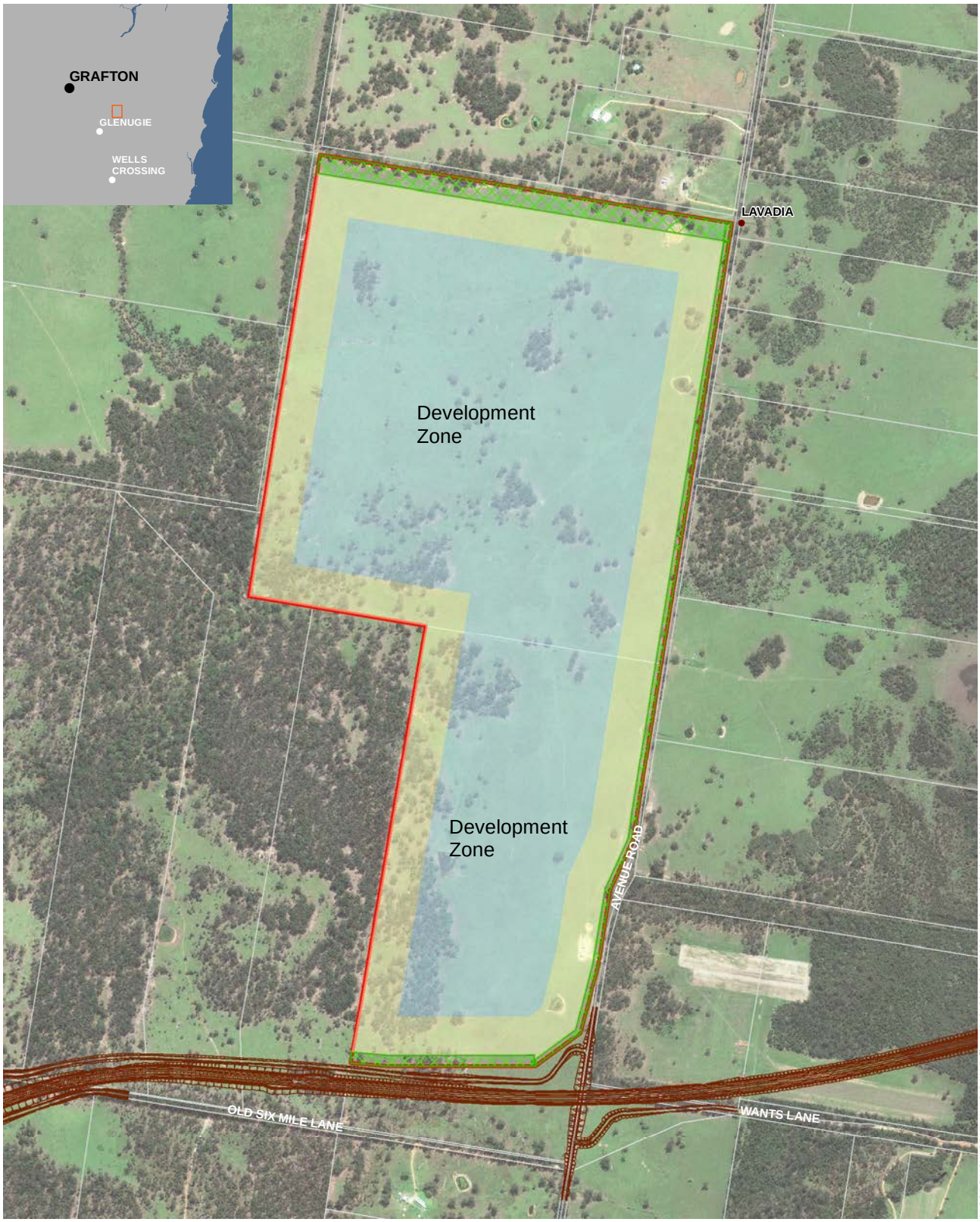
Future works regarding the design, construction and servicing of the Project will be based on the final design and layout of the facilities and will be the subject of future staged development application(s).

The construction activities associated with the Stage 1 site clearance and preparatory works is estimated to take six to 12 months and provide around 50 full time equivalent positions.

1.4 Project objectives

The objectives of the Project are:

1) Be a safe and secure correctional centre.
2) Be a humane and ethically managed centre.
3) Help reduce the risk of re-offending through (among other things) preparing inmates for reintegration into the community on release from the CSNSW network.
4) Manage resources effectively and efficiently, enhancing value for money.
5) Utilise effective governance arrangements.
6) Produce strong economic and social benefits to the local Grafton region, the northern NSW region and the broader NSW community.
7) Be a valuable physical asset for the duration of the Operating Phase and beyond.
8) Be operated in such a way as to keep pace with best correctional practice over the term of its operational life.
9) Be operated so that it links with the broader management strategies and operational needs of the CSNSW network.



Legend

- The Project
- Landscaping zone
- Asset Protection Zone
- Development Zone
- Grafton Bypass (proposed)

0 250 500 Metres

1:15,000 @ A4

N

Data sources

Jacobs 2015
LPI 2015
NSW DPE 2015
RMS 2013 (W2B Alliance)

Figure 1-3 | The Project

Wastewater Strategy objectives:

The objectives of the Wastewater Strategy are as follows:

- Review the existing wastewater system in the vicinity of the Project.
- Identify any feasible options for the provision of water services, taking into consideration the water servicing options.
- Select a preferred wastewater servicing option.

1.5 Report structure

This working paper has been prepared to support the EIS, which is required under Division 4.1, Part 4 of the EP&A Act. The structure of the report is summarised in **Table 1-2**. SEARs relevant to this paper and where they have been addressed in the report are summarised in **Table 1-3**.

Table 1-2 Report structure

Section reference	Section heading	Description
Executive summary	Executive summary	Concise summary of this working paper and the key findings
1	Introduction • Background • Locality • Proposal description • Proposal objectives • Report structure • Council comments	Description of the Project relevant to potential impacts on wastewater. Provides an overview of the study objectives and structure of this paper.
2	Assessment requirements and approach • Other legislative requirements • Water demand and wastewater flows assessment approach	Identifies and the key legislation that this technical study must follow and lists the criterion that the project aims to comply with. It also outlines the assessment approach for this working paper.
3	Water quality requirements	Establishes key water quality requirements.
4	Wastewater Servicing Strategy • Strategy Overview • Onsite sewage management system	Identifies key wastewater service demands and assesses the potential impacts and strategy.
5	Conclusions	Preferred option

Table 1-3 Summary of SEARs relevant to this specialist working paper

SEARs	Cross reference
SEAR No 12 - Utilities Prepare an Infrastructure Management Plan detailing the existing capacity and any augmentation requirements of the development for the provision of utilities, including wastewater management. The Plan shall also detail staging of any infrastructure works.	The management of wastewater is addressed in Section 3 and 4 of this report.

2. Assessment requirements and approach

2.1 Legislative requirements

The Project concept proposal satisfies the criteria of Clause 16, Schedule 1 of *State Environmental Planning Policy (State and Regional Development) 2011*, as it is for the purposes of a new correctional centre that has a capital investment value of more than $30 million. As such, the Project is declared to be State Significant Development (SDD) in accordance with Section 89C of the EP&A Act. The Minister for Planning, or his delegate, is the consent authority for the SSD under Section 89 D of the EP&A Act.

A staged development application is being made for the Project in accordance with Section 83B and Section 89D of the EP&A Act. The EIS, and this working paper, provides an assessment of the concept proposal and Stage 1 of the Project. Subsequent applications will be made for future stages of the Project.

Under Section 78(8A) of the EP&A Act, an EIS must accompany an application for SSD. The SEARs for the Project were issued by DPE on 21 December 2015 in accordance with Schedule 2 of the *Environmental Planning and Assessment Regulation 2000*.

This working paper has been prepared to address the relevant requirements outlined in the SEARs. Other legislative requirements relevant to the servicing of the Project are outlined below.

2.1.1 Protection of the Environment Operations POEO Act 1997

The *Protection of the Environment Operations Act 1997* (POEO Act) lists activities that have the potential to cause significant environmental impacts that require a licence. The licences are issued to control the air, noise, water and waste impacts of an activity. Licences are ongoing but are subject to review at least once in a five year period.

The Act also provides for the issuing of three types of environmental protection notices including clean-up, prevention and prohibition notices. The Act establishes a three tier regime of offences, which carry penalties depending on the seriousness of the offence.

An Environment Protection Licence (EPL) under Section 55 of the POEO Act must be obtained for scheduled development work and scheduled activities (as defined under the Act). Projects that do not constitute scheduled development work or scheduled activities do not require an EPL, although an EPL may be sought on a voluntary basis to regulate any off-site discharges or impacts to the environment.

Under Schedule 1 of the POEO Act wastewater treatment is a Scheduled Activity if it has a processing capacity that exceeds 2,500 persons equivalent or 750 kilolitres per day, whichever is the greater.

2.1.2 State Environmental Planning Policy No. 14 – Coastal Wetlands

The aim of the *State Environmental Planning Policy No. 14 – Coastal Wetlands* (SEPP 14) is to ensure that the coastal wetlands are preserved and protected in the environmental and economic interests of the State. It requires development consent for works within areas mapped as being coastal wetlands. This policy is in force under the *Environmental Planning and Assessment Act 1979*. It is noted that there is an area of SEPP 14 wetlands less than one kilometre to the east of the Project Site around Coldstream River (refer to **Figure 1-2**).

2.2 Water demand and wastewater flows assessment approach

2.2.1 Waste use model

Jacobs has used an in-house model (IWMSim model) to estimate the water demands and wastewater flows for the Project at ultimate development (i.e. 1,700 beds). The IWMSim model uses an end use/Monte Carlo simulation approach for the likely operation of the Project from a water demand and use perspective. Details of the IWMSim model, including methodology and discussion of model results, are included in the *Water Cycle Management Plan Working Paper* (Jacobs, 2016).

The model was established using residential water demand data for the inmates and commercial water demand data for the staff. The results were checked against published benchmarks for correctional centres and found to be acceptable. The modelling was undertaken for the ultimate development which includes a facility with 1,700 beds, 600 to 650 support staff and up to 50 visitors per day. The water balance modelling was based on the ultimate development for the site. Other assumptions are documented in *Water Cycle Management Plan Working Paper* (Jacobs, 2016).

2.2.2 Model outcomes

Four model scenarios were run through the IWMSim model and include:

- Scenario 1: Business as Usual Traditional Development
  - No roofwater harvesting or recycled water use or water efficient fixtures/appliances
- Scenario 2: Concurrent Rainwater and Recycled Wastewater Recycling
  - Water efficient fixtures/appliances
  - Roofwater harvesting for toilet and urinal flushing
  - Recycled wastewater for irrigation and cooling towers
- Scenario 3: Maximised Rainwater and Recycled Wastewater Harvesting
  - Roofwater for hot water and laundry (with potable top-up)
  - Recycled wastewater for irrigation, cooling towers and toilet/urinal flushing
- Scenario 4: Recycled water use only
  - Recycled wastewater for irrigation, cooling towers and toilet/urinal flushing

Project wastewater flows from the IWMSim model for the four scenarios are summarised in **Table 2-1**.

Table 2-1 Projected Wastewater Flows from IWMSim Model (Ultimate Development)

Parameter	Scenario 1 - Base Case: Traditional Development	Scenario 2 - Concurrent Rainwater and Recycled Wastewater Harvesting	Scenario 3 - Maximised Rainwater and Recycled Wastewater Harvesting	Scenario 4 – Recycled Wastewater Harvesting only
Wastewater Flows				
Average Day Wastewater Flows (ML/d)	0.47	0.47	0.47	0.47
Peak Day Wastewater Flow (ML/d)	0.61	0.61	0.61	0.61
Average Wastewater Discharge (ML/d)	0.47	0.32	0.23	0.23
Peak Wastewater Discharge (ML/d)	0.61	0.51	0.40	0.40
Recycled Water System Demand				
Average Day Recycled Water System Demand (ML/d)	N/A	0.16	0.24	0.24
Peak Day Recycled Water System Demand (ML/d)	N/A	0.49	0.58	0.58

2.2.3 Adopted flows for the study

For this study, the following flows were adopted, taken from **Table 2-1** for Scenario 3 and Scenario 4 (recycled water for cooling, irrigation and toilet/urinal flushing):

A. Average day wastewater flows: 0.47 Mega Litres per day (ML/d)

B. Average day recycled water system demand: 0.24 ML/d

C. Average wastewater discharge (or irrigation reuse): 0.23 ML/d

This study investigates options for wastewater servicing, including exploring options for reuse of the remaining effluent. Any effluent that is not reused would need to be discharged to the environment.

2.3 Appropriate regulatory authority

As discussed in **Section 2.1.1**, under the POEO Act 1 – Schedule 1 – wastewater treatment is a Scheduled Activity if it has a processing capacity that exceeds 2,500 persons equivalent or 750 kilolitres per day, whichever is the greater.

From **Section 2.2**, it is noted that the projected wastewater flow at ultimate development is an average of 470 kL/d (0.47 ML/d) and peak of 610 kL/d (0.61 ML/d). The average flow would correspond to around 2,240 ‘persons equivalent’ (PE), based on an assumed per capita wastewater flow of 210 L/PE/day. The processing capacity of the wastewater treatment system is less than the threshold, both in terms of the persons equivalent capacity and the flow capacity. This means that the NSW Environment Protection Agency (EPA) does not automatically become the appropriate regulatory authority; instead the local council (Clarence Valley Council) would be the appropriate regulatory authority.

If not all of the treated effluent is reused at the site, then the portion of effluent that is not reused would need to be discharged to the environment. The local council cannot give a licence for discharge of excess treated effluent to the environment. Any discharge to the environment would require an Environment Protection Licence to be issued by the NSW EPA

It is recommended that an Environment Protection Licence, granting limited discharge of treated effluent, be sought. This would provide flexibility to discharge treated effluent in case it is not possible to reuse all of the treated effluent onsite. This would require the NSW EPA to be the appropriate regulatory authority.

3. Water quality requirements

3.1 Overview

The requirements for the quality of the treated wastewater produced by the onsite wastewater management system (OWMS) for the Project would depend on the end use of the treated wastewater. The OWMS would produce treated water for the following uses:

1. Reuse within the Project including for irrigation of playing fields, water for cooling towers and toilet/urinal flushing:
   - Water quality requirements for reuse within the Project would primarily focus on ensuring public health of the users of the recycled water. The most appropriate document for this type of reuse is *Australian Guidelines for Water Recycling* (AGWR): *Managing Health and Environmental Risks (Phase 1)* (Natural Resource Management Ministerial Council, Environment Protection and Heritage Council, Australian Health Ministers Council 2006).
2. Irrigation reuse in suitable areas within the Project site external to the centre:
   - Water quality requirements for irrigation use would primarily focus on protection of the environment, as well as public health. The most appropriate document for this type of reuse *is Environmental Guidelines: Use of Effluent by Irrigation* (NSW DEC, 2004).
3. Discharge of excess effluent to the environment via a suitable water course:
   - Water quality requirements for discharge to the environment would primarily focus on protection of the water course, as well as public health. Suitable water quality objectives would need to be determined through environmental studies and discussions with the NSW EPA.

3.2 Reuse within the Project

The AGWR does not provide specific water quality criteria to be achieved for the intended type of reuse (which can be considered equivalent to 'dual reticulation'), other than providing an objective of E. coli <1 per 100 mL (50 percentile). Rather, the AGWR provides target log reductions to be achieved by the treatment process for three types of pathogens:

- Viruses: 6.5 log reduction.
- Protozoa: 5.0 log reduction.
- Bacteria: 5.0 log reduction.

The AGWR also provides indicative log reductions for various treatment processes, and identifies the following indicative treatment process to achieve the target log reductions:

- Secondary (biological) followed by coagulation (chemical dosing), filtration and disinfection (e.g. chlorine and/or UV), or.
- Secondary (biological) followed by membrane filtration and disinfection (e.g. chlorine and/or UV).

3.3 Irrigation reuse

In terms of public health, the AGWR provides target log reductions to be achieved for 'municipal use with restricted access and application'. Log reductions are applied to the targets due to on-site preventative

measures including restricting public access during irrigation and maintaining 25-30 metre buffer distance from the irrigation area. The remaining log reductions would be met by the treatment process, giving the following treatment targets for three types of pathogens:

- Viruses: 2.0 – 3.0 log reduction.
- Protozoa: 1.0 log reduction.
- Bacteria: 1.0 – 2.0 log reduction.

The AGWR states that secondary treatment followed by disinfection would be suitable for irrigation reuse, and provides the following water quality targets:

- Biological Oxygen Demand: <20 mg/L (50 percentile).
- Suspended solids: <30 mg/L (50 percentile).
- E. coli: <100 per 100 mL (50 percentile).

However it is likely that in order to prevent irrigation equipment from clogging, tighter solids targets would be implemented to provide better water quality. Alternatively, water of a quality suitable for dual reticulation (**Section 3.2**) would also be suitable for irrigation use, from a public health perspective.

In terms of environmental protection, the document *Environmental Guidelines: Use of Effluent by Irrigation* (NSW DEC, 2004) provides for a comprehensive site and soil assessment to be undertaken to ascertain that the site is suitable for effluent irrigation. This includes undertaking nitrogen and phosphorous balances to ensure that the nutrients in the irrigation water can be taken up by the plants and soil.

For this report, as nutrient balances have not been undertaken for the irrigation area, it is assumed that the effluent used for irrigation would contain the same nutrient concentrations as the effluent that is discharged to the environment (**Section 3.4**).

3.4 Effluent discharge to the environment

For the effluent discharged to the environment, water quality objectives would need to be determined through environmental studies and discussions with the NSW Environment Protection Authority (EPA). It is proposed that the current effluent quality targets for the Clarenza Sewage Treatment Plant (STP), which is owned and operated by Clarence Valley Council, be adopted as an indicative of the possible targets for discharge from the Project OSMS. The Clarenza STP is the closest plant to the site of the Project and discharges via a pipe to the east bank of the Clarence River. The plant was upgraded as part of the Maclean and Grafton sewerage augmentation in 2009-2010 to achieve the Department of Environment and Climate Change's (Accepted Modern Technology) standard.

The water quality targets in the EPL for Clarenza STP are summarised in **Table 3-1**.

Table 3-1 Clarenza STP EPL

Parameter	50 percentile target	90 percentile target	100 percentile target
Biological oxygen demand (mg/L)	N/A	10	20
Faecal Coliforms (cfu/100 mL)	N/A	200	600
Total Nitrogen (mg/L)	N/A	10	20
Oil & Grease (mg/L)	N/A	5	10
Total Phosphorous (mg/L)	N/A	0.5	1.0
Total Suspended Solids (mg/L)	N/A	15	30

3.5 Proposed targets for the Project

The following targets are proposed for the effluent quality for the Project OSMS.

Table 3-2 Proposed Water Quality Targets for Project OSMS

Parameter	50 percentile target	90 percentile target	Comments
Dual reticulation reuse within the Project			
Biological oxygen demand (BOD) (mg/L)	5	10	Other requirements are for log reductions: - Virus: 6.5 - Protozoa: 5.0 - Bacteria: 5.0
Faecal Coliforms (cfu/100 mL)	1	5	
Total Nitrogen (mg/L)	7	10	
Oil & Grease (mg/L)	3	5	
Total Phosphorous (mg/L)	1	2	
Total Suspended Solids (mg/L)	5	10	
Irrigation reuse on Project Site			
Biological oxygen demand (BOD) (mg/L)	5	10	Other requirements are for log reductions: - Virus: 2.0 – 3.0 - Protozoa: 1.0 - Bacteria: 1.0 – 2.0
Faecal Coliforms (mg/L)	100	200	
Total Nitrogen* (mg/L)	7	10	
Oil & Grease (mg/L)	3	5	
Total Phosphorous* (mg/L)	1	2	
Total Suspended Solids (mg/L)	10	15	
Discharge to environment			

Parameter	50 percentile target	90 percentile target	Comments
Biological oxygen demand (BOD) (mg/L)	5	10	
Faecal Coliforms (cfu/100 mL)	100	200	
Total Nitrogen (mg/L)	7	10	
Oil & Grease (mg/L)	3	5	
Total Phosphorous (mg/L)	0.3	0.5	Tighter phosphorous target
Total Suspended Solids (mg/L)	10	15	

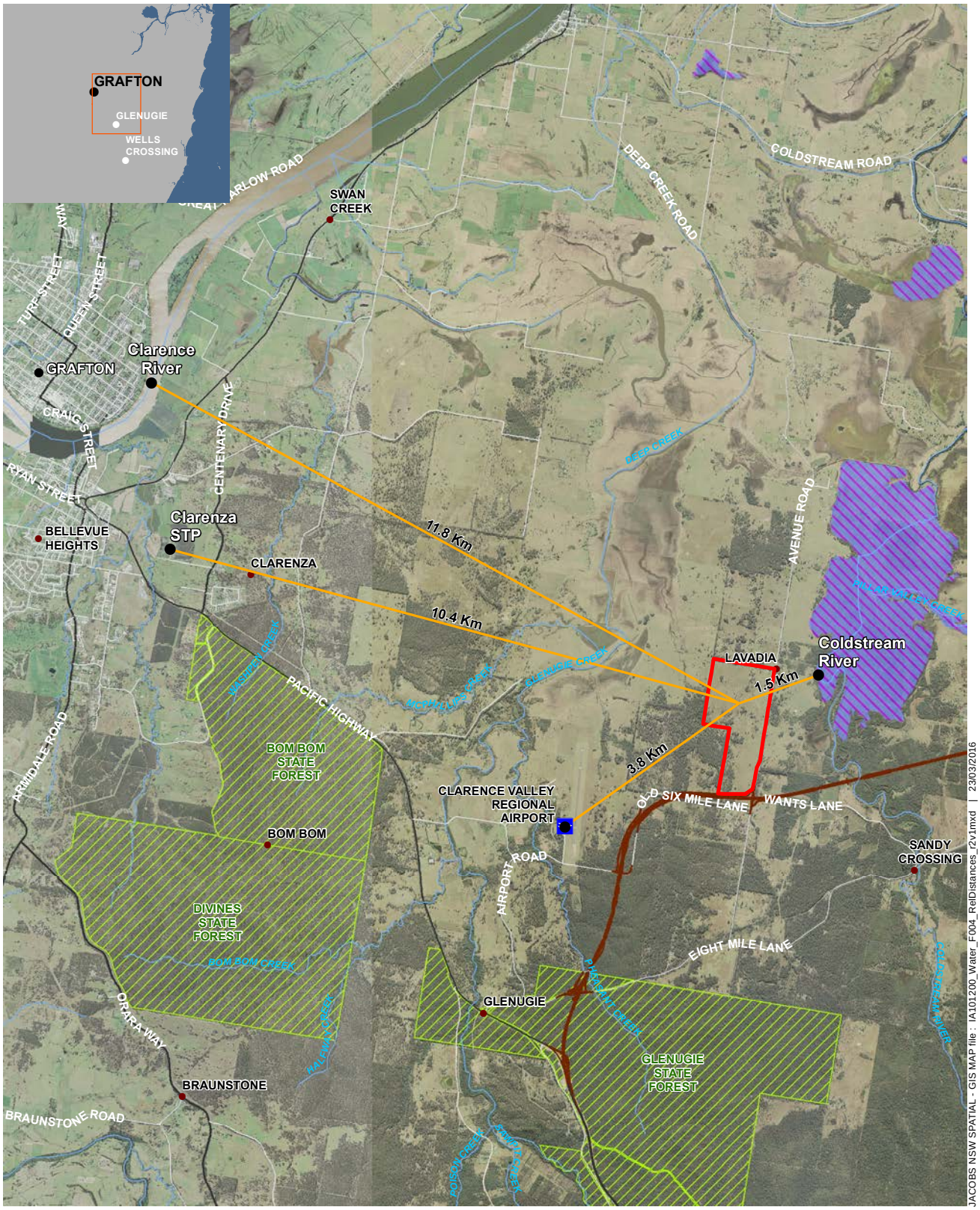
* The total nitrogen and total phosphorous targets for effluent that is reused for irrigation would need to be confirmed by undertaking a nutrient balance for the irrigation area.

4. Wastewater servicing strategy

4.1 Strategy overview

Council has stated that due to the distance from the Council's sewerage system, a rising main transfer to Council's existing Clarenza sewage treatment plant is not feasible as the detention time in the rising main would mean that the current treatment train would be unable to treat the sewage. Hence wastewater servicing would be provided from an on-site wastewater management system. This would incorporate the following components:

- Conveyance system to transfer the wastewater from the various sources within the Project Site to the on-site treatment plant. This would incorporate a network of pipelines to convey the wastewater and one or more pump stations to feed the wastewater to the treatment plant. The design of the conveyance system is significantly affected by the topography of the Project Site and site layout.
- On-site treatment plant, with capacity to accommodate average flows of 0.47 ML/d and peak flows of 0.61 ML/d. The treatment plant would consist of a number of treatment processes, typically including inlet works (screenings and grit removal), biological treatment (typical process is activated sludge), followed by tertiary treatment (filtration and disinfection). The plant would typically include chemical dosing, such as for phosphorous removal and/or for pH correction. The sludge that is produced by the treatment plant would also need to be managed (e.g. sludge lagoons or aerobic digestion). Typically the on-site treatment plant would be located some distance away from the facilities to minimise impacts such as noise and odour. However the site of the plant would need to be further investigated once details such as site topography, geotechnical conditions, and the layout of the site has been determined (including the location for any effluent irrigation system and effluent storage dam). Mitigation measures to manage any potential impacts such as noise and odour would be developed accordingly.
- Effluent reuse/discharge system, incorporating one or more of the following:
  - Dual reticulation recycled water system consisting of water storage and pump system to produce pressurised water for use within the Project Site for irrigation of playing fields, water for cooling towers and toilet/urinal flushing.
  - Irrigation system consisting of water storage dam and irrigation equipment (e.g. pumps, pipe network and spray irrigators).
  - Discharge to the environment of any excess effluent that cannot be reused. A suitable location for discharge of the effluent is required. This would depend on the capability of the water body to receive the discharged flow without adversely affecting the environment. Discharge to the environment may require a pumping station and pipeline to transfer the flow to the designated discharge location. **Figure 4-1** shows the relative distances from the Project Site to various regional features:
    - The closest water body to the Project Site is Coldstream River which is located approximately 1.6 kilometres from the centre of the Project Site. It is noted that the Coldstream River is listed under the *State Environmental Planning Policy No 14 – Coastal Wetlands* (SEPP 14) (refer to **Figure 1-2**). The ability of Coldstream River to receive any effluent flow is unknown and would need to be investigated, as would the potential impacts to water quality of the SEPP 14 wetland.
    - The Clarence River, which currently receives flow from the Clarenza STP, is located approximately 12 kilometres from the Project Site, as a direct line. A pipeline to discharge effluent to the Clarence River would need to follow existing roads or create a new easement, and would be considerably longer (e.g. 20 kilometres).
    - The Clarence Valley Regional Airport, which may represent an opportunity for either additional effluent reuse through irrigation or an opportunity for servicing, is located approximately 3.5 kilometres from the Project Site as a direct line.
    - Further studies are required to determine the most appropriate location for discharge of the un-reused treated effluent.



Legend

- The Project
- Grafton Bypass (proposed)
- Potential overflow discharge locations (to be confirmed)
- SEPP 14 Wetlands
- State Forests

0 2 4 Km

1:100,000 @ A4

N

Data sources

Jacobs 2015
LPI 2015
NSW DPE 2015
RMS 2013 (W2B Alliance)

Figure 4-1 | Potential overflow discharge locations

4.2 Onsite sewage management system options

4.2.1 Overview

The options primary relate to how much treated effluent reuse is undertaken at the Project Site. There is typically a trade-off with effluent reuse. On one hand effluent that is reused would typically require a higher level of treatment than effluent that is discharged (at least with regards to pathogens to manage the risk to human health from reuse systems). However reuse of effluent helps to reduce the demand on the potable water system, and it reduces the amount of effluent that is discharged, possibly leading to no discharge of effluent. This has benefits for the environment.

4.2.2 Option 1: No reuse

With this option, all of the wastewater produced by the Project is treated and discharged. Based on the water demand modelling undertaken this would equate to an average discharge, at ultimate development, of 0.47 ML/d which is equivalent to 172 ML/yr. Such a large volume of wastewater may require pumping all the way to the Clarence River; if a suitable closer receiving water body cannot be identified.

This option is discounted from further study as it provides no benefit in terms of water savings through reuse.

4.2.3 Option 2: Reuse within the Project

Option 2 involves reuse of treated effluent within the Project via a 'dual reticulation' system. The treated effluent would be recycled to the Project in a separate pipe network from the potable water system to ensure no cross connection. The recycled water would be used for irrigation of playing fields (two hectares assumed), water for cooling towers and toilet/urinal flushing.

This option corresponds to Scenario 3 and Scenario 4 in **Table 2-1** and would result in an average excess treated effluent to discharge of 0.23 ML/d, or 84 ML/yr. This corresponds to reuse of 51% of the effluent and discharge of 49%.

4.2.4 Option 3: Reuse within the Project and irrigation reuse within the Project Site

This option maximises reuse by adding irrigation of open spaces on to Option 2. Hence Option 3 includes irrigation of the remaining open spaces at the Project Site, outside of the correctional facilities at a location yet to be identified if this option is selected as the preferred option, in addition to the dual reticulation reuse system.

In order to determine the suitability of the site, and identify any specific areas or locations that are not suitable for effluent irrigation, a detailed site and soil suitability study is required to be undertaken in accordance with the requirements of the *Environmental Guidelines: Use of Effluent by Irrigation* (NSW DEC, 2004). This would include an analysis of the site suitability and any associated issues that may make an area unsuitable for effluent irrigation. In addition the soils of the proposed irrigation areas would be sampled and analysed across a number of parameters to ensure that effluent irrigation can be undertaken in a sustainable manner. This analysis would identify any areas on the site that are not suited to effluent irrigation, and would identify any mitigating factors, such as soil improvement and target nutrient concentrations in the recycled water, to manage potential impacts to the environment.

Another factor to consider is the size of the effluent storage dam. Typically irrigation rates are significantly higher in summer than winter, due to both evaporation rates and crop factors with plants generally growing faster, and hence consuming more water, in summer. Hence a typical feature of effluent irrigation systems is an irrigation storage dam that allows effluent to be stored during the winter months for irrigation during summer. A suitable location would need to be found onsite for an irrigation dam. The dam site, and capacity, would be impacted by the topography and site features such as geotechnical conditions.

4.2.5 Irrigation water balance modelling

For Option 3, irrigation water balance modelling was undertaken in order to determine the relationship between the amount of effluent that can be reused and the irrigation area and storage dam volume. As limited site information is available at this time, the modelling undertaken is preliminary only.

Irrigation water balance modelling was undertaken using an in-house modelling tool. Inputs to the tool include daily rainfall data from Bureau of Meteorology gauge 058102 (Grafton South (Yeerong)) for 1968 to 2014, and daily evaporation data from Bureau of Meteorology gauge 059040 (Coffs Harbour Meteorological Office) for 1968 to 2014. The model assumed pasture irrigation would be undertaken at the site.

The modelling was undertaken over a range of irrigation areas and storage volumes to determine what combination of irrigation area and storage volume would be required to reuse all of the excess effluent. This would eliminate any discharge of effluent. The results from the irrigation water balance modelling are shown in **Figure 4-2** as a percentage of the remaining treated effluent of 84 ML/yr (remaining after accounting for the dual reticulation reuse system) that is reused for irrigation.

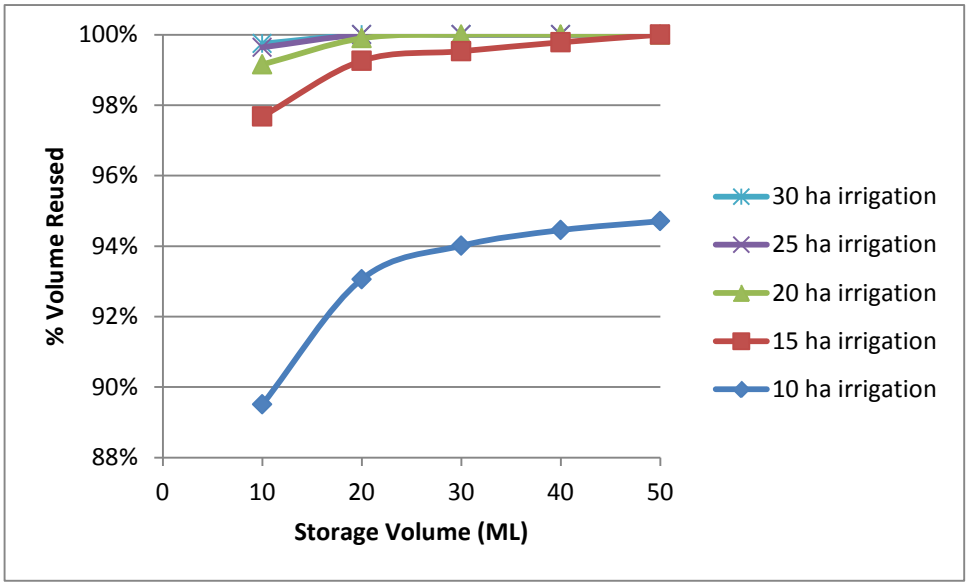


Figure 4-2 Irrigation Water Balance Modelling Results – Percentage of Volume Reused

The results show diminishing returns, in terms of an increase in the percentage of water that is reused, by incrementally increasing the irrigation area or storage volume. Increasing the storage volume beyond 20 ML provides only minor increases in the volume of effluent that is reused, as does increasing the irrigation area above 25 ha. However, in order to reuse 100% of the effluent, the scheme needs to be oversized to account for the variation in climate that has occurred over the last 47 years (over which the model was run). The model indicates that an irrigation area of at least 25 ha is required, along with a storage volume of at least 20 ML.

In terms of the frequency of discharge, the results are shown in **Figure 4-3**, which shows a similar pattern as described above with diminishing returns.

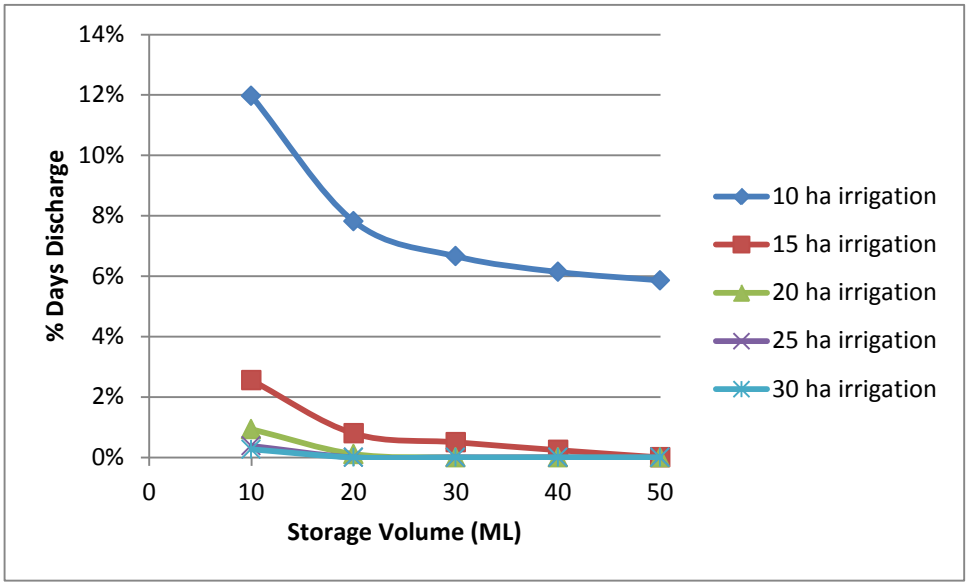


Figure 4-3 Irrigation Water Balance Modelling Results - % of Days Discharge

In order to focus in on the irrigation schemes that result in no effluent discharged, further modelling was undertaken for a select subset of combinations or irrigation area and storage volume. For this modelling it was assumed that the storage dam had a water depth of 2.5 metres and was uncovered, allowing rainfall and evaporation to occur from the storage dam. The results are shown in **Figure 4-4**.

The following combinations of irrigation area and storage dam result in zero effluent discharge (i.e. 100% reuse of effluent) over the 47 year modelled period from 1968 to 2014:

- 20 ha irrigation area and 40 ML dam (1.6 ha dam area at average water depth of 2.5 m).
- 25 ha irrigation area and 20 ML dam (0.8 ha dam area at average water depth of 2.5 m).

Note that these results are preliminary and would need to be further investigated once more details of the site are known, including site and soil assessment and details of the crop to be grown. Also, these results are based on historical rainfall and evaporation data, which may not be representative of future conditions, particularly considering possible impacts of climate change.

It is recommended that even if the scheme is sized for zero discharge, the scheme should be designed with the flexibility to discharge some effluent if required. This may be as simple as designing the dam with a pathway for spilling, rather than allowing the dam to overtop in an uncontrolled manner. This consideration may influence the location and design of the effluent storage dam.

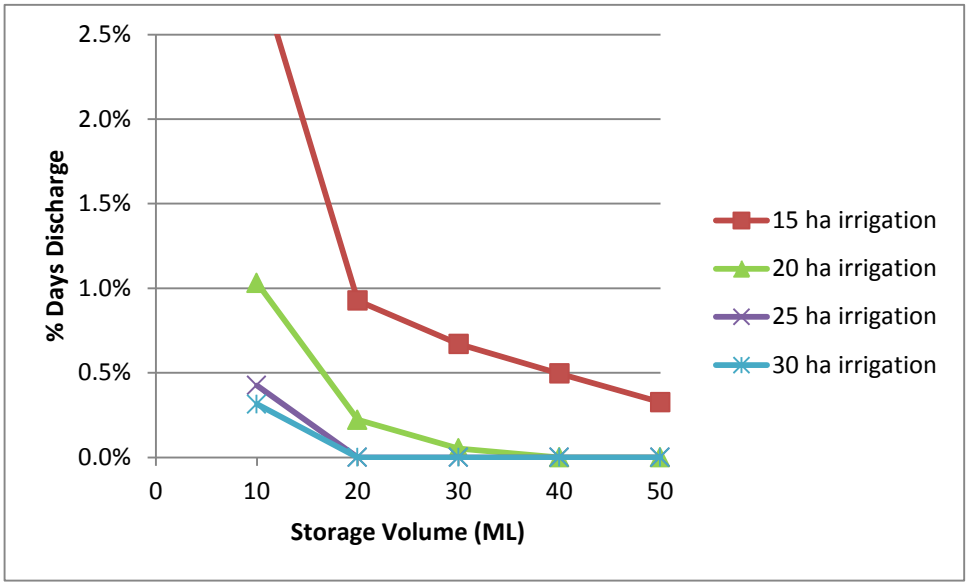


Figure 4-4 Irrigation Water Balance Modelling Results - % of Days Discharge

4.3 Discussion of options

Option 1 involves no reuse, and hence all effluent (172 ML/yr on average) would need to be discharged to the environment. Based on the volume discharged, it may be necessary to construct a transfer pipeline to enable discharge to the Clarence River, which is a considerable distance away (>10 kilometres). Also this option does not include any beneficial reuse of the effluent, and hence it is not preferred for both financial and environmental reasons.

Option 2 involves reuse within the Project facility, such as irrigation of playing fields, water for cooling towers and toilet/urinal flushing. However 49% of the effluent produced would need to be discharged to the environment. The cost and environmental impact of this option would depend on the availability of nearby waterways to receive the flow of treated effluent (average of 84 ML/yr).

Option 3 essentially involves adding on onsite effluent irrigation to Option 2. From an environmental perspective, Option 3 would provide a better environmental outcome as more of the effluent is reused and, ideally, none is discharged. This assumes that the site soils are amenable to irrigation with treated effluent. From a financial perspective, Option 3 is likely to be similar cost or cheaper than Option 2. If, due to the volume of effluent to be discharged in Option 2 a pipeline (10 – 20 kilometres) and pump station needs to be constructed to discharge to the Clarence River, then Option 3 would likely to be cheaper.

On the other hand, if Option 2 can discharge to a nearby watercourse, such as pumping to Coldstream River, then Option 2 may be cheaper to construct. However, due to the presence of SEPP 14 wetlands along Coldstream Creek to the east of the Project Site, it is unlikely that effluent discharge to Coldstream Creek would be allowed. Hence it is likely that Option 2 would require a pump station and long pipeline to transfer the effluent to a suitable location for discharge, essentially making Option 3 more financially attractive.

The operating costs of the irrigation system may be wholly or partially offset by any proceeds received through the sale of the irrigated crop, depending on the commercial arrangements entered into for management of the irrigation system.

4.4 Preferred option

Option 3 is recommended as the preferred option as it maximises reuse on the site and hence minimises, or eliminates, discharge to the environment. In particular this option, with complete reuse of effluent, would avoid effluent discharge to the SEPP 14 wetlands that are located around Coldstream Creek. However this detail

would not be confirmed until later stages of development. The following is a preliminary desktop assessment of the preferred option and further assessment is recommended to be undertaken in the Stage 2 DA when the preferred option is confirmed.

4.4.1 Collection system

A system of pipes, and pump stations, is required to transfer the wastewater generated by the Project to the onsite treatment plant. The design of the collection system would be tailored for the specific location of the treatment plant and the various sources of wastewater within the facility.

4.4.2 Treatment

The collected wastewater would be conveyed to the onsite treatment plant which would typically be located some distance away from the Project to prevent issues of noise and/or odour. The treatment plant would consist of a number of treatment processes that produce water suitable for the various uses. This could be achieved by putting all of the wastewater through the same process, or providing different treatment processes for the different uses. Possible examples include:

- Example A:
  - Preliminary (screening + grit removal), secondary (biological) treatment, tertiary filtration and disinfection (UV or chlorine) for irrigation reuse and discharge.
  - As above, with additional treatment of membrane filtration and additional disinfection (UV or chlorine) for dual reticulation reuse.
- Example B:
  - Preliminary (screening + grit removal), secondary (biological) treatment incorporating membrane filtration as membrane bioreactor, followed by disinfection (UV or chlorine) for dual reticulation reuse and irrigation reuse.
  - As above, with additional phosphorous removal if required for effluent discharge.
  - Sludge can be treated in sludge lagoons that require periodic desludging (typically once a year), or can be aerobically digested and mechanically dewatered for removal offsite each week. In addition, the screenings and grit removed from the wastewater would typically be removed offsite weekly.

4.4.3 Dual reticulation reuse

Reuse of treated effluent via a dual reticulation system requires a storage reservoir to hold the recycled water (0.5-1 ML of storage volume may be sufficient, subject to further investigation) as well as a pressure pumping system to deliver the recycled water to the Project facility. The recycled water would be conveyed through a second reticulation system that keeps the recycled water separate from the potable water.

4.4.4 Irrigation reuse

The irrigation reuse system would consist of a storage reservoir that would be an earthen dam constructed on the site, as well as a suitable irrigation system (e.g. spray irrigation). The type and design of the irrigation system would need to suit the specific site conditions and the type of crop that will be grown.

At this stage, preliminary analysis of the Project Site's geomorphological and soil characteristics has been undertaken which indicates that there is no severe impediment to effluent irrigation. This analysis is based on the results of the assessments completed as part of the EIS for the Project including the Flooding Working Paper, the Geotechnical Working Paper and the Land Capability and Soil Salinity Working Paper.

The topography of the Project Site is gently undulating with natural depressions occurring throughout. A small ridge runs through the Project Site in a north to south direction; refer to **Figure 4-4**. The slope of Lot 26 DP

751376 (northern portion) of the Project Site typically head down gradient drainage channels located along the east (towards Avenue Road) and to west (towards adjacent properties). Within Lot 1 DP 1190399 (southern portion) of the Project Site, the slope is typically in the direction of east and west towards drainage features located in the north west and south east of the Project Site.

Consistent with the topography of the Project Site, the surrounding topography is gently undulating, sloping towards drainage channels which feed into Glenugie Creek located to the west and north west and towards the Coldstream River located to the east, refer to **Figure 1-2**. From a geomorphological perspective it would appear that the Project Site is suitable as it not flood prone, it is comprised of gentle sloping landform with small crests, convex slopes and plains and there is virtually no surface rock outcrops, refer to elevation map included as **Figure 4-5**.

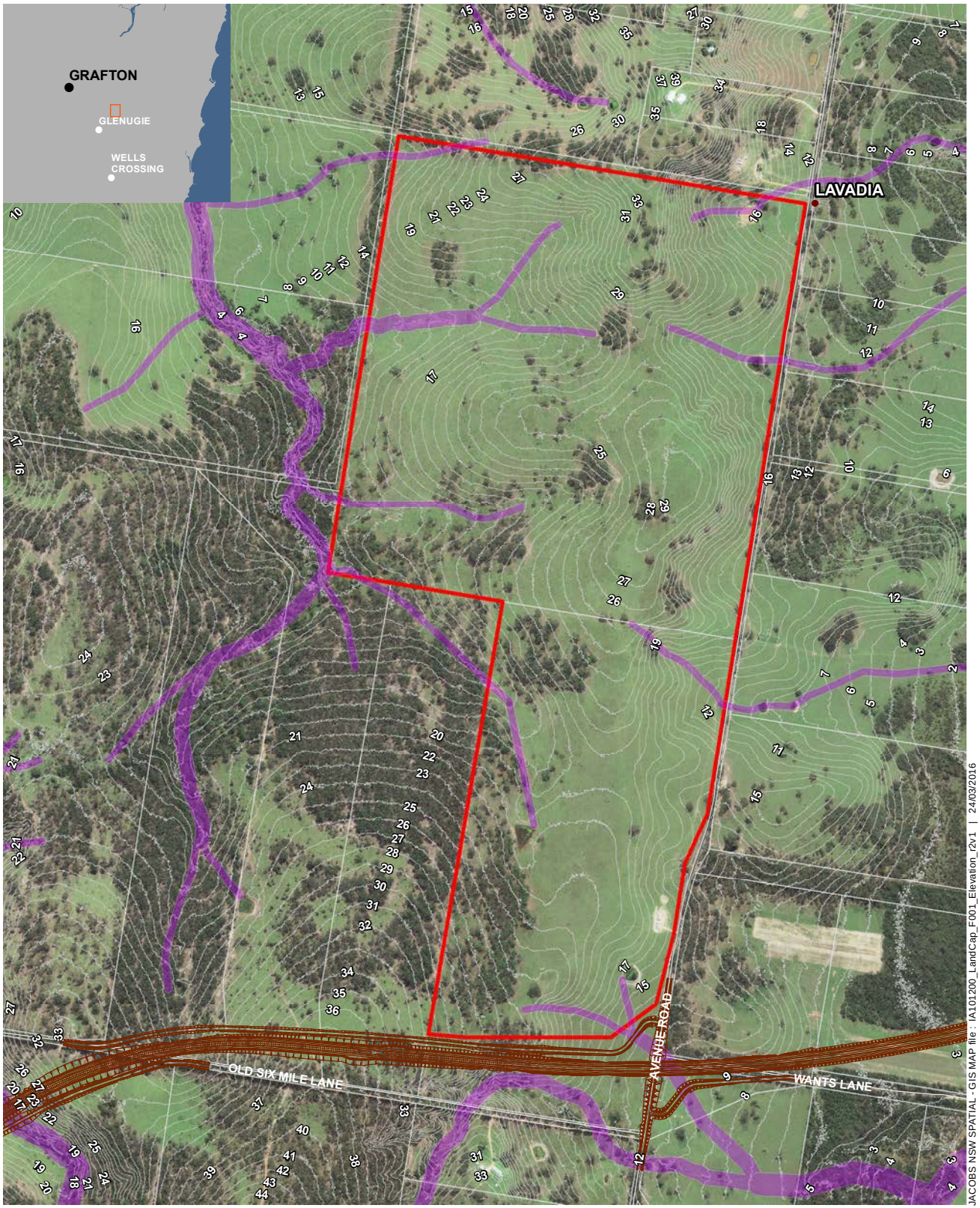
The predominant surface water features surrounding the site are the Coldstream River and associated wetlands (approximately 600 metres to the east) and Glenugie Creek (approximately 1.5 kilometres to the west/north west). On-site there are no established creeks or rivers however there are multiple ephemeral tributaries heading off-site which feed into the Coldstream River to the east and Glenugie Creek to the west (refer to **Figure 1-2**.). These drainage channels / riparian zones appear to form a natural low point in the topography and a relocated high in the surrounding catchments. The proposed effluent reuse area should avoid these ephemeral drainage channels / riparian areas (refer to **Figure 4-5**). Eight catchment areas have been identified on the Project Site and the catchments (B, D, E and F) which drain into Coldstream River and the SEPP 14 wetlands to the east of the Project Site should be avoided (refer to **Figure 4-6**).

There are four artificially constructed dams within the Project Site which have been located at natural depression to capture overland flows. A constructed storm water drain that runs adjacent to Avenue Road, east of the Project Site is also present.

From a groundwater perspective, the groundwater table is deep in the northern and central parts of the Project Site (more than 15 metres below surface) compared to the lower elevations in the southern portion of the site where the groundwater was encountered at 5.5 metres below the surface, indicating a shallow groundwater table. The proposed effluent reuse area should avoid areas with a shallow groundwater table (refer to **Figure 4-6**).

The majority of rain falling onto the site would fall onto unsealed (cleared and vegetated) surfaces, and is expected to infiltrate into sub-soils and run off into the natural drainage channels heading off-site to the east and west as well as to the four artificially constructed dams present within the Project Site . Rain falling onto surrounding areas is expected to infiltrate into sub-soils, fall onto unsealed (cleared and vegetated) surfaces or run off across sealed surfaces (Avenue Road to the east) into formalised storm water drains.

Soils on the Project Site are comprised of a silty clay topsoil overlying medium to heavy clay subsoils, with low permeability and evidence of seasonal waterlogging. These clay soils are generally sodic and acidic and susceptible to dispersion, further reducing permeability and soil structure. The three main soil mapping units are shown on **Figure 4-6**. From a soil suitability perspective, soil salinity is low to moderate, soil pH is between 5.3 to 5.9 and soil electrical conductivity is between 0.044 dS/m and 0.330 dS/m. The soils classified as uniform and gradational would be slightly better suited for effluent reuse but all three soil types would be potentially suitable.



Legend

- The Project
- Grafton Bypass (proposed)
- 1m contours
- Riparian zone (strahler order)

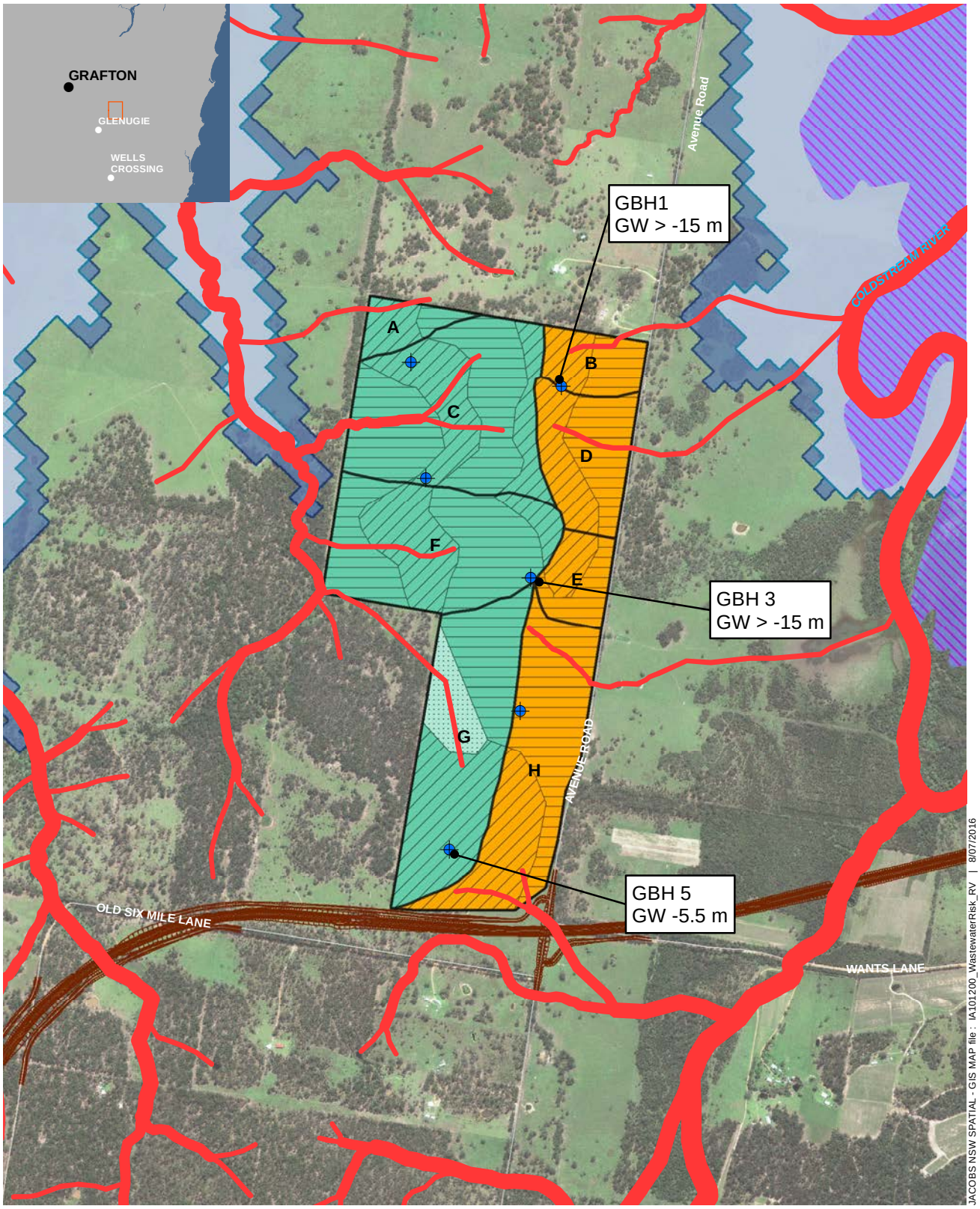
0 250 500 Metres

1:15,000 @ A4

N

Data sources
Jacobs 2015
LPI 2015
RMS 2013 (W2B Alliance)

Figure 4-5 | Elevation and drainage features



Legend

- Grafton Bypass (proposed)
- SEPP 14 Wetlands
- Flood planning area (1 in 100)
- Flood prone land (extreme)
- Riparian zone (strahler order)
- Project Site Catchment Boundaries

Catchment Risk Areas

- High
- Low

Soil Mapping Units

- Acidic Texture Contrast Soils
- Sodic Texture Contrast Soils
- Uniform and Gradational Soils
- Boreholes Sites

0 250 500 Metres

N

1:22,000 @ A4

Data sources

Jacobs 2015
LPI 2015
NSW DPE 2015
RMS 2013 (W2B Alliance)

Figure 4-6 | Treated Effluent Irrigation Reuse Risk Map

The Land Capability and Soil Salinity Working Paper includes an assessment of the suitability of the site for urban land use. This assessment follows a similar set of criteria as listed in the *Environmental Guidelines: Use of Effluent by Irrigation* (NSW DEC, 2004). As such, the geomorphological and soil limitations to effluent disposal have been broadly identified for the soil types for the Project Site. In addition, the preliminary analysis using criteria from the *Environmental Guidelines: Use of Effluent by Irrigation* (NSW DEC, 2004) indicates that the Project Site has slight to moderate geomorphological and soil suitability limitations and may be suitable for effluent disposal if these limitations are managed. However due to the shallow groundwater table in the lower elevations in the southern parts of the Project Site the irrigation reuse area would be better located at higher elevations in the northern part of the Project Site away from areas identified as riparian zones. In addition areas with moderate soil salinity should be avoided as should catchments B, D, E and H to the east of the site. While the soil characteristics for the Project Site are well understood, it is recommended that once the exact location for the irrigation reuse area is identified in Stage 2 that further assessment be completed according to the full suite of requirements listed in Table 2-1 and Table 2-2 of the *Environmental Guidelines: Use of Effluent by Irrigation* (NSW DEC, 2004). This detailed assessment would identify management strategies for the existing limitations, and identify additional limitations for the Project Site., Additionally, the assessment would identify any mitigating factors, such as soil improvement and target nutrient concentrations in the recycled water, to manage potential impacts to the environment.

In regards to the capacity of the Project Site to accommodate an irrigation reuse area, it is noted that the Project Site is 195 hectares comprised of 124 hectares within the development zone, 61 hectares in the asset protection zone and 10 hectares within the vegetation buffer, refer to Figure 1-3. Based on the analysis done above around 125 hectares are located within catchments A, C, F and G and areas of this that do not have a shallow water table would be available for an irrigation reuse area. Of these 125 hectares, 34 hectares is located within the asset protection zone and would also need to adhere to requirements as outlined within the Bushfire Assessment Report which may control how high any crops can grow in this area.

In closing it is likely that the Project Site has space to accommodate a 25 hectare irrigation reuse area. Other offsite options would also be considered in Stage 2 including piping the treated wastewater to nearby agricultural areas within five to ten kilometres of the Project for irrigation purposes. It is noted that there are a number of agricultural areas that are not flood prone that would potentially be suitable. If an offsite reuse irrigation area is to be used the site would also be required to undergo assessment in accordance with *Environmental Guidelines: Use of Effluent by Irrigation* (NSW DEC, 2004). Any irrigation offsite would require the scheme to be licenced under the Water Industry Competition Act (in addition to an Environment Protection Licence from the NSW EPA).

4.4.5 Discharge

Ideally the effluent irrigation scheme would be sized to eliminate any effluent discharge. This would negate the need for a discharge licence from the EPA. However, the effluent storage dam would need to be designed with a spillover to prevent uncontrolled overtopping of the dam. Discharge of effluent would only occur when the dam for the irrigation system is full. A suitable location for the dam to spill to would need to be determined and incorporated into the dam siting and design.

Depending on the outcome of investigations of possible locations for dam spillover, there may be a need to pump and unused treated effluent to a nearby water course (e.g. Coldstream River which is also a SEPP 14 wetland, consequently this is not the ideal solution). An alternative would be to using the unused treated effluent on adjacent or nearby farms that may have an interest in the treated effluent for irrigation on their land. This detail to be confirmed in Stage 2 and further investigations are recommended that include appropriate mitigation measures to manage potential discharge leaving the Project Site.

4.4.6 Staging

It is possible to stage the construction of the infrastructure required for the OWMS as the Project progresses in stages. That is, it is possible to only construct the conveyance system as required for the first stages of the development and allowing points for future connection. Also, the treatment plant could be designed for ultimate capacity but only the components relating to the capacity of the relevant development stage would need to be initially constructed. A similar approach can be taken for the effluent reuse system. Though for some

components, such as the effluent storage dam, it may be more feasible to construct the ultimate capacity, unless there are two separate viable dam sites that can be used at the different stages.

4.4.7 Indicative order of cost

These costs are very preliminary and intended only to provide a possible order of magnitude of the required capital investment. These costs are not to be used for budgeting purposes. These costs relate to the ultimate capacity.

Jacobs has prepared the preliminary cost estimate set out below using information reasonably available and based on assumptions and judgments made by Jacobs. The cost estimate has been prepared for the purpose of providing an indicative order of magnitude for the cost of the preferred option and must not be used for any other purpose.

The cost estimate is a preliminary estimate only. Actual prices, costs and other variables may be different to those used to prepare the cost estimate and may change. Unless as otherwise specified in this report, no detailed quotation has been obtained for actions identified in this report. Jacobs does not represent, warrant or guarantee that the works can or will be undertaken at a cost which is the same or less than the cost estimate.

Where estimates of potential costs are provided with an indicated level of confidence, notwithstanding the conservatism of the level of confidence selected as the planning level, there remains a chance that the cost will be greater than the planning estimate, and any funding would not be adequate. The confidence level considered to be most appropriate for planning purposes will vary depending on the conservatism of the user and the nature of the project. The user should therefore select appropriate confidence levels to suit their particular risk profile.

Table 4-1 Indicative Order of Cost

Item	Indicative Order of Cost	Comments
Conveyance system	$1 M – 3 M	Assume three small pump stations with two km of DN100 rising main
Treatment plant	$10 M – 15 M	For treatment plant with average flow of 0.47 ML/d, based on construction costs for a reference plant of average flow of 1.8 ML/d
Dual reticulation system	$1 M – 3 M	Assume pressure booster pump set with 1 ML concrete surface reservoir and two km of DN100 supply main
Irrigation system	$2 M – 5 M	25 ha of irrigation with 20 ML earthen storage dam
TOTAL	**$14 – 26 M**	

5. Conclusion

The Project Site may be serviced by an onsite wastewater management system as the closest existing wastewater system (Clarenza STP which is owned and operated by Clarence Valley Council) is too far away. An onsite wastewater management system would require construction of a wastewater treatment plant at the site, along with suitable conveyance infrastructure (pumps and pipes) to transfer the wastewater from the facilities to the wastewater treatment plant.

The preferred option recommended by this assessment consists of onsite treatment of the sewage generated by the Project during operations. However this would not be confirmed until the Stage 2 of the Project. A portion of the treated effluent (approximately 51%) would be reused within the facility via a dual reticulation system (for compatible uses such as irrigation of playing fields, water for cooling towers and toilet/urinal flushing). The remainder of the treated effluent (49%) would be used for an agricultural irrigation scheme located on the remaining land at the Project Site, including an irrigation storage dam. This would be established at the site to maximise reuse of effluent and, provided there is sufficient area available for irrigation and a suitable storage dam is constructed onsite, all remaining effluent can be reused. This would avoid any discharge of treated effluent to the environment. This approach maximises reuse by including irrigation of the remaining open spaces at the site, outside of the correctional facilities, in addition to the dual reticulation reuse system.

In order to determine the suitability of the site, and identify any specific areas or locations that are not suitable for effluent irrigation, a detailed site and soil study is required to be undertaken. In the absence of such information, a desktop level analysis has been undertaken on the possible scale of the irrigation area. For the analysis, an agricultural irrigation system with an irrigation area of 25 ha with a 20 ML storage dam is proposed. The Project Site has a total area of around 195 ha, of which 125 hectares is considered from the preliminary analysis to be suitable for effluent reuse, hence it is likely that suitable space is available for a 25 ha irrigation area, although placement within the asset protection zone would need to adhere to the requirements of the Bushfire Assessment Report. At this stage only a preliminary analysis of the site's soil characteristics has been undertaken, which indicated no severe impediment to effluent irrigation. However it is recommended that once the exact location is identified in the Stage 2 DA that further assessment, including a detailed soil suitability study be undertaken in accordance with the requirements of the *Environmental Guidelines: Use of Effluent by Irrigation* (NSW DEC, 2004). This would identify any areas on the site that are not suited to effluent irrigation, and would identify any mitigating factors, such as soil improvement and target nutrient concentrations in the recycled water, to manage potential impacts to the environment.

An indicative order of magnitude cost for the preferred option is estimated to be within a range of $14 million to $26 million.

The average inflow of wastewater to the onsite facility at ultimate capacity is 470 kL/d which is equivalent to around 2,240 equivalent persons. Whilst this is less than the threshold for scheduled activities under the *Protection of the Environment Operations Act 1997* (2,500 equivalent persons), it is recommended that the NSW Environment Protection Authority would be the appropriate regulatory authority for the wastewater system. This would allow discharge of any excess treated effluent to the environment via an Environment Protection Licence for the wastewater management system for the Project.

This *Wastewater Working Paper* helps to fulfil some of the requirements under the SEARs No 12 issued for the Project in regards to regards to the management of operational wastewater. Further assessment will be required as part of the Stage 2 DA.

6. References

Australian Guidelines for Water Recycling: Managing Health and Environmental Risks (Phase 1), (Natural Resource Management Ministerial Council, Environment Protection and Heritage Council, Australian Health Ministers Council, 2006)

Environmental Guidelines: Use of Effluent by Irrigation (NSW DEC, 2004)
http://www.clarence.nsw.gov.au/cp_themes/metro/page.asp?p=DOC-KDY-42-34-14

*Water Cycle Management Working Paper (*Jacobs, 29 February 2016)