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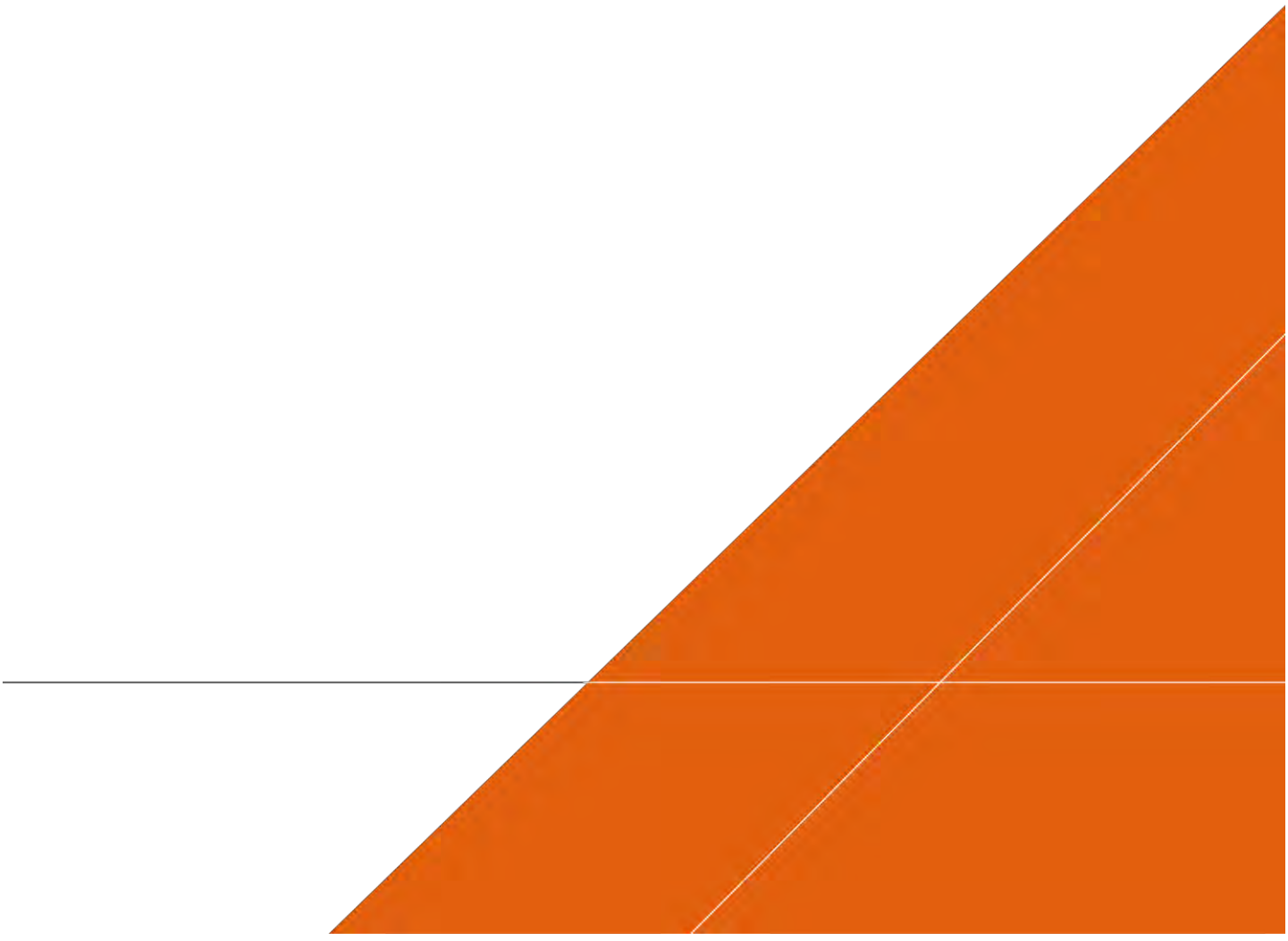
KINGS HILL DEVELOPMENT WATER AND WASTEWATER INFRASTRUCTURE

Stormwater Impact Assessment

16 OCTOBER 2019



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KINGS HILL DEVELOPMENT WATER AND WASTEWATER INFRASTRUCTURE

Stormwater Impact Assessment

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1 INTRODUCTION

1.1 Project Background

Kings Hill Development Pty Ltd (KHD) is seeking approval for the development of a water and wastewater supply pipeline and a wastewater pumping station (the Proposal) to support the development of the Kings Hill Urban Release Area (Kings Hill URA).

The Kings Hill URA was rezoned in 2010 to support a mix of general residential, mixed use and local centre land uses. It is expected to comprise in excess of 3,500 residential dwellings developed over a twenty-five-year period. Key development features of the Kings Hill URA will also include the provision of utilities and supporting infrastructure, including a Pacific Highway grade separated interchange, stormwater channel and water and wastewater infrastructure. There is currently no water and wastewater infrastructure present with the capacity to service Kings Hill URA.

1.2 Key Terms & Abbreviations

The key terms and abbreviations used in this report are outlined in Table 1 below.

Table 1: Terminology

Term	Definition
AEP	Annual Exceedance Probability
CEMP	Construction Environmental Management Plan
Council	Port Stephens Council
Port Stephens DCP	*Port Stephens Development Control Plan 2014*
ESCP	Erosions and Sediment Control Plan
EIS	Environmental Impact Statement
FPL	Flood Planning Level
FPA	Flood Planning Area
HWC	Hunter Water Corporation
Kings Hill URA	Kings Hill Urban Release Area
Port Stephens LEP	*Port Stephens Local Environment Plan 2013*
NRAR	Natural Resources Access Regulator
PMF	Probable Maximum Flood
Proposal	Water and wastewater supply pipeline and a wastewater pumping station to support the Kings Hill URA
Proposal site	The Proposal stretches about 6.7 kilometres between Raymond Terrace in the south and Kings Hill Urban Release Area in the north

Term	Definition
SEARs	Secretary's Environmental Assessment Requirements
SWMP	Soil and Water Management Plan
WWPS	Wastewater Pumping Station

1.3 Proposal Site

The Proposal is located within Port Stephens Local Government Area (LGA), approximately 4 kilometres north of Raymond Terrace, 25 kilometres north of Newcastle and 135 kilometres north of Sydney. The Proposal stretches approximately 6.7 kilometres (the Proposal Site) between Raymond Terrace in the south, and Kings Hill URA in the north. The location of the Proposal site is shown in Figure 1.

The Proposal Site includes the footprints of the wastewater pumping station, water pipeline and wastewater pipeline, in addition to buffer areas and temporary construction compounds. The Proposal construction footprint is provided as Appendix A.

1.4 Proposal Description

An Environmental Impact Statement (EIS) is to be prepared for the Proposal seeking approval as Designated Development under Part 4 of the *Environmental Planning and Assessment 1979* (EP&A Act).

The key components of the Proposal would include:

- Installation of a water and wastewater pipelines, approximately 6.7km and 4.2km in length, respectively. These pipelines would be located within a joint corridor. This would require vegetation clearing, trenching and underboring for the pipes to be laid.
- Construction of a wastewater pumping station (WWPS) within the southern catchment of Kings Hill URA, including installation of electrical components, mechanical installation of pumps, valves and fittings, and construction of adjacent hardstand areas.
- Restoration of area upon completion of pipe laying, including backfilling the trench and restoring all surfaces to their pre-construction condition where practicable.
- Connection of the proposed infrastructure to existing Hunter Water services.

The water pipeline would connect to existing Hunter Water infrastructure in the south and the Kings Hill URA in the north, while the wastewater pipeline would connect to the proposed WWPS in Kings Hill URA and existing Hunter Water infrastructure in the south.

1.5 Purpose of this Report

This report provides the stormwater impact assessment to support the EIS for the Proposal. The Proposal EIS requirements are as per the Secretary's Environmental Assessment Requirements (SEARs) (No. 1291, 19/02/2019) provided for the Proposal in accordance with Section 4.12(8) of the EP&A Act and Schedule 3 the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation).

The purpose of this report is to address the requirements associated with stormwater. SEARs. Requirements related to soils and groundwater have been assessed in separate specialist reports.

Figure 1: Proposal Location

2 REQUIREMENTS & GUIDELINES

2.1 Secretary's Environmental Assessment Requirements (SEARs)

The Proposal EIS requirements are as per the SEARs (No. 1291, 19/02/2019) provided for the Proposal in accordance with Section 4.12(8) of the EP&A Act and Schedule 3 the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation). The SEARs related to stormwater include:

- Assessment of all potential impacts of the proposed development on the existing environment (including cumulative impacts if necessary) and develop appropriate measures to avoid, minimise, mitigate and/or mange these potential impacts.
- Soil and Water including:
  - A description of local soils, topography, drainage and landscapes
  - Details of sediment and erosion controls
  - An assessment of potential impacts on the quality and quantity of surface and groundwater resources, including downstream impacts on Irrawang Swamp and Hunter River
  - Details of any ongoing monitoring programs to access any impacts on water quality, water flow and aquatic and riparian environments within and downstream of all waterways within the vicinity of the site.
- Flooding including:
  - Constraints to detailed design and impacts on the operation of the infrastructure, potential adverse impacts of the proposal on flood behaviour, and contingency measures in the event of operational impacts due to flooding.

2.2 Port Stephens Development Control Plan 2014

In addition to the SEARs the Proposal is to comply with the following objectives and requirements from the P*ort Stephens Development Control Plan 2014* (Port Stephens DCP) where applicable (extracts provided as Appendix B). The detailed design of the Proposal will address the applicable requirements to the satisfaction of Council.

1) B4 Drainage and Water Quality

Applicable to development which:
- increases impervious surface; or
- drains to the public drainage system; or
- involves a controlled activity within 40m of waterfront land.

Requirements consider:
- On-site Detention/On-site Infiltration
- Water Quality
- Riparian Corridors

For the Proposal the requirements may be applicable to locations within 40 meters of ephemeral watercourses crossing the Proposal site as well as the WWPS.

2) B5 Flooding

Applicable to development within the flood planning area (FPA), being areas below the flood planning level (FPL). Council defines the FPL as the 1% AEP flood level plus 0.5m freeboard.

For the Proposal the requirements may be applicable to some locations along the Proposal site. The WWPS is expected to be located above the FPL.

Relevant Flood Planning Maps from the *Port Stephens Local Environment Plan 2013* are provided as Appendix C.

3) D14 Kings Hill – Raymond Terrace

Applicable to development within the identified Kings Hill – Raymond Terrace area. This is essentially the Kings Hill URA located to the north of Proposal site. The requirements also reference the Kings Hill Urban Release Area Water Management Strategy Guidelines (BMT WBM, 2013) mentioned in Section 2.4 below and Section 3.

For the Proposal the requirements may be applicable to the Proposal site at the northern extent in the vicinity of the Riding for the Disabled Association NSW property.

2.3 Waterfront Land Requirements

Approval for development on waterfront land must be obtained from the Natural Resources Access Regulator (NRAR). The NRAR administers the *Water Management Act 2000* to ensure that no more than minimal harm will be done to waterfront land as a consequence of carrying out a controlled activity. The overarching objective of the act is to establish and preserve the integrity of riparian corridors.

Waterfront land applies to all land within 40 meters of the highest bank of a river, lake or estuary. The Guidelines for Controlled Activities on Waterfront Land (NRAR, 2018) outline the required riparian corridor widths based on the watercourse order and identify which works can take place within the riparian corridor.

Where a watercourse does not exhibit the features of a defined channel with bed and banks, the Office of Water may determine that the watercourse is not waterfront land for the purposes of the *Water Management Act 2000*.

For the Proposal the waterfront land requirements may be applicable to areas within 40 meters of the ephemeral waterways crossing the Proposal site.

Note that the Port Stephens DCP requirements for riparian corridors widths vary from these requirements. Consultation with Council will be undertaken to confirm the required widths to be applied for the Proposal during detailed design.

2.4 Kings Hill Urban Release Area Water Management Strategy Guidelines

The Kings Hill Urban Release Area Water Management Strategy Guidelines were developed by BMT WBM (2013) on behalf of Port Stephens Council to provide guidance for preparing water management strategies for future development within the Kings Hill URA. The water management objectives and actions from the report are also provided as Appendix D.

An overview of the Kings Hill Urban Release Area Water Management Strategy Guidelines is provided as Section 3.

For the Proposal the guidelines may be applicable to the Proposal site at the northern extent in the vicinity of the Riding for the Disabled Association NSW property as specified in the Port Stephens DCP Section D14 as mentioned in Section 2.2.

2.5 Hunter Water Design Standards

The Water and Wastewater infrastructure would be designed and constructed in accordance with HWC Standard Technical Specifications and Water Services Association of Australia (WSAA) Codes, including, but not limited to:

- *Hunter Water Corporation Standard Technical Specification for Construction of Sewer Rising Mains (STS403)*
- *Hunter Water Corporation Standard Technical Specification for Construction of Submersible Sewage Pumping Stations (STS402)*
- *Hunter Water Corporation Standard Technical Specification for Chemical Storage and Delivery Systems (STS670)*
- *Hunter Water Corporation Standard Technical Specification for Environmental Protection Measures for Construction sites (STS900)*
- *Wastewater Supply Code of Australia (WSA 02-2014) – Hunter Water Edition*
- *Water Supply Code of Australia (WSA 03 – 2011) – Hunter Water Edition.*

Regarding flooding HWC specifies the following requirements for sewer pumping stations:

- Switch gear to be located above the 100-year flood level
- Finished surface of the top of the wet well roof slab to be 0.3m above the 100-year flood level
- Base of the electrical switchboard cabinet to be mounted a minimum of 0.6m above the 100-year flood level

The WWPS is expected to be located above these flood levels.

3 PREVIOUS STUDIES

3.1 Kings Hill Urban Release Area Water Management Strategy Guidelines

3.1.1 Overview

The Kings Hill Urban Release Area Water Management Strategy Guidelines were developed by BMT WBM (2013) on behalf of Port Stephens Council to provide guidance for preparing water management strategies for future development within the Kings Hill URA. The water management objectives and actions from the report are also provided as Appendix D.

The report identified the following main catchment areas as illustrated in Appendix D and referenced in the Port Stephens DCP (Appendix B):

- the Kings Hill South sub-catchment - the Kings Hill URA area draining directly south to Irrawang Swamp via a number of ephemeral watercourses
- the Kings Hill East sub-catchment - the Kings Hill URA area draining east through existing culverts beneath the Pacific Highway to Grahamstown Dam

With the future development of the area, the Kings Hill URA is expected to divert stormwater flows from the Kings Hill East sub-catchment south to drain directly to Irrawang Swamp. This diversion of flows aims to reduce potential impacts of the Kings Hill URA development on the Grahamstown Dam drinking water quality.

3.1.2 Flood Mapping and Flood Impacts

The Kings Hill Urban Release Area Water Management Strategy Guidelines (BMT WBM, 2013) considered the impact of the proposed Kings Hill URA development on flooding. The report assumes that stormwater runoff from the Kings Hill East sub-catchment will be collected and diverted south to the existing watercourse adjacent to the Riding for the Disabled Association NSW property.

The hydrologic modelling provided the following peak flow estimates for the 2nd order watercourse crossing the unnamed road (and Proposal site) upstream of the Riding for the Disabled Association NSW property:

- Existing scenario: estimated peaks flows of 10, 20 and 131m^3/s for the 20%, 1% AEP and PMF
- Kings Hill URA developed scenario: estimated peaks flows of 10, 19 and 115m^3/s for the 20%, 1% AEP and PMF

The report notes that although the future developed areas increase catchment imperviousness and consequently runoff volumes and peak flows, in some locations the more rapid runoff response of the urbanised lower catchment does not coincide with the slower runoff response of the forested upper catchment. This is one such location where the resulting peak flows have not increased as a result of the Kings Hill URA development.

Flood mapping from the BMT WBM report for the Kings Hill URA developed scenario along with flood impact mapping of the development for the 20% and 1% AEP have been provided in Appendix D. The mapping demonstrates that the development of the Kings Hill URA is expected to increase peak flood levels upstream of the Riding for the Disabled Association NSW property by 0.25m in the 1% AEP and 0.5m in the 20% AEP. This flood impact has largely resulted from the diversion of the Kings Hill East sub-catchment to the watercourse.

4 EXISTING ENVIRONMENT

4.1 Existing Land Use

The southern portion of the Proposal site is located within Raymond Terrace and traverses urban areas characterised by low density residential development.

The northern portion of the Proposal Site is located beneath an overhead electrical easement in otherwise undeveloped "greenfield" land, owned and managed by HWC. This land also contains Irrawang Swamp, a Coastal Wetland (I.D. 36586) listed under *State Environmental Planning Policy (Coastal Management) 2018* (Coastal Management SEPP). The northern-most extent of the Proposal Site is located within the Kings Hill URA, which is currently undeveloped and supports cattle grazing.

Located to the east of the northern portion of the Proposal Site is the Pacific Highway, and further east, Grahamstown Dam. Grahamstown Spillway, constructed in 2005, allows for the safe discharge of flows from the dam towards the Coastal Wetland in the west. The smaller Irrawang Spillway (located north of Grahamstown Spillway) is no longer operational. The Proposal would traverse both spillways through the constructed channels upstream of the spillway structures located on the western side of the Pacific Highway. Site photos of the Proposal site which illustrate the typical existing land use are provided as Appendix E.

4.2 Soils

The soil runoff potential and erosion hazard has been reviewed based on the Landcom 2004 Managing Urban Stormwater: Soils and Construction – Volume 1 (commonly known as the 'Blue Book'). The following soils landscapes were identified for the Proposal site based on the Soil Conservation Service of NSW Sydney 1:100,000 Soil Landscapes Series Newcastle Sheet:

- Wallalong – residual: located in the Proposal site, north of the Grahamstown Spillway
- Bolwarra Heights – erosional: located in the Proposal site, south of the Grahamstown Spillway

These soils are considered to have a moderate to high runoff potential with a slow to moderate rate of infiltration. Based on the site location and typical slopes for the Proposal site the potential erosion hazard was generally found to be low.

4.3 Topography and Hydrology

4.3.1 Regional Area

The Proposal site is located between two significant waterbodies with Grahamstown Dam to the east and Irrawang Swamp to the west. The Proposal site (along with the Pacific Highway and Adelaide Street) typically follows the north/south ridgeline dividing the catchment areas of these waterbodies.

Grahamstown Dam covers 2,800 hectares and is the Hunter's largest drinking water supply dam. Flows from Grahamstown Dam may discharge to the Irrawang Swamp via the Grahamstown Spillway, with the smaller Irrawang Spillway no longer in service. Irrawang Swamp is located within the larger Williams River floodplain. Williams River drains south to the Hunter River and ultimately discharges to the ocean at Newcastle. Site photos of both spillways are provided as Appendix E.

The existing topography and watercourses of the region are illustrated in Figure 2.

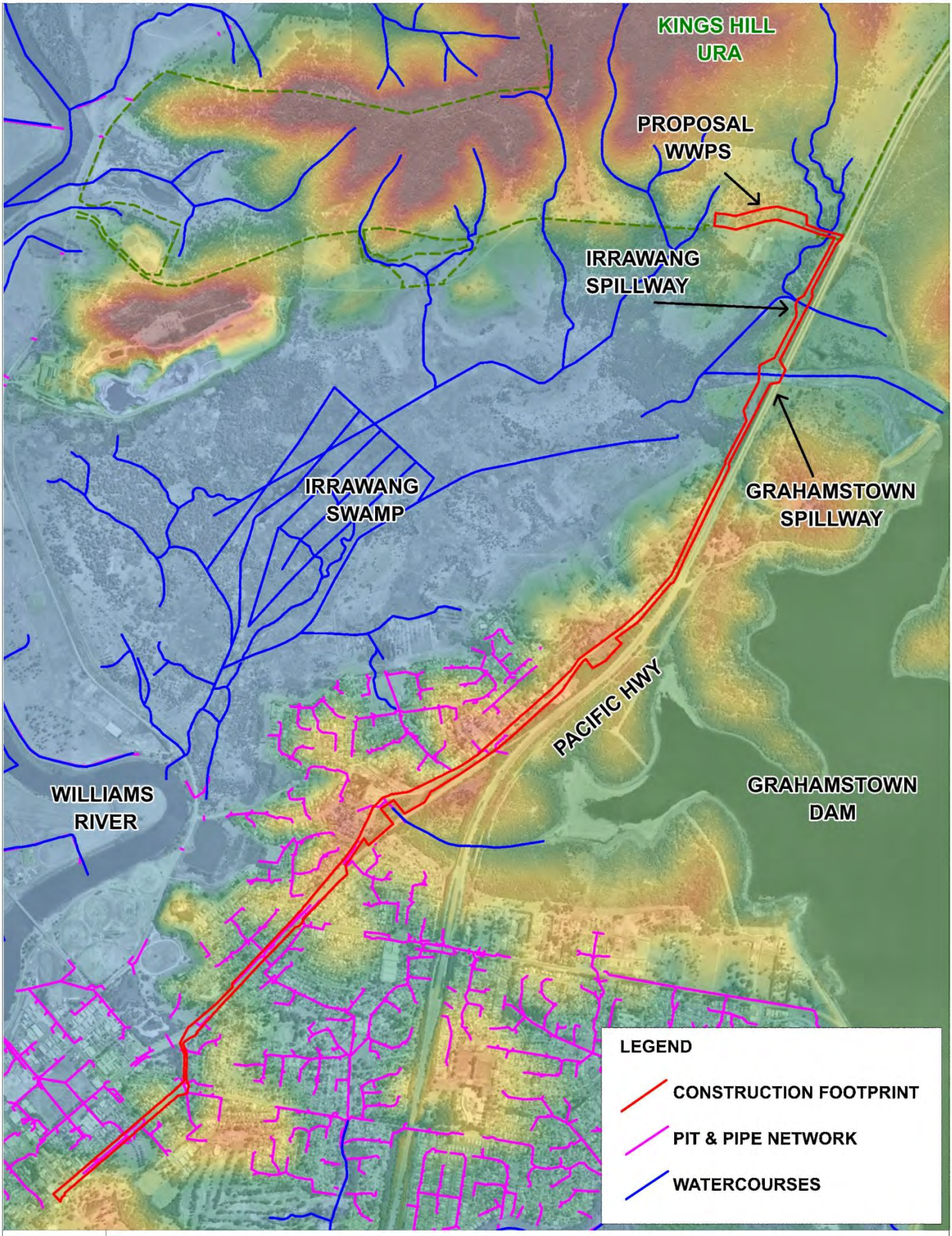

Figure:	Title:
2	**Regional Topography and Watercourses**
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4.3.2 Proposal Site

Along the Proposal site elevations regularly undulate ranging from high points of 33mAHD down to as low as 4mAHD in low lying areas. The lowest locations along the Proposal site occur at the spillway locations and the southern area of the Raymond Terrace urban areas where the Williams River meets the Hunter River. The WWPS location sits at a high point of the surrounding terrain.

Stormwater runoff from the majority of the Proposal site would generally drain west to Irrawang Swamp as overland sheet flow with little to no formal drainage network present. Through the Raymond Terrace residential area and sections of the Proposal site, located north of the Richardson Road and Pacific Highway intersection, may drain to Grahamstown Dam via the local pit and pipe drainage network and roadways.

The Port Stephens Council pit and pipe drainage network may be present along the Proposal site. The drainage network serves the residential development and is expected to be more prevalent in denser and newer residential areas, along the main roadways and low points in the topography.

The Proposal site crosses three ephemeral watercourses, two of which have been created by the operating Grahamstown Spillway and the obsolete Irrawang Spillway. The third watercourse is from the Kings Hill URA area draining from the north (part of the Kings Hill South sub-catchment area). This watercourse crosses the Proposal site at the unnamed road upstream of the Riding for the Disabled Association NSW property. The upstream of this watercourse is predominately undeveloped bushland. The watercourse as viewed from the unnamed road is illustrated below in Figure 3.

Figure 3: Kings Hill URA Watercourse

Based on the Strahler System of ordering watercourses and the Guidelines for Controlled Activities on Waterfront Land (NRAR, 2018), the following riparian corridor widths and controls apply to the watercourses:

- Irrawang and Grahamstown Spillway Watercourses
  - 1st order watercourses
  - Required vegetated riparian zone of 10 meters either side of the watercourse
  - Total riparian corridor width of 20 meters plus the channel width from top of bank
  - Stormwater outlet structures and essential services, stream realignment and road crossings allowed within the riparian corridor.
- Kings Hill URA at the Riding for the Disabled Association NSW property Watercourse
  - 2nd order watercourse
  - Required vegetated riparian zone of 20 meters either side of the watercourse
  - Total riparian corridor width of 40 meters plus the channel width from top of bank
  - Stormwater outlet structures and essential services and road crossings allowed within the riparian corridor.

Note that the Port Stephens DCP requirements for riparian corridors widths vary from NRAR requirements. Consultation with Council will be required to determine the required widths to be applied for the Proposal during detailed design.

4.4 Flooding

4.4.1 Port Stephens Local Environment Plan 2013

The *Port Stephens Local Environment Plan 2013* provides flood hazard mapping of the Proposal site as provided in Appendix C. The majority of the Proposal site is outside of the flood prone land. Near the northern and southern extents of the Proposal site some areas are within the low hazard flood fringe and flood planning area.

4.4.2 Williams River Flood Study

The Williams River Flood Study was prepared by BMT WBM (2009) for Port Stephens Council and Dungog Shire Council to describe and define the existing flood behaviour for the Williams River area. The flood study provides the following estimated design flood levels for the Irrawang Swamp:

- Irrawang Swamp (Location 18)
  - 10% AEP = 2.3mAHD
  - 5% AEP = 4.1mAHD
  - 1% AEP = 4.6mAHD
  - PMF = 9.6mAHD

The majority of the Proposal site is located above the Irrawang Swamp PMF level including the WWPS.

4.4.3 Kings Hill Urban Release Area Water Management Strategy Guidelines

As outlined in Section 3.1.2, the Kings Hill Urban Release Area Water Management Strategy Guidelines (BMT WBM, 2013) considered the impact of the proposed Kings Hill URA development on flooding. The report assumes that stormwater runoff from the Kings Hill East sub-catchment will be collected and diverted south to the existing watercourse adjacent to the Riding for the Disabled Association NSW property.

Flood mapping from the BMT WBM report for Kings Hill URA developed scenario along with flood impact mapping of the development for the 20% and 1% AEP have been provided in Appendix D. The flood mapping of the developed scenario does not appear significantly different to the Port Stephens LEP flood hazard mapping mentioned in Section 4.4.1. It is possible that the flood mapping from the BMT WBM report has been used for the LEP flood hazard mapping, which can be confirmed with Council during detailed design.

The BMT WBM flood impact mapping demonstrates that the development of the Kings Hill URA is expected to increase peak flood levels upstream of the Riding for the Disabled Association NSW property by 0.25 meters in the 1% AEP and 0.5 meters in the 20% AEP. This flood impact has largely resulted from the diversion of the Kings Hill East sub-catchment to the watercourse. This flood impact will need to be addressed as part of the Kings Hill URA development.

5 PROPOSAL CONSTRUCTION WORKS

5.1 Infrastructure

The Proposal would involve the construction of the following infrastructure:

- water and wastewater pipelines located within a joint corridor including hydrants, valves and ventilation stacks
- wastewater pumping station (WWPS) within the southern catchment of the Kings Hill URA, including:
  - electrical components, mechanical installation of pumps, valves and fittings
  - vent stack
  - overflow relief structure
  - adjacent hardstand area and access track
  - security fencing, gates and/or chains as required

The exact location of the infrastructure would be determined during detailed design but would remain within the construction footprint, the area within which a final location would be chosen. An example of a typical WWPS and vent stack are illustrated in Figure 4 and Figure 5.

5.2 Sequence of Works

The Proposal would involve the following sequence of construction works:

- site establishment including construction compounds and stockpile areas
- vegetation clearing
- trenching and underboring for the pipes to be laid
- installation of water and wastewater pipelines and commissioning
- WWPS construction
- connection to existing HWC infrastructure
- site restoration

5.3 Pipeline Commissioning

The water and wastewater pipelines would be commissioned in sections as construction progresses. Commissioning would involve flushing the pipelines with potable water to remove any debris present. HWC protocols will be followed.

Between approximately 800 and approximately 1500 kilolitres of water would be discharged to land or adjacent waterways during pipeline commissioning. The variance in the amount of water required is due to the quantity of debris that needs to be flushed from the pipeline and the requirement to achieve safe water quality levels.

Figure 4: Example of a Typical WWPS

Figure 5: Example of a Typical Vent Stack

6 POTENTIAL IMPACTS

Surface water quality and quantity may be impacted where changes are made to land use, topography or drainage networks. Potential impacts of the Proposal on surface water quality and quantity during construction and operation are discussed below. Potential impacts are identified for both within the Proposal site and surrounding areas.

If not adequately managed, construction activities and infrastructure development have the potential to impact surface water quality and quantity either directly or indirectly by providing contaminant sources, altering ground cover, concentrating flows, altering flow paths and reducing flood storage. This may result in increased surface runoff volumes, velocities and peak flows, scouring and mitigation of pollutants. Ultimately this can lead to increased pollutant loads and flood impacts adversely impacting the surrounding environment. The potential impacts identified for the Proposal can be avoided, minimised, mitigated and/or managed by implementing suitable mitigation measures through the Proposal design and construction management.

6.1 Construction

Construction activities with the potential to impact the surface water quality and quantity of the downstream environment associated with the Proposal construction include:

- Alteration of the topography and associated catchment areas of the Proposal site
- Alteration or removal of drainage pathways across the construction area
- Removal or modification of existing drainage, retention or diversion structures
- Concentration of surface water flows
- Use of water for construction activities such as dust suppression, commissioning of the pipelines and dewatering
- Vegetation clearing
- Demolition or removal of existing structures, infrastructure or materials
- Stockpiling of materials
- Spills or leaks of substances such as oil, hydraulic fluids and fuels
- Waste materials from construction activities
- Movement of vehicles and equipment

The risk of construction activities impacting water quality or water quantity is increased in proximity to areas such as:

- Concentrated flow paths such as the ephemeral watercourses (Irrawang and Grahamstown Spillway watercourse and the Kings Hill URA watercourse) and the existing pit and pipe drainage lines
- Flood planning areas which may be impacted by flooding in a large event
- Construction compound areas where stockpiling of materials and equipment occurs
- Locations where the pipeline commissioning will involve discharging of water to adjacent land or waterways.

There would be minimal removal of aquatic habitat in the Kings Hill URA watercourse. A small area of aquatic sedges and some instream coarse woody debris may be impacted. Works would be undertaken during periods of no flow so that fish passage would not be impacted. No impacts to threatened fish are anticipated. Ecology impacts are discussed further in the Biodiversity Development Assessment Report (BDAR) prepared by Arcadis and provided as an Appendix to the EIS for the Proposal.

6.2 Operation

6.2.1 Proposal Pipelines

Once the proposed pipelines have been constructed, the construction footprint would be rehabilitated to its existing condition along the full length of the pipelines. Backfilling of the pipeline trench may reduce the permeability of the Proposal site due to compaction, potentially resulting in increased stormwater runoff volumes. Minimal additional aboveground infrastructure would be present along the alignment of the pipelines such as vent stacks, hydrants and valves.

Given the above, existing stormwater runoff quality, volumes and peak flows are not expected to be significantly impacted as a result of the proposed pipelines being constructed and operational.

There is a risk of minor increase in inundation of the swamp during pipeline commissioning when flushed water is discharged. Volumes of water to be discharged are small: between 800kL and 1500kL over the length of the pipeline. Hydrological impacts are therefore likely to be minor. As discussed in the BDAR, impacts to water quality in the swamp and changes to biophysical properties are likely to be minor or negligible and localised during construction.

Whilst unlikely, during the operational period there is the risk of the pipelines leaking or spillage during maintenance activities which could potentially impact the downstream water quality of nearby waterways. The extent of water quality impacts would depend on the volume of leakage/spill and spread.

6.2.2 Proposal WWPS

Construction and operation of the WWPS have the potential to impact water quality and quantity by:

- Altering the topography and associated catchment areas
- Concentrating surface water flows
- Increasing the imperviousness of the ground cover
- Reducing flood storage
- Providing a source of contaminants including discharge from the overflow relief structure

The above may increase stormwater runoff volumes, peak flows and pollutant loads discharging to the downstream environment.

7 MITIGATION MEASURES

The following mitigation measures can be implemented through the infrastructure design and construction management to avoid, minimise, mitigate and/or manage the potential impacts of the Proposal.

7.1 Design

Detailed topographic survey would be undertaken during the detailed design phase to ensure any constructability issues and impacts on the existing drainage, catchment areas and topography are identified and minimised as far as practicable.

The latest planning and design of the Kings Hill URA, any associated studies and investigations will be sought to inform the detailed design of Proposal. Consultation will be held with Council to ensure that the future development of the Kills Hill URA is suitably considered, and that Proposal is in line with the regional approach to minimising stormwater impacts.

The Proposal pipelines may intersect the existing pit and pipe drainage network. In these instances, it is envisaged that:

- the alignment may be adjusted to avoid impacting the network;
- modification may be made to the existing network to accommodate the alignment of the pipelines; or
- underboring may be used to pass under the existing drainage network.

Consultation with Council will occur during the design process to ensure that any impacts on the Council existing network are agreed to prior to construction.

7.1.1 WWPS

Where practicable the design of the WWPS will:

- Ensure specified design elements are above the 100-year flood level in accordance with HWC requirements
- Minimise the above ground footprint and impervious area
- Maintain the existing local catchment and surface grades

The construction footprint is sizable enough for the WWPS to be located both above the 100-year flood level and outside of the riparian corridors of the ephemeral watercourses to the east and west.

The WWPS will require on-site detention to mitigate peak flows to existing conditions in accordance with Port Stephens DCP requirements. Additional water quality treatment may also be required. This will be determined during detailed design based on the size and configuration of the aboveground footprint in accordance with Council requirements.

Given the relatively small footprint of the WWPS in relation to the upstream catchment area and being located above the FPL, the WWPS it is not expected to produce a significant water quality or quantity impact on the downstream environment. This would be confirmed during detailed design.

Any concentrated stormwater discharge or sewer overflow relief would be directed east. Stormwater outlets to the watercourse would be strategically positioned to minimise the potential for localised scouring due to point discharge with scour protection provided where required.

Any mitigation measures required to address water quality and quantity for the WWPS would be managed prior to discharge to the watercourse. Management of the WWPS flow relief structure would be in accordance with HWC standards.

7.2 Construction

7.2.1 Staging and Timing of Works

Construction activities will be staged and timed to:

- Limit the area and duration of disturbance
- Avoid wet weather periods

Staging and timing of works are particularly important when working in higher risk areas for impacts such as near concentrated flow paths (existing or temporary), watercourses and riparian corridors, spillways, the existing pit and pipe drainage network and areas below the flood planning level.

7.2.2 Erosion and Sediment Control

A Soil and Water Management Plan (SWMP) and Erosion and Sediment Control Plan (ESCP), or equivalent, would be incorporated into the Construction Environmental Management Plan (CEMP) for the construction of the Proposal. The SWMP and ESCP would be developed in accordance with the principles and requirements of the Landcom 2004 Managing Urban Stormwater: Soils and Construction – Volume 1 (commonly known as the 'Blue Book').

Temporary construction erosion and sediment control measures that would be implemented prior to construction of the Proposal include sediment fences, temporary sediment ponds, shaker grids and/or wash down areas at all vehicle access points, and sandbags (or similar) for protection of all existing stormwater infrastructure.

The ESCP will be progressively updated to reflect the changing nature of the Proposal site as construction activities progress. The following aspects would be addressed within the SWMP and ESCP:

- Appropriate sediment and erosion controls to be implemented prior to soil disturbance around the impact area, to reduce run-off into adjoining vegetation and downstream to the Coastal Wetland.
- Demarcation of vegetation clearing boundaries, sensitive areas and vegetation within vicinity of the construction footprint that is to be retained prior to construction, clearing or stripping works commencing.
- Stormwater management to avoid flow over exposed soils.
- Location of stockpiles to be outside of localised depressions, overland flow paths, riparian corridors and areas below the flood planning level as far as practicable.
- Inspection of all erosion and sedimentation control works prior to and post rainfall events.
- Discharge of water into watercourses and overland flow paths that drain to Irrawang Swamp during pipeline flushing would be avoided. Where this cannot be avoided, measures to dissipate water and reduce volume of flows would be implemented.
- Stabilisation / revegetation of disturbed areas is to be undertaken as soon as practicable progressively throughout the phased works to minimise disturbed areas exposed to the forces of erosion at any one time.
- Wheel wash or rumble grid systems installed at exit points to minimise dirt on roads.
- Construction traffic restricted to delineated access tracks and maintained until construction complete.
- Pre-start checks, as well as maintenance in accordance with manufacturers requirements to be undertaken on equipment to minimise the potential for leaks and spills from vehicles.

- Storage of materials on-site to be minimised.
- Suitable waste receptacles to be provided and maintained.
- Storage of any fuels, oils, lubricants, chemicals and Dangerous Goods and similar products will be stored in accordance with appropriate standards with emergency spill kits maintained on-site.
- Wet weather monitoring protocol including Grahamstown Dam water levels as well as predicted rainfall events.

In general, the ESCP will aim to maximise the separation of 'clean' water from offsite, and 'dirty' water from on-site. Site boundary controls will be implemented (e.g. sediment fencing, earth banks, mulch bunds, swales and table/diversion drains) around the perimeter of the Proposal site, as early in the construction process as possible. Water diversion drains will be stabilised to minimise channel erosion. Locations where surface runoff ultimately drains to Grahamstown Dam will be identified and given increased measures to avoid any impacts to the downstream waterbody.

In addition, the SWMP will include the protocol and specific mitigation measures related to the pipeline commissioning in accordance with HWC requirements.

7.3 Monitoring

Inspection and monitoring of erosion and sediment control measures, pipeline performance, watercourses and downstream water quality will be undertaken regularly throughout the construction period and following large rainfall events.

For a period of six (6) months following construction, regular monitoring will be undertaken for the Proposal site rehabilitation, pipeline performance, watercourses and downstream water quality. Any scour, vegetation or water quality issues that arise would be investigated and rectified.

An incident response procedure would be developed in the event of a pipeline leak and monitoring of relevant adjacent waterways, Irrawang Swamp and/or vegetation communities would be undertaken where there is a risk of impact from a leak.

8 CONCLUSION

The construction of the Proposal presents a range of potential water quality and quantity impacts. However, it is expected that these impacts can be suitably managed through the well-planned application of standard erosion and sediment control in accordance with the Landcom 2004 Managing Urban Stormwater: Soils and Construction – Volume 1 (commonly known as the 'Blue Book').

The Proposal is not anticipated to have any significant operational impacts on water quality and quantity as the ground surface will be returned to its existing condition with little above ground infrastructure present. The pipeline alignment may impact the Port Stephens Council pit and pipe drainage network. Any modification to Council's network would be based on consultation and agreement with Council prior to construction.

Whilst its impact is expected to be minimal, the design of the WWPS would aim to minimise its footprint and impacts on the existing water quality and quantity in accordance with Council requirements. In addition, it would be suitably located above the 100-year flood level in accordance with HWC requirements.

The commissioning of the pipelines, ongoing inspection of the pipelines and management of the WWPS overflow relief would be in accordance with HWC standards.

Monitoring and inspection of erosion and sediment control measures, Proposal infrastructure and surrounding watercourses and waterbodies would occur through the construction period and for a period of six (6) months after.

9 REFERENCES

- BMT WBM (2013) *Kings Hill Urban Release Area Water Management Strategy Guidelines*
- BMT WBM (2009) *Williams River Flood Study*
- Landcom (2004) *Managing Urban Stormwater: Soils and Construction – Volume 1*
- Natural Resources Access Regulator (2018) *Guidelines for Controlled Activities on Waterfront Land*
- Port Stephens Council (2014) *Port Stephens Development Control Plan*
- Port Stephens Council (2013) *Port Stephens Local Environment*

APPENDIX A

Proposal Construction Footprint

0 100 m

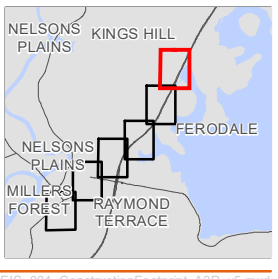
LEGEND

- Construction footprint
- Compound area
- Cadastre (LPI 2017)
- Proposed water alignment
- Proposed wastewater alignment

ARCADIS AUSTRALIA PACIFIC PTY LTD
ABN 76 104 485 289
Level 16, 580 George Street, Sydney NSW 2000
P: +61 (0) 2 8907 9000 | F: +61 (0) 2 8907 9001

Coordinate System: GDA 1994 MGA Zone 56
Date issued: October 9, 2019

1:3,000 at A3



Construction Footprint

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Created by : RP
QA by : EM

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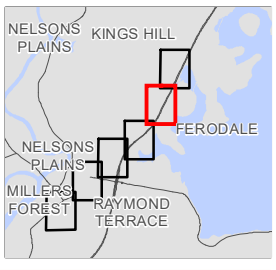

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GRAHAMSTOWN LAKE

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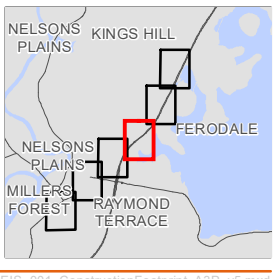

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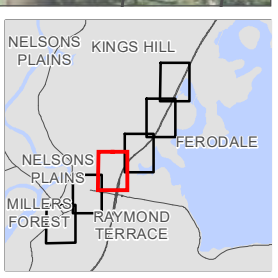

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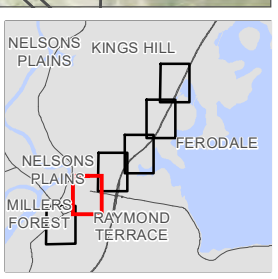

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