Patons Lane Resource Recovery Centre – Integrated Water and Leachate Plant Modifications

Soil and Water Impact Assessment

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Executive Summary

The Patons Lane Resource Recovery Centre (PLRRC) (the Facility) is a resource management facility located at 123-179 Patons Lane, Orchard Hills (Lot 40, DP 738126) within the former Erskine Park Quarry owned by SRC Properties Pty Ltd (a wholly owned subsidiary of Bingo Industries).

The PLRRC operates under a State Significant Development approval (MP09_0074) as a resource recovery centre and landfill for commercial and industrial (C&I) and construction and demolition (C&D) wastes (non-putrescible general solid waste).

Since the existing approval was granted for the Facility by the NSW Land and Environment Court in 2012, there has been changes to market conditions, Bingo's broader network operations and the NSW waste management regulatory framework. These changes have highlighted the need for Bingo to adjust site operations at the Facility.

Rhelm has undertaken a specialist Soil and Water Impact Assessment (SWIA) in support of the environmental assessment (Modification Report) for the proposed modifications at the Facility (the Modification Proposal).

Existing Water Management Context

With respect to overall water management, the site currently has a number of constructed water management basins that serve the purpose of either:

- Leachate storage in an existing leachate dam (dealing with leachate from the landfill portions of the site or water that has been in contact with waste, also referred to as 'contact' water), or
- Recycling Water Treatment Plant (RWTP) water storage tanks (within the RRC area), or
- Stormwater runoff capture and treatment in a range of dams known as Dams 1, 2a, 2, 3, 4, 5 and 6 (generally treatment by settlement and losses from the surface by evaporation).

Leachate from the site is not released to the environment and is currently tankered off-site (as there is no sewerage system connection currently available at the site).

The site is subject to the conditions of existing environment protection licences (EPL) issued under the Protection of the Environment Operations Act, 1997 (EPLs 21259 and 20814). These licences include requirements for water management and monitoring for the site. EPL 21259 relates to the resource recovery centre operations at the site (resource recovery and waste storage activities), while EPL 20814 relates to landfill operations (extractive activities and waste disposal (application to land) activities).

Proposed Modification and Associated Water Management Arrangements

The Modification Proposal aims to improve the quality of recovered soils from processing of building waste, to protect human health and the environment. This plant and investment will help Bingo improve the quality of recovered soils and aggregates, increase diversion rates and better deliver on the objectives of the NSW Government's Waste and Sustainable Materials Strategy 2041: Stage 1 – 2021-2027. NSW currently has an under supply of processing capacity for general solid waste resource recovery, therefore the modified development will provide additional processing capacity to ensure more wastes are recovered and re-used and less are sent to landfill. The Modification Proposal is also seeking to upgrade the landfill leachate treatment system to achieve improved water quality outcomes related to the landfill. Provision of a leachate treatment plant would improve the reliability and efficacy of the leachate management system, bringing the site in line with modern best practice and improving environmental outcomes.

The proposed elements of the integrated water treatment management system upgrades include:

- an additional new raw leachate dam,
- new contact water dam,
- Leachate Treatment Plant (LTP),
- Recycling Water Treatment Plant (RWTP) infrastructure to support the resource recovery centre, and
- a future connection to sewer and potable water.

The RWTP is proposed to be located north-east of the existing PLRRC buildings and within the confines of the earthen bunds of the PLRRC. Existing dual sand conveyors are considered part of the RWTP and will be regularised as part of the Modification Proposal. The proposed LTP is proposed to be located to the north-east of the proposed raw leachate dam and a potential future sewer connection point near the existing site entrance. The compound and infrastructure layout are indicative and subject to final contractor requirements and detailed design.

The RWTP would assist in removing silt loads within process water from the resource recovery centre enabling reuse of this water in the system. This upgrade to the RWTP is required to ensure adequate treatment of wash water for reuse in an NSW EPA approved resource recovery trial. The trial will identify if the Facility's processes are suitable to accept and treat materials classified as general solid waste (GSW). The upgrades to the RWTP and water reuse would allow additional resource recovery of aggregates, sands, ferrous and non-ferrous metals that would otherwise be lost to landfill. Provision of the LTP would improve the reliability and efficacy of the leachate management system, bringing the site in line with modern best practice and improving environmental outcomes.

To support the modification application this assessment covers the following aspects of soil and water management:

- Surface Water Quantity,
- Surface Water Quality,
- Erosion and Sediment Control,
- Groundwater, and
- Water Monitoring.

Impact Assessment

Surface Water Quantity

A MUSIC model was developed to inform both the water quantity and water quality assessment of the Modification Proposal, as compared to the 2012 Approval. The water balance characteristics of both the existing conditions and proposed scenario with modified site stormwater catchments were considered and compared to the results of the *Orchard Hills Waste and Resource Management Facility – Surface Water Assessment* (GSS Environmental & BMT WBM, 2010) to assess incremental impacts. Details of the leachate water balance are provided in the *Patons Lane Resource Recovery Centre – Leachate Water Balance Assessment* (GHD, 2022).

The assessment revealed a shortfall in dry year water availability for the proposed scenario if the site is reliant solely on surface runoff water and baseflow from the local catchment and stored in site dams. A shortfall is also predicted in average rainfall years when the plant is operated at full capacity. The current permissible groundwater extraction under the site Water Access Licence of 16ML/year fills the water deficit in wet years;

however, additional sources of water are required to meet the projected demand in dry rainfall years and at the maximum RWTP processing rate in average rainfall years. Additional water will be provided using a combination of the options below during dry years and when required at the maximum RWTP processing rate:

- using water available under the existing Water Access Licence (WAL),
- import of water (water tankering) and storage on site,
- a potable water connection (there is currently no potable water connection at the site, however an application with Sydney Water Corporation is currently underway and potable water connection will be in place by February 2023), or
- a regional recycled water connection (from the Upper South Creek Advanced Water Recycling Centre, when complete, which is currently estimated to be operational in 2026[1]).

A flow duration analysis using MUSIC model results revealed that outflow durations under the existing and proposed scenarios are similar to the Final Landform scenario reported in GSS Environmental & BMT WBM (2010) and that of an undeveloped catchment draining to a first order stream. The Modification Proposal is thus not expected to adversely impact the environmental flow regime of South Creek.

Surface Water Quality

The MUSIC model was used to quantify the site pollutant loading under existing conditions and with the proposed treatment facilities and modifications to site leachate catchments.

Results of the MUSIC model show a slight reduction in outflow stormwater pollutant loads from the site in the proposed scenario due to the reduced stormwater catchment area, increased site re-use and land use changes over the footprint of the proposed treatment plants.

Erosion and Sediment Control

The requirement for additional erosion and sediment controls is limited due to the significant measures already present on site as part of the existing operations, primarily through the existing approved *Patons Lane Resource Recovery Centre Soil, Water and Leachate Management Plan* (SWLMP) (GHD, 2019b).

Recommended erosion and sediment controls include silt fencing around the downslope side of the proposed treatment plants during construction.

Groundwater

The regional groundwater aquifer exists within the Hawkesbury Sandstone beneath the site. There is expected to be negligible recharge of groundwater from the overlying Bringelly Shale into the underlying Hawkesbury Sandstone. The site itself is underlain by low permeability clay/shale geology which will act as a natural barrier to prevent the off-site migration of pollutants and is an aquitard. There is also no measured interconnection between groundwater in the shale beneath the site and Blaxland Creek (Aquaterra, 2010).

Work as executed plans for the existing leachate dam indicate the dam is underlain by a clay liner more than 600mm thick, which acts as a leachate barrier system to protect the underlying Hawkesbury Sandstone aquifer.

Given the Modification Proposal works involve only minor changes to surface water infrastructure and changes to the leachate management system, which is not connected to the groundwater system, the modification

[1] https://www.sydneywatertalk.com.au/uppersouthcreek, accessed 30 November 2022

works are not expected to intersect regional groundwater and there is no expected risk of adverse impacts on groundwater associated with the modification.

Water Monitoring

There is an existing water monitoring program for the site (Soil, Water and Leachate Management Plan (SWLMP)), which includes surface water and leachate monitoring (GHD, 2019b).

Water level monitoring is proposed for Dam 1 once this is converted to a leachate and contact water dam.

Conclusions

In conclusion, the Modification Proposal is not constrained by any water quality or groundwater issues. Water balance modelling revealed additional water sources will be required for the RWTP operation during dry years and also in average rainfall years when the plant is operating at maximum capacity.

This assessment indicates the Modification Proposal will not have any significant environmental impact on soil or water at or surrounding the site during the construction or operation phase, provided the mitigation measures proposed in **Section 5** are implemented.

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A – Site Photographs (30 August 2022)

1 Introduction

1.1 Background

SRC Operations Pty Limited (SRC Operations, a wholly owned subsidiary of Bingo Industries) are proposing to undertake modifications to the Patons Lane Resource Recovery Centre (PLRRC) in Orchard Hills, NSW (the Modification Proposal). The proposed modifications are the subject of a modification application to the existing State Significant Development (SSD) consent (MP09_0074), under Part 4.55(1A) of the NSW *Environmental Planning and Assessment Act 1979*.

Jackson Environment and Planning Pty Ltd (JEP) on behalf of SRC Operations, engaged Rhelm Pty Ltd (Rhelm) to prepare supporting documentation in the form of a specialist Soil and Water Impact Assessment (SWIA) for the Modification Proposal. This SWIA will be incorporated as a technical appendix to the Modification Report being prepared by JEP, which will accompany the modification application.

This report presents the methodology and results of the SWIA of the Modification Proposal. The impact assessment focuses on quantifying the impacts (both positive and negative) to the site's existing water management system, and compares the impacts as quantified under the 2012 Approval.

1.2 Relevant Guidelines and Regulatory Context

There are a range of relevant soil and water-related planning controls and policies and other guidelines that apply to the development. These are summarised below, and reference is made where relevant in the Impact Assessment section of this report (**Section 4**).

1.2.1 Department of Planning and Environment Requirements

There are no formal Secretary's Environmental Assessment Requirements (SEARs) for the Modification Proposal, however the Department of Planning and Environment (DPE) provided some high-level direction about water management expectations, as listed in **Table 1-1**, which have been addressed in this assessment.

Table 1-1 DPE Water Management Requirements for the Modification Proposal

Water Management Requirement	Addressed in
Details of nearby water resources	Section 2.1
Site water balance	Section 4.5.2
Details of stormwater/wastewater/leachate management systems – including characterisation of water quality at point of discharge	Section 2.3 and Section 4.4.1
Mitigation/management and monitoring measures	Section 5

1.2.2 Penrith LEP/DCP

The site is located within the Penrith LGA. The *Penrith Local Environmental Plan 2010* (Penrith LEP 2010) and *Penrith Development Control Plan 2014* (Penrith DCP 2014) apply to the site and contain a number of soil and water-related clauses that have been considered for their relevance to the proposed modifications. The site is zoned RU2 Rural Landscape and C2 Environmental Conservation under this LEP.

The following clauses that have been considered for their relevance to the development:

- Clause 5.21 Flood Planning - a small portion in the far northwest of the site is indicated as Flood Planning Area on Council's Flood Planning Land Map, however no modifications to landform are proposed in this area of the site. This clause therefore does not apply to the proposed modifications.
- Chapter 7.1 Earthworks – the proposed development involves earthworks associated with the construction of the leachate treatment plant and wash treatment plant facilities. Proposed erosion and sediment controls for the proposed modifications are discussed in **Section 0**.

The following portions of the Penrith DCP 2014 have been identified as being informative for the assessment (noting that the associated LEP provisions generally do not directly apply and therefore the DCP provisions have been applied only as examples of acceptable practice):

- C3 Water Management
- C4 Land Management.

1.2.3 Wianamatta-South Creek Stormwater Management Guidelines

The site is located in the Wianamatta-South Creek catchment where stormwater management plans for development are required to comply with *Technical guidance for achieving Wianamatta-South Creek stormwater management targets* (Wianamatta-South Creek Guidelines) (DPE, 2022). This guide was issued in September 2022.

However, whilst this guide is relevant, it is important to note that the RRC operations for the site operate under an existing consent (**Section 1.2.5**) and discharge requirements for site are also controlled by the provisions of an existing Environmental Protection Licence (**Section 1.2.6**). As such there are boundaries to the application of some of the management targets (largely water quantity and environmental flow objectives) set out in DPE (2022) and these are discussed with respect to the proposed modifications in this report where relevant.

1.2.4 Climate Change

A review of publicly available documents on the Penrith City Council website during the preparation of this assessment revealed no specific guidance regarding climate change assessments. Climate change is mentioned a number of times in the Penrith LEP 2010 and Penrith DCP 2014, but with no specific direction regarding suitable climate change factors to be applied to stormwater assessments.

Despite a projected increase in rainfall intensity associated with climate change, rainfall events are predicted to become less frequent. A review of NSW climate projections from the central online repository (http://climatechange.environment.nsw.gov.au/Climate-projections-for-NSW) suggests that over the remaining lifespan of the project (of approximately 20 years), impacts to annual rainfall at the site locality will be less than 2%. This is unlikely to have a substantive impact on the water quality (**Section 4.4**) or water balance assessments (**Section 4.5**) as these have been based on 51 years of historic rainfall data covering a wide range of climatic conditions. As such, the impacts of climate change have not been directly incorporated into these assessments.

1.2.5 Conditions of Consent

The Conditions of Consent – Orchard Hills Waste and Resource Management Facility (LEC, 2012) and Modification No 1 (March 2016) (referred to collectively as the 'consent conditions') contain a number of conditions with regards to the environmental management of the existing operation.

Key conditions relating to soil and water in Schedule 4 are reproduced below, including Conditions 17 to 20, and reference is made where relevant in the Impact Assessment section of this report (**Section** Error! Reference source not found.).

Discharge Limits

17. Except as may be expressly provided in the EPL, the Proponent shall comply with Section 120 of the POEO Act.

Note: Section 120 of the POEO Act prohibits the pollution of waters.

Soil

18. The Proponent shall:

a) minimise soil loss;

b) set aside any topsoil won on-site for the revegetation and rehabilitation of the site;

and

c) ensure that any topsoil stockpiles on-site are suitably managed to ensure that the topsoil in these stockpiles can be beneficially used in the proposed revegetation and rehabilitation of the site.

19. The Proponent shall not track mud or waste from vehicles on public roads.

Soil, Water and Leachate Management

20. The Proponent shall prepare and implement a Soil, Water and Leachate Management Plan for the Project. This plan must:

a) be prepared in consultation with the Council, EPA and NOW by a suitably qualified and experienced expert whose appointment has been endorsed by the Director-General;

b) be approved by the Director-General prior to commencement of site establishment;

c) include a site water balance;

d) include an erosion and sediment control plan that is consistent with the requirements in the latest version of Managing Urban Stormwater: Soils and Construction (Volume 1, Landcom, and Volume 2b: Waste Landfills, DECCW, 2008);

e) include a stormwater management scheme that is consistent with the latest version of Managing Urban Stormwater: Volume 2b: Waste Landfills (DECCW, 2008);

f) include design specifications and plans for the leachate containment system that comply with the minimum design specifications in Schedule 7 of this Approval and the relevant Benchmark Techniques in Appendix A of the Environmental Guidelines for Solid Waste Landfills EPA, 1996, unless otherwise approved by the EPA;

g) includes a surface water, groundwater and leachate monitoring program that:

i) is in accordance with the requirements of the EPL;

ii) includes:

- *collection of baseline data;*
- *details of the proposed monitoring network; and*

- *the parameters for testing and respective trigger levels for action under the surface water, groundwater and leachate response plan;*

h) specifies that any stormwater from all areas of the site which has the potential to interact with waste shall be managed as leachate and directed into the leachate containment system;

i) include a sampling and testing program to be developed in consultation with the EPA, to further characterise the quality of the water in the quarry void as well as any settled sediment at the base of the flooded quarry void. This is to occur prior to any of the permitter bunds being disturbed;

j) includes a surface water, ground water and leachate response plan that:

i) includes a protocol for the investigation, notification to the EPA and mitigation of any exceedances of the respective trigger levels; and

ii) describes the array of measures that could be implemented to respond to any surface or groundwater contamination that may be caused by any development.

1.2.6 PoEO Licensing Requirements

Under the PoEO Act, the NSW Environment Protection Authority (EPA) regulates certain sites and issues licences, many of which are load based. The existing premises is covered under two EPLs issued under the PoEO Act, being EPLs 21259 and 20814.

EPL 21259 relates to the resource recovery centre operations at the site (resource recovery and waste storage activities), while EPL 20814 relates to landfill operations (extractive activities and waste disposal (application to land) activities).

EPL 20814 includes a number of water and leachate monitoring points as follows:

- Three wet weather discharge and water quality monitoring points,
- Fifteen groundwater quality and subsurface gas monitoring points,
- One surface water monitoring point, and
- Two leachate quality monitoring points.

EPL 21259 includes one discharge and monitoring point from the site, which corresponds to one of the wet weather discharge and water quality monitoring points in EPL 20814.

Relevant water monitoring point data and results are discussed in **Section 4.8**.

1.2.7 Water Access Licensing Requirements

Under the *Water Management Act 2000*, WaterNSW regulates issues regarding water entitlements in NSW. SRC Operations sources water through this mechanism under Water Access Licence 24329.

Water Access Licence 24329 nominates water supply works approval 10WA109407 (issued 1 July 2011, expires 30 June 2024), to extract up to 16 ML of groundwater annually from the Sydney Basin Central Groundwater Source. Water rules for extractions of water from this groundwater source are set under the *Greater Metropolitan Region Groundwater Sources 2011*. Water Access Licence 24329 is associated registered groundwater bore GW105054, located on site next to the existing Leachate Dam as shown on **Figure 4-7**. During dry periods when the water level in the on-site storages is low, the balance of the water required would be sourced from the registered groundwater bore GW105054.

Water supply works approval 10WA122909 to extract groundwater from the Sydney Basin Central Groundwater Source (issued 4 December 2018, expires 3 December 2028) also appears to be associated

with Lot 40, DP 738126, however it does not seem to have a corresponding Water Access Licence, so has been assumed not to be in use.

The following two water licences issued under the *Water Act 1912* are also associated with Lot 40, DP 738126. No other details regarding these licences was available, as such they have been assumed not to currently be in use:

- Licence No. 10BL602962 (issued 12 March 2009),
- Licence No. 10BL605102 (issued 14 February 2012).

2 Existing Environment

2.1 Site and Catchment Context

The PLRRC is located at 123-179 Patons Lane, Orchard Hills in the Penrith City local government area (LGA) and is legally known as Lot 40, DP 738126.

The site is primarily zoned RU2 Rural Landscape in the *Penrith Local Environmental Plan 2010* (Penrith LEP 2010), with a small portion in the north-west corner of the site zoned C2 Environmental Conservation. The C2 Environmental Conservation zone is associated with Blaxland Creek, which runs through the northwest corner of the site. Unnamed tributaries of Blaxland Creek and South Creek also originate within the site. The site, topography and surrounding watercourses (noting the alignment to be that prior to the operations at the site commencing) are shown in **Figure 2-1**.

The site is located within the catchment of Blaxland Creek, an ephemeral creek which flows to South Creek, a tributary of the Hawkesbury/Nepean River system. Blaxland Creek generally flows in a north-easterly direction.

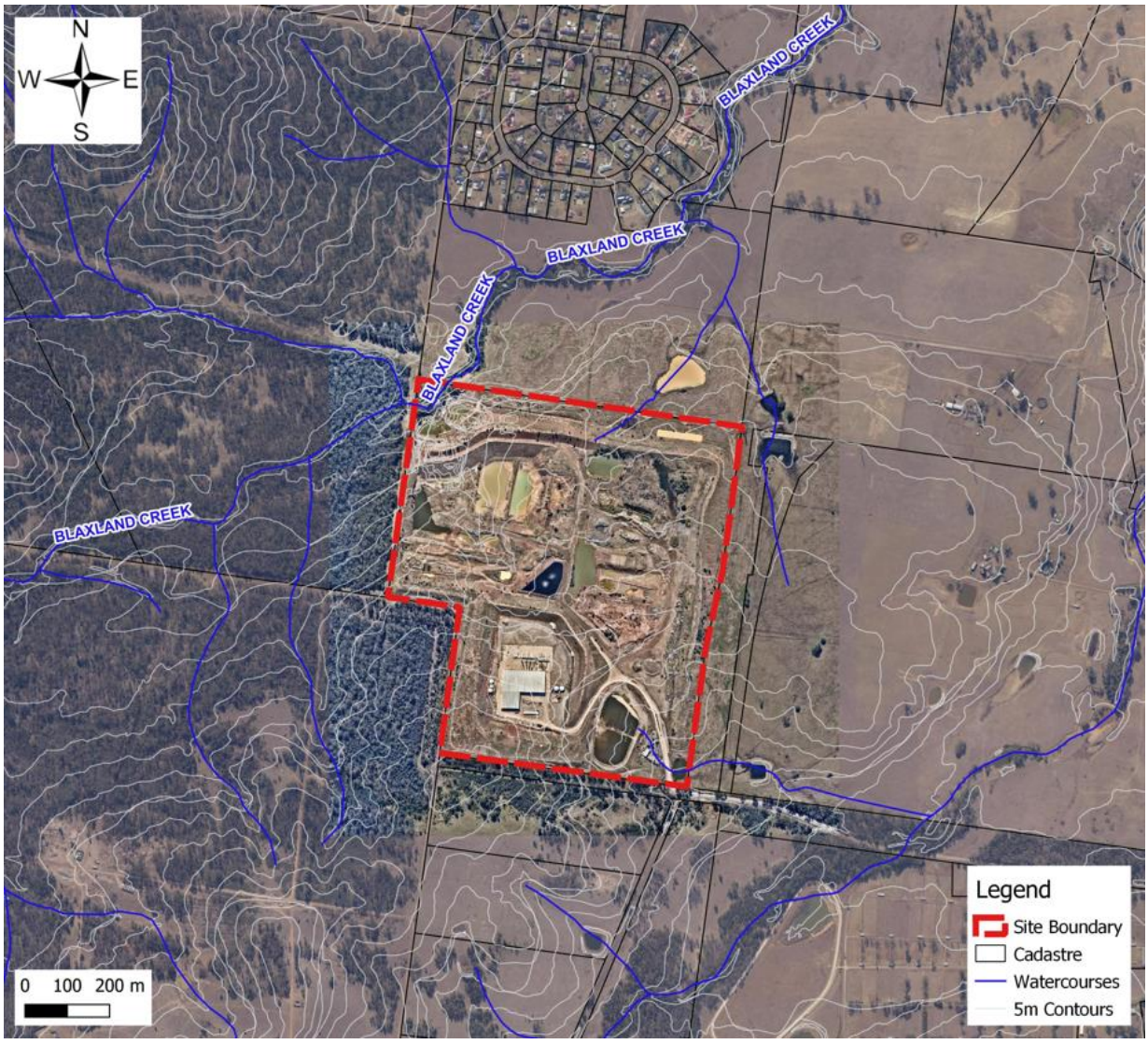

Figure 2-1 Catchment Context (Aerial Image Source: Nearmap (Site) and Six Maps (Surrounds), Accessed September 2022)

The majority of the landform within the site has been altered by previous extraction and current operations at the site. The site is predominantly bunded from its surrounds (except for a small portion at the south-east corner) and consists of:

- South-west quadrant - the RRC area (being the south-west quadrant, also referred to as the Resource Recovery Area, RRA),
- North-west quadrant (Cell 1) - excavated voids (historic and contemporary quarrying operations),
- North-east quadrant – (Cells 2 and 3) future quarrying operations and current stockpiles of excavated clay and shale material,
- South-east quadrant - site office, weighbridge, carpark and ancillary facilities, stockpiling areas
- General:
    - sealed and unsealed access roads,
    - perimeter and internal bund walls,
    - dams (one leachate and five stormwater dams inside the perimeter bund)
    - stormwater outlet treatment facilities along northern perimeter flowing to north-west corner at point of discharge to Blaxland Creek (including chemical dosing and automated outflow water monitoring facilities).

The perimeter bund walls have been constructed from clay/shale extracted on site and imported construction and demolition waste which have steep batter slopes of around 60%.

The western areas of the site are covered by two major voids associated with previous quarrying operations. The deepest void is the north void which is estimated to have an invert level of around 17m AHD, whilst the southern void is much shallower at around 48m AHD. The other areas of the site that surround the voids, dams and stockpiles are gentle sloping with grades typically less than 2%. The topography surrounding the site is relatively flat, consisting predominantly of agricultural land (GSS Environmental & BMT WBM Pty Ltd, 2010).

Significant features within the existing site, landform and water management features, are shown in **Figure 2-2**.

Figure 2-2 Patons Lane RRC Site Features (Source: SWLMP (GHD, 2019b))

The DPE's mapped soil landscapes (eSPADE) cover the subject site and indicate a Blacktown soil landscape for most of the site, with a small portion in the northwest corner of the site indicated as a South Creek soil landscape.

A Landfill Environmental Management Plan (LEMP) has also been prepared for the site (GHD, 2019a).

2.2 Overview of Existing Operations

The PPLRRC is a resource management facility within the former Erskine Park Quarry owned by SRC Properties Pty Ltd. Project Approval MP09_0074 was granted by the Land and Environment Court (LEC) for the establishment and operation of the RRC in August 2012 and approved for the landfilling of commercial and industrial (C&I) and construction and demolition (C&D) waste types (general solid (non-putrescible) waste) (GHD, 2019b).

Existing operations involve recycling and resource recovery of C&I and C&D waste, landfilling non putrescible waste in the former quarry void, a waste transfer station, continued clay/shale extraction and site rehabilitation.

Under EPL 21259 the existing operation is licensed to receive up to 350,000 tonnes of waste in any 12-month period. Under EPL 20814 the existing operation is licensed to landfill up to 205,000 tonnes of non-putrescible waste in any 12-month period and extract up to 160,000 tonnes of clay/shale in any 12-month period.

The objectives of the PLRRC are to (GHD, 2019b):

- Provide a facility to assist the NSW Government to meet the recycling targets for C&I and C&D waste,
- Recover a high proportion of clay/shale resources for the brick and construction industry,
- Receive and emplace wastes and residuals from the on-site recycling activities, and
- Progressively rehabilitate a disused quarry to re-instate the agriculturally productive land consistent with the surrounding lands.

Since commencing operations in August 2019, the site has only received waste intermittently at both the landfill and RRC. The landfill portion of the site is not currently receiving waste (as at December 2022) and is not expected to operate over the next six months, with normal operations due to recommence in July 2023. The RRC (in the southern portion of the site) to date has been operating with a focus on processing recovered aggregates (<60mm) sourced from SRC Operations' network of transfer stations and recycling facilities, in accordance with SRC Operations' Recycling Water Treatment Plant (RWTP) trial project approved by the EPA under EPL 21259 (under Special condition E3 Wash Plant Trial).

2.3 Overview of Water Management Arrangements

With respect to overall water management, the site currently has no existing potable water supply and relies on rainfall, captured stormwater re-use and groundwater extraction (under Water Access Licence 24329) and potable water delivery (by tanker). Note that an application with Sydney Water Corporation is currently underway and potable water connection will be in place by December 2022. The site also has no existing connection to the Sydney Water sewerage system.

In its current configuration, the site has a number of constructed water management dams/basins/tanks that serve the purpose of either:

- Stormwater runoff capture and treatment in a range of dams known as Dams 1, 2a, 2, 3, 4, 5 and 6 (generally treatment by settlement and losses from the surface by evaporation),
- Leachate storage in an existing leachate dam (dealing with leachate from the landfill portions of the site), or
- Recycling water storage tanks (within the RRC area).

The current water management configuration is largely consistent with the Year 1 configuration reported in the *Orchard Hills Waste and Resource Management Facility – Surface Water Assessment* (GSS Environmental & BMT WBM, 2010). Key areas of difference between the existing site conditions and the GSS Environmental & BMT WBM (2010) Year 1 scenario include the following:

- Stormwater discharges only occur via passive (gravity) overflows rather than additional pumped low flow discharges (to ensure the conditions of the EPL are met), and
- Surface contact water collected in the Cell 1 sump is pumped to the existing leachate dam and tankered off site rather than being directed to Dam 4 (also to ensure the conditions of the EPL are met).

The site office has a rainwater tank that captures roof runoff for toilet flushing. The site office has an on-site sewerage system for treatment and disposal (including a sub-surface irrigation area adjacent to the southern boundary.).

The RRC building also has rainwater tanks that capture runoff from the RRC roof. Water captured in these tanks is used for dust suppression for operations within the RRC building (via an overhead sprinkler system within the building).

Additionally, there are two firefighting water supply tanks located on the western side of the RRC for the purposes of fire suppression at the RRC.

Water from the sediment dams is reused on site where possible for operational purposes (such as dust suppression). Water not re-used is transferred to external dams (Dam 2 series, being 2a, 2b, 2c) beyond the bunds and discharged if above the design rainfall event or otherwise once testing for appropriate water quality has been undertaken. If extended retention in the dams does not reduce water turbidity to acceptable levels through settling alone, then further treatment using flocculant is undertaken. Flocculant treatment is undertaken as per the protocols set out in the Stormwater Dewatering Management Plan (Appendix G of the SWLMP) (GHD, 2019b).

Stormwater from the site is discharged in wet weather conditions to the northwest corner from Dam 2 to Blaxland Creek via an engineered spillway under the conditions set in Environment Protection Licences (EPLs) 21259 and 20814, both issued under the *Protection of the Environment Operations Act 1997* (PoEO Act). There are also licenced discharge points located at Dam 6 in the south-east corner of the site and Dam 3 in the northeast corner of the site. Dam 6 and Dam 3 drain to unnamed tributaries of South Creek and Blaxland Creek, respectively. These licensed discharge point dams, along with other surface water dams, are shown on **Figure 2-3**.

Leachate from the site is currently tankered off-site for disposal at an EPA-licenced facility (as there is no sewerage system connection currently available at the site) and can potentially be re-used on the site with additional treatment or, when available, discharge to the sewerage system. It is the construction of the additional treatment facilities (primarily new buildings and associated pipework to

transfer leachate from ponds to the treatment system) that is the subject of the modification application.

Details of existing soil, water and leachate management practices associated with the RRC operations can be found in the *Patons Lane Resource Recovery Centre Soil, Water and Leachate Management Plan* (SWLMP) (GHD, 2019b). The Conditions of Consent – Orchard Hills Waste and Resource Management Facility (LEC, 2012) and Modification No 1 (March 2016) (referred to collectively as the 'consent conditions') contain a number of conditions with regards to the environmental management of the existing operation. Specifically, Schedule 4, Condition 20 details the requirements for the SWLMP (GHD, 2019b).

Figure 2-3 Water Management Dams

3 Overview of the Modification Proposal

In order to improve water management at the site and increase water reuse, SRC Operations is proposing to upgrade the existing water and leachate management systems on site. The upgrades would comprise two systems:

- A leachate management system upgrade to support broader site and landfill operations, and
- A RWTP including a thickener and filter press to treat water to support RRC operations and the wash plant trial.

The aim of the leachate management system upgrade is to improve the effectiveness of leachate management from the landfill, to ultimately permit the site to potentially connect and discharge surplus leachate to sewer. Currently leachate water is tankered off-site and disposed of at an EPA-licenced facility. The Modification Proposal involves treating and tankering the treated leachate water until a sewer connection is provided.

A new leachate treatment plant is proposed to the north-east of Dam 1 from where treated leachate will be discharged to the future sewer connection (likely to be connected at the south-east corner of the site). Raw leachate and contact water will be stored in Dam 1, which will replace the existing leachate dam adjacent to Dam 5. An overflow line will be provided from the contact water portion of Dam 1 to allow excess flows to bypass the leachate treatment plant and discharge directly to sewer.

Upgrades to the proposed leachate management system also include bunding of 0.5 Ha section of paved area to the north of the RRC, with runoff collected in a sump and directed to the contact water portion of Dam 1.

A flow chart showing components of the proposed leachate management system is provided in **Figure 3-1**.

The aim of the proposed thickener press and centrifuge system being installed within the water management system is to further clean the water used within the resource recovery activities, maximising the efficacy of the existing recycling water treatment plant, and reducing the amount of water needed and required to be disposed by maximising water reuse within the wash plant. The proposed RWTP will be located adjacent to the north-eastern corner of the RRC.

A RWTP trial project will be undertaken by SRC Operations for a six-month period in accordance with the following conditions and documentation:

- Special condition E3 Wash Plant Trial in EPL 21259,
- *Patons Lane GSW Wash Plant – Project Trial Monitoring Plan* (Beca, 2021a), and
- *Patons Lane GSW Wash Plant – Project Trial Plan* (Beca, 2021a).

Elements of the upgraded system are shown in **Figure 3-2**.

Potential impacts from these proposed elements which have been considered in this impact assessment are as follows:

- Changes to stormwater catchments associated with the Modification Proposal and associated impacts on site discharge quantity and quality,
- The water requirements of the proposed new elements, and

- Any interactions with groundwater due to changes to stormwater and leachate catchment areas and management processes.

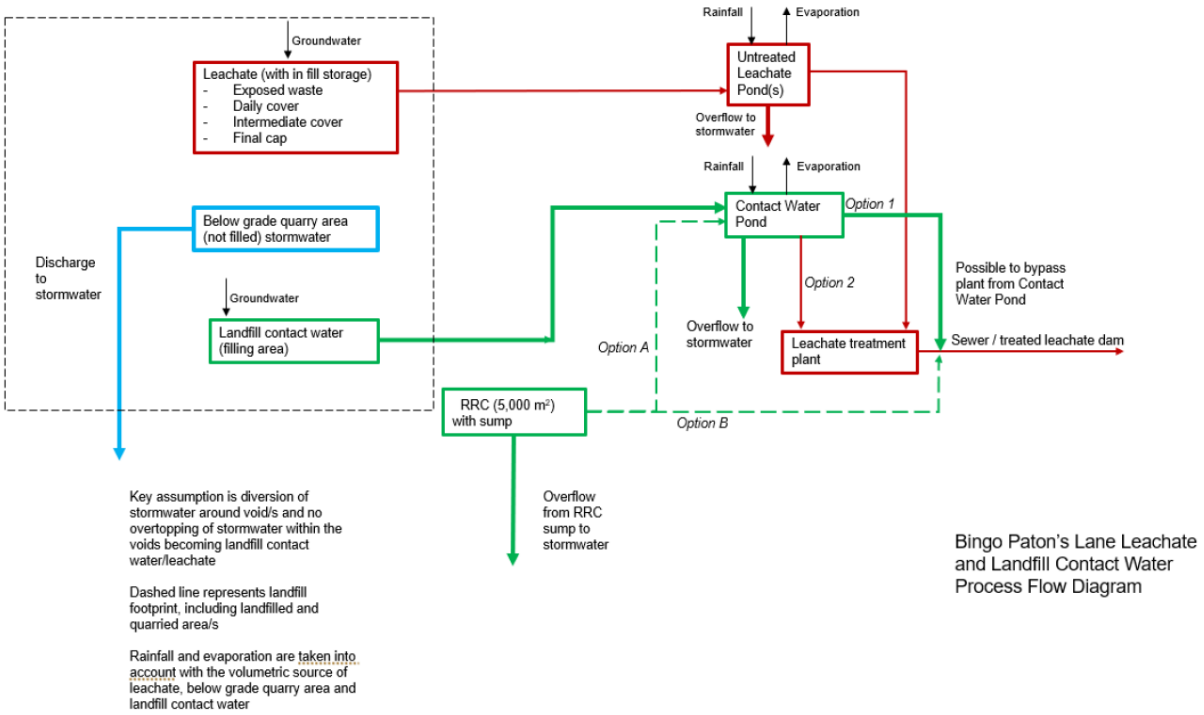

Figure 3-1 Leachate Management System Flowchart (Source: GHD (2022))

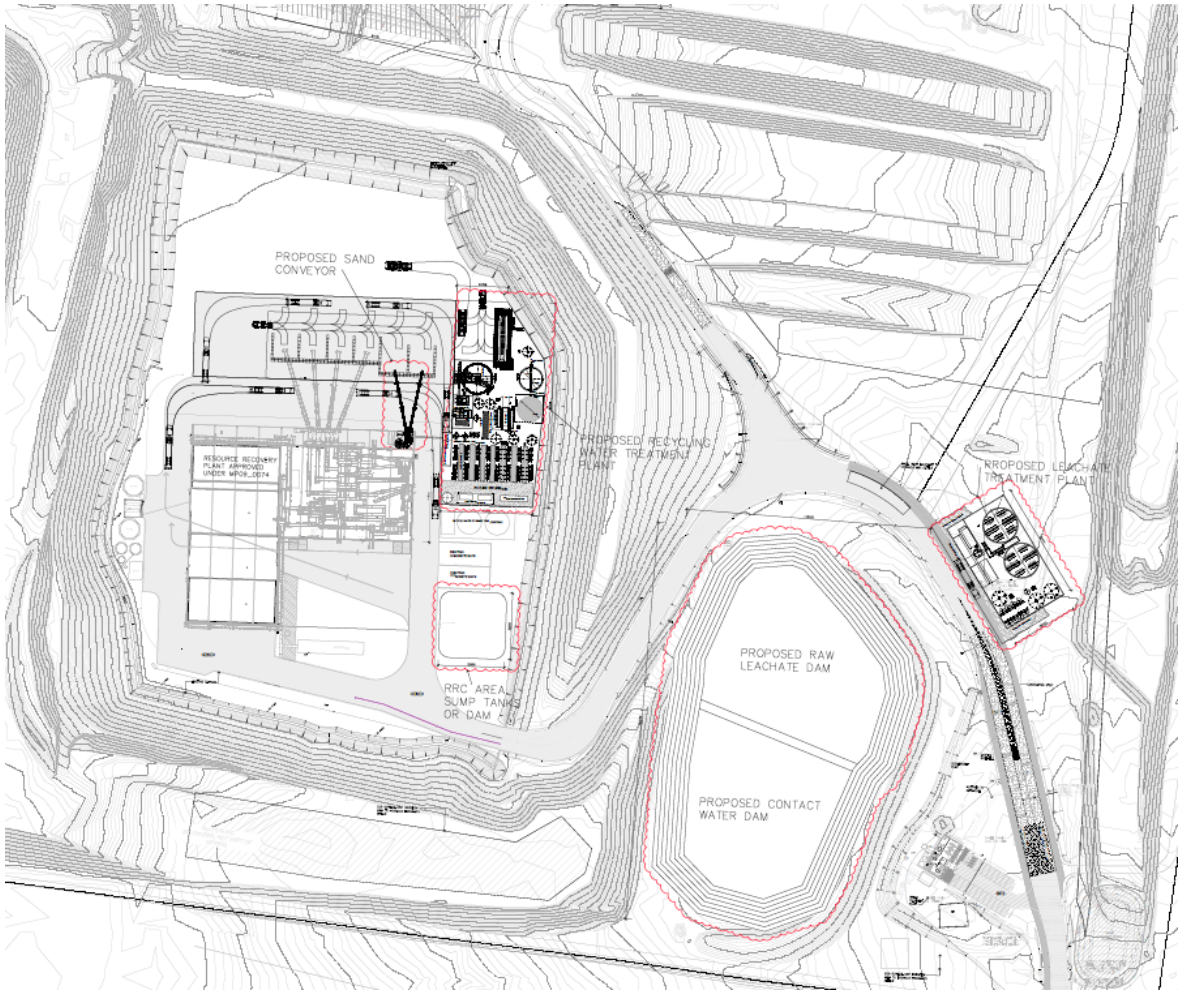

Figure 3-2 Proposed Concept (Source: Bingo Industries, December 2022)

4 Impact Assessment

4.1 Scope of Soil and Water Impact Assessment

This assessment covers the following soil and water-related matters during the construction and operational phases:

- Water Balance,
- Surface Water Quality,
- Erosion and Sediment Control,
- Groundwater, and
- Water Monitoring.

The analysis of these specific matters can be found in **Sections 4.4- 4.8**.

Water balance details for the proposed leachate management system can be found in the *Patons Lane Resource Recovery Centre – Leachate Water Balance Assessment* (GHD, 2022).

4.2 Approach and Methodology

To complete this soil and water impact assessment, the following approach was adopted:

- Review of existing regulatory requirements (**Section 1.2**).
- Review of information for the existing conditions and the proposed modifications (**Section 4.2.1**).
- Investigation of the existing conditions as it relates to on-site surface water management, including analysis of water quantity and water quality, and an assessment of the water-related requirements for the proposed modifications (**Sections 4.4- 4.8**).
- Description of management measures, where these are required, and the expected outcomes of the implementation of these measures (**Section 5**).

The existing and proposed scenario results were compared against the Year 1, Year 13 and Final Landform scenarios from the *Orchard Hills Waste and Resource Management Facility – Surface Water Assessment* (GSS Environmental & BMT WBM, 2010) in order to assess the incremental impact of the Modification Proposal in relation to the conditions that the 2012 approval were based upon.

4.2.1 Data Review

A list of the available data (and the source of the data) to perform the assessment is provided below.

JEP provided a range of information relevant to the existing and the proposed development, including:

- Documentation associated with existing Project Approval MP09_0074, including:
  - *Orchard Hills Waste and Resource Management Facility – Environmental Assessment* (R.W. Corkery & Co. Pty Limited, 2010),
  - *Orchard Hills Waste and Resource Management Facility – Surface Water Assessment* (GSS Environmental & BMT WBM, 2010),
  - *Orchard Hills Waste and Resource Management Facility – Cell Design and Groundwater Assessment* (Aquaterra Consulting, 2010)
  - *Patons Lane Landfill and Resource Recovery Centre – Section 75W Modification Application – Environmental Assessment* (EMM, 2015),
  - Land and Environment Court (2012) *Conditions of Consent – Orchard Hills Waste and Resource Management Facility* and Modification No 1 (March 2016),

- Environment Protection Licences 21259 and 20814 issued under the *Protection of the Environment Operations Act 1997*,
- Water Access Licence 24329 issued under the *Water Management Act 2000*,
- *Patons Lane Resource Recovery Centre Landfill Environmental Management Plan* (GHD, 2019a),
- *Patons Lane Resource Recovery Centre Soil, Water and Leachate Management Plan* (GHD, 2019b),
- *Patons Lane GSW Wash Plant – Project Trial Monitoring Plan* (Beca, 2021a) and *Patons Lane GSW Wash Plant – Project Trial Plan* (Beca, 2021b),
- *Basis of Design for Wastewater Treatment – Patons Lane Resource Recovery Centre* (Beca, 2022),
- *Patons Lane Resource Recovery Centre – Leachate Water Balance Assessment* (GHD, 2022),
- Correspondence from DPE (email from Sheelagh Laguna at DPE to Sean Fishwick at Bingo Industries dated 19 July 2022 RE Patons Lane Water Management Infrastructure Upgrade Modification Proposal) detailing DPE's modification application requirements,
- Design plans for the proposed works by SRC Operations (Bingo Industries dated 13 December 2022), in PDF format (Revision 15),
- Leachate Dam and Dams 2 to 6 Work As Executed plans by Matthew Freeburn, various dates 2018 and 2019 (Ref 35579),
- Nearmap aerial imagery of the site dated 14 June 2022,
- Leachate Treatment Plant 520 m^3/day plans by EnviroPacific (Drawing Number 1016-L01-001, Revision A, dated 15/9/2022),
- Process Flow Diagram (PFD) Leachate Treatment Plant (LTP) 520 m^3/day plans by EnviroPacific (Drawing Number RG00XXX-PFD-01, Revision 0, dated 13/9/2022),
- Patons Lane Leachate and Landfill Contact Water Process Flow Diagram,
- Surface water discharge monitoring data collected for discharge events from 19 September 2019 to 6 October 2022 (in excel), including details of monitoring locations and number of discharge events, and
- All surface water monitoring data collected for sites as per the SWLMP (GHD, 2019b) from 20 December 2018 to 6 October 2022,
- Links to publicly available attended monitoring collected by SRC Operations under its EPLs, including groundwater and surface water monitoring results at: https://patonslane.com.au/attended-monitoring/,
- *Technical guidance for achieving Wianamatta-South Creek stormwater management targets* (DPE, 2022), and
- *MUSIC modelling toolkit for Wianamatta-South Creek* (DPE, 2022).

In addition to the data described above, the following data was accessed to assist with the assessment:

- Additional ground Level data (mAHD) (Source: Geoscience Australia ELVIS elevation dataset, http://www.ga.gov.au/elvis/),
- NSW Soil and Land information (Source: eSPADE, https://www.environment.nsw.gov.au/eSpade2Webapp),
- Cadastre and topography (Source: Six Maps Clip and Ship, https://maps.six.nsw.gov.au/clipnship.html),

- Hydrolines (Source: Six Maps Clip and Ship, https://maps.six.nsw.gov.au/clipnship.html),
- NSW Groundwater Database (via WaterNSW https://realtimedata.waternsw.com.au/), and
- Penrith City Council MUSIC source nodes, and
- Bureau of Meteorology rainfall and potential evapotranspiration data.

4.2.2 Site Inspection

A site inspection was undertaken by Rhelm in the company of several SRC Operations and JEP representatives on 30 August 2022. A selection of relevant site photographs has been included in **Appendix A**.

4.3 Catchment Details for Assessment

Sub-catchment areas relevant to the PLRRC under the existing and proposed configurations were delineated using survey elevation data provided by JEP (file reference '35579 LIC 20814 December 2021.dwg) for internal areas and 2019 LiDAR data from Geoscience Australia ELVIS elevation dataset for the small external catchment to the south of the site.

Figure 4-1 and **Figure 4-2** show the site sub-catchments and direction of overland flows for the existing and post-development scenarios, respectively. Sub-catchments with green shading contribute stormwater runoff to site discharge locations and are included in the surface water quality (**Section 4.4**) and quantity (**Section 4.5**) assessments, whereas sub-catchments with brown shading are assumed to drain to leachate management measures and are accounted for in the *Leachate Water Balance Assessment* (GHD, 2022).

Of the scenarios assessed as part of the *Orchard Hills Waste and Resource Management Facility – Surface Water Assessment* (GSS Environmental & BMT WBM, 2010), the adopted sub-catchments for the impact assessment are closest to the Year 1 scenario. The main difference between current sub-catchments and the Year 1 Scenario from is the Cell 1 (Sub-Catchment B) drains to the leachate management system rather than the stormwater network. Year 1 of operations represents a worst case scenario from a site discharge perspective as disturbed catchment areas and runoff volumes are highest in this scenario compared to the remaining life cycle of the landfill operation.

Table 4-1 and **Table 4-2** provide details of existing and post-development sub-catchments.

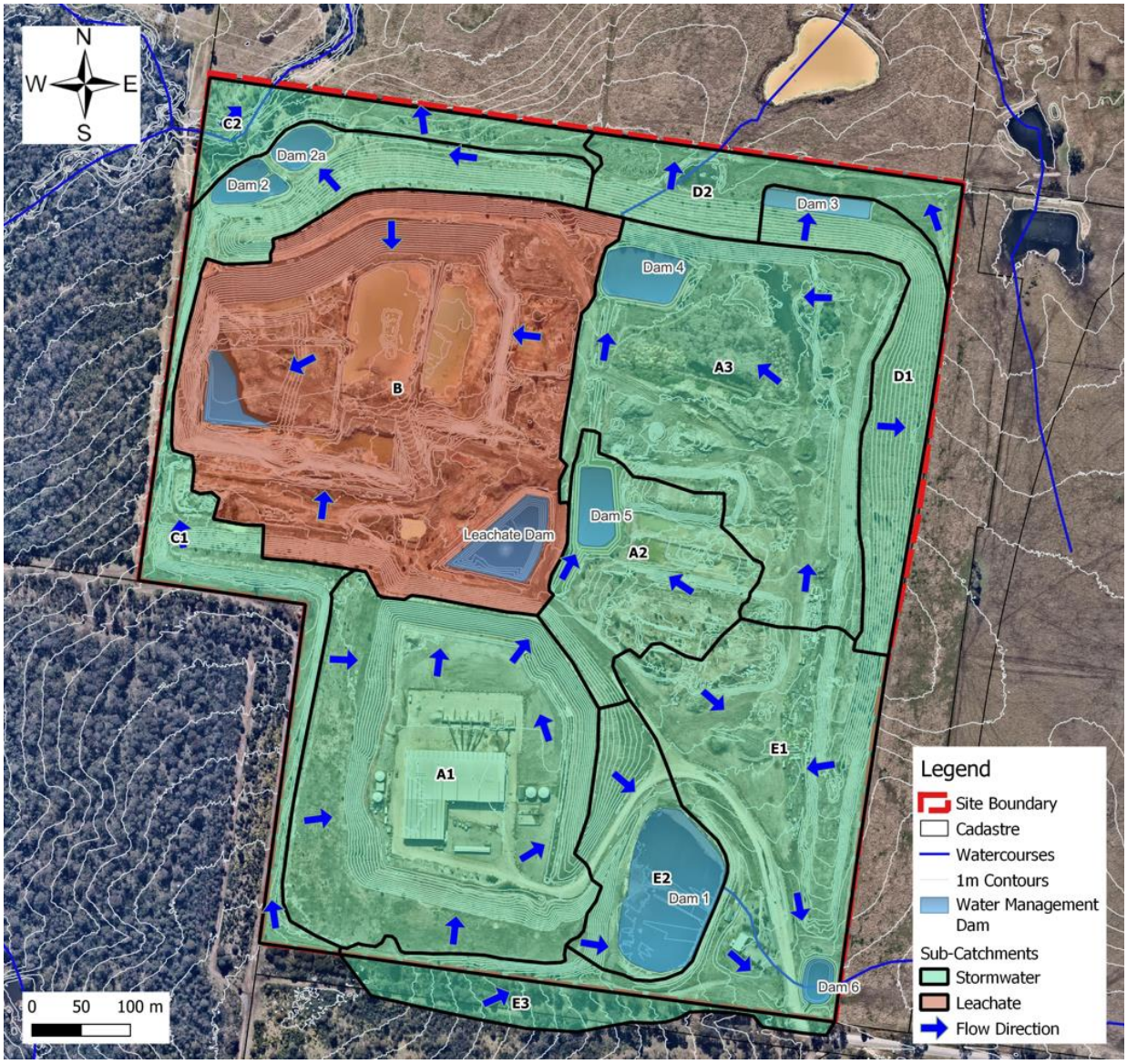

Figure 4-1 Existing Sub-Catchments

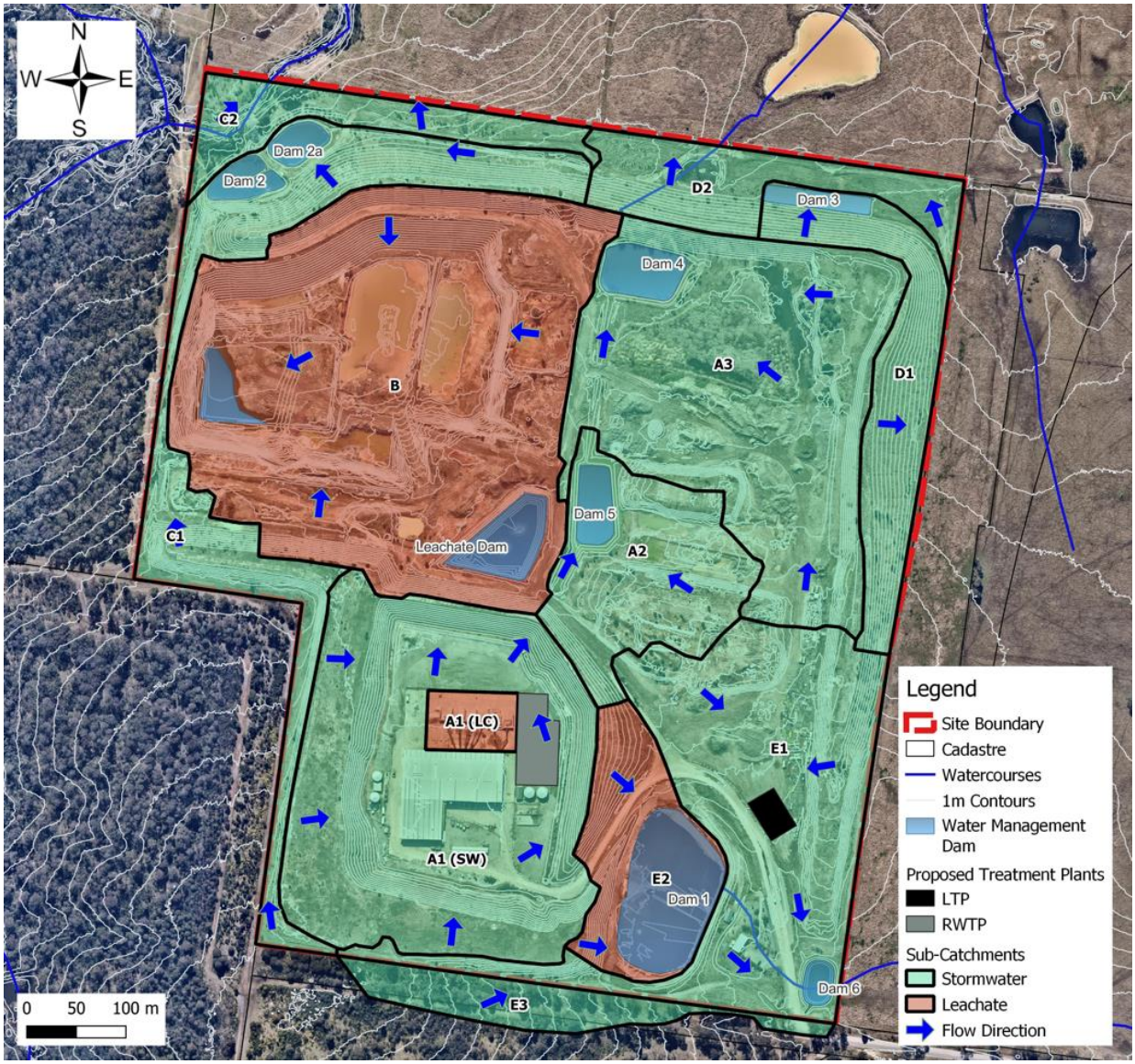

Figure 4-2 Post-Development Sub-Catchments

Table 4-1 Existing Sub-Catchment Details

Name	Catchment Area (Ha)	Percentage Impervious (%)
A1	10.149	24.5
A2	3.483	8.0
A3	9.235	4.1
B	14.495	5.0
C1	5.327	7.2
C2	1.697	0.0
D1	2.958	6.3
D2	2.281	0.0

Name	Catchment Area (Ha)	Percentage Impervious (%)
E1	7.782	6.4
E2	2.831	47.7
E3	1.482	1.5
Total Stormwater Catchment Area (Ha)	47.225	
Total Leachate Catchment Area (Ha)	14.495	

Table 4-2 Post-Development Sub-Catchment Details

Name	Catchment Area (Ha)	Percentage Impervious (%)
A1 (SW)	9.649	24.0
A1 (LC)	0.5	100
A2	3.483	8.0
A3	9.235	4.1
B	14.495	5.0
C1	5.327	7.2
C2	1.697	0.0
D1	2.958	6.3
D2	2.281	0.0
E1	7.782	8.1
E2	2.831	47.7
E3	1.482	1.5
Total Stormwater Catchment Area (Ha)	43.894	
Total Leachate Catchment Area (Ha)	17.826	

4.4 Surface Water Quality

Construction Phase Impacts

Construction phase soil, water and leachate surface water quality impacts of the Modification Proposal are expected to include:

- Short term and temporary alternative stormwater and leachate management system arrangements during construction of the new leachate dam. This may involve diverting stormwater on site and/or additional tankering of leachate offsite during construction of the new leachate dam, until the dam is verified and comes online,
- Short term and temporary disruptions to RRC plant operations during connection of the proposed new treatment system, and

- Potential impacts i.e., contaminated runoff from the construction works area during rainfall events.

Operational Phase Impacts

The proposed modifications do not involve any significant changes to the footprint of the operation or to any operational procedures that would adversely impact surface water quality leaving the site. Localised increases in runoff generation (within the site itself) could be expected due to the slight increase in impervious area associated with the proposed treatment plant slabs; however, this will be offset by the additional stormwater catchments draining to the leachate management system with the proposed upgrades.

The proposed thickener press and centrifuge system within the water management system will further clean the water used within the resource recovery activities, maximising the efficacy of the recycling water treatment plant, and reducing the amount of water needed and required to be disposed by maximising water reuse within the wash plant. Overall, the proposed thickener press and centrifuge system is expected to improve the water quality and reduce the water quantity leaving the RRC area and entering the site stormwater management measures.

The proposed leachate management modifications are expected to improve the effectiveness of leachate management from the landfill, to ultimately permit the site to establish a future connection and discharge surplus leachate to sewer. Leachate water is separated from surface water and will be tankered off site prior to the future sewer connection. As such, leachate water quality is not included in this surface water quality analysis.

The following sections aim to provide an overview of water quality conditions in the Blaxland Creek and South Creek catchments and assess the performance of site surface water management measures via quantifying the discharge loads of key pollutants under the existing and proposed scenarios.

4.4.1 Catchment Water Quality Context

The site is located within the catchment of Blaxland Creek, an ephemeral creek which flows to South Creek, a tributary of the Hawkesbury/Nepean River system. Blaxland Creek generally flows in a north-easterly direction.

Defence Establishment Orchard Hills (DEOH) is a major Defence facility that has been operational since 1945 and is located directly upstream of the project site with Blaxland Creek and its tributaries running through the centre of the site (GHD, 2019b).

There are three licenced wet weather discharge points from the site under EPL 20814 (one also included in EPL 21259) as follows:

- Dam 2 in the northwest corner of site to Blaxland Creek via an engineered spillway,
- Dam 3 in the northeast corner of the site to an unnamed tributary of Blaxland Creek, and
- Dam 6 in the southeast corner of the site to an unnamed tributary of South Creek.

The Stormwater Dewatering Management Plan by Niche Environment and Heritage (2016), which forms Appendix G of the SWLMP (GHD, 2019b) contains 10 years of monthly water quality data at two locations along South Creek, one upstream and one downstream of the confluence with Blaxland Creek, collected by Penrith City Council since August 2005. Appendix G of the SWLMP also contains water quality sampling data for several sites within the quarry void, Blaxland Creek and South Creek, collected

in 2009, 2014 and also in 2016 as part of an extensive sampling program conducted by Niche Environment and Heritage and BMT WBM for Patons Lane Quarry (Niche Environment and Heritage, 2016), which is reproduced in **Table 4-3** and discussed below for catchment context. Additional monitoring data collected by SRC Operations between December 2018 and October 2022 as part of the SWLMP was also provided to Rhelm for reference. A summary of monitoring data during this more recent period for the Blaxland Creek upstream (S07) and South Creek upstream (S09) sites has also been included in **Table 4-3**.

A summary of key water quality parameters from monitoring as well as other studies relevant to the catchment, is provided in **Table 4-3**, including pH, turbidity, electrical conductivity, dissolved oxygen, total suspended solids, total aluminium and total zinc. A summary of trigger values of physical and chemical stressors sourced from ANZECC Water Quality Guidelines (2000) is also provided in **Table 4-3** for context.

In summary the monitoring results in **Table 4-3** indicate:

- pH within receiving waters typically lies within the ANZECC guidelines range,
- Turbidity is typically very low at the Blaxland Creek and South Creek sites and often below the minimum ANZECC guideline range, however, results are variable, reflecting the ephemeral nature of flows and the dispersive soils of the catchment. Turbidity results in both Blaxland Creek and South Creek have been higher since December 2018, potentially influenced by a larger number of significant rainfall events with the present La Nina conditions (over the 2020-2022 period),
- Electrical conductivity levels within Blaxland Creek were generally elevated above those observed in South Creek, this is not uncommon given the soils of the locality tend to have a high salinity content,
- Dissolved oxygen concentrations typically fall within the ANZECC aquatic ecosystem trigger concentration bounds within Blaxland Creek, however readings below the minimum ANZECC guideline range have been recorded in receiving waters, and
- Total suspended solids within receiving waters typically lie within the ANZECC guidelines range, however since December 2018 there have been a number of results above the ANZECC guidelines range (14 results at Blaxland Creek upstream and three results at South Creek upstream), potentially influenced by a larger number of significant rainfall events with the present La Nina conditions (over the 2020-2022 period).

Table 4-3 Catchment Water Quality Context (Source: Adapted from Niche Environment and Heritage, 2016)

Parameter (Units)	Indicative Historical Ranges						ANZECC 2000 Water Quality Guidelines for Aquatic Ecosystems for Lowland Rivers
	Patons Lane Monitoring Program				Other Studies		
	Blaxland Creek (Upstream sites) 2009-July 2016	Blaxland Creek (Upstream site S07) Dec 2018-Oct 2022^	South Creek (Upstream site) 2009- July 2016	South Creek (Upstream site S09) Jan 2019-Feb 2020^	Tributaries to South Creek Data*	South Creek Data*	
pH (pH Units)	6.6-7.8 (Field) 6.9-7.8 (Lab)	6.5-7.4 (Field) 6.9-7.6 (Lab)	7.5-7.6 (Field) 7.6-7.8 (Lab)	7.3 (Field – 1 sample) 7.5 (Lab – 1 sample)	6.6-7.7 (DEOH)	6.9-7.8 (PCC*)	6.5 to 8.0 (Lowland Rivers)
Turbidity (NTU)	2.9-114 (Field) 3.6-104 (Lab)	4.3-4100 (Lab)	10-35 (Field) 6.2-10.1 (Lab)	4.1-579 (Lab)	23.0-199.3 (DEOH)	6-139 (PCC*) Median 22.7	6-50 (Lowland Rivers)
Electrical Conductivity (µS/cm)	557-4643 (Field) 415-5480 (Lab)	98-703 (Field) 98-155,000,000 (Lab)	784-1133 (Field) 742-1500 (Lab)	191 (Field – 1 sample) 191-893 (Lab)	1050-5020 (BCEIS)	504-1595 (PCC*)	125-2200
Dissolved Oxygen (mg/L)	4.7-11.8 (Field) 6.2-10.1 (Lab)	3.9-7.1 (Field) 9.0-10.6 (Lab)	3.2-9.7 (Field) 6.7-10.1 (Lab)	9.8 (Lab – 1 sample)	2.06-9.17 (DEOH)	3.1-8.3 (PCC*)	7.4-11.8 (for 12-22°C)
*Total Suspended Solids (mg/L)***	2-23	5-1540	5-21	13-280	<5-44 (BCEIS)	-	50
Total Aluminium (µg/L)	10-780	0.03-28.9	80-210	0.10-10.8	10-810 (DEOH)	-	55
Total Zinc (µg/L)	5-84***	0-8,000	5-18***	0-0.06	5-10 (BCEIS) 3-15 (DEOH)	6-38 (PCC*) Median 23	8 (soft water) 31.2-41.6 (hard to very water)

**Refer to Section 5.5 of the Stormwater Dewatering Management Plan by Niche Environment and Heritage (2016): Includes Defence Establishment Orchard Hills data (DEOH) data in Blaxland Creek catchment, Penrith City Council (PCC) Luddenham Road upstream data for South Creek, and Western Sydney Airport EIS (Badgerys and Cosgrove Creeks) (BCEIS) as key related sites. PCC data ranges listed represent the 10th-90th percentile ranges from substantial data sets. Figures showing all locations can be found in Section 5 of the Stormwater Dewatering Management Plan (Niche Environment and Heritage, 2016).*

*** TSS lab results do not include sub-45µm sized particles (lab standard filter size 45µm, (clays are <2µm (i.e., >20x smaller than filter, and silts 2- 50µm are predominantly smaller). High turbidity known to occur with low TSS values both on and offsite. Subsequently turbidity viewed as key water quality indicator with respect to managing and monitoring colloidal clay particles.*

**** Excludes single anomalous results April 2016 Blaxland Creek upstream sites (582) and South Creek Upstream (147).*

^ These monitoring results between December 2018 and October 2022 have been analysed and added by Rhelm to the table produced by Niche Environment and Heritage (2016), in order to provide more recent monitoring data in context.

4.4.2 MUSIC Modelling

The stormwater management software MUSIC (v6.3.0) was used to simulate water quality characteristics of runoff generated from the site catchment and assess the effectiveness of surface water management measures. Existing and post-development site MUSIC models were established to assess the impact of proposed impervious surfaces on the quality of stormwater discharge, with the aim of matching pre-development pollutant loads as much as practical.

The post-development MUSIC model is reflective of present-day conditions for the site areas surrounding the Modification Proposal where the percentage of exposed surfaces and stormwater discharge quantities are highest in the context of the remaining life of the project (i.e. worst case scenario). The quality of site discharge under the final (rehabilitated) landform scenario will largely mimic a natural catchment and thus has not been included in the MUSIC assessment.

The MUSIC model has been used to assess stormwater discharges only. It is assumed that any runoff that becomes leachate or contact water will be stored in the site leachate management measures and removed via tankering or future sewer connection, with no overflows into the site stormwater management system.

4.4.2.1 GSS Environmental & BMT WBM (2010) Modelling

A site MUSIC model was developed as part of the *Orchard Hills Waste and Resource Management Facility – Surface Water Assessment* (GSS Environmental & BMT WBM, 2010) for the Year 1, Year 13 and Final Landform scenarios (the assessment to support the existing consent). This model was primarily used to generate inputs into a spreadsheet water balance model rather than quantifying pollutant loading and assessing the effectiveness of site treatment measures. As such, a contemporary existing scenario model rather than the GSS Environmental & BMT WBM (2010) model has been used to define baseline conditions for assessing water quality impacts associated with the Modification Proposal.

Key differences in assumptions between the GSS Environmental & BMT WBM (29010) Year 1 scenario model and the existing scenario model used for the subject impact assessment are summarised in **Table 4-4.**

Table 4-4 Comparison of GSS Environmental & BMT WBM (2010) and Updated MUSIC Model Assumptions

Key Assumption/ Parameter	GSS Environmental & BMT (2010) Model	Updated Existing Conditions Model
Consideration of pollutant loading	MUSIC model not used to assess pollutant generation and performance of treatment measures	MUSIC model used to assess total suspended solid (TSS), total nitrogen (TN) and total phosphorus (TP) generation and performance of treatment measures
Discharge assumptions	Assumes pumped low flow discharge from site dams when storage is between 10% and 50% of total storage and high flow discharge when storage is between 50% and 100%	Assumes passive (gravity) discharges only (to ensure conditions set under the EPL are met)

Key Assumption/ Parameter	GSS Environmental & BMT (2010) Model	Updated Existing Conditions Model
Cell 1 catchment	Assumes Cell 1 surface water is directed to Dam 4 and contributes to overall site stormwater discharge	Assumes Cell 1 surface water is directed to the existing leachate dam and evaporated or tankered off site
Meteorological data	Uses interpolated daily SILO data from 1950 to 2008 with a mean annual rainfall of 821mm	Uses daily data from nearby BoM Station 067204 (refer **Section 4.4.2.2**)
Pervious area parameters for undisturbed surfaces/final landform	Assumes typical values for a loamy soil type	Values based on the Wianamatta-South Creek Guidelines (DPE, 2022)

4.4.2.2 Base Information

Daily rainfall data from the St Marys Bowling Club meteorological station (Station 067024) was utilised for the MUSIC model. This station is located approximately 5km from the site and is the closest meteorological station with complete data over a sufficiently long rainfall record to enable a reasonable assessment of long-term water quality and flow behaviour. Available site meteorological data and other nearby stations with 6-minute pluviograph data do not contain sufficiently long periods of uninterrupted data to be considered suitable for the analysis.

The historic rainfall data was analysed over a 51-year period from 01/01/1900 to 31/03/1951, which recorded a mean annual rainfall (MAR) of 719 mm. More contemporary gridded rainfall data from the Bureau of Meteorology (BoM) shows a MAR of 758.3mm at the site locality over the period from 1981 to 2010, suggesting that that adopted time series is adequately representative of recent conditions. Monthly potential evapotranspiration (PET) data used for the simulation was obtained from BoM and equated to an average rate of 1155 mm/year.

4.4.2.3 Source Nodes

Source node pollutant parameters were derived from Penrith City Council's MUSIC nodes and the *NSW MUSIC Modelling Guidelines* (BMT WBM, 2015), with stochastic pollutant generation selected for the analysis. Adopted rainfall/runoff parameters for un-disturbed soils were obtained from the *MUSIC modelling toolkit for Wianamatta-South Creek* (DPE, 2022). Adopted rainfall/runoff parameters for disturbed areas match those from the GSS Environmental and BMT WBM (2010) assessment as these are considered appropriate for stripped surfaces.

Table 4-5 summarises the adopted source node parameters.

Table 4-5 MUSIC Source Node Parameters

		Catchment					
		Disturbed Soil/Roads/RRC Pavement	**Internal Vegetated Areas**	**External Vegetated Areas**	**Water Surface**	**RRC Roof**	**Proposed Treatment Plants (LT/WTP)**
Source Node Type		Quarry	Revegetated	Rural	Forest	Roof	Industrial
Impervious Area Properties							
Rainfall Threshold (mm/day)		1.0	1.0	1.0	0	0.3	1.0
Pervious Area Properties							
Soil Storage Capacity (mm)		35	150	150	150	-	-
Initial Storage (% of Capacity)		30	30	30	30	-	-
Field Capacity (mm)		25	130	130	130	-	-
Infiltration Capacity Coefficient – a		135	175	175	175	-	-
Infiltration Capacity Coefficient – b		4	2.5	2.5	2.5	-	-
Groundwater Properties							
Initial Depth (mm)		10	10	10	-	-	-
Daily Recharge Rate (%)		10	25	25	-	-	-
Daily Baseflow Rate (%)		10	1.4	1.4	-	-	-
Daily Deep Seepage Rate (%)		0	0	0	-	-	-
Total Suspended Solids Generation (log mg/L)							
Base Flow	Mean	1.20	1.15	1.15	-	-	-
	Std Dev	0.17	0.17	0.17	-	-	-
Storm Flow	Mean	3.00	1.95	1.95	1.60	1.30	2.15
	Std Dev	0.32	0.32	0.32	0.20	0.32	0.32
Total Phosphorus Generation (log mg/L)							
Base Flow	Mean	-0.85	-1.22	-1.22	-	-	-
	Std Dev	0.19	0.19	0.19	-	-	-
Storm Flow	Mean	-0.30	-0.66	-0.66	-1.10	-0.89	-0.60
	Std Dev	0.25	0.25	0.25	0.22	0.25	0.25
Total Nitrogen Generation (log mg/L)							
Base Flow	Mean	0.11	-0.05	-0.05	-	-	-
	Std Dev	0.12	0.12	0.12	-	-	-
Storm Flow	Mean	0.34	0.30	0.30	-0.52	0.30	0.30
	Std Dev	0.19	0.19	0.19	0.13	0.19	0.19

4.4.2.4 Treatment Nodes

Four treatment node types have been included in the MUSIC models to represent elements of the treatment train:

- Rainwater Tanks
- Swales
- Sediment Basins – this has been used to represent site dams where the contributing catchment contains significant portions of exposed surfaces.
- Ponds – this has been used to represent site dams where the contributing catchment is predominantly vegetated or is downstream of a sediment basin.

Details of site treatment measures were obtained from aerial imagery, provided terrain data and work as executed drawings for the site dams/sediment basins. No work as executed drawings were provided for Dam 1 and thus the storage volume was obtained from the GHD (2022) GoldSim model.

Rainwater Tanks

A 10kL rainwater tank node has been used to represent the twin 5kL tanks that receive runoff from the RRC roof. Re-use has been assumed for internal dust suppression within the RRC at a rate of 0.5mm/day a day over the 6,730m^2 internal surface area.

Swales

Swale treatment nodes have been used to represent the vegetated perimeter drains around the RRC area and the drain along the northern boundary that runs between the outlet of Dam 4 and the inlet of Dam 2.

Key swale parameters are summarised in **Table 4-6**.

Table 4-6 Swale Parameters

Parameter	RRC Perimeter Swale (x2)	Dam 4 Outlet Swale
Low Flow Bypass (m^3/s)	0	0
Bed Slope (%)	0.1	1.1
Base Width (m)	1	2
Top Width (m)	13	5
Depth (m)	1	1
Vegetation Height (m)	0.25	0.25
Exfiltration Rate (mm/hr)	0	0

Sediment Basin

A sediment basin treatment node has been used for Dam 5 where the upstream catchment is predominantly comprised of surfaces expected to generate a significant quantity of suspended sediment.

Water stored in this basin will be used as top up water for the proposed RWTP as part of the Modification Proposal. A water supply rate of 28kL/hour for the proposed washing operations was obtained from the *Basis of Design for Wastewater Treatment* (Beca, 2022). This was converted to an average daily re-use volume for two material processing rate scenarios nominated by SRC Operations:

- Maximum processing rate (220,000 tonnes/year of material) – 112.9 kL/day
- Standard processing rate (120,000 tonnes/year of material) – 63.2 kL/day

For the purpose of the water quality assessment, the standard processing rate was adopted as this results in the highest quantity of pollutants being discharged from the site. Both scenarios were considered for the site water balance (**Section 4.5.2**).

Key sediment basin parameters are summarised in **Table 4-7**.

Table 4-7 Sediment Basin Parameters

Parameter	Dam 5
High Flow Bypass (m^3/s)	100
Surface Area (m^2)	2,676
Permanent Pool Volume (m^3)	5,760
Exfiltration Rate (mm/hr)	0.04
Evaporative Loss as % of PET	75
Re-Use Demand (kL/day)	63.2 (proposed scenario only)

Pond

Pond treatment nodes have been used to represent Dams 1, 2a, 2, 3, 4 and 6 where inflows would contain a low percentage of coarser sediment due to either the contributing catchment being predominantly vegetated or where inflows would have received prior treatment by upstream measures.

It is assumed water stored in Dams 4 and 6 will be re-used for dust suppression across the site at a rate of 1.5mm over a quarter of the 24.5 Ha of disturbed area each day, equating to an annual re-use rate of 33.5ML. This re-use rate was proportioned between Dam 4 and Dam 6 based on storage volume and distributed according to the difference between PET and rainfall over the time series.

Key pond parameters are summarised in **Table 4-8.**

Table 4-8 Pond Parameters

Parameter	Dam 1	Dam 2a	Dam 2	Dam 3	Dam 4	Dam 6
High Flow Bypass (m^3/s)	100	100	100	100	100	100
Surface Area (m^2)	12,711	1,791	2,028	1,863	3,819	1,202
Permanent Pool Volume (m^3)	24,000	2,471	3,233	2,316	10,835	2,910
Exfiltration Rate (mm/hr)	0.04	0.04	0.04	0.04	0.04	0.04
Evaporative Loss as % of PET	75	75	75	75	75	75
Re-Use Demand (kL/yr)	0	0	0	0	26,395	7,089

4.4.2.5 Results

Table 4-9 below summarises the results of the MUSIC water quality assessment for the existing and proposed scenarios, including the percentage reduction compared to untreated catchment runoff.

Table 4-9 Site Water Quality Results

Pollutant	Catchment (un-treated) Loads (kg/yr)		Outflow Loads (kg/yr)[2]		Percentage Reduction	
	Existing	Proposed	Existing	Proposed	Existing	Proposed
Total Suspended solids (TSS)	72,300	63,900	7,510	6,060	89.6	90.5
Total Phosphorus (TP)	42.0	36.0	8.63	7.16	79.5	80.1
Total Nitrogen (TN)	226	195	83.4	67.7	63.0	65.2

The results presented in **Table 4-9** show an improvement in overall water quality associated with the proposed modifications. This is a result of the additional catchment areas draining to leachate management measures rather than the stormwater network, the increased stormwater re-use associated with the proposed wash plant and the change in land use over the footprint of the proposed treatment plants. This reduction in stormwater flows and pollutant generation outweighs the localised increases in runoff associated with the additional impervious surfaces of the two proposed treatment plants.

Table 4-9 also shows the percentage reduction in pollutant loading compared to an un-treated scenario is compliant with reduction targets specified in Chapter C3 of the Penrith DCP 2014 for both the existing and post-development scenarios and Table 3 of the *Technical guidance for achieving Wianamatta-South Creek stormwater management targets* (DPE, 2022) for the post-development scenario.

4.5 Surface Water Quantity

Construction Phase Impacts

Construction phase soil, water and leachate surface water quantity impacts of the Modification Proposal are expected to include:

- Short term and temporary alternative leachate management system arrangements during construction of the new leachate dam. This may involve tankering all leachate offsite during construction of the new leachate dam, until the dam is verified and comes online,
- Short term and temporary disruptions to RRC plant operations during connection of the proposed new treatment system,
- Potential impacts i.e., contaminated runoff from the construction works area during rainfall events.

[2] Actual outflow loads will likely be slightly lower than reported due to chemical treatment of water in the sediment dams (flocculation) to reduce the concentration of suspended solids prior to discharge events (which cannot be represented in the model)

Operational Phase Impacts

Operational phase soil, water and leachate surface water quantity impacts of the Modification Proposal are discussed in the sections below.

4.5.1 Existing Consent Modelling

Water balance modelling was undertaken as part of the *Orchard Hills Waste and Resource Management Facility – Surface Water Assessment* (GSS Environmental & BMT WBM, 2010) to quantify the site water surplus/deficits under the Year 1 and Year 13 scenarios. Results are reproduced in **Table 4-10** for comparison with results from the updated assessment (**Section 4.5.2**).

GSS Environmental & BMT WBM (2010) also conducted a flow duration analysis for the Year 1, Year 13 and Final Landform scenarios. The Year 1, Year 13 and Final Landform results from this analysis are reproduced in **Figure 4-3** to **Figure 4-5**. The analysis is shown in these figures against an analysis of recorded flows within the actual stream itself (which are representative of flow derived from the wider catchment rather than the Facility itself).

Table 4-10 Water Balance Results for Year 1 and Year 13 Operations (GSS Environmental & BMT, 2010)

Input/Output	Input/Output Description	Dry Year (ML/yr)	Median Year (ML/Yr)	Wet Year (ML/yr)
	Year 1			
Sources (1)	Surface water runoff	45	136	270
Losses (2)	Evaporation losses from storages	13	14	15
	Low and high flow site discharge	21	102	222
Supply (1) – (2)	Surface water available for re-use	11	20	33
Demand	Demand for internal site re-use	37	37	37
Deficit	Alternative water source	**26**	**17**	**4**
	Year 13			
Sources (1)	Surface water runoff	31	120	241
Losses (2)	Evaporation losses from storages	9	11	12
	Low and high flow site discharge	15	99	214
Supply (1) – (2)	Surface water available for re-use	7	10	15
Demand	Demand for internal site re-use	34	34	34
Deficit	Alternative water source	**27**	**24**	**19**

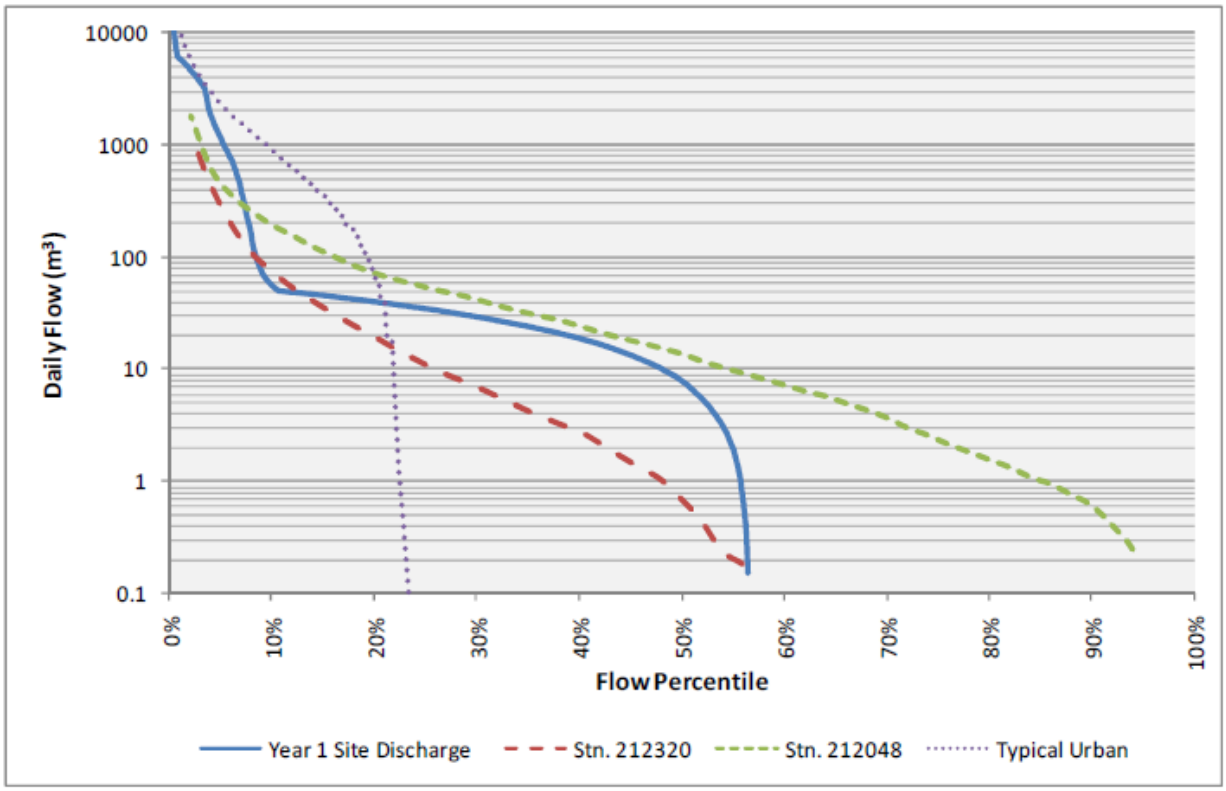

Figure 4-3 GSS Environmental & BMT WBM (2010) Year 1 Flow Duration Curve

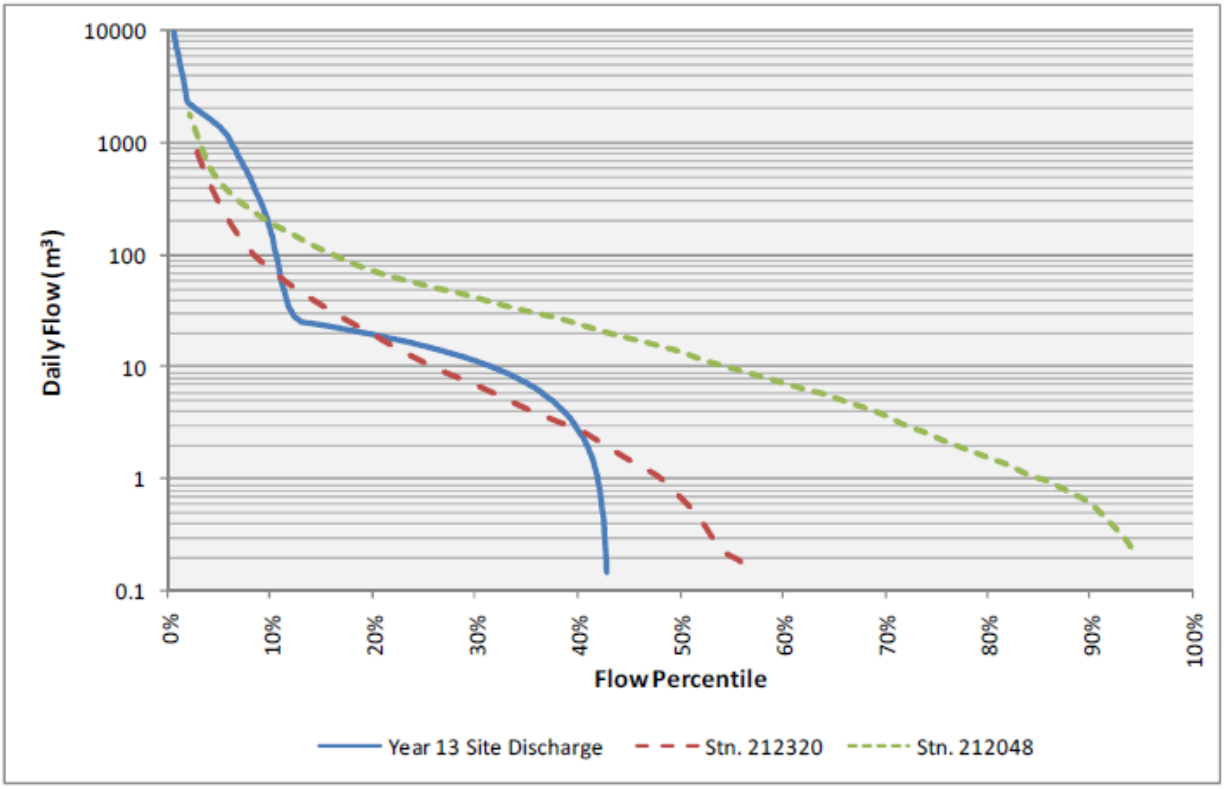

Figure 4-4 GSS Environmental & BMT WBM (2010) Year 13 Flow Duration Curve

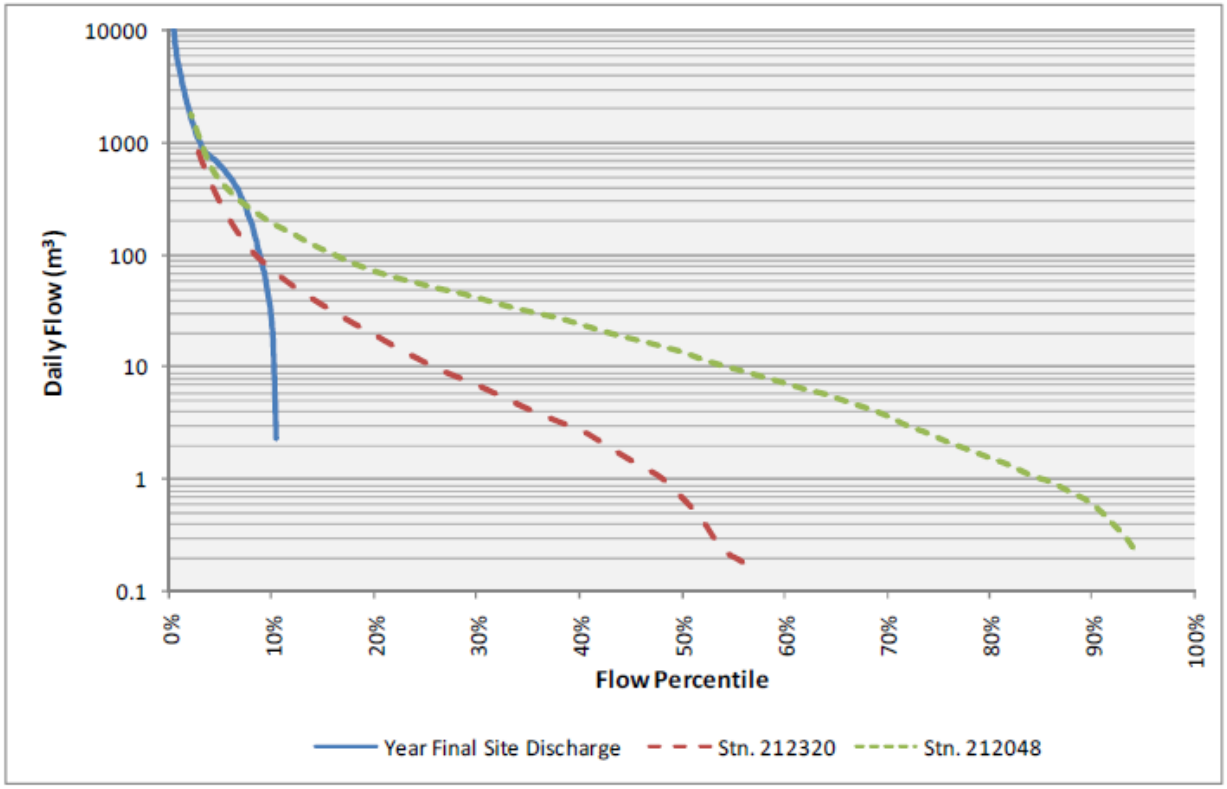

Figure 4-5 GSS Environmental & BMT WBM (2010) Final Landform Flow Duration Curve

4.5.2 Updated Water Balance

The MUSIC model described in **Section 4.4.2** was used for the purpose of an updated site water balance assessment for the existing and proposed scenarios. The adopted 51-year time series is inclusive of a sufficient number of wet, dry and average rainfall years to enable the assessment of the site water balance over a full range of climatic conditions. Rainfall depths for wet (90th percentile), dry (10th percentile) and average (50th percentile) rainfall years were obtained from Bureau of Meteorology statistics for Station 067024 (**Table 4-11**), with results from representative years extracted from the timeseries for the purpose of the water balance assessment.

Table 4-11 Wet, Dry and Average Year Rainfall Depths

	Wet Year	Dry Year	Average Year
Rainfall (mm)	1040	498	768
Representative Year	1949	1939	1945

The MUSIC model simulates stormwater catchment runoff generation, storage and re-use but does not consider any groundwater extraction permitted under the site Water Access Licence. It is assumed that these inflows would only be used to meet water demands when a deficit occurs and not have a significant impact on site hydrology. The MUSIC water balance also excludes water generated from the leachate catchments shown in **Figure 4-1** and **Figure 4-2**. Refer to the *Leachate Water Balance Assessment* GHD (2022) for details of the water balance for the site leachate management system.

The results of the MUSIC water balance assessment are summarised in **Table 4-12** for the existing scenario and **Table 4-13** for the proposed scenario. This includes the average annual volume of re-use water provided via Dam 4, Dam 5, Dam 6 and the RRC rainwater tanks (RWTs) as well as the discharge frequency and quantity at the licenced discharge locations (Dam 2, Dam 3 and Dam 6). **Table 4-14** and **Table 4-15** provide a summary of the total site water excess/deficit in the wet, dry and average rainfall years for the existing and proposed scenarios, respectively. Proposed scenario results have been provided for the maximum and standard wash plant re-use scenarios mentioned in **Section 0**.

Table 4-12 Water Balance Results – Existing Scenario

Parameter	Dam 2	Dam 3	Dam 4	Dam 5	Dam 6	RRC RWTs
Inflow (ML/yr)	30.45	4.04	50.44	35.60	23.79	4.70
ET Loss (ML/yr)	1.37	1.50	2.78	2.32	1.01	-
Infiltration Loss (ML/yr)	0.56	0.62	1.30	0.94	0.41	-
Re-Use Requested (ML/yr)	-	-	26.41	-	7.09	1.13
Re-Use Supplied (ML/yr)	-	-	20.96	-	6.82	0.53
Overflow (ML/yr)	28.50	1.89	25.19	32.29	15.51	4.17
Overflow Frequency (per year)	22	20	12	76	52	55
Net Site Inflow (ML/yr)	137					
Net Site Outflow (ML/yr)	53.7					

Table 4-13 Water Balance Results – Proposed Scenario

Parameter	Dam 2	Dam 3	Dam 4	Dam 5	Dam 6	RRC RWTs
Inflow (ML/yr)	18.06 (max) 20.44 (stnd)	4.04	28.38 (max) 31.73 (stnd)	33.65	20.73	4.70
ET Loss (ML/yr)	1.24 (max) 1.23 (stnd)	1.50	1.93 (max) 2.02 (stnd)	1.41 (max) 1.80 (stnd)	0.95	-
Infiltration Loss (ML/yr)	0.50	0.62	1.03 (max) 1.11 (stnd)	0.66 (max) 0.77 (stnd)	0.40	-
Re-Use Requested (ML/yr)	-	-	26.41	41.24 (max) 23.08 (stnd)	7.09	1.13

Parameter	Dam 2	Dam 3	Dam 4	Dam 5	Dam 6	RRC RWTs
Re-Use Supplied (ML/yr)	-	-	12.27 (max) 13.12 (stnd)	19.67 (max) 16.93 (stnd)	6.25	0.53
Overflow (ML/yr)	16.29 (max) 18.67 (stnd)	1.89	12.79 (max) 15.18 (stnd)	10.51 (max) 13.74 (stnd)	13.11	4.17
Overflow Frequency (per year)	18 (max) 17 (stnd)	20	4 (max) 6 (stnd)	4 (max) 7 (stnd)	21	55
Net Site Inflow (ML/yr)	138					
Net Site Outflow (ML/yr)	38.8 (max) 41.2 (stnd)					

Table 4-14 Water Surplus/Deficit – Existing Scenario

Parameter	Wet Year	Dry Year	Average Year
Re-Use Requested (ML/yr)[3]	33.2	34.3	34.7
Re-Use Supplied (ML/yr)	32.7	23.3	31.9
Surplus/Deficit (ML/yr)	-0.5	-11.0	-2.8

Table 4-15 Water Surplus/Deficit – Proposed Scenario

Parameter	Wet Year	Dry Year	Average Year
Re-Use Requested (ML/yr)[2]	74.5 (max) 56.2 (stnd)	75.6 (max) 57.4 (stnd)	76.0 (max) 57.7 (stnd)
Re-Use Supplied (ML/yr)	62.8 (max) 54.9 (stnd)	20.2 (max) 22.6 (stnd)	51.0 (max) 48.5 (stnd)
Surplus/Deficit (ML/yr)	-11.7 (max) -1.3 (stnd)	-55.4 (max) -34.8 (stnd)	-25.0 (max) -9.2 (stnd)

Results of the existing scenario water balance suggest that the site currently operates on a slight deficit when relying on water generated by stormwater catchments alone. The deficit is less than predicted by GSS Environmental & BMT WBM (2010) (**Table 4-10**) which can primarily be attributed to the low flow discharge assumptions adopted in this assessment (refer **Table 4-4**) reducing the quantity of water available to meet the operational demand. A comparison of average rainfall year surface flows from the GSS Environmental & BMT WBM (2010) model (136 ML/year) with the average site flows from the 51-

[3] The average re-use rate is scaled based on daily PET – rainfall and thus varies based on the rainfall patterns of a particular year.

year timeseries in the updated existing scenario MUSIC model created for this assessment (137 ML/year) indicates there is consistency between the two models in terms of water balance inflows.

For the post-development scenario, the above results show a significant water deficit in dry years due to the water high demand from the RWTP when compared to the quantity of runoff and base flow generated from the site stormwater catchments when annual rainfalls are low.

The 16 ML/year groundwater extraction volume permissible under the Water Access Licence is sufficient to fill the annual water deficit in wet years for both the maximum and standard RWTP processing rates. In dry rainfall years and in average years at the maximum RWTP processing rate, the 16ML/year groundwater extraction substantially reduces the deficit; however, additional sources of water are required to meet the demand. Additional water will be provided using a combination of the options below during dry years and when required at the maximum RWTP processing rate:

- using water available under the existing Water Access Licence (WAL),
- import of water (water tankering) and storage on site,
- a potable water connection (there is currently no potable water connection at the site, however an application with Sydney Water Corporation is currently underway and potable water connection will be in place by February 2023), or
- a regional recycled water connection (from the Upper South Creek Advanced Water Recycling Centre, when complete, which is currently estimated to be operational in 2026[4]).

4.5.3 Flow Duration Analysis

A flow duration analysis was undertaken in accordance with the *Technical guidance for achieving Wianamatta-South Creek stormwater management targets* (Wianamatta-South Creek Guidelines) (DPE, 2022). This involved running the existing and proposed scenario MUSIC models with an alternate meteorological template for Penrith, provided with the guidelines for use in such assessments, and post-processing results with the associated flow duration curve spreadsheet (file reference 'Flow Duration Curve Development Scale – South Creek – locked.xlsx). Existing and proposed scenario flow duration curves for the site are shown in **Figure 4-6**, with green lines representing the target daily flow and flow exceedance ranges from the guidelines (DPE, 2022). The adopted RWTP processing rate was not found to have a significant impact on overall site flow duration curves and thus only those for the maximum RWTP processing rate have been included in **Figure 4-6**.

[4] https://www.sydneywatertalk.com.au/uppersouthcreek, accessed 30 November 2022

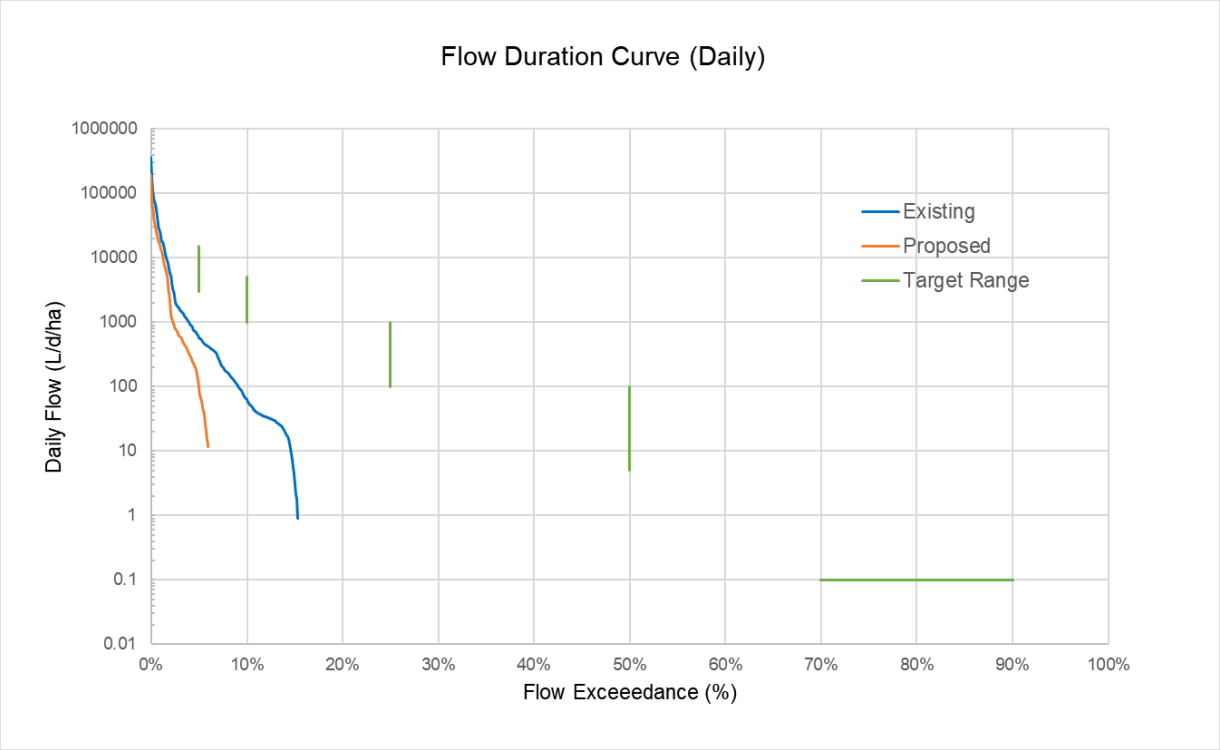

Figure 4-6 Flow Duration Curve Comparison

The existing and proposed scenario flow duration curves shown in **Figure 4-6** are outside the target ranges (shown as the green lines on **Figure 4-6**) due to the quantity of runoff being captured and re-used on site and the nature of the site itself. Provisions under Section 120 of the Protection of the Environment Operations Act, 1997 within the current EPLs in force for the Facility effectively restrict discharges to manage the risk of water pollution (**Section 4.8**).

Surface flow events are slightly less frequent in the proposed scenario due to the Dam 1 catchment being directed to the leachate management system (with no assumed overflow to the stormwater system) which reduces the Dam 6 overflow frequency.

When compared to the flow duration curves from the *Orchard Hills Waste and Resource Management Facility – Surface Water Assessment* (GSS Environmental & BMT WBM, 2010) (**Figure 4-3** to **Figure 4-5**), the existing and proposed scenario curves are most similar to the Final Landform scenario, which is representative of a fully rehabilitated site.

The flow duration curves for both the existing and proposed scenarios **Figure 4-6** are typical of pervious catchments draining to first order streams where the hydrologic behaviour is characterised by infrequent surface flow events (i.e., much of the day to day rainfall either infiltrates or evaporates). They are also consistent with the Final Landform analysis outcome in **Figure 4-5**. As such, the existing and proposed flow durations are considered more representative of both pre-developed and fully rehabilitated hydrologic conditions and are not likely to have an adverse impact on the South Creek environmental flow regime.

4.6 Erosion and Sediment Control

Construction Phase Impacts

There is the potential for erosion of any areas on the premises where surface excavation occurs during construction works, particularly at the proposed new leachate dam. This in turn can lead to increased sedimentation of downstream areas, including dams on site and potentially offsite waterways if erosion and sedimentation is not managed adequately during construction works.

Despite adequate sediment storage volumes being provided in existing site dams, it is recommended that silt fencing is also installed on the downslope side of the proposed treatment plants during construction to minimise the sediment loading on Dam 5 and Dam 6 as well as on their associated upstream swales.

Operational Phase Impacts

A number of existing erosion and sediment controls are in place at the site, as detailed in the SWLMP (GHD, 2019b). These include a number of sediment basins/dams as shown in **Figure 2-3**. The proposed recycling water treatment plant and leachate treatment plant drain to Dam 5 and Dam 6 respectively. Storage calculations using *Managing Urban Stormwater: Soils and Construction – Volume 1* (4th ed, Landcom 2004) procedures were undertaken for these dams as part of the *Surface Water Assessment* (GSS Environmental & BMT WBM, 2010) and report a maximum required capacity over the life of the project of 5.3 ML and 3.3 ML respectively, with these dams being sized to account for the disturbed surfaces over the footprints of the proposed treatment plants. Dam storage volumes nominated in work as executed drawings suggest Dam 5 (5.8 ML) has adequate storage capacity, whereas Dam 6 (2.9 ML) has a 0.4 ML shortfall in capacity up to Year 17 site conditions from GSS Environmental & BMT WBM (2010). However, the nominated storage volume in the Dam 6 work as executed drawings is to the level where water spills into the southern inlet culverts, with the overall volume to the dam spill level being considerably higher and in excess of the 3.3 ML volume requirement from GSS Environmental & BMT WBM (2010).

4.7 Groundwater

A review of groundwater vulnerability mapping available on the NSW Planning Portal and also Penrith City Council's Natural Resources Sensitivity Land Map under the Penrith LEP 2010 revealed the site is not located within a groundwater vulnerability area.

Under EPL 20814 SRC Operations monitor fifteen groundwater quality monitoring points on site. Groundwater monitoring data required by EPL 20814 is publicly available at https://patonslane.com.au/attended-monitoring/. This groundwater monitoring data was not reviewed in detail by Rhelm as part of this assessment, as it has been concluded that the proposed modification works will have no interaction with groundwater at the site.

Publicly available groundwater information from a total of six nearby boreholes was reviewed to gain an understanding of typical groundwater profiles within and in the vicinity of the site. **Figure 4-7** shows the location of nearby groundwater bores that were reviewed as part of the desktop groundwater assessment.

Ground elevation data and groundwater level data for three of the bores was extracted from the Cell Design and Groundwater Assessment (Aquaterra, 2010). **Table 4-16** provides a summary of borehole

data and approximate groundwater levels where available from Aquaterra (2010), noting these levels were recorded in 2009.

The regional groundwater aquifer exists within the Hawkesbury Sandstone beneath the site. Aquaterra (2010) concluded there is expected to be negligible recharge of groundwater from the overlying Bringelly Shale into the underlying Hawkesbury Sandstone. The groundwater level measured in the Bringelly Shale is about 4-5 m below the undisturbed land's surface, whereas the groundwater level in the underlying Hawkesbury Sandstone is at least 12-13 m lower than in the shale at 27.8 mAHD (Aquaterra, 2010).

The site is underlain by low permeability clay/shale geology which will act as a natural barrier to prevent the off-site migration of pollutants and is an aquitard. There is also no measured interconnection between groundwater in the shale beneath the site and Blaxland Creek (Aquaterra, 2010).

EPL 20814 specifies the requirements for the leachate dam lining. Work as executed plans for the leachate dam were reviewed, which indicate the dam is underlain by a clay liner more than 600mm thick, which acts as a leachate barrier system to protect the underlying Hawkesbury Sandstone aquifer.

Figure 4-7 Onsite and Nearby Groundwater Bores (Source: Water NSW, Accessed November 2022)

Table 4-16 Summary of Groundwater Bore Information (Source: Adapted from WaterNSW Data and Aquaterra, 2010)

Bore No.	Bore Depth (m)*	Standing Water Level (m)*	Yield (L/s)*	Ground Elevation (mAHD) (Aquaterra, 2010)	Groundwater Level (mAHD) (Aquaterra, 2010)	Aquifer/ Formation Measured (Aquaterra, 2010)
GW110454	30.3	6.3	1.4	35.5	30.4	Bringelly Shale
GW110455	44.4	-	-	42.0	37.9	Bringelly Shale
GW112799	21.0	-	-	-	-	-
GW105054	210.0	46.0	0.5	45.0	27.8	Hawkesbury Sandstone
GW113238	18.5	-	-	-	-	-
GW105382	252.0	24.0	1.1	-	-	-

* From WaterNSW Work Summary Reports (https://realtimedata.waternsw.com.au/)

Construction and Operational Phase Impacts

Given the Modification Proposal involve only minor changes to surface water infrastructure and changes to the leachate management system, which is not connected to the groundwater system, the Modification Proposal is not expected to intersect regional groundwater and there is no expected risk of adverse impacts on groundwater during either the construction or operational phases, associated with the Modification Proposal.

4.8 Water Monitoring

As outlined in **Section 1.2.5**, EPLs 21259 and 20814 have been issued by the EPA for operations at the site under the PoEO Act.

EPL 21259 was originally issued on 28 June 2019 and varied by a notice on 9 August 2021 containing conditions related to the RWTP trial. EPL 20814 was originally issued on 08 November 2016 and varied by several notices, the most recent being on 20 August 2019, which involved changes to several water monitoring points, parameters and discharge limits.

As previously discussed, EPL 20814 includes a number of water and leachate monitoring points as follows:

- Three wet weather discharge and water quality monitoring points (Dam 6, Weir monitoring point (located on the smaller spillway off Dam 2) and Dam 3) (referred to as EPL Points 1 to 3),
- Fifteen groundwater quality and subsurface gas monitoring points (referred to as EPL Points 4 to 18),
- One surface water monitoring point (Monitoring gantry) (referred to as EPL Point 19), and
- Two leachate quality monitoring points (Leachate sump riser and Leachate dam entry) (referred to as EPL Points 20 and 21.

SRC Operations publishes groundwater and surface water monitoring data required by their EPLs on their website at: https://patonslane.com.au/attended-monitoring/

During wet weather discharge events, SRC Operations is required to monitor water quality at its three licensed discharge points (LDPs, EPL Points 1 to 3). Under EPL 20814 the three LDPs have concentration limits for receiving waters for ammonia, pH and total suspended solids, as shown in **Table 4-17**.

A number of wet weather discharge events have occurred at the site between 19 September 2019 and 6 October 2022 (surface water discharge data was provided to Rhelm for this period), resulting in discharge from all or some LDPs from the site, as shown in **Table 4-17**. An analysis of parameters with concentration limits in EPL 20814 has been undertaken for the three LDPs for the period of monitoring data provided and the monitoring summary is shown in **Table 4-17**, with exceedances shown in red.

Table 4-17 Licenced Discharge Point Concentration Limits from EPL 20814 and Monitoring Summary^

Parameter (Units)	Concentration Limit	LDP1 (Dam 6)	LDP2 (Dam 2)	LDP3 (Dam 3)
Ammonia (mg/L)	1	<0.01-0.16	<0.01-10.30	<0.01-0.12
pH (pH Units)	6.5-8.5	6.9-8.7	6.9-8.4	7.2-8.3
*Total Suspended Solids (mg/L)**	50	<5-213	<5-715	<5-492
Number of wet weather discharge events	-	30	47	25

^ For the monitoring period 19 September 2019 and 6 October 2022

** Note that SRC Operations is taken not to have exceeded the concentration limit for the discharge of total suspended solids from LDP1-LDP3 if the discharge occurs solely for rainfall events exceeding the 90th percentile 5-day rainfall event, and SRC Operations took all practical measures to avoid or minimise water pollution. No analysis of rainfall data for each wet weather event was undertaken by Rhelm to determine if any of the TSS exceedances recorded are considered actual exceedances under the licence, the maximum values recorded are provided here for water quality context only.*

EPL 20814 includes monitoring requirements for various surface water, groundwater and leachate monitoring sites, under Condition M2.2 as follows:

- Points 1 to 3 and 19 (three wet weather discharge and water quality monitoring points and one surface water monitoring point)

Pollutant	Units of measure	Frequency	Sampling Method
Dissolved Oxygen	milligrams per litre	Special Frequency 1	Probe
Electrical conductivity	microsiemens per centimetre	Special Frequency 1	Probe
Nitrogen (ammonia)	milligrams per litre	Special Frequency 1	Grab sample
pH	pH	Special Frequency 1	Probe
Potassium	milligrams per litre	Special Frequency 1	Grab sample
Total dissolved solids	milligrams per litre	Special Frequency 1	Grab sample
Total organic carbon	milligrams per litre	Special Frequency 1	Grab sample
Total suspended solids	milligrams per litre	Special Frequency 1	Grab sample

- Points 4 to 18 (groundwater quality and subsurface gas monitoring points)

Pollutant	Units of measure	Frequency	Sampling Method
Alkalinity (as calcium carbonate)	milligrams per litre	Quarterly	Representative sample
Aluminium	milligrams per litre	Yearly	Representative sample
Arsenic	milligrams per litre	Yearly	Representative sample
Barium	milligrams per litre	Yearly	Representative sample
Benzene	milligrams per litre	Yearly	Representative sample
Benzo(a)pyrene	milligrams per litre	Yearly	Representative sample
Bicarbonate alkalinity	milligrams per litre	Quarterly	Representative sample
Cadmium	milligrams per litre	Yearly	Representative sample
Calcium	milligrams per litre	Quarterly	Representative sample
Carbon dioxide	percent by volume	Quarterly	Special Method 1
Chloride	milligrams per litre	Quarterly	Representative sample
Chromium (hexavalent)	milligrams per litre	Yearly	Representative sample
Chromium (total)	milligrams per litre	Yearly	Representative sample
Cobalt	milligrams per litre	Yearly	Representative sample
Copper	milligrams per litre	Yearly	Representative sample
Ethyl benzene	milligrams per litre	Yearly	Representative sample
Fluoride	milligrams per litre	Yearly	Representative sample
Lead	milligrams per litre	Yearly	Representative sample
Magnesium	milligrams per litre	Quarterly	Representative sample
Manganese	milligrams per litre	Yearly	Representative sample
Mercury	milligrams per litre	Yearly	Representative sample
Methane	percent by volume	Quarterly	Special Method 1
Nickel	milligrams per litre	Yearly	Representative sample
Nitrate	milligrams per litre	Quarterly	Representative sample
Nitrite	milligrams per litre	Quarterly	Representative sample
Nitrogen (ammonia)	milligrams per litre	Quarterly	Representative sample
Organochlorine pesticides	milligrams per litre	Yearly	Representative sample

Organophosphate pesticides	milligrams per litre	Yearly	Representative sample
PCBs	milligrams per litre	Yearly	Representative sample
pH	pH	Quarterly	Probe
Phenols	milligrams per litre	Yearly	Representative sample
Phosphorus	milligrams per litre	Quarterly	Representative sample
Polycyclic aromatic hydrocarbons	milligrams per litre	Yearly	Representative sample
Potassium	milligrams per litre	Quarterly	Representative sample
Redox potential	millivolts	Quarterly	Representative sample
Selenium	milligrams per litre	Yearly	Representative sample
Sodium	milligrams per litre	Quarterly	Representative sample
Standing Water Level	metres	Quarterly	In situ
Sulfate	milligrams per litre	Quarterly	Representative sample
Temperature	degrees Celsius	Quarterly	Probe
Toluene	milligrams per litre	Yearly	Representative sample
Total dissolved solids	milligrams per litre	Quarterly	Representative sample
Total organic carbon	milligrams per litre	Quarterly	Representative sample
Total petroleum hydrocarbons	milligrams per litre	Yearly	Representative sample
Xylene	milligrams per litre	Yearly	Representative sample
Zinc	milligrams per litre	Yearly	Representative sample

- Points 20 and 21 (leachate quality monitoring points)

Pollutant	Units of measure	Frequency	Sampling Method
Alkalinity (as calcium carbonate)	milligrams per litre	Yearly	Grab sample
Aluminium	milligrams per litre	Yearly	Grab sample
Arsenic	milligrams per litre	Yearly	Grab sample
Barium	milligrams per litre	Yearly	Grab sample
Benzene	milligrams per litre	Yearly	Grab sample
Bicarbonate	milligrams per litre	Yearly	Grab sample
BOD	milligrams per litre	Yearly	Grab sample
Cadmium	milligrams per litre	Yearly	Grab sample
Calcium	milligrams per litre	Yearly	Grab sample
Chemical oxygen demand	milligrams per litre	Yearly	Grab sample
Chloride	milligrams per litre	Yearly	Grab sample
Chromium	milligrams per litre	Yearly	Grab sample
Cobalt	milligrams per litre	Yearly	Grab sample
Copper	milligrams per litre	Yearly	Grab sample
Electrical conductivity	microsiemens per centimetre	Quarterly	Probe
Ethyl benzene	milligrams per litre	Yearly	Grab sample
Fluoride	milligrams per litre	Yearly	Grab sample

Lead	milligrams per litre	Yearly	Grab sample
Magnesium	milligrams per litre	Yearly	Grab sample
Manganese	milligrams per litre	Yearly	Grab sample
Mercury	milligrams per litre	Yearly	Grab sample
Nickel	milligrams per litre	Yearly	Grab sample
Nitrate	milligrams per litre	Yearly	Grab sample
Nitrite	milligrams per litre	Yearly	Grab sample
Organochlorine pesticides	milligrams per litre	Yearly	Grab sample
Organophosphate pesticides	milligrams per litre	Yearly	Grab sample
pH	pH	Quarterly	Probe
Phenols	milligrams per litre	Yearly	Grab sample
Phosphorus	milligrams per litre	Yearly	Grab sample
Polycyclic aromatic hydrocarbons	milligrams per litre	Yearly	Grab sample
Potassium	milligrams per litre	Yearly	Grab sample
Sodium	milligrams per litre	Yearly	Grab sample
Standing Water Level	metres (Australian Height Datum)	Quarterly	In situ
Sulfate	milligrams per litre	Yearly	Grab sample
Toluene	milligrams per litre	Yearly	Grab sample
Total dissolved solids	milligrams per litre	Yearly	Grab sample
Total organic carbon	milligrams per litre	Yearly	Grab sample
Total petroleum hydrocarbons	milligrams per litre	Yearly	Grab sample
Total suspended solids	milligrams per litre	Yearly	Grab sample
Xylene	milligrams per litre	Yearly	Grab sample
Zinc	milligrams per litre	Yearly	Grab sample

Both EPLs 20814 and 21259 also contain the following condition relating to pollution of waters:

Condition L1.1 – Except as may be expressly provided in any other condition of this licence, the licensee must comply with section 120 of the Protection of the Environment Operations Act 1997.

Section 120 of the PoEO Act states that:

120 Prohibition of pollution of waters

(1) A person who pollutes any waters is guilty of an offence.

Note—

An offence against subsection (1) committed by a corporation is an offence attracting special executive liability for a director or other person involved in the management of the corporation—see section 169.

(2) In this section—

pollute waters includes cause or permit any waters to be polluted.

NSW EPA (2022[1]) states that:

[1] https://www.epa.nsw.gov.au/your-environment/water, accessed 7 November 2022

At its broadest, water pollution means introducing any matter into waters which changes the physical, chemical or biological condition of the water. It also includes placing any matter where it might fall, descend, be washed, be blown or percolates into any waters (e.g., soil which might washed into a waterway).

Additionally, the Protection of the Environment Operations (General) Regulation 2009 (see Schedule 5) includes a list of specific substances (prescribed matter) which, if they are introduced onto or into waters, are automatically assumed to constitute pollution of waters (e.g., animal matter, soil, thermal waste, any matter that contains faecal coliforms, pesticides, etc.).

Note that the General Regulation is currently dated 2022. Schedule 5 Prescribed matter for the definition of water pollution provides a comprehensive list of specific substances. A review of this list suggests that in order to determine whether pollution has occurred, testing for over 7000 analytes in water discharged from the site would be required.

Details of existing soil, water and leachate management practices associated with the RRC operations can be found in the *Patons Lane Resource Recovery Centre Soil, Water and Leachate Management Plan* (SWLMP) (GHD, 2019b). The consent conditions contain a number of conditions with regards to the environmental management of the project, with Schedule 4, Condition 20 of the consent conditions details the requirements for the SWLMP (GHD, 2019b).

Construction Phase Impacts

There are no construction phase impacts to water quality monitoring other than short and temporary disruptions to required monitoring if Dam 1 is taken offline for a period of time during construction.

Operational Phase Impacts

During the operational phase, due to a change in contents of the proposed new Dam 1 leachate dam, water monitoring will be required on Dam 1.

No changes are considered to be required to existing EPL 20814 wet weather discharge and water quality monitoring points (Points 1 to 3), surface water monitoring point (Point 19) or groundwater quality and subsurface gas monitoring points (Points 4 to 18) due to the Modification Proposal.

Note that the current SWLMP (GHD, 2019b) does not align exactly with the current version of EPL 20814 (dated 20 August 2019) with regards to water monitoring requirements. For example, SWLMP (GHD, 2019b) indicates the surface water monitoring site frequency should be as follows:

> *Monthly during any pumped discharge and for overflow discharges also monthly within 24 hours after detection of an overflow discharge (during operational hours) whilst the overflow discharge occurs*

However, in EPL 20814 the frequency of surface water monitoring is required to be:

> *If discharges occur, the collection of samples within 24 hours of discharge and at a minimum of weekly intervals during discharge*

Once the SWLMP (GHD, 2019b) has been revised to align with the water monitoring requirements in EPL 20814, then no other changes are considered to be required to the surface water and groundwater monitoring requirements in the SWLMP due to the Modification Proposal.

5 Proposed Management and Mitigation Measures

5.1 Construction Phase

Measures recommended during the construction phase of the Modification Proposal are as follows:

- Update of the site Soil, Water and Leachate Management Plan to suit the Modification Proposal. This will include the nomination of suitable controls to manage construction phase soil and water impacts, and
- Temporary management of stormwater and leachate on site by other means to prevent pollution when Dam 1 is taken offline to construct and line the new leachate dam.

5.2 Operational Phase

Measures recommended to meet water quantity and quality objectives during the operational phase of the Modification Proposal are as follows:

- Update of the site Soil, Water and Leachate Management Plan to suit the Modification Proposal. This will include the nomination of suitable controls to manage operational soil and water impacts, and
- Water level monitoring of Dam 1 and tankering or discharge to sewer when the dam exceeds 75% of maximum capacity in order to prevent leachate overflow events.

6 Conclusions

A number of assessments have been undertaken to assess the performance of existing surface water management measures at the Patons Lane RRC and identify any water-related constraints associated with the proposed changes to the site leachate management system and RWTP operations.

Results of the assessments revealed the Modification Proposal is not constrained by any water quality or groundwater issues.

Water balance modelling revealed additional water sources will be required for the RWTP operation during dry years and also in average rainfall years when the plant is operating at maximum capacity.

Proposed management and mitigation measures are specified in **Section 5**. This assessment indicates the Modification Proposal will not have any significant environmental impact on soil or water at or surrounding the site during the construction or operation phase, provided the mitigation measures proposed are implemented.

7 References

Aquaterra Consulting (2010) *Orchard Hills Waste and Resource Management Facility – Cell Design and Groundwater Assessment*. Prepared for Dellara, March 2010.

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BMT WBM (2015) *NSW MUSIC Modelling Guidelines.*

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DPE (2022) *MUSIC modelling toolkit for Wianamatta-South Creek*, September 2022.

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Appendix A

Site Photographs
(30 August 2022)

Leachate Dam

Southern extent of Dam 5, looking south towards outlet pipes from Resource Recovery Centre

Dam 5

Dam 4

Dam 4 outlet structure (looking north to northern perimeter bund wall)

Looking west across existing quarry void to be dewatered, towards vegetation along western site boundary

View of Central Quarry void to be dewatered

Dam 2C looking east across the dam towards the spillway (left) and pipes (right) connecting to Dams 2A, & 2B

Spillway from Dam 2C which connects to larger spillway off Dam 2A, also showing monitoring equipment

Spillway from Dam 2C, showing monitoring equipment, looking towards Dam 2B

Large, engineered spillway from Dam 2A that discharges to Blaxland Creek, looking towards Dam 2A

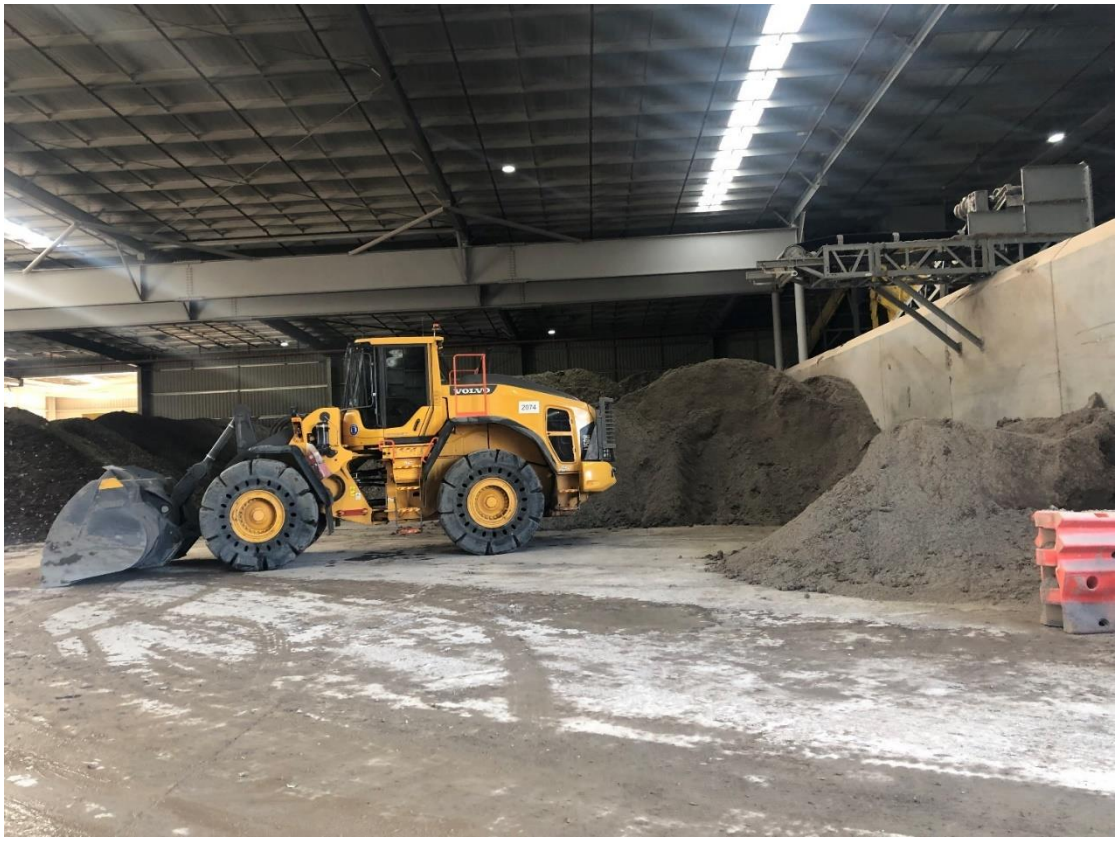
Large, engineered spillway from Dam 2A that discharges to Blaxland Creek, looking towards Blaxland Creek

Internal perimeter drainage channel at base of earthen bund, Resource Recovery Centre in background

Southern perimeter earthen bund draining north under access road to internal perimeter drainage channel

View of Southern earthen bund around Resource Recovery Centre and On-Site Sewerage Tanks

Stockpiles of material inside Resource Recovery Centre



Stockpiles of material and equipment inside Resource Recovery Centre

Stockpiles of recovered material next to the Resource Recovery Centre

Outlet structure looking northeast under northeast corner of Resource Recovery Centre bunded area

Looking southeast along internal perimeter drainage channel of Resource Recovery Centre bunded area

Existing clarified water tanks and pump shed next to Resource Recovery Plant

Resource Recovery Centre and existing conveyors

Existing Dam 1, the proposed raw leachate dam (foreground) and proposed contact water dam (background)

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