BANKSMEADOW WASTE TRANSFER TERMINAL

Stormwater Management Report

November 2013

Prepared for **Veolia Environmental Services Pty Ltd**

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BANKSMEADOW INTERMODAL FACILITY

Banksmeadow Transfer Terminal

Stormwater Management Report

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Report No N0001-AA005924-AAR-01

Date 26 November 2013

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1 INTRODUCTION

1.1 BACKGROUND

Veolia Environmental Services (Australia) Pty Ltd (Veolia) is proposing to develop the Banksmeadow Transfer Terminal (TT) and associated rail infrastructure at an existing industrial site in Banksmeadow, within the Local Government Areas (LGA) of Botany Bay and Randwick (the Proposal).

The Proposal involves the construction of a transfer terminal that would containerise putrescible waste for rail haulage to the Woodlawn Eco Project site, near Goulburn, NSW, for treatment, recycling and energy recovery. The terminal would also house an area where loads of non-putrescible waste would be consolidated into semi-trailers for transfer to resource recovery facilities, such as the proposed Camellia Recycling Centre, for further recovery of recyclable material.

The Proposal would, over time, be capable of processing up to 400,000 tonnes (t) of putrescible waste and 100,000 t of non-putrescible waste per annum for transfer to various resource recovery facilities.

The Banksmeadow TT would involve the development of a new waste transfer building, as well as associated road and rail infrastructure, including:

- An access road for putrescible and non-putrescible waste trucks entering and exiting the facility from Beauchamp Road
- Incoming and outgoing weighbridges to check the waste type and weight of the waste being delivered to the facility
- An enclosed building for the unloading and handling of waste, with environmental controls such as dust suppression and odour control systems
- A hardstand area for temporary storage and manoeuvring of full and empty sealed shipping containers prior to loading onto trains
- Rail sidings for the loading of containers onto trains for rail transport to Woodlawn.

The proposed site (the Site) is situated in the suburb of Banksmeadow, on the western side of Beauchamp Road, and the northern side of McPherson Street. It includes part of the land owned by Asciano Services Pty Ltd (Asciano) at 14 Beauchamp Road, as well as land owned by Keith Engineering Pty Ltd at 34-36 McPherson Street. The lot and deposited plan identification of the site is provided in Table 1-1, below.

Table 1-1 Lot and deposited plans of site

Lot	Deposited Plan	Owner
1	435497	Keith Engineering
A	366725	
B	366725	
2 (Part only)	1006565	Asciano

The site is located largely within the Botany Bay City Council local government area (LGA). The proposed entry at the intersection between Beauchamp Road and Perry Street is located in the LGA of Randwick City Council.

1.2 PURPOSE AND OBJECTIVES

The purpose of this report is to present finding of water resources assessment for the proposed Banksmeadow TT site, herein referred to as the Proposal site.

The objectives of this assessment are to:

- Understand the potential impacts to water management of the site from the proposed development.
- Provide recommendations for the specific management of stormwater at the proposed site.
- Identify the onsite detention requirements and flood storage requirements for the site that would result in 'no change' to the existing flood behaviour.
- Identify opportunities to improve stormwater quality on site.
- Identify measures required to manage stormwater during the construction phase of the Proposal, in accordance with *Managing Urban Stormwater: Soils and Construction – Volume 1, 4th Edition* (Landcom, 2004).

The potential impacts of the proposal on groundwater are discussed in the Draft Remediation Action Plan – Proposed Waste Transfer Facility (Douglas Partners 2013) and summarised in the Environmental Impact Assessment (EIS) for the Proposal. Impacts of the Proposal on water quality are briefly addressed within this report; with further detail on existing water quality provided in the EIS.

1.3 DIRECTOR GENERAL REQUIREMENTS

The relevant Director General requirements (DGRs) around water management for the proposed activity are given in Table 1-2 below. The table also identifies where each requirement is discussed, either in this technical report of the EIS surface water chapter.

Table 1-2 Director General Requirements

Director General Requirements - Surface Water Management	Relevant Section
A description of the existing surface and groundwater quality, including an assessment of any water resource likely to be affected by the proposal	Surface Water Chapter (EIS)
The proposed erosion and sediment controls during construction	Section 6
A comprehensive flood study, including consideration of flooding impacts, the proposed site layout and any changes in flood behaviour	Section 2.4 & Section 5.1
The proposed stormwater management system, including the capacity of onsite detention systems, and measures to treat, reuse or dispose of water	Section 5.1
A site water balance, including a detailed description of the measures to minimise the water use at the site	Section 4

Director General Requirements - Surface Water Management	Relevant Section
Wastewater (including leachate) predictions, including volume and the measures that would be implemented to avoid discharges, collect, treat, reuse and/or dispose of this water	Section 5.2
An assessment of the impacts of the project on watercourses and riparian areas, groundwater sources and dependent ecosystems	Surface Water Chapter (EIS)

In addition to the above-listed assessment requirements, the Australian Rail Track Corporation (ARTC) requested the following consideration, as an adjoining landowner:

- Drainage and stormwater runoff from the development land needs to be prevented from entering the rail corridor both during and post construction unless formal permission has been provided by ARTC.

The proposed stormwater management strategy has been developed to achieve this request.

1.4 SCOPE OF WORK

To address the above requirements, the following scope of work has been defined:

- Preparation of a site water balance to determine the operational site water demand and identify opportunities to offset non-potable water demand through rain water capture and wastewater reuse.
- Assessment of onsite detention storage requirements and development of a stormwater management strategy.
- Identification of opportunities for stormwater quality improvement devices.
- Review of the existing flood behaviour on site and assessment of changes to flood behaviour using available survey and existing flood models.
- Determine the erosion and sedimentation controls required during the construction phase of the proposal using:
    - NSW guidelines “Managing Urban Stormwater - Soil and Construction, 2004” to determine the minimum storage required to control sediments.

1.5 AVAILABLE INFORMATION

The following information has been used in preparation of this Stormwater Management Report:

- Botany Bay City Council *Springvale Drain and Floodvale Drain Flood Study – Draft Report: R.S1282.002.02, Draft dated June 2013.*
- Site Survey *dated August 2013*
- Banksmeadow Transfer Terminal proposed site layout
- Botany Bay City Council Draft Development Control Plan
- Botany Bay City Council Draft Stormwater Management Technical Guidelines (2013).

2 SITE DESCRIPTION

2.1 REGIONAL AND LOCAL CATCHMENTS

The proposed site is situated in the suburb of Banksmeadow, on the western side of Beauchamp Road, and the northern side of McPherson Street. The site is located on an area of approximately 2.18 hectares, and is currently owned by Asciano Services Pty Ltd (at 14 Beauchamp Road) and Keith Engineering (34-36 McPherson Street). Predominantly, the site is located within the Botany Bay City Council local government area (LGA) with the proposed entry between Beauchamp Road and Perry Street located in the LGA of Randwick City Council.

The proposed Banksmeadow TT site is located within the Springvale Drain catchment, which comprises part of the greater Botany Bay catchment area. The regional topography of the area slopes downwards towards the southwest, with steeper slopes to the north and east. Most of the site has been levelled out; however there is a slight slope downwards to the south west towards Botany Bay; where the Springvale Drain ultimately discharges.

Figure 2-1 shows the site of the Banksmeadow TT within its local context.

The underlying topography of the site is relatively flat, having been mostly levelled out. There is a slight slope, of on average 0.62%, downwards to the south west, towards Botany Bay. The neighbouring sites to the east (Botany Building Recyclers) and west (the railway line) have been raised above the level of the subject site. Surface water drainage movement of the site and surrounding area is downwards to the southwest with steeper slopes to the north and east into the Springvale Drain. The Asciano owned portion of the site drains to the north-west, where it ponds and gradually releases along the ARTC rail way to the south and into the stormwater drain on McPherson St.

The Springvale Drain catchment area comprises part of the wider Botany Bay catchment area. The Botany Bay catchment covers an area of approximately 1,165 km^2. The Botany Bay catchment has a high level of urbanisation resulting in large areas of impervious surfaces. The catchment generates approximately 292,435 ML of stormwater runoff each year.

The Springvale Drain has a catchment area of approximately 241 ha and a total length of 6.9 km, comprising of 2.5 km of closed conduit and 1.4 km of open channel. The catchment drains low-lying areas, including domestic underground stormwater drains, and incorporates 111.77 ha of impervious surface areas (Lawson & Treloar, 2003). The Springvale catchment is comprised of 11 sub-catchments of which the Banksmeadow TT site sits within sub-catchment S15 (Figure 2-2). The S15 catchment discharges to the stormwater drain on McPherson Street, which flows to the main Springvale Drain and ultimately discharges at Penrhyn Estuary.

Figure 2-1 Local context for the Banksmeadow TT

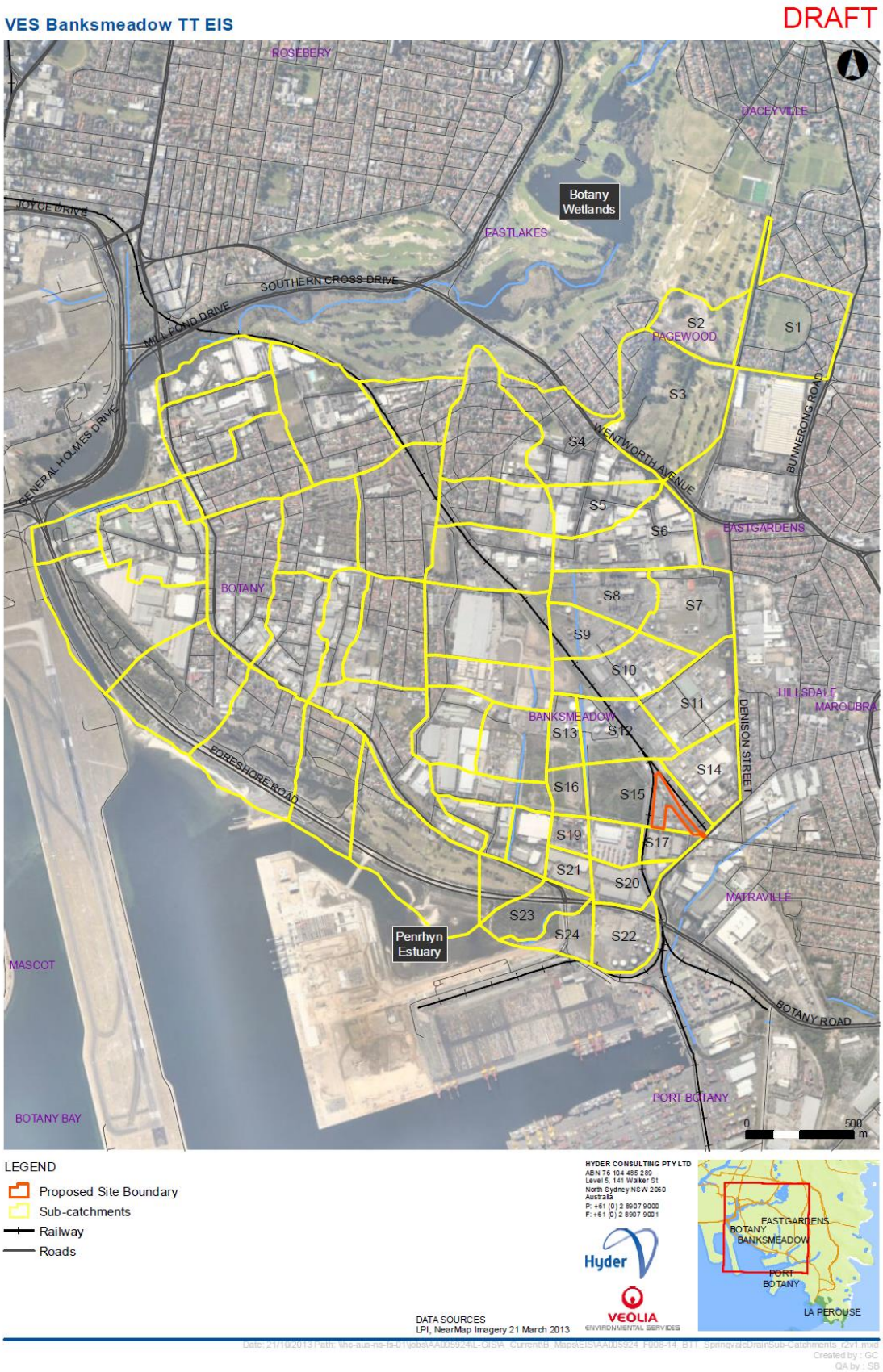

Figure 2-2 Sub-catchments of Springvale Drain

2.2 CURRENT SITE LAYOUT

2.2.1 ASCIANO LAND

The Asciano owned portion of the site is presently used for rolling stock storage and is temporarily being used for container handling purposes. These activities would cease prior to commencement of construction at the Proposal site. However, the rail sidings and a large portion of the Site are largely unused. The topography of the site is relatively level, as a result of various filling activities that have occurred on the Asciano site over time. The south-eastern portion of the Asciano site is relatively higher than surrounding areas, while at the north western end of the site, towards the ARTC land, there is a raised soil platform.

The central portion of the site is covered with hardstand, comprising unbound road base and crushed concrete gravels and recently applied bitumen. The eastern portion of the site has recently been asphalted and jersey curbing has been installed to separate the western rail sidings from the eastern sidings. There is no formal stormwater drainage system currently on site, and water falling on the Asciano site, prior to asphalting, has been observed to pond on site and absorb into the groundwater.

Structures currently on the Asciano owned portion of the site include:

- Concrete office building that was formerly used as an office for Pacific National operations, located adjacent to the northern site boundary and bordering on ARTC land.
- Several masonry and sheet metal clad buildings, located within the central western portion of the land, associated with the previous rail yard land use.
- Covered parking and barbeque area, adjacent to the western boundary of the site.
- Temporary office building at the site entry, currently used by Patricks.

The site has been largely unused and the western boundary of the site is overgrown with exotic species. Recent activities on the site include the transport of old rail carriages for deconstruction and recycling and the temporary use of the site by Patricks Stevedoring for handling of containers.

Access to the site is from the intersection of Beauchamp Road and Perry Street, where an access gate has been installed to prevent unauthorised egress to the site. Traffic movements on the site are limited to the temporary use of the site by Patricks. This use of the site would cease prior to commencement of construction of the Proposal.

2.2.2 KEITH ENGINEERING LAND

The topography of the Keith Engineering site currently slopes from a retaining wall that has been constructed along the eastern boundary of the site towards the south-west, falling approximately 0.6 m over 60 m. The ground surface is covered with reinforced concrete slab floors within the buildings, with exposed pavements of both reinforced concrete and asphalt. Unsealed portions of the site have been covered with loose gravel and recycled building aggregate.

Structures on the Keith Engineering site currently include:

- A large warehouse that fronts McPherson Street and is constructed from a steel frame with part brick and asbestos-cement cladding and roof sheeting. This warehouse is relatively tall (estimated at 15 m RL) and contains gantry cranes. It is known as the main factory building.
- A smaller warehouse, located adjacent to the large warehouse, constructed from brick and sheet metal roofing. This warehouse is joined to an existing office building of similar construction, on its eastern side.
- Several smaller sheds constructed from steel frames with metal cladding.
- Several portable site office buildings and industrial storage bins.
- Other existing site features included a small substation and adjoining shed and concrete paving.

Vegetation on the site comprises an area of planted casuarinas along the eastern site boundary and several planted, mature eucalypts along the McPherson Street frontage.

2.3 EXISTING SITE DRAINAGE

Stormwater flow across the site is generally uncontrolled. A large portion of the runoff flows to the northern boundary of the site, with runoff from the Asciano portion of the site flowing to the north-west, where it ponds and gradually releases along the ARTC railway to the south and into the stormwater drain on McPherson street. Surface water on the western portion of the site gathers at a point of low elevation along the western boundary of the site, where it is presently pumped out to the stormwater drainage system on McPherson Street, although some of the runoff on site may escape along the western boundary. It has been observed that after periods of high rainfall water does pond at various locations across the site. This stormwater generally slowly escapes the site through the boundaries and / or infiltrates into the groundwater, notably within the eastern portion (Asciano Botany Site) of the site. Stormwater on the Asciano Botany Site, to the north-east of the Proposal site has been observed to also flow to the north-east.

Keith Engineering currently utilise pumps to discharge built up run-off into the Council stormwater system. These pumps are operated manually and switched on and off based on a visual observation of the site. There is no data detailing the amount of water that is discharged during these scenarios.

The Botany Building Recyclers catchment is bounded by a retaining wall to the west and contains stockpiles around the northern and eastern boundary; these constraints ensure no run-off contributes to the Proposal site. It is also noted that a sedimentation basin exists on-site which connects into the existing stormwater system (URS, 2005). This further confirms that the Botany Building Recyclers stormwater is presently separate from the Proposal site.

Figure 2-3 illustrates current drainage conditions at the site.

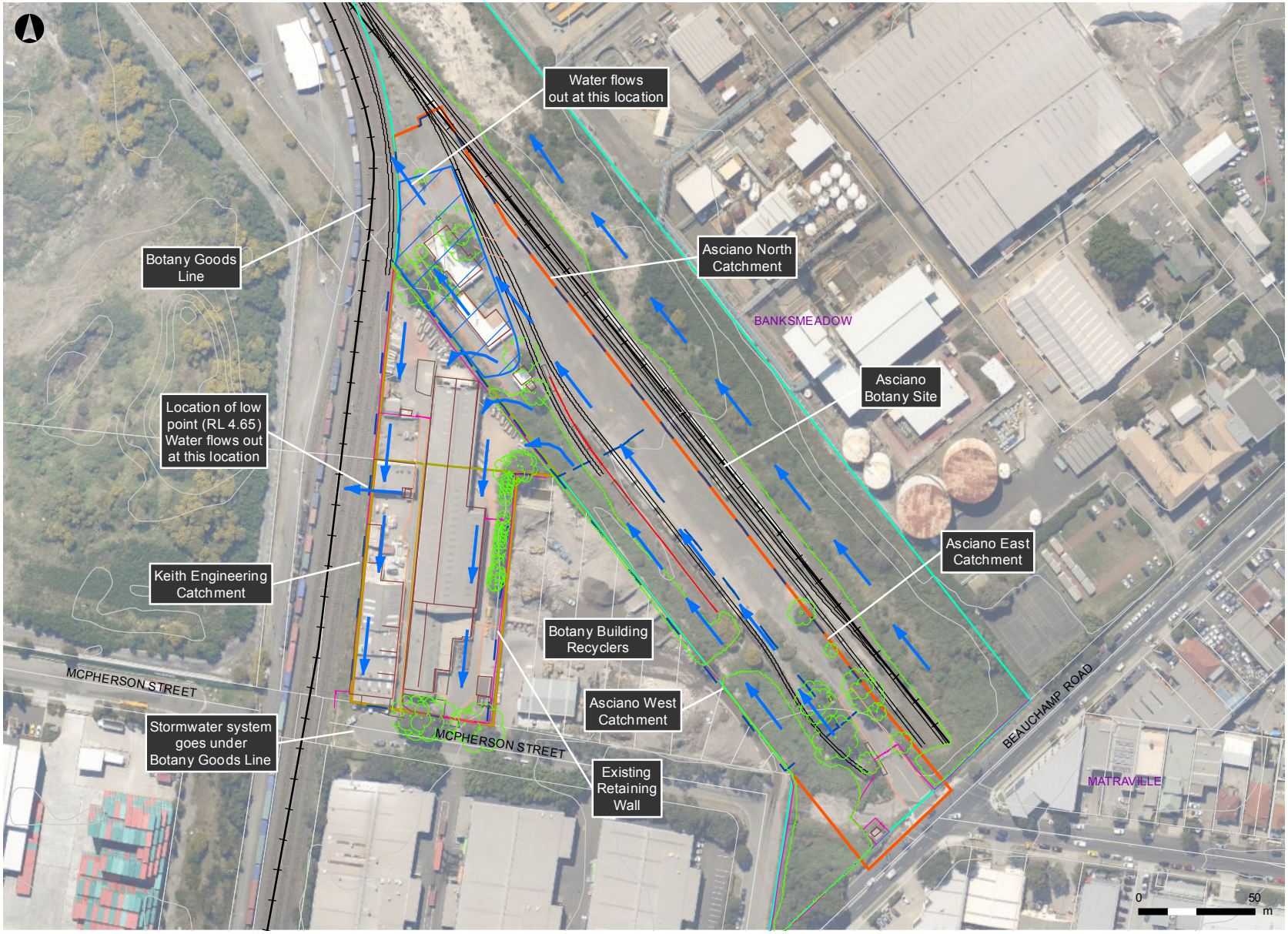

Figure 2-3: Existing Stormwater Flows

Date: 26/11/2013 Path: \\hc-aus-ns-fs-01\jobs\AA005924\L-GIS\A_Current\B_Maps\Hydrology\AA005924_F002-3_BTT_ExistingStormwaterFlows_r4v1.mxd
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2.4 FLOODING

Based on the draft outcomes of flood modelling commissioned by the Botany Cay City Council it would appear that flooding does not pose a significant risk to the site.

Flood waters are generally confined to the Keith Engineering portion of the site. The retaining wall to the east of the lot, adjacent to the Botany Building Recyclers and the raised ARTC rail corridor to the west of the site cause water to pond in a north-south 'channel like' alignment between the north of the site and McPherson St in the south. These flood waters do not appear to be linked or a result of any flows from upstream sections of the catchment; suggesting that the flooding at the site is caused by rainfall falling directly on the site itself. Flood mapping suggests that flood waters on the Asciano Botany Site are confined to the area east of the rail siding, and outside of the Proposal site. It is noted that the portion of the Asciano land will not be utilised as part of the Proposal and flood waters in this area are unlikely to impact the site. This is discussed further in Section 3.6.

Preliminary flood modelling indicates that the peak flood depth at the Proposal site and the adjacent Asciano Botany Site during the 1% AEP event is in the range of 0m – 0.5 m, with peak flow velocities below 0.6m/s. Using the depth and velocity relationship (NSW Government, 2005) flood hazard at the site is considered low. This shows that even during 'extreme' events the flood is relatively minor. Results also demonstrate that the flood hazard at the site is low and during any flood event that may affect the Springvale Drain and Botany Bay catchment any floodwater at the site would be classified as part of the 'flood fringe'.

Based on these preliminary findings it would be reasonable to assume that higher frequency events (such as 20% and 10% AEP) would pose an even lower risk to the Proposal. It is also noted that flood behaviour would be unlikely to change significantly due the Proposal as the rail alignment and retaining wall will remain in place.

Refer to Section 5.1 for more information on flood behaviour, in regards to flood storage on the site

3 PROPOSED DEVELOPMENT

3.1 PROPOSED DEVELOPMENT

The Proposal would involve the remediation of the site to an appropriate level for redevelopment of the Site as a transfer station, demolition of existing infrastructure on the site, and the development of a new waste transfer terminal building, as well as associated road and rail infrastructure, including:

- An access road for putrescible and non-putrescible waste trucks entering and exiting the facility from Beauchamp Road.
- Incoming and outgoing weighbridges to check the waste type and weight of the waste being delivered to the facility.
- An enclosed building for the unloading and handling of waste, with environmental controls such as dust suppression and odour control systems.
- A hardstand area for temporary storage and manoeuvring of full and empty sealed shipping containers prior to loading on to trains.
- Rail sidings for the loading of containers onto trains for rail transport to Woodlawn.

3.2 TERMINAL BUILDING

The terminal building would be of steel portal frame construction with steel cladding and concrete slab floor. The terminal would be divided into two areas via a concrete block wall, in order to separately receive up to 400,000 tpa of putrescible waste and up to 100,000 tpa of non-putrescible waste.

Each area would be fully enclosed, with concrete slab flooring and upturned concrete walls to allow stockpiling of material. Each area would be fitted with a dust suppression system, a fire deluge system, and a single vehicular access. The non-putrescible area, which would be approximately 1,600 m^2 in size, would contain concrete bays for recyclable material which has either been source-separated or is separated from incoming mixed waste loads (bulky items, for instance), and a large area for stockpiling of mixed non-putrescible waste. The waste would be transferred from the terminal floor to outgoing trucks via a loading zone. The covered loading zone, which incorporates a weighbridge, would sit below the level of the non-putrescible area floor on the west side of the building.

The putrescible waste area, approximately 2,000 m^2 in size, would be serviced by two compactors on the western side of the building. The compactors would compress the waste into a bale, which would then be inserted into transport containers via railway tracks. This area would also be serviced by an odour control system.

A maintenance carport and a self bunded diesel tank would be situated on the north-western side of the terminal building.

3.3 OFFICE BUILDINGS

The main office building would be situated at the front of the terminal building, adjacent to the McPherson Street entrance. The office would be located on the first floor, with nine car parking spaces beneath. A further 17 car parking spaces would be located beneath the non-putrescible area which would be accessed via the front of the building.

Additionally, the double weighbridge for incoming putrescible waste trucks at the Beauchamp Road entrance would incorporate an office for the weighbridge operators.

3.4 RAIL

The rail operations associated with the Banksmeadow TT would incorporate two new private sidings (Veolia sidings). These sidings would be constructed on the north-western side of the site and would replace the two existing sidings which currently occupy this space. The Veolia sidings would form part of Asciano's Botany Site, consisting of a number of existing rial sidings adjacent to the Veolia sidings. The Veolia sidings would have a concrete hardstand area in between the tracks to allow manoeuvring of container handlers. The area between the sidings and the terminal building would also be concrete hardstand to allow for container handling activities including temporary container storage. Man proof fencing would be installed on the boundary between the site and the main rail corridor.

Incoming trains would enter the Proposal site via Asciano's connection point onto the main Botany Goods line and then proceed to the Veolia sidings. Once in the Asciano Botany Site, Pacific National would shunt the wagons on the Veolia sidings in order to allow Veolia to undertake container handling operations. These would include unloading of the empty containers from the train using a container handler and loading full containers onto wagons. Once the wagons have been loaded the train would be assembled ready for transport to the Crisps Creek Intermodal Facility.

3.5 TERMINAL ACCESS

The Banksmeadow TT would have two vehicular accesses points – via the existing traffic lights at Beauchamp Road and Perry Street, and via McPherson Street.

The Beauchamp Road entrance would be used for vehicles delivering putrescible and non-putrescible waste. The vehicles would be weighed over the incoming weighbridge and weighed again upon leaving the site via the outgoing weighbridge. This entrance would include a '10-minute' parking area for incoming vehicles prior to the incoming weighbridge. Vehicles would turn around within the terminal building, reversing to the waste bays, before depositing their waste and exiting via the Beauchamp Road access.

The McPherson Street entrance would be used for semi-trailers collecting non-putrescible waste from the Banksmeadow TT for transport to a recycling facility, and for light vehicle access and parking.

Semi-trailers entering the site via the McPherson Street entrance would use the concrete hardstand in front of the terminal building to reverse into the non-putrescible waste loading dock. The loading dock would incorporate a weighbridge, which would weigh the semi-trailers after loading has taken place.

3.6 PROPOSED CHANGES TO THE CATCHMENTS

Catchment analysis through site inspections and use of aerial imagery has allowed a breakdown of the impervious and pervious areas of the site as described in Table 3-3.

As shown in .Figure 3-4 the building coverage will generally remain unchanged with the terminal building occupying a similar location to the Keith Engineering Factory sheds.

The majority of the site would be paved due to the operational requirements of the Proposal. The increase in the impervious fraction of the site will increase run-off; however this has been addressed with an onsite detention system (OSD). Water sensitive urban design (WSUD) measures will also be incorporated into the landscaping – this will serve to maintain the existing quality of run-off and limit the intensity of the flood peak through the site. The site drainage from the Keith Engineering land will follow the same flow path, discharging to McPherson Street. Runoff from the Asciano portion of the site would be prevented from flowing onto the ARTC owned land to the north and west of the site, and would be directed, via OSD, through the Keith Site[1]. Refer to Section 5.1 for more information on these measures.

Due to the development grading of the Site will be required to ensure the run-off drains effectively after rainfall; the Site would be graded in such a way that run-off would be directed away from remaining portion of the Asciano property therefore it is very unlikely that run-off from the Proposal will impact on the remaining Asciano site. It is anticipated that run-off from the undeveloped portion of the Asciano Botany Site will behave in a similar way to the existing conditions; with run-off flowing to the north-west, parallel to the rail siding.

The Botany Building Recyclers stormwater is presently separated from the Proposal site by a retaining wall to the west and stockpiles around the northern and eastern boundary. It is also noted that a sedimentation basin exists on-site which connects into the existing stormwater system (URS, 2005). These constraints will not be impacted by the Proposal site as it is developed, ensuring that the Botany Building Recyclers stormwater will remain separate from the Proposal site.

Figure 5-6 outlines the proposed layout of the Site – the main terminal building will occupy the current Keith Engineering warehouse site and additional roads and container storage will be provided as part of the development. As Table 3-3 illustrates the changes to the catchment are relatively minimal as the Site is already extensively developed.

Table 3-3 Fraction Impervious Existing Conditions vs. the Proposal

Description	Area (ha)	%
Total site area	2.18	100
Existing conditions		
Existing Vegetation (pervious)	0.44	20.2
Existing buildings (impervious)	0.87	39.9
Existing hardstand (impervious)	0.87	39.9
Proposed development		
Proposed Landscape (pervious)	0.29	13.3
Proposed building (impervious)	0.50	22.9
Proposed hardstand (impervious)	1.39	63.8

[1] The detailed design of the stormwater management system would allow for the diversion of water from the Asciano owned portion of the site to an alternative location at the end of the Proposals operational life.

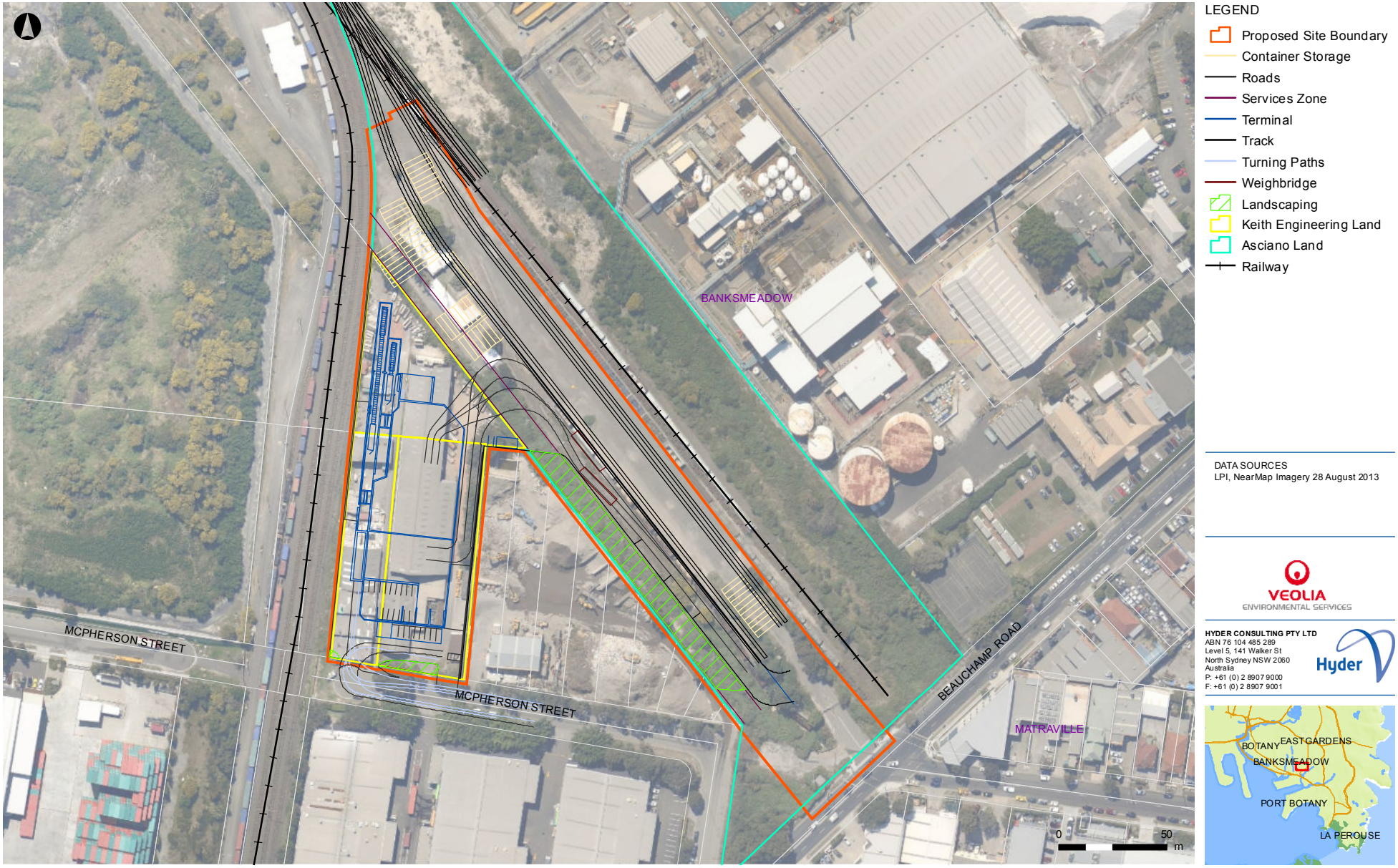

Figure 3-4: Existing and Proposed Development at the Banksmeadow TT Site

4 WATER BALANCE ASSESSMENT

4.1 APPROACH

A water balance assessment has been undertaken to determine the potential water demand and water supply requirements during the operations phase of the Proposal. The water balance was calculated as follows:

$$Water\ demand - water\ supply = net\ water\ balance$$

The net water balance was calculated for each month to give more accurate representation of the supply and demand relationship and variability across the year.

4.2 WATER DEMAND

4.2.1 CONDITIONS/ASSUMPTIONS

For the purposes of the water balance the demand portion of the balance was assumed to consist of any water uses where the water quality wouldn't normally be required to be of potable standard. This included:

- Toilet flushing; and
- Washdown water.

Toilet Flushing

Table 4-4 outlines the assumptions used for the toilet flushing demand calculations. It was assumed4.5/3L dual flush toilets would be installed as part of the Proposal.

Table 4-4 Toilet Flushing Assumptions

Number of Staff	½ Flushes	Full Flushes	Water Use (L/day)
28 (includes day and night shift)	28 x 2 = 56@3L	28 x 1 = 28@4.5L	294

Washdown Water

Water is required to clean and hose down the waste handling areas inside the terminal building each day. Based the size of the waste handling area it was assumed that 2,000 L per day would be required. This figure is similar to the consumption currently used at Veolia's Clyde Transfer Terminal site.

4.3 WATER SUPPLY

4.3.1 CONDITIONS/ASSUMPTIONS

Water that could be used to supplement non potable water demand was deemed to fall under the water supply portion of the water balance. The main water supply source is rainwater, which can be harvested from the facilities roofed areas.

Rain Water Harvesting

The roof area has been calculated as 4,098m^2 as per the current design for the terminal and office buildings. A run-off coefficient of 0.95 has been applied to the roof area – this takes into account the rainfall that may not reach the gutter system due to rainfall intensity (high intensity may splash of or spill from gutters) or leaks in the roof.

Average monthly rainfall was sourced from the rain gauge at Randwick Racecourse (Bureau of Meteorology, 2013). This gauge was chosen due to its proximity to the site and quality of the data set. Average monthly rainfall (mm) is outlined in Table 4-5

Table 4-5 Randwick Racecourse monthly rainfall averages (mm)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
120.1	131.8	146.2	125.5	130.6	158.8	85.8	92.0	67.1	85.1	101.2	80.5

As per the City of Botany Bay DCP a first flush system must be incorporated into any rainwater harvesting so that dust and debris are not captured with the rainwater. Guidelines state that the volume of rain water that gets diverted by the first flush should be 1L per m^2 (City of Botany Bay, 2013). Based on a 4,098m^2 roof area the amount of water diverted per rainfall event would be 4,098 L. To make an accurate assumption on the amount of rain water diverted as part of the first flush the average amount of days of rain per month was used and each day of rain would trigger a diversion of rain water. Table 4-6 shows the mean number of day's rain for each month. Sydney Airport was used as the Randwick gauge did not have this information – this was deemed suitable due to the proximity of the two gauges.

Table 4-6 Sydney airport average number of rain days per month

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
11.5	11.5	12.3	11.0	11.0	11.3	9.3	9.1	9.3	10.7	11.5	10.6

4.4 OUTCOMES

4.4.1 WATER DEMAND

Table 4-7 outlines the water demand portion of the site water balance across each month. As the water demand is stable from day to day the monthly volumes do not vary considerably. Refer to Section 4.2.1 for daily water demand assumptions.

Table 4-7 Monthly non potable water demand

Month	Days	Demand (L)	Demand (kL)
Jan	31	71,114	71.11
Feb	28	64,232	64.23
Mar	31	71,114	71.11
Apr	30	68,820	68.82
May	31	71,114	71.11
Jun	30	68,820	68.82
Jul	31	71,114	71.11
Aug	31	71,114	71.11
Sep	30	68,820	68.82
Oct	31	71,114	71.11
Nov	30	68,820	68.82
Dec	31	71,114	71.11

4.4.2 WATER SUPPLY

Table 4-8 outlines the water supply portion of the site water balance across each month. The water supply from rainfall, while variable follows a pattern, with large volumes available for capture during the 'wet' months (January to June) compared with relatively low volumes in the latter part of the year. Refer to Section 4.3.1 for daily rain water harvesting assumptions.

Table 4-8 Monthly rainwater harvesting potential

Month	Rainfall for capture (kL)	Volume diverted by first flush (kL)	Rainfall for storage (kL)
Jan	467.54	47.13	420.42
Feb	513.09	47.13	465.97
Mar	569.15	50.41	518.75
Apr	488.57	45.08	443.49
May	508.42	45.08	463.34
Jun	618.20	46.31	571.90
Jul	334.02	38.11	295.90
Aug	358.15	37.29	320.86
Sep	261.22	38.11	223.11
Oct	331.29	43.85	287.44
Nov	393.97	47.13	346.84
Dec	313.38	43.44	269.94

4.4.4 NET WATER BALANCE

As shown in Table 4-9 there is potential to capture enough rainwater to offset toilet flushing and washdown water demands and, that over the course of 12 months, the net water balance would be 3,791 kL.

It should also be noted that even where there is a positive water balance this doesn't guarantee supply at every stage during the month. Rainfall variability and storage capacities will determine whether there is a positive water balance at any given time.

Table 4-9 Monthly net water balance

Month	Demand (kL)	Supply (kL)	Balance (kL)
Jan	71.11	420.42	349.30
Feb	64.23	465.97	401.73
Mar	71.11	518.75	447.63
Apr	68.82	443.49	374.67
May	71.11	463.34	392.23
Jun	68.82	571.90	503.08
Jul	71.11	295.90	224.79
Aug	71.11	320.86	249.75
Sep	68.82	223.11	154.29
Oct	71.11	287.44	216.33
Nov	68.82	346.84	278.02
Dec	71.11	269.94	198.83
TOTAL	837.28	4627.96	3790.65

Figure 4-5 shows the difference between the potential for water harvesting in the early part of the year compared with later in the year and that non-potable water demand is generally constant throughout the year. Refer to Section 5.1.5 for the strategy regarding the rainwater tanks sizing and storage strategy.

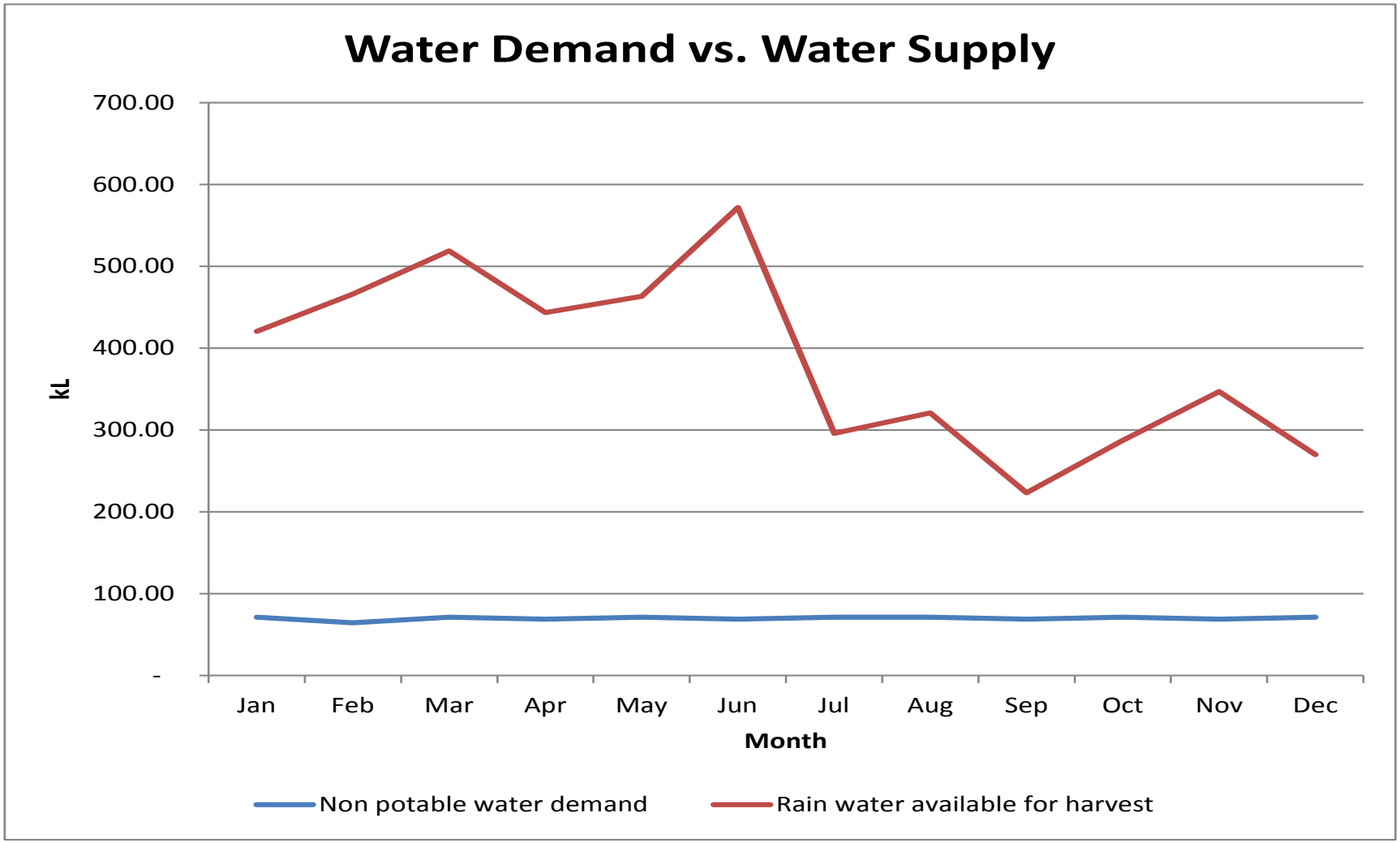

Figure 4-5 Water Supply vs. Water Demand

5 PROPOSED STORMWATER MANAGEMENT STRATEGY

The main focus of the overarching stormwater management strategy is to maintain separation between rainfall run-off and leachate. To do this each water source will be managed in its own specific way with drainage and leachate infrastructure designed as independent systems.

The drainage management strategy covers all areas outside the terminal building including, the pavement, roof and landscaped areas. The infrastructure associated with the drainage strategy will be passive, utilising traditional drainage and WSUD elements to maintain existing water quality, reuse water were possible and ensure that any run-off is released from the site in accordance with City of Botany Bay Development Control Plan (DCP) requirements.

The leachate management strategy will focus on the bunded areas within the terminal building where the waste will be transferred from trucks to the compactors for transport to the Woodlawn site.

5.1 DRAINAGE STRATEGY

5.1.1 DRAINAGE

As discussed in Section 2.3 and 1.1, drainage on the site is independent of external catchment flows; this includes the Botany Building Recyclers catchment and the remaining portion of the Asciano site. Drainage requirements will be dependent on the amount of rain falling directly on the property; this minimises the amount of additional drainage infrastructure required for the Proposal.

The drainage strategy will generally follow the existing drainage pattern on site. Rain that falls and collects to the west of the new rail sidings will drain through a terraced bioretention system before entering a DN300 pipe. This will convey the water to the northern portion of the site and into a pit which will transfer the water via a DN525 pipe in a southerly direction, towards McPherson Street.

A series of detention systems will be located at the northern portion of the site. These will capture overland flow run-off, and the layout of the system will ensure that large volumes of run-off can be stored for a period of time while smaller flows are released into the new drainage infrastructure before connecting into the council drain in McPherson Street.

OSD has also been provided in the area under the terminal building.

The drainage infrastructure has been designed so that the maximum discharge leaving the Site is equivalent to the 20% Annual Exceedance Probability (AEP) ‘natural condition’ flow. Bunding or kerbing would be installed along the western boundary of the Proposal site to prevent stormwater from entering ARTC’s land. Refer to Figure 5-6 for stormwater management strategy concept.

In order to efficiently manage the drainage requirements associated with the Proposal it is intended (as demonstrated above) that the Asciano site and Keith Engineering site be linked via drainage assets. This will ensure that stormwater run-off can be effectively managed while minimising the amount of new infrastructure required if each site was treated separately.

It is noted that Veolia intend to have an agreement between the two landholders to allow this to occur. At the end of the lease it would be a simple exercise to disconnect the drainage infrastructure, if this is required.

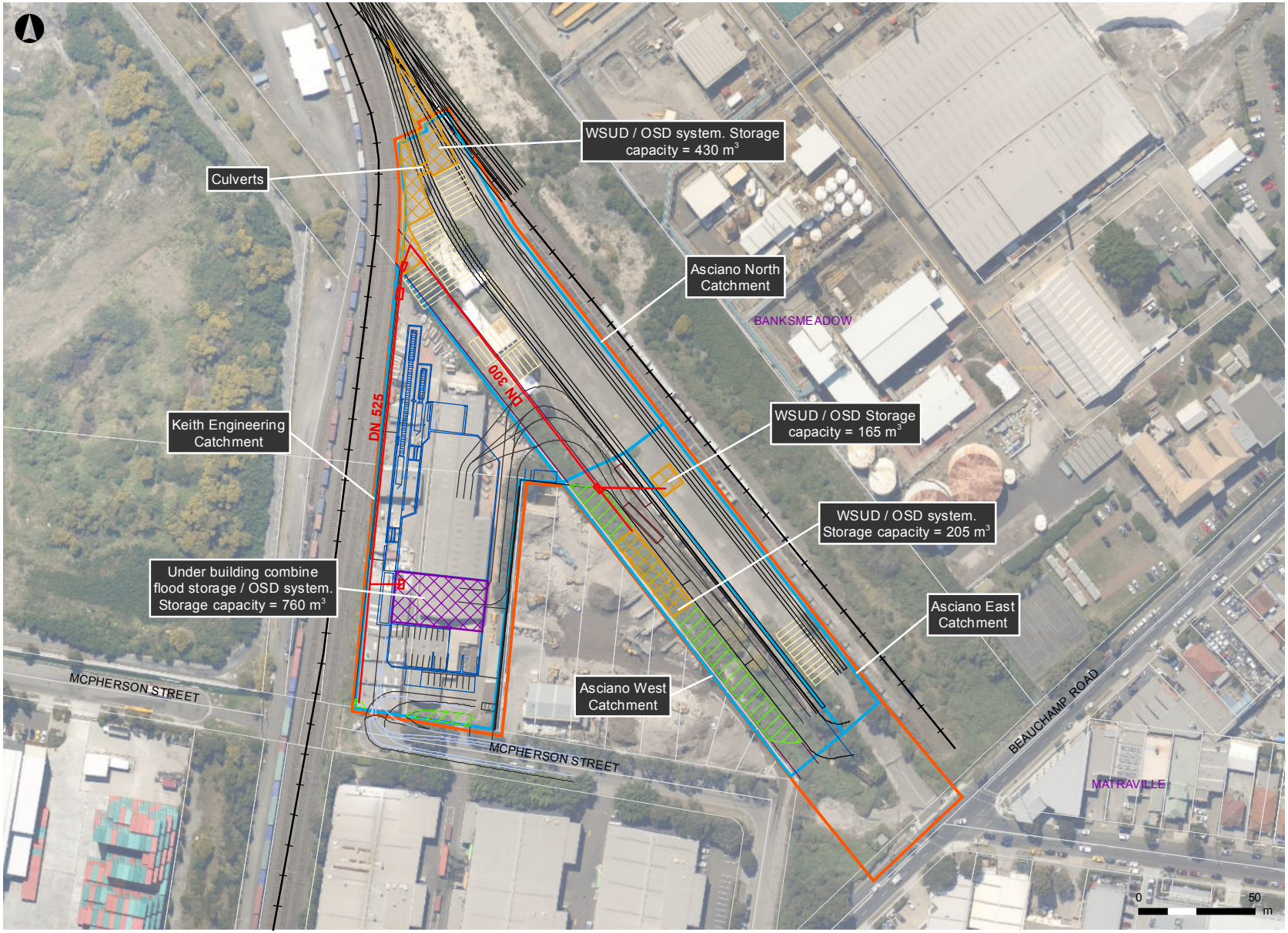

Figure 5-6: Proposed Stormwater Management Strategy (OnSite Detention)

5.1.2 FLOOD STORAGE AND ONSITE DETENTION

Flood storage based on the existing conditions has been investigated to determine if any volume needs to be accounted for as part of the Proposal; where calculations have been required 12D has been utilised.

Keith Engineering Land

As explained in Section 2.3 there is a system in place where any build-up of stormwater around the Keith Engineering buildings in pumped away from the site. As there have been no noticeable effects downstream when this is undertaken it would be reasonable to assume that any natural flood storage at the site is of a minimal volume.

Investigations into the area around where stormwater currently collects suggest that flows will exit the site in two ways. Initially water will escape to the west and flow down the ARTC rail siding towards McPherson St. If water continues to build up it is likely to also escape via the Keith Engineering driveway and onto McPherson St. Survey indicates that the low point along the ARTC siding is 4.65mAHD while the low point at the driveway is 5.10mAHD. As there will be no discharge of stormwater onto ARTC land and conservative it has been assumed that flood storage exists below 5.10mAHD

Using 12D, a triangulation of the existing survey was developed; the ‘storage’ tool was then utilised which calculates the area and volume of any polygon drawn. In the absence of a site specific flood model this technique is considered suitable.

Table 5-10 shows the stage volume relationship of the flood storage produced in 12D. While

Figure 5-7 gives a visual representation of what the flood storage may look like.

Table 5-10 Flood storage stage volume relationship

Flood Level (mAHD)	Flood Volume (m^3)	Flood Surface Area (m^2)
5.10	763	3481
5.00	471	2508
4.90	257	1711
4.80	115	1163
4.70	35	491
4.60	5	136
4.50	0.01	2.00
4.40	0.0	0.0

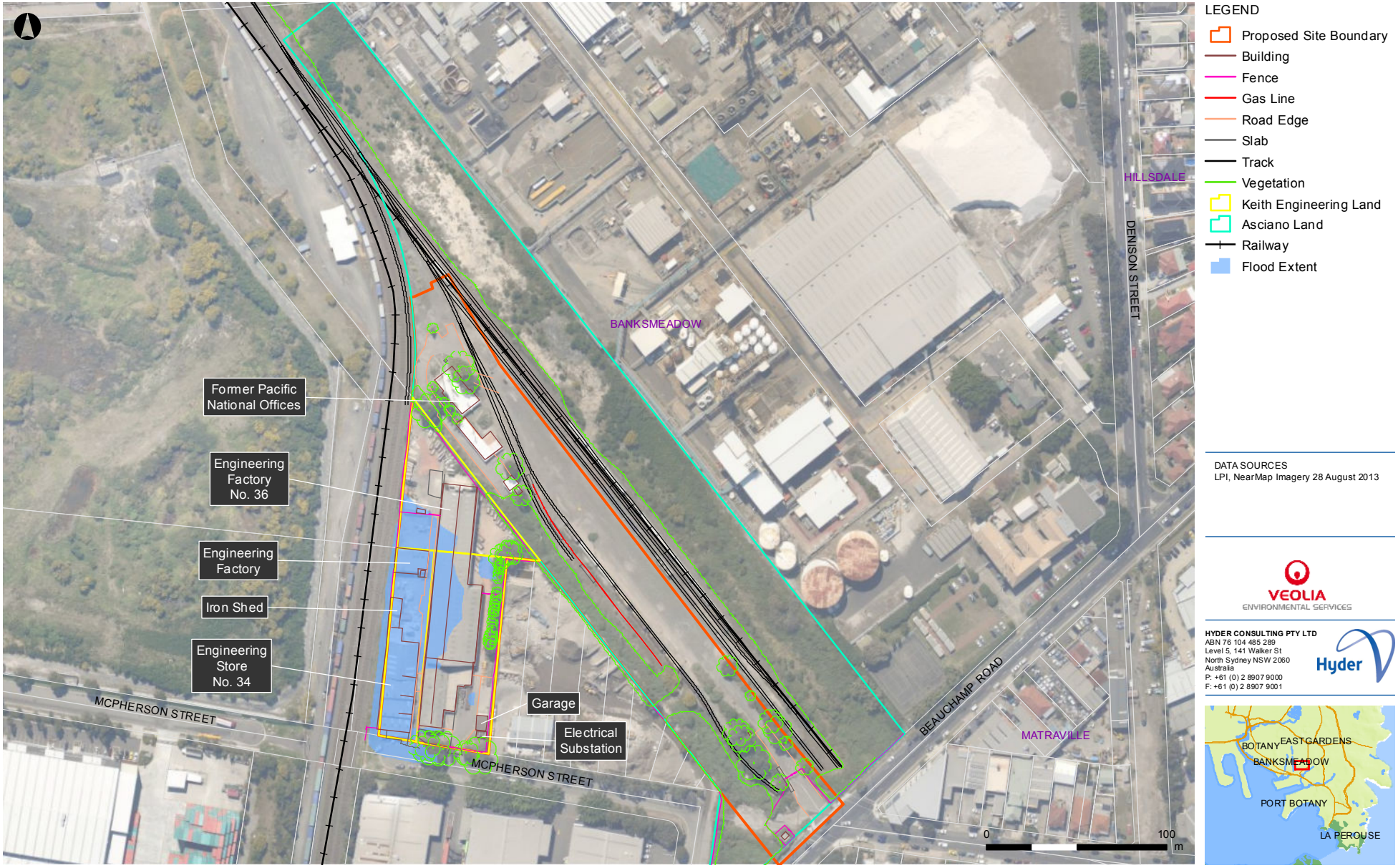

Figure 5-7: Existing Flood Storage

Asciano Land

Due to the constant grade of the Asciano Botany Site there would be little capacity for flood storage in this area of the Site. As rain would fall it would almost immediately begin to flow downstream before any significant ponding occurred. As a result flood storage capacity has not been calculated for this portion of the Site and no onsite detention systems are necessary.

As outlined in Section 3.6 it is unlikely that the Proposal will impact on existing flood storage behaviour in the undeveloped portion of the Asciano Botany Site.

As noted in Section 5.1.4 WSUD elements have been proposed in this area; these will provide attenuation of stormwater flows through this portion of the site.

5.1.3 ON SITE DETENTION

Due to the high groundwater level OSD is required to offset the existing flood storage at the site as infiltration systems are not permitted.

OSD has been provided on the Keith Engineering land as the site assessment and survey indicates that no storage exists on the Asciano lot. The OSD system is located at the downstream end of the catchment to ensure the run-off generated from the development can be easily captured and stored.

DRAINS was used to determine to performance of the on-site detention in relation to providing adequate flood storage and ensuring that the PSD remained below the 20% AEP 'natural state'.

The 20% AEP natural state discharge was calculated for entire site; with the site broken up into four sub-catchments and linked by overland flow paths. Each sub-catchment was100% pervious and the Manning roughness parameter were assumed to be 0.040; which Australian Rainfall and Runoff considers light brush and trees.

Table 5-11 Sub-catchment breakdown for OSD

Catchment Name	Area (ha)	Fraction Impervious (Natural)	Mannings (Roughness)
Asciano North	0.79	0%	0.040
Asciano East	0.30	0%	0.040
Asciano West	0.46	0%	0.040
Keith Engineering	1.00	0%	0.040

Based on the above assumptions the 20% AEP PSD was determined to be **0.37m^3/s**.

A DRAINS model was developed that consisted of the Keith Engineering catchment, the proposed OSD system and the drainage network associated with the site. Only the Keith Engineering sub-catchment was included as the Asciano property has no flood storage. As noted in Section 5.1.2 flood storage was calculated to be 762m^3 hence the OSD was also sized at 762m^3. 750m^2 is available under the non-putrescible section of the terminal building; this has been chosen as the location for the OSD as it does not impact on the operation of the facility (Figure 5-6). In order to achieve the required volume the depth of the OSD under the building is 1010mm – this is below the absolute maximum of 1200mm for covered/fenced storage.

The storage will be defined by separate watertight dwarf walls in masonry construction as outlined in the Botany Bay City Council DCP.

Running the DRAINS model indicates that during the 1% AEP critical event (1.5hr storm) the spillway associated with the OSD does not spill while the discharge into Council drainage is 0.14m^3/s which is below the PSD.

The OSD system will be designed to ensure safe access for operational and maintenance requirements.

5.1.4 WATER QUALITY

WSUD measures have been employed throughout the site to mitigate any impact site run-off may have on the receiving waters – in this case the ultimate receiving waters is Botany Bay.

As noted in Section 5.1.1 WSUD elements have been incorporated onto the site. These not only attenuate stormwater flows but also treat run-off for gross pollutants, suspended solids and nutrients before entering the drainage system. One will be located in the Asciano East sub-catchment which will discharge via pipe into the new drainage system. A series of bioretention systems will be employed in the Asciano West sub-catchment – these will be shallow (300mm deep) to ensure that any services running along this corridor are not interfered with. Three ponds will also be located at the northern portion of the Asciano North sub-catchment– these will capture and attenuate overland flows and gradually discharge this water into a drainage system connecting into McPherson Street. Table 5-12 presents details on each WSUD component.

Table 5-12 WSUD details

Sub-catchment	WSUD Surface Area (m^2)	Volume (m^3)	Orifice outlet DN (mm)
Asciano West	400	205	300
Asciano East	100	165	150
Asciano North	700	430	600

It is also noted that, as per the City of Botany Bay DCP, oil and grease interceptors will be installed in all new drainage pits. This will ensure that 95% of oils and grease is captured before entering the council drainage system.

Refer to Figure 5-6 for WSUD concepts.

5.1.5 RAINWATER TANKS

As per the City of Botany Bay DCP rainwater storage of 10,000L is required as a minimum. However this is will not be effective at storing the amount of water required to adequately offset potable water demand.

It is recommended that the equivalent of 40kL of rainwater tank storage be provided as part of the Proposal – tanks will be located depending on the final layout of the buildings and the roof pitch. The individual tanks will be sized depending on what area they are servicing and site and operational constraints. Small tanks will be used for toilet flushing while large tanks would be required for the washdown requirements.

All tanks will be connected to the mains water supply to allow for replenishment during extended dry periods. A float switch will turn a pump on when the tank capacity reaches 10% and will switch off once the capacity reaches 20%. All pumps associated with the rain water storages will be installed in accordance with the City of Botany Bay DCP. Tanks will be fitted with an overflow system that will discharge any excess rainwater into the drainage system.

5.2 LEACHATE STRATEGY

The leachate management system for the Proposal would be entirely independent of the stormwater system for the site. Leachate is considered to be any liquid that has come into contact with waste or waste processing areas. The leachate management strategy therefore focuses on the bunded areas within the terminal building where waste would be transferred from trucks to the compactors for transport to the Woodlawn site.

Based on the experience at the Clyde Transfer Terminal, approximately 2,000 L of leachate is generated each day due to liquid with the waste itself and washdown water used to clean terminal building. It should also be noted that the Proposal design has incorporated learnings from the Clyde Transfer Terminal, where the compactors are currently exposed to stormwater. The compactors at the Banksmeadow TT would be enclosed, reducing the amount of leachate that would be generated by the Proposal. The total estimated volume of leachate generated at the site would therefore by 2,000 L per day.

A 20 kL leachate tank would be installed below the transfer terminal building to capture all leachate from the tipping floor, around the compactors and washdown water.

Leachate would be injected into the waste containers to assist in the beneficial decomposition of waste at Woodlawn. The compactors would have a small pipe located at the top of the compactors, which would be connected to an electrical pump, located at the foot of the leachate tank. As the compactor finishes producing a bale of waste the transport container would be placed against the front end of the compactor. At this point the end of the compactor would overlap into the container by approximately 1 m. Once it is confirmed that the container has been located in the correct position the gate of the compactor would be opened. Once the gate is fully opened the compactor would begin pushing the bale into the container. At this point, the leachate pump would begin pumping leachate onto the bale. As the bale is pushed inside the container the pump would continue to operate until the bale has been fully fed into the container. At this point, the gate of the compactor would begin to drop, triggering the pump to cease pumping. The amount of leachate pumped into the containers would therefore be dependent on the time taken to insert the bale into the container.

Based on the experience at Clyde, the 200 litres of water is an average for each container. The Banksmeadow TT would transport 42 containers over 6 train movements per week, equating to 7,200 L per day of leachate that could be disposed of in the fashion described above, equating to approximately 5 000L excess capacity for leachate disposal.

Veolia is also considering a trade waste agreement with Sydney Water Corporation for leachate disposal in the event that surplus leachate eventuates on site.

6 CONSTRUCTION SOIL AND WATER MANAGEMENT

Construction soil and water management requirements for the Proposal have been developed in accordance with the Blue Book (Landcom, 2004).

The site has been divided into four catchments as outlined in Section 5.1 to determine the specific sediment and erosion control measures for each site.

6.1 DISTURBED AREAS OF THE SITE

The Proposal makes use of the entire site therefore it was assumed that 100% each sub-catchment will be disturbed.

6.1.1 SITE SOIL LOSS

Soil loss has been calculated as per the Blue Book and the RUSLE equation. Based on soil analysis the soil at the site was classified as Type D; these soils are dispersive and require flocculation so ensure they settle in an appropriate time frame.

Table 6-13 outlines the parameters used as part of the RUSLE equation to determine soil loss for each sub-catchment. The following parameters were used for each catchment:

- Rainfall erosivity factor – 3540
- Soil erodibility – 0.038
- Erosion control practice – 1.3
- Ground cover – 1

Table 6-13 RUSLE parameters

Catchment	Slope Length (m)	Slope Gradient (%)	LS factor
Asciano North	166	1	0.23
Asciano East	154	3	0.87
Asciano West	154	2	0.52
Keith Engineering	188	1	0.24

Based on RUSLE equations and the area of each catchment the following soil loss was calculated of each sub-catchment:

- Asciano North – 24m^3/yr
- Asciano East – 54m^3/yr
- Asciano West – 21m^3/yr
- Keith Engineering – 32m^3/yr

6.1.2 SEDIMENT BASINS

According Section 6.3.2 of the Blue Book where average annual soil loss from the total area of land disturbance in less than 150m^3/yr the building of a sedimentation basin can be considered unnecessary (Landcom, 2004).

As the sum of the soil loss from each sub-catchment equates to 132m^3/yr it is not necessary for sedimentation basins to be developed for construction.

6.2 EROSION AND SEDIMENT CONTROLS

Despite the fact the sedimentation basins are not required during the construction phase of the Proposal erosion and sediment controls should still be implemented in the form of a Soil and Water Management Plan (SWMP). The following principles would be adopted within the SWMP for the effective management of soil and water during the land disturbance phase of construction, as identified in the Blue Book:

1 Plan for erosion and sediment control concurrently with detailed engineering design and before earthworks begin, ensuring proper assessment of site constraints and integration of the various components.

2 Minimise the area of soil disturbed and exposed to erosion.

3 Priority should be given to management practices that minimise erosion (rather than to those that capture sediment downslope or at the catchment outlet).

4 Conserve topsoil for later site rehabilitation/revegetation.

5 Control water flow from the top of, and through the construction site.

6 Rehabilitate disturbed lands quickly.

7 Maintain soil and water management measures appropriately.

The following sections outline the design principles that would be adopted during development of progressive erosion and sediment control plans (ESCPs) that would be developed by the construction contractor, in accordance with the SWMP requirements.

Erosion control

In managing erosion potential on site, the following principles would be adopted:

- Wherever practical, priority shall be given to the prevention, or at least the minimisation, of soil erosion, rather than the trapping of displaced sediment.
- Where possible and where more than 1,000 square metres of land are to be disturbed, ensure that slope lengths do not exceed 80 metres immediately before forecast rainfall or during shutdown periods. Any temporary diversions should outlet to stable discharge areas.
- Diversion drains should be constructed on the up gradient site of catchments to divert clean water around the construction site. Drains should be stabilised with matting or vegetation and installed prior to commencement of clearing and earthwork activities.
- Rock check dams should be installed within diversion channels and stormwater channels to slow the velocity of water within the channel and reduce the potential for scour.
- Flow diversion banks and/or catch drains should be installed above batters to prevent up-slope stormwater runoff eroding the batter face.

- Where practical, "clean" surface waters shall be diverted away from sediment control devices and untreated, sediment-laden waters.
- During the construction period, roof water shall be managed in a manner that minimises soil erosion throughout the site, and site wetness within active work areas.
- All temporary earth banks, flow diversion systems and sediment dam embankments are to be machine-compacted, seeded and mulched for temporary vegetative cover within 10 days after grading.
- Unprotected slope lengths shall not exceed 80 metres, or an equivalent vertical fall of 3 metres prior to shutdown periods or anticipated significant rainfall.
- Stabilised site entry and egress points must be identified and at these points, measures to minimise mud tracking onto public roads must be installed.
- Cover, or otherwise manage, stockpiles that will be in place for more than 4 weeks as well as any stockpiles that are susceptible to wind or water erosion. Apply covering, seeding or other management treatment within 7 calendar days of forming each stockpile.

Sediment control

- Sediment fencing should be installed on the down-gradient side of the construction site.
- Suitable all-weather access shall be provided to all sediment control devices.
- Sediment control devices shall be de-silted and made fully operational as soon as practical after a sediment-runoff event if their sediment retention capacity falls below 75% of the required capacity.
- Solid materials removed from sediment control devices shall be disposed of in a manner that does not cause ongoing soil erosion or environmental harm.

Site Stabilisation

- Site stabilisation should occur progressively as construction works are complete.
- All disturbed areas shall be rendered erosion resistant by mulching, paving or otherwise suitably stabilised within 14 days of completion.
- No disturbed area is to remain denuded longer than 60 days.
- Unless otherwise stated in the ESCP, ground cover sufficient to restrain erosion (minimum 70% coverage of all soil) shall be provided within 30 calendar days from completion of any works where the soil is at risk of accelerated erosion. During the interim period between completion of works and the establishment of at least 70% ground cover, appropriate ESC measures shall be maintained on the site.

Staging of Works

Construction works would be phased so that land disturbance is confined to minimum areas of workable size, but consistent with the scale and economics of the development. Where practicable, the construction program would be scheduled so that the time from commencement of land disturbance activities to rehabilitation is less than six months.

7 CONCLUSIONS AND RECOMMENDATIONS

Hyder has developed a Stormwater Management Report for the proposed Banksmeadow Transfer Terminal. The facility would be capable of processing up to 400,000 tonnes (t) of putrescible waste and 100,000 t of non-putrescible waste per annum for transfer to various resource recovery facilities. The Banksmeadow Transfer Terminal would involve the development of a new waste transfer building and associated road and rail infrastructure.

This report addresses the Director General Requirements for Surface Water Management including:

- A description of the existing surface and groundwater quality, including as assessment of any water resource likely to be affected by the proposal;
- The proposed erosion and sediment controls during construction;
- A comprehensive flood study, including consideration of flooding impacts, the proposed site layout and any changes in flood behaviour;
- The proposed stormwater management system, including the capacity of OSD systems and measures to treat re-use or dispose of water;
- A site water balance, including a detailed description of the measures to minimise the water use at the site;
- Wastewater predications including volume and the measures that would be implemented to avoid discharges, collect, treat, reuse and/or dispose of this water; and
- An assessment of the impacts of the project on watercourses and riparian areas, groundwater sources and dependant ecosystems.

This report also shows that stormwater run-off from the Proposal will be confined to the site and will not impact on current conditions or be allowed to flow onto ARTC land.

The area around the site has been heavily disturbed and is a predominately industrial area; there are no permanent water resources on the site and groundwater quality is low due to contamination from industrial activity in the area. The quality of these water resources is unlikely to be reduced further by the Proposal.

Draft flood data from Council suggests that flood risk at the site is low and any flood waters would be classified as part of the flood fringe.

The Proposal site does not directly drain to natural watercourses or riparian areas but will eventually be discharged into Penrhyn Estuary via the Springvale Drain. Due to measures taken as part of this Stormwater Management Plan this additional flow is not expected to degrade this water body further.; Council drainage will receive stormwater from the site in line with the 20% AEP ‘natural state’ flows. There will be a minor impact on the groundwater level during the construction of the facility due to dewatering, infiltration systems will not be utilised due to the proximity of the water table to surface level.

Based on the findings of this report the following recommendations have been presented to ensure the Proposal is compliant with local stormwater management guidelines:

R1 – A Soil and Water Management Plan (SWMP) should be implemented during the construction phase of the Proposal; sedimentation basins are not required as part of the SWMP due to the limited amount of soil loss across the site.

R2 – An OSD system should be incorporated into the development to help maintain the existing flood storage at the site. Initial investigations indicate that there is sufficient space and fall for this to be located under the terminal building. The series of bioretention systems outlined in this

report will maintain existing water quality discharging from site and should also be included in the development.

R3 – A system of rainwater tanks with capacity of 40kL should be installed to offset non-potable water demand with harvested rainwater. The water balance indicates that rainwater harvesting can potentially offset non-potable water demand during nine months of the year.

R4 – A 20kL leachate storage tank should be installed to capture all leachate from the tipping floor, compactors and washdown liquid. It is noted that Veolia are pursuing a trade waste agreement with Sydney Water – this should continue to be investigated.

8 REFERENCES

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