Appendix 19

Soil and Surface Water Management

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RESOURCECO
TOMORROW'S SOLUTIONS. TODAY

Waste and Resource Management Facility

Surface Water Assessment

January 2016

Version Control

Revision	Date	Author	Reviewed by	Comments
1	24/1/2016	SP	NK, MH	Preliminary Draft
2	25/1/2016	SP	BS	Draft
3	27/1/2016	SP		Final

Table of Contents

List of Figures

List of Tables

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1 Introduction

ResourceCo proposes to establish a resource recovery facility at No 35-37 Frank Street, Wetherill Park (Lot 31, DP 589097) to process waste materials to produce processed engineering fuel (PEF) as well as other reusable commodities.

This report describes the proposed systems for surface water management on the site including:

- Rainwater collection for re-use and reduction of demand from the mains potable supply;
- Stormwater pollution control using various proprietary treatment devices.

This report draws on information provided in other reports prepared in support of the application for development consent:

- *Validation Report – Remediation of Former Sims Metal Scrap Yard*, (Hazchem Pty Ltd, May 2015)
- *Detail Survey*, 35-37 Frank St, Wetherill Park (William Backhouse Pty Ltd, 2015);
- *Stormwater Management Report* (Mott MacDonald, January 2016);
- *Development Application Drawings* (Mott MacDonald, January 2016);
- *Landscape Design Statement* and accompanying landscape plans (Tract Consultants, January 2016).

2 Assessment Requirements

The Secretary's Environmental Assessment Requirements (SEARS) for the proposed development were issued by the Department of Planning & Environment on 1 October 2015.

Table 2.1 lists the SEARs relating to surface water aspects of the development and the section in this report where each matter is addressed.

Table 2.1: SEARs Relating to Surface Water

Requirement	Relevant Section of this Report
• Soil & Water - including	
– identification of water and soil resources, drainage lines, watercourses and riparian lands;	Section 3.1
– the proposed erosion and sediment controls during construction;	Section 5
– a detailed site water balance, including identification of water requirements for the life of the project,	Sections 4.2 and 4.3
– measures that would be implemented to ensure an adequate and secure water supply is available for the proposal and a detailed description of the measures to minimise the water use at the site;	Sections 4.2 and 4.3
– potential impacts on watercourses and groundwater;	Section 6
– the proposed stormwater/wastewater/leachate management systems including the capacity of onsite detention systems, and measures to treat, reuse or dispose of water; and	Section 4.4
– consideration of any potential salinity, soil contamination, flooding and acid sulfate soil impacts of the project.	Section 6

3 Site Characteristics and Proposed Development

3.1 Existing Site

Figure 3.1 is an aerial photograph of 35-37 Frank Street (outlined in red) and its immediate surroundings. The site measures about 268 m x 77.5 m has an area of about 2.08 ha and grades from about 52 m AHD in the south eastern corner to about 44 m AHD in the north-western corner.

Figure 3.1: 35-37 Frank Street, Wetherill Park and Adjacent Lots

The site is largely cleared with mixture of broken concrete and bare soil. A triangular shaped sediment control basin is located in the north-west corner and a building is located on the Frank Street frontage. As shown in Figure 3.1 the site is bounded by:

- An existing carpark to the north;
- Existing industrial buildings to the east and west; and
- Frank Street to the south.

The site was previously used for scrap metal processing which ceased at the end of 2013. Subsequently, contamination investigations, remediation and validation were undertaken to rendering the site suitable for ongoing industrial land use. The remedial works were completed in April 2015 and a validation report was prepared by Hazchem Pty Ltd in May 2015.

There are no riparian lands adjacent to the site.

The majority of the site drains to a sediment control basin in north-west corner which discharges into an existing 900 mm diameter stormwater pipeline located in a drainage easement along the northern boundary of the site. Flows are conveyed to the west into the open concrete channel before draining to an existing natural creek further to the north that passes under Widemere Road. This creek then flows to Prospect Creek.

A small proportion of the site (about 20%) along the southern boundary drains to Frank Street which has a 450 mm diameter stormwater pipeline along the northern side of the street.

3.2 Proposed Development

The proposed site engineering works are set out in the *Development Application Drawings* prepared by Mott MacDonald which form part of the supporting documentation. The main features of the proposed development of relevance to water management are:

- Earthworks to create an almost level pad to accommodate a plant building (about 7,900 m^2) and an office/workshop (about 1,000 m^2);
- The earthworks would comprise on site cut and fill of about 3,000 m^3 and the placement of about 9,000 m^3 of imported fill. All imported fill will be verified to ensure it does not contain any contaminants, saline soils or acid sulfate soils;
- Apart from the car parking area (porous pavers) and landscaping along the street frontage, the site will be fully sealed.
- Retaining walls constructed along the northern and western side of the site;
- Roof drainage from the production shed would be directed to an underground rainwater tank which has provisionally been sized at 300 kL. This water would be used for the production process;
- Roof drainage from the office and workshop building would be directed to two above ground rainwater tanks (combined capacity 27 kL). This water would be used for toilet flushing and landscape watering;
- A self-bunded fuel tank (total capacity 30,000 L) would be located on the western side of the workshop and would provide fuel for use in on-site machinery. As bunding is provided within the enclosed structure, roofing to exclude rainfall is not required.

- Stormwater drainage from about 20% of the southern side of the site would be directed via pollution control systems (see Section 4.4.2) towards the existing stormwater drainage in Frank Street;
- Stormwater drainage from about 80% of the northern side of the site would be directed via pollution control systems (see Section 4.4.2) towards the existing 900 mm pipe in the drainage easement on the northern boundary;
- Landscaping covering about 300 m^2 on the street frontage and adjacent to the office and workshop building.

4 Water Re-use and Stormwater Management

The proposed stormwater management system applies the relevant principles of water sensitive urban design applicable to an industrial site, including maximising the capture and re-use of rainwater. This section describes the methodology used to assess the effectiveness of the proposed stormwater management systems:

- Rainwater re-use for dust suppression in the production process;
- Rainwater re-use for toilet flushing and landscape watering;
- Stormwater treatment prior to discharge from the site.

4.1 Climate

For purposes of assessing the performance of the rainwater re-use systems, the following climate data has been used from the closest Bureau of Meteorology site:

- Daily rainfall for Prospect Reservoir (1889 – 2015);
- Daily pan evaporation for Prospect Reservoir (1965 - 2000).

Table 4.1 summarises the long term average monthly climate statistics for rainfall and pan evaporation (Epan) together with the corresponding evapotranspiration (ET) calculated on the basis of pan factors given by McMahon at al (2013).

Table 4.1: Average Monthly Climate Statistics for Prospect Reservoir

Month	Rainfall (mm)	Epan (mm)	Pan Factor	ET (mm)
Jan	93.7	169.5	0.839	142.2
Feb	96.4	139.0	0.837	116.3
Mar	97.3	124.6	0.846	105.4
Apr	77.0	90.4	0.842	76.1
May	71.1	63.2	0.899	56.8
Jun	75.7	51.5	0.880	45.3
Jul	56.5	56.6	0.869	49.2
Aug	49.9	80.7	0.850	68.6
Sep	46.6	109.6	0.849	93.0
Oct	59.2	139.1	0.848	117.9
Nov	73.2	151.3	0.854	129.2
Dec	74.0	182.2	0.825	150.4
Year	869.9	1,357.7		1,150.6

4.2 Potential Rainwater Re-use

The water demands that could utilise rainwater in lieu of potable supply have been derived as follows:

Process Water: Quarterly water use data for an existing waste and resource management facility was provided by ResourceCo and, based on discussion with ResourceC0, was disaggregated on a monthly basis using the overall monthly distribution of pan evaporation as a guide.

Toilet Flushing: Estimated water requirements for toilet flushing were based on 40 employees allowing for 2 x full flush (6 L) and 3 x half flush (3 L) per day.

Landscape Watering: Water requirements for landscape watering have been estimated based on 300 m² of landscaping (from landscape plans) and difference between evapotranspiration and rainfall (from Table 4.1). Where monthly rainfall exceeds evapotranspiration, it is assumed that no landscape watering is required.

Table 4.2 summarises the estimated daily water demands for each month of the year.

Table 4.2: Daily Water Demands

Month	Processing Use (kL/day)	Toilet Flushing (kL/day)	Landscape Watering (kL/day)
Jan	55.9	0.84	0.47
Feb	54.6	0.84	0.19
Mar	50.5	0.84	0.08
Apr	43.4	0.84	0.00
May	33.1	0.84	0.00
Jun	19.9	0.84	0.00
Jul	16.5	0.84	0.00
Aug	29.0	0.84	0.18
Sep	39.3	0.84	0.45
Oct	47.6	0.84	0.57
Nov	51.7	0.84	0.54
Dec	55.9	0.84	0.74

4.3 Assessment Rainwater Re-use

For purposes of assessing the potential for rainwater re-use, the daily water demands listed in Table 4.2 were incorporated into a daily rainfall:runoff model with the following features:

- 127 years of daily rainfall from Prospect Reservoir;
- Roof runoff from the processing warehouse (7,900 m²) directed to an in ground tank from which supply is drawn to meet processing water demands;
- Roof runoff from the office and workshop (1,000 m²) directed to two rainwater tanks with a combined capacity of 27 kL from which supply is drawn for both toilet flushing and landscape watering;

- In the event there being insufficient water in the rainwater tanks to meet the water demand, the model assumes that water from the mains potable supply is used;
- Parameters derived from measurements of roof runoff in Sydney by Chapman and Salmon (1996) have been used to characterise roof runoff;

In the case of water supply for processing, the analysis included an assessment of the proportion of supply that could be met from roof runoff with different size tanks. The results of that assessment are summarised in Figure 4.1. The figure shows significant diminishing benefit for tank sizes greater that 300 kL and indicates that the supply from rainwater is primarily constrained by the available roof area. A tank size of 300 kL is proposed for the process water supply.

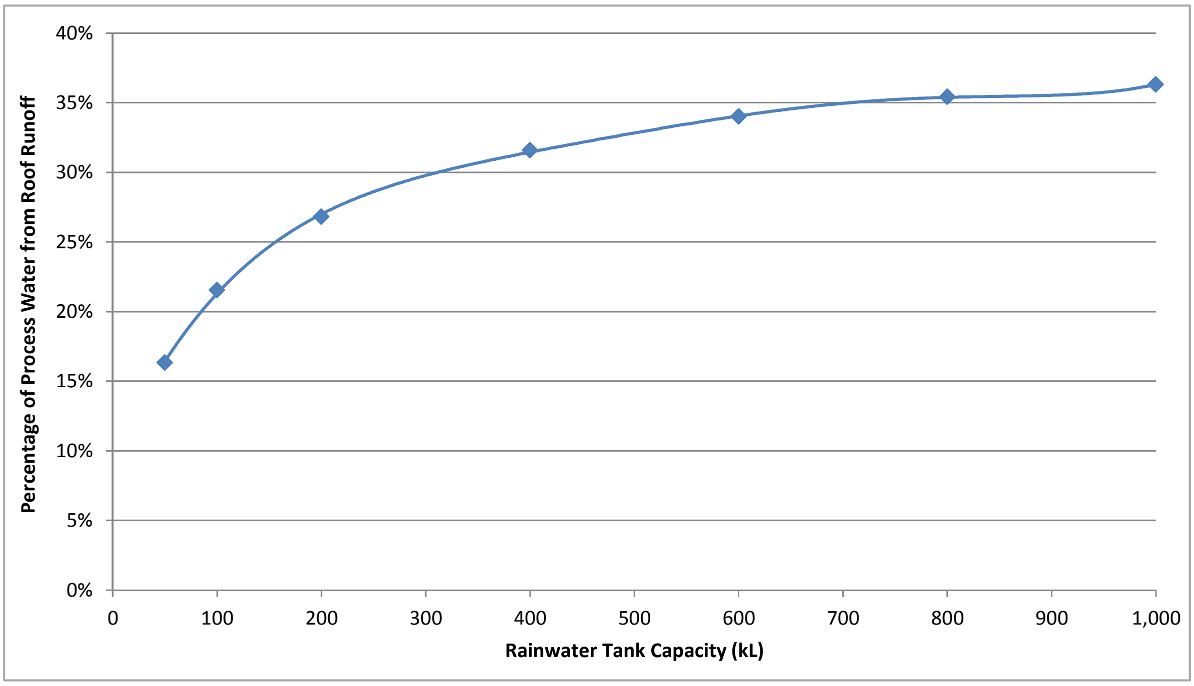

Figure 4.1: Relationship between Tank Capacity and Proportion of Process Water Supplied by Rainwater

Apart from a minor volume of water for amenities, the facility is expected to require about 15.5 ML of water per year of which an average of 4.82 ML per year (31%) would be provided by rainwater as follows:

- Process water supply of 30% from rainwater (a saving of potable water of 4.49 ML/year);
- Toilet flushing and landscape water supply of 82% from rainwater (a saving of potable water of 0.33 ML/year).

4.4 Stormwater Drainage and Pollution Control

Details of the site stormwater drainage and pollution control systems are included in the *Stormwater Management Report* (Mott MacDonald, 2016). The features and performance of these systems are summarised below.

4.4.1 Stormwater Drainage

The proposed stormwater drainage system provides a below ground pit and pipe network designed to control nuisance flooding and enable effective stormwater management for the site. The piped system has been designed for to convey runoff from 20 year average recurrence interval (ARI) storm.

For storms larger than 20 year ARI up to 100 year ARI, drainage system incorporates overland flow routes over proposed hardstand, car parking and landscaped areas designed to ensure that personal safety is not compromised.

An indicative pit and pipe network was developed which reflected the existing split of drainage between Frank Street (20%) and the north-west corner (80%). The DRAINS software has been used to assess the required capacity of the drainage system to convey runoff from a 20 year ARI storm, with safe overland flows for a 100 year ARI storm.

4.4.2 Stormwater Pollution Control

In addition to capture and re-use of rainwater, the following typical stormwater pollution control systems are proposed:

- Draining to Frank Street: HumeGuard GPT and HumeCeptor;
- Draining to Frank Street: HumeGuard GPT and Humes JellyFish.

The performance of the stormwater pollution control systems, including the capture and re-use of rainwater as described in Section 0, have been assessed using the MUSIC software. As Fairfield City Council does not specify stormwater pollution control targets, the relevant targets and pollutant generation characteristics specified by Blacktown City Council have been adopted for the analysis. Details of the MUSIC modelling are set out in the *Stormwater Management Report* and the results summarised in Table 4.3. The table shows that the proposed stormwater pollution control system would achieve or exceed the relevant target reductions in pollutant loads.

Table 4.3: Results of Stormwater Pollution Assessment using MUSIC

Pollutant	Post Development (no Treatment) (kg/year)	Post Development (with Treatment) (kg/year)	Removal Rate (%)	Target Removal Rate (%)
Gross pollutants	377	8	99%	90%
Total suspended solids	2820	422	85%	85%
Total Phosphorus	5.4	1.6	70%	65%
Total Nitrogen	33.4	10.5	69%	45%

5 Construction Erosion and Sediment Control

Concept erosion and sediment control plans, which have been prepared by Mott MacDonald generally in accordance with *Managing Urban Stormwater: Soils and Construction* (Landcom, 2004), are outlined in the *Stormwater Management Report*. The following drawings prepared by Mott MacDonald provide details of the proposed erosion and sediment control measures:

- *Concept Sediment and Erosion Control Plan* (Drawing MMD-364729-C-DR-DA01-DA-104);
- *Concept Sediment and Erosion Management Details* (Drawing MMD-364729-C-DR-DA01-DA-105).

Key features of the proposed sediment and erosion control facilities are:

- Installation of a 1.8 m high chain wire fence covered with geo-textile filter fabric, to the perimeter of the work site area, where required;
- The use of sediment diverting methods to minimise sediment in Council's stormwater drainage using sandbags around kerb inlet pits and geo-textile filter fabric around drop inlet pits;
- Direction of most site runoff towards the north-west corner of the site;
- Retention of the sediment control basin in the north-west corner of the site, and enlargement if necessary to provide a total volume of 501 m^3 (including sediment retention zone); and
- The provision of a temporary site entrance with shaker grid for vehicles exiting the site during the construction stage.

The proposed capacity of the sediment control basin is based on a 5 day 85th percentile rainfall event of 32.2 mm (Table 6.3a of *Managing Urban Stormwater: Soils and Construction*). In accordance with the management requirements, the basin will be emptied within 5 days of the end of a storm as long as sufficient settlement has occurred. If necessary, a flocculant may be used to accelerate the settlement process.

6 Surface Water Impact Assessment

The existing site is located within the Wetherill Park industrial area and is largely vacant with a mixture of concrete and bare soil surfaces. Adjoining land use is limited to industrial buildings and associated vehicle parking. There are no riparian lands adjacent to the site.

As outlined in Section 5 a concept erosion and sediment control plan has been prepared in accordance with the relevant requirements of *Managing Urban Stormwater: Soils & Construction* (Landcom 2004). Following project approval, the erosion and sediment control plan will be finalised. Implementation of the plan will ensure that potential impacts will be managed in accordance with the relevant guidelines.

Sections 0 and 4.3 provide details of the methodology adopted for the assessment of the water demands for the project (estimated 15.5 ML/year) and a detailed daily water balance analysis using 127 years of daily data. Rainwater collected from the roofs of the buildings is estimated to provide:

- 30% of the water required for the waste processing (a saving of potable water of 4.49 ML/year);
- 82% of the water required for toilet flushing and landscape watering (a saving of potable water of 0.33 ML/year).

The ability to provide rainwater for the waste process is primarily constrained by the area of available roof, not the capacity of the rainwater collection tank.

The proposed water management system is based on the relevant principles of 'water sensitive urban design' and the analysis demonstrates that stormwater pollutant loads discharged from the site would comply with, or exceed the relevant guidelines. In accordance with the requirements of Fairfield City Council, no on-site detention of stormwater is proposed. It is expected that the development would have no impact on water quality in Prospect Creek.

The proposed fuel tank will be fully enclosed and self-bunded. There will, therefore, be no risk of hydrocarbons draining to the stormwater system.

The site will be fully sealed and would, therefore, have no impact on any groundwater underlying the site.

All imported fill will be verified to ensure it does not contain any contaminants, saline soils or acid sulfate soils

In conclusion, the assessment provided in this report demonstrates that:

- Surface water risks can be adequately managed by application of relevant guidelines;
- The development poses no significant risk to the downstream environment.

7 References

Chapman T and Salmon M, (1996), Roof Runoff Data and Acquisition, Hydrology and Water Resources Symposium, Institution of Engineers, Australia, NCP 96/05, pp 657-661.

Fairfield City Council, (1997), *Urban Area On-site Detention Handbook*.

Fairfield City Council (2002) *Stormwater Drainage Policy*.

Hazchem Pty Ltd, (May 2015), *Validation Report – Remediation of Former Sims Metal Scrap Yard*

Landcom, (2004), *Managing Urban Stormwater: Soils and Construction*.

McMahon TA, et al., (2013), *Estimating actual, potential, reference crop and pan evaporation using standard meteorological data: a pragmatic synthesis*, Hydrol. Earth Syst. Sci., 17, 1331-1363.

Mott MacDonald, (January 2016), *Stormwater Management Report* – ResourceCo, Wetherill Park.

Mott MacDonald, (January 2016), *Development Application Drawings – ResourceCo, 35-37 Frank Street, Wetherill Park*.

Tract Consultants, (January 2016), *Resource Co Redevelopment - Landscape Design Statement* and accompanying landscape plans.

William Backhouse Pty Ltd, (2015), *Detail Survey*, 35-37 Frank St, Wetherill Park.

Stormwater Management Report

Resource Co. Wetherill Park

January 2016

BELL Architecture

RESOURCECO

Mott MacDonald

Stormwater Management Report

Resource Co. Wetherill Park

January 2016

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Issue and revision record

Revision	Date	Originator	Checker	Approver	Description
A	23.12.15	G. Hosseini	J. Gilligan	C. Avis	Issued For Approval
B	21.01.16	G. Hosseini	J. Gilligan	C. Avis	Issued For Approval/ amendment to MUSIC modelling
C	25.01.16	G. Hosseini	J. Gilligan	C. Avis	Issued For Approval

Contents

1 Introduction

Mott MacDonald has been commissioned by BELL Architecture to prepare a Stormwater Management Report for the proposed industrial development works at 35-37 Frank Street, Wetherill Park.

The advice as outlined in this report and documented on Mott MacDonald drawings MMD-364729-C-SK-DA01-DA-0001 to 011 addresses the following engineering components:

- Water Quantity (refer to section 4.1 of this report); and
- Water Quality Measures (refer to section 4.2 of this report).

2 Site Description and Proposed Works

The subject site is located approximately 27km to the west of the Sydney CBD at 35-37 Frank Street, Wetherill Park, and falls within the Fairfield City Council local government area (LGA). The proposed works are to take place on an existing cleared piece of land that was previously developed (as shown) and is situated in the existing industrial developments known as the Wetherill Industrial Park. The development is to consist of:

a. A recycling factory warehouse at the rear of the site and an office building with workshops fronting Frank Street.
b. Hard paving areas and access roads with associated on-grade car parking in two locations.
c. A large retaining wall on the northern and western boundaries; minor retaining walls around the office.

The proposed layout has been taken from the current BELL Architecture documentation.

Figure 2.1: Existing Site

Source: Google Maps

The site covers an area of approximately 2.08Ha and is bounded by:

- An existing carpark to the north;
- Existing industrial buildings to the east and west; and
- Frank Street to the south.

There is an existing 900mm dia. stormwater line situated at the north western corner of the development area (within the existing drainage easement) and this is to be the proposed discharge point for stormwater flows generated within the site.

The site itself sits on a substantial grade – 4m westward fall along the Frank Street boundary and 8m fall in the northwest direction along the longest length of the site. As a consequence, we have proposed the use of retaining walls to manage this grade.

3 Sediment and Erosion Control

Prior to any earthworks commencing on the site, erosion and sediment control measures will be put in place generally in accordance with Managing Urban Stormwater: Soils and Construction 4th Edition, March 2004. These measures include:

- Installation of a 1.8m high chain wire fence covered with geo-textile filter fabric, to the perimeter of the work site area, where required;
- The use of sediment diverting methods to minimise sediment in Council's stormwater drainage using sandbags around kerb inlet pits and geo-textile filter fabric around drop inlet pits;
- The provision of a sediment basin towards the lower perimeter of the site for which stormwater runoff shall be channelled and treated during construction. It is possible that an existing pond in the northwest corner may be utilised and converted for this purpose depending on its current capacity; and
- Construct temporary site entrance with shaker grid.

Please refer to Sediment and Erosion Control Plans MMD-364729-C-DR-DA01-DA-104 to 105.

4 Stormwater Management

4.1 Water Quantity

4.1.1 Stormwater Policy and Guidelines

The stormwater drainage for the proposed development has been designed to comply with the following guidelines:

- Australian Rainfall and Runoff 2001;
- Fairfield City Council's *Urban Area On-site Detention Handbook* 1997;
- Fairfield City Council's *Stormwater Drainage Policy – September 2002* ;
- Managing Urban Stormwater: Soils and Construction, Volume 1, 4th Edition, March 2004; and

4.1.2 Stormwater Drainage

4.1.2.1 On-Site Stormwater Detention (OSD)

The urban area on-site detention handbook indicates that On-Site Stormwater Detention is not required within the Wetherill Park Industrial Area. As such, no provision for On-Site Stormwater Detention facilities is required as part of this proposal.

4.1.2.2 Major / Minor Drainage System

A major/minor approach to stormwater drainage is the recognised drainage concept for industrial sites.

The minor drainage system is comprised of the below ground pit and pipe network and is designed to control nuisance flooding and enable effective stormwater management for the site. Council's DCP requires that the minor drainage system be designed for a minimum 20yr ARI for industrial development sites.

The major drainage system incorporates overland flow routes over proposed hardstand, car parking and landscaped areas and is assessed against the 100yr ARI design storm event. The major system also exists to cater for minor drainage system failures. In accordance with council's requirements, the major drainage system is to be designed in a manner that ensures that personal safety is not compromised.

For the purposes of this report, DRAINS software is used to calculate flows exiting the site for the proposed scenario. Stormwater piped capacities have been designed to convey the minor (20yr ARI) storm event with safe overland flows for the 100yr ARI storm event. If the major system cannot meet the safety and flooding criteria, then the capacity of the minor drainage system has been increased.

4.1.3 Existing System

Detail site survey by William Backhouse (dated 25/08/15 – 01/09/15) does not show any significant piped stormwater systems. Fairfield Council indicated in a telephone call that there is an existing 450mm dia. stormwater pipe on the northern side of Frank Street and an existing 900mm dia. stormwater outlet pipe in the drainage easement on the northern outlet situated at the north-west corner of the development area. This information is currently being confirmed by survey. From the existing 900mm dia. pipe, flows are conveyed through the adjoining downstream lot drainage easement to the west to the open concrete channel before draining to an existing natural creek further to the north that passes under Widemere Road. This creek then flows to Prospect Creek.

4.1.4 Proposed System

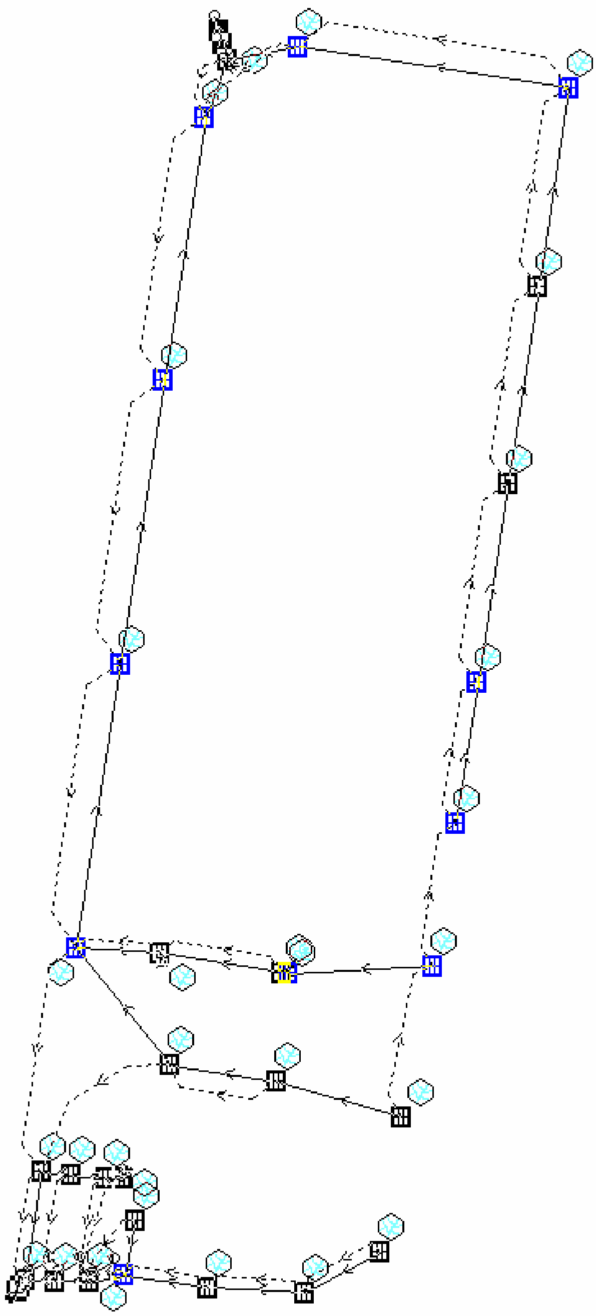
The DRAINS Model for the proposed site was developed based upon the following methodology:

- 80% of the site pit and pipe network is proposed to connect to the existing 900mm dia. stormwater line located at the north-west corner of the development site;
- The remaining 20% of the site pit and pipe network is proposed to connect to the existing 450mm dia. stormwater line located in Frank Street on the northern side of the road;
- The 80/20% split of the pit and pipe network replicates the existing site conditions.
- An indicative pit and pipe network was developed for the proposed siteworks (refer civil engineering plans MMD-364729-C-DR-DA01-DA-109 to 110 for details);
- The tail water conditions at the connection to the existing 900mm pipe were assumed to be at 1/3 of the pipe size which would be lower than the proposed pipe invert level.
- The roof water from the new factory buildings (approximately 0.79Ha) is to drain directly to an underground rainwater harvesting tank of approximately 300kL of storage with overflows to the piped

network. This rainwater will be used for dust suppression for the recycling process. A portion of roof water from the new office & workshop building (approximately 0.1Ha) is to drain directly to above ground rainwater harvesting tanks of 27kL with overflows to the piped network. Designs for roof drainage shall be undertaken as either conventional or siphonic drainage by a certified Hydraulic Engineer during the detail design stage of the works;

- For the purposes of modelling, the rainwater tanks are considered full during simulation;
- All paved areas are collected within grated pits and drains;
- A portion of the new customer car park for the offices on the southern portion of the site has been graded to stormwater pits which will discharge to council's 450mm dia. road stormwater pipe in Frank Street.
- The catchments shown on drawing MMD-364729-C-DR-DA01-DA-112 closely match the existing conditions catchment areas.
- 20yr and 100yr ARI events were considered for all standard durations; and
- A conservative blockage factor of 20% for on grade pits 50% for sag pits has been applied to all stormwater pits within the development area.
- Whilst the unground stormwater drainage system flows are split between the northern and southern outlet pipes, any overland flows are designed to drain to the south where they can safely exit the site onto Frank Street via the access road.

Figure 4.1: Proposed DRAINS Model



Note: Pit and Catchment Numbers have not been shown for clarity

4.1.5 Results

Iterations were performed in the DRAINS model to determine the size of the proposed piped network in order to satisfy major / minor system requirements in accordance with Fairfield City Council standards.

The proposed piped drainage system has been designed to cater for the 1 in 20 year ARI event leading to the existing northwest outlet 900mm dia. stormwater drainage line and southern 450mm dia. road stormwater drainage line. A provision for overland flows for events greater than the 1 in 20 year ARI event has also been considered.

Results indicate that the major / minor system requirements are satisfied at all proposed pits in the development area and that the piped system sufficiently conveys minor storm flows with safe provision for major system flows (refer to Appendix A for DRAINS results).

4.2 Water Quality

The stormwater management systems for the site shall comply with the *Managing Urban Stormwater: Soils and Construction 4th Edition, March 2004* (herein under referred to as the "blue book"). This policy requires improved water quality of the stormwater flow from the developed site prior to discharge into the authority's drainage system.

This policy also requires the removal of target pollutants from the site during the construction phase as vehicles that may enter or exit could generate various pollutants such as silt, oil and grease. These target pollutants can be identified into five major groups of stormwater pollutants:

- Gross pollutants;
- Coarse, medium and fine sediments;
- Oil and grease;
- Heavy metals; and
- Nutrients.

4.2.1 Water Quality Objective

It is noted that water quality targets are not specified by Fairfield City Council. The proposed MUSIC model is designed in accordance with the following targets in Blacktown City Council DCP:

1. Reduction in annual average suspended solids (TSS) export load of 85%
2. Reduction in annual average total phosphorus (TP) export load of 65%
3. Reduction in annual average total nitrogen (TN) export load of 45%
4. Reduction in annual average gross pollutant (GP) export load of 90%

To demonstrate compliance with these objectives, treatment removal loads were analysed from pre to post development scenarios using MUSIC (Model for Urban Stormwater Improvement Conceptualisation) Version 6.1 software. Model development and results are discussed in section 4.2.3.

4.2.2 Proposed Treatments

Possible stormwater quality treatment devices such as HumeGard gross pollutant traps, Humes JellyFish, HumeCeptor and Rainwater Tanks are discussed below:

4.2.2.1 HumeGard Gross Pollutant Traps

The HumeGard GPT is designed for residential and commercial developments where litter and sediment are the target pollutants. Gross pollutant traps in the form of HumeGard GPT are to be provided as a primary treatment device to capture gross pollutants and coarse sediment (≥ 150 micron) from urban stormwater, even during bypass flow.

The expected removal rates that were utilised in the water quality modelling process to represent the pollutant filters were based on manufacturer's specifications as follows:

Table 4.1: HumeGard GPT MUSIC Input Parameters

Pollutant	Input	Output	Removal Efficiency
Suspended Solids (mg/L)	500	295	41%
Phosphorus (mg/L)	5	3.3	34%
Nitrogen (mg/L)	5	3.8	24%
Gross Pollutants (kg/ML)	15	2.2	90%

Source: Humes

4.2.2.2 Humes JellyFish

The Humes JellyFish filter uses gravity, flow rotation, and up-flow membrane filtration to provide treatment to stormwater in an underground structure. Using unique filtration cartridges, each JellyFish filter provides a large membrane surface area, resulting in high flow rates and pollutant removal capacity. Filtration cartridges in the form of JellyFish are to be provided as an end-of-line treatment targeting a wide range of pollutants (≥ to 2 micron), including total suspended solids, soluble heavy metals, oil and grease and total nutrients.

The expected removal rates that were utilised in the water quality modelling process to represent the Humes JellyFish were based on the following manufacturer's specifications:

Table 4.2: Humes JellyFish MUSIC Input Parameters

Pollutant	Input	Output	Removal Efficiency
Suspended Solids (mg/L)	200	22	89%
Phosphorus (mg/L)	40	14	67%
Nitrogen (mg/L)	7	3.2	48%
Gross Pollutants (kg/ML)	100	1	99%

Source: Humes

4.2.2.3 HumeCeptor

The HumeCeptor hydrodynamic separator is a stormwater pollution prevention device that efficiently removes hydrocarbons and fine sediment at its source. It is designed as an alternative end-of-line treatment device targeting hardstand applications. Being a cost-efficient treatment device without using any cartridge filters, HumeCeptor is also easy to retrofit and maintain.

In developing the MUSIC model for the proposed site, a HumeCeptor was proposed with the following parameters:

Table 4.3: HumeCeptor MUSIC Parameters

Pollutant	Input	Output	Removal Efficiency
Suspended Solids (mg/L)	500	100	80%
Phosphorus (mg/L)	100	47	53%
Nitrogen (mg/L)	5	3.5	37%
Gross Pollutants (kg/ML)	15.1	14.9	1%

Source: Humes

4.2.2.4 Rainwater Tanks

Rainwater tanks are sealed tanks designed to retain rainwater collected from roofs for subsequent re-use on site. In developing the MUSIC model for the proposed site, a portion of roof water from the new buildings has been modelled to discharge directly to rainwater harvesting tanks.

Assumptions have been made in relation to the volume of rainwater tanks for the proposed development as stated in the table below:

Table 4.4: Rainwater Tank Parameters

Catchment	Quantity of RWT	Individual Storage Volume (kL)	Total Storage Volume (kL)
Sub-Catchment 1	1	300	300
Sub-Catchment 2	2	13.5	27

Source: Proposed MUSIC Model

4.2.3 Water Quality Modelling – MUSIC Model, Parameters, and Methodology

A water quality modeling tool, MUSIC was utilised to simulate urban stormwater systems operating at a range of temporal and spatial scales. MUSIC models the total amounts of gross pollutants and nutrients produced within various types of catchments. It allows the user to simulate the removal rates expected when implementing removal filters to reduce the increased gross pollutant and nutrient levels created by the proposed development.

The following methodology and parameters were incorporated in the MUSIC modeling:

- The MUSIC model was created to assess the effectiveness of water quality nodes which are to be constructed as part of the proposed development;
- In accordance with Council's requirements, pluviograph data from 067035 Liverpool (1967-1976) 6 minute interval was utilised within the model;
- A MUSIC model was setup to represent the post-developed site. From architectural plans the site was then categorised into the following areas:
  - Roof;
  - Road;
  - Landscape (pervious); and
  - Concrete footpath (impervious).

Table 4.5: MUSIC Post-Developed Catchments

Post-Developed Region	Area (Ha)
Sub Catchment 1	
Roof	0.7687
Impervious	0.0891
Road	0.8382
Subtotal	**1.696**
Sub Catchment 2	
Roof	0.1
Pervious	0.030
Impervious	0.052
Road	0.1241
Subtotal	**0.3061**
Total Area Treated	**2.0021**
Pervious bypass	0.0165
Impervious bypass	0.0054
Total Area Bypass	**0.0219**
Total Area	**2.024**

Source: Proposed MUSIC Model

- Pollutant concentration parameters used within the model were based on the recommended model defaults for different land use categories as specified in Blacktown City Council's WSUD Handbook. These are summarised in the following table:

Table 4.6: Post-Development Areas – MUSIC Node Classification

MUSIC Node	Category
Roof	"BCC Roof Area"
Pervious	"BCC Pervious Area"
Impervious	"BCC Impervious Area"
Road	"BCC Road Area"
Pervious bypass	"BCC Pervious Bypass Area"
Impervious bypass	"BCC Impervious Bypass Area"

Source: Proposed MUSIC Model

- A treatment train was designed to incorporate a series of treatment nodes including HumeGard GPT, Humes JellyFish, HumeCeptor and Rainwater Tank. The effectiveness of the proposed treatments is summarised in Section 4.2.4; and

Figure 4.2: Proposed MUSIC Model

Source: Proposed MUSIC Model

4.2.4 Results

The following results were achieved in the model:

Table 4.10: MUSIC Results

Pollutant	Post-Development with no WSUD measures (kg/yr)	Post-Development with WSUD measures (kg/yr)	Removal Rate (%)	Target Removal Rate (%)
Total Suspended Solids	2820	422	85	85
Phosphorus	5.42	1.6	70.5	65
Nitrogen	33.4	10.5	68.6	45
Gross Pollutants	377	8.15	97.8	90

Results of the MUSIC analysis indicate that the proposed treatment train consisting of HumeGard GPT, Humes JellyFish, HumeCeptor and Rainwater Tank satisfies Blacktown City Council's statutory requirements for target pollutant removal.

Appendix A. Engineering Drawing Set