Frasers Broadway Project, Sydney

STORMWATER MANAGEMENT PLAN

MAY 2009

Client

FRASERS GREENCLIFF DEVELOPMENTS PTY LTD

Final

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Issue/Status	Revision	Date Issued	Author	Checked	Approved	Comment
Draft	A	03/04/09	JRD	AJC	AJC	For Arup/HT/FGD comments
Draft	B	11/05/09	JRD	AJC	AJC	For HT/FGD comments
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1 INTRODUCTION

The Fraser Broadway project is located in Chippendale, NSW near the Sydney CBD.

The proposed site is bounded by Broadway to the north, Abercrombie Street to the west, O'Connor Street and Wellington Street to the south and Kensington Street to the east.

The site falls generally from approximately RL 19m AHD to the southeast corner of Kensington & Regent Streets to approximately RL 10m at the north-west corner of Broadway & Abercrombie Street. Site slopes are typically steeper running east-west approximately 5% or 1 in 20 and gentler running south-north approximately 2% or 1 in 50. The development is approximately a 6 hectare redevelopment of the former Carlton United Brewery, to a mixed use Residential, Commercial and Retail Precinct.

A separate Civil Engineering Stormwater Management Plan has been prepared by Hughes Trueman Consulting Engineers that supports this Water Quality report and together provides the overall guidance of water management for the site precinct

Figure 1: Precinct locality Map

1.1 BACKGROUND

The report has been based on the following information:

- Water Sensitive Urban Design Strategy – Ecological Engineering Report (Sept 2006)
- Water Management Principals – Hughes Trueman (August 2007)
- Stormwater Quantity Management Study – Hughes Trueman (August 2008)
- Blackwattle Bay Stormwater Pollution Abatement Report Stage 3 – City of Sydney (April 2005)
- Managing Urban Stormwater: Harvesting and Reuse – DECC (April 2006)
- Discussions and meetings with Sydney Water and City of Sydney

1.2 PURPOSE OF THE REPORT

a) The site wide strategy for integrated stormwater management for the development and is to support the Major Project application MP 06_0171 (MOD 2);

b) Confirm any relevant Director Requirements (DGR's) and

c) Confirm any relevant Statement of Commitments is included in the Project Application.

d) A guide for future Water Cycle development of the site and agreement with all regulatory government departments and other stack holders:

e) Implements the principals of best stormwater management practices for the developments catchment using the NSW Dept of Environment & Conservation and the National Engineers WSUD manual –Australian Runoff Quality:

2 DEVELOPMENT DESCRIPTION

2.1 GENERAL

The development is to be 255,500m2 of Gross Floor Area (GFA) with mix of commercial, retail and residential areas spread throughout eleven building blocks.

Additionally the development shall feature:

- the main park and related infrastructure including excavation; installation of a stormwater detention tank; embellishment of the park; temporary roads and footpaths surrounding the main park;
- Two major common basement carparks, one located under Blocks 1 and 4, and one located under Blocks 2, 5, 9 and 3b.
- Main Park located between existing heritage Brewery building to the north, O'Connor Street to the south, Block 5a to the east and Carlton Street to the west.
- Site tri-generation plant and Central Thermal Plant with 5MW capacity located underground between the existing heritage Brewery building and the proposed Block 4. This plant is reliant on the non potable water supply for the central cooling tower water loads.
- An appropriately sized Water Reclamation Treatment plant will be located in a plant room of the basement of Blocks 2, 2a, 5 & 9. The treatment plant services needs of the non potable water demand for the site via common pipework reticulation to each user/lot within the development.

The calculated site area of the:-

Total post-development (draft sub division) is 55,126m2 made up of:

- Block 2, 2a, 5 & 9 (residential/retail)
- Block 4a (retail/commercial)
- Block 1 & 4 (retail/commercial)
- Block 8
- Block 11
- Block 3a, 3b & 3c
- Main Park

2.2 EXISTING WATER INFRASTRUCTURE

2.2.1 Stormwater Drainage

The site is located within the catchment of the Blackwattle Bay (SWC 17) trunk drainage system.

This system is listed on the s.170 NSW State agency heritage register under the Heritage Act.

The site is traversed by two major drainage systems.

- The Prince Alfred Park Branch has a catchment area of 25 hectares upstream of the site. It originates to the east of the main railway line near Cleveland Street Redfern.
  It runs along Queen Street, Balfour Street then Irving Street before joining the Wattle Street Branch that runs along Abercrombie Street.
  Its capacity is reported to be less than the 2 year ARI.
- The Tooth's Brewery Branch has a catchment area of about 9 hectares.
  it originates on the Railway land and flows under Regent and Kensington Streets then runs partly through the site and joins the Prince Alfred Park Branch near the intersection of Balfour and Irving Streets.
  Downstream of the site, the Prince Alfred Park Branch joins the Wattle Street Branch that runs along Abercrombie Street.

The capacity of the Wattle Street Branch is also reported to be less than the 2 year ARI.

2.2.2 Sewer Drainage

A trunk sewer traverses the site, running from Abercrombie Street eastwards along O'Connor Street then northwards in Balfour Street.

This trunk sewer is an ovoid brick sewer (1.37m high x 0.91m wide) and intercepts the stormwater drain at Irving Street.

This cross connection of sewerage into the stormwater drain will be disconnected to separate the systems.

The sewer falls towards and merges into a larger ovoid sewer (1.55m high x 1.24m wide) in Broadway, which drains towards the east.

The stormwater drain which runs down Irving Street acts as a combined sewer over part of its length.

All existing Sewer drainage connections within the development will be removed as part of agreement with Sydney Water.

2.2.3 Water Supply

Sydney Water has several Prymont Gravity water mains within and around the site that meet most of the servicing requirements for the sub-division.

Two reservoir zones reticulate within the development, the Prymont Gravity and Centennial Park which interconnect within Balfour Street.

Within Balfour Street, there are 3 water mains.

- A DN600 CICL trunk main is located on the western side, and runs across Broadway.
- A DN300 DICL /SCL main are located on the eastern side, and terminate at Broadway.
- A third main of DN150 CICL runs from Irving to O,Connor Streets.

Other mains servicing the site include:-

- a DN250mm CICL main along the southern side of Broadway,
- DN200 and DN150 CICL mains in Kensington Street,
- a 200mm diameter CICL main on the eastern side of Abercrombie Street, and
- 150mm CICL mains in O'Connor Street, Irving Street and Wellington Street.

A 375mm diameter CICL main is located on the western side of Abercrombie Street but also provides water to the site through a branch located approximately 50 metres north of Irving Street.

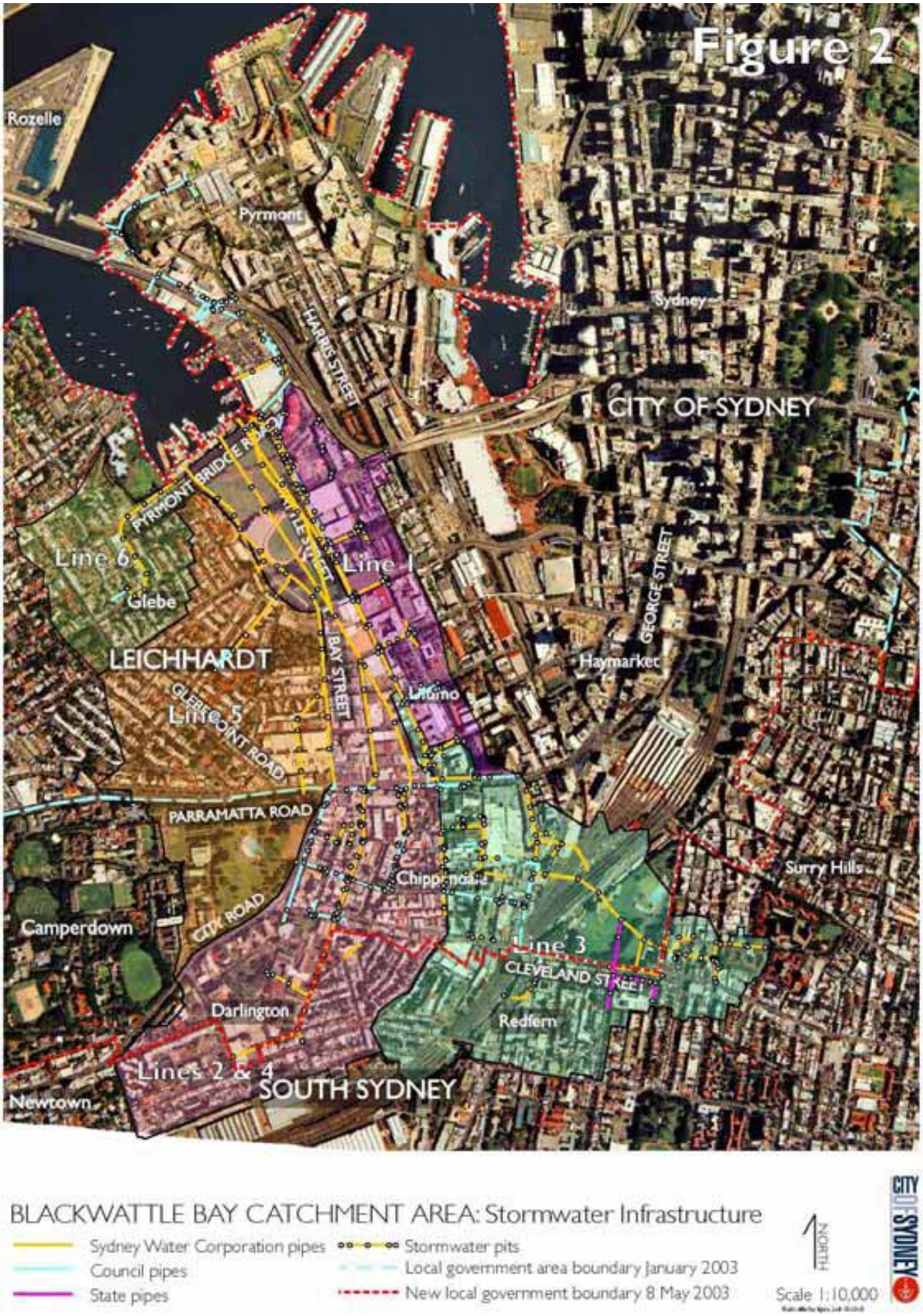


Figure 2: Catchment Map – The Precinct development is located in the Green zone

3 STORMWATER MANAGEMENT OBJECTIVES

The following objectives and principals represent the management practice for adoption into the stormwater infrastructure design for the development.

3.1 QUANITY OBJECTIVE

- **Minimise the impact Stormwater Quantity on the Watercourse**

  Minimise peak flow rates runoff from the developed site through minimizing impervious areas and implementing Detention;

  Provide Green Star requirements for the Green Star Precinct and respective Building ratings.

  (Refer to Section 4 & the Hughes Trueman report)

- **Minimise the impact of Stormwater Quantity on the Development**

  Minimise the impacts of flooding on buildings within the property by design of an appropriate drainage systems both piped and overland flow pathways;

  Reduce the roadway overland flow pathways hazards to people and traffic:

  (Refer to Section 4 & the Hughes Trueman report)

3.2 QUALITY OBJECTIVE

- **Minimise the impact of Water Quality on the Watercourse**

  Minimise the water quality impacts by (nutrient, sediment and gross pollution) during and following construction activities;

  Provide Green Star requirements for the Green Star Precinct and respective Building ratings.

  (Refer to Section 5)

3.3 WATER CONSUMPTION REDUCTION OBJECTIVE

- **Reduce Potable water Demand on the Sydney Water Street mains**

  Reduce the potable water demand of the development by implementing water re-use and Work towards Water Neutrality;

  Provide Green Star requirements for the Green Star Precinct and respective Building ratings.

  (Refer to Section 6)

4 WATER QUANTITY

4.1 PREDEVELOPMENT CATCHMENT RUNOFF

The pre-development brewery site was of industrial nature and 100% impervious hardstand site made up of buildings, concreted open storage space and roads with no On Site Detention.

The site previously acted as a flood path for the overland flow from the catchment upstream of the site. When combined with the stormwater falling on the site, this water discharged immediately to the existing Sydney Water pipe system and eventually to Sydney Harbour at Blackwattle Bay.

No water quality treatment trains were installed on any discharge to the receiving waters.

4.2 ROADWAY DRAINAGE

The DRAINS model of the Blackwattle Bay Catchment by Hughes Trueman in 2004 and current revision to evaluate 100 year ARI flows in the vicinity of the site.

Found that:

- The existing overland flow velocities and depths in Irving, Balfour, Abercrombie and Wellington Streets are not safe.
- Ponding occurs in the Kensington Street sag and the sag in Wellington Street near Balfour Street.
- The ponding depths are approximately 1m and 0.3m respectively. The Kensington Street sag acts as a defacto detention basin. When the wall along Kensington Street is removed, this will potentially increase flows through the site to Abercrombie Street. Thus compensatory detention storage is needed to be provided elsewhere in the site to mitigate this.

Sydney Water has provided written guidance of On-site Detention, asset protection and water quality guidelines referenced in the Hughes Trueman report.

All site drainage catchments will grade to the Main Park centralized On-Site Detention tank which has the required capacity of capturing all the developments runoff and the upsteam offsite capacity required by Sydney Water.

The strategy measures in dealing with the Quantity aspects are provided in the Hughes Trueman Stormwater Management Plan. Including Construction erosion and sediment control, flood plain, major & minor stormwater flows and On Site detention.

The DRAINS model by Hughes Trueman was modified to evaluate the impact of the proposed development on surrounding areas.

The following three design elements have been provide into the roadway drainage system.

4.2.1 Runoff Volume Control

The majority of the non-built up site catchment is designed to drain to a proposed detention tank.

An onsite detention tank was added to the model with a calculated required storage volume of 2500 m3. The tank has been designed to accommodate the site catchment running to the tank, the removed Kensington Street sag and the overland flow from offsite in Balfour Street, with the aim of reducing the outflow from the site and to not increase flows downstream of the site.

4.2.2 Overland Flow Paths

New overland flow paths and road cross sections to reflect the proposed road layout and grading.

The velocity x depth relationship was calculated for each overland flow path throughout the site.

The flood levels calculated were all classified as low hazard within the site.

The total flows downstream of the site for the sum of the piped and overland flows, were also determined to be reduced from the existing conditions in Irving Street, Abercrombie Street and Broadway.

4.2.3 Road Drainage System

New road stormwater drainage will be provided to capture the 1 in 20 year events and to reflect the proposed new road layout.

The road drainage will also collect excess runoff from each building development via a branch stubs.

Tooth Lane and Carlton Sreet will generally be suspended over the developments two super basements.

A zone of deep soil will allow services to be reticulated in ground as utilities would expect for access and maintenance.

The suspended structural slab will be protected by a membrane and compacted fill & services laid within prior to the surface finishes.

The dedicated roads when accepted will be administered by council and the utilities above the subject membrane.

Ground water in the suspended roads will be suitable collected and drained by the building owners.

4.3 BUILDING DEVELOPMENT DRAINAGE

All roof catchments will drain via down pipes to the rainwater retention tanks and be transferred to the Water Reclamation Treatment plant for non-potable reuse water.

The excess stormwater from the rainwater tank will overflow to the Precinct Onsite Detention tank via the roadway drainage.

Each future buildings drainage will be designed after MP approval to the authority requirements and to discharge to the branch stub provided in the Hughes Trueman roadway drainage.

Each building development is reliant on the central OSD for the Green Star credits.

The pipe drainage and overland flow paths system designs will cater for all events to the 1 in 100 year and consider the buildings floor level to flood path requirements.

Exceptions to these standard design criteria are that Building Block 2a Retail precinct has a major catchment area below the receiving road drainage systems.

A pumpout system in the basement will be required to drain this retail area.

4.3.1 Pumpout Drainage

The design of the pumpout system will utilize mass curve storage & discharge analysis to the Australian Rain Fall & Runoff guidelines.

All surface catchments/drainage on Building 2a that can gravitate to the road drainage system will be achieved.

All other surface catchments/drainage will drain via downpipes to the basement level to a detention storage tank and pump-out system.

The pumpout retention tank storage is diverted to the Water Reclamation treatment plant and excess stormwater will diverted to the gravity drainage and the roadway drainage.

The pumpout system will incorporate the all possible redundancies and best practices for this type of system.

For example

- Selection of the most reliable mechanical pumps with alternative power supply;
- Dual surface catchment grated outlets and downpipes to the basement each with 1 in 100 year capacity;
- The detention storage and pump-out system will have an overflow to the adjoining sub-soil detention storage and pump-out system with similar redundancy;
- Early warning alarm to the BMS system to allow evacuation.

4.4 PUBLIC DOMAIN DRAINAGE

The Balfour catchment zone is within Heritage Building 4a lot and will be hard-scraped surfaces with water features and other community elements.

The pipe drainage and overland flow paths system designs will cater for all events to the 1 in 100 year and consider the buildings floor level to flood path requirements.

The private drainage pipe system will discharge to the roadway drainage and OSD tank in the Main Park.

The main park zone will be grass landscaped areas and will settle minor flows by filtering across the grassed zones prior to draining to the grass pollution trap.

The drainage pipe system will discharge to the civil roadway drainage and OSD tank in the Main Park via a Gross Pollution Trap.

5 WATER QUALITY

5.1 PREDEVELOPMENT CATCHMENT QUALITY

The pre-development brewery site was of industrial nature and 100% impervious hardstand site made up of buildings, concreted open storage space and roads with no treatment to any water discharge.

The site previously acted as a flood path for the overland flow from the catchment upstream of the site. When combined with the stormwater falling on the site, this water discharged immediately to the existing Sydney Water pipe system and eventually to Sydney Harbour at Blackwattle Bay.

Various site sewerage drainage had also been discharging into the stormwater drainage which will be rectified under the new developments works.

The pre-development site drainage system had no treatment trains provided. As such the stormwater run off discharging off the site was high in pollutants.

5.2 TARGETS, RATINGS AND AUTHORITIES REQUIREMENTS

5.2.1 Sydney Water

Sydney Water is the manager of the truck drainage and Blackwattle Bay catchment.

Sydney Water interim guidelines encourage all developers to implement best practice urban stormwater management using WSUD as summarized below:

Treatment stormwater runoff to NSW EPA draft practice treatment objectives:

- 45% reduction in Total Nitrogen (TN),
- 45% reduction in Total Phosphorous (TP),
- 80% reduction in Total Suspended Solids (TSS),
- Maximise stormwater reuse through integrated water cycle management, which can reduce potable water demand and assist in achieving the above pollutant load reduction objectives.

5.2.2 City of Sydney

The City of Sydney Council is the manager of the road catchment drainage that connects to the trunk drainage and development drainage discharge to the road drainage.

There are general laws that outline Councils broad environmental responsibilities and specific laws that outlines Council operational and management enforcement responsibilities.

- The Local Government Act 1993 (as amended 1997)

The Local Government Act outlines overarching responsibilities for Council in terms of ensuring the local environment is effectively managed.

- All works will be within the requirements of the Protection of the Environment Operations Act 1997 (POEO Act),

This is the main environmental protection law in NSW.

It can be used by Council to deal with inappropriate practice on building and development sites in their area.

5.2.3 Green Star Precinct

The Precinct drainage relates to any stormwater that falls in open space on the titled land. No treatment will be provided to any external catchments, flows or overland flow waters which may or may not pass through the development site.

The industry standard for stormwater treatment is to target treatment of all flows up to a 1 in 3 month storm. This site will target and achieve this standard.

In addition, as part of a precinct approach to design, there is a co-ordinated design response between the buildings and the common areas of the precinct to achieve excellence in stormwater treatment and management.

The Green Star Precinct tool is still in development, however, it is anticipated that in targeting a 6 Star rating under a potential tool that the equivalent credit of EMI-5 in existing building rating tools is likely to be targeted.

Should this credit be targeted, the following standards are likely to be implemented, which are equivalent to existing Green Star requirements for buildings:

a) The development does not increase peak stormwater flows for rainfall events of up to a 1-in 2 year storm; and

b) All stormwater leaving the site, at any time up to a 1-in-20 year storm event, is treated or filtered in accordance with either:

- CSIRO Urban Stormwater: Best Practice Environmental Management Guidelines.

OR

- Australian and New Zealand Environment Conservation Council (ANZECC)'s Guidelines for Urban Stormwater Management.

5.2.4 Others

- The standards stipulated in Australian Runoff Quality (ARQ), Engineers Australia 2006, compliment the above Sydney Water standard.

- The design, construction, harvesting detention and storage and reuse system will be in accordance with Reuse Non potable reticulation quality as stipulated in the document

  "Managing Urban Stormwater, Harvesting and Reuse DECC April 2006" Table 6.4

  See Appendix A

5.2.5 Construction Phase Measures

All stormwater quality impacts during each construction phase will be managed and maintain to the council's guidelines and the "Blue Book" (NSW Dept of Housing 1998)

Detailed strategies are in accordance with the Hughes Truemans Report but include

- Protection of the Heritage drain;
- Material management & Stockpile practices;
- Topsoil practices;
- Erosion control practices (earth sediment basins, straw bales, sediment fences, turbidity barriers, stabilized site accesses, diversions and catch drains).

- General site practices and responsibilities;

5.2.6 Roadway Drainage Measures

The new development will introduce large areas of pervious landscaping and parklands that provide major pollution reduction benefits from the Predevelopment conditions stated in clause 5.1.

The proposed stormwater treatment from runoff from footpaths and roadway drainage for the development would be as follows:

Roadway Water Treatment to be used will be as follows:

- **Roadway Gross pollution traps**

The road drainage pipe system will have various discharge lines to the centralized OSD tank in the Main Park that need structural treatment in the form of Gross Pollution Traps (GPT) or other suitable devise that meets the targets prior to the centralized OSD tank.

The GPT will be designed to treat up to 1in 3 month design flows.

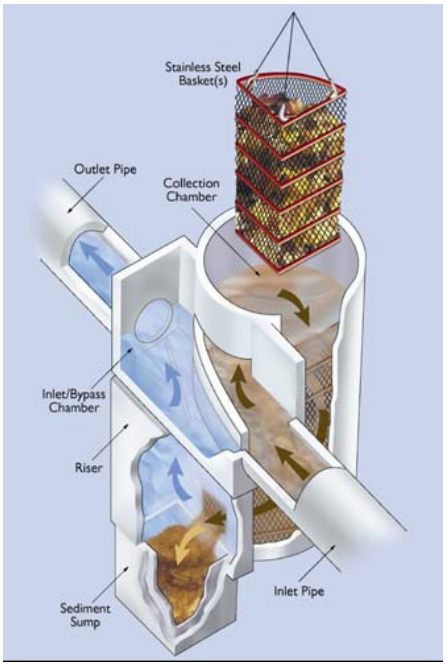


Figure 5: Precinct Gross Pollution Traps

5.3 PUBLIC DOMAIN DRAINAGE

➢ **Main Park Treatments**

Grassed areas will fall to collection pits and drain to Centralized Precinct Gross Pollution Traps (GPT).

The road drainage pipe system will have various discharge lines to the OSD tank within the Main Park with the roadway GPTs that may be utilized for the Precinct needs.

The GPT's will be designed to treat up to 1 in 3 month design.

5.4 BUILDING DEVELOPMENTS

Buildings Treatment to be used will be as follows:-

o **Rainwater Tanks**

Runoff from roof areas including green roof areas would be collected and retained in rainwater tanks for reuse via the Water reclamation Treatment plant. Overflow by-pass to the piped drainage system;

Rainwater tanks will have gravity overflows to the street drainage system.

All rainwater tanks are to incorporate the best design and installation principals set down in the appropriate Australian Standards and authority requirements.

For example

- Surcharge grates at ground level with suitable flow paths in the event of blockages
- First flush devise prior to water entry to the tank
- Mosquito protection
- Suitable post treatment
- Suitable cleaning and maintenance access
- Automatic silt removal and treatment
- level indication

All harvested tank rainwater will be pumped to the Water reclamation plant to be further treated with all other waste water bodies that can be treated and reused as Non-Potable water for the central plant reticulation.

Rainwater tank locations

The tanks will be located in ground as a priority to reduce the impact on basement areas and associated leakage risks.

For the developments that do not have the benefit of deep soil to locate the tanks due to basements below, the following options are tabled.

c) The tank will be located in the drainage line in the most appropriate location to allow a gravity overflow to the road drainage system.

d) This option is envisage to be practically and structurally challenging.

e) The tank will be located off line in basement below any gravity drainage but with gravity overflow principals being maintained.

This can be achieved by the installation of a diversion pits inline of the gravity drainage that allows gravity distribution to the basement rainwater tank.

When the tanks are full the gravity overflow to the road drainage system will activate.

Flows to the basement rainwater tank will be regulated by specific control valves with numerous redundancy measures to regulate gravity overflow to the road system and thus avoid inundation.

- **Building Gross Pollution Traps**

Each building's drainage pipe system draining to the roadway drainage system will have a GPT provided.

The Green Star tool is still in development, however, it is anticipated that in targeting a 6 Star rating under a potential tool that the equivalent credit of EMI-5 in existing building rating tools is likely to be targeted.

The following Green Star standards will be implemented:

- The development does not increase peak stormwater flows for rainfall events of up to a 1-in 2 year storm; and
- All stormwater leaving the site, at any time up to a 1-in-20 year storm event, is treated or filtered in accordance with either:
- CSIRO Urban Stormwater: Best Practice Environmental Management Guidelines.

OR

- Australian and New Zealand Environment Conservation Council (ANZECC)'s Guidelines for Urban Stormwater Management.

5.5 MUSIC MODEL DEVELOPMENT

A treatment train approach to modelling the water quality of the proposed development reflecting the integrated water management strategy has been adopted for the site. This includes rainwater tanks for reusing roof run off to reduce the development's potable water demand gross pollutant traps.

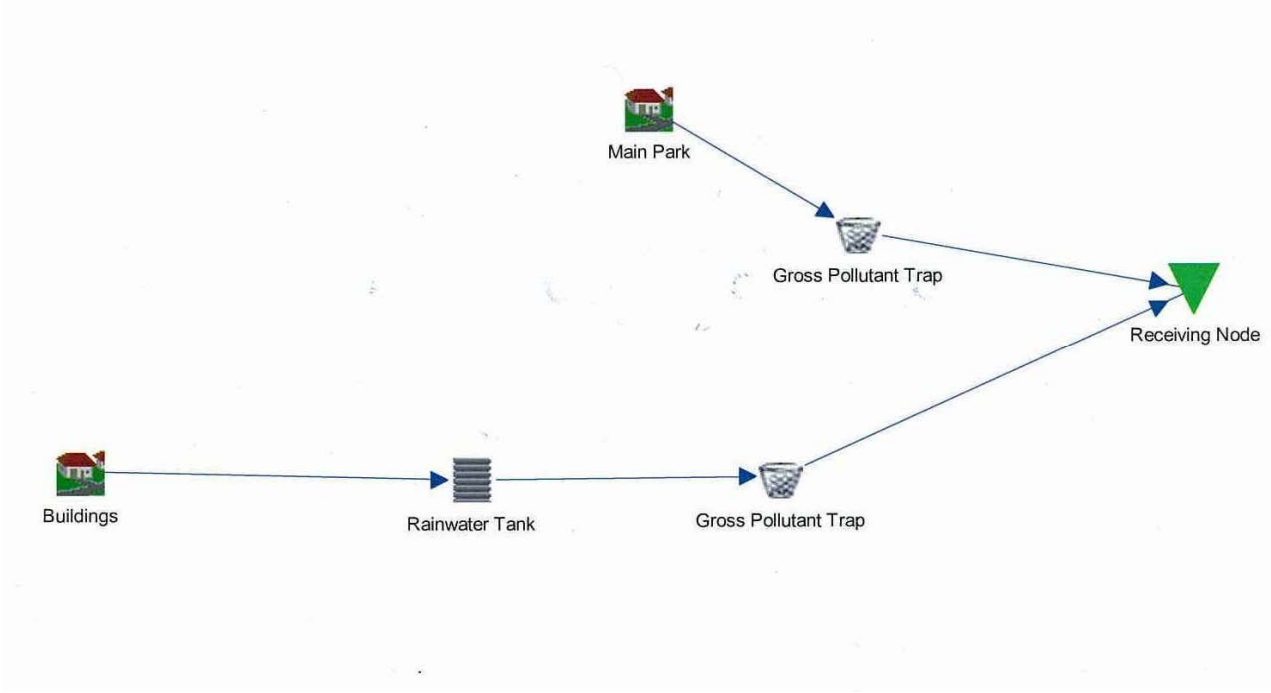
5.6 WATER QUALITY MODEL RESULTS

The table below shows the results of the music model for the Frasers Broadway development. The results compare the pollutant inputs from the land surface with the water quality leaving the site.

	Source	Residual Load	% Reduction
Flow (ML/yr)	62	36	41
Total Suspended Solids (kg/yr)	11,500	2200	80
Total Phosphorous (kg/yr)	23	11	53
Total Nitrogen(kg/yr)	177	93	46
Gross Pollutants (kg/yr)	1550	0	100

The above water quality model results demonstrate that the proposed treatment train approach to stormwater runoff provides a high level of treatment which meets the targets set by both Sydney Wate and the NSW EPA.

The Music Flow diagram below is a simple representation of the proposed development and its catchments.



6 MINIMISING POTABLE WATER DEMAND

At Frasers Broadway the intent is to be a zero neutral water use development, subject to the appropriate approvals and agreements. This target is to be achieved through a range of initiatives that will have the benefit of:

Minimising demand on potable water supplies through installation of water efficient fittings and appliances

Reducing stormwater runoff volumes due to rainwater capture and reuse.

Mining and recycling sewer flows for non-potable water needs– this will alleviate system capacity constraints and reduce risks of downstream sewer overflows in wet weather.

Providing high quality recycled water for off-site uses to offset any mains water used for the development

Saving energy by locally sourcing non-potable water supplies and reducing water transport and pumping requirements

6.1 STORMWATER HARVEST AND REUSE

6.1.1 Water Balance

The factors considered in the WSUD solutions have been climate, rainfall, site topography and the inherited constraints of the original industrial site, proposed development and the large amount of harvested runoff water.

The proposed water quality improvement devices on new stormwater drainage infrastructure are intended to produce reduction in pollutants at a reasonable cost considering the environmental benefit.

Table 2- **Rainwater harvest supply and reuse volumes**

Block no.	Roof Area (m2)	Harvest potential (L/day)	Daily Rainwater Demand	% non-potable demand satisfied	% rainwater overflow	Tank Size (litres)
1	2500	6867	6000	76	33	**150,000**
2	5300	14559	14000	75	27	**400,000**
3	2400	6593	6000	74	30	**150,000**
4A	6300	17306	17000	75	26	**450,000**
4B	2000	5494	5000	74	32	**120,000**
5	3500	9614	9000	76	33	**250,000**
6	500	1373	1300	75	29	**35,000**
7	220	604	600	76	24	**20,000**
8	1900	5219	5000	76	27	**150,000**
9	1630	4478	4000	75	32	**120,000**
10	600	1648	1500	74	32	**30,000**
11	3900	10713	10000	76	33	**250,000**

All harvested tank rainwater will be pumped to the Water reclamation plant to be further treated with all other waste water bodies that can be treated and reused as Non-Potable water for the central plant reticulation.

Further detailed Water balance analysis can be undertaken at subsequent approval stages to refine the tank sizes and catchments to achieve the required targets and best outcome for the overall design and functionality of each building.

6.2 SEWER DRAINAGE, TREATMENT AND REUSE

The sewerage system is integral to the Water minimsing potable water demand and possible water neutrality.

A centralised treatment plant is proposed to be provided as a Build Own Operate and Transfer (BOOT) scheme operator.

A major benefit to the development will be the constant supply of non potable water during drought or water restriction periods.

6.2.1 Sewer drainage

The site is within the Blackwattle Bay catchment of the Sydney Water sewer drainage system which flows to the Bondi ocean outfall system (BOOS).

Various Sydney Water reticulation sewers drain into the Trunk drainage sewer system and these sewers will be extended or adjusted to service each lot of the new sub division with a sideline.

Most building lots will drain the plumbing waste to this sideline but will be intercepted and diverted to supply the water reclamation treatment plant with waste water for recycling to non potable water.

In the event of a need for a treatment plant shut down the whole buildings waste water will on flow to the Sydney Water sideline as a normal plumbing system.

6.2.2 Harvesting the Development Sewerage

Generally any water used in the buildings will be recycled to non-potable water usage and provide a water cycle.

Some smaller remote minor buildings will drain directly to the sideline and not to the water reclamation treatment plant because there is little benefit to the system.

6.2.3 Sewer mining

Sewer mining from the Sydney Water sewer trunk drainage within the development site will add further supply capacity.

Sewer mining is the process of tapping directly into a sewer (either before or after a sewage treatment plant) and extracting wastewater for treatment and then reuse as recycled water.

Some sewer mining by-products may be returned into the sewerage system.

Interim advice and approval has been obtained for Sydney Water Corporation to harvest their sewerage and have rights to the upstream catchment.

6.2.4 Water Reclamation Treatment Plant

Waste water will be sourced from:

- Sanitary plumbing waste from most of the Buildings on the development site;
- Rainwater and stormwater retention harvested in the rainwater tanks;
- Sewer mining from the Sydney Water sewer trunk drainage within the development site;

The plant will be designed to deliver the estimated peak load required to deliver 100% of non potable water needs.

Stormwater and Rainwater will be used to supplement the sewage supply to the front of the treatment plant.

This approach has the following benefits:

Will treat the stormwater harvested and reduces the incoming TDS and therefore improves the performance of the salt removal process. .

Size of biological reactor is not affected by addition of stormwater and rainwater.

Stored rainwater can be used to assist in meeting peak daily cooling tower demand.

The plant will basically consist of

- Balance tank to capture the waste water and pump feed to the Bio-reactor;
- Bio-reactor tank primary treatment, secondary filters and polishing filtration;
- The final non potable water produced will be stored in two storage tanks to meet the day demand these tanks will have will have an alternative emergency potable water top-up with registered air gap backflow protection;
- The tanks will deliver the water via a pump (with secondary power supply) to the two central pipe work reticulation systems that supply most of the development.
- The owners of the lots, stratum or strata will be provided with private reticulation via meters that will allow the operator to proportion costs based on usage.

All irrigation demand (100%) will be met by non-potable water sources.

6.2.5 Treatment Plant Operation and Maintenance

The BOOT scheme operator will provide all management aspects during the life of the system.

Sewerage Management Plan is to be prepared to meet the performance required for conveyance, treat and disposal for sewage.
This will include:-

- Ongoing water sampling, NATA laboratory analysis and record keeping of data to the supervision of the Dept of Health requirements.
- All required maintenance and renewal
- Contingency plans are to be prepared for failures in the system and declaration to stakeholders.
- Disputes and complaints processes schemes are to be established and approved by the Ombudsman.
- Water quality plans consistent with the Australian Guidelines for Water Recycling are to be implemented.
- Infrastructure operating plans are to be prepared to meet the performance, maintenance, monitoring and reporting standards required.

6.3 NON-POTABLE WATER RETICULATION

Non-potable water is water that is not of drinking water quality, but which may still be used for many other purposes, depending on its quality.

Under the Workplace Health and Safety Act 1995 non-potable water is a ‘substance’ for which manufacturers, suppliers and end users have obligations in regard to risk management.

The Water Reclamation Treatment Plant will produce only Grade ‘A’ water quality as defined in the Australian Guidelines for Water Recycling, to the Frasers Broadway site.

The system will be installed and monitored on an ongoing basis to the NSW Dept of Health requirements.

Two types of Grades 'A' water are to be produced for the developments non potable supply with differing levels of Total Dissolved Solids (TDS).

The low TDS (~100mg/L) level non potable water will be used to supply the central thermal cooling tower water supply.

The high TDS (~1,000mg/L) level non potable water will be used to supply the all other uses like landscape irrigation, green wall irrigation, sanitary flushing, wash down and laundry washing water supplies.

Infrastructure reticulation will be ring mains with branch connections to each building's basement meter room.

Pipework will be manifold with metered branches for each stratum, strata and lot within the building and deliver the required non potable water.

The infrastructure reticulation will reticulate generally in the common basement area and will be protected under the sub division management plans.

The Infrastructure reticulation will deliver non potable at pressure and flow similar to the Street potable mains. Water may need to be further boosted for each buildings strata or stratum needs.

Infrastructure reticulation delivery will be achieved with static day load storage tanks and booster pump systems.

Pipework installation & materials will be selected using the selection guidelines set in the Water Code of Australia.

6.3.1 Non-Potable Metering

Metering will be in line with current Sydney Water metering requirements but remotely read at the Building Management System (BMS).

6.3.2 Alterative Water Supply

In the event of an emergency or plant shut down the plant will be provided with a Potable (Street main) Sydney Water supply.

The Frasers Broadway site non potable water demands are:

- Toilet flushing
- Cooling towers
- Irrigation
- Laundry washing machines
- wash down

Frasers Broadway in consultation with Sydney Water is considering the opportunities to expand the capacity of the Water Reclamation treatment plant to allow the export of treated waste water to a future "City Grid" for recycled water.

6.4 FIXTURES AND FITTINGS

The potable water supplied from the Sydney Water street mains to the buildings is to provide with best practice system efficiency's.

Water usage will incorporate

- Wels approved fixtures and fittings with specific flow reduction to each developments requirements;
- 100% landscape irrigation water supplied from the central Non potable system and somewhat drought proofing the Landscape irrigation systems;
- Irrigation water demand s for the Green wall systems will be provided from the Non Potable water system.
- Potable water supply to each building for potable uses only;
- Recycled/ non potable water supply to each building for non-potable uses;
- Water meters are installed for all major water uses;
- Temporary storage requirement within each building for a minimum of 80% of the routine fire protection system test water and maintenance drain-downs, to serve non potable demands;
- Rainwater collection treatment and reuse.

Residential Water Consumption

Basix scheme is the statutory requirement for efficient water appliances & tapware each residential development requiring detailed modeling assessment.

The fixtures and appliances will include dishwashers, clothes washers, toilets and all tapware.

Potable water loads are obligated to be reduced by 40% and with this developments system separation of non potable water loads will far exceed this benchmark.

Commercial Water Consumption

Greenstar scheme is the proposed guidelines for efficient water appliances & tapware each commercial developments requiring detailed modeling assessment.

The fixtures and appliances will include cooling towers, dishwashers, urinals, toilets and all tapware.

Water audits conducted by Sydney Water in office buildings indicate breakdown usage as follows:-

Amenities=40%

Cooling Towers =30%

Irrigation =5%

Wastage/Leakage =25%

Potable water loads will be greatly reduced with the efficiency reductions, 100% non-potable supply for the cooling tower & landscape water and leakage metering.

7 CONCLUSIONS AND RECOMMENDATIONS

The proposed measures and controls can be successfully integrated into the development to achieve the Stormwater management objectives.

7.1 QUANTITY

The development will deliver water quality improvements from the predevelopment due to the pre-treatment of stormwater discharge, detention & retention and increase of landscape areas.

The pre-developed site allowes 100% of Suspended Solids, Phosphorous, Nitrogen and gross pollutants to discharge into the receiving waters untreated.

The proposed Fraser Broadway Development provides the required treatment trains to achieve the water quantity targets as outlined in section 5.2.1 of this report. In summary, the design targets anticipated are:

- Suspended Solids reduced by 80%
- Total Phosphorous reduced by 53%
- Total Nitrogen reduced by 46%
- Gross Pollutants reduced by 100%

As can be seen, the reduction in pollutant loads by the treatment train provides a substantial improvement on the water quality discharging to the receiving waters.

The Fraser Broadway Development will contribute to improving the water quality of downstream water bodies and improve the amenity of both local flora and fauna in these areas.

Stormwater Quantity on the Watercourse

- The peak flow rates of stormwater discharge from the development will be reduced with the implementation of the Onsite Detention Tank and re-grading work of the existing roadways;
- Impervious areas within the development will be reduced with the implementation of the Public Domain Parks, and development landscaping;
- Construction phases impacts, such as asset protection of the heritage drain will be undertaken to Sydney Water requirements;

Stormwater Quantity on the Development

- The potential hazard of overland flow and flooding will be reduced;
- Safe flood levels and freeboards established to protect people and buildings;
- The increase of landscape areas including Green roofs & rainwater tanks provides a reduced runoff flow rates.

  (refer to Section 4 & the Hughes Trueman report)

7.2 QUALITY

WSUD targets have been identified for the development and the minimum requirements to treat runoff to the watercourse.

Construction phases impacts, such as asset protection, erosion and sedimentation

Water Quality on the Watercourse

Reduction targets will be meet in accordance with the targeted best management practice and DECC requirements

The runoff water quality for the development with the treatments proposed will significantly improved by:

- The runoff water quality for the development during construction activities will be implemented and maintained;
- The runoff water quality for the development will be improved from the pre development conditions by the reductions of impervious areas;
- Gross pollution traps to be installed in the Precinct and building developments.
- Rainwater and Stormwater tank harvesting will reduce the runoff volume and pollution load;
- The harvested rainwater tanks in the precinct and building developments will be treated in the Water Reclamation Treatment plant and the Non-potable water will be reused

(refer to Section 5)

7.3 MINIMUIUM POTABLE WATER CONSUMPTION

The integrated water cycle aspects have been considered the drainage, storage, treatment & reuse and maintenance of the various water systems.

Potable water Demand on the Sydney Water Street mains

An integrated water system that provides reduction and reuse benefits to the watercourse potable water mains and sewerage system.

The demand for potable water will significantly reduced by the following:

- The provision of a central water treatment plant that will deliver maximum non potable supply to the non potable requirements and reduce potable main loads;
- Increased water loads can be delivered with non potable water during peak summer periods;
- Demand management reductions of the constant potable water year round load.
- WSUD strategies will be incorporated at the site to retain as much stormwater as possible to site, transport as little stormwater pollutants as possible to receiving waters;

APPENDIX A – NON POTABLE WATER QUALITY

"Managing Urban Stormwater, Harvesting and Reuse DECC April 2006" Table 6.4		
Level	**Criteria 1**	**Applications**
LEVEL1	*E. coli* <1 cfu/100 mL Turbidity ≤ 2 NTU2 pH 6.5–8.5 1 mg/L Cl2 residual after 30 minutes or equivalent level of pathogen reduction	Reticulated non-potable residential uses (e.g. garden watering, toilet flushing, car washing)
LEVEL 2	*E. coli* <10 cfu/100 mL Turbidity ≤ 2 NTU2 pH 6.5–8.5 1 mg/L Cl2 residual after 30 minutes or equivalent level of pathogen reduction	Spray or drip irrigation of open spaces, parks and sportsgrounds (no access controls) Industrial uses – dust suppression, construction site use (human exposure possible) Ornamental water bodies (no access controls) Fire Fighting
LEVEL 3	*E. coli* <1000 cfu/100 mL pH 6.5–8.5	Spray or drip irrigation (controlled access) or subsurface irrigation of open spaces, parks and sportsgrounds Industrial uses – dust suppression, construction site use, process water (no human exposure) Ornamental water bodies (access controls)
The Central Water Reclamation Treatment Plant is proposed to provide LEVEL 1 water and Grade A under the National Guidelines.		