



SUSTAINABLE BUILDING CONSULTANTS

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PLANS AND DOCUMENTS
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**192-200 ABBOTSFORD ROAD
BOWEN HILLS**

SITE BASED STORMWATER MANAGEMENT PLAN

Prepared For:

STEEL STORAGE

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EXECUTIVE SUMMARY

Floth Sustainable Building Consultants have been engaged, by Steel Storage Australia, to provide a Site Based Stormwater Management Plan (SBSMP) for a new development located in Bowen Hills. The subject property, 192-200 Abbotsford Road, is proposed to be re-developed into a four (4) level storage facility.

This report provides recommendations for management of stormwater run-off from the proposed development. The stormwater run-off is managed from both a stormwater quality and stormwater quantity perspective, in accordance with the Queensland State Planning Policy 2013 and Brisbane City Council (BCC) Stormwater Management Code.

The report includes:

- A review of site characteristics.
- Identification and evaluation of stormwater management devices to meet stormwater quality design objectives.
- Development of a stormwater management concept plan.

Flood Mitigation

As indicated in the BCC FloodWise Report, the existing ground floor levels of the proposed site sit below the Defined Flood Level (DFL) of 2.6m. The BCC Flood Overlay Code requires that the development have a minimum floor level of equal or greater than the DFL for a Class 7b and Class 5 building. It is proposed that a minimum floor level of DFL plus 300mm will be adopted to provide flood immunity to the proposed development.

Stormwater Quantity Management

Following the review of site characteristics, it is found that the stormwater discharge flow would not be increased as the percentage of impervious area of the proposed development is not increased.

Stormwater Quality Management

A prediction of pollutant removal was undertaken using Model for Urban Stormwater Improvement Conceptualisation (MUSIC) software. Based on the modelling result, the following Water Sensitive Urban Design (WSUD) concept options are proposed:

Concept 1:

- The ground floor trafficable area (530m²), is proposed to be treated via a primary gross pollutant trap (proposed HumeGard or equivalent), followed by a secondary Stormwater Quality Improvement Device (SQID) (proposed Humes Jellyfish or equivalent) and discharging to the receiving node, i.e. Breakfast Creek.
- The rainwater run-off from the roof (2,485m²), is proposed to be collected in a rainwater tank. The rainwater will be re-used for irrigation and toilet flushing purposes. The overflow from the rainwater will be treated via a primary gross pollutant trap (HumeGard), followed by a secondary SQID (Jellyfish) and discharging to the receiving node, i.e. Breakfast Creek.

Concept 2:

- The ground floor trafficable area (530m²), is proposed to be treated via primary gross pollutant traps (proposed EnviroPod or equivalent), followed by a secondary Stormwater Quality Improvement Device (SQID) (proposed StormFilter or equivalent) and discharging to the receiving node, i.e. Breakfast Creek.
- The rainwater run-off from the roof (2,485m²), is proposed to be collected in a rainwater tank. The rainwater will be re-used for irrigation and toilet flushing purposes. The overflow from the rainwater will be treated via primary gross pollutant traps (EnviroPod), followed by a secondary SQID (StormFilter) and discharging to the receiving node, i.e. Breakfast Creek.

Concept 3:

- A portion of the ground floor trafficable area (330m²), is proposed to be treated via a series of primary gross pollutant traps. The remaining portion of ground floor area (200m²) is proposed to pass through a bioretention system (80m²). The outlet of the bioretention system will be discharge to the receiving node, i.e. Breakfast Creek.

- A portion of the rainwater run-off from the roof (725m²) is proposed to be collected in a rainwater tank. The rainwater will be re-used for irrigation and toilet flushing purposes. The overflow from the rainwater tank will be treated via primary gross pollutant traps. The remaining portion of the roof run-off will discharge through a bioretention system (80m²). The outlet from the bioretention system will be discharged to the receiving node, i.e. Breakfast Creek.

Following design development, one of the above proposed options will be selected for adoption.

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1. INTRODUCTION

Floth Sustainable Building Consultants have been engaged, by Steel Storage Australia, to provide a Site Based Stormwater Management Plan (SBSMP) for a proposed four (4) level storage facility development at 192-200 Abbotsford Road, Bowen Hills. The property descriptions are:

- Lots 74 and 75 on RP9371,
- Lots 1 and 2 on RP55530, and
- Lots 79 and 80 on RP57006.

The subject property is located in an inner northern suburb of Brisbane, approximately 7km from the CBD.

The SBSMP integrates stormwater quantity and quality management during the operational stage of the proposed development. The SBSMP is prepared in accordance with the Queensland State Planning Policy 2013, and the Brisbane City Council (BCC) Stormwater Management Code, for submission to Economic Development Queensland (EDQ) as part of the Development Approval application of the proposed development.

2. SITE CHARACTERISTICS

2.1 SITE LOCATION

The proposed development is located at 192-200 Abbotsford Road, Bowen Hills, an inner city suburb and approximately 7km from the CBD. The property has an area of approximately 3,013 m². As indicated in Figure 1, the subject property is bordered by Abbotsford Road and Burrow Street to the east, existing buildings to the north and south, and a railway line to the west.

The proposed work will include demolition of the existing buildings on site and construction of a new four (4) levels storage facility. The area impacted is estimated at 3,013 m².

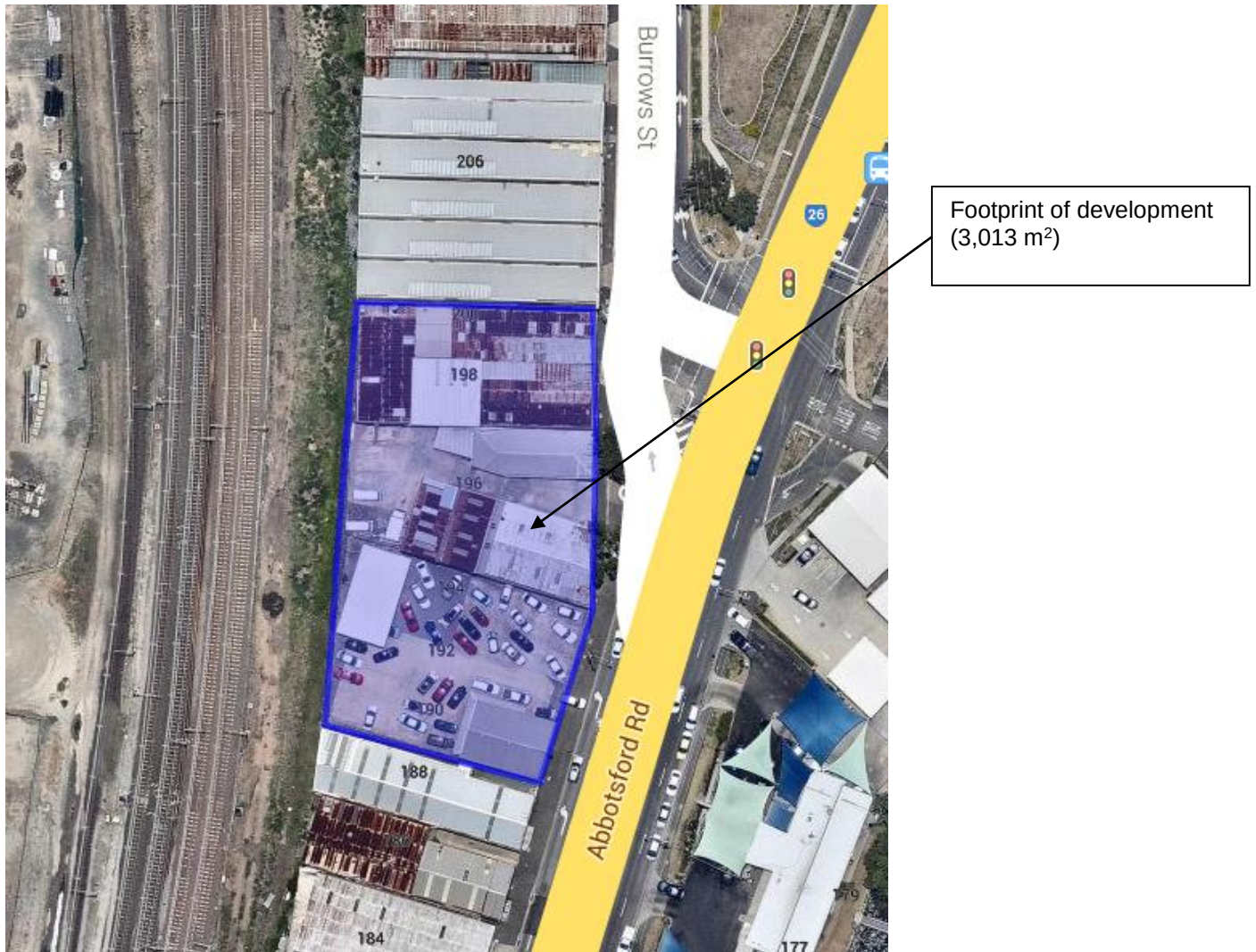


Figure 1 - Site Location

2.2 TOPOGRAPHY AND VEGETATION

A contour map of 0.5m intervals, obtained from BCC's Planning and Development online Interactive Mapping tool, is shown in Appendix A.

The contour map indicates that the western boundary of the proposed site sits at approximately 2.5m AHD, with a steep bank ascending to the railway line at approximately 4.0m AHD. The site generally slopes to the east towards Breakfast Creek, to an approximate level of 2.0m AHD.

The majority of the site consists of existing development, with more than 90% of the site covered with impervious surfaces. Aerial view of the subject property indicates that there is no vegetation on site.

3. DATA

3.1 SOURCES OF INFORMATION

In order to identify the water quality design objectives to undertake the SBSMP, the following procedures were adopted:

- Identify the site constraints through BCC's Planning and Development Online (PD Online).
- Undertake a Floodwise Property report
- Review the State Planning Policy with respect to Stormwater Quality Management.

3.2 SITE CONSTRAINTS

As indicated through BCC's PD Online, the site is located in close proximity to Breakfast Creek and Brisbane River. The site is predominately flat, at approximately 2.5m AHD, with more than 90% impervious surface area.

3.3 FLOODWISE PROPERTY REPORT

BCC FloodWise Property Report for 192-200 Abbotsford Road, refer to Appendix B, states that this property may be affected by one or more floods. The report indicates that the Defined Flood Level (DFL) of 2.6m has a 1% chance of occurring in any given year. The January 2011 flood level is stated as 2.7m and the property ground level varies from 1.9m up to 2.4m.

In addition, the Flood Awareness Map indicates that the proposed site was affected by the January 2011 Flood. Refer to Appendix C for the BCC Flood Awareness Maps.

3.4 WATER QUALITY DESIGN OBJECTIVES

Following the review of State Planning Policy with respect to Stormwater Quality Management, the water quality design objectives for the post-construction phase of the proposed development were determined.

An extract of the State Planning Policy outlines post-construction stormwater management design objectives relevant to various climatic regions in Queensland.

Refer to Appendix D for the State Planning Policy extract.

The following sections of this report detail the stormwater management concept, with respect to stormwater quantity and quality.

4. FLOOD MITIGATION

Based on the BCC FloodWise Property Report, the source of potential flooding affecting the subject property originates from Breakfast Creek or Brisbane River. The BCC Flood Overlay Code states that the flood planning categories applicable for BCA Class 7b building and Class 5 building are Category C and Category D.

Flooding source ⁽¹⁾	Minimum design floor or pavement levels (m AHD) ⁽²⁾ (refer to Table 8.2.11.3.D for assignment of these categories)				
	Category A	Category B	Category C	Category D	Category E
Brisbane River	RFL + 500mm	RFL + 300mm	DFL	5% AEP flood level	5% AEP flood level
Creek/ waterway	1% AEP flood level + 500mm	1% AEP flood level + 300mm	1% AEP flood level	1% AEP flood level	5% AEP flood level
Overland flow	2% AEP flood level + 500mm	2% AEP flood level + 300mm	2% AEP flood level	2% AEP flood level	5% AEP flood level

Figure 2 - Extract from BCC Flood Overlay Code (Table 8.2.11.3.L)

The minimum flood immunity level corresponding to these categories and flooding sources, is the DFL of 2.6m (refer to FloodWise Report in Appendix B).

In order to minimize the risk of potential flooding at this location, a minimum floor level of equal or greater than the Defined Flood Level (DFL) of 2.6m plus 300mm is proposed to be adopted for the proposed development.

5. WATER QUANTITY (HYDROLOGY AND HYDRAULICS)

5.1 METHODOLOGY

Calculations were undertaken using the rational method and the recommendations in Queensland Urban Drainage Manual (QUDM) to determine the stormwater discharge from the site.

Refer to the calculations undertaken in Appendix E.

5.2 EXISTING HYDRAULICS

Based on the Dial Before You Dig (DBYD) existing records, obtained from BCC, it appears that there is existing stormwater infrastructure surrounding the subject site. Please refer to BCC DBYD drawings, contained in Appendix F, indicating existing stormwater running along Abbotsford Road and discharging to Breakfast Creek.

5.3 MODELLING APPROACH

Modelling of stormwater runoff quantity was considered for the affected site area (3,013 m²), before and post-development.

The discharge rates from the subject property have been calculated for both the existing site and post-development based on the rational method, as per QUDM. Table 1 provides a summary of the peak flow rates from the site for various rainfall events and for both cases.

Refer to Appendix E for detailed calculations.

Table 1 - Existing and Developed Site Peak Flows

Average Recurrence Interval, ARI (years)	Peak Flow Rate, Q (l/sec) Existing	Peak Flow Rate, Q (l/sec) Post - Development
1	70	70
2	95	95
5	134	134
10	159	159
20	191	191
50	243	243
100	270	270

The total area of impervious surfaces does not increase post development, therefore the existing and post-construction stormwater discharge flow rates do not differ.

5.4 PROPOSED STORMWATER LAWFUL POINT OF DISCHARGE

Referring to existing records, obtained from BCC, contained in Appendix F, it appears that there are two (2) stormwater inlet pits provided to service the subject property. These two inlet pits discharge to a 525mm diameter stormwater main located in Abbotsford Road, which discharges to Breakfast Creek.

Therefore, these two (2) stormwater inlet pits, located at the eastern border of the subject site, is proposed to be the lawful point of discharge for the subject site.

6. WATER QUALITY

6.1 WATER QUALITY DESIGN OBJECTIVES

Referring to the State Planning Policy extract in Appendix D, the applicable stormwater quality design objectives relevant to South-East Queensland are as follows:

Table 2 - Stormwater Quality Design Objectives

Pollutants	Minimum reductions (%)
Total suspended solids (TSS)	80
Total phosphorus (TP)	60
Total nitrogen (TN)	45
Gross pollutants >5mm	90

6.2 MODELLING APPROACH

In order to achieve post-construction phase stormwater quality design objectives, as per above, a prediction of pollutant removal has been undertaken using the “Model for Urban Stormwater Improvement Conceptualisation” (MUSIC) software. MUSIC is an urban stormwater modelling tool that predicts the performance of Stormwater Quality Improvement Devices (SQIDs) proposed to be implemented within the development.

The MUSIC model adopted required various input data, including meteorological data, stormwater source nodes, runoff generation parameters, treatment nodes (proposed SQIDs), and receiving nodes. The following sections detail the parameters that were input into the model.

Refer to Appendix G for the stormwater management plan concept detail for the three concept options.

6.2.1 INPUT PARAMETERS

6.2.1.1 MODELLING POLLUTANT REMOVAL EFFECTIVENESS

The modelling for the subject catchment with the proposed treatment system has been carried out using MUSIC software. MUSIC determines the pollutant loads from the source nodes, and then calculates the percentage reductions.

6.2.1.2 METEOROLOGICAL DATA

The first step in creating a MUSIC model is to select appropriate rainfall data and time steps as per Water by Design MUSIC Modelling Guidelines Version 1.0 – 2010 and BCC Guidelines for Pollutant Export Modelling in Brisbane Version 7 (2003). The following data was adopted as input in the MUSIC software:

- Brisbane City Council (central) rainfall data 1980-1989, at a six minute step for the purpose of MUSIC modelling.

6.2.1.3 SOURCE NODES

For the proposed development the considered source nodes were defined as “Commercial Source Nodes”. Commercial areas are characterized by a high percentage of total impervious area (e.g. approximately 70%). The model proposed consisted of the commercial source nodes detailed in Table 3.

Table 3 - Commercial Source Nodes

Source Node	Node Type	Area (Ha)	Fraction Impervious (%)
Roof	Commercial	0.249	100
Ground Floor (Paved)	Commercial	0.053	82

The source node properties for each node were based on MUSIC software guidelines.

6.2.1.4 TREATMENT NODES

For the proposed development we have considered the stormwater quality improvement devices (SQID) detailed in Table 4.

Table 4 – Concept 1 Stormwater Quality Improvement Devices (SQIDs)

SQID	Description
Rainwater Tank	A 25kL Rainwater tank will capture runoff from the roof and will be reused for the irrigation of the proposed landscape and toilet flushing within the building.
Primary treatment: Humegard HG12 (or equivalent)	A Gross pollutant trap (GPT) device will be used to capture gross pollutants and total suspended solids from stormwater runoff.
Tertiary Treatment: Jellyfish (or Equivalent)	A Humes Jellyfish device will be used to target gross pollutants, total suspended solids (TSS) and nutrients. Additional supporting documents for the Humes Jellyfish product can be made available upon request.

Table 5 - Concept 2 Stormwater Quality Improvement Devices (SQIDs)

SQID	Description
Rainwater Tank	A 25kL Rainwater tank will capture runoff from the roof and will be reused for the irrigation of the proposed landscape and toilet flushing within the building.
Primary treatment: EnviroPod 200 µm (or equivalent)	A Gross pollutant trap (GPT) device will be used to capture gross pollutants and total suspended solids from stormwater runoff.
Secondary treatment: 690mm StormFilter System (or equivalent)	A StormFilter cartridge (or equivalent) device will be used to treat captured stormwater that has passed through the gross pollutant traps. Runoff from the ground floor paved areas and overflow from the rainwater tanks shall pass through the gross pollutant traps before treatment via StormFilter.

Table 6 - Concept 3 Stormwater Quality Improvement Devices (SQIDs)

SQID	Description
Rainwater Tank	A 30kL Rainwater tank will capture runoff from the roof and will be reused for the irrigation of the proposed landscape and toilet flushing within the building.
Primary treatment: Humegard HG12 (or equivalent)	A Gross pollutant trap (GPT) device will be used to capture gross pollutants and total suspended solids from stormwater runoff.
Tertiary Treatment: Bioretention	A bioretention will be used to capture stormwater runoff. The bioretention shall have the following characteristics as per snapshot from MUSIC model below.

Location Bioretention
 Products >>

Inlet Properties
Low Flow By-pass (cubic metres per sec) 0.000
High Flow By-pass (cubic metres per sec) 100.000

Storage Properties
Extended Detention Depth (metres) 0.60
Surface Area (square metres) 80.00

Filter and Media Properties
Filter Area (square metres) 80.00
Unlined Filter Media Perimeter (metres) 51.20
Saturated Hydraulic Conductivity (mm/hour) 100.00
Filter Depth (metres) 0.80
TN Content of Filter Media (mg/kg) 600
Orthophosphate Content of Filter Media (mg/kg) 40.0

Infiltration Properties
Exfiltration Rate (mm/hr) 0.00

Lining Properties
Is Base Lined? ☒ Yes ☐ No

Vegetation Properties
☒ Vegetated with Effective Nutrient Removal Plants
☐ Vegetated with Ineffective Nutrient Removal Plants
☐ Unvegetated

Outlet Properties
Overflow Weir Width (metres) 1.00
Underdrain Present? ☒ Yes ☐ No
Submerged Zone With Carbon Present? ☐ Yes ☒ No
Depth (metres) 0.00

Fluxes...
Notes...
More

X Cancel
< Back
✓ Finish

Note: The filter media shall have the above characteristics and a certificate shall be obtained from the supplier to confirm these parameters, in accordance with FAWB guidelines.
The vegetation/plant species selection will be done during detailed design in conjunction with the landscape Architect and in accordance with the Water by Design Bioretention Technical Design Guidelines.

6.2.1.5 RECEIVING NODES

The receiving node for the proposed development has been identified as Breakfast Creek for both concepts.

6.2.2 DEVELOPED MITIGATED SCENARIO (PROPOSED TREATMENT TRAIN)

The outputs of the model for each concept are shown in Figure 3 and 3, respectively.

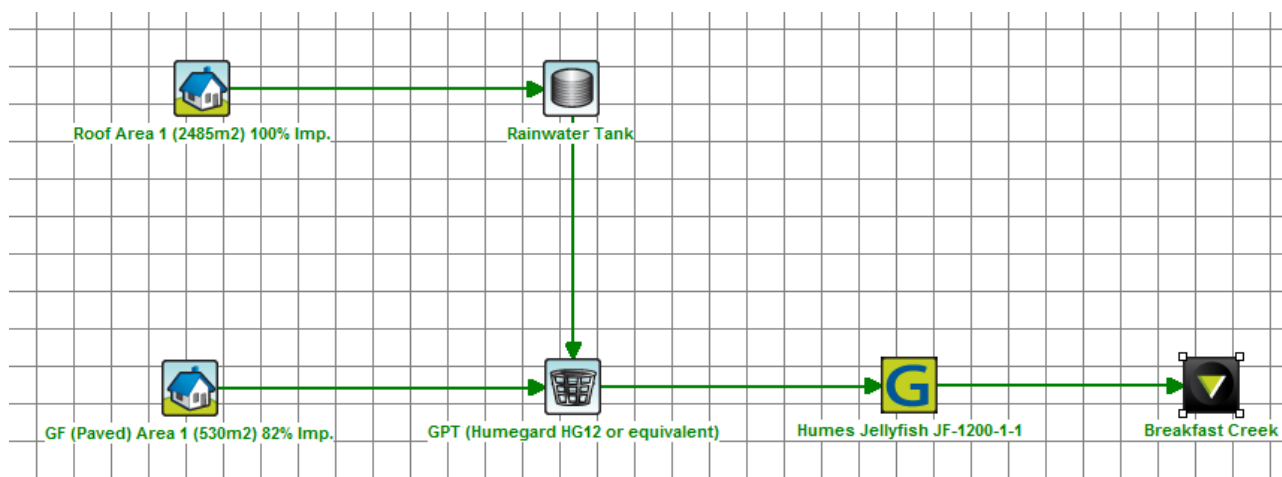


Figure 3 – Concept 1 Developed Mitigated Scenario

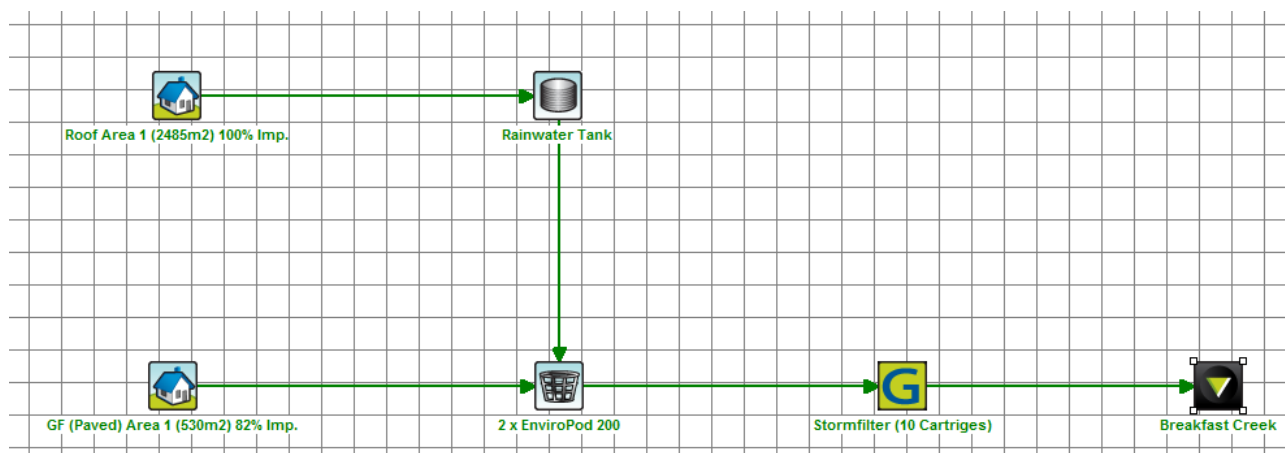


Figure 4 - Concept 2 Developed Mitigated Scenario

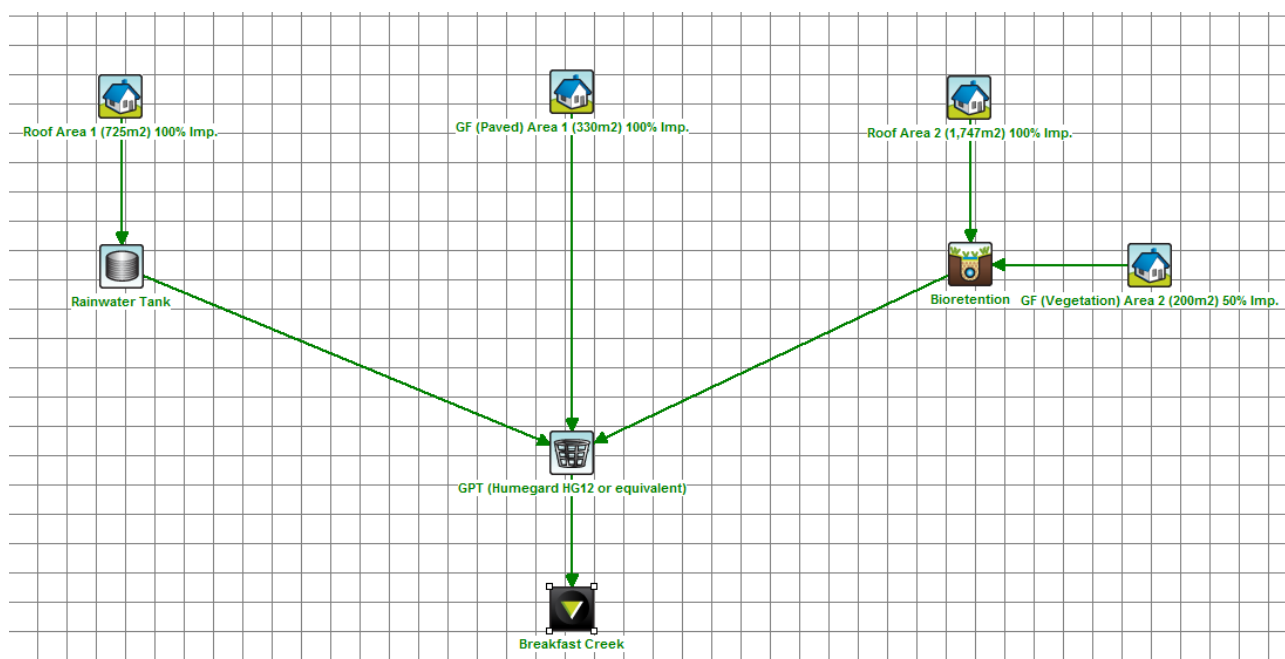


Figure 5 - Concept 3 Developed Mitigated Scenario

6.2.3 MUSIC RESULTS

A summary of the pollutant removal percentages for the proposed development, as modelled by MUSIC software, is provided in Table 7 and Table 8 for each concept, respectively. These results outline the effectiveness of the treatment train recommended for the proposed development. The results indicate that the load reductions achieved comply with State Planning Policy Stormwater Management Design Objectives.

Table 7 - Concept 1 Pollutant Load Reductions

	Sources	Residual Load	Reduction %	SPP WQOs %
Total Suspended Solids (kg/yr)	474	35.9	92.4	80
Total Phosphorus (kg/yr)	0.91	0.267	70.7	60
Total Nitrogen (kg/yr)	12.1	6.06	50.1	45
Gross Pollutants (kg/yr)	79.6	0	100	90

Table 8 - Concept 2 Pollutant Load Reductions

	Sources	Residual Load	Reduction %	SPP WQOs %
Total Suspended Solids (kg/yr)	443	47.8	89.2	80
Total Phosphorus (kg/yr)	0.901	0.346	61.6	60
Total Nitrogen (kg/yr)	11.7	6.17	47.2	45
Gross Pollutants (kg/yr)	79.6	0.0433	99.9	90

Table 9 - Concept 3 Pollutant Load Reductions

	Sources	Residual Load	Reduction %	SPP WQOs %
Total Suspended Solids (kg/yr)	579	86.5	85	80
Total Phosphorus (kg/yr)	0.871	0.344	60.5	60
Total Nitrogen (kg/yr)	12.4	3.36	72.8	45
Gross Pollutants (kg/yr)	79	1.33	98.3	90

The SQID devices proposed above are therefore recommended for adoption. The proposed SQID devices are to be further detailed during Design Development of the project.

As part of Design Development, other SQID devices may be adopted in lieu of the currently proposed devices, subject to satisfying the minimum stormwater quality design objectives, as per the State Planning Policy.

7. CONSTRUCTION PHASE

During the construction phase of the development, an Erosion and Sediment Control Program (E&SCP) will be implemented, in accordance with BCC Subdivision and Development Guidelines, to minimise water quality impacts. A detailed E&SCP will be prepared for the development, consistent with the requirements of Council's Erosion and Sediment Control Standard, and will be provided as part of the operational works.

8. MAINTENANCE

8.1 GROSS POLLUTANT TRAP

8.1.1 HUMEGARD

The Gross Pollutant Trap proposed for the site in Concept 1 and Concept 3 will be Humegard or equivalent. Maintenance of the Humegard is performed using vacuum trucks, generally once per year. A typical maintenance procedure, as per the Humegard Owner's Manual, is as follows:

- The cover over the holding tank is opened for cleaning
- The vacuum truck suction hose is dropped to the surface of the water in the holding chamber and skimmed across the surface to capture the floating litter
- The hose is then lowered to the bottom of the holding chamber to remove sunken sediment, organic matter, and litter.

Inspection of the Humegard should be performed every three months.

8.1.2 ENVIROPOD

The Gross Pollutant Trap proposed for the site in Concept 2 will be EnviroPod or equivalent. Maintenance of the EnviroPod is performed using an inductor truck or cleaned manually by hand. A typical maintenance procedure, as per the StormFilter EnviroPod Treatment Train Operations and Maintenance Manual, is as follows:

- Remove the grate
- Clean the filter bag either by use of an inductor truck or cleaning manually by hand. If an inductor truck is used, the material is sucked up before the filter bag is removed from the pit. If manually cleaning, the filter bag is removed from the pit before being emptied.
- Inspect the EnviroPod unit, checking all connections and joints and plastic pit seals.
- Reinstall filter bags and gully pit lids.

The material collected by the EnviroPod should be emptied when the level of material is no more than a half to two thirds the depth of the bag or when there is evidence of material overflow

8.2 JELLYFISH

The tertiary treatment system proposed on concept design one for the site will be the Jellyfish or equivalent. A typical maintenance procedure for the Jellyfish, as per the Jellyfish filter inspection and maintenance guide, is as follows:

- Removal of oil, floatable trash and debris
- Removal of sediment
- Rising and re-commissioning of filter cartridges
- Replacement of spent or damaged filter cartridge tentacles

Maintenance frequency of the Jellyfish is dependent on the specific pollutant loading characteristic of each site. Inspections should be performed as follows:

- Post-construction inspection is required prior to putting the Jellyfish into service
- A minimum of two inspections are recommended during the first year
- Inspection frequency in subsequent years is based on the inspections and maintenance plan performed on the first year of operation, generally once per year
- Inspections are recommended after major storm events

Inspections must be performed immediately after an oil, fuel or other chemical spill.

8.3 STORMFILTER

The secondary treatment system proposed for the site in Concept 2 will be the StormFilter or equivalent. There are two levels of maintenance developed for the StormFilter:

- Inspection and/or minor maintenance, which typically involves opening the flow restricting valves and cleaning vegetation and debris.
- Major maintenance, which typically includes cartridge recharging and may include disposal of materials.

A typical maintenance procedure for the StormFilter, as per the StormFilter EnviroPod Treatment Train Operations and Maintenance Manual, is as follows:

- Inspection/Minor Maintenance: Inspect the internal and external conditions of the vault, without entering the vault. Remove large debris and litter from the vault using a pole with a grapple or not on the end.

- Major Maintenance/Filter Cartridge Replacement:
 - Inspect the internal and external conditions of the vault, without entering the vault.
 - Remove top caps, upper seal and float from all cartridges within the vault.
 - Remove the three screws from the top perimeter of the cartridge hood.
 - Move the vacuum truck towards the StormFilter vault, and feed the vacuum nozzle into the cartridge bay and start the vacuum truck.
 - Place the vacuum nozzle directly on the filter media and completely remove the filter media from each cartridge. Remove the cartridges from the vault.
 - Deposited sediment from the floor of the vault is removed via vacuum truck.
 - Lower and install the new cartridges into the vault.

The frequency of maintenance of the StormFilter is dependent on the pollutant load characteristic of each site. Minor maintenance and inspection should be performed twice a year, and major maintenance and inspection should be performed once a year. The maintenance is usually performed in dry periods, in order to rejuvenate the filter media and prepare the system for the next rainy period. Inspections should be performed after heavy rain events and immediately after an oil, fuel or other chemical spill.

8.4 BIORETENTION BASIN

The tertiary treatment system proposed on concept design one for the site will be the bioretention. Bioretention basins require regular and pro-active maintenance to function effectively, to ensure long-term operation, and to minimise lifecycle costs. This section of the report provides a standard approach to maintenance of the various components of the proposed bioretention system.

8.4.1 VEGETATION

Vegetation within a bioretention system is critical in the removal of nutrients and maintenance of the rate of infiltration of the filter media. Care must be taken during the establishment phase to respond to any issues concerning the health of the plants as they arise.

Vegetation must be regularly watered during the establishment phase, with the frequency depending on the time of the year and weather patterns. The Water By Design Bioretention Technical Design Guidelines recommend watering frequencies, during the establishment phase, as follows:

- Weeks 1-6: Five waterings per week
- Weeks 6-10: Three waterings per week
- Weeks 11-15: Two waterings per week

The vegetation watering requirements following the establishment phase can be determined by ongoing inspections.

If the vegetation cover of the bioretention basin does not meet performance indicators, re-establishment of vegetation using new stock should occur.

8.4.2 WEED REMOVAL

Weed growth within a bioretention system can impact the health, cover and diversity of the vegetation, and can result in an excessive organic layer accumulating on the surface of the filter material. The removal and control of weeds in the proposed bioretention system shall be incorporated into a regular maintenance program.

8.4.3 FILTER MEDIA

The constant wetting of the filter surface may result in the growth of algal or moss. Inspection of the surface for the presence of algae or moss shall be incorporated into a regular maintenance program for the bioretention system. If the algal and moss growth cover is more than 10% of the filter media surface, the design of the bioretention system will need to be rectified.

8.4.4 MANAGING EROSION

Minor erosion in the bioretention system can extend to larger problems. Inspection of the surface of the bioretention system for signs of erosion shall be included in the regular maintenance program. If minor erosion occurs, re-profiling shall occur using hand tools or light machinery.

8.4.5 UNDER DRAIN

A cleanout riser pipe, connected to the underdrainage pipe, must be provided with the bioretention system to inspect and clean the underdrainage.

8.4.6 MAINTENANCE ACCESS

Maintenance access tracks must be included in the design of the bioretention system, to allow for easy access to the filter media and vegetation, and for sediment removal access.

9. CONCLUSION

The SBSMP has demonstrated that stormwater run-off from the proposed development can be adequately managed, from both stormwater quantity and quality perspectives through implementation of the recommended stormwater management concept plan (Refer to sketches in Appendix G).

9.1 STORMWATER QUANTITY MANAGEMENT

As the proposed development does not result in an increase of the impervious surfaces, the stormwater discharge flow rates, post-development, are not expected to differ from the current stormwater discharge flow rates.

9.2 FLOOD MITIGATION

As identified through BCC's PD Online, the site is located in close proximity to Breakfast Creek and Brisbane River, and is characterised by a predominately flat terrain. As indicated in the BCC FloodWise report, the current RL of the site ranges from 1.9m-2.4m AHD, which is below the Defined Flood Level (DFL) of 2.6m. A minimum floor level of the DFL plus 300mm is proposed to be adopted to provide flood immunity to the development.

9.3 STORMWATER QUALITY MANAGEMENT

Applying WSUD principles, the following stormwater quality treatment train has been recommended for the site:

Concept 1:

- The ground floor trafficable area (530m²), is proposed to be treated via a primary gross pollutant trap (proposed HumeGard or equivalent), followed by a secondary Stormwater Quality Improvement Device (SQID) (proposed Humes Jellyfish or equivalent) and discharging to the receiving node, i.e. Breakfast Creek.
- The rainwater run-off from the roof (2,485m²), is proposed to be collected in a rainwater tank. The rainwater will be re-used for irrigation and toilet flushing purposes. The overflow from the rainwater will be treated via a primary gross pollutant trap (HumeGard), followed by a secondary SQID (Jellyfish) and discharging to the receiving node, i.e. Breakfast Creek.

Concept 2:

- The ground floor trafficable area (530m²), is proposed to be treated via primary gross pollutant traps (proposed EnviroPod or equivalent), followed by a secondary Stormwater Quality Improvement Device (SQID) (proposed StormFilter or equivalent) and discharging to the receiving node, i.e. Breakfast Creek.
- The rainwater run-off from the roof (2,485m²), is proposed to be collected in a rainwater tank. The rainwater will be re-used for irrigation and toilet flushing purposes. The overflow from the rainwater will be treated via primary gross pollutant traps (EnviroPod), followed by a secondary SQID (StormFilter) and discharging to the receiving node, i.e. Breakfast Creek.

Concept 3:

- A portion of the ground floor trafficable area (330m²), is proposed to be treated via a series of primary gross pollutant traps. The remaining portion of ground floor area (200m²) is proposed to pass through a bioretention system (80m²). The outlet of the bioretention system will be discharge to the receiving node, i.e. Breakfast Creek.
- A portion of the rainwater run-off from the room (725m²) is proposed to be collected in a rainwater tank. The rainwater will be re-used for irrigation and toilet flushing purposes. The overflow from the rainwater tank will be treated via a primary gross pollutant trap. The remaining portion of the roof run-off will discharge through a bioretention system (80m²). The outlet from the bioretention system will be discharged to the receiving node, i.e. Breakfast Creek.

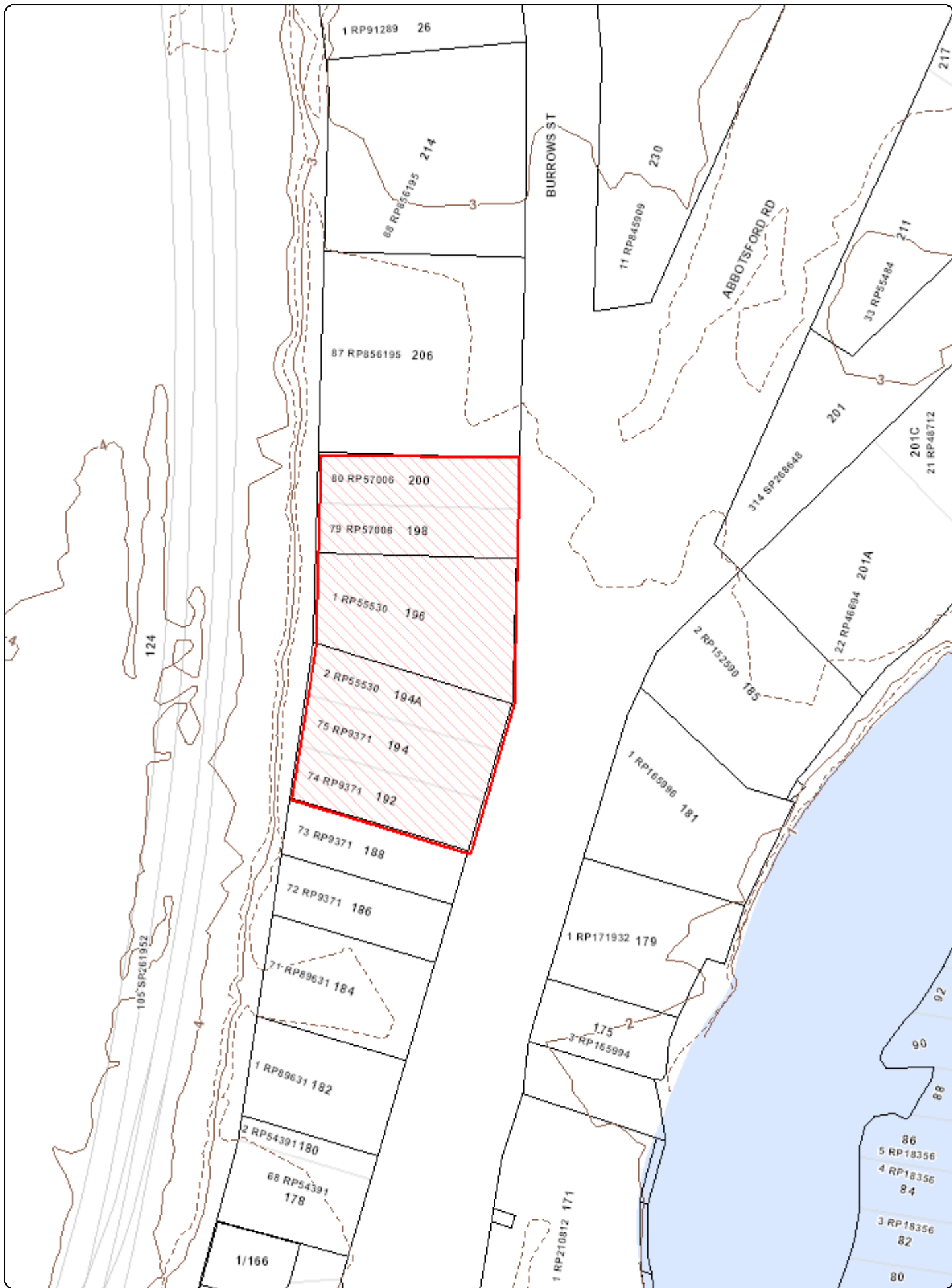
The above treatment trains have been modelled using MUSIC software. The resulting pollutant load reductions comply with the stormwater management design objectives, as per the Queensland State Planning Policy.

Therefore the impact of stormwater run-off (quantity and quality) from the proposed development is mitigated.

10. REFERENCES

- Bioretention Technical Design Guideline (2012), Water By Design
- Bureau of Meteorology, Australian Government website, <http://www.bom.gov.au/hydro/has/cdirswebx/cdirswebx.shtml>, visited on 21st May 2014.
- Guidelines for Pollutant Export Modelling in Brisbane (2003), Brisbane City Council, Version 7 – Draft, Supplement to BCC Water Quality Management Guidelines, October 2003
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- Queensland Urban Drainage Manual (provisional edition 2013), Queensland Government, Department of Energy and Water Supply, Third Edition 2013
- State Planning Policy 4/10: Healthy Waters, Queensland Government, Department of Environment and Resource Management
- State Planning Policy (2013), Queensland Government, Department of State Development, Infrastructure and Planning, December 2013
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- Water Quality Management Guidelines (2008), Brisbane City Council, Urban Management Division Subdivision and Development Guidelines, Part C, February 2008
- Water Sensitive Urban Design –MUSIC Modelling Guidelines (2010), Healthy Waterways, version 1, 2010.
- Water Sensitive Urban Design – Technical Design Guidelines for South East Queensland (2006), Healthy Waterways, version 1, June 2006.

APPENDIX A: CONTOUR MAP



Brisbane City Plan 2014

© Copyright Brisbane City Council 2014

NOTES

This map is notional only and should not be used for interpreting City Plan provisions relating to specific sites. To properly interpret the maps, the planning scheme must be referred to. The Digital Cadastre Database (supplied by State of Queensland - Department of Natural Resources and Mines) will be updated from time to time.

Mapping adopted by Council, effective 12 September 2014.

Council and the copyright owners permit the use of the data on this map, but the Council and copyright owners give no warranty in relation to the data (including accuracy, reliability, completeness, currency or suitability) and accept no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage), relating to any use of this data.

Projection: Map Grid of Australia, Zone 56
Horizontal Datum: Geocentric Datum of Australia 1994

Approximate Scale @ A4 1:1,000

0 30

Metres



BRISBANE CITY
Planning Scheme

Date: 6/02/2015

Page 1

Legend

- LGA Name
- LGA Boundary
- Labels - NAVTEQ_Str...
- Street Number
- Lot and Plan
- Railway Line
- Airport Roads
- Waterbody
- Waterway Area
- Waterway Line (BCC Masked)
- Drainageline

Brisbane City Plan 2014

© Copyright Brisbane City Council 2014

NOTES

This map is notional only and should not be used for interpreting City Plan provisions relating to specific sites. To properly interpret the maps, the planning scheme must be referred to. The Digital Cadastre Database (supplied by State of Queensland - Department of Natural Resources and Mines) will be updated from time to time.

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Projection: Map Grid of Australia, Zone 56
Horizontal Datum: Geocentric Datum of Australia 1994



BRISBANE CITY
Planning Scheme

APPENDIX B: FLOODWISE REPORT



Brisbane City Council FloodWise Property Report

Report Reference

3219703

27/11/2014 11:44:16

Dedicated to a better Brisbane

THIS REPORT IS FOR BUILDING AND DEVELOPMENT PURPOSES ONLY

The FloodWise Property Report provides property or lot-based flood information for building and development requirements. This report provides information on estimated flood levels, habitable floor level requirements and more technical information on the four sources of flooding: river, creek / waterway, storm tide and overland flow. Refer to the Useful Definitions section for a glossary of terms.

To find out more about how the contents of this report may affect building or development on this property, please visit www.brisbane.qld.gov.au/planning-building. For more general information about understanding your flood risk and how to prepare your property, family or business for potential flooding visit www.brisbane.qld.gov.au/beprepared

PROPERTY DETAILS:

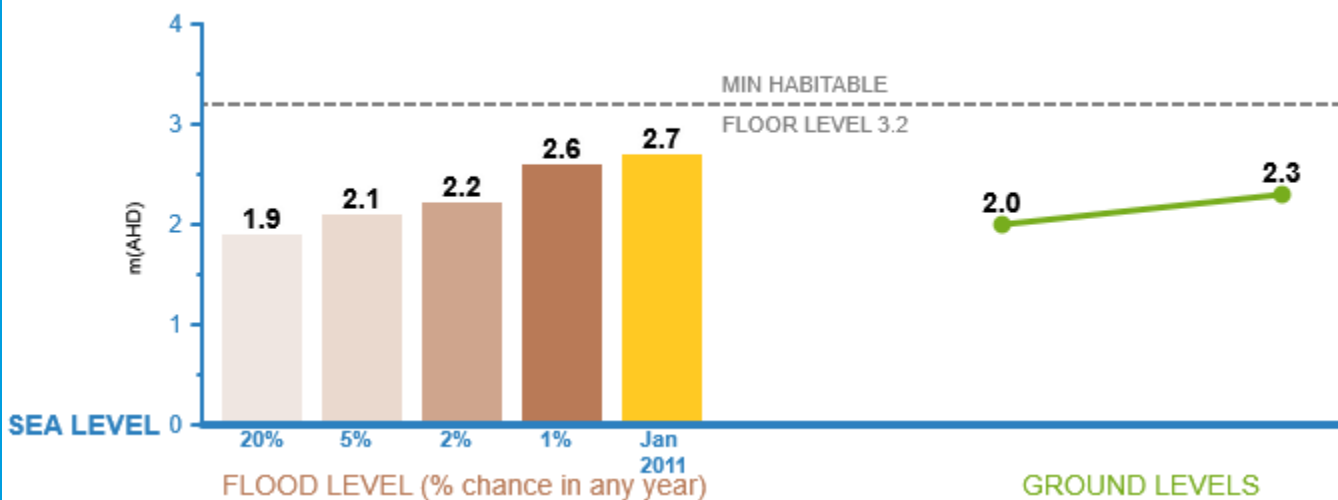
Address: 200 ABBOTSFORD RD, BOWEN HILLS QLD 4006

Lot Details: L.80 RP.57006, L.79 RP.57006

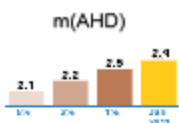
Multiple Lot warning

The Property being reported on contains multiple lots. This report is a summary for the entire Property. To obtain a Lot specific report, please use the search tool to search for the specific Lot you wish to report on.

FLOOD LEVEL INFORMATION



EXPLANATION



m(AHD) - Metres Australia Height Datum. The level of 0.0m AHD is approximately mean sea level.

Flood Levels - The Flood level bar chart above shows the possible flooding level and percentage chance of that level being reached or exceeded in any year. If an orange bar shows, it is the calculated January 2011 flood level at this address or lot.

Minimum Habitable Floor Level - Applies to residential development only. Please refer to Council's planning scheme to learn how this may affect you. If a property is in an overland flow path, or a large allotment, a minimum habitable floor level cannot be provided. Refer flood and planning development flags below.

Ground Levels - The green line above shows this property's approximate lowest and highest ground levels based on latest available information (2009 airborne laser survey) to Council. If you are building, please confirm with a surveyor.

For further information and definitions please refer to the Useful Definitions page



Brisbane City Council FloodWise Property Report

Report Reference

3219703

27/11/2014 11:44:16

Dedicated to a better Brisbane

TECHNICAL SUMMARY

This section of the FloodWise Property Report contains more detailed flood information for this property so surveyors, builders, certifiers, architects and engineers can plan and build in accordance with Council's planning scheme. For more information about building and development in Brisbane please visit www.brisbane.qld.gov.au/planning-building or talk to a Development Assessment Planning Information Officer via Council's Contact Centre on (07) 3403 8888.

PROPERTY DETAILS:

Address: 200 ABBOTSFORD RD, BOWEN HILLS QLD 4006

Lot Details: L.80 RP.57006, L.79 RP.57006

Multiple Lot warning

The Property being reported on contains multiple lots. This report is a summary for the entire Property. To obtain a Lot specific report, please use the search tool to search for the specific Lot you wish to report on.

PROPERTY INFORMATION (Summary)

The following table provides a summary of flood information for this property. More detailed flood level information is provided in the following sections of this report.

PROPERTY SUMMARY	LEVEL (mAHD)
Minimum Ground Level	2.0
Maximum Ground Level	2.3
Min Habitable Floor Level	3.2
Residential Flood Level (RFL)	2.7
Residential Flood Level Source	RIVER
Source of Highest Flooding	RIVER
Flooding may also occur from	STORM TIDE,CREEK/WATERWAY

ESTIMATED PEAK FLOODING LEVELS

The table below displays the peak estimated flood levels by probability for this property. Estimated flood level data should be used in conjunction with applicable planning scheme requirements - Refer to Flood Planning Development Information.

Note that the overland flow flooding level maybe higher than the levels below from other sources.

DESCRIPTION	LEVEL (mAHD)	SOURCE
20% AEP	1.9	STORM TIDE
5% AEP	2.1	STORM TIDE
2% AEP	2.2	STORM TIDE
1% AEP	2.6	CREEK/WATERWAY
January 2011	2.7	RIVER
DFL	2.6	CREEK/WATERWAY
RFL	2.7	RIVER

FLOOD PLANNING DEVELOPMENT INFORMATION

This section of the FloodWise Property Report contains information about Council's planning scheme overlays. Overlays identify areas within the planning scheme that reflect distinct themes that may include constrained land and/or areas sensitive to the effects of development.

FLOOD OVERLAY CODE

The Flood overlay code of Council's planning scheme uses the following information to provide guidelines when developing properties. The table below summarises the Flood Planning Areas (FPAs) that apply to this property. Development guidelines for the FPAs are explained in Council's planning scheme, which is available from www.brisbane.qld.gov.au/planning-building.

FLOOD PLANNING AREAS (FPA)		
RIVER	CREEK/WATERWAY	OVERLAND FLOW
FPA3		Not Applicable
FPA4	FPA4	

COASTAL HAZARD OVERLAY CODE

The coastal hazard overlay code of Council's planning scheme uses the following information to provide guidelines when conducting new development. The table below summarises the coastal hazard categories that apply to this property. Development guidelines for the following coastal hazard overlay sub-categories are explained in the planning scheme, which is available from www.brisbane.qld.gov.au/planning-building.

COASTAL HAZARD OVERLAY SUB-CATEGORIES
Medium Storm Tide Inundation Area
Erosion Prone – Coastal Erosion
Erosion Prone Area - permanent inundation by 2100
Coastal Management District

NOTE: Where land is identified within one or more flood planning area on the Flood Overlay, or is identified within a Storm Tide Inundation area on the Coastal Hazard Overlay, the assessment criteria that provide the highest level of protection from any source of flooding applies.



Brisbane City Council FloodWise Property Report

Report Reference

3219703

27/11/2014 11:44:16

Dedicated to a better Brisbane

Useful Definitions

Australian Height Datum (AHD) - The reference level for defining ground levels in Australia. The level of 0.0m AHD is approximately mean sea level.

Annual Exceedance Probability (AEP) – The probability of a flood event of a given size occurring in any one year, usually expressed as a percentage annual chance.

Defined Flood Level (DFL) - The DFL for Brisbane River flooding is a level of 3.7m AHD at the Brisbane City Gauge based on a flow of 6,800 m³/s.

Maximum and Minimum Ground Level – Highest and lowest ground levels on the property based on available ground level information. A Registered Surveyor can confirm exact ground levels.

Minimum Habitable Floor Level – The minimum level in metres AHD at which habitable areas of development (generally including bedrooms, living rooms, kitchen, study, family and rumpus rooms) must be constructed.

Council's Planning Scheme - The City Plan (planning scheme) has been prepared in accordance with the Sustainable Planning Act as a framework for managing development in a way that advances the purpose of the Act. In seeking to achieve this purpose, the planning scheme sets out the Council's intention for future development in the planning scheme area, over the next 20 years.

Residential Flood Level (RFL) – Residential flood level (RFL) for Brisbane River flooding equates to the flood level applicable to the extent of January 2011 floods as depicted by mapping on the Queensland Reconstruction Authority website or the Council's defined flood level (DFL) for the Brisbane River, whichever is higher.

Brisbane City Council's Online Flood Tools

Council provides a number of online flood tools:

- to guide planning and development
- to help residents and businesses understand their flood risk and prepare for flooding.

Planning and Development Online Flood Tools

Council's online flood tools for planning and development purposes include:

- FloodWise Property Report
- Flood Overlay Code

For more information on Council's planning scheme and online flood tools for planning and development:

- phone 07 3403 8888 to talk to a Development Assessment Customer Liaison Officer
- visit www.brisbane.qld.gov.au/planning-building
- visit a Regional Business Centre.

Helping residents and businesses be prepared for flooding

Council has a range of free tools and information to help residents and businesses understand potential flood risks and how to be prepared. This includes:

- Flood Awareness Maps
- Flooding in Brisbane – A Guide for Residents
- Flooding in Brisbane – A Guide for Business
- Early Warning Alert Service. Visit www.brisbane.qld.gov.au/earlywarning to register for email, home phone or SMS severe weather alert updates.

Note: The Flood Awareness Maps show four levels of flood risk from high risk (flooding is very likely to occur) through to very low risk (very rare and extreme flood events). Flooding in the low and very low risk areas has no planning and development requirements and is therefore not reflected in the FloodWise Property Report.

For more information on Council's online flood tools for residents and business:

- Visit www.brisbane.qld.gov.au/beprepared
- Phone (07) 3403 8888.



Brisbane City Council FloodWise Property Report

Report Reference

3219703

27/11/2014 11:44:16

Dedicated to a better Brisbane

Disclaimer

1. Defined Flood Levels and Residential Flood Levels, and the Minimum Habitable Floor Levels are determined from the best available information to Council at the date of issue. These flood levels, for a particular property, may change if more detailed information becomes available or changes are made in the method of calculating flood levels.
2. Council makes no warranty or representation regarding the accuracy or completeness of a FloodWise Property report. Council disclaims any responsibility or liability in relation to the use or reliance by any person on a FloodWise Property Report.



Planning to build or renovate?

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You can also find the Brisbane City Plan 2014 and Neighbourhood Plans as well as other information and training videos to help with your building and development plans.



Brisbane City Council FloodWise Property Report

Report Reference

3219705

27/11/2014 11:49:56

Dedicated to a better Brisbane

THIS REPORT IS FOR BUILDING AND DEVELOPMENT PURPOSES ONLY

The FloodWise Property Report provides property or lot-based flood information for building and development requirements. This report provides information on estimated flood levels, habitable floor level requirements and more technical information on the four sources of flooding: river, creek / waterway, storm tide and overland flow. Refer to the Useful Definitions section for a glossary of terms.

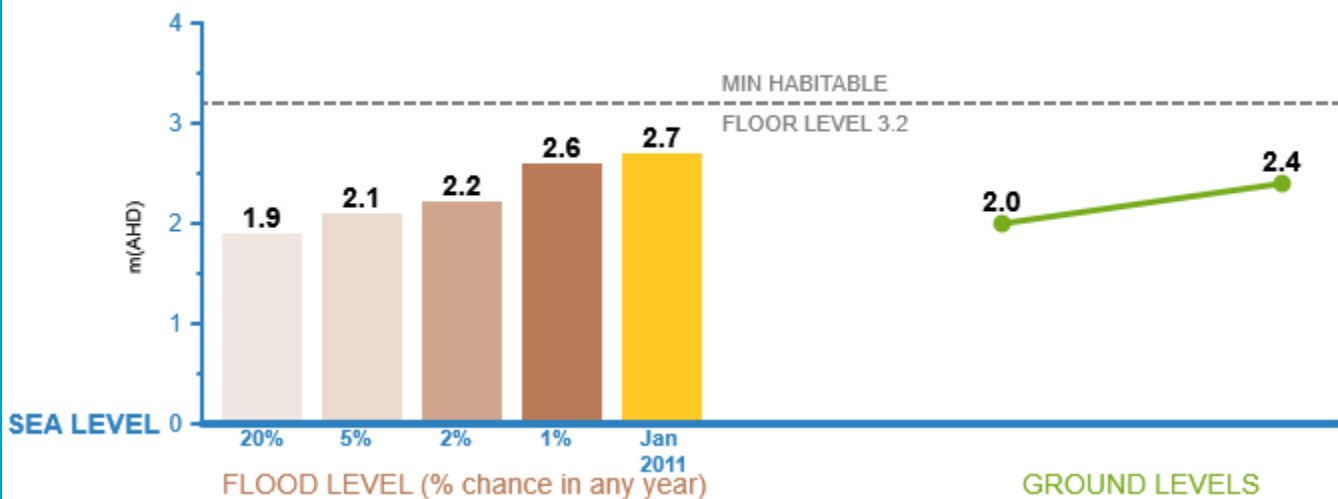
To find out more about how the contents of this report may affect building or development on this property, please visit www.brisbane.qld.gov.au/planning-building. For more general information about understanding your flood risk and how to prepare your property, family or business for potential flooding visit www.brisbane.qld.gov.au/beprepared

PROPERTY DETAILS:

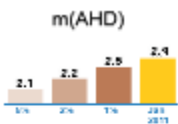
Address: 196 ABBOTSFORD RD, BOWEN HILLS QLD 4006

Lot Details: L.1 RP.55530

FLOOD LEVEL INFORMATION



EXPLANATION



m(AHD) - Metres Australia Height Datum. The level of 0.0m AHD is approximately mean sea level.

Flood Levels - The Flood level bar chart above shows the possible flooding level and percentage chance of that level being reached or exceeded in any year. If an orange bar shows, it is the calculated January 2011 flood level at this address or lot.

Minimum Habitable Floor Level - Applies to residential development only. Please refer to Council's planning scheme to learn how this may affect you. If a property is in an overland flow path, or a large allotment, a minimum habitable floor level cannot be provided. Refer flood and planning development flags below.

Ground Levels - The green line above shows this property's approximate lowest and highest ground levels based on latest available information (2009 airborne laser survey) to Council. If you are building, please confirm with a surveyor.

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Brisbane City Council FloodWise Property Report

Report Reference

3219705

27/11/2014 11:49:56

Dedicated to a better Brisbane

TECHNICAL SUMMARY

This section of the FloodWise Property Report contains more detailed flood information for this property so surveyors, builders, certifiers, architects and engineers can plan and build in accordance with Council's planning scheme. For more information about building and development in Brisbane please visit www.brisbane.qld.gov.au/planning-building or talk to a Development Assessment Planning Information Officer via Council's Contact Centre on (07) 3403 8888.

PROPERTY DETAILS:

Address: 196 ABBOTSFORD RD, BOWEN HILLS QLD 4006

Lot Details: L.1 RP.55530

PROPERTY INFORMATION (Summary)

The following table provides a summary of flood information for this property. More detailed flood level information is provided in the following sections of this report.

PROPERTY SUMMARY	LEVEL (mAHD)
Minimum Ground Level	2.0
Maximum Ground Level	2.4
Min Habitable Floor Level	3.2
Residential Flood Level (RFL)	2.7
Residential Flood Level Source	RIVER
Source of Highest Flooding	RIVER
Flooding may also occur from	STORM TIDE,CREEK/WATERWAY

ESTIMATED PEAK FLOODING LEVELS

The table below displays the peak estimated flood levels by probability for this property. Estimated flood level data should be used in conjunction with applicable planning scheme requirements - Refer to Flood Planning Development Information.

Note that the overland flow flooding level maybe higher than the levels below from other sources.

DESCRIPTION	LEVEL (mAHD)	SOURCE
20% AEP	1.9	STORM TIDE
5% AEP	2.1	STORM TIDE
2% AEP	2.2	STORM TIDE
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January 2011	2.7	RIVER
DFL	2.6	CREEK/WATERWAY
RFL	2.7	RIVER

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This section of the FloodWise Property Report contains information about Council's planning scheme overlays. Overlays identify areas within the planning scheme that reflect distinct themes that may include constrained land and/or areas sensitive to the effects of development.

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FLOOD PLANNING AREAS (FPA)		
RIVER	CREEK/WATERWAY	OVERLAND FLOW
FPA3		Not Applicable
FPA4	FPA4	

COASTAL HAZARD OVERLAY CODE

The coastal hazard overlay code of Council's planning scheme uses the following information to provide guidelines when conducting new development. The table below summarises the coastal hazard categories that apply to this property. Development guidelines for the following coastal hazard overlay sub-categories are explained in the planning scheme, which is available from www.brisbane.qld.gov.au/planning-building.

COASTAL HAZARD OVERLAY SUB-CATEGORIES
High Storm Tide Inundation Area
Medium Storm Tide Inundation Area
Erosion Prone – Coastal Erosion
Erosion Prone Area - permanent inundation by 2100
Coastal Management District

NOTE: Where land is identified within one or more flood planning area on the Flood Overlay, or is identified within a Storm Tide Inundation area on the Coastal Hazard Overlay, the assessment criteria that provide the highest level of protection from any source of flooding applies.



Brisbane City Council FloodWise Property Report

Report Reference

3219705

27/11/2014 11:49:56

Dedicated to a better Brisbane

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Brisbane City Council FloodWise Property Report

Report Reference

3219705

27/11/2014 11:49:56

Dedicated to a better Brisbane

Disclaimer

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Brisbane City Council FloodWise Property Report

Report Reference

3219707

27/11/2014 11:51:12

Dedicated to a better Brisbane

THIS REPORT IS FOR BUILDING AND DEVELOPMENT PURPOSES ONLY

The FloodWise Property Report provides property or lot-based flood information for building and development requirements. This report provides information on estimated flood levels, habitable floor level requirements and more technical information on the four sources of flooding: river, creek / waterway, storm tide and overland flow. Refer to the Useful Definitions section for a glossary of terms.

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PROPERTY DETAILS:

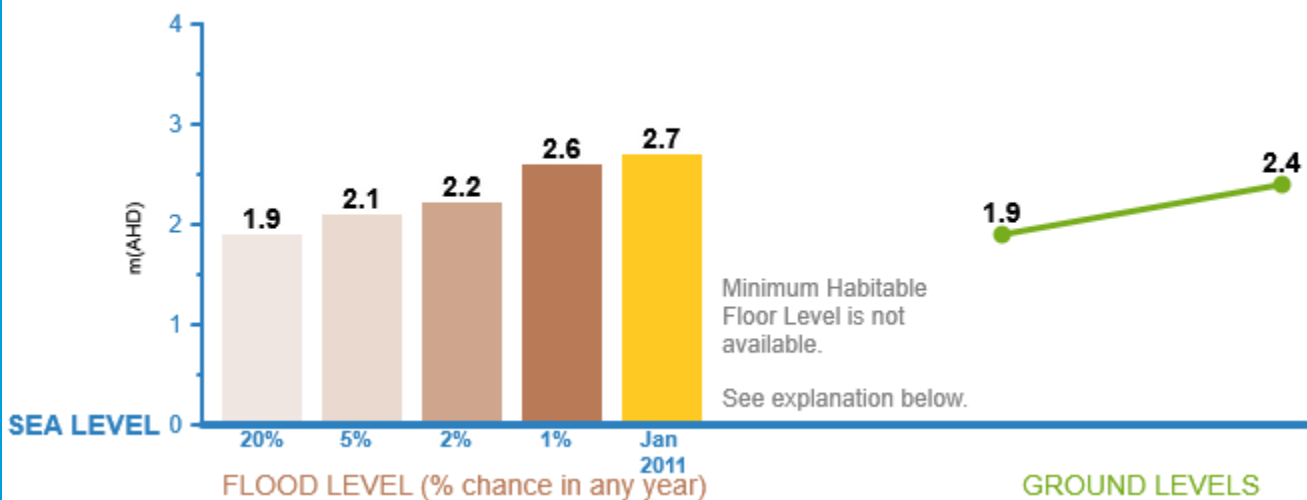
Address: 192 ABBOTSFORD RD, BOWEN HILLS QLD 4006

Lot Details: L.74 RP.9371, L.2 RP.55530, L.75 RP.9371 *This landholding has more than one street address*

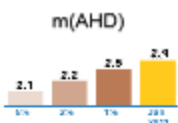
Multiple Lot warning

The Property being reported on contains multiple lots. This report is a summary for the entire Property. To obtain a Lot specific report, please use the search tool to search for the specific Lot you wish to report on.

FLOOD LEVEL INFORMATION



EXPLANATION



m(AHD) - Metres Australia Height Datum. The level of 0.0m AHD is approximately mean sea level.

Flood Levels - The Flood level bar chart above shows the possible flooding level and percentage chance of that level being reached or exceeded in any year. If an orange bar shows, it is the calculated January 2011 flood level at this address or lot.

Minimum Habitable Floor Level - Applies to residential development only. Please refer to Council's planning scheme to learn how this may affect you. If a property is in an overland flow path, or a large allotment, a minimum habitable floor level cannot be provided. Refer flood and planning development flags below.

Ground Levels - The green line above shows this property's approximate lowest and highest ground levels based on latest available information (2009 airborne laser survey) to Council. If you are building, please confirm with a surveyor.

For further information and definitions please refer to the Useful Definitions page

FLOOD AND PLANNING DEVELOPMENT FLAGS

DEVELOPMENT
FLAG(S)

This property is affected by one or more flood or property development overlay or flags. These are: LARGE ALLOTMENT

Please review the technical summary over page for more detail.



Brisbane City Council FloodWise Property Report

Report Reference

3219707

27/11/2014 11:51:12

Dedicated to a better Brisbane

TECHNICAL SUMMARY

This section of the FloodWise Property Report contains more detailed flood information for this property so surveyors, builders, certifiers, architects and engineers can plan and build in accordance with Council's planning scheme. For more information about building and development in Brisbane please visit www.brisbane.qld.gov.au/planning-building or talk to a Development Assessment Planning Information Officer via Council's Contact Centre on (07) 3403 8888.

PROPERTY DETAILS:

Address: 192 ABBOTSFORD RD, BOWEN HILLS QLD 4006

Lot Details: L.74 RP.9371, L.2 RP.55530, L.75 RP.9371

Multiple Lot warning

The Property being reported on contains multiple lots. This report is a summary for the entire Property. To obtain a Lot specific report, please use the search tool to search for the specific Lot you wish to report on.

PROPERTY INFORMATION (Summary)

The following table provides a summary of flood information for this property. More detailed flood level information is provided in the following sections of this report.

PROPERTY SUMMARY	LEVEL (mAHD)
Minimum Ground Level	1.9
Maximum Ground Level	2.4
Min Habitable Floor Level	Contact Council
Residential Flood Level (RFL)	2.7
Residential Flood Level Source	RIVER
Source of Highest Flooding	RIVER
Flooding may also occur from	STORM TIDE,CREEK/WATERWAY

ESTIMATED PEAK FLOODING LEVELS

The table below displays the peak estimated flood levels by probability for this property. Estimated flood level data should be used in conjunction with applicable planning scheme requirements - Refer to Flood Planning Development Information.

Note that the overland flow flooding level maybe higher than the levels below from other sources.

DESCRIPTION	LEVEL (mAHD)	SOURCE
20% AEP	1.9	STORM TIDE
5% AEP	2.1	STORM TIDE
2% AEP	2.2	STORM TIDE
1% AEP	2.6	CREEK/WATERWAY
January 2011	2.7	RIVER
DFL	2.6	CREEK/WATERWAY
RFL	2.7	RIVER

FLOOD PLANNING DEVELOPMENT INFORMATION

This section of the FloodWise Property Report contains information about Council's planning scheme overlays. Overlays identify areas within the planning scheme that reflect distinct themes that may include constrained land and/or areas sensitive to the effects of development.

FLOOD OVERLAY CODE

The Flood overlay code of Council's planning scheme uses the following information to provide guidelines when developing properties. The table below summarises the Flood Planning Areas (FPAs) that apply to this property. Development guidelines for the FPAs are explained in Council's planning scheme, which is available from www.brisbane.qld.gov.au/planning-building.

FLOOD PLANNING AREAS (FPA)		
RIVER	CREEK/WATERWAY	OVERLAND FLOW
FPA3		Not Applicable
FPA4	FPA4	

COASTAL HAZARD OVERLAY CODE

The coastal hazard overlay code of Council's planning scheme uses the following information to provide guidelines when conducting new development. The table below summarises the coastal hazard categories that apply to this property. Development guidelines for the following coastal hazard overlay sub-categories are explained in the planning scheme, which is available from www.brisbane.qld.gov.au/planning-building.

COASTAL HAZARD OVERLAY SUB-CATEGORIES
High Storm Tide Inundation Area
Medium Storm Tide Inundation Area
Erosion Prone – Coastal Erosion
Erosion Prone Area - permanent inundation by 2100
Coastal Management District

NOTE: Where land is identified within one or more flood planning area on the Flood Overlay, or is identified within a Storm Tide Inundation area on the Coastal Hazard Overlay, the assessment criteria that provide the highest level of protection from any source of flooding applies.

PROPERTY DEVELOPMENT FLAGS

Large Allotment - This property is a Large Allotment of over 1000 square metres. Flood levels may vary significantly across allotments of this size. Further investigations may be warranted in determining the variation in flood levels and the minimum habitable floor level across the site. For more information or advice, it is recommended you engage a Registered Professional Engineer of Queensland.



Brisbane City Council FloodWise Property Report

Report Reference

3219707

27/11/2014 11:51:12

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Useful Definitions

Australian Height Datum (AHD) - The reference level for defining ground levels in Australia. The level of 0.0m AHD is approximately mean sea level.

Annual Exceedance Probability (AEP) – The probability of a flood event of a given size occurring in any one year, usually expressed as a percentage annual chance.

Defined Flood Level (DFL) - The DFL for Brisbane River flooding is a level of 3.7m AHD at the Brisbane City Gauge based on a flow of 6,800 m³/s.

Maximum and Minimum Ground Level – Highest and lowest ground levels on the property based on available ground level information. A Registered Surveyor can confirm exact ground levels.

Minimum Habitable Floor Level – The minimum level in metres AHD at which habitable areas of development (generally including bedrooms, living rooms, kitchen, study, family and rumpus rooms) must be constructed.

Council's Planning Scheme - The City Plan (planning scheme) has been prepared in accordance with the Sustainable Planning Act as a framework for managing development in a way that advances the purpose of the Act. In seeking to achieve this purpose, the planning scheme sets out the Council's intention for future development in the planning scheme area, over the next 20 years.

Residential Flood Level (RFL) – Residential flood level (RFL) for Brisbane River flooding equates to the flood level applicable to the extent of January 2011 floods as depicted by mapping on the Queensland Reconstruction Authority website or the Council's defined flood level (DFL) for the Brisbane River, whichever is higher.

Brisbane City Council's Online Flood Tools

Council provides a number of online flood tools:

- to guide planning and development
- to help residents and businesses understand their flood risk and prepare for flooding.

Planning and Development Online Flood Tools

Council's online flood tools for planning and development purposes include:

- FloodWise Property Report
- Flood Overlay Code

For more information on Council's planning scheme and online flood tools for planning and development:

- phone 07 3403 8888 to talk to a Development Assessment Customer Liaison Officer
- visit www.brisbane.qld.gov.au/planning-building
- visit a Regional Business Centre.

Helping residents and businesses be prepared for flooding

Council has a range of free tools and information to help residents and businesses understand potential flood risks and how to be prepared. This includes:

- Flood Awareness Maps
- Flooding in Brisbane – A Guide for Residents
- Flooding in Brisbane – A Guide for Business
- Early Warning Alert Service. Visit www.brisbane.qld.gov.au/earlywarning to register for email, home phone or SMS severe weather alert updates.

Note: The Flood Awareness Maps show four levels of flood risk from high risk (flooding is very likely to occur) through to very low risk (very rare and extreme flood events). Flooding in the low and very low risk areas has no planning and development requirements and is therefore not reflected in the FloodWise Property Report.

For more information on Council's online flood tools for residents and business:

- Visit www.brisbane.qld.gov.au/beprepared
- Phone (07) 3403 8888.



Brisbane City Council FloodWise Property Report

Report Reference

3219707

27/11/2014 11:51:12

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Disclaimer

1. Defined Flood Levels and Residential Flood Levels, and the Minimum Habitable Floor Levels are determined from the best available information to Council at the date of issue. These flood levels, for a particular property, may change if more detailed information becomes available or changes are made in the method of calculating flood levels.
2. Council makes no warranty or representation regarding the accuracy or completeness of a FloodWise Property report. Council disclaims any responsibility or liability in relation to the use or reliance by any person on a FloodWise Property Report.



Planning to build or renovate?

For information, guidelines, tools and resources to help you track, plan or apply for your development visit www.brisbane.qld.gov.au/planning-building

You can also find the Brisbane City Plan 2014 and Neighbourhood Plans as well as other information and training videos to help with your building and development plans.

APPENDIX C: FLOOD AWARENESS MAP



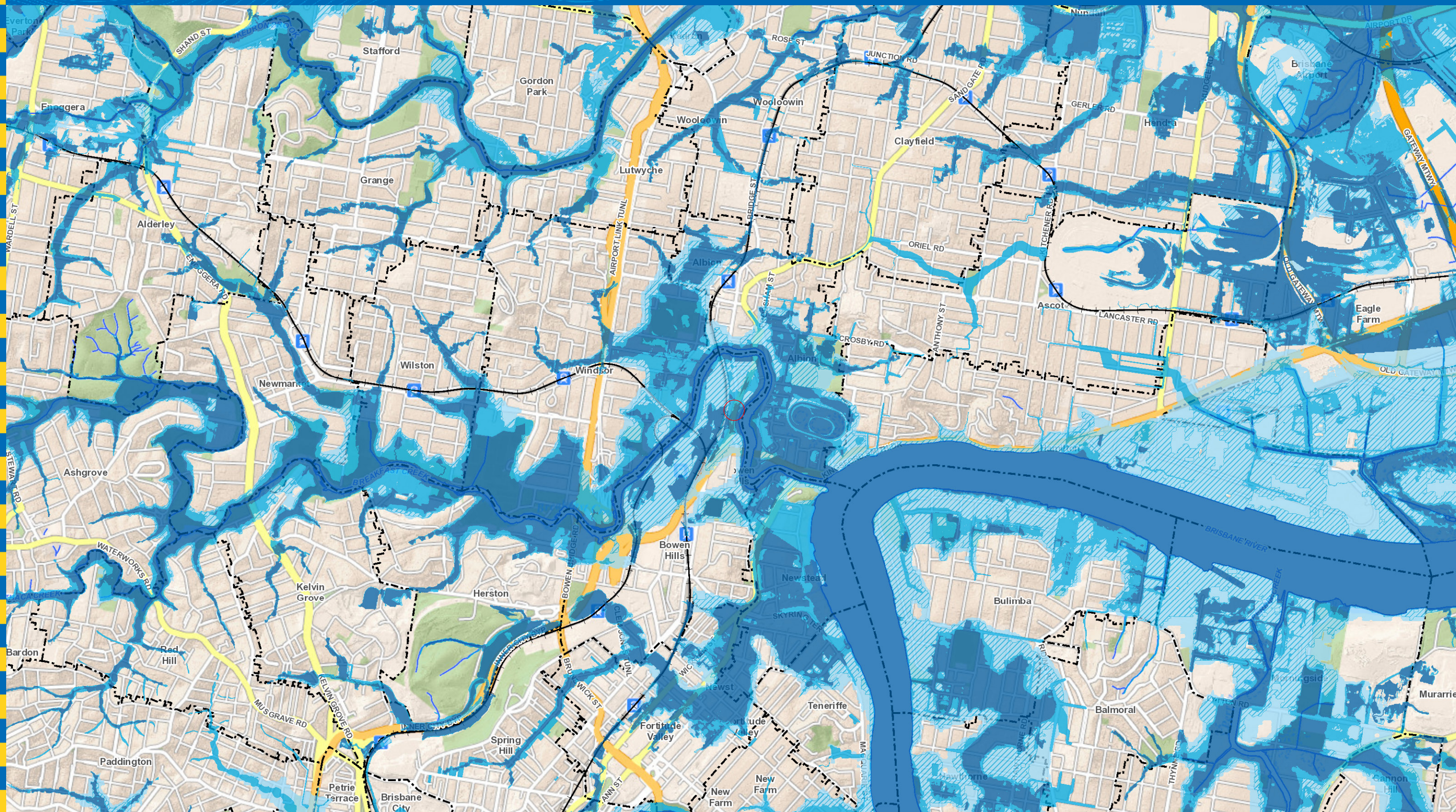
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Map produced on 11/2/2015 at 1:39 PM

FLOOD AWARENESS MAP

192 ABBOTSFORD RD, BOWEN HILLS (74RP9371)

Be Aware.
Be Prepared.



High Flood Risk

Flooding is almost certain to occur in a high risk area. Residents and businesses are strongly advised to learn about the flood risk for their property so they can be prepared to help minimise the impact on their home, business and family.

Medium Flood Risk

Flooding is likely to occur in a medium risk area. Residents and businesses are advised to learn about the flood risk for their property so they can be prepared to help minimise the impact on their home, business and family.

Low Flood Risk

A low flood risk area may experience flooding in a rare flood event. Flooding is unlikely in a low flood risk area, but may still occur.

Very Low Flood Risk

A very low flood risk area is unlikely to flood except in a very rare or extreme flood event. Flooding is very unlikely in a very low flood risk area, but may still occur.

Residents and businesses should consider how flooding may affect their local suburb, area or community.

This map uses data produced via computer modelling. The information is for awareness purposes. Please consider that you may need individual professional advice. Council makes no warranty or representation regarding the accuracy or completeness of a Flood Awareness Map and disclaims all liability to any person arising directly or indirectly from using the Flood Awareness Maps. For flood information relating to building or renovating visit www.brisbane.qld.gov.au/planning-building

0 250 500 750 1,000
Meters

Publisher:
Publication Date:
Reference:
Projection:
Horizontal Datum:

Brisbane City Council
11/2/2015
BWM04699
Map Grid of Australia, Zone 56
Geodetic Datum of Australia

Cadastre © 2012 Department of Natural Resources and Mines
2010 NAVTEQ Street Data © 2010 NAVTEQ
© Brisbane City Council 2012 ESRI Australia

How to prepare for flooding

Council is working hard to reduce the impact of flooding but we all have a responsibility to understand our flood risk and how to be better prepared to minimise the impact on our homes and businesses. **Once you have used Council's Flood Awareness Map to identify the flood risk for your property, use the tips in this table to put a plan in place for your home and family.**

 **strongly advised**  **advised**

Brisbane's weather

Understand Brisbane's climate and weather patterns

- Sign up for Council's Severe Weather Early Warning Alert Service. www.brisbane.qld.gov.au/earlywarning.
- Pay attention to radio, television and online weather updates.
- Visit www.bom.gov.au for the latest weather updates.

Flooding and your property

Understand how water flows in and around your property and street

- Observe where water flows from and to during heavy rain. This will indicate the path of potential floodwaters.
- Consider that properties near a river, creek, gully or tidal waterway are more likely to flood.
- Consider how fast moving flood waters may damage your home and interfere with evacuation plans.
- Consider loss of power, road closures and interruptions to public transport.
- Consider how close your property is to bordering other Flood Awareness Map risk areas.

Building or renovating

Check Brisbane's City Plan

- You must comply with City Plan planning requirements. Visit www.brisbane.qld.gov.au/planning-building.
- Download a FloodWise Property Report for information about building and development for a specific property. Visit www.brisbane.qld.gov.au/planning-building.

Insurance

Make sure you are appropriately insured

- Talk to your insurer about flood insurance and your property.

Have an evacuation plan

Create an emergency plan and emergency kit

- Prepare an emergency kit.
- Have emergency contact phone numbers easily accessible.
- Consider your pets. They may need temporary to long-term alternative shelter away from your home during a flood.
- Plan multiple evacuation routes. Some roads may be cut off by floodwaters.

Personal possessions

Consider how and where to move valuables during a flood event

- Store valuables and possessions (jewellery, passports, financial statements etc) safely during a flood event.
- Consider where you can safely store your vehicle/s.

Your local area

Know your local area and talk with your neighbours

- Consider how potential loss of power, road closures and interruptions to public transport could affect you.
- Talk to your neighbours. Those living in the area for a long time may have experience of previous flood events.
- Consider how you can help your community. The elderly, disabled or families with young children may need your help to evacuate during a flood.

Flood Risk			
High	Medium	Low	Very low
			
			
			
			
			
			
			
			
			
			
			
			
			
			
			
			
			
			
			
			
			
			
			
			
			

Flooding in Brisbane is natural and part of our environment therefore we need to be prepared for flooding and the impact it can have on our homes and families. Once you have used Council's Flood Awareness Map to identify the flood risk for your property use the tips in this table to put a plan in place. If you need an interpreter contact 131 450.

브리스번에서 홍수는 자연 현상이며 우리 환경의 일환입니다. 따라서, 우리는 홍수가 우리 집과 가족에 가져다 줄 수 있는 피해에 대비해야 합니다. 브리스번 시의회의 홍수 경계 지도 (Flood Awareness Map)를 이용하여 여러분 주택의 홍수 위험도를 파악한 후, 아래 표에 실려 있는 유용한 정보를 이용하여 계획을 세우십시오. 통역사가 필요하면 131 450번으로 연락하십시오.

Lũ lụt ở Brisbane là hiện tượng tự nhiên và là một phần của môi trường sống chúng ta, do đó chúng ta cần được chuẩn bị sẵn sàng ứng phó với lũ lụt và tác động của chúng lên mái ấm và gia đình của bạn. Nếu bạn đã dùng Bản đồ Cảnh báo Lũ lụt của Hội Đồng để xác định nguy cơ lũ lụt ở khu bất động sản của bạn, hãy dùng thông tin trong bảng này để lập kế hoạch ứng phó. Nếu bạn cần thông dịch viên, hãy liên lạc số 131 450.

洪水對於布里斯本而言是件正常的事情，是我們環境的一個部分，因此我們需要隨時準備好應對洪水以及其對我們的住宅和家人的影響。您用市政府的防洪意識地圖 (Flood Awareness Map) 來確定自己房產的洪水風險之後，請用本表中的建議制定一個計劃。若您需要傳譯員，請聯絡 131 450。

يحيى بطة عيش نبريزب يف تاناضيفل نوكن نال ةجاحب نحت لفلل ،انتئيىب نم عزجو لمحتحمل اهر يثأتو تاناضيفلل نيذعتسم قطيرخ لفللمعتسا دعب .انرسأو انتويىب لىل ع سرحملاب قصاخلا تاناضيفلا لىل ع فيعوتلا ،افراقع لىل ع تاناضيفلا رطخ ديدحتل يذبلل عضول يلاتلا لودجلا يف حىاضنلا لمعتسا لصتا ،يففش مچرتم لىل ةجاحب نك اذا .اكتطخ 450 131 مچرلاب



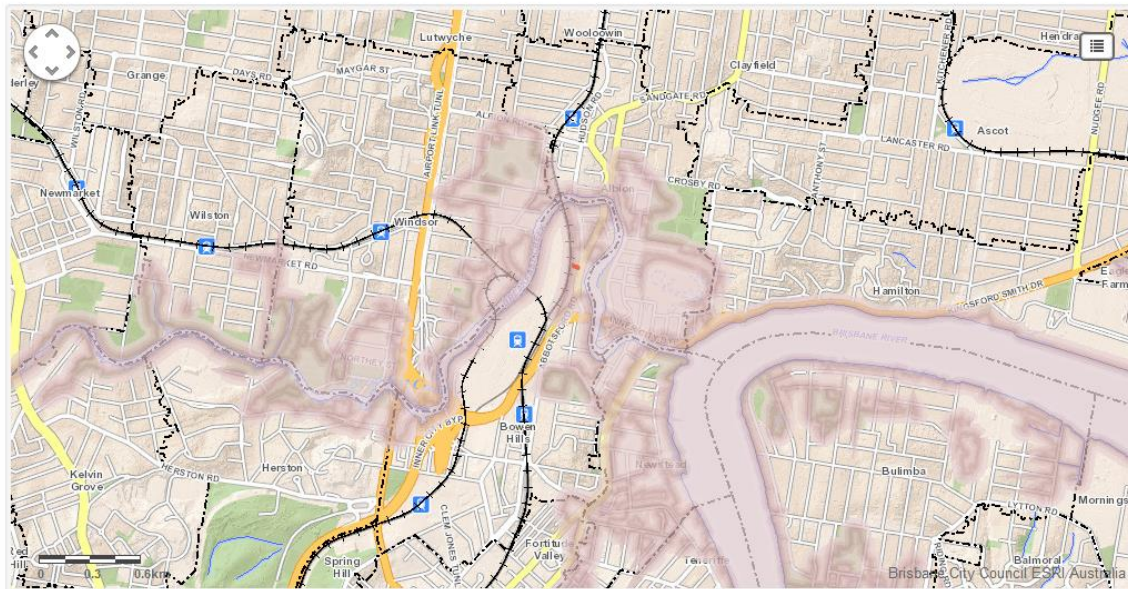
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Using the interactive historical maps

Use the interactive historical map to explore the history of river floods in Brisbane. The lines show the estimated extent of each of these floods so you can see where your property is in relation to these events. Large river floods are rare but may have a greater impact due to the size of the area flooded, depth of water and amount of debris in the water.

The flood maps are **based on the best data available to Council at the time the maps were developed**.

[Flood Awareness](#) [Flood Sources](#) [Historic Floods](#)



2011

The January 2011 Brisbane Flood was a result of heavy rainfall caused by Tropical Cyclone Tasha. December 2010 was Queensland's wettest period on record and left the State's river systems at capacity.

The Brisbane River peaked on 13 January at 4.46 metres in the city, over a number of days affecting parts of the Brisbane CBD, inner city suburbs, southern and western suburbs.

Map legend

✓ January 2011

✗ January 1974

Historical flood information is sourced from the Queensland Government. The State Government's Department of Natural Resources and Mines owns the 1974 and 2011 flood data. The flood extents used in these maps were jointly developed by the State Government and Brisbane City Council.

The January 2011 flood extent was created using aerial flood imagery that was flown over a number of days between the 13th to 15th January and pre-flood aerial imagery. This line was verified against digital elevation models and contours (Lidar). The completeness of the data is dependent on image quality and the ability to identify feature detail, such as in the Brisbane CBD area due to high rise buildings, areas of heavy vegetation along the river banks and low lying flat areas such as near the mouth of the Brisbane River.

APPENDIX D: EXTRACT FROM STATE PLANNING POLICY

Table B: Post construction phase-stormwater management design objectives

Climatic region (Refer SPP Interactive Mapping System)	Design objectives Minimum reductions in mean annual load from unmitigated development (%)				Application
	Total suspended solids (TSS)	Total phosphorus (TP)	Total nitrogen (TN)	Gross pollutants >5 mm	
South East Queensland	80	60	45	90	Development for urban purposes within population centres greater than 3000 persons.
Central Queensland (south)	85	60	45	90	As above.
Central Queensland (north)	75	60	40	90	As above.
Dry Tropics	80	60 #	40	90	As above. # Townsville City Council has adopted a 65% reduction for TP.
Wet Tropics	80	60	40	90	As above.
Cape York/FNQ	80	60	40	90	Development for urban purposes within population centres greater than 25,000 persons.
Western Queensland	85	60	45	90	As above.
All	N/A	N/A	N/A	N/A	Excludes development that is less than 25% impervious. In lieu of modelling, the default bio-retention treatment area to comply with load reduction targets for all Queensland regions is 1.5% of the contributing catchment area.
	Waterway stability management Limit the peak 1-year ARI event discharge within the receiving waterway to the pre-development peak 1-year ARI event discharge.				Catchments contributing to un-lined receiving waterway. Local government may not require compliance if the waterway is degraded. For peak flow for the 1-year ARI event, use co-located storages to attenuate site discharge rate of stormwater.

APPENDIX E: FLOW CALCULATIONS

FLOW CALCULATION

The stormwater discharge from the site was calculated using the Rational Method and the recommendations in Queensland Urban Drainage Manual (QUDM).

The Rational Formula:

For design purposes, the Rational Formula is:

$$Q_y = (C_y \cdot I_y \cdot A) / 360$$

Where:

Q_y = peak flow rate (m^3/s) for annual exceedence probability (AEP) of 1 in 'y' years

C_y = coefficient of discharge (dimensionless) for AEP of 1 in 'y' years

I_y = average rainfall intensity (mm/h) for a design duration of 't' hours and an AEP of 1 in 'y' years

A = area of catchment (ha)

t = the nominal design storm duration as defined by the time of concentration (t_c)

Average Rainfall Intensity, I_y (mm/h)

Average Rainfall Intensity was obtained from Bureau of Meteorology (BOM) for Bowen Hills area. (Refer to Table F1 below for the extract from the Australian Bureau of Meteorology – 02/03/2015)

Table E1 Average Rainfall Intensity

Intensity-Frequency-Duration Table							
Location: 27.450S 153.050E NEAR.. Bowen Hills Issued: 2/3/2015							
Rainfall intensity in mm/h for various durations and Average Recurrence Interval							
Average Recurrence Interval							
Duration	1 YEAR	2 YEARS	5 YEARS	10 YEARS	20 YEARS	50 YEARS	100 YEARS
5Mins	118	152	192	216	247	290	323
6Mins	111	142	180	202	232	272	303
10Mins	90.4	116	148	167	192	226	252
20Mins	66.4	85.8	110	125	144	170	191
30Mins	54.1	70.0	90.3	103	119	141	158
1Hr	36.2	47.1	61.2	69.9	81.3	96.8	109
2Hrs	22.8	29.7	39.0	44.8	52.3	62.6	70.6
3Hrs	17.1	22.3	29.4	33.9	39.7	47.6	53.8
6Hrs	10.3	13.5	18.0	20.8	24.5	29.5	33.5
12Hrs	6.42	8.43	11.3	13.1	15.4	18.6	21.2
24Hrs	4.19	5.49	7.36	8.54	10.1	12.2	13.8
48Hrs	2.76	3.62	4.84	5.60	6.60	7.96	9.04
72Hrs	2.06	2.70	3.62	4.19	4.94	5.95	6.76

(Raw data: 48.06, 8.44, 2.74, 95.64, 18.02, 5.79, skew=0.13, F2=4.4, F50=17.26)

© Australian Government, Bureau of Meteorology

Coefficient of Discharge Calculation

In accordance with QUDM, the coefficient of discharge, C_y , is calculated as follows:

$$C_y = F_y \cdot C_{10}$$

Where

C_y = coefficient of discharge (dimensionless) for AEP of 1 in 'y' years

F_y = frequency factor (dimensionless) for AEP of 1 in 'y' years

C_{10} = coefficient of discharge for a 1 in 10 year ARI (dimensionless)

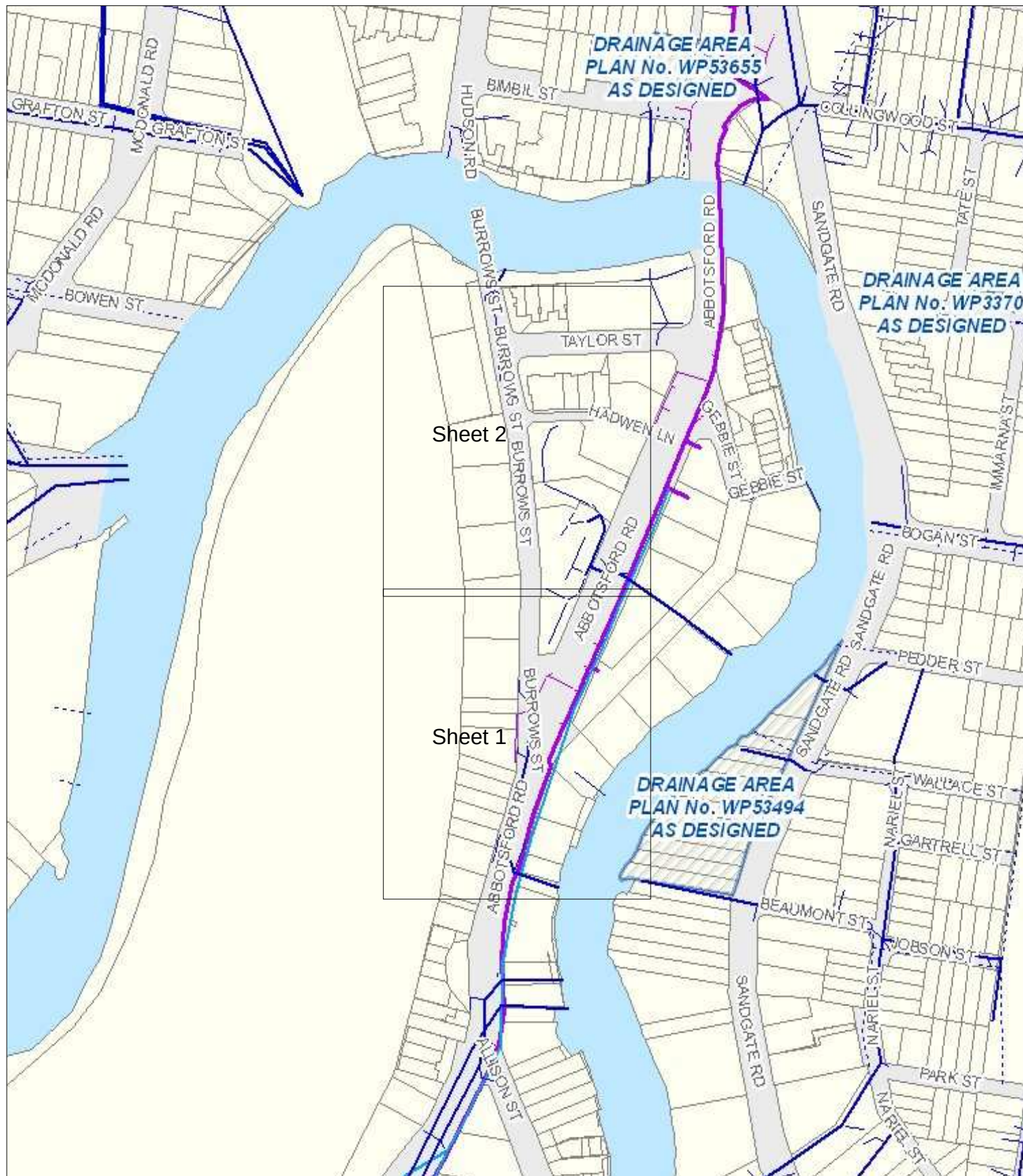
Flow Calculation

Using the equation mentioned above and information from QUDM, the flow from the existing and post-development catchments has been calculated using the rational method. The result is tabulated below:

Table E2: Existing and Post-Development Flows

ARI (years)	F_y	C_y	5I (mm/hr)	Area (ha)	Q (m ³ /s)	Q (l/s)
1	0.8	0.70	118	0.3013	0.07	70
2	0.85	0.75	152	0.3013	0.10	95
5	0.95	0.84	192	0.3013	0.13	134
10	1	0.88	216	0.3013	0.16	159
20	1.05	0.92	247	0.3013	0.19	191
50	1.015	1.00	290	0.3013	0.24	243
100	1.2	1.00	323	0.3013	0.27	270

APPENDIX F: BCC STORMWATER INFRASTRUCTURE



Map Sheet Overview

Sequence Number: 42781733

Disclaimer:

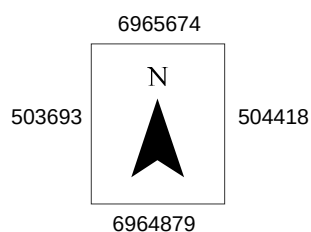
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Street Names and House Numbers (c) 2014 Brisbane City Council

Caution: This map may contain the locations of abandoned underground asbestos pipes. Council gives no warranty to the completeness or accuracy of these records. Appropriate care needs to be taken in all cases.

BCC Stormwater and Cable Networks

Date: Nov 27, 2014



Copyright BCC, 2014



BCC Stormwater and Cable Networks

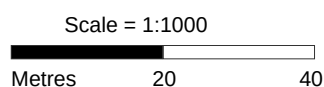
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Disclaimer:

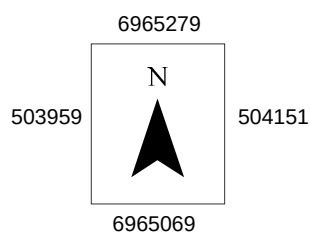
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Location:

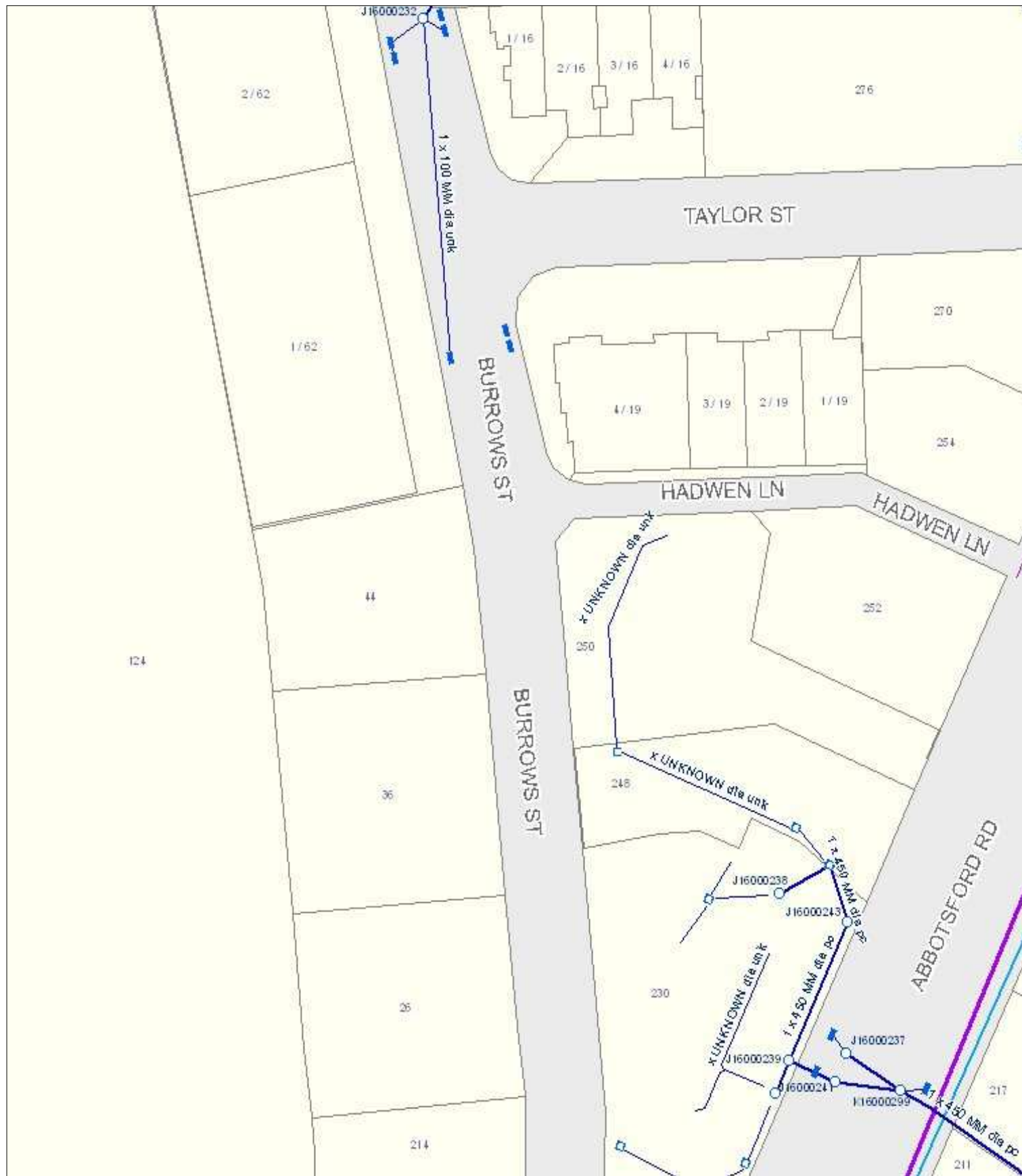


Sheet 1



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**DRAINAGE AREA
PLAN No. WP53494
AS DESIGNED**



BCC Stormwater and Cable Networks

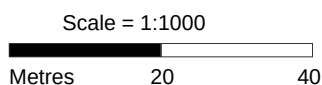
Sequence Number: 42781733

Disclaimer:

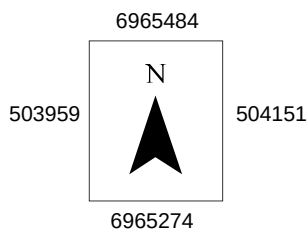
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Location:



Sheet 2



Copyright BCC, 2014

Legend

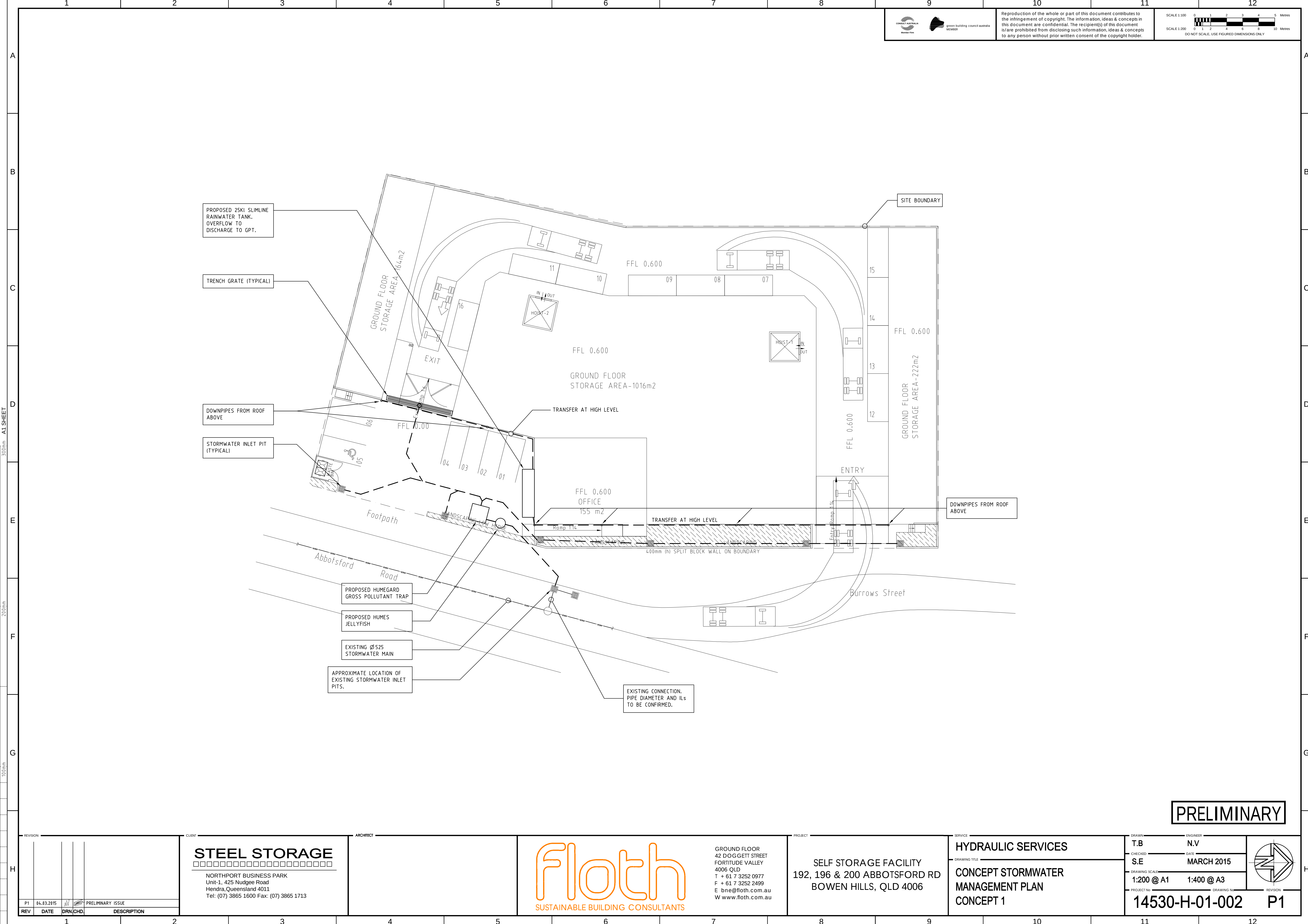
Stormwater Network

-  Stormwater Drain
-  Stormwater Gully / Roofwater Connection
-  Future Stormwater Drain
-  Stormwater Maintenance Hole
-  Stormwater Roofwater Pit
-  Stormwater Gully Pit

BCC Cable Network

-  Traffic System Cable
-  Traffic Signal Ducting
-  Traffic Light Conduit
-  Fibre Optic Cable Location
-  Flood Telemetry Conduit
-  Fibre Optic Pit Location

APPENDIX G: CONCEPT STORMWATER MANAGEMENT PLANS





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SCALE 1:100

0 1 2 3 4 5 Metres

SCALE 1:200

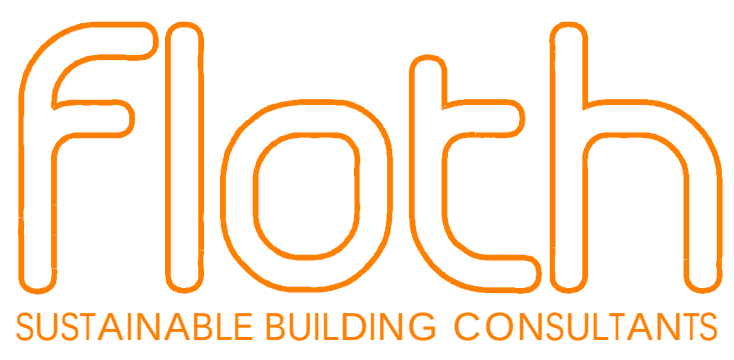
0 1 2 3 4 5 10 Metres

DO NOT SCALE, USE FIGURED DIMENSIONS ONLY

300mm
200mm
100mm

REVISION	DATE	DRN/CHD	DESCRIPTION
P1	04.03.2015	NV	PRELIMINARY ISSUE

STEEL STORAGE
NORTHPORT BUSINESS PARK
Unit-1, 425 Nudgee Road
Hendra, Queensland 4011
Tel: (07) 3865 1600 Fax: (07) 3865 1713



GROUND FLOOR
42 DOGGETT STREET
FORTITUDE VALLEY
4006 QLD
T + 61 7 3252 0977
F + 61 7 3252 2499
E bne@floath.com.au
W www.floath.com.au

PROJECT

SELF STORAGE FACILITY
192, 196 & 200 ABBOTSFORD RD
BOWEN HILLS, QLD 4006

SERVICE

HYDRAULIC SERVICES
CONCEPT STORMWATER
MANAGEMENT PLAN
CONCEPT 1

DRAWN
T.B
S.E

CHECKED
S.E

DRAWING SCALE
1:200 @ A1
1:400 @ A3

PROJECT NO
14530-H-01-002

ENGINEER
N.V
MARCH 2015

DRAWING NO
P1

REVISION

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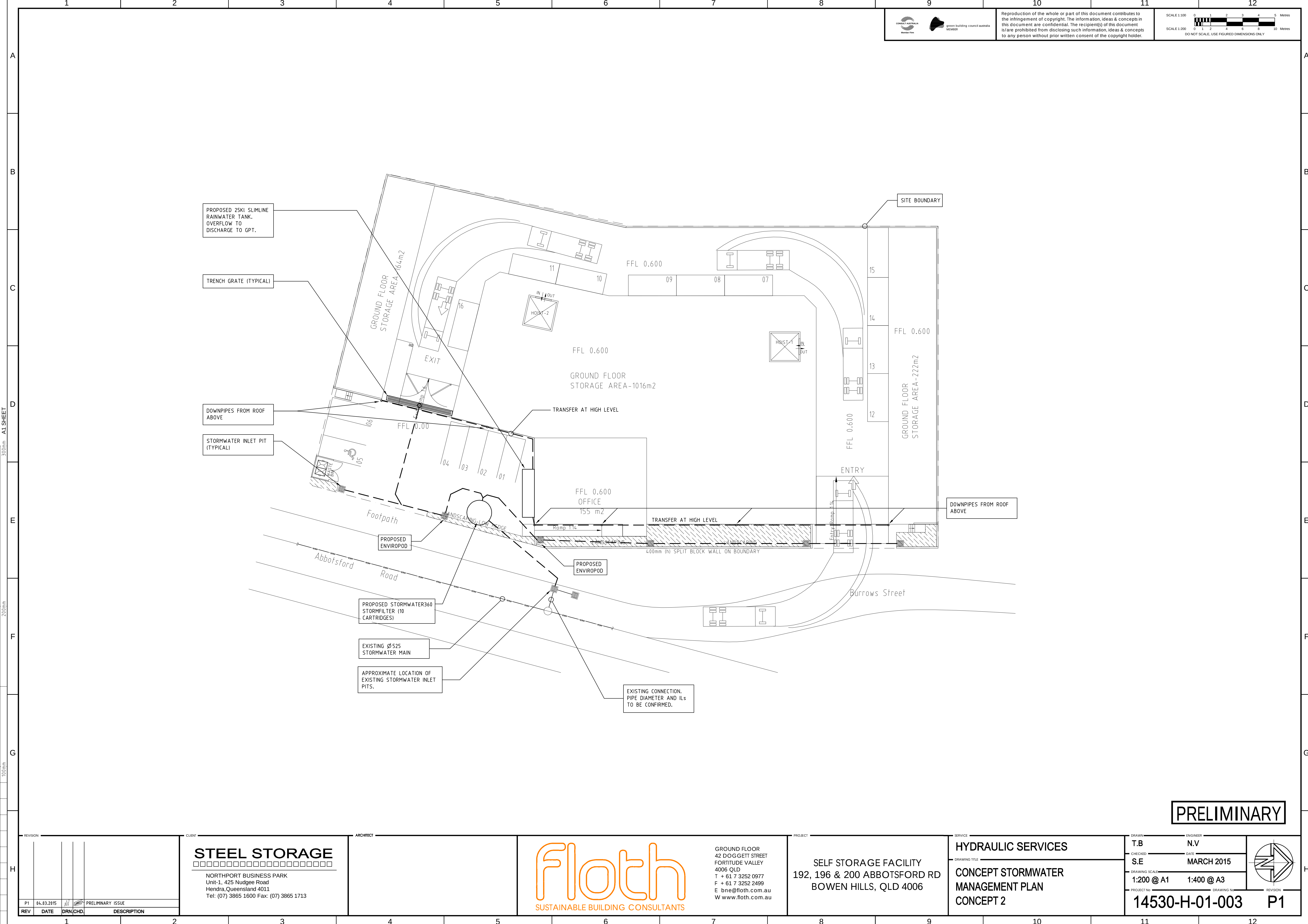
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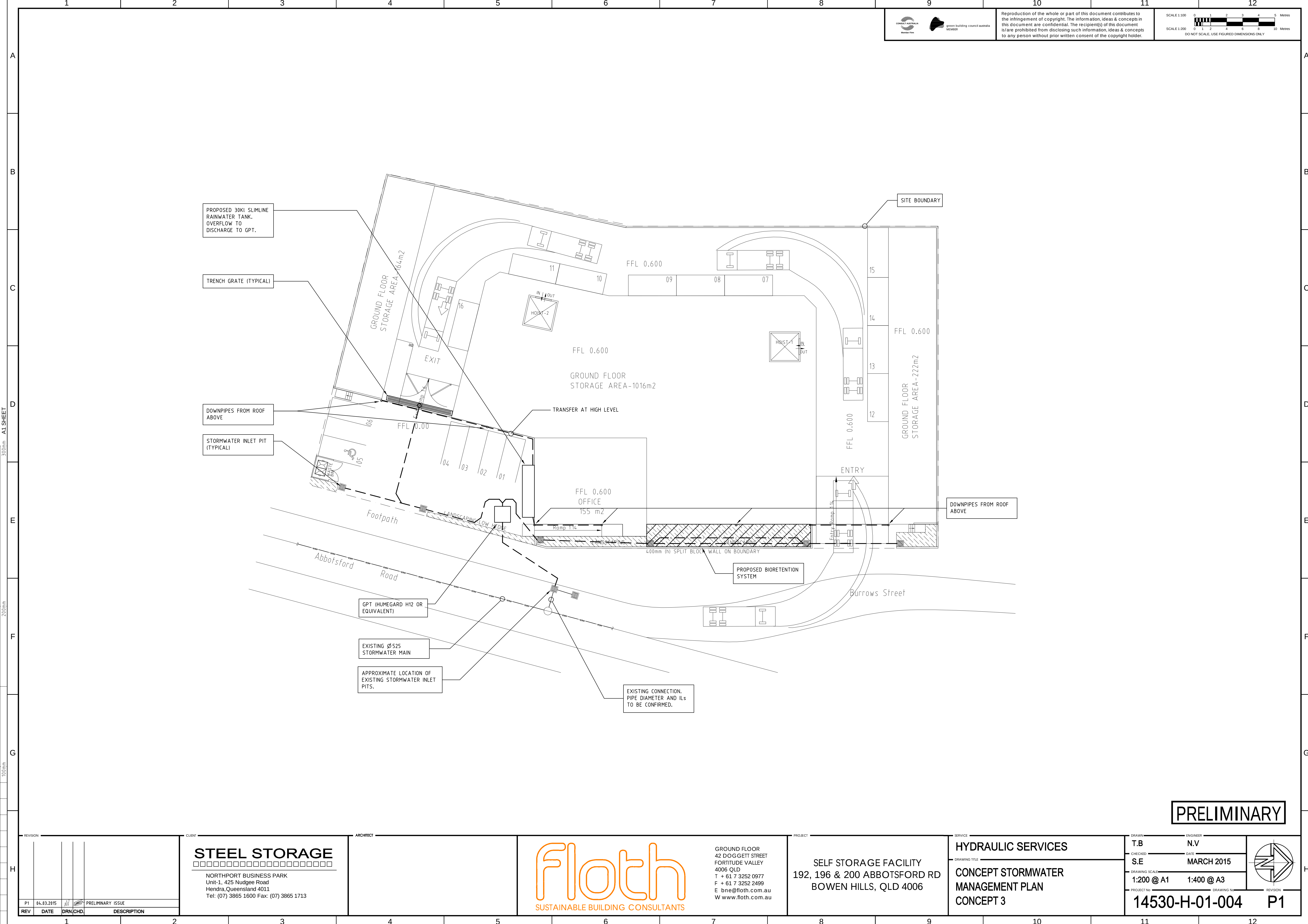
11

12



A1 SHEET
300mm
200mm
100mm

REVISION <table><tr><td>P1</td><td>04.03.2015</td><td>N.V.</td><td>PRELIMINARY ISSUE</td></tr><tr><td>REV</td><td>DATE</td><td>DRN/CHD</td><td>DESCRIPTION</td></tr></table>		P1	04.03.2015	N.V.	PRELIMINARY ISSUE	REV	DATE	DRN/CHD	DESCRIPTION	CUSTOMER STEEL STORAGE NORTHPORT BUSINESS PARK Unit-1, 425 Nudgee Road Hendra, Queensland 4011 Tel: (07) 3865 1600 Fax: (07) 3865 1713		ARCHITECT		Floath SUSTAINABLE BUILDING CONSULTANTS		PROJECT GROUND FLOOR 42 DOGGETT STREET FORTITUDE VALLEY 4006 QLD T + 61 7 3252 0977 F + 61 7 3252 2499 E bne@floath.com.au W www.floath.com.au		SERVICE SELF STORAGE FACILITY 192, 196 & 200 ABBOTSFORD RD BOWEN HILLS, QLD 4006		SERVICE HYDRAULIC SERVICES CONCEPT STORMWATER MANAGEMENT PLAN CONCEPT 2		DRAWN T.B		ENGINEER N.V		CHECKED S.E		DATE MARCH 2015		DRAWING SCALE 1:200 @ A1 1:400 @ A3		PROJECT NO 14530-H-01-003		DRAWING NO P1	
P1	04.03.2015	N.V.	PRELIMINARY ISSUE																																
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SCALE 1:100

0 1 2 3 4 5 Metres

SCALE 1:200

0 1 2 3 4 5 10 Metres

DO NOT SCALE, USE FIGURED DIMENSIONS ONLY

A1 SHEET
300mm
200mm
100mm

REVISION <table><tr><td>P1</td><td>04.03.2015</td><td>NY</td><td>PRELIMINARY ISSUE</td></tr><tr><th>REV</th><th>DATE</th><th>DRN/CHD</th><th>DESCRIPTION</th></tr><tr><td>1</td><td></td><td></td><td></td></tr></table>		P1	04.03.2015	NY	PRELIMINARY ISSUE	REV	DATE	DRN/CHD	DESCRIPTION	1				CUSTOMER STEEL STORAGE NORTHPORT BUSINESS PARK Unit-1, 425 Nudgee Road Hendra, Queensland 4011 Tel: (07) 3865 1600 Fax: (07) 3865 1713		ARCHITECT		PROJECT SUSTAINABLE BUILDING CONSULTANTS		SERVICE GROUND FLOOR 42 DOGGETT STREET FORTITUDE VALLEY 4006 QLD T + 61 7 3252 0977 F + 61 7 3252 2499 E bne@floath.com.au W www.floath.com.au		PROJECT SELF STORAGE FACILITY 192, 196 & 200 ABBOTSFORD RD BOWEN HILLS, QLD 4006		SERVICE HYDRAULIC SERVICES CONCEPT STORMWATER MANAGEMENT PLAN CONCEPT 3		DRAWN T.B		ENGINEER N.V		CHECKED S.E		DATE MARCH 2015		DRAWING SCALE 1:200 @ A1 1:400 @ A3		PROJECT NO 14530-H-01-004		DRAWING NO P1	
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