

# Proposed Stables Complex at the Newcastle Jockey Club, Darling Street Broadmeadow NSW

## Stormwater Management and Soil & Water Management Report

for

**Newcastle Jockey Club**

MPC Ref: 160548.1  
26 April 2022  
[5]

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# 1. Background Information

## 1.1 Basis of Report

This report has been prepared by MPC Consulting Engineers ('MPC') to assist with the Development Approval of the Stormwater Management and Soil & Water Management works for the proposed Stables Complex and associated car park at the Newcastle Jockey Club ('NJC'). It is not intended to represent a final engineering design for the proposed stormwater infrastructure.

Further detailed design and documentation of the stormwater management infrastructure would be conducted for the Construction Certificate application once approval of the concept has been advised and any specific Development Conditions issued by Newcastle City Council ('NCC').

MPC will be happy to provide any additional information, regarding the proposed stormwater management or sediment and erosion control measures, which would assist with the Development Approval process, if requested by NCC.

## 1.2 Preamble

The general arrangement of the proposed Stables Complex and associated car park is depicted on the architectural drawings by EJE that are included in **Appendix B** of this report.

The Stables Complex will be situated on the south-west corner of the existing NJC site, near the corner of Chatham Street and Darling Street Broadmeadow NSW. The car park will be located to the south and east of the stables area, fronting onto Darling Street to the South.

Pavements will generally comprise a combination of permeable paving and flexible asphalt for the car park, and concrete slabs on ground for pathways.

Management of stormwater runoff for the proposed development has been designed in accordance with the Council's Development Control Plan and relevant Technical Manuals, relevant Australian Standards (in particular AS3500.3) and Australian Rainfall and Runoff.

## 1.3 Stormwater Management Plan

In devising this Stormwater Management Plan for the proposed development, the following issues have been addressed:

- Water Quality Management;
- Stormwater Management;
- Soil & Water Management;
- Stormwater Harvesting.

The stormwater and environmental management philosophy employed in the Stormwater Management Plan is discussed in Section 3 of this report.

As well as permanent water management controls, construction phase controls are also addressed, in Section 5 of this report.

## **1.4 Background Information**

The following background information has been considered in the design of the proposed stormwater management system.

- A copy of the flood certificate supplied by the City of Newcastle ('CN') for the NJC property is included in **Appendix H** of this report.
- The recently completed Race Day Tie-Up Stalls development on the NJC site serves as a precedent for the overall design approach to management of stormwater on the NJC site. The approach to stormwater harvesting, quality, detention and general management of flows for the proposed Stables Complex will be similar to the approach accepted by CN for the Tie-Up Stalls development.
- MPC has consulted with the CN's asset department and obtained information relating to the existing CN stormwater drainage assets in Darling Street and Chatham Street.
- MPC has obtained confirmation from CN's Mr. Alastair Peddie (Senior Development Officer – Engineering) in an email dated 30 September 2020 that the flood certificate issued by CN in May 2019 (Flood Information Certificate No. FL2019/00101) can be used for this proposed development in the south-west corner of the NJC site.

## 2. Site and Catchment Details

### 2.1 The Existing Site

The existing site comprises five lots with a total area of 48.9 Ha and is utilised as an equine racing and training facility.

The proposed development area is to be located in the south-west corner of the site, in the position shown in Figure 1.



**Figure 1: Site Location**

The northern portion of the development site comprises existing asphalt pavements, existing (decommissioned) race day tie-up stalls, and grassed surfaces. This northern area slopes to the north-east towards the race track where surface stormwater is collected in a network of grassed swales and in-ground pipes.

The existing southern portion of the development site comprises grassed surfaces, and slopes southward towards Darling Street. Existing surface flows in the southern portion of the site drain to the street drainage in Darling Street and Chatham.

Photographs of the existing site are included in **Appendix A** of this report.

### 2.2 The Proposed Site

Architectural drawings by EJE Architects have been provided to MPC and show the site layout for the proposed development. These have been used as the basis of the stormwater management and sediment and erosion control concept design. A copy of the architectural site plan is included in **Appendix B** of this report.

The proposed site generally comprises the following:

- An equine arrivals and goods storage area, comprising:
  - o Asphalt pavements for equine and goods drop-offs
  - o Goods storage shed, equipment shed and site office
  - o Stormwater basins
- A two-storey equine stables complex, comprising:
  - o Two-storey stables buildings (7x “blocks”)
  - o Elevated concourses including access ramps and stairs
  - o Horse walkers, wash bays and sand rolls
- The car park to the south and east, comprising:
  - o Asphalt pavements
  - o Portions of permeable pavement
  - o Concrete dish drains, kerbs and gutters
  - o Raingardens for water quality
- A maintenance area to the north, comprising:
  - o Two-storey maintenance and amenities building
  - o Asphalt hardstand

The proposed site entry points will be from Darling Street and Chatham Street which are consistent with the pre-existing site entry points.

The general arrangement of the proposed car park and the driveway crossings is illustrated on the Stormwater Management Plans in **Appendix C** of this report.

### 3. Stormwater Management Philosophy

The proposed stormwater management system has been designed in accordance with the requirements of the current Newcastle City Council Development Control Plan, relevant NCC Technical Manuals, *AS3500.3 Stormwater Drainage*, and Australian Rainfall and Runoff.

The key design considerations were as follows.

- Safety and Efficiency  
Ensure that rainwater runoff from the developed site for all design storms up to a 1:100-year ARI event is directed through the drainage network to the proposed stormwater discharge points safely and efficiently and in accordance with NCC Development Control Plan ('DCP') and AS/NZS 3500.3-2003.  
Ensure that overland flow in the event of a choked or blocked piped system does not adversely impact on adjacent properties and does not exceed accepted safe velocity-depth criteria.
- Flood  
Compliance with the requirements specified in the Flood Certificate supplied by NCC.
- Stormwater Quantity  
Provide detention of the post-developed flows for all storms up to the 100-year ARI event, such that they do not exceed the pre-developed condition.
- Stormwater Quality  
Ensure contaminated water from developed areas is passed through an appropriate pollution and sediment control system and meets the WSUD requirements of the NCC DCP.
- Stormwater Re-Use / Harvesting  
New rainwater collection tanks with a water re-use facility to service horse wash bays and irrigation of surrounding landscaped areas.

## 4. Proposed Stormwater Management Facilities

### 4.1 Description of Proposed Stormwater Management Facilities

The stormwater management concept plans are shown in **Appendix C** to this report. The principal stormwater management components are listed below:

#### 4.1.1 Arrivals Area

- Stormwater runoff from roof areas (goods storage shed, equipment shed and site office) will be directed via an in-ground (charged) pipe network to above-ground rainwater storage tanks located adjacent to each respective building. The rainwater tanks will be fitted with a first-flush system to address water quality and will be plumbed back into the facility to re-use collected water for amenities, hose-down and landscaping.
- Overflow from the rainwater collection tank behind the goods storage shed will be directed to Chatham Street.
- Overflow from the rainwater collection tank behind the equipment shed and site office will be directed into an infiltration trench with high-level overflows directed to Chatham Street.
- Where possible, rainwater runoff from new paved surfaces will be directed to landscaped areas or permeable paving for infiltration.
- Stormwater from paved areas will be directed via an in-ground pipe system to a bio-retention basin (via a Gross Pollutant Trap) for water quality treatment and also with capacity to provide detention for all storms up to and including the 1% AEP storm event.
- The site office building has been specified with a floor level of RL 7.00m AHD which is higher than the minimum habitable floor level of RL 6.85m AHD specified in the flood certificate from CN.
- The goods storage shed and equipment shed (non-habitable buildings) have been specified with a floor level of RL 6.500m AHD which is higher than the 1% AEP flood level of RL 6.35m AHD specified in the flood certificate from CN.

#### 4.1.2 Stables Complex

- Stormwater runoff from roof areas will be directed via an in-ground (charged) pipe network to above-ground rainwater storage tanks located adjacent to each respective building. The rainwater tanks will be fitted with a first-flush system to address water quality and will be plumbed back into the stables buildings to re-use collected water for amenities, hose-down and landscaping.
- Overflow from the rainwater collection tanks adjacent to Blocks B, C and D will be directed into an infiltration trench. High-level overflows from each trench will be directed through an in-ground stormwater pit and pipe network to the existing drainage system in Darling Street.

- Overflow from the rainwater collection tanks adjacent to Block A will be directed into an infiltration trench. High-level overflows from this trench will be directed through an in-ground stormwater pit and pipe network to the existing drainage system on the NJC site, directing the stormwater towards the dam in the middle of the track.
- Overflow from the rainwater collection tanks adjacent to Blocks E, F and G will be directed into an infiltration trench. High-level overflows from each trench will be directed through an in-ground stormwater pit and pipe network to the existing drainage system in Chatham Street.
- Stormwater from the southern side of the roof of Block D, and from adjacent pavement areas, will be directed to a bio-retention basin between the building and the arrivals area.
- Stormwater runoff from the elevated concourse areas will generally be directed towards landscaped areas on site for infiltration. Stormwater from the portion of the elevated concourse adjacent to the arrivals area will be directed to the bio-retention basin west of Block D.

#### **4.1.3 Car Parks**

- Stormwater runoff from the car parks will be directed towards portions of permeable paving and raingardens at various locations throughout the car parks.
- The design intent for the car parks is to encourage infiltration of stormwater on the site, with water quality provided by the raingardens for treatable flows.
- On-site detention will be provided on the surface of the car parks, keeping storage depths below the required 200mm.

#### **4.1.4 Maintenance Precinct**

- Stormwater runoff from paved areas will be directed via an in-ground pipe system to Gross Pollutant Trap and sand filter pit for water quality, with outflows directed to the existing drainage system in Chatham Street.
- On site detention of stormwater in the maintenance hardstand will be provided on the pavement surface, keeping storage depths below the required 200mm.

Stormwater quality requirements have been addressed further in Section 4.5 of this report.

## **4.2 Design Storm Events**

The stormwater management system will collect runoff for all design events up to the 100-year ARI for subsequent storage, re-use and disposal (as appropriate).

In-ground pits and pipes on the proposed development have been designed for a Minor Storm event of 1:10 years ARI (10% AEP).



The site has been designed for a 1:100-year ARI (1% AEP) Major Storm event using a pit blockage factor of 0.5 for all pits.

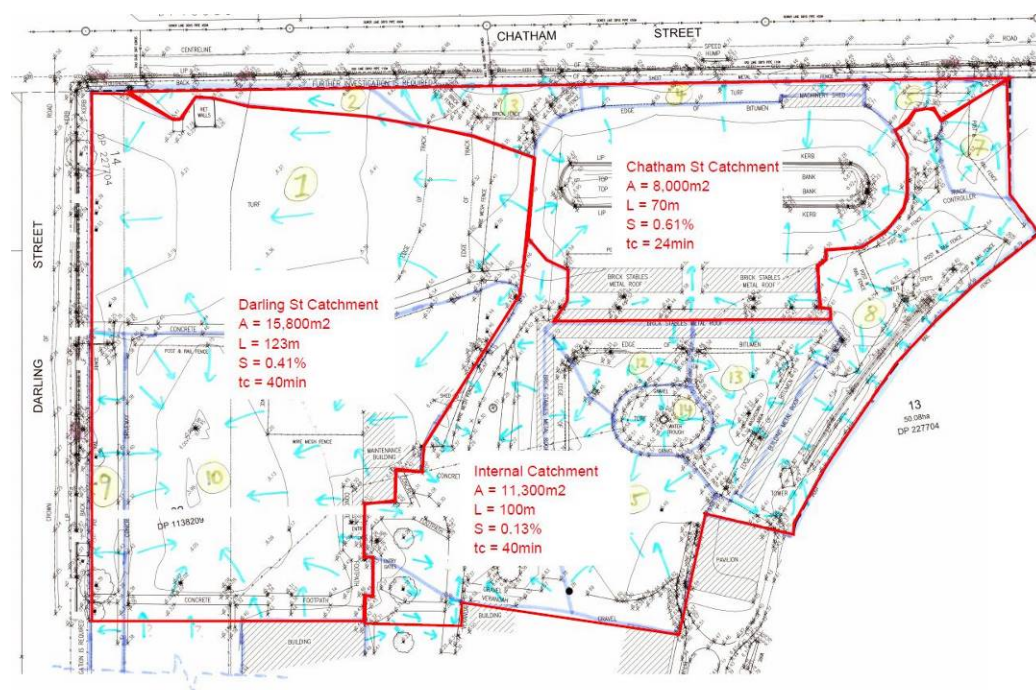
## 4.3 Site Catchment Parameters

### 4.3.1 Pre-Developed Site

MPC conducted a site analysis using the following information:

- Site survey (copy included in Appendix I of this report)
- Visual inspection of the existing site
- Visual inspection of the existing road stormwater drainage infrastructure
- Desktop review of drainage asset data obtained from City of Newcastle asset management department.

The existing site was split into sub-catchments as depicted on Figure 2, based on the existing surface fall directions.



**Figure 2: Pre-Developed Sub-Catchment Plan (Site Analysis)**

The results of the site analysis were relied on for estimating pre-developed storm flows for all storms up to and including the major storm event. A summary of the minor and major storm pre-developed flows is provided in Table 1.

**Table 1: Pre-Developed Catchment Parameters and Flows**

| Sub-catchment ID | Sub-catchment Description                                                      | Area (Ha) | Minor Storm (ARI= 10yrs) |                       | Major Storm (ARI= 100yrs) |                        |
|------------------|--------------------------------------------------------------------------------|-----------|--------------------------|-----------------------|---------------------------|------------------------|
|                  |                                                                                |           | tc (min)                 | Q <sub>10</sub> (L/s) | tc (min)                  | Q <sub>100</sub> (L/s) |
| Darling          | Southern portion of the site, draining to Darling Street                       | 1.58      | 47                       | 104                   | 35                        | 345                    |
| Chatham          | Western portion of the site, draining to Chatham Street                        | 0.80      | 25                       | 105                   | 20                        | 242                    |
| Internal         | North-east portion of the site, draining to the dam in the middle of the track | 1.13      | 63                       | 84                    | 48                        | 201                    |

Calculations used for estimating the pre-developed flow rates are included in Appendix D of this report.

#### 4.3.2 Post-Developed Site

The arrangement of sub-catchments adopted in the stormwater management design for this development are depicted in Figure 3.

The break-up of the post-developed site is approximately as described in Table 2 (areas shown are approximate):

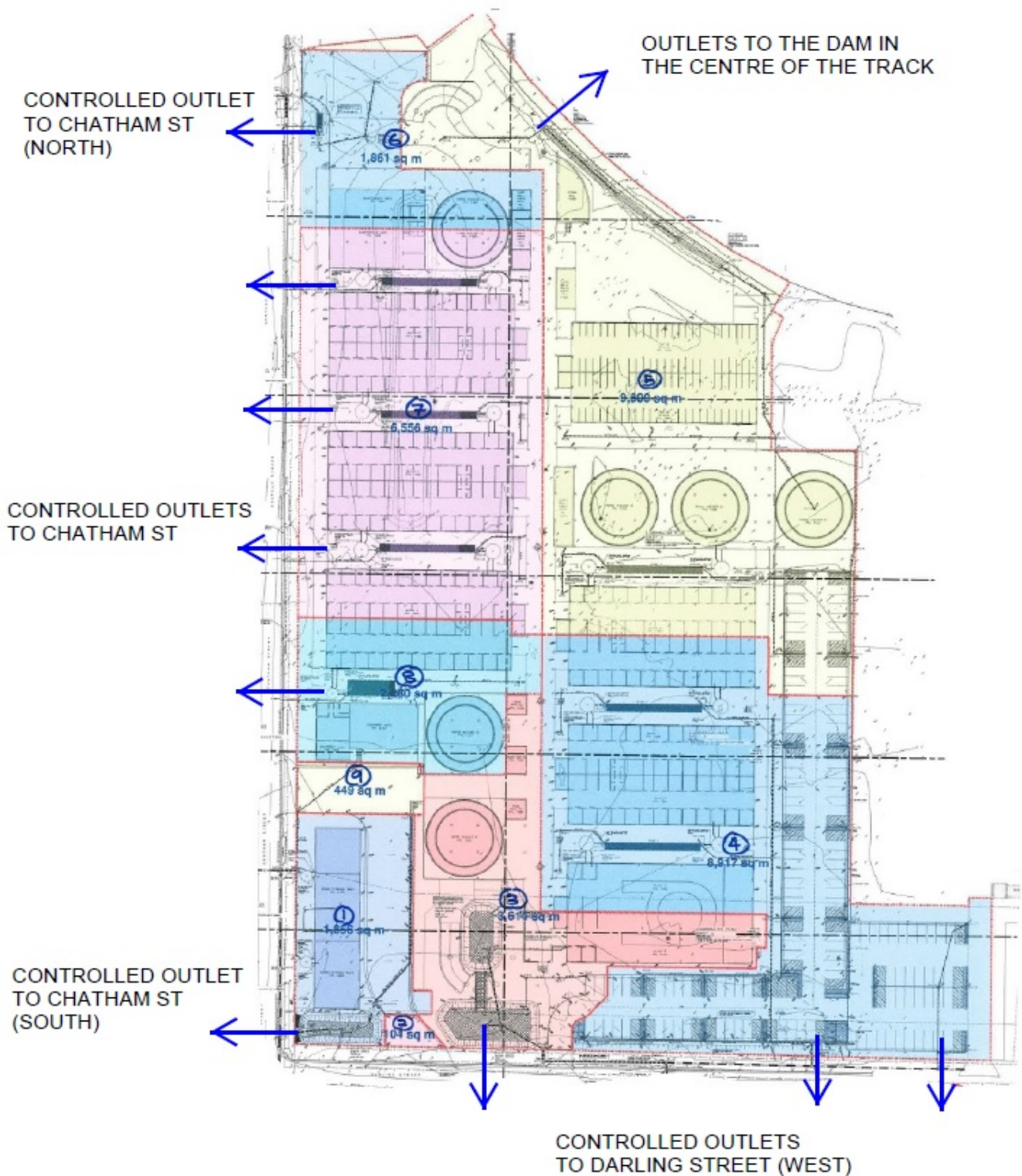
**Table 2: Post-Developed Catchment Parameters**

| No. | Sub-catchment Description                                                                                                                  | Area (Ha) | % Impervious | tc (min) |
|-----|--------------------------------------------------------------------------------------------------------------------------------------------|-----------|--------------|----------|
| 1   | Arrivals and Good Storage Shed                                                                                                             | 0.186     | 75%          | 5        |
| 2   | Arrivals area - exit pavement                                                                                                              | 0.010     | 100%         | 5        |
| 3   | Southern half of Block D, south-western horse walker, and the Bio Retention basins.                                                        | 0.361     | 81%          | 5        |
| 4   | Car park, North half of Block D, all of Block C, and the southern half of Block B.                                                         | 0.892     | 82%          | 5        |
| 5   | Northern half of Block B, adjacent horse walkers, the tie-up stalls, and marshalling area (directed to the dam in the centre of the track) | 0.961     | 93%          | 5        |
| 6   | Maintenance area (north)                                                                                                                   | 0.186     | 91%          | 5        |
| 7   | Northern half of Block E, all of Blocks F and G, and part of the maintenance shed.                                                         | 0.656     | 81%          | 5        |
| 8   | Equipment shed, adjacent horse walker, and southern half of Block E                                                                        | 0.228     | 79%          | 5        |
| 9   | Arrivals area - entry pavement                                                                                                             | 0.045     | 100%         | 5        |

The post-developed stables complex and car park site will therefore incorporate a total of 3.5 ha catchment area (being 85% impervious) and which is only 7.3% of the existing 47.8 ha Newcastle Jockey Club lot area.

#### Pit Blockage Factors

All stormwater pits were checked for inlet capacity using a 50% pit blockage factor for the major storm analysis.



**Figure 3: Post-Developed Sub-Catchment Plan**

## 4.4 Safety and Efficiency

### 4.4.1 Site Discharge Index

Calculations relating to the site discharge index are included in **Appendix D** of this report.

The sub-catchments direct-connected to the street drainage are as follows:

- Frontage to Chatham Street =  $1,262 + 255 = 1,517 \text{ m}^2$
- Frontage to Darling Street =  $247 \text{ m}^2$

The total direct-connected area is therefore  $1,517 + 247 = 1,764 \text{ m}^2$  noting that 100% of this direct-connected area is pervious landscaped / turfed area.

All other areas are managed using the controls described in this report.

The total developed area is  $30,000 \text{ m}^2$ . Subsequently, the site discharge index is:

$$\text{SDI} = 1,764 / 30,000 = 0.059 < 0.10 \text{ therefore complies with SDI requirement.}$$

### 4.4.2 Pits and Pipes

In-ground stormwater pits and pipes were sized using the following:

- Rainfall intensities as specified in the IFD table within the stormwater management Technical Manual issued by NCC
- Sub-catchments as illustrated in Figure 2 of this report
- Minor and major storm flow rates calculated for each sub-catchment using the rational method, as summarised in Appendix D
- Pit inlet capacities using methods prescribed in Australian Rainfall and Runoff
- Pipe flow capacities using methods prescribed in Australian Rainfall and Runoff and AS3500.3

## 4.5 Flooding and Coastal Erosion

### 4.5.1 General

MPC has identified and considered the flood risk of the site through consultation with the City of Newcastle ('CN'), in particular Alastair Peddie, CN's Senior Development Officer in Engineering. The flooding and coastal erosion requirements of the SEARs have been addressed as follows.

1. A flood certificate for the site was issued by CN (Certificate No FL2019/00101), a copy of which is included in Appendix H of this report.
2. The constraints specified in the flood certificate issued by CN are informed by the most recent flood modelling that has been undertaken for the local catchment. A copy of the relevant flood study is included in Appendix J of this report ("Throsby, Cottage and CDB Flood Study", BMT WBM, Report No. R.B15058.002.01.doc, revision 0).

3. Potential changes to flood risk on-site or off-site due to the proposed development have been considered through the constraint imposed on the quantity of site filling as specified in the flood certificate. The flood certificate prescribes a limit to the amount of filling that can be added to the site by the development to address flood risk associated with redistribution of flood water from flood storage areas.
4. Constraints on the finished floor levels for the development were imposed by the flood certificate. These constraints are set at 500mm above the 1% AEP flood surface level so as to take into account potential effects of coastal processes and hazards, climate change, sea level rise and increases in rainfall intensity.
5. The flood certificate stipulates that onsite flood refuge is required for the proposed development. This constraint mitigates the on-site flood risk by ensuring there is adequate safe refuge space on site in the event of a flood.

#### **4.5.2 Filling**

In accordance with the flood certificate, filling of a flood storage area by more than 20% is not generally allowed due to redistribution of flood water.

The existing NJC site comprises a total of 47.8Ha of land. Of that area virtually 100% of the property is affected by the PMF event at RL 7.3m AHD (Map 3-A, Newcastle Flood plain Risk Management Study, Rev A, and the Flood certificate). MPC conducted an overlay of the site survey data with PMF flood map and determined that the Storage depths for the PMF are likely to be in the vicinity of 1.0m – 1.3m around the majority of the site

The proposed development will overlap with only the south-western portion of the flood storage extent, as illustrated by the hatched area in Figure 4, which has been obtained by overlaying the site survey flood map included with the Flood certificate received from CN.

The maximum possible displaced flood storage extent from the proposed development is approximately 0.95ha, which is 2.0% of the overall property area, which is significantly less than the required 20% as per the flood certificate.

So, considering that the City of Newcastle flood modelling and planning has allowed for fill to be placed on up to 20% of the site to mitigate the risk of adverse impacts to flood risk, and the proposed development only proposes to place fill on 2.0% of the site, the filling associated with the proposed development will not have a detrimental impact on flood risk and so complies with the SEARs.

MPC has estimated that fill placed on the entire footprint of the 1%AEP flood storage area, up to the 1% AEP flood level (which is very conservative) would displace in the order of 1300m<sup>3</sup> of flood storage. Analysis of the flood maps included with the flood certificate indicate a flood storage (within the vicinity of this proposed development) for the current 1% AEP flood storage surface area would be in the order of 190,000m<sup>2</sup>. Subsequently, if the 1300m<sup>3</sup> was displaced from the NJC site then the worst case would be an increase in flood levels in the order of 7mm. Noting that this is a conservative scenario, the potential for a 7mm increase in 1% AEP flood level is considered negligible.

#### 4.5.3 Floor Levels

According to the flood certificate, the minimum level for occupiable rooms has been set as RL 6.85m AHD, being 500mm above the 1% AEP flood level. All “occupiable rooms” within the proposed stables complex have been set with a floor level of RL 7.000m AHD so comply with the flood certificate and the SEARs.

##### Regarding non-occupiable rooms:

- MPC has relied on the Flood certificate from CoN (Ref: FL2019/00101, dated 22 May 2019) in the design of flood management for this development.
- MPC sought and received confirmation from CoN’s Mr Alastair Peddie on [4:29pm, Wednesday 30 September 2020] that the above-mentioned flood certificate was still current and relevant for this development.
- The flood certificate states a 1% AEP flood level in the South West corner of the NJC site (i.e. in the area of this proposed Stables development) of RL 6.35m AHD.
- The Goods Storage Shed and Equipment Shed are non-habitable buildings (similar risk to a garage structure) with a design floor level of RL 6.500m AHD, which is 150mm higher than the 1% AEP flood level in that location.
- Given that the Goods Storage Shed and Equipment Shed areas with floor levels at RL 6.500m AHD are not habitable areas, and are 150mm above the 1% AEP flood level, it is reasonable to maintain the currently proposed floor level of RL 6.500m AHD





#### 4.5.4 Onsite Flood Refuge

Onsite flood refuge in a PMF event is already available on the site at the grandstands and buildings located directly east of the proposed development area. In addition, the proposed Stables Complex comprises two-storey construction with an extensive elevated concourse and elevated stables. Access to the elevated concourse is via stairs and ramps that are shown on the architectural drawings. Subsequently, the existing NJC facilities, and the proposed elevated stables and concourse, provide sufficient flood refuge for the development, and so comply with the flood certificate and the SEARs.

#### 4.5.5 Responses to the Relevant SEARs Requirements

| SEARs Item No. | Requirement                                                                                                                            | Response                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 9              | Flooding & Coastal Erosion – mapping of relevant features as described in the Floodplain Development Manual 2005 (NSW Government 2005) |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 9a             | Flood prone land.                                                                                                                      | <p>Flood prone land on the proposed development site has been mapped in the flood study Throsby, Cottage and CDB Flood Study (BMT WBM, Report No. R.B15058.002.01.doc, revision 0), a copy of which is included in Appendix J of this report.</p> <p>A flood certificate for the proposed development site was issued by the City of Newcastle (Certificate No FL2019/00101), a copy of which is included in Appendix H of this report. The flood certificate has been prepared by the City of Newcastle on the basis of the flood mapping undertaken by BMT WBM described above.</p> <p>MPC has overlayed the flood mapping with the site survey and produced the flood prone land illustration in Figure 4 of this report.</p> |
| 9b             | Flood planning area.                                                                                                                   | <p>The flood planning level for habitable floors of the proposed development site is RL 6.85m AHD which is 500mm above the 1% AEP flood level of the flood prone land on the site.</p> <p>Within the plan extent of the proposed redevelopment, the highest pre-existing ground surface level is at approximately RL 6.75m AHD, therefore the full extent of the proposed redevelopment area lies within the Flood Planning Area being the site area below the flood planning area.</p> <p>All “occupiable rooms” within the proposed stables complex have been set with a floor level of not less than RL 7.000m AHD so will not be below the flood planning level.</p>                                                         |
| 9c             | Hydraulic categorisation.                                                                                                              | <p>Flood storage and flood fringe areas of the flood prone land have been defined by the “Flood Classification” map included with the flood certificate. An annotated copy of the map is included in Appendix H of this report.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |



| SEARs Item No. | Requirement                                                                                      | Response                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|----------------|--------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 10             | Describe the flood assessment and flood modelling.                                               | <p>The flood modelling relied on for the flood assessment of the development was undertaken by BMT WBM and is described in their Report No. R.B15058.002.01.doc, revision 0, a copy of which is included in Appendix J of this report.</p> <p>Flood levels for the assessment were determined from the flood report, the flood maps (which were generated as part of the flood report), and from the flood certificate.</p> <p>The relevant flood maps are included in Appendix J of this report and show the extent of the development area affected by each of the flood events with a 10-year ARI, 20-year ARI, 50-year ARI, 100-year ARI, 200-year ARI, and PMF events.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 11             | Effects of the proposed development on the flood behaviour under a range of flood design events. | <p>The effect of the proposed development on the flood behaviour has been addressed using the prior assessment and modelling undertaken by the City of Newcastle.</p> <p>Potential changes to flood risk on-site or off-site due to the proposed development have been considered through the constraint imposed on the quantity of site filling for the development as specified in the flood certificate.</p> <p>The flood certificate prescribes a limit to the amount of filling that can be added to the site by the development to address flood risk associated with redistribution of flood water from flood storage areas.</p> <p>In accordance with the flood certificate, filling of a flood storage area by more than 20% is not generally allowed due to redistribution of flood water.</p> <p>The existing NJC site comprises a total of 47.8Ha of land. Of that area virtually 100% of the property is affected by the PMF event at RL 7.3m AHD (Map 3-A, Newcastle Flood plain Risk Management Study, Rev A, and the Flood certificate). MPC conducted an overlay of the site survey data with PMF flood map and determined that the Storage depths for the PMF are likely to be in the vicinity of 1.0m – 1.3m around the majority of the site</p> <p>The proposed development will overlap with only the south-western portion of the flood storage extent, as illustrated by the hatched area in Figure 4, which has been obtained by overlaying the site survey flood map included with the Flood certificate.</p> <p>The maximum possible displaced flood storage extent from the proposed development is approximately 0.95ha, which is 2.0% of the overall property area, which is significantly less than the required 20% as per the flood certificate.</p> <p>So, considering that the City of Newcastle flood modelling and planning has allowed for fill to be placed on up to 20% of the site to mitigate the risk of adverse impacts to flood risk, and the proposed development only proposes to place fill on 1.6% of the site, the filling associated with the proposed development will not have a detrimental impact on flood risk and so complies with the SEARs</p> |

| SEARs Item No. | Requirement                                                                                                                   | Response                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|----------------|-------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 12a            | Impact of the development on flood behaviour for flood events up to and including the PMF.                                    | <p>MPC considered the proposed development footprint in conjunction with the flood maps of the flood events with a 10-year ARI, 20-year ARI, 50-year ARI, 100-year ARI, 200-year ARI, and PMF events.</p> <p>The results indicated that:</p> <ul style="list-style-type: none"> <li>• The 10, 20 and 50-year ARI flood events are not affected by the proposed development.</li> <li>• The 100-year and 200-year ARI flood events partly overlap the proposed development.</li> <li>• The PMF flood event fully overlaps the proposed development.</li> </ul> <p>The extent of fill proposed for the development is generally limited to the building footprints which only partly overlap with the 100-year and 200-year ARI flood events.</p> <p>MPC considers the small extent of the site area proposed to be filled for the development (0.95Ha = 2.0% of the Property area) being such a small portion of the 20% permissible under the prescribed conditions of the Flood Certificate, indicates that the impact on the flood behaviour by the proposed development will be negligible.</p> |
| 12b            | Impact of the development on flood behaviour affecting other properties.                                                      | <p>In addition to the process described in the response to Item 12a, MPC considered the "Risk to Property", "Risk to Life", "PMF Stability" and "Flow velocities" maps included with the flood certificate.</p> <p>MPC considers the small extent of the site area proposed to be filled for the development (0.95Ha = 2.0% of the Property area) being such a small portion of the 20% permissible under the prescribed conditions of the Flood Certificate, indicates that the impact on the flood risk to property and life on adjacent properties by the proposed development will be negligible.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 12c            | Relevant provisions of the NSW Flood plain Development Manual 2005 have been considered                                       | <p>The Newcastle City-wide Floodplain Risk Management Study and Plan (BMT WBM Pty Ltd, No. R.N2246.001.03.docx, revision 3, 2012) was prepared using the principles for floodplain management as outlined in the NSW Floodplain Development Manual (2005), as described in the executive summary of the report.</p> <p>The flood modelling relied on for the flood assessment of the proposed development was also undertaken by BMT WBM (Report No. R.B15058.002.01.doc, revision 0).</p> <p>MPC therefore considers that the relevant provisions of the NSW Flood plain Development Manual 2005 have been considered in the flood modelling and flood assessment for the proposed development.</p>                                                                                                                                                                                                                                                                                                                                                                                               |
| 13a            | Whether there will be detrimental increases in the potential flood affectation of other properties, assets and infrastructure | <p>As described in the response to Item 12b, the impact on the flood risk to property, assets and infrastructure on adjacent properties by the proposed development will be negligible.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

| SEARs Item No. | Requirement                                                                                                                                                                | Response                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 13b            | Consistency with Council floodplain risk management plans                                                                                                                  | As described in the response to Item 12c, the relevant provisions of the NSW Flood plain Development Manual 2005 have been considered in the flood modelling and flood assessment for the proposed development.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 13c            | Compatibility with the flood hazard of the land                                                                                                                            | <p>The proposed development is predominantly within a "flood fringe" classification with a smaller portion being "flood storage". The portions are illustrated on the Flood Classification Map in Appendix H of this report.</p> <p>The proposed development is predominantly within a "H2" PMF stability hazard (unsafe for small vehicles) with a smaller portion being "H3" PMF stability hazard (unsafe for all vehicles, children and the elderly). The portions are illustrated on the PMF Stability Map in Appendix H of this report.</p> <p>Considering the nature of the proposed development, being an equine racing and training facility no general public access, the proposed use of the land within the development area is compatible with the flood hazard of the land.</p> |
| 13d            | Compatibility with the hydraulic functions of flow conveyance in floodways and storage in flood storage areas of the land                                                  | <p>The proposed development is not within a floodway, confirmed by the flood certificate and the "Flood Classification Map" included in Appendix H of this report.</p> <p>As described in the response to item 12a the impact on the flood behaviour (which includes flood storage) by the proposed development will be negligible.</p> <p>The development is therefore considered to be compatible with the hydraulic functions of flow conveyance in floodways and storage in flood storage areas of the land.</p>                                                                                                                                                                                                                                                                         |
| 13e            | Whether there will be adverse effect to beneficial inundation of the floodplain environment, on, adjacent to or downstream of the site.                                    | MPC considers the small extent of the site area proposed to be filled for the development (0.95Ha = 2.0% of the Property area) being such a small portion of the 20% permissible under the prescribed conditions of the Flood Certificate, indicates that the impact on the flood behaviour by the proposed development will be negligible.                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 13f            | Whether there will be direct or indirect increase in erosion, siltation, destruction of riparian vegetation or a reduction in the stability of river banks or watercourses | <p>As described in the response to item 12a the impact on the flood behaviour by the proposed development will be negligible.</p> <p>In addition, the stormwater management infrastructure of the proposed development, and the construction phase soil and water management systems, has been designed with on-site detention to limit discharge flow rates leaving the development site to manage the risk of direct or indirect increases in erosion, siltation, destruction of riparian vegetation or a reduction in the stability of river banks or watercourses.</p>                                                                                                                                                                                                                   |

| SEARs Item No. | Requirement                                                                                                                                                                                                                                                                                          | Response                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 13g            | Any impacts the development may have upon existing community emergency management arrangements for flooding. These matters are to be discussed with the SES and Council                                                                                                                              | The proposed development will have a beneficial impact on existing community emergency management arrangements for flooding due to the extensive area of flood refuge being provided by the development. The requirement for flood refuge space in the development was specified in Council's flood certificate.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 13h            | Whether the proposal incorporates specific measures to manage risk to life from flood. These matters are to be discussed with the SES and Council                                                                                                                                                    | The ground floor equine stables have been designed with a floor level at RL 7.000m AHD which is higher than the flood planning level of RL 6.85m AHD specified by Council, even though the equine stables themselves are not necessarily "occupiable rooms". These floor levels will manage the risk to life for the horses and the people accessing the facility.                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 13i            | Emergency management, evacuation and access, and contingency measures for the development considering the full range of flood risk (based upon the probable maximum flood or an equivalent extreme flood event). These matters are to be discussed with and have the support of Council and the SES. | <p>The flood certificate specifies a PMF flood level of RL7.30m AHD with a maximum flow velocity of 1.10m/s.</p> <p>The floor level in the ground floor stables of the proposed development is designed as RL 7.00m AHD.</p> <p>Subsequently, under a PMF flood event, the depth of water (0.30m) x flow velocity (1.10m/s) = 0.33m/s<sup>2</sup> which is below the accepted safe threshold of 0.40m/s<sup>2</sup>. Subsequently, even during a PMF event the flow depths and velocities will be within levels that are safe for emergency management, evacuation and access.</p> <p>In addition, there are numerous egress paths, ramps and stairs providing access to the flood refuge areas on the upper level of the proposed development, which will provide adequate contingency for the protection of life during a PMF event.</p> |
| 13j            | Any impacts the development may have on the social and economic costs to the community as consequence of flooding                                                                                                                                                                                    | Considering the responses listed above, MPC is not cognisant of any changes to the social or economic costs to the community as consequence of flooding on the proposed development site.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 14             | Potential effects of coastal processes and hazards (within the meaning of the Coastal Management Act 2016), including sea level rise and climate change:                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 14a            | On the proposed development                                                                                                                                                                                                                                                                          | <p>Existing ground surface levels within the proposed development site are generally higher than RL 6.0m AHD, and the majority of the proposed development will be constructed higher than RL 7.0m AHD.</p> <p>Subsequently, the risk to the proposed development of sea level rise from climate change is considered very low.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 14b            | Arising from the proposed development                                                                                                                                                                                                                                                                | Considering the responses to the previous items listed above, MPC is not cognisant of any potential effects on coastal processes or hazards arising from the proposed development site.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

## 4.6 Responses to City of Newcastle Comments 19 Nov 2021

The following comments are offered in response to Flood Management and Stormwater Management items in the “EIS” reply from the City of Newcastle (Ref: SD2020/0014, dated 19 November 2021).

| CoN Item No. | Requirement                                                                                                                                                                                                         | Response                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|--------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3.           | Flood Management                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 3.1          | <p><u>Flood Planning Level:</u></p> <p>CoN recommended the “Goods Storage Shed” and the “Equipment Shed” be set with a floor level of RL 6.850m AHD, based on anecdotal data from the 2007 “Pasha Bulka” storm.</p> | <p>MPC disagrees with CoN's request for the following reasons.</p> <ul style="list-style-type: none"> <li>MPC has relied on the Flood certificate from CoN (Ref: FL2019/00101, dated 22 May 2019) in the design of flood management for this development.</li> <li>MPC sought and received confirmation from CoN's Mr Alastair Peddie on [4:29pm, Wednesday 30 September 2020] that the above-mentioned flood certificate was still current and relevant for this development.</li> <li>The flood certificate states a 1% AEP flood level in the South West corner of the NJC site (i.e. in the area of this proposed Stables development) of RL 6.35m AHD.</li> <li>The Goods Storage Shed and Equipment Shed are non-habitable buildings (similar risk to a garage structure) with a design floor level of RL 6.500m AHD, which is 150mm higher than the 1% AEP flood level in that location.</li> <li>Given that the Goods Storage Shed and Equipment Shed areas with floor levels at RL 6.500m AHD are not habitable areas, and are 150mm above the 1% AEP flood level, it is reasonable to maintain the currently proposed floor level of RL 6.500m AHD.</li> </ul> |
| 3.2          | <p><u>Flood Storage:</u></p> <p>CoN requested additional analysis of flood storage potential impacts on adjacent properties.</p>                                                                                    | <p>MPC has estimated that fill placed on the entire footprint of the 1%AEP flood storage area within the proposed development, up to the 1% AEP flood level (which is very conservative), would displace in the order of 1,300m<sup>3</sup> of flood storage. Analysis of the flood maps included with the flood certificate indicate a flood storage (within the vicinity of this proposed development) for the current 1% AEP flood storage surface area would be in the order of 190,000m<sup>2</sup>. Subsequently, if the 1,300m<sup>3</sup> was displaced from the NJC site then the worst case would be an increase in flood levels in the order of 7mm. Noting that this is a conservative scenario, the potential for a 7mm increase in 1% AEP flood level is considered negligible, and subsequently MPC is satisfied that there would be no adverse impact on the neighbouring properties.</p>                                                                                                                                                                                                                                                                |
| 3.3          | <p><u>Refuge Provision:</u></p>                                                                                                                                                                                     | <p>No additional information was requested by CoN regarding provision for flood refuge in the development,</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

| CoN Item No. | Requirement                                                                                                                                                                                                                                                                                                                         | Response                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3.4          | <p><u>Flood Risk Management:</u></p> <p>CoN recommended that a Flood Management Plan be prepared due to the intention to rely on surface on-site detention of stormwater in the car parks.</p>                                                                                                                                      | <p>MPC has designed the car parks with numerous localised temporary on-site surface detention storage areas. These locations generally coincide with "rain gardens" in the carpark and have been designed to limit the depth of storage of surface water to 200mm so as to comply with the Council DCP requirements in this regard.</p> <p>Subsequently, with surface storage of stormwater being limited to discreet low-points in the car parks, with water depths not exceeding 200mm, MPC does not consider there to be a need for additional flood planning as a result of the proposed surface stormwater detention.</p>                                                                                                                                                                                                                                               |
| 4.           | Stormwater Management                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 4.1          | <p><u>Assessment Philosophy:</u></p> <p>CoN made reference to the publication by Sydney Water Catchment Authority and the NSW Government titled "Horse Property Developments in the Sydney Drinking Water Catchment" and recommended the development proposal be considered in the context of this document as well as the DCP.</p> | <p>MPC has reviewed the document and confirms that the stormwater management provisions recommended in the civil engineering design are:</p> <ul style="list-style-type: none"> <li>• Consistent with the recommended principles in the "Horse Property Developments in the Sydney Drinking Water Catchment" document.</li> <li>• Consistent with the stormwater management design philosophy that was prepared for the recent NJC "Tie-Up Stalls" development, which previously received development approval from CoN.</li> <li>• Consistent with stormwater management systems that MPC has designed for large scale equine developments in Western Sydney (Darley Australia Equine Training Facilities), in Moss vale NSW (Bong Bong Farm Stud and Training Facility), in the Hunter Valley (Godolphin Horse Stud, Kia Ora Stud) and Victoria (Yu Long Stud).</li> </ul> |
| 4.2          | <p><u>Impact from Horse Waste:</u></p> <p>CoN raised concerns for the potential for horse waste to discharge into the Hunter Water of CoN drainage systems.</p>                                                                                                                                                                     | <p>Surface rainwater from parking areas, internal vehicular access and horse walkways will be directed to Gross Pollutant Traps and/or on-site bioretention basins for treatment prior to discharge.</p> <p>The NJC facility will have systems and procedures in place for management of horse waste within the site. These are described in further detail by other consultants as part of the approval documentation.</p> <p>A large portion of the proposed development (the north-east corner) drains to the existing dam in the centre of the track, so replicates the pre-existing drainage philosophy for that area.</p> <p>All of these systems in place will effectively manage the risk of the potential for horse waste to discharge into the Hunter Water of CoN drainage systems.</p>                                                                           |

| CoN Item No. | Requirement                                                                                                                                                                                 | Response                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|--------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4.3<br>4.3.1 | <p><u>Stormwater Design Comments:</u></p> <p>CoN raised concern that Bioretention Basins BRB2 and BRB3 were close to the property boundary (within 4m of the boundary for a clay site).</p> | <p>The requirement to have a basin more than 4m from a property boundary is generally to prevent abnormal ground moisture conditions from having an adverse impact on footings of adjacent structures on neighbouring properties. For this particular development, the basins are proposed to be located close to the street frontage boundary and not adjacent to a neighbouring private property. Subsequently, there are no structures that would be adversely impacted by the proposed basin locations.</p> <p>The proposed BRB2 and BRB3 basin locations (close to the Darling Street boundary) are consistent with the proximity of similar basins that were approved by CoN for the NJC "Tie-Up Stalls" project fronting onto Darling Street.</p> <p>Subsequently, there is no need to relocate the basins 4m from the proposed locations.</p> |
| 4.3.2        | CoN raised concern that Bioretention Basin BRB2 was close to the Goods Storage Building (within 4m of the building for a clay site).                                                        | The possible impacts of abnormal soil conditions from the basin BRB2 on the Goods Storage Building can easily be managed through good structural design of the building. MPC does not have any concerns regarding the proposed proximity of the basin BRB2 to the Goods Storage Building.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 4.3.3        | CoN requested On-Site Detention locations be clearly marked on the stormwater plans and typical sections.                                                                                   | <p>Stormwater Basins have been clearly marked on the stormwater plans. Typical basin details are included on the Section on Drawing 16-548-1-C03.50 (Section 1).</p> <p>Rain gardens in the car parks have been hatched on plan, and typical details (confirming the maximum Extended Detention depth of 200mm) are included on Drawing 16-548-1-C03.50.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 4.3.4        | CoN raised concern that bio-retention basins located along Darling Street could be impacted by extreme weather events.                                                                      | MPC confirms that the bio-retention basins have been designed for the 1% AEP storm event. The basin is designed to not rely on the emergency spillway unless the outlet pipes from the basin are fully blocked (which is extremely unlikely due to the configuration of the GPT into the basin and the outlet pits from the basin) just prior to a 1% AEP storm event occurring. The bases of the basins are specified to be vegetated which also minimised the risk of re-mobilization of materials during extreme weather events. Subsequently MPC is satisfied that this concern has been addressed.                                                                                                                                                                                                                                               |
| 4.4          | <u>Covenant on 90 Darling Street</u>                                                                                                                                                        | This issue is being addressed by other consultants (planning).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

| CoN Item No. | Requirement                                                                                                                                                                                                                                                                                            | Response                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|--------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4.5          | <p><u>Stormwater Discharge Connections – Impact on CoN Drainage Infrastructure:</u></p> <p>CoN requested that further demonstration be provided showing the proposed design meets CoN's design requirements (including Hydraulic Grade Lines for stormwater pipes in Chatham and Darling Streets).</p> | <p>The new stormwater pipes in Darling Street have been nominated away from the nominal kerb line so as to line up with the existing CoN drainage infrastructure in the road reserve. The existing CoN pipes in Darling Street along the NJC frontage are not located under the kerb and gutter so are not conventional. MPC determined that it is a better outcome for the stakeholders to maintain the current drainage pipe positions to manage risk of damage or disruption to in-ground services in the road reserve. Also, this approach has already been approved by CoN for the "Race Day Tie-Up Stalls" project in Darling Street for the NJC site.</p> <p>MPC has included the existing CoN stormwater pits, pipes and road gutters in the DRAINS model of the development and found that, due to the extensive amount of on-site detention being provided in the development, there will not be an adverse impact on the existing CoN stormwater drainage infrastructure as a result of the proposed development. Pipe long-sections with hydraulic grade lines for the existing pipes are included in Appendix D of this report (Stormwater Calculations).</p> |

## 4.7 Stormwater Quantity (Detention)

On-site detention has been provided in the following:

- Arrivals Area – OSD storage provided in the bioretention basins "BRB3"
- Southern elevated concourse – OSD storage provided in the bioretention basins "BRB1" and "BRB2"
- Stables buildings – Rainwater re-use storage provided in above-ground rainwater tanks, plus OSD storage within infiltration trenches.
- Maintenance Area hardstand – OSD provided as surface detention on the hardstand (up to 200mm storage depth)
- Northern elevated concourse – OSD storage not required since rainwater will be directed to the dam in the centre of the race track
- Car Park – OSD provided as surface detention on the hardstand (up to 200mm storage depth) and infiltration through permeable paving and rain gardens.

Basin numbers referred to in this report are as denoted on MPC's stormwater management plans included in **Appendix C** of this report.

The basin geometry has been set using landscaped slopes not exceeding 1V:3H so as to maximise the plan extent of the basin and still enable access for maintenance.



The software package “DRAINS” was used to model the post-developed stormwater system, using an ILSAX hydrological model. Relevant calculations and sketches are included in **Appendix D** of this report.

Pre-developed and post-developed Flows are summarised in **Table 3** below.

**Table 3: OSD Results**

| Sub-catchment ID                          | Sub-catchment Description                                | Minor Storm (ARI= 10yrs) |                                        | Major Storm (ARI= 100yrs) |                                         |
|-------------------------------------------|----------------------------------------------------------|--------------------------|----------------------------------------|---------------------------|-----------------------------------------|
|                                           |                                                          | Pre-dev Flow (L/s)       | Controlled Post-dev Flow (L/s)         | Pre-dev Flow (L/s)        | Controlled Post-dev Flow (L/s)          |
| Darling                                   | Southern portion of the site, draining to Darling Street | 104                      | 107 (10% AEP, 15min burst)             | 345                       | 176 (1% AEP, 45min burst)               |
| Chatham                                   | Western portion of the site, draining to Chatham Street  | 105                      | 13 (north)<br>40 (south)<br>53 (total) | 242                       | 19 (north)<br>82 (south)<br>101 (total) |
| Total flows to the public drainage system | Darling St + Chatham St flows                            | 209                      | 160 (<209 therefore acceptable)        | 587                       | 277 (<587 therefore acceptable)         |

Table 3 demonstrates that the controlled post-developed flows from the proposed Stables Complex site do not exceed the pre-developed flow rates for the minor or the major storm events.

#### Emergency Overflow Weir from the Basin

Consideration was given to the possibility of full blockage of the outlet pipe system draining the basins. In this event, it was assumed that the OSD basins filled completely and the post-developed (uncontrolled) major storm flows over the weir of the basin.

Overflow of the basins over their respective spillways, resulting from potential system blockages during major storm flows, are summarised in **Table 4** below.

**Table 4: OSD Basin Spillway Flows**

| Basin ID                                | Peak Major Storm Flow Rate (L/s) | Weir Length (m) | Flow Depth (m) | Flow Velocity (m/s) | Velocity x Depth (m <sup>2</sup> /s) |
|-----------------------------------------|----------------------------------|-----------------|----------------|---------------------|--------------------------------------|
| BRB1 (to BRB2)                          | 722                              | 3               | 0.328          | 0.70                | 0.19 (<0.40 therefore okay)          |
| BRB2 (to Darling Street)                | 178                              | 20              | 0.187          | 0.9                 | 0.01 (<0.40 therefore okay)          |
| BRB3 (to Chatham Street)                | 244                              | 4               | 0.063          | 1.2                 | 0.07 (<0.40 therefore okay)          |
| Maintenance hardstand to Chatham Street | 15                               | 9               | 0.007          | 0.40                | 0.003 (<0.40 therefore okay)         |

Table 4 demonstrates that the emergency spillway flows are all within recommended safe levels.

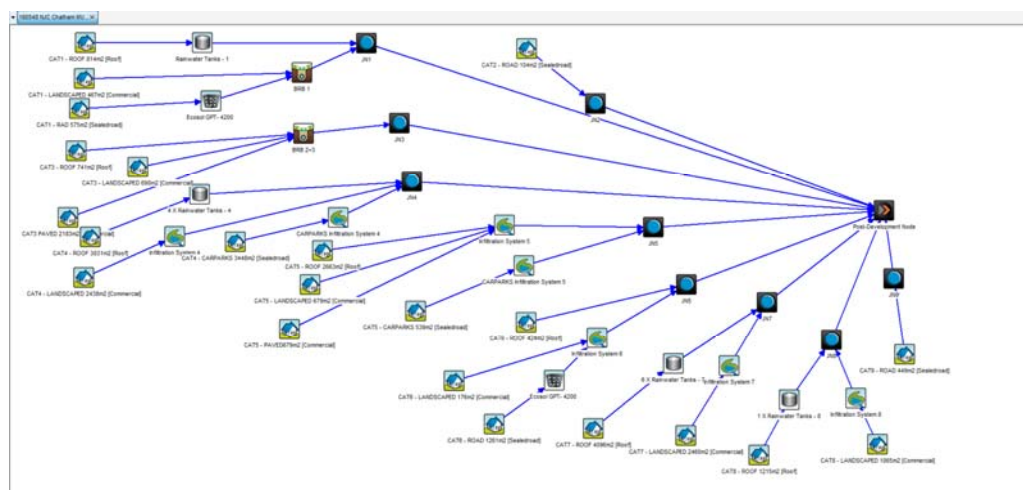
## 4.8 Stormwater Quality (WSUD)

Stormwater quality requirements from the NCC DCP have been incorporated into the overall stormwater management design for the site.

Water quality measures for the site have been modelled using MUSIC software and include the following:

- Rainwater from the roof of the proposed new buildings will be directed through a first-flush device before being stored in water re-use tanks. Stored water will be re-used on site, and overflows from this system will be directed to infiltration trench with OSD storage capacity. High-level overflows from the infiltration trenches will be directed to the existing site drainage network.
- Stormwater from impermeable car park pavement areas will be directed to areas of permeable paving for infiltration, and to “rain gardens” (similar to WSUD Bioretention System – Roadway – City of Newcastle Standard Drawing A2404) for treatment before being released to the Chatham Street stormwater drainage system.
- Stormwater from pavements in the Arrivals Area will be directed via an in-ground pipe system to a Gross Pollutant Trap for primary treatment, then to the bio-retention basin “BRB3” for tertiary treatment.
- Stormwater from pavements in the Maintenance Area will be directed via an in-ground pipe system to a Gross Pollutant Trap for primary treatment, then to a sand filter for tertiary treatment, before being released to the Chatham Street drainage network.
- Stormwater from the southern portion of the elevated concourse will be directed via suspended pipe system with a first-flush system for primary treatment, then to the bio-retention basin “BRB1” and “BRB2” for tertiary treatment.
- Typical details of the bio-retention basins have been included on the stormwater management drawings.

The stormwater quality devices and systems have been specified on the stormwater management plans included in **Appendix C**. A schematic of the MUSIC model for the car park catchment is included in Figure 5.



**Figure 5: MUSIC Model Schematic**

The proposed treatment train achieves the water quality targets listed Table 4.

**Table 4: Stormwater Quality Outcome Summary**

| Pollutant                    | Target Reduction in annual load | Reduction in annual load Achieved |
|------------------------------|---------------------------------|-----------------------------------|
| Total Suspended Solids (TSS) | 85%                             | 89.5%                             |
| Total Phosphorus (TP)        | 65%                             | 78.6%                             |
| Total Nitrogen (TN)          | 45%                             | 73.6%                             |
| Gross Pollutants (GP)        | 90%                             | 96.8%                             |

A copy of the MUSICLink report is included in **Appendix G**.

The OSD basins have also been sized as a temporary sediment control basin for initial bulk earthworks construction phase, in accordance with the procedures in the “*Soils and Construction – Managing Urban Stormwater*” guidelines. Additional details in this regard are included in **Appendix E** and **Appendix F**.

#### 4.9 Stormwater Re-Use / Harvesting

Rainwater from the roof of the new buildings will be directed through a first-flush device before being stored in water re-use tanks. Stored water will be re-used on site as follows:

- In horse wash bays within the new Stables buildings
- In horse wash bays within the new concourse
- For toilets in the Stables Complex
- For irrigation within the Stables Complex precinct

Thirteen (13) rainwater tanks, each holding up to 25,000L, will be adjacent to the Stables buildings.

Three (3) rainwater tanks, each holding up to 15,000L, will be adjacent to the Goods and Equipment Store buildings.

Therefore, there will be a total of 370,000L of additional re-use storage capacity provided in above-ground rainwater tanks within the Stables Complex which will be supplied by the roof areas of the new Stables buildings.

#### **4.10 Maintenance of Stormwater Management Facilities**

Maintenance of concrete pits, pipes and paved flow paths will be minimal however will still involve occasional cleaning.

- Ideally, pits and pipes should be inspected (and cleaned if necessary) at 3 month intervals and following large rainfall events.
- Trash screens and silt ponds should be inspected and cleaned at 3 month intervals and following large rainfall events;
- Removal of sediment from the sediment ponds to be undertaken annually, or after heavy rainfall events;
- Bio-retention basins should be inspected and maintained in accordance with the recommendations in "Bioretention Technical Design Guidelines" by Water By Design (October 2014).

## 5. Construction Phase Soil and Water Management

The construction phase approach adopted for this site will incorporate principles recommended by the NSW Department of Housing, namely:

- Plan for erosion and sediment control concurrently with engineering design and in advance of earthworks proper assessment of site constraints and integration of the various needs;
- Minimise the area of soil exposure;
- Conserve the topsoil where possible;
- Control water flow from top of the development area, through the works and out the bottom of the site, for example,
  - divert clean runoff above denuded areas
  - minimize slope gradient and length. Excavated batter slopes of 3H:1V are considered acceptable provided they are turfed and landscaped as soon as possible;
  - keep runoff at non-erodible velocities
  - trap soil and water pollutants
- Rehabilitate disturbed lands quickly.

A sediment and erosion control plan is shown on MPC Drawings included in **Appendix E** of this report. Calculations used in the sizing of the sediment basins have been included in **Appendix F**. The required volumes for each temporary basin are specified on the sediment and erosion control plan in **Appendix F**.

The volume of the settling and storage zones of the temporary basins have been sized using methods outlined in the “Soils and Construction” (Blue Book) by NSW Department of Housing. The volumes for each temporary basin are specified on the

In addition, general controls will be provided on the site prior to and during all earthworks in accordance with EPA Site Work Practices. Features of the construction phase erosion and sediment controls adopted for this site include:

- Prevention of sediment and polluted runoff water from being directed off the construction site;
- Control of actual and potential soil erosion – grassing and stabilization of embankments and drainage outlets where required.
- Stabilised stockpile areas adjacent to existing access roads on the site, to minimise site disturbance required for access to the stockpile areas during initial stages of construction;
- Scour protection at discharge locations, comprising combinations of geofabrics (jute mesh) and rock-filled mattresses.
- Stabilised site access to provide a firm base for vehicle entry/exit and to prevent the main access from becoming a source of sediment;

- Sediment control measures are to be constructed prior to any other site disturbance works.

## 6. Summary

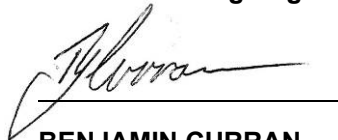
This report has been prepared by MPC Consulting Engineers to assist with the Development Approval of the Stormwater Management and Soil & Water Management works for the proposed Chatham Street Stables Complex and associated car park at the Newcastle Jockey Club.

This report has been prepared to assist with the Development Approval of the proposed stormwater management works. Further detailed design and documentation would be conducted once approval of the Development Approval has been advised and any specific Development Conditions issued by Newcastle City Council.

For further information in relation to this stormwater management plan please contact the undersigned.

Signed:

**MPC Consulting Engineers**

A handwritten signature in black ink, appearing to read 'B. Curran', is written over a horizontal line.

**BENJAMIN CURRAN**

BE (Civil)(Hons), MIEAust (#1465387)

CPEng, NPER (Civil/Structural) RPEQ

**Director, Senior Engineer**

## Appendix A

# Photographs of the Existing Site





**Photograph 1: Existing Pit “ExP1” in Darling Street**



**Photograph 2: Existing Pits “ExP2” and “ExP3” in Darling Street**





**Photograph 3: Existing Pit “ExP4” in Chatham Street**



**Photograph 4: Existing Pit “ExP5” in Chatham Street**





**Photograph 5: Existing Pit “ExP6” in Chatham Street**



**Photograph 6: Existing Pit “ExP7” Adjacent to the Track**





**Photograph 7: View of Darling Street – Looking East**

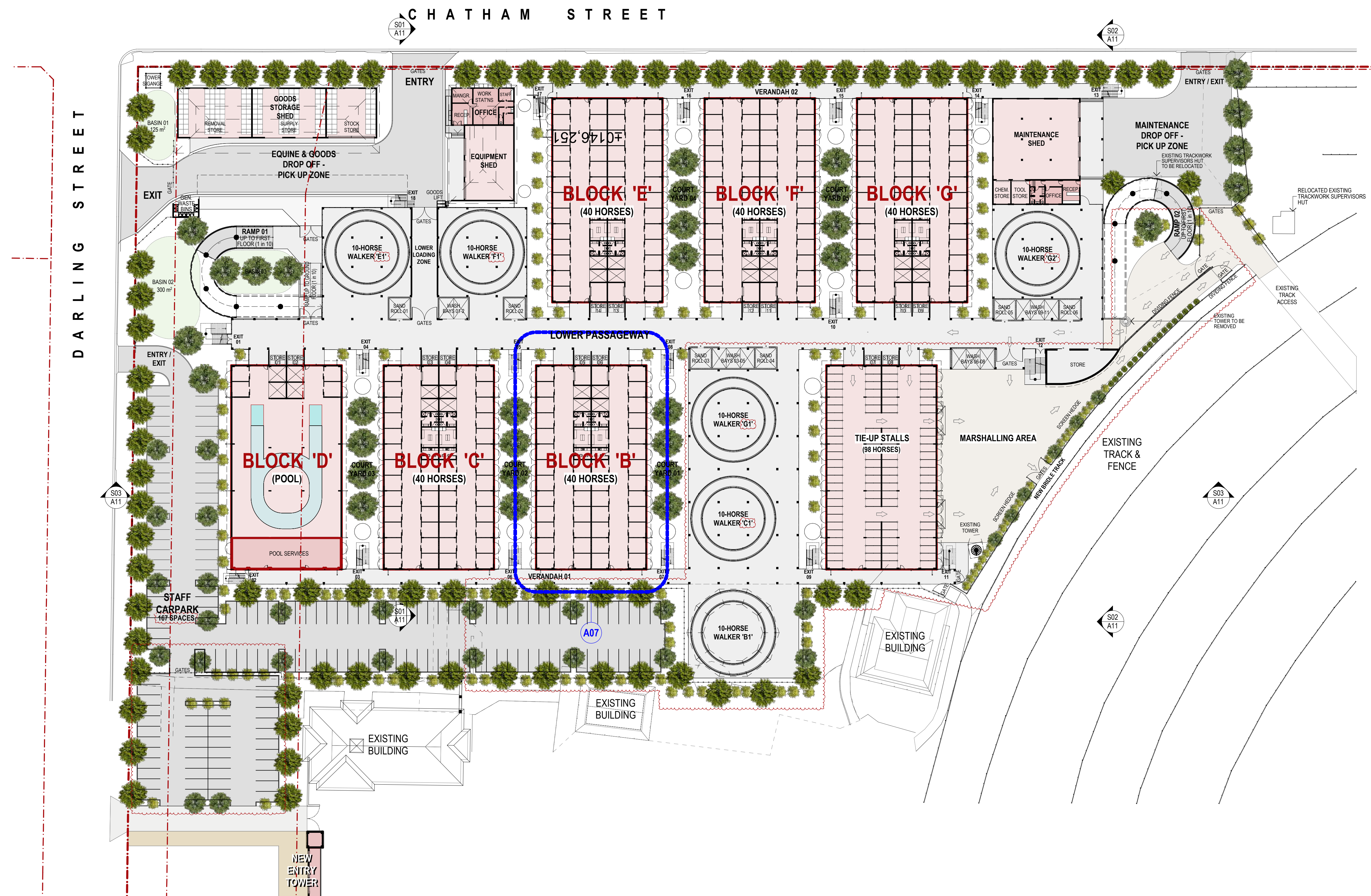


**Photograph 8: View of the Chatham Street Entry – Looking South**

## Appendix B

# Architectural Site Plan

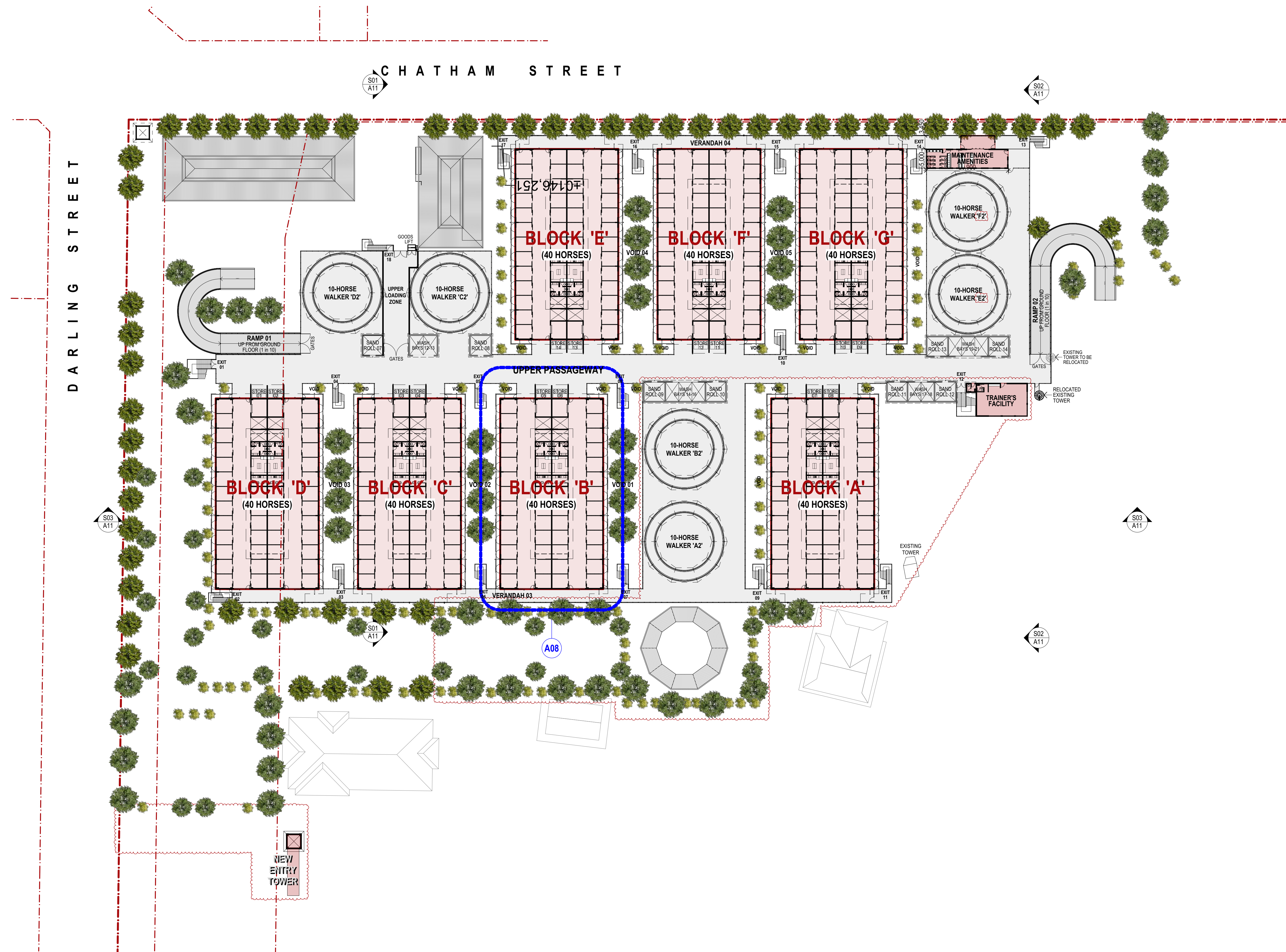




**OVERALL GROUND FLOOR PLAN**

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**OVERALL FIRST FLOOR PLAN**

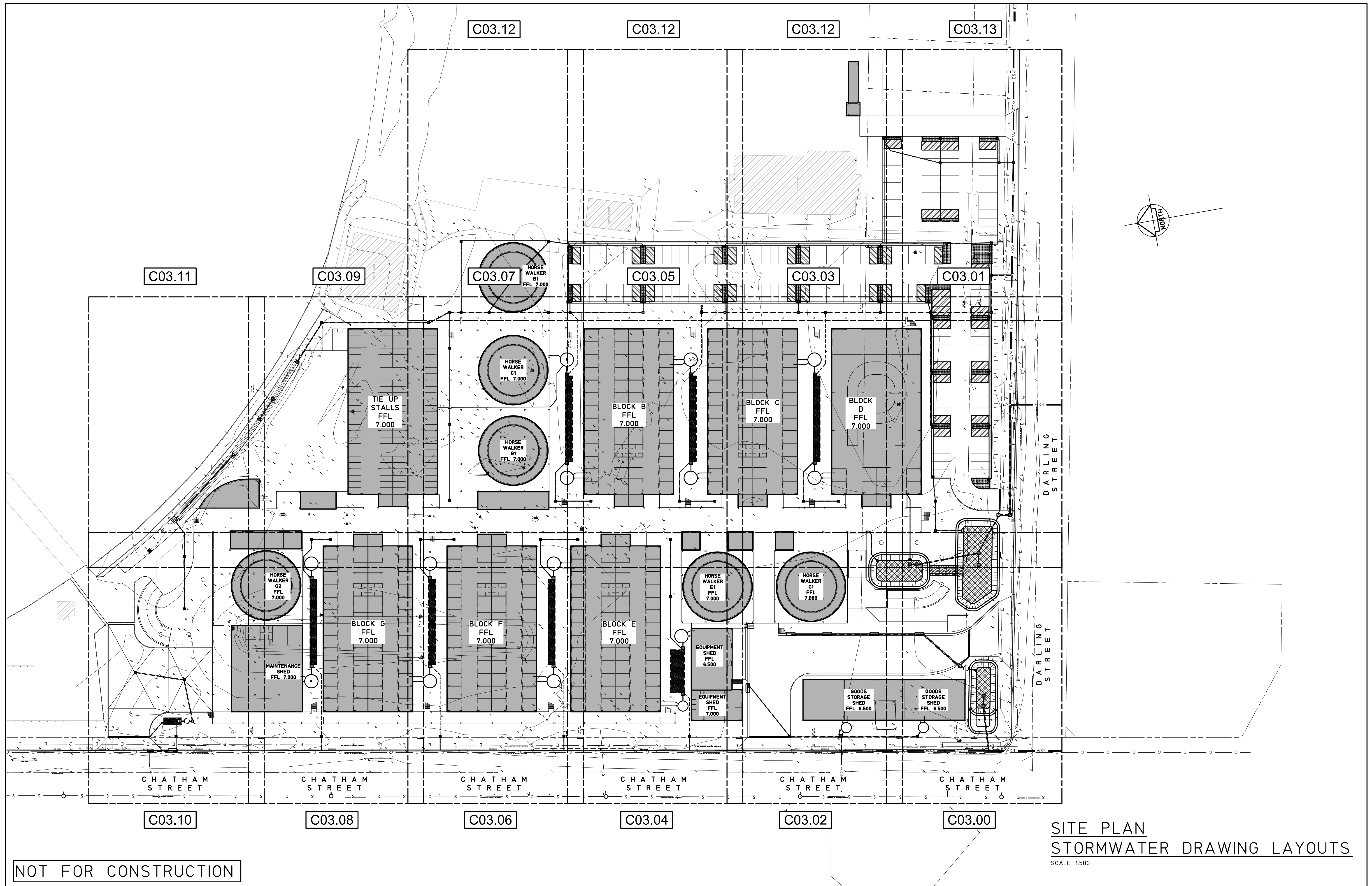
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## Appendix C

# Stormwater Management Plans





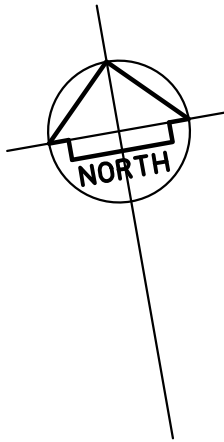
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| 3     |  | REVISED DEVELOPMENT APPLICATION |  | 7.4.22                                                                   |  |                                                                                                                                                                                                                                                                                 |  |                                                                                                                                                                                                                                 |  |                                                  |  |                                                                                                           |  | SCALES               |  | JOB No           |  | DRAWING No     |  | ISSUE       |  |
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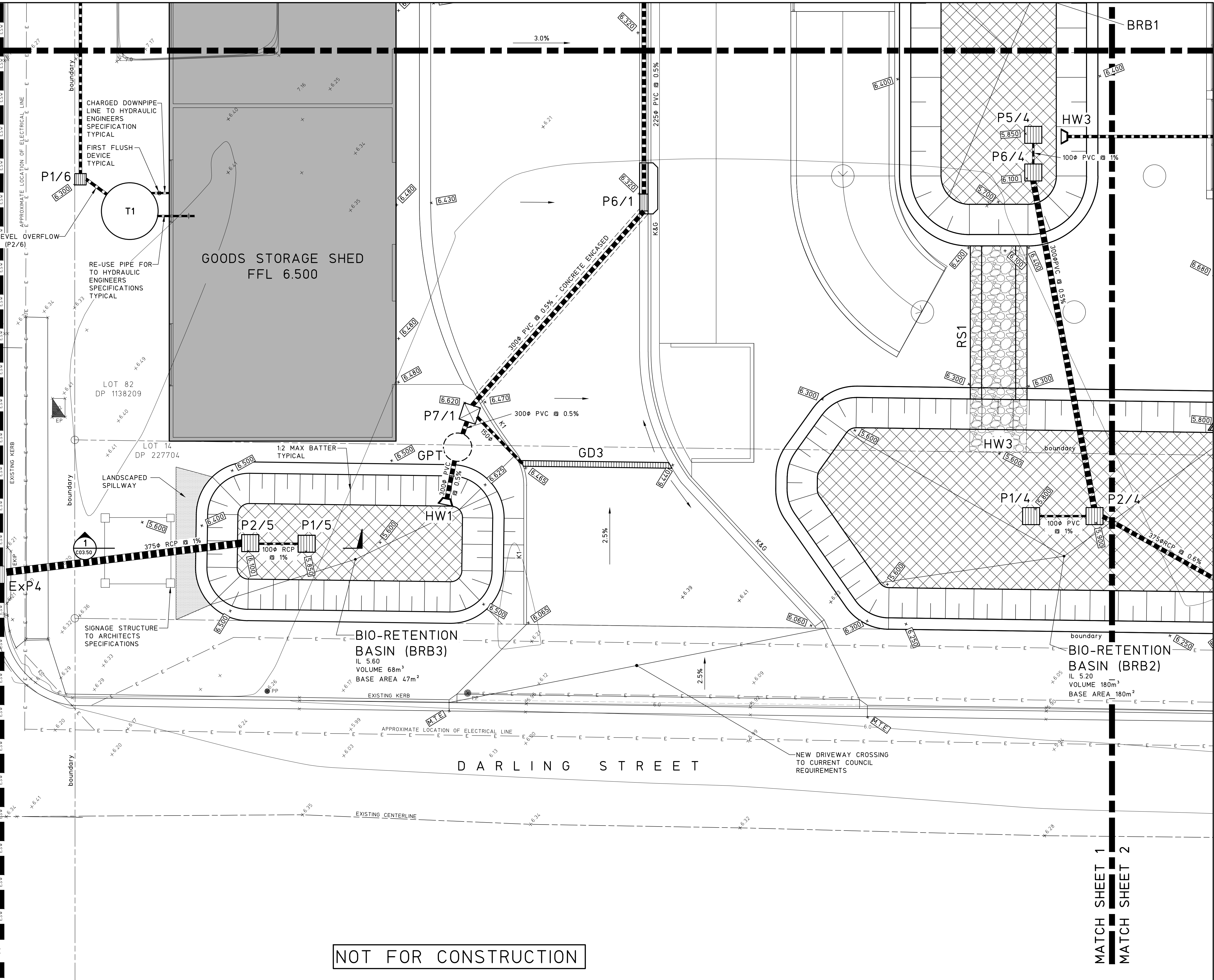
MATCH SHEET 3  
MATCH SHEET 1



CHATHAM STREET

STORMWATER PLAN  
SHEET 1

SCALE 1:100  
STORMWATER NOTES  
1. REFER TO DRAWING C03.11 FOR STORMWATER NOTES AND PIT SCHEDULE  
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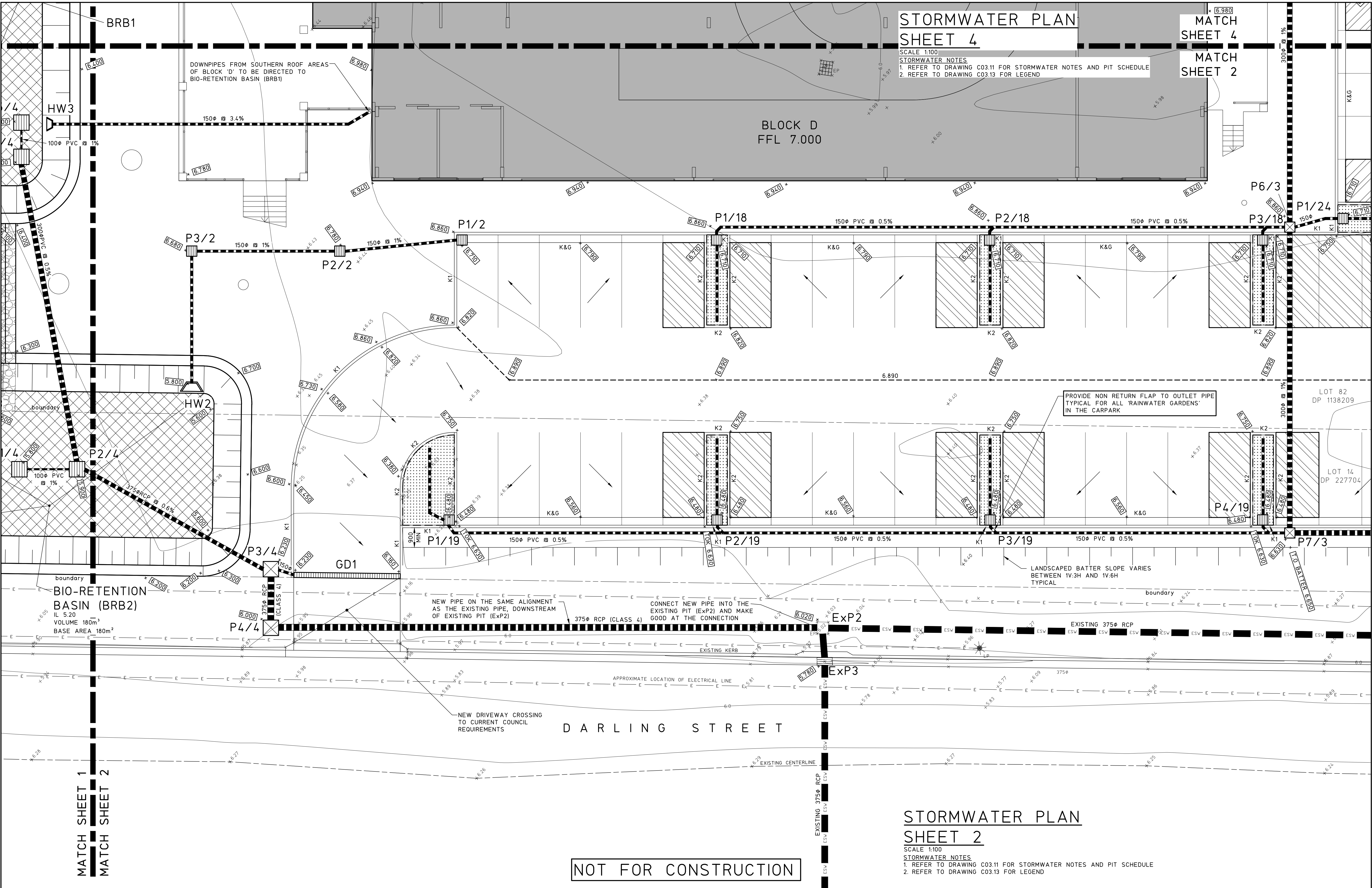
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| TITLE  | STORMWATER PLAN<br>SHEET 1 |

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FULL SIZE ON ORIGINAL 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 cm





STORMWATER PLAN  
SHEET 4

SCALE 1:100  
STORMWATER NOTES  
1. REFER TO DRAWING C03.11 FOR STORMWATER NOTES AND PIT SCHEDULE  
2. REFER TO DRAWING C03.13 FOR LEGEND

MATCH  
SHEET 4  
MATCH  
SHEET 2

STORMWATER PLAN  
SHEET 2

SCALE 1:100  
STORMWATER NOTES  
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FULL SIZE ON ORIGINAL 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 cm



MATCH SHEET 3

☐ HORSE WALKER E1  
FFL 7.000

WASH BAY 01  
FFL 7.000

SAND  
ROLL 01  
FFL 7.000

HORSE WALKER C1  
FFL 7.000

GOODS STORAGE SHED  
FFL 6.500

STORMWATER PLAN  
SHEET 3

SCALE 1:100

STORMWATER NOTES

1. REFER TO DRAWING C03.11 FOR STORMWATER NOTES AND PIT SCHEDULE  
2. REFER TO DRAWING C03.13 FOR LEGEND

MATCH SHEET 3

MATCH SHEET 1

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DOWNPIPES FROM FLOOR WASTE/DRAINS  
IN THE PODIUM SLAB SURFACE TO BE  
DIRECTED TO BIO-RETENTION BASIN (BRB1)  
VIA A SUSPENDED PIPE NETWORK DESIGN  
BY A HYDRAULIC ENGINEER

BIO-RETENTION  
BASIN (BRB1)  
IL 5.30  
VOLUME 96m<sup>3</sup>  
BASE AREA 80m<sup>2</sup>

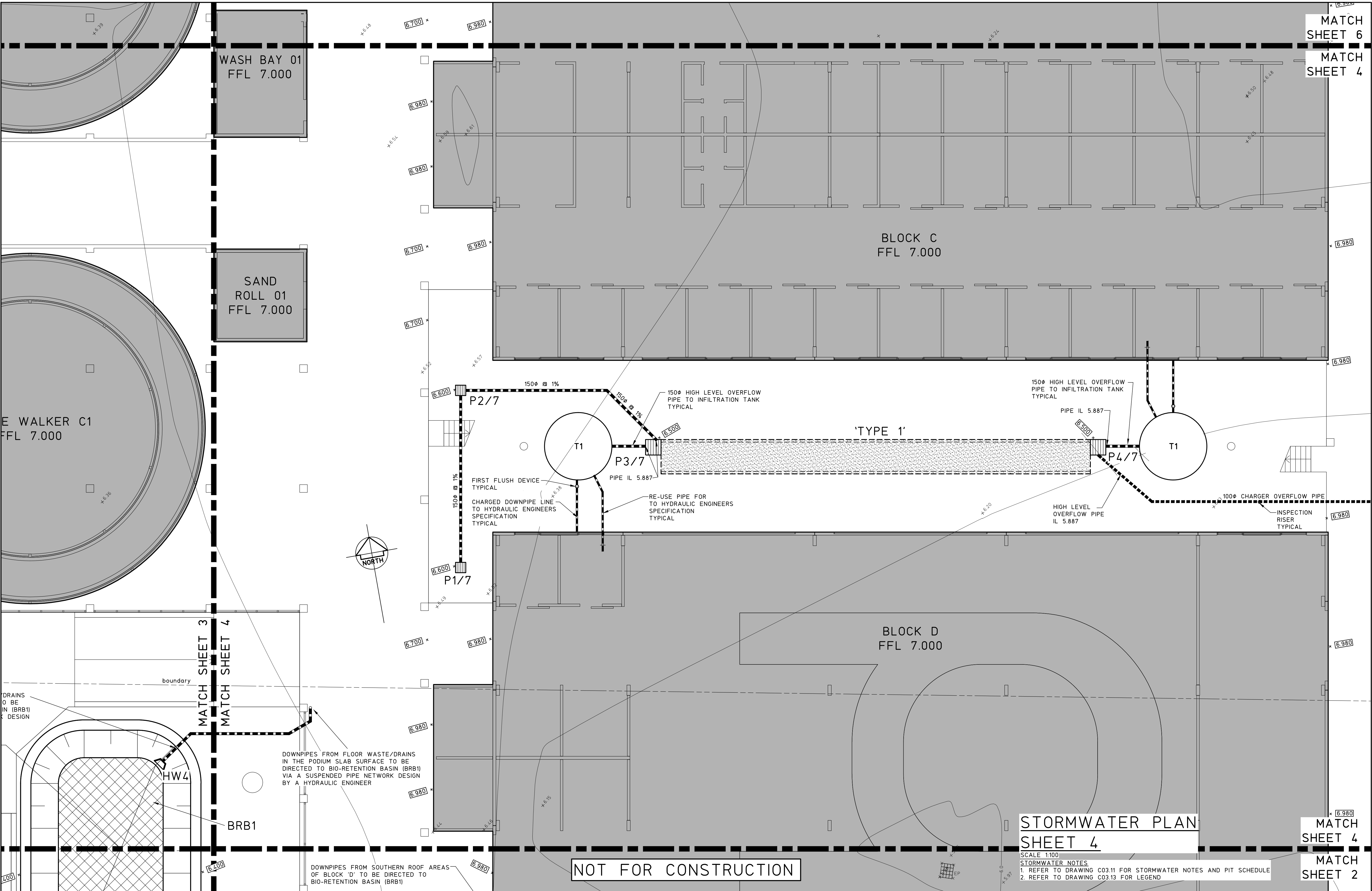
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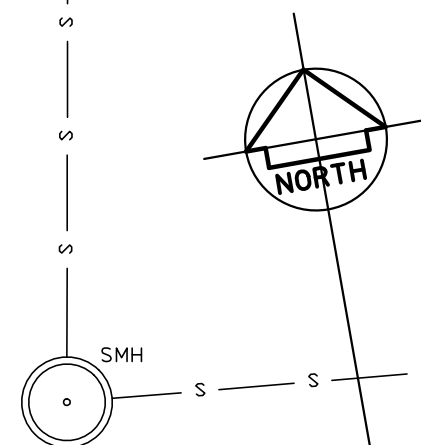
## STORMWATER PLAN SHEET 4

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STORMWATER NOTES  
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2. REFER TO DRAWING C03.13 FOR LEGEND

FULL SIZE ON ORIGINAL 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 cm



MATCH SHEET 5



REMOVE EXISTING DRIVEWAY -  
LAYBACK AND REPLACE WITH  
STANDARD KERB & GUTTER

CHATHAM STREET

STORMWATER PLAN  
SHEET 5

SCALE 1:100

## STORMWATER NOTES

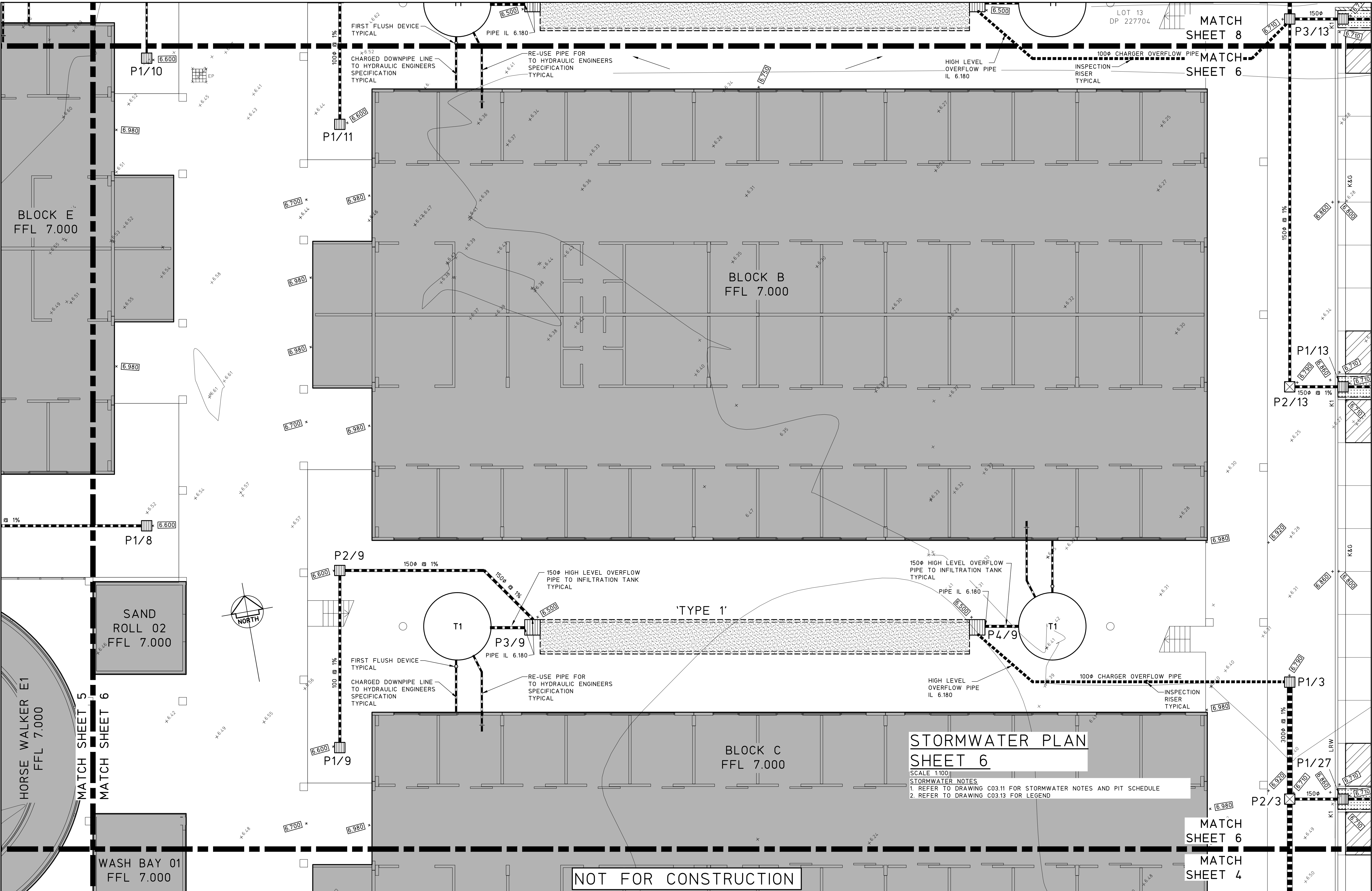
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FULL SIZE ON ORIGINAL 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 cm



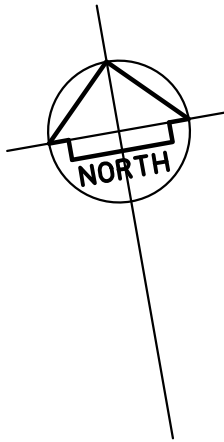


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| 3 REVISED DEVELOPMENT APPLICATION 7.4.22                              |  |  | 2 DEVELOPMENT APPLICATION 12.08.21                                                                                                                                                                                                                             |  |  | TITLE STORMWATER PLAN SHEET 6             |  |  | 1 REFER TO DRAWING C03.11 FOR STORMWATER NOTES AND PIT SCHEDULE                       |  |  | JOB No 16-548-1                               |  |  |
| 1 ISSUED FOR APPROVAL 09.07.21                                        |  |  | 0 PRELIMINARY 02.07.21                                                                                                                                                                                                                                         |  |  | mpc consulting engineers civil+structural |  |  | HIGH LEVEL OVERFLOW PIPE IL 6.180                                                     |  |  | DRAWING No C03.05                             |  |  |
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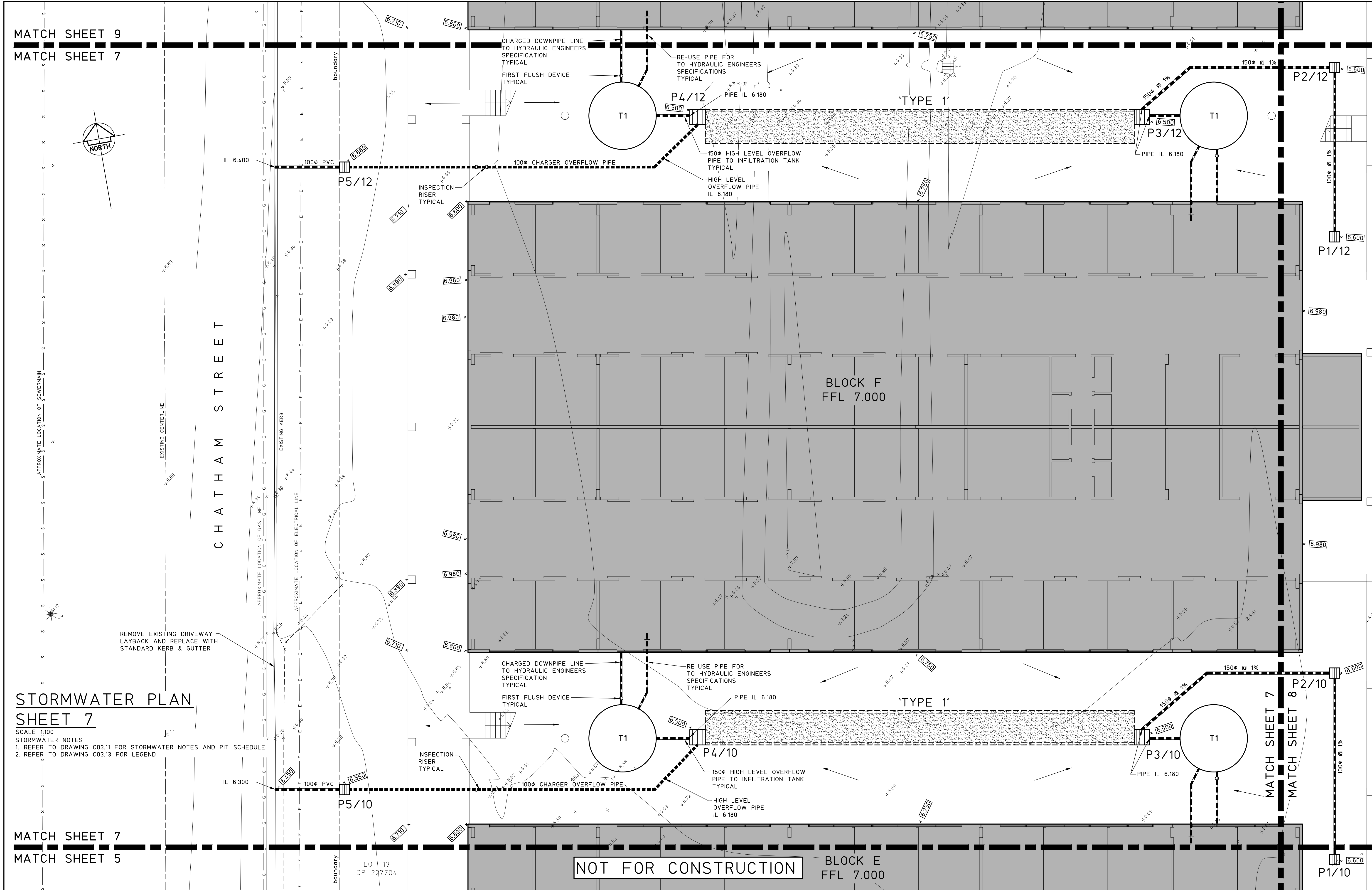


CHATHAM STREET

STORMWATER PLAN  
SHEET 7

SCALE 1:100  
STORMWATER NOTES  
1. REFER TO DRAWING C03.11 FOR STORMWATER NOTES AND PIT SCHEDULE  
2. REFER TO DRAWING C03.13 FOR LEGEND

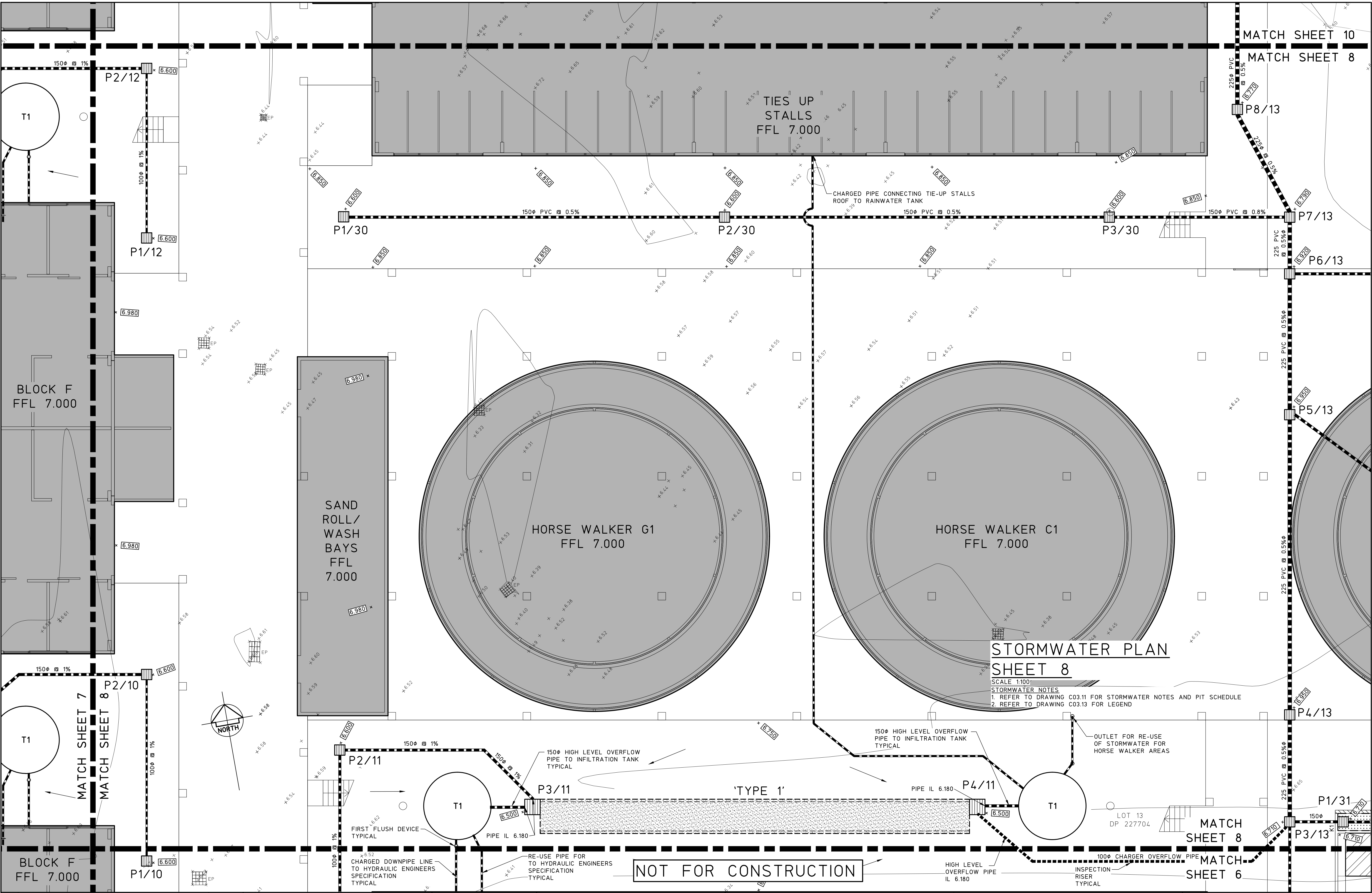
MATCH SHEET 7  
MATCH SHEET 5



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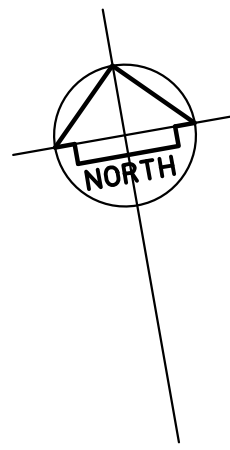


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FULL SIZE ON ORIGINAL 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 cm



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MATCH SHEET 9

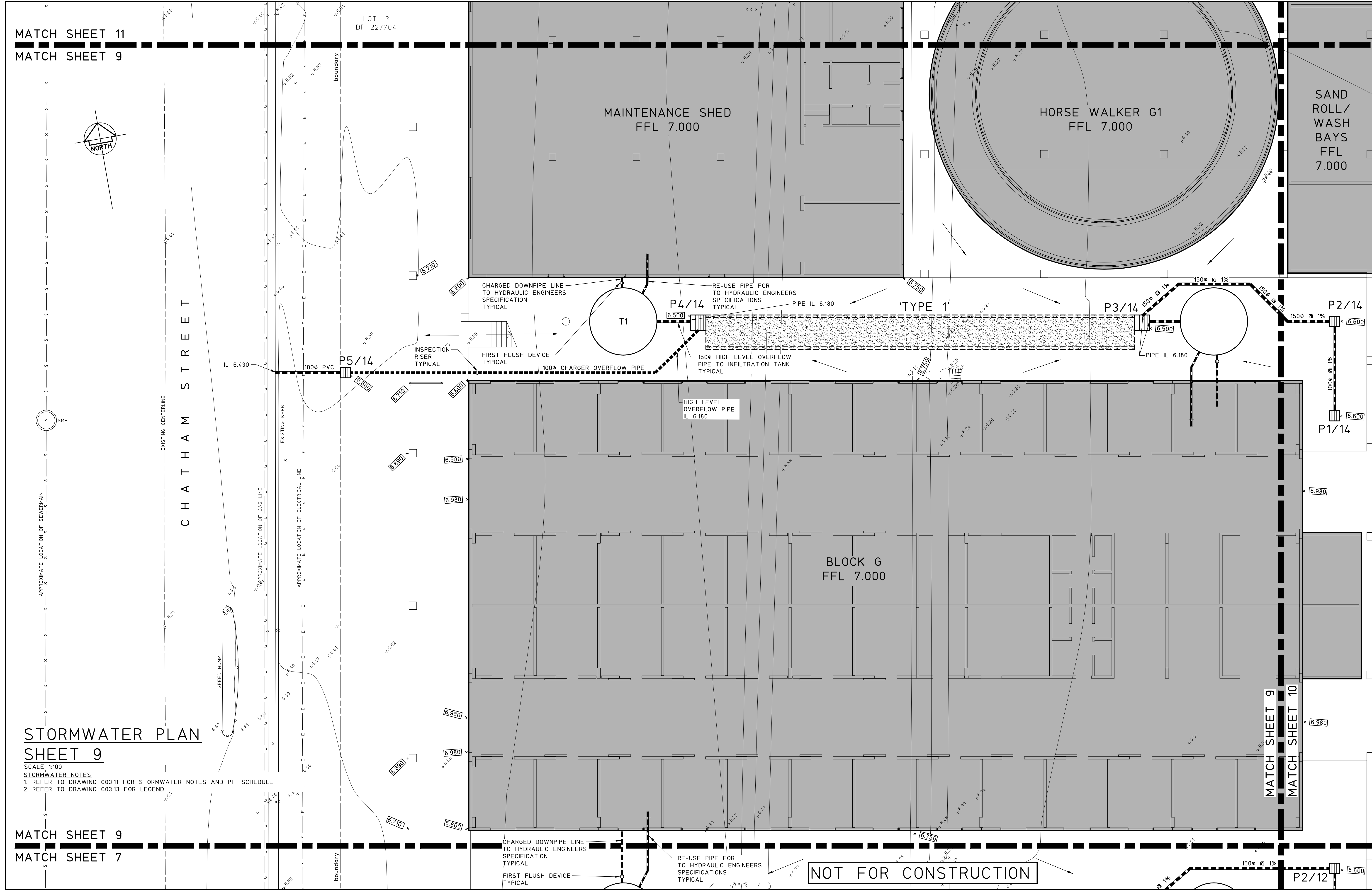


CHATHAM STREET

STORMWATER PLAN  
SHEET 9

SCALE 1:100  
STORMWATER NOTES  
1. REFER TO DRAWING C03.11 FOR STORMWATER NOTES AND PIT SCHEDULE  
2. REFER TO DRAWING C03.13 FOR LEGEND

MATCH SHEET 9  
MATCH SHEET 7



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| 2 DEVELOPMENT APPLICATION 12.08.21                                    |                  |      |                                                                                                                                                                                                                                                                |                                 |  |                               |  |  |                                                                                       |  |  |                                               |  |  |
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FULL SIZE ON ORIGINAL 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 cm



MATCH SHEET 10

SCALE 1:100

STORMWATER NOTES

1. REFER TO DRAWING C03.11 FOR STORMWATER NOTES AND PIT SCHEDULE

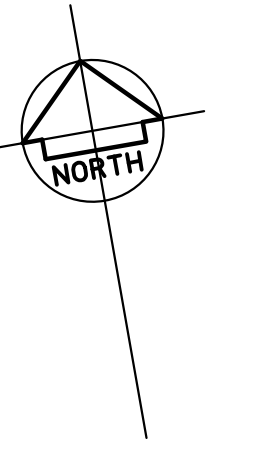
2. REFER TO DRAWING C03.13 FOR LEGEND

SCALE 1:100

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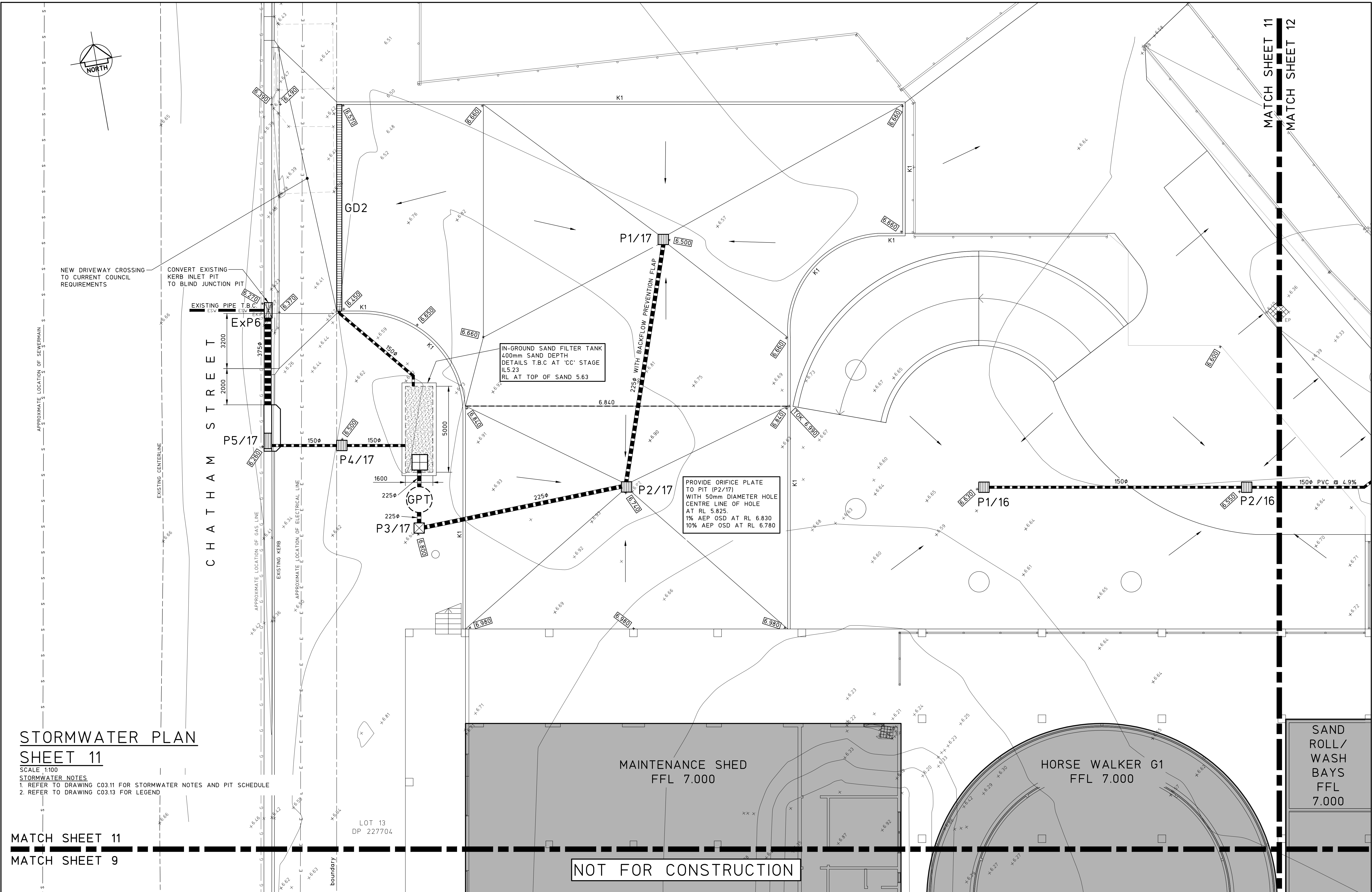


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|       |                                 |          |                                                                                  |                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                              |                                                                                                                     |                             |                       |                    |
|-------|---------------------------------|----------|----------------------------------------------------------------------------------|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|---------------------------------------------------------------------------------------------------------------------|-----------------------------|-----------------------|--------------------|
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| 3     | REVISED DEVELOPMENT APPLICATION | 7.4.22   | <b>THIS DRAWING IS NOT TO BE<br/>USED FOR CONSTRUCTION UNLESS ENDORSED BELOW</b> |                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | TITLE<br><b>STORMWATER PLAN<br/>SHEET 10</b> | DRAWN<br><b>C.W.</b>                                                                                                | ENGINEER<br><b>J.B. No</b>  | No in SET<br><b>-</b> | SHEET<br><b>A1</b> |
| 2     | DEVELOPMENT APPLICATION         | 12.08.21 |                                                                                  |                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                              | SCALE/S                                                                                                             | JOB C.O.                    | DRAWING No            | ISSUE              |
| 1     | ISSUED FOR APPROVAL             | 09.07.21 |                                                                                  |                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                              | <b>1:100</b>                                                                                                        | <b>16-548-1</b>             | <b>C03.09</b>         | <b>3</b>           |
| 0     | PRELIMINARY                     | 02.07.21 |                                                                                  |                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                              |                                                                                                                     |                             |                       |                    |
| ISSUE | REASON FOR ISSUE                | DATE     | DATE OF RELEASE                                                                  | RESPONSIBLE PRINCIPAL SIGNATURE |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | ISSUE                                        |                                                                                                                     |                             |                       |                    |

FULL SIZE ON ORIGINAL      0      1      2      3      4      5      6      7      8      9      10      11      12      13      14      15 cm





STORMWATER PLAN  
SHEET 11

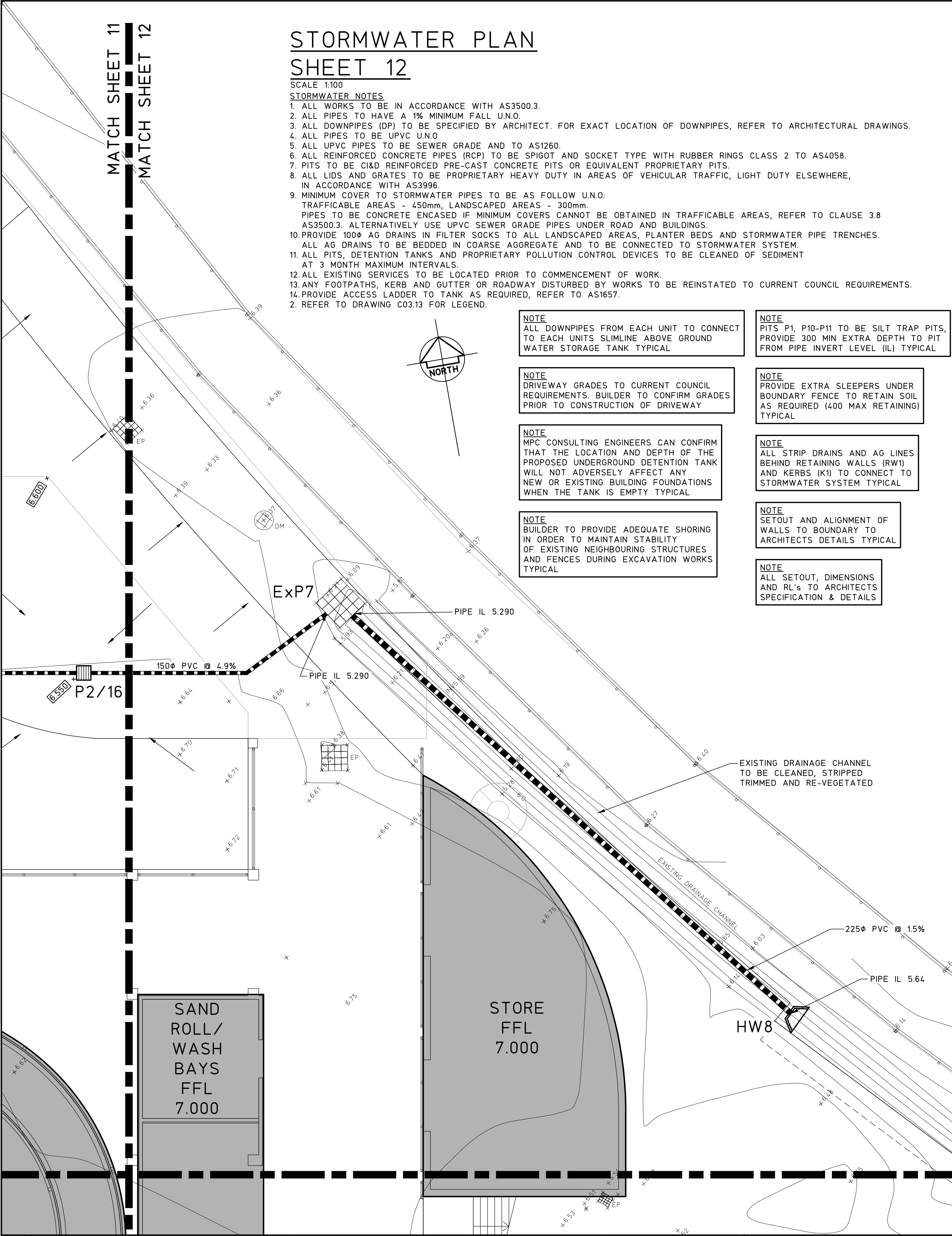
SCALE 1:100  
STORMWATER NOTES  
1. REFER TO DRAWING C03.11 FOR STORMWATER NOTES AND PIT SCHEDULE  
2. REFER TO DRAWING C03.13 FOR LEGEND

MATCH SHEET 11  
MATCH SHEET 9

|       |  |                                                                          |  |                                                                                                                                                                                                                                                                                 |  |                                      |  |                                                                                                |  |                      |                    |                      |             |
|-------|--|--------------------------------------------------------------------------|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--------------------------------------|--|------------------------------------------------------------------------------------------------|--|----------------------|--------------------|----------------------|-------------|
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|       |  |                                                                          |  |                                                                                                                                                                                                                                                                                 |  | TITLE<br>STORMWATER PLAN<br>SHEET 11 |  |                                                                                                |  | SCALES<br>1:100      | JOB No<br>16-548-1 | DRAWING No<br>C03.10 | ISSUE<br>4  |
| ISSUE |  | REASON FOR ISSUE                                                         |  | DATE                                                                                                                                                                                                                                                                            |  | DATE OF RELEASE                      |  | RESPONSIBLE PRINCIPAL SIGNATURE                                                                |  | ISSUE                |                    |                      |             |
| 4     |  | REVISED DEVELOPMENT APPLICATION                                          |  | 26.4.22                                                                                                                                                                                                                                                                         |  |                                      |  |                                                                                                |  |                      |                    |                      |             |
| 3     |  | REVISED DEVELOPMENT APPLICATION                                          |  | 7.4.22                                                                                                                                                                                                                                                                          |  |                                      |  |                                                                                                |  |                      |                    |                      |             |
| 2     |  | DEVELOPMENT APPLICATION                                                  |  | 12.08.21                                                                                                                                                                                                                                                                        |  |                                      |  |                                                                                                |  |                      |                    |                      |             |
| 1     |  | ISSUED FOR APPROVAL                                                      |  | 09.07.21                                                                                                                                                                                                                                                                        |  |                                      |  |                                                                                                |  |                      |                    |                      |             |
| 0     |  | PRELIMINARY                                                              |  | 02.07.21                                                                                                                                                                                                                                                                        |  |                                      |  |                                                                                                |  |                      |                    |                      |             |

FULL SIZE ON ORIGINAL 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 cm





# STORMWATER PLAN

## SHEET 12

SCALE 1:100

### STORMWATER NOTES

1. ALL WORKS TO BE IN ACCORDANCE WITH AS3500.3.
2. ALL PIPES TO HAVE A 1% MINIMUM FALL U.N.O.
3. ALL DOWNPIPES (DP) TO BE SPECIFIED BY ARCHITECT. FOR EXACT LOCATION OF DOWNPIPES, REFER TO ARCHITECTURAL DRAWINGS.
4. ALL PIPES TO BE UPVC U.N.O.
5. ALL UPVC PIPES TO BE SEWER GRADE AND TO AS1260.
6. ALL REINFORCED CONCRETE PIPES (RCPI) TO BE SPIGOT AND SOCKET TYPE WITH RUBBER RINGS CLASS 2 TO AS4058.
7. PITS TO BE C&D REINFORCED PRE-CAST CONCRETE PITS OR EQUIVALENT PROPRIETARY PITS.
8. ALL LIDS AND GRATES TO BE PROPRIETARY HEAVY DUTY IN AREAS OF VEHICULAR TRAFFIC, LIGHT DUTY ELSEWHERE, IN ACCORDANCE WITH AS3996.
9. MINIMUM COVER TO STORMWATER PIPES TO BE AS FOLLOW U.N.O:  
TRAFFICABLE AREAS - 450mm, LANDSCAPED AREAS - 300mm.  
PIPES TO BE CONCRETE ENCASED IF MINIMUM COVERS CANNOT BE OBTAINED IN TRAFFICABLE AREAS, REFER TO CLAUSE 3.8 AS3500.3. ALTERNATIVELY USE UPVC SEWER GRADE PIPES UNDER ROAD AND BUILDINGS.
10. PROVIDE 100# AG DRAINS IN FILTER SOCKS TO ALL LANDSCAPED AREAS, PLANTER BEDS AND STORMWATER PIPE TRENCHES. ALL AG DRAINS TO BE BEDDED IN COARSE AGGREGATE AND TO BE CONNECTED TO STORMWATER SYSTEM.
11. ALL PITS, DETENTION TANKS AND PROPRIETARY POLLUTION CONTROL DEVICES TO BE CLEANED OF SEDIMENT AT 3 MONTH MAXIMUM INTERVALS.
12. ALL EXISTING SERVICES TO BE LOCATED PRIOR TO COMMENCEMENT OF WORK.
13. ANY FOOTPATHS, KERB AND GUTTER OR ROADWAY DISTURBED BY WORKS TO BE REINSTATED TO CURRENT COUNCIL REQUIREMENTS.
14. PROVIDE ACCESS LADDER TO TANK AS REQUIRED, REFER TO AS1657.
2. REFER TO DRAWING C03.13 FOR LEGEND.

**NOTE**  
ALL DOWNPIPES FROM EACH UNIT TO CONNECT TO EACH UNITS SLOMLINE ABOVE GROUND WATER STORAGE TANK TYPICAL

**NOTE**  
PITS P1, P10-P11 TO BE SILT TRAP PITS, PROVIDE 300 MIN EXTRA DEPTH TO PIT FROM PIPE INVERT LEVEL (IL) TYPICAL

**NOTE**  
DRIVEWAY GRADES TO CURRENT COUNCIL REQUIREMENTS. BUILDER TO CONFIRM GRADES PRIOR TO CONSTRUCTION OF DRIVEWAY

**NOTE**  
PROVIDE EXTRA SLEEPERS UNDER BOUNDARY FENCE TO RETAIN SOIL AS REQUIRED (400 MAX RETAINING) TYPICAL

**NOTE**  
MPC CONSULTING ENGINEERS CAN CONFIRM THAT THE LOCATION AND DEPTH OF THE PROPOSED UNDERGROUND DETENTION TANK WILL NOT ADVERSELY AFFECT ANY NEW OR EXISTING BUILDING FOUNDATIONS WHEN THE TANK IS EMPTY TYPICAL

**NOTE**  
ALL STRIP DRAINS AND AG LINES BEHIND RETAINING WALLS (RW1) AND KERBS (K1) TO CONNECT TO STORMWATER SYSTEM TYPICAL

**NOTE**  
BUILDER TO PROVIDE ADEQUATE SHORING IN ORDER TO MAINTAIN STABILITY OF EXISTING NEIGHBOURING STRUCTURES AND FENCES DURING EXCAVATION WORKS TYPICAL

**NOTE**  
SETOUT AND ALIGNMENT OF WALLS TO BOUNDARY TO ARCHITECTS DETAILS TYPICAL

**NOTE**  
ALL SETOUT, DIMENSIONS AND RL's TO ARCHITECTS SPECIFICATION & DETAILS

## PIT SCHEDULE

| LINE    | PIT No. | SIZE        | TYPE             | SURFACE LEVEL S.L. | INVERT LEVEL I.L. | LINE    | PIT No. | SIZE        | TYPE             | SURFACE LEVEL S.L. | INVERT LEVEL I.L. |
|---------|---------|-------------|------------------|--------------------|-------------------|---------|---------|-------------|------------------|--------------------|-------------------|
| LINE 1  | P1/1    | 600x600     | GRATED PIT       | 6.360              | 5.708             | LINE 14 | P1/14   | 600x600     | GRATED PIT       | 6.600              | 6.150             |
|         | P2/1    | 2400 LINTEL | GRATED KIP       | 6.250              | 5.800             |         | P2/14   | 900x900     | GRATED PIT       | 6.600              | 6.003             |
|         | P3/1    | 2400 LINTEL | GRATED KIP       | 6.250              | 5.857             |         | P3/14   | 900x900     | GRATED PIT       | 6.500              | 5.170             |
|         | P4/1    | 2400 LINTEL | GRATED KIP       | 6.250              | 5.808             |         | P4/14   | 600x600     | GRATED PIT       | 6.500              | 5.170             |
|         | P5/1    | 2400 LINTEL | GRATED KIP       | 6.250              | 5.744             |         | P5/14   | 600x600     | GRATED PIT       | 6.660              | 6.470             |
|         | P6/1    | 2400 LINTEL | GRATED KIP       | 6.320              | 5.682             | LINE 15 | P1/15   | 600x600     | GRATED PIT       | 6.480              | 5.825             |
|         | P7/1    | 900x900     | JUNCTION PIT     | 6.620              | 5.616             |         | P2/15   | 600x600     | GRATED PIT       | 6.480              | 5.801             |
| LINE 2  | P1/2    | 600x600     | GRATED PIT       | 6.710              | 6.068             |         | P3/15   | 600x600     | GRATED PIT       | 6.480              | 5.698             |
|         | P2/2    | 600x600     | GRATED PIT       | 6.780              | 6.003             |         | P4/15   | 600x600     | GRATED PIT       | 6.280              | 5.483             |
|         | P3/2    | 600x600     | GRATED PIT       | 6.680              | 5.873             |         | P5/15   | 600x600     | JUNCTION PIT     | 6.580              | 5.421             |
| LINE 3  | P1/3    | 600x600     | GRATED PIT       | 6.790              | 6.218             | LINE 16 | P1/16   | 600x600     | GRATED PIT       | 6.630              | 6.030             |
|         | P2/3    | 600x600     | JUNCTION PIT     | 6.710              | 6.207             |         | P2/16   | 600x600     | GRATED PIT       | 6.550              | 5.830             |
|         | P3/3    | 600x600     | JUNCTION PIT     | 6.920              | 6.187             | LINE 17 | P1/17   | 600x600     | GRATED PIT       | 6.500              | 5.900             |
|         | P4/3    | 600x600     | JUNCTION PIT     | 6.920              | 5.999             |         | P2/17   | 600x600     | GRATED PIT       | 6.740              | 5.800             |
|         | P5/3    | 600x600     | JUNCTION PIT     | 6.920              | 5.979             |         | P3/17   | 600x600     | GRATED PIT       | 6.800              | 5.700             |
|         | P6/3    | 600x600     | JUNCTION PIT     | 6.860              | 5.905             |         | P4/17   | 600x600     | GRATED PIT       | 6.500              | 5.200             |
|         | P7/3    | 600x600     | JUNCTION PIT     | 6.630              | 5.771             | LINE 18 | P5/17   | 2700 LINTEL | GRATED KIP       | 6.260              | 5.140             |
| LINE 4  | P1/4    | 900x900     | GRATED INLET PIT | 5.800              | 5.120             |         | P1/18   | 600x600     | GRATED PIT       | 6.710              | 5.770             |
|         | P2/4    | 900x900     | GRATED INLET PIT | 5.900              | 5.100             |         | P2/18   | 600x600     | GRATED PIT       | 6.710              | 5.694             |
|         | P3/4    | 600x600     | JUNCTION PIT     | 6.230              | 5.066             |         | P3/18   | 600x600     | GRATED PIT       | 6.710              | 5.620             |
|         | P4/4    | 600x600     | JUNCTION PIT     | 6.000              | 5.053             | LINE 19 | P1/19   | 600x600     | GRATED PIT       | 6.480              | 5.674             |
|         | P5/4    | 900x900     | GRATED PIT       | 5.850              | 5.220             |         | P2/19   | 600x600     | GRATED PIT       | 6.480              | 5.599             |
|         | P6/4    | 900x900     | GRATED PIT       | 6.100              | 5.200             |         | P3/19   | 600x600     | GRATED PIT       | 6.480              | 5.523             |
| LINE 5  | P1/5    | 900x900     | GRATED INLET PIT | 5.850              | 5.120             |         | P4/19   | 600x600     | GRATED PIT       | 6.480              | 5.458             |
|         | P2/5    | 900x900     | GRATED INLET PIT | 6.100              | 5.100             | LINE 20 | P1/20   | 600x600     | GRATED PIT       | 6.200              | 5.660             |
| LINE 6  | P1/6    | 600x600     | GRATED PIT       | 6.300              | 5.868             |         | P2/20   | 600x600     | JUNCTION PIT     | 6.350              | 5.490             |
|         | P2/6    | 900x900     | GRATED PIT       | 6.320              | 5.635             |         | P3/20   | 600x600     | JUNCTION PIT     | 6.450              | 5.280             |
| LINE 7  | P1/7    | 600x600     | GRATED PIT       | 6.600              | 6.150             |         | P4/20   | 600x600     | GRATED PIT       | 6.120              | 4.687 *           |
|         | P2/7    | 600x600     | GRATED PIT       | 6.600              | 6.003             | LINE 21 | P1/21   | 600x600     | GRATED PIT       | 6.200              | 5.400             |
|         | P3/7    | 900x900     | GRATED PIT       | 6.500              | 5.170             |         | P1/22   | 600x600     | GRATED PIT       | 6.200              | 5.572             |
|         | P4/7    | 900x900     | GRATED PIT       | 6.500              | 5.170             | LINE 22 | P1/22   | 600x600     | GRATED PIT       | 6.200              | 5.572             |
| LINE 8  | P1/8    | 600x600     | GRATED PIT       | 6.600              | 6.300             | LINE 23 | P1/23   | 600x600     | GRATED PIT       | 6.200              | 5.663             |
|         | P2/8    | 600x600     | GRATED PIT       | 6.550              | 6.140             | LINE 24 | P1/24   | 600x600     | GRATED PIT       | 6.710              | 5.949             |
|         | P3/8    | 900x900     | GRATED PIT       | 6.500              | 5.170             | LINE 25 | P1/25   | 600x600     | GRATED PIT       | 6.710              | 6.023             |
|         | P4/8    | 900x900     | GRATED PIT       | 6.500              | 5.170             | LINE 26 | P1/26   | 600x600     | GRATED PIT       | 6.710              | 6.231             |
|         | P5/8    | 600x600     | GRATED PIT       | 6.430              | 6.240             | LINE 27 | P1/27   | 600x600     | GRATED PIT       | 6.710              | 6.251             |
| LINE 9  | P1/9    | 600x600     | GRATED PIT       | 6.600              | 6.150             | LINE 28 | P1/28   | 600x600     | GRATED PIT       | 6.480              | 6.290             |
|         | P2/9    | 600x600     | GRATED PIT       | 6.600              | 6.003             | LINE 29 | P2/28   | 600x600     | GRATED PIT       | 6.480              | 6.170             |
|         | P3/9    | 900x900     | GRATED PIT       | 6.500              | 5.170             |         | P3/28   | 600x600     | GRATED PIT       | 6.600              | 6.120             |
|         | P4/9    | 900x900     | GRATED PIT       | 6.500              | 5.170             |         | P4/28   | 600x600     | GRATED PIT       | 6.780              | 6.090             |
| LINE 10 | P1/10   | 600x600     | GRATED PIT       | 6.600              | 6.150             |         | P1/29   | 600x600     | GRATED PIT       | 6.500              | 6.097             |
|         | P2/10   | 600x600     | GRATED PIT       | 6.600              | 6.003             | LINE 30 | P1/30   | 600x600     | GRATED PIT       | 6.600              | 6.260             |
|         | P3/10   | 900x900     | GRATED PIT       | 6.500              | 5.170             |         | P2/30   | 600x600     | GRATED PIT       | 6.600              | 6.155             |
|         | P4/10   | 900x900     | GRATED PIT       | 6.500              | 5.170             |         | P3/30   | 600x600     | GRATED PIT       | 6.600              | 6.050             |
|         | P5/10   | 600x600     | GRATED PIT       | 6.550              | 6.340             | LINE 31 | P1/31   | 600x600     | GRATED PIT       | 6.710              | 6.184             |
| LINE 11 | P1/11   | 600x600     | GRATED PIT       | 6.600              | 6.150             |         | GD1     | 300 WIDE    | GRATED DRAIN     | REFER TO PLAN      | 200 MIN DEEP      |
|         | P2/11   | 600x600     | GRATED PIT       | 6.600              | 6.003             |         | GD2     | 300 WIDE    | GRATED DRAIN     | REFER TO PLAN      | 200 MIN DEEP      |
|         | P3/11   | 900x900     | GRATED PIT       | 6.500              | 5.170             |         | GD3     | 300 WIDE    | GRATED DRAIN     | REFER TO PLAN      | 200 MIN DEEP      |
|         | P4/11   | 900x900     | GRATED PIT       | 6.500              | 5.170             |         | GD4     | 300 WIDE    | GRATED DRAIN     | REFER TO PLAN      | 200 MIN DEEP      |
| LINE 12 | P1/12   | 600x600     | GRATED PIT       | 6.600              | 6.150             |         | ExP1    | Ex PIT      | JUNCTION PIT     | 6.120              | 4.820 (TBC)       |
|         | P2/12   | 600x600     | GRATED PIT       | 6.600              | 6.003             |         | ExP2    | Ex PIT      | JUNCTION PIT     | 6.020              | 4.947 (TBC)       |
|         | P3/12   | 900x900     | GRATED PIT       | 6.500              | 5.170             |         | ExP3    | Ex LINTEL   | EXISTING KIP     | 5.780              | 4.961 (TBC)       |
|         | P4/12   | 900x900     | GRATED PIT       | 6.500              | 5.170             |         | ExP4    | Ex LINTEL   | EXISTING KIP     | 6.050              | 5.000 (TBC)       |
|         | P5/12   | 600x600     | GRATED PIT       | 6.660              | 6.440             |         | ExP5    | Ex LINTEL   | EXISTING KIP     | 6.150              | 5.102 (TBC)       |
| LINE 13 | P1/13   | 600x600     | GRATED PIT       | 6.710              | 6.421             |         | ExP6    | Ex LINTEL   | NEW JUNCTION PIT | 6.260              | 5.070 (TBC)       |
|         | P2/13   | 600x600     | JUNCTION PIT     | 6.790              | 6.365             |         | ExP7    | Ex PIT      | GRATED PIT       | 6.210 (GRATE)      | 4.760 (TBC)       |
|         | P3/13   | 600x600     | GRATED PIT       | 6.710              | 6.140             |         |         |             |                  |                    |                   |
|         | P4/13   | 600x600     | GRATED PIT       | 6.950              | 6.100             |         |         |             |                  |                    |                   |
|         | P5/13   | 600x600     | GRATED PIT       | 6.950              | 6.033             |         |         |             |                  |                    |                   |
|         | P6/13   | 600x600     | GRATED PIT       | 6.920              | 6.000             |         |         |             |                  |                    |                   |
|         | P7/13   | 600x600     | GRATED PIT       | 6.790              | 5.980             |         |         |             |                  |                    |                   |
| LINE 13 | P8/13   | 600x600     | GRATED PIT       | 6.770              | 5.950             |         |         |             |                  |                    |                   |
|         | P9/13   | 600x600     | GRATED PIT       | 6.500              | 5.790             |         |         |             |                  |                    |                   |

MATCH SHEET 12

MATCH SHEET 10

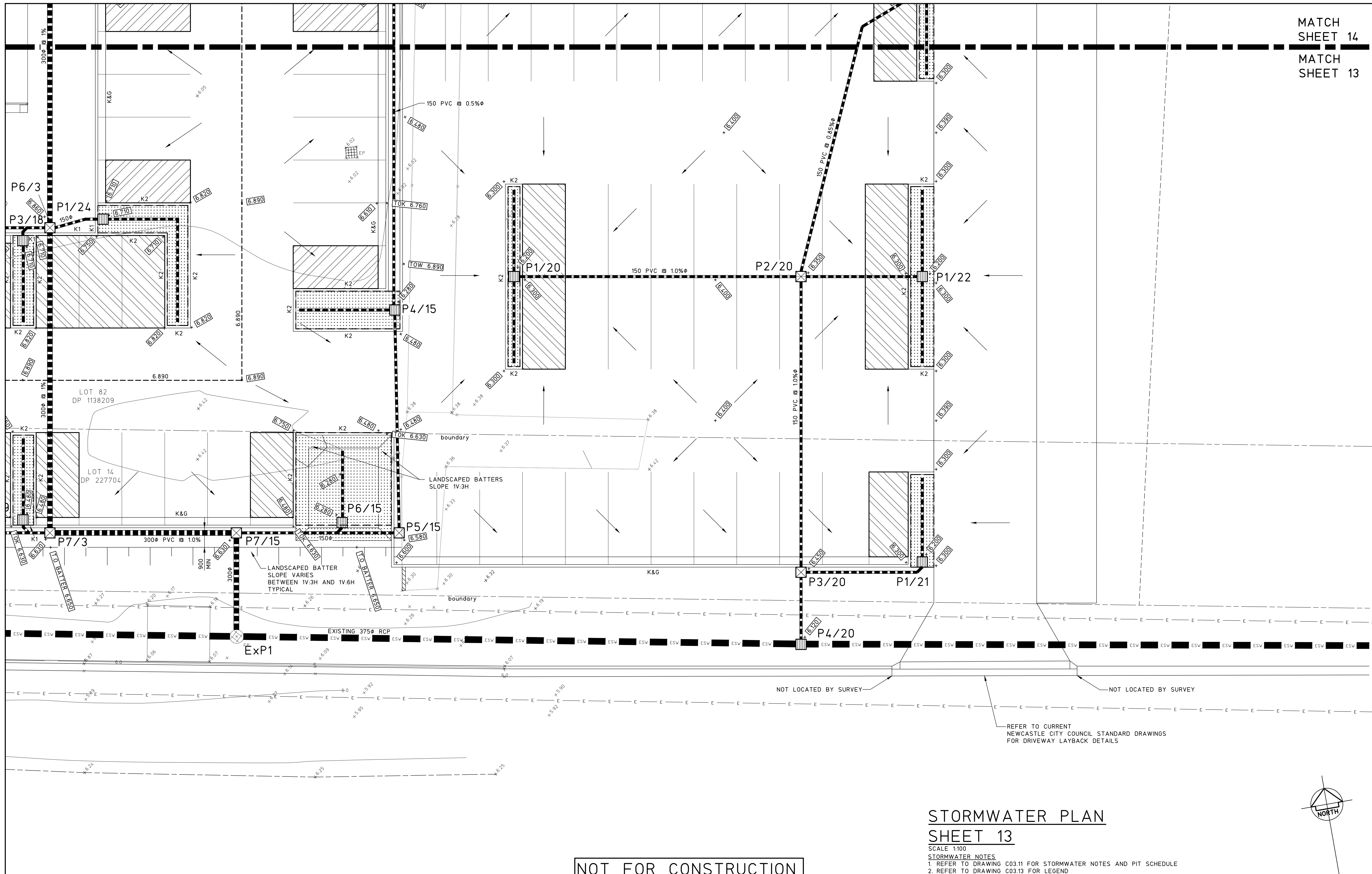
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|  |  |  |  |                                                                       |  |                                                                                                                                                                                                                                                                |  | TITLE STORMWATER PLAN SHEET 12 |  |                                                                                       |  | SCALES 1:100         |  | JOB No 16-548-1  |  | DRAWING No C03.11 |  | ISSUE 4  |  |
|  |  |  |  |                                                                       |  |                                                                                                                                                                                                                                                                |  |                                |  |                                                                                       |  |                      |  |                  |  |                   |  |          |  |
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MATCH  
SHEET 14

MATCH  
SHEET 13



REFER TO CURRENT  
NEWCASTLE CITY COUNCIL STANDARD DRAWINGS  
FOR DRIVEWAY LAYBACK DETAILS

## STORMWATER PLAN SHEET 13

SCALE 1:100

### STORMWATER NOTES

1. REFER TO DRAWING C03.11 FOR STORMWATER NOTES AND PIT SCHEDULE
2. REFER TO DRAWING C03.13 FOR LEGEND

NOT FOR CONSTRUCTION

|                                                                          |                  |      |                                                                                                                                                                                                                                                                                  |                                 |  |                           |  |  |                                                                                                |  |  |                      |                  |                |             |
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| 3 REVISED DEVELOPMENT APPLICATION                                        |                  |      | 7.4.22                                                                                                                                                                                                                                                                           |                                 |  | TITLE                     |  |  | JOB No                                                                                         |  |  | DRAWING No           |                  | ISSUE          |             |
| 2 DEVELOPMENT APPLICATION                                                |                  |      | 12.08.21                                                                                                                                                                                                                                                                         |                                 |  | STORMWATER PLAN           |  |  | 16-548-1                                                                                       |  |  | C03.12               |                  | 3              |             |
| 1 ISSUED FOR APPROVAL                                                    |                  |      | 09.07.21                                                                                                                                                                                                                                                                         |                                 |  | SHEET 13                  |  |  | 1:100                                                                                          |  |  |                      |                  |                |             |
| 0 PRELIMINARY                                                            |                  |      | 02.07.21                                                                                                                                                                                                                                                                         |                                 |  |                           |  |  |                                                                                                |  |  |                      |                  |                |             |
| ISSUE                                                                    | REASON FOR ISSUE | DATE | DATE OF RELEASE                                                                                                                                                                                                                                                                  | RESPONSIBLE PRINCIPAL SIGNATURE |  | ISSUE                     |  |  |                                                                                                |  |  |                      |                  |                |             |

FULL SIZE ON ORIGINAL 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 cm



MATCH  
SHEET 15

MATCH  
SHEET 14

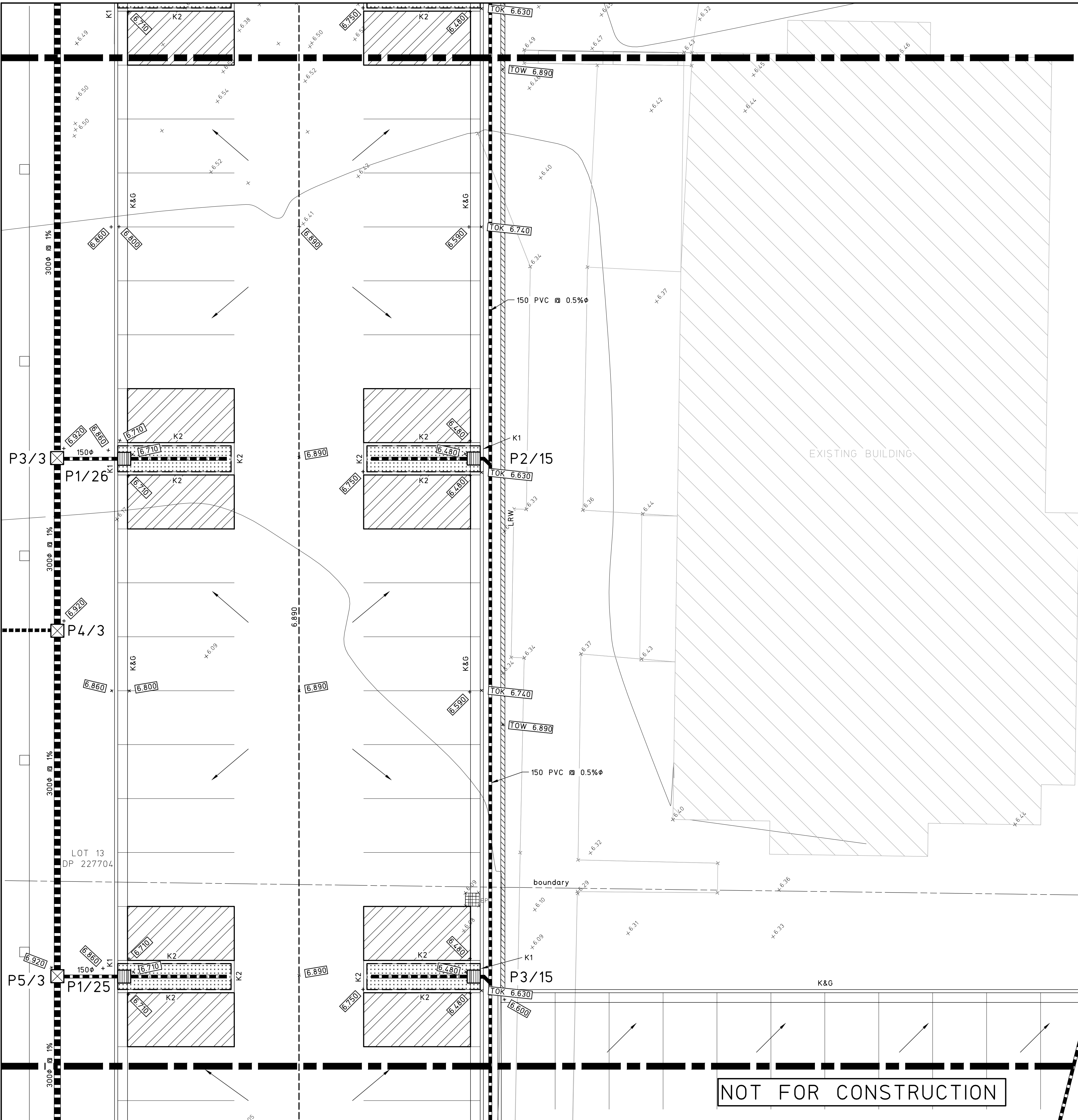
## STORMWATER PLAN SHEET 14

SCALE 1:100

### STORMWATER NOTES

1. REFER TO DRAWING C03.11 FOR STORMWATER NOTES AND PIT SCHEDULE

| LEGEND |                                                                                                                                                                                                                                                                                                                                                    |
|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|        | DENOTES STORMWATER PIPE                                                                                                                                                                                                                                                                                                                            |
|        | DENOTES CHARGED STORMWATER PIPE                                                                                                                                                                                                                                                                                                                    |
|        | DENOTES EXISTING CONTOUR                                                                                                                                                                                                                                                                                                                           |
|        | DENOTES DESIGN CONTOUR                                                                                                                                                                                                                                                                                                                             |
|        | DENOTES EXISTING LEVELS                                                                                                                                                                                                                                                                                                                            |
|        | DENOTES DESIGN SPOT LEVELS                                                                                                                                                                                                                                                                                                                         |
|        | DENOTES 150 HIGH KERB U.N.O.                                                                                                                                                                                                                                                                                                                       |
|        | DENOTES 150 WIDE EDGE STRIP FLUSH WITH THE ADJACENT PAVEMENT                                                                                                                                                                                                                                                                                       |
|        | DENOTES 120 HIGH KERB AND GUTTER                                                                                                                                                                                                                                                                                                                   |
|        | DENOTES RETAINING WALL                                                                                                                                                                                                                                                                                                                             |
|        | DENOTES LANDSCAPE RETAINING WALL                                                                                                                                                                                                                                                                                                                   |
|        | DENOTES RETAINING EDGE BEAM TO BUILDING SLAB                                                                                                                                                                                                                                                                                                       |
|        | DENOTES 2000 WIDE x 200 MIN DEEP GRASS LINED SWALE, 1% MIN FALL UNO                                                                                                                                                                                                                                                                                |
|        | DENOTES DIRECTION OF SURFACE FLOWS                                                                                                                                                                                                                                                                                                                 |
|        | DENOTES PERMEABLE PAVING TO LANDSCAPE ARCHITECTS DETAILS                                                                                                                                                                                                                                                                                           |
|        | DENOTES 1000 LITRE SLIMLINE WATER STORAGE TANK STORING ROOF RAINWATER TO MANUFACTURERS SPECIFICATION. TANK SHALL BE FITTED WITH A FIRST FLUSH SYSTEM, PUMP TO SUPPLY TOILETS AND LAUNDRY AND A DIVERSION SWITCH TO MAINS SUPPLY ON TANK BEING EMPTY. BACK FLOW PREVENTION TO MAINS WATER SHALL BE PROVIDED. TANK TO OVERFLOW TO STORMWATER SYSTEM. |
|        | DENOTES INFILTRATION TRENCH 25m LONG x 2m WIDE x 0.88m DEEP REFER TO DETAILS                                                                                                                                                                                                                                                                       |
|        | DENOTES INFILTRATION TRENCH 12.5m LONG x 4m WIDE x 0.88m DEEP REFER TO DETAILS                                                                                                                                                                                                                                                                     |
|        | DENOTES 900x900 MANHOLE PIT LID                                                                                                                                                                                                                                                                                                                    |
|        | DENOTES OVERLAND FLOW DIRECTION IN MAJOR STORM EVENT                                                                                                                                                                                                                                                                                               |
|        | DENOTES ECOSOL GPT-4200 GROSS POLLUTANT TRAP OR APPROVED EQUIVALENT TO MANUFACTURERS SPECIFICATION                                                                                                                                                                                                                                                 |
|        | DENOTES ROCK LINED TRAPAZOIDAL SPILLWAY CHANNEL, REFER TO DETAILS                                                                                                                                                                                                                                                                                  |
|        | DENOTES RAIN GARDEN, WSUD BIORETENTION SYSTEM TO N.C.C. STANDARD DRAWING A2404                                                                                                                                                                                                                                                                     |



MATCH  
SHEET 14

MATCH  
SHEET 13

|       |                                 |          |                 |                                                                       |  |                                                                                                                                                                                                                                                                |                                                                                       |                                                                                                                                                                                                                                |                                      |                                                                                                |                    |                      |            |                  |  |                |  |             |  |
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| 3     | REVISED DEVELOPMENT APPLICATION | 7.4.22   |                 |                                                                       |  |                                                                                                                                                                                                                                                                |  | Level 1,<br>16 Telford Street,<br>NEWCASTLE EAST, NSW 2300<br>PO BOX 558<br>THE JUNCTION, NSW 2291<br>Tel: (02) 4927 5566<br>Fax: (02) 4927 5577<br>Email: admin@mpceng.com.au<br>Web: www.mpceng.com.au<br>A.C.N. 098 542 575 | TITLE<br>STORMWATER PLAN<br>SHEET 14 | SCALES<br>1:100                                                                                | JOB No<br>16-548-1 | DRAWING No<br>C03.13 | ISSUE<br>3 |                  |  |                |  |             |  |
| 2     | DEVELOPMENT APPLICATION         | 12.08.21 |                 |                                                                       |  |                                                                                                                                                                                                                                                                |                                                                                       |                                                                                                                                                                                                                                |                                      |                                                                                                |                    |                      |            |                  |  |                |  |             |  |
| 1     | ISSUED FOR APPROVAL             | 09.07.21 |                 |                                                                       |  |                                                                                                                                                                                                                                                                |                                                                                       |                                                                                                                                                                                                                                |                                      |                                                                                                |                    |                      |            |                  |  |                |  |             |  |
| 0     | PRELIMINARY                     | 02.07.21 |                 |                                                                       |  |                                                                                                                                                                                                                                                                |                                                                                       |                                                                                                                                                                                                                                |                                      |                                                                                                |                    |                      |            |                  |  |                |  |             |  |
| ISSUE | REASON FOR ISSUE                | DATE     | DATE OF RELEASE | RESPONSIBLE PRINCIPAL SIGNATURE                                       |  | ISSUE                                                                                                                                                                                                                                                          |                                                                                       |                                                                                                                                                                                                                                |                                      |                                                                                                |                    |                      |            |                  |  |                |  |             |  |

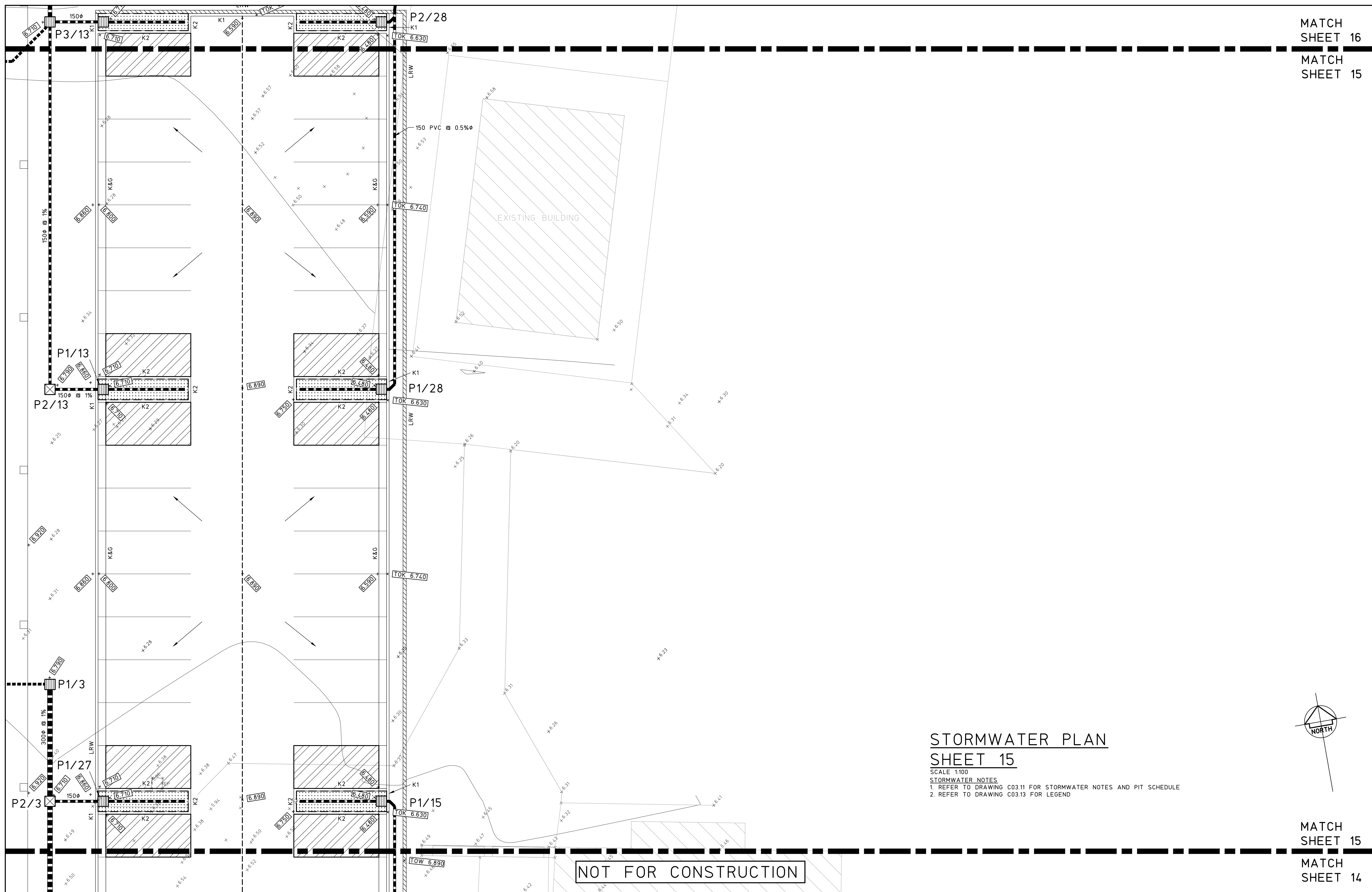


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Web: www.mpceng.com.au  
A.C.N. 098 542 575

FULL SIZE ON ORIGINAL 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 cm



MATCH  
SHEET 15

[illegible]

FULL SIZE ON ORIGINAL 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 cm



MATCH SHEET 10

MATCH SHEET 8

P8/13

P7/13

P6/13

P1/29

P5/13

HORSE WALKER B1  
FFL 7.000

P4/28

P4/13

P3/28

P1/31

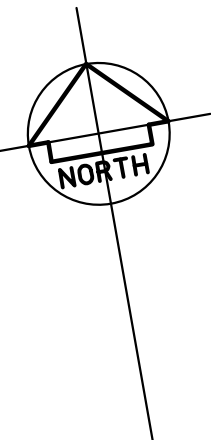
P3/13

P2/28

NOT FOR CONSTRUCTION

STORMWATER PLAN  
SHEET 16

SCALE 1:100  
STORMWATER NOTES  
1. REFER TO DRAWING C03.11 FOR STORMWATER NOTES AND PIT SCHEDULE  
2. REFER TO DRAWING C03.13 FOR LEGEND



MATCH  
SHEET 16

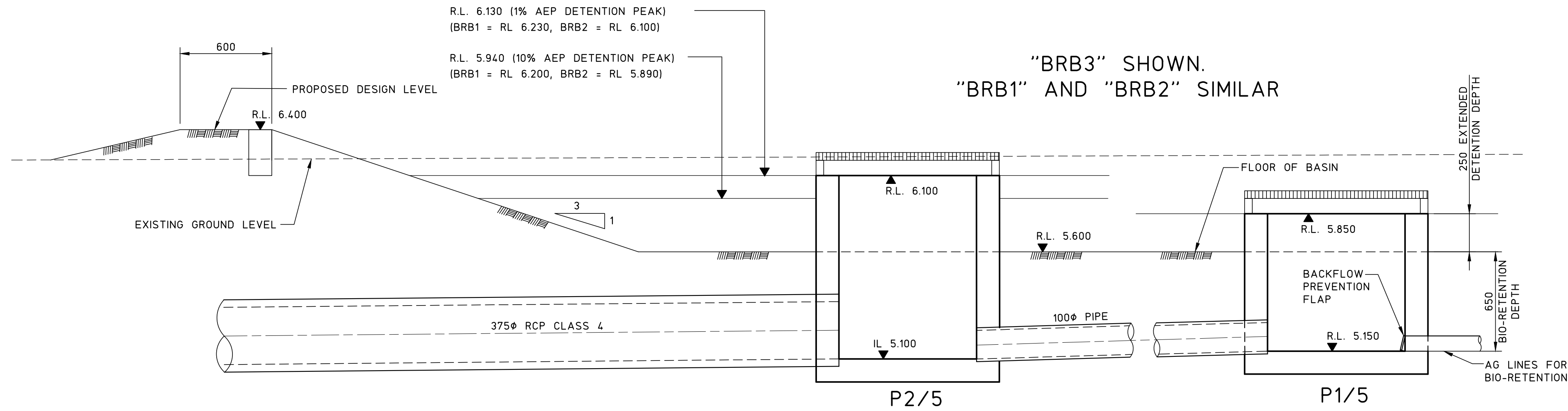
MATCH  
SHEET 15

|                                   |  |  |                                                                          |  |  |                                                                                                                                                                                                                                                                                 |  |  |                           |  |  |                                                                                                |  |  |                      |                    |                      |             |
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| 0 REVISED DEVELOPMENT APPLICATION |  |  | 7.4.22                                                                   |  |  |                                                                                                                                                                                                                                                                                 |  |  | TITLE                     |  |  |                                                                                                |  |  | SCALES<br>1:100      | JOB No<br>16-548-1 | DRAWING No<br>C03.15 | ISSUE<br>0  |
| ISSUE                             |  |  | REASON FOR ISSUE                                                         |  |  | DATE                                                                                                                                                                                                                                                                            |  |  | DATE OF RELEASE           |  |  | RESPONSIBLE PRINCIPAL SIGNATURE                                                                |  |  | ISSUE                |                    |                      |             |

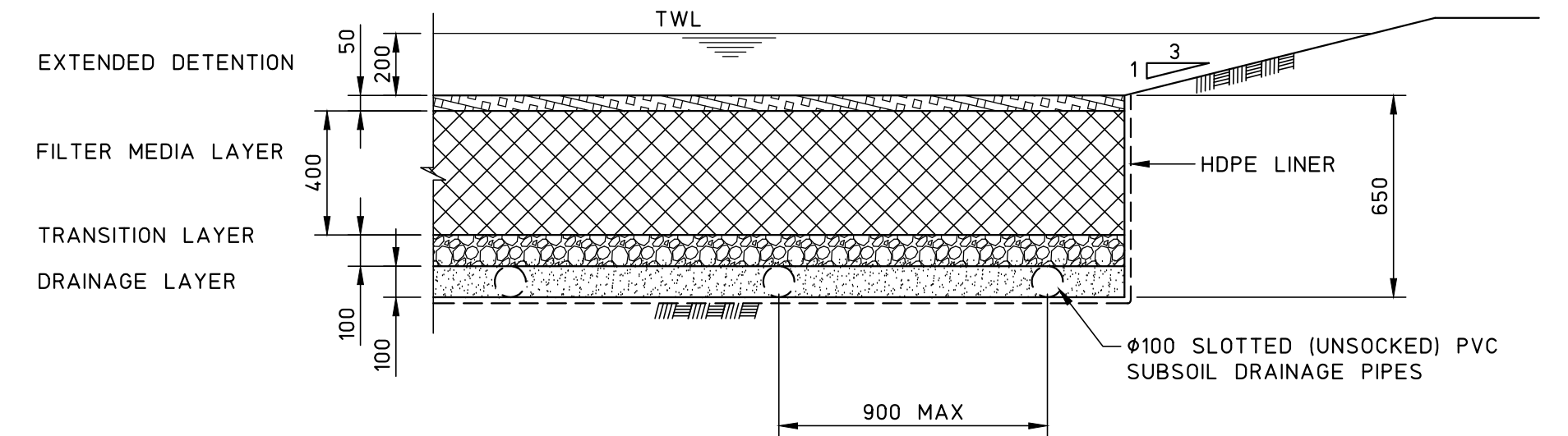
FULL SIZE ON ORIGINAL 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 cm



“BRB3” SHOWN.  
“BRB1” AND “BRB2” SIMILAR



NOTE  
PROVIDE COMPACTED FILL WHERE  
REQUIRED TO UNDERSIDE OF  
BIO-RETENTION BASIN



## TYPICAL BIO-RETENTION CROSS-SECTION

NOT TO SCALE

### MULCH LAYER:

- WASHED AGGREGATE 10-20 mm
- MIN 50mm THICK

### FILTER MEDIA LAYER:

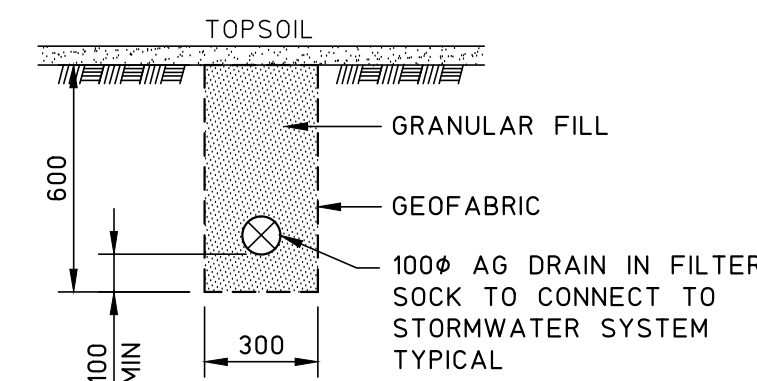
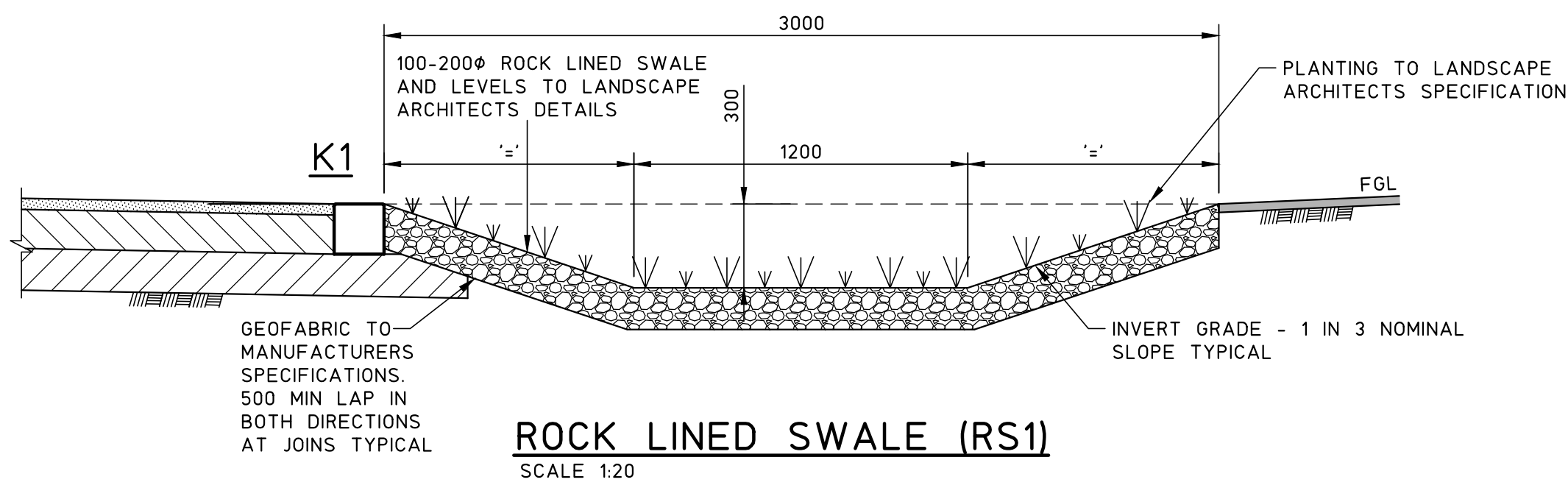
- MIN 450mm THICK
- BENEDICTS 'BIO-RETENTION FILTER MEDIA (M165)' OR APPROVED EQUIVALENT WITH MINIMUM REQUIREMENTS
  - SANDY LOAM MIX
  - SATURATED HYDRAULIC CONDUCTIVITY 100mm/HR - 300mm/HR
  - TOTAL CLAYAND SILT CONTENT <3%
  - ORGANIC CONTENT <5%

### TRANSITION LAYER SPECIFICATIONS:

- MIN 100mm THICK
- BENEDICTS 'WASHED GLASS-SAND (GS MEDIUM)' OR APPROVED EQUIVALENT WITH MINIMUM REQUIREMENTS AS FOLLOWS:
  - COARSE WASHED RIVER SAND CONTAINING LITTLE OR NO FINES OR RECYCLED CRUSHED GLASS EQUIVALENT

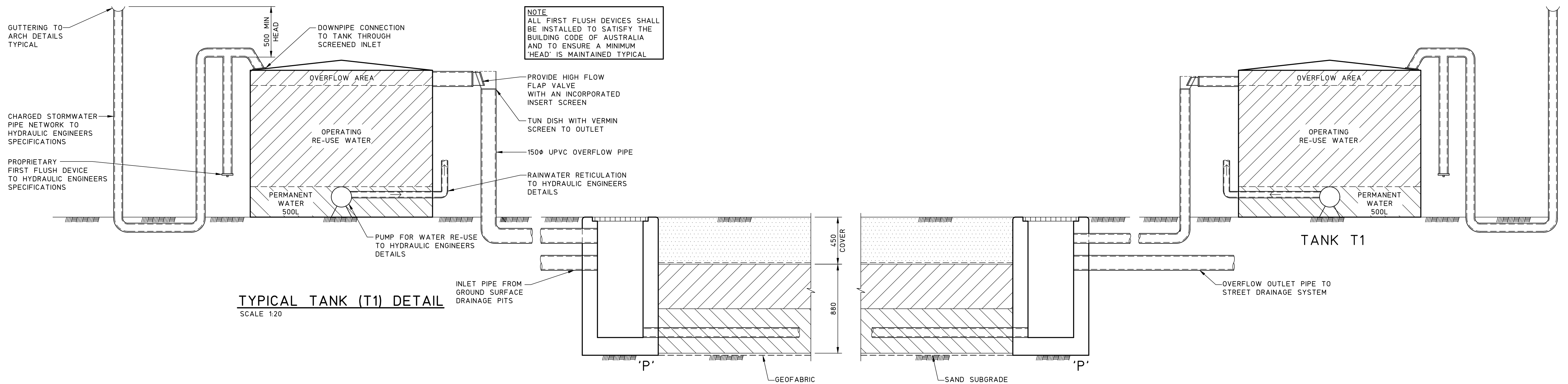
### DRAINAGE LAYER SPECIFICATIONS:

- MIN 150mm THICK
- BENEDICTS 'NO FINES DRAINAGE GRAVEL (5mm GRADE)' OR APPROVED EQUIVALENT WITH MINIMUM PRODUCT REQUIREMENTS AS FOLLOWS:
  - CLEAN GRAVEL 5mm



## AG DRAIN TRENCH

SCALE 1:20



## TYPICAL INFILTRATION TRENCH DETAIL

SCALE 1:20

NOT FOR CONSTRUCTION

|       |  |                                                                          |         |                                                                                                                                                                                                                                                                                 |                                 |                           |  |                                                                                                |  |                      |                  |                |             |
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| 1     |  | REVISED DEVELOPMENT APPLICATION                                          | 26.4.22 |                                                                                                                                                                                                                                                                                 |                                 | TITLE                     |  |                                                                                                |  | SCALES               | JOB No           | DRAWING No     | ISSUE       |
| 0     |  | DEVELOPMENT APPLICATION                                                  | 7.4.22  |                                                                                                                                                                                                                                                                                 |                                 | STORMWATER DETAILS        |  |                                                                                                |  | 1:20                 | 16-548-1         | C03.50         | 1           |
| ISSUE |  | REASON FOR ISSUE                                                         | DATE    | DATE OF RELEASE                                                                                                                                                                                                                                                                 | RESPONSIBLE PRINCIPAL SIGNATURE |                           |  |                                                                                                |  |                      |                  |                |             |

FULL SIZE ON ORIGINAL 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 cm



## Appendix D

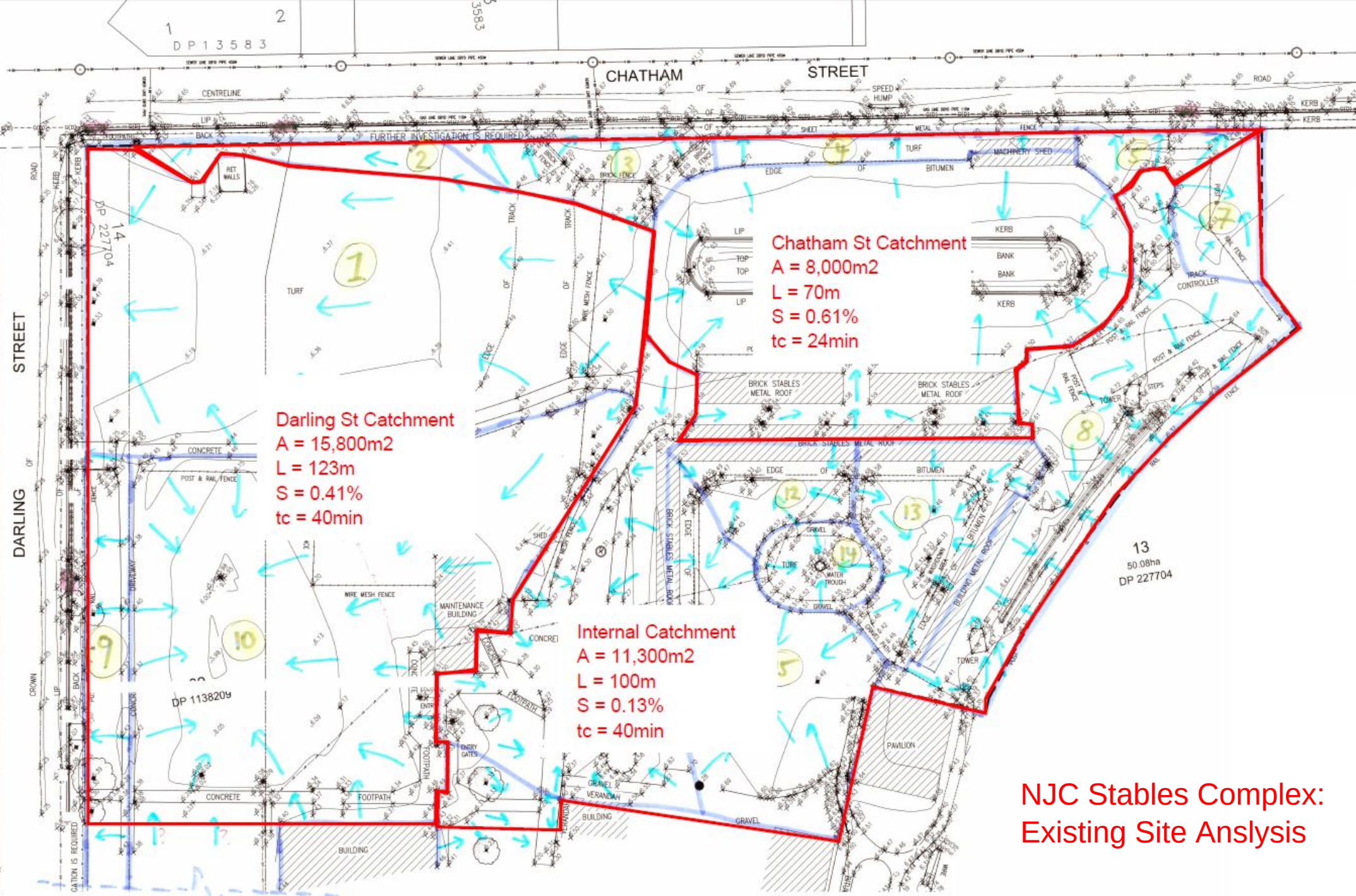
# Stormwater Management Calculations

Pre-Developed site analysis

Pre-Developed flow calculations

DRAINS schematic

DRAINS calculation summary



NJC Stables Complex:  
Existing Site Analysis

**Project:** NJC Chatham St  
**Job No:** 16-548  
**Subject:** Chatham St Sub-Catchment - Pre-developed flow estimates

**Date:** 27.7.2021

## PRE-DEVELOPED SITE FLOWS - Chatham Street Sub-Catchment

|                      |             |                |                |
|----------------------|-------------|----------------|----------------|
| Sub-catchment No.    |             | <b>Chatham</b> |                |
| Sub-catchment area   | $A_{sub} =$ | 8000           | m <sup>2</sup> |
| Sub-catchment length | $L_{sub} =$ | 70             | m              |
| Average slope        | $s =$       | 0.0061         |                |
| Roughness            | $n =$       | 0.2            |                |

|                      |             |      |
|----------------------|-------------|------|
| Runoff coefficients: | $C_5 =$     | 0.48 |
|                      | $C_{10} =$  | 0.50 |
|                      | $C_{20} =$  | 0.53 |
|                      | $C_{50} =$  | 0.58 |
|                      | $C_{100} =$ | 0.61 |

### 20% AEP Storm: (ARI=4.48)

|                                         |              |      |       |
|-----------------------------------------|--------------|------|-------|
| Initial trial time of concentration     | $t_{c_i} =$  | 28   | min   |
| 5 Yr Storm Rainfall Intensity           | $I_{tc_5} =$ | 71.9 | mm/hr |
| Calculated time of concentration        | $t_{c_5} =$  | 28.2 | min   |
| Actual rainfall intensity (Minor storm) | $I_{tc_5} =$ | 71.9 | mm/hr |
| Minor Flow                              | $Q_5 =$      | 77   | L/s   |

### MINOR Storm: (ARI=10)

|                                         |                 |      |       |
|-----------------------------------------|-----------------|------|-------|
| Initial trial time of concentration     | $t_{c_i} =$     | 25   | min   |
| 10 Yr Storm Rainfall Intensity          | $I_{tc_{10}} =$ | 93.9 | mm/hr |
| Calculated time of concentration        | $t_{c_{10}} =$  | 25.4 | min   |
| Actual rainfall intensity (Minor storm) | $I_{tc_{10}} =$ | 93.9 | mm/hr |
| Minor Flow                              | $Q_{10} =$      | 105  | L/s   |

### MAJOR Storm: (ARI=20)

|                                         |                 |      |       |
|-----------------------------------------|-----------------|------|-------|
| Initial trial time of concentration     | $t_{c_i} =$     | 25   | min   |
| 20 Yr Storm Rainfall Intensity          | $I_{tc_{20}} =$ | 93.9 | mm/hr |
| Calculated time of concentration        | $t_{c_{20}} =$  | 25.4 | min   |
| Actual rainfall intensity (Minor storm) | $I_{tc_{20}} =$ | 93.9 | mm/hr |
| Minor Flow                              | $Q_{20} =$      | 110  | L/s   |

### MAJOR Storm: (ARI=50)

|                                         |                 |      |       |
|-----------------------------------------|-----------------|------|-------|
| Initial trial time of concentration     | $t_{c_i} =$     | 21   | min   |
| 50 Yr Storm Rainfall Intensity          | $I_{tc_{50}} =$ | 152  | mm/hr |
| Calculated time of concentration        | $t_{c_{50}} =$  | 20.9 | min   |
| Actual rainfall intensity (Minor storm) | $I_{tc_{50}} =$ | 152  | mm/hr |
| Minor Flow                              | $Q_{50} =$      | 196  | L/s   |

### MAJOR Storm: (ARI=100)

|                                         |                  |      |       |
|-----------------------------------------|------------------|------|-------|
| Initial trial time of concentration     | $t_{c_i} =$      | 20   | min   |
| 100 Yr Storm Rainfall Intensity         | $I_{tc_{100}} =$ | 180  | mm/hr |
| Calculated time of concentration        | $t_{c_{100}} =$  | 19.6 | min   |
| Actual rainfall intensity (Minor storm) | $I_{tc_{100}} =$ | 180  | mm/hr |
| Minor Flow                              | $Q_{100} =$      | 242  | L/s   |



**Project:** NJC Chatham St  
**Job No:** 16-548  
**Subject:** Darling St Sub-Catchment - Pre-developed flow estimates

**Date:** 27.7.2021

## PRE-DEVELOPED SITE FLOWS - Darling Street Sub-Catchment

|                      |             |                |                |
|----------------------|-------------|----------------|----------------|
| Sub-catchment No.    |             | <b>Darling</b> |                |
| Sub-catchment area   | $A_{sub} =$ | 15800          | m <sup>2</sup> |
| Sub-catchment length | $L_{sub} =$ | 123            | m              |
| Average slope        | $s =$       | 0.0041         |                |
| Roughness            | $n =$       | 0.2            |                |

|                      |             |      |
|----------------------|-------------|------|
| Runoff coefficients: | $C_5 =$     | 0.48 |
|                      | $C_{10} =$  | 0.50 |
|                      | $C_{20} =$  | 0.53 |
|                      | $C_{50} =$  | 0.58 |
|                      | $C_{100} =$ | 0.61 |

### 20% AEP Storm: (ARI=4.48)

|                                         |              |      |       |
|-----------------------------------------|--------------|------|-------|
| Initial trial time of concentration     | $t_{c_i} =$  | 52   | min   |
| 5 Yr Storm Rainfall Intensity           | $I_{tc_5} =$ | 49.3 | mm/hr |
| Calculated time of concentration        | $t_{c_5} =$  | 51.9 | min   |
| Actual rainfall intensity (Minor storm) | $I_{tc_5} =$ | 49.3 | mm/hr |
| Minor Flow                              | $Q_5 =$      | 104  | L/s   |

### MINOR Storm: (ARI=10)

|                                         |                 |      |       |
|-----------------------------------------|-----------------|------|-------|
| Initial trial time of concentration     | $t_{c_i} =$     | 47   | min   |
| 10 Yr Storm Rainfall Intensity          | $I_{tc_{10}} =$ | 64.3 | mm/hr |
| Calculated time of concentration        | $t_{c_{10}} =$  | 46.6 | min   |
| Actual rainfall intensity (Minor storm) | $I_{tc_{10}} =$ | 64.3 | mm/hr |
| Minor Flow                              | $Q_{10} =$      | 142  | L/s   |

### MAJOR Storm: (ARI=20)

|                                         |                 |      |       |
|-----------------------------------------|-----------------|------|-------|
| Initial trial time of concentration     | $t_{c_i} =$     | 43   | min   |
| 20 Yr Storm Rainfall Intensity          | $I_{tc_{20}} =$ | 80.9 | mm/hr |
| Calculated time of concentration        | $t_{c_{20}} =$  | 42.6 | min   |
| Actual rainfall intensity (Minor storm) | $I_{tc_{20}} =$ | 80.9 | mm/hr |
| Minor Flow                              | $Q_{20} =$      | 188  | L/s   |

### MAJOR Storm: (ARI=50)

|                                         |                 |      |       |
|-----------------------------------------|-----------------|------|-------|
| Initial trial time of concentration     | $t_{c_i} =$     | 38   | min   |
| 50 Yr Storm Rainfall Intensity          | $I_{tc_{50}} =$ | 107  | mm/hr |
| Calculated time of concentration        | $t_{c_{50}} =$  | 38.0 | min   |
| Actual rainfall intensity (Minor storm) | $I_{tc_{50}} =$ | 107  | mm/hr |
| Minor Flow                              | $Q_{50} =$      | 272  | L/s   |

### MAJOR Storm: (ARI=100)

|                                         |                  |      |       |
|-----------------------------------------|------------------|------|-------|
| Initial trial time of concentration     | $t_{c_i} =$      | 35   | min   |
| 100 Yr Storm Rainfall Intensity         | $I_{tc_{100}} =$ | 130  | mm/hr |
| Calculated time of concentration        | $t_{c_{100}} =$  | 35.2 | min   |
| Actual rainfall intensity (Minor storm) | $I_{tc_{100}} =$ | 130  | mm/hr |
| Minor Flow                              | $Q_{100} =$      | 345  | L/s   |

**Project:** NJC Chatham St  
**Job No:** 16-548  
**Subject:** Internal Sub-Catchment - Pre-developed flow estimates

**Date:** 27.7.2021

## PRE-DEVELOPED SITE FLOWS - Internal Sub-Catchment

|                      |                                      |
|----------------------|--------------------------------------|
| Sub-catchment No.    |                                      |
| Sub-catchment area   | $A_{\text{sub}} = 11300 \text{ m}^2$ |
| Sub-catchment length | $L_{\text{sub}} = 100 \text{ m}$     |
| Average slope        | $s = 0.0013$                         |
| Roughness            | $n = 0.2$                            |

|                      |      |
|----------------------|------|
| Runoff coefficients: |      |
| $C_5$                | 0.48 |
| $C_{10}$             | 0.50 |
| $C_{20}$             | 0.53 |
| $C_{50}$             | 0.58 |
| $C_{100}$            | 0.61 |

### 20% AEP Storm: (ARI=4.48)

|                                         |                                 |
|-----------------------------------------|---------------------------------|
| Initial trial time of concentration     | $t_{c_i} = 70 \text{ min}$      |
| 5 Yr Storm Rainfall Intensity           | $I_{tc_5} = 40.7 \text{ mm/hr}$ |
| Calculated time of concentration        | $t_{c_5} = 69.8 \text{ min}$    |
| Actual rainfall intensity (Minor storm) | $I_{tc_5} = 40.7 \text{ mm/hr}$ |
| Minor Flow                              | $Q_5 = 61 \text{ L/s}$          |

### MINOR Storm: (ARI=10)

|                                         |                                    |
|-----------------------------------------|------------------------------------|
| Initial trial time of concentration     | $t_{c_i} = 63 \text{ min}$         |
| 10 Yr Storm Rainfall Intensity          | $I_{tc_{10}} = 53.3 \text{ mm/hr}$ |
| Calculated time of concentration        | $t_{c_{10}} = 62.7 \text{ min}$    |
| Actual rainfall intensity (Minor storm) | $I_{tc_{10}} = 53.3 \text{ mm/hr}$ |
| Minor Flow                              | $Q_{10} = 84 \text{ L/s}$          |

### MAJOR Storm: (ARI=20)

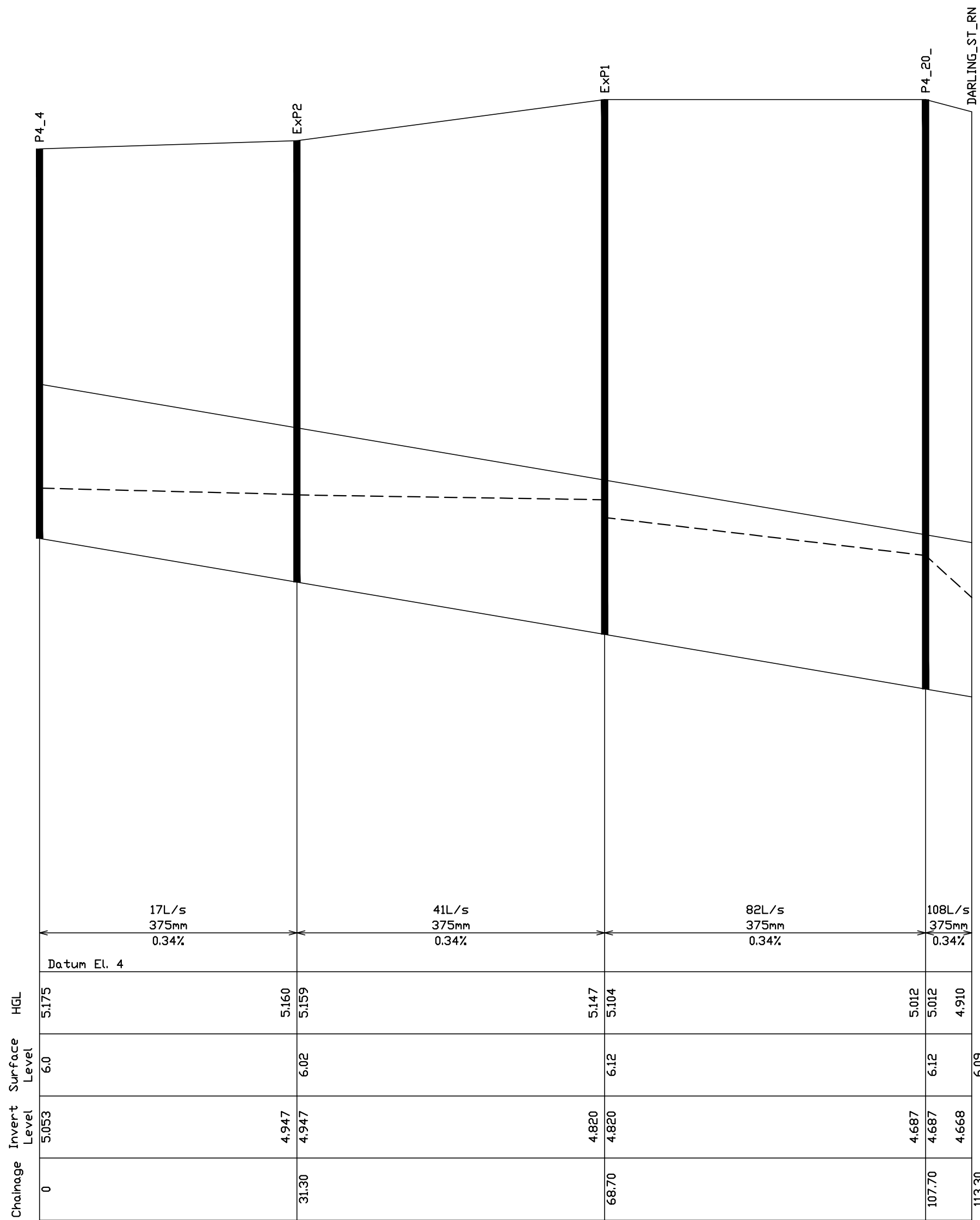
|                                         |                                    |
|-----------------------------------------|------------------------------------|
| Initial trial time of concentration     | $t_{c_i} = 57 \text{ min}$         |
| 20 Yr Storm Rainfall Intensity          | $I_{tc_{20}} = 67.7 \text{ mm/hr}$ |
| Calculated time of concentration        | $t_{c_{20}} = 57.0 \text{ min}$    |
| Actual rainfall intensity (Minor storm) | $I_{tc_{20}} = 67.7 \text{ mm/hr}$ |
| Minor Flow                              | $Q_{20} = 113 \text{ L/s}$         |

### MAJOR Storm: (ARI=50)

|                                         |                                    |
|-----------------------------------------|------------------------------------|
| Initial trial time of concentration     | $t_{c_i} = 51 \text{ min}$         |
| 50 Yr Storm Rainfall Intensity          | $I_{tc_{50}} = 88.9 \text{ mm/hr}$ |
| Calculated time of concentration        | $t_{c_{50}} = 51.1 \text{ min}$    |
| Actual rainfall intensity (Minor storm) | $I_{tc_{50}} = 88.9 \text{ mm/hr}$ |
| Minor Flow                              | $Q_{50} = 162 \text{ L/s}$         |

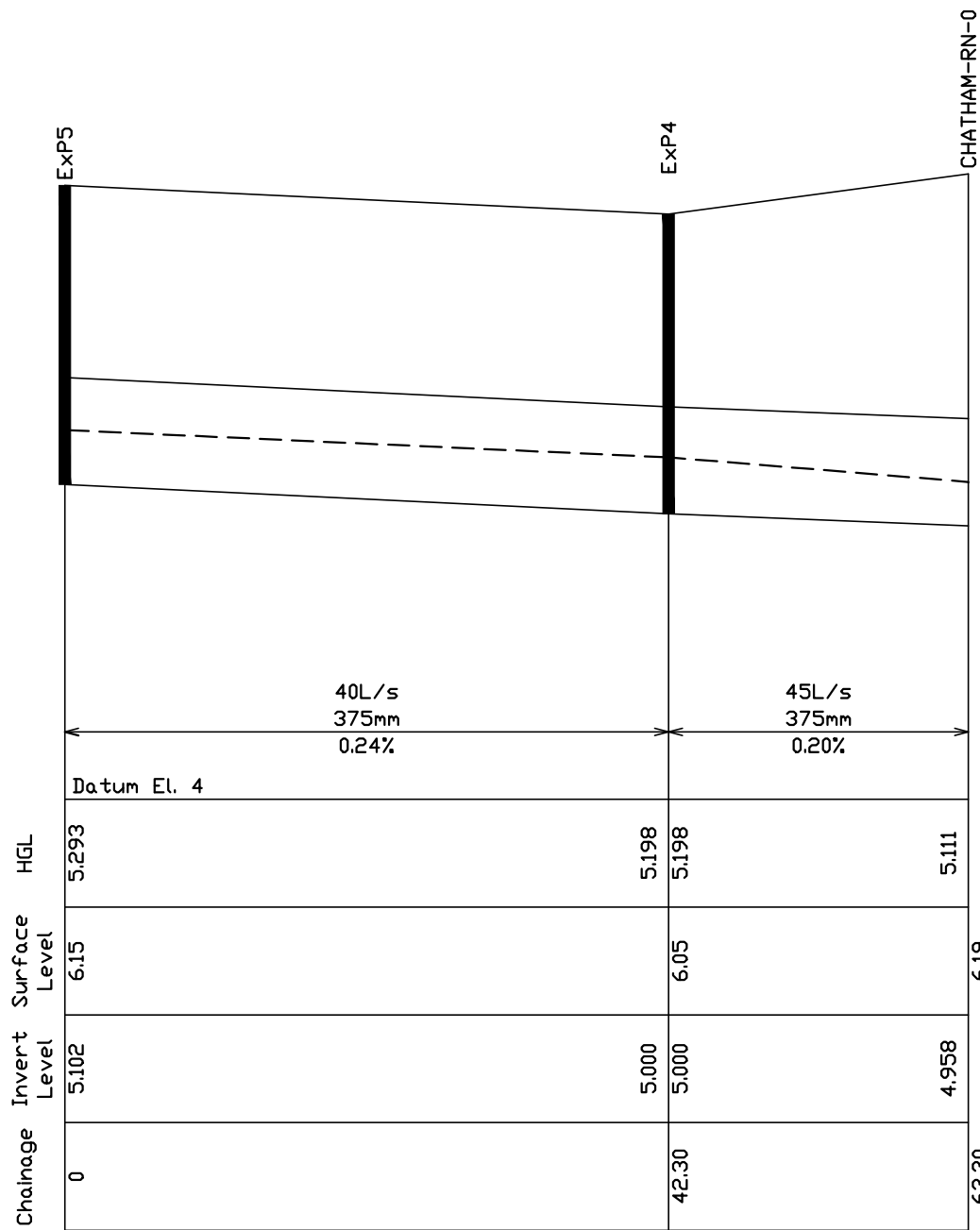
### MAJOR Storm: (ARI=100)

|                                         |                                    |
|-----------------------------------------|------------------------------------|
| Initial trial time of concentration     | $t_{c_i} = 48 \text{ min}$         |
| 100 Yr Storm Rainfall Intensity         | $I_{tc_{100}} = 106 \text{ mm/hr}$ |
| Calculated time of concentration        | $t_{c_{100}} = 47.6 \text{ min}$   |
| Actual rainfall intensity (Minor storm) | $I_{tc_{100}} = 106 \text{ mm/hr}$ |
| Minor Flow                              | $Q_{100} = 201 \text{ L/s}$        |



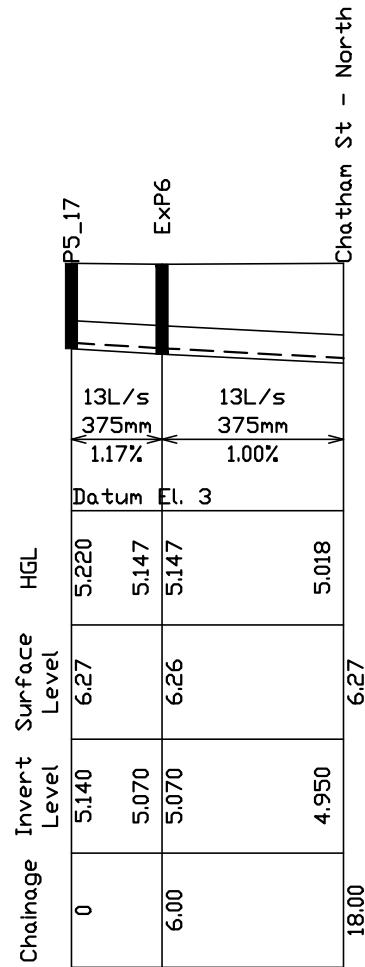
PIPE LONG-SECTION:  
DARLING ST (WEST)

(POST-DEVELOPED MINOR STORM FLOWS)



PIPE LONG-SECTION:  
CHATHAM ST (SOUTH)

(POST-DEVELOPED MINOR STORM FLOWS)



PIPE LONG-SECTION:  
CHATHAM ST (NORTH)

(POST-DEVELOPED MINOR STORM FLOWS)

|       |  |                                                                          |  |                                                       |  |                                                                                                                                                                                                                                                                                 |  |                                                                                                                                                                                                                                |  |                                                   |  |                                                                                                         |  |                      |  |                   |  |             |  |
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| 0     |  | ISSUED WITH DA STORMWATER REPORT                                         |  | 8.4.2022                                              |  | -                                                                                                                                                                                                                                                                               |  | -                                                                                                                                                                                                                              |  | -                                                 |  | SCALES<br>NTS                                                                                           |  | JOB No<br>16-548     |  | DRAWING No<br>SK1 |  | ISSUE<br>0  |  |
| ISSUE |  | REASON FOR ISSUE                                                         |  | DATE                                                  |  | DATE OF RELEASE                                                                                                                                                                                                                                                                 |  | RESPONSIBLE PRINCIPAL SIGNATURE                                                                                                                                                                                                |  | ISSUE                                             |  |                                                                                                         |  |                      |  |                   |  |             |  |



## DRAINS Input Data

| PIT / NODE DETAILS   |         |             | Version 15  |                       |                           |                  |                    |                      |                 |            |             |               |        |                      |                   |          |                     |                      |                           |                           |  |  |
|----------------------|---------|-------------|-------------|-----------------------|---------------------------|------------------|--------------------|----------------------|-----------------|------------|-------------|---------------|--------|----------------------|-------------------|----------|---------------------|----------------------|---------------------------|---------------------------|--|--|
| Name                 | Type    | Family      | Size        | Ponding Volume (cu.m) | Pressure Change Coeff. Ku | Surface Elev (m) | Max Pond Depth (m) | Base Inflow (cu.m/s) | Blocking Factor | x          | y           | Bolt-down lid | id     | Part Full Shock Loss | Inflow Hydrograph | Pit is   | Internal Width (mm) | Inflow is Misaligned | Minor Safe Pond Depth (m) | Major Safe Pond Depth (m) |  |  |
| P1-11                | Sag     | Grated inle | 600x600     | 3.7                   | 3.0                       | 6.6              | 0.1                | 0                    | 0.5             | -825058.24 | -258577.77  | No            | 42     | 1 x Ku               | No                | New      | 600                 | No                   | 0.10                      | 0.15                      |  |  |
| P2-11                | Sag     | Grated inle | 600x600     | 3.7                   | 2.8                       | 6.6              | 0.1                | 0                    | 0.5             | -825058.24 | -248267.77  | No            | 41     | 1 x Ku               | No                | New      | 600                 | Yes                  | 0.10                      | 0.15                      |  |  |
| P3-11                | Sag     | Grated inle | 900x900     | 14                    | 1.8                       | 6.5              | 0.2                | 0                    | 0.5             | -813841.11 | -251577.77  | No            | 40     | 1 x Ku               | No                | New      | 900                 | No                   | 0.15                      | 0.30                      |  |  |
| P3_1                 | Sag     | NEWCAST     | 3.0m Lintel | 1.2                   | 2.0                       | 6.25             | 0.05               | 0                    | 0.5             | -864258.23 | -317871.98  | No            | 55     | 1 x Ku               | No                | New      | 900                 | No                   | 0.15                      | 0.30                      |  |  |
| P4_1                 | Sag     | NEWCAST     | 2.4m Lintel | 1.2                   | 4.7                       | 6.25             | 0.05               | 0                    | 0.5             | -864229.07 | -328326.84  | No            | 74278  | 1 x Ku               | No                | New      |                     | No                   | 0.15                      | 0.30                      |  |  |
| P5_1                 | Sag     | NEWCAST     | 2.4m Lintel | 1.2                   | 5.0                       | 6.25             | 0.05               | 0                    | 0.5             | -864279.52 | -342200.77  | No            | 74480  | 1 x Ku               | No                | New      | 900                 | No                   | 0.15                      | 0.30                      |  |  |
| P6_1                 | Sag     | NEWCAST     | 2.4m Lintel | 2.4                   | 1.6                       | 6.25             | 0.2                | 0                    | 0.5             | -864178.62 | -355519.60  | No            | 74671  | 1 x Ku               | No                | New      | 900                 | No                   | 0.15                      | 0.30                      |  |  |
| P7_1                 | OnGrade | Grated inle | 900x900     |                       | 1.2                       | 6.62             |                    | 0                    | 0               | -873422.73 | -366716.74  | Yes           | 51     | 1 x Ku               | No                | New      | 900                 | No                   |                           |                           |  |  |
| GPT-BRB3             | OnGrade | Grated inle | 900x900     |                       | 1.3                       | 6.625            |                    | 0                    | 0               | -874066.27 | -368501.77  | Yes           | 50     | 1 x Ku               | No                | New      | 900                 | No                   |                           |                           |  |  |
| HW1-BRB3             | Node    |             |             |                       |                           | 5.60             |                    | 0                    |                 | -875022.52 | -371252.454 |               | 76266  |                      | No                |          |                     |                      |                           |                           |  |  |
| P2_1                 | Sag     | NEWCAST     | 2.4m Lintel | 4.5                   | 4.9                       | 6.25             | 0.1                | 0                    | 0.5             | -879123.23 | -304676.38  | No            | 56     | 1 x Ku               | No                | New      | 900                 | No                   | 0.15                      | 0.25                      |  |  |
| P1_1 + GD4           | OnGrade | Grated inle | 900x900     |                       | 1.9                       | 6.36             |                    | 0                    | 0               | -894028.53 | -316651.77  | No            | 57     | 1 x Ku               | No                | New      | 900                 | Yes                  |                           |                           |  |  |
| P2_6                 | OnGrade | Grated inle | 900x900     |                       | 2.7                       | 6.32             |                    | 0                    | 0               | -893873.23 | -331911.58  | Yes           | 58     | 1 x Ku               | No                | New      | 900                 | Yes                  |                           |                           |  |  |
| ExP5                 | OnGrade | NEWCAST     | 2.4m Lintel |                       | 5.9                       | 6.15             |                    | 0                    | 0               | -898098.64 | -331763.52  | No            | 117748 | 1 x Ku               | No                | Existing | 900                 | No                   |                           |                           |  |  |
| ExP4                 | Sag     | NEWCAST     | 2.4m Lintel | 11.4                  | 1.2                       | 6.05             | 0.12               | 0                    | 0.5             | -898011.46 | -375073.65  | No            | 118365 | 1 x Ku               | No                | Existing | 900                 | No                   | 0.15                      | 0.30                      |  |  |
| CHATHAM-RN-0         | Node    |             |             |                       |                           | 6.19             |                    | 0                    |                 | -898490.94 | -401070.259 |               | 121172 |                      | No                |          |                     |                      |                           |                           |  |  |
| P2_2                 | Sag     | Grated inle | 600x600     | 2.6                   | 5.9                       | 6.78             | 0.08               | 0                    | 0.5             | -825058.23 | -359454.36  | No            | 67     | 1 x Ku               | No                | New      | 600                 | No                   | 0.08                      | 0.20                      |  |  |
| P3_2                 | Sag     | Grated inle | 600x600     | 1.3                   | 7.9                       | 6.68             | 0.08               | 0                    | 0.5             | -833683.23 | -359454.36  | No            | 66     | 1 x Ku               | No                | New      | 600                 | Yes                  | 0.08                      | 0.20                      |  |  |
| HW2 (BRB2)           | Node    |             |             |                       |                           | 5.8              |                    | 0                    |                 | -833712.76 | -367050.329 |               | 52843  |                      | No                |          |                     |                      |                           |                           |  |  |
| GD2_NORTH            | OnGrade | Grated inle | 900x900     |                       | 5.9                       | 6.45             |                    | 0                    | 0               | -894023.17 | -129650.08  | No            | 100    | 1 x Ku               | No                | New      | 900                 | No                   |                           |                           |  |  |
| SAND_FILTER_N ORTH   | OnGrade | Grated inle | 900x900     |                       | 0.0                       | 6.80             |                    | 0                    | 0               | -889933.24 | -133882.84  | No            | 110    | 1 x Ku               | No                | New      | 900                 | No                   |                           |                           |  |  |
| P4_27                | OnGrade | Grated inle | 900x900     |                       | 0.2                       | 6.50             |                    | 0                    | 0               | -894142.50 | -138449.95  | No            | 99     | 1 x Ku               | No                | New      | 900                 | No                   |                           |                           |  |  |
| P5_17                | OnGrade | NEWCAST     | 2.4m Lintel |                       | 1.1                       | 6.27             |                    | 0                    | 0               | -898290.50 | -138435.98  | No            | 98     | 1 x Ku               | No                | New      | 600                 | Yes                  |                           |                           |  |  |
| ExP6                 | Sag     | Grated inle | 900x900     | 130                   | 0.3                       | 6.26             | 0.39               | 0                    | 0.5             | -898308.44 | -129160.17  | No            | 97     | 1 x Ku               | No                | New      | 900                 | Yes                  | 0.15                      | 0.50                      |  |  |
| Chatham St - North   | Node    |             |             |                       |                           | 6.27             |                    | 0                    |                 | -902695.46 | -129186.367 |               | 805    |                      | No                |          |                     |                      |                           |                           |  |  |
| P1_17                | Sag     | Grated inle | 900x900     | 30                    | 3.0                       | 6.50             | 0.16               | 0                    | 0.5             | -877983.25 | -124671.73  | No            | 103    | 1 x Ku               | No                | New      | 900                 | No                   | 0.20                      | 0.30                      |  |  |
| P2_17                | Sag     | Grated inle | 900x900     | 12                    | 1.5                       | 6.74             | 0.1                | 0                    | 0.5             | -877519.88 | -141729.51  | No            | 497    | 1 x Ku               | No                | New      | 900                 | Yes                  | 0.08                      | 0.15                      |  |  |
| P1_16                | Sag     | Grated inle | 900x900     | 6                     | 5.2                       | 6.63             | 0.12               | 0                    | 0.5             | -856633.14 | -139457.58  | No            | 104    | 1 x Ku               | No                | New      | 900                 | No                   | 0.10                      | 0.30                      |  |  |
| P2_16                | Sag     | Grated inle | 900x900     | 10                    | 1.7                       | 6.55             | 0.15               | 0                    | 0.5             | -841333.21 | -139457.58  | No            | 105    | 1 x Ku               | No                | New      | 900                 | No                   | 0.15                      | 0.30                      |  |  |
| ExPit_Track          | Sag     | Grated inle | 1200x1200   | 120                   | 7.9                       | 5.59             | 0.78               | 0                    | 0.5             | -827584.15 | -139526.30  | No            | 108    | 1 x Ku               | No                | Existing | 1200                | Yes                  | 0.61                      | 0.93                      |  |  |
| JP at Track Crossing | Node    |             |             |                       |                           | 6.37             |                    | 0                    |                 | -830096.26 | -137200.942 |               | 842    |                      | No                |          |                     |                      |                           |                           |  |  |
| Tank_T1-B-N          | Node    |             |             |                       |                           | 6.5              |                    | 0                    |                 | -818166.77 | -253777.218 |               | 285    |                      | No                |          |                     |                      |                           |                           |  |  |
| Tank_T1-A-S          | Node    |             |             |                       |                           | 6.5              |                    | 0                    |                 | -783571.05 | -249188.998 |               | 328    |                      | No                |          |                     |                      |                           |                           |  |  |
| P4-11                | Sag     | Grated inle | 900x900     | 14                    | 1.8                       | 6.5              | 0.2                | 0                    | 0.5             | -787914.58 | -251537.67  | No            | 317    | 1 x Ku               | No                | New      |                     | No                   | 0.15                      | 0.30                      |  |  |
| P1-9                 | Sag     | Grated inle | 600x600     | 3.7                   | 3.0                       | 6.6              | 0.1                | 0                    | 0.5             | -825125.14 | -295337.78  | No            | 378    | 1 x Ku               | No                | New      |                     | No                   | 0.10                      | 0.15                      |  |  |
| P2-9                 | Sag     | Grated inle | 600x600     | 3.7                   | 2.5                       | 6.6              | 0.1                | 0                    | 0.5             | -824981.01 | -284456.24  | No            | 380    | 1 x Ku               | No                | New      |                     | No                   | 0.10                      | 0.15                      |  |  |
| P3-9                 | Sag     | Grated inle | 900x900     | 14                    | 1.8                       | 6.5              | 0.2                | 0                    | 0.5             | -813633.06 | -287785.18  | No            | 403    | 1 x Ku               | No                | New      |                     | No                   | 0.15                      | 0.30                      |  |  |
| T1-C-N               | Node    |             |             |                       |                           | 6.5              |                    | 0                    |                 | -818344.42 | -290169.008 |               | 390    |                      | No                |          |                     |                      |                           |                           |  |  |
| TANK-T1-B-S          | Node    |             |             |                       |                           | 6.5              |                    | 0                    |                 | -783595.07 | -285392.523 |               | 417    |                      | No                |          |                     |                      |                           |                           |  |  |
| P4-9                 | Sag     | Grated inle | 900x900     | 14                    | 1.8                       | 6.5              | 0.2                | 0                    | 0.5             | -788060.63 | -287851.88  | No            | 412    | 1 x Ku               | No                | New      |                     | No                   | 0.15                      | 0.30                      |  |  |
| TRACK1               | Node    |             |             |                       |                           | 6.04             |                    | 0                    |                 | -822899.48 | -136342.968 |               | 1045   |                      | No                |          |                     |                      |                           |                           |  |  |
| P1_30_               | Sag     | Grated inle | 900x900     | 5                     | 5.0                       | 6.60             | 0.25               | 0                    | 0.5             | -824826.85 | -217311.43  | No            | 1148   | 1 x Ku               | No                | New      | 900                 | No                   | 0.15                      | 0.30                      |  |  |
| P2_30_               | Sag     | Grated inle | 900x900     | 18                    | 4.3                       | 6.60             | 0.25               | 0                    | 0.5             | -802600.75 | -217232.90  | No            | 1144   | 1 x Ku               | No                | New      | 900                 | No                   | 0.15                      | 0.30                      |  |  |
| P3_30_               | Sag     | Grated inle | 900x900     | 11                    | 1.4                       | 6.60             | 0.25               | 0                    | 0.5             | -780252.97 | -217237.77  | No            | 89     | 1 x Ku               | No                | New      | 900                 | No                   | 0.15                      | 0.30                      |  |  |
| P7_13_               | OnGrade | Grated inle | 900x900     |                       | 1.2                       | 6.79             |                    | 0                    | 0               | -771980.35 | -217383.01  | No            | 91     | 1 x Ku               | No                | New      |                     |                      |                           |                           |  |  |
| P8_13_               | OnGrade | Grated inle | 900x900     |                       | 1.2                       | 6.77             |                    | 0                    | 0               | -772793.24 | -210966.78  | No            | 90     | 1 x Ku               | No                | New      | 900                 | No                   |                           |                           |  |  |
| P9_13_               | OnGrade | Grated inle | 900x900     |                       | 1.6                       | 6.50             |                    | 0                    | 0               | -772411.66 | -179571.93  | No            | 95     | 1 x Ku               | No                | New      | 900                 | No                   |                           |                           |  |  |
| HW5                  | Node    |             |             |                       |                           | 5.73             |                    | 0                    |                 | -784037.10 | -172554.099 |               | 844    |                      | No                |          |                     |                      |                           |                           |  |  |
| TRACK2               | Node    |             |             |                       |                           | 6.37             |                    | 0                    |                 | -767337.35 | -173487.446 |               | 1214   |                      | No                |          |                     |                      |                           |                           |  |  |
| BYPASS1              | Node    |             |             |                       |                           | 6.60             |                    | 0                    |                 | -766222.12 | -216164.790 |               | 1394   |                      | No                |          |                     |                      |                           |                           |  |  |

## DRAINS Input Data

|                      |         |             |          |     |     |       |      |   |     |            |             |     |          |        |    |          |     |     |      |      |  |  |
|----------------------|---------|-------------|----------|-----|-----|-------|------|---|-----|------------|-------------|-----|----------|--------|----|----------|-----|-----|------|------|--|--|
| P2_15                | OnGrade | Grated inle | 900x900  |     | 1.8 | 6.48  |      | 0 | 0   | -749693.32 | -319355.55  | Yes | 27       | 1 x Ku | No | New      | 900 | No  |      |      |  |  |
| P3_15                | OnGrade | Grated inle | 900x900  |     | 1.4 | 6.48  |      | 0 | 0   | -749693.32 | -343355.55  | Yes | 21       | 1 x Ku | No | New      | 900 | No  |      |      |  |  |
| P4_15_Pit            | OnGrade | Grated inle | 900x900  |     | 0.7 | 6.48  |      | 0 | 0   | -749696.25 | -363164.10  | Yes | 83532618 | 1 x Ku | No | New      |     | No  |      |      |  |  |
| P5_15                | OnGrade | Grated inle | 900x900  |     | 2.3 | 6.48  |      | 0 | 0   | -749693.23 | -375857.77  | Yes | 13       | 1 x Ku | No | New      | 900 | Yes |      |      |  |  |
| P7_15                | OnGrade | Grated inle | 900x900  |     | 2.3 | 6.630 |      | 0 | 0   | -758862.76 | -375857.77  | Yes | 14       | 1 x Ku | No | New      | 900 | Yes |      |      |  |  |
| ExP1                 | OnGrade | Grated inle | 900x900  |     | 1.5 | 6.12  |      | 0 | 0   | -758873.63 | -381882.56  | Yes | 32910    | 1 x Ku | No | Existing | 900 | Yes |      |      |  |  |
| P4_20                | OnGrade | Grated inle | 900x900  |     | 0.9 | 6.12  |      | 0 | 0   | -724632.65 | -382500.95  | Yes | 83532960 | 1 x Ku | No | New      | 900 | Yes |      |      |  |  |
| DARLING_ST_RN        | Node    |             |          |     |     | 6.09  |      | 0 |     | -718915.15 | -382447.703 |     | 33012    |        | No |          |     |     |      |      |  |  |
| P5_3                 | OnGrade | Grated inle | 900x900  |     | 1.5 | 6.92  |      | 0 | 0   | -769811.25 | -319331.81  | Yes | 1689     | 1 x Ku | No | New      | 900 | No  |      |      |  |  |
| P6_3                 | OnGrade | Grated inle | 900x900  |     | 0.2 | 6.92  |      | 0 | 0   | -769728.04 | -327308.05  | Yes | 1735     | 1 x Ku | No | New      | 900 | No  |      |      |  |  |
| P7_3                 | OnGrade | Grated inle | 900x900  |     | 1.0 | 6.92  |      | 0 | 0   | -769728.04 | -343254.37  | Yes | 1743     | 1 x Ku | No | New      | 900 | No  |      |      |  |  |
| Pit21                | OnGrade | Grated inle | 900x900  |     | 2.1 | 6.860 |      | 0 | 0   | -769740.70 | -358057.77  | Yes | 20       | 1 x Ku | No | New      | 900 | No  |      |      |  |  |
| P11_3                | OnGrade | Grated inle | 900x900  |     | 1.3 | 6.63  |      | 0 | 0   | -769740.70 | -375857.77  | Yes | 15       | 1 x Ku | No | New      |     | No  |      |      |  |  |
| BLOCK_D_ROOF         | Node    |             |          |     |     | 7     |      | 0 |     | -822499.52 | -348744.928 |     | 16868    |        | No |          |     |     |      |      |  |  |
| P3_4                 | OnGrade | Grated inle | 900x900  |     | 1.4 | 6.23  |      | 0 | 0   | -829071.95 | -377968.81  | Yes | 6        | 1 x Ku | No | New      | 900 | Yes |      |      |  |  |
| P4_4                 | OnGrade | Grated inle | 900x900  |     | 1.6 | 6.0   |      | 0 | 0   | -829099.87 | -380874.88  | Yes | 7        | 1 x Ku | No | New      | 900 | Yes |      |      |  |  |
| ExP2                 | OnGrade | Grated inle | 900x900  |     | 0.4 | 6.02  |      | 0 | 0   | -796943.95 | -381299.35  | Yes | 33247    | 1 x Ku | No | Existing | 900 | Yes |      |      |  |  |
| P3_19                | OnGrade | Grated inle | 900x900  |     | 1.3 | 6.630 |      | 0 | 0   | -787193.23 | -375857.77  | Yes | 16       | 1 x Ku | No | New      | 900 | No  |      |      |  |  |
| P2_19                | OnGrade | Grated inle | 900x900  |     | 1.8 | 6.63  |      | 0 | 0   | -803093.23 | -375857.77  | Yes | 17       | 1 x Ku | No | New      | 900 | No  |      |      |  |  |
| P1_19                | OnGrade | Grated inle | 900x900  |     | 0.8 | 6.63  |      | 0 | 0   | -818676.95 | -375710.13  | Yes | 25794    | 1 x Ku | No | New      | 900 | No  |      |      |  |  |
| N402                 | Node    |             |          |     |     | 5.94  |      | 0 |     | -749376.37 | -384017.368 |     | 30043    |        | No |          |     |     |      |      |  |  |
| N403                 | Node    |             |          |     |     | 5.87  |      | 0 |     | -769569.61 | -383722.576 |     | 30160    |        | No |          |     |     |      |      |  |  |
| N404                 | Node    |             |          |     |     | 5.81  |      | 0 |     | -787404.52 | -383398.305 |     | 30235    |        | No |          |     |     |      |      |  |  |
| N405                 | Node    |             |          |     |     | 5.803 |      | 0 |     | -802999.00 | -383250.909 |     | 30385    |        | No |          |     |     |      |      |  |  |
| N406                 | Node    |             |          |     |     | 5.866 |      | 0 |     | -818593.45 | -382956.117 |     | 30481    |        | No |          |     |     |      |      |  |  |
| ExP3                 | Sag     | NEWCAST     | 2.4m Lin | 240 | 5.0 | 5.78  | 0.49 | 0 | 0.5 | -796866.15 | -383181.33  | No  | 32056    | 1 x Ku | No | Existing | 900 | Yes | 0.15 | 0.22 |  |  |
| P2_18                | OnGrade | Grated inle | 900x900  |     | 1.5 | 6.86  |      | 0 | 0   | -787193.23 | -358057.77  | Yes | 19       | 1 x Ku | No | New      | 900 | No  |      |      |  |  |
| P1_18                | OnGrade | Grated inle | 900x900  |     | 1.8 | 6.86  |      | 0 | 0   | -803093.23 | -358057.77  | Yes | 18       | 1 x Ku | No | New      | 900 | No  |      |      |  |  |
| GD1                  | Node    |             |          |     |     | 6.16  |      | 0 |     | -821918.74 | -378257.136 |     | 46775    |        | No |          |     |     |      |      |  |  |
| N458                 | Node    |             |          |     |     | 5.944 |      | 0 |     | -834731.55 | -382459.688 |     | 50539    |        | No |          |     |     |      |      |  |  |
| N469                 | Node    |             |          |     |     | 6.4   |      | 0 |     | -832439.25 | -365522.128 |     | 53656    |        | No |          |     |     |      |      |  |  |
| L1 CONCOURSE (SOUTH) | Node    |             |          |     |     | 7     |      | 0 |     | -838167.85 | -330964.006 |     | 56961    |        | No |          |     |     |      |      |  |  |
| N480                 | Node    |             |          |     |     | 6.0   |      | 0 |     | -845349.15 | -366775.253 |     | 58595    |        | No |          |     |     |      |      |  |  |
| P1_7                 | Sag     | Grated inle | 600x600  | 3.7 | 3.0 | 6.6   | 0.1  | 0 | 0.5 | -824876.15 | -330787.94  | No  | 63010    | 1 x Ku | No | New      |     | No  | 0.10 | 0.15 |  |  |
| P2_7                 | Sag     | Grated inle | 600x600  | 3.7 | 2.5 | 6.6   | 0.1  | 0 | 0.5 | -824788.15 | -320665.15  | No  | 63119    | 1 x Ku | No | New      |     | No  | 0.10 | 0.15 |  |  |
| P3_7                 | Sag     | Grated inle | 900x900  | 14  | 1.8 | 6.5   | 0.2  | 0 | 0.5 | -814049.15 | -324802.30  | No  | 63237    | 1 x Ku | No | New      |     | No  | 0.15 | 0.30 |  |  |
| T1-D-NTH             | Node    |             |          |     |     | 6.5   |      | 0 |     | -818208.33 | -326125.110 |     | 63683    |        | No |          |     |     |      |      |  |  |
| T1-C-STH             | Node    |             |          |     |     | 6.5   |      | 0 |     | -783402.03 | -322102.886 |     | 64590    |        | No |          |     |     |      |      |  |  |
| P4_7                 | Sag     | Grated inle | 900x900  | 14  | 1.8 | 6.5   | 0.2  | 0 | 0.5 | -787641.87 | -324538.22  | No  | 63354    | 1 x Ku | No | New      |     | No  | 0.15 | 0.30 |  |  |
| T1-GOODS_SHED_S TH   | Node    |             |          |     |     | 6.35  |      | 0 |     | -891441.85 | -356051.925 |     | 85816    |        | No |          |     |     |      |      |  |  |
| P1_6                 | OnGrade | Grated inle | 600x600  |     | 1.2 | 6.30  |      | 0 | 0   | -894023.23 | -354321.05  | Yes | 63       | 1 x Ku | No | New      | 600 | Yes |      |      |  |  |
| T1-GOOD-STORAGE-NTH  | Node    |             |          |     |     | 6.35  |      | 0 |     | -891377.55 | -333253.948 |     | 86315    |        | No |          |     |     |      |      |  |  |
| P1_8                 | OnGrade | Grated inle | 600x600  |     | 5.9 | 6.6   |      | 0 | 0   | -836725.13 | -282071.90  | No  | 90566    | 1 x Ku | No | New      | 600 | No  |      |      |  |  |
| P2_8                 | OnGrade | Grated inle | 600x600  |     | 5.9 | 6.55  |      | 0 | 0   | -852755.97 | -282299.11  | No  | 90813    | 1 x Ku | No | New      | 600 | No  |      |      |  |  |
| P3_8                 | Sag     | Grated inle | 900x900  | 14  | 2.2 | 6.5   | 0.2  | 0 | 0.5 | -869419.93 | -285474.75  | No  | 70       | 1 x Ku | No | New      | 900 | No  | 0.15 | 0.30 |  |  |
| T2-EQSHD             | Node    |             |          |     |     | 6.5   |      | 0 |     | -864582.22 | -287149.517 |     | 91746    |        | No |          |     |     |      |      |  |  |
| T1-E-STH             | Node    |             |          |     |     | 6.5   |      | 0 |     | -882693.91 | -281862.036 |     | 94069    |        | No |          |     |     |      |      |  |  |
| P4_8                 | Sag     | Grated inle | 900x900  | 14  | 2.9 | 6.5   | 0.2  | 0 | 0.5 | -880319.93 | -285474.75  | No  | 69       | 1 x Ku | No | New      | 900 | No  | 0.15 | 0.30 |  |  |
| CHATHAM-RN-1         | Node    |             |          |     |     | 6.20  |      | 0 |     | -898017.61 | -287449.612 |     | 97152    |        | No |          |     |     |      |      |  |  |
| P1_10                | Sag     | Grated inle | 600x600  | 3.7 | 3.0 | 6.6   | 0.1  | 0 | 0.5 | -836219.01 | -254174.86  | No  | 103436   | 1 x Ku | No | New      |     | No  | 0.10 | 0.15 |  |  |
| P2_10                | Sag     | Grated inle | 600x600  | 3.7 | 2.5 | 6.6   | 0.1  | 0 | 0.5 | -836582.25 | -244851.62  | No  | 103530   | 1 x Ku | No | New      |     | No  | 0.10 | 0.15 |  |  |
| P3_10                | Sag     | Grated inle | 900x900  | 14  | 1.8 | 6.5   | 0.2  | 0 | 0.5 | -847540.05 | -246970.54  | No  | 103840   | 1 x Ku | No | New      | 900 | No  | 0.50 | 0.40 |  |  |
| T1-E-NTH             | Node    |             |          |     |     | 6.5   |      | 0 |     | -843603.27 | -250650.059 |     | 104045   |        | No |          |     |     |      |      |  |  |
| T1-F-STH             | Node    |             |          |     |     | 6.5   |      | 0 |     | -877790.42 | -245422.838 |     | 107970   |        | No |          |     |     |      |      |  |  |

## DRAINS Input Data

|               |          |             |          |             |     |         |           |             |          |           |           |     |           |            |      |     |     |     |      |      |  |  |
|---------------|----------|-------------|----------|-------------|-----|---------|-----------|-------------|----------|-----------|-----------|-----|-----------|------------|------|-----|-----|-----|------|------|--|--|
| P4_10         | Sag      | Grated inle | 900x900  | 14          | 1.8 | 6.5     | 0.2       | 0           | 0.5      | -873281.8 | -247055.3 | No  | 106798    | 1 x Ku     | No   | New |     | No  | 0.20 | 0.40 |  |  |
| CHATHAM-RN-2  | Node     |             |          |             |     | 6.300   |           | 0           |          | -898011.4 | -250077.4 | No  | 109193    |            | No   |     |     |     |      |      |  |  |
| N646          | Node     |             |          |             |     | 5.78    |           | 0           |          | -796782.9 | -398236.9 | No  | 126392    |            | No   |     |     |     |      |      |  |  |
| GD3           | OnGrade  | Grated inle | 900x900  |             | 5.0 | 6.440   |           | 0           | 0        | -863367.8 | -368856.6 | No  | 131576    | 1 x Ku     | No   | New | 600 | No  |      |      |  |  |
| P1_19         | Sag      | Grated inle | 900x900  | 6.5         | 4.1 | 6.500   | 0.13      | 0           | 0.5      | -750996.8 | -220575.1 | No  | 83531435  | 1 x Ku     | No   | New | 600 | No  | 0.13 | 0.23 |  |  |
| P6_13         | OnGrade  | Grated inle | 900x900  |             | 1.1 | 6.92    |           | 0           | 0        | -771788.6 | -220641.7 | No  | 83531432  | 1 x Ku     | No   | New |     | No  |      |      |  |  |
| P2_28_Pit     | OnGrade  | Grated inle | 900x900  |             | 1.8 | 6.480   |           | 0           | 0        | -750633.6 | -250100.8 | Yes | 83531320  | 1 x Ku     | No   | New |     |     |      |      |  |  |
| P3_28         | OnGrade  | Grated inle | 900x900  |             | 1.4 | 6.600   |           | 0           | 0        | -750909.6 | -243476.0 | No  | 83531412  | 1 x Ku     | No   | New |     | No  |      |      |  |  |
| P4_28         | OnGrade  | Grated inle | 900x900  |             | 3.0 | 6.780   |           | 0           | 0        | -760846.9 | -230985.4 | No  | 83531441  | 1 x Ku     | No   | New | 900 | No  |      |      |  |  |
| P5_13         | OnGrade  | Grated inle | 900x900  |             | 1.8 | 6.950   |           | 0           | 0        | -771644.8 | -228692.7 | No  | 112918342 | 1 x Ku     | No   | New |     | No  |      |      |  |  |
| P3_13         | OnGrade  | Grated inle | 900x900  |             | 1.2 | 6.71    |           | 0           | 0        | -769392.5 | -249826.7 | No  | 83531315  | 1 x Ku     | No   | New |     |     |      |      |  |  |
| P4_13         | OnGrade  | Grated inle | 900x900  |             | 1.5 | 6.95    |           | 0           | 0        | -771501.1 | -242686.2 | No  | 38        | 1 x Ku     | No   | New | 900 | Yes |      |      |  |  |
| P1_28_Pit     | OnGrade  | Grated inle | 900x900  |             | 2.1 | 6.480   |           | 0           | 0        | -750948.3 | -273246.4 | Yes | 83531287  | 1 x Ku     | No   | New |     | Yes |      |      |  |  |
| P2_13         | OnGrade  | Grated inle | 900x900  |             | 2.3 | 6.79    |           | 0           | 0        | -769431.6 | -273329.2 | Yes | 83531281  | 1 x Ku     | No   | New |     | Yes |      |      |  |  |
| P3-3          | OnGrade  | Grated inle | 900x900  |             | 1.0 | 6.92    |           | 0           | 0        | -769743.2 | -297932.8 | Yes | 30        | 1 x Ku     | No   | New |     | Yes |      |      |  |  |
| P1_15         | OnGrade  | Grated inle | 900x900  |             | 1.4 | 6.480   |           | 0           | 0        | -749693.3 | -297955.5 | Yes | 28        | 1 x Ku     | No   | New | 900 | No  |      |      |  |  |
| HW6           | Headwall |             |          |             | 0.5 | 6.693   |           | 0           |          | -797085.5 | -164309.5 | No  | 83532505  |            |      |     |     |     |      |      |  |  |
| HW7           | Node     |             |          |             |     | 5.681   |           | 0           |          | -801237.1 | -161362.2 | No  | 83532430  |            | No   |     |     |     |      |      |  |  |
| P2_20         | OnGrade  | Grated inle | 900x900  |             | 2.3 | 6.35    |           | 0           | 0        | -724766.8 | -360020.3 | Yes | 83532797  | 1 x Ku     | No   | New | 900 | Yes |      |      |  |  |
| P3_20         | OnGrade  | Grated inle | 900x900  |             | 0.7 | 6.45    |           | 0           | 0        | -724712.5 | -376949.8 | Yes | 83532912  | 1 x Ku     | No   | New | 900 | No  |      |      |  |  |
| N391937       | Node     |             |          |             |     | 5.98    |           | 0           |          | -719745.2 | -384460.9 | No  | 83533284  |            | No   |     |     |     |      |      |  |  |
| HW4           | Headwall |             |          |             | 0.5 | 6.37    |           | 0           |          | -812907.1 | -152342.9 | No  | 83533562  |            |      |     |     |     |      |      |  |  |
| N197          | Node     |             |          |             |     | 6.78    |           | 0           |          | -879868.9 | -142962.7 | No  | 522       |            | No   |     |     |     |      |      |  |  |
| P3_17         | OnGrade  | Grated inle | 900x900  |             | 3.0 | 6.80    |           | 0           | 0        | -889892.0 | -146012.3 | Yes | 102       | 1 x Ku     | No   | New | 900 | Yes |      |      |  |  |
| GPT-4200      | OnGrade  | Grated inle | 900x900  |             | 1.3 | 6.80    |           | 0           | 0        | -889824.1 | -144926.0 | Yes | 101       | 1 x Ku     | No   | New | 900 | No  |      |      |  |  |
| SAND_FILTER_S |          |             |          |             |     |         |           |             |          |           |           |     |           |            |      |     |     |     |      |      |  |  |
| TH PIT        | OnGrade  | Grated inle | 900x900  |             | 0.2 | 6.80    |           | 0           | 0        | -889864.3 | -143566.1 | No  | 109       | 1 x Ku     | No   | New | 900 | No  |      |      |  |  |
| DETENTION     |          |             |          |             |     |         |           |             |          |           |           |     |           |            |      |     |     |     |      |      |  |  |
| BASIN DETAILS |          |             |          |             |     |         |           |             |          |           |           |     |           |            |      |     |     |     |      |      |  |  |
| Name          | Elev     | Surf. Area  | Not Used | Outlet Type | K   | Dia(mm) | Centre RL | Pit Family  | Pit Type | x         | y         | HED | Crest RL  | Crest Leng | id   |     |     |     |      |      |  |  |
| TRENCH_11     | 5.07     | 31.6        |          | None        |     |         |           |             |          | -800798.4 | -252083.8 | No  |           |            | 347  |     |     |     |      |      |  |  |
|               | 5.95     | 31.6        |          |             |     |         |           |             |          |           |           |     |           |            |      |     |     |     |      |      |  |  |
|               | 5.951    | 1.62        |          |             |     |         |           |             |          |           |           |     |           |            |      |     |     |     |      |      |  |  |
|               | 6.5      | 1.62        |          |             |     |         |           |             |          |           |           |     |           |            |      |     |     |     |      |      |  |  |
|               | 6.501    | 31.6        |          |             |     |         |           |             |          |           |           |     |           |            |      |     |     |     |      |      |  |  |
|               | 6.55     | 140         |          |             |     |         |           |             |          |           |           |     |           |            |      |     |     |     |      |      |  |  |
|               | 6.6      | 248         |          |             |     |         |           |             |          |           |           |     |           |            |      |     |     |     |      |      |  |  |
|               | 6.7      | 600         |          |             |     |         |           |             |          |           |           |     |           |            |      |     |     |     |      |      |  |  |
|               | 6.8      | 620         |          |             |     |         |           |             |          |           |           |     |           |            |      |     |     |     |      |      |  |  |
| SAND FILTER   | 5.23     | 0.81        |          | Culvert     | 2   |         |           |             |          | -889985.0 | -138377.3 | No  |           |            | 487  |     |     |     |      |      |  |  |
|               | 5.63     | 0.81        |          |             |     |         |           |             |          |           |           |     |           |            |      |     |     |     |      |      |  |  |
|               | 5.631    | 8           |          |             |     |         |           |             |          |           |           |     |           |            |      |     |     |     |      |      |  |  |
|               | 6.45     | 8           |          |             |     |         |           |             |          |           |           |     |           |            |      |     |     |     |      |      |  |  |
|               | 6.451    | 0.81        |          |             |     |         |           |             |          |           |           |     |           |            |      |     |     |     |      |      |  |  |
|               | 6.8      | 0.81        |          |             |     |         |           |             |          |           |           |     |           |            |      |     |     |     |      |      |  |  |
| TRENCH9       | 5.07     | 31.6        |          | None        |     |         |           |             |          | -800600.4 | -288516.7 | No  |           |            | 1537 |     |     |     |      |      |  |  |
|               | 5.95     | 31.6        |          |             |     |         |           |             |          |           |           |     |           |            |      |     |     |     |      |      |  |  |
|               | 5.951    | 1.62        |          |             |     |         |           |             |          |           |           |     |           |            |      |     |     |     |      |      |  |  |
|               | 6.5      | 1.62        |          |             |     |         |           |             |          |           |           |     |           |            |      |     |     |     |      |      |  |  |
|               | 6.501    | 31.6        |          |             |     |         |           |             |          |           |           |     |           |            |      |     |     |     |      |      |  |  |
|               | 6.55     | 140         |          |             |     |         |           |             |          |           |           |     |           |            |      |     |     |     |      |      |  |  |
|               | 6.6      | 248         |          |             |     |         |           |             |          |           |           |     |           |            |      |     |     |     |      |      |  |  |
|               | 6.7      | 600         |          |             |     |         |           |             |          |           |           |     |           |            |      |     |     |     |      |      |  |  |
|               | 6.8      | 620         |          |             |     |         |           |             |          |           |           |     |           |            |      |     |     |     |      |      |  |  |
| P2_15 BASIN   | 6.38     | 6           |          | Pit/Sump    |     |         |           | Grated inle | 600x600  | -753002.3 | -319457.9 | No  |           |            | 7100 |     |     |     |      |      |  |  |
|               | 6.479    | 6           |          |             |     |         |           |             |          |           |           |     |           |            |      |     |     |     |      |      |  |  |
|               | 6.48     | 33          |          |             |     |         |           |             |          |           |           |     |           |            |      |     |     |     |      |      |  |  |



## DRAINS Input Data

|              |       |      |  |          |  |  |  |              |         |            |            |    |  |  |  |       |  |  |  |  |  |
|--------------|-------|------|--|----------|--|--|--|--------------|---------|------------|------------|----|--|--|--|-------|--|--|--|--|--|
|              | 6.59  | 90   |  |          |  |  |  |              |         |            |            |    |  |  |  |       |  |  |  |  |  |
|              | 6.74  | 100  |  |          |  |  |  |              |         |            |            |    |  |  |  |       |  |  |  |  |  |
| P4_3 BASIN   | 6.61  | 6    |  | Pit/Sump |  |  |  | Grated inlet | 600x600 | -764499.15 | -319369.51 | No |  |  |  | 8150  |  |  |  |  |  |
|              | 6.709 | 6    |  |          |  |  |  |              |         |            |            |    |  |  |  |       |  |  |  |  |  |
|              | 6.71  | 33   |  |          |  |  |  |              |         |            |            |    |  |  |  |       |  |  |  |  |  |
|              | 6.8   | 90   |  |          |  |  |  |              |         |            |            |    |  |  |  |       |  |  |  |  |  |
|              | 6.86  | 100  |  |          |  |  |  |              |         |            |            |    |  |  |  |       |  |  |  |  |  |
| P3_15 BASIN  | 6.38  | 6    |  | Pit/Sump |  |  |  | Grated inlet | 600x600 | -753193.92 | -343390.14 | No |  |  |  | 9202  |  |  |  |  |  |
|              | 6.479 | 6    |  |          |  |  |  |              |         |            |            |    |  |  |  |       |  |  |  |  |  |
|              | 6.48  | 33   |  |          |  |  |  |              |         |            |            |    |  |  |  |       |  |  |  |  |  |
|              | 6.59  | 90   |  |          |  |  |  |              |         |            |            |    |  |  |  |       |  |  |  |  |  |
|              | 6.74  | 100  |  |          |  |  |  |              |         |            |            |    |  |  |  |       |  |  |  |  |  |
| P7_3 BASIN   | 6.61  | 6    |  | Pit/Sump |  |  |  | Grated inlet | 600x600 | -764731.45 | -343312.27 | No |  |  |  | 9285  |  |  |  |  |  |
|              | 6.709 | 6    |  |          |  |  |  |              |         |            |            |    |  |  |  |       |  |  |  |  |  |
|              | 6.71  | 33   |  |          |  |  |  |              |         |            |            |    |  |  |  |       |  |  |  |  |  |
|              | 6.8   | 90   |  |          |  |  |  |              |         |            |            |    |  |  |  |       |  |  |  |  |  |
|              | 6.86  | 100  |  |          |  |  |  |              |         |            |            |    |  |  |  |       |  |  |  |  |  |
| P9_3 BASIN   | 6.61  | 12   |  | Pit/Sump |  |  |  | Grated inlet | 600x600 | -766061.55 | -359720.62 | No |  |  |  | 10270 |  |  |  |  |  |
|              | 6.709 | 12   |  |          |  |  |  |              |         |            |            |    |  |  |  |       |  |  |  |  |  |
|              | 6.71  | 68   |  |          |  |  |  |              |         |            |            |    |  |  |  |       |  |  |  |  |  |
|              | 6.82  | 68   |  |          |  |  |  |              |         |            |            |    |  |  |  |       |  |  |  |  |  |
|              | 6.89  | 286  |  |          |  |  |  |              |         |            |            |    |  |  |  |       |  |  |  |  |  |
| P6_15_ BASIN | 6.28  | 18   |  | Pit/Sump |  |  |  | Grated inlet | 600x600 | -752434.55 | -372521.25 | No |  |  |  | 11005 |  |  |  |  |  |
|              | 6.479 | 32   |  |          |  |  |  |              |         |            |            |    |  |  |  |       |  |  |  |  |  |
|              | 6.48  | 60   |  |          |  |  |  |              |         |            |            |    |  |  |  |       |  |  |  |  |  |
|              | 6.63  | 120  |  |          |  |  |  |              |         |            |            |    |  |  |  |       |  |  |  |  |  |
|              | 6.89  | 195  |  |          |  |  |  |              |         |            |            |    |  |  |  |       |  |  |  |  |  |
| BRB1         | 5.2   | 0.81 |  | Pit/Sump |  |  |  | Grated inlet | 900x900 | -844945.73 | -349097.02 | No |  |  |  | 57810 |  |  |  |  |  |
|              | 5.699 | 0.81 |  |          |  |  |  |              |         |            |            |    |  |  |  |       |  |  |  |  |  |
|              | 5.7   | 80   |  |          |  |  |  |              |         |            |            |    |  |  |  |       |  |  |  |  |  |
|              | 6.4   | 146  |  |          |  |  |  |              |         |            |            |    |  |  |  |       |  |  |  |  |  |
| BRB2         | 5.1   | 0.81 |  | Pit/Sump |  |  |  | Grated inlet | 900x900 | -834347.65 | -374912.35 | No |  |  |  | 49280 |  |  |  |  |  |
|              | 5.599 | 0.81 |  |          |  |  |  |              |         |            |            |    |  |  |  |       |  |  |  |  |  |
|              | 5.6   | 180  |  |          |  |  |  |              |         |            |            |    |  |  |  |       |  |  |  |  |  |
|              | 6.2   | 280  |  |          |  |  |  |              |         |            |            |    |  |  |  |       |  |  |  |  |  |
|              | 6.3   | 350  |  |          |  |  |  |              |         |            |            |    |  |  |  |       |  |  |  |  |  |
| P11_3 BASIN  | 6.38  | 6    |  | Pit/Sump |  |  |  | Grated inlet | 600x600 | -771353.65 | -373621.55 | No |  |  |  | 24980 |  |  |  |  |  |
|              | 6.479 | 6    |  |          |  |  |  |              |         |            |            |    |  |  |  |       |  |  |  |  |  |
|              | 6.48  | 20   |  |          |  |  |  |              |         |            |            |    |  |  |  |       |  |  |  |  |  |
|              | 6.59  | 90   |  |          |  |  |  |              |         |            |            |    |  |  |  |       |  |  |  |  |  |
|              | 6.74  | 100  |  |          |  |  |  |              |         |            |            |    |  |  |  |       |  |  |  |  |  |
| P3_19 BASIN  | 6.38  | 6    |  | Pit/Sump |  |  |  | Grated inlet | 600x600 | -787348.85 | -373468.77 | No |  |  |  | 25238 |  |  |  |  |  |
|              | 6.479 | 6    |  |          |  |  |  |              |         |            |            |    |  |  |  |       |  |  |  |  |  |
|              | 6.48  | 20   |  |          |  |  |  |              |         |            |            |    |  |  |  |       |  |  |  |  |  |
|              | 6.59  | 90   |  |          |  |  |  |              |         |            |            |    |  |  |  |       |  |  |  |  |  |
|              | 6.74  | 100  |  |          |  |  |  |              |         |            |            |    |  |  |  |       |  |  |  |  |  |
| P2_19 BASIN  | 6.38  | 6    |  | Pit/Sump |  |  |  | Grated inlet | 600x600 | -803089.33 | -373825.35 | No |  |  |  | 25271 |  |  |  |  |  |
|              | 6.479 | 6    |  |          |  |  |  |              |         |            |            |    |  |  |  |       |  |  |  |  |  |
|              | 6.48  | 20   |  |          |  |  |  |              |         |            |            |    |  |  |  |       |  |  |  |  |  |
|              | 6.59  | 90   |  |          |  |  |  |              |         |            |            |    |  |  |  |       |  |  |  |  |  |
|              | 6.74  | 100  |  |          |  |  |  |              |         |            |            |    |  |  |  |       |  |  |  |  |  |
| P1_19 BASIN  | 6.38  | 6    |  | Pit/Sump |  |  |  | Grated inlet | 600x600 | -819746.72 | -373774.41 | No |  |  |  | 25525 |  |  |  |  |  |
|              | 6.479 | 6    |  |          |  |  |  |              |         |            |            |    |  |  |  |       |  |  |  |  |  |
|              | 6.48  | 20   |  |          |  |  |  |              |         |            |            |    |  |  |  |       |  |  |  |  |  |
|              | 6.59  | 90   |  |          |  |  |  |              |         |            |            |    |  |  |  |       |  |  |  |  |  |
|              | 6.74  | 100  |  |          |  |  |  |              |         |            |            |    |  |  |  |       |  |  |  |  |  |
| Basin73      | 6.61  | 6    |  | Pit/Sump |  |  |  | Grated inlet | 600x600 | -787230.05 | -361277.12 | No |  |  |  | 42163 |  |  |  |  |  |
|              | 6.709 | 6    |  |          |  |  |  |              |         |            |            |    |  |  |  |       |  |  |  |  |  |

## DRAINS Input Data

|             |       |      |  |          |  |  |  |              |         |            |            |    |  |  |  |          |  |  |  |  |  |  |
|-------------|-------|------|--|----------|--|--|--|--------------|---------|------------|------------|----|--|--|--|----------|--|--|--|--|--|--|
|             | 6.71  | 33   |  |          |  |  |  |              |         |            |            |    |  |  |  |          |  |  |  |  |  |  |
|             | 6.8   | 90   |  |          |  |  |  |              |         |            |            |    |  |  |  |          |  |  |  |  |  |  |
|             | 6.86  | 100  |  |          |  |  |  |              |         |            |            |    |  |  |  |          |  |  |  |  |  |  |
| Basin76     | 6.61  | 6    |  | Pit/Sump |  |  |  | Grated inlet | 600x600 | -803140.27 | -361701.62 | No |  |  |  | 42724    |  |  |  |  |  |  |
|             | 6.709 | 6    |  |          |  |  |  |              |         |            |            |    |  |  |  |          |  |  |  |  |  |  |
|             | 6.71  | 33   |  |          |  |  |  |              |         |            |            |    |  |  |  |          |  |  |  |  |  |  |
|             | 6.8   | 90   |  |          |  |  |  |              |         |            |            |    |  |  |  |          |  |  |  |  |  |  |
|             | 6.86  | 100  |  |          |  |  |  |              |         |            |            |    |  |  |  |          |  |  |  |  |  |  |
| TRENCH7     | 5.07  | 31.6 |  | None     |  |  |  |              |         | -801211.77 | -324643.45 | No |  |  |  | 64276    |  |  |  |  |  |  |
|             | 5.95  | 31.6 |  |          |  |  |  |              |         |            |            |    |  |  |  |          |  |  |  |  |  |  |
|             | 5.951 | 1.62 |  |          |  |  |  |              |         |            |            |    |  |  |  |          |  |  |  |  |  |  |
|             | 6.5   | 1.62 |  |          |  |  |  |              |         |            |            |    |  |  |  |          |  |  |  |  |  |  |
|             | 6.501 | 31.6 |  |          |  |  |  |              |         |            |            |    |  |  |  |          |  |  |  |  |  |  |
|             | 6.55  | 140  |  |          |  |  |  |              |         |            |            |    |  |  |  |          |  |  |  |  |  |  |
|             | 6.6   | 248  |  |          |  |  |  |              |         |            |            |    |  |  |  |          |  |  |  |  |  |  |
|             | 6.7   | 600  |  |          |  |  |  |              |         |            |            |    |  |  |  |          |  |  |  |  |  |  |
|             | 6.8   | 620  |  |          |  |  |  |              |         |            |            |    |  |  |  |          |  |  |  |  |  |  |
| BRB3        | 5.1   | 0.81 |  | Pit/Sump |  |  |  | Grated inlet | 900x900 | -887985.60 | -373335.60 | No |  |  |  | 82268    |  |  |  |  |  |  |
|             | 5.599 | 0.81 |  |          |  |  |  |              |         |            |            |    |  |  |  |          |  |  |  |  |  |  |
|             | 5.6   | 69   |  |          |  |  |  |              |         |            |            |    |  |  |  |          |  |  |  |  |  |  |
|             | 6.4   | 143  |  |          |  |  |  |              |         |            |            |    |  |  |  |          |  |  |  |  |  |  |
|             | 6.5   | 180  |  |          |  |  |  |              |         |            |            |    |  |  |  |          |  |  |  |  |  |  |
| TRENCH8     | 5.07  | 50   |  | None     |  |  |  |              |         | -874672.30 | -285494.46 | No |  |  |  | 96056    |  |  |  |  |  |  |
|             | 5.95  | 50   |  |          |  |  |  |              |         |            |            |    |  |  |  |          |  |  |  |  |  |  |
|             | 5.951 | 1.62 |  |          |  |  |  |              |         |            |            |    |  |  |  |          |  |  |  |  |  |  |
|             | 6.5   | 1.62 |  |          |  |  |  |              |         |            |            |    |  |  |  |          |  |  |  |  |  |  |
|             | 6.501 | 50   |  |          |  |  |  |              |         |            |            |    |  |  |  |          |  |  |  |  |  |  |
|             | 6.55  | 140  |  |          |  |  |  |              |         |            |            |    |  |  |  |          |  |  |  |  |  |  |
|             | 6.6   | 248  |  |          |  |  |  |              |         |            |            |    |  |  |  |          |  |  |  |  |  |  |
|             | 6.7   | 600  |  |          |  |  |  |              |         |            |            |    |  |  |  |          |  |  |  |  |  |  |
|             | 6.8   | 620  |  |          |  |  |  |              |         |            |            |    |  |  |  |          |  |  |  |  |  |  |
| TRENCH10    | 5.07  | 31.6 |  | None     |  |  |  |              |         | -858897.47 | -247127.94 | No |  |  |  | 106594   |  |  |  |  |  |  |
|             | 5.95  | 31.6 |  |          |  |  |  |              |         |            |            |    |  |  |  |          |  |  |  |  |  |  |
|             | 5.951 | 1.62 |  |          |  |  |  |              |         |            |            |    |  |  |  |          |  |  |  |  |  |  |
|             | 6.5   | 1.62 |  |          |  |  |  |              |         |            |            |    |  |  |  |          |  |  |  |  |  |  |
|             | 6.501 | 31.6 |  |          |  |  |  |              |         |            |            |    |  |  |  |          |  |  |  |  |  |  |
|             | 6.55  | 140  |  |          |  |  |  |              |         |            |            |    |  |  |  |          |  |  |  |  |  |  |
|             | 6.6   | 248  |  |          |  |  |  |              |         |            |            |    |  |  |  |          |  |  |  |  |  |  |
|             | 6.7   | 600  |  |          |  |  |  |              |         |            |            |    |  |  |  |          |  |  |  |  |  |  |
|             | 6.8   | 620  |  |          |  |  |  |              |         |            |            |    |  |  |  |          |  |  |  |  |  |  |
| P2_28_Basin | 6.38  | 6    |  | Pit/Sump |  |  |  | Grated inlet | 600x600 | -754567.13 | -250100.85 | No |  |  |  | 83531512 |  |  |  |  |  |  |
|             | 6.479 | 6    |  |          |  |  |  |              |         |            |            |    |  |  |  |          |  |  |  |  |  |  |
|             | 6.48  | 20   |  |          |  |  |  |              |         |            |            |    |  |  |  |          |  |  |  |  |  |  |
|             | 6.59  | 46   |  |          |  |  |  |              |         |            |            |    |  |  |  |          |  |  |  |  |  |  |
|             | 6.74  | 50   |  |          |  |  |  |              |         |            |            |    |  |  |  |          |  |  |  |  |  |  |
| P1_31_Basin | 6.61  | 6    |  | Pit/Sump |  |  |  | Grated inlet | 600x600 | -766091.60 | -250100.85 | No |  |  |  | 83531518 |  |  |  |  |  |  |
|             | 6.709 | 6    |  |          |  |  |  |              |         |            |            |    |  |  |  |          |  |  |  |  |  |  |
|             | 6.71  | 20   |  |          |  |  |  |              |         |            |            |    |  |  |  |          |  |  |  |  |  |  |
|             | 6.8   | 46   |  |          |  |  |  |              |         |            |            |    |  |  |  |          |  |  |  |  |  |  |
|             | 6.86  | 50   |  |          |  |  |  |              |         |            |            |    |  |  |  |          |  |  |  |  |  |  |
| P1_28_Basin | 6.38  | 6    |  | Pit/Sump |  |  |  | Grated inlet | 600x600 | -753531.64 | -273251.43 | No |  |  |  | 83531523 |  |  |  |  |  |  |
|             | 6.479 | 6    |  |          |  |  |  |              |         |            |            |    |  |  |  |          |  |  |  |  |  |  |
|             | 6.48  | 33   |  |          |  |  |  |              |         |            |            |    |  |  |  |          |  |  |  |  |  |  |
|             | 6.59  | 90   |  |          |  |  |  |              |         |            |            |    |  |  |  |          |  |  |  |  |  |  |
|             | 6.74  | 100  |  |          |  |  |  |              |         |            |            |    |  |  |  |          |  |  |  |  |  |  |
| P1_13_Basin | 6.61  | 6    |  | Pit/Sump |  |  |  | Grated inlet | 600x600 | -765429.13 | -273306.85 | No |  |  |  | 83531527 |  |  |  |  |  |  |
|             | 6.709 | 6    |  |          |  |  |  |              |         |            |            |    |  |  |  |          |  |  |  |  |  |  |
|             | 6.71  | 33   |  |          |  |  |  |              |         |            |            |    |  |  |  |          |  |  |  |  |  |  |

DRAINS Input Data

|                       |            |        |       |          |      |       |       |       |              |         |            |            |       |       |       |       |       |           |        |        |            |            |
|-----------------------|------------|--------|-------|----------|------|-------|-------|-------|--------------|---------|------------|------------|-------|-------|-------|-------|-------|-----------|--------|--------|------------|------------|
|                       | 6.8        | 90     |       |          |      |       |       |       |              |         |            |            |       |       |       |       |       |           |        |        |            |            |
|                       | 6.86       | 100    |       |          |      |       |       |       |              |         |            |            |       |       |       |       |       |           |        |        |            |            |
| P2_3 BASIN            | 6.61       | 6      |       | Pit/Sump |      |       |       |       | Grated inlet | 600x600 | -764488.43 | -298076.96 | No    |       |       |       |       |           |        |        |            |            |
|                       | 6.709      | 6      |       |          |      |       |       |       |              |         |            |            |       |       |       |       |       |           |        |        |            |            |
|                       | 6.71       | 33     |       |          |      |       |       |       |              |         |            |            |       |       |       |       |       |           |        |        |            |            |
|                       | 6.8        | 90     |       |          |      |       |       |       |              |         |            |            |       |       |       |       |       |           |        |        |            |            |
|                       | 6.86       | 100    |       |          |      |       |       |       |              |         |            |            |       |       |       |       |       |           |        |        |            |            |
| P1_15 BASIN           | 6.38       | 6      |       | Pit/Sump |      |       |       |       | Grated inlet | 600x600 | -752867.15 | -297997.11 | No    |       |       |       |       |           |        |        |            |            |
|                       | 6.479      | 6      |       |          |      |       |       |       |              |         |            |            |       |       |       |       |       |           |        |        |            |            |
|                       | 6.48       | 33     |       |          |      |       |       |       |              |         |            |            |       |       |       |       |       |           |        |        |            |            |
|                       | 6.59       | 90     |       |          |      |       |       |       |              |         |            |            |       |       |       |       |       |           |        |        |            |            |
|                       | 6.74       | 100    |       |          |      |       |       |       |              |         |            |            |       |       |       |       |       |           |        |        |            |            |
| P4_15_Basin           | 6.38       | 6      |       | Pit/Sump |      |       |       |       | Grated inlet | 600x600 | -753194.62 | -363164.10 | No    |       |       |       |       |           |        |        |            |            |
|                       | 6.479      | 6      |       |          |      |       |       |       |              |         |            |            |       |       |       |       |       |           |        |        |            |            |
|                       | 6.48       | 33     |       |          |      |       |       |       |              |         |            |            |       |       |       |       |       |           |        |        |            |            |
|                       | 6.59       | 90     |       |          |      |       |       |       |              |         |            |            |       |       |       |       |       |           |        |        |            |            |
|                       | 6.74       | 100    |       |          |      |       |       |       |              |         |            |            |       |       |       |       |       |           |        |        |            |            |
| P1_23_Basin           | 5.64       | 0.81   |       | Orifice  |      | 100   | 5.69  |       |              |         | -717675.03 | -343221.33 | No    |       |       |       |       |           |        |        |            |            |
|                       | 6.199      | 0.81   |       |          |      |       |       |       |              |         |            |            |       |       |       |       |       |           |        |        |            |            |
|                       | 6.2        | 7.2    |       |          |      |       |       |       |              |         |            |            |       |       |       |       |       |           |        |        |            |            |
|                       | 6.3        | 7.2    |       |          |      |       |       |       |              |         |            |            |       |       |       |       |       |           |        |        |            |            |
|                       | 6.39       | 25     |       |          |      |       |       |       |              |         |            |            |       |       |       |       |       |           |        |        |            |            |
|                       | 6.45       | 35     |       |          |      |       |       |       |              |         |            |            |       |       |       |       |       |           |        |        |            |            |
| P1_22 Basin           | 5.64       | 0.81   |       | Orifice  |      | 100   | 5.69  |       |              |         | -717592.22 | -360197.45 | No    |       |       |       |       |           |        |        |            |            |
|                       | 6.199      | 0.81   |       |          |      |       |       |       |              |         |            |            |       |       |       |       |       |           |        |        |            |            |
|                       | 6.2        | 7.2    |       |          |      |       |       |       |              |         |            |            |       |       |       |       |       |           |        |        |            |            |
|                       | 6.3        | 7.2    |       |          |      |       |       |       |              |         |            |            |       |       |       |       |       |           |        |        |            |            |
|                       | 6.39       | 25     |       |          |      |       |       |       |              |         |            |            |       |       |       |       |       |           |        |        |            |            |
|                       | 6.45       | 35     |       |          |      |       |       |       |              |         |            |            |       |       |       |       |       |           |        |        |            |            |
| P1_20_Basin           | 5.66       | 0.81   |       | Orifice  |      | 100   | 5.71  |       |              |         | -741800.50 | -359962.86 | No    |       |       |       |       |           |        |        |            |            |
|                       | 6.199      | 0.81   |       |          |      |       |       |       |              |         |            |            |       |       |       |       |       |           |        |        |            |            |
|                       | 6.2        | 7.2    |       |          |      |       |       |       |              |         |            |            |       |       |       |       |       |           |        |        |            |            |
|                       | 6.3        | 7.2    |       |          |      |       |       |       |              |         |            |            |       |       |       |       |       |           |        |        |            |            |
|                       | 6.39       | 25     |       |          |      |       |       |       |              |         |            |            |       |       |       |       |       |           |        |        |            |            |
|                       | 6.45       | 35     |       |          |      |       |       |       |              |         |            |            |       |       |       |       |       |           |        |        |            |            |
| P1_21_Basin           | 5.4        | 0.81   |       | Pit/Sump |      |       |       |       | Grated inlet | 600x600 | -717178.16 | -377587.71 | No    |       |       |       |       |           |        |        |            |            |
|                       | 6.199      | 0.81   |       |          |      |       |       |       |              |         |            |            |       |       |       |       |       |           |        |        |            |            |
|                       | 6.2        | 7.2    |       |          |      |       |       |       |              |         |            |            |       |       |       |       |       |           |        |        |            |            |
|                       | 6.3        | 7.2    |       |          |      |       |       |       |              |         |            |            |       |       |       |       |       |           |        |        |            |            |
|                       | 6.39       | 25     |       |          |      |       |       |       |              |         |            |            |       |       |       |       |       |           |        |        |            |            |
|                       | 6.45       | 35     |       |          |      |       |       |       |              |         |            |            |       |       |       |       |       |           |        |        |            |            |
| SUB-CATCHMENT DETAILS |            |        |       |          |      |       |       |       |              |         |            |            |       |       |       |       |       |           |        |        |            |            |
| Name                  | Pit or     | Total  | Paved | Grass    | Supp | Paved | Grass | Supp  | Paved        | Grass   | Supp       | Paved      | Grass | Supp  | Paved | Grass | Supp  | Lag Time  | Gutter | Gutter | Gutter     | Rainfall   |
|                       | Node       | Area   | Area  | Area     | Area | Time  | Time  | Time  | Length       | Length  | Length     | Slope(%)   | Slope | Slope | Rough | Rough | Rough | or Factor | Length | Slope  | FlowFactor | Multiplier |
|                       |            | (ha)   | %     | %        | %    | (min) | (min) | (min) | (m)          | (m)     | (m)        | %          | %     | %     |       |       |       |           | (m)    | %      |            |            |
| CAT_P1-11             | P1-11      | 0.0134 | 75.0  | 25.0     | 0.0  | 5     | 5     | 0     |              |         |            |            |       |       |       |       |       | 0         |        |        |            | 1          |
| CAT_P2-11             | P2-11      | 0.0134 | 75.0  | 25.0     | 0.0  | 5     | 5     | 0     |              |         |            |            |       |       |       |       |       | 0         |        |        |            | 1          |
| CAT_P3-11             | P3-11      | 0.0243 | 0.0   | 100.0    | 0.0  | 5     | 5     | 0     |              |         |            |            |       |       |       |       |       | 0         |        |        |            | 1          |
| CAT_P3_1              | P3_1       | 0.0330 | 100.0 | 0.0      | 0.0  | 5     | 5     | 2     |              |         |            |            |       |       |       |       |       | 0         |        |        |            | 1          |
| CAT_P4_1              | P4_1       | 0.0210 | 100.0 | 0.0      | 0.0  | 5     | 5     | 2     |              |         |            |            |       |       |       |       |       | 0         |        |        |            | 1          |
| CAT_P5_1              | P5_1       | 0.0440 | 100.0 | 0.0      | 0.0  | 5     | 5     | 2     |              |         |            |            |       |       |       |       |       | 0         |        |        |            | 1          |
| CAT_P6_1              | P6_1       | 0.0340 | 100.0 | 0.0      | 0.0  | 5     | 5     | 2     |              |         |            |            |       |       |       |       |       | 0         |        |        |            | 1          |
| CAT_P2_1              | P2_1       | 0.0270 | 100.0 | 0.0      | 0.0  | 5     | 5     | 2     |              |         |            |            |       |       |       |       |       | 0         |        |        |            | 1          |
| CAT_P1_1 + GD4        | P1_1 + GD4 | 0.0050 | 100.0 | 0.0      | 0.0  | 5     | 5     | 2     |              |         |            |            |       |       |       |       |       | 0         |        |        |            | 1          |
| CAT_P2_2              | P2_2       | 0.0060 | 100.0 | 0.0      | 0.0  | 5     | 5     | 2     |              |         |            |            |       |       |       |       |       | 0         |        |        |            | 1          |



## DRAINS Input Data

|                   |              |        |       |       |     |   |   |   |  |  |  |  |  |  |  |  |  |   |  |  |  |   |
|-------------------|--------------|--------|-------|-------|-----|---|---|---|--|--|--|--|--|--|--|--|--|---|--|--|--|---|
| CAT P3_2          | P3_2         | 0.0060 | 100.0 | 0.0   | 0.0 | 5 | 5 | 2 |  |  |  |  |  |  |  |  |  | 0 |  |  |  | 1 |
| CAT_GD2_NORTH     | GD2_NORTH    | 0.0180 | 100.0 | 0.0   | 0.0 | 5 | 5 | 2 |  |  |  |  |  |  |  |  |  | 0 |  |  |  | 1 |
| Cat-P1_17         | P1_17        | 0.0400 | 100.0 | 0.0   | 0.0 | 5 | 5 | 2 |  |  |  |  |  |  |  |  |  | 0 |  |  |  | 1 |
| Cat_P2_17         | P2_17        | 0.0250 | 100.0 | 0.0   | 0.0 | 5 | 5 | 2 |  |  |  |  |  |  |  |  |  | 0 |  |  |  | 1 |
| CAT P1_16         | P1_16        | 0.0380 | 0.0   | 100.0 | 0.0 | 5 | 5 | 2 |  |  |  |  |  |  |  |  |  | 0 |  |  |  | 1 |
| CAT P2_16         | P2_16        | 0.0180 | 0.0   | 100.0 | 0.0 | 5 | 5 | 2 |  |  |  |  |  |  |  |  |  | 0 |  |  |  | 1 |
| CAT ExPit_Track   | ExPit_Track  | 0.1200 | 0.0   | 100.0 | 0.0 | 5 | 5 | 2 |  |  |  |  |  |  |  |  |  | 0 |  |  |  | 1 |
| CAT-T1-B-N        | Tank_T1-B    | 0.0243 | 100.0 | 0.0   | 0.0 | 5 | 0 | 0 |  |  |  |  |  |  |  |  |  | 0 |  |  |  | 1 |
| CAT-Tank_T1-A-S   | Tank_T1-A    | 0.0243 | 100.0 | 0.0   | 0.0 | 5 | 0 | 0 |  |  |  |  |  |  |  |  |  | 0 |  |  |  | 1 |
| CAT_P4-11         | P4-11        | 0.0243 | 0.0   | 100.0 | 0.0 | 5 | 5 | 0 |  |  |  |  |  |  |  |  |  | 0 |  |  |  | 1 |
| CAT_P1-9          | P1-9         | 0.0134 | 75.0  | 25.0  | 0.0 | 5 | 5 | 0 |  |  |  |  |  |  |  |  |  | 0 |  |  |  | 1 |
| CAT_P2-9          | P2-9         | 0.0134 | 75.0  | 25.0  | 0.0 | 5 | 5 | 0 |  |  |  |  |  |  |  |  |  | 0 |  |  |  | 1 |
| CAT_P3-9          | P3-9         | 0.0243 | 0.0   | 100.0 | 0.0 | 5 | 5 | 0 |  |  |  |  |  |  |  |  |  | 0 |  |  |  | 1 |
| CAT-T1-C-N        | T1-C-N       | 0.0243 | 100.0 | 0.0   | 0.0 | 5 | 0 | 0 |  |  |  |  |  |  |  |  |  | 0 |  |  |  | 1 |
| CAT_TANK-T1-B-S   | TANK-T1-B    | 0.0243 | 100.0 | 0.0   | 0.0 | 5 | 0 | 0 |  |  |  |  |  |  |  |  |  | 0 |  |  |  | 1 |
| CAT_P4-9          | P4-9         | 0.0243 | 0.0   | 100.0 | 0.0 | 5 | 5 | 0 |  |  |  |  |  |  |  |  |  | 0 |  |  |  | 1 |
| CAT P1_30         | P1_30        | 0.0100 | 0.0   | 100.0 | 0.0 | 5 | 5 | 2 |  |  |  |  |  |  |  |  |  | 0 |  |  |  | 1 |
| CAT P2_30         | P2_30        | 0.0140 | 0.0   | 100.0 | 0.0 | 5 | 5 | 2 |  |  |  |  |  |  |  |  |  | 0 |  |  |  | 1 |
| CAT P3_30         | P3_30        | 0.0100 | 0.0   | 100.0 | 0.0 | 5 | 5 | 2 |  |  |  |  |  |  |  |  |  | 0 |  |  |  | 1 |
| CAT P8_13         | P8_13        | 0.0170 | 0.0   | 100.0 | 0.0 | 5 | 5 | 2 |  |  |  |  |  |  |  |  |  | 0 |  |  |  | 1 |
| CAT P9_13         | P9_13        | 0.0110 | 0.0   | 100.0 | 0.0 | 5 | 5 | 2 |  |  |  |  |  |  |  |  |  | 0 |  |  |  | 1 |
| CAT P2_15 BASIN   | P2_15 BASIN  | 0.0193 | 81.0  | 19.0  | 0.0 | 5 | 5 | 2 |  |  |  |  |  |  |  |  |  | 0 |  |  |  | 1 |
| CAT P4_3 BASIN    | P4_3 BASIN   | 0.0193 | 81.0  | 19.0  | 0.0 | 5 | 5 | 2 |  |  |  |  |  |  |  |  |  | 0 |  |  |  | 1 |
| CAT P3_15 BASIN   | P3_15 BASIN  | 0.0182 | 80.0  | 20.0  | 0.0 | 5 | 5 | 2 |  |  |  |  |  |  |  |  |  | 0 |  |  |  | 1 |
| CAT P7_3 BASIN    | P7_3 BASIN   | 0.0161 | 78.0  | 22.0  | 0.0 | 5 | 5 | 2 |  |  |  |  |  |  |  |  |  | 0 |  |  |  | 1 |
| CAT P9_3 BASIN    | P9_3 BASIN   | 0.0248 | 64.0  | 36.0  | 0.0 | 5 | 5 | 2 |  |  |  |  |  |  |  |  |  | 0 |  |  |  | 1 |
| CAT P6_15 BASIN   | P6_15 BASIN  | 0.0191 | 59.0  | 41.0  | 0.0 | 5 | 5 | 2 |  |  |  |  |  |  |  |  |  | 0 |  |  |  | 1 |
| CAT BLOCK_D ROOF  | BLOCK_D      | 0.0780 | 100.0 | 0.0   | 0.0 | 5 | 5 | 2 |  |  |  |  |  |  |  |  |  | 0 |  |  |  | 1 |
| CAT BRB1          | BRB1         | 0.0730 | 50.0  | 50.0  | 0.0 | 5 | 5 | 2 |  |  |  |  |  |  |  |  |  | 0 |  |  |  | 1 |
| CAT BRB2          | BRB2         | 0.0500 | 0.0   | 100.0 | 0.0 | 5 | 5 | 2 |  |  |  |  |  |  |  |  |  | 0 |  |  |  | 1 |
| CAT P1_3 BASIN    | P11_3 BASIN  | 0.0139 | 77.0  | 23.0  | 0.0 | 5 | 5 | 2 |  |  |  |  |  |  |  |  |  | 0 |  |  |  | 1 |
| CAT P3_19 BASIN   | P3_19 BASIN  | 0.0134 | 74.0  | 26.0  | 0.0 | 5 | 5 | 2 |  |  |  |  |  |  |  |  |  | 0 |  |  |  | 1 |
| CAT P2_19 BASIN   | P2_19 BASIN  | 0.0134 | 74.0  | 26.0  | 0.0 | 5 | 5 | 2 |  |  |  |  |  |  |  |  |  | 0 |  |  |  | 1 |
| CAT P1_19 BASIN   | P1_19 BASIN  | 0.0139 | 90.0  | 10.0  | 0.0 | 5 | 5 | 2 |  |  |  |  |  |  |  |  |  | 0 |  |  |  | 1 |
| CAT P2_18 BASIN   | Basin73      | 0.0184 | 81.0  | 19.0  | 0.0 | 5 | 5 | 2 |  |  |  |  |  |  |  |  |  | 0 |  |  |  | 1 |
| CAT P1_18 BASIN   | Basin76      | 0.0263 | 87.0  | 13.0  | 0.0 | 5 | 5 | 2 |  |  |  |  |  |  |  |  |  | 0 |  |  |  | 1 |
| CAT L1 CONCOURSE  | L1 CONCOURSE | 0.2100 | 100.0 | 0.0   | 0.0 | 5 | 5 | 2 |  |  |  |  |  |  |  |  |  | 0 |  |  |  | 1 |
| CAT P1_7          | P1_7         | 0.0134 | 75.0  | 25.0  | 0.0 | 5 | 5 | 0 |  |  |  |  |  |  |  |  |  | 0 |  |  |  | 1 |
| CAT P2_7          | P2_7         | 0.0134 | 75.0  | 25.0  | 0.0 | 5 | 5 | 0 |  |  |  |  |  |  |  |  |  | 0 |  |  |  | 1 |
| CAT P3_7          | P3_7         | 0.0243 | 0.0   | 100.0 | 0.0 | 5 | 5 | 0 |  |  |  |  |  |  |  |  |  | 0 |  |  |  | 1 |
| CAT T1-D-NTH      | T1-D-NTH     | 0.0243 | 100.0 | 0.0   | 0.0 | 5 | 0 | 0 |  |  |  |  |  |  |  |  |  | 0 |  |  |  | 1 |
| CAT T1-C-STH      | T1-C-STH     | 0.0243 | 100.0 | 0.0   | 0.0 | 5 | 0 | 0 |  |  |  |  |  |  |  |  |  | 0 |  |  |  | 1 |
| CAT P4_7          | P4_7         | 0.0243 | 0.0   | 100.0 | 0.0 | 5 | 5 | 0 |  |  |  |  |  |  |  |  |  | 0 |  |  |  | 1 |
| CAT GOOD SHED STH | T1-GOOD      | 0.0300 | 100.0 | 0.0   | 0.0 | 5 | 5 | 2 |  |  |  |  |  |  |  |  |  | 0 |  |  |  | 1 |

### DRAINS Input Data

[illegible]

## DRAINS Input Data

|                           |            |            |      |       |       |      |           |     |     |       |          |   |            |   |  |  |  |  |  |  |  |  |
|---------------------------|------------|------------|------|-------|-------|------|-----------|-----|-----|-------|----------|---|------------|---|--|--|--|--|--|--|--|--|
| SAND_FILTER_IN<br>LET2    | SAND_FIL   | SAND FIL   | 2.5  | 5.660 | 5.630 | 1.20 | uPVC, not | 225 | 242 | 0.01  | NewFixed | 1 | SAND_FIL   | 0 |  |  |  |  |  |  |  |  |
| SAND FILTER -<br>P4_17    | SAND FIL   | P4_27      | 3.5  | 5.230 | 5.200 | 0.86 | uPVC, not | 150 | 154 | 0.01  | NewFixed | 1 | SAND FIL   | 0 |  |  |  |  |  |  |  |  |
| P4_17 - P5_27             | P4_27      | P5_17      | 3.8  | 5.200 | 5.160 | 1.05 | uPVC, not | 150 | 154 | 0.01  | NewFixed | 1 | P4_27      | 0 |  |  |  |  |  |  |  |  |
| P5_17 - ExP6              | P5_17      | ExP6       | 6    | 5.140 | 5.070 | 1.17 | Concrete, | 375 | 375 | 0.013 | NewFixed | 1 | P5_17      | 0 |  |  |  |  |  |  |  |  |
| ExP6 - Chatham<br>North   | ExP6       | Chatham S  | 12   | 5.070 | 4.950 | 1.00 | Concrete, | 375 | 375 | 0.013 | Existing | 1 | ExP6       | 0 |  |  |  |  |  |  |  |  |
| P1_17 - P2_17             | P1_17      | P2_17      | 15   | 5.900 | 5.820 | 0.53 | uPVC, und | 225 | 239 | 0.01  | NewFixed | 1 | P1_17      | 0 |  |  |  |  |  |  |  |  |
| P1_16 - P2_16             | P1_16      | P2_16      | 14.7 | 6.030 | 5.880 | 1.02 | uPVC, not | 150 | 154 | 0.01  | NewFixed | 1 | P1_16      | 0 |  |  |  |  |  |  |  |  |
| Pipe69                    | P2_16      | ExPit_Trac | 11   | 5.830 | 5.290 | 4.91 | uPVC, not | 150 | 154 | 0.01  | NewFixed | 1 | P2_16      | 0 |  |  |  |  |  |  |  |  |
| Pipe at Track<br>Crossing | ExPit_Trac | JP at Trac | 3.8  | 4.760 | 4.722 | 1.00 | Concrete, | 375 | 375 | 0.013 | Existing | 1 | ExPit_Trac | 0 |  |  |  |  |  |  |  |  |
| T1-B-N P3-11              | Tank T1-B  | P3-11      | 2    | 6.090 | 6.050 | 2.00 | uPVC, not | 150 | 154 | 0.01  | NewFixed | 1 | Tank T1-B  | 0 |  |  |  |  |  |  |  |  |
| T1-A-S P4-9               | Tank T1-A  | P4-11      | 2    | 6.090 | 6.050 | 2.00 | uPVC, not | 150 | 154 | 0.01  | NewFixed | 1 | Tank T1-A  | 0 |  |  |  |  |  |  |  |  |
| TRENCH-11_2               | P4-11      | TRENCH     | 12.5 | 5.320 | 5.070 | 2.00 | uPVC, not | 150 | 154 | 0.01  | NewFixed | 1 | P4-11      | 0 |  |  |  |  |  |  |  |  |
| P1-9_P2-9                 | P1-9       | P2-9       | 9.7  | 6.150 | 6.053 | 1.00 | uPVC, not | 150 | 154 | 0.01  | NewFixed | 1 | P1-9       | 0 |  |  |  |  |  |  |  |  |
| P2-9_P3-9                 | P2-9       | P3-9       | 11.6 | 6.003 | 5.887 | 1.00 | uPVC, not | 150 | 154 | 0.01  | NewFixed | 1 | P2-9       | 0 |  |  |  |  |  |  |  |  |
| P196                      | P3-9       | TRENCH9    | 12.5 | 5.320 | 5.070 | 2.00 | uPVC, not | 150 | 154 | 0.01  | NewFixed | 1 | P3-9       | 0 |  |  |  |  |  |  |  |  |
| T1-C-N P3-9               | T1-C-N     | P3-9       | 2    | 6.090 | 6.050 | 2.00 | uPVC, not | 150 | 154 | 0.01  | NewFixed | 1 | T1-C-N     | 0 |  |  |  |  |  |  |  |  |
| TANK-T1-B-S_P4-<br>9      | TANK-T1-B  | P4-9       | 2    | 6.090 | 6.050 | 2.00 | uPVC, not | 150 | 154 | 0.01  | NewFixed | 1 | TANK-T1-B  | 0 |  |  |  |  |  |  |  |  |
| P198                      | P4-9       | TRENCH9    | 12.5 | 5.320 | 5.070 | 2.00 | uPVC, not | 150 | 154 | 0.01  | NewFixed | 1 | P4-9       | 0 |  |  |  |  |  |  |  |  |
| P1_30_ - P2_30_           | P1_30_     | P2_30_     | 21.5 | 6.280 | 6.170 | 0.51 | uPVC, not | 150 | 154 | 0.01  | NewFixed | 1 | P1_30_     | 0 |  |  |  |  |  |  |  |  |
| P2_30_ - P3_30_           | P2_30_     | P3_30_     | 21   | 6.170 | 6.060 | 0.52 | uPVC, not | 150 | 154 | 0.01  | NewFixed | 1 | P2_30_     | 0 |  |  |  |  |  |  |  |  |
| P3_30_ - P7_13_           | P3_30_     | P7_13_     | 9.6  | 6.060 | 5.980 | 0.83 | uPVC, not | 150 | 154 | 0.01  | NewFixed | 1 | P3_30_     | 0 |  |  |  |  |  |  |  |  |
| P7_13_ - P8_13_           | P7_13_     | P8_13_     | 6.2  | 5.981 | 5.950 | 0.50 | uPVC, not | 225 | 242 | 0.01  | NewFixed | 1 | P7_13_     | 0 |  |  |  |  |  |  |  |  |
| P8_13_ - P9_13_           | P8_13_     | P9_13_     | 30.7 | 5.950 | 5.796 | 0.50 | uPVC, not | 225 | 242 | 0.01  | NewFixed | 1 | P8_13_     | 0 |  |  |  |  |  |  |  |  |
| P7_13_ - HW5              | P9_13_     | HW5        | 13.2 | 5.796 | 5.730 | 0.50 | uPVC, not | 225 | 242 | 0.01  | NewFixed | 1 | P9_13_     | 0 |  |  |  |  |  |  |  |  |
| P2_15 BASIN<br>OUTLET     | P2_15 BAS  | P2_15      | 2.4  | 5.722 | 5.698 | 1.00 | uPVC, not | 100 | 105 | 0.01  | NewFixed | 1 | P2_15 BAS  | 0 |  |  |  |  |  |  |  |  |
| P2_15 - P3_15             | P2_15      | P3_15      | 23.4 | 5.698 | 5.581 | 0.50 | uPVC, not | 150 | 154 | 0.01  | NewFixed | 1 | P2_15      | 0 |  |  |  |  |  |  |  |  |
| P278037                   | P3_15      | P4_15_Pit  | 19.3 | 5.581 | 5.484 | 0.50 | uPVC, not | 150 | 154 | 0.01  | NewFixed | 1 | P3_15      | 0 |  |  |  |  |  |  |  |  |
| P4_15_ - P5_15_           | P4_15_Pit  | P5_15_     | 12.4 | 5.483 | 5.421 | 0.50 | uPVC, not | 150 | 154 | 0.01  | NewFixed | 1 | P4_15_Pit  | 0 |  |  |  |  |  |  |  |  |
| P5_15_ - P7_15_           | P5_15_     | P7_15_     | 8.6  | 5.421 | 5.335 | 1.00 | uPVC, not | 150 | 154 | 0.01  | NewFixed | 1 | P5_15_     | 0 |  |  |  |  |  |  |  |  |
| P5_15 - ExP1              | P7_15      | ExP1       | 5.4  | 5.235 | 5.127 | 2.00 | uPVC, not | 300 | 303 | 0.01  | NewFixed | 1 | P7_15      | 0 |  |  |  |  |  |  |  |  |
| ExP1 - P1_20              | ExP1       | P4_20_     | 39   | 4.820 | 4.687 | 0.34 | Concrete, | 375 | 375 | 0.013 | Existing | 1 | ExP1       | 0 |  |  |  |  |  |  |  |  |
| P1_20 -<br>DARLING_ST_RN  | P4_20_     | DARLING    | 5.6  | 4.687 | 4.668 | 0.34 | Concrete, | 375 | 375 | 0.013 | Existing | 1 | P4_20_     | 0 |  |  |  |  |  |  |  |  |
| P4_3 BASIN<br>OUTLET      | P4_3 BAS   | P5_3       | 2.4  | 6.003 | 5.979 | 1.00 | uPVC, not | 100 | 105 | 0.01  | NewFixed | 1 | P4_3 BAS   | 0 |  |  |  |  |  |  |  |  |
| P5_3 - P6_3               | P5_3       | P6_3       | 7.4  | 5.979 | 5.905 | 1.00 | uPVC, not | 300 | 303 | 0.01  | NewFixed | 1 | P5_3       | 0 |  |  |  |  |  |  |  |  |
| P6_3 - P8_3               | P6_3       | P7_3       | 15.4 | 5.905 | 5.751 | 1.00 | uPVC, not | 300 | 303 | 0.01  | NewFixed | 1 | P6_3       | 0 |  |  |  |  |  |  |  |  |
| P8_3 - P10_3              | P7_3       | Pit21      | 14.1 | 5.751 | 5.610 | 1.00 | uPVC, not | 300 | 303 | 0.01  | NewFixed | 1 | P7_3       | 0 |  |  |  |  |  |  |  |  |
| P10_3 - P11_3             | Pit21      | P11_3      | 17.2 | 5.610 | 5.438 | 1.00 | uPVC, not | 300 | 303 | 0.01  | NewFixed | 1 | Pit21      | 0 |  |  |  |  |  |  |  |  |
| P11_3 - P5_15             | P11_3      | P7_15_     | 10.3 | 5.438 | 5.335 | 1.00 | uPVC, not | 300 | 303 | 0.01  | NewFixed | 1 | P11_3      | 0 |  |  |  |  |  |  |  |  |
| P3_15 BASIN<br>OUTLET     | P3_15 BAS  | P3_15      | 2.4  | 5.605 | 5.581 | 1.00 | uPVC, not | 100 | 105 | 0.01  | NewFixed | 1 | P3_15 BAS  | 0 |  |  |  |  |  |  |  |  |
| P7_3 BASIN<br>OUTLET      | P7_3 BAS   | P7_3       | 2.4  | 5.775 | 5.751 | 1.00 | uPVC, not | 100 | 105 | 0.01  | NewFixed | 1 | P7_3 BAS   | 0 |  |  |  |  |  |  |  |  |
| P9_3 BASIN<br>OUTLET      | P9_3 BAS   | Pit21      | 2.4  | 5.634 | 5.610 | 1.00 | uPVC, not | 100 | 105 | 0.01  | NewFixed | 1 | P9_3 BAS   | 0 |  |  |  |  |  |  |  |  |
| P4_15 BASIN<br>OUTLET     | P6_15_BA   | P5_15_     | 2.4  | 5.445 | 5.421 | 1.00 | uPVC, not | 100 | 105 | 0.01  | NewFixed | 1 | P6_15_BA   | 0 |  |  |  |  |  |  |  |  |
| block d roof - brb1       | BLOCK_D    | BRB1       | 19   | 6.550 | 5.900 | 3.42 | uPVC, not | 150 | 154 | 0.01  | NewFixed | 1 | BLOCK_D    | 0 |  |  |  |  |  |  |  |  |
| BRB1 - BRB2               | BRB1       | BRB2       | 22   | 5.200 | 5.100 | 0.45 | uPVC, not | 100 | 105 | 0.01  | NewFixed | 1 | BRB1       | 0 |  |  |  |  |  |  |  |  |
| P2_4 - P3_4               | BRB2       | P3_4       | 6    | 5.100 | 5.066 | 0.57 | uPVC, not | 375 | 386 | 0.01  | NewFixed | 1 | BRB2       | 0 |  |  |  |  |  |  |  |  |



## DRAINS Input Data

|                         |              |           |      |       |       |      |                |     |       |          |          |      |              |   |
|-------------------------|--------------|-----------|------|-------|-------|------|----------------|-----|-------|----------|----------|------|--------------|---|
| P3_4 - P4_4             | P3_4         | P4_4      | 2.6  | 5.066 | 5.053 | 0.50 | Concrete, 1375 | 375 | 0.013 | NewFixed | 1        | P3_4 | 0            |   |
| P4_4 - ExP2             | P4_4         | ExP2      | 31.3 | 5.053 | 4.947 | 0.34 | Concrete, 1375 | 375 | 0.013 | NewFixed | 1        | P4_4 | 0            |   |
| ExP2 - ExP1             | ExP2         | ExP1      | 37.4 | 4.947 | 4.820 | 0.34 | Concrete, 1375 | 375 | 0.013 | Existing | 1        | ExP2 | 0            |   |
| P11_3 BASIN OUTLET      | P11_3 BASIN  | P11_3     | 2.4  | 5.462 | 5.438 | 1.00 | uPVC, not      | 100 | 105   | 0.01     | NewFixed | 1    | P11_3 BASIN  | 0 |
| P3_19 BASIN OUTLET      | P3_19 BASIN  | P3_19     | 2.4  | 5.547 | 5.523 | 1.00 | uPVC, not      | 100 | 105   | 0.01     | NewFixed | 1    | P3_19 BASIN  | 0 |
| P3_19 - P11_3           | P3_19        | P11_3     | 16.9 | 5.523 | 5.438 | 0.50 | uPVC, not      | 150 | 154   | 0.01     | NewFixed | 1    | P3_19        | 0 |
| P2_19 BASIN OUTLET      | P2_19 BASIN  | P2_19     | 2.4  | 5.623 | 5.599 | 1.00 | uPVC, not      | 100 | 105   | 0.01     | NewFixed | 1    | P2_19 BASIN  | 0 |
| P2_19 - P3_19           | P2_19        | P3_19     | 15.2 | 5.599 | 5.523 | 0.50 | uPVC, not      | 150 | 154   | 0.01     | NewFixed | 1    | P2_19        | 0 |
| P1_19 BASIN OUTLET      | P1_19 BASIN  | P1_19     | 2.4  | 5.698 | 5.674 | 1.00 | uPVC, not      | 100 | 105   | 0.01     | NewFixed | 1    | P1_19 BASIN  | 0 |
| P1_19 - P2_19           | P1_19        | P2_19     | 15   | 5.674 | 5.599 | 0.50 | uPVC, not      | 150 | 154   | 0.01     | NewFixed | 1    | P1_19        | 0 |
| ExP3 - ExP2             | ExP3         | ExP2      | 1.4  | 4.961 | 4.947 | 1.00 | Concrete, 1375 | 375 | 0.013 | Existing | 1        | ExP3 | 0            |   |
| P2_18 BASIN OUTLET      | Basin73      | P2_18     | 2.4  | 5.718 | 5.694 | 1.00 | uPVC, und      | 100 | 105   | 0.01     | NewFixed | 1    | Basin73      | 0 |
| P2_18 - P10_3           | P2_18        | P10_3     | 16.9 | 5.694 | 5.610 | 0.50 | uPVC, und      | 150 | 154   | 0.01     | NewFixed | 1    | P2_18        | 0 |
| P1_18 BASIN OUTLET      | Basin76      | P1_18     | 2.4  | 5.794 | 5.770 | 1.00 | uPVC, und      | 100 | 105   | 0.01     | NewFixed | 1    | Basin76      | 0 |
| P1_19 - P2_18           | P1_18        | P2_18     | 15.2 | 5.770 | 5.694 | 0.50 | uPVC, und      | 150 | 154   | 0.01     | NewFixed | 1    | P1_18        | 0 |
| GD1 - P3_4              | GD1          | P3_4      | 7    | 5.136 | 5.066 | 1.00 | Concrete, 1150 | 150 | 0.013 | NewFixed | 1        | GD1  | 0            |   |
| CONCOURSE - BRB1        | L1 CONCOURSE | BRB1      | 13   | 6.550 | 5.900 | 5.00 | uPVC, not      | 225 | 242   | 0.01     | NewFixed | 1    | L1 CONCOURSE | 0 |
| P1_7 - P2_7             | P1_7         | P2_7      | 9.7  | 6.150 | 6.053 | 1.00 | uPVC, not      | 150 | 154   | 0.01     | NewFixed | 1    | P1_7         | 0 |
| P2_7 - P3_7             | P2_7         | P3_7      | 11.6 | 6.003 | 5.887 | 1.00 | uPVC, not      | 150 | 154   | 0.01     | NewFixed | 1    | P2_7         | 0 |
| P3_7 - TRENCH7          | P3_7         | TRENCH7   | 12.5 | 5.320 | 5.070 | 2.00 | uPVC, not      | 150 | 154   | 0.01     | NewFixed | 1    | P3_7         | 0 |
| T1-D-NTH OVERFLOW       | T1-D-NTH     | P3_7      | 2    | 6.090 | 6.050 | 2.00 | uPVC, not      | 150 | 154   | 0.01     | NewFixed | 1    | T1-D-NTH     | 0 |
| T1-C-STH - P4_7         | T1-C-STH     | P4_7      | 2    | 6.090 | 6.050 | 2.00 | uPVC, not      | 150 | 154   | 0.01     | NewFixed | 1    | T1-C-STH     | 0 |
| P4_7 = TRENCH7          | P4_7         | TRENCH7   | 12.5 | 5.320 | 5.070 | 2.00 | uPVC, not      | 150 | 154   | 0.01     | NewFixed | 1    | P4_7         | 0 |
| BRB3 - ExP4             | BRB3         | ExP4      | 10   | 5.100 | 5.000 | 1.00 | uPVC, und      | 100 | 105   | 0.01     | NewFixed | 1    | BRB3         | 0 |
| T1 - P1_6               | T1-GOOD      | P1_6      | 1.2  | 5.900 | 5.888 | 1.00 | uPVC, und      | 150 | 154   | 0.01     | NewFixed | 1    | T1-GOOD      | 0 |
| P1_6 - P2_6             | P1_6         | P2_6      | 21.6 | 5.868 | 5.652 | 1.00 | uPVC, und      | 150 | 154   | 0.01     | NewFixed | 1    | P1_6         | 0 |
| T1 - P2_6               | T1-GOOD      | P2_6      | 1.2  | 5.900 | 5.888 | 1.00 | uPVC, und      | 150 | 154   | 0.01     | NewFixed | 1    | T1-GOOD      | 0 |
| P1_8 - P2_8             | P1_8         | P2_8      | 16   | 6.300 | 6.140 | 1.00 | uPVC, not      | 150 | 154   | 0.01     | NewFixed | 1    | P1_8         | 0 |
| P2_8 - TRENCH8          | P2_8         | TRENCH8   | 17.3 | 6.140 | 5.967 | 1.00 | uPVC, not      | 150 | 154   | 0.01     | NewFixed | 1    | P2_8         | 0 |
| P3_8 - TRENCH8          | P3_8         | TRENCH8   | 5    | 5.320 | 5.070 | 5.00 | uPVC, not      | 150 | 154   | 0.01     | NewFixed | 1    | P3_8         | 0 |
| T2-EQPSHD - P3_8        | T2-EQPSHD    | P3_8      | 2    | 6.090 | 6.050 | 2.00 | uPVC, not      | 150 | 154   | 0.01     | NewFixed | 1    | T2-EQPSHD    | 0 |
| T1-E-STH - P4_8         | T1-E-STH     | P4_8      | 2    | 6.090 | 6.050 | 2.00 | uPVC, not      | 150 | 154   | 0.01     | NewFixed | 1    | T1-E-STH     | 0 |
| P4_8 - TRENCH8          | P4_8         | TRENCH8   | 5    | 5.320 | 5.070 | 5.00 | uPVC, not      | 150 | 154   | 0.01     | NewFixed | 1    | P4_8         | 0 |
| P1_10 - P2_10           | P1_10        | P2_10     | 9.7  | 6.150 | 6.053 | 1.00 | uPVC, not      | 150 | 154   | 0.01     | NewFixed | 1    | P1_10        | 0 |
| P2_10 - P3_10           | P2_10        | P3_10     | 11.6 | 6.003 | 5.887 | 1.00 | uPVC, not      | 150 | 154   | 0.01     | NewFixed | 1    | P2_10        | 0 |
| P3_10 - TRENCH10        | P3_10        | TRENCH10  | 12.5 | 5.320 | 5.070 | 2.00 | uPVC, not      | 150 | 154   | 0.01     | NewFixed | 1    | P3_10        | 0 |
| P1008                   | T1-E-NTH     | P3_10     | 2    | 6.090 | 6.050 | 2.00 | uPVC, not      | 150 | 154   | 0.01     | NewFixed | 1    | T1-E-NTH     | 0 |
| T1-F-STH - P4_10        | T1-F-STH     | P4_10     | 2    | 6.090 | 6.050 | 2.00 | uPVC, not      | 150 | 154   | 0.01     | NewFixed | 1    | T1-F-STH     | 0 |
| P4_10 - TRENCH10        | P4_10        | TRENCH10  | 12.5 | 5.320 | 5.070 | 2.00 | uPVC, not      | 150 | 154   | 0.01     | NewFixed | 1    | P4_10        | 0 |
| GD3 - P7_1              | GD3          | P7_1      | 10   | 5.791 | 5.691 | 1.00 | uPVC, und      | 150 | 154   | 0.01     | NewFixed | 1    | GD3          | 0 |
| P4_21 - P5_22           | P1_19        | P6_13     | 19.4 | 6.097 | 6.000 | 0.50 | uPVC, not      | 150 | 154   | 0.01     | New      | 1    | P1_19        | 0 |
| P5_22 - P5_13           | P6_13        | P7_13     | 2.9  | 6.000 | 5.981 | 0.66 | uPVC, not      | 225 | 242   | 0.01     | New      | 1    | P6_13        | 0 |
| P2_28_Basin - P2_28_Pit | P2_28_Basin  | P2_28_Pit | 4.1  | 6.248 | 6.227 | 0.51 | uPVC, not      | 100 | 105   | 0.01     | NewFixed | 1    | P2_28_Basin  | 0 |
| P2_28 - P3_28           | P2_28_Pit    | P3_28     | 6    | 6.189 | 6.159 | 0.50 | uPVC, not      | 150 | 154   | 0.01     | New      | 1    | P2_28_Pit    | 0 |
| P3_28 - P4_28           | P3_28        | P4_28     | 14   | 6.159 | 6.089 | 0.50 | uPVC, not      | 150 | 154   | 0.01     | New      | 1    | P3_28        | 0 |

## DRAINS Input Data

|                                    |           |                 |                   |                 |                  |                 |               |                 |                  |                    |                 |                         |         |                 |                 |            |                 |                 |         |                 |                 |         |                 |                 |         |
|------------------------------------|-----------|-----------------|-------------------|-----------------|------------------|-----------------|---------------|-----------------|------------------|--------------------|-----------------|-------------------------|---------|-----------------|-----------------|------------|-----------------|-----------------|---------|-----------------|-----------------|---------|-----------------|-----------------|---------|
| P4_28 - P5_13                      | P4_28     | P5_13           | 11.8              | 6.089           | 6.030            | 0.50            | uPVC, not     | 150             | 154              | 0.01               | New             | 1                       |         | P4_28           | 0               |            |                 |                 |         |                 |                 |         |                 |                 |         |
| P5_13 - P6_30                      | P5_13     | P6_13           | 7.4               | 6.030           | 6.000            | 0.41            | uPVC, not     | 225             | 242              | 0.01               | NewFixed        | 1                       |         | P5_13           | 0               |            |                 |                 |         |                 |                 |         |                 |                 |         |
| P1_31_Basin - P3_13                | P1_31 Bas | P3_13           | 3.2               | 6.421           | 6.389            | 1.00            | uPVC, not     | 100             | 105              | 0.01               | NewFixed        | 1                       |         | P1_31 Bas       | 0               |            |                 |                 |         |                 |                 |         |                 |                 |         |
| P3_13 - P4_13                      | P3_13     | P4_13           | 7.2               | 6.140           | 6.100            | 0.56            | uPVC, not     | 150             | 154              | 0.01               | New             | 1                       |         | P3_13           | 0               |            |                 |                 |         |                 |                 |         |                 |                 |         |
| P4_13 - P5_13                      | P4_13     | P5_13           | 16.3              | 6.100           | 6.030            | 0.43            | uPVC, not     | 225             | 242              | 0.01               | NewFixed        | 1                       |         | P4_13           | 0               |            |                 |                 |         |                 |                 |         |                 |                 |         |
| P1_28 Basin - P1_28 Pit            | P1_28 Bas | P1_28 Pit       | 4.1               | 6.321           | 6.300            | 0.51            | uPVC, not     | 100             | 105              | 0.01               | NewFixed        | 1                       |         | P1_28 Bas       | 0               |            |                 |                 |         |                 |                 |         |                 |                 |         |
| P1_28 - P2_28                      | P1_28 Pit | P2_28 Pit       | 21                | 6.290           | 6.190            | 0.48            | uPVC, not     | 150             | 154              | 0.01               | New             | 1                       |         | P1_28 Pit       | 0               |            |                 |                 |         |                 |                 |         |                 |                 |         |
| P1_13_Basin - P2_13                | P1_13 Bas | P2_13           | 3.9               | 6.421           | 6.382            | 1.00            | uPVC, not     | 150             | 154              | 0.01               | NewFixed        | 1                       |         | P1_13 Bas       | 0               |            |                 |                 |         |                 |                 |         |                 |                 |         |
| P2_13 - P3_13                      | P2_13     | P3_13           | 22.7              | 6.365           | 6.140            | 0.99            | uPVC, not     | 150             | 154              | 0.01               | New             | 1                       |         | P2_13           | 0               |            |                 |                 |         |                 |                 |         |                 |                 |         |
| P2_3 BASIN OUTLET                  | P2_3 BASI | P3-3            | 2.4               | 6.211           | 6.187            | 1.00            | uPVC, not     | 100             | 105              | 0.01               | NewFixed        | 1                       |         | P2_3 BASI       | 0               |            |                 |                 |         |                 |                 |         |                 |                 |         |
| P3_3 - P5_3                        | P3-3      | P5_3            | 20.8              | 6.187           | 5.979            | 1.00            | uPVC, not     | 300             | 303              | 0.01               | NewFixed        | 1                       |         | P3-3            | 0               |            |                 |                 |         |                 |                 |         |                 |                 |         |
| P1_15 BASIN OUTLET                 | P1_15 BAS | P1_15           | 2.4               | 5.825           | 5.801            | 1.00            | uPVC, not     | 100             | 105              | 0.01               | NewFixed        | 1                       |         | P1_15 BAS       | 0               |            |                 |                 |         |                 |                 |         |                 |                 |         |
| P1_15 - P2_15                      | P1_15     | P2_15           | 20.7              | 5.801           | 5.698            | 0.50            | uPVC, not     | 150             | 154              | 0.01               | New             | 1                       |         | P1_15           | 0               |            |                 |                 |         |                 |                 |         |                 |                 |         |
| Track Access Culvert               | HW6       | HW7             | 5                 | 5.693           | 5.681            | 0.24            | uPVC, not     | 225             | 242              | 0.01               | NewFixed        | 1                       |         | HW6             | 0               |            |                 |                 |         |                 |                 |         |                 |                 |         |
| Basin - P4_15                      | P4_15 Bas | P4_15 Pit       | 2.4               | 5.605           | 5.581            | 1.00            | uPVC, not     | 100             | 105              | 0.01               | NewFixed        | 1                       |         | P4_15 Bas       | 0               |            |                 |                 |         |                 |                 |         |                 |                 |         |
| P1_23 Basin - P2_20                | P1_23 Bas | P2_20           | 17.7              | 5.640           | 5.490            | 0.85            | uPVC, und     | 150             | 154              | 0.01               | NewFixed        | 1                       |         | P1_23 Bas       | 0               |            |                 |                 |         |                 |                 |         |                 |                 |         |
| P2_20 - P3_20                      | P2_20     | P3_20           | 16.2              | 5.490           | 5.330            | 0.99            | uPVC, und     | 150             | 154              | 0.01               | NewFixed        | 1                       |         | P2_20           | 0               |            |                 |                 |         |                 |                 |         |                 |                 |         |
| P3_20 - P4_20                      | P3_20     | P4_20           | 3.4               | 5.280           | 5.246            | 1.00            | uPVC, und     | 150             | 154              | 0.01               | New             | 1                       |         | P3_20           | 0               |            |                 |                 |         |                 |                 |         |                 |                 |         |
| P6_20 Basin - P3_20                | P1_22 Bas | P2_20           | 6.9               | 5.640           | 5.571            | 1.00            | uPVC, und     | 150             | 154              | 0.01               | NewFixed        | 1                       |         | P1_22 Bas       | 0               |            |                 |                 |         |                 |                 |         |                 |                 |         |
| P1_20_basin - P2_20                | P1_20 Bas | P2_20           | 15.6              | 5.660           | 5.510            | 0.96            | uPVC, und     | 150             | 154              | 0.01               | NewFixed        | 1                       |         | P1_20 Bas       | 0               |            |                 |                 |         |                 |                 |         |                 |                 |         |
| P1_21_Basin - P3_20                | P1_21 Bas | P3_20           | 6.9               | 5.400           | 5.330            | 1.01            | uPVC, und     | 100             | 105              | 0.01               | NewFixed        | 1                       |         | P1_21 Bas       | 0               |            |                 |                 |         |                 |                 |         |                 |                 |         |
| Buried Pipe                        | HW4       | ExPit_Trac      | 24                | 5.645           | 5.290            | 1.48            | uPVC, not     | 225             | 242              | 0.01               | NewFixed        | 1                       |         | HW4             | 0               |            |                 |                 |         |                 |                 |         |                 |                 |         |
| P2_17 - P3_17                      | N197      | P3_17           | 13                | 5.800           | 5.700            | 0.77            | uPVC, und     | 225             | 239              | 0.01               | NewFixed        | 1                       |         | N197            | 0               |            |                 |                 |         |                 |                 |         |                 |                 |         |
| P3_17 - GPT                        | P3_17     | GPT-4200        | 2.4               | 5.700           | 5.680            | 0.83            | uPVC, not     | 225             | 242              | 0.01               | NewFixed        | 1                       |         | P3_17           | 0               |            |                 |                 |         |                 |                 |         |                 |                 |         |
| GPT - SAND FILTER                  | GPT-4200  | SAND FIL        | 2.4               | 5.680           | 5.660            | 0.83            | uPVC, not     | 225             | 242              | 0.01               | NewFixed        | 1                       |         | GPT-4200        | 0               |            |                 |                 |         |                 |                 |         |                 |                 |         |
| SAND_TANK_INLET1                   | SAND FIL  | SAND FIL        | 2.5               | 5.660           | 5.630            | 1.20            | uPVC, not     | 225             | 242              | 0.01               | NewFixed        | 1                       |         | SAND_FIL        | 0               |            |                 |                 |         |                 |                 |         |                 |                 |         |
| DETAILS of SERVICES CROSSING PIPES |           |                 |                   |                 |                  |                 |               |                 |                  |                    |                 |                         |         |                 |                 |            |                 |                 |         |                 |                 |         |                 |                 |         |
| Pipe                               | Chg (m)   | Bottom Elev (m) | Height of S (m)   | Chg (m)         | Bottom Elev (m)  | Height of S (m) | Chg (m)       | Bottom Elev (m) | Height of S (m)  | Chg (m)            | Bottom Elev (m) | Height of S (m)         | Chg (m) | Bottom Elev (m) | Height of S (m) | Chg (m)    | Bottom Elev (m) | Height of S (m) | Chg (m) | Bottom Elev (m) | Height of S (m) | Chg (m) | Bottom Elev (m) | Height of S (m) | Chg (m) |
| CHANNEL DETAILS                    |           |                 |                   |                 |                  |                 |               |                 |                  |                    |                 |                         |         |                 |                 |            |                 |                 |         |                 |                 |         |                 |                 |         |
| Name                               | From      | To              | Type              | Length (m)      | U/S IL (m)       | D/S IL (m)      | Slope (%)     | Base Width (m)  | L.B. Slope (1:?) | R.B. Slope (1:?)   | Manning n       | Depth (m)               | Roofed  |                 |                 |            |                 |                 |         |                 |                 |         |                 |                 |         |
| OVERFLOW ROUTE DETAILS             |           |                 |                   |                 |                  |                 |               |                 |                  |                    |                 |                         |         |                 |                 |            |                 |                 |         |                 |                 |         |                 |                 |         |
| Name                               | From      | To              | Travel Time (min) | Spill Level (m) | Crest Length (m) | Weir Coeff. C   | Cross Section | Safe Depth (m)  | SafeDepth (m)    | SafeDxV (sq.m/sec) | Bed Slope (%)   | D/S Area Contributing % | id      | U/S IL          | D/S IL          | Length (m) |                 |                 |         |                 |                 |         |                 |                 |         |
| OF P1 11 - P3 11                   | P1-11     | P3-11           | 0.1               |                 |                  |                 | 4m wide gr    | 1.2             | 0.3              | 0.4                | 1.00            | 0                       |         | 1386            | 6.7             | 6.6        | 10              |                 |         |                 |                 |         |                 |                 |         |

## DRAINS Input Data

|                          |           |           |     |       |   |      |             |      |      |      |       |     |  |          |      |       |      |  |  |  |  |  |
|--------------------------|-----------|-----------|-----|-------|---|------|-------------|------|------|------|-------|-----|--|----------|------|-------|------|--|--|--|--|--|
| OF P2_11 - P3_11         | P2-11     | P3-11     | 0.1 |       |   |      | 4m wide gr  | 1.2  | 0.3  | 0.4  | 1.33  | 0   |  | 1387     | 6.7  | 6.6   | 7.5  |  |  |  |  |  |
| OF P3_11 - TRENCH11      | P3-11     | TRENCH    | 0.2 |       |   |      | 4m wide gr  | 1.2  | 0.3  | 0.4  | 0.80  | 0   |  | 1388     | 6.5  | 6.4   | 12.5 |  |  |  |  |  |
| OF TRENCH11 - BYPASS2    | TRENCH    | P3_13_    | 0.1 | 6.800 | 4 | 1.62 | 4m wide gr  | 1.2  | 0.3  | 0.4  | 1.00  | 0   |  | 1499     | 6.8  | 6.71  | 9    |  |  |  |  |  |
| OF P3_1 - P4_1           | P3_1      | P4_1      | 0.1 |       |   |      | Gutter Flov | 0.3  | 0.3  | 0.36 | 1.03  | 0   |  | 79375    | 6.3  | 6.25  | 4.85 |  |  |  |  |  |
| OF P4_1 - P5_1           | P4_1      | P5_1      | 0.1 |       |   |      | Gutter Flov | 0.3  | 0.3  | 0.36 | 0.78  | 0   |  | 79565    | 6.3  | 6.25  | 6.4  |  |  |  |  |  |
| OF P5_1 - P6_1           | P5_1      | P6_1      | 0.1 |       |   |      | Gutter Flov | 0.3  | 0.3  | 0.36 | 0.81  | 0   |  | 79657    | 6.3  | 6.25  | 6.15 |  |  |  |  |  |
| OF P6_1 - GD3            | P6_1      | GD3       | 0.1 |       |   |      | Gutter Flov | 0.3  | 0.3  | 0.36 | 0.33  | 0   |  | 79768    | 6.45 | 6.44  | 3    |  |  |  |  |  |
| OF HW1 - BRB3            | HW1-BRB3  | BRB3      | 0.1 |       |   |      | 4m wide gr  | 1.2  | 0.3  | 0.4  | 1.00  | 0   |  | 83853    | 5.6  | 5.5   | 10   |  |  |  |  |  |
| OF386                    | P2_1      | P3_1      | 0.1 |       |   |      | Dummy Of    | 0.15 | 0.05 | 0.36 | 1.49  | 0   |  | 125429   | 6.35 | 6.25  | 6.7  |  |  |  |  |  |
| OF372                    | ExP5      | ExP4      | 0.7 |       |   |      | Gutter Flov | 0.3  | 0.3  | 0.36 | 0.24  | 0   |  | 119287   | 6.15 | 6.05  | 41.3 |  |  |  |  |  |
| OF374                    | ExP4      | CHATHAM   | 0.1 |       |   |      | PAVEMEN     | 0.3  | 0.3  | 0.4  | 1.30  | 0   |  | 121667   | 6.17 | 6.05  | 9.2  |  |  |  |  |  |
| OF P2_2 - BRB2           | P2_2      | N469      | 0.1 |       |   |      | Pathway 4   | 0.3  | 0.15 | 0.6  | 9.58  | 0   |  | 53808    | 6.86 | 6.4   | 4.8  |  |  |  |  |  |
| OF P3_2                  | P3_2      | N469      | 0.1 |       |   |      | Pathway 4   | 0.3  | 0.15 | 0.6  | 9.58  | 0   |  | 53880    | 6.68 | 6.4   | 4.8  |  |  |  |  |  |
| OF234                    | HW2 (BRB) | BRB2      | 0.1 |       |   |      | 4m wide gr  | 1.2  | 0.3  | 0.4  | 2.86  | 0   |  | 54467    | 5.8  | 5.6   | 7    |  |  |  |  |  |
| OF GD2 - ExP6            | GD2_NOR   | ExP6      | 0.1 |       |   |      | Gutter Flov | 0.3  | 0.3  | 0.36 | 4.75  | 0   |  | 43863681 | 6.45 | 6.26  | 4    |  |  |  |  |  |
| OF SandFilterNth - P5_17 | SAND_FIL  | P5_17     | 0.1 |       |   |      | Spillway    | 0.3  | 0.3  | 0.36 | 6.63  | 0   |  | 850      | 6.8  | 6.27  | 8    |  |  |  |  |  |
| OF SandFilter - P5_17    | SAND FILT | P5_17     | 0.1 | 6.800 | 5 | 1.62 | 7.5m wide   | 0.3  | 0.3  | 0.36 | 6.63  | 0   |  | 855      | 6.8  | 6.27  | 8    |  |  |  |  |  |
| OF P4_17 - P5_17         | P4_17     | P5_17     | 0.1 |       |   |      | 7.5m wide   | 0.3  | 0.3  | 0.36 | 5.75  | 0   |  | 849      | 6.5  | 6.27  | 4    |  |  |  |  |  |
| OF P5_17 - eXp6          | P5_17     | ExP6      | 0.2 |       |   |      | Gutter Flov | 0.3  | 0.3  | 0.36 | 0.12  | 0   |  | 856      | 6.27 | 6.26  | 8    |  |  |  |  |  |
| OF ExP6 - ChathamSt Node | ExP6      | Chatham S | 0.1 |       |   |      | 20 m wide   | 0.2  | 0.2  | 0.4  | 6.67  | 0   |  | 857      | 6.61 | 6.27  | 6    |  |  |  |  |  |
| OF P1_17 - GD2           | P1_17     | GD2_NOR   | 0.1 |       |   |      | 7.5m wide   | 0.3  | 0.3  | 0.36 | 1.67  | 100 |  | 846      | 6.6  | 6.45  | 12   |  |  |  |  |  |
| OF P2_17 - GD2           | P2_17     | GD2_NOR   | 0.1 |       |   |      | Gutter Flov | 0.3  | 0.3  | 0.36 | 3.90  | 0   |  | 847      | 6.84 | 6.45  | 10   |  |  |  |  |  |
| OF P1_16 - P2_16         | P1_16     | P2_16     | 0.1 |       |   |      | 7.5m wide   | 0.3  | 0.3  | 0.36 | 2.74  | 0   |  | 1028     | 6.75 | 6.55  | 7.3  |  |  |  |  |  |
| OF P2_16 - ExPt_Track    | P2_16     | ExPt_Trac | 0.1 |       |   |      | 7.5m wide   | 0.3  | 0.3  | 0.36 | 13.47 | 0   |  | 1029     | 6.6  | 5.59  | 7.5  |  |  |  |  |  |
| OF_TO_TRACK1             | ExPt_Trac | TRACK1    | 0.1 |       |   |      | 20 m wide   | 0.2  | 0.2  | 0.4  | 3.30  | 0   |  | 1044     | 6.37 | 6.04  | 10   |  |  |  |  |  |
| OF P4_11 - TRENCH11      | P4-11     | TRENCH    | 0.2 |       |   |      | 4m wide gr  | 1.2  | 0.3  | 0.4  | 0.80  | 0   |  | 1389     | 6.5  | 6.4   | 12.5 |  |  |  |  |  |
| OF P1_9 - P3_9           | P1-9      | P3-9      | 0.1 |       |   |      | 4m wide gr  | 1.2  | 0.3  | 0.4  | 1.00  | 0   |  | 1567     | 6.7  | 6.6   | 10   |  |  |  |  |  |
| OF P2_9 - P3_9           | P2-9      | P3-9      | 0.1 |       |   |      | 4m wide gr  | 1.2  | 0.3  | 0.4  | 1.33  | 0   |  | 1553     | 6.7  | 6.6   | 7.5  |  |  |  |  |  |
| OF P3_9 - TRENCH9        | P3-9      | TRENCH9   | 0.2 |       |   |      | 4m wide gr  | 1.2  | 0.3  | 0.4  | 0.80  | 0   |  | 1576     | 6.5  | 6.4   | 12.5 |  |  |  |  |  |
| OF TRENCH9 - BYPASS3     | TRENCH9   | P2_3 BAS  | 0.1 | 6.800 | 4 | 1.62 | 4m wide gr  | 1.2  | 0.3  | 0.4  | 1.00  | 0   |  | 1590     | 6.8  | 6.71  | 9    |  |  |  |  |  |
| OF P4-9 - TRENCH9        | P4-9      | TRENCH9   | 0.2 |       |   |      | 4m wide gr  | 1.2  | 0.3  | 0.4  | 0.80  | 0   |  | 1582     | 6.5  | 6.4   | 12.5 |  |  |  |  |  |
| OF P1_13 - P2_13         | P1_30_    | P2_30_    | 0.1 |       |   |      | 4m wide gr  | 1.2  | 0.3  | 0.4  | 2.38  | 0   |  | 1210     | 6.85 | 6.6   | 10.5 |  |  |  |  |  |
| OF P2_30_ - P3_30_       | P2_30_    | P3_30_    | 0.1 |       |   |      | 4m wide gr  | 1.2  | 0.3  | 0.4  | 2.38  | 0   |  | 1211     | 6.85 | 6.6   | 10.5 |  |  |  |  |  |
| OF P3_30_ - P8_13_       | P3_30_    | P8_13_    | 0.1 |       |   |      | 4m wide gr  | 1.2  | 0.3  | 0.4  | 1.56  | 0   |  | 1212     | 6.85 | 6.77  | 4.5  |  |  |  |  |  |
| OF P5_13 - BYPASS1       | P7_13_    | BYPASS1   | 0.1 |       |   |      | 4m wide gr  | 1.2  | 0.3  | 0.4  | 16.67 | 0   |  | 1395     | 6.79 | 6.6   | 1.14 |  |  |  |  |  |
| OF P8_13_ - P9_13_       | P8_13_    | P9_13_    | 0.2 |       |   |      | 4m wide gr  | 1.2  | 0.3  | 0.4  | 1.39  | 0   |  | 1213     | 6.77 | 6.5   | 20.1 |  |  |  |  |  |
| OF P9_13_ - TRACK2       | P9_13_    | TRACK2    | 0.2 |       |   |      | 4m wide gr  | 1.2  | 0.3  | 0.4  | 0.81  | 0   |  | 1215     | 6.5  | 6.37  | 16   |  |  |  |  |  |
| Existing V Drain 1       | HW5       | HW6       | 0.4 |       |   |      | Dummy Of    | 0.15 | 0.05 | 0.36 | .24   | 100 |  | 83532421 | 5.73 | 5.693 | 15   |  |  |  |  |  |
| OF BYP1 - P7_13          | BYPASS1   | P9_13_    | 0.5 |       |   |      | 4m wide gr  | 1.2  | 0.3  | 0.4  | 0.38  | 0   |  | 20040    | 6.6  | 6.5   | 26   |  |  |  |  |  |



## DRAINS Input Data

|                              |             |             |     |       |     |      |             |     |     |      |       |    |  |          |       |       |      |  |  |  |  |  |
|------------------------------|-------------|-------------|-----|-------|-----|------|-------------|-----|-----|------|-------|----|--|----------|-------|-------|------|--|--|--|--|--|
| OF P2_15 - P3_15             | P2_15 BASIN | P3_15 BASIN | 0.1 | 6.590 | 2.7 | 1.62 | Gutter Flow | 0.3 | 0.3 | 0.36 | 0.87  | 50 |  | 23665    | 6.59  | 6.48  | 12.7 |  |  |  |  |  |
| OF P4_3 - P2_15              | P4_3 BASIN  | P2_15 BASIN | 0.1 | 6.890 | 20  | 1.62 | 20 m wide   | 0.2 | 0.2 | 0.4  | 4.88  | 0  |  | 17172    | 6.89  | 6.48  | 8.4  |  |  |  |  |  |
| OF222634                     | P3_15 BASIN | P4_15 BASIN | 0.1 | 6.590 | 2.7 | 1.62 | Gutter Flow | 0.3 | 0.3 | 0.36 | 0.87  | 50 |  | 83532694 | 6.59  | 6.48  | 12.7 |  |  |  |  |  |
| OF P7_3 - P3_15              | P7_3 BASIN  | P3_15 BASIN | 0.1 | 6.890 | 20  | 1.62 | 20 m wide   | 0.2 | 0.2 | 0.4  | 4.88  | 0  |  | 17519    | 6.89  | 6.48  | 8.4  |  |  |  |  |  |
| OF P9_3 BASIN - P11_3 BASIN  | P9_3 BASIN  | P11_3 BASIN | 0.1 | 6.890 | 10  | 1.62 | Spillway    | 0.3 | 0.3 | 0.36 | 4.88  | 0  |  | 29140    | 6.89  | 6.48  | 8.4  |  |  |  |  |  |
| OF P4_15 BASIN               | P6_15 BASIN | N402        | 0.1 | 6.630 | 10  | 1.62 | Spillway    | 0.3 | 0.3 | 0.36 | 10.62 | 0  |  | 31478    | 6.63  | 5.94  | 6.5  |  |  |  |  |  |
| OF BRB1 - BRB2               | BRB1        | N480        | 0.1 | 6.100 | 3   | 1.62 | 4m wide gr  | 1.2 | 0.3 | 0.4  | 1.00  | 0  |  | 58680    | 6.1   | 6     | 10   |  |  |  |  |  |
| OF BRB2 - N458               | BRB2        | N458        | 0.1 | 6.200 | 18  | 1.62 | 20 m wide   | 0.2 | 0.2 | 0.4  | 5.45  | 0  |  | 51134    | 6.2   | 5.944 | 4.7  |  |  |  |  |  |
| OF P11_3 BASIN               | P11_3 BASIN | N403        | 0.1 | 6.630 | 10  | 1.62 | Spillway    | 0.3 | 0.3 | 0.36 | 11.69 | 0  |  | 31421    | 6.63  | 5.87  | 6.5  |  |  |  |  |  |
| OF P3_19 BASIN               | P3_19 BASIN | N404        | 0.1 | 6.630 | 10  | 1.62 | Spillway    | 0.3 | 0.3 | 0.36 | 12.62 | 0  |  | 31317    | 6.63  | 5.81  | 6.5  |  |  |  |  |  |
| OF P2_19 BASIN               | P2_19 BASIN | N405        | 0.1 | 6.630 | 10  | 1.62 | Spillway    | 0.3 | 0.3 | 0.36 | 12.72 | 0  |  | 31252    | 6.63  | 5.803 | 6.5  |  |  |  |  |  |
| OF P1_19 BASIN               | P1_19 BASIN | N406        | 0.1 | 6.630 | 4   | 1.62 | 4m wide gr  | 1.2 | 0.3 | 0.4  | 11.75 | 0  |  | 31192    | 6.63  | 5.866 | 6.5  |  |  |  |  |  |
| OF179                        | N402        | N403        | 0.3 |       |     |      | Gutter Flow | 0.3 | 0.3 | 0.36 | 0.35  | 0  |  | 33718    | 5.94  | 5.87  | 20   |  |  |  |  |  |
| OF181                        | N403        | N404        | 0.3 |       |     |      | Gutter Flow | 0.3 | 0.3 | 0.36 | 0.34  | 0  |  | 33856    | 5.87  | 5.81  | 17.6 |  |  |  |  |  |
| OF184                        | N404        | ExP3        | 0.1 |       |     |      | Gutter Flow | 0.3 | 0.3 | 0.36 | 0.32  | 0  |  | 34151    | 5.81  | 5.78  | 9.5  |  |  |  |  |  |
| OF178                        | N405        | ExP3        | 0.1 |       |     |      | Gutter Flow | 0.3 | 0.3 | 0.36 | 0.37  | 0  |  | 33625    | 5.803 | 5.78  | 6.2  |  |  |  |  |  |
| OF172                        | N406        | N405        | 0.2 |       |     |      | Gutter Flow | 0.3 | 0.3 | 0.36 | 0.40  | 0  |  | 31112    | 5.866 | 5.803 | 15.8 |  |  |  |  |  |
| OF395                        | ExP3        | N646        | 0.1 |       |     |      | 30m wide    | 0.3 | 0.3 | 0.6  | 8.17  | 0  |  | 126690   | 6.27  | 5.78  | 6    |  |  |  |  |  |
| OF P2_18 BASIN - P3_19 BASIN | Basin73     | P3_19 BASIN | 0.1 | 6.890 | 10  | 1.62 | Spillway    | 0.3 | 0.3 | 0.36 | 4.88  | 0  |  | 42324    | 6.89  | 6.48  | 8.4  |  |  |  |  |  |
| OF P1_18 BASIN - P2_19 BASIN | Basin76     | P2_19 BASIN | 0.1 | 6.890 | 10  | 1.62 | Spillway    | 0.3 | 0.3 | 0.36 | 4.88  | 0  |  | 42639    | 6.89  | 6.48  | 8.4  |  |  |  |  |  |
| OF219                        | N458        | N406        | 0.3 |       |     |      | Gutter Flow | 0.3 | 0.3 | 0.36 | 0.34  | 0  |  | 50632    | 5.944 | 5.866 | 23   |  |  |  |  |  |
| OF230                        | N469        | HW2 (BRB)   | 0.1 |       |     |      | 4m wide gr  | 1.2 | 0.3 | 0.4  | 37.50 | 0  |  | 53962    | 6.4   | 5.8   | 1.6  |  |  |  |  |  |
| OF N480 - BRB2               | N480        | BRB2        | 0.1 |       |     |      | 4m wide gr  | 1.2 | 0.3 | 0.4  | 2.86  | 0  |  | 58757    | 6     | 5.6   | 14   |  |  |  |  |  |
| OF262                        | P1_7        | P3_7        | 0.1 |       |     |      | 4m wide gr  | 1.2 | 0.3 | 0.4  | 1.00  | 0  |  | 67973    | 6.7   | 6.6   | 10   |  |  |  |  |  |
| OF P2_7 - P3_7               | P2_7        | P3_7        | 0.1 |       |     |      | 4m wide gr  | 1.2 | 0.3 | 0.4  | 1.33  | 0  |  | 68318    | 6.7   | 6.6   | 7.5  |  |  |  |  |  |
| OF P3_7 - TRENCH7            | P3_7        | TRENCH7     | 0.2 |       |     |      | 4m wide gr  | 1.2 | 0.3 | 0.4  | 0.80  | 0  |  | 67677    | 6.5   | 6.4   | 12.5 |  |  |  |  |  |
| OF243                        | TRENCH7     | P4_3 BASIN  | 0.1 | 6.800 | 4   | 1.62 | 4m wide gr  | 1.2 | 0.3 | 0.4  | 1.00  | 0  |  | 66584    | 6.8   | 6.71  | 9    |  |  |  |  |  |
| OF254                        | P4_7        | TRENCH7     | 0.2 |       |     |      | 4m wide gr  | 1.2 | 0.3 | 0.4  | 0.80  | 0  |  | 67340    | 6.5   | 6.4   | 12.5 |  |  |  |  |  |
| OF BRB3 - ExP4               | BRB3        | ExP4        | 0.1 | 6.400 | 4   | 1.62 | 4m wide gr  | 1.2 | 0.3 | 0.4  | 7.00  | 0  |  | 84179    | 6.4   | 6.05  | 5    |  |  |  |  |  |
| OF P1_8 - P2_8               | P1_8        | P2_8        | 0.1 |       |     |      | 4m wide gr  | 1.2 | 0.3 | 0.4  | 0.59  | 0  |  | 91577    | 6.6   | 6.55  | 8.5  |  |  |  |  |  |
| OF P2_8 - P3_8               | P2_8        | P3_8        | 0.3 |       |     |      | 4m wide gr  | 1.2 | 0.3 | 0.4  | 0.53  | 0  |  | 91626    | 6.55  | 6.5   | 16.6 |  |  |  |  |  |
| OF P3_8 - TRENCH8            | P3_8        | TRENCH8     | 0.1 |       |     |      | 4m wide gr  | 1.2 | 0.3 | 0.4  | 2.00  | 0  |  | 99254    | 6.5   | 6.4   | 5    |  |  |  |  |  |
| OF TRENCH8 - CHATHAM-RN-1    | TRENCH8     | CHATHAM     | 0.1 | 6.700 | 4   | 1.62 | 4m wide gr  | 1.2 | 0.3 | 0.4  | 4.55  | 0  |  | 99757    | 6.7   | 6.2   | 11   |  |  |  |  |  |
| OF P4_8 - TRENCH8            | P4_8        | TRENCH8     | 0.1 |       |     |      | 4m wide gr  | 1.2 | 0.3 | 0.4  | 2.00  | 0  |  | 98982    | 6.5   | 6.4   | 5    |  |  |  |  |  |
| OF370                        | CHATHAM     | ExP5        | 1.1 |       |     |      | Gutter Flow | 0.3 | 0.3 | 0.36 | 0.11  | 0  |  | 118007   | 6.2   | 6.15  | 44   |  |  |  |  |  |
| OF P1_10 - P3_10             | P1_10       | P3_10       | 0.1 |       |     |      | 4m wide gr  | 1.2 | 0.3 | 0.4  | 1.00  | 0  |  | 104583   | 6.7   | 6.6   | 10   |  |  |  |  |  |
| OF P2_10 - P3_10             | P2_10       | P3_10       | 0.1 |       |     |      | 4m wide gr  | 1.2 | 0.3 | 0.4  | 1.33  | 0  |  | 106203   | 6.7   | 6.6   | 7.5  |  |  |  |  |  |
| OF P3_10 - TRENCH10          | P3_10       | TRENCH10    | 0.2 |       |     |      | 4m wide gr  | 1.2 | 0.3 | 0.4  | 0.80  | 0  |  | 112022   | 6.5   | 6.4   | 12.5 |  |  |  |  |  |
| OF TRENCH10 - CHATHAM-RN-2   | TRENCH10    | CHATHAM     | 0.1 | 6.700 | 4   | 1.62 | 4m wide gr  | 1.2 | 0.3 | 0.4  | 3.64  | 0  |  | 111010   | 6.7   | 6.3   | 11   |  |  |  |  |  |
| OF P4_10 - TRENCH10          | P4_10       | TRENCH10    | 0.2 |       |     |      | 4m wide gr  | 1.2 | 0.3 | 0.4  | 0.80  | 0  |  | 111646   | 6.5   | 6.4   | 12.5 |  |  |  |  |  |
| OF368                        | CHATHAM     | CHATHAM     | 0.6 |       |     |      | Gutter Flow | 0.3 | 0.3 | 0.36 | 0.27  | 0  |  | 117085   | 6.3   | 6.2   | 36.8 |  |  |  |  |  |
| OF GD3 - BRB3                | GD3         | HW1-BRB3    | 0.1 |       |     |      | PAVEMENT    | 0.3 | 0.3 | 0.4  | 5.20  | 0  |  | 131686   | 6.44  | 5.8   | 12.3 |  |  |  |  |  |
| OF P1_19 - P9_13             | P1_19       | P9_13       | 1.1 |       |     |      | Spillway    | 0.3 | 0.3 | 0.36 | 0.28  | 0  |  | 89645984 | 6.63  | 6.5   | 47   |  |  |  |  |  |

## DRAINS Input Data

|                                |           |            |            |           |        |      |             |      |      |      |      |     |  |           |       |       |      |  |  |  |  |  |
|--------------------------------|-----------|------------|------------|-----------|--------|------|-------------|------|------|------|------|-----|--|-----------|-------|-------|------|--|--|--|--|--|
| OF P2_28_Basin - P3_28_        | P2_28_Ba  | P3_28_     | 0.1        | 6.650     | 2.7    | 1.62 | 4m wide gr  | 1.2  | 0.3  | 0.4  | 1.00 | 0   |  | 83532160  | 6.65  | 6.6   | 5    |  |  |  |  |  |
| OF P3_28_ - P1_29_             | P3_28_    | P1_19_     | 0.2        |           |        |      | PAVEMEN     | 0.3  | 0.3  | 0.4  | 0.40 | 0   |  | 83533386  | 6.6   | 6.5   | 25   |  |  |  |  |  |
| OF P4_28_ - P1_29_             | P4_28_    | P1_19_     | 0.1        |           |        |      | PAVEMEN     | 0.3  | 0.3  | 0.4  | 1.56 | 0   |  | 83533334  | 6.78  | 6.5   | 18   |  |  |  |  |  |
| OF P5_13_ - BYP1               | P5_13_    | BYPASS1    | 0.2        |           |        |      | Pathway 4   | 0.3  | 0.15 | 0.6  | 1.45 | 0   |  | 83531464  | 6.95  | 6.6   | 24.2 |  |  |  |  |  |
| OF P3_22_Basin - P2_22_Basin   | P1_31_Ba  | P2_28_Ba   | 0.1        | 6.890     | 10     | 1.62 | Spillway    | 0.3  | 0.3  | 0.36 | 4.88 | 0   |  | 83532050  | 6.89  | 6.48  | 8.4  |  |  |  |  |  |
| OF P3_13_ - P3_28_             | P3_13_    | P3_28_     | 0.2        |           |        |      | PAVEMEN     | 0.3  | 0.3  | 0.4  | 0.55 | 0   |  | 112918662 | 6.71  | 6.6   | 20   |  |  |  |  |  |
| OF P4_13_ - P3_28_             | P4_13_    | P3_28_     | 0.1        |           |        |      | PAVEMEN     | 0.3  | 0.3  | 0.4  | 1.75 | 0   |  | 112918675 | 6.95  | 6.6   | 20   |  |  |  |  |  |
| OF P1_28_ - P2_28_             | P1_28_Ba  | P2_28_Ba   | 0.2        | 6.590     | 2.7    | 1.62 | Gutter Flow | 0.3  | 0.3  | 0.36 | 1.03 | 50  |  | 83532121  | 6.59  | 6.48  | 18.7 |  |  |  |  |  |
| OF P1_13_ Basin - P1_28_ Basin | P1_13_Ba  | P1_28_Ba   | 0.1        | 6.890     | 10     | 1.62 | Spillway    | 0.3  | 0.3  | 0.36 | 4.88 | 0   |  | 83532013  | 6.89  | 6.48  | 8.4  |  |  |  |  |  |
| OF1 P2_3 - P1_15               | P2_3_BAS  | P1_15_BAS  | 0.1        | 6.890     | 10     | 1.62 | Spillway    | 0.3  | 0.3  | 0.36 | 4.88 | 0   |  | 17105     | 6.89  | 6.48  | 8.4  |  |  |  |  |  |
| OF P1_15 - P2_15               | P1_15_BAS | P2_15_BAS  | 0.1        | 6.590     | 2.7    | 1.62 | Gutter Flow | 0.3  | 0.3  | 0.36 | 1.03 | 50  |  | 21071     | 6.59  | 6.48  | 10.7 |  |  |  |  |  |
| OF Track Access Culvert        | HW6_      | HW7_       | 0.1        | 6.693     | 3      | 1    | PAVEMEN     | 0.3  | 0.3  | 0.4  | 1    | 0   |  | 83532537  | 6.693 | 5.681 | 5    |  |  |  |  |  |
| Existing V Drain 2             | HW7_      | HW4        | 0.4        |           |        |      | Dummy Of    | 0.15 | 0.05 | 0.36 | .24  | 100 |  | 83532440  | 5.681 | 5.645 | 14.9 |  |  |  |  |  |
| OF P3_15 - P4_15 BASIN         | P4_15_Ba  | P6_15_Ba   | 0.1        | 6.590     | 2.7    | 1.62 | Gutter Flow | 0.3  | 0.3  | 0.36 | 0.87 | 40  |  | 24193     | 6.59  | 6.48  | 9.2  |  |  |  |  |  |
| OF P1_23_ Basin - P1_22_ Basin | P1_23_Ba  | P1_22_Bas  | 0.1        | 6.390     | 2.7    | 1.62 | PAVEMEN     | 0.3  | 0.3  | 0.4  | 2.37 | 0   |  | 83533256  | 6.39  | 6.2   | 8    |  |  |  |  |  |
| OF P6_20 Basin - P7_20 Basin   | P1_22_Bas | P1_21_Ba   | 0.1        | 6.390     | 2.7    | 1.62 | PAVEMEN     | 0.3  | 0.3  | 0.4  | 2.37 | 0   |  | 83533266  | 6.39  | 6.2   | 8    |  |  |  |  |  |
| OF P1_20_ - P1_22_             | P1_20_Ba  | P1_22_Bas  | 0.1        | 6.400     | 3      | 1.62 | PAVEMEN     | 0.3  | 0.3  | 0.4  | 1.82 | 0   |  | 83533250  | 6.4   | 6.2   | 11   |  |  |  |  |  |
| OF177                          | N391937   | N402       | 0.4        |           |        |      | Gutter Flow | 0.3  | 0.3  | 0.36 | 0.35 | 0   |  | 83533291  | 5.98  | 5.94  | 29.1 |  |  |  |  |  |
| OF P7_20 - Outlet              | P1_21_Ba  | N391937    | 0.1        | 6.390     | 2.7    | 1.62 | PAVEMEN     | 0.3  | 0.3  | 0.4  | 5.62 | 0   |  | 83533278  | 6.39  | 5.98  | 7.3  |  |  |  |  |  |
| OF Buried Pipe                 | HW4       | ExPit_Trac | 0.2        | 6.370     | 2.7    | 1.62 | 4m wide gr  | 1.2  | 0.3  | 0.4  | 1    | 0   |  | 83533643  | 5.87  | 5.59  | 18.9 |  |  |  |  |  |
| OF SandFilterSth - P5_17       | SAND_FIL  | P5_17      | 0.1        |           |        |      | Spillway    | 0.3  | 0.3  | 0.36 | 6.63 | 0   |  | 848       | 6.8   | 6.27  | 8    |  |  |  |  |  |
|                                |           |            |            |           |        |      |             |      |      |      |      |     |  |           |       |       |      |  |  |  |  |  |
|                                |           |            |            |           |        |      |             |      |      |      |      |     |  |           |       |       |      |  |  |  |  |  |
| PIPE COVER DETAILS             |           |            |            |           |        |      |             |      |      |      |      |     |  |           |       |       |      |  |  |  |  |  |
| Name                           | Type      | Dia (mm)   | Safe Cover | Cover (m) |        |      |             |      |      |      |      |     |  |           |       |       |      |  |  |  |  |  |
| P1_11 - P2_11                  | uPVC, not | 154        | 0.6        | 0.29      | Unsafe |      |             |      |      |      |      |     |  |           |       |       |      |  |  |  |  |  |
| P2-11_P3-11                    | uPVC, not | 154        | 0.6        | 0.44      | Unsafe |      |             |      |      |      |      |     |  |           |       |       |      |  |  |  |  |  |
| TRENCH-11_1                    | uPVC, not | 154        | 0.6        | -0.16     | Unsafe |      |             |      |      |      |      |     |  |           |       |       |      |  |  |  |  |  |
| P3_1 - P4_1                    | uPVC, und | 105        | 0.6        | 0.29      | Unsafe |      |             |      |      |      |      |     |  |           |       |       |      |  |  |  |  |  |
| P4_1 - P5_1                    | uPVC, und | 239        | 0.6        | 0.20      | Unsafe |      |             |      |      |      |      |     |  |           |       |       |      |  |  |  |  |  |
| P5_1 - P6_1                    | uPVC, und | 239        | 0.6        | 0.26      | Unsafe |      |             |      |      |      |      |     |  |           |       |       |      |  |  |  |  |  |
| P6_1 - P7_1                    | uPVC, und | 303        | 0.6        | 0.26      | Unsafe |      |             |      |      |      |      |     |  |           |       |       |      |  |  |  |  |  |
| P7_1 - GPT_BRB3                | uPVC, not | 242        | 0.6        | 0.76      |        |      |             |      |      |      |      |     |  |           |       |       |      |  |  |  |  |  |
| GPT_BRB3 - BRB3                | uPVC, not | 242        | 0.6        | -0.25     | Unsafe |      |             |      |      |      |      |     |  |           |       |       |      |  |  |  |  |  |
| P2_1 - P1_1 + GD4              | uPVC, und | 154        | 0.6        | 0.29      | Unsafe |      |             |      |      |      |      |     |  |           |       |       |      |  |  |  |  |  |
| P1_1 - P2_6                    | uPVC, und | 154        | 0.6        | 0.49      | Unsafe |      |             |      |      |      |      |     |  |           |       |       |      |  |  |  |  |  |
| P2_6 - ExP5                    | uPVC, und | 239        | 0.6        | 0.31      | Unsafe |      |             |      |      |      |      |     |  |           |       |       |      |  |  |  |  |  |

## DRAINS Input Data

|                        |               |     |       |        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|------------------------|---------------|-----|-------|--------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
| Exp5 - Exp4            | Concrete, 375 | 0.6 | 0.64  |        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Pipe1059               | Concrete, 375 | 0.6 | 0.64  |        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Pipe17                 | uPVC, not 154 | 0.6 | 0.60  |        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P3_2 - HW2             | uPVC, not 154 | 0.6 | -0.16 | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| GD2 - SAND FILTER      | uPVC, not 154 | 0.6 | 0.36  | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| SAND_FILTER_IN LET2    | uPVC, not 242 | 0.6 | -0.65 | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| SAND FILTER - P4_17    | uPVC, not 154 | 0.6 | -0.16 | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P4_17 - P5_27          | uPVC, not 154 | 0.6 | 0.95  |        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P5_17 - Exp6           | Concrete, 375 | 0.6 | 0.72  |        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Exp6 - Chatham North   | Concrete, 375 | 0.6 | 0.78  |        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P1_17 - P2_17          | uPVC, und 239 | 0.6 | 0.36  | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P1_16 - P2_16          | uPVC, not 154 | 0.6 | 0.44  | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Pipe69                 | uPVC, not 154 | 0.6 | 0.14  | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Pipe at Track Crossing | Concrete, 375 | 0.6 | 0.42  | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| T1-B-N P3-11           | uPVC, not 154 | 0.6 | 0.25  | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| T1-A-S P4-9            | uPVC, not 154 | 0.6 | 0.25  | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| TRENCH-11_2            | uPVC, not 154 | 0.6 | -0.16 | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P1-9 P2-9              | uPVC, not 154 | 0.6 | 0.29  | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P2-9 P3-9              | uPVC, not 154 | 0.6 | 0.44  | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P196                   | uPVC, not 154 | 0.6 | -0.16 | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| T1-C-N P3-9            | uPVC, not 154 | 0.6 | 0.25  | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| TANK-T1-B-S_P4-9       | uPVC, not 154 | 0.6 | 0.25  | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P198                   | uPVC, not 154 | 0.6 | -0.16 | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P1_30 - P2_30          | uPVC, not 154 | 0.6 | 0.16  | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P2_30 - P3_30          | uPVC, not 154 | 0.6 | 0.27  | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P3_30 - P7_13          | uPVC, not 154 | 0.6 | 0.38  | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P7_13 - P8_13          | uPVC, not 242 | 0.6 | 0.56  | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P8_13 - P9_13          | uPVC, not 242 | 0.6 | 0.46  | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P7_13 - HW5            | uPVC, not 242 | 0.6 | -0.25 | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P2_15 BASIN OUTLET     | uPVC, not 105 | 0.6 | 0.55  | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P2_15 - P3_15          | uPVC, not 154 | 0.6 | 0.63  |        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P278037                | uPVC, not 154 | 0.6 | 0.74  |        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P4_15 - P5_15          | uPVC, not 154 | 0.6 | 0.84  |        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P5_15 - P7_15          | uPVC, not 154 | 0.6 | 0.90  |        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P5_15 - Exp1           | uPVC, not 303 | 0.6 | 0.68  |        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Exp1 - P1_20           | Concrete, 375 | 0.6 | 0.89  |        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P1_20 - DARLING_ST_RN  | Concrete, 375 | 0.6 | 1.01  |        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P4_3 BASIN OUTLET      | uPVC, not 105 | 0.6 | 0.50  | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P5_3 - P6_3            | uPVC, not 303 | 0.6 | 0.63  |        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P6_3 - P8_3            | uPVC, not 303 | 0.6 | 0.71  |        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P8_3 - P10_3           | uPVC, not 303 | 0.6 | 0.86  |        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P10_3 - P11_3          | uPVC, not 303 | 0.6 | 0.88  |        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P11_3 - P5_15          | uPVC, not 303 | 0.6 | 0.88  |        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P3_15 BASIN OUTLET     | uPVC, not 105 | 0.6 | 0.67  |        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P7_3 BASIN OUTLET      | uPVC, not 105 | 0.6 | 0.73  |        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P9_3 BASIN OUTLET      | uPVC, not 105 | 0.6 | 0.87  |        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |



### DRAINS Input Data

|                       |             |     |     |       |        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------|-------------|-----|-----|-------|--------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
| P4_15 BASIN<br>OUTLET | uPVC, not   | 105 | 0.6 | 0.73  |        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| block d roof - brb1   | uPVC, not   | 154 | 0.6 | -0.86 | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| BRB1 - BRB2           | uPVC, not   | 105 | 0.6 | -0.11 | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P2_4 - P3_4           | uPVC, not   | 386 | 0.6 | -0.39 | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P3_4 - P4_4           | Concrete, t | 375 | 0.6 | 0.54  | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P4_4 - Exp2           | Concrete, t | 375 | 0.6 | 0.54  | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Exp2 - Exp1           | Concrete, t | 375 | 0.6 | 0.66  |        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P11_3 BASIN<br>OUTLET | uPVC, not   | 105 | 0.6 | 0.81  |        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P3_19 BASIN<br>OUTLET | uPVC, not   | 105 | 0.6 | 0.73  |        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P3_19 - P11_3         | uPVC, not   | 154 | 0.6 | 0.95  |        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P2_19 BASIN<br>OUTLET | uPVC, not   | 105 | 0.6 | 0.65  |        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P2_19 - P3_19         | uPVC, not   | 154 | 0.6 | 0.87  |        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P1_19 BASIN<br>OUTLET | uPVC, not   | 105 | 0.6 | 0.57  | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P1_19 - P2_19         | uPVC, not   | 154 | 0.6 | 0.80  |        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Exp3 - Exp2           | Concrete, t | 375 | 0.6 | 0.41  | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P2_18 BASIN<br>OUTLET | uPVC, und   | 105 | 0.6 | 0.78  |        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P2_18 - P10_3         | uPVC, und   | 154 | 0.6 | 1.01  |        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P1_18 BASIN<br>OUTLET | uPVC, und   | 105 | 0.6 | 0.71  |        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P1_19 - P2_18         | uPVC, und   | 154 | 0.6 | 0.93  |        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| GD1 - P3_4            | Concrete, t | 150 | 0.6 | 0.85  |        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CONCOURSE -<br>BRB1   | uPVC, not   | 242 | 0.6 | -0.95 | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P1_7 - P2_7           | uPVC, not   | 154 | 0.6 | 0.29  | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P2_7 - P3_7           | uPVC, not   | 154 | 0.6 | 0.44  | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P3_7 - TRENCH7        | uPVC, not   | 154 | 0.6 | -0.16 | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| T1-D-NTH<br>OVERFLOW  | uPVC, not   | 154 | 0.6 | 0.25  | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| T1-C-STH - P4_7       | uPVC, not   | 154 | 0.6 | 0.25  | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P4_7 = TRENCH7        | uPVC, not   | 154 | 0.6 | -0.16 | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| BRB3 - Exp4           | uPVC, und   | 105 | 0.6 | -0.11 | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| T1 - P1_6             | uPVC, und   | 154 | 0.6 | 0.25  | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P1_6 - P2_6           | uPVC, und   | 154 | 0.6 | 0.27  | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| T1 - P2_6             | uPVC, und   | 154 | 0.6 | 0.27  | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P1_8 - P2_8           | uPVC, not   | 154 | 0.6 | 0.14  | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P2_8 - TRENCH8        | uPVC, not   | 154 | 0.6 | 0.25  | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P3_8 - TRENCH8        | uPVC, not   | 154 | 0.6 | -0.16 | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| T2-EQPSHD -<br>P3_8   | uPVC, not   | 154 | 0.6 | 0.25  | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| T1-E-STH - P4_8       | uPVC, not   | 154 | 0.6 | 0.25  | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P4_8 - TRENCH8        | uPVC, not   | 154 | 0.6 | -0.16 | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P1_10 - P2_10         | uPVC, not   | 154 | 0.6 | 0.29  | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P2_10 - P3_10         | uPVC, not   | 154 | 0.6 | 0.44  | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P3_10 -<br>TRENCH10   | uPVC, not   | 154 | 0.6 | -0.16 | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P1008                 | uPVC, not   | 154 | 0.6 | 0.25  | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| T1-F-STH - P4_10      | uPVC, not   | 154 | 0.6 | 0.25  | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P4_10 -<br>TRENCH10   | uPVC, not   | 154 | 0.6 | -0.16 | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| GD3 - P7_1            | uPVC, und   | 154 | 0.6 | 0.49  | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

## DRAINS Input Data

|                                                                                                                                                                                                                                                                                                                                                                                    |           |     |     |       |        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-----|-----|-------|--------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
| P4_21 - P5_22                                                                                                                                                                                                                                                                                                                                                                      | uPVC, not | 154 | 0.6 | 0.25  | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P5_22 - P5_13                                                                                                                                                                                                                                                                                                                                                                      | uPVC, not | 242 | 0.6 | 0.56  | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P2_28_Basin -<br>P2_28_Pit                                                                                                                                                                                                                                                                                                                                                         | uPVC, not | 105 | 0.6 | 0.02  | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P2_28 - P3_28                                                                                                                                                                                                                                                                                                                                                                      | uPVC, not | 154 | 0.6 | 0.13  | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P3_28 - P4_28                                                                                                                                                                                                                                                                                                                                                                      | uPVC, not | 154 | 0.6 | 0.28  | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P4_28 - P5_13                                                                                                                                                                                                                                                                                                                                                                      | uPVC, not | 154 | 0.6 | 0.53  | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P5_13 - P6_30                                                                                                                                                                                                                                                                                                                                                                      | uPVC, not | 242 | 0.6 | 0.67  |        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P1_31_Basin -<br>P3_13                                                                                                                                                                                                                                                                                                                                                             | uPVC, not | 105 | 0.6 | 0.08  | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P3_13 - P4_13                                                                                                                                                                                                                                                                                                                                                                      | uPVC, not | 154 | 0.6 | 0.41  | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P4_13 - P5_13                                                                                                                                                                                                                                                                                                                                                                      | uPVC, not | 242 | 0.6 | 0.60  |        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P1_28_Basin -<br>P1_28_Pit                                                                                                                                                                                                                                                                                                                                                         | uPVC, not | 105 | 0.6 | -0.05 | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P1_28 - P2_28                                                                                                                                                                                                                                                                                                                                                                      | uPVC, not | 154 | 0.6 | 0.03  | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P1_13_Basin -<br>P2_13                                                                                                                                                                                                                                                                                                                                                             | uPVC, not | 154 | 0.6 | 0.03  | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P2_13 - P3_13                                                                                                                                                                                                                                                                                                                                                                      | uPVC, not | 154 | 0.6 | 0.27  | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P2_3 BASIN<br>OUTLET                                                                                                                                                                                                                                                                                                                                                               | uPVC, not | 105 | 0.6 | 0.29  | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P3_3 - P5_3                                                                                                                                                                                                                                                                                                                                                                        | uPVC, not | 303 | 0.6 | 0.42  | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P1_15 BASIN<br>OUTLET                                                                                                                                                                                                                                                                                                                                                              | uPVC, not | 105 | 0.6 | 0.45  | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P1_15 - P2_15                                                                                                                                                                                                                                                                                                                                                                      | uPVC, not | 154 | 0.6 | 0.52  | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Track Access<br>Culvert                                                                                                                                                                                                                                                                                                                                                            | uPVC, not | 242 | 0.6 | -0.25 | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Basin - P4_15                                                                                                                                                                                                                                                                                                                                                                      | uPVC, not | 105 | 0.6 | 0.67  |        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P1_23_Basin -<br>P2_20                                                                                                                                                                                                                                                                                                                                                             | uPVC, und | 154 | 0.6 | -0.16 | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P2_20 - P3_20                                                                                                                                                                                                                                                                                                                                                                      | uPVC, und | 154 | 0.6 | 0.70  |        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P3_20 - P4_20                                                                                                                                                                                                                                                                                                                                                                      | uPVC, und | 154 | 0.6 | 0.72  |        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P6_20_Basin -<br>P3_20                                                                                                                                                                                                                                                                                                                                                             | uPVC, und | 154 | 0.6 | -0.16 | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P1_20_basin -<br>P2_20                                                                                                                                                                                                                                                                                                                                                             | uPVC, und | 154 | 0.6 | -0.16 | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P1_21_Basin -<br>P3_20                                                                                                                                                                                                                                                                                                                                                             | uPVC, und | 105 | 0.6 | -0.11 | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Burried Pipe                                                                                                                                                                                                                                                                                                                                                                       | uPVC, not | 242 | 0.6 | 0.05  | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P2_17 - P3_17                                                                                                                                                                                                                                                                                                                                                                      | uPVC, und | 239 | 0.6 | 0.74  |        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| P3_17 - GPT                                                                                                                                                                                                                                                                                                                                                                        | uPVC, not | 242 | 0.6 | 0.85  |        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| GPT - SAND<br>FILTER                                                                                                                                                                                                                                                                                                                                                               | uPVC, not | 242 | 0.6 | 0.87  |        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| SAND_TANK_INL<br>ET1                                                                                                                                                                                                                                                                                                                                                               | uPVC, not | 242 | 0.6 | -0.65 | Unsafe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                    |           |     |     |       |        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| These pipes have non-return valves: GPT_BRB3 - BRB3, P1_17 - P2_17, P2_15 BASIN OUTLET, P4_3 BASIN OUTLET, P3_15 BASIN OUTLET, P7_3 BASIN OUTLET, P9_3 BASIN OUTLET, P4_15 BASIN OUTLET, BRB1 - BRB2, P11_3 BASIN OUTLET, P3_19 BASIN OUTLET, P2_19 BASIN OUTLET, P1_19 BASIN OUTLET, P2_18 BASIN OUTLET, P1_18 BASIN OUTLET, P2_3 BASIN OUTLET, P1_15 BASIN OUTLET, Basin - P4_15 |           |     |     |       |        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                    |           |     |     |       |        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

# DRAINS - Minor "K"

| Pit          | Initial K | Revised K      | Chart (200 Ratios)                               |
|--------------|-----------|----------------|--------------------------------------------------|
| P5_13_       | 1.77      | 1.76           | A1-24 DI/Do=0.64, B/Do=1.50, (Qu/Qo)(Do/Du)=0.48 |
| P4_20_       | 0.94      | 0.94           | A1-20 Du/Do=1.00, Qg/Qo=0.17, S/Do=1.3           |
| P3_20_       | 0.67      | 0.67           | A1-24 DI/Do=0.68, B/Do=5.84, (Qu/Qo)(Do/Du)=0.85 |
| P2_20_       | 2.27      | 2.27           | H-O'L Qg/Qo=0.00, S/Do=3.1                       |
| P4_15_ Pit   | 0.72      | 0.72           | A1-24 DI/Do=0.68, B/Do=1.50, (Qu/Qo)(Do/Du)=0.82 |
| P4_28_       | 2.95      | 2.94           | A1-4 H/Do=1.4, Vo2/(2gDo)=0.27                   |
| P1_19_       | 4.13      | 4.11           | A1-4 H/Do=1.0, Vo2/(2gDo)=0.01                   |
| P6_13_       | 1.09      | 1.09           | A1-20 Du/Do=1.00, Qg/Qo=0.14, S/Do=1.6           |
| P3_28_       | 1.37      | 1.37           | A1-9 Du/Do=1.00, Qg/Qo=0.33, S/Do=2.5            |
| P2_28_ Pit   | 1.82      | 1.89           | H-O'L Qg/Qo=0.00, S/Do=2.4                       |
| P3_13_       | 1.23      | 1.23           | H-O'L Qg/Qo=0.00, S/Do=2.2                       |
| P1_28_ Pit   | 2.08      | 2.07           | A1-18 Du/Do=0.68, Qg/Qo=0.00, S/Do=1.5           |
| P2_13_       | 2.31      | 2.31           | H-O'L Qg/Qo=0.00, S/Do=1.2                       |
| GD3          | 5         | 5.12           | A1-4 H/Do=0.4, Vo2/(2gDo)=0.00                   |
| ExP4         | 1.2       | 0.93           | A1-25 Du/Do=1.00, Qg/Qo=0.00, S/Do=1.0           |
| ExP5         | 5.93      | 5.93           | A1-4 H/Do=0.0, Vo2/(2gDo)=0.02                   |
| P4_10        | 1.79      | 1.79           | A1-4 H/Do=6.9, Vo2/(2gDo)=0.34                   |
| P3_10        | 1.79      | 1.79           | A1-4 H/Do=7.0, Vo2/(2gDo)=0.81                   |
| P2_10        | 2.46      | 2.48           | A1-4 H/Do=2.7, Vo2/(2gDo)=0.12                   |
| P1_10        | 3.02      | 3.06           | A1-4 H/Do=1.8, Vo2/(2gDo)=0.03                   |
| P2_8         | 5.93      | 5.93           | A1-4 H/Do=0.0, Vo2/(2gDo)=0.08                   |
| P1_8         | 5.93      | 5.93           | A1-4 H/Do=0.0, Vo2/(2gDo)=0.02                   |
| P6_1         | 1.56      | 1.56           | A1-9 Du/Do=0.79, Qg/Qo=0.37, S/Do=1.2            |
| P5_1         | 4.96      | 5.01           | A1-4 H/Do=0.4, Vo2/(2gDo)=0.12                   |
| P4_1         | 4.66      | 4.66           | A1-4 H/Do=0.6, Vo2/(2gDo)=0.03                   |
| P4_7         | 1.79      | 1.79           | A1-4 H/Do=6.9, Vo2/(2gDo)=0.34                   |
| P3_7         | 1.79      | 1.79           | A1-4 H/Do=7.0, Vo2/(2gDo)=0.81                   |
| P2_7         | 2.48      | 2.48           | A1-4 H/Do=2.7, Vo2/(2gDo)=0.12                   |
| P1_7         | 3.05      | 3.06           | A1-4 H/Do=1.8, Vo2/(2gDo)=0.03                   |
| ExP2         | 0.44      | 0.45           | H-O'L Qg/Qo=0.00, S/Do=1.8                       |
| ExP1         | 1.55      | 1.54           | A1-24 DI/Do=0.81, B/Do=2.40, (Qu/Qo)(Do/Du)=0.52 |
| ExP3         | 5.01      | not calculated |                                                  |
| P1_19        | 0.84      | 0.84           | A1-14 Du/Do=0.68, Qg/Qo=0.00, S/Do=1.6           |
| P7_3         | 1.01      | 1.01           | A1-25 Du/Do=1.00, Qg/Qo=0.00, S/Do=1.0           |
| P6_3         | 0.2       | 0.2            | A1-5 Du/Do=1.00, Qg/Qo=0.00, S/Do=1.0            |
| P5_3         | 1.5       | 1.5            | A1-25 Du/Do=1.00, Qg/Qo=0.00, S/Do=1.0           |
| P1_30_       | 4.96      | 5.03           | A1-4 H/Do=0.4, Vo2/(2gDo)=0.01                   |
| P2_30_       | 4.34      | 4.37           | A1-4 H/Do=0.8, Vo2/(2gDo)=0.06                   |
| P2_17        | 1.5       | not calculated |                                                  |
| P4-9         | 1.79      | 1.79           | A1-4 H/Do=6.9, Vo2/(2gDo)=0.34                   |
| P3-9         | 1.79      | 1.79           | A1-4 H/Do=7.0, Vo2/(2gDo)=0.81                   |
| P2-9         | 2.48      | 2.48           | A1-4 H/Do=2.7, Vo2/(2gDo)=0.12                   |
| P1-9         | 3.05      | 3.06           | A1-4 H/Do=1.8, Vo2/(2gDo)=0.03                   |
| P4-11        | 1.79      | 1.79           | A1-4 H/Do=6.9, Vo2/(2gDo)=0.34                   |
| SAND_FIL 0   | 0         |                | A1-9 Du/Do=0.64, Qg/Qo=0.00, S/Do=1.0            |
| SAND_FIL 0.2 | 0.2       |                | A1-5 Du/Do=1.00, Qg/Qo=0.00, S/Do=1.0            |
| ExPit_Trac   | 7.92      | 7.92           | A1-4 H/Do=0.0, Vo2/(2gDo)=0.04                   |
| P2_16        | 1.74      | 1.75           | A1-5 Du/Do=1.00, Qg/Qo=0.42, S/Do=1.6            |
| P1_16        | 5.17      | 5.17           | A1-4 H/Do=0.0, Vo2/(2gDo)=0.17                   |
| P1_17        | 2.96      | 2.93           | A1-4 H/Do=2.0, Vo2/(2gDo)=0.01                   |
| P3_17        | 3.02      | 3.02           | H-O'L Qg/Qo=0.00, S/Do=1.0                       |
| GD2_NOR      | 5.93      | 5.93           | A1-4 H/Do=0.0, Vo2/(2gDo)=0.07                   |
| P4_27        | 0.2       | 0.2            | A1-5 Du/Do=1.00, Qg/Qo=0.00, S/Do=1.0            |
| P5_17        | 1.11      | 1.11           | A1-18 Du/Do=0.41, Qg/Qo=0.00, S/Do=0.2           |
| ExP6         | 0.29      | 0.29           | A1-18 Du/Do=1.00, Qg/Qo=0.00, S/Do=0.2           |

# DRAINS - Minor "K"

|           |      |      |       |                                                    |
|-----------|------|------|-------|----------------------------------------------------|
| P9_13_    | 1.59 | 1.59 | H-O'L | $Qg/Qo=0.11$ , $S/Do=1.5$                          |
| P7_13_    | 1.19 | 1.2  | H-O'L | $Qg/Qo=0.00$ , $S/Do=1.6$                          |
| P8_13_    | 1.19 | 1.19 | H-O'L | $Qg/Qo=0.17$ , $S/Do=1.4$                          |
| P3_30     | 1.39 | 1.4  | A1-5  | $Du/Do=1.00$ , $Qg/Qo=0.39$ , $S/Do=2.3$           |
| P3_8      | 2.19 | 2.19 | A1-4  | $H/Do=1.7$ , $Vo2/(2gDo)=0.78$                     |
| P4_8      | 2.91 | 2.91 | A1-4  | $H/Do=1.6$ , $Vo2/(2gDo)=0.24$                     |
| P2_2      | 5.93 | 5.93 | A1-4  | $H/Do=0.0$ , $Vo2/(2gDo)=0.01$                     |
| P3_2      | 7.92 | 7.92 | A1-4  | $H/Do=0.0$ , $Vo2/(2gDo)=0.03$                     |
| P1_6      | 1.2  | 1.2  | H-O'L | $Qg/Qo=0.00$ , $S/Do=1.2$                          |
| P2_6      | 2.72 | 1.81 | H-O'L | $Qg/Qo=0.00$ , $S/Do=1.3$                          |
| P1_1 + GL | 1.91 | 1.85 | A1-10 | $Du/Do=1.00$ , $Qg/Qo=0.20$ , $S/Do=1.9$           |
| P2_1      | 4.9  | 4.51 | A1-4  | $H/Do=0.6$ , $Vo2/(2gDo)=0.13$                     |
| P3_1      | 2.04 | 2.04 | A1-4  | $H/Do=2.9$ , $Vo2/(2gDo)=0.68$                     |
| P7_1      | 1.2  | 1.2  | H-O'L | $Qg/Qo=0.00$ , $S/Do=1.7$                          |
| P1-11     | 3.05 | 3.05 | A1-4  | $H/Do=1.8$ , $Vo2/(2gDo)=0.03$                     |
| P2-11     | 2.79 | 2.79 | A1-4  | $H/Do=2.7$ , $Vo2/(2gDo)=0.11$                     |
| P3-11     | 1.79 | 1.79 | A1-4  | $H/Do=7.0$ , $Vo2/(2gDo)=0.81$                     |
| P4_13_    | 1.51 | 1.5  | A1-7  | $Du/Do=0.64$ , $Qg/Qo=0.32$ , $S/Do=1.4$           |
| P3-3      | 1.01 | 1.01 | A1-18 | $Du/Do=0.35$ , $Qg/Qo=0.00$ , $S/Do=0.2$           |
| P1_15     | 1.42 | 1.42 | A1-18 | $Du/Do=0.68$ , $Qg/Qo=0.00$ , $S/Do=3.8$           |
| P2_15     | 1.8  | 1.79 | A1-24 | $DI/Do=0.68$ , $B/Do=5.84$ , $(Qu/Qo)(Do/Du)=0.51$ |
| P3_15     | 1.37 | 1.37 | A1-24 | $DI/Do=0.68$ , $B/Do=5.84$ , $(Qu/Qo)(Do/Du)=0.65$ |
| Pit21     | 2.1  | 2.1  | H-O'L | $Qg/Qo=0.00$ , $S/Do=1.1$                          |
| P2_18     | 1.55 | 1.55 | A1-24 | $DI/Do=0.68$ , $B/Do=5.84$ , $(Qu/Qo)(Do/Du)=0.60$ |
| P1_18     | 1.82 | 1.81 | A1-18 | $Du/Do=0.68$ , $Qg/Qo=0.00$ , $S/Do=2.1$           |
| P2_19     | 1.78 | 1.78 | A1-24 | $DI/Do=0.68$ , $B/Do=5.84$ , $(Qu/Qo)(Do/Du)=0.52$ |
| P3_19     | 1.3  | 1.3  | A1-24 | $DI/Do=0.68$ , $B/Do=5.84$ , $(Qu/Qo)(Do/Du)=0.67$ |
| P11_3     | 1.32 | 1.32 | A1-20 | $Du/Do=0.51$ , $Qg/Qo=0.00$ , $S/Do=1.2$           |
| P7_15_    | 2.3  | 2.3  | H-O'L | $Qg/Qo=0.00$ , $S/Do=1.7$                          |
| P5_15_    | 2.3  | 2.3  | H-O'L | $Qg/Qo=0.00$ , $S/Do=3.4$                          |
| P4_4      | 1.6  | 1.63 | A1-18 | $Du/Do=1.00$ , $Qg/Qo=0.00$ , $S/Do=1.8$           |
| P3_4      | 1.36 | 1.38 | H-O'L | $Qg/Qo=0.00$ , $S/Do=1.9$                          |



DRAINS - Minor results

DRAINS results  
prepared from Version  
2022.012

PIT / NODE DETAILS

| Name                 | Max HGL | Max Pond<br>HGL | Max Surface<br>Flow Arriving<br>(cu.m/s) | Version 8<br>Max Pond<br>Volume<br>(cu.m) | Min<br>Freeboard<br>(m) | Overflow<br>(cu.m/s) | Constraint     |
|----------------------|---------|-----------------|------------------------------------------|-------------------------------------------|-------------------------|----------------------|----------------|
| P1-11                | 6.60    | 6.62            | 0.008                                    | 0.5                                       | 0.00                    | 0.000                | Outlet System  |
| P2-11                | 6.59    | 6.62            | 0.008                                    | 0.4                                       | 0.01                    | 0.000                | Inlet Capacity |
| P3-11                | 6.56    | 6.56            | 0.013                                    | 2.1                                       | 0.00                    | 0.000                | Outlet System  |
| P3_1                 | 6.30    | 6.32            | 0.020                                    | 1.0                                       | 0.00                    | 0.001                | Outlet System  |
| P4_1                 | 6.22    | 6.28            | 0.013                                    | 1.0                                       | 0.03                    | 0.000                | Inlet Capacity |
| P5_1                 | 6.19    | 6.30            | 0.026                                    | 1.0                                       | 0.06                    | 0.000                | Inlet Capacity |
| P6_1                 | 6.05    | 6.29            | 0.020                                    | 0.3                                       | 0.20                    | 0.000                | Inlet Capacity |
| P7_1                 | 6.01    |                 | 0.000                                    |                                           | 0.61                    |                      | None           |
| GPT-BRB3             | 5.96    |                 | 0.000                                    |                                           | 0.67                    |                      | None           |
| HW1-BRB3             | 5.94    |                 | 0.000                                    |                                           |                         |                      |                |
| P2_1                 | 6.10    | 6.29            | 0.016                                    | 0.9                                       | 0.15                    | 0.000                | Inlet Capacity |
| P1_1 + GD4           | 5.96    |                 | 0.003                                    |                                           | 0.40                    |                      | None           |
| P2_6                 | 5.84    |                 | 0.000                                    |                                           | 0.48                    |                      | None           |
| Exp5                 | 5.33    |                 | 0.000                                    |                                           | 0.82                    | 0.000                | None           |
| Exp4                 | 5.20    | 6.05            | 0.000                                    | 0.0                                       | 0.85                    | 0.000                | None           |
| CHATHAM-RN-0         | 5.11    |                 | 0.000                                    |                                           |                         |                      |                |
| P2_2                 | 6.06    | 6.79            | 0.004                                    | 0.2                                       | 0.72                    | 0.000                | Inlet Capacity |
| P3_2                 | 5.98    | 6.69            | 0.004                                    | 0.1                                       | 0.70                    | 0.000                | Inlet Capacity |
| HW2 (BRB2)           | 5.89    |                 | 0.000                                    |                                           |                         |                      |                |
| GD2_NORTH            | 6.04    |                 | 0.005                                    |                                           | 0.41                    | 0.000                | None           |
| SAND_FILTER_NORTH    | 5.71    |                 | 0.000                                    |                                           | 1.09                    | 0.000                | None           |
| P4_27                | 5.30    |                 | 0.000                                    |                                           | 1.20                    | 0.000                | None           |
| P5_17                | 5.22    |                 | 0.000                                    |                                           | 1.05                    | 0.000                | None           |
| Exp6                 | 5.15    | 6.26            | 0.000                                    | 0.0                                       | 1.11                    | 0.000                | None           |
| Chatham St - North   | 5.02    |                 | 0.000                                    |                                           |                         |                      |                |
| P1_17                | 6.61    | 6.61            | 0.024                                    | 13.6                                      | 0.00                    | 0.000                | Outlet System  |
| P2_17                | 6.77    | 6.78            | 0.015                                    | 3.0                                       | 0.00                    | 0.000                | Outlet System  |
| P1_16                | 6.18    | 6.66            | 0.020                                    | 0.8                                       | 0.45                    | 0.000                | Inlet Capacity |
| P2_16                | 5.98    | 6.56            | 0.010                                    | 0.5                                       | 0.57                    | 0.000                | Inlet Capacity |
| Expit_Track          | 5.05    | 5.63            | 0.064                                    | 3.6                                       | 0.54                    | 0.000                | Inlet Capacity |
| JP at Track Crossing | 4.87    |                 | 0.000                                    |                                           |                         |                      |                |
| Tank_T1-B-N          | 6.56    |                 | 0.014                                    |                                           |                         |                      |                |
| Tank_T1-A-S          | 6.54    |                 | 0.014                                    |                                           |                         |                      |                |
| P4-11                | 6.54    | 6.54            | 0.013                                    | 1.3                                       | 0.00                    | 0.000                | Outlet System  |
| P1-9                 | 6.60    | 6.62            | 0.008                                    | 0.5                                       | 0.00                    | 0.000                | Outlet System  |
| P2-9                 | 6.59    | 6.62            | 0.008                                    | 0.4                                       | 0.01                    | 0.000                | Inlet Capacity |
| P3-9                 | 6.56    | 6.56            | 0.013                                    | 2.1                                       | 0.00                    | 0.000                | Outlet System  |
| T1-C-N               | 6.56    |                 | 0.014                                    |                                           |                         |                      |                |
| TANK-T1-B-S          | 6.54    |                 | 0.014                                    |                                           |                         |                      |                |
| P4-9                 | 6.54    | 6.54            | 0.013                                    | 1.3                                       | 0.00                    | 0.000                | Outlet System  |
| P1_30_               | 6.52    | 6.61            | 0.005                                    | 0.3                                       | 0.08                    | 0.000                | Inlet Capacity |
| P2_30_               | 6.49    | 6.61            | 0.007                                    | 0.5                                       | 0.11                    | 0.000                | Inlet Capacity |
| P3_30_               | 6.41    | 6.61            | 0.005                                    | 0.2                                       | 0.19                    | 0.000                | Inlet Capacity |
| P7_13_               | 6.36    |                 | 0.000                                    |                                           | 0.43                    | 0.000                | None           |
| P8_13_               | 6.28    |                 | 0.009                                    |                                           | 0.49                    | 0.000                | None           |
| P9_13_               | 6.06    |                 | 0.006                                    |                                           | 0.44                    | 0.000                | None           |
| HW5_                 | 5.90    |                 | 0.000                                    |                                           |                         |                      |                |
| BYPASS1              | 6.60    |                 | 0.000                                    |                                           |                         |                      |                |
| P2_15                | 6.36    |                 | 0.000                                    |                                           | 0.12                    |                      | None           |
| P3_15                | 6.25    |                 | 0.000                                    |                                           | 0.23                    |                      | None           |
| P4_15_Pit            | 6.04    |                 | 0.000                                    |                                           | 0.44                    |                      | None           |
| P5_15_               | 5.87    |                 | 0.000                                    |                                           | 0.61                    |                      | None           |
| P7_15_               | 5.66    |                 | 0.000                                    |                                           | 0.97                    |                      | None           |
| Exp1                 | 5.53    |                 | 0.000                                    |                                           | 0.59                    |                      | None           |
| P4_20_               | 5.14    |                 | 0.000                                    |                                           | 0.98                    |                      | None           |
| DARLING_ST_RN        | 4.97    |                 | 0.000                                    |                                           |                         |                      |                |
| P5_3                 | 6.07    |                 | 0.000                                    |                                           | 0.85                    |                      | None           |
| P6_3                 | 5.99    |                 | 0.000                                    |                                           | 0.93                    |                      | None           |
| P7_3                 | 5.87    |                 | 0.000                                    |                                           | 1.05                    |                      | None           |
| Pit21                | 5.82    |                 | 0.000                                    |                                           | 1.04                    |                      | None           |
| P11_3                | 5.71    |                 | 0.000                                    |                                           | 0.92                    |                      | None           |
| BLOCK_D_ROOF         | 6.68    |                 | 0.046                                    |                                           |                         |                      |                |
| P3_4                 | 5.75    |                 | 0.000                                    |                                           | 0.48                    |                      | None           |
| P4_4                 | 5.72    |                 | 0.000                                    |                                           | 0.28                    |                      | None           |
| Exp2                 | 5.63    |                 | 0.000                                    |                                           | 0.39                    |                      | None           |

DRAINS - Minor results

|                          |                           |                            |                              |                      |                        |                      |                                 |
|--------------------------|---------------------------|----------------------------|------------------------------|----------------------|------------------------|----------------------|---------------------------------|
| P3_19                    | 5.83                      |                            | 0.000                        |                      | 0.80                   |                      | None                            |
| P2_19                    | 5.90                      |                            | 0.000                        |                      | 0.73                   |                      | None                            |
| P1_19                    | 5.92                      |                            | 0.000                        |                      | 0.71                   |                      | None                            |
| N402                     | 5.94                      |                            | 0.000                        |                      |                        |                      |                                 |
| N403                     | 5.87                      |                            | 0.000                        |                      |                        |                      |                                 |
| N404                     | 5.81                      |                            | 0.000                        |                      |                        |                      |                                 |
| N405                     | 5.80                      |                            | 0.000                        |                      |                        |                      |                                 |
| N406                     | 5.87                      |                            | 0.000                        |                      |                        |                      |                                 |
| ExP3                     | 5.64                      | 5.78                       | 0.000                        | 0.0                  | 0.14                   | 0.000                | Inlet Capacity                  |
| P2_18                    | 6.02                      |                            | 0.000                        |                      | 0.84                   |                      | None                            |
| P1_18                    | 6.09                      |                            | 0.000                        |                      | 0.77                   |                      | None                            |
| GD1                      | 5.75                      |                            | 0.000                        |                      |                        |                      |                                 |
| N458                     | 5.94                      |                            | 0.000                        |                      |                        |                      |                                 |
| N469                     | 6.40                      |                            | 0.000                        |                      |                        |                      |                                 |
| L1 CONCOURSE<br>(SOUTH)  | 6.69                      |                            | 0.125                        |                      |                        |                      |                                 |
| N480                     | 6.05                      |                            | 0.179                        |                      |                        |                      |                                 |
| P1_7                     | 6.60                      | 6.62                       | 0.008                        | 0.5                  | 0.00                   | 0.000                | Outlet System                   |
| P2_7                     | 6.59                      | 6.62                       | 0.008                        | 0.4                  | 0.01                   | 0.000                | Inlet Capacity                  |
| P3_7                     | 6.56                      | 6.56                       | 0.013                        | 2.1                  | 0.00                   | 0.000                | Outlet System                   |
| T1-D-NTH                 | 6.56                      |                            | 0.014                        |                      |                        |                      |                                 |
| T1-C-STH                 | 6.54                      |                            | 0.014                        |                      |                        |                      |                                 |
| P4_7                     | 6.54                      | 6.54                       | 0.013                        | 1.3                  | 0.00                   | 0.000                | Outlet System                   |
| T1-GOODS_SHED_STH        | 6.01                      |                            | 0.018                        |                      |                        |                      |                                 |
| P1_6                     | 6.00                      |                            | 0.000                        |                      | 0.30                   |                      | None                            |
| T1-GOOD-STORAGE-<br>NTH  | 5.99                      |                            | 0.018                        |                      |                        |                      |                                 |
| P1_8                     | 6.40                      |                            | 0.006                        |                      | 0.20                   | 0.000                | None                            |
| P2_8                     | 6.24                      |                            | 0.006                        |                      | 0.31                   | 0.000                | None                            |
| P3_8                     | 5.77                      | 6.51                       | 0.007                        | 0.4                  | 0.73                   | 0.000                | Inlet Capacity                  |
| T2-EQSHD                 | 6.18                      |                            | 0.022                        |                      |                        |                      |                                 |
| T1-E-STH                 | 6.16                      |                            | 0.014                        |                      |                        |                      |                                 |
| P4_8                     | 5.72                      | 6.51                       | 0.007                        | 0.5                  | 0.78                   | 0.000                | Inlet Capacity                  |
| CHATHAM-RN-1             | 6.20                      |                            | 0.000                        |                      |                        |                      |                                 |
| P1_10                    | 6.60                      | 6.62                       | 0.008                        | 0.5                  | 0.00                   | 0.000                | Outlet System                   |
| P2_10                    | 6.59                      | 6.62                       | 0.008                        | 0.4                  | 0.01                   | 0.000                | Inlet Capacity                  |
| P3_10                    | 6.56                      | 6.56                       | 0.013                        | 2.1                  | 0.00                   | 0.000                | Outlet System                   |
| T1-E-NTH                 | 6.56                      |                            | 0.014                        |                      |                        |                      |                                 |
| T1-F-STH                 | 6.54                      |                            | 0.014                        |                      |                        |                      |                                 |
| P4_10                    | 6.54                      | 6.54                       | 0.013                        | 1.3                  | 0.00                   | 0.000                | Outlet System                   |
| CHATHAM-RN-2             | 6.30                      |                            | 0.000                        |                      |                        |                      |                                 |
| GD3                      | 6.01                      |                            | 0.002                        |                      | 0.43                   | 0.000                | None                            |
| P1_19_                   | 6.41                      | 6.51                       | 0.005                        | 0.3                  | 0.09                   | 0.000                | Inlet Capacity                  |
| P6_13_                   | 6.39                      |                            | 0.005                        |                      | 0.53                   |                      | None                            |
| P2_28_ Pit               | 6.52                      |                            | 0.000                        |                      | 0.00                   |                      | Outlet System                   |
| P3_28_                   | 6.52                      |                            | 0.005                        |                      | 0.08                   | 0.000                | None                            |
| P4_28_                   | 6.53                      |                            | 0.014                        |                      | 0.25                   | 0.000                | None                            |
| P5_13_                   | 6.43                      |                            | 0.000                        |                      | 0.52                   | 0.000                | None                            |
| P3_13_                   | 6.49                      |                            | 0.000                        |                      | 0.22                   | 0.000                | None                            |
| P4_13_                   | 6.44                      |                            | 0.005                        |                      | 0.51                   | 0.000                | None                            |
| P1_28_ Pit               | 6.53                      |                            | 0.000                        |                      | 0.00                   |                      | Outlet System                   |
| P2_13_                   | 6.55                      |                            | 0.000                        |                      | 0.24                   |                      | None                            |
| P3-3                     | 6.26                      |                            | 0.000                        |                      | 0.66                   |                      | None                            |
| P1_15                    | 6.39                      |                            | 0.000                        |                      | 0.09                   |                      | None                            |
| HW6_                     | 5.90                      |                            | 0.047                        |                      | 0.80                   | 0.000                | None                            |
| HW7_                     | 5.81                      |                            | 0.006                        |                      |                        |                      |                                 |
| P2_20_                   | 5.97                      |                            | 0.000                        |                      | 0.38                   |                      | None                            |
| P3_20_                   | 5.54                      |                            | 0.000                        |                      | 0.91                   |                      | None                            |
| N391937                  | 5.98                      |                            | 0.000                        |                      |                        |                      |                                 |
| HW4                      | 5.81                      |                            | 0.020                        |                      | 0.56                   | 0.000                | None                            |
| N197                     | 5.85                      |                            | 0.000                        |                      |                        |                      |                                 |
| P3_17                    | 5.77                      |                            | 0.000                        |                      | 1.03                   |                      | None                            |
| GPT-4200                 | 5.74                      |                            | 0.000                        |                      | 1.06                   |                      | None                            |
| SAND_FILTER_STH PIT      | 5.71                      |                            | 0.000                        |                      | 1.09                   | 0.000                | None                            |
| SUB-CATCHMENT<br>DETAILS |                           |                            |                              |                      |                        |                      |                                 |
| Name                     | Max<br>Flow Q<br>(cu.m/s) | Paved<br>Max Q<br>(cu.m/s) | Grassed<br>Max Q<br>(cu.m/s) | Paved<br>Tc<br>(min) | Grassed<br>Tc<br>(min) | Supp.<br>Tc<br>(min) | Due to Storm                    |
| CAT_P1-11                | 0.006                     | 0.005                      | 0.001                        | 5.00                 | 5.00                   | 0.00                 | 10% AEP, 15 min burst, Storm 10 |

## DRAINS - Minor results

|                   |       |       |       |      |      |      |                                 |
|-------------------|-------|-------|-------|------|------|------|---------------------------------|
| CAT_P2-11         | 0.006 | 0.005 | 0.001 | 5.00 | 5.00 | 0.00 | 10% AEP, 15 min burst, Storm 10 |
| CAT_P3-11         | 0.009 | 0.000 | 0.009 | 5.00 | 5.00 | 0.00 | 10% AEP, 15 min burst, Storm 5  |
| CAT P3_1          | 0.016 | 0.016 | 0.000 | 5.00 | 5.00 | 2.00 | 10% AEP, 5 min burst, Storm 1   |
| CAT P4_1          | 0.010 | 0.010 | 0.000 | 5.00 | 5.00 | 2.00 | 10% AEP, 5 min burst, Storm 1   |
| CAT P5_1          | 0.021 | 0.021 | 0.000 | 5.00 | 5.00 | 2.00 | 10% AEP, 5 min burst, Storm 1   |
| CAT P6_1          | 0.016 | 0.016 | 0.000 | 5.00 | 5.00 | 2.00 | 10% AEP, 5 min burst, Storm 1   |
| CAT P2_1          | 0.013 | 0.013 | 0.000 | 5.00 | 5.00 | 2.00 | 10% AEP, 5 min burst, Storm 1   |
| CAT P1_1 + GD4    | 0.002 | 0.002 | 0.000 | 5.00 | 5.00 | 2.00 | 10% AEP, 5 min burst, Storm 1   |
| CAT P2_2          | 0.003 | 0.003 | 0.000 | 5.00 | 5.00 | 2.00 | 10% AEP, 5 min burst, Storm 1   |
| CAT P3_2          | 0.003 | 0.003 | 0.000 | 5.00 | 5.00 | 2.00 | 10% AEP, 5 min burst, Storm 1   |
| CAT_GD2_NORTH     | 0.009 | 0.009 | 0.000 | 5.00 | 5.00 | 2.00 | 10% AEP, 5 min burst, Storm 1   |
| Cat-P1_17         | 0.019 | 0.019 | 0.000 | 5.00 | 5.00 | 2.00 | 10% AEP, 5 min burst, Storm 1   |
| Cat_P2_17         | 0.012 | 0.012 | 0.000 | 5.00 | 5.00 | 2.00 | 10% AEP, 5 min burst, Storm 1   |
| CAT P1_16         | 0.014 | 0.000 | 0.014 | 5.00 | 5.00 | 2.00 | 10% AEP, 15 min burst, Storm 5  |
| CAT P2_16         | 0.007 | 0.000 | 0.007 | 5.00 | 5.00 | 2.00 | 10% AEP, 15 min burst, Storm 5  |
| CAT ExPit_Track   | 0.045 | 0.000 | 0.045 | 5.00 | 5.00 | 2.00 | 10% AEP, 15 min burst, Storm 5  |
| CAT-T1-B-N        | 0.012 | 0.012 | 0.000 | 5.00 | 0.00 | 0.00 | 10% AEP, 5 min burst, Storm 1   |
| CAT-Tank_T1-A-S   | 0.012 | 0.012 | 0.000 | 5.00 | 0.00 | 0.00 | 10% AEP, 5 min burst, Storm 1   |
| CAT_P4-11         | 0.009 | 0.000 | 0.009 | 5.00 | 5.00 | 0.00 | 10% AEP, 15 min burst, Storm 5  |
| CAT_P1-9          | 0.006 | 0.005 | 0.001 | 5.00 | 5.00 | 0.00 | 10% AEP, 15 min burst, Storm 10 |
| CAT_P2-9          | 0.006 | 0.005 | 0.001 | 5.00 | 5.00 | 0.00 | 10% AEP, 15 min burst, Storm 10 |
| CAT_P3-9          | 0.009 | 0.000 | 0.009 | 5.00 | 5.00 | 0.00 | 10% AEP, 15 min burst, Storm 5  |
| CAT-T1-C-N        | 0.012 | 0.012 | 0.000 | 5.00 | 0.00 | 0.00 | 10% AEP, 5 min burst, Storm 1   |
| CAT_TANK-T1-B-S   | 0.012 | 0.012 | 0.000 | 5.00 | 0.00 | 0.00 | 10% AEP, 5 min burst, Storm 1   |
| CAT_P4-9          | 0.009 | 0.000 | 0.009 | 5.00 | 5.00 | 0.00 | 10% AEP, 15 min burst, Storm 5  |
| CAT P1_30_        | 0.004 | 0.000 | 0.004 | 5.00 | 5.00 | 2.00 | 10% AEP, 15 min burst, Storm 5  |
| CAT P2_30_        | 0.005 | 0.000 | 0.005 | 5.00 | 5.00 | 2.00 | 10% AEP, 15 min burst, Storm 5  |
| CAT P3_30_        | 0.004 | 0.000 | 0.004 | 5.00 | 5.00 | 2.00 | 10% AEP, 15 min burst, Storm 5  |
| CAT P8_13_        | 0.006 | 0.000 | 0.006 | 5.00 | 5.00 | 2.00 | 10% AEP, 15 min burst, Storm 5  |
| CAT P9_13_        | 0.004 | 0.000 | 0.004 | 5.00 | 5.00 | 2.00 | 10% AEP, 15 min burst, Storm 5  |
| CAT P2_15 BASIN   | 0.009 | 0.008 | 0.001 | 5.00 | 5.00 | 2.00 | 10% AEP, 5 min burst, Storm 1   |
| CAT P4_3 BASIN    | 0.009 | 0.008 | 0.001 | 5.00 | 5.00 | 2.00 | 10% AEP, 5 min burst, Storm 1   |
| CAT P3_15 BASIN   | 0.008 | 0.007 | 0.001 | 5.00 | 5.00 | 2.00 | 10% AEP, 15 min burst, Storm 10 |
| CAT P7_3 BASIN    | 0.007 | 0.006 | 0.001 | 5.00 | 5.00 | 2.00 | 10% AEP, 15 min burst, Storm 10 |
| CAT P9_3 BASIN    | 0.011 | 0.007 | 0.004 | 5.00 | 5.00 | 2.00 | 10% AEP, 15 min burst, Storm 10 |
| CAT P6_15_ BASIN  | 0.008 | 0.005 | 0.003 | 5.00 | 5.00 | 2.00 | 10% AEP, 15 min burst, Storm 10 |
| CAT BLOCK_D ROOF  | 0.038 | 0.038 | 0.000 | 5.00 | 5.00 | 2.00 | 10% AEP, 5 min burst, Storm 1   |
| CAT BRB1          | 0.031 | 0.020 | 0.013 | 5.00 | 5.00 | 2.00 | 10% AEP, 15 min burst, Storm 3  |
| CAT BRB2          | 0.019 | 0.000 | 0.019 | 5.00 | 5.00 | 2.00 | 10% AEP, 15 min burst, Storm 5  |
| CAT P1_3 BASIN    | 0.006 | 0.005 | 0.001 | 5.00 | 5.00 | 2.00 | 10% AEP, 15 min burst, Storm 10 |
| CAT P3_19 BASIN   | 0.006 | 0.005 | 0.001 | 5.00 | 5.00 | 2.00 | 10% AEP, 15 min burst, Storm 10 |
| CAT P2_19 BASIN   | 0.006 | 0.005 | 0.001 | 5.00 | 5.00 | 2.00 | 10% AEP, 15 min burst, Storm 10 |
| CAT P1_19 BASIN   | 0.006 | 0.006 | 0.000 | 5.00 | 5.00 | 2.00 | 10% AEP, 5 min burst, Storm 1   |
| CAT P2_18 BASIN   | 0.008 | 0.007 | 0.001 | 5.00 | 5.00 | 2.00 | 10% AEP, 5 min burst, Storm 1   |
| CAT P1_18 BASIN   | 0.012 | 0.011 | 0.001 | 5.00 | 5.00 | 2.00 | 10% AEP, 5 min burst, Storm 1   |
| CAT L1 CONCOURSE  | 0.101 | 0.101 | 0.000 | 5.00 | 5.00 | 2.00 | 10% AEP, 5 min burst, Storm 1   |
| CAT P1_7          | 0.006 | 0.005 | 0.001 | 5.00 | 5.00 | 0.00 | 10% AEP, 15 min burst, Storm 10 |
| CAT P2_7          | 0.006 | 0.005 | 0.001 | 5.00 | 5.00 | 0.00 | 10% AEP, 15 min burst, Storm 10 |
| CAT P3_7          | 0.009 | 0.000 | 0.009 | 5.00 | 5.00 | 0.00 | 10% AEP, 15 min burst, Storm 5  |
| CAT T1-D-NTH      | 0.012 | 0.012 | 0.000 | 5.00 | 0.00 | 0.00 | 10% AEP, 5 min burst, Storm 1   |
| CAT T1-C-STH      | 0.012 | 0.012 | 0.000 | 5.00 | 0.00 | 0.00 | 10% AEP, 5 min burst, Storm 1   |
| CAT P4_7          | 0.009 | 0.000 | 0.009 | 5.00 | 5.00 | 0.00 | 10% AEP, 15 min burst, Storm 5  |
| CAT GOOD SHED STH | 0.015 | 0.015 | 0.000 | 5.00 | 5.00 | 2.00 | 10% AEP, 5 min burst, Storm 1   |
| CAT GOODS SHED    |       |       |       |      |      |      |                                 |
| NTH               | 0.015 | 0.015 | 0.000 | 5.00 | 5.00 | 2.00 | 10% AEP, 5 min burst, Storm 1   |
| CAT P1_8          | 0.005 | 0.004 | 0.001 | 5.00 | 5.00 | 0.00 | 10% AEP, 15 min burst, Storm 10 |
| CAT P2_8          | 0.004 | 0.003 | 0.001 | 5.00 | 5.00 | 0.00 | 10% AEP, 15 min burst, Storm 10 |
| CAT P3_8          | 0.005 | 0.000 | 0.005 | 5.00 | 5.00 | 0.00 | 10% AEP, 15 min burst, Storm 5  |
| CAT EQPTSHD       | 0.018 | 0.018 | 0.000 | 5.00 | 5.00 | 2.00 | 10% AEP, 5 min burst, Storm 1   |
| CAT T1-E-STH      | 0.012 | 0.012 | 0.000 | 5.00 | 0.00 | 0.00 | 10% AEP, 5 min burst, Storm 1   |
| CAT P4_8          | 0.005 | 0.000 | 0.005 | 5.00 | 5.00 | 0.00 | 10% AEP, 15 min burst, Storm 5  |
| CAT P1_10         | 0.006 | 0.005 | 0.001 | 5.00 | 5.00 | 0.00 | 10% AEP, 15 min burst, Storm 10 |
| CAT P2_10         | 0.006 | 0.005 | 0.001 | 5.00 | 5.00 | 0.00 | 10% AEP, 15 min burst, Storm 10 |
| Cat619            | 0.009 | 0.000 | 0.009 | 5.00 | 5.00 | 0.00 | 10% AEP, 15 min burst, Storm 5  |
| CAT T1-E-NTH      | 0.012 | 0.012 | 0.000 | 5.00 | 0.00 | 0.00 | 10% AEP, 5 min burst, Storm 1   |
| CAT T1-F-STH      | 0.012 | 0.012 | 0.000 | 5.00 | 0.00 | 0.00 | 10% AEP, 5 min burst, Storm 1   |
| CAT P4_10         | 0.009 | 0.000 | 0.009 | 5.00 | 5.00 | 0.00 | 10% AEP, 15 min burst, Storm 5  |
| CAT GD3           | 0.002 | 0.002 | 0.000 | 5.00 | 5.00 | 2.00 | 10% AEP, 5 min burst, Storm 1   |
| Cat P4_21         | 0.004 | 0.004 | 0.000 | 5.00 | 5.00 | 2.00 | 10% AEP, 5 min burst, Storm 1   |
| Cat P6_13_        | 0.004 | 0.004 | 0.000 | 5.00 | 5.00 | 2.00 | 10% AEP, 5 min burst, Storm 1   |
| Cat P2_28_ Basin  | 0.004 | 0.003 | 0.001 | 5.00 | 5.00 | 2.00 | 10% AEP, 15 min burst, Storm 10 |
| Cat P3_28_        | 0.004 | 0.004 | 0.000 | 5.00 | 5.00 | 2.00 | 10% AEP, 5 min burst, Storm 1   |
| Cat P6_22         | 0.011 | 0.011 | 0.000 | 5.00 | 5.00 | 2.00 | 10% AEP, 5 min burst, Storm 1   |

DRAINS - Minor results

|                 |       |       |       |      |      |      |                                 |
|-----------------|-------|-------|-------|------|------|------|---------------------------------|
| Cat P1_31_Basin | 0.004 | 0.003 | 0.001 | 5.00 | 5.00 | 2.00 | 10% AEP, 15 min burst, Storm 10 |
| Cat P4_13_      | 0.004 | 0.004 | 0.000 | 5.00 | 5.00 | 2.00 | 10% AEP, 5 min burst, Storm 1   |
| Cat P1_28_Basin | 0.009 | 0.008 | 0.001 | 5.00 | 5.00 | 2.00 | 10% AEP, 5 min burst, Storm 1   |
| Cat P1_13_Basin | 0.009 | 0.008 | 0.001 | 5.00 | 5.00 | 2.00 | 10% AEP, 5 min burst, Storm 1   |
| CAT P2_3 BASIN  | 0.009 | 0.008 | 0.001 | 5.00 | 5.00 | 2.00 | 10% AEP, 5 min burst, Storm 1   |
| CAT P1_15 BASIN | 0.009 | 0.008 | 0.001 | 5.00 | 5.00 | 2.00 | 10% AEP, 5 min burst, Storm 1   |
| Cat178542       | 0.004 | 0.004 | 0.000 | 5.00 | 5.00 | 2.00 | 10% AEP, 5 min burst, Storm 1   |
| Cat P4_15_Basin | 0.005 | 0.004 | 0.001 | 5.00 | 5.00 | 2.00 | 10% AEP, 15 min burst, Storm 10 |
| Cat P1_23_Basin | 0.004 | 0.004 | 0.000 | 5.00 | 5.00 | 2.00 | 10% AEP, 5 min burst, Storm 1   |
| Cat P1_22_      | 0.010 | 0.008 | 0.002 | 5.00 | 5.00 | 2.00 | 10% AEP, 15 min burst, Storm 10 |
| Cat P1_20_Basin | 0.024 | 0.002 | 0.023 | 5.00 | 5.00 | 2.00 | 10% AEP, 15 min burst, Storm 5  |
| Cat P1_21_Basin | 0.004 | 0.004 | 0.000 | 5.00 | 5.00 | 2.00 | 10% AEP, 5 min burst, Storm 1   |

PIPE DETAILS

| Name                   | Max Q<br>(cu.m/s) | Max V<br>(m/s) | Max U/S<br>HGL (m) | Max D/S<br>HGL (m) | Due to Storm                    |
|------------------------|-------------------|----------------|--------------------|--------------------|---------------------------------|
| P1_11 - P2_11          | 0.006             | 0.30           | 6.590              | 6.585              | 10% AEP, 10 min burst, Storm 10 |
| P2-11_P3-11            | 0.011             | 0.58           | 6.568              | 6.556              | 10% AEP, 15 min burst, Storm 6  |
| TRENCH-11_1            | 0.029             | 1.56           | 6.547              | 6.536              | 10% AEP, 15 min burst, Storm 9  |
| P3_1 - P4_1            | 0.010             | 1.18           | 6.264              | 6.219              | 10% AEP, 10 min burst, Storm 7  |
| P4_1 - P5_1            | 0.015             | 0.34           | 6.198              | 6.193              | 10% AEP, 10 min burst, Storm 3  |
| P5_1 - P6_1            | 0.034             | 0.75           | 6.072              | 6.047              | 10% AEP, 10 min burst, Storm 5  |
| P6_1 - P7_1            | 0.049             | 0.68           | 6.021              | 6.007              | 10% AEP, 5 min burst, Storm 1   |
| P7_1 - GPT_BRB3        | 0.051             | 1.11           | 5.962              | 5.959              | 10% AEP, 5 min burst, Storm 1   |
| GPT_BRB3 - BRB3        | 0.052             | 1.12           | 5.942              | 5.940              | 10% AEP, 5 min burst, Storm 1   |
| P2_1 - P1_1 + GD4      | 0.012             | 0.63           | 6.013              | 5.959              | 10% AEP, 5 min burst, Storm 1   |
| P1_1 - P2_6            | 0.014             | 0.74           | 5.906              | 5.845              | 10% AEP, 5 min burst, Storm 1   |
| P2_6 - Exp5            | 0.042             | 1.64           | 5.804              | 5.731              | 10% AEP, 5 min burst, Storm 1   |
| Exp5 - Exp4            | 0.040             | 0.72           | 5.292              | 5.195              | 10% AEP, 5 min burst, Storm 1   |
| Pipe1059               | 0.045             | 1.06           | 5.195              | 5.112              | 10% AEP, 20 min burst, Storm 3  |
| Pipe17                 | 0.003             | 0.43           | 6.062              | 5.982              | 10% AEP, 5 min burst, Storm 1   |
| P3_2 - HW2             | 0.006             | 0.71           | 5.940              | 5.891              | 10% AEP, 15 min burst, Storm 10 |
| GD2 - SAND FILTER      | 0.009             | 1.14           | 6.014              | 5.925              | 10% AEP, 5 min burst, Storm 1   |
| SAND_FILTER_INLET2     | 0.009             | 1.22           | 5.714              | 5.681              | 10% AEP, 5 min burst, Storm 1   |
| SAND FILTER - P4_17    | 0.013             | 1.08           | 5.336              | 5.298              | 10% AEP, 15 min burst, Storm 10 |
| P4_17 - P5_27          | 0.013             | 1.25           | 5.298              | 5.245              | 10% AEP, 10 min burst, Storm 1  |
| P5_17 - Exp6           | 0.013             | 0.80           | 5.220              | 5.147              | 10% AEP, 15 min burst, Storm 6  |
| Exp6 - Chatham North   | 0.013             | 0.93           | 5.147              | 5.018              | 10% AEP, 15 min burst, Storm 5  |
| P1_17 - P2_17          | 0.011             | 0.25           | 6.613              | 6.770              | 10% AEP, 5 min burst, Storm 1   |
| P1_16 - P2_16          | 0.013             | 1.00           | 6.136              | 5.984              | 10% AEP, 15 min burst, Storm 5  |
| Pipe69                 | 0.020             | 2.42           | 5.958              | 5.360              | 10% AEP, 15 min burst, Storm 5  |
| Pipe at Track Crossing | 0.059             | 1.42           | 4.936              | 4.872              | 10% AEP, 15 min burst, Storm 4  |
| T1-B-N_P3-11           | 0.012             | 0.63           | 6.558              | 6.556              | 10% AEP, 5 min burst, Storm 1   |
| T1-A-S_P4-9            | 0.012             | 0.63           | 6.538              | 6.536              | 10% AEP, 5 min burst, Storm 1   |
| TRENCH-11_2            | 0.019             | 1.02           | 6.536              | 6.536              | 10% AEP, 15 min burst, Storm 5  |
| P1-9_P2-9              | 0.006             | 0.30           | 6.594              | 6.591              | 10% AEP, 10 min burst, Storm 10 |
| P2-9_P3-9              | 0.011             | 0.59           | 6.571              | 6.556              | 10% AEP, 10 min burst, Storm 10 |
| P196                   | 0.029             | 1.56           | 6.547              | 6.536              | 10% AEP, 15 min burst, Storm 9  |
| T1-C-N_P3-9            | 0.012             | 0.63           | 6.558              | 6.556              | 10% AEP, 5 min burst, Storm 1   |
| TANK-T1-B-S_P4-9       | 0.012             | 0.63           | 6.538              | 6.536              | 10% AEP, 5 min burst, Storm 1   |
| P198                   | 0.019             | 1.02           | 6.536              | 6.536              | 10% AEP, 15 min burst, Storm 5  |
| P1_30_ - P2_30_        | 0.004             | 0.21           | 6.503              | 6.491              | 10% AEP, 15 min burst, Storm 10 |
| P2_30_ - P3_30_        | 0.008             | 0.44           | 6.444              | 6.410              | 10% AEP, 15 min burst, Storm 5  |
| P3_30_ - P7_13_        | 0.011             | 0.60           | 6.383              | 6.356              | 10% AEP, 15 min burst, Storm 5  |
| P7_13_ - P8_13_        | 0.044             | 0.96           | 6.301              | 6.278              | 10% AEP, 15 min burst, Storm 6  |
| P8_13_ - P9_13_        | 0.050             | 1.08           | 6.207              | 6.056              | 10% AEP, 15 min burst, Storm 6  |
| P7_13 - HW5_           | 0.054             | 1.39           | 6.038              | 5.921              | 10% AEP, 15 min burst, Storm 6  |
| P2_15 BASIN OUTLET     | 0.007             | 0.84           | 6.382              | 6.365              | 10% AEP, 15 min burst, Storm 9  |
| P2_15 - P3_15          | 0.014             | 0.73           | 6.327              | 6.253              | 10% AEP, 15 min burst, Storm 3  |
| P278037                | 0.019             | 1.04           | 6.185              | 6.039              | 10% AEP, 10 min burst, Storm 3  |
| P4_15_ - P5_15_        | 0.023             | 1.25           | 5.991              | 5.866              | 10% AEP, 15 min burst, Storm 6  |
| P5_15_ - P7_15_        | 0.023             | 1.25           | 5.733              | 5.659              | 10% AEP, 15 min burst, Storm 6  |
| P5_15 - Exp1           | 0.093             | 1.29           | 5.550              | 5.534              | 10% AEP, 15 min burst, Storm 3  |
| Exp1 - P1_20           | 0.144             | 1.30           | 5.400              | 5.135              | 10% AEP, 20 min burst, Storm 3  |
| P1_20 -                |                   |                |                    |                    |                                 |
| DARLING_ST_RN          | 0.169             | 1.78           | 5.062              | 4.970              | 10% AEP, 20 min burst, Storm 3  |
| P4_3 BASIN OUTLET      | 0.008             | 0.95           | 6.160              | 6.074              | 10% AEP, 15 min burst, Storm 9  |
| P5_3 - P6_3            | 0.016             | 1.02           | 6.074              | 5.986              | 10% AEP, 15 min burst, Storm 9  |
| P6_3 - P8_3            | 0.016             | 1.00           | 5.986              | 5.870              | 10% AEP, 15 min burst, Storm 9  |
| P8_3 - P10_3           | 0.022             | 0.83           | 5.870              | 5.818              | 10% AEP, 15 min burst, Storm 3  |
| P10_3 - P11_3          | 0.046             | 1.15           | 5.775              | 5.708              | 10% AEP, 15 min burst, Storm 3  |
| P11_3 - P5_15          | 0.068             | 1.11           | 5.677              | 5.659              | 10% AEP, 15 min burst, Storm 3  |



## DRAINS - Minor results

|                         |       |      |       |       |                                 |
|-------------------------|-------|------|-------|-------|---------------------------------|
| P3_15 BASIN OUTLET      | 0.007 | 0.84 | 6.285 | 6.253 | 10% AEP, 15 min burst, Storm 3  |
| P7_3 BASIN OUTLET       | 0.006 | 0.71 | 5.982 | 5.870 | 10% AEP, 15 min burst, Storm 3  |
| P9_3 BASIN OUTLET       | 0.008 | 0.96 | 5.937 | 5.818 | 10% AEP, 15 min burst, Storm 4  |
| P4_15 BASIN OUTLET      | 0.000 | 0.00 | 5.866 | 5.866 | 10% AEP, 5 min burst, Storm 1   |
| block d roof - brb1     | 0.038 | 2.27 | 6.679 | 6.202 | 10% AEP, 5 min burst, Storm 1   |
| BRB1 - BRB2             | 0.010 | 1.19 | 6.071 | 5.890 | 10% AEP, 5 min burst, Storm 1   |
| P2_4 - P3_4             | 0.097 | 0.83 | 5.758 | 5.749 | 10% AEP, 20 min burst, Storm 10 |
| P3_4 - P4_4             | 0.097 | 0.88 | 5.720 | 5.716 | 10% AEP, 20 min burst, Storm 10 |
| P4_4 - ExP2             | 0.098 | 0.88 | 5.682 | 5.632 | 10% AEP, 20 min burst, Storm 3  |
| ExP2 - ExP1             | 0.098 | 0.89 | 5.619 | 5.534 | 10% AEP, 20 min burst, Storm 3  |
| P11_3 BASIN OUTLET      | 0.006 | 0.65 | 5.811 | 5.708 | 10% AEP, 15 min burst, Storm 3  |
| P3_19 BASIN OUTLET      | 0.005 | 0.63 | 5.914 | 5.827 | 10% AEP, 15 min burst, Storm 9  |
| P3_19 - P11_3           | 0.017 | 0.89 | 5.787 | 5.708 | 10% AEP, 15 min burst, Storm 9  |
| P2_19 BASIN OUTLET      | 0.005 | 0.63 | 5.980 | 5.903 | 10% AEP, 15 min burst, Storm 9  |
| P2_19 - P3_19           | 0.011 | 0.60 | 5.870 | 5.827 | 10% AEP, 15 min burst, Storm 9  |
| P1_19 BASIN OUTLET      | 0.006 | 0.67 | 5.994 | 5.918 | 10% AEP, 15 min burst, Storm 9  |
| P1_19 - P2_19           | 0.006 | 0.31 | 5.914 | 5.903 | 10% AEP, 15 min burst, Storm 9  |
| ExP3 - ExP2             | 0.003 | 0.02 | 5.632 | 5.632 | 10% AEP, 15 min burst, Storm 6  |
| P2_18 BASIN OUTLET      | 0.007 | 0.85 | 6.110 | 6.018 | 10% AEP, 15 min burst, Storm 3  |
| P2_18 - P10_3           | 0.018 | 0.98 | 5.942 | 5.818 | 10% AEP, 15 min burst, Storm 9  |
| P1_18 BASIN OUTLET      | 0.011 | 1.25 | 6.176 | 6.092 | 10% AEP, 15 min burst, Storm 9  |
| P1_19 - P2_18           | 0.011 | 0.58 | 6.059 | 6.018 | 10% AEP, 15 min burst, Storm 9  |
| GD1 - P3_4              | 0.000 | 0.00 | 5.746 | 5.749 | 10% AEP, 15 min burst, Storm 2  |
| CONCOURSE - BRB1        | 0.102 | 3.63 | 6.692 | 6.202 | 10% AEP, 5 min burst, Storm 1   |
| P1_7 - P2_7             | 0.006 | 0.30 | 6.594 | 6.591 | 10% AEP, 10 min burst, Storm 10 |
| P2_7 - P3_7             | 0.011 | 0.59 | 6.571 | 6.556 | 10% AEP, 10 min burst, Storm 10 |
| P3_7 - TRENCH7          | 0.029 | 1.56 | 6.547 | 6.536 | 10% AEP, 15 min burst, Storm 9  |
| T1-D-NTH OVERFLOW       | 0.012 | 0.63 | 6.558 | 6.556 | 10% AEP, 5 min burst, Storm 1   |
| T1-C-STH - P4_7         | 0.012 | 0.63 | 6.538 | 6.536 | 10% AEP, 5 min burst, Storm 1   |
| P4_7 = TRENCH7          | 0.019 | 1.02 | 6.536 | 6.536 | 10% AEP, 15 min burst, Storm 5  |
| BRB3 - ExP4             | 0.014 | 1.56 | 5.483 | 5.195 | 10% AEP, 25 min burst, Storm 5  |
| T1 - P1_6               | 0.014 | 1.02 | 6.009 | 6.004 | 10% AEP, 5 min burst, Storm 1   |
| P1_6 - P2_6             | 0.015 | 1.02 | 5.978 | 5.845 | 10% AEP, 5 min burst, Storm 1   |
| T1 - P2_6               | 0.015 | 1.24 | 5.994 | 5.981 | 10% AEP, 5 min burst, Storm 1   |
| P1_8 - P2_8             | 0.005 | 0.67 | 6.363 | 6.242 | 10% AEP, 15 min burst, Storm 10 |
| P2_8 - TRENCH8          | 0.009 | 1.09 | 6.226 | 6.037 | 10% AEP, 15 min burst, Storm 10 |
| P3_8 - TRENCH8          | 0.029 | 1.54 | 5.728 | 5.715 | 10% AEP, 15 min burst, Storm 4  |
| T2-EQPSHD - P3_8        | 0.018 | 1.72 | 6.176 | 6.135 | 10% AEP, 5 min burst, Storm 1   |
| T1-E-STH - P4_8         | 0.012 | 1.51 | 6.157 | 6.117 | 10% AEP, 5 min burst, Storm 1   |
| P4_8 - TRENCH8          | 0.016 | 0.84 | 5.715 | 5.715 | 10% AEP, 15 min burst, Storm 4  |
| P1_10 - P2_10           | 0.006 | 0.30 | 6.594 | 6.591 | 10% AEP, 10 min burst, Storm 10 |
| P2_10 - P3_10           | 0.011 | 0.59 | 6.571 | 6.556 | 10% AEP, 10 min burst, Storm 10 |
| P3_10 - TRENCH10        | 0.029 | 1.56 | 6.547 | 6.536 | 10% AEP, 15 min burst, Storm 9  |
| P1008                   | 0.012 | 0.63 | 6.558 | 6.556 | 10% AEP, 5 min burst, Storm 1   |
| T1-F-STH - P4_10        | 0.012 | 0.63 | 6.538 | 6.536 | 10% AEP, 5 min burst, Storm 1   |
| P4_10 - TRENCH10        | 0.019 | 1.02 | 6.536 | 6.536 | 10% AEP, 15 min burst, Storm 5  |
| GD3 - P7_1              | 0.002 | 0.12 | 6.007 | 6.007 | 10% AEP, 5 min burst, Storm 1   |
| P4_21 - P5_22           | 0.004 | 0.20 | 6.399 | 6.389 | 10% AEP, 10 min burst, Storm 6  |
| P5_22 - P5_13           | 0.035 | 0.76 | 6.362 | 6.356 | 10% AEP, 10 min burst, Storm 5  |
| P2_28_Basin - P2_28_Pit | 0.007 | 0.84 | 6.525 | 6.523 | 10% AEP, 15 min burst, Storm 7  |
| P2_28 - P3_28           | 0.011 | 0.58 | 6.523 | 6.523 | 10% AEP, 10 min burst, Storm 3  |
| P3_28 - P4_28           | 0.011 | 0.58 | 6.523 | 6.529 | 10% AEP, 10 min burst, Storm 3  |
| P4_28 - P5_13           | 0.017 | 0.90 | 6.464 | 6.425 | 10% AEP, 15 min burst, Storm 1  |
| P5_13 - P6_30           | 0.028 | 0.61 | 6.399 | 6.389 | 10% AEP, 10 min burst, Storm 5  |
| P1_31_Basin - P3_13     | 0.003 | 0.42 | 6.524 | 6.485 | 10% AEP, 15 min burst, Storm 5  |
| P3_13 - P4_13           | 0.011 | 0.61 | 6.463 | 6.443 | 10% AEP, 15 min burst, Storm 5  |
| P4_13 - P5_13           | 0.015 | 0.33 | 6.434 | 6.425 | 10% AEP, 15 min burst, Storm 3  |
| P1_28 Basin - P1_28 Pit | 0.006 | 0.70 | 6.529 | 6.528 | 10% AEP, 15 min burst, Storm 9  |
| P1_28 - P2_28           | 0.007 | 0.36 | 6.526 | 6.523 | 10% AEP, 10 min burst, Storm 3  |
| P1_13_Basin - P2_13     | 0.008 | 0.43 | 6.569 | 6.546 | 10% AEP, 15 min burst, Storm 3  |
| P2_13 - P3_13           | 0.008 | 0.43 | 6.521 | 6.485 | 10% AEP, 15 min burst, Storm 10 |
| P2_3 BASIN OUTLET       | 0.008 | 1.01 | 6.318 | 6.275 | 10% AEP, 15 min burst, Storm 9  |
| P3_3 - P5_3             | 0.008 | 0.61 | 6.257 | 6.074 | 10% AEP, 15 min burst, Storm 9  |
| P1_15 BASIN OUTLET      | 0.008 | 0.87 | 6.401 | 6.386 | 10% AEP, 10 min burst, Storm 7  |
| P1_15 - P2_15           | 0.008 | 0.41 | 6.380 | 6.365 | 10% AEP, 10 min burst, Storm 3  |
| Track Access Culvert    | 0.024 | 0.96 | 5.858 | 5.811 | 10% AEP, 25 min burst, Storm 6  |
| Basin - P4_15           | 0.004 | 0.50 | 6.098 | 6.039 | 10% AEP, 15 min burst, Storm 5  |
| P1_23 Basin - P2_20     | 0.004 | 0.20 | 5.982 | 5.967 | 10% AEP, 15 min burst, Storm 4  |
| P2_20 - P3_20           | 0.025 | 1.34 | 5.760 | 5.537 | 10% AEP, 15 min burst, Storm 3  |
| P3_20 - P4_20           | 0.029 | 1.61 | 5.434 | 5.389 | 10% AEP, 15 min burst, Storm 3  |
| P6_20 Basin - P3_20     | 0.009 | 0.48 | 6.006 | 5.967 | 10% AEP, 15 min burst, Storm 9  |

DRAINS - Minor results

|                      |       |      |       |       |                                 |
|----------------------|-------|------|-------|-------|---------------------------------|
| P1_20_basin - P2_20_ | 0.016 | 0.84 | 6.130 | 5.967 | 10% AEP, 10 min burst, Storm 7  |
| P1_21_Basin - P3_20_ | 0.004 | 0.50 | 5.741 | 5.537 | 10% AEP, 15 min burst, Storm 10 |
| Burried Pipe         | 0.017 | 1.48 | 5.749 | 5.361 | 10% AEP, 25 min burst, Storm 6  |
| P2_17 - P3_17        | 0.005 | 0.82 | 5.847 | 5.773 | 10% AEP, 15 min burst, Storm 10 |
| P3_17 - GPT          | 0.005 | 0.58 | 5.773 | 5.739 | 10% AEP, 15 min burst, Storm 10 |
| GPT - SAND FILTER    | 0.005 | 0.78 | 5.739 | 5.708 | 10% AEP, 15 min burst, Storm 8  |
| SAND_TANK_INLET1     | 0.005 | 1.08 | 5.708 | 5.669 | 10% AEP, 15 min burst, Storm 8  |

CHANNEL DETAILS

| Name | Max Q<br>(cu.m/s) | Max V<br>(m/s) | Due to Storm |
|------|-------------------|----------------|--------------|
|------|-------------------|----------------|--------------|

OVERFLOW ROUTE  
DETAILS

| Name                           | Max Q U/S | Max Q D/S | Safe Q | Max D | Max DxV | Max Width | Max V | Due to Storm          |
|--------------------------------|-----------|-----------|--------|-------|---------|-----------|-------|-----------------------|
| OF P1_11 - P3_11               | 0         | 0         | 1.404  | 0     | 0       | 0         | 0     |                       |
| OF P2_11 - P3_11               | 0         | 0         | 1.542  | 0     | 0       | 0         | 0     |                       |
| OF P3_11 - TRENCH11            | 0         | 0         | 1.256  | 0     | 0       | 0         | 0     |                       |
| OF TRENCH11 -<br>BYPASS2       | 0         | 0         | 1.404  | 0     | 0       | 0         | 0     |                       |
| OF P3_1 - P4_1                 | 0.001     | 0.001     | 3.052  | 0.023 | 0.01    | 0.25      | 0.36  | 10% AEP, 15 min burs  |
| OF P4_1 - P5_1                 | 0         | 0         | 3.392  | 0     | 0       | 0         | 0     |                       |
| OF P5_1 - P6_1                 | 0         | 0         | 3.298  | 0     | 0       | 0         | 0     |                       |
| OF P6_1 - GD3                  | 0         | 0         | 4.206  | 0     | 0       | 0         | 0     |                       |
| OF HW1 - BRB3                  | 0.044     | 0.044     | 1.404  | 0.441 | 0.01    | 3.98      | 0.03  | 10% AEP, 5 min burst, |
| OF386                          | 0         | 0         | 0.077  | 0     | 0       | 0         | 0     |                       |
| OF372                          | 0         | 0         | 3.587  | 0     | 0       | 0         | 0     |                       |
| OF374                          | 0         | 0         | 1.020  | 0     | 0       | 0         | 0     |                       |
| OF P2_2 - BRB2                 | 0         | 0         | 1.567  | 0     | 0       | 0         | 0     |                       |
| OF P3_2                        | 0         | 0         | 1.567  | 0     | 0       | 0         | 0     |                       |
| OF234                          | 0.009     | 0.009     | 1.520  | 0.290 | 0.00    | 3.98      | 0.03  | 10% AEP, 15 min burs  |
| OF GD2 - ExP6                  | 0         | 0         | 1.511  | 0     | 0       | 0         | 0     |                       |
| OF SandFilterNth -<br>P5_17    | 0         | 0         | 3.814  | 0     | 0       | 0         | 0     |                       |
| OF SandFilter - P5_17          | 0         | 0         | 2.723  | 0     | 0       | 0         | 0     |                       |
| OF P4_17 - P5_17               | 0         | 0         | 2.707  | 0     | 0       | 0         | 0     |                       |
| OF P5_17 - eXp6                | 0         | 0         | 2.536  | 0     | 0       | 0         | 0     |                       |
| OF ExP6 - ChathamSt<br>Node    | 0         | 0         | 7.935  | 0     | 0       | 0         | 0     |                       |
| OF P1_17 - GD2                 | 0.000     | 0.009     | 2.695  | 0.005 | 0.00    | 7.50      | 0.26  | 10% AEP, 5 min burst, |
| OF P2_17 - GD2                 | 0         | 0         | 1.711  | 0     | 0       | 0         | 0     |                       |
| Orifice_P2_17                  | 0.005     | 0.000     | 0.000  | 0.450 | 0.00    | 20.00     | 0.00  | 10% AEP, 15 min burs  |
| OF P1_16 - P2_16               | 0         | 0         | 2.682  | 0     | 0       | 0         | 0     |                       |
| OF P2_16 - ExPt_Track          | 0         | 0         | 2.676  | 0     | 0       | 0         | 0     |                       |
| OF_TO_TRACK1                   | 0         | 0         | 7.970  | 0     | 0       | 0         | 0     |                       |
| OF P4_11 - TRENCH11            | 0         | 0         | 1.256  | 0     | 0       | 0         | 0     |                       |
| OF P1_9 - P3_9                 | 0         | 0         | 1.404  | 0     | 0       | 0         | 0     |                       |
| OF P2_9 - P3_9                 | 0         | 0         | 1.542  | 0     | 0       | 0         | 0     |                       |
| OF P3_9 - TRENCH9              | 0         | 0         | 1.256  | 0     | 0       | 0         | 0     |                       |
| OF TRENCH9 -<br>BYPASS3        | 0         | 0         | 1.404  | 0     | 0       | 0         | 0     |                       |
| OF P4-9 - TRENCH9              | 0         | 0         | 1.256  | 0     | 0       | 0         | 0     |                       |
| OF P1_13 - P2_13               | 0         | 0         | 1.531  | 0     | 0       | 0         | 0     |                       |
| OF P2_30_ - P3_30_             | 0         | 0         | 1.531  | 0     | 0       | 0         | 0     |                       |
| OF P3_30_ - P8_13_             | 0         | 0         | 1.540  | 0     | 0       | 0         | 0     |                       |
| OF P5_13_ - BYPASS1            | 0         | 0         | 1.467  | 0     | 0       | 0         | 0     |                       |
| OF P8_13_ - P9_13_             | 0         | 0         | 1.535  | 0     | 0       | 0         | 0     |                       |
| OF P9_13_ - TRACK2             | 0         | 0         | 1.264  | 0     | 0       | 0         | 0     |                       |
| Existing V Drain 1             | 0.037     | 0.027     | 0.031  | 0.202 | 0.00    | 16.58     | 0.03  | 10% AEP, 25 min burs  |
| OF BYP1 - P7_13                | 0         | 0         | 0.866  | 0     | 0       | 0         | 0     |                       |
| OF P2_15 - P3_15               | 0.000     | 0.004     | 3.258  | 0.039 | 0.02    | 0.43      | 0.48  | 10% AEP, 15 min burs  |
| OF P4_3 - P2_15                | 0         | 0         | 7.982  | 0     | 0       | 0         | 0     |                       |
| OF222634                       | 0.000     | 0.003     | 3.258  | 0.033 | 0.01    | 0.36      | 0.44  | 10% AEP, 15 min burs  |
| OF P7_3 - P3_15                | 0         | 0         | 7.982  | 0     | 0       | 0         | 0     |                       |
| OF P9_3 BASIN - P11_3<br>BASIN | 0         | 0         | 3.807  | 0     | 0       | 0         | 0     |                       |
| OF P4_15 BASIN                 | 0         | 0         | 3.815  | 0     | 0       | 0         | 0     |                       |
| OF BRB1 - BRB2                 | 0.127     | 0.127     | 1.404  | 0.078 | 0.04    | 3.98      | 0.74  | 10% AEP, 15 min burs  |
| OF BRB2 - N458                 | 0         | 0         | 8.006  | 0     | 0       | 0         | 0     |                       |
| OF P11_3 BASIN                 | 0         | 0         | 3.780  | 0     | 0       | 0         | 0     |                       |
| OF P3_19 BASIN                 | 0         | 0         | 3.814  | 0     | 0       | 0         | 0     |                       |
| OF P2_19 BASIN                 | 0         | 0         | 3.772  | 0     | 0       | 0         | 0     |                       |
| OF P1_19 BASIN                 | 0         | 0         | 1.486  | 0     | 0       | 0         | 0     |                       |

DRAINS - Minor results

|                         |       |       |        |       |      |       |      |                       |
|-------------------------|-------|-------|--------|-------|------|-------|------|-----------------------|
| OF179                   | 0     | 0     | 4.332  | 0     | 0    | 0     | 0    |                       |
| OF181                   | 0     | 0     | 4.270  | 0     | 0    | 0     | 0    |                       |
| OF184                   | 0     | 0     | 4.142  | 0     | 0    | 0     | 0    |                       |
| OF178                   | 0     | 0     | 4.427  | 0     | 0    | 0     | 0    |                       |
| OF172                   | 0     | 0     | 4.279  | 0     | 0    | 0     | 0    |                       |
| OF395                   | 0     | 0     | 13.746 | 0     | 0    | 0     | 0    |                       |
| OF P2_18 BASIN -        |       |       |        |       |      |       |      |                       |
| P3_19 BASIN             | 0     | 0     | 3.807  | 0     | 0    | 0     | 0    |                       |
| OF P1_18 BASIN -        |       |       |        |       |      |       |      |                       |
| P2_19 BASIN             | 0     | 0     | 3.807  | 0     | 0    | 0     | 0    |                       |
| OF219                   | 0     | 0     | 4.270  | 0     | 0    | 0     | 0    |                       |
| OF230                   | 0     | 0     | 1.447  | 0     | 0    | 0     | 0    |                       |
| OF N480 - BRB2          | 0.125 | 0.125 | 1.520  | 0.290 | 0.04 | 3.98  | 0.73 | 10% AEP, 15 min burs  |
| OF262                   | 0     | 0     | 1.404  | 0     | 0    | 0     | 0    |                       |
| OF P2_7 - P3_7          | 0     | 0     | 1.542  | 0     | 0    | 0     | 0    |                       |
| OF P3_7 - TRENCH7       | 0     | 0     | 1.256  | 0     | 0    | 0     | 0    |                       |
| OF243                   | 0     | 0     | 1.404  | 0     | 0    | 0     | 0    |                       |
| OF254                   | 0     | 0     | 1.256  | 0     | 0    | 0     | 0    |                       |
| OF BRB3 - ExP4          | 0     | 0     | 1.493  | 0     | 0    | 0     | 0    |                       |
| OF P1_8 - P2_8          | 0     | 0     | 1.079  | 0     | 0    | 0     | 0    |                       |
| OF P2_8 - P3_8          | 0     | 0     | 1.022  | 0     | 0    | 0     | 0    |                       |
| OF P3_8 - TRENCH8       | 0     | 0     | 1.530  | 0     | 0    | 0     | 0    |                       |
| OF TRENCH8 -            |       |       |        |       |      |       |      |                       |
| CHATHAM-RN-1            | 0     | 0     | 1.508  | 0     | 0    | 0     | 0    |                       |
| OF P4_8 - TRENCH8       | 0     | 0     | 1.530  | 0     | 0    | 0     | 0    |                       |
| OF370                   | 0     | 0     | 2.428  | 0     | 0    | 0     | 0    |                       |
| OF P1_10 - P3_10        | 0     | 0     | 1.404  | 0     | 0    | 0     | 0    |                       |
| OF P2_10 - P3_10        | 0     | 0     | 1.542  | 0     | 0    | 0     | 0    |                       |
| OF P3_10 - TRENCH10     | 0     | 0     | 1.256  | 0     | 0    | 0     | 0    |                       |
| OF TRENCH10 -           |       |       |        |       |      |       |      |                       |
| CHATHAM-RN-2            | 0     | 0     | 1.514  | 0     | 0    | 0     | 0    |                       |
| OF P4_10 - TRENCH10     | 0     | 0     | 1.256  | 0     | 0    | 0     | 0    |                       |
| OF368                   | 0     | 0     | 3.805  | 0     | 0    | 0     | 0    |                       |
| OF GD3 - BRB3           | 0     | 0     | 0.925  | 0     | 0    | 0     | 0    |                       |
| OF P1_19 - P9_13        | 0     | 0     | 2.231  | 0     | 0    | 0     | 0    |                       |
| OF P2_28_ Basin -       |       |       |        |       |      |       |      |                       |
| P3_28_                  | 0     | 0     | 1.404  | 0     | 0    | 0     | 0    |                       |
| OF P3_28_ - P1_29_      | 0     | 0     | 1.075  | 0     | 0    | 0     | 0    |                       |
| OF P4_28_ - P1_29_      | 0     | 0     | 1.013  | 0     | 0    | 0     | 0    |                       |
| OF P5_13_ - BYP1        | 0     | 0     | 0.680  | 0     | 0    | 0     | 0    |                       |
| OF P3_22 Basin - P2_22  |       |       |        |       |      |       |      |                       |
| Basin                   | 0     | 0     | 3.807  | 0     | 0    | 0     | 0    |                       |
| OF P3_13_ - P3_28_      | 0     | 0     | 1.054  | 0     | 0    | 0     | 0    |                       |
| OF P4_13_ - P3_28_      | 0     | 0     | 0.997  | 0     | 0    | 0     | 0    |                       |
| OF P1_28_ - P2_28_      | 0.000 | 0.002 | 3.052  | 0.052 | 0.01 | 1.54  | 0.23 | 10% AEP, 15 min burs  |
| OF P1_13_ Basin -       |       |       |        |       |      |       |      |                       |
| P1_28_ Basin            | 0     | 0     | 3.807  | 0     | 0    | 0     | 0    |                       |
| OF1 P2_3 - P1_15        | 0     | 0     | 3.807  | 0     | 0    | 0     | 0    |                       |
| OF P1_15 - P2_15        | 0.000 | 0.004 | 3.052  | 0.038 | 0.02 | 0.42  | 0.52 | 10% AEP, 5 min burst, |
| OF Track Access Culvert | 0     | 0     | 1.031  | 0     | 0    | 0     | 0    |                       |
| Existing V Drain 2      | 0.020 | 0.017 | 0.031  | 0.166 | 0.00 | 16.09 | 0.02 | 10% AEP, 25 min burs  |
| OF P3_15 - P4_15        |       |       |        |       |      |       |      |                       |
| BASIN                   | 0.000 | 0.003 | 3.258  | 0.034 | 0.02 | 0.37  | 0.51 | 10% AEP, 15 min burs  |
| OF P1_23_ Basin -       |       |       |        |       |      |       |      |                       |
| P1_22_ Basin            | 0     | 0     | 0.990  | 0     | 0    | 0     | 0    |                       |
| OF P6_20 Basin - P7_20  |       |       |        |       |      |       |      |                       |
| Basin                   | 0     | 0     | 0.990  | 0     | 0    | 0     | 0    |                       |
| OF P1_20_ - P1_22_      | 0     | 0     | 1.002  | 0     | 0    | 0     | 0    |                       |
| OF177                   | 0     | 0     | 4.332  | 0     | 0    | 0     | 0    |                       |
| OF P7_20 - Outlet       | 0     | 0     | 0.919  | 0     | 0    | 0     | 0    |                       |
| OF Burried Pipe         | 0     | 0     | 1.404  | 0     | 0    | 0     | 0    |                       |
| OF SandFilterSth -      |       |       |        |       |      |       |      |                       |
| P5_17                   | 0     | 0     | 3.814  | 0     | 0    | 0     | 0    |                       |

DETENTION BASIN

DETAILS

| Name        | Max WL | MaxVol | Max Q<br>Total | Max Q<br>Low Level | Max Q<br>High Level |
|-------------|--------|--------|----------------|--------------------|---------------------|
| TRENCH_11   | 6.54   | 31.0   | 0.000          | 0.000              | 0.000               |
| SAND FILTER | 5.39   | 0.1    | 0.013          | 0.013              | 0.000               |
| TRENCH9     | 6.54   | 30.9   | 0.000          | 0.000              | 0.000               |

# DRAINS - Minor results

|              |      |      |       |       |       |
|--------------|------|------|-------|-------|-------|
| P2_15 BASIN  | 6.50 | 1.3  | 0.007 | 0.007 | 0.000 |
| P4_3 BASIN   | 6.73 | 1.2  | 0.008 | 0.008 | 0.000 |
| P3_15 BASIN  | 6.49 | 1.1  | 0.007 | 0.007 | 0.000 |
| P7_3 BASIN   | 6.72 | 1.1  | 0.006 | 0.006 | 0.000 |
| P9_3 BASIN   | 6.73 | 2.3  | 0.008 | 0.008 | 0.000 |
| P6_15_ BASIN | 6.47 | 4.6  | 0.000 | 0.000 | 0.000 |
| BRB1         | 6.20 | 51.6 | 0.137 | 0.010 | 0.127 |
| BRB2         | 5.89 | 59.2 | 0.097 | 0.097 | 0.000 |
| P11_3 BASIN  | 6.49 | 0.9  | 0.006 | 0.006 | 0.000 |
| P3_19 BASIN  | 6.49 | 0.9  | 0.005 | 0.005 | 0.000 |
| P2_19 BASIN  | 6.49 | 0.9  | 0.005 | 0.005 | 0.000 |
| P1_19 BASIN  | 6.49 | 0.9  | 0.006 | 0.006 | 0.000 |
| Basin73      | 6.72 | 1.2  | 0.007 | 0.007 | 0.000 |
| Basin76      | 6.73 | 1.4  | 0.011 | 0.011 | 0.000 |
| TRENCH7      | 6.54 | 30.9 | 0.000 | 0.000 | 0.000 |
| BRB3         | 5.94 | 28.6 | 0.014 | 0.014 | 0.000 |
| TRENCH8      | 5.71 | 32.2 | 0.000 | 0.000 | 0.000 |
| TRENCH10     | 6.54 | 30.9 | 0.000 | 0.000 | 0.000 |
| P2_28_ Basin | 6.53 | 1.9  | 0.007 | 0.007 | 0.000 |
| P1_31_ Basin | 6.72 | 0.8  | 0.003 | 0.003 | 0.000 |
| P1_28_ Basin | 6.53 | 3.0  | 0.006 | 0.006 | 0.000 |
| P1_13_ Basin | 6.73 | 1.2  | 0.008 | 0.008 | 0.000 |
| P2_3 BASIN   | 6.73 | 1.2  | 0.008 | 0.008 | 0.000 |
| P1_15 BASIN  | 6.50 | 1.4  | 0.008 | 0.008 | 0.000 |
| P4_15_ Basin | 6.49 | 1.0  | 0.004 | 0.004 | 0.000 |
| P1_23_ Basin | 6.00 | 0.3  | 0.004 | 0.004 | 0.000 |
| P1_22 Basin  | 6.16 | 0.4  | 0.009 | 0.009 | 0.000 |
| P1_20_ Basin | 6.41 | 3.0  | 0.016 | 0.016 | 0.000 |
| P1_21_ Basin | 6.21 | 0.7  | 0.004 | 0.004 | 0.000 |

Run Log for 160548 NJC

Stables run at 11:00:07

on 26/4/2022 using

version 2022.012

Upwelling occurred at:

P4\_10, P3\_10, P4\_7,

P3\_7, P4-9, P3-9, P4-11,

P3-11

Freeboard was less than

0.05m at P2\_10, P1\_10,

P4\_1, P2\_7, P1\_7,

P2\_17, P2-9, P1-9,

P1\_17, P3\_1, P1-11, P2-

11

The maximum flow in

these overflow routes is

unsafe: Existing V Drain

2, Existing V Drain 1, OF

HW1 - BRB3



# DRAINS - Major "K"

| Pit            | Initial K | Revised K      | Chart (200 Ratios)                              |
|----------------|-----------|----------------|-------------------------------------------------|
| P5_13_         | 1.73      | 1.75           | A1-24 D/Do=0.64, B/Do=1.50, (Qu/Qo)(Do/Du)=0.48 |
| P4_20_         | 0.79      | 0.76           | A1-25 Du/Do=1.00, Qg/Qo=0.00, S/Do=1.4          |
| P3_20_         | 1.27      | 1.25           | A1-24 D/Do=0.68, B/Do=5.84, (Qu/Qo)(Do/Du)=0.69 |
| P2_20_         | 2.18      | 2.18           | H-O'L Qg/Qo=0.00, S/Do=5.1                      |
| P4_15_ Pit     | 0.99      | 1              | A1-24 D/Do=0.68, B/Do=1.50, (Qu/Qo)(Do/Du)=0.73 |
| P4_28_         | 2.23      | 2.19           | A1-4 H/Do=2.5, Vo2/(2gDo)=0.43                  |
| P1_19_         | 2.72      | 2.6            | A1-4 H/Do=2.0, Vo2/(2gDo)=0.27                  |
| P6_13_         | 1.47      | 1.49           | A1-20 Du/Do=1.00, Qg/Qo=0.16, S/Do=2.4          |
| P3_28_         | 1.4       | 1.4            | A1-9 Du/Do=1.00, Qg/Qo=0.44, S/Do=3.2           |
| P2_28_ Pit     | 1.91      | 1.92           | H-O'L Qg/Qo=0.00, S/Do=3.1                      |
| P3_13_         | 1.24      | 1.24           | H-O'L Qg/Qo=0.00, S/Do=3.6                      |
| P1_28_ Pit     | 1.82      | 1.82           | A1-18 Du/Do=0.68, Qg/Qo=0.00, S/Do=2.3          |
| P2_13_         | 1.93      | 1.92           | A1-18 Du/Do=1.00, Qg/Qo=0.00, S/Do=2.2          |
| GD3            | 3.21      | 3.15           | A1-4 H/Do=1.7, Vo2/(2gDo)=0.02                  |
| ExP4           | 0.93      | 0.95           | A1-24 D/Do=1.00, B/Do=2.40, (Qu/Qo)(Do/Du)=0.68 |
| ExP5           | 5.93      | 5.93           | A1-4 H/Do=0.0, Vo2/(2gDo)=0.05                  |
| P4_10          | 1.79      | 1.79           | A1-4 H/Do=7.5, Vo2/(2gDo)=1.13                  |
| P3_10          | 1.79      | 1.79           | A1-4 H/Do=7.6, Vo2/(2gDo)=2.05                  |
| P2_10          | 2.1       | 2.1            | A1-4 H/Do=3.3, Vo2/(2gDo)=0.30                  |
| P1_10          | 2.57      | 2.57           | A1-4 H/Do=2.4, Vo2/(2gDo)=0.14                  |
| P2_8           | 2.77      | 2.76           | A1-4 H/Do=1.9, Vo2/(2gDo)=0.21                  |
| P1_8           | 4.22      | 4.22           | A1-4 H/Do=0.9, Vo2/(2gDo)=0.06                  |
| P6_1           | 1.64      | 1.59           | A1-9 Du/Do=0.79, Qg/Qo=0.48, S/Do=2.0           |
| P5_1           | 3.55      | 3.42           | A1-4 H/Do=1.2, Vo2/(2gDo)=0.18                  |
| P4_1           | 3.9       | 3.91           | A1-4 H/Do=1.1, Vo2/(2gDo)=0.08                  |
| P4_7           | 1.79      | 1.79           | A1-4 H/Do=7.5, Vo2/(2gDo)=1.13                  |
| P3_7           | 1.79      | 1.79           | A1-4 H/Do=7.6, Vo2/(2gDo)=2.05                  |
| P2_7           | 2.1       | 2.1            | A1-4 H/Do=3.3, Vo2/(2gDo)=0.30                  |
| P1_7           | 2.57      | 2.57           | A1-4 H/Do=2.4, Vo2/(2gDo)=0.14                  |
| ExP2           | 0.59      | 0.54           | H-O'L Qg/Qo=0.00, S/Do=2.4                      |
| ExP1           | 1.63      | 1.63           | A1-24 D/Do=0.81, B/Do=2.40, (Qu/Qo)(Do/Du)=0.47 |
| ExP3           | 4.38      | 4.4            | A1-4 H/Do=1.3, Vo2/(2gDo)=0.00                  |
| P1_19          | 0.66      | 0.66           | A1-14 Du/Do=0.68, Qg/Qo=0.00, S/Do=4.0          |
| P7_3           | 1.07      | 1.07           | A1-25 Du/Do=1.00, Qg/Qo=0.00, S/Do=1.8          |
| P6_3           | 0.2       | 0.2            | A1-5 Du/Do=1.00, Qg/Qo=0.00, S/Do=1.3           |
| P5_3           | 1.57      | 1.57           | A1-25 Du/Do=1.00, Qg/Qo=0.00, S/Do=1.1          |
| P1_30_         | 3.49      | 3.5            | A1-4 H/Do=1.4, Vo2/(2gDo)=0.03                  |
| P2_30_         | 2.91      | 2.84           | A1-4 H/Do=1.9, Vo2/(2gDo)=0.17                  |
| P2_17          | 1.5       | not calculated |                                                 |
| P4-9           | 1.79      | 1.79           | A1-4 H/Do=7.5, Vo2/(2gDo)=1.13                  |
| P3-9           | 1.79      | 1.79           | A1-4 H/Do=7.6, Vo2/(2gDo)=2.05                  |
| P2-9           | 2.1       | 2.1            | A1-4 H/Do=3.3, Vo2/(2gDo)=0.30                  |
| P1-9           | 2.57      | 2.57           | A1-4 H/Do=2.4, Vo2/(2gDo)=0.14                  |
| P4-11          | 1.79      | 1.79           | A1-4 H/Do=7.5, Vo2/(2gDo)=1.12                  |
| SAND_FILTER_NO |           |                |                                                 |
| RTH            | 0         | 0              | A1-9 Du/Do=0.64, Qg/Qo=0.00, S/Do=1.0           |
| SAND_FILTER_ST |           |                |                                                 |
| H PIT          | 0.2       | 0.2            | A1-5 Du/Do=1.00, Qg/Qo=0.00, S/Do=1.0           |
| ExPit_Track    | 7.29      | 7.17           | A1-4 H/Do=0.0, Vo2/(2gDo)=0.14                  |
| P2_16          | 1.42      | 1.33           | A1-5 Du/Do=1.00, Qg/Qo=0.41, S/Do=2.6           |
| P1_16          | 3.09      | 2.75           | A1-4 H/Do=0.8, Vo2/(2gDo)=0.60                  |
| P1_17          | 2.78      | 2.78           | A1-4 H/Do=2.2, Vo2/(2gDo)=0.02                  |
| P3_17          | 2.9       | 2.9            | H-O'L Qg/Qo=0.00, S/Do=1.0                      |
| GD2_NORTH      | 4.82      | 4.84           | A1-4 H/Do=0.0, Vo2/(2gDo)=0.21                  |
| P4_27          | 0.2       | 0.2            | A1-5 Du/Do=1.00, Qg/Qo=0.00, S/Do=1.1           |
| P5_17          | 1.09      | 1.09           | A1-18 Du/Do=0.41, Qg/Qo=0.00, S/Do=0.3          |
| ExP6           | 0.25      | 0.25           | A1-18 Du/Do=1.00, Qg/Qo=0.00, S/Do=0.2          |
| P9_13_         | 1.77      | 1.79           | H-O'L Qg/Qo=0.16, S/Do=1.7                      |
| P7_13_         | 1.25      | 1.26           | H-O'L Qg/Qo=0.00, S/Do=2.3                      |
| P8_13_         | 1.5       | 1.53           | H-O'L Qg/Qo=0.25, S/Do=2.1                      |
| P3_30          | 1.24      | 1.22           | A1-5 Du/Do=1.00, Qg/Qo=0.42, S/Do=3.5           |

# DRAINS - Major "K"

|            |      |      |       |                                              |
|------------|------|------|-------|----------------------------------------------|
| P3_8       | 1.79 | 1.79 | A1-4  | $H/Do=7.1, Vo2/(2gDo)=2.27$                  |
| P4_8       | 1.79 | 1.79 | A1-4  | $H/Do=7.1, Vo2/(2gDo)=0.67$                  |
| P2_2       | 5.3  | 5.38 | A1-4  | $H/Do=0.3, Vo2/(2gDo)=0.02$                  |
| P3_2       | 4.91 | 4.92 | A1-4  | $H/Do=1.1, Vo2/(2gDo)=0.09$                  |
| P1_6       | 1.2  | 1.2  | H-O'L | $Qg/Qo=0.00, S/Do=3.6$                       |
| P2_6       | 1.71 | 1.72 | H-O'L | $Qg/Qo=0.00, S/Do=1.8$                       |
| P1_1 + GD4 | 1.6  | 1.59 | A1-10 | $Du/Do=1.00, Qg/Qo=0.22, S/Do=3.1$           |
| P2_1       | 2.79 | 2.68 | A1-4  | $H/Do=1.7, Vo2/(2gDo)=0.31$                  |
| P3_1       | 1.94 | 1.93 | A1-4  | $H/Do=3.5, Vo2/(2gDo)=0.73$                  |
| P7_1       | 1.25 | 1.25 | H-O'L | $Qg/Qo=0.00, S/Do=2.9$                       |
| P1-11      | 2.56 | 2.56 | A1-4  | $H/Do=2.4, Vo2/(2gDo)=0.15$                  |
| P2-11      | 2.26 | 2.25 | A1-4  | $H/Do=3.3, Vo2/(2gDo)=0.30$                  |
| P3-11      | 1.79 | 1.79 | A1-4  | $H/Do=7.6, Vo2/(2gDo)=2.04$                  |
| P4_13_     | 1.5  | 1.5  | A1-7  | $Du/Do=0.64, Qg/Qo=0.38, S/Do=2.2$           |
| P3-3       | 0.95 | 0.95 | A1-18 | $Du/Do=0.35, Qg/Qo=0.00, S/Do=0.4$           |
| P1_15      | 1.38 | 1.38 | A1-18 | $Du/Do=0.68, Qg/Qo=0.00, S/Do=4.0$           |
| P2_15      | 1.73 | 1.73 | A1-24 | $DI/Do=0.68, B/Do=5.84, (Qu/Qo)(Do/Du)=0.54$ |
| P3_15      | 1.33 | 1.34 | A1-24 | $DI/Do=0.68, B/Do=5.84, (Qu/Qo)(Do/Du)=0.66$ |
| Pit21      | 2.14 | 2.14 | H-O'L | $Qg/Qo=0.00, S/Do=2.3$                       |
| P2_18      | 1.7  | 1.7  | H-O'L | $Qg/Qo=0.00, S/Do=5.5$                       |
| P1_18      | 2.3  | 2.3  | H-O'L | $Qg/Qo=0.00, S/Do=5.2$                       |
| P2_19      | 1.81 | 1.8  | A1-24 | $DI/Do=0.68, B/Do=5.84, (Qu/Qo)(Do/Du)=0.51$ |
| P3_19      | 1.39 | 1.39 | A1-24 | $DI/Do=0.68, B/Do=5.84, (Qu/Qo)(Do/Du)=0.65$ |
| P11_3      | 1.32 | 1.32 | A1-20 | $Du/Do=0.51, Qg/Qo=0.00, S/Do=2.6$           |
| P7_15_     | 2.3  | 2.3  | H-O'L | $Qg/Qo=0.00, S/Do=3.0$                       |
| P5_15_     | 2.44 | 2.45 | H-O'L | $Qg/Qo=0.00, S/Do=6.0$                       |
| P4_4       | 1.83 | 1.83 | A1-18 | $Du/Do=1.00, Qg/Qo=0.00, S/Do=2.4$           |
| P3_4       | 1.37 | 1.37 | H-O'L | $Qg/Qo=0.00, S/Do=2.6$                       |

DRANS - Major results

DRAINS results prepared from Version 2022.012

| PIT / NODE DETAILS   |         | Version 8    |                           |                        |                   |                   |                |
|----------------------|---------|--------------|---------------------------|------------------------|-------------------|-------------------|----------------|
| Name                 | Max HGL | Max Pond HGL | Max Surface Flow (cu.m/s) | Max Pond Volume (cu.m) | Min Freeboard (m) | Overflow (cu.m/s) | Constraint     |
| P1-11                | 6.68    | 6.69         | 0.014                     | 3.0                    | 0.00              | 0.000             | Outlet System  |
| P2-11                | 6.68    | 6.69         | 0.014                     | 2.8                    | 0.00              | 0.000             | Outlet System  |
| P3-11                | 6.66    | 6.66         | 0.024                     | 8.6                    | 0.00              | 0.000             | Outlet System  |
| P3_1                 | 6.34    | 6.35         | 0.034                     | 1.0                    | 0.00              | 0.012             | Outlet System  |
| P4_1                 | 6.32    | 6.35         | 0.029                     | 1.0                    | 0.00              | 0.006             | Outlet System  |
| P5_1                 | 6.31    | 6.34         | 0.039                     | 1.0                    | 0.00              | 0.005             | Outlet System  |
| P6_1                 | 6.25    | 6.30         | 0.039                     | 0.5                    | 0.00              | 0.000             | Inlet Capacity |
| P7_1                 | 6.21    |              | 0.000                     |                        | 0.41              |                   | None           |
| GPT-BRB3             | 6.17    |              | 0.000                     |                        | 0.46              |                   | None           |
| HW1-BRB3             | 6.13    |              | 0.000                     |                        |                   |                   |                |
| P2_1                 | 6.29    | 6.33         | 0.028                     | 3.9                    | 0.00              | 0.000             | Outlet System  |
| P1_1 + GD4           | 6.15    |              | 0.005                     |                        | 0.21              |                   | None           |
| P2_6                 | 6.01    |              | 0.000                     |                        | 0.31              |                   | None           |
| ExP5                 | 5.42    |              | 0.000                     |                        | 0.73              | 0.000             | None           |
| ExP4                 | 5.24    | 6.05         | 0.000                     | 0.0                    | 0.81              | 0.000             | None           |
| CHATHAM-RN-0         | 5.14    |              | 0.000                     |                        |                   |                   |                |
| P2_2                 | 6.20    | 6.80         | 0.006                     | 0.3                    | 0.58              | 0.000             | Inlet Capacity |
| P3_2                 | 6.20    | 6.70         | 0.006                     | 0.2                    | 0.48              | 0.000             | Inlet Capacity |
| HW2 (BRB2)           | 6.19    |              | 0.000                     |                        |                   |                   |                |
| GD2_NORTH            | 6.13    |              | 0.009                     |                        | 0.32              | 0.000             | None           |
| SAND_FILTER_NORTH    | 5.73    |              | 0.000                     |                        | 1.07              | 0.000             | None           |
| P4_27                | 5.33    |              | 0.000                     |                        | 1.17              | 0.000             | None           |
| P5_17                | 5.24    |              | 0.000                     |                        | 1.03              | 0.000             | None           |
| ExP6                 | 5.16    | 6.26         | 0.000                     | 0.0                    | 1.10              | 0.000             | None           |
| Chatham St - North   | 5.03    |              | 0.000                     |                        |                   |                   |                |
| P1_17                | 6.65    | 6.65         | 0.041                     | 24.6                   | 0.00              | 0.000             | Outlet System  |
| P2_17                | 6.81    | 6.83         | 0.026                     | 8.4                    | 0.00              | 0.000             | Outlet System  |
| P1_16                | 6.54    | 6.67         | 0.037                     | 2.3                    | 0.09              | 0.000             | Inlet Capacity |
| P2_16                | 6.09    | 6.57         | 0.018                     | 0.9                    | 0.46              | 0.000             | Inlet Capacity |
| ExPit_Track          | 5.32    | 5.66         | 0.117                     | 5.8                    | 0.27              | 0.000             | Inlet Capacity |
| JP at Track Crossing | 4.94    |              | 0.000                     |                        |                   |                   |                |
| Tank_T1-B-N          | 6.67    |              | 0.025                     |                        |                   |                   |                |
| Tank_T1-A-S          | 6.65    |              | 0.025                     |                        |                   |                   |                |
| P4-11                | 6.64    | 6.65         | 0.024                     | 8.6                    | 0.00              | 0.000             | Outlet System  |
| P1-9                 | 6.68    | 6.69         | 0.014                     | 3.0                    | 0.00              | 0.000             | Outlet System  |
| P2-9                 | 6.68    | 6.69         | 0.014                     | 2.8                    | 0.00              | 0.000             | Outlet System  |
| P3-9                 | 6.66    | 6.66         | 0.024                     | 8.6                    | 0.00              | 0.000             | Outlet System  |
| T1-C-N               | 6.67    |              | 0.025                     |                        |                   |                   |                |
| TANK-T1-B-S          | 6.65    |              | 0.025                     |                        |                   |                   |                |
| P4-9                 | 6.64    | 6.65         | 0.024                     | 8.6                    | 0.00              | 0.000             | Outlet System  |
| P1_30_               | 6.66    | 6.67         | 0.010                     | 1.0                    | 0.00              | 0.000             | Outlet System  |
| P2_30_               | 6.63    | 6.65         | 0.014                     | 2.3                    | 0.00              | 0.000             | Outlet System  |
| P3_30                | 6.59    | 6.62         | 0.010                     | 0.6                    | 0.01              | 0.000             | Inlet Capacity |
| P7_13_               | 6.52    |              | 0.000                     |                        | 0.27              | 0.000             | None           |
| P8_13_               | 6.43    |              | 0.017                     |                        | 0.34              | 0.000             | None           |
| P9_13_               | 6.16    |              | 0.011                     |                        | 0.34              | 0.000             | None           |
| HW5_                 | 5.96    |              | 0.000                     |                        |                   |                   |                |
| BYPASS1              | 6.60    |              | 0.000                     |                        |                   |                   |                |
| P2_15                | 6.52    |              | 0.000                     |                        | 0.00              |                   | Outlet System  |
| P3_15                | 6.49    |              | 0.000                     |                        | 0.00              |                   | Outlet System  |
| P4_15_Pit            | 6.42    |              | 0.000                     |                        | 0.06              |                   | None           |
| P5_15_               | 6.32    |              | 0.000                     |                        | 0.16              |                   | None           |
| P7_15_               | 6.05    |              | 0.000                     |                        | 0.58              |                   | None           |
| ExP1                 | 5.76    |              | 0.000                     |                        | 0.36              |                   | None           |
| P4_20_               | 5.21    |              | 0.000                     |                        | 0.91              |                   | None           |
| DARLING_ST_RN        | 5.00    |              | 0.000                     |                        |                   |                   |                |
| P5_3                 | 6.31    |              | 0.000                     |                        | 0.61              |                   | None           |
| P6_3                 | 6.30    |              | 0.000                     |                        | 0.62              |                   | None           |
| P7_3                 | 6.29    |              | 0.000                     |                        | 0.63              |                   | None           |
| Pit21                | 6.27    |              | 0.000                     |                        | 0.59              |                   | None           |
| P11_3                | 6.17    |              | 0.000                     |                        | 0.46              |                   | None           |
| BLOCK_D_ROOF         | 7.88    |              | 0.081                     |                        |                   |                   |                |
| P3_4                 | 6.01    |              | 0.000                     |                        | 0.22              |                   | None           |
| P4_4                 | 5.96    |              | 0.000                     |                        | 0.04              |                   | None           |
| ExP2                 | 5.84    |              | 0.000                     |                        | 0.18              |                   | None           |

DRANS - Major results

|                         |      |      |       |     |      |       |               |
|-------------------------|------|------|-------|-----|------|-------|---------------|
| P3_19                   | 6.34 |      | 0.000 |     | 0.29 |       | None          |
| P2_19                   | 6.41 |      | 0.000 |     | 0.22 |       | None          |
| P1_19                   | 6.42 |      | 0.000 |     | 0.21 |       | None          |
| N402                    | 5.97 |      | 0.023 |     |      |       |               |
| N403                    | 5.89 |      | 0.008 |     |      |       |               |
| N404                    | 5.83 |      | 0.003 |     |      |       |               |
| N405                    | 5.80 |      | 0.003 |     |      |       |               |
| N406                    | 5.87 |      | 0.009 |     |      |       |               |
| ExP3                    | 5.83 | 5.80 | 0.004 | 8.3 | 0.00 | 0.000 | Outlet System |
| P2_18                   | 6.47 |      | 0.000 |     | 0.39 |       | None          |
| P1_18                   | 6.52 |      | 0.000 |     | 0.34 |       | None          |
| GD1                     | 6.01 |      | 0.000 |     |      |       |               |
| N458                    | 5.94 |      | 0.030 |     |      |       |               |
| N469                    | 6.40 |      | 0.000 |     |      |       |               |
| L1 CONCOURSE<br>(SOUTH) | 7.08 |      | 0.217 |     |      |       |               |
| N480                    | 6.19 |      | 0.275 |     |      |       |               |
| P1_7                    | 6.68 | 6.69 | 0.014 | 3.0 | 0.00 | 0.000 | Outlet System |
| P2_7                    | 6.68 | 6.69 | 0.014 | 2.8 | 0.00 | 0.000 | Outlet System |
| P3_7                    | 6.66 | 6.66 | 0.024 | 8.6 | 0.00 | 0.000 | Outlet System |
| T1-D-NTH                | 6.67 |      | 0.025 |     |      |       |               |
| T1-C-STH                | 6.65 |      | 0.025 |     |      |       |               |
| P4_7                    | 6.64 | 6.65 | 0.024 | 8.6 | 0.00 | 0.000 | Outlet System |
| T1-                     |      |      |       |     |      |       |               |
| GOODS_SHED_STH          | 6.44 |      | 0.031 |     |      |       |               |
| P1_6                    | 6.42 |      | 0.000 |     | 0.00 |       | Outlet System |
| T1-GOOD-STORAGE-<br>NTH | 6.06 |      | 0.031 |     |      |       |               |
| P1_8                    | 6.60 |      | 0.011 |     | 0.00 | 0.001 | Outlet System |
| P2_8                    | 6.58 |      | 0.015 |     | 0.00 | 0.006 | Outlet System |
| P3_8                    | 6.58 | 6.58 | 0.022 | 3.3 | 0.00 | 0.000 | Outlet System |
| T2-EQSHD                | 6.59 |      | 0.038 |     |      |       |               |
| T1-E-STH                | 6.57 |      | 0.025 |     |      |       |               |
| P4_8                    | 6.57 | 6.57 | 0.013 | 2.8 | 0.00 | 0.000 | Outlet System |
| CHATHAM-RN-1            | 6.20 |      | 0.000 |     |      |       |               |
| P1_10                   | 6.68 | 6.69 | 0.014 | 3.0 | 0.00 | 0.000 | Outlet System |
| P2_10                   | 6.68 | 6.69 | 0.014 | 2.8 | 0.00 | 0.000 | Outlet System |
| P3_10                   | 6.66 | 6.66 | 0.024 | 8.6 | 0.00 | 0.000 | Outlet System |
| T1-E-NTH                | 6.67 |      | 0.025 |     |      |       |               |
| T1-F-STH                | 6.65 |      | 0.025 |     |      |       |               |
| P4_10                   | 6.64 | 6.65 | 0.024 | 8.6 | 0.00 | 0.000 | Outlet System |
| CHATHAM-RN-2            | 6.30 |      | 0.000 |     |      |       |               |
| GD3                     | 6.21 |      | 0.004 |     | 0.23 | 0.000 | None          |
| P1_19_                  | 6.56 | 6.56 | 0.022 | 2.9 | 0.00 | 0.000 | Outlet System |
| P6_13_                  | 6.56 |      | 0.009 |     | 0.36 |       | None          |
| P2_28_ Pit              | 6.62 |      | 0.000 |     | 0.00 |       | Outlet System |
| P3_28_                  | 6.63 |      | 0.009 |     | 0.00 | 0.006 | Outlet System |
| P4_28_                  | 6.66 |      | 0.024 |     | 0.12 | 0.000 | None          |
| P5_13_                  | 6.60 |      | 0.000 |     | 0.35 | 0.000 | None          |
| P3_13_                  | 6.68 |      | 0.000 |     | 0.03 | 0.000 | None          |
| P4_13_                  | 6.64 |      | 0.009 |     | 0.31 | 0.000 | None          |
| P1_28_ Pit              | 6.63 |      | 0.000 |     | 0.00 |       | Outlet System |
| P2_13_                  | 6.71 |      | 0.000 |     | 0.08 |       | None          |
| P3-3                    | 6.31 |      | 0.000 |     | 0.61 |       | None          |
| P1_15                   | 6.53 |      | 0.000 |     | 0.00 |       | Outlet System |
| HW6_                    | 5.96 |      | 0.050 |     | 0.74 | 0.000 | None          |
| HW7_                    | 5.86 |      | 0.010 |     |      |       |               |
| P2_20_                  | 6.24 |      | 0.000 |     | 0.11 |       | None          |
| P3_20_                  | 5.78 |      | 0.000 |     | 0.67 |       | None          |
| N391937                 | 6.04 |      | 0.028 |     |      |       |               |
| HW4                     | 5.86 |      | 0.031 |     | 0.51 | 0.000 | None          |
| N197                    | 5.85 |      | 0.000 |     |      |       |               |
| P3_17                   | 5.77 |      | 0.000 |     | 1.03 |       | None          |
| GPT-4200                | 5.74 |      | 0.000 |     | 1.06 |       | None          |
| SAND_FILTER_STH<br>PIT  | 5.71 |      | 0.000 |     | 1.09 | 0.000 | None          |

SUB-CATCHMENT  
DETAILS

| Name | Max<br>Flow Q | Paved<br>Max Q | Grassed<br>Max Q | Paved<br>Tc | Grassed<br>Tc | Supp.<br>Tc | Due to Storm |
|------|---------------|----------------|------------------|-------------|---------------|-------------|--------------|
|------|---------------|----------------|------------------|-------------|---------------|-------------|--------------|



DRANS - Major results

|                   | (cu.m/s) | (cu.m/s) | (cu.m/s) | (min) | (min) | (min) |                               |
|-------------------|----------|----------|----------|-------|-------|-------|-------------------------------|
| CAT_P1-11         | 0.010    | 0.008    | 0.002    | 5.00  | 5.00  | 0.00  | 1% AEP, 5 min burst, Storm 1  |
| CAT_P2-11         | 0.010    | 0.008    | 0.002    | 5.00  | 5.00  | 0.00  | 1% AEP, 5 min burst, Storm 1  |
| CAT_P3-11         | 0.017    | 0.000    | 0.017    | 5.00  | 5.00  | 0.00  | 1% AEP, 10 min burst, Storm 1 |
| CAT_P3_1          | 0.027    | 0.027    | 0.000    | 5.00  | 5.00  | 2.00  | 1% AEP, 5 min burst, Storm 1  |
| CAT_P4_1          | 0.017    | 0.017    | 0.000    | 5.00  | 5.00  | 2.00  | 1% AEP, 5 min burst, Storm 1  |
| CAT_P5_1          | 0.037    | 0.037    | 0.000    | 5.00  | 5.00  | 2.00  | 1% AEP, 5 min burst, Storm 1  |
| CAT_P6_1          | 0.028    | 0.028    | 0.000    | 5.00  | 5.00  | 2.00  | 1% AEP, 5 min burst, Storm 1  |
| CAT_P2_1          | 0.022    | 0.022    | 0.000    | 5.00  | 5.00  | 2.00  | 1% AEP, 5 min burst, Storm 1  |
| CAT_P1_1 + GD4    | 0.004    | 0.004    | 0.000    | 5.00  | 5.00  | 2.00  | 1% AEP, 5 min burst, Storm 1  |
| CAT_P2_2          | 0.005    | 0.005    | 0.000    | 5.00  | 5.00  | 2.00  | 1% AEP, 5 min burst, Storm 1  |
| CAT_P3_2          | 0.005    | 0.005    | 0.000    | 5.00  | 5.00  | 2.00  | 1% AEP, 5 min burst, Storm 1  |
| CAT_GD2_NORTH     | 0.015    | 0.015    | 0.000    | 5.00  | 5.00  | 2.00  | 1% AEP, 5 min burst, Storm 1  |
| Cat-P1_17         | 0.033    | 0.033    | 0.000    | 5.00  | 5.00  | 2.00  | 1% AEP, 5 min burst, Storm 1  |
| Cat_P2_17         | 0.021    | 0.021    | 0.000    | 5.00  | 5.00  | 2.00  | 1% AEP, 5 min burst, Storm 1  |
| CAT_P1_16         | 0.026    | 0.000    | 0.026    | 5.00  | 5.00  | 2.00  | 1% AEP, 10 min burst, Storm 1 |
| CAT_P2_16         | 0.012    | 0.000    | 0.012    | 5.00  | 5.00  | 2.00  | 1% AEP, 10 min burst, Storm 1 |
| CAT ExPit_Track   | 0.083    | 0.000    | 0.083    | 5.00  | 5.00  | 2.00  | 1% AEP, 10 min burst, Storm 1 |
| CAT-T1-B-N        | 0.020    | 0.020    | 0.000    | 5.00  | 0.00  | 0.00  | 1% AEP, 5 min burst, Storm 1  |
| CAT-Tank_T1-A-S   | 0.020    | 0.020    | 0.000    | 5.00  | 0.00  | 0.00  | 1% AEP, 5 min burst, Storm 1  |
| CAT_P4-11         | 0.017    | 0.000    | 0.017    | 5.00  | 5.00  | 0.00  | 1% AEP, 10 min burst, Storm 1 |
| CAT_P1-9          | 0.010    | 0.008    | 0.002    | 5.00  | 5.00  | 0.00  | 1% AEP, 5 min burst, Storm 1  |
| CAT_P2-9          | 0.010    | 0.008    | 0.002    | 5.00  | 5.00  | 0.00  | 1% AEP, 5 min burst, Storm 1  |
| CAT_P3-9          | 0.017    | 0.000    | 0.017    | 5.00  | 5.00  | 0.00  | 1% AEP, 10 min burst, Storm 1 |
| CAT-T1-C-N        | 0.020    | 0.020    | 0.000    | 5.00  | 0.00  | 0.00  | 1% AEP, 5 min burst, Storm 1  |
| CAT_TANK-T1-B-S   | 0.020    | 0.020    | 0.000    | 5.00  | 0.00  | 0.00  | 1% AEP, 5 min burst, Storm 1  |
| CAT_P4-9          | 0.017    | 0.000    | 0.017    | 5.00  | 5.00  | 0.00  | 1% AEP, 10 min burst, Storm 1 |
| CAT_P1_30_        | 0.007    | 0.000    | 0.007    | 5.00  | 5.00  | 2.00  | 1% AEP, 10 min burst, Storm 1 |
| CAT_P2_30_        | 0.010    | 0.000    | 0.010    | 5.00  | 5.00  | 2.00  | 1% AEP, 10 min burst, Storm 1 |
| CAT_P3_30_        | 0.007    | 0.000    | 0.007    | 5.00  | 5.00  | 2.00  | 1% AEP, 10 min burst, Storm 1 |
| CAT_P8_13_        | 0.012    | 0.000    | 0.012    | 5.00  | 5.00  | 2.00  | 1% AEP, 10 min burst, Storm 1 |
| CAT_P9_13_        | 0.008    | 0.000    | 0.008    | 5.00  | 5.00  | 2.00  | 1% AEP, 10 min burst, Storm 1 |
| CAT_P2_15 BASIN   | 0.015    | 0.013    | 0.002    | 5.00  | 5.00  | 2.00  | 1% AEP, 5 min burst, Storm 1  |
| CAT_P4_3 BASIN    | 0.015    | 0.013    | 0.002    | 5.00  | 5.00  | 2.00  | 1% AEP, 5 min burst, Storm 1  |
| CAT_P3_15 BASIN   | 0.014    | 0.012    | 0.002    | 5.00  | 5.00  | 2.00  | 1% AEP, 5 min burst, Storm 1  |
| CAT_P7_3 BASIN    | 0.013    | 0.010    | 0.002    | 5.00  | 5.00  | 2.00  | 1% AEP, 5 min burst, Storm 1  |
| CAT_P9_3 BASIN    | 0.019    | 0.013    | 0.005    | 5.00  | 5.00  | 2.00  | 1% AEP, 5 min burst, Storm 1  |
| CAT_P6_15_ BASIN  | 0.014    | 0.009    | 0.005    | 5.00  | 5.00  | 2.00  | 1% AEP, 5 min burst, Storm 1  |
| CAT BLOCK_D ROOF  | 0.065    | 0.065    | 0.000    | 5.00  | 5.00  | 2.00  | 1% AEP, 5 min burst, Storm 1  |
| CAT BRB1          | 0.054    | 0.030    | 0.025    | 5.00  | 5.00  | 2.00  | 1% AEP, 10 min burst, Storm 1 |
| CAT BRB2          | 0.035    | 0.000    | 0.035    | 5.00  | 5.00  | 2.00  | 1% AEP, 10 min burst, Storm 1 |
| CAT_P1_3 BASIN    | 0.011    | 0.009    | 0.002    | 5.00  | 5.00  | 2.00  | 1% AEP, 5 min burst, Storm 1  |
| CAT_P3_19 BASIN   | 0.010    | 0.008    | 0.002    | 5.00  | 5.00  | 2.00  | 1% AEP, 5 min burst, Storm 1  |
| CAT_P2_19 BASIN   | 0.010    | 0.008    | 0.002    | 5.00  | 5.00  | 2.00  | 1% AEP, 5 min burst, Storm 1  |
| CAT_P1_19 BASIN   | 0.011    | 0.010    | 0.001    | 5.00  | 5.00  | 2.00  | 1% AEP, 5 min burst, Storm 1  |
| CAT_P2_18 BASIN   | 0.014    | 0.012    | 0.002    | 5.00  | 5.00  | 2.00  | 1% AEP, 5 min burst, Storm 1  |
| CAT_P1_18 BASIN   | 0.021    | 0.019    | 0.002    | 5.00  | 5.00  | 2.00  | 1% AEP, 5 min burst, Storm 1  |
| CAT L1 CONCOURSE  | 0.174    | 0.174    | 0.000    | 5.00  | 5.00  | 2.00  | 1% AEP, 5 min burst, Storm 1  |
| CAT_P1_7          | 0.010    | 0.008    | 0.002    | 5.00  | 5.00  | 0.00  | 1% AEP, 5 min burst, Storm 1  |
| CAT_P2_7          | 0.010    | 0.008    | 0.002    | 5.00  | 5.00  | 0.00  | 1% AEP, 5 min burst, Storm 1  |
| CAT_P3_7          | 0.017    | 0.000    | 0.017    | 5.00  | 5.00  | 0.00  | 1% AEP, 10 min burst, Storm 1 |
| CAT T1-D-NTH      | 0.020    | 0.020    | 0.000    | 5.00  | 0.00  | 0.00  | 1% AEP, 5 min burst, Storm 1  |
| CAT T1-C-STH      | 0.020    | 0.020    | 0.000    | 5.00  | 0.00  | 0.00  | 1% AEP, 5 min burst, Storm 1  |
| CAT_P4_7          | 0.017    | 0.000    | 0.017    | 5.00  | 5.00  | 0.00  | 1% AEP, 10 min burst, Storm 1 |
| CAT GOOD SHED STH | 0.025    | 0.025    | 0.000    | 5.00  | 5.00  | 2.00  | 1% AEP, 5 min burst, Storm 1  |
| CAT GOODS SHED    |          |          |          |       |       |       |                               |
| NTH               | 0.025    | 0.025    | 0.000    | 5.00  | 5.00  | 2.00  | 1% AEP, 5 min burst, Storm 1  |
| CAT_P1_8          | 0.009    | 0.007    | 0.002    | 5.00  | 5.00  | 0.00  | 1% AEP, 5 min burst, Storm 1  |
| CAT_P2_8          | 0.008    | 0.006    | 0.002    | 5.00  | 5.00  | 0.00  | 1% AEP, 5 min burst, Storm 1  |
| CAT_P3_8          | 0.009    | 0.000    | 0.009    | 5.00  | 5.00  | 0.00  | 1% AEP, 10 min burst, Storm 1 |
| CAT EQPTSHD       | 0.031    | 0.031    | 0.000    | 5.00  | 5.00  | 2.00  | 1% AEP, 5 min burst, Storm 1  |
| CAT T1-E-STH      | 0.020    | 0.020    | 0.000    | 5.00  | 0.00  | 0.00  | 1% AEP, 5 min burst, Storm 1  |
| CAT_P4_8          | 0.009    | 0.000    | 0.009    | 5.00  | 5.00  | 0.00  | 1% AEP, 10 min burst, Storm 1 |
| CAT_P1_10         | 0.010    | 0.008    | 0.002    | 5.00  | 5.00  | 0.00  | 1% AEP, 5 min burst, Storm 1  |
| CAT_P2_10         | 0.010    | 0.008    | 0.002    | 5.00  | 5.00  | 0.00  | 1% AEP, 5 min burst, Storm 1  |
| Cat619            | 0.017    | 0.000    | 0.017    | 5.00  | 5.00  | 0.00  | 1% AEP, 10 min burst, Storm 1 |
| CAT T1-E-NTH      | 0.020    | 0.020    | 0.000    | 5.00  | 0.00  | 0.00  | 1% AEP, 5 min burst, Storm 1  |
| CAT T1-F-STH      | 0.020    | 0.020    | 0.000    | 5.00  | 0.00  | 0.00  | 1% AEP, 5 min burst, Storm 1  |
| CAT_P4_10         | 0.017    | 0.000    | 0.017    | 5.00  | 5.00  | 0.00  | 1% AEP, 10 min burst, Storm 1 |
| CAT GD3           | 0.003    | 0.003    | 0.000    | 5.00  | 5.00  | 2.00  | 1% AEP, 5 min burst, Storm 1  |
| Cat_P4_21         | 0.007    | 0.007    | 0.000    | 5.00  | 5.00  | 2.00  | 1% AEP, 5 min burst, Storm 1  |

DRANS - Major results

|                  |       |       |       |      |      |      |                               |
|------------------|-------|-------|-------|------|------|------|-------------------------------|
| Cat P6_13_       | 0.007 | 0.007 | 0.000 | 5.00 | 5.00 | 2.00 | 1% AEP, 5 min burst, Storm 1  |
| Cat P2_28_ Basin | 0.007 | 0.006 | 0.001 | 5.00 | 5.00 | 2.00 | 1% AEP, 5 min burst, Storm 1  |
| Cat P3_28_       | 0.007 | 0.007 | 0.000 | 5.00 | 5.00 | 2.00 | 1% AEP, 5 min burst, Storm 1  |
| Cat P6_22        | 0.019 | 0.019 | 0.000 | 5.00 | 5.00 | 2.00 | 1% AEP, 5 min burst, Storm 1  |
| Cat P1_31_ Basin | 0.007 | 0.006 | 0.001 | 5.00 | 5.00 | 2.00 | 1% AEP, 5 min burst, Storm 1  |
| Cat P4_13_       | 0.007 | 0.007 | 0.000 | 5.00 | 5.00 | 2.00 | 1% AEP, 5 min burst, Storm 1  |
| Cat P1_28_ Basin | 0.015 | 0.013 | 0.002 | 5.00 | 5.00 | 2.00 | 1% AEP, 5 min burst, Storm 1  |
| Cat P1_13_ Basin | 0.015 | 0.013 | 0.002 | 5.00 | 5.00 | 2.00 | 1% AEP, 5 min burst, Storm 1  |
| CAT P2_3 BASIN   | 0.015 | 0.013 | 0.002 | 5.00 | 5.00 | 2.00 | 1% AEP, 5 min burst, Storm 1  |
| CAT P1_15 BASIN  | 0.015 | 0.013 | 0.002 | 5.00 | 5.00 | 2.00 | 1% AEP, 5 min burst, Storm 1  |
| Cat178542        | 0.008 | 0.007 | 0.001 | 5.00 | 5.00 | 2.00 | 1% AEP, 5 min burst, Storm 1  |
| Cat P4_15_ Basin | 0.010 | 0.008 | 0.002 | 5.00 | 5.00 | 2.00 | 1% AEP, 5 min burst, Storm 1  |
| Cat P1_23_ Basin | 0.008 | 0.007 | 0.001 | 5.00 | 5.00 | 2.00 | 1% AEP, 5 min burst, Storm 1  |
| Cat P1_22_       | 0.017 | 0.014 | 0.003 | 5.00 | 5.00 | 2.00 | 1% AEP, 5 min burst, Storm 1  |
| Cat P1_20_ Basin | 0.044 | 0.003 | 0.041 | 5.00 | 5.00 | 2.00 | 1% AEP, 10 min burst, Storm 1 |
| Cat P1_21_ Basin | 0.008 | 0.007 | 0.001 | 5.00 | 5.00 | 2.00 | 1% AEP, 5 min burst, Storm 1  |

PIPE DETAILS

| Name                   | Max Q<br>(cu.m/s) | Max V<br>(m/s) | Max U/S<br>HGL (m) | Max D/S<br>HGL (m) | Due to Storm                   |
|------------------------|-------------------|----------------|--------------------|--------------------|--------------------------------|
| P1_11 - P2_11          | 0.012             | 0.66           | 6.678              | 6.677              | 1% AEP, 5 min burst, Storm 1   |
| P2_11_P3-11            | 0.018             | 0.95           | 6.668              | 6.661              | 1% AEP, 5 min burst, Storm 1   |
| TRENCH-11_1            | 0.046             | 2.49           | 6.641              | 6.621              | 1% AEP, 5 min burst, Storm 1   |
| P3_1 - P4_1            | 0.011             | 1.23           | 6.332              | 6.321              | 1% AEP, 5 min burst, Storm 1   |
| P4_1 - P5_1            | 0.027             | 0.60           | 6.310              | 6.308              | 1% AEP, 10 min burst, Storm 1  |
| P5_1 - P6_1            | 0.041             | 0.92           | 6.261              | 6.247              | 1% AEP, 5 min burst, Storm 1   |
| P6_1 - P7_1            | 0.064             | 0.89           | 6.223              | 6.211              | 1% AEP, 5 min burst, Storm 1   |
| P7_1 - GPT_BRB3        | 0.068             | 1.48           | 6.171              | 6.167              | 1% AEP, 5 min burst, Storm 1   |
| GPT_BRB3 - BRB3        | 0.069             | 1.49           | 6.133              | 6.129              | 1% AEP, 5 min burst, Storm 1   |
| P2_1 - P1_1 + GD4      | 0.018             | 0.97           | 6.223              | 6.155              | 1% AEP, 10 min burst, Storm 7  |
| P1_1 - P2_6            | 0.019             | 1.02           | 6.094              | 6.011              | 1% AEP, 10 min burst, Storm 1  |
| P2_6 - ExP5            | 0.066             | 1.73           | 5.840              | 5.787              | 1% AEP, 5 min burst, Storm 1   |
| ExP5 - ExP4            | 0.064             | 0.87           | 5.341              | 5.236              | 1% AEP, 5 min burst, Storm 1   |
| Pipe1059               | 0.063             | 1.18           | 5.236              | 5.140              | 1% AEP, 10 min burst, Storm 5  |
| Pipe17                 | 0.005             | 0.25           | 6.198              | 6.198              | 1% AEP, 10 min burst, Storm 8  |
| P3_2 - HW2             | 0.010             | 0.52           | 6.191              | 6.189              | 1% AEP, 10 min burst, Storm 3  |
| GD2 - SAND FILTER      | 0.015             | 1.33           | 6.041              | 5.948              | 1% AEP, 5 min burst, Storm 1   |
| SAND_FILTER_INLET2     | 0.015             | 1.33           | 5.732              | 5.700              | 1% AEP, 5 min burst, Storm 1   |
| SAND FILTER - P4_17    | 0.019             | 1.17           | 5.366              | 5.326              | 1% AEP, 5 min burst, Storm 1   |
| P4_17 - P5_27          | 0.019             | 1.30           | 5.326              | 5.273              | 1% AEP, 5 min burst, Storm 1   |
| P5_17 - ExP6           | 0.019             | 0.89           | 5.237              | 5.163              | 1% AEP, 5 min burst, Storm 1   |
| ExP6 - Chatham North   | 0.019             | 1.04           | 5.163              | 5.034              | 1% AEP, 5 min burst, Storm 1   |
| P1_17 - P2_17          | 0.013             | 0.29           | 6.654              | 6.813              | 1% AEP, 10 min burst, Storm 8  |
| P1_16 - P2_16          | 0.025             | 1.35           | 6.290              | 6.086              | 1% AEP, 10 min burst, Storm 1  |
| Pipe69                 | 0.035             | 2.78           | 5.981              | 5.389              | 1% AEP, 10 min burst, Storm 1  |
| Pipe at Track Crossing | 0.111             | 1.68           | 5.003              | 4.939              | 1% AEP, 10 min burst, Storm 7  |
| T1-B-N_P3-11           | 0.020             | 1.08           | 6.666              | 6.661              | 1% AEP, 5 min burst, Storm 1   |
| T1-A-S_P4-9            | 0.021             | 1.11           | 6.648              | 6.642              | 1% AEP, 5 min burst, Storm 1   |
| TRENCH-11_2            | 0.034             | 1.84           | 6.631              | 6.621              | 1% AEP, 10 min burst, Storm 2  |
| P1-9_P2-9              | 0.012             | 0.65           | 6.678              | 6.676              | 1% AEP, 5 min burst, Storm 1   |
| P2-9_P3-9              | 0.018             | 0.95           | 6.668              | 6.661              | 1% AEP, 5 min burst, Storm 1   |
| P196                   | 0.046             | 2.49           | 6.641              | 6.621              | 1% AEP, 5 min burst, Storm 1   |
| T1-C-N_P3-9            | 0.020             | 1.08           | 6.666              | 6.661              | 1% AEP, 5 min burst, Storm 1   |
| TANK-T1-B-S_P4-9       | 0.021             | 1.12           | 6.648              | 6.642              | 1% AEP, 5 min burst, Storm 1   |
| P198                   | 0.034             | 1.83           | 6.631              | 6.621              | 1% AEP, 5 min burst, Storm 1   |
| P1_30_ - P2_30_        | 0.005             | 0.28           | 6.646              | 6.634              | 1% AEP, 5 min burst, Storm 1   |
| P2_30_ - P3_30_        | 0.013             | 0.70           | 6.611              | 6.586              | 1% AEP, 10 min burst, Storm 6  |
| P3_30_ - P7_13_        | 0.015             | 0.78           | 6.555              | 6.519              | 1% AEP, 10 min burst, Storm 4  |
| P7_13_ - P8_13_        | 0.049             | 1.07           | 6.458              | 6.433              | 1% AEP, 10 min burst, Storm 7  |
| P8_13_ - P9_13_        | 0.056             | 1.22           | 6.329              | 6.157              | 1% AEP, 10 min burst, Storm 5  |
| P7_13 - HW5_           | 0.063             | 1.42           | 6.038              | 5.955              | 1% AEP, 10 min burst, Storm 1  |
| P2_15 BASIN OUTLET     | 0.010             | 1.13           | 6.527              | 6.521              | 1% AEP, 5 min burst, Storm 1   |
| P2_15 - P3_15          | 0.018             | 0.96           | 6.510              | 6.488              | 1% AEP, 25 min burst, Storm 10 |
| P278037                | 0.022             | 1.19           | 6.465              | 6.417              | 1% AEP, 15 min burst, Storm 3  |
| P4_15_ - P5_15_        | 0.025             | 1.35           | 6.383              | 6.319              | 1% AEP, 5 min burst, Storm 1   |
| P5_15_ - P7_15_        | 0.024             | 1.28           | 6.140              | 6.046              | 1% AEP, 20 min burst, Storm 8  |
| P5_15 - ExP1           | 0.125             | 1.74           | 5.800              | 5.764              | 1% AEP, 10 min burst, Storm 4  |
| ExP1 - P1_20           | 0.169             | 1.53           | 5.571              | 5.212              | 1% AEP, 25 min burst, Storm 7  |
| P1_20 -                |                   |                |                    |                    |                                |
| DARLING_ST_RN          | 0.207             | 2.02           | 5.075              | 4.997              | 1% AEP, 25 min burst, Storm 1  |

DRANS - Major results

|                         |       |      |       |       |                               |
|-------------------------|-------|------|-------|-------|-------------------------------|
| P4_3 BASIN OUTLET       | 0.014 | 1.60 | 6.362 | 6.306 | 1% AEP, 10 min burst, Storm 5 |
| P5_3 - P6_3             | 0.025 | 0.35 | 6.299 | 6.297 | 1% AEP, 10 min burst, Storm 6 |
| P6_3 - P8_3             | 0.025 | 0.35 | 6.296 | 6.292 | 1% AEP, 10 min burst, Storm 6 |
| P8_3 - P10_3            | 0.035 | 0.48 | 6.282 | 6.275 | 1% AEP, 5 min burst, Storm 1  |
| P10_3 - P11_3           | 0.071 | 0.98 | 6.202 | 6.166 | 1% AEP, 10 min burst, Storm 1 |
| P11_3 - P5_15           | 0.102 | 1.41 | 6.084 | 6.046 | 1% AEP, 10 min burst, Storm 4 |
| P3_15 BASIN OUTLET      | 0.009 | 1.06 | 6.496 | 6.488 | 1% AEP, 5 min burst, Storm 1  |
| P7_3 BASIN OUTLET       | 0.011 | 1.29 | 6.349 | 6.292 | 1% AEP, 10 min burst, Storm 1 |
| P9_3 BASIN OUTLET       | 0.015 | 1.74 | 6.335 | 6.275 | 1% AEP, 10 min burst, Storm 1 |
| P4_15 BASIN OUTLET      | 0.008 | 0.89 | 6.342 | 6.319 | 1% AEP, 20 min burst, Storm 8 |
| block d roof - brb1     | 0.065 | 3.49 | 7.877 | 6.229 | 1% AEP, 5 min burst, Storm 1  |
| BRB1 - BRB2             | 0.095 | 1.32 | 6.199 | 6.189 | 1% AEP, 5 min burst, Storm 1  |
| P2_4 - P3_4             | 0.108 | 0.93 | 6.023 | 6.011 | 1% AEP, 25 min burst, Storm 1 |
| P3_4 - P4_4             | 0.109 | 0.98 | 5.970 | 5.964 | 1% AEP, 25 min burst, Storm 1 |
| P4_4 - ExP2             | 0.109 | 0.98 | 5.909 | 5.836 | 1% AEP, 25 min burst, Storm 1 |
| ExP2 - ExP1             | 0.112 | 1.01 | 5.825 | 5.764 | 1% AEP, 25 min burst, Storm 1 |
| P11_3 BASIN OUTLET      | 0.010 | 1.16 | 6.209 | 6.166 | 1% AEP, 10 min burst, Storm 1 |
| P3_19 BASIN OUTLET      | 0.009 | 1.09 | 6.360 | 6.339 | 1% AEP, 10 min burst, Storm 8 |
| P3_19 - P11_3           | 0.026 | 1.38 | 6.278 | 6.166 | 1% AEP, 5 min burst, Storm 1  |
| P2_19 BASIN OUTLET      | 0.009 | 1.01 | 6.421 | 6.408 | 1% AEP, 5 min burst, Storm 1  |
| P2_19 - P3_19           | 0.017 | 0.92 | 6.378 | 6.339 | 1% AEP, 5 min burst, Storm 1  |
| P1_19 BASIN OUTLET      | 0.009 | 1.06 | 6.433 | 6.421 | 1% AEP, 15 min burst, Storm 4 |
| P1_19 - P2_19           | 0.009 | 0.49 | 6.418 | 6.408 | 1% AEP, 5 min burst, Storm 1  |
| ExP3 - ExP2             | 0.007 | 0.06 | 5.833 | 5.836 | 1% AEP, 25 min burst, Storm 1 |
| P2_18 BASIN OUTLET      | 0.012 | 1.40 | 6.507 | 6.473 | 1% AEP, 5 min burst, Storm 1  |
| P2_18 - P10_3           | 0.024 | 1.27 | 6.393 | 6.275 | 1% AEP, 5 min burst, Storm 1  |
| P1_18 BASIN OUTLET      | 0.015 | 1.69 | 6.558 | 6.525 | 1% AEP, 10 min burst, Storm 1 |
| P1_19 - P2_18           | 0.015 | 0.79 | 6.499 | 6.473 | 1% AEP, 10 min burst, Storm 2 |
| GD1 - P3_4              | 0.001 | 0.04 | 6.013 | 6.011 | 1% AEP, 5 min burst, Storm 1  |
| CONCOURSE - BRB1        | 0.177 | 3.85 | 7.084 | 6.229 | 1% AEP, 5 min burst, Storm 1  |
| P1_7 - P2_7             | 0.012 | 0.65 | 6.678 | 6.676 | 1% AEP, 5 min burst, Storm 1  |
| P2_7 - P3_7             | 0.018 | 0.95 | 6.668 | 6.661 | 1% AEP, 5 min burst, Storm 1  |
| P3_7 - TRENCH7          | 0.046 | 2.49 | 6.641 | 6.621 | 1% AEP, 5 min burst, Storm 1  |
| T1-D-NTH OVERFLOW       | 0.020 | 1.08 | 6.666 | 6.661 | 1% AEP, 5 min burst, Storm 1  |
| T1-C-STH - P4_7         | 0.021 | 1.12 | 6.648 | 6.642 | 1% AEP, 5 min burst, Storm 1  |
| P4_7 = TRENCH7          | 0.034 | 1.83 | 6.631 | 6.621 | 1% AEP, 5 min burst, Storm 1  |
| BRB3 - ExP4             | 0.030 | 0.41 | 5.381 | 5.236 | 1% AEP, 25 min burst, Storm 6 |
| T1 - P1_6               | 0.025 | 1.34 | 6.440 | 6.424 | 1% AEP, 5 min burst, Storm 1  |
| P1_6 - P2_6             | 0.025 | 1.34 | 6.313 | 6.011 | 1% AEP, 5 min burst, Storm 1  |
| T1 - P2_6               | 0.025 | 1.43 | 6.056 | 6.025 | 1% AEP, 5 min burst, Storm 1  |
| P1_8 - P2_8             | 0.008 | 0.42 | 6.589 | 6.583 | 1% AEP, 5 min burst, Storm 1  |
| P2_8 - TRENCH8          | 0.015 | 0.80 | 6.582 | 6.582 | 1% AEP, 5 min burst, Storm 1  |
| P3_8 - TRENCH8          | 0.049 | 2.62 | 6.569 | 6.564 | 1% AEP, 10 min burst, Storm 1 |
| T2-EQPSHD - P3_8        | 0.031 | 1.65 | 6.593 | 6.582 | 1% AEP, 5 min burst, Storm 1  |
| T1-E-STH - P4_8         | 0.020 | 1.09 | 6.571 | 6.567 | 1% AEP, 5 min burst, Storm 1  |
| P4_8 - TRENCH8          | 0.027 | 1.42 | 6.565 | 6.564 | 1% AEP, 5 min burst, Storm 1  |
| P1_10 - P2_10           | 0.012 | 0.65 | 6.678 | 6.676 | 1% AEP, 5 min burst, Storm 1  |
| P2_10 - P3_10           | 0.018 | 0.95 | 6.668 | 6.661 | 1% AEP, 5 min burst, Storm 1  |
| P3_10 - TRENCH10        | 0.046 | 2.49 | 6.641 | 6.621 | 1% AEP, 5 min burst, Storm 1  |
| P1008                   | 0.020 | 1.08 | 6.666 | 6.661 | 1% AEP, 5 min burst, Storm 1  |
| T1-F-STH - P4_10        | 0.021 | 1.12 | 6.648 | 6.642 | 1% AEP, 5 min burst, Storm 1  |
| P4_10 - TRENCH10        | 0.034 | 1.83 | 6.631 | 6.621 | 1% AEP, 5 min burst, Storm 1  |
| GD3 - P7_1              | 0.005 | 0.25 | 6.212 | 6.211 | 1% AEP, 5 min burst, Storm 1  |
| P4_21 - P5_22           | 0.017 | 0.91 | 6.559 | 6.560 | 1% AEP, 20 min burst, Storm 4 |
| P5_22 - P5_13           | 0.042 | 0.91 | 6.525 | 6.519 | 1% AEP, 10 min burst, Storm 8 |
| P2_28_Basin - P2_28_Pit | 0.008 | 0.95 | 6.621 | 6.624 | 1% AEP, 25 min burst, Storm 1 |
| P2_28 - P3_28           | 0.012 | 0.63 | 6.624 | 6.631 | 1% AEP, 5 min burst, Storm 1  |
| P3_28 - P4_28           | 0.012 | 0.63 | 6.631 | 6.662 | 1% AEP, 5 min burst, Storm 1  |
| P4_28 - P5_13           | 0.021 | 1.14 | 6.629 | 6.602 | 1% AEP, 5 min burst, Storm 1  |
| P5_13 - P6_30           | 0.032 | 0.70 | 6.571 | 6.560 | 1% AEP, 5 min burst, Storm 1  |
| P1_31_Basin - P3_13     | 0.006 | 0.66 | 6.688 | 6.677 | 1% AEP, 10 min burst, Storm 4 |
| P3_13 - P4_13           | 0.015 | 0.81 | 6.658 | 6.640 | 1% AEP, 10 min burst, Storm 4 |
| P4_13 - P5_13           | 0.020 | 0.43 | 6.620 | 6.602 | 1% AEP, 5 min burst, Storm 1  |
| P1_28_Basin - P1_28_Pit | 0.008 | 0.88 | 6.626 | 6.625 | 1% AEP, 25 min burst, Storm 4 |
| P1_28 - P2_28           | 0.007 | 0.39 | 6.625 | 6.624 | 1% AEP, 10 min burst, Storm 9 |
| P1_13_Basin - P2_13     | 0.012 | 0.67 | 6.717 | 6.710 | 1% AEP, 10 min burst, Storm 5 |
| P2_13 - P3_13           | 0.012 | 0.67 | 6.698 | 6.677 | 1% AEP, 10 min burst, Storm 5 |
| P2_3 BASIN OUTLET       | 0.012 | 1.38 | 6.368 | 6.312 | 1% AEP, 10 min burst, Storm 1 |
| P3_3 - P5_3             | 0.012 | 0.43 | 6.312 | 6.306 | 1% AEP, 10 min burst, Storm 1 |

DRANS - Major results

|                       |       |      |       |       |                               |
|-----------------------|-------|------|-------|-------|-------------------------------|
| P1_15 BASIN OUTLET    | 0.011 | 1.27 | 6.534 | 6.528 | 1% AEP, 25 min burst, Storm 8 |
| P1_15 - P2_15         | 0.011 | 0.60 | 6.526 | 6.521 | 1% AEP, 25 min burst, Storm 6 |
| Track Access Culvert  | 0.036 | 1.00 | 5.935 | 5.857 | 1% AEP, 25 min burst, Storm 1 |
| Basin - P4_15_        | 0.008 | 0.95 | 6.428 | 6.417 | 1% AEP, 10 min burst, Storm 1 |
| P1_23 Basin - P2_20_  | 0.009 | 0.47 | 6.317 | 6.241 | 1% AEP, 10 min burst, Storm 9 |
| P2_20_ - P3_20_       | 0.028 | 1.51 | 6.025 | 5.782 | 1% AEP, 25 min burst, Storm 1 |
| P3_20_ - P4_20_       | 0.039 | 2.08 | 5.434 | 5.400 | 1% AEP, 15 min burst, Storm 8 |
| P6_20 Basin - P3_20   | 0.012 | 0.63 | 6.280 | 6.241 | 1% AEP, 5 min burst, Storm 1  |
| P1_20_ basin - P2_20_ | 0.014 | 0.73 | 6.317 | 6.241 | 1% AEP, 5 min burst, Storm 1  |
| P1_21_ Basin - P3_20_ | 0.013 | 1.46 | 5.974 | 5.782 | 1% AEP, 15 min burst, Storm 8 |
| Burried Pipe          | 0.026 | 1.62 | 5.777 | 5.383 | 1% AEP, 25 min burst, Storm 1 |
| P2_17 - P3_17         | 0.005 | 0.82 | 5.848 | 5.773 | 1% AEP, 25 min burst, Storm 6 |
| P3_17 - GPT           | 0.005 | 0.59 | 5.773 | 5.740 | 1% AEP, 25 min burst, Storm 6 |
| GPT - SAND FILTER     | 0.005 | 0.78 | 5.740 | 5.709 | 1% AEP, 25 min burst, Storm 6 |
| SAND_TANK_INLET1      | 0.005 | 1.09 | 5.709 | 5.669 | 1% AEP, 25 min burst, Storm 6 |

CHANNEL DETAILS

| Name | Max Q<br>(cu.m/s) | Max V<br>(m/s) | Due to Storm |
|------|-------------------|----------------|--------------|
|------|-------------------|----------------|--------------|

OVERFLOW ROUTE  
DETAILS

| Name                        | Max Q U/S | Max Q D/S | Safe Q | Max D | Max DxV | Max Width | Max V | Due to Storm                  |
|-----------------------------|-----------|-----------|--------|-------|---------|-----------|-------|-------------------------------|
| OF P1_11 - P3_11            | 0         | 0         | 1.546  | 0     | 0       | 0         | 0     |                               |
| OF P2_11 - P3_11            | 0         | 0         | 1.542  | 0     | 0       | 0         | 0     |                               |
| OF P3_11 - TRENCH11         | 0         | 0         | 1.543  | 0     | 0       | 0         | 0     |                               |
| OF TRENCH11 -<br>BYPASS2    | 0         | 0         | 1.546  | 0     | 0       | 0         | 0     |                               |
| OF P3_1 - P4_1              | 0.012     | 0.012     | 3.052  | 0.054 | 0.03    | 1.71      | 0.50  | 1% AEP, 20 min burst, Storm 5 |
| OF P4_1 - P5_1              | 0.006     | 0.006     | 3.392  | 0.049 | 0.02    | 1.27      | 0.39  | 1% AEP, 25 min burst, Storm 1 |
| OF P5_1 - P6_1              | 0.005     | 0.005     | 3.298  | 0.045 | 0.02    | 0.81      | 0.42  | 1% AEP, 25 min burst, Storm 1 |
| OF P6_1 - GD3               | 0         | 0         | 4.206  | 0     | 0       | 0         | 0     |                               |
| OF HW1 - BRB3               | 0.059     | 0.059     | 1.546  | 0.629 | 0.02    | 3.98      | 0.03  | 1% AEP, 5 min burst, Storm 1  |
| OF386                       | 0         | 0         | 1.645  | 0     | 0       | 0         | 0     |                               |
| OF372                       | 0         | 0         | 3.587  | 0     | 0       | 0         | 0     |                               |
| OF374                       | 0         | 0         | 1.020  | 0     | 0       | 0         | 0     |                               |
| OF P2_2 - BRB2              | 0         | 0         | 1.567  | 0     | 0       | 0         | 0     |                               |
| OF P3_2                     | 0         | 0         | 1.567  | 0     | 0       | 0         | 0     |                               |
| OF234                       | 0.010     | 0.010     | 1.520  | 0.589 | 0.00    | 3.98      | 0.01  | 1% AEP, 5 min burst, Storm 1  |
| OF GD2 - Exp6               | 0         | 0         | 1.511  | 0     | 0       | 0         | 0     |                               |
| OF SandFilterNth -<br>P5_17 | 0         | 0         | 3.814  | 0     | 0       | 0         | 0     |                               |
| OF SandFilter - P5_17       | 0         | 0         | 2.723  | 0     | 0       | 0         | 0     |                               |
| OF P4_17 - P5_17            | 0         | 0         | 2.707  | 0     | 0       | 0         | 0     |                               |
| OF P5_17 - eXp6             | 0         | 0         | 2.536  | 0     | 0       | 0         | 0     |                               |
| OF Exp6 - ChathamSt<br>Node | 0         | 0         | 7.935  | 0     | 0       | 0         | 0     |                               |
| OF P1_17 - GD2              | 0.000     | 0.015     | 2.695  | 0.007 | 0.00    | 7.50      | 0.31  | 1% AEP, 5 min burst, Storm 1  |
| OF P2_17 - GD2              | 0         | 0         | 1.711  | 0     | 0       | 0         | 0     |                               |
| Orifice_P2_17               | 0.005     | 0.000     | 0.000  | 0.450 | 0.00    | 20.00     | 0.00  | 1% AEP, 25 min burst, Storm 6 |
| OF P1_16 - P2_16            | 0         | 0         | 2.682  | 0     | 0       | 0         | 0     |                               |
| OF P2_16 - ExPt_Track       | 0         | 0         | 2.676  | 0     | 0       | 0         | 0     |                               |
| OF_TO_TRACK1                | 0         | 0         | 7.970  | 0     | 0       | 0         | 0     |                               |
| OF P4_11 - TRENCH11         | 0         | 0         | 1.543  | 0     | 0       | 0         | 0     |                               |
| OF P1_9 - P3_9              | 0         | 0         | 1.546  | 0     | 0       | 0         | 0     |                               |
| OF P2_9 - P3_9              | 0         | 0         | 1.542  | 0     | 0       | 0         | 0     |                               |
| OF P3_9 - TRENCH9           | 0         | 0         | 1.543  | 0     | 0       | 0         | 0     |                               |
| OF TRENCH9 -<br>BYPASS3     | 0         | 0         | 1.546  | 0     | 0       | 0         | 0     |                               |
| OF P4-9 - TRENCH9           | 0         | 0         | 1.543  | 0     | 0       | 0         | 0     |                               |
| OF P1_13 - P2_13            | 0         | 0         | 1.531  | 0     | 0       | 0         | 0     |                               |
| OF P2_30_ - P3_30_          | 0         | 0         | 1.531  | 0     | 0       | 0         | 0     |                               |
| OF P3_30_ - P8_13_          | 0         | 0         | 1.540  | 0     | 0       | 0         | 0     |                               |
| OF P5_13 - BYPASS1          | 0         | 0         | 1.467  | 0     | 0       | 0         | 0     |                               |
| OF P8_13_ - P9_13_          | 0         | 0         | 1.535  | 0     | 0       | 0         | 0     |                               |
| OF P9_13_ - TRACK2          | 0         | 0         | 1.544  | 0     | 0       | 0         | 0     |                               |
| Existing V Drain 1          | 0.050     | 0.024     | 0.660  | 0.262 | 0.00    | 17.41     | 0.02  | 1% AEP, 5 min burst, Storm 1  |
| OF BYP1 - P7_13             | 0         | 0         | 1.557  | 0     | 0       | 0         | 0     |                               |
| OF P2_15 - P3_15            | 0.000     | 0.007     | 3.258  | 0.075 | 0.01    | 3.82      | 0.30  | 1% AEP, 5 min burst, Storm 1  |
| OF P4_3 - P2_15             | 0         | 0         | 7.982  | 0     | 0       | 0         | 0     |                               |
| OF222634                    | 0.000     | 0.005     | 3.258  | 0.044 | 0.02    | 0.76      | 0.41  | 1% AEP, 10 min burst, Storm 5 |



DRANS - Major results

|                         |       |       |        |       |      |       |      |                               |
|-------------------------|-------|-------|--------|-------|------|-------|------|-------------------------------|
| OF P7_3 - P3_15         | 0     | 0     | 7.982  | 0     | 0    | 0     | 0    |                               |
| OF P9_3 BASIN - P11_3   |       |       |        |       |      |       |      |                               |
| BASIN                   | 0     | 0     | 3.807  | 0     | 0    | 0     | 0    |                               |
| OF P4_15 BASIN          | 0     | 0     | 3.815  | 0     | 0    | 0     | 0    |                               |
| OF BRB1 - BRB2          | 0.168 | 0.168 | 1.546  | 0.085 | 0.05 | 3.98  | 0.79 | 1% AEP, 10 min burst, Storm 7 |
| OF BRB2 - N458          | 0     | 0     | 8.006  | 0     | 0    | 0     | 0    |                               |
| OF P11_3 BASIN          | 0     | 0     | 3.780  | 0     | 0    | 0     | 0    |                               |
| OF P3_19 BASIN          | 0     | 0     | 3.814  | 0     | 0    | 0     | 0    |                               |
| OF P2_19 BASIN          | 0     | 0     | 3.772  | 0     | 0    | 0     | 0    |                               |
| OF P1_19 BASIN          | 0     | 0     | 1.486  | 0     | 0    | 0     | 0    |                               |
| OF179                   | 0.002 | 0.002 | 4.332  | 0.037 | 0.01 | 0.41  | 0.48 | 1% AEP, 20 min burst, Storm 4 |
| OF181                   | 0.001 | 0.001 | 4.270  | 0.025 | 0.00 | 0.27  | 0.00 | 1% AEP, 20 min burst, Storm 4 |
| OF184                   | 0     | 0     | 4.142  | 0     | 0    | 0     | 0    |                               |
| OF178                   | 0     | 0     | 4.427  | 0     | 0    | 0     | 0    |                               |
| OF172                   | 0     | 0     | 4.279  | 0     | 0    | 0     | 0    |                               |
| OF395                   | 0     | 0     | 13.746 | 0     | 0    | 0     | 0    |                               |
| OF P2_18 BASIN -        |       |       |        |       |      |       |      |                               |
| P3_19 BASIN             | 0     | 0     | 3.807  | 0     | 0    | 0     | 0    |                               |
| OF P1_18 BASIN -        |       |       |        |       |      |       |      |                               |
| P2_19 BASIN             | 0     | 0     | 3.807  | 0     | 0    | 0     | 0    |                               |
| OF219                   | 0     | 0     | 4.270  | 0     | 0    | 0     | 0    |                               |
| OF230                   | 0     | 0     | 1.447  | 0     | 0    | 0     | 0    |                               |
| OF N480 - BRB2          | 0.167 | 0.167 | 1.520  | 0.589 | 0.04 | 3.98  | 0.23 | 1% AEP, 10 min burst, Storm 7 |
| OF262                   | 0     | 0     | 1.546  | 0     | 0    | 0     | 0    |                               |
| OF P2_7 - P3_7          | 0     | 0     | 1.542  | 0     | 0    | 0     | 0    |                               |
| OF P3_7 - TRENCH7       | 0     | 0     | 1.543  | 0     | 0    | 0     | 0    |                               |
| OF243                   | 0     | 0     | 1.546  | 0     | 0    | 0     | 0    |                               |
| OF254                   | 0     | 0     | 1.543  | 0     | 0    | 0     | 0    |                               |
| OF BRB3 - ExP4          | 0     | 0     | 1.493  | 0     | 0    | 0     | 0    |                               |
| OF P1_8 - P2_8          | 0.001 | 0.001 | 1.553  | 0.033 | 0.00 | 3.98  | 0.00 | 1% AEP, 25 min burst, Storm 8 |
| OF P2_8 - P3_8          | 0.006 | 0.006 | 1.553  | 0.034 | 0.00 | 3.98  | 0.07 | 1% AEP, 25 min burst, Storm 8 |
| OF P3_8 - TRENCH8       | 0     | 0     | 1.530  | 0     | 0    | 0     | 0    |                               |
| OF TRENCH8 -            |       |       |        |       |      |       |      |                               |
| CHATHAM-RN-1            | 0     | 0     | 1.508  | 0     | 0    | 0     | 0    |                               |
| OF P4_8 - TRENCH8       | 0     | 0     | 1.530  | 0     | 0    | 0     | 0    |                               |
| OF370                   | 0     | 0     | 2.428  | 0     | 0    | 0     | 0    |                               |
| OF P1_10 - P3_10        | 0     | 0     | 1.546  | 0     | 0    | 0     | 0    |                               |
| OF P2_10 - P3_10        | 0     | 0     | 1.542  | 0     | 0    | 0     | 0    |                               |
| OF P3_10 - TRENCH10     | 0     | 0     | 1.543  | 0     | 0    | 0     | 0    |                               |
| OF TRENCH10 -           |       |       |        |       |      |       |      |                               |
| CHATHAM-RN-2            | 0     | 0     | 1.514  | 0     | 0    | 0     | 0    |                               |
| OF P4_10 - TRENCH10     | 0     | 0     | 1.543  | 0     | 0    | 0     | 0    |                               |
| OF368                   | 0     | 0     | 3.805  | 0     | 0    | 0     | 0    |                               |
| OF GD3 - BRB3           | 0     | 0     | 0.925  | 0     | 0    | 0     | 0    |                               |
| OF P1_19 - P9_13_       | 0     | 0     | 2.231  | 0     | 0    | 0     | 0    |                               |
| OF P2_28_ Basin -       |       |       |        |       |      |       |      |                               |
| P3_28_                  | 0     | 0     | 1.546  | 0     | 0    | 0     | 0    |                               |
| OF P3_28_ - P1_29_      | 0.006 | 0.006 | 1.075  | 0.027 | 0.01 | 1.62  | 0.30 | 1% AEP, 10 min burst, Storm 7 |
| OF P4_28_ - P1_29_      | 0     | 0     | 1.013  | 0     | 0    | 0     | 0    |                               |
| OF P5_13_ - BYP1        | 0     | 0     | 1.901  | 0     | 0    | 0     | 0    |                               |
| OF P3_22 Basin - P2_22  |       |       |        |       |      |       |      |                               |
| Basin                   | 0     | 0     | 3.807  | 0     | 0    | 0     | 0    |                               |
| OF P3_13_ - P3_28_      | 0     | 0     | 1.054  | 0     | 0    | 0     | 0    |                               |
| OF P4_13_ - P3_28_      | 0     | 0     | 0.997  | 0     | 0    | 0     | 0    |                               |
| OF P1_28_ - P2_28_      | 0.002 | 0.005 | 3.052  | 0.141 | 0.01 | 10.48 | 0.31 | 1% AEP, 15 min burst, Storm 1 |
| OF P1_13_ Basin -       |       |       |        |       |      |       |      |                               |
| P1_28_ Basin            | 0     | 0     | 3.807  | 0     | 0    | 0     | 0    |                               |
| OF1 P2_3 - P1_15        | 0     | 0     | 3.807  | 0     | 0    | 0     | 0    |                               |
| OF P1_15 - P2_15        | 0.000 | 0.008 | 3.052  | 0.087 | 0.01 | 5.07  | 0.33 | 1% AEP, 5 min burst, Storm 1  |
| OF Track Access Culvert | 0     | 0     | 1.031  | 0     | 0    | 0     | 0    |                               |
| Existing V Drain 2      | 0.030 | 0.027 | 0.660  | 0.212 | 0.00 | 16.71 | 0.02 | 1% AEP, 25 min burst, Storm 3 |
| OF P3_15 - P4_15        |       |       |        |       |      |       |      |                               |
| BASIN                   | 0.000 | 0.006 | 3.258  | 0.046 | 0.02 | 0.92  | 0.45 | 1% AEP, 10 min burst, Storm 1 |
| OF P1_23_ Basin -       |       |       |        |       |      |       |      |                               |
| P1_22_ Basin            | 0.001 | 0.001 | 0.990  | 0.230 | 0.00 | 3.00  | 0.00 | 1% AEP, 10 min burst, Storm 7 |
| OF P6_20 Basin - P7_20  |       |       |        |       |      |       |      |                               |
| Basin                   | 0.023 | 0.023 | 0.990  | 0.216 | 0.02 | 3.00  | 0.79 | 1% AEP, 10 min burst, Storm 7 |
| OF P1_20_ - P1_22_      | 0.031 | 0.031 | 1.002  | 0.230 | 0.03 | 3.00  | 0.77 | 1% AEP, 10 min burst, Storm 1 |
| OF177                   | 0.007 | 0.007 | 4.332  | 0.065 | 0.04 | 2.82  | 1.34 | 1% AEP, 15 min burst, Storm 8 |
| OF P7_20 - Outlet       | 0.012 | 0.012 | 0.919  | 0.065 | 0.02 | 3.00  | 0.93 | 1% AEP, 15 min burst, Storm 8 |

DRANS - Major results

|                          |   |   |       |   |   |   |   |
|--------------------------|---|---|-------|---|---|---|---|
| OF Burried Pipe          | 0 | 0 | 1.546 | 0 | 0 | 0 | 0 |
| OF SandFilterSth - P5_17 | 0 | 0 | 3.814 | 0 | 0 | 0 | 0 |

DETENTION BASIN  
DETAILS

| Name         | Max WL | MaxVol | Max Q<br>Total | Max Q<br>Low Level | Max Q<br>High Level |
|--------------|--------|--------|----------------|--------------------|---------------------|
| TRENCH_11    | 6.62   | 47.9   | 0.000          | 0.000              | 0.000               |
| SAND FILTER  | 5.52   | 0.2    | 0.019          | 0.019              | 0.000               |
| TRENCH9      | 6.62   | 47.9   | 0.000          | 0.000              | 0.000               |
| P2_15 BASIN  | 6.57   | 5.2    | 0.010          | 0.010              | 0.000               |
| P4_3 BASIN   | 6.73   | 1.5    | 0.014          | 0.014              | 0.000               |
| P3_15 BASIN  | 6.55   | 4.3    | 0.009          | 0.009              | 0.000               |
| P7_3 BASIN   | 6.73   | 1.4    | 0.011          | 0.011              | 0.000               |
| P9_3 BASIN   | 6.74   | 3.0    | 0.015          | 0.015              | 0.000               |
| P6_15_ BASIN | 6.50   | 6.0    | 0.008          | 0.008              | 0.000               |
| BRB1         | 6.23   | 55.0   | 0.263          | 0.095              | 0.168               |
| BRB2         | 6.19   | 134.3  | 0.108          | 0.108              | 0.000               |
| P11_3 BASIN  | 6.50   | 1.1    | 0.010          | 0.010              | 0.000               |
| P3_19 BASIN  | 6.50   | 1.0    | 0.009          | 0.009              | 0.000               |
| P2_19 BASIN  | 6.51   | 1.3    | 0.009          | 0.009              | 0.000               |
| P1_19 BASIN  | 6.52   | 1.6    | 0.009          | 0.009              | 0.000               |
| Basin73      | 6.74   | 1.6    | 0.012          | 0.012              | 0.000               |
| Basin76      | 6.78   | 4.1    | 0.015          | 0.015              | 0.000               |
| TRENCH7      | 6.62   | 47.9   | 0.000          | 0.000              | 0.000               |
| BRB3         | 6.13   | 48.6   | 0.030          | 0.030              | 0.000               |
| TRENCH8      | 6.56   | 51.5   | 0.000          | 0.000              | 0.000               |
| TRENCH10     | 6.62   | 47.9   | 0.000          | 0.000              | 0.000               |
| P2_28_ Basin | 6.62   | 5.6    | 0.008          | 0.008              | 0.000               |
| P1_31_ Basin | 6.74   | 1.3    | 0.006          | 0.006              | 0.000               |
| P1_28_ Basin | 6.63   | 10.7   | 0.010          | 0.008              | 0.002               |
| P1_13_ Basin | 6.76   | 3.2    | 0.012          | 0.012              | 0.000               |
| P2_3 BASIN   | 6.74   | 1.7    | 0.012          | 0.012              | 0.000               |
| P1_15 BASIN  | 6.57   | 5.6    | 0.011          | 0.011              | 0.000               |
| P4_15_ Basin | 6.50   | 1.3    | 0.008          | 0.008              | 0.000               |
| P1_23_ Basin | 6.43   | 3.7    | 0.009          | 0.009              | 0.001               |
| P1_22 Basin  | 6.43   | 3.7    | 0.035          | 0.012              | 0.023               |
| P1_20_ Basin | 6.45   | 4.2    | 0.044          | 0.014              | 0.031               |
| P1_21_ Basin | 6.42   | 3.5    | 0.025          | 0.013              | 0.012               |

Run Log for 160548 NJC

Stables run at 11:08:29

on 26/4/2022 using

version 2022.012

Upwelling occurred at:

P1\_19\_, P3\_28\_,  
P4\_10, P3\_10, P2\_8,  
P4\_7, P3\_7, ExP3, P4-9,  
P3-9, P4-11, P3\_8,  
P4\_8, P3-11

Freeboard was less than

0.05m at P3\_13\_,  
P2\_10, P1\_10, P1\_8,  
P6\_1, P5\_1, P4\_1,  
P2\_7, P1\_7, P1\_30\_,  
P2\_30\_, P2\_17, P2-9,  
P1-9, P1\_17, P3\_30,  
P2\_1, P3\_1, P1-11, P2-  
11

The maximum flow in  
these overflow routes is  
unsafe: Existing V Drain  
2, Existing V Drain 1

## Appendix E

# Soil and Water Management Plans

SEDIMENTATION  
BASIN LAYOUT PLAN

SCALE 1:500

LEGEND

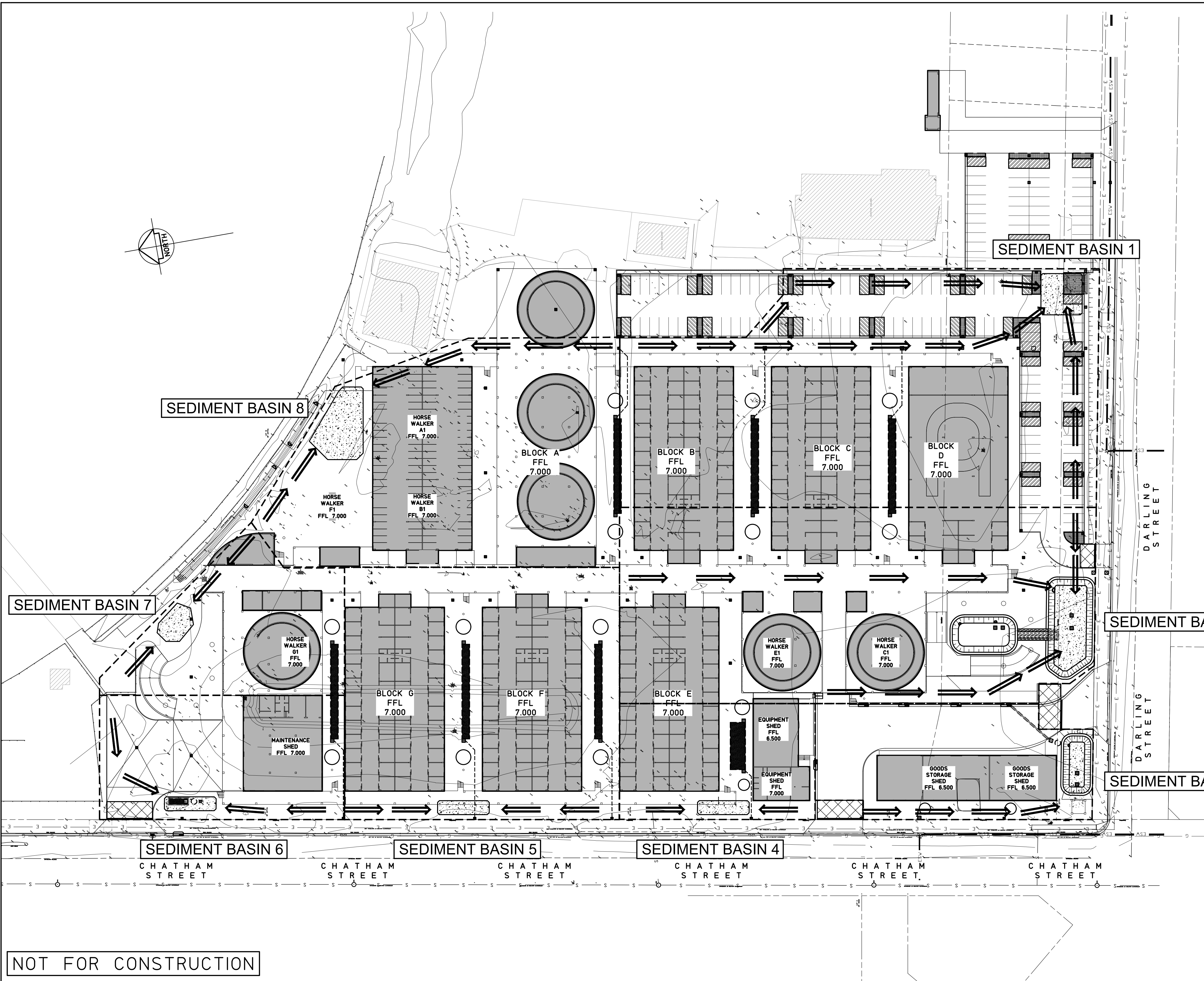
DENOTES STABILISED SITE ACCESS,  
REFER TO DETAIL SD6-14

DENOTES EARTHBANK (HIGH FLOW),  
REFER TO DETAIL SD5-6

DENOTES SEDIMENT BASIN,  
REFER TO SCHEDULE FOR  
SETTLING ZONE AND STORAGE  
AREA VOLUMES  
REFER TO DETAIL SD6-4

DENOTES SEDIMENT BASIN,  
SUB-CATCHMENT EXTENTS

| SEDIMENT BASIN SCHEDULE |                |                    |                   |                         |
|-------------------------|----------------|--------------------|-------------------|-------------------------|
| SEDIMENT BASIN No.      | PLAN AREA (m2) | SETTLING ZONE (m3) | STORAGE ZONE (m3) | TOTAL BASIN VOLUME (m3) |
| 1                       | 225            | 90                 | 45                | 135                     |
| 2                       | 192            | 77                 | 38                | 115                     |
| 3                       | 72             | 29                 | 14                | 43                      |
| 4                       | 54             | 21                 | 11                | 32                      |
| 5                       | 154            | 61                 | 31                | 92                      |
| 6                       | 65             | 26                 | 13                | 39                      |
| 7                       | 60             | 24                 | 12                | 36                      |
| 8                       | 160            | 64                 | 32                | 96                      |



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|       |                                 |          |
|-------|---------------------------------|----------|
| 1     | REVISED DEVELOPMENT APPLICATION | 7.4.22   |
| 0     | DEVELOPMENT APPLICATION         | 12.08.21 |
| ISSUE | REASON FOR ISSUE                | DATE     |

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CLIENT

NEWCASTLE JOCKEY CLUB LTD

TITLE

SEDIMENTATION BASIN LAYOUT PLAN

PROJECT

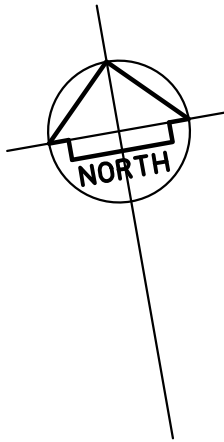
PROPOSED STABLES COMPLEX AT;  
NEWCASTLE JOCKEY CLUB  
No.100 DARLING STREET,  
BROADMEADOW

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| SCALES<br>1:500      | JOB No<br>16-548-1 | DRAWING No<br>C02.0 | ISSUE<br>1  |

FULL SIZE ON ORIGINAL 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 cm



MATCH SHEET 3  
MATCH SHEET 1



CHATHAM STREET

GOODS STORAGE SHED  
FFL 6.500

LOT 82  
DP 1138209

LOT 14  
DP 227704

DARLING STREET

SEDIMENTATION AND  
EROSION CONTROL PLAN  
SHEET 1

SCALE 1:100  
SEDIMENTATION AND EROSION CONTROL NOTES  
1. REFER TO DRAWING C02.11 FOR SEDIMENTATION AND EROSION CONTROL NOTES  
AND LEGEND

NOT FOR CONSTRUCTION

MATCH SHEET 1  
MATCH SHEET 2

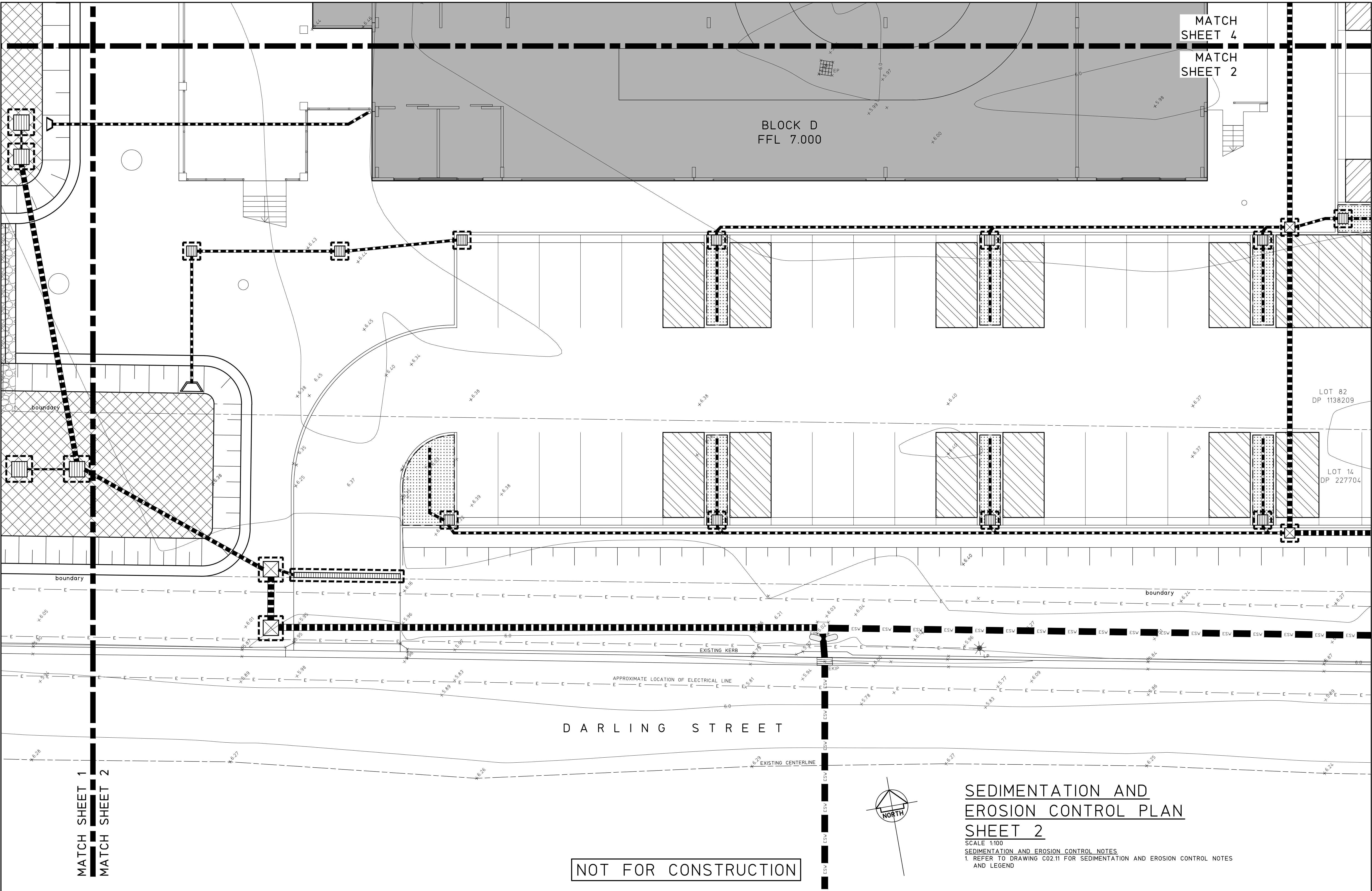
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| 3     |                  |  | REVISED DEVELOPMENT APPLICATION                                          | 7.4.22          |                                 |                                                                                                                                                                                                                                                                                 |       |  |                           |  |  |                                                                                                |  |  | SCALES<br>1:100      | JOB No<br>16-548-1 | DRAWING No<br>C02.00 | ISSUE<br>3  |
| 2     |                  |  | DEVELOPMENT APPLICATION                                                  | 12.08.21        |                                 |                                                                                                                                                                                                                                                                                 |       |  |                           |  |  |                                                                                                |  |  |                      |                    |                      |             |
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FULL SIZE ON ORIGINAL 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 cm

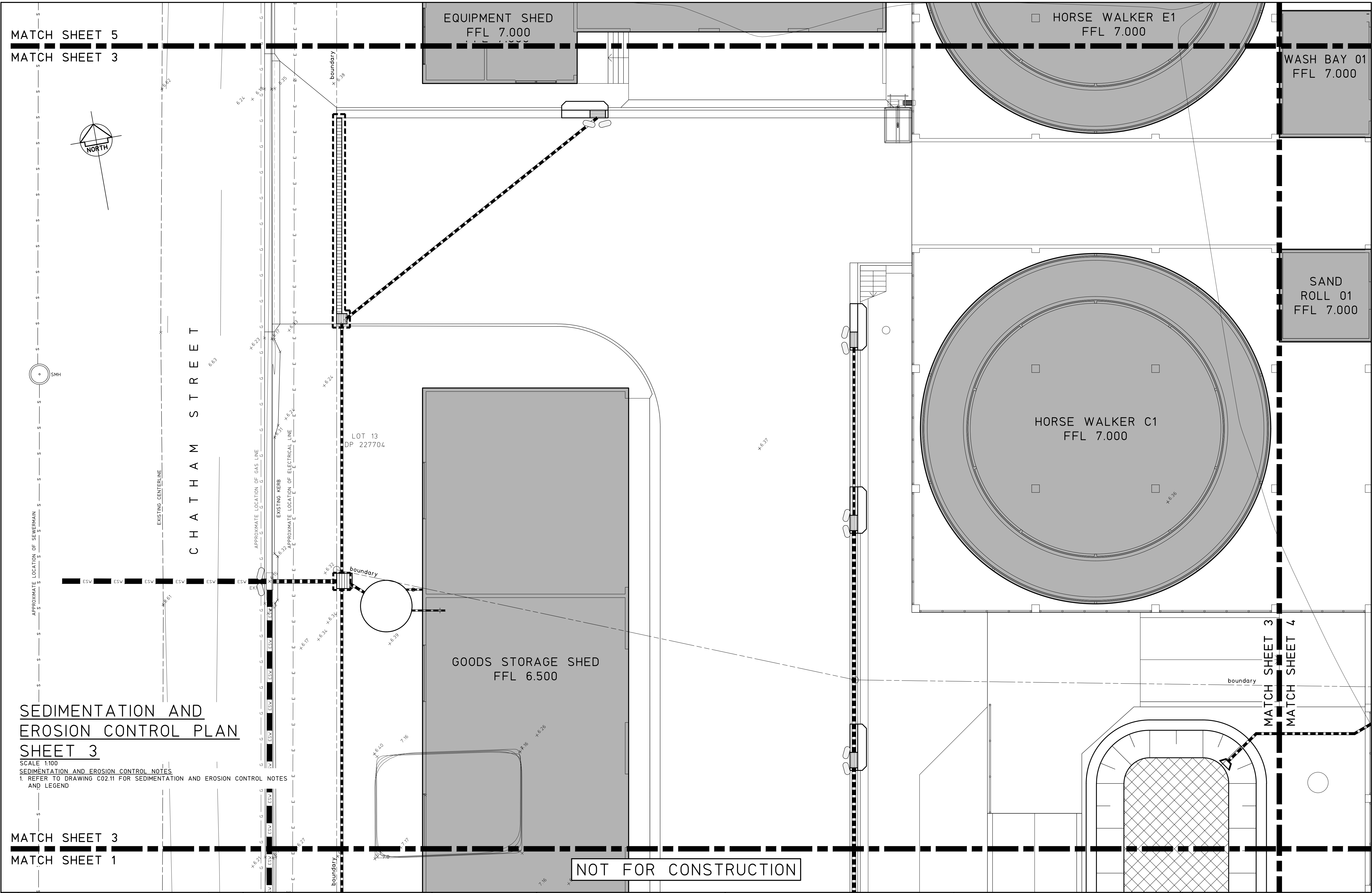




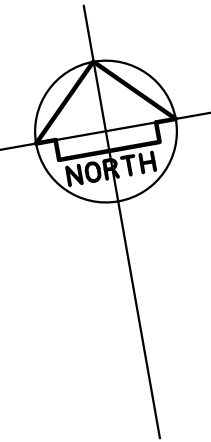
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| 3 REVISED DEVELOPMENT APPLICATION                                     |  |  | 7.4.22                                                                                                                                                                                                                                                         |  |  | TITLE                     |  |  | SEDIMENTATION AND EROSION CONTROL PLAN SHEET 2                                        |  |  | ENGINEER B.C.                   |  |  |
| 2 DEVELOPMENT APPLICATION                                             |  |  | 12.08.21                                                                                                                                                                                                                                                       |  |  | ESW                       |  |  | No in SET                                                                             |  |  | JOB No                          |  |  |
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|                                                                       |  |  | DATE OF RELEASE                                                                                                                                                                                                                                                |  |  | ESW                       |  |  |                                                                                       |  |  |                                 |  |  |

FULL SIZE ON ORIGINAL 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 cm





MATCH SHEET 5  
MATCH SHEET 3



C H A T H A M   S T R E E T

SEDIMENTATION AND  
EROSION CONTROL PLAN  
SHEET 3

SCALE 1:100  
SEDIMENTATION AND EROSION CONTROL NOTES  
1. REFER TO DRAWING C02.11 FOR SEDIMENTATION AND EROSION CONTROL NOTES  
AND LEGEND

MATCH SHEET 3  
MATCH SHEET 1

|       |                                 |                  |  |                                                                          |  |                                                                                                                                                                                                                                                                                 |  |                                        |  |                                                                                                |  |                      |  |                  |  |                |  |             |  |
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| 2     | DEVELOPMENT APPLICATION         | 12.08.21         |  |                                                                          |  |                                                                                                                                                                                                                                                                                 |  | SEDIMENTATION AND EROSION CONTROL PLAN |  |                                                                                                |  | 1:100                |  | 16-548-1         |  | C02.02         |  | 3           |  |
| 1     | ISSUED FOR APPROVAL             | 09.07.21         |  |                                                                          |  |                                                                                                                                                                                                                                                                                 |  | SHEET 3                                |  |                                                                                                |  |                      |  |                  |  |                |  |             |  |
| 0     | PRELIMINARY                     | 02.07.21         |  |                                                                          |  |                                                                                                                                                                                                                                                                                 |  |                                        |  |                                                                                                |  |                      |  |                  |  |                |  |             |  |
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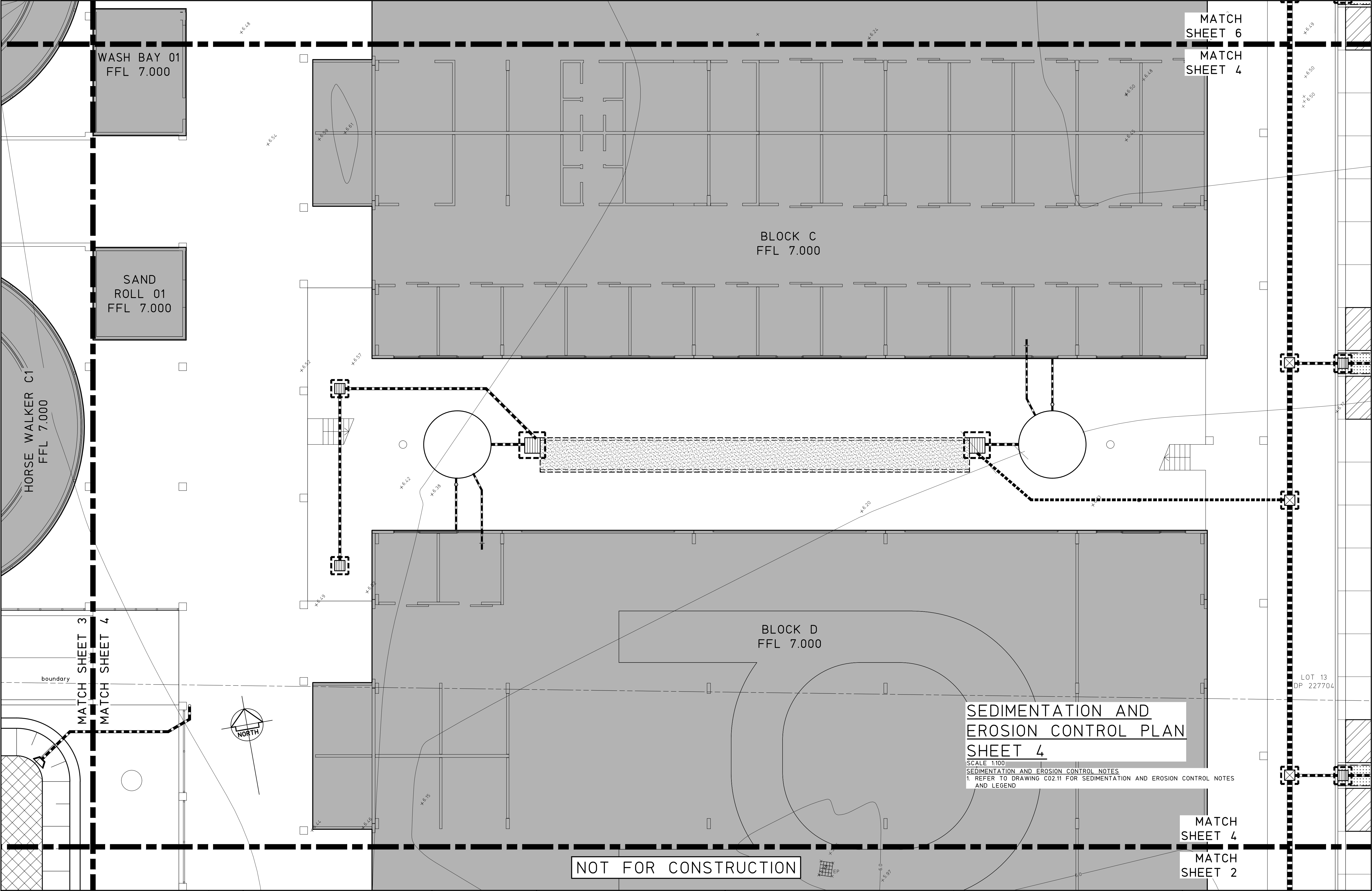
NEWCASTLE JOCKEY CLUB LTD  
TITLE  
SEDIMENTATION AND EROSION CONTROL PLAN  
SHEET 3

PROPOSED STABLES COMPLEX AT;  
NEWCASTLE JOCKEY CLUB  
No.100 DARLING STREET,  
BROADMEADOW

|                 |  |                    |  |                      |  |             |  |
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FULL SIZE ON ORIGINAL 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 cm





SEDIMENTATION AND  
EROSION CONTROL PLAN  
SHEET 4

SCALE 1:100  
SEDIMENTATION AND EROSION CONTROL NOTES  
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AND LEGEND

|                                                                          |                                 |          |                                                                                                                                                                                                                                                                                 |                                 |  |                                        |  |  |                                                                                                |  |  |                      |  |  |
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| 3                                                                        | REVISED DEVELOPMENT APPLICATION | 7.4.22   |                                                                                                                                                                                                                                                                                 |                                 |  | TITLE                                  |  |  | ENGINEER<br>B.C.                                                                               |  |  | No in SET            |  |  |
| 2                                                                        | DEVELOPMENT APPLICATION         | 12.08.21 |                                                                                                                                                                                                                                                                                 |                                 |  | SEDIMENTATION AND EROSION CONTROL PLAN |  |  | JOB No                                                                                         |  |  | DRAWING No           |  |  |
| 1                                                                        | ISSUED FOR APPROVAL             | 09.07.21 |                                                                                                                                                                                                                                                                                 |                                 |  | SHEET 4                                |  |  | 16-548-1                                                                                       |  |  | C02.03               |  |  |
| 0                                                                        | PRELIMINARY                     | 02.07.21 |                                                                                                                                                                                                                                                                                 |                                 |  |                                        |  |  |                                                                                                |  |  | ISSUE                |  |  |
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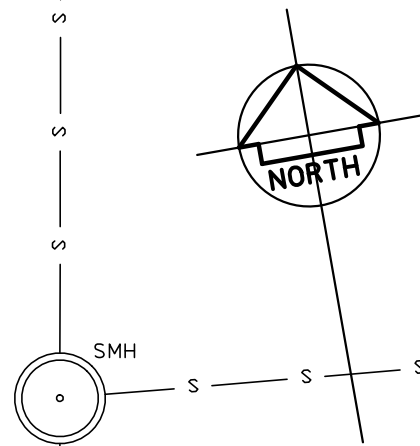


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FULL SIZE ON ORIGINAL 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 cm



MATCH SHEET 7  
MATCH SHEET 5

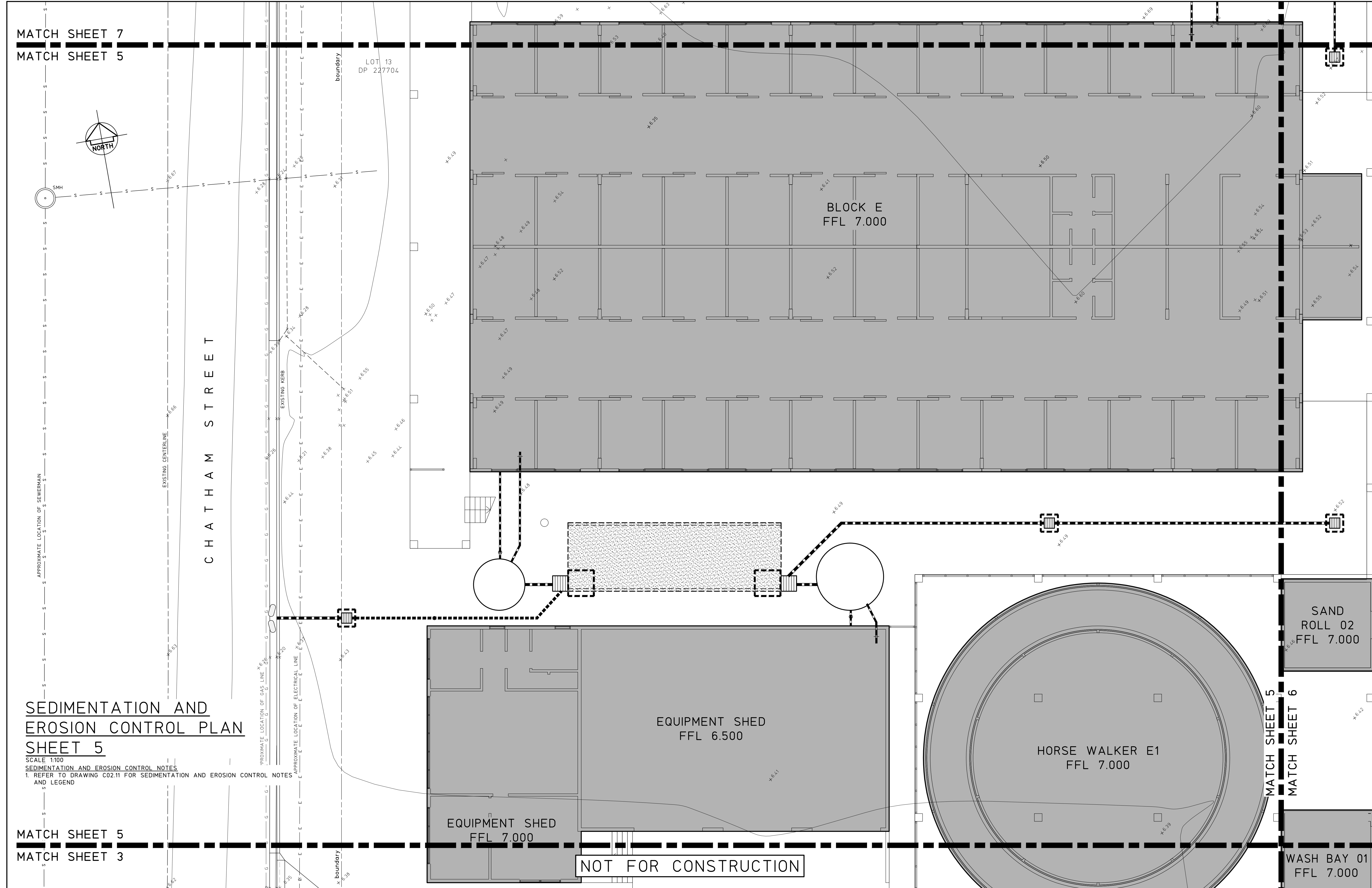


CHATHAM STREET

SEDIMENTATION AND  
EROSION CONTROL PLAN  
SHEET 5

SCALE 1:100  
SEDIMENTATION AND EROSION CONTROL NOTES  
1. REFER TO DRAWING C02.11 FOR SEDIMENTATION AND EROSION CONTROL NOTES  
AND LEGEND

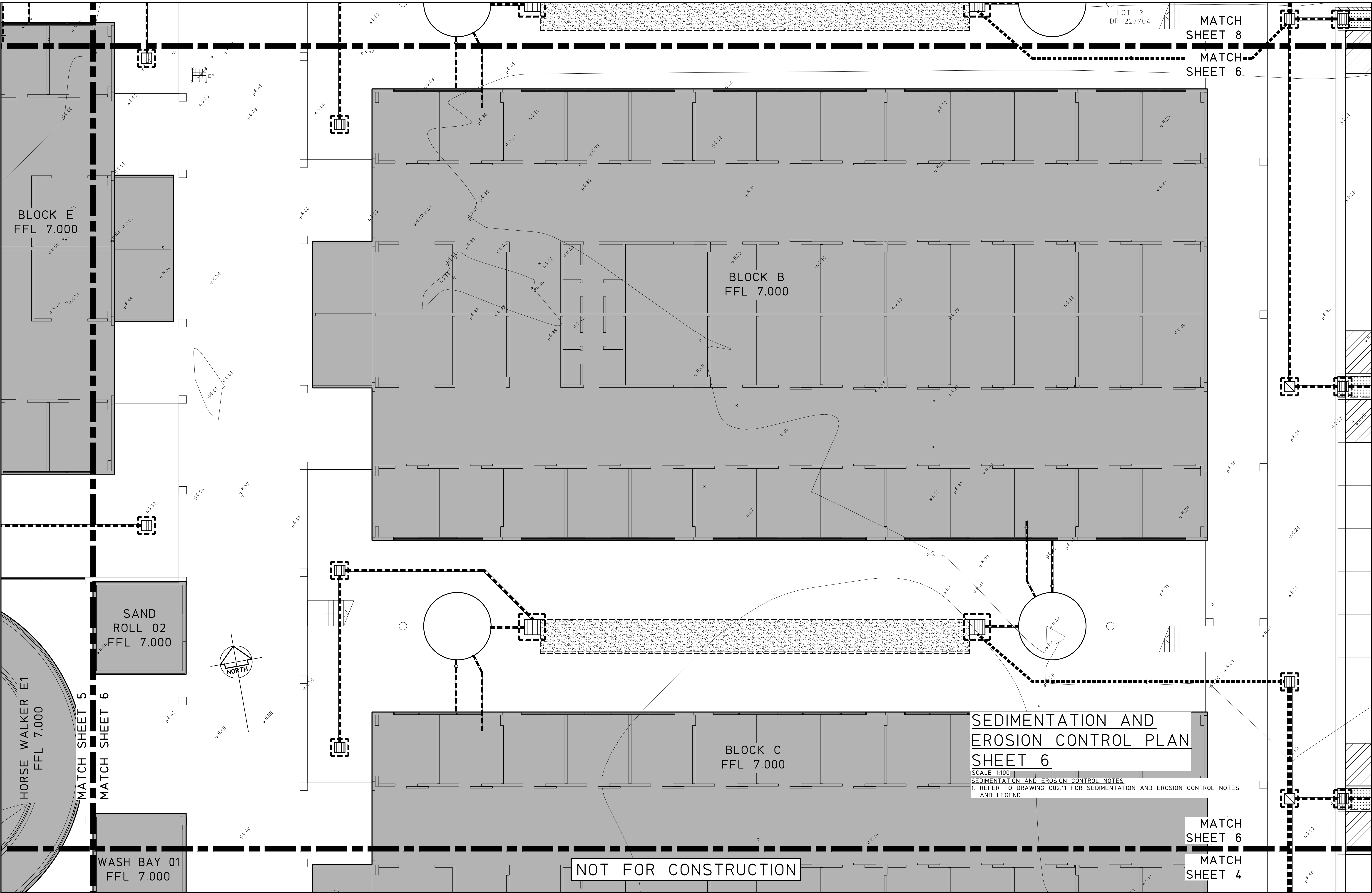
MATCH SHEET 5  
MATCH SHEET 3



|                                                                          |  |  |                                                                                                                                                                                                                                                                                 |  |  |                                        |  |  |                                                                                                |  |  |                      |  |  |
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| 3 REVISED DEVELOPMENT APPLICATION                                        |  |  | 7.4.22                                                                                                                                                                                                                                                                          |  |  | TITLE                                  |  |  | ENGINEER<br>B.C.                                                                               |  |  | No in SET            |  |  |
| 2 DEVELOPMENT APPLICATION                                                |  |  | 12.08.21                                                                                                                                                                                                                                                                        |  |  | SEDIMENTATION AND EROSION CONTROL PLAN |  |  | JOB No                                                                                         |  |  | DRAWING No           |  |  |
| 1 ISSUED FOR APPROVAL                                                    |  |  | 09.07.21                                                                                                                                                                                                                                                                        |  |  | SHEET 5                                |  |  | 16-548-1                                                                                       |  |  | C02.04               |  |  |
| 0 PRELIMINARY                                                            |  |  | 02.07.21                                                                                                                                                                                                                                                                        |  |  | SHEET 5                                |  |  | 16-548-1                                                                                       |  |  | C02.04               |  |  |
| ISSUE                                                                    |  |  | DATE                                                                                                                                                                                                                                                                            |  |  | RESPONSIBLE PRINCIPAL SIGNATURE        |  |  | ISSUE                                                                                          |  |  | SHEET                |  |  |
| REASON FOR ISSUE                                                         |  |  | DATE OF RELEASE                                                                                                                                                                                                                                                                 |  |  | RESPONSIBLE PRINCIPAL SIGNATURE        |  |  | ISSUE                                                                                          |  |  | A1                   |  |  |
|                                                                          |  |  |                                                                                                                                                                                                                                                                                 |  |  |                                        |  |  |                                                                                                |  |  | 3                    |  |  |

FULL SIZE ON ORIGINAL 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 cm



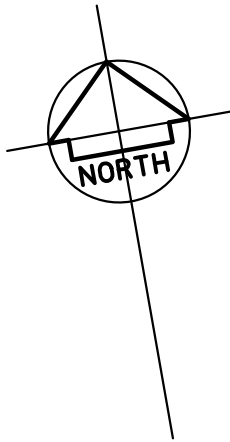


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| 2 DEVELOPMENT APPLICATION                                             |  |  | 7.4.22                                                                                                                                                                                                                                                         |  |  | SEDIMENTATION AND EROSION CONTROL PLAN SHEET 6 |  |  | 1:100                                                                                 |  |  | JOB No 16-548-1      |  |  |
| 1 ISSUED FOR APPROVAL                                                 |  |  | 12.08.21                                                                                                                                                                                                                                                       |  |  | SHEET 6                                        |  |  | 16-548-1                                                                              |  |  | DRAWING No C02.05    |  |  |
| 0 PRELIMINARY                                                         |  |  | 09.07.21                                                                                                                                                                                                                                                       |  |  | NOT FOR CONSTRUCTION                           |  |  | 16-548-1                                                                              |  |  | ISSUE                |  |  |
| ISSUE                                                                 |  |  | DATE                                                                                                                                                                                                                                                           |  |  | RESPONSIBLE PRINCIPAL SIGNATURE                |  |  | 16-548-1                                                                              |  |  | 3                    |  |  |
| REASON FOR ISSUE                                                      |  |  | DATE OF RELEASE                                                                                                                                                                                                                                                |  |  | DATE                                           |  |  | 16-548-1                                                                              |  |  | 16-548-1             |  |  |

FULL SIZE ON ORIGINAL 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 cm



MATCH SHEET 9  
MATCH SHEET 7



CHATHAM STREET

SEDIMENTATION AND  
EROSION CONTROL PLAN  
SHEET 7

SCALE 1:100  
SEDIMENTATION AND EROSION CONTROL NOTES  
1. REFER TO DRAWING C02.11 FOR SEDIMENTATION AND EROSION CONTROL NOTES  
AND LEGEND

MATCH SHEET 7  
MATCH SHEET 5

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A.C.N. 098 642 575

CLIENT

NEWCASTLE JOCKEY CLUB LTD

TITLE

SEDIMENTATION AND EROSION CONTROL PLAN  
SHEET 7

PROJECT

PROPOSED STABLES COMPLEX AT;  
NEWCASTLE JOCKEY CLUB  
No.100 DARLING STREET,  
BROADMEADOW

DO NOT SCALE DRAWING

DRAWN  
C.H.

ENGINEER  
B.C.

No in SET

SHEET  
A1

SCALES  
1:100

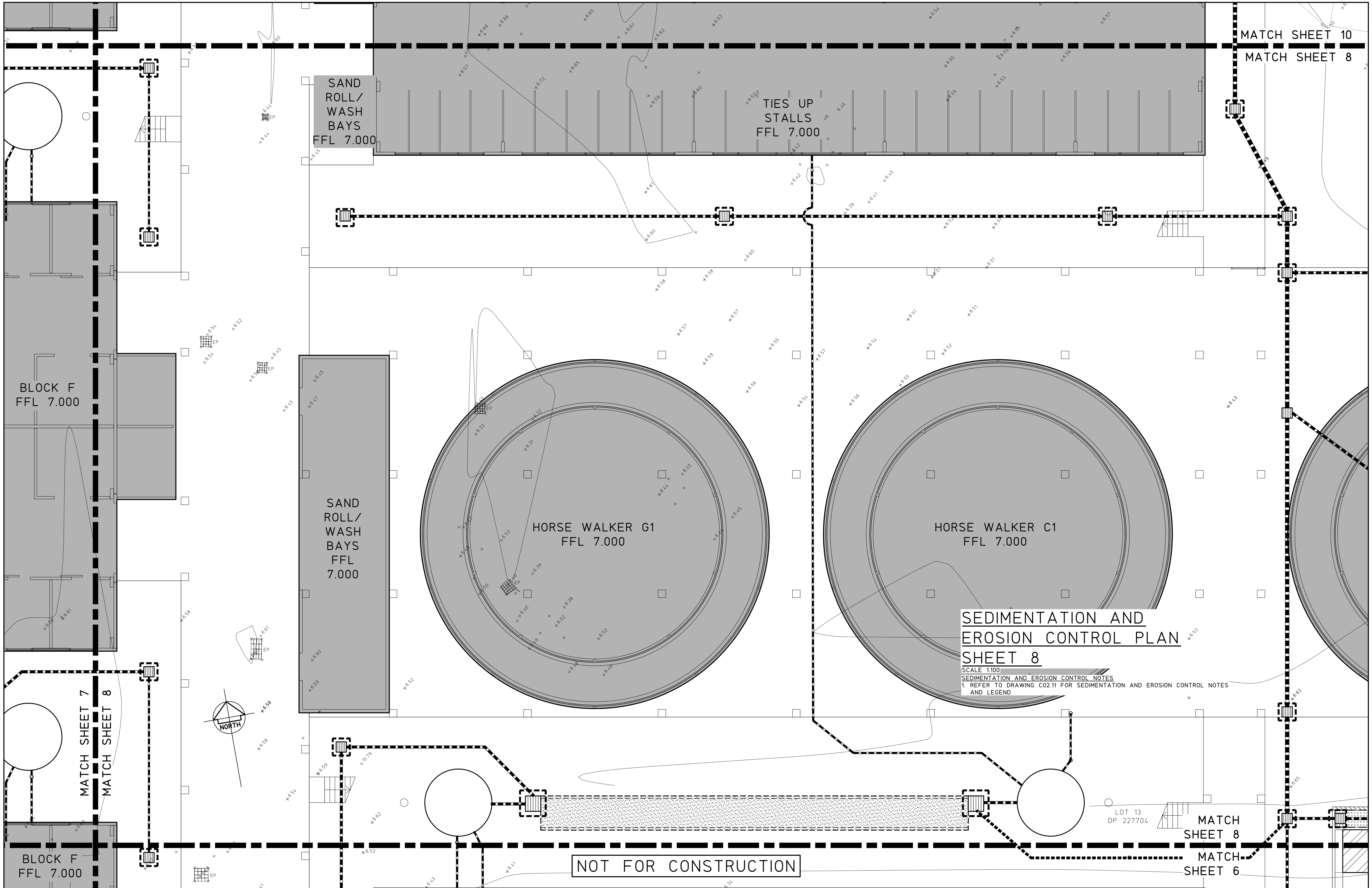
JOB No  
16-548-1

DRAWING No  
C02.06

ISSUE  
3

FULL SIZE ON ORIGINAL 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 cm



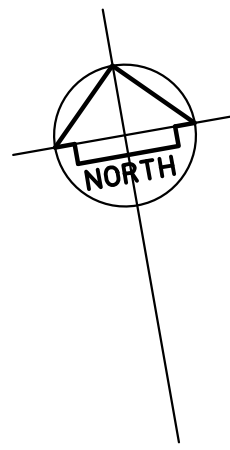


|       |  |                                 |  |                                                                          |  |                                                                                                                                                                                                                                                                                 |  |                                                                                                                                                                                                                                |  |                                                            |  |                                                                                                           |  |                      |  |                  |  |                |  |             |  |
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| 3     |  | REVISED DEVELOPMENT APPLICATION |  | 7.4.22                                                                   |  |                                                                                                                                                                                                                                                                                 |  |                                                                                                                                                                                                                                |  |                                                            |  |                                                                                                           |  | SCALES               |  | JOB No           |  | DRAWING No     |  | ISSUE       |  |
| 2     |  | DEVELOPMENT APPLICATION         |  | 12.08.21                                                                 |  |                                                                                                                                                                                                                                                                                 |  |                                                                                                                                                                                                                                |  |                                                            |  |                                                                                                           |  | 1:100                |  | 16-548-1         |  | C02.07         |  | 3           |  |
| 1     |  | ISSUED FOR APPROVAL             |  | 09.07.21                                                                 |  |                                                                                                                                                                                                                                                                                 |  |                                                                                                                                                                                                                                |  |                                                            |  |                                                                                                           |  |                      |  |                  |  |                |  |             |  |
| 0     |  | PRELIMINARY                     |  | 02.07.21                                                                 |  |                                                                                                                                                                                                                                                                                 |  |                                                                                                                                                                                                                                |  |                                                            |  |                                                                                                           |  |                      |  |                  |  |                |  |             |  |
| ISSUE |  | REASON FOR ISSUE                |  | DATE                                                                     |  | DATE OF RELEASE                                                                                                                                                                                                                                                                 |  | RESPONSIBLE PRINCIPAL SIGNATURE                                                                                                                                                                                                |  | ISSUE                                                      |  |                                                                                                           |  |                      |  |                  |  |                |  |             |  |

FULL SIZE ON ORIGINAL 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 cm



MATCH SHEET 11  
MATCH SHEET 9

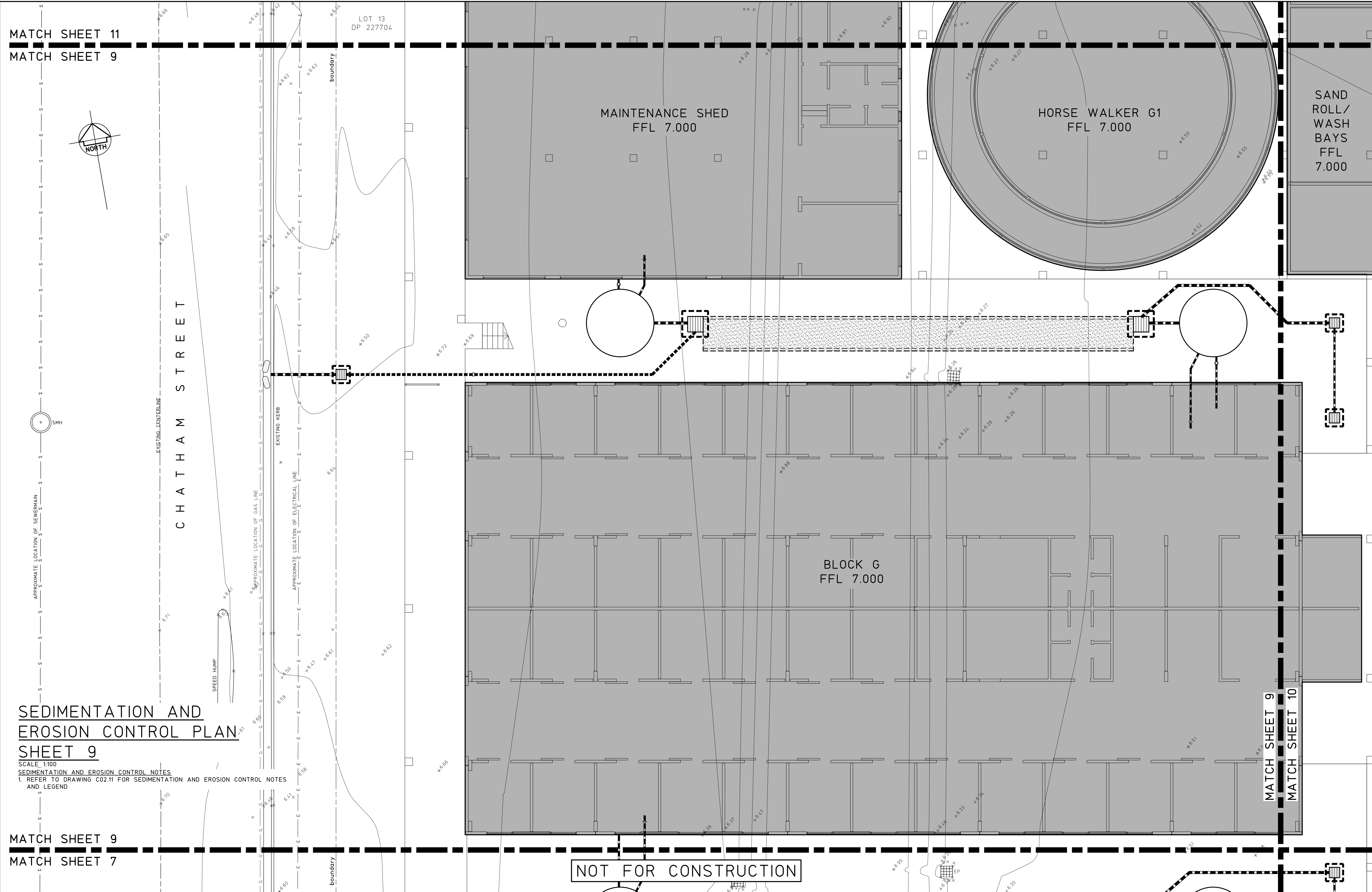


CHATHAM STREET

SEDIMENTATION AND  
EROSION CONTROL PLAN  
SHEET 9

SCALE 1:100  
SEDIMENTATION AND EROSION CONTROL NOTES  
1. REFER TO DRAWING C02.11 FOR SEDIMENTATION AND EROSION CONTROL NOTES  
AND LEGEND

MATCH SHEET 9  
MATCH SHEET 7

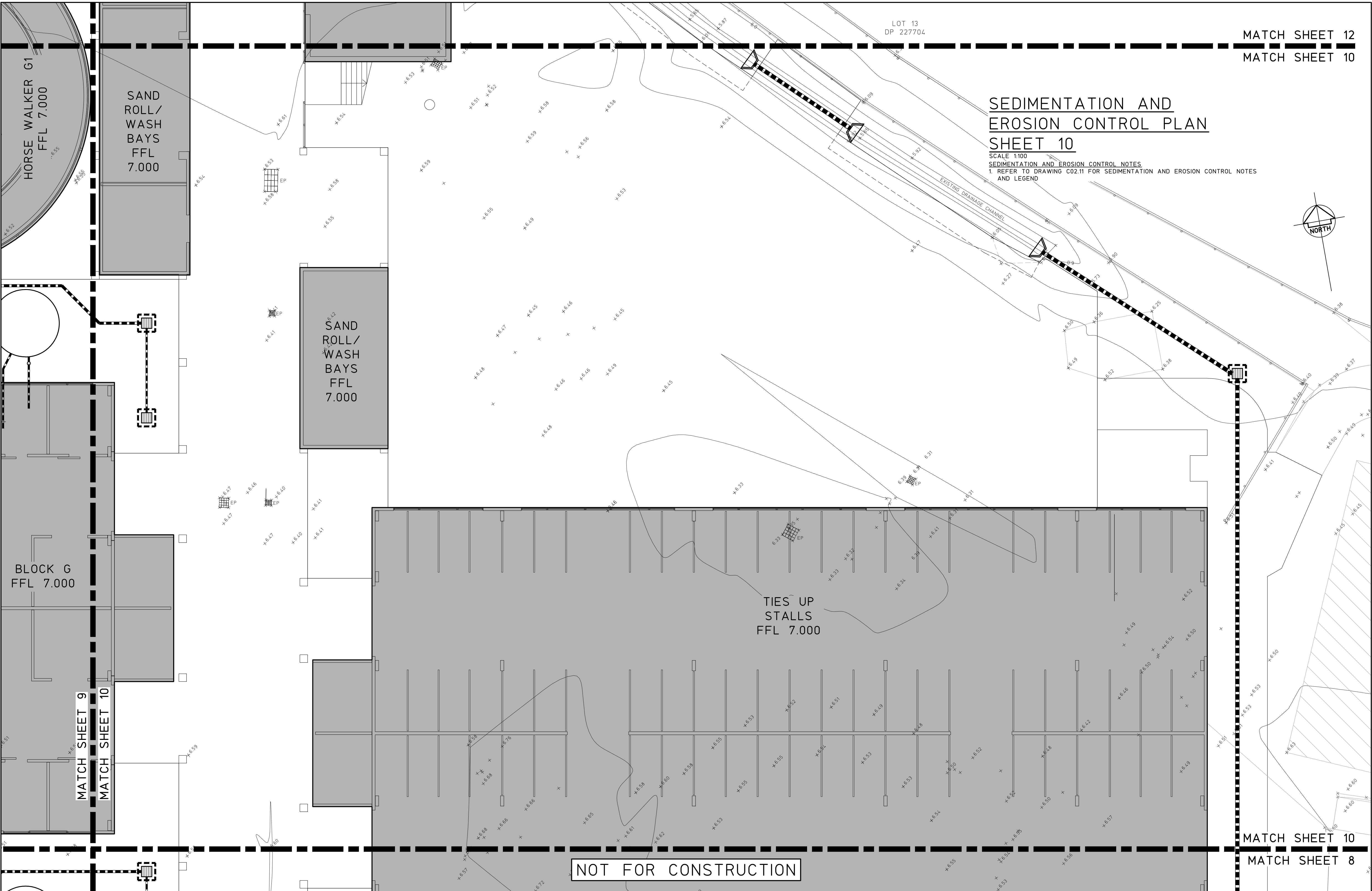


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| 2 DEVELOPMENT APPLICATION                                                |  |  | mpc consulting engineers<br>civil+structural                                                                                                                                                                                                                                    |  |  | SEDIMENTATION AND EROSION CONTROL PLAN<br>SHEET 9 |  |  | JOB No                                                                                         |  |  | SHEET                |  |  |
| 1 ISSUED FOR APPROVAL                                                    |  |  |                                                                                                                                                                                                                                                                                 |  |  |                                                   |  |  | 16-548-1                                                                                       |  |  | A1                   |  |  |
| 0 PRELIMINARY                                                            |  |  |                                                                                                                                                                                                                                                                                 |  |  |                                                   |  |  | DRAWING No                                                                                     |  |  | ISSUE                |  |  |
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| ISSUE                                                                    |  |  |                                                                                                                                                                                                                                                                                 |  |  |                                                   |  |  |                                                                                                |  |  |                      |  |  |

FULL SIZE ON ORIGINAL 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 cm

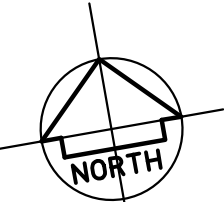




MATCH SHEET 12  
MATCH SHEET 10

SEDIMENTATION AND  
EROSION CONTROL PLAN  
SHEET 10

SCALE 1:100  
SEDIMENTATION AND EROSION CONTROL NOTES  
1. REFER TO DRAWING C02.11 FOR SEDIMENTATION AND EROSION CONTROL NOTES  
AND LEGEND



TIES UP  
STALLS  
FFL 7.000

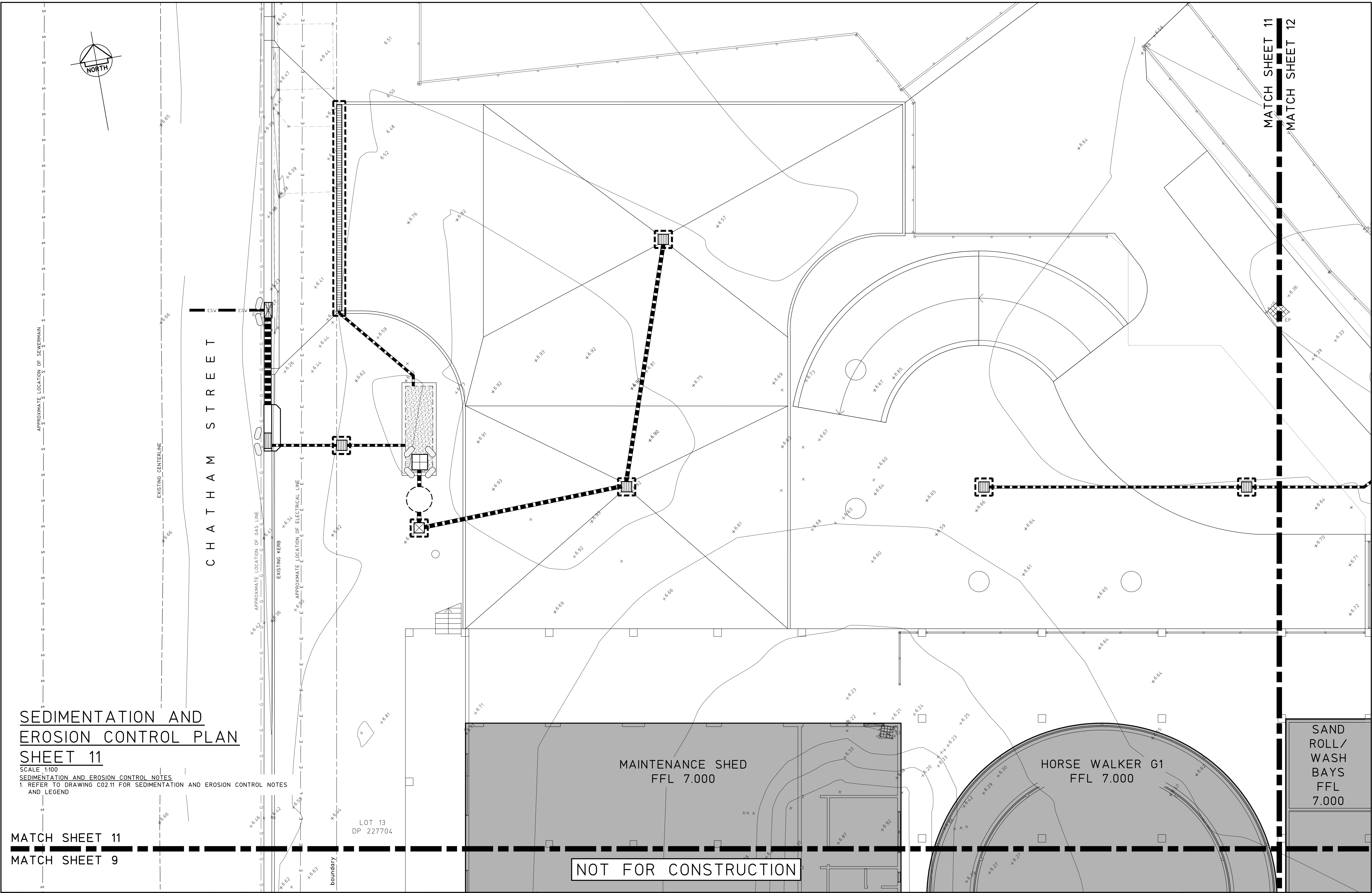
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MATCH SHEET 10  
MATCH SHEET 8

|                                                                          |  |  |                                                                                                                                                                                                                                                                                 |  |  |                                        |  |  |                                                                                                |  |  |                      |  |  |
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| 2 DEVELOPMENT APPLICATION                                                |  |  | 7.4.22                                                                                                                                                                                                                                                                          |  |  | SEDIMENTATION AND EROSION CONTROL PLAN |  |  | JOB No                                                                                         |  |  | DRAWING No           |  |  |
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| 0 PRELIMINARY                                                            |  |  | 09.07.21                                                                                                                                                                                                                                                                        |  |  |                                        |  |  | ISSUE                                                                                          |  |  | 3                    |  |  |
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| DATE                                                                     |  |  | DATE                                                                                                                                                                                                                                                                            |  |  | DATE                                   |  |  | DATE                                                                                           |  |  | DATE                 |  |  |

FULL SIZE ON ORIGINAL 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 cm





SEDIMENTATION AND  
EROSION CONTROL PLAN  
SHEET 11

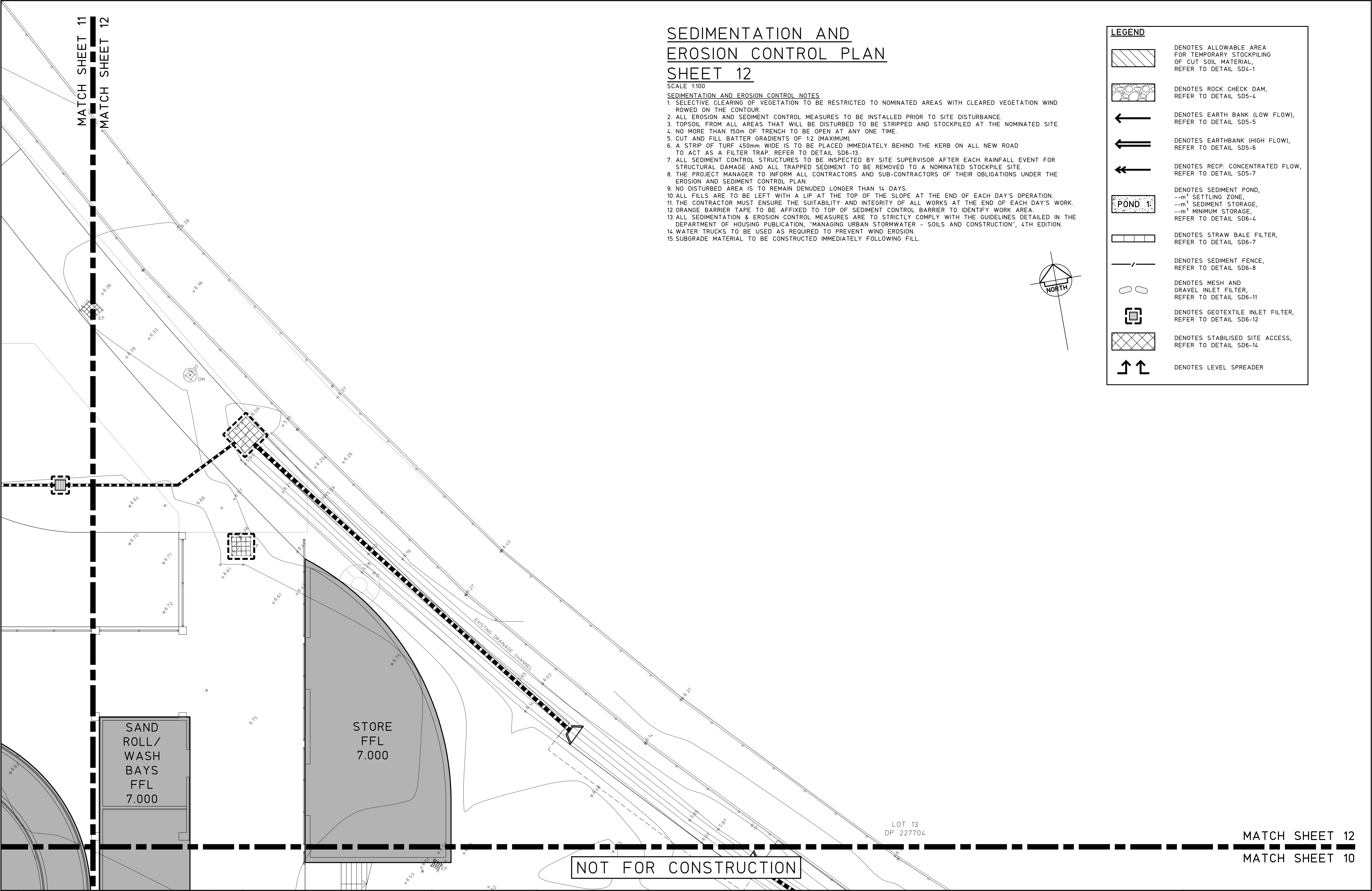
SCALE 1:100  
SEDIMENTATION AND EROSION CONTROL NOTES  
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AND LEGEND

MATCH SHEET 11  
MATCH SHEET 9

|                                 |  |  |                                                                          |  |  |                                                                                                                                                                                                                                                                                 |  |  |                                        |  |  |                                                                                                |  |  |                      |  |  |
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| 2                               |  |  | DEVELOPMENT APPLICATION                                                  |  |  | m                                                                                                                                                                                                                                                                               |  |  | SEDIMENTATION AND EROSION CONTROL PLAN |  |  | JOB No                                                                                         |  |  | DRAWING No           |  |  |
| 1                               |  |  | ISSUED FOR APPROVAL                                                      |  |  | 7.4.22                                                                                                                                                                                                                                                                          |  |  | SHEET                                  |  |  | 16-548-1                                                                                       |  |  | C02.10               |  |  |
| 0                               |  |  | PRELIMINARY                                                              |  |  | 12.08.21                                                                                                                                                                                                                                                                        |  |  | SHEET 11                               |  |  | JOB No                                                                                         |  |  | ISSUE                |  |  |
| DATE                            |  |  | 09.07.21                                                                 |  |  | 02.07.21                                                                                                                                                                                                                                                                        |  |  | SHEET 12                               |  |  | 16-548-1                                                                                       |  |  | 3                    |  |  |
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| RESPONSIBLE PRINCIPAL SIGNATURE |  |  |                                                                          |  |  |                                                                                                                                                                                                                                                                                 |  |  |                                        |  |  |                                                                                                |  |  |                      |  |  |

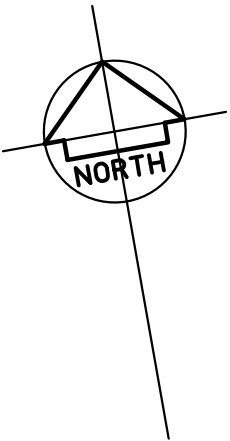
FULL SIZE ON ORIGINAL 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 cm





SEDIMENTATION AND  
EROSION CONTROL PLAN  
SHEET 12

- SCALE 1:100
- SEDIMENTATION AND EROSION CONTROL NOTES**
1. SELECTIVE CLEARING OF VEGETATION TO BE RESTRICTED TO NOMINATED AREAS WITH CLEARED VEGETATION WIND ROWED ON THE CONTOUR.
  2. ALL EROSION AND SEDIMENT CONTROL MEASURES TO BE INSTALLED PRIOR TO SITE DISTURBANCE.
  3. TOPSOIL FROM ALL AREAS THAT WILL BE DISTURBED TO BE STRIPPED AND STOCKPILED AT THE NOMINATED SITE.
  4. NO MORE THAN 150m OF TRENCH TO BE OPEN AT ANY ONE TIME.
  5. CUT AND FILL BATTER GRADIENTS OF 1:2 (MAXIMUM).
  6. A STRIP OF TURF 450mm WIDE IS TO BE PLACED IMMEDIATELY BEHIND THE KERB ON ALL NEW ROAD TO ACT AS A FILTER TRAP. REFER TO DETAIL SD6-13.
  7. ALL SEDIMENT CONTROL STRUCTURES TO BE INSPECTED BY SITE SUPERVISOR AFTER EACH RAINFALL EVENT FOR STRUCTURAL DAMAGE AND ALL TRAPPED SEDIMENT TO BE REMOVED TO A NOMINATED STOCKPILE SITE.
  8. THE PROJECT MANAGER TO INFORM ALL CONTRACTORS AND SUB-CONTRACTORS OF THEIR OBLIGATIONS UNDER THE EROSION AND SEDIMENT CONTROL PLAN.
  9. NO DISTURBED AREA IS TO REMAIN DENUDED LONGER THAN 14 DAYS.
  10. ALL FILLS ARE TO BE LEFT WITH A LIP AT THE TOP OF THE SLOPE AT THE END OF EACH DAY'S OPERATION.
  11. THE CONTRACTOR MUST ENSURE THE SUITABILITY AND INTEGRITY OF ALL WORKS AT THE END OF EACH DAY'S WORK.
  12. ORANGE BARRIER TAPE TO BE AFFIXED TO TOP OF SEDIMENT CONTROL BARRIER TO IDENTIFY WORK AREA.
  13. ALL SEDIMENTATION & EROSION CONTROL MEASURES ARE TO STRICTLY COMPLY WITH THE GUIDELINES DETAILED IN THE DEPARTMENT OF HOUSING PUBLICATION, "MANAGING URBAN STORMWATER - SOILS AND CONSTRUCTION", 4TH EDITION.
  14. WATER TRUCKS TO BE USED AS REQUIRED TO PREVENT WIND EROSION.
  15. SUBGRADE MATERIAL TO BE CONSTRUCTED IMMEDIATELY FOLLOWING FILL.



| LEGEND |                                                                                                               |
|--------|---------------------------------------------------------------------------------------------------------------|
|        | DENOTES ALLOWABLE AREA FOR TEMPORARY STOCKPILING OF CUT SOIL MATERIAL, REFER TO DETAIL SD4-1                  |
|        | DENOTES ROCK CHECK DAM, REFER TO DETAIL SD5-4                                                                 |
|        | DENOTES EARTH BANK (LOW FLOW), REFER TO DETAIL SD5-5                                                          |
|        | DENOTES EARTHBANK (HIGH FLOW), REFER TO DETAIL SD5-6                                                          |
|        | DENOTES RECP: CONCENTRATED FLOW, REFER TO DETAIL SD5-7                                                        |
|        | DENOTES SEDIMENT POND, --m³ SETTLING ZONE, --m³ SEDIMENT STORAGE, --m³ MINIMUM STORAGE, REFER TO DETAIL SD6-4 |
|        | DENOTES STRAW BALE FILTER, REFER TO DETAIL SD6-7                                                              |
|        | DENOTES SEDIMENT FENCE, REFER TO DETAIL SD6-8                                                                 |
|        | DENOTES MESH AND GRAVEL INLET FILTER, REFER TO DETAIL SD6-11                                                  |
|        | DENOTES GEOTEXTILE INLET FILTER, REFER TO DETAIL SD6-12                                                       |
|        | DENOTES STABILISED SITE ACCESS, REFER TO DETAIL SD6-14                                                        |
|        | DENOTES LEVEL SPREADER                                                                                        |

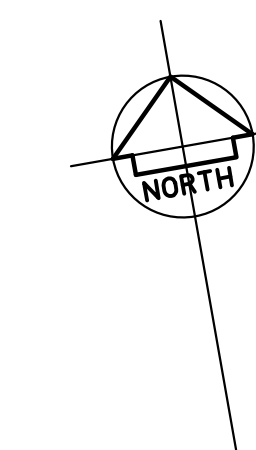
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MATCH  
SHEET 13



SCALE 1:100  
SEDIMENTATION AND EROSION CONTROL NOTES  
1. REFER TO DRAWING C02.11 FOR SEDIMENTATION AND EROSION CONTROL NOTES  
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TITLE  
SEDIMENTATION AND EROSION CONTROL PLAN  
SHEET 13

|         |                                                                                                |
|---------|------------------------------------------------------------------------------------------------|
| PROJECT | PROPOSED STABLES COMPLEX AT;<br>NEWCASTLE JOCKEY CLUB<br>No.100 DARLING STREET,<br>BROADMEADOW |
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|        |          |            |       |
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| 1:100  | 16-548-1 | C02.12     | 3     |

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FULL SIZE ON ORIGINAL      0      1      2      3      4      5      6      7      8      9      10      11      12      13      14      15 cm



MATCH  
SHEET 14

SCALE 1:100  
SEDIMENTATION AND EROSION CONTROL NOTES  
 1. REFER TO DRAWING C02.11 FOR SEDIMENTATION AND EROSION CONTROL NOTES  
 AND LEGEND

NEW ENTRY TOWER  
FEL ---

MATCH  
SHEET 13

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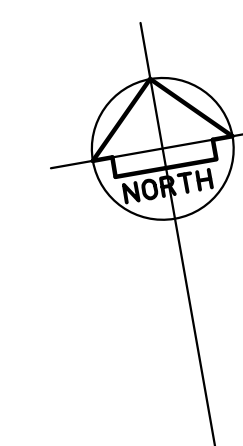
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FULL SIZE ON ORIGINAL 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 cm



MATCH  
SHEET 15

SCALE 1:100  
SEDIMENTATION AND EROSION CONTROL NOTES  
1. REFER TO DRAWING C02.11 FOR SEDIMENTATION AND EROSION CONTROL NOTES  
AND LEGEND



MATCH  
SHEET 14

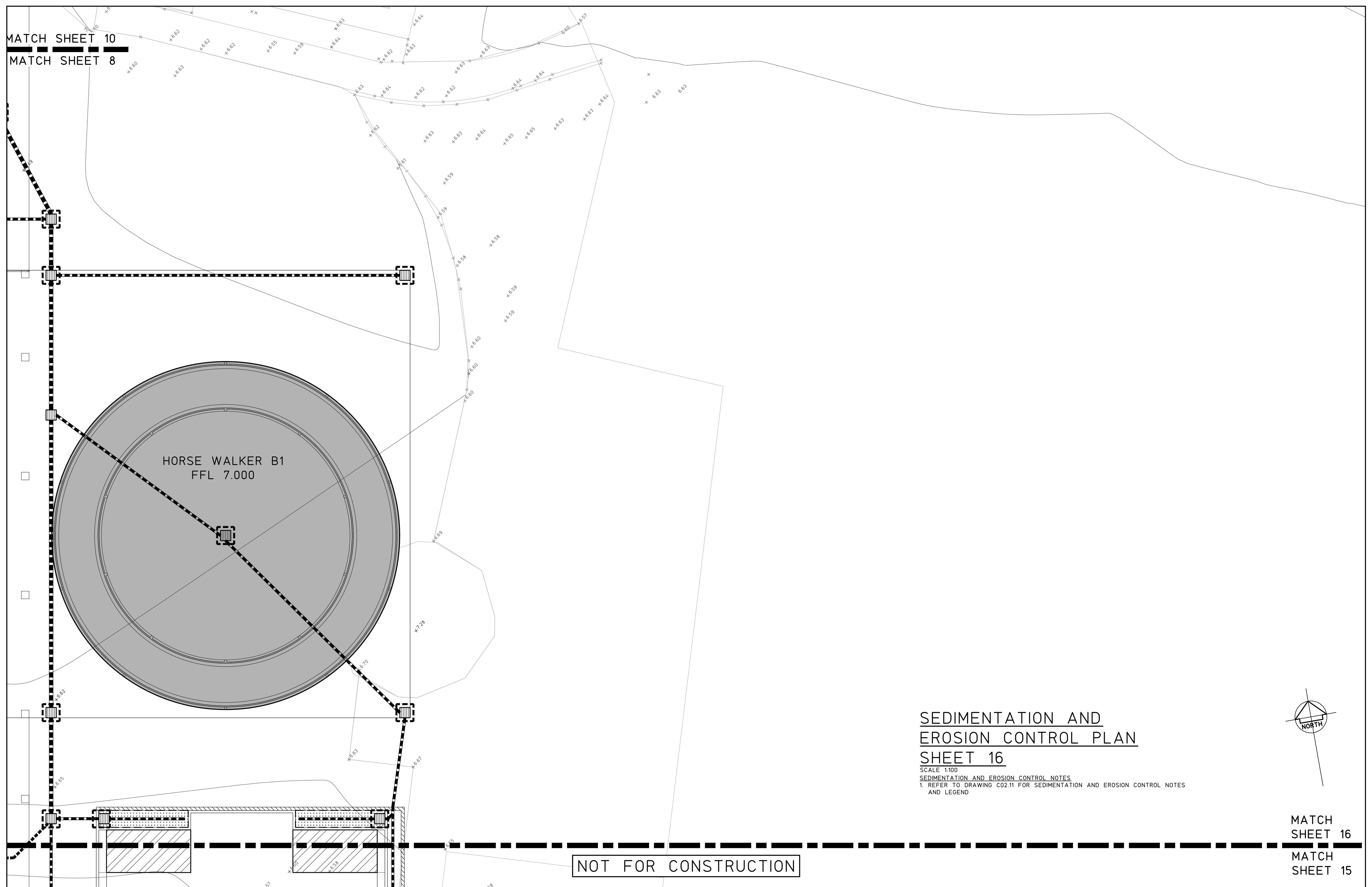
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FULL SIZE ON ORIGINAL 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 cm

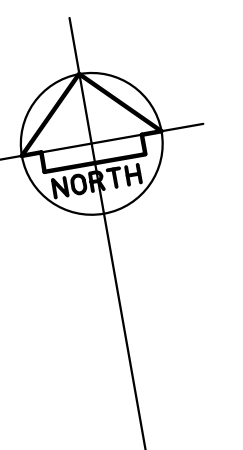


MATCH SHEET 8



SEDIMENTATION AND  
EROSION CONTROL PLAN  
SHEET 16

1. REFER TO DRAWING C02.11 FOR SEDIMENTATION AND EROSION CONTROL NOTES AND LEGEND



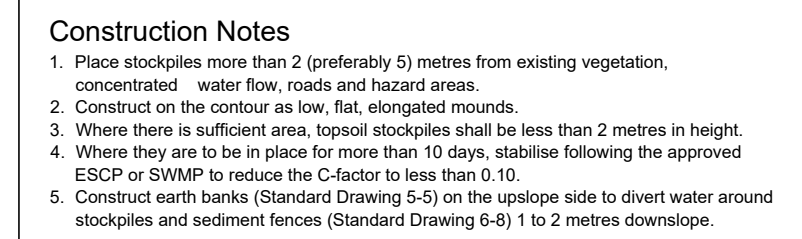
MATCH  
SHEET 16

MATCH  
SHEET 15

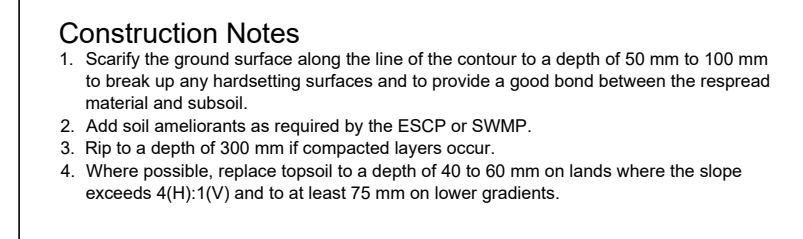
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FULL SIZE ON ORIGINAL      0    1    2    3    4    5    6    7    8    9    10    11    12    13    14    15 cm

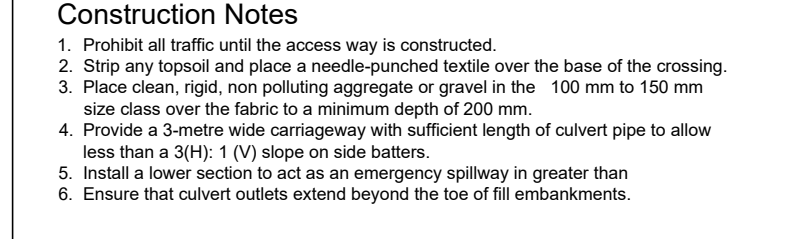




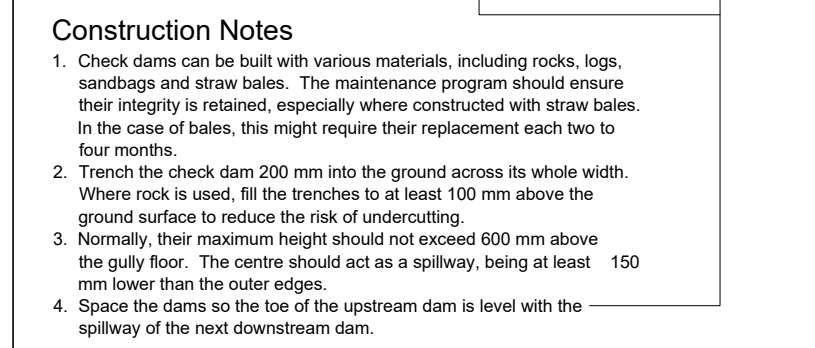
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|------------|--------|
| STOCKPILES | SD 4-1 |
|------------|--------|



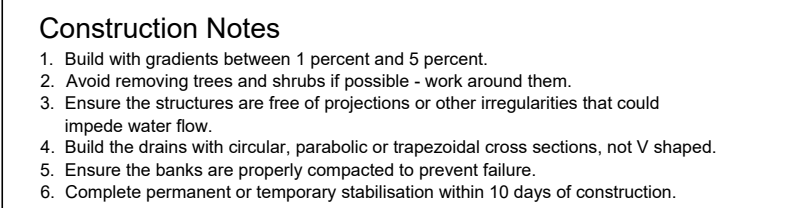
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| REPLACING TOPSOIL | SD 4-2 |
|-------------------|--------|



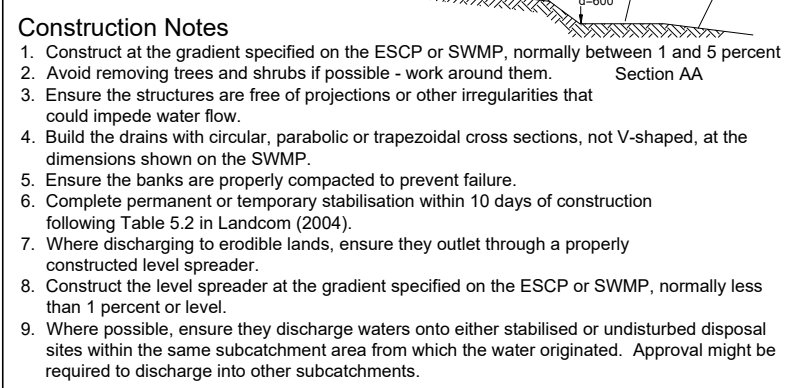
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| TEMPORARY WATERWAY CROSSING | SD 5-1 |
|-----------------------------|--------|



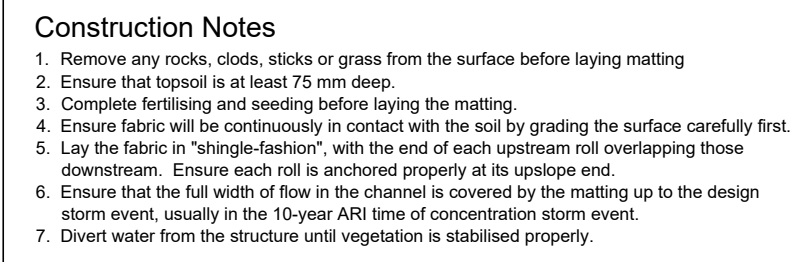
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|----------------|--------|
| ROCK CHECK DAM | SD 5-4 |
|----------------|--------|



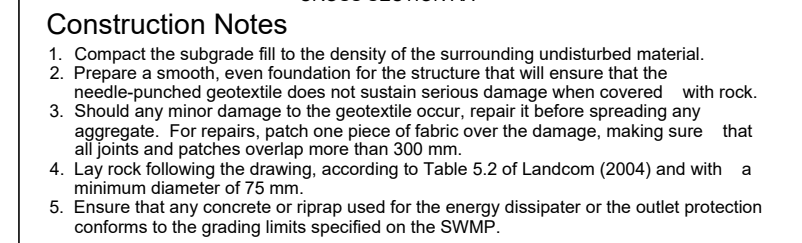
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|-----------------------|--------|
| EARTH BANK (LOW FLOW) | SD 5-5 |
|-----------------------|--------|



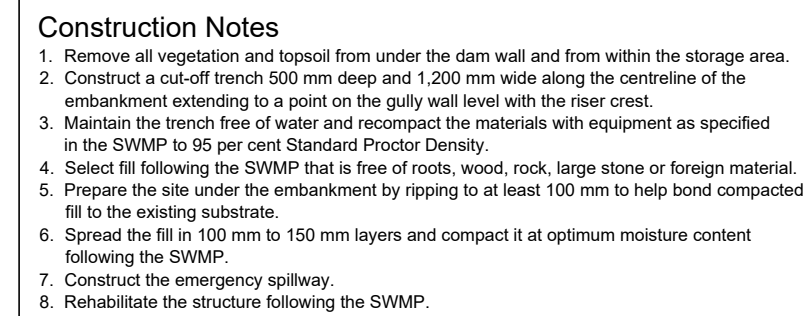
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| EARTH BANK (HIGH FLOWS) | SD 5-6 |
|-------------------------|--------|



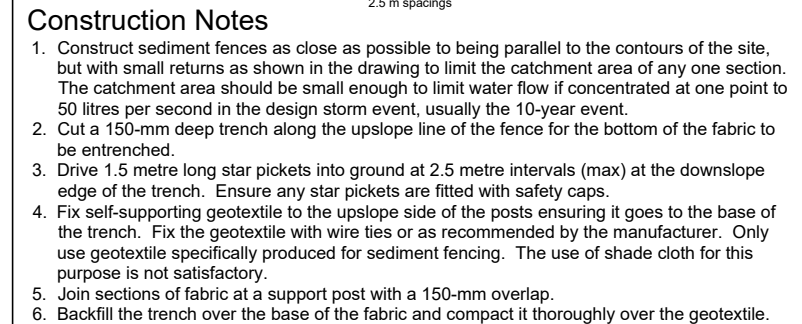
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| RECP : CONCENTRATED FLOW | SD 5-7 |
|--------------------------|--------|



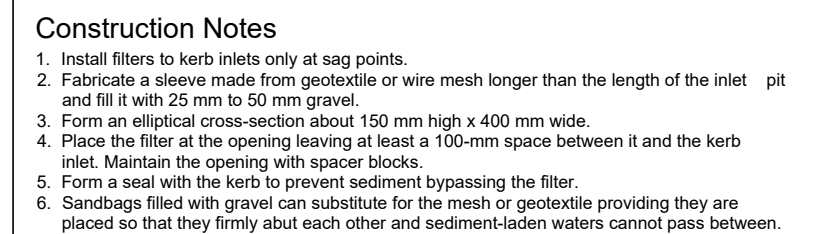
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| ENERGY DISSIPATER | SD 5-8 |
|-------------------|--------|



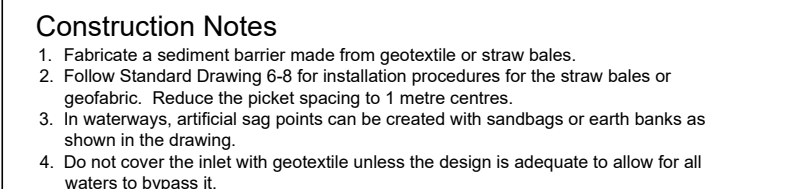
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| EARTH BASIN - WET<br>(APPLIES TO TYPE CY AND TYPE C SOILS ONLY) | SD 6-4 |
|-----------------------------------------------------------------|--------|



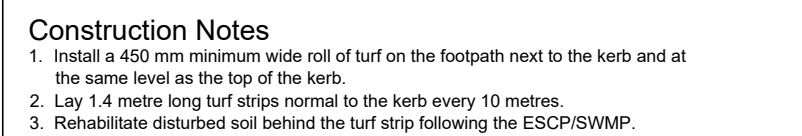
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| SEDIMENT FENCE | SD 6-8 |
|----------------|--------|



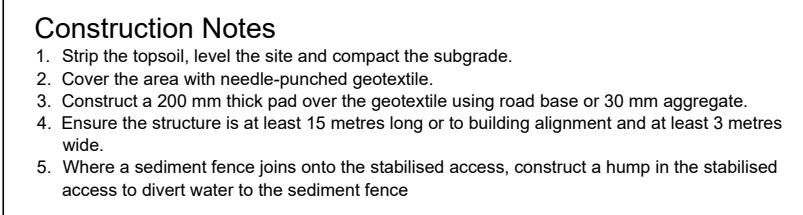
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| MESH AND GRAVEL INLET FILTER | SD 6-11 |
|------------------------------|---------|



|                         |         |
|-------------------------|---------|
| GEOTEXTILE INLET FILTER | SD 6-12 |
|-------------------------|---------|



|                     |         |
|---------------------|---------|
| KERBSIDE TURF STRIP | SD 6-13 |
|---------------------|---------|



|                        |         |
|------------------------|---------|
| STABILISED SITE ACCESS | SD 6-14 |
|------------------------|---------|

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|       |  |                         |  |                                                                          |  |                                                                                                                                                                                                                                                                                 |  |                                                                                                                                                                                                                                                                                                                                      |  |                                                                                                |  |         |  |                      |  |            |  |       |  |
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|       |  |                         |  |                                                                          |  |                                                                                                                                                                                                                                                                                 |  | TITLE                                                                                                                                                                                                                                                                                                                                |  | SEDIMENTATION AND<br>EROSION CONTROL DETAILS                                                   |  | C.W.    |  | B.C.                 |  | -          |  | A1    |  |
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FULL SIZE ON ORIGINAL      0      1      2      3      4      5      6      7      8      9      10      11      12      13      14      15 cm

## Appendix F

# Soil and Water Management Calculations

## SWMP Commentary, Standard Calculation

---

**Note:** These "Standard Calculation" spreadsheets relate only to low erosion hazard lands as identified in figure 4.6 where the designer chooses to not use the RUSLE to size sediment basins. The more "Detailed Calculation" spreadsheets should be used on high erosion hazard lands as identified by figure 4.6 or where the designer chooses to run the RUSLE in calculations.

### 1. Site Data Sheet

**Site name:** Newcastle Jockey Club

**Site location:** Chatham and Darling Streets, Broadmeadow NSW

**Precinct:** Newcastle

**Description of site:** Proposed Stables Complex and Car Park

| Site area                     | Site |     |       |       |      |     | Remarks |
|-------------------------------|------|-----|-------|-------|------|-----|---------|
|                               | 1    | 2   | 3     | 4     | 5    | 6   |         |
| Total catchment area (ha)     | 0.7  | 0.6 | 0.226 | 0.164 | 0.48 | 0.2 |         |
| Disturbed catchment area (ha) | 0.7  | 0.6 | 0.226 | 0.164 | 0.48 | 0.2 |         |

#### Soil analysis

|                    |                                                      |        |        |        |        |        |                                                                    |
|--------------------|------------------------------------------------------|--------|--------|--------|--------|--------|--------------------------------------------------------------------|
| Soil landscape     | Sloping Site - Silty soils with some sand and gravel |        |        |        |        |        | From Geotech report for the site<br>Sections 6.3.3(c), (d) and (e) |
| Soil Texture Group | Type D                                               | Type D | Type D | Type D | Type D | Type D |                                                                    |

#### Rainfall data

|                                          |       |       |       |       |       |       |                                       |
|------------------------------------------|-------|-------|-------|-------|-------|-------|---------------------------------------|
| Design rainfall depth (days)             | 5     | 5     | 5     | 5     | 5     | 5     | See Sections 6.3.4 (d) and (e)        |
| Design rainfall depth (percentile)       | 80    | 80    | 80    | 80    | 80    | 80    | See Sections 6.3.4 (f) and (g)        |
| x-day, y-percentile rainfall event       | 30.5  | 30.5  | 30.5  | 30.5  | 30.5  | 30.5  | See Section 6.3.4 (h)                 |
| Rainfall intensity: 2-year, 6-hour storm | 10.89 | 10.89 | 10.89 | 10.89 | 10.89 | 10.89 | See IFD chart for the site            |
| Rainfall erosivity (R-factor)            | 2580  | 2580  | 2580  | 2580  | 2580  | 2580  | Automatic calculation from above data |

#### Comments:

## SWMP Commentary, Standard Calculation

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**Note:** These "Standard Calculation" spreadsheets relate only to low erosion hazard lands as identified in figure 4.6 where the designer chooses to not use the RUSLE to size sediment basins. The more "Detailed Calculation" spreadsheets should be used on high erosion hazard lands as identified by figure 4.6 or where the designer chooses to run the RUSLE in calculations.

### 1. Site Data Sheet

**Site name:** Newcastle Jockey Club

**Site location:** Chatham and Darling Streets, Broadmeadow NSW

**Precinct:** Newcastle

**Description of site:** Proposed Stables Complex and Car Park

| Site area                     | Site |     |  |  |  |  | Remarks |
|-------------------------------|------|-----|--|--|--|--|---------|
|                               | 7    | 8   |  |  |  |  |         |
| Total catchment area (ha)     | 0.19 | 0.5 |  |  |  |  |         |
| Disturbed catchment area (ha) | 0.19 | 0.5 |  |  |  |  |         |

#### Soil analysis

|                    |                                                      |        |  |  |  |  |                                                                    |
|--------------------|------------------------------------------------------|--------|--|--|--|--|--------------------------------------------------------------------|
| Soil landscape     | Sloping Site - Silty soils with some sand and gravel |        |  |  |  |  | From Geotech report for the site<br>Sections 6.3.3(c), (d) and (e) |
| Soil Texture Group | Type D                                               | Type D |  |  |  |  |                                                                    |

#### Rainfall data

|                                          |       |       |  |  |  |  |                                       |
|------------------------------------------|-------|-------|--|--|--|--|---------------------------------------|
| Design rainfall depth (days)             | 5     | 5     |  |  |  |  | See Sections 6.3.4 (d) and (e)        |
| Design rainfall depth (percentile)       | 80    | 80    |  |  |  |  | See Sections 6.3.4 (f) and (g)        |
| x-day, y-percentile rainfall event       | 30.5  | 30.5  |  |  |  |  | See Section 6.3.4 (h)                 |
| Rainfall intensity: 2-year, 6-hour storm | 10.89 | 10.89 |  |  |  |  | See IFD chart for the site            |
| Rainfall erosivity (R-factor)            | 2580  | 2580  |  |  |  |  | Automatic calculation from above data |

#### Comments:



## 2. Storm Flow Calculations

Peak flow is given by the Rational Formula:

$$Q_y = 0.00278 \times C_{10} \times F_y \times I_{y,tc} \times A$$

where:

- $Q_y$  is peak flow rate ( $m^3/sec$ ) of average recurrence interval (ARI) of "Y" years
- $C_{10}$  is the runoff coefficient (dimensionless) for ARI of 10 years. Rural runoff coefficients are given in Volume 2, figure 5 of Pilgrim (1998), while urban runoff coefficients are given in Volume 1, Book VIII, figure 1.13 of Pilgrim (1998) and construction runoff coefficients are given in Appendix F
- $F_y$  is a frequency factor for "Y" years. Rural values are given in Volume 1, Book IV, Table 1.1 of Pilgrim (1998) while urban coefficients are given in Volume 1, Book VIII, Table 1.6 of Pilgrim (1998)
- $A$  is the catchment area in hectares (ha)
- $I_{y,tc}$  is the average rainfall intensity (mm/hr) for an ARI of "Y" years and a design duration of "tc" (minutes or hours)

Time of concentration ( $t_c$ ) =  $0.76 \times (A/100)^{0.38}$  hrs (Volume 1, Book IV of Pilgrim, 1998)

Note: For urban catchments the time of concentration should be determined by more precise calculations or reduced by a factor of 50 per cent.

### Peak flow calculations, 1

| Site | A<br>(ha) | tc<br>(mins) | Rainfall intensity, I, mm/hr |                    |                     |                     |                     |                      | $C_{10}$ |
|------|-----------|--------------|------------------------------|--------------------|---------------------|---------------------|---------------------|----------------------|----------|
|      |           |              | 1 <sub>yr,tc</sub>           | 5 <sub>yr,tc</sub> | 10 <sub>yr,tc</sub> | 20 <sub>yr,tc</sub> | 50 <sub>yr,tc</sub> | 100 <sub>yr,tc</sub> |          |
| 1    | 0.7       | 7            | 78                           | 122                | 135                 | 154                 | 177                 | 195                  | 0.76     |
| 2    | 0.6       | 7            | 78                           | 122                | 135                 | 154                 | 177                 | 195                  | 0.76     |
| 3    | 0.226     | 5            | 78                           | 122                | 135                 | 154                 | 177                 | 195                  | 0.76     |
| 4    | 0.164     | 4            | 78                           | 122                | 135                 | 154                 | 177                 | 195                  | 0.76     |
| 5    | 0.48      | 6            | 78                           | 122                | 135                 | 154                 | 177                 | 195                  | 0.76     |
| 6    | 0.2       | 4            | 78                           | 122                | 135                 | 154                 | 177                 | 195                  | 0.76     |

### Peak flow calculations, 2

| ARI<br>yrs           | Frequency<br>factor<br>( $F_y$ ) | Peak flows  |             |             |             |             |             | Comment |
|----------------------|----------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|---------|
|                      |                                  | 1           | 2           | 3           | 4           | 5           | 6           |         |
|                      |                                  | ( $m^3/s$ ) | ( $m^3/s$ ) | ( $m^3/s$ ) | ( $m^3/s$ ) | ( $m^3/s$ ) | ( $m^3/s$ ) |         |
| 1 <sub>yr,tc</sub>   | 0.8                              | 0.092       | 0.079       | 0.030       | 0.022       | 0.063       | 0.026       |         |
| 5 <sub>yr,tc</sub>   | 0.95                             | 0.171       | 0.147       | 0.055       | 0.040       | 0.118       | 0.049       |         |
| 10 <sub>yr,tc</sub>  | 1                                | 0.200       | 0.171       | 0.064       | 0.047       | 0.137       | 0.057       |         |
| 20 <sub>yr,tc</sub>  | 1.05                             | 0.239       | 0.205       | 0.077       | 0.056       | 0.164       | 0.068       |         |
| 50 <sub>yr,tc</sub>  | 1.15                             | 0.301       | 0.258       | 0.097       | 0.071       | 0.206       | 0.086       |         |
| 100 <sub>yr,tc</sub> | 1.2                              | 0.346       | 0.297       | 0.112       | 0.081       | 0.237       | 0.099       |         |

## 2. Storm Flow Calculations

Peak flow is given by the Rational Formula:

$$Q_y = 0.00278 \times C_{10} \times F_y \times I_{y,tc} \times A$$

where:

- $Q_y$  is peak flow rate ( $m^3/sec$ ) of average recurrence interval (ARI) of "Y" years
- $C_{10}$  is the runoff coefficient (dimensionless) for ARI of 10 years. Rural runoff coefficients are given in Volume 2, figure 5 of Pilgrim (1998), while urban runoff coefficients are given in Volume 1, Book VIII, figure 1.13 of Pilgrim (1998) and construction runoff coefficients are given in Appendix F
- $F_y$  is a frequency factor for "Y" years. Rural values are given in Volume 1, Book IV, Table 1.1 of Pilgrim (1998) while urban coefficients are given in Volume 1, Book VIII, Table 1.6 of Pilgrim (1998)
- $A$  is the catchment area in hectares (ha)
- $I_{y,tc}$  is the average rainfall intensity (mm/hr) for an ARI of "Y" years and a design duration of "tc" (minutes or hours)

Time of concentration ( $t_c$ ) =  $0.76 \times (A/100)^{0.38}$  hrs (Volume 1, Book IV of Pilgrim, 1998)

Note: For urban catchments the time of concentration should be determined by more precise calculations or reduced by a factor of 50 per cent.

### Peak flow calculations, 1

| Site | A<br>(ha) | tc<br>(mins) | Rainfall intensity, I, mm/hr |                    |                     |                     |                     |                      | $C_{10}$ |
|------|-----------|--------------|------------------------------|--------------------|---------------------|---------------------|---------------------|----------------------|----------|
|      |           |              | 1 <sub>yr,tc</sub>           | 5 <sub>yr,tc</sub> | 10 <sub>yr,tc</sub> | 20 <sub>yr,tc</sub> | 50 <sub>yr,tc</sub> | 100 <sub>yr,tc</sub> |          |
| 7    | 0.19      | 4            | 78                           | 122                | 135                 | 154                 | 177                 | 195                  | 0.76     |
| 8    | 0.5       | 6            | 78                           | 122                | 135                 | 154                 | 177                 | 195                  | 0.76     |
|      |           |              |                              |                    |                     |                     |                     |                      |          |
|      |           |              |                              |                    |                     |                     |                     |                      |          |
|      |           |              |                              |                    |                     |                     |                     |                      |          |
|      |           |              |                              |                    |                     |                     |                     |                      |          |

### Peak flow calculations, 2

| ARI<br>yrs           | Frequency<br>factor<br>( $F_y$ ) | Peak flows  |             |             |             |             |             | Comment |
|----------------------|----------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|---------|
|                      |                                  | 7           | 8           |             |             |             |             |         |
|                      |                                  | ( $m^3/s$ ) | ( $m^3/s$ ) | ( $m^3/s$ ) | ( $m^3/s$ ) | ( $m^3/s$ ) | ( $m^3/s$ ) |         |
| 1 <sub>yr,tc</sub>   | 0.8                              | 0.025       | 0.066       |             |             |             |             |         |
| 5 <sub>yr,tc</sub>   | 0.95                             | 0.047       | 0.122       |             |             |             |             |         |
| 10 <sub>yr,tc</sub>  | 1                                | 0.054       | 0.143       |             |             |             |             |         |
| 20 <sub>yr,tc</sub>  | 1.05                             | 0.065       | 0.171       |             |             |             |             |         |
| 50 <sub>yr,tc</sub>  | 1.15                             | 0.082       | 0.215       |             |             |             |             |         |
| 100 <sub>yr,tc</sub> | 1.2                              | 0.094       | 0.247       |             |             |             |             |         |

### 4. Volume of Sediment Basins, *Type D* and *Type F* Soils

Basin volume = settling zone volume + sediment storage zone volume

#### Settling Zone Volume

The settling zone volume for *Type F* and *Type D* soils is calculated to provide capacity to contain all runoff expected from up to the y-percentile rainfall event. The volume of the basin's settling zone (V) can be determined as a function of the basin's surface area and depth to allow for particles to settle and can be determined by the following equation:

$$V = 10 \times C_v \times A \times R_{y\text{-}\%ile, x\text{-}day} \text{ (m}^3\text{)}$$

where:

10 = a unit conversion factor

$C_v$  = the volumetric runoff coefficient defined as that portion of rainfall that runs off as stormwater over the x-day period

R = is the x-day total rainfall depth (mm) that is not exceeded in y percent of rainfall events. (See Sections 6.3.4(d), (e), (f), (g) and (h)).

A = total catchment area (ha)

#### Sediment Storage Zone Volume

In the standard calculation, the sediment storage zone is 50 percent of the setting zone. However, designers can work to capture the 2-month soil loss as calculated by the RUSLE (Section 6.3.4(i)(ii)), in which case the "Detailed Calculation" spreadsheets should be used.

#### Total Basin Volume

| Site | $C_v$ | R<br>x-day<br>y-%ile | Total<br>catchment<br>area<br>(ha) | Settling<br>zone<br>volume<br>(m <sup>3</sup> ) | Sediment<br>storage<br>volume<br>(m <sup>3</sup> ) | Total<br>basin<br>volume<br>(m <sup>3</sup> ) |
|------|-------|----------------------|------------------------------------|-------------------------------------------------|----------------------------------------------------|-----------------------------------------------|
| 1    | 0.42  | 30.5                 | 0.7                                | 89.67                                           | 45                                                 | 134.505                                       |
| 2    | 0.42  | 30.5                 | 0.6                                | 76.86                                           | 38                                                 | 115.29                                        |
| 3    | 0.42  | 30.5                 | 0.226                              | 28.9506                                         | 14                                                 | 43.4259                                       |
| 4    | 0.42  | 30.5                 | 0.164                              | 21.0084                                         | 11                                                 | 31.5126                                       |
| 5    | 0.42  | 30.5                 | 0.48                               | 61.488                                          | 31                                                 | 92.232                                        |
| 6    | 0.42  | 30.5                 | 0.2                                | 25.62                                           | 13                                                 | 38.43                                         |

### 4. Volume of Sediment Basins, *Type D* and *Type F* Soils

Basin volume = settling zone volume + sediment storage zone volume

#### Settling Zone Volume

The settling zone volume for *Type F* and *Type D* soils is calculated to provide capacity to contain all runoff expected from up to the y-percentile rainfall event. The volume of the basin's settling zone (V) can be determined as a function of the basin's surface area and depth to allow for particles to settle and can be determined by the following equation:

$$V = 10 \times C_v \times A \times R_{y\text{-}\%ile, x\text{-}day} \text{ (m}^3\text{)}$$

where:

10 = a unit conversion factor

$C_v$  = the volumetric runoff coefficient defined as that portion of rainfall that runs off as stormwater over the x-day period

R = is the x-day total rainfall depth (mm) that is not exceeded in y percent of rainfall events. (See Sections 6.3.4(d), (e), (f), (g) and (h)).

A = total catchment area (ha)

#### Sediment Storage Zone Volume

In the standard calculation, the sediment storage zone is 50 percent of the setting zone. However, designers can work to capture the 2-month soil loss as calculated by the RUSLE (Section 6.3.4(i)(ii)), in which case the "Detailed Calculation" spreadsheets should be used.

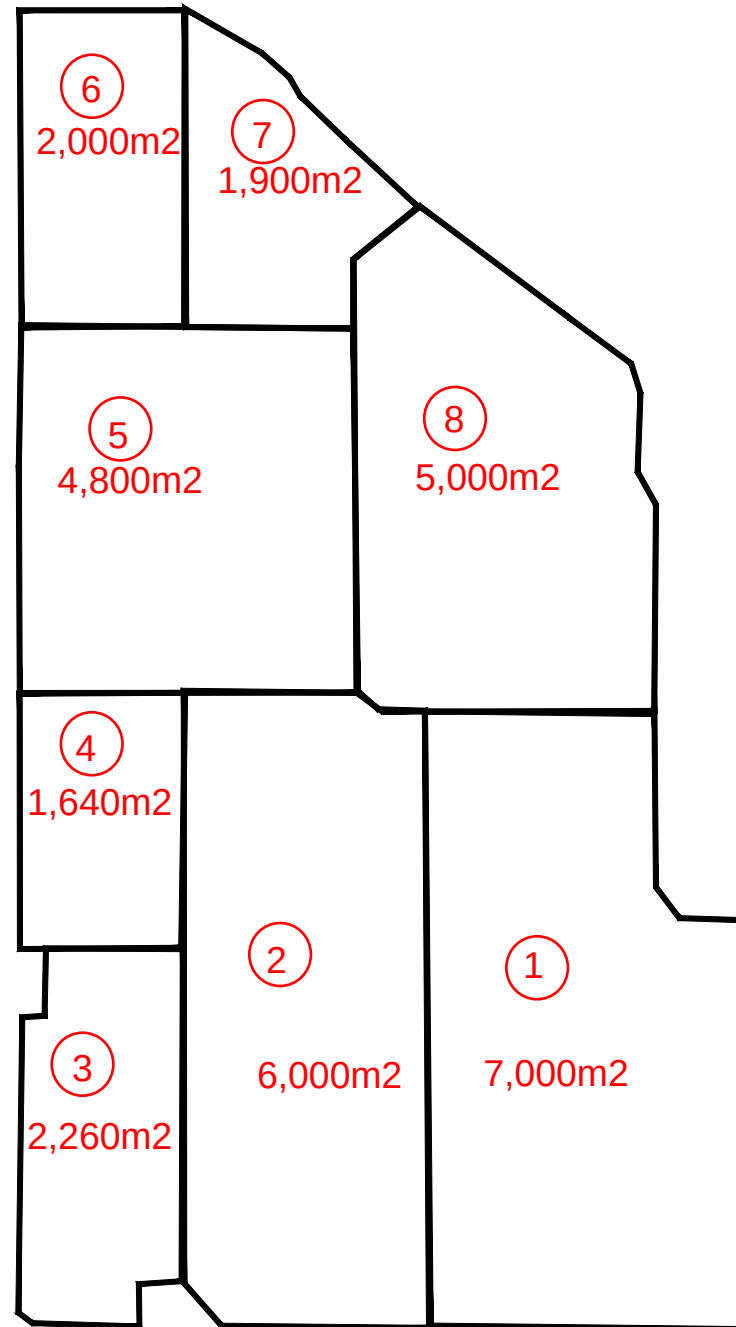
#### Total Basin Volume

| Site | $C_v$ | R<br>x-day<br>y-%ile | Total<br>catchment<br>area<br>(ha) | Settling<br>zone<br>volume<br>(m <sup>3</sup> ) | Sediment<br>storage<br>volume<br>(m <sup>3</sup> ) | Total<br>basin<br>volume<br>(m <sup>3</sup> ) |
|------|-------|----------------------|------------------------------------|-------------------------------------------------|----------------------------------------------------|-----------------------------------------------|
| 7    | 0.42  | 30.5                 | 0.19                               | 24.339                                          | 12                                                 | 36.5085                                       |
| 8    | 0.42  | 30.5                 | 0.5                                | 64.05                                           | 32                                                 | 96.075                                        |
|      |       |                      |                                    |                                                 |                                                    |                                               |
|      |       |                      |                                    |                                                 |                                                    |                                               |
|      |       |                      |                                    |                                                 |                                                    |                                               |
|      |       |                      |                                    |                                                 |                                                    |                                               |



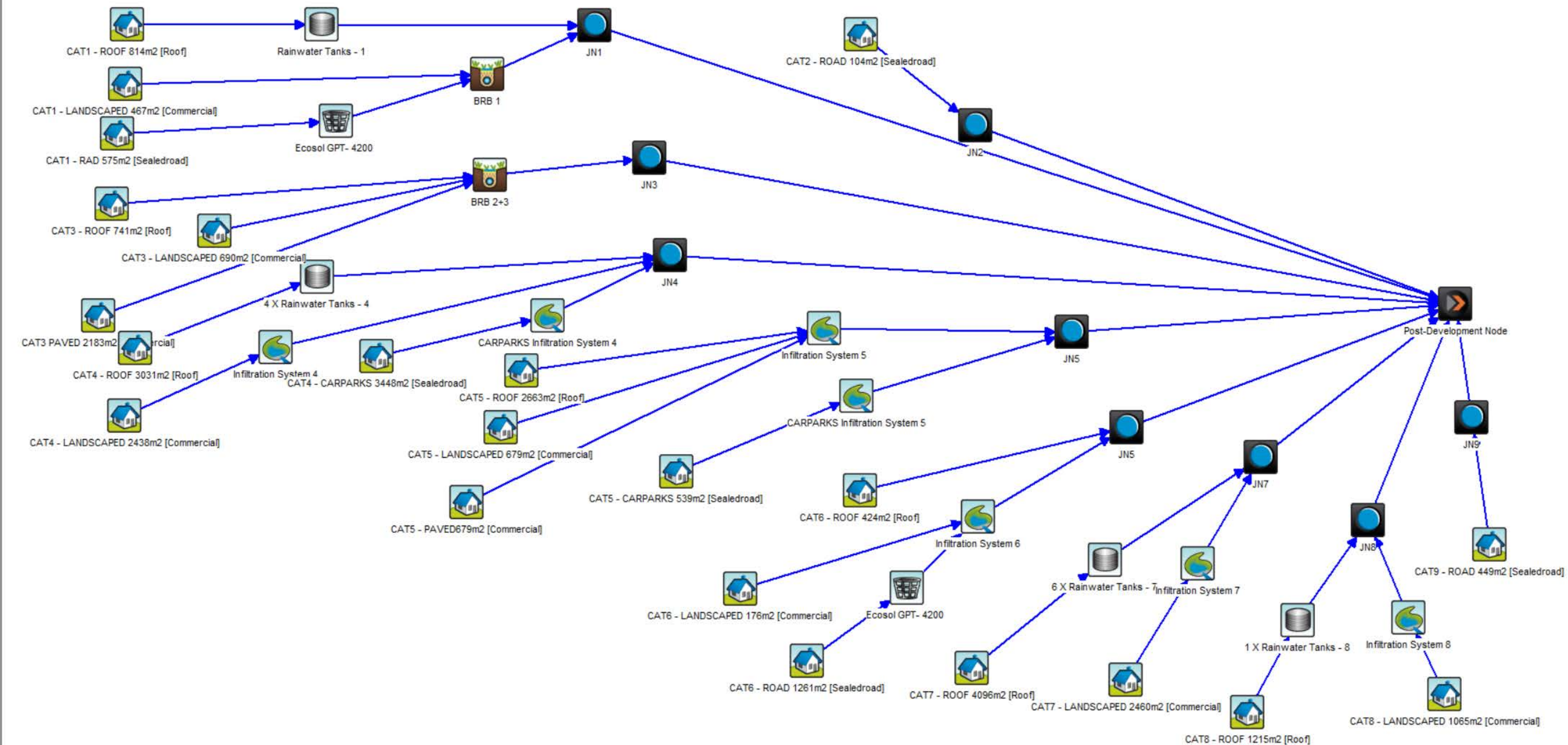
**MPC Ref:** 160548.1  
**Project:** Newcastle Jockey Club - Proposed Stables Complex  
**Subject:** Summary of Construction Phase Sediment Basin Volumes

| Sediment Basin No. | Plan Area<br>of base (m2) | Settling Zone<br>(m3) | Storage Zone<br>(m3) | Total Basin Volume<br>(m3) |
|--------------------|---------------------------|-----------------------|----------------------|----------------------------|
| 1                  | 225                       | 90                    | 45                   | 135                        |
| 2                  | 192                       | 77                    | 38                   | 115                        |
| 3                  | 72                        | 29                    | 14                   | 43                         |
| 4                  | 54                        | 21                    | 11                   | 32                         |
| 5                  | 154                       | 61                    | 31                   | 92                         |
| 6                  | 65                        | 26                    | 13                   | 39                         |
| 7                  | 60                        | 24                    | 12                   | 36                         |
| 8                  | 160                       | 64                    | 32                   | 96                         |



## Appendix G

# Stormwater Quality (MUSICLink) Report





## MUSIC-link Report

| Project Details                 |                                               | Company Details |                                                 |
|---------------------------------|-----------------------------------------------|-----------------|-------------------------------------------------|
| <b>Project:</b>                 | Newcastle Jockey Club Development             | <b>Company:</b> | MPC Consulting Engineers                        |
| <b>Report Export Date:</b>      | 6/04/2022                                     | <b>Contact:</b> | Benjamin Curran                                 |
| <b>Catchment Name:</b>          | 160548 NJC Chatham MUSIC_WITH GPTS_06.04.2022 | <b>Address:</b> | L1, 16 Telford Street, Newcastle East, NSW 2300 |
| <b>Catchment Area:</b>          | 3.529ha                                       | <b>Phone:</b>   | 0249275566                                      |
| <b>Impervious Area*:</b>        | 84.29%                                        | <b>Email:</b>   | benjamin@mpceng.com.au                          |
| <b>Rainfall Station:</b>        | 61078 WILLIAMTOWN                             |                 |                                                 |
| <b>Modelling Time-step:</b>     | 6 Minutes                                     |                 |                                                 |
| <b>Modelling Period:</b>        | 1/01/1995 - 31/12/2008 11:54:00 PM            |                 |                                                 |
| <b>Mean Annual Rainfall:</b>    | 1125mm                                        |                 |                                                 |
| <b>Evapotranspiration:</b>      | 1735mm                                        |                 |                                                 |
| <b>MUSIC Version:</b>           | 6.3.0                                         |                 |                                                 |
| <b>MUSIC-link data Version:</b> | 6.34                                          |                 |                                                 |
| <b>Study Area:</b>              | Newcastle                                     |                 |                                                 |
| <b>Scenario:</b>                | Newcastle                                     |                 |                                                 |

\* takes into account area from all source nodes that link to the chosen reporting node, excluding Import Data Nodes

| Treatment Train Effectiveness |           | Treatment Nodes          |        | Source Nodes      |        |
|-------------------------------|-----------|--------------------------|--------|-------------------|--------|
| Node: Post-Development Node   | Reduction | Node Type                | Number | Node Type         | Number |
| Flow                          | 66%       | Rain Water Tank Node     | 4      | Urban Source Node | 22     |
| TSS                           | 89.5%     | Bio Retention Node       | 2      |                   |        |
| TP                            | 78.5%     | Infiltration System Node | 7      |                   |        |
| TN                            | 73.5%     | GPT Node                 | 2      |                   |        |
| GP                            | 96.8%     |                          |        |                   |        |

| Comments               |
|------------------------|
| 16-548 MPC MUSIC Model |

| Passing Parameters |                                |                               |      |      |         |
|--------------------|--------------------------------|-------------------------------|------|------|---------|
| Node Type          | Node Name                      | Parameter                     | Min  | Max  | Actual  |
| Bio                | BRB 1                          | Hi-flow bypass rate (cum/sec) | None | None | 100     |
| Bio                | BRB 1                          | PET Scaling Factor            | 2.1  | 2.1  | 2.1     |
| Bio                | BRB 2+3                        | Hi-flow bypass rate (cum/sec) | None | None | 100     |
| Bio                | BRB 2+3                        | PET Scaling Factor            | 2.1  | 2.1  | 2.1     |
| GPT                | Ecosol GPT- 4200               | Hi-flow bypass rate (cum/sec) | None | None | 0.051   |
| GPT                | Ecosol GPT- 4200               | Hi-flow bypass rate (cum/sec) | None | None | 0.051   |
| Infiltration       | CARPARKS Infiltration System 4 | Area (sqm)                    | None | None | 180     |
| Infiltration       | CARPARKS Infiltration System 4 | Filter area (sqm)             | None | None | 180     |
| Infiltration       | CARPARKS Infiltration System 4 | Hi-flow bypass rate (cum/sec) | None | None | 100     |
| Infiltration       | CARPARKS Infiltration System 5 | Area (sqm)                    | None | None | 24      |
| Infiltration       | CARPARKS Infiltration System 5 | Filter area (sqm)             | None | None | 24      |
| Infiltration       | CARPARKS Infiltration System 5 | Hi-flow bypass rate (cum/sec) | None | None | 100     |
| Infiltration       | Infiltration System 4          | Area (sqm)                    | None | None | 50      |
| Infiltration       | Infiltration System 4          | Filter area (sqm)             | None | None | 50      |
| Infiltration       | Infiltration System 4          | Hi-flow bypass rate (cum/sec) | None | None | 100     |
| Infiltration       | Infiltration System 5          | Area (sqm)                    | None | None | 120     |
| Infiltration       | Infiltration System 5          | Filter area (sqm)             | None | None | 120     |
| Infiltration       | Infiltration System 5          | Hi-flow bypass rate (cum/sec) | None | None | 100     |
| Infiltration       | Infiltration System 6          | Area (sqm)                    | None | None | 8       |
| Infiltration       | Infiltration System 6          | Filter area (sqm)             | None | None | 8       |
| Infiltration       | Infiltration System 6          | Hi-flow bypass rate (cum/sec) | None | None | 100     |
| Infiltration       | Infiltration System 7          | Area (sqm)                    | None | None | 150     |
| Infiltration       | Infiltration System 7          | Filter area (sqm)             | None | None | 150     |
| Infiltration       | Infiltration System 7          | Hi-flow bypass rate (cum/sec) | None | None | 100     |
| Infiltration       | Infiltration System 8          | Area (sqm)                    | None | None | 50      |
| Infiltration       | Infiltration System 8          | Filter area (sqm)             | None | None | 50      |
| Infiltration       | Infiltration System 8          | Hi-flow bypass rate (cum/sec) | None | None | 100     |
| Post               | Post-Development Node          | % Load Reduction              | None | None | 66      |
| Post               | Post-Development Node          | GP % Load Reduction           | 90   | None | 96.8    |
| Post               | Post-Development Node          | TN % Load Reduction           | 45   | None | 73.5    |
| Post               | Post-Development Node          | TP % Load Reduction           | 65   | None | 78.5    |
| Post               | Post-Development Node          | TSS % Load Reduction          | 85   | None | 89.5    |
| Rain               | 1 X Rainwater Tanks - 8        | % Reuse Demand Met            | 70   | None | 98.7994 |
| Rain               | 4 X Rainwater Tanks - 4        | % Reuse Demand Met            | 70   | None | 82.0788 |
| Rain               | 6 X Rainwater Tanks - 7        | % Reuse Demand Met            | 70   | None | 91.9983 |
| Rain               | Rainwater Tanks - 1            | % Reuse Demand Met            | 70   | None | 90.60   |
| Urban              | CAT1 - LANDSCAPED 467m2        | Area Impervious (ha)          | None | None | 0       |
| Urban              | CAT1 - LANDSCAPED 467m2        | Area Pervious (ha)            | None | None | 0.047   |
| Urban              | CAT1 - LANDSCAPED 467m2        | Total Area (ha)               | None | None | 0.047   |
| Urban              | CAT1 - RAD 575m2               | Area Impervious (ha)          | None | None | 0.058   |

Only certain parameters are reported when they pass validation

| Node Type | Node Name                | Parameter            | Min  | Max  | Actual |
|-----------|--------------------------|----------------------|------|------|--------|
| Urban     | CAT1 - RAD 575m2         | Area Pervious (ha)   | None | None | 0      |
| Urban     | CAT1 - RAD 575m2         | Total Area (ha)      | None | None | 0.058  |
| Urban     | CAT1 - ROOF 814m2        | Area Impervious (ha) | None | None | 0.082  |
| Urban     | CAT1 - ROOF 814m2        | Area Pervious (ha)   | None | None | 0      |
| Urban     | CAT1 - ROOF 814m2        | Total Area (ha)      | None | None | 0.082  |
| Urban     | CAT2 - ROAD 104m2        | Area Impervious (ha) | None | None | 0.011  |
| Urban     | CAT2 - ROAD 104m2        | Area Pervious (ha)   | None | None | 0      |
| Urban     | CAT2 - ROAD 104m2        | Total Area (ha)      | None | None | 0.011  |
| Urban     | CAT3 - LANDSCAPED 690m2  | Area Impervious (ha) | None | None | 0      |
| Urban     | CAT3 - LANDSCAPED 690m2  | Area Pervious (ha)   | None | None | 0.069  |
| Urban     | CAT3 - LANDSCAPED 690m2  | Total Area (ha)      | None | None | 0.069  |
| Urban     | CAT3 - ROOF 741m2        | Area Impervious (ha) | None | None | 0.074  |
| Urban     | CAT3 - ROOF 741m2        | Area Pervious (ha)   | None | None | 0      |
| Urban     | CAT3 - ROOF 741m2        | Total Area (ha)      | None | None | 0.074  |
| Urban     | CAT3 PAVED 2183m2        | Area Impervious (ha) | None | None | 0.218  |
| Urban     | CAT3 PAVED 2183m2        | Area Pervious (ha)   | None | None | 0      |
| Urban     | CAT3 PAVED 2183m2        | Total Area (ha)      | None | None | 0.218  |
| Urban     | CAT4 - CARPARKS 3448m2   | Area Impervious (ha) | None | None | 0.326  |
| Urban     | CAT4 - CARPARKS 3448m2   | Area Pervious (ha)   | None | None | 0.018  |
| Urban     | CAT4 - CARPARKS 3448m2   | Total Area (ha)      | None | None | 0.345  |
| Urban     | CAT4 - LANDSCAPED 2438m2 | Area Impervious (ha) | None | None | 0.072  |
| Urban     | CAT4 - LANDSCAPED 2438m2 | Area Pervious (ha)   | None | None | 0.171  |
| Urban     | CAT4 - LANDSCAPED 2438m2 | Total Area (ha)      | None | None | 0.244  |
| Urban     | CAT4 - ROOF 3031m2       | Area Impervious (ha) | None | None | 0.303  |
| Urban     | CAT4 - ROOF 3031m2       | Area Pervious (ha)   | None | None | 0      |
| Urban     | CAT4 - ROOF 3031m2       | Total Area (ha)      | None | None | 0.303  |
| Urban     | CAT5 - CARPARKS 539m2    | Area Impervious (ha) | None | None | 0.051  |
| Urban     | CAT5 - CARPARKS 539m2    | Area Pervious (ha)   | None | None | 0.002  |
| Urban     | CAT5 - CARPARKS 539m2    | Total Area (ha)      | None | None | 0.054  |
| Urban     | CAT5 - LANDSCAPED 679m2  | Area Impervious (ha) | None | None | 0      |
| Urban     | CAT5 - LANDSCAPED 679m2  | Area Pervious (ha)   | None | None | 0.068  |
| Urban     | CAT5 - LANDSCAPED 679m2  | Total Area (ha)      | None | None | 0.068  |
| Urban     | CAT5 - PAVED 679m2       | Area Impervious (ha) | None | None | 0.573  |
| Urban     | CAT5 - PAVED 679m2       | Area Pervious (ha)   | None | None | 0      |
| Urban     | CAT5 - PAVED 679m2       | Total Area (ha)      | None | None | 0.573  |
| Urban     | CAT5 - ROOF 2663m2       | Area Impervious (ha) | None | None | 0.266  |
| Urban     | CAT5 - ROOF 2663m2       | Area Pervious (ha)   | None | None | 0      |
| Urban     | CAT5 - ROOF 2663m2       | Total Area (ha)      | None | None | 0.266  |
| Urban     | CAT6 - LANDSCAPED 176m2  | Area Impervious (ha) | None | None | 0.018  |
| Urban     | CAT6 - LANDSCAPED 176m2  | Area Pervious (ha)   | None | None | 0      |

Only certain parameters are reported when they pass validation

| Node Type | Node Name                | Parameter            | Min  | Max  | Actual |
|-----------|--------------------------|----------------------|------|------|--------|
| Urban     | CAT6 - LANDSCAPED 176m2  | Total Area (ha)      | None | None | 0.018  |
| Urban     | CAT6 - ROAD 1261m2       | Area Impervious (ha) | None | None | 0.126  |
| Urban     | CAT6 - ROAD 1261m2       | Area Pervious (ha)   | None | None | 0      |
| Urban     | CAT6 - ROAD 1261m2       | Total Area (ha)      | None | None | 0.126  |
| Urban     | CAT6 - ROOF 424m2        | Area Impervious (ha) | None | None | 0.043  |
| Urban     | CAT6 - ROOF 424m2        | Area Pervious (ha)   | None | None | 0      |
| Urban     | CAT6 - ROOF 424m2        | Total Area (ha)      | None | None | 0.043  |
| Urban     | CAT7 - LANDSCAPED 2460m2 | Area Impervious (ha) | None | None | 0.122  |
| Urban     | CAT7 - LANDSCAPED 2460m2 | Area Pervious (ha)   | None | None | 0.123  |
| Urban     | CAT7 - LANDSCAPED 2460m2 | Total Area (ha)      | None | None | 0.246  |
| Urban     | CAT7 - ROOF 4096m2       | Area Impervious (ha) | None | None | 0.41   |
| Urban     | CAT7 - ROOF 4096m2       | Area Pervious (ha)   | None | None | 0      |
| Urban     | CAT7 - ROOF 4096m2       | Total Area (ha)      | None | None | 0.41   |
| Urban     | CAT8 - LANDSCAPED 1065m2 | Area Impervious (ha) | None | None | 0.053  |
| Urban     | CAT8 - LANDSCAPED 1065m2 | Area Pervious (ha)   | None | None | 0.053  |
| Urban     | CAT8 - LANDSCAPED 1065m2 | Total Area (ha)      | None | None | 0.107  |
| Urban     | CAT8 - ROOF 1215m2       | Area Impervious (ha) | None | None | 0.122  |
| Urban     | CAT8 - ROOF 1215m2       | Area Pervious (ha)   | None | None | 0      |
| Urban     | CAT8 - ROOF 1215m2       | Total Area (ha)      | None | None | 0.122  |
| Urban     | CAT9 - ROAD 449m2        | Area Impervious (ha) | None | None | 0.045  |
| Urban     | CAT9 - ROAD 449m2        | Area Pervious (ha)   | None | None | 0      |
| Urban     | CAT9 - ROAD 449m2        | Total Area (ha)      | None | None | 0.045  |

Only certain parameters are reported when they pass validation





## Appendix H

# City of Newcastle Supplied Information

Flood Certificate and Relevant Flood Maps

Existing road drainage information

22 May 2019

Avid Project Management Pty Ltd  
C/- Ncle Jockey Club Ltd  
Po Box 30  
BROADMEADOW NSW 2292

---

**Flood Information Certificate No:** FL2019/00101

**Land:** Lot 13 DP 227704

**Property Address:** 125 Chatham Street Broadmeadow NSW 2292

---

Thank you for your recent enquiry regarding flood behaviour at the above property. This letter confirms the property is located in a flood prone area.

The pertinent features of the flood behaviour are estimated as follows:

**Local Catchment Flooding**

|                                                                                                                                                 |                                                                                                    |
|-------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|
| Is any part of the site affected by a floodway?                                                                                                 | No                                                                                                 |
| Is any part of the site affected by a flood storage area?                                                                                       | Yes (See Attachment)                                                                               |
| Estimated 1% Annual Exceedance Probability event level:<br>(equivalent to the " <i>Defined Flood Level</i> " in the Building Code of Australia) | 6.35m AHD (North West corner)<br>6.35m AHD (South West corner)<br>6.10m AHD (middle of race track) |
| Estimated Maximum Flow Velocity of floodwaters<br>(in the " <i>Defined Flood Event</i> " as per the Building Code of Australia)                 | 0.8m/s                                                                                             |
| Highest Property Hazard Category                                                                                                                | P2                                                                                                 |
| Estimated Probable Maximum Flood Level                                                                                                          | 7.3m AHD (maximum velocity 1.10m/s)                                                                |
| Highest Life Hazard Category                                                                                                                    | L4 (H3)                                                                                            |

The flood study from which the above information is derived is part of a Newcastle City Wide Floodplain Management Plan. The above advice may change in the future, however the advice is based on the best information held by Council at the time of issue of this certificate.

The Newcastle Development Control Plan 2012 addresses the issues of flood management for new development. You can view the development control plan at [www.newcastle.nsw.gov.au](http://www.newcastle.nsw.gov.au). In summary, the following requirements apply for all future development applications on the site.

|                                                                                                                                                                       |                |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| Development in a floodway is not generally allowable due to likely redistribution of flood water.                                                                     | Not Applicable |
| Filling of a flood storage area by more than 20% is not generally allowable due to redistribution of flood water.                                                     | Applicable     |
| Minimum floor level for occupiable rooms in a new development on this site is:<br>(equivalent to the " <i>Flood Hazard Level</i> " in the Building Code of Australia) | 6.85m AHD      |
| Is onsite flood refuge required?                                                                                                                                      | Yes            |

Council holds no information concerning floor levels of existing structures on the site. Site levels and floor levels should be verified by survey based on the Australian Height Datum.

Please note that:

1. No assessment of the lot's suitability for the purposes of making an application for a complying development certificate under the Housing Code or Rural Housing Code of *State Environmental Planning Policy (Exempt and Complying Development Codes) 2008*, or for a Secondary Dwelling under *State Environmental Planning Policy (Affordable Rental Housing) 2009*, has been made. This type of flood information can also be obtained from Council via a Flood Information Application. There are two services provided by Council relating to Complying Development flood criteria, as follows:
  - a) Identification of lots affected by any of the flood control lot exclusions identified in subclause 3.5(1) or 3A.38(1) of *State Environmental Planning Policy (Exempt and Complying Development Codes) 2008*. If this information is required, select Box 4. b) (i) on the Flood Information Application form and pay the required fee.
  - b) An assessment of a proposal for development of the lot for compliance with the requirements of subclause 3.36(2) or 3A.38(2) of *State Environmental Planning Policy (Exempt and Complying Development Codes) 2008*. If this information is required, select Box 4. b) (ii) on the Flood Information Application form, submit plans and other relevant documentation for the proposal and pay the required fee.
2. The information contained in this certificate may alter in the future. The applicant should at all times ensure the currency of this information.

Should you require any further clarification please contact Alastair Peddie on 4974 2788.  
Yours faithfully

**Alastair Peddie**  
**SENIOR DEVELOPMENT OFFICER (ENGINEERING)**







## **Additional information for the holders of Flood Information Certificates**

---

This information explains the terms used in Newcastle City Council's Flood Information Certificates and provides some basic information on Councils requirements for future development of flood prone land.

Compliance with these requirements in the Development Control Plan does not guarantee approval, however, in most cases, the flood issues can be resolved by adhering to these guidelines.



**Newcastle City-wide Floodplain Risk  
Management Plan 2012  
Newcastle Development Control Plan**

## FLOOD CERTIFICATE NOTES

### GENERAL:

- The information presented in the Certificate relates to the Newcastle City-wide Floodplain Risk Management Plan and the Newcastle Development Control Plan, which have been developed in accordance with the principles of the NSW Government's Flood Prone Land Policy.
- Council's flood information is compiled from a composite of data. The variability of rainfall itself is a major factor in the uncertainty of flood information and accordingly, this certificate is only an estimate of real flood characteristics. Any particular flood is likely to be different to the conditions described in this certificate.
- Council acknowledges that its flood information is incomplete and varies in accuracy, however it is the best available to Council at the time of issue.
- Where information is presently not known, it is denoted by "unknown"
- From time to time, on going research and studies will replace or add to Council's flood information. Accordingly, the information in this certificate is not warranted after the day of issue.
- Should you disagree with Council's assessment of the flood behaviour, you may conduct your own investigations or enquires and submit them to Council for consideration. Where revision of this assessment is warranted, Council is committed to making such amendments to its information.

### EXPLANATIONS FOR TERMS USED IN THE FLOOD INFORMATION CERTIFICATE

#### Is any part of the site affected by a Floodway?

Generally, where a property is affected by a floodway, we will provide you with additional information on where we believe the floodway to be by way of a map. In some circumstances it may be possible to redirect a floodway subject to appropriate engineering advice. You should start by discussing the matter with a development officer from Council.

A **Floodway** is a pathway taken by major discharges of floodwaters, the obstruction or partial obstruction of which would cause a significant redistribution of floodwaters, or a significant increase in flood levels. Floodways are often aligned with natural channels and are usually characterised by deep and relatively fast flowing water.

The Newcastle DCP 2012 states:

*"No building or structure is to be erected and no land is to be filled by way of the deposition of any material within any area identified as a floodway except for:*

*Minor alterations to ground levels for roads, parking, below ground structures and landscaping, provided that the fundamental flow patterns are not significantly altered.*

*Where dividing fences across floodways are unavoidable, they are to be constructed only of open type fencing that will not restrict the flow of flood waters and be resistant to blockage. New development shall be designed to avoid fences in floodways."*

#### Is any part of the site affected by a flood storage area?

Where a property is wholly affected by flood storage area, we will answer "yes" to this question on the Flood Information Certificate. Where a property is partly affected, we will provide additional information by way of a map.

**Flood storage area** is an area where flood water accumulates and the displacement of that floodwater will cause a significant redistribution of floodwaters, or a significant increase in

flood levels, or a significant increase in downstream flood frequency. Flood storage areas are often aligned with floodplains and are usually characterised by deep and slow moving floodwater.

The Newcastle DCP 2012 states:

*“Not more than 20% of the area of any development site in a flood storage area is to be filled. The remaining 80% can generally be developed allowing for underfloor storage of floodwater by the use of suspended floor techniques such as pier and beam construction.*

*Where it is proposed to fill development sites, the fill is not to impede the flow of ordinary drainage from neighbouring properties, including overland flow.”*

### **1% Annual Exceedence Probability (AEP) event level:**

The 1% AEP event is the basic benchmark for Council's development controls. It is a flood event that has a 1 in 100 chance of being exceeded in any one year. Conceptually, it is similar to a “1 in 100 year” event, except that the term 1 in 100 years conveys the notion that the event is definitely going to happen in a 100 year time frame, and will only occur once in that time frame. In fact, a 1 in 100 year event has a 67% probability of occurring once in any nominate hundred year period.

Levels are reduced to the Australian Height Datum. This means that the quoted levels are heights above sea level. They can be compared to ground levels determined by a surveyor using the same datum to ascertain the likely flood depth.

In general, the minimum requirement for development of flood prone land is to set floor levels above the **Flood planning level (FPL)**. The flood planning level is the peak flood level for the flood planning event (usually the 1% AEP flood) **plus** the appropriate freeboard (usually, but not always 500mm, depending on the circumstances) to account for uncertainty, wave action and model error.

The Newcastle DCP 2012 states:

*“Floor levels of all occupiable rooms of all buildings are not to be set lower than the FPL.”*

*“Garage floor levels are to be set no lower than the 1% AEP flood event. However it is recognised that in some circumstances this may be impractical due to vehicular access constraints. In these cases, garage floor levels should be as high as practicable.”*

*“Basement garages may be acceptable where all potential water entry points are at or above the probable maximum flood (PMF), excepting that vehicular entry points can be at the FPL. In these cases, explicit points of refuge should be accessible from the carpark in accordance with the provisions for risk to life set out below.”*

*“Electrical fixtures such as power points, light fittings and switches are to be sited above the FPL unless they are on a separate circuit (with earth leakage protection) to the rest of the building.”*

*“Where parts of the building are proposed to be below the flood planning level, they are to be constructed of water-resistant materials. “*

### **Highest Property Hazard Category:**

Property hazards describe the danger that flood waters might pose to the property of persons affected by flooding. Generally, the descriptions are:

- P1** Parked or moving cars remain stable
- P2** Parked or moving heavy vehicles remain stable
- P3** Suitable for light construction (eg timber frame, masonry and brick veneer)



**P4** Suitable for heavy construction (eg steel frame, and concrete)

**P5** Hydraulically unsuitable for normal building construction

They are determined by direct correlation to the Hydraulic Behaviour Threshold (P1 relates to a Hydraulic Behaviour Threshold of H1) as determined at the flood-planning event, usually the 1% AEP flood. The Hydraulic behaviour thresholds used in the determination of these hazards are shown in the figure N1.

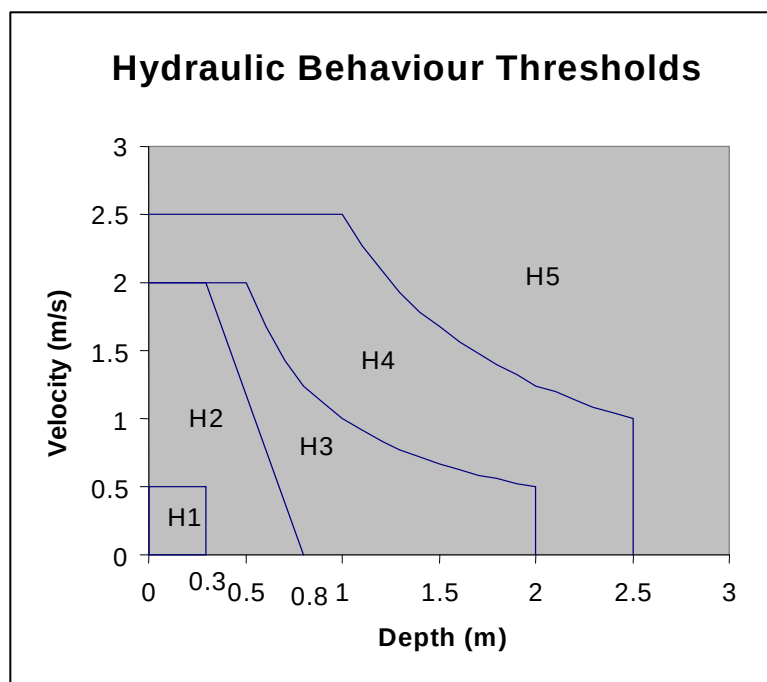


Figure N1 – Hydraulic Behaviour Thresholds

For the purposes of the flood information quoted here, the property hazard relates to the ground level as understood by Council at the time the information was collected. The property hazard cannot be used to determine the ground level of the site.

Property hazards can be reduced by filling a site, or raising floor levels as appropriate provided that the work is compatible with the applicable (if any) floodway or flood storage area.

In general, the minimum requirement for managing property risk is to set floor levels to the Flood planning level. The flood planning level is the level (usually expressed as a reduced level above the Australian Height Datum (AHD)).

The Newcastle DCP 2012 states:

“Areas where cars, vans and trailers etc are parked, displayed or stored are not to be located in areas subject to property hazard of P2 or higher. Containers, bins, hoppers and other large floatable objects also are not to be stored in these areas. Heavy vehicle parking areas are not to be located in areas subject to property hazard P3 or higher.”

“Timber framed, light steel construction, cavity brickwork and other conventional domestic building materials are generally not suitable forms of construction where the property hazard is P4 or higher. Where property hazard is P4, the structure shall be certified by a practising structural engineer to withstand the hydraulic loads (including debris) induced by the flood waters.”

“Property hazards of P5 are generally unsuitable for any type of building construction and building is discouraged from these areas. Where building is necessary, the

structure is to be certified by a practising structural engineer to withstand the hydraulic loads (including debris) induced by the flood waters.”

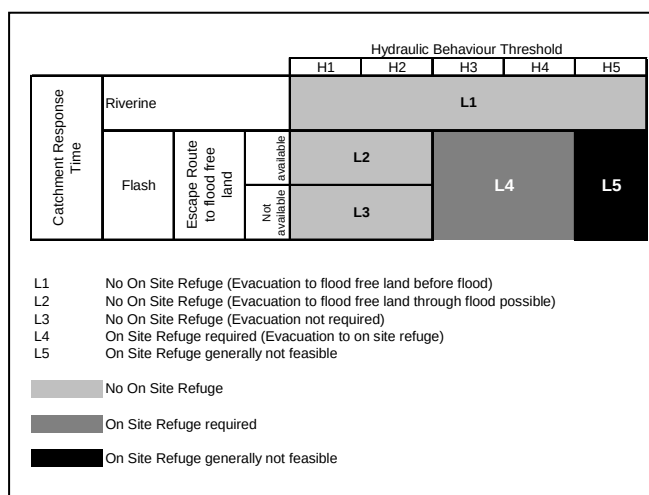
### Highest life Hazard Category:

Life hazards describe the danger that flood waters might pose to the lives of persons affected by flooding. Generally, the descriptions are:

**Table N1 Life hazard descriptions**

| HAZARD FACTOR                                             | HAZARD CLASSIFICATION                                                                                                             |                                                                                                                                                                                       |                                                                                                                            |                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                   |
|-----------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                           | L1                                                                                                                                | L2                                                                                                                                                                                    | L3                                                                                                                         | L4                                                                                                                                                                                    | L5                                                                                                                                                                                                                                                                                                                                |
| Effective Warning                                         | Y                                                                                                                                 | N                                                                                                                                                                                     | N                                                                                                                          | N                                                                                                                                                                                     | N                                                                                                                                                                                                                                                                                                                                 |
| Effective capacity to allow evacuation to flood free land | Y                                                                                                                                 | Y                                                                                                                                                                                     | N                                                                                                                          | N                                                                                                                                                                                     | N                                                                                                                                                                                                                                                                                                                                 |
| Rate of rise of flood waters                              | Slow                                                                                                                              | Flash                                                                                                                                                                                 | Flash                                                                                                                      | Flash                                                                                                                                                                                 | Flash                                                                                                                                                                                                                                                                                                                             |
| Duration of Flooding                                      | Too long for refuge enclosed by floodwaters to be appropriate.                                                                    | Short enough for occupation during the entire flood to be appropriate                                                                                                                 | Short enough for occupation during the entire flood to be appropriate                                                      | Short enough for flood free refuge enclosed by floodwaters to be appropriate                                                                                                          | Short enough for flood free refuge enclosed by floodwaters to be appropriate                                                                                                                                                                                                                                                      |
| Escape route                                              | An obvious rising escape route to flood free land outside of the entire flood is available                                        | An obvious rising escape route to flood free land outside of the entire flood is available                                                                                            | There is be no obvious rising escape route to flood free land outside of the entire flood.                                 | There is be no obvious rising escape route to flood free land outside of the entire flood. An obvious rising escape route to flood free land outside of the entire flood is available | There is be no obvious rising escape route to flood free land outside of the entire flood.                                                                                                                                                                                                                                        |
| Nature of encising floodwaters                            | Flood free land outside of the entire flood can be reached before the flooding affects the site itself                            | Reaching flood free land outside of the entire flood requires evacuation through enclosing floodwaters, and these flood waters are suitable for wading or heavy vehicles at all times | Enclosing floodwaters are suitable for wading and for medical emergency evacuation by wading or heavy vehicle at all times | Enclosing floodwaters are not suitable for wading or heavy vehicles, and require heavy construction for structural stability of buildings (eg steel frame and concrete)               | No form of normal building construction would be feasible to ensure structural stability in enclosing floodwaters                                                                                                                                                                                                                 |
| Evacuation need:                                          | Required to flood free land outside of the entire flood                                                                           | Required to flood free land outside of the entire flood                                                                                                                               | Not Required                                                                                                               | Required to a suitable flood free refuge within the enclosed flood waters                                                                                                             | Normally not possible (therefore normally unsuitable for development)                                                                                                                                                                                                                                                             |
| Evacuation problems                                       | Still need to ensure that any proposed development in these areas will not cause additional burden on emergency response services | Still need to ensure that any proposed development in these areas will not cause additional burden on emergency response services                                                     | Nil (for abled bodied adults)                                                                                              | Evacuation shall be self directed and fail safe.                                                                                                                                      | Enclosing flood waters are so hazardous that evacuation by normal means to flood free land outside the entire flood would not be contemplated. The structural stability of an on-site refuge cannot be assured by normally available building types, and therefore a refuge enclosed by floodwaters cannot (normally) be provided |

Life hazards are used to manage risks to life and accordingly, are determined by considering the hydraulic behaviour threshold (see figure N1) at the Probable Maximum Flood (PMF).



**Figure N2 – Life Hazard determination**

Figure N2 shows how the life hazard categories are determined in accordance with the methodology of the Newcastle City-wide Floodplain Risk Management Plan.

The Newcastle DCP 2012 states:

“On site refuge is to be provided for all development where the life hazard category is L4 or higher unless the proposed development is less than 40m from the perimeter of the PMF extent and the higher ground is accessible. “

“The minimum on-site refuge level is to be the level of the PMF. On site refuges are to be designed to cater for the number of people reasonably expected to be on the development site and are to be provided with emergency lighting.”

“On site refuges are to be of a construction type able to withstand the effects of flooding. Design certification by a practising structural engineer that the building is able to withstand the hydraulic loading due to flooding (at the PMF) is required. “

The requirement for on site refuge (where applicable) will generally be satisfied by a two storey building form. However, for residential properties, an attic access ladder and suitable small platform will usually also suffice.

In most cases where on site refuge is required, the duration of the peak flood event is short and accordingly, it is not expected to have to utilise flood refuge areas for long periods of time, especially when their use the chance of them being used is generally less than 1% in any given year. Accordingly, comfort factors are not of large concern to owners, occupiers or Council in determining the suitability of flood refuges.



# FLOOD CLASSIFICATION MAP

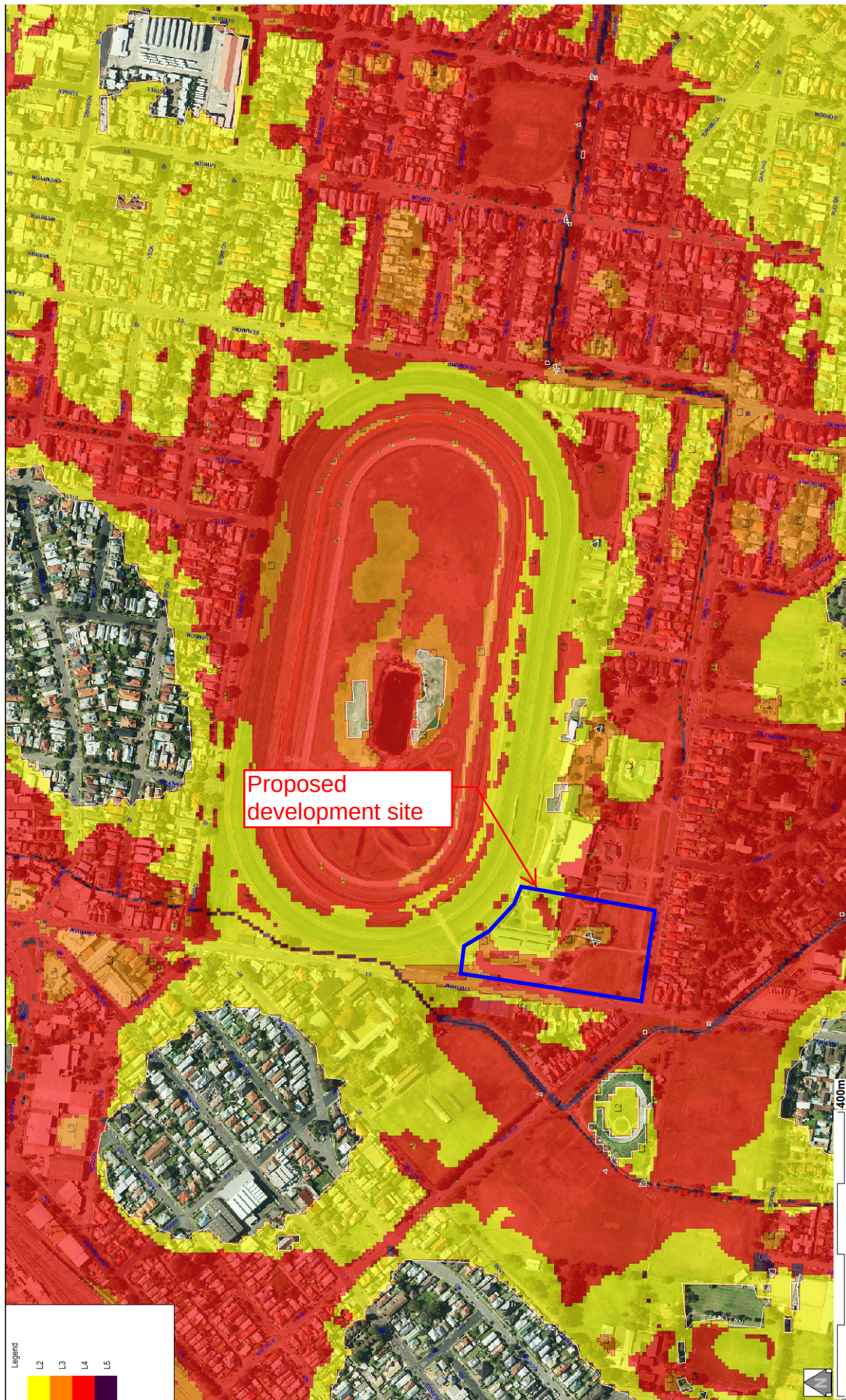
(Extract from the City of Newcastle Floor certificate No. FL2019/00101)





# "RISK TO LIFE" MAP

(Extract from the City of Newcastle Floor certificate No. FL2019/00101)





# "RISK TO PROPERTY" MAP

(Extract from the City of Newcastle Floor certificate No. FL2019/00101)





# "FLOW VELOCITIES" MAP

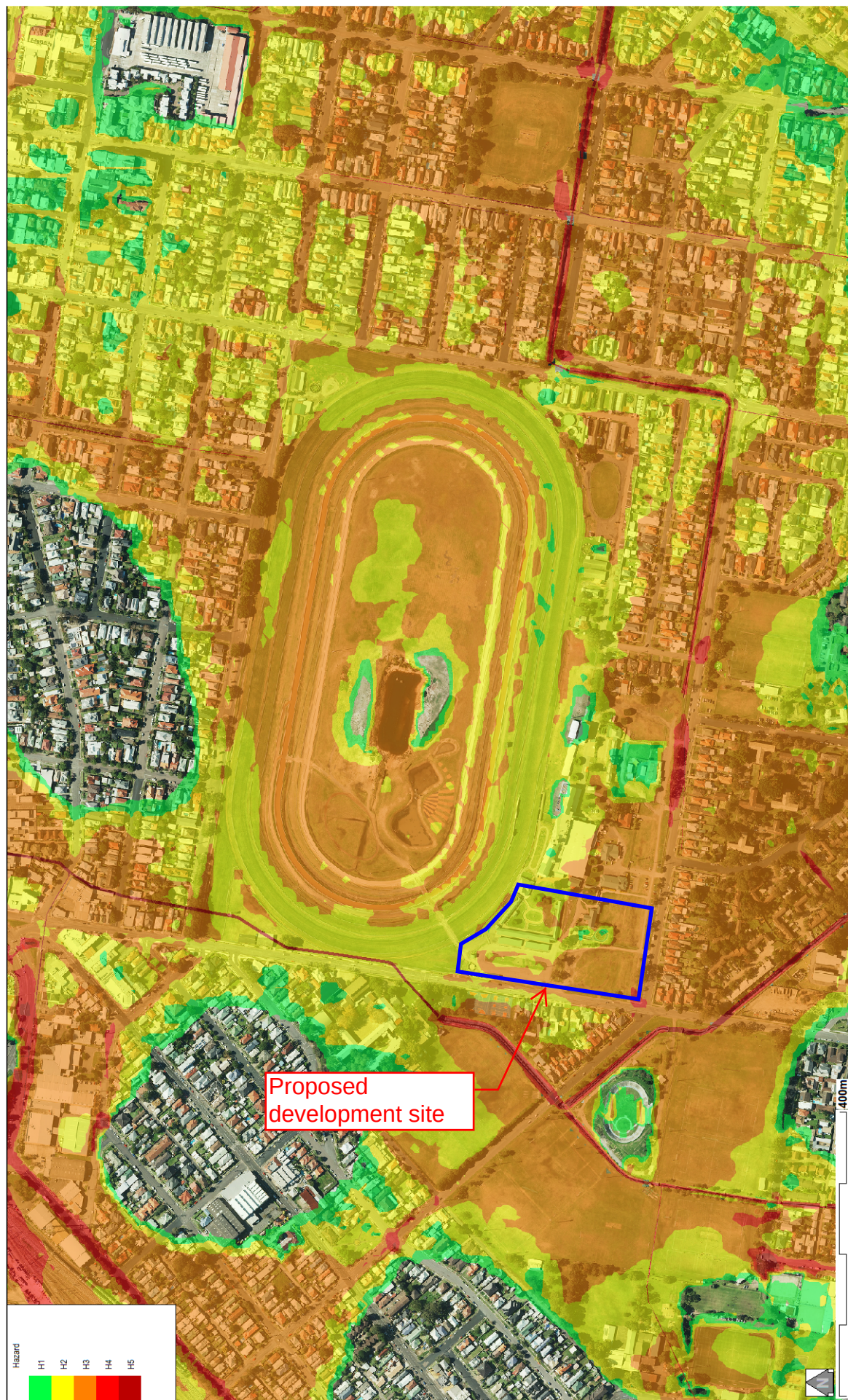
(Extract from the City of Newcastle Floor certificate No. FL2019/00101)





# "PMF STABILITY" MAP

(Extract from the City of Newcastle Floor certificate No. FL2019/00101)





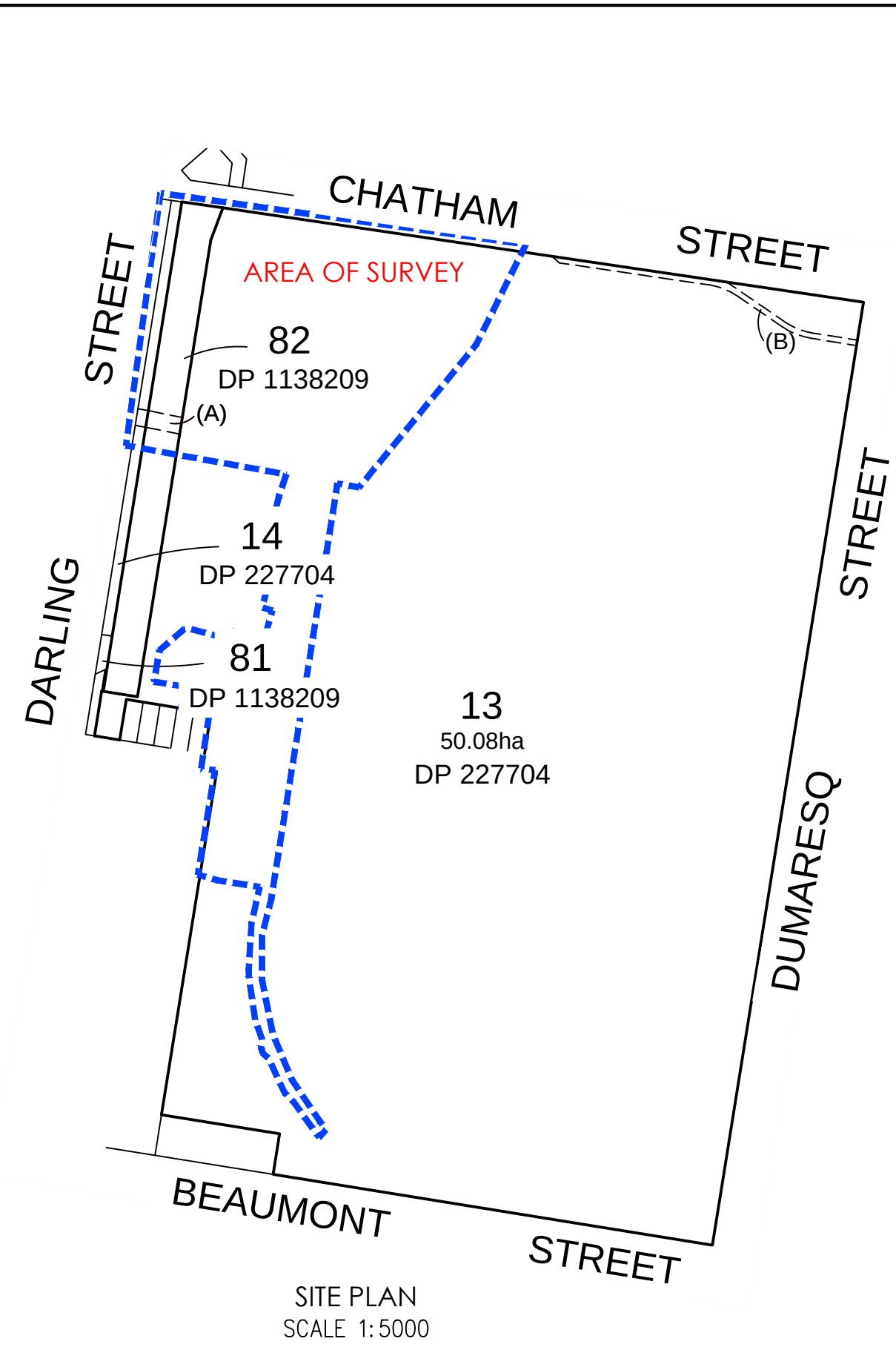
## Appendix I

# Site Survey









- (A) EASEMENT FOR ELECTRICITY CABLES AND SUBSTATION 15 WIDE (DP 638744)
- (B) EASEMENT FOR COVERED STORMWATER CHANNEL RESUMED BY GOVT GAZ. 29/5/1936 FOL 2101 (DP 227704)

- LEGEND**
- SIGN
  - COMMS PIT
  - ELECTRICITY PIT
  - FUSE PILLAR
  - POWER POLE
  - LIGHT POLE
  - FLOOD LIGHT
  - WATER HYDRANT
  - WATER STOP VALVE
  - GRATED DRAINAGE PIT
  - DRAINAGE MANHOLE
  - IRRIGATION CONTROL BOX
  - IRRIGATION SPRINKLER
  - DRAINAGE KERB INLET PIT
  - GRATED KERB INLET PIT
  - SEWER VENT
  - SEWER MANHOLE
  - LOUD SPEAKER POLE OR CAMERA POLE
  - APPROXIMATE LOCATION OF WATER PIPE DBYD
  - APPROXIMATE LOCATION OF DRAINAGE CHANNEL
  - APPROXIMATE LOCATION OF UNDERGROUND ELECTRICITY FURTHER INVESTIGATION IS REQUIRED
  - APPROXIMATE LOCATION OF A/G LOW VOLTAGE ELECTRICITY CABLE
  - APPROXIMATE LOCATION OF A/G HIGH VOLTAGE ELECTRICITY CABLE
  - APPROXIMATE LOCATION OF U/G NBN DBYD
  - APPROXIMATE LOCATION OF SEWER DBYD
  - APPROXIMATE LOCATION OF GAS DBYD



**PROPOSED EXTENT OF THE CHATHAM STREET STABLES DEVELOPMENT**  
MPC REF: 160548 27 / 7 / 2021

**NOTE:**

THIS DETAIL SURVEY IS NOT A "LAND SURVEY" AS DEFINED BY THE SURVEYING AND SPATIAL INFORMATION ACT, 2002. IF ANY CONSTRUCTION OR DESIGN WORK WHICH RELIES ON CRITICAL SETBACKS FROM THE STREET OR BOUNDARIES IS PLANNED, IT WOULD BE IMPERATIVE TO CARRY OUT FURTHER SURVEY WORK TO DETERMINE THE BOUNDARY DIMENSIONS.

THE POSITION OF THE BOUNDARIES HAVE BEEN CALCULATED FROM THE SURVEY DEFINITION SHOWN ON DP 37737, DP 227704, DP 340476 & DP 1016517.

IF FURTHER DEVELOPMENT IS CONTEMPLATED ON OR NEAR THE BOUNDARIES, THEN SURVEY MARKS SHOULD BE PLACED AND THE POSITION OF IMPROVEMENTS VERIFIED.

BEARINGS SHOWN RELATE TO MGA NORTH.

ORIGIN OF AUSTRALIAN HEIGHT DATUM WAS FROM SSM 128599 RL 6.233 AS OBTAINED FROM SCIMS 19TH MAY 2016.

CONTOURS SHOWN DEPICT THE TOPOGRAPHY, EXCEPT AT SPOT LEVELS SHOWN, THEY DO NOT REPRESENT THE EXACT LEVEL AT ANY PARTICULAR POINT.

DO NOT SCALE OFF THIS PLAN. RELATIONSHIPS OF IMPROVEMENTS TO BOUNDARIES IS DIAGRAMMATIC ONLY. WHERE CLEARANCES ARE CRITICAL THEY SHOULD BE CONFIRMED BY A FURTHER BOUNDARY SURVEY.

SERVICES SHOWN HEREON HAVE BEEN DETERMINED FROM VISUAL EVIDENCE ONLY. PRIOR TO ANY DEMOLITION, EXCAVATION OR CONSTRUCTION ON THE SITE, THE RELEVANT AUTHORITY SHOULD BE CONTACTED TO ESTABLISH DETAILED LOCATION AND DEPTH.

ANY PERMITTED DOWNLOADING, ELECTRONIC STORAGE, DISPLAY, PRINT, COPY OR REPRODUCTION OF THIS SURVEY SHOULD CONTAIN NO ALTERATION OR ADDITION TO THE SURVEY.

COPYRIGHT. THIS DRAWING IS THE PROPERTY OF, AND SHOULD NOT BE REPRODUCED IN PART OR WHOLE WITHOUT THE WRITTEN PERMISSION OF PULVER L COOPER & BLACKLEY P/L.

**THESE NOTES FORM AN INTEGRAL PART OF THE PLAN.**

|                        |     |                                         |       |            |
|------------------------|-----|-----------------------------------------|-------|------------|
| JOB NUMBER: 16/80      |     |                                         |       |            |
| FILE ID: ID 112285     |     |                                         |       |            |
| SURVEYED: LJB          |     |                                         |       |            |
| DESIGNED: DKH          |     |                                         |       |            |
| DRAWN: DKH             |     |                                         |       |            |
| CHECKED: BDK           |     |                                         |       |            |
| DATUM: AHD             |     |                                         |       |            |
| CONTOUR INTERVAL: 0.2m |     |                                         |       |            |
|                        | C   | ADDITIONAL SURVEY WORK ADDED            | DKH   | 17/11/2016 |
|                        | B   | ADDITIONAL SHEET ADDED WITH DAMS DETAIL | DKH   | 03/06/2016 |
|                        | A   | INITIAL ISSUE                           | DKH   | 01/06/2016 |
|                        | NO. | DESCRIPTION                             | DRAWN | DATE       |



SURVEYORS  
TOWN PLANNERS  
CIVIL ENGINEERS  
PROJECT MANAGERS

P.O. Box 729  
NEWCASTLE 2300  
Ph (02) 4929 3882

98 LAWES STREET  
EAST MAITLAND 2323  
Ph (02) 4934 3026

PLAN:  
PARTIAL DETAIL SURVEY OF  
LOTS 13 & 14 DP 227704  
LOTS 81 & 82 DP 1138209  
DARLING STREET  
HAMILTON

CLIENT:  
NEWCASTLE JOCKEY CLUB  
BROADMEADOW

10 5 0 10 20 30  
Horizontal Scale 1:500 (A1)  
1:1000 (A3)

TOTAL SHEETS  
8  
SHEET No.  
2



## Appendix J

# Flood Study

# Throsby, Cottage and CBD

## Flood Study

R.B15058.002.01.doc  
August 2008



# Throsby, Cottage and CBD Flood Study

Prepared For: Newcastle City Council

Prepared By: BMT WBM Pty Ltd (Member of the BMT group of companies)

## **Offices**

*Brisbane  
Denver  
Karratha  
Melbourne  
Morwell  
Newcastle  
Perth  
Sydney  
Vancouver*



## DOCUMENT CONTROL SHEET

|                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                   |                     |                          |           |                 |                        |                        |               |                         |  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|---------------------|--------------------------|-----------|-----------------|------------------------|------------------------|---------------|-------------------------|--|
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|                   |                                                                                   |
|-------------------|-----------------------------------------------------------------------------------|
| <b>Title :</b>    | Throsby, Cottage and CBD Flood Study                                              |
| <b>Author :</b>   | Bill Syme, Phillip Ryan                                                           |
| <b>Synopsis :</b> | Presents the findings from the Throsby, Cottage and CBD Flood Study in Newcastle. |

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# 1 INTRODUCTION

## 1.1 Background

Throsby and Cottage Creeks, and to a lesser extent the Newcastle CBD, have an established history of flooding. The catchments are steep around their perimeter, but drain onto low-lying, flat areas, where it is difficult for floodwaters to escape. In response to the flooding problems, the creeks have been heavily engineered into concrete lined stormwater channels, or replaced by underground pipes and box culverts. In a number of areas, the creek lines have become non-existent, with the pipes and culverts being relied upon to carry the floodwaters. Roads also act as flowpaths once the capacity of the channels and culverts is exceeded. A number of rail, road and other embankments exacerbate the flood problem by diverting and blocking floodwaters.

While the engineering works have reduced the flood risk, problem areas remain and it is not unfeasible for floods to exceed the capacity of the channels and culverts, with the potential for widespread flooding, risk to life-and-limb and damage to buildings and infrastructure. This was demonstrated during the April 1988, February 1990 and June 2007 floods.

This Flood Study of Throsby and Cottage Creeks, and the Newcastle CBD area, was carried out to better understand the flood behaviour and the flood risk to the community. A product of the study is leading-edge computer based models that simulate the flooding processes of the whole catchment, and also the potential interaction between catchments in the low-lying areas, hence the combining of the three catchments into one study. The study is carried out in preparation for a Flood Risk Management Study that will investigate options and planning strategies for reducing the flood risk and minimising damage to buildings and infrastructure. Drawing 1-1 shows the locality and coverage of the study area.

The computer models were developed to quantify flood discharges, the speed of floodwaters, flood heights and the flood depths. As part of their development process, the models were calibrated to historical flood events, to demonstrate their ability to reproduce reality. Calibrated computer models were used with statistically generated rainfall estimates to represent possible future flood scenarios and their likelihoods (such as a 1 in 100 annual chance flood). These design flood events were simulated and mapped.

On the Queens Birthday long weekend in 2007 the Newcastle district experienced a devastating flood. Heavy rainfall was experienced on the afternoon and evening of the 8/6/2007. This resulted in severe flooding within the Newcastle area, including the Throsby, Cottage and CBD catchments. This flood occurred towards the end of the study, after the computer models had been calibrated and design flood modelling completed.

After the 2007 flood a major data collection exercise was conducted by Newcastle City Council and BMT WBM staff, providing the opportunity for further validation of the computer models. Due to the near completion status of this study, it was decided to incorporate the June 2007 flood validation of the models into the early stages of the flood risk management investigations rather than this present study.



A Flood Risk Management Study is scheduled to start in 2008. This risk management study will investigate measures to reduce the flood risk. Possible measures vary from community education to building modifications to voluntary house raising and voluntary purchase schemes. The computer models will be verified to the data collected from the June 2007 flood events as part of the study.

The sensitivity of model results to a number of factors such as blockages to pipes and structures, increased rainfalls, structure losses and roughness will also be investigated as part of the floodplain risk management study.

## 1.2 Funding

This study is being carried out under the State Government's flood programme, with State and Commonwealth Grant assistance for flood investigations and implementation of flood risk management measures. To receive implementation funding, the State Government requires councils to carry out the necessary studies so that informed decisions are made in consultation with the community.

## 1.3 Previous Studies

A number of investigations have addressed the issues of flooding in the catchment and/or elevated ocean levels. Studies relevant to the current flood study are:

- Lawson and Treloar (1994), *Lower hunter River Flood Study (Green Rocks to Newcastle)*
- Newcastle City Council (1997), *Brief: Cottage Creek Flood Study*
- Newcastle City Council (1997), *Brief: Newcastle City Wide – Historic Flood Data Collection Study*
- Newcastle City Council (1997), *Brief: Newcastle City Wide – Design of Flood Data Collection System*
- Lawson and Treloar (1999), *Design Water Levels in Newcastle Harbour – Joint Probability Study*
- Lawson and Treloar (2000), *Design of a City-Wide Flood Data Collection System*
- WBM Oceanics Australia (2000), *Newcastle City Wide Flood Studies – Data Collection Study*
- WBM Oceanics Australia (2004), *Cottage Creek Flood Study – Final Report*

## 1.4 About This Report

This report documents the Throsby, Cottage and CBD Flood Study objectives, results and conclusions. All A3 drawings are included in a separate volume. The report consists of the following sections:

### **Volume 1 of 2: Main Body of Report**

#### **1 Introduction**

Introduces the background of the study.

#### **2 Methodology Overview**

Presents a general discussion on the study methodology.

### **3 Available Data**

Details of the topographic, hydrographic and GIS data available for the flood study.

### **4 Computer Model Development**

Details the hydrologic and hydraulic models developed for the flood study.

### **5 Model Calibration**

Discusses the calibration of the hydrologic and hydraulic models.

### **6 Design Floods**

Presents the derivation of design floods and discusses design flood results.

### **7 Conclusions and Recommendations**

Presents the general conclusions and recommendations of the study.

### **8 References**

Reference list

### ***Volume 2 of 2: A3 Drawing Addendum***

Volume 2 is an addendum of A3 drawings which accompanies this report.

## **1.5 Provision of Electronic Data**

Hydraulic modelling results have been provided to Newcastle City Council in WaterRIDE format. Both time-varying and peak results have been provided.

Modelling files in MapInfo and TUFLOW format are provided on DVD to accompany this report.

Newcastle City Council has been provided with a location specific version of TUFLOW. This allows Newcastle City Council to use the hydraulic model, developed as part of the Throsby, Cottage and CBD Flood Study.

## 2 METHODOLOGY OVERVIEW

The general approach and method employed to achieve the study objectives involved the following steps (as shown in Figure 2-1).

- Compilation and review of available information
- Acquisition of additional data required for flood study
- Development of hydrological and hydraulic models
- Calibration and verification of models
- Selection of design event combinations
- Modelling of design events under existing conditions
- Reporting and mapping

Selection of calibration events was based on the availability of historic rainfall, river and flood level data. This is discussed in more detail in Section 5.1.



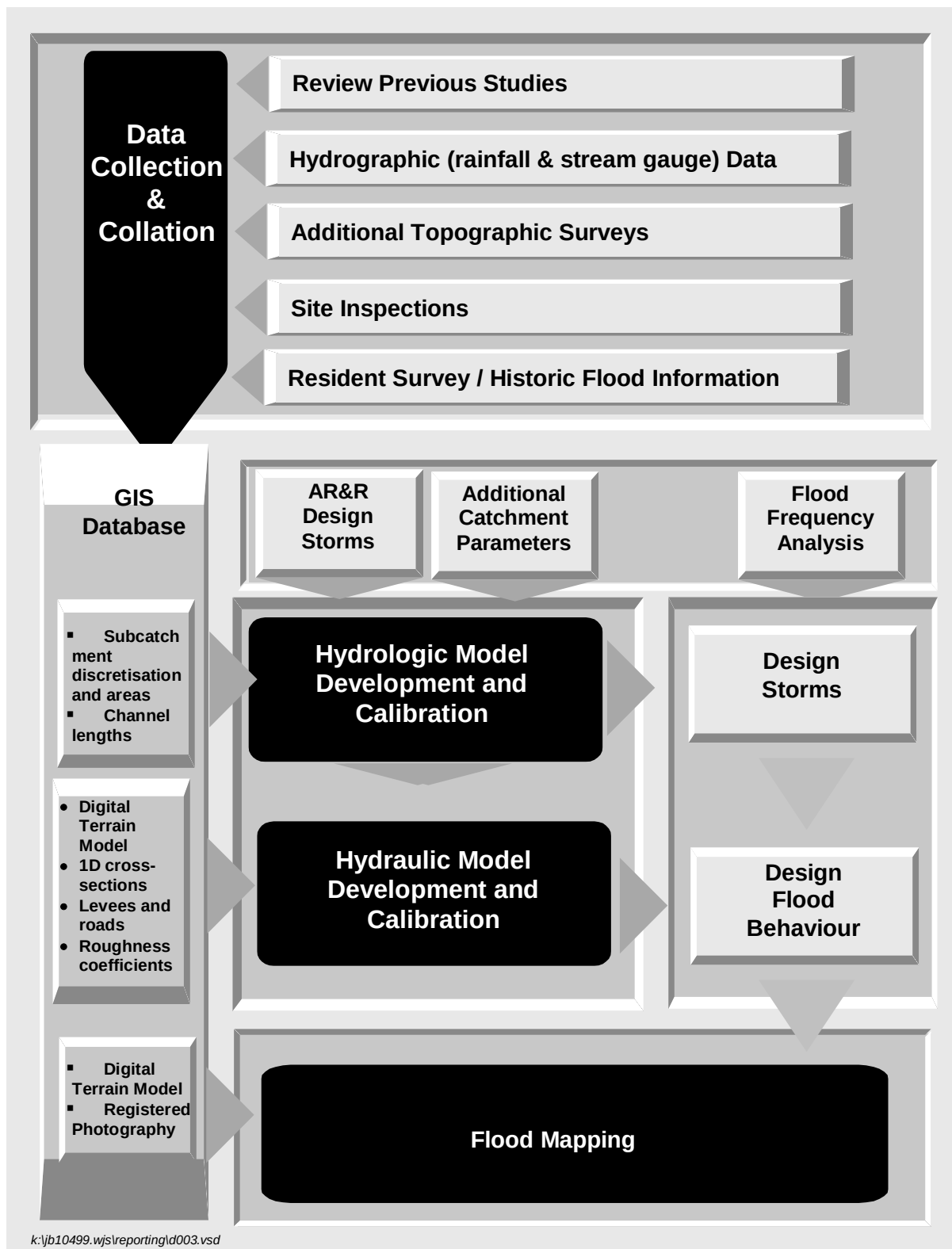


Figure 2-1 Study Approach

## 3 AVAILABLE DATA

### 3.1 Topographic Data

This section of the report details the topographical, hydrographic and GIS data used as part of the flood study.

#### 3.1.1 Photogrammetry

Photogrammetry was collected by QASCO in 2000. It covers the majority of the study area and has a vertical accuracy  $\pm 0.2\text{m}$ .

2004 photogrammetry is of lower vertical accuracy (higher plane flying level) than 2000 photogrammetry. The vertical accuracy of the 2004 photogrammetry is  $\pm 0.5\text{m}$ .

The photogrammetry extents are presented in Drawing 3-1.

#### 3.1.2 Bathymetry

Current bathymetric survey of the tidal areas was provided by Newcastle Port Corporation. The data was provided as points with easting, northing and levels, and is a compilation of surveys over various years.

#### 3.1.3 Ground Surveys

A number of different surveys using ground based techniques were utilised to supplement the DEM data due to civil works since 2000, where an improved vertical accuracy was beneficial (eg. along the creeks and concrete lined drains) or the aerial survey was inadequate (eg. through the Kotara shopping centre carpark). Ground survey is used in both the calibration and design modelling. Details of ground survey used in modelling are presented in Table 3-1 and their locations are presented in Drawing 3-1.

**Table 3-1 Ground Survey Details**

| Area                      | Year | Source |
|---------------------------|------|--------|
| Stewart Avenue            | 2005 | NCC    |
| Linwood St                | 2005 | NCC    |
| Carrington                | 2005 | NCC    |
| Honeysuckle               | 2005 | NCC    |
| Wickham                   | 2005 | NCC    |
| Kotara                    | 2005 | NCC    |
| Waratah Rail              | 2005 | NCC    |
| Glebe Road                | 2005 | NCC    |
| Kotara                    | 1998 | NCC    |
| Maryville Pre Subdivision | 1990 | NCC    |
| Broadmeadow Soccer Fields | 1990 | NCC    |

I:\B15058\_I\_BRH\_Throsby  
Cottage\_WJS\MPI\Topography\_Sources\_TUFLOW.xls\Ground\_Survey

### **3.1.4 Structure Data**

Structure details were provided by Newcastle City Council. These included a comprehensive database of photographs, each annotated with field measurements of the structure's openings, deck and handrails. Examples of the structure details are provided in Figure 3-1. Drawing 3-3 illustrates the location of the structures measured and photographed.

## **3.2 Hydrographic Data**

### **3.2.1 Rainfall**

Historic rainfall data was primarily obtained from data collected by Hunter Water Corporation (HWC) during the 1980s and early 1990s. In addition to these data, Bureau of Meteorology data was available from the Nobby's Head gauge. Locations of rainfall pluviograph data are presented in Drawing 3-3.

For design flood events, the estimated rainfall volumes and distribution were based on Australian Rainfall and Runoff, 1987.

### **3.2.2 Streamflow Gauging**

HWC also operated a number of stream gauging stations during the same period as the rainfall monitoring. This data was also extracted from data collected by Hunter Water Corporation. The locations of the stream flow gauges are presented in Drawing 3-3.

### **3.2.3 Tidal**

Recorded tidal data was available from a tidal gauge at Dyke Point in Throsby Basin. This gauge data is provided by the National Tidal Facility. Recordings are taken on an hourly basis.

## **3.3 GIS Data**

### **3.3.1 Aerial Photos**

Three aerial photo sets were available. These are all geographically registered.

- 1983 aerial photography
- 1990 aerial photography
- 2004 aerial photography

The 1990 aerial photography is presented in Drawing 3-4, and the 2004 photography in Drawing 3-5.

### **3.3.2 Cadastre**

Newcastle City Council provided cadastral data to BMT WBM in GIS format (MapInfo). Newcastle City Council also provided GIS format data of suburb boundaries, street names and house numbers.



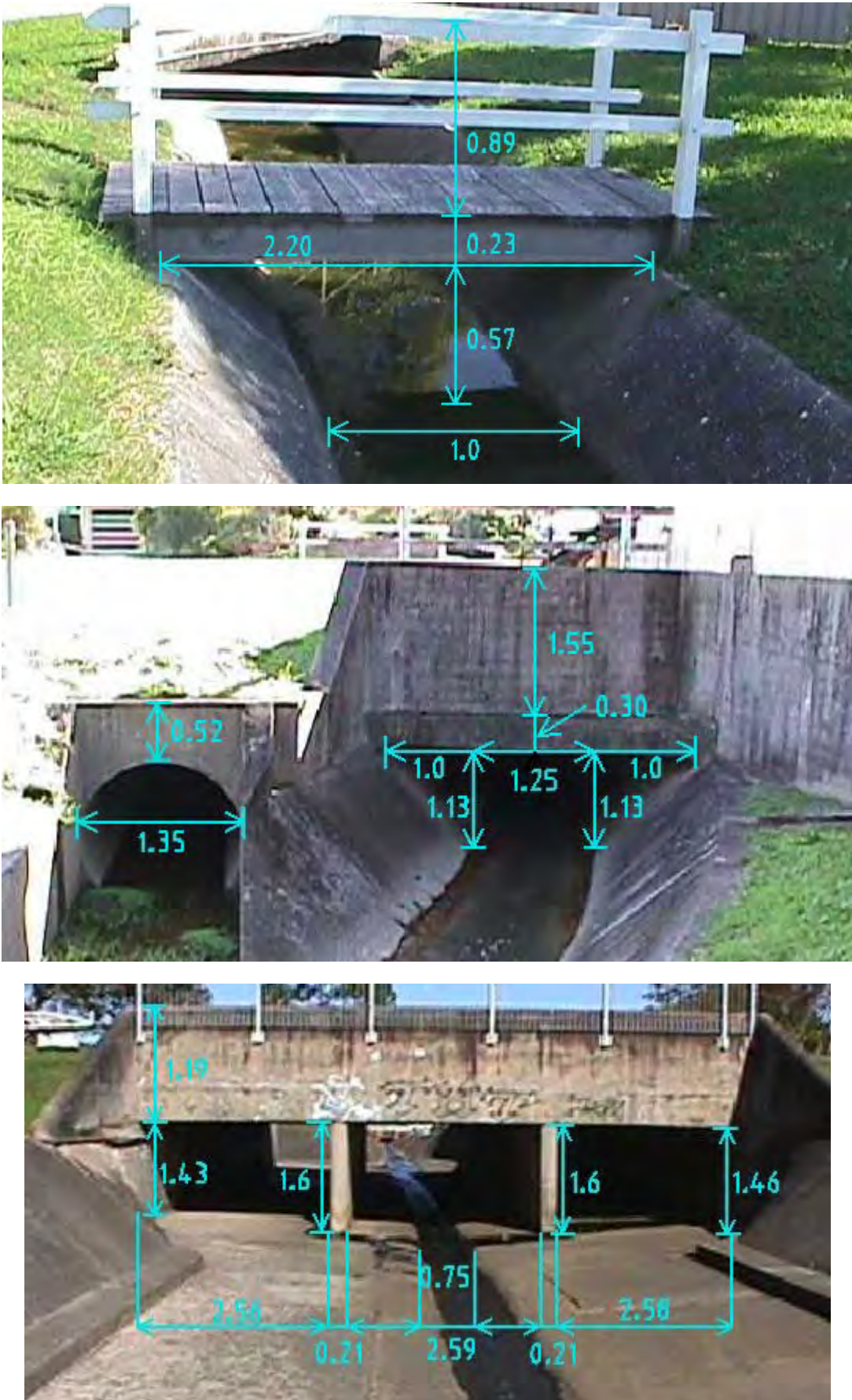


Figure 3-1 Example Structure Details

## **4 COMPUTER MODEL DEVELOPMENT**

### **4.1 DEMs**

A digital elevation model (DEM) is a three dimensional (3D) representation of the ground surface. A number of different DEMs were utilised in the current flood study. These were derived from various topographical data sources and have varying accuracies. The DEMs utilised in the Throsby, Cottage and CBD flood study are listed and described below.

#### **4.1.1 DEM 2000**

The DEM of conditions in the year 2000 was prepared by WBM for the purpose of this flood study. The DEM is based on various data sources including low level (higher accuracy) photogrammetry, ground survey and bathymetry. Of note is the use of ground survey to accurately define concrete lined drains using surveyed breaklines along the channel (eg. top of bank, toe, low flow drains). The ground surveys were merged with the photogrammetry to produce a high quality DEM. It was decided that the DEM should include bridge decks and other obstructions picked up by the aerial survey so as to aid in identifying evacuation routes, rather than replace the decks with the ground surveys.

This is the most accurate representation of the topography of the Throsby, Cottage and CBD catchments. The DEM of 2000 conditions is presented in Drawing 4-1.

For more information on this DEM see Appendix A.

#### **4.1.2 DEM Modified for hydrology**

An automated process of delineating the sub-catchments for the hydrologic was used. This process required that the DEM did not include obstructions across flow paths, such as bridge decks, and that major culverts (eg. the 1.6km racecourse culvert) be incised so as to delineate the low flow paths. Therefore, the DEM was artificially incised to create low flow paths, allowing automated delineation of these low flow routes and sub-catchments emanating from them.

The 2000 DEM also does not cover the whole of the Throsby, Cottage and CBD catchments. This is also necessary for sub-catchment delineation, so the 2000 DEM was extended to the catchment boundaries using a DEM created from 2m contour data.

The catchment delineation process is further described in Section 4.2.1. The modified DEM used for sub-catchment delineation is presented in Drawing 4-2.

#### **4.1.3 DEM 2004**

This DEM was created from the photogrammetry flown in 2004. This photogrammetry is of lower vertical accuracy than the 2000 photogrammetry, hence, the 2000 DEM is preferred for flood modelling. A section of this DEM was used in Hamilton South, where major changes have occurred to the topography between 2000 and 2004 due to a residential estate that was previously a dog racing track.

## 4.2 WBNM Hydrologic Model

Hydrologic modelling calculates the quantity and rate of catchment runoff from rainfall during a flood event. The model produces estimates of the discharges in the creeks and tributaries during the course of a flood. The Watershed Bounded Network Model (WBNM) software was utilised for the hydrological modelling. WBNM is distributed by the University of Wollongong.

WBNM requires input for each subcatchment of:

- Catchment area
- Percentage impervious

Calibration parameters within the WBNM model are:

- Initial loss
- Continuing loss
- Stream Lag Factor

### 4.2.1 Sub-Catchment Delineation

The hydrological model was split into 198 subcatchments. The sub-catchments are delineated using an automated process. The software package Streambuilder (Avantra Geosystems Pty Ltd) was used for the catchment delineation. A modified version of the DEM of 2000 conditions was used for the catchment delineation. Section 4.1.2 describes the modifications the 2000 DEM for hydrological modelling.

The modified DEM and catchment delineation are presented in Drawing 4-2.

### 4.2.2 Land-Use Types

Land use types were digitised from aerial photos, and a percentage impervious for each land use type was assigned. The average percentage impervious for each subcatchment was based on field inspections and the aerial photography. Percentage impervious is used as an input to the WBNM model.

## 4.3 TUFLOW Hydraulic Model

### 4.3.1 Model Extent

The complicated nature of flow patterns in the urban study area required the use of advanced modelling techniques and software. During low flows, stormwater is mostly restricted to the underground piped drainage and concrete lined drains, and is relatively simple to model. However, once the capacity of these conduits are exceeded, as amply demonstrated in April 1988, February 1990 and June 2007, the flow patterns become highly complex with flow into and out of drains, surcharging of manholes, along streets, and through houses, gardens and commercial properties. This requires a more advanced modelling approach to simulate the flow interaction between pipes, open channels and overland areas. As such, TUFLOW ([www.tuflow.com](http://www.tuflow.com)), a fully 2D/1D dynamically



linked hydraulic modelling system was used to model flooding behaviour in the Throsby/Cottage Creek catchments.

Pipes smaller than 900mm in diameter were generally excluded from the model to keep the model simulation times manageable and pipe survey costs within budget. Similarly, broad assumptions on gully traps and manholes were assumed as data on these were not available. This does not significantly reduce the accuracy of the hydraulic model for the study objectives, because in large flood events the majority of flow is carried in overland areas, open channels or larger conduits. It is noted however, that for detailed local drainage assessments into the future, that the sub-900mm pipe drainage and surface/pipe flow exchange via gully-traps may need to be added to the model for a more accurate representation.

The hydraulic model covers an extent of 28.2km<sup>2</sup>. The extent of hydraulic modelling is shown in Drawing 4-3.

There may be areas subject to flooding that are outside the extent of the hydraulic modelling. This may occur for a variety of reasons, including:

- The area is outside the extent of the 2000 photogrammetry.
- Pipe sizes less than 900mm need to be included.
- Broad assumptions associated with gully traps.
- Blockages in drains and culverts due to debris and other obstructions.
- Vertical inaccuracies associated with DEM data.
- Uncertainties associated with data inputs, modelling and rainfall estimates.

### 4.3.2 2D Grid Dimensions and Cell Size

The 2D domain of the hydraulic model is based on a 10m square grid. This results in approximately 280,000 2D cells over the hydraulic model. Approximately 195,000 2D cells are active or wet near the peak of a large flood (PMF).

### 4.3.3 Topography in Hydraulic Model

TUFLOW allows topographic data to be inputted sequentially. This facilitates changes to be made easily, for example, ground survey data can be inputted to overwrite the DEM data. This is particularly useful to model changes in the floodplain, where development has occurred after the photogrammetry.

The base data for the hydraulic model is the DEM of 2000 conditions. Changes are made to this topography to represent the calibration (1988/1990) and existing (2005) conditions. Topographic changes for the calibration and design are discussed in Section 5.2.1 and 6.1 respectively.

### 4.3.4 1D Domains

The 10m cell size of the 2D model is too coarse to accurately model some sections of the drainage network, particularly the open drains. These and the underground pipe drainage network are modelled as 1D elements. Cross-sections were used to define the geometry of the open channel 1D

elements, and measured dimensions of bridges, culverts and pipes were used for 1D hydraulic structure elements. The model includes over 2,000 1D elements. The three main types of 1D elements are described below.

#### *4.3.4.1 Open Stormwater Channels*

Open stormwater channels are modelled as 1D elements. The geometry of these open channels is defined by assigning a cross-section to each channel. Bed resistance is varied across the section based on land-use mapping to allow for changes in construction type and vegetation to be represented.

The DEM of the open channels is based on ground survey break lines along the channels at key points in the section. The survey, which consists of break-lines along the top of bank, toe of batter, low flow channels, etc, was built into the 2000 DEM, and is sufficiently detailed to allow cross-sections to be extracted from the DEM.

#### *4.3.4.2 Underground Conduits*

Underground conduits of greater than 900mm in size were included in the hydraulic model based on surveys carried out by Newcastle City Council. Details required for accurate representation include:

- Size
- Shape
- Inverts
- Number of barrels

The underground pipe network is connected to the surface via pits, which are modelled as an upright rectangular channel. The pit inlet is dynamically connected to the 2D model, see Section 4.3.5.

#### *4.3.4.3 Bridges, Culverts and Weirs*

The many structures play a major role in determining flood behaviour in the study area. It is important to represent these structures correctly in the hydraulic model. These structures were typically modelled as 1D elements.

Bridges are modelled using depth varying energy losses to simulate extra losses associated with piers and the bridge deck. Losses were calculated using the standard techniques outlined in AustRoads (1994).

Culverts can be either rectangular or circular in shape, and can accommodate all inlet and outlet controlled flow regimes including uni-directional flow due to flap-gates.

Flow over structures are modelled as 1D weir channels. Cross-sections were used to define the shape of the 1D weirs.

### 4.3.5 1D/2D Dynamic Linking

1D elements are dynamically linked to the 2D model. The 2D/1D hydraulic model layout is shown in Drawing 4-3.

The underground pipe network is linked to the 2D model via a pit inlet, allowing flow in both directions. A schematic diagram of this linkage is presented in Figure 4-1.

1D open channels are linked to the 2D domain, usually along the top of bank of the open channel to ensure the exchange of water between open channel and overland area occurs at the correct height. The arrangement allows for both flows into and out of the open channel. The 2D cells within the open channel are deactivated, to prevent conveyance being duplicated. A schematic diagram for this type of linkage is presented in Figure 4-2. An example of the linkages utilised in the hydraulic model are presented in Drawing 4-4.

## 4.4 Hydrologic/Hydraulic Model Linkage

Flows into the hydraulic model are generated using the hydrological model. At the upstream of the hydraulic model cumulative flows (from multiple subcatchments) are added to the 1D pipe/open channel model. For subcatchments within the hydraulic model extent, flows are either added directly to 2D cells or split evenly between 1D nodes within the subcatchment. Hydrological inflow boundaries for the hydraulic model are presented in Drawing 4-5.

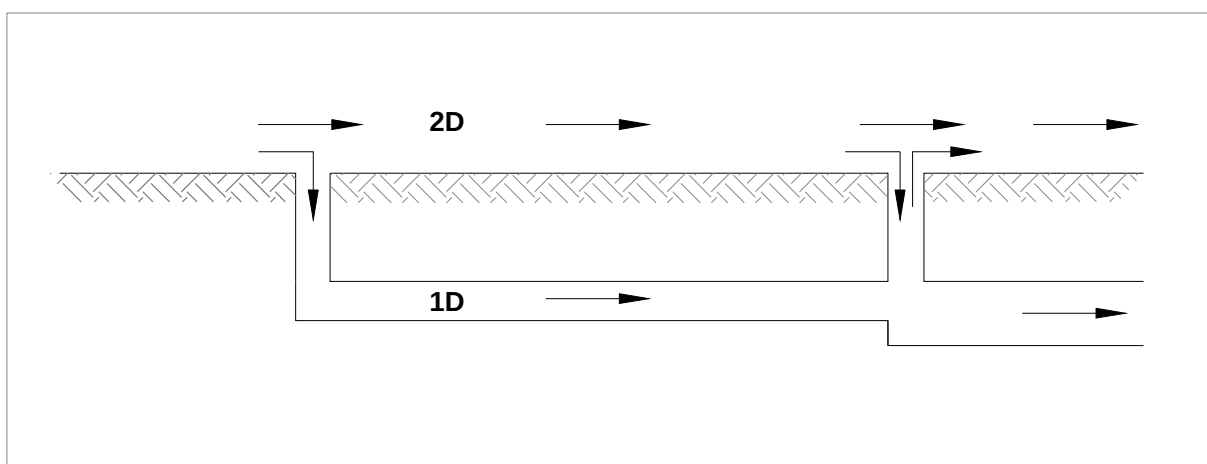
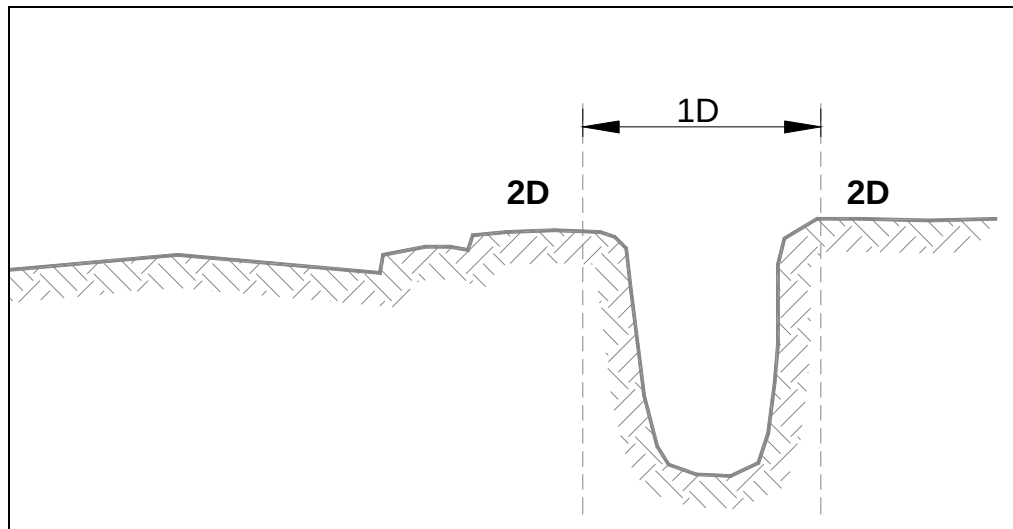


Figure 4-1 Schematic TUFLOW 2D / 1D Link in Urban Pipe Networks





**Figure 4-2 Modelling an Open Channel in 1D and Floodplain in 2D**

## 5 MODEL CALIBRATION

### 5.1 Selection of Calibration/Verification Events

Data from known flood events were collated and reviewed to select events from which to calibrate and verify the computer models. The main criteria for a flood event to be a useful calibration/verification event are:

- pluviograph (a recorder that records rainfall over short time intervals) data are available in or close to the study area;
- preferably daily rainfall totals from other gauges within and/or close to the study area; and
- recorded flood levels are available.

Two floods, those in April 1988 and February 1990, stand out from other floods based on the criteria above. Two minor floods in 1992 in the Cottage Creek area are also potentially useful should further model verification be required.

The June 2007 flood, which occurred after the hydraulic model was calibrated, also has the potential to be an excellent calibration or verification event due to the large volume of flood marks that have been recorded and available for survey. Unfortunately the HWC rain and streamflow gauges were decommissioned in the 1990s, so there will be much greater uncertainty over the rainfall timing, depths and distribution for this flood compared with the 1988 and 1990 events. It is planned to validate the computer models to the June 2007 event during the following flood risk management study.

#### 5.1.1 February 1990 Flood

Around 300 mm in a 48 hour period fell over the study area on the 2<sup>nd</sup> and 3<sup>rd</sup> of February 1990 in several bursts. The rainfall records show that the rainfall across the catchments was relatively uniform varying from around 316 mm in the west to 250 mm in the east. Six pluviograph recordings within the study area were available, of which one was discarded due to suspected malfunctioning.

Five flood height gauges recorded the rises and falls of the flood within the stormwater channels. There is some doubt over the actual water level heights for one or two of these gauges, however, the gauges clearly show the timing of when the flood peaks occurred. The first and largest peak, which caused the worst overland flooding, occurred around 3pm on the 2<sup>nd</sup> of February, 1990.

From previous investigations commissioned by Council, around 160 sites within the study area provided information on flooding. Of these, around 70 have identified a potential flood height to assist in the model calibration. These flood marks provide valuable information on flood levels away from the stormwater channels. In addition, there are a number of photographs and recollections that also assist in the model calibration process.

Drawing 5-1 shows the rainfall totals recorded and the location of the flood height information. Due to the comprehensive data set available for the February 1990 flood, it was selected as the primary calibration event.

### 5.1.2 April 1988 Flood

Unlike the February 1990 flood, the April 1988 flood rainfall was extremely varied over the study area. For the 48 hour period from 9:00am, 27<sup>th</sup> April, 141 mm of rain fell at Rankin Park Hospital, 101 mm to the south at Kotara Bowling Club, 44 mm in Waratah, 22 mm in Merewether and just 8 mm at Nobbys Head. At Rankin Park Hospital 75 mm (3 inches) of rain fell in just one hour from 9:30pm to 10:30pm on the 27<sup>th</sup> causing flash flooding in nearby creeks.

Only one of the Hunter Water Cooperation flood height gauges at Jellicoe Parade recorded the rise and fall of the flood within the stormwater channels. The second flood peak, which occurred around 11:00pm on the 27<sup>th</sup>, caused the worst overland flooding.

From previous investigations commissioned by Council, around 180 sites provided information on flooding. Of these, around 80 have identified a potential flood height to assist in the model calibration. These flood marks provide valuable information on flood levels away from the stormwater channels. In addition, there are a number of photographs and recollections that also assist in the model verification process.

Drawing 5-2 shows the rainfall totals recorded and the location of the flood height information. Due to the less comprehensive data set and greater uncertainty associated with the high variation in rainfall over the catchments, the April 1988 flood was selected as a verification event.

## 5.2 Model Calibration and Verification

### 5.2.1 Changes to 2000 Topography

A number of changes have occurred in the catchment since the calibration events. As the DEM is based on the conditions as of 2000, a number of layers were added (overwriting the 2000 topography) to adjust the calibration model so as to reflect conditions in 1988/1990. Layers added to modify the elevations sampled from the 2000 DEM are listed below in Table 5-1. The location of these modifications is presented in Drawing 5-3.



**Table 5-1 Modifications to 2000 Topography for Calibration Modelling**

| <b>Description/Source</b>               | <b>Area</b>               | <b>Change</b>                             |
|-----------------------------------------|---------------------------|-------------------------------------------|
| DEM 2000                                | Hydraulic Modelling Area  | Base                                      |
| Harbour Data                            | Harbour                   | Missing in DEM 2000                       |
| Harbour Data                            | Harbour                   | Missing in DEM 2000                       |
| Harbour Data                            | Harbour                   | Missing in DEM 2000                       |
| Allworth St DEM (NCC)                   | Glebe Road                | Missing in DEM 2000                       |
| Based on 1998 Ground Survey             | Kotara                    | Changes to Homemaker Centre               |
| DEM (NCC)                               | Maryville                 | Pre Subdivision                           |
| DEM (NCC)                               | Broadmeadow Soccer Fields | Pre Soccer Fields                         |
| Cowper St Bridge pre 1993               | Harbour                   | Changes to bridge arrangement and isthmus |
| Elevations of Cycleway along Throsby Ck | Cycleway Maryville        | No bund along cycleway                    |
| Harbour area pre-fill                   | Edges of Harbour          | Pre-fill conditions                       |
| RTA Carpark above Cottage Ck            | Newcastle West            | DEM picks up channel                      |
| Ground Survey                           | Waratah Rail              | More Accurate Ground Survey               |
| Ground Survey                           | Glebe Road                | More Accurate Ground Survey               |

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## 5.2.2 Interpretation of Calibration Data and Model Predictions

Calibration of computer models involves the adjustment of model parameters within industry-accepted ranges. It also requires having an understanding of uncertainties in the data sets used to build the model.

Reasons for differences between model results and recorded information are important to understand and appreciate when reviewing comparisons between the model and historical observations. Key areas of uncertainty are:

- Rainfall recorders (pluviographs) only represent a record of the rainfall at their exact location. Therefore, the rainfall used in the modelling away from the pluviograph sites is an estimate using interpolation or extrapolation techniques. A good example of a difficult rainfall event is the 1988 flood, where there are major variations in rainfall over relatively short distances, making it difficult to confidently estimate the rainfall at locations away from the pluviographs.

It is noted that the New Lambton pluviograph was not used for modelling the 1988 and 1990 events on the basis that it's recordings were not consistent with the other pluviographs (this could be due to malfunctioning, an error in storing the data or other reason).

- Flood marks vary greatly in quality depending on how they are recorded (or recollected). Most of the flood marks available were derived and documented in previous studies, during which they were graded from 1 to 5 in terms of their reliability (i.e. accuracy). A Grade 1 level is one that is considered to be well defined (eg. a watermark on a wall) and should be representative of the flood peak. A Grade 4 level is considered to have considerable uncertainty associated with it. A Grade 5 has no level associated with it, but some recollections or observations of flooding were noted.

The general approach to calibrating the model is that the model's predicted levels are at or around Grade 1 levels (preferably within +/- 0.2m, i.e. 20cm). For lesser grades, the flood model should be predicting levels at or above these levels as the recorded levels are not necessarily indicative of the flood peak.

- The flood gauges in the open stormwater channels not only provide information on the flood peak, but also the rate of rise and fall of the floodwaters. The gauges record the depth of water over time in the stormwater channel, however, the datum (the height of the gauges relative to a fixed survey mark) is not known, so there is some uncertainty over the level of the gauges. There is also believed to be considerable uncertainty of the Bates St gauge (see Figure 5-1) as desktop analyses have shown that the gauge was underestimating the depth of water. However, the gauge clearly shows the rise and fall of the floodwaters which is still of considerable use. The average speed of the water in the channel at Bates St gauge is very high at around 6 m/s (over 20 km/h), which may cause problems with the gauge's performance.
- As discussed previously, the hydraulic model only includes the underground pipe drainage system for pipes 900 mm diameter or larger. Consequently, some areas are modelled as having no underground drainage and may show considerable extents of quite shallow inundation that may not have occurred.
- The ground level data over the floodplain is from photogrammetry (a technique that uses aerial photography to determine the level of the ground surface). The vertical accuracy of the photogrammetric ground levels on clearly visible surfaces is as a rule no more than 0.1 metres (about 4 inches) higher or lower than the real ground level. This is a very high accuracy that was needed to support the prediction of past and future flood levels. In some areas, such as under vegetation and other obstructions, the accuracy can be considerably less. This uncertainty affects the extent of flooding predicted, particularly where wide shallow inundation is displayed.

Also of note, is that photogrammetry cannot "see" underneath building roofs, therefore, if the building is on a built up pad or the floor is elevated above the ground, the information on the floor level is not known. This means that buildings may appear as flooded, when they may not have experienced flooding above the floor. Conversely, some larger buildings have been modelled as a total blockage to floodwaters, and therefore appear not to have been flooded when they may have experienced inundation above their floors.

- Any debris build-up and partial blockage of bridges, culverts and pipes, which maybe the cause of more extensive flooding, were not included in the computer model simulations.
- The computer models themselves have uncertainties, as no computer model can be a perfect representation of reality. The hydraulic model presented in this report simulates flooding down to a resolution of 10 metres. Therefore, fine-scale obstructions to floodwaters such as fences, small buildings, etc are only roughly represented, and any localised flood affects (eg. water surcharging against a wall) are not necessarily depicted.

### 5.2.3 Presentation Formats of Model Calibration

The performance of the computer models to reproduce the 1988 and 1990 floods are presented in several formats as follows:

- Maps showing information at the flood peak including:
  - Predicted maximum extent and depths of inundation (the darker blue shades indicate greater depths of inundation – refer to the legend on the map).
  - Small coloured circles indicating the location of a recorded flood mark. Next to some circles is a number representing the difference in metres between the model's prediction and the flood mark. The circles and numbers are colour coded according to their grade (Magenta for Grade 1, Orange for Grade 2, Yellow for 3 and Green for 4 – no recorded flood marks are available for Grade 5 sites). A positive number indicates the model is above the recorded level, while a negative number indicates the model is below the recorded level. Refer to the discussion in Section 5.2.2 on reasons why there may be a difference. If no number appears next to the flood mark, the flood mark is located outside the area covered by the model, or the model did not predict any inundation at that site.
  - The predicted speed and direction of the water illustrated by the size and direction of the red arrows.
  - Predicted water level contours, shown as blue lines, on a half metre interval.
- Graphs showing a comparison between the recorded levels at the Hunter Water Cooperation gauges and the model's predictions. These show the rise and fall of the flood. Of particular interest here is the timing of the flood rise and fall, and whether the model is reproducing this.
- A profile of the peak water level down Throsby Creek is provided along with any recorded flood marks within 100 m of the creek centreline.
- Profiles down the major tributaries are presented with the design modelling results. This has been done to avoid replication and wastage. See Section 6.4 for detail on long sections.

## Calibration to February 1990 Flood

The adopted rainfall isohyets for the February 1990 event are presented in Drawing 5-7.

Five maps, as described in Section 5.2.3, are provided in Drawing 5-8 to Drawing 5-12, to illustrate the predicted flood extent, depths and flow patterns. The first map is a key map showing the locations of the local map sheets. The local map sheets present the difference between the model's predicted level and the recorded level.

Figure 5-1 shows the model predictions at the five HWC gauges. Figure 5-2 presents the profile of peak water levels along Throsby Creek along with the recorded levels within 100 m of the creek centreline.

Observed and predicted flood levels for the 1990 calibration are presented in Table 5-2. A statistical analysis of flood marks by region is presented in Table 5-3.



Table 5-2 Feb 1990 Calibration to Flood Marks

| Flood ID | Recorded<br>Flood Level<br>(mAHD) | Modelled Level<br>(mAHD) | Difference<br>[Modelled -<br>Recorded] (m) | Data<br>Grade |
|----------|-----------------------------------|--------------------------|--------------------------------------------|---------------|
| tc008a   | 12.70                             | 12.88                    | 0.18                                       | 1             |
| tc207b   | 8.03                              | 8.28                     | 0.25                                       | 1             |
| tc214    | 8.61                              | 8.29                     | -0.32                                      | 1             |
| tc404b   | 8.31                              | 8.28                     | -0.03                                      | 1             |
| tc601    | 15.73                             | 15.65                    | -0.08                                      | 1             |
| tc604    | 13.83                             | 13.68                    | -0.15                                      | 1             |
| tc702a   | 5.71                              | 5.91                     | 0.19                                       | 1             |
| tc707    | 5.80                              | 5.85                     | 0.05                                       | 1             |
| tc707b   | 5.68                              | 5.84                     | 0.16                                       | 1             |
| tc708a   | 5.52                              | 5.57                     | 0.05                                       | 1             |
| tc713    | 12.47                             | 12.61                    | 0.14                                       | 1             |
| tc725c   | 17.39                             | 17.55                    | 0.15                                       | 1             |
| tc743    | 9.34                              | 9.30                     | -0.04                                      | 1             |
| tc799b   | 12.06                             | 12.13                    | 0.06                                       | 1             |
| tc804a   | 5.25                              | 5.25                     | 0.00                                       | 1             |
| tc1207a  | 8.51                              | 8.27                     | -0.24                                      | 1             |
| tc1210   | 12.62                             | 12.61                    | -0.01                                      | 1             |
| tc1303   | 13.86                             | 13.69                    | -0.17                                      | 1             |
| tc1304b  | 13.15                             | 13.04                    | -0.12                                      | 1             |
| tc1306   | 12.68                             | 12.80                    | 0.12                                       | 1             |
| tc1306a  | 12.69                             | 12.65                    | -0.04                                      | 1             |
| tc1307   | 14.62                             | 14.64                    | 0.02                                       | 1             |
| tc1308   | 12.89                             | 12.81                    | -0.08                                      | 1             |
| cc3010   | 19.32                             | 19.75                    | 0.43                                       | 1             |
| tc203    | 8.15                              | 8.38                     | 0.22                                       | 2             |
| tc707a   | 5.87                              | 5.64                     | -0.23                                      | 2             |
| tc1304a  | 12.97                             | 12.79                    | -0.18                                      | 2             |
| tc1521   | 5.64                              | 6.03                     | 0.39                                       | 2             |
| tc1604   | 2.58                              | 3.04                     | 0.46                                       | 2             |
| tc1702   | 23.53                             | 23.51                    | -0.02                                      | 2             |
| cc011    | 9.83                              | 9.59                     | -0.24                                      | 2             |
| cc021    | 3.59                              | 3.52                     | -0.07                                      | 2             |
| cc058a   | 5.24                              | 5.65                     | 0.41                                       | 2             |
| cc076    | 6.74                              | 6.59                     | -0.15                                      | 2             |
| tc218    | 7.98                              | 8.32                     | 0.34                                       | 3             |
| tc219    | 7.79                              | 8.29                     | 0.5                                        | 3             |
| tc717    | 13.60                             | 13.65                    | 0.05                                       | 3             |
| tc725    | 16.83                             | 16.99                    | 0.16                                       | 3             |
| tc725a   | 16.68                             | 16.80                    | 0.12                                       | 3             |
| tc729    | 15.87                             | 16.00                    | 0.13                                       | 3             |
| tc748    | 8.96                              | 9.19                     | 0.24                                       | 3             |
| tc750    | 10.72                             | 11.00                    | 0.28                                       | 3             |
| tc767    | 29.44                             | 29.64                    | 0.2                                        | 3             |
| tc768    | 23.03                             | 23.10                    | 0.07                                       | 3             |
| tc771    | 29.65                             | 29.64                    | -0.01                                      | 3             |
| tc772    | 30.29                             | 30.40                    | 0.11                                       | 3             |
| tc774    | 32.41                             | 32.43                    | 0.02                                       | 3             |

|        |       |       |       |   |
|--------|-------|-------|-------|---|
| tc781  | 32.28 | 32.31 | 0.03  | 3 |
| tc782  | 8.10  | 8.41  | 0.31  | 3 |
| tc787  | 11.55 | 11.50 | -0.05 | 3 |
| tc1014 | 18.68 | 19.08 | 0.4   | 3 |
| tc1101 | 5.42  | 13.08 | 7.66  | 3 |
| tc769  | 22.88 | 23.75 | 0.87  | 4 |
| tc1526 | 11.28 | 11.50 | 0.22  | 4 |
| cc012  | 8.56  | 8.65  | 0.09  | 4 |
| cc016  | 8.56  | 8.71  | 0.15  | 4 |
| cc1040 | 4.79  | 5.58  | 0.79  | 4 |

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**Table 5-3 Regional Statistical Analysis of Feb 1990 Flood Marks**

| Region/Grade      | % Levels Within<br>±0.1m | % Levels Within<br>±0.2m | Average Deviation<br>(m) | Total Number of<br>Levels |
|-------------------|--------------------------|--------------------------|--------------------------|---------------------------|
| <b>Total</b>      |                          |                          |                          |                           |
| Grade 1           | 46%                      | 83%                      | 0.02                     | 24                        |
| Grade 2           | 20%                      | 40%                      | 0.06                     | 10                        |
| Grade 3           | 33%                      | 56%                      | 0.59                     | 18                        |
| Grade 4           | 20%                      | 40%                      | 0.42                     | 5                         |
| <b>All Grades</b> | 33%                      | 61%                      | 0.24                     | 57                        |
| <b>Merewether</b> |                          |                          |                          |                           |
| Grade 1           | 0%                       | 0%                       | 0.43                     | 1                         |
| Grade 2           | 25%                      | 50%                      | -0.01                    | 4                         |
| Grade 3           | N/A                      | N/A                      | N/A                      | 0                         |
| Grade 4           | 50%                      | 100%                     | 0.12                     | 2                         |
| <b>All Grades</b> | 29%                      | 57%                      | 0.09                     | 7                         |
| <b>Kotara</b>     |                          |                          |                          |                           |
| Grade 1           | N/A                      | N/A                      | N/A                      | 0                         |
| Grade 2           | 100%                     | 100%                     | -0.02                    | 1                         |
| Grade 3           | 57%                      | 71%                      | 0.12                     | 7                         |
| Grade 4           | 0%                       | 0%                       | 0.87                     | 1                         |
| <b>All Grades</b> | 56%                      | 67%                      | 0.19                     | 9                         |
| <b>Mayfield</b>   |                          |                          |                          |                           |
| Grade 1           | 50%                      | 100%                     | 0.11                     | 4                         |
| Grade 2           | 0%                       | 0%                       | 0.12                     | 2                         |
| Grade 3           | N/A                      | N/A                      | N/A                      | 0                         |
| Grade 4           | N/A                      | N/A                      | N/A                      | 0                         |
| <b>All Grades</b> | 33%                      | 67%                      | 0.11                     | 6                         |
| <b>ISC</b>        |                          |                          |                          |                           |
| Grade 1           | 25%                      | 25%                      | -0.09                    | 4                         |
| Grade 2           | 0%                       | 0%                       | 0.22                     | 1                         |
| Grade 3           | 0%                       | 0%                       | 0.42                     | 2                         |
| Grade 4           | N/A                      | N/A                      | N/A                      | 0                         |
| <b>All Grades</b> | 14%                      | 14%                      | 0.10                     | 7                         |
| <b>Lambton</b>    |                          |                          |                          |                           |
| Grade 1           | 50%                      | 100%                     | 0.00                     | 14                        |
| Grade 2           | 0%                       | 100%                     | -0.18                    | 1                         |
| Grade 3           | 14%                      | 57%                      | 0.18                     | 7                         |
| Grade 4           | N/A                      | N/A                      | N/A                      | 0                         |
| <b>All Grades</b> | 36%                      | 86%                      | 0.05                     | 22                        |

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### 5.2.4 April 1988 Verification

The April 1988 flood event was simulated through the model as a verification of the 1990 flood calibration. As discussed previously, the 1988 event is more problematic given the large variation and uncertainty in the rainfall that fell over the catchment, and was therefore selected for verification purposes. The objective of the verification stage is to check the model performs satisfactorily to another flood event, using the same parameters as adopted for the calibration stage. The same level of agreement as achieved during the model calibration stage is not necessarily expected for the verification stage.

The adopted rainfall isohyets for the April 1988 calibration are presented in Drawing 5-13.

As for the 1990 flood calibration, the 1988 verification is presented using the same map arrangement. These maps are presented in (Drawing 5-14 to Drawing 5-18).

Figure 5-3 shows the model predictions at the Jellicoe Parade HWC gauge, the only gauge for which information was available. Figure 5-4 presents the profile of peak water levels along Throsby Creek, along with the recorded levels within 100 m of the creek centreline.

Observed and predicted flood levels for the 1988 verification are presented in Table 5-4. A statistical analysis of flood marks by region is presented in Table 5-4.

**Table 5-4 Apr 1988 Calibration to Flood Marks**

| Flood ID | Recorded Flood Level (mAHD) | Modelled Level (mAHD) | Difference [Modelled - Recorded] (m) | Data Grade |
|----------|-----------------------------|-----------------------|--------------------------------------|------------|
| tc006    | 8.34                        | 8.21                  | -0.13                                | 1          |
| tc006a   | 8.28                        | 8.24                  | -0.04                                | 1          |
| tc010    | 10.21                       | 10.22                 | 0.01                                 | 1          |
| tc017    | 14.65                       | 14.19                 | -0.46                                | 1          |
| tc765    | 12.21                       | 11.84                 | -0.37                                | 1          |
| tc765a   | 11.80                       | 11.84                 | 0.05                                 | 1          |
| tc1017   | 20.80                       | 20.40                 | -0.4                                 | 1          |
| tc1308b  | 12.31                       | 12.29                 | -0.02                                | 1          |
| tc021    | 8.62                        | 8.06                  | -0.55                                | 2          |
| tc776    | 29.59                       | 29.39                 | -0.2                                 | 2          |
| tc1308a  | 12.39                       | 12.39                 | 0.01                                 | 2          |
| tc1018   | 8.11                        | 8.08                  | -0.03                                | 3          |

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**Table 5-5 Regional Statistical Analysis of Apr 1988 Flood Marks**

| Region/Grade      | % Levels Within<br>±0.1m | % Levels Within<br>±0.2m | Average<br>Deviation (m) | Total Number of<br>Levels |
|-------------------|--------------------------|--------------------------|--------------------------|---------------------------|
| <b>Total</b>      |                          |                          |                          |                           |
| Grade 1           | 50%                      | 63%                      | -0.17                    | 8                         |
| Grade 2           | 33%                      | 33%                      | -0.25                    | 3                         |
| Grade 3           | 100%                     | 100%                     | -0.03                    | 1                         |
| Grade 4           | N/A                      | N/A                      | N/A                      | 0                         |
| <b>All Grades</b> | 50%                      | 58%                      | -0.18                    | 12                        |
| <b>Merewether</b> |                          |                          |                          |                           |
| Grade 1           | N/A                      | N/A                      | N/A                      | 0                         |
| Grade 2           | N/A                      | N/A                      | N/A                      | 0                         |
| Grade 3           | N/A                      | N/A                      | N/A                      | 0                         |
| Grade 4           | N/A                      | N/A                      | N/A                      | 0                         |
| <b>All Grades</b> | N/A                      | N/A                      | N/A                      | 0                         |
| <b>Kotara</b>     |                          |                          |                          |                           |
| Grade 1           | N/A                      | N/A                      | N/A                      | 0                         |
| Grade 2           | 0%                       | 0%                       | -0.20                    | 1                         |
| Grade 3           | N/A                      | N/A                      | N/A                      | 0                         |
| Grade 4           | N/A                      | N/A                      | N/A                      | 0                         |
| <b>All Grades</b> | 0%                       | 0%                       | -0.20                    | 1                         |
| <b>Mayfield</b>   |                          |                          |                          |                           |
| Grade 1           | N/A                      | N/A                      | N/A                      | 0                         |
| Grade 2           | N/A                      | N/A                      | N/A                      | 0                         |
| Grade 3           | N/A                      | N/A                      | N/A                      | 0                         |
| Grade 4           | N/A                      | N/A                      | N/A                      | 0                         |
| <b>All Grades</b> | N/A                      | N/A                      | N/A                      | 0                         |
| <b>ISC</b>        |                          |                          |                          |                           |
| Grade 1           | 50%                      | 75%                      | -0.12                    | 4                         |
| Grade 2           | 0%                       | 0%                       | -0.55                    | 1                         |
| Grade 3           | 100%                     | 100%                     | -0.03                    | 1                         |
| Grade 4           | N/A                      | N/A                      | N/A                      | 0                         |
| <b>All Grades</b> | 50%                      | 67%                      | -0.18                    | 6                         |
| <b>Lambton</b>    |                          |                          |                          |                           |
| Grade 1           | 50%                      | 50%                      | -0.22                    | 4                         |
| Grade 2           | 100%                     | 100%                     | 0.01                     | 1                         |
| Grade 3           | N/A                      | N/A                      | N/A                      | 0                         |
| Grade 4           | N/A                      | N/A                      | N/A                      | 0                         |
| <b>All Grades</b> | 60%                      | 60%                      | -0.17                    | 5                         |

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Statistics\_Summary

### 5.2.5 Public Exhibition and Fine-Tuning

The calibration/verification of the computer models was placed on public exhibition and presented at community workshops. No negative feedback or changes in the models' calibration/verification resulted from the community feedback, although on-going investigation and fine-tuning occurred in localised areas (Broadmeadow/Adamstown area at start of racecourse culvert, Waratah Railway Station, Glebe Road, and upper areas of New Lambton) based on feedback from committee meetings.

## 5.3 Calibrated Model Parameters

### 5.3.1 Hydrological Parameters

The main calibration parameters in the WBNM hydrological model are the lag parameter, the initial rainfall loss and the continuing rainfall losses.

A number of other parameters in WBNM can be changed if justification for modifying these exist. For the Throsby, Cottage and CBD hydrological model these remained at the recommended default values. The calibrated model parameters are presented in Table 5-6.

**Table 5-6 Calibrated Hydrologic Parameters**

| Parameter                 | 1988 Calibration | 1990 Calibration |
|---------------------------|------------------|------------------|
| Initial Loss (mm)         | 5.0              | 10.0             |
| Continuing Losses (mm/hr) | 2.0              | 2.0              |
| Lag Parameter             | 1.3              | 1.3              |

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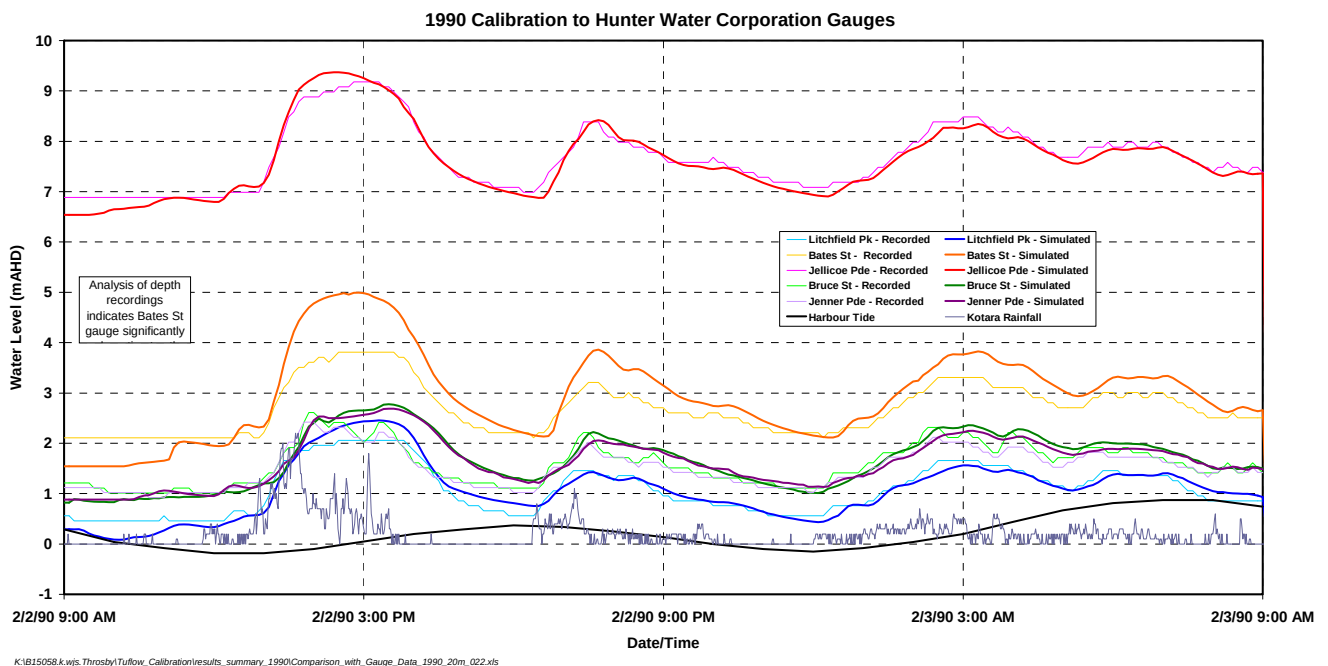
### 5.3.2 Hydraulic Model Parameters

The focus of the hydraulic model calibration was on varying hydraulic roughness (Manning's n). The calibrated Manning's n values are listed in Table 5-7.

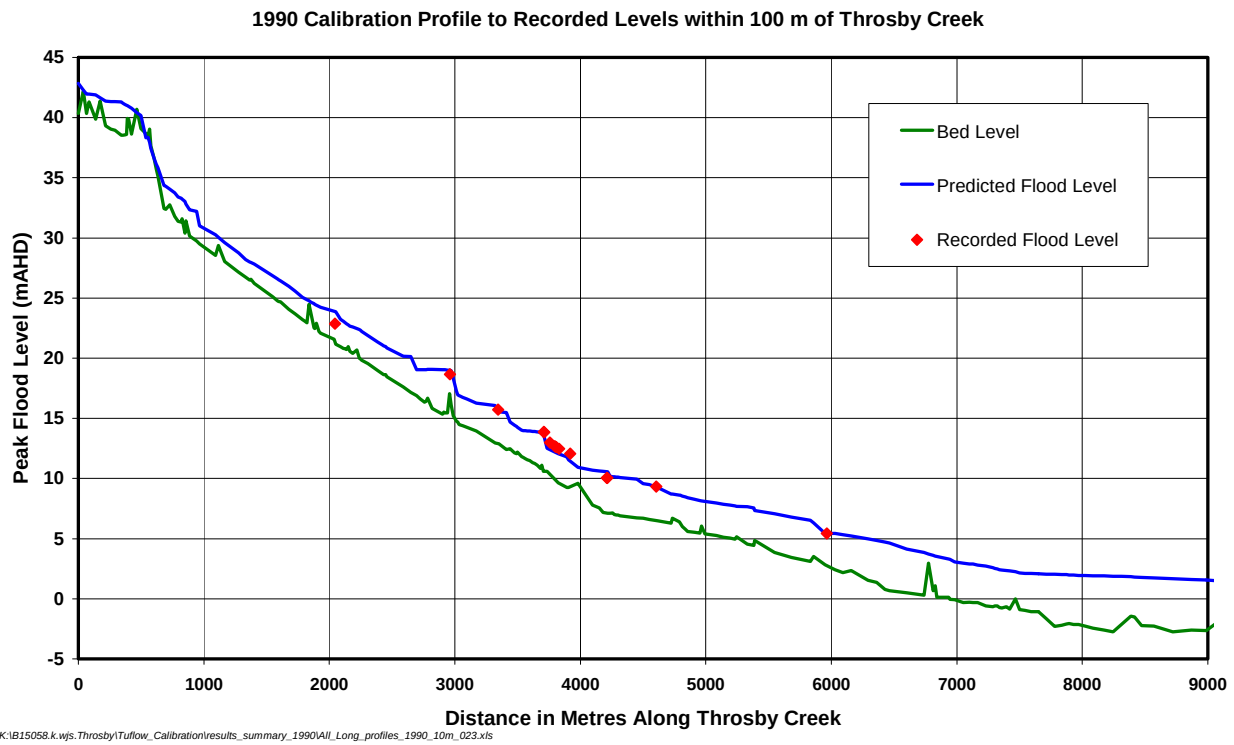
**Table 5-7 Calibrated Manning's n Values**

| Land Use                               | Manning's n Value |
|----------------------------------------|-------------------|
| <b>2D Areas</b>                        |                   |
| Grass (maintained)                     | 0.030             |
| Parkland                               | 0.040             |
| Roads / Railway                        | 0.020             |
| Open Concrete/Asphalt                  | 0.020             |
| Riparian Vegetation                    | 0.100             |
| Dense Land Vegetation / Forest         | 0.090             |
| Building                               | 1.000             |
| Urban Block                            | 0.300             |
| Concrete Lined Channel                 | 0.018             |
| Bare Earth / unkempt low-level foliage | 0.045             |
| Harbour, dams, water                   | 0.022             |
| <b>1D Areas</b>                        |                   |
| Channel overbank                       | 0.030             |
| Parkland                               | 0.040             |
| Roads                                  | 0.020             |
| Open Concrete/Asphalt                  | 0.020             |
| Riparian Vegetation                    | 0.100             |
| Dense Land Vegetation / Forest         | 0.090             |
| Building                               | 1.000             |
| Urban Block                            | 0.300             |
| Concrete Lined Channels                | 0.018             |
| Tidal Creek Bed                        | 0.022             |
| Fences                                 | 0.300             |
| Bare Earth / unkempt low-level foliage | 0.045             |

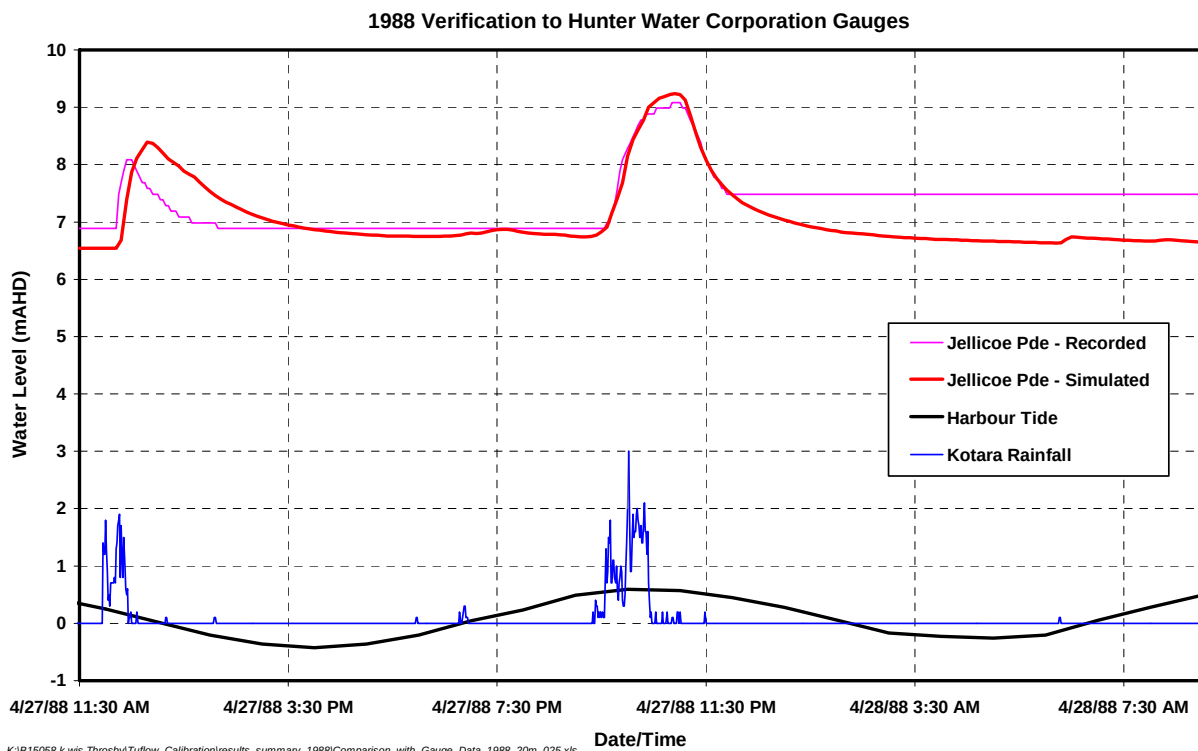
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**Figure 5-1 1990 Calibration to Flood Level Gauges**

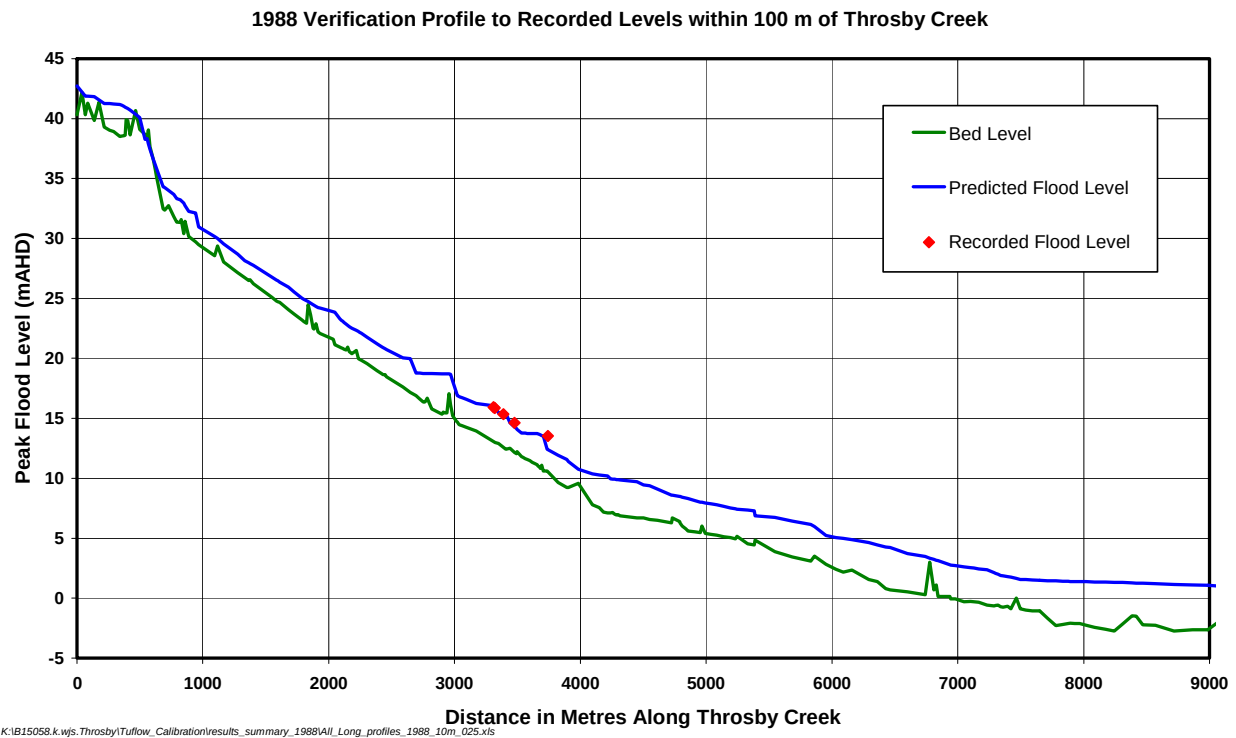




**Figure 5-2 1990 – Calibration Profile to Recorded Levels with 100m of Throsby Creek**



**Figure 5-3 1988 Verification to Flood Level Gauges**



**Figure 5-4 1988 Verification Profile to Recorded Levels within 100m of Throsby Creek**

## 6 DESIGN FLOODS

### 6.1 Topography Adjustments (1990 to 2005)

There have been a number of changes to the catchment since the 1990 calibration event that need to be incorporated as the design modelling is based on existing (2005) topography. The topography of the calibrated model was updated to ensure that the design model was reflective of the existing topography.

#### 6.1.1 DEM and Bathymetry

The primary DEM is based on the conditions as of 2000. Changes made to reflect conditions as of 1988/1990 were removed from the design model, and changes to the topography between 2000 and 2005 included. Layers added to modify the DEM of 2000 are listed below in Table 6-1. The locations of these modifications are presented in Drawing 6-1.

**Table 6-1 Modifications to 2000 Topography for Design Modelling**

| Description             | Area                     | Change                      |
|-------------------------|--------------------------|-----------------------------|
| DEM 2000                | Hydraulic Modelling Area | Base                        |
| Bathymetry              | Harbour                  | Missing in DEM 2000         |
| Bathymetry              | Harbour                  | Missing in DEM 2000         |
| Bathymetry              | Harbour                  | Missing in DEM 2000         |
| Allworth St DEM (NCC)   | Glebe Road               | Missing in DEM 2000         |
| 2005 Ground Survey      | Stewart Avenue           | Development Since DEM 2000  |
| 2005 Ground Survey      | Linwood St               | Development Since DEM 2000  |
| 2005 Ground Survey      | Carrington               | Development Since DEM 2000  |
| 2005 Ground Survey      | Honeysuckle              | Development Since DEM 2000  |
| 2005 Ground Survey      | Wickham                  | Development Since DEM 2000  |
| 2005 Ground Survey      | Kotara                   | Development Since DEM 2000  |
| DEM 2004 Photogrammetry | Hamilton South           | Development Since DEM 2000  |
| Ground Survey           | Waratah Railway          | More Accurate Ground Survey |
| Ground Survey           | Glebe Road               | More Accurate Ground Survey |

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#### 6.1.2 Cross-Sections

The lower sections of Throsby Creek and the harbour are modelled in 2D. Changes to topography caused by dredging and development in these areas are represented.

#### 6.1.3 Land-Use

The 2004 aerial photographs were used to digitise the current land uses in areas that have changed since the calibration events. The land uses used in the design modelling are presented in Drawing 6-2.



### 6.1.4 Hydraulic Structures

The rail bridge over Styx Creek was replaced in 2004. Newcastle City Council provided details of both bridges. The model was updated to reflect the current arrangement.

Details for the hydraulic structures are based on the drawings provided by Newcastle City Council. These structures were surveyed / measured in the years 2000 and 2001. It is assumed that these are reflective of the current structures.

## 6.2 Design Flood Behaviour

### 6.2.1 Flood Mechanisms

In general, the flooding behaviour in the Throsby, Cottage and CBD areas in its current developed state can be summarised as follows:

- Rainfall on the catchment initially drains via the underground drainage network to the network of concrete lined open channels that discharge to the harbour.
- When runoff exceeds the capacity of the underground drainage and open channel network, floodwaters primarily travel along the road system as a network of flowpaths draining the catchment into the open channels or parallel to open channels.
- In some areas, the major overland flowpaths are through residential/commercial buildings and grounds and parkland.
- Flooding in the lower areas (Carrington in particular) can result as a back up from Throsby Basin either from a Hunter River flood, an elevated ocean level (eg storm surge) or from a combination of both.

### 6.2.2 Critical Duration Analysis

The hydrological model was used to simulate 11 rainfall durations for the 1% AEP event to ascertain the critical duration storm periods. Flows generated were input to the hydraulics model to determine the design rainfall durations that result in the highest modelled water level at locations throughout the study area.

To ensure that the timing of the tide in the harbour did not influence the critical duration analysis, the downstream water level for the critical duration simulations was held constant at 0.0m AHD. Results of the critical duration analysis are presented in Drawing 6-3. This figure shows where the various rainfall durations yield the highest predicted water level.

The rainfall durations used in the critical duration and the area that each of these is critical is presented in Table 6-2. It should be noted that while the 1 and 1.5 hour durations have a greater percentage than the 9 hour, the depth is generally very close in value to the 2 hour duration. In lower areas, the longer durations are critical and these are significantly deeper than the 2 hour duration.

The locations where the depth of the 2 and 9 hour durations is within 50mm of the critical depth was calculated. Drawing 6-5 shows areas where the 2 and 9 hour events are within 50mm of the critical

duration. This drawing shows that over the extent of the model the 2 and 9 hour events are generally either critical or within 50mm of the critical depth.

In consultation with the flood study technical committee it was decided that two and nine hour rainfall durations would be used for design flood simulations.

**Table 6-2 Results Critical Duration Analysis of 1% AEP**

| Duration      | Area km <sup>2</sup> | Percentage of Area Critical |
|---------------|----------------------|-----------------------------|
| 0.5 hour      | 0.28                 | 3.0%                        |
| 1 hour        | 1.25                 | 13.5%                       |
| 1.5 hour      | 1.53                 | 16.5%                       |
| <b>2 hour</b> | <b>3.97</b>          | <b>42.9%</b>                |
| 3 hour        | 0.32                 | 3.5%                        |
| 4.5 hour      | 0.22                 | 2.4%                        |
| 6 hour        | 0.22                 | 2.4%                        |
| <b>9 hour</b> | <b>0.71</b>          | <b>7.6%</b>                 |
| 12 hour       | 0.26                 | 2.8%                        |
| 18 hour       | 0.16                 | 1.7%                        |
| 24 hour       | 0.35                 | 3.8%                        |
| <b>Total</b>  | <b>9.26</b>          | <b>100.0%</b>               |

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[TCC\_Q100\_Critical\_Duration\_Statistics.xls]Crit\_Dur\_Stat

## 6.3 Design Flood Combinations

### 6.3.1 Design Event Abbreviations

The following abbreviations are used for the design event section of the Throsby, Cottage and CBD Flood study:

**Table 6-3 Design Event Abbreviations**

| Abbreviation                                                  | Description                                                                                                        |
|---------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|
| <b>Topography</b>                                             |                                                                                                                    |
| TEX                                                           | Topography as at 2005 (ie. existing conditions)                                                                    |
| TFD                                                           | Fully developed topography                                                                                         |
| <b>Event Probability</b>                                      |                                                                                                                    |
| QPMF                                                          | PMF Flood Event                                                                                                    |
| Q200                                                          | 200 year ARI or 0.5% AEP Event                                                                                     |
| Q100                                                          | 100 year ARI or 1% AEP Event                                                                                       |
| Q050                                                          | 50 year ARI or 2% AEP Event                                                                                        |
| Q020                                                          | 20 year ARI or 5% AEP Event                                                                                        |
| Q010                                                          | 10 year ARI or 10% AEP Event                                                                                       |
| Q005                                                          | 5 year ARI or 20% AEP Event                                                                                        |
| Q002                                                          | 2 year ARI or 50% AEP Event                                                                                        |
| <b>Duration</b>                                               |                                                                                                                    |
| D0030m                                                        | 30 minute critical duration                                                                                        |
| D01.0h                                                        | 1 hour critical duration                                                                                           |
| D01.5h                                                        | 90 minute critical duration                                                                                        |
| D02.0h                                                        | 2 hour critical duration                                                                                           |
| D03.0h                                                        | 3 hour critical duration                                                                                           |
| D04.5h                                                        | 4.5 hour critical duration                                                                                         |
| D06.0h                                                        | 6 hour critical duration                                                                                           |
| D09.0h                                                        | 9 hour critical duration                                                                                           |
| D12.0h                                                        | 12 hour critical duration                                                                                          |
| D18.0h                                                        | 18 hour critical duration                                                                                          |
| D24.0h                                                        | 24 hour critical duration                                                                                          |
| <b>Harbour Conditions (Hunter River / Ocean Combinations)</b> |                                                                                                                    |
| RPMF                                                          | Hunter River PMF flood event with a 1.3m ocean storm tide. The two peaks are timed to coincide within the harbour. |
| H0.5e                                                         | 0.5% exceedance for any given hour harbour boundary from L&T joint probability study.                              |
| H01e                                                          | 1% exceedance for any given hour harbour boundary from L&T joint probability study.                                |
| H02e                                                          | 2% exceedance for any given hour harbour boundary from L&T joint probability study.                                |



|                       |                                                                                      |
|-----------------------|--------------------------------------------------------------------------------------|
| H05e                  | 5% exceedance for any given hour harbour boundary from L&T joint probability study.  |
| H10e                  | 10% exceedance for any given hour harbour boundary from L&T joint probability study. |
| H20e                  | 20% exceedance for any given hour harbour boundary from L&T joint probability study. |
| H50e                  | 50% exceedance for any given hour harbour boundary from L&T joint probability study. |
| <b>Climate Change</b> |                                                                                      |
| C01                   | Climate Change Scenario 01: 0.4m sea level rise.                                     |

### 6.3.2 Design Event Probabilities

Flooding was simulated using the hydraulic model for eleven combinations of design event probabilities for the TEX (Existing) and TFD (Future) topographic scenarios as follows.

- Existing (TEX) conditions: PMF, Q200, Q100, Q50, Q20, Q10, Q5 and Q2.
- Future (TFD) conditions: PMF, Q100 and Q10.

### 6.3.3 Design Event Combinations

The selection of rainfall event durations (two and nine hour) was based on the critical duration analysis, see Section 6.2.2. The following combinations were simulated for the design probabilities listed in Table 6-4.

All design events have a 1 hour, 1% AEP time varying tailwater condition, based on the joint probability study of water levels in Newcastle Harbour (Lawson and Treloar, 1999). The fully developed condition simulations have an allowance of 0.4m on tailwater levels to account for possible sea level rise in the future.

**Table 6-4 Design Flood Combinations**

| Design Flood Probability                            | Combinations                                                 |
|-----------------------------------------------------|--------------------------------------------------------------|
| <b>Existing Condition (TEX) Combinations</b>        |                                                              |
| PMF                                                 | 1. TEX_QPMF_D02.0h_H01e                                      |
| Q200                                                | 2. TEX_Q200_D02.0h_H01e<br>3. TEX_Q200_D09.0h_H01e           |
| Q100                                                | 4. TEX_Q100_D02.0h_H01e<br>5. TEX_Q100_D09.0h_H01e           |
| Q050                                                | 6. TEX_Q050_D02.0h_H01e<br>7. TEX_Q050_D09.0h_H01e           |
| Q020                                                | 8. TEX_Q020_D02.0h_H01e<br>9. TEX_Q020_D09.0h_H01e           |
| Q010                                                | 10. TEX_Q010_D02.0h_H01e<br>11. TEX_Q010_D09.0h_H01e         |
| Q005                                                | 12. TEX_Q005_D02.0h_H01e<br>13. TEX_Q005_D09.0h_H01e         |
| Q002                                                | 14. TEX_Q002_D02.0h_H01e<br>15. TEX_Q002_D09.0h_H01e         |
| <b>Fully Developed Condition (TFD) Combinations</b> |                                                              |
| PMF                                                 | 16. TFD_QPMF_D02.0h_H01e_C01                                 |
| Q100                                                | 17. TFD_Q100_D02.0h_H01e_C01<br>18. TFD_Q100_D09.0h_H01e_C01 |
| Q010                                                | 19. TFD_Q010_D02.0h_H01e_C01<br>20. TFD_Q010_D09.0h_H01e_C01 |

## 6.4 Presentation of Results

Design flood levels and depths are presented for the eight existing design event probabilities. The results for each design probability are the maximum envelope of two critical durations (two and nine hour durations).

The peak water level does not occur everywhere at the same time, therefore, values presented are based on the maximum that occurred at each computational point in the model during a combination of event durations. Hence, results do not represent an instantaneous point in time, but rather an envelope of the maximum values that have occurred.

Unless otherwise stated, presentations in this report are based on peak values, not at an instant in time. Peak velocity and peak velocity-depth products are those that occur at the time of the peak water level.

Long sections down each of the major tributaries are presented for all the design and calibration events. An index of the long profiles is presented in Table 6-5. A map of the location of profiles is presented in Drawing 6-5.

**Table 6-5 Index Of Long Profiles**

| Branch           | Drawing Number |
|------------------|----------------|
| Location Plan    | Drawing 6-4    |
| Adamstown        | Drawing 6-5    |
| Broadmeadow East | Drawing 6-6    |
| Broadmeadow      | Drawing 6-7    |
| Cottage Creek    | Drawing 6-8    |
| Georgetown       | Drawing 6-9    |
| Griffiths Flat   | Drawing 6-10   |
| Kotara           | Drawing 6-11   |
| Lambton          | Drawing 6-12   |
| Mayfield         | Drawing 6-13   |
| New Lambton      | Drawing 6-14   |
| Orchardtown      | Drawing 6-15   |
| Racecourse       | Drawing 6-16   |
| Throsby Upper    | Drawing 6-17   |
| Throsby Lower    | Drawing 6-18   |
| Waratah          | Drawing 6-19   |

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Long\_Profiles\_123\Excel[Index\_of\_LPs.xls]Index\_Table

Five drawings are presented for each design event probability and output type, as a keysheet (A3) and four A3 maps. An index of the design mapping is presented in Table 6-6.

**Table 6-6 Index of Design Flood Maps**

| Event    | Levels                       | Depths                       |
|----------|------------------------------|------------------------------|
| Q002_TEX | Drawing 6-20 to Drawing 6-24 | Drawing 6-25 to Drawing 6-29 |
| Q005_TEX | Drawing 6-30 to Drawing 6-34 | Drawing 6-35 to Drawing 6-39 |
| Q010_TEX | Drawing 6-40 to Drawing 6-44 | Drawing 6-45 to Drawing 6-49 |
| Q020_TEX | Drawing 6-50 to Drawing 6-54 | Drawing 6-55 to Drawing 6-59 |
| Q050_TEX | Drawing 6-60 to Drawing 6-64 | Drawing 6-65 to Drawing 6-69 |
| Q100_TEX | Drawing 6-70 to Drawing 6-74 | Drawing 6-75 to Drawing 6-79 |
| Q200_TEX | Drawing 6-80 to Drawing 6-84 | Drawing 6-85 to Drawing 6-89 |
| QPMF_TEX | Drawing 6-90 to Drawing 6-94 | Drawing 6-95 to Drawing 6-99 |

I:\B15058\_I\_BRH\_Throsby Cottage\_WJS\DRG\Design\_Mapping\A3\_Drawing\_Addendum.xls]Table

## 6.5 Design Flood Peak Envelopes

### 6.5.1 2 year ARI Event

The following comments are made with respect to the 50% AEP (2 year ARI) flood probability combination:

- There are significant areas predicted to experience shallow flooding, these include New Lambton, The Junction, Hamilton North and Carrington. Many of these are likely to be as a result of the sub-900mm pipes not being included.



- Velocity and velocity-depth products are typically low for overland areas, the exception being Merewether.
- The railway embankment at Kotara acts as a significant restriction to flow with a head drop of approximately 1.5m at the culverts.
- There is no interaction between the Throsby and Cottage Creek catchments.
- Predicted area inundated is 5.9km<sup>2</sup>.

### 6.5.2 5 year ARI Event

The following comments are made with respect to the 5 year ARI (20% AEP) probability design event combination:

- Significant increases to flood extent (compared with the 2 year ARI event) occur in New Lambton (Bridges Road and Errington Ave / Mackie Ave) and the CBD (Hunter and King Streets).
- A flow path is created along Bridges Road, New Lambton (between Longworth Ave and Russell Rd).
- A small interaction between the Throsby and Cottage Creek catchments occurs. A peak flow of approximately 0.5m<sup>3</sup>/s from the Cottage Creek catchment to the Throsby Creek occurs in the nine hour event. The flow occurs along Fowler and Coady Streets in Hamilton South.
- Predicted area inundated is 7.3km<sup>2</sup>.

### 6.5.3 10 year ARI Event

The following comments are made with respect to the 10 year ARI (10% AEP) probability design event combination:

- Significant increases to flood extent (compared to the 5 year ARI event) occur in Mayfield and New Lambton.
- Proportion of flow along Bridges Road / Penman Avenue / Fairfield Avenue increases. Velocities of greater than 1m/s are predicted.
- Approximately 40% of flow in overland areas along Selwyn and Wilton Streets (Merewether).
- Predicted area inundated is 7.9km<sup>2</sup>.

### 6.5.4 20 year ARI Event

The following comments are made with respect to the 20 year ARI (5% AEP) probability design event combination:

- Increases in flood extent and overland flow.
- Flowpath along Silsoe Street / Dangar Park in Mayfield develops.
- Overland flow path along Dawson, Queen and Darby Streets in Cooks Hill develops.
- Overland flow path along Mitchell St (between Llewellyn and Robert Streets) in Merewether develops.
- Predicted area inundated is 8.7km<sup>2</sup>.

### 6.5.5 50 year ARI Event

The following comments are made with respect to the 50 year ARI (2% AEP) probability design event combination:

- General increases in flood extent and overland flow, notably in Hamilton North, Broadmeadow, Adamstown and Cooks Hill.
- Overland flowpath along Griffiths Road and Broadmeadow Road into Hamilton North develops.
- Overland flowpath north along Brunner, Chatham and Broadmeadow Roads develops.
- Overland flowpath along Mowbray and Wood Streets Adamstown develops.
- Overland flowpath along St James Road (east of Evenscourt Road) develops.
- Peak flow between the Throsby and Cottage Creek catchments is  $2.6\text{m}^3/\text{s}$  from Throsby Creek to Cottage Creek catchment.
- Predicted area inundated is  $9.6\text{km}^2$ .

### 6.5.6 100 year ARI Event

The following comments are made with respect to the 100 year ARI (1% AEP) probability design event combination:

- General increases in flood extent and overland flow, notably in New Lambton, Hamilton, Hamilton South and Newcastle West.
- Overland flow occurs north along Orchardtown Road, Birdwood Street and Knight Street.
- 75% of flow occurs in overland areas (as opposed to underground conduits) along Selwyn and Wilton Streets (Merewether).
- Predicted area inundated is  $10.2\text{km}^2$ .

### 6.5.7 200 year ARI Event

The following comments are made with respect to the 200 year ARI (0.5% AEP) probability design event combination:

- General increases in flood extent and overland flow.
- A significant number of streets have velocities of greater than  $1\text{m/s}$ , particularly in Merewether and New Lambton.
- Predicted area inundated is  $10.8\text{km}^2$ .

### 6.5.8 PMF Event

The following comments are made with respect to the Probable Maximum Flood (PMF) event combination:

- The PMF event combination results in very large areas being inundated.

- Large portions of Broadmeadow, Hamilton, Hamilton North, Hamilton South, Hamilton East, The Junction, Wickham, Islington, Maryville, Carrington and New Lambton are predicted to experience flooding.
- Numerous roads have peak velocities of greater than 1m/s and a significant number have predicted velocities greater than 2m/s.
- Predicted area inundated is 19.3km<sup>2</sup>.



## **7 CONCLUSIONS AND RECOMMENDATIONS**

### **7.1 Conclusions**

The following points summarise the findings for the Throsby, Cottage and CBD Flood Study:

- A hydrological model of the Throsby, Cottage and CBD catchments has been developed. The model uses industry standard parameters.
- A dynamically linked two-dimensional/one-dimensional (2D/1D) TUFLOW hydraulic model of the Throsby, Cottage and CBD areas was developed and calibrated/verified to the 1988 and 1990 flood events
- The models have successfully been used to derive a detailed representation of flooding in creek/channel and urban areas for the 50%, 20%, 10%, 5%, 2%, 1% and 0.5% AEP design flood events as well as the probable maximum flood.
- The models are considered to form a reliable and representative base from which to carry out flood risk management investigations and quantitatively assess impacts of flood mitigation options.

### **7.2 Recommendations**

The following recommendations are made with respect to the Throsby, Cottage and CBD flood study:

- The computer models developed of the Throsby, Cottage and CBD catchments should be verified against the June 2007 flood event.
- The computer models should form the basis of all future floodplain risk management investigations for the study area.

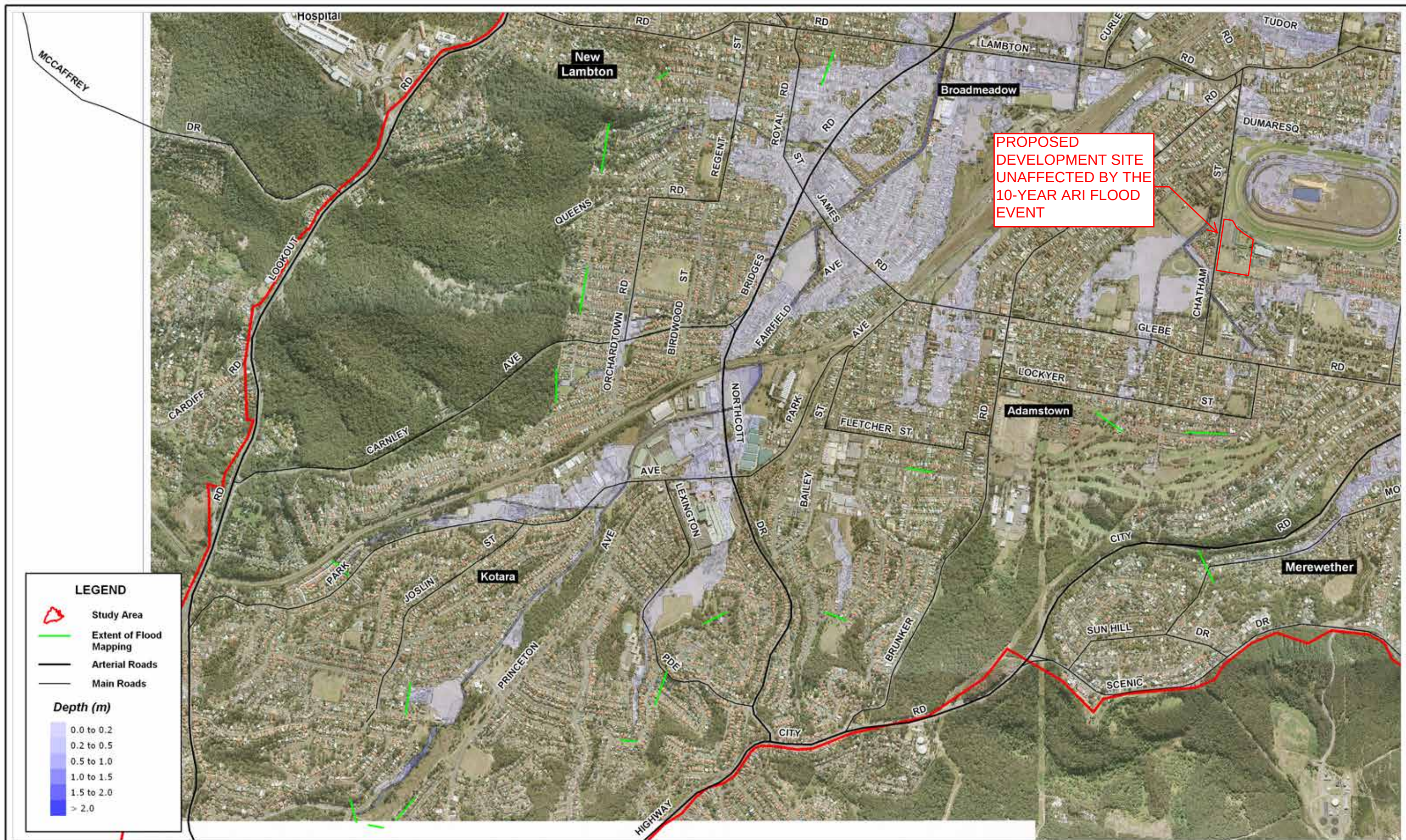
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PROPOSED  
DEVELOPMENT SITE  
UNAFFECTED BY THE  
10-YEAR ARI FLOOD  
EVENT



|              |              |
|--------------|--------------|
| Sheet 1 of 4 | Sheet 3 of 4 |
| Sheet 2 of 4 | Sheet 4 of 4 |

Title:  
**10 Year ARI Event Maximum Depths  
- Existing Conditions**

BMT WBM endeavours to ensure that the information provided in this map is correct at the time of publication. BMT WBM does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.



0 400 800m  
Approx. Scale

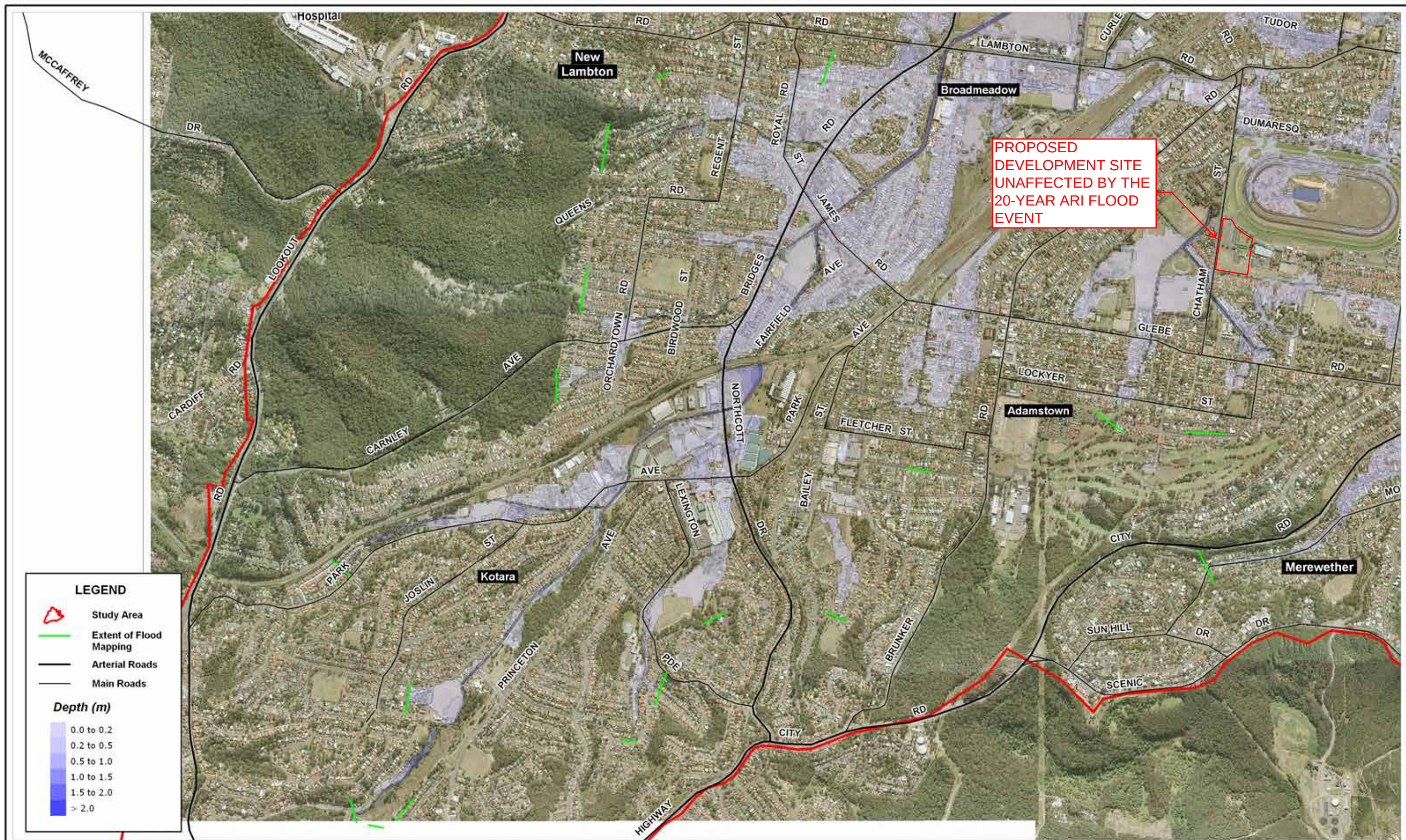
Figure:  
**6-48**

Rev:  
**A**



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|              |              |
|--------------|--------------|
| Sheet 1 of 4 | Sheet 3 of 4 |
| Sheet 2 of 4 | Sheet 4 of 4 |

Title:  
**20 Year ARI Event Maximum Depths  
- Existing Conditions**

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0 400 800m  
Approx. Scale

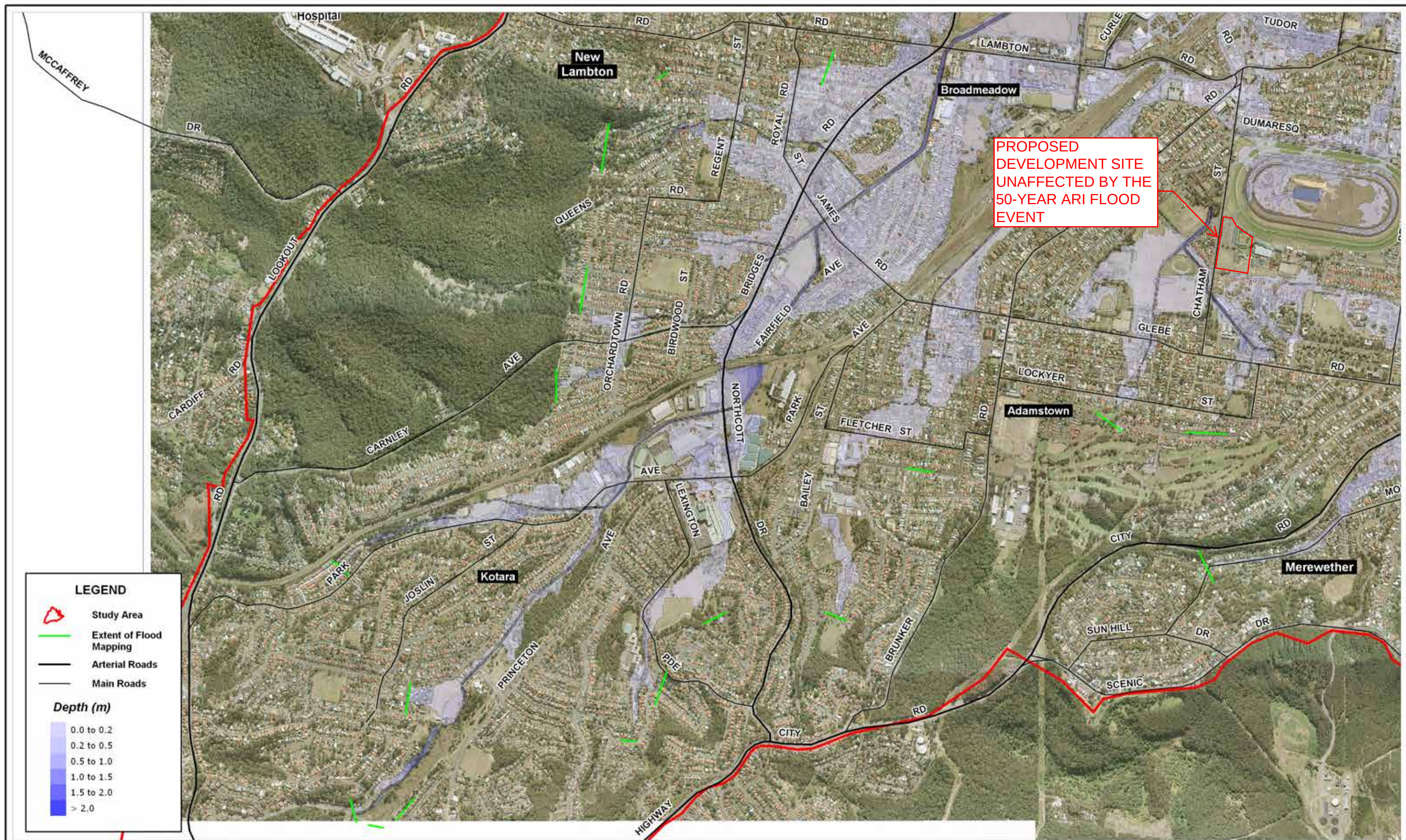
Figure:  
**6-58**

Rev:  
**A**



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|              |              |
|--------------|--------------|
| Sheet 1 of 4 | Sheet 3 of 4 |
| Sheet 2 of 4 | Sheet 4 of 4 |

Title:  
**50 Year ARI Event Maximum Depths  
- Existing Conditions**

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0 400 800m  
Approx. Scale

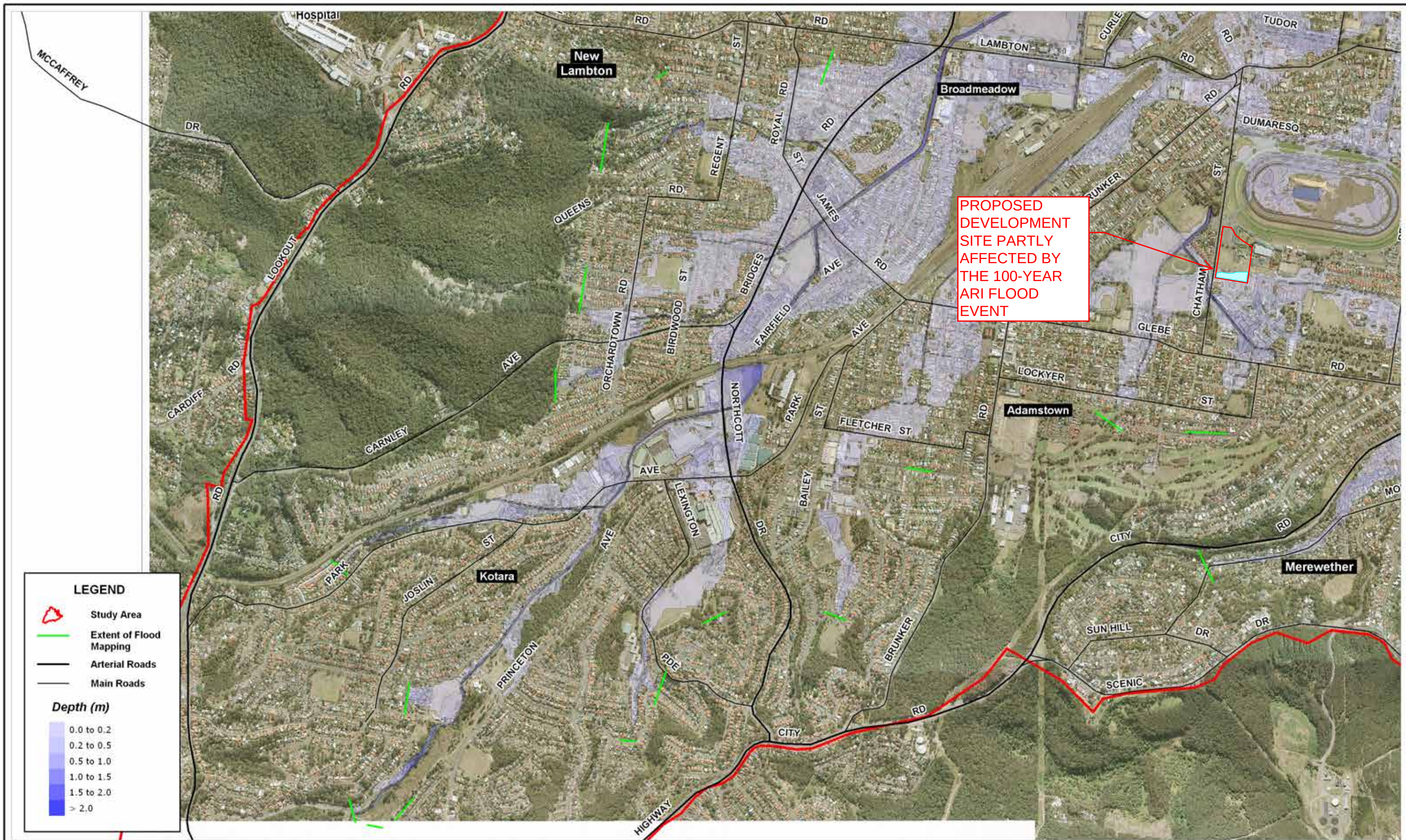
Figure:  
**6-68**

Rev:  
**A**



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|              |              |
|--------------|--------------|
| Sheet 1 of 4 | Sheet 3 of 4 |
| Sheet 2 of 4 | Sheet 4 of 4 |

Title:  
**100 Year ARI Event Maximum Depths  
- Existing Conditions**

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0 400 800m  
Approx. Scale

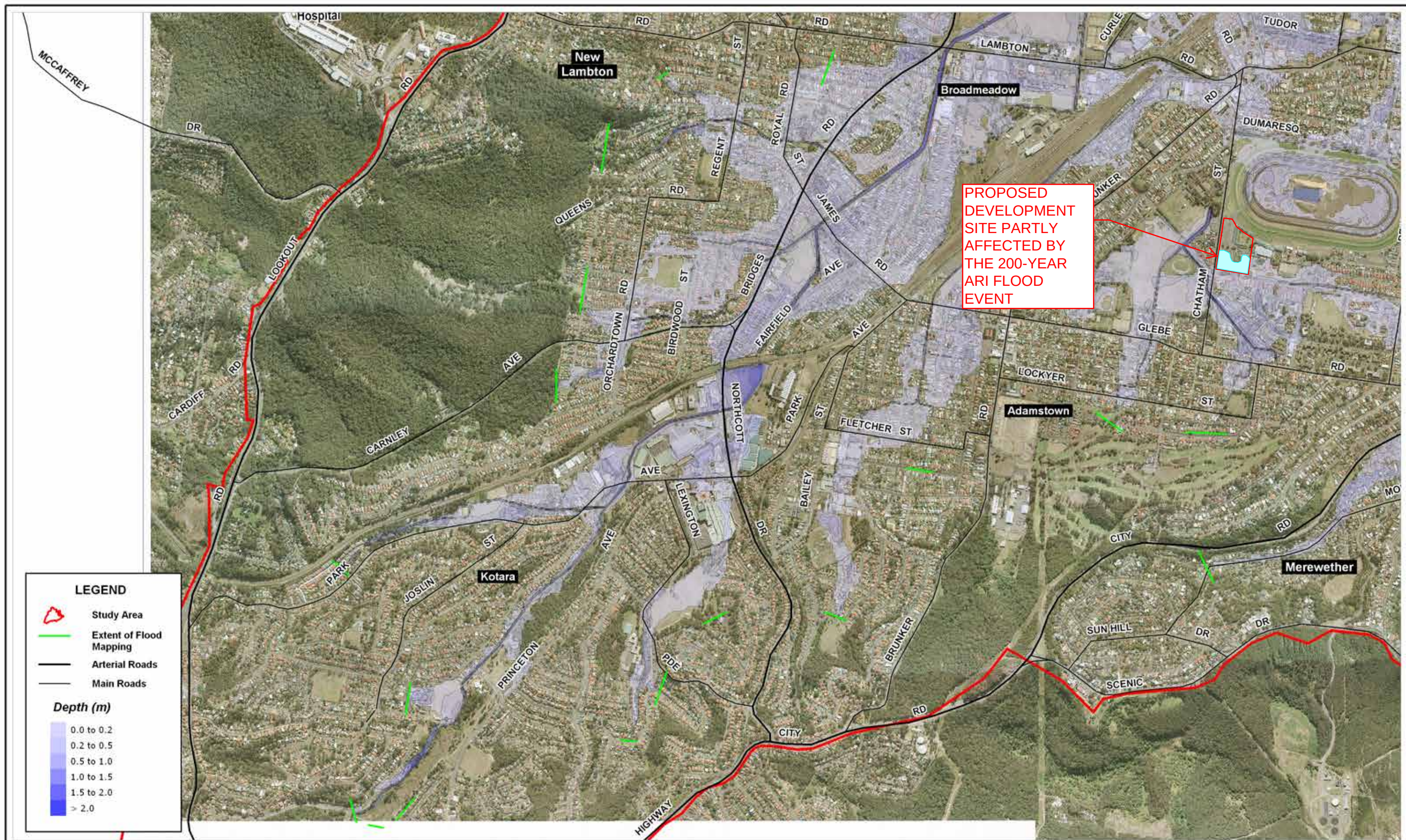
Figure:  
**6-78**

Rev:  
**A**



Filepath : I:\B15058\_I\_BRH\_Throsby Cottage\_WJS\DRG\Design\_Mapping\FLD\_038\_080620\_TEX\_Q100\_d.WOR





**LEGEND**

- Study Area
- Extent of Flood Mapping
- Arterial Roads
- Main Roads

**Depth (m)**

- 0.0 to 0.2
- 0.2 to 0.5
- 0.5 to 1.0
- 1.0 to 1.5
- 1.5 to 2.0
- > 2.0



|              |              |
|--------------|--------------|
| Sheet 1 of 4 | Sheet 3 of 4 |
| Sheet 2 of 4 | Sheet 4 of 4 |

Title:  
**200 Year ARI Event Maximum Depths  
- Existing Conditions**

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0 400 800m  
Approx. Scale

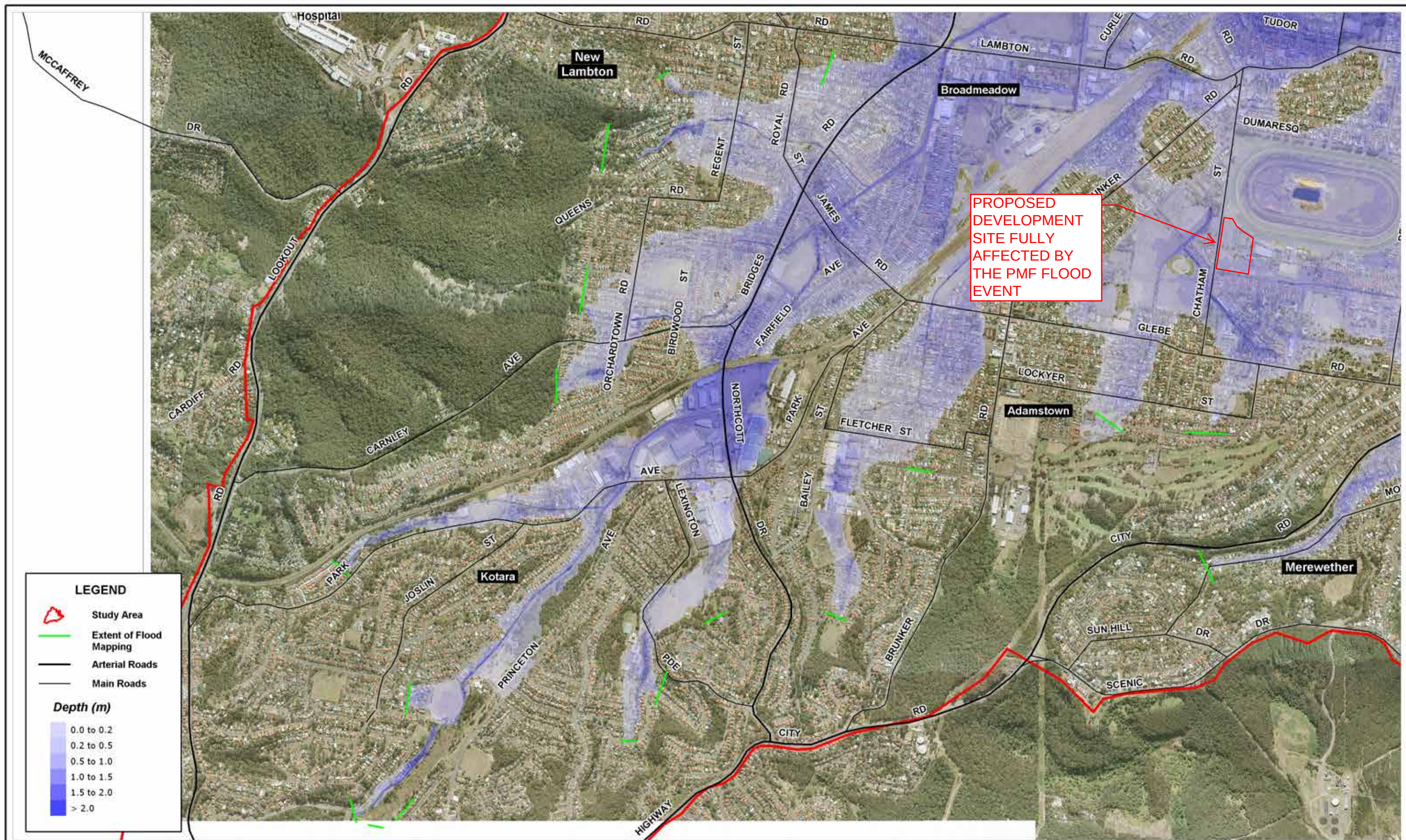
Figure:  
**6-88**

Rev:  
**A**



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|              |              |
|--------------|--------------|
| Sheet 1 of 4 | Sheet 3 of 4 |
| Sheet 2 of 4 | Sheet 4 of 4 |

Title:  
**PMF Event Maximum Depths  
- Existing Conditions**

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0 400 800m  
Approx. Scale

Figure:  
**Drawing 6-98**

Rev:  
**A**

