

# SITE BASED STORMWATER MANAGEMENT PLAN

## DEVELOPMENT APPLICATION FOR RECONFIGURATION OF LOT (38 INDUSTRIAL LOTS)

### ADDRESS

31 Yellowwood Road, 60 Stapylton Jacobs Well Road  
and 82 Christensen Road, Stapylton

### REAL PROPERTY DESCRIPTION

Lot 4 on RP6843, Lot 1 on RP6882 and Lot 240 on  
W31320

### PREPARED FOR

KS8 Pty. Ltd.

August 2018 (Rev. 3)



gassman  
development  
perspectives

project coordination  
urban + regional planning  
landscape + urban design  
engineering services  
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| 1.             | Mitchell Gassman | Ian Grieves | 9 February 2018 |
| 2.             | Mitchell Gassman | Ian Grieves | 10 May 2018     |
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## Approval for Issue

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| 3.       | Mitchell Gassman | Civil Project Engineer<br>RPEQ 16939 |  | 30 August 2018 |

## Final Distribution

|                                              |                   |
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| KS8 Pty. Ltd. (Client)                       | 1 electronic copy |
| Gold Coast City Council (Assessment Manager) | 1 electronic copy |
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## TABLE OF CONTENTS

|       |                                                                        |    |
|-------|------------------------------------------------------------------------|----|
| 1.0   | INTRODUCTION .....                                                     | 6  |
| 2.1   | LOCATION .....                                                         | 7  |
| 2.2   | SITE AREA .....                                                        | 7  |
| 2.3   | EXISTING TOPOGRAPHY AND SITE DRAINAGE .....                            | 7  |
| 2.4   | EXISTING LAND USAGE .....                                              | 8  |
| 2.5   | PLANNING PROVISIONS AND PROPOSED DEVELOPMENT .....                     | 8  |
| 2.6   | FLOODING .....                                                         | 8  |
| 3.0   | CONVEYANCE MANAGEMENT AND PRE AND POST DEVELOPMENT<br>CATCHMENTS ..... | 9  |
| 3.1   | LAWFUL POINT OF DISCHARGE .....                                        | 9  |
| 3.2   | PRE DEVELOPMENT CATCHMENTS .....                                       | 10 |
| 3.3   | POST DEVELOPMENT CATCHMENTS .....                                      | 10 |
| 4.0   | HYDROLOGICAL ASSESSMENT .....                                          | 10 |
| 4.1   | TEMPORAL PATTERNS AND RAINFALL DATA .....                              | 10 |
| 4.2   | CATCHMENTS .....                                                       | 11 |
| 5.0   | STORMWATER QUANTITY, DETENTION & HYDRAULIC DESIGN .....                | 18 |
| 5.1   | ATTENUATION OF DEVELOPED FLOWS .....                                   | 18 |
| 5.2.1 | MODEL CONDITIONS .....                                                 | 18 |
| 5.2.2 | CRITICAL STORM EVENT AND DURATIONS .....                               | 19 |
| 5.2.3 | DETENTION SYSTEM DESIGN .....                                          | 21 |
| 5.2.4 | MODEL RESULTS .....                                                    | 22 |
| 5.2.5 | DISCUSSION ON MODELLING OUTCOMES .....                                 | 25 |
| 6.0   | STORMWATER QUALITY .....                                               | 26 |
| 6.1   | POLLUTANTS OF CONCERN .....                                            | 26 |
| 6.2   | STORMWATER QUALITY OBJECTIVES (OPERATIONAL PHASE) .....                | 26 |
| 6.3   | PROPOSED STORMWATER QUALITY MANAGEMENT STRATEGY .....                  | 27 |
| 6.3.1 | BIO RETENTION BASINS .....                                             | 27 |
| 6.4   | MUSIC MODELLING METHODOLOGY FOR THE DEVELOPMENT SITE .....             | 28 |
| 6.4.1 | METEOROLOGICAL DATA .....                                              | 29 |
| 6.4.2 | SOURCE NODES .....                                                     | 29 |
| 6.4.3 | DRAINAGE LINKS .....                                                   | 31 |
| 6.4.4 | MUSIC MODEL LAYOUT AND RESULTS .....                                   | 31 |
| 7.0   | CONSTRUCTION, OPERATIONAL MANAGEMENT & MAINTENANCE .....               | 34 |
| 7.1   | CONSTRUCTION PHASE SEDIMENT AND EROSION CONTROL .....                  | 34 |
| 7.2   | ASSET OWNERSHIP AND HANDOVER .....                                     | 34 |

|     |                                                                       |    |
|-----|-----------------------------------------------------------------------|----|
| 7.3 | MAINTENANCE OF BIO RETENTION BASINS DURING OPERATIONAL PHASE .....    | 35 |
| 8.0 | CONCLUSION .....                                                      | 36 |
|     |                                                                       |    |
|     | APPENDIX A – SITE SURVEY PLAN .....                                   | 37 |
|     | APPENDIX B – PRE AND POST DEVELOPMENT CATCHMENT PLANS .....           | 38 |
|     | APPENDIX C – DESIGN OF STORMWATER QUANTITY AND QUALITY BASIN .....    | 39 |
|     | APPENDIX D – BALANCE EARTHWORKS BELOW DEFINED FLOOD EVENT LEVEL ..... | 40 |
|     | APPENDIX E – MUSIC CATCHMENT PLAN .....                               | 41 |
|     | APPENDIX F – MUSIC LINK REPORT .....                                  | 42 |
|     | APPENDIX G – WSUD BIO RETENTION BASIN MAINTENANCE CHECKLISTS .....    | 43 |

## 1.0 INTRODUCTION

Gassman Development Perspectives (GDP) has been engaged by KS8 Pty. Ltd. (Client) to prepare a Site Based Stormwater Management Plan over land situated at 60 Stapylton Jacobs Well Road and 82 Christensen Road, Stapylton (Lot 1 on RP6882 and Lot 240 on W31320) being the 'subject site'.

This report has been prepared for submission to City of Gold Coast Council (Council) as part of a Development Application for Reconfiguration of Lot (38 industrial lots) with the intent of investigating and addressing the stormwater quantity and stormwater quality requirements for the proposed development in accordance with the applicable State and Local Government standards.

Stormwater quantity is addressed through pre and post development scenarios modelled in XPSTORM software utilising temporal pattern inputs from Council's Current Schedule 6.09 Land Development Guidelines Version 2.0. A strategy for managing post development peak flows discharging from the site and the required attenuation measures are provided to demonstrate that any increase in peak flows can be managed within the subject site as not to measurably impact neighbouring properties.

Stormwater quality analysis is also undertaken through the use of MUSIC software to confirm the adequacy of proposed Stormwater Quality Improvement Devices (SQIDs) required to meet the State Planning Policy's Water Quality Objectives (WQOs) and the pollutant removal targets set by City of Gold Coast Council.

A copy of the XPSTORM and MUSIC modelling data files are attached on a DVD for Council's records.

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*Revision 3 of this report (dated 30 August 2018) primarily focuses on the alterations to the bio-retention basin design arrangement for M38 Industrial Park - Stage 1. As a result of a SARA / QTMR request for the design modelling of the ultimate Stapylton Jacobs Well Road profile – the basin geometry and storage characteristics were amended. The hydraulic analysis results of the revised geometry and outlet configurations are contained in this report.*

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## 2.0 SITE CHARACTERISTICS

### 2.1 LOCATION

The subject site is located within the City of Gold Coast Council local government boundaries. The subject site is bounded by Stapylton Jacobs Well Road to the north, Christensen Road and existing industrial uses to the west and Council's land fill facility to the south-east.

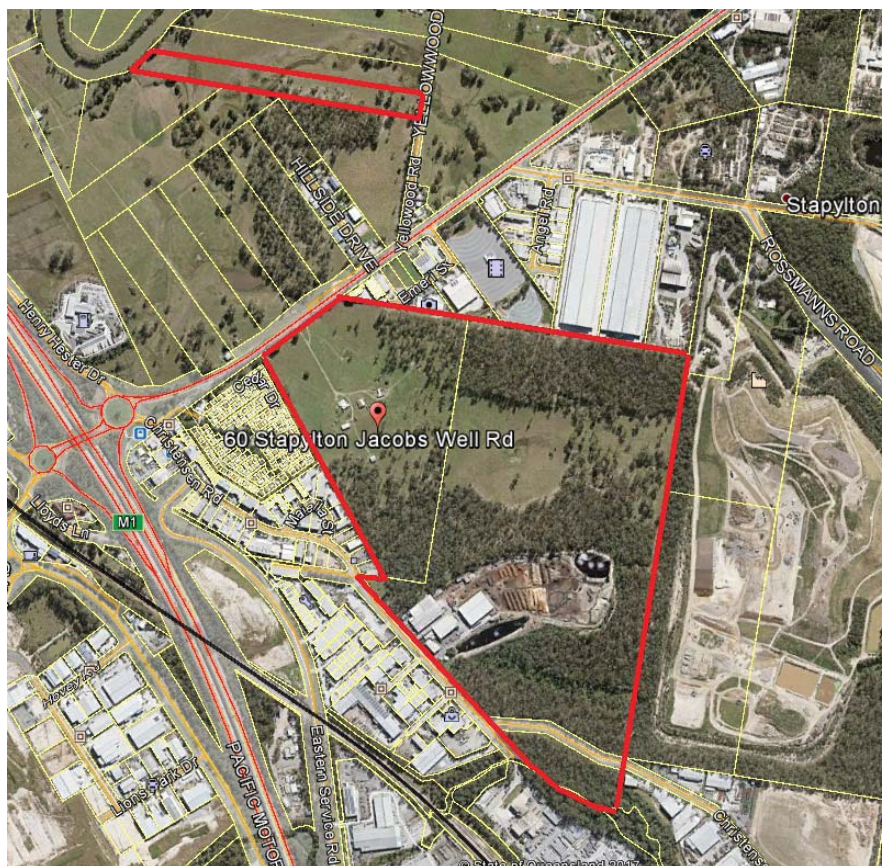


Figure 2.1: Site Locality Plan, Source: Google Earth 2017

### 2.2 SITE AREA

The current area of the site is 73.114 Ha of which the proposed bulk earthworks change to ground level works for Stage 1 makes up approximately 25.0 Ha, (16.1Ha development area).

### 2.3 EXISTING TOPOGRAPHY AND SITE DRAINAGE

Along the south-eastern boundary of the subject site is the existing high point of 29.23m AHD with a ridge line extending through to the properties' northern boundary. This existing topography defines the existing catchments of the site and current stormwater discharge locations along the northern and eastern boundaries. These low points are visible within

**Appendix A – Site Survey Plan** of the report with the pre development catchments defined within **Appendix B – Pre and Post Development Catchment Plans**.

## 2.4 EXISTING LAND USAGE

The subject land is mainly improved by an existing rural homestead and accompanying farming sheds consisting of vacant land and agricultural uses for specifically cattle grazing.

Amgrow Pty. Ltd. (soil and fertilizer distributor) leases approximately 9.4ha of part Lot 240 on W31320, for the purpose of mixing, reconditioning and distributing soil and fertilizer, on a wholesale basis. Warehouse buildings and ancillary offices are located on the leased land with sole access from Christensen Road.

The property at No.31 Yellowwood Road is currently used for the grazing of cattle mainly associated with the adjoining lands to the west. The land has a frontage to the Albert River to the rear of the property.

## 2.5 PLANNING PROVISIONS AND PROPOSED DEVELOPMENT

The subject site is zoned “Low Impact Industry, Future Precinct” and “Medium Impact Industry, Future Precinct” under Council’s current City Plan. The current proposal involves creating further industrial lots created within the subject site which will require large scale bulk earthworks necessary to facilitate clear and flat earthwork pads suitable for this land use.

## 2.6 FLOODING

The subject site is located within the extent of the Flood Overlay as defined in Council’s City Plan Interactive Mapping – Version 3.

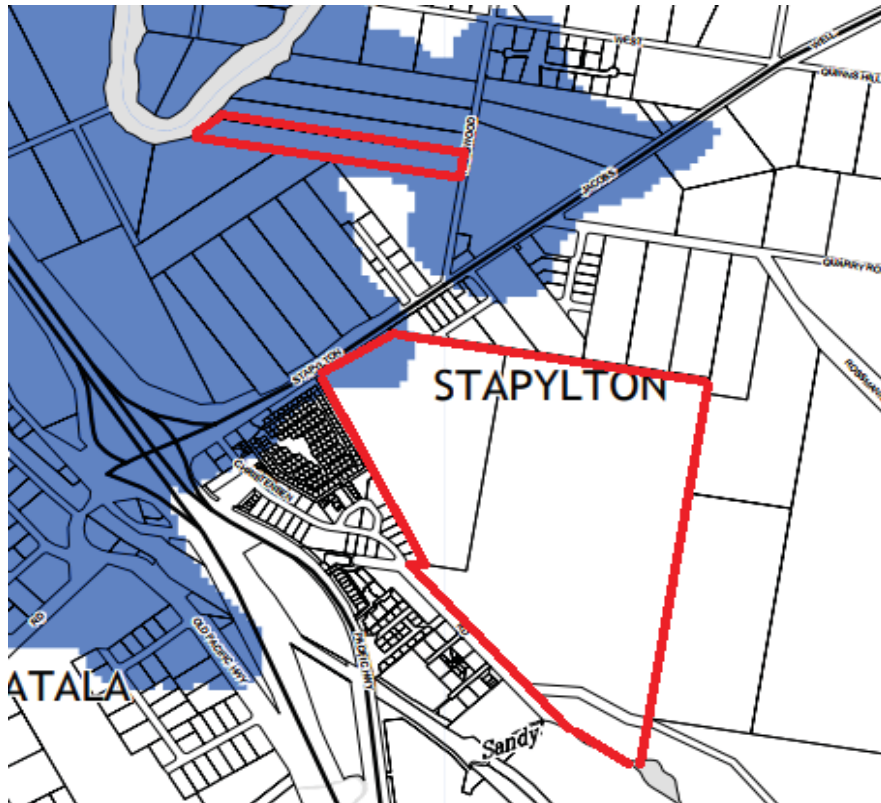
Compensatory cut within the Yellowwood Road property is proposed to balance flood storage where fill within the subject site is proposed below the defined flood event level of RL8.60m AHD (Q100).

On-site regional flood storage volumes have been calculated for the site based on Council’s provided flood level of 8.60m AHD and the existing surface levels within the property boundary. The volume of on-site regional flood storage is equal to **19,927 m<sup>3</sup>**. In summary, the compensatory balance flood storage proposal is as follows:

| Site Address                               | Available Q100 Flood Storage Volume |                       |
|--------------------------------------------|-------------------------------------|-----------------------|
|                                            | Pre Developed                       | Post Developed        |
| 60 Stapylton Jacobs Well Road, Stapylton   | 19,927 m <sup>3</sup>               | 14,544 m <sup>3</sup> |
| Shortfall of Flood Storage at Subject Site | 5,383 m <sup>3</sup>                |                       |
| Earthworks below Q100 at Yellowwood Rd     | 5,769 m <sup>3</sup> *              |                       |

\* A gain of 386 m<sup>3</sup> of flood storage has been achieved in the post development scenario.

Refer **Appendix D** which provides detailed drawings of the bulk earthworks proposal and how a flood storage balance between the pre and post development scenario will be achieved.



### 3.0 CONVEYANCE MANAGEMENT AND PRE AND POST DEVELOPMENT CATCHMENTS

#### 3.1 LAWFUL POINT OF DISCHARGE

The *Queensland Urban Drainage Manual* (QUDM) has set criteria that define a lawful point of discharge for a proposed development. These being:

- 1) The location of the discharge is under the control of the Local Authority or other statutory authority from whom permission to discharge has been received. This will include park, drainage or road reserve, stormwater drainage easement; and
- 2) That in discharging in that location, the discharge will not cause actionable nuisance (i.e. a nuisance from which the current or some future neighbouring proprietor may bring an action or claim for damages arising out of the nuisance). In general terms this implies no worsening as a result of the discharge.

The Stage 1 development will utilise one (1) lawful point of discharge being to the northern boundary of the site; utilising the existing 2.70m x 3.00m RCBC “cattle crossing” located under Stapylton Jacobs Well Road. The existing structure – used primarily for paddock-to-paddock farm access is an asset of QTMR. An extension to this structure is required to accommodate for the widened carriageway of the ultimate QTMR intersection upgrade.

### 3.2 PRE DEVELOPMENT CATCHMENTS

The existing natural slope currently dictates the overland flow and drainage pattern of the subject site as illustrated in the pre development stormwater catchment plan within **Appendix B**. The flow patterns generally follow the ridgeline out falling towards the existing low points of the site.

### 3.3 POST DEVELOPMENT CATCHMENTS

The intent of the proposed bulk earthworks outlined within this Stormwater Management Plan is to generally follow the pre development conditions to ensure no worsening of stormwater impacts downstream both during and post the construction period. Whilst the proposed bulk earthworks over the site generally flatten the existing steep grades of the land as part of creating the earthworked pads, the increase in impervious areas associated with the proposed land use mean that a hydrologic review is required to determine the changes in discharge characteristics (i.e. peak flow, water quality) from the site and identify suitable attenuation measures that need to be implemented to mitigate any potential downstream impacts. The post development catchments are illustrated within the post development catchment plan included within **Appendix B**.

## 4.0 HYDROLOGICAL ASSESSMENT

### 4.1 TEMPORAL PATTERNS AND RAINFALL DATA

In accordance with Council's City Plan Current Schedule 6.09 Land Development Guidelines, Council's Standard Drawings have been utilised to generate rainfall data for the various design storm hydrographs which have been utilised in the below modelling of stormwater runoff from the subject site. The parameters outlined in **Figure 4.10 and 4.11** below were determined from Council's standard drawings and were confirmed by referencing the Polynomial Coefficients table sourced from the Bureau of Meteorology.

| Parameter                        | Value (mm/hr where applicable)     |
|----------------------------------|------------------------------------|
| <b>Easting / Northing / Zone</b> | 523 493.88 E / 6 931 923.68 N / 56 |
| <b>Latitude / Longitude</b>      | 27.725 S / 153.250 E               |
| <b>1-2</b>                       | 49.40                              |
| <b>12-2</b>                      | 9.48                               |
| <b>72-2</b>                      | 3.19                               |
| <b>1-50</b>                      | 87.16                              |
| <b>12-50</b>                     | 18.68                              |
| <b>72-50</b>                     | 7.19                               |
| <b>Geographical Factor (F2)</b>  | 4.4                                |
| <b>Geographical Factor (F50)</b> | 17.22                              |
| <b>Map Skewness (G)</b>          | 0.08                               |

Figure 4.10: Temporal Pattern Summary, Sourced: CoGC City Plan Schedule 6.09

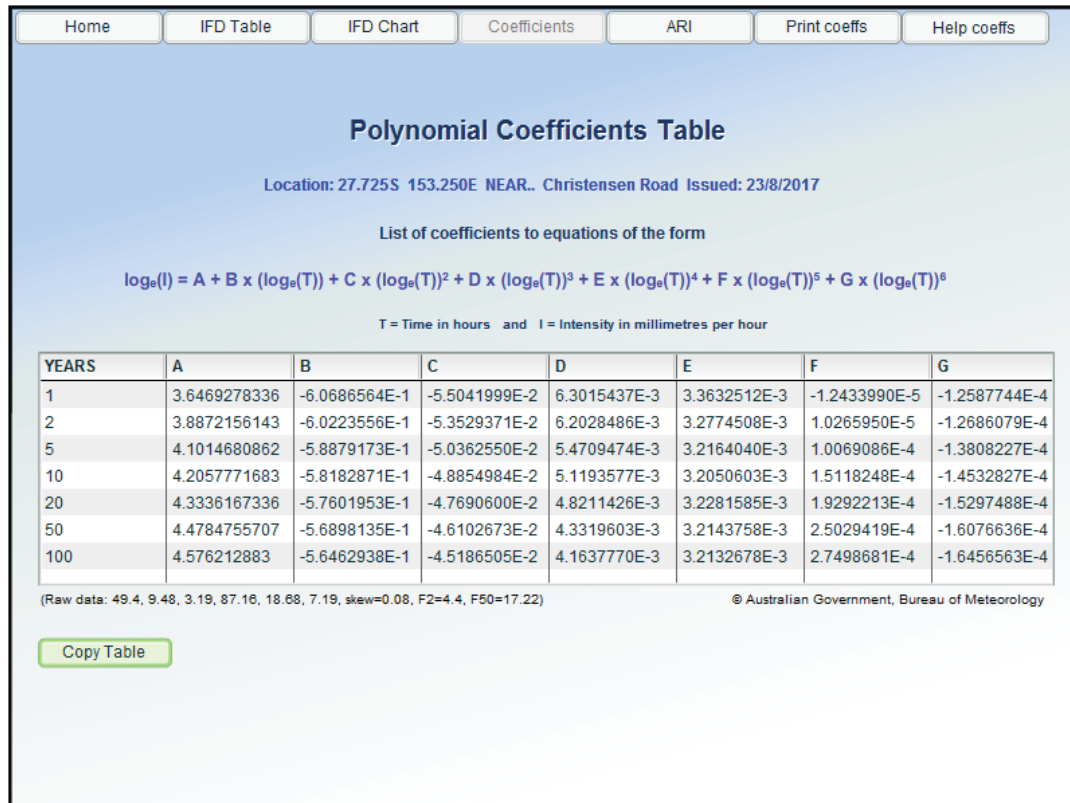


Figure 4.11: Temporal Pattern Summary Sourced from The BoM (Provided by XP Solutions)

## 4.2 CATCHMENTS

As discussed within Section 3 of this report the pre and post development stormwater catchments (refer **Appendix B**) have been determined using a combination of the site based Contour and Detail survey undertaken by Gassman Development Perspectives (refer **Appendix A**) along with Lidar survey of the surrounding area to identify any potential external catchments.

A summary of the parameters assigned to these sub-catchments used to assess the pre and post development flows is contained within **Tables 4.2A, 4.2B and 4.2C** below which aligns with the two scenarios assessed within this reporting.

| Parameter           |  | Sub-Catchments (Pre Development - Total Site) |        |        |
|---------------------|--|-----------------------------------------------|--------|--------|
| Name                |  | CAT-X1                                        | CAT-X2 | CAT-1  |
| Area (Ha)           |  | 1.637                                         | 2.182  | 12.715 |
| Vectored Slope (%)  |  | 1.00                                          | 1.00   | 5.41   |
| Impervious Area (%) |  | 90.00                                         | 90.00  | 5.00   |
| Pervious Area (%)   |  | 10.00                                         | 10.00  | 95.00  |
| Roughness (n)       |  | 0.020                                         | 0.020  | 0.080  |
| Parameter           |  | Catchments (Pre Development - Total Site)     |        |        |
| Name                |  | CAT-2                                         | CAT-3  | CAT-4  |
| Area (Ha)           |  | 7.114                                         | 3.015  | 8.666  |
| Vectored Slope (%)  |  | 5.95                                          | 5.54   | 5.80   |
| Impervious Area (%) |  | 1.00                                          | 0.00   | 0.00   |
| Pervious Area (%)   |  | 99.00                                         | 100.00 | 100.00 |
| Roughness (n)       |  | 0.050                                         | 0.080  | 0.100  |
| Parameter           |  | Catchments (Pre Development - Total Site)     |        |        |
| Name                |  | CAT-5                                         | CAT-6  | CAT-6A |
| Area (Ha)           |  | 4.144                                         | 6.474  | 4.767  |
| Vectored Slope (%)  |  | 4.02                                          | 3.91   | 3.50   |
| Impervious Area (%) |  | 0.00                                          | 0.00   | 35.00  |
| Pervious Area (%)   |  | 100.00                                        | 100.00 | 65.00  |
| Roughness (n)       |  | 0.050                                         | 0.100  | 0.030  |
| Parameter           |  | Catchments (Pre Development - Total Site)     |        |        |
| Name                |  | CAT-7                                         | CAT-7A | CAT-8  |
| Area (Ha)           |  | 9.981                                         | 3.410  | 2.481  |
| Vectored Slope (%)  |  | 3.51                                          | 2.50   | 3.00   |
| Impervious Area (%) |  | 0.00                                          | 85.00  | 0.00   |
| Pervious Area (%)   |  | 100.00                                        | 15.00  | 100.00 |
| Roughness (n)       |  | 0.060                                         | 0.020  | 0.060  |
| Parameter           |  | Catchments (Pre Development - Total Site)     |        |        |
| Name                |  | CAT-9                                         | CAT-10 |        |
| Area (Ha)           |  | 2.210                                         | 8.523  |        |
| Vectored Slope (%)  |  | 2.21                                          | 6.45   |        |
| Impervious Area (%) |  | 0.00                                          | 8.20   |        |
| Pervious Area (%)   |  | 100.00                                        | 91.80  |        |
| Roughness (n)       |  | 0.060                                         | 0.030  |        |

Table 4.2A: Pre Development Catchment Parameters

| Parameter                   |                                                                      | Catchments (Total Site) |        |
|-----------------------------|----------------------------------------------------------------------|-------------------------|--------|
| Reporting Location          | LPOD-1                                                               | LPOD-2                  | LPOD-3 |
| Contributing Sub Catchments | CAT-1, CAT-2, CAT-3, CAT-X2, CAT-4, CAT-5, CAT-6, CAT-6A, and CAT-X1 | CAT-7 and CAT-7A        | CAT-8  |
| Area (Ha)                   | 50.714                                                               | 13.391                  | 2.481  |
| Vectored Slope (%)          | 4.01                                                                 | 3.01                    | 3.00   |
| Impervious Area (%)         | 3.10                                                                 | 2.50                    | 0.00   |
| Pervious Area (%)           | 96.90                                                                | 97.50                   | 100.00 |
| Roughness (n)               | 0.059                                                                | 0.059                   | 0.060  |
| Initial Loss (mm)           | 5.00                                                                 | 5.00                    | 5.00   |
| Continuing Loss (mm/hr)     | 2.50                                                                 | 2.50                    | 2.50   |
| Parameter                   |                                                                      | Catchments (Total Site) |        |
| Reporting Location          | LPOD-4                                                               | LPOD-5                  |        |
| Contributing Sub Catchments | CAT-9                                                                | CAT-10                  |        |
| Area (Ha)                   | 2.21                                                                 | 8.523                   |        |
| Vectored Slope (%)          | 2.21                                                                 | 6.45                    |        |
| Impervious Area (%)         | 0.00                                                                 | 8.20                    |        |
| Pervious Area (%)           | 100.00                                                               | 91.80                   |        |
| Roughness (n)               | 0.060                                                                | 0.030                   |        |
| Initial Loss (mm)           | 5.00                                                                 | 5.00                    |        |
| Continuing Loss (mm/hr)     | 2.50                                                                 | 2.50                    |        |

Table 4.2B: Contributing Catchment Parameters to Reporting Locations

| Parameter                         |  | Catchments (Post Development - Stage 1) |                     |
|-----------------------------------|--|-----------------------------------------|---------------------|
| Name                              |  | CAT-10A<br>Impervious                   | CAT-10A<br>Pervious |
| Total Area (Ha)                   |  | 15.882                                  |                     |
| Area Split (Ha)                   |  | 14.294                                  | 1.588               |
| Vectored Slope (%)                |  | 2.55                                    | 2.55                |
| Impervious Area (%)               |  | 100.00                                  | 0.00                |
| Roughness (n) for Impervious Area |  | 0.020                                   | -                   |
| Pervious Area (%)                 |  | 0.00                                    | 100.00              |
| Roughness (n) for Pervious Area   |  | -                                       | 0.045               |
| Initial Loss (mm)                 |  | 0.00                                    | 5.00                |
| Continuing Loss (mm/hr)           |  | 2.50                                    | 2.50                |

Table 4.2C: Post Development Catchment Parameters

### 4.3 LAND USE

Land uses were mapped within the pre and post development catchments with the varying hydraulic roughness and hydrological losses input into the XPSTORM model summarised in **Table 4.3 below**.

| Land Use Type        | Initial Loss<br>(mm) | Continuing Loss<br>(mm/hr) |
|----------------------|----------------------|----------------------------|
| <b>Pre Developed</b> |                      |                            |
| <b>Pervious</b>      | 5.0                  | 2.5                        |
| <b>Impervious</b>    | 0.0                  | 2.5                        |

| Land Use Type         | Initial Loss<br>(mm) | Continuing Loss<br>(mm/hr) |
|-----------------------|----------------------|----------------------------|
| <b>Post Developed</b> |                      |                            |
| <b>Pervious</b>       | 5.0                  | 2.5                        |
| <b>Impervious</b>     | 0.0                  | 2.5                        |

Table 4.3: Summary of Adopted Initial & Continuing Losses

### 4.4 PRE AND POST DEVELOPMENT FLOW CALCULATIONS

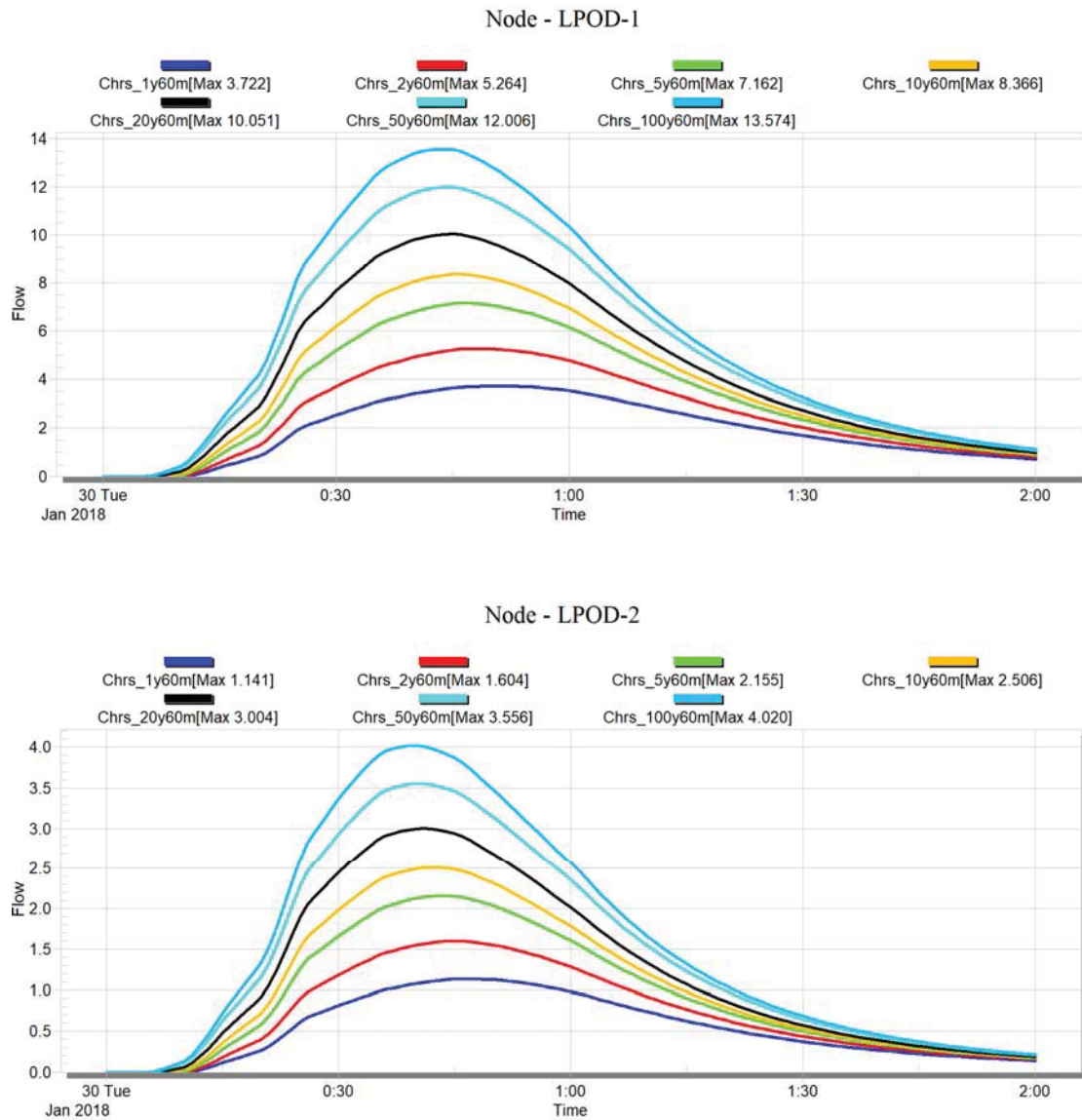
XPSTORM modelling software was utilised to determine the pre and post development discharge flow rate for each catchment based on the parameters listed above.

The computations were run for the standard Average Recurrence Intervals (ARI) 1, 2, 5, 10, 20, 50 and 100 years. Catchment runoff volumes to the respective existing lawful points of discharge (reporting locations) are summarised in **Table 4.4**. *Catchment: CAT-10 for LPOD-5 is the only catchment area influenced by the subject Stage 1 development proposal.*

| Catchment                                               | Peak Flow Rates for Average Recurrence Interval (m <sup>3</sup> /s)      |                      |                      |                       |                       |                       |                        |
|---------------------------------------------------------|--------------------------------------------------------------------------|----------------------|----------------------|-----------------------|-----------------------|-----------------------|------------------------|
| <b>Pre Developed Condition<br/>(Critical Duration)</b>  | <b>Q<sub>1</sub></b>                                                     | <b>Q<sub>2</sub></b> | <b>Q<sub>5</sub></b> | <b>Q<sub>10</sub></b> | <b>Q<sub>20</sub></b> | <b>Q<sub>50</sub></b> | <b>Q<sub>100</sub></b> |
| <b>LPOD-1 (60 min)</b>                                  | 3.722                                                                    | 5.264                | 7.162                | 8.366                 | 10.051                | 12.006                | 13.574                 |
| <b>LPOD-2 (60 min)</b>                                  | 1.141                                                                    | 1.604                | 2.155                | 2.506                 | 3.004                 | 3.556                 | 4.020                  |
| <b>LPOD-3 (60 min)</b>                                  | 0.268                                                                    | 0.372                | 0.498                | 0.578                 | 0.688                 | 0.801                 | 0.902                  |
| <b>LPOD-4 (60 min)</b>                                  | 0.213                                                                    | 0.297                | 0.399                | 0.463                 | 0.553                 | 0.650                 | 0.736                  |
| <b>LPOD-5 (CAT-10) (25 min)</b>                         | 1.875                                                                    | 2.640                | 3.472                | 3.901                 | 4.565                 | 4.848                 | <b>5.403</b>           |
| <b>Catchment</b>                                        | <b>Peak Flow Rates for Average Recurrence Interval (m<sup>3</sup>/s)</b> |                      |                      |                       |                       |                       |                        |
| <b>Post Developed Condition<br/>(Critical Duration)</b> | <b>Q<sub>1</sub></b>                                                     | <b>Q<sub>2</sub></b> | <b>Q<sub>5</sub></b> | <b>Q<sub>10</sub></b> | <b>Q<sub>20</sub></b> | <b>Q<sub>50</sub></b> | <b>Q<sub>100</sub></b> |
| <b>LPOD-5 (CAT-10A) (15 min)</b>                        | 4.798                                                                    | 6.083                | 7.484                | 8.272                 | 9.369                 | 10.138                | <b>11.152</b>          |

Table 4.4: Flow Rates Calculated Using the Laurenson Method in XPSTORM

**Figure 4.12** below contains the pre developed peak flow rate hydrographs per reporting location / lawful point of discharge:



**Figure 4.12: Pre Developed Peak Flow Rate Hydrographs**

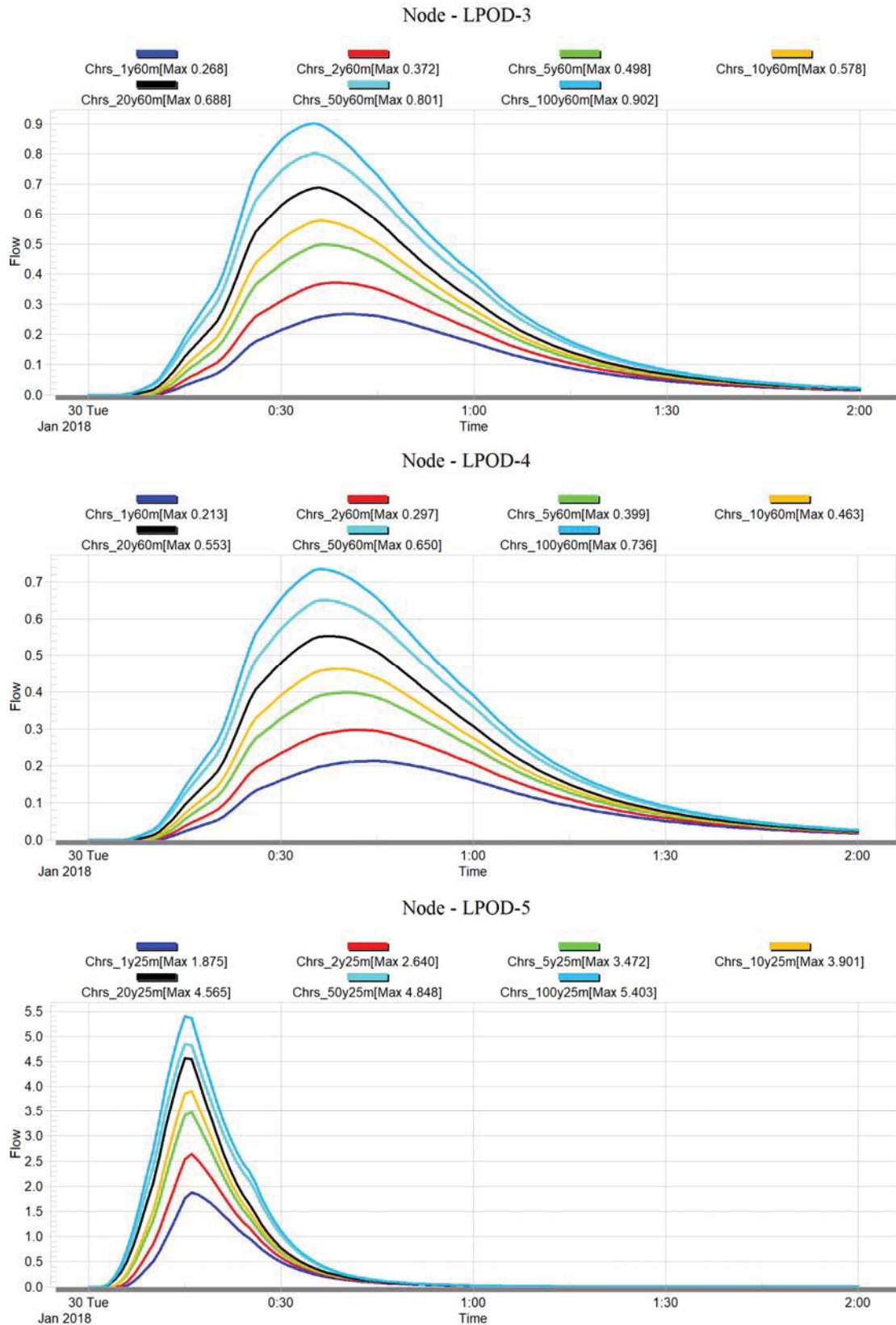
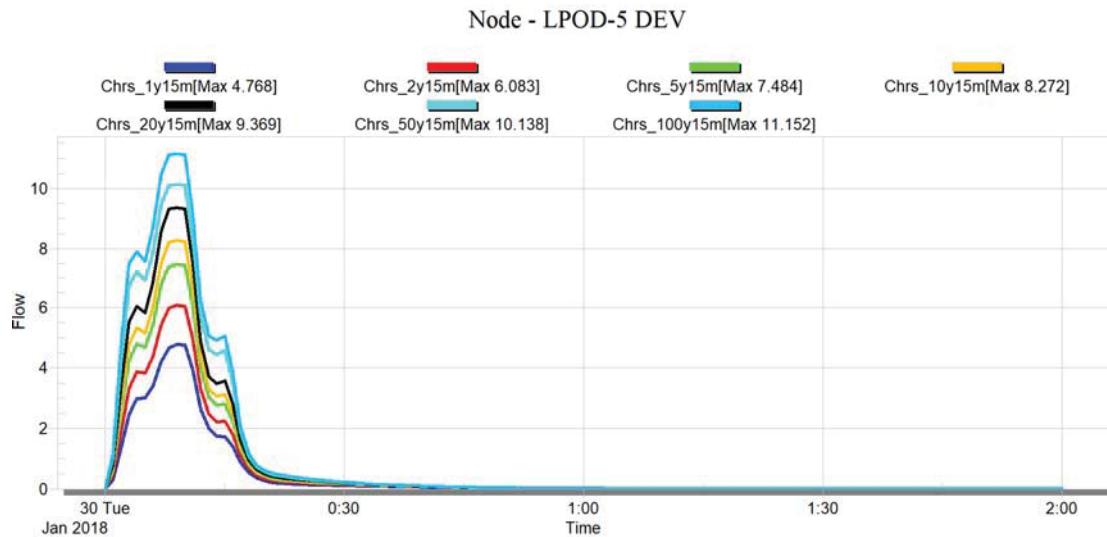


Figure 4.12: Pre Developed Peak Flow Rate Hydrographs (cont.)

**Figure 4.13** below contains the post developed peak flow rate hydrograph at the reporting location / lawful point of discharge (CAT-10A / LPOD-5):



**Figure 4.13: Post Developed Peak Flow Rate Hydrograph**

## 5.0 STORMWATER QUANTITY, DETENTION & HYDRAULIC DESIGN

### 5.1 ATTENUATION OF DEVELOPED FLOWS

To ensure that the increased flow rates from the developed site have minimal impact on downstream property, the following hydrological objective has been set for stormwater exiting the subject site;

- *No increase in peak discharge flow rates from the developed site to downstream infrastructure.*

To achieve this objective, stormwater discharge from the development must be detained to pre development flow rates for all storm events up to and including Q100. The following sections provide a summary of the procedure used to design the onsite detention system at subject site.

### 5.2 METHODOLOGY

For the site catchment identified as having an increase in peak flow rates when developed, a hydrologic model was created using XPSTORM. The model was then used to route post-development runoff through various proposed detention structures to determine the most efficient on-site detention system.

#### 5.2.1 MODEL CONDITIONS

In XPSTORM three (3) hydraulic conditions were modelled in order to demonstrate the stormwater quantity, detention and hydraulic objective;

1. Existing Condition - Current condition of site with all the external catchments to assess the natural hydrology.
2. Developed Condition - Future condition of site when developed with all the external catchments. The main changes in hydrology as part of development include; increase in impervious area of the subject site due to the construction of the hardstand and other impervious areas and reduction in Manning's roughness coefficient for sections of the site to be developed.
3. Mitigated Condition - Future condition of site when developed with proposed detention structures in place with all the external catchments where applicable.

## 5.2.2 CRITICAL STORM EVENT AND DURATIONS

An analysis of storm events ranging from Q1 to Q100 was undertaken to determine the critical storm event and the critical storm duration per catchment. The determined critical storm events for the pre developed and post developed condition are indicated in **Table 5.2.2** below.

| MODEL CONDITION | CRITICAL STORM EVENT | CRITICAL STORM DURATION |
|-----------------|----------------------|-------------------------|
| Pre Developed   | Storm                | (mins)                  |
| LPOD-1          | Q100                 | 60                      |
| LPOD-2          | Q100                 | 60                      |
| LPOD-3          | Q100                 | 60                      |
| LPOD-4          | Q100                 | 60                      |
| LPOD-5          | Q100                 | 25                      |

| MODEL CONDITION | CRITICAL STORM EVENT | CRITICAL STORM DURATION |
|-----------------|----------------------|-------------------------|
| Post Developed  | Storm                | (mins)                  |
| LPOD-5          | Q100                 | 15                      |

Table 5.2.2: Critical Storm Event and Duration Summary Table

Critical storm duration hydrographs per model condition are indicated in **Figures 5.2.1 and 5.2.2**.

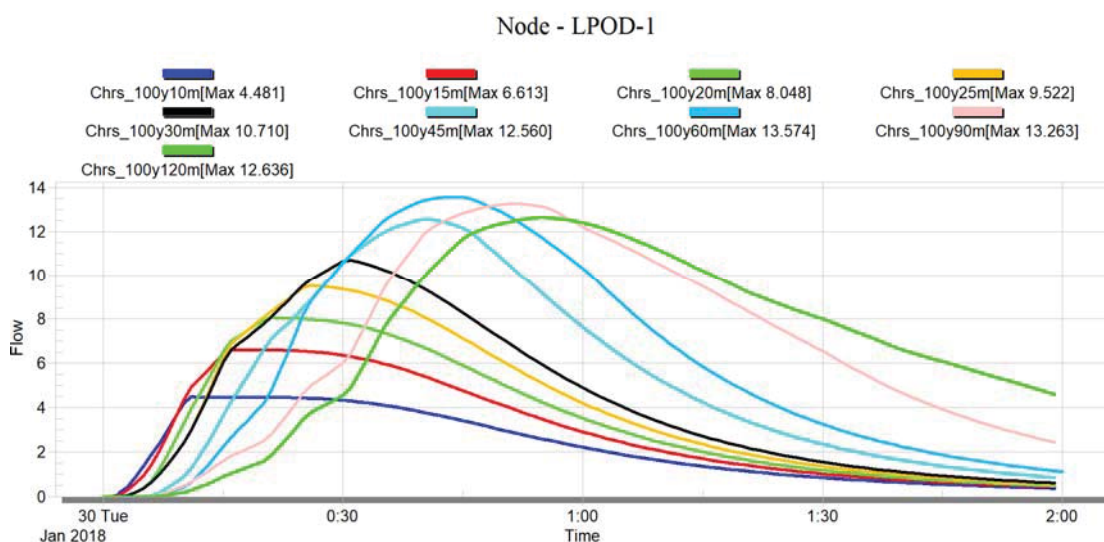
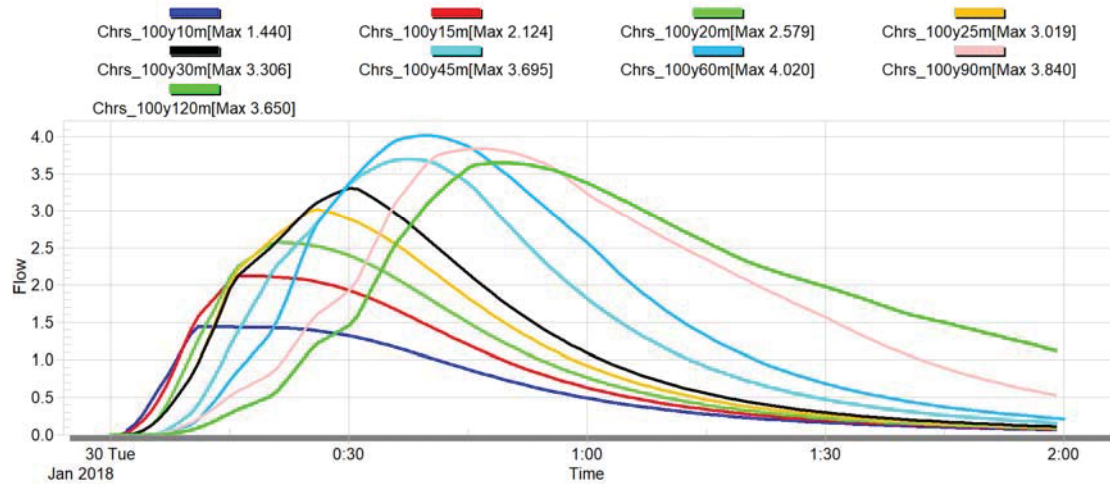
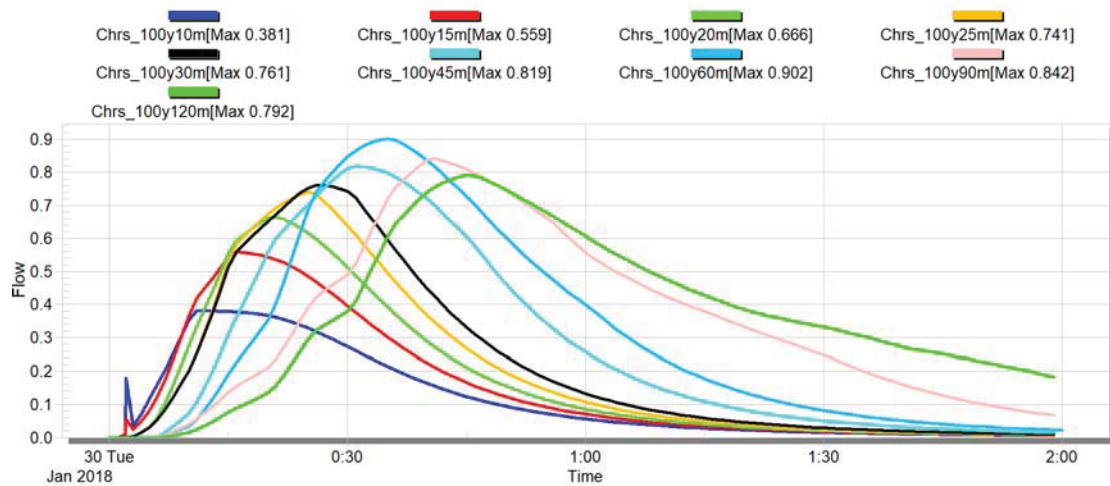


Figure 5.2.1: Critical Storm Event Durations for all *Pre Developed* Catchments (LPOD-1,2,3,4,5)

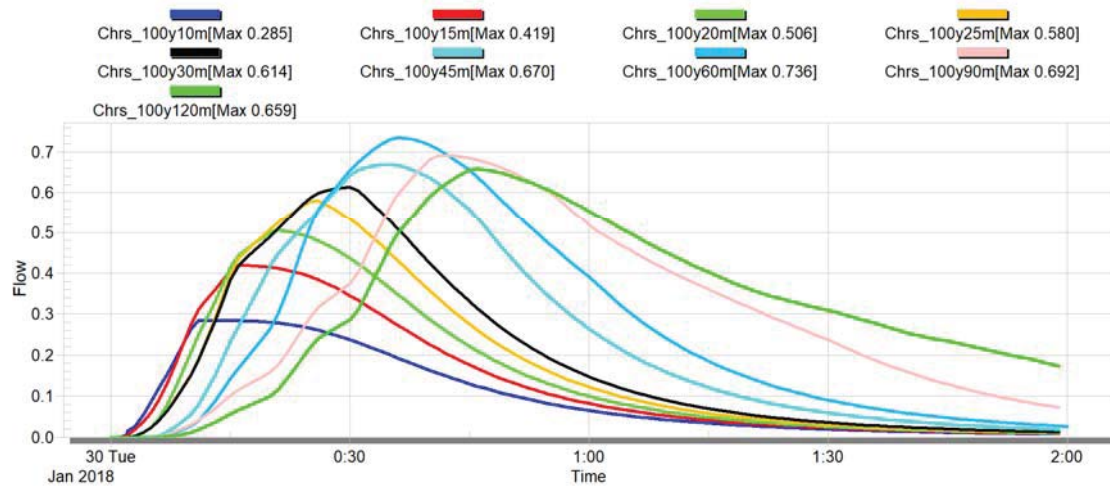
### Node - LPOD-2



### Node - LPOD-3



### Node - LPOD-4



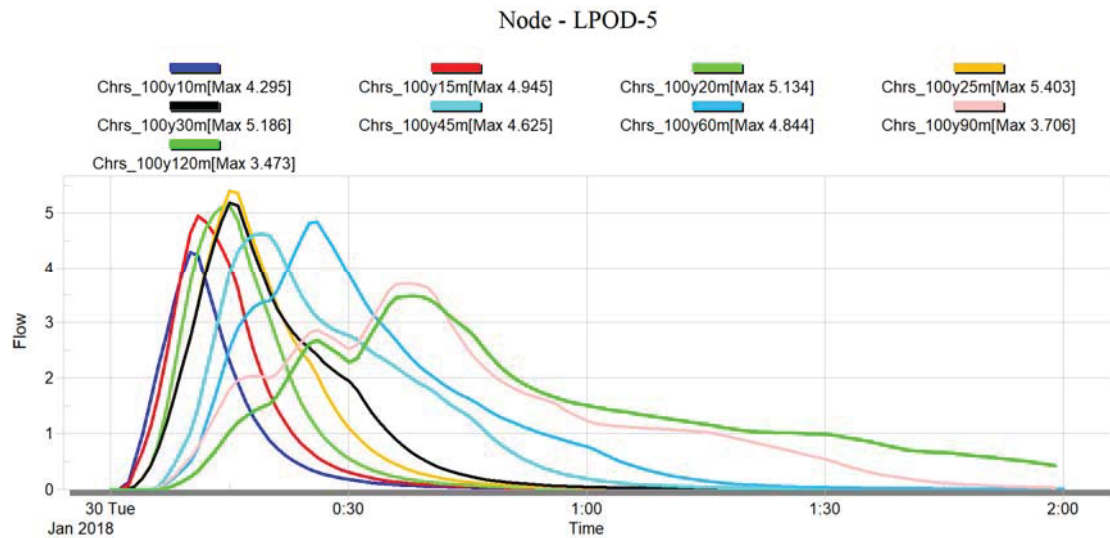


Figure 5.2.1: Critical Storm Event Durations for *Pre Developed* Catchments (LPOD-1,2,3,4,5)

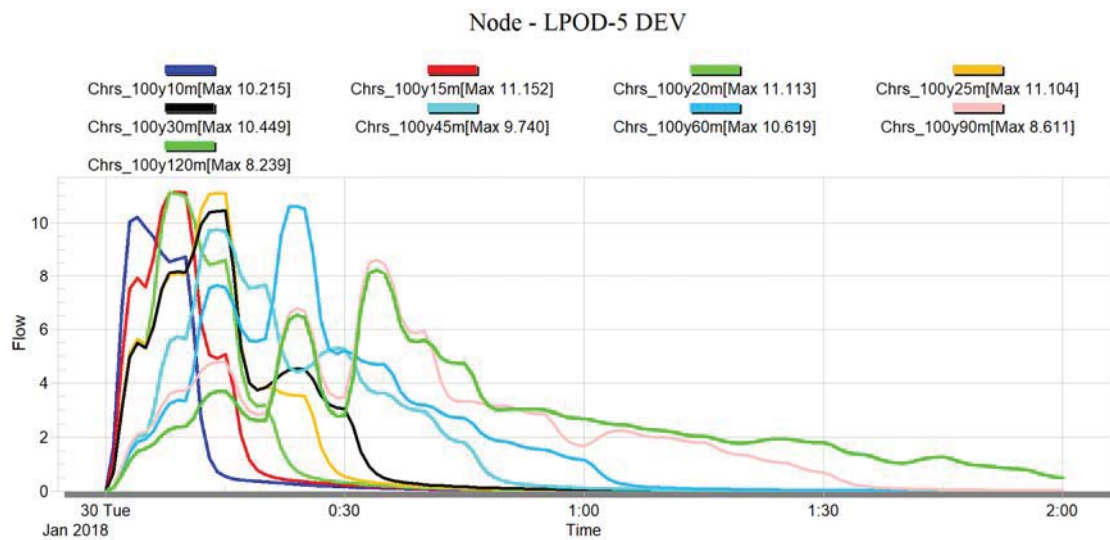


Figure 5.2.2: Critical Storm Event Durations for *Post Developed* Catchment (LPOD-5)

### 5.2.3 DETENTION SYSTEM DESIGN

Detention devices capture and temporarily store stormwater runoff during major / critical storm events and release to the Lawful Point of Discharge (LPoD) at a controlled rate. Hence, detention devices act to mitigate potential downstream flooding impacts and also provide minor water quality treatment.

Therefore, to achieve the objective of zero post development flow rate increase to pre-developed Q1 to Q100 year ARI flow rates at the downstream reporting location (outfall), on-site detention basins are introduced with low and high flow discharge devices.

**Table 5.2.3** includes the design details for the proposed on site detention system for Stage 1.

| Parameter                                        | Value                                                                                                                                                                                                                |
|--------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Catchment</b>                                 | <b>CAT-10A</b>                                                                                                                                                                                                       |
| Type                                             | Detention Basin (in ground)                                                                                                                                                                                          |
| Internal Batter Slope on Basin Sides             | 1 in 3                                                                                                                                                                                                               |
| Basin Base RL                                    | 5.80 m AHD                                                                                                                                                                                                           |
| Basin Embankment / Crown R.L                     | 8.10 m AHD                                                                                                                                                                                                           |
| Basin Weir Crest RL                              | 7.66 m AHD                                                                                                                                                                                                           |
| Freeboard to Crown                               | 0.44m                                                                                                                                                                                                                |
| Detention Volume Depth                           | 1.889m to Q100 WSL ( <i>measured from floor IL of basin</i> )                                                                                                                                                        |
| Detention Volume to Crown (m <sup>3</sup> )      | 8,458 to RL 8.10m ( <i>deducting 0.30m extended detention</i> )                                                                                                                                                      |
| Detention Volume to Q100 WSL (m <sup>3</sup> )   | 6,348 to RL 7.689m ( <i>deducting 0.30m extended detention</i> )                                                                                                                                                     |
| Detention Volume to Weir Crest (m <sup>3</sup> ) | 6,208 to RL 7.660m ( <i>deducting 0.30m extended detention</i> )                                                                                                                                                     |
| Low Flow Outlets                                 | 2 / 600mm x 600mm dome top field inlet pits, top of grate level set at 0.300m above basin floor; and 225mm dia. outlet orifice; IL at 0.600m above basin floor                                                       |
| High Flow Outlets                                | 1 / 1500 x 2000mm grated field inlet pit at 1.175m above basin floor, 1 / 1050mm RCP laid at max. grade of 3.50%, 10.0 metre wide broad crested weir set at 1.860m above basin floor with 1.70 discharge coefficient |

**Table 5.2.3: Summary of Design Parameters of Proposed Detention System for Stage 1**

#### 5.2.4 MODEL RESULTS

**Table 5.2.4.1** presents the results obtained from XPSTORM modelling as a result of implementing the above detention system for flow mitigation.

| PRE-DEVELOPED PEAK FLOWS FOR CAT-10 |       |       |       |       |       |       |              |
|-------------------------------------|-------|-------|-------|-------|-------|-------|--------------|
| ARI (Years)                         | Q1    | Q2    | Q5    | Q10   | Q20   | Q50   | Q100         |
| LPOD-5 (CAT-10) (25 min)            | 1.875 | 2.640 | 3.472 | 3.901 | 4.565 | 4.848 | <b>5.403</b> |

| PEAK FLOWS (POST MITIGATION) FOR CAT-10A |              |              |              |              |              |              |              |
|------------------------------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| ARI (Years)                              | Q1           | Q2           | Q5           | Q10          | Q20          | Q50          | Q100         |
| Peak Flow (m <sup>3</sup> /sec)          | <b>1.132</b> | <b>2.046</b> | <b>3.472</b> | <b>3.828</b> | <b>4.240</b> | <b>4.576</b> | <b>4.962</b> |
| Max Water Elevation RL                   | 7.006        | 7.181        | 7.275        | 7.361        | 7.475        | 7.578        | 7.689        |
| Peak Duration (min)                      | 60           | 60           | 90           | 90           | 90           | 60           | 60           |
| Depth to WSL (m)                         | 1.206        | 1.381        | 1.475        | 1.561        | 1.675        | 1.778        | 1.889        |

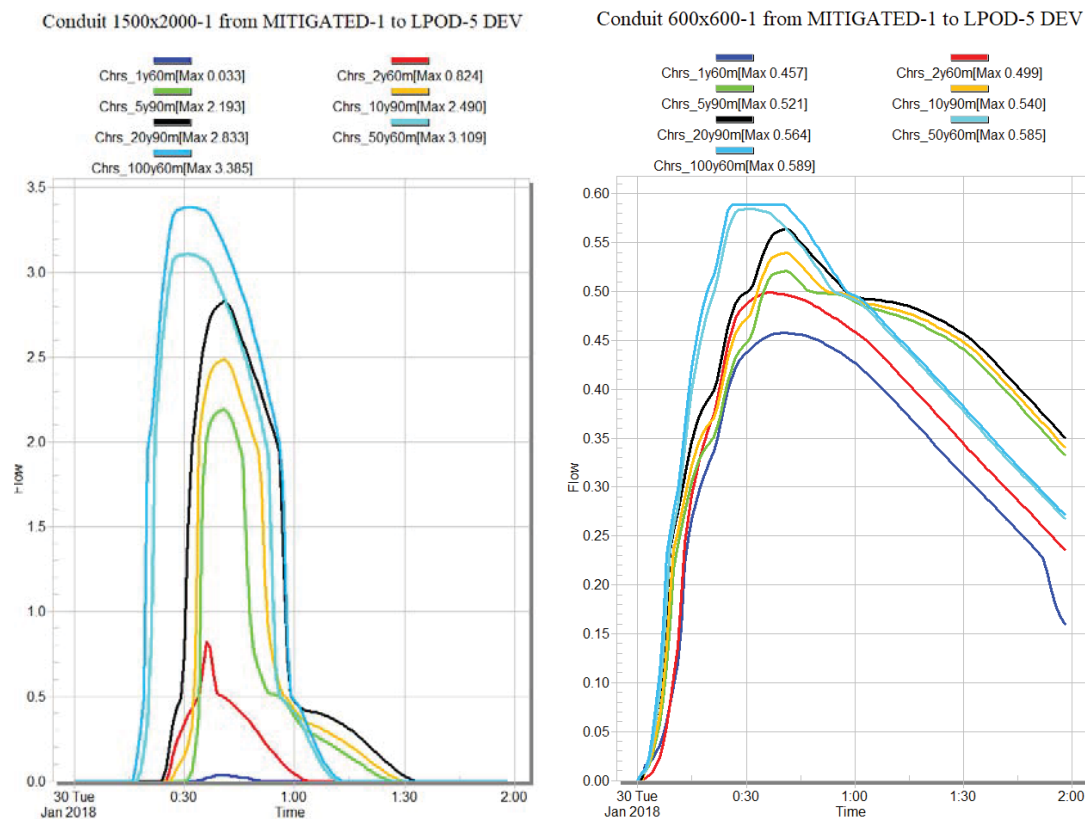
**Table 5.2.4.1: Summary of XPSTORM Hydrologic / Hydraulic Results at Catchment CAT-10A**

**Figures 5.2.3-1 to 5.2.3-3** below presents the hydrograph results obtained from XPSTORM for the multiple outflow discharges from the proposed detention basin. **Table 5.2.4.2** sums the discharges and compares directly against the pre developed hydrology condition across a range of storm events.

| MITIGATED DISCHARGE SUMMARY PROPOSED DETENTION BASIN |              |              |              |              |              |              |              |
|------------------------------------------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| ARI (Years)                                          | Q1           | Q2           | Q5           | Q10          | Q20          | Q50          | Q100         |
| 1500 x 2000mm F.I. (m3/s)                            | 0.033        | 0.824        | 2.192        | 2.490        | 2.833        | 3.109        | 3.385        |
| 600 x 600mm F.I. (1) (m3/s)                          | 0.457        | 0.499        | 0.520        | 0.540        | 0.564        | 0.585        | 0.589        |
| 600 x 600mm F.I. (2) (m3/s)                          | 0.457        | 0.499        | 0.520        | 0.540        | 0.564        | 0.585        | 0.589        |
| 225mm dia. Orifice (m3/s)                            | 0.185        | 0.224        | 0.240        | 0.258        | 0.279        | 0.297        | 0.315        |
| 10 metre Wide Weir (m3/s)                            | 0.000        | 0.000        | 0.000        | 0.000        | 0.000        | 0.000        | 0.084        |
| <b>TOTAL (m3/s)</b>                                  | <b>1.132</b> | <b>2.046</b> | <b>3.472</b> | <b>3.828</b> | <b>4.240</b> | <b>4.576</b> | <b>4.962</b> |

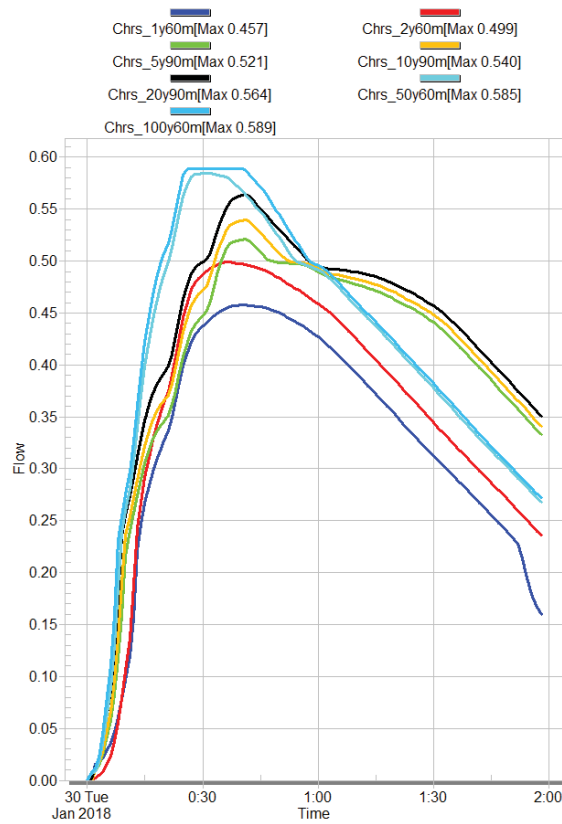
|                                                       |       |       |       |       |       |       |       |
|-------------------------------------------------------|-------|-------|-------|-------|-------|-------|-------|
| <b>Flow Mitigation from Existing Condition (m3/s)</b> | 0.743 | 0.594 | 0.000 | 0.073 | 0.325 | 0.272 | 0.441 |
| <b>Attenuation Achieved (Y/N)</b>                     | Y     | Y     | Y     | Y     | Y     | Y     | Y     |

**Table 5.2.4.2: Summary of Mitigated Discharges from XPSTORM Hydrologic / Hydraulic Results**

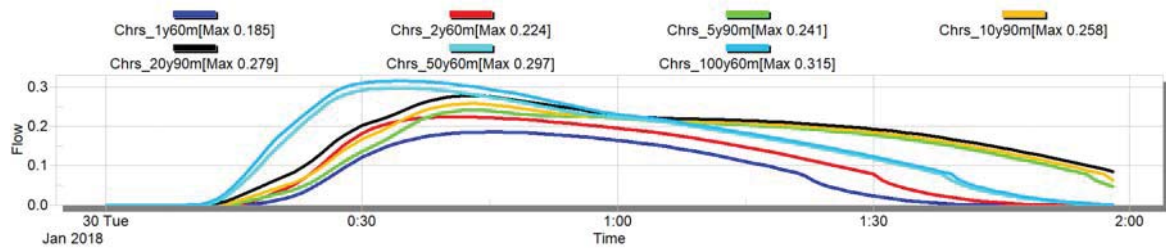


**Figure 5.2.3-1: Peak Duration Mitigated Discharge Hydrographs from XPSTORM**

Conduit 600x600-2 from MITIGATED-1 to LPOD-5 DEV



Diversion ORIF-1 from MITIGATED-1 to LPOD-5 DEV



Diversion WEIR-1 from MITIGATED-1 to LPOD-5 DEV

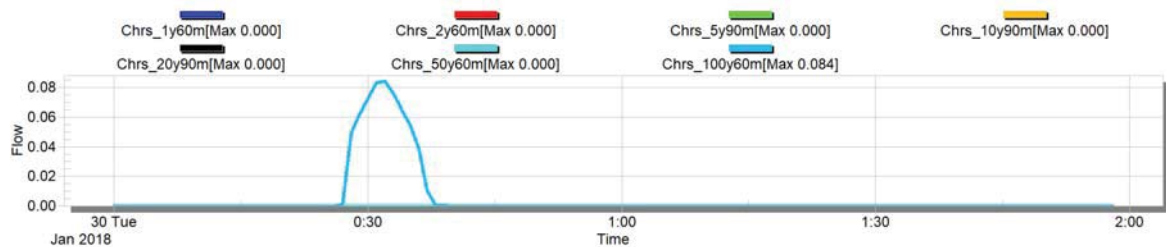


Figure 5.2.3-2: Peak Mitigated Discharge Hydrographs from XPSTORM (cont.)

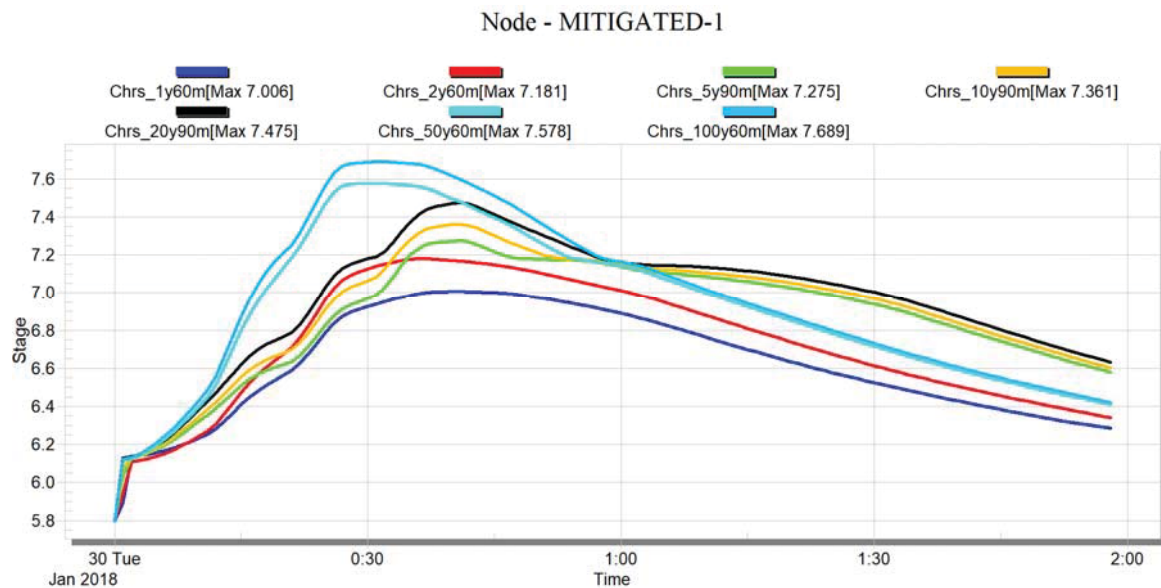


Figure 5.2.3-3: Peak Stage Relationship Indicating Water Surface Elevations from XPSTORM

## 5.2.5 DISCUSSION ON MODELLING OUTCOMES

The above hydraulic modelling has confirmed that there is no increase in peak discharge flow rates from the development site to existing infrastructure or downstream / neighbouring properties by implementing the proposed designed detention measures. All ARI's ranging from Q1 to Q100 achieve mitigation.

Refer important note below.

### Important Note:

*Due to the predicted water surface elevations and depths – it is proposed that the bio-retention basin will be fenced to restrict public access for safety, at it's perimeter. Fencing is proposed as the City of Gold Coast Council's standard chain wire type fencing at a height of 1.80 metres above finished ground level. Chain wire, posts and fittings are proposed to be black in colour.*

*Reference is made to CoGC Standard Drawing 05-014 (City Plan v5).*

*Adequate provision has been made for a master-key locked gate location to enable access for Council staff to the maintenance track, adjoining the internal entry road in Stage 1.*

## 6.0 STORMWATER QUALITY

Stormwater quality analysis has been undertaken through the use of MUSIC software to confirm the adequacy of proposed Stormwater Quality Improvement Devices (SQIDs) required to meet the State Planning Policy's (SPP 2014) Water Quality Objectives (WQOs) and the pollutant removal targets set by the City of Gold Coast Council. A suitable treatment strategy addressing the typical pollutant types generated during construction and operation of an industrial development are outlined within this section of reporting.

### 6.1 POLLUTANTS OF CONCERN

There are a number of pollutants typically generated during the operational phase (following construction) of an industrial development. These include:

- **Litter / gross pollutants**
- **Sediment**
- Toxic materials
- Heavy metals
- Hydrocarbons
- **Nutrients (i.e. nitrogen & phosphorous)**
- Pathogens / faecal coliforms
- Oxygen demanding substance
- Surfactants
- Acid or alkaline substances
- Organochlorines & organophosphates
- Thermal pollution

The key pollutants highlighted in **bold** above represent those that will be further addressed within this report. This will be done through the use of MUSIC modelling software which will assist in estimating the generation of the pollutants in the developed condition and the associated treatment measures requiring implementation in order to meet the stormwater quality objectives as defined within Section 6.2 of this report.

### 6.2 STORMWATER QUALITY OBJECTIVES (OPERATIONAL PHASE)

City of Gold Coast Council have set stormwater quality objectives with the intent of "protecting receiving water quality by limiting the quantity (loads) of stormwater pollutants discharged into receiving waters from development" such as that proposed over the subject site. These are summarised in Table SC6.9.3-3 of Council's City Plan Version 2.0 Schedule 6.9 and outlined below.

| Pollutant                    | Load Reduction Objective<br>(in mean annual load) |
|------------------------------|---------------------------------------------------|
| Gross Pollutants (>5mm)      | 90%                                               |
| Total Suspended Solids (TSS) | 80%                                               |
| Total Phosphorous (TP)       | 60%                                               |
| Total Nitrogen (TN)          | 45%                                               |

Table 6.2: CoGC's Stormwater Quality Objectives (Source: City Plan, Schedule 6.9)

### 6.3 PROPOSED STORMWATER QUALITY MANAGEMENT STRATEGY

Development over the subject site has the potential to introduce increased pollutant loads and concentrate stormwater runoff into existing downstream waterways. To mitigate any potential increase in the export of pollutants from the subject site, suitable stormwater treatment devices will be utilised throughout the developed area as part of the integrated design of the road and stormwater drainage networks.

The implementation of a site specific stormwater treatment train prior to the discharge of stormwater from the site will ensure the quality objectives outlined in Section 6.2 of this report are achieved.

#### 6.3.1 BIO RETENTION BASINS

Due to the spatial allowances over the subject site and the proposed development type, bio retention basins have been identified as a suitable Stormwater Quality Improvement Device (SQID) to reduce the off-site discharge of pollutants in line with the operational phase stormwater quality objectives identified within this report.

Bio retention basins are designed to treat conveyed stormwater by filtering the water through various layers of vegetation, biologically active sands and loam filter media which capture the pollutants as the water percolates down through the system.

The treated water is then conveyed through slotted / perforated pipes to downstream drainage systems (*Bioretention Technical Design Guidelines Version 1.1, October 2014*). A typical configuration of a bio retention system is outlined in Figure 6.3.1 below.

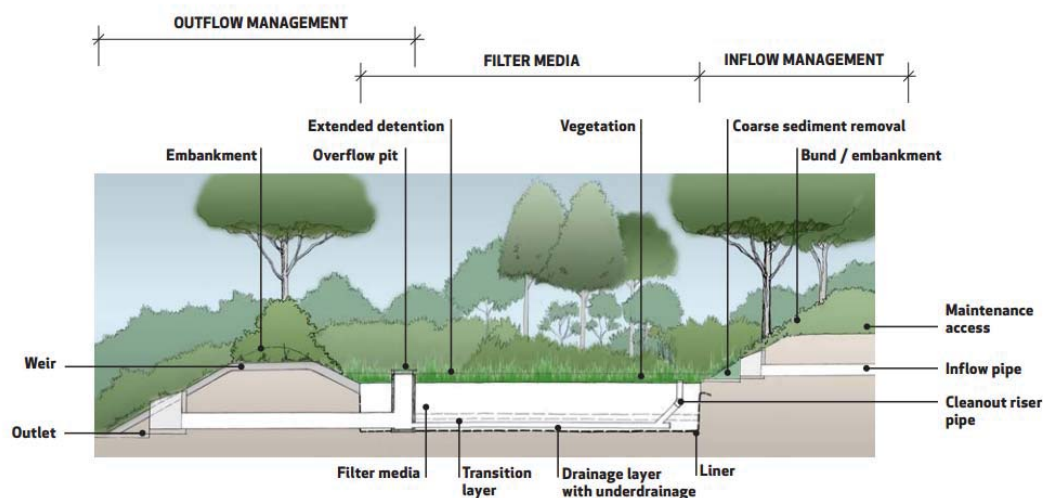


Figure 6.3.1: Components of a Typical Bio Retention System (Source: Water by Design, Bio Retention Technical Design Guidelines Version 1.1)

The bio retention basin for the subject site has been designed in accordance with Bio Retention Technical Design Guidelines (2012) with the properties as outlined in **Table 6.3.1** below.

Outlet structures within the basin are designed to ensure an extended detention depth of 300mm is maintained over the filter media. The required surface area and filter media profile required to adequately treat the contributing developed catchment is discussed within Section 6.4 of this report.

| Parameter                        | Value                                                        |
|----------------------------------|--------------------------------------------------------------|
| <b>Geofabric Lining to Base</b>  | Yes                                                          |
| <b>Hydraulic Conductivity</b>    | 180 mm per hour                                              |
| <b>Orthophosphate Content</b>    | 40 mg per kg                                                 |
| <b>Filter Media's TN Content</b> | 800 mg per kg                                                |
| <b>Vegetation Properties</b>     | Basin to be vegetated with effective nutrient removal plants |

Table 6.3.1: Summary of Adopted Bio Retention Properties

## 6.4 MUSIC MODELLING METHODOLOGY FOR THE DEVELOPMENT SITE

MUSIC Version 6.3.0 was utilised for the water quality modelling of the proposed development and was calibrated in accordance with Water by Design's MUSIC Modelling Guidelines for South East Queensland Version 1.0 (2010).

Modelling of the developed scenario with the nominated SQIDs in place was undertaken replicate the transfer of pollutants through a stormwater drainage system and to assist in determining the effectiveness of the proposed stormwater treatment train in meeting the City of Gold Coast Stormwater Quality Objectives (Section 6.2).

#### 6.4.1 METEOROLOGICAL DATA

The meteorological data required for input into MUSIC software was obtained from the eWater website for Beenleigh Bowls Club Station (No. 040406). The data received is in the form of 6-minute pluviographic data for a 10-year period from 01<sup>st</sup> January 1990 to 31<sup>st</sup> December 1999. The mean average rainfall for this period was 1105mm.

Daily potential evapo-transpiration (PET) data (01/01/1990 to 31/12/1999) from the above mentioned station has been used.

A summary of the information is indicated below:

**Catchment Name:** 5738 CoGC M38 Industrial Park, Yatala MUSIC Model  
**Rainfall Station:** 40406 BEENLEIGH  
**ET Station:** User-defined monthly PET  
**Start Date:** 1/01/1990 12:00 AM  
**End Date:** 31/12/1999 11:54 PM  
**Modelling Time Step:** 6 Minutes

|               | Rainfall/6 Minutes | Evapo-Transpiration |
|---------------|--------------------|---------------------|
| mean          | 0.013              | 4.086               |
| median        | 0.000              | 3.600               |
| maximum       | 22.100             | 6.290               |
| minimum       | 0.000              | 2.000               |
| 10 percentile | 0.000              | 2.033               |
| 90 percentile | 0.001              | 6.194               |
| mean annual   | 1105               | 1492                |

#### 6.4.2 SOURCE NODES

MUSIC modelling has utilised the *City of Gold Coast (North) MUSIC-Link data (Version 6.30)* to define the parameters assigned to the pollutant source node inputs for the MUSIC model.

Refer to **Appendix E** for the MUSIC Catchment Plan.

|                                |
|--------------------------------|
| <b>CITY OF<br/>GOLDCOAST™</b>  |
| City of Gold Coast (Central)   |
| City of Gold Coast Central.mlb |
| City of Gold Coast (North)     |
| City of Gold Coast North.mlb   |
| City of Gold Coast (South)     |
| City of Gold Coast South.mlb   |

#### Current Project Version

|                         |                            |
|-------------------------|----------------------------|
| Music Version           | 6.3.0                      |
| MUSIC-link Data Version | 6.30                       |
| Authority               | City of Gold Coast         |
| Area                    | City of Gold Coast (North) |
| Scenario                | City of Gold Coast (North) |

The intended industrial land use allows the developed catchment parameters to be conservatively assumed with the catchments broken down into a number of major surface types being ground level, roads (includes entire road reserve), roofs and drainage reserves. These surface types were allocated an effective impervious area (%) and further refined through the MUSIC modelling process via the “split” catchment approach.

The below table and figures summarise the imperviousness of the allocated source nodes within the MUSIC model.

External catchments that are conveyed through the site are assumed to be treated on site by the relevant lot owner prior to entering the subject site.

| Catchment - MUSIC Source Node       | Modelling Approach | Area (Ha)     | Impervious % |
|-------------------------------------|--------------------|---------------|--------------|
| CAT-10A TOTAL CATCHMENT = 15.882 Ha |                    |               |              |
| ROAD                                | SPLIT              | 2.800         | 90 *         |
| ROOF                                | SPLIT              | 8.546         | 100 *        |
| GROUND                              | SPLIT              | 3.663         | 90 *         |
| DRAINAGE RESERVE                    | SPLIT              | 0.873         | 10 *         |
| TOTAL                               |                    | <b>15.882</b> |              |

\* *Effective impervious areas were calibrated to ensure an overall site imperviousness of 90% was achieved. Refer to MUSIC Link Report in **Appendix F** for further details.*

**Table 6.4: MUSIC Modelling Summary of Source Node Impervious Allocations**

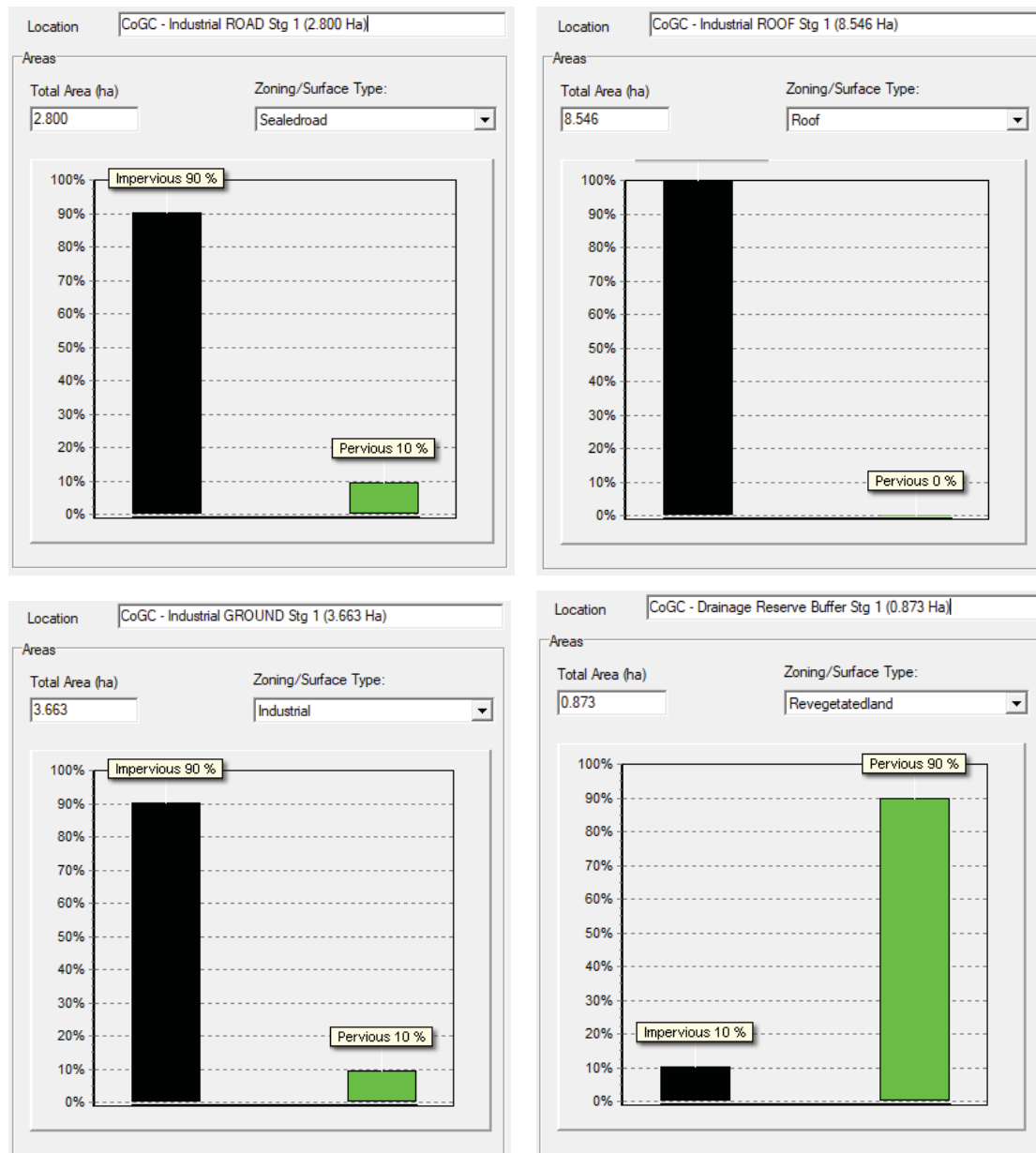


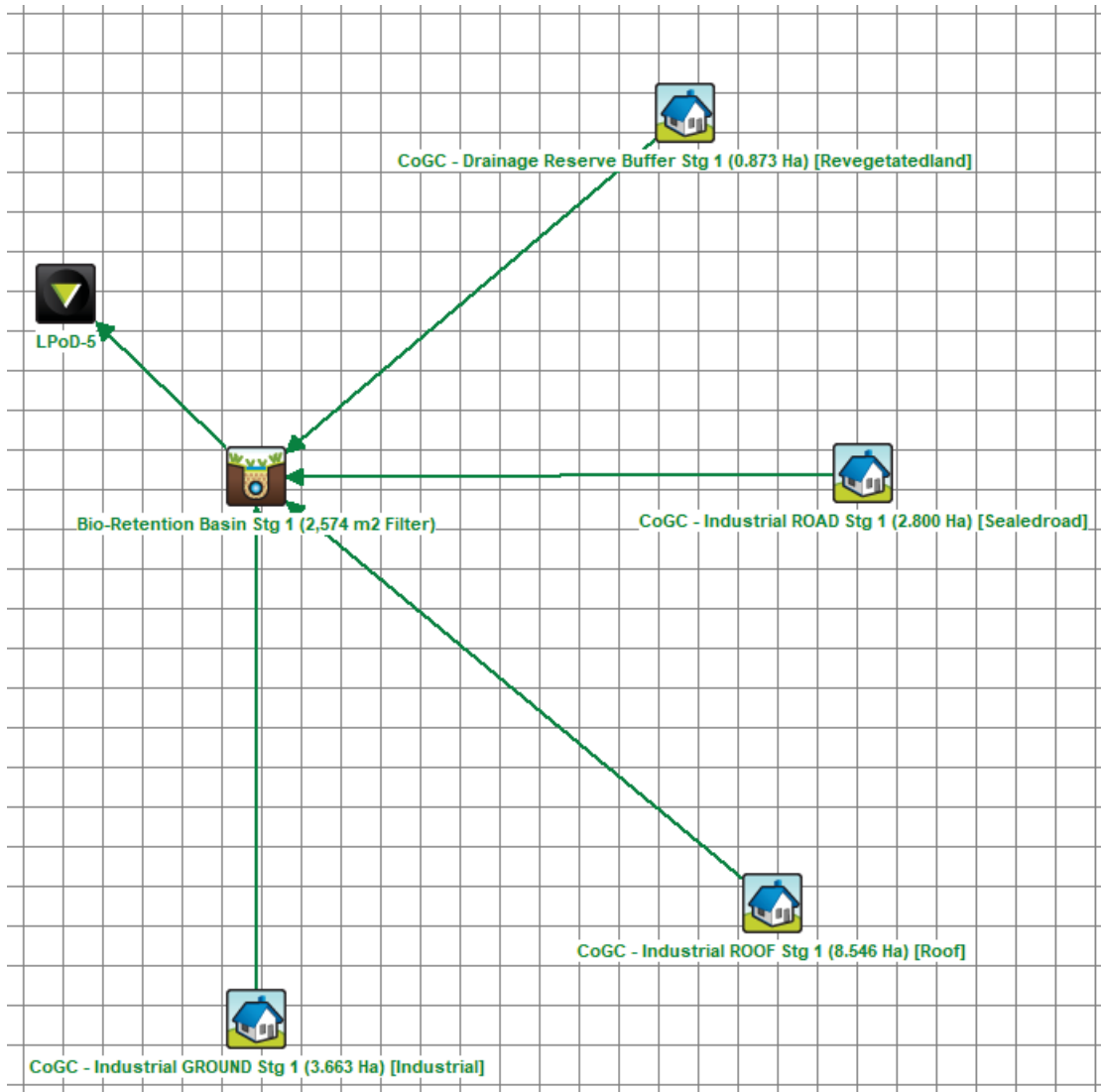
Figure 6.4.1: MUSIC Modelling Source Node Impervious Allocations

### 6.4.3 DRAINAGE LINKS

No routing has been adopted for the drainage links within the modelling that has been undertaken. This approach is believed to provide more conservative results.

### 6.4.4 MUSIC MODEL LAYOUT AND RESULTS

The diagrammatic representation of the source nodes, modelling configuration and results of pollutant reduction is outlined in Figure 6.4.4-1 below for the post developed catchment.



|                                | Sources | Residual Load | % Reduction |
|--------------------------------|---------|---------------|-------------|
| Flow (ML/yr)                   | 148     | 141           | 4.6         |
| Total Suspended Solids (kg/yr) | 17900   | 1890          | 89.4        |
| Total Phosphorus (kg/yr)       | 43.5    | 12.8          | 70.7        |
| Total Nitrogen (kg/yr)         | 316     | 134           | 57.5        |
| Gross Pollutants (kg/yr)       | 3560    | 4.76          | 99.9        |

Figure 6.4.4-1: Catchment CAT-10A MUSIC Layout and Results

The reduction in target pollutants to meet City of Gold Coast Council's requirements are achieved based on the below bio retention measures being implemented for the catchment.

| Parameter                    | Value   |
|------------------------------|---------|
|                              | CAT-10A |
| Filter Area (m2)             | 2,574   |
| Filter Media Depth (m)       | 0.50    |
| Extended Detention Depth (m) | 0.30    |
| Weir Crest Width (m)         | 10.00   |

|                                                |  |                                             |
|------------------------------------------------|--|---------------------------------------------|
| Location                                       |  | Bio-Retention Basin Stg 1 (2,574 m2 Filter) |
| <b>Inlet Properties</b>                        |  |                                             |
| Low Flow By-pass (cubic metres per sec)        |  | 0.000                                       |
| High Flow By-pass (cubic metres per sec)       |  | 4.962                                       |
| <b>Storage Properties</b>                      |  |                                             |
| Extended Detention Depth (metres)              |  | 0.30                                        |
| Surface Area (square metres)                   |  | 2905.00                                     |
| <b>Filter and Media Properties</b>             |  |                                             |
| Filter Area (square metres)                    |  | 2574.00                                     |
| Unlined Filter Media Perimeter (metres)        |  | 0.01                                        |
| Saturated Hydraulic Conductivity (mm/hour)     |  | 180.00                                      |
| Filter Depth (metres)                          |  | 0.50                                        |
| TN Content of Filter Media (mg/kg)             |  | 800                                         |
| Orthophosphate Content of Filter Media (mg/kg) |  | 40.0                                        |
| <b>Infiltration Properties</b>                 |  |                                             |
| Exfiltration Rate (mm/hr)                      |  | 0.00                                        |

Table 6.4.4: Summary of Proposed Bio Retention Measures

|                                                                                   |                                                                     |
|-----------------------------------------------------------------------------------|---------------------------------------------------------------------|
| <b>Lining Properties</b>                                                          |                                                                     |
| Is Base Lined?                                                                    | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No |
| <b>Vegetation Properties</b>                                                      |                                                                     |
| <input checked="" type="radio"/> Vegetated with Effective Nutrient Removal Plants |                                                                     |
| <input type="radio"/> Vegetated with Ineffective Nutrient Removal Plants          |                                                                     |
| <input type="radio"/> Unvegetated                                                 |                                                                     |
| <b>Outlet Properties</b>                                                          |                                                                     |
| Overflow Weir Width (metres)                                                      | <input type="text" value="10.00"/>                                  |
| Underdrain Present?                                                               | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No |
| Submerged Zone With Carbon Present?                                               | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No |
| Depth (metres)                                                                    | <input type="text" value="0.45"/>                                   |

Table 6.4.4: Summary of Proposed Bio Retention Measures (cont.)

## 7.0 CONSTRUCTION, OPERATIONAL MANAGEMENT & MAINTENANCE

### 7.1 CONSTRUCTION PHASE SEDIMENT AND EROSION CONTROL

The operational phase detention basin is proposed to be utilised as a sediment basin during the construction phase of the development.

Where ultimate detention basin sizing does not align with the volumetric requirements of International Erosion Control Association's (IECA) Best Practice Guidelines, temporary construction phase sediment basins will be implemented.

Monitoring and maintenance of both the construction phase sediment basins and associated sediment and erosion control measures implemented over the site will be in accordance with IECA's Best Practice Guidelines and City of Gold Coast Council's standards.

### 7.2 ASSET OWNERSHIP AND HANDOVER

The SQIDs have been designed in accordance with QUDM standards and City of Gold Coast Council's Land Development Guidelines and in doing so aim to provide suitable and safe vehicular access for future maintenance. The current development proposal retains the SQIDs as assets of the developer though a formal handover from the Contractor to the Asset Owner will be required to ensure the SQIDs have been built in accordance with the requirements

### 7.3 MAINTENANCE OF BIO RETENTION BASINS DURING OPERATIONAL PHASE

Inspections and maintenance are to be carried out on a yearly basis to determine if the SQIDs are functioning as intended.

WSUD Technical Design Guidelines for South East Queensland have a Maintenance Checklist (*refer **Appendix G***) covering the items to be inspected and should be utilised and kept on record to ensure that a mechanism is in place to log the continued effectiveness of the SQIDs. Inspections and any required maintenance will be the responsibility of the asset owner.

## 8.0 CONCLUSION

Gassman Development Perspectives have prepared this Site Based Stormwater Management Plan to support an application for *Reconfiguration of Lot* over Lot 1 on RP6882 (60 Stapylton Jacobs Well Road, Stapylton) and Lot 240 on W31320 (82 Christensen Road, Stapylton).

The purpose of which is to address and manage stormwater quantity and quality requirements of the proposed development over the subject site in accordance with the relevant State and Local Authority's legislation and regulatory guidelines.

The key outcomes achieved through the analysis and modelling undertaken within this report are demonstrated in the stormwater bio-retention and sediment basin designs within **Appendix C**, and are as described below:

### ***Stormwater Quantity***

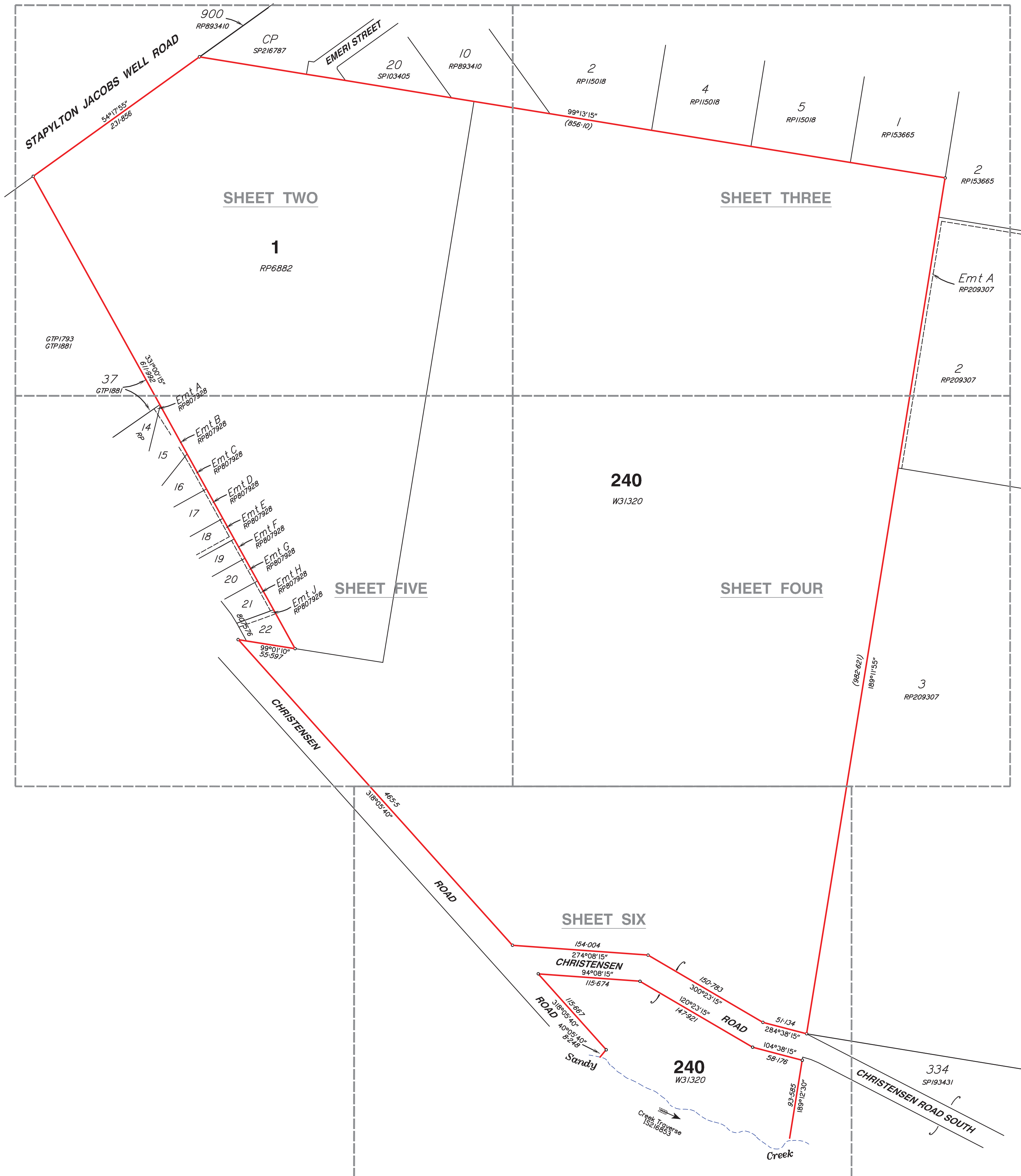
Suitable attenuation measures are able to be incorporated into the proposed development to ensure there is no adverse impacts to downstream properties, waterways or infrastructure as a result of an increase in peak stormwater flow rates discharging from the subject site upon development.

This is achieved through the design of an appropriately sized detention basin that complies with City of Gold Coast Council's Land Development Guidelines along with the Queensland Urban Drainage Manual (QUDM). Adequate provision has also been made within the earthworks design and associated reporting to cater for the conveyance of external upstream catchments through the subject site.

### ***Stormwater Quality***

Stormwater quality objectives for the subject site are achieved through the design of a suitable stormwater treatment train that implements all necessary steps to ensure that the quality of stormwater discharging from the subject site meets the necessary standards to comply with City of Gold Coast Council's Water Sensitive Urban Design (WSUD) requirements, Queensland Urban Drainage Manual (QUDM) and the performance objectives of the Queensland State Planning Policy (SPP).

## Appendix A – Site Survey Plan



#### Notes

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**HESTER**

#### Project

**CONTOUR AND DETAIL PLAN**

Over Lot 1 on RP6882 and Lot 240 on WD31320

Parish of **ALBERT**

County of **Ward**

Local Govt **GOLD COAST CITY COUNCIL**

|                  |            |               |              |
|------------------|------------|---------------|--------------|
| Level Datum      | A.H.D.     | Date Surveyed | Jan 2011     |
| Meridian         | 15216853   | Surveyor      | A. Macdonald |
| Contour Interval | 0.2        | Drawn         | S. Holt      |
| F.B.             | No         | Date Drafted  | 02-02-2011   |
| Origin           | PSM 133471 | Checked       |              |
|                  | RL 22.169  |               |              |

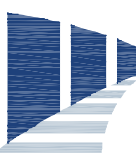
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Designed

Drawn

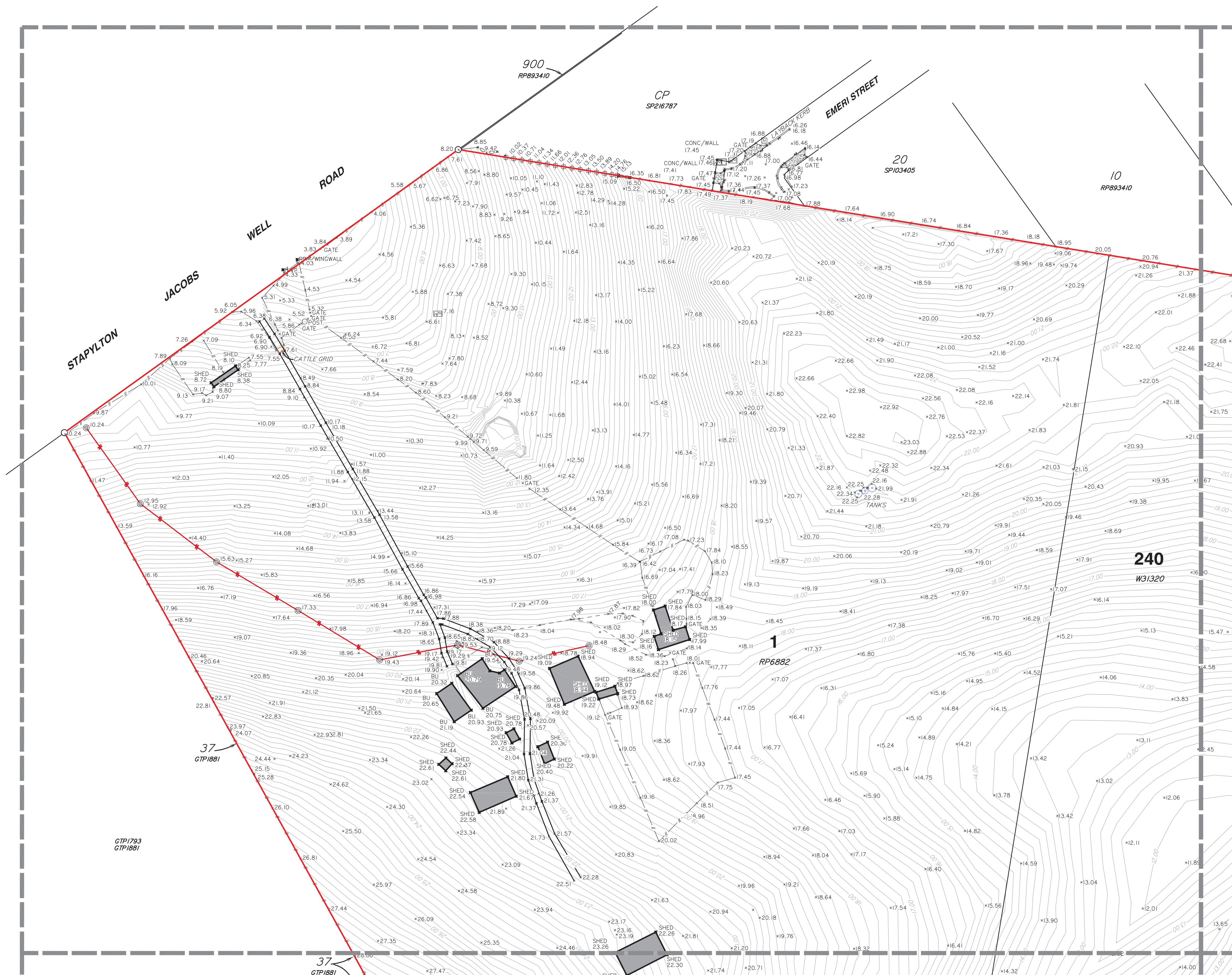
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#### LEGEND

- PERMANENT MARK
- SEWER MANHOLE
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- ELECTRICITY PILLAR
- ELECTRICITY POLE
- ELECTRICITY POLE WITH LIGHT
- TELSTRA PIT
- MANHOLE
- STORMWATER MANHOLE
- GULLY TRAP
- WATER METER
- FIRE HYDRANT
- VALVE
- GATE
- BOLLARD
- CONCRETE
- EDGE OF BITUMEN
- FENCE
- OVERHEAD ELECTRICITY
- OPEN DRAIN
- RETAINING WALL
- EDGE OF GARDEN
- CONTOUR LEVEL

#### Notes

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**CONTOUR AND DETAIL PLAN**

Over Lot 1 on RP6882 and Lot 240 on WD31320

Parish of **ALBERT**

County of **Ward**

Local Govt **GOLD COAST CITY COUNCIL**

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|------------------|------------|---------------|--------------|
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| Meridian         | IS133471   | Surveyor      | A. Macdonald |
| Contour Interval | 0.2        | Drawn         | S. Holt      |
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Drawn

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PLAN No. **5093 S CD 01**



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| F.B.                   | No            | Date Drafted  | 02-02-2011   |
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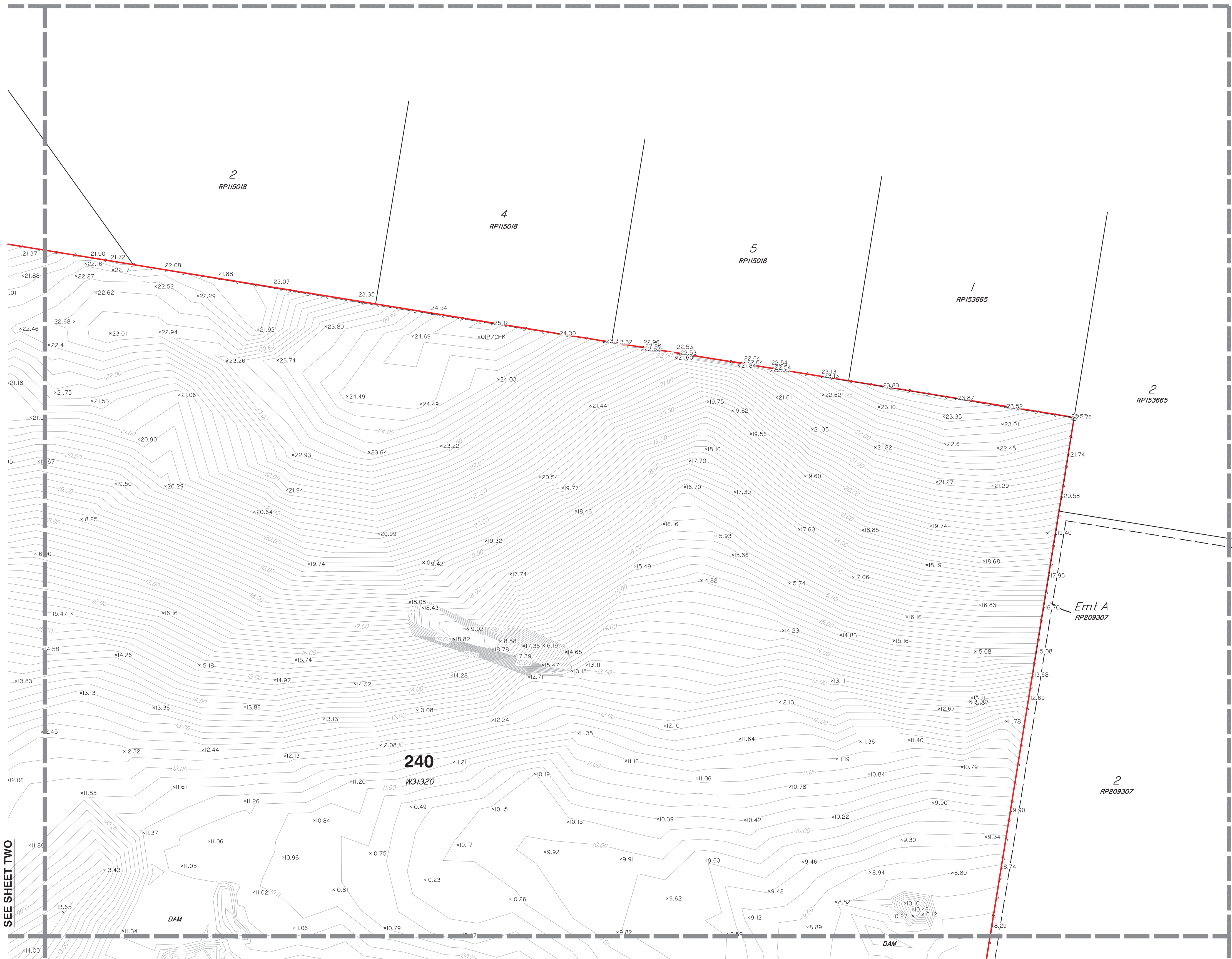
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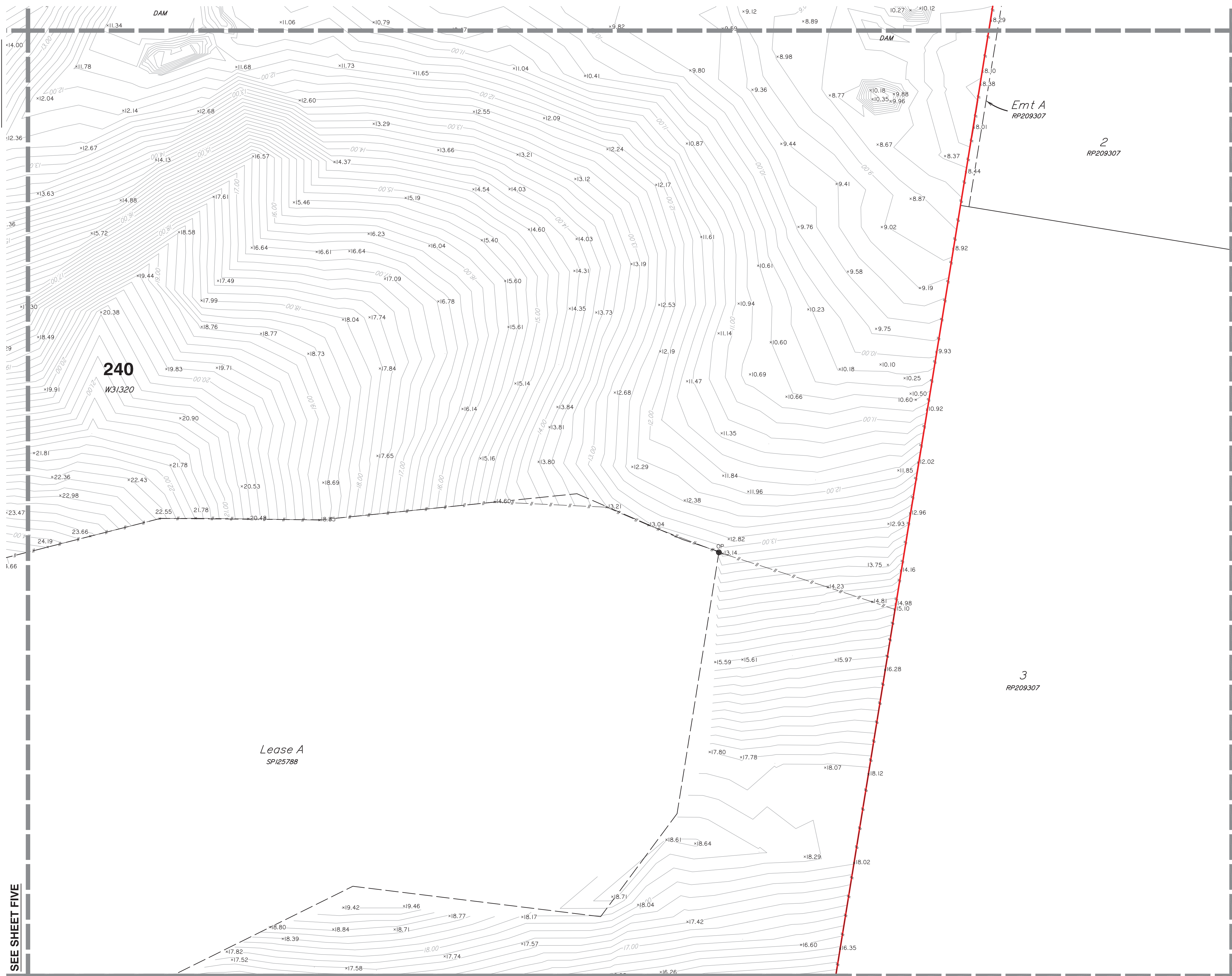


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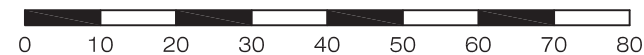
SEE SHEET THREE

SEE SHEET FIVE



SEE SHEET SIX

Scale 1:1000 - Lengths are in Metres.



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**CONTOUR AND DETAIL PLAN**

Over Lot 1 on RP6882 and Lot 240 on WD31320

Parish of **ALBERT**

County of **Ward**

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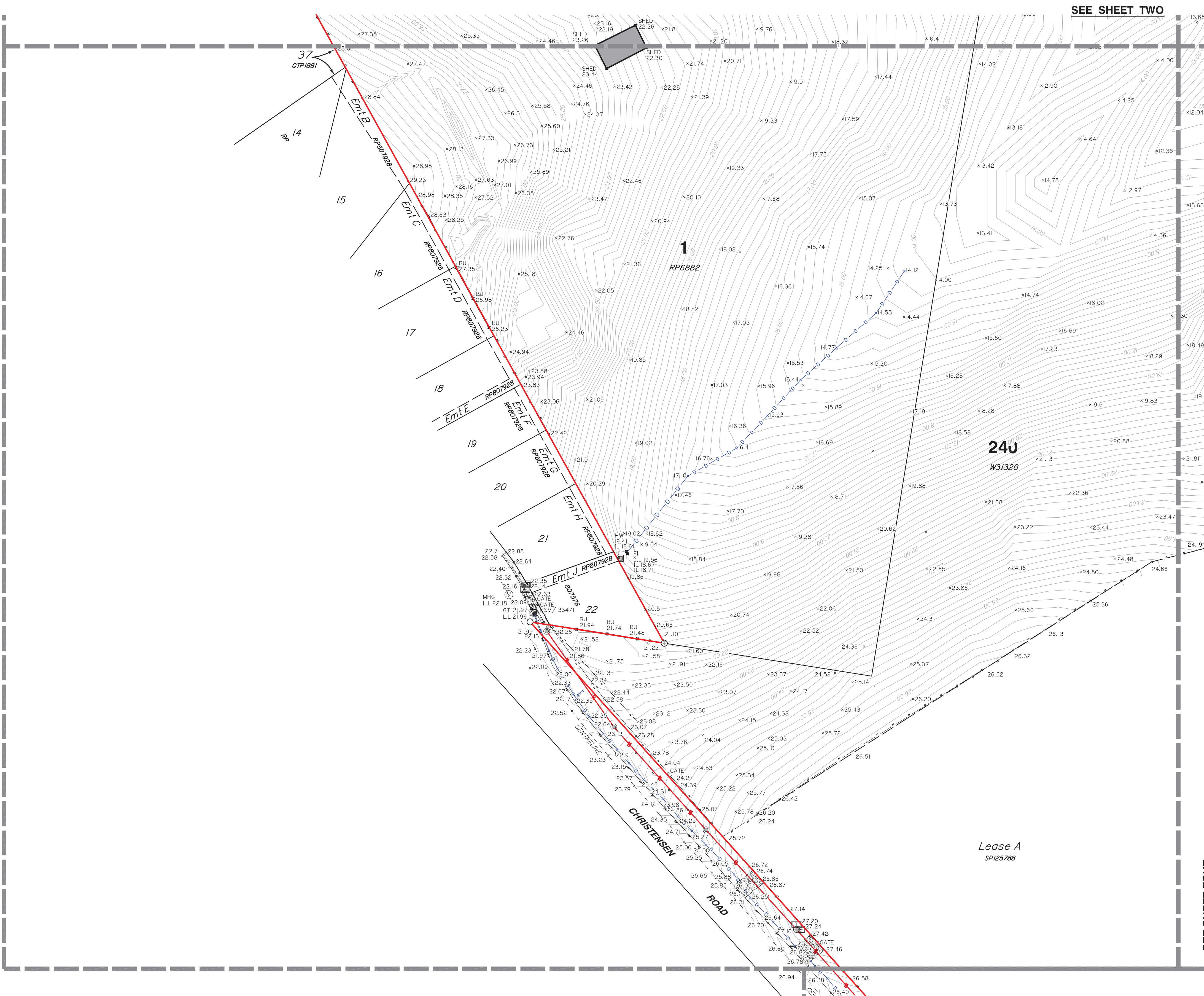
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- LEGEND**
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**CONTOUR AND DETAIL PLAN**

Over Lot 1 on RP6882 and Lot 240 on WD31320

Parish of **ALBERT**

County of **Ward**

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| Level Datum      | A.H.D.     | Date Surveyed | Jan 2011     |
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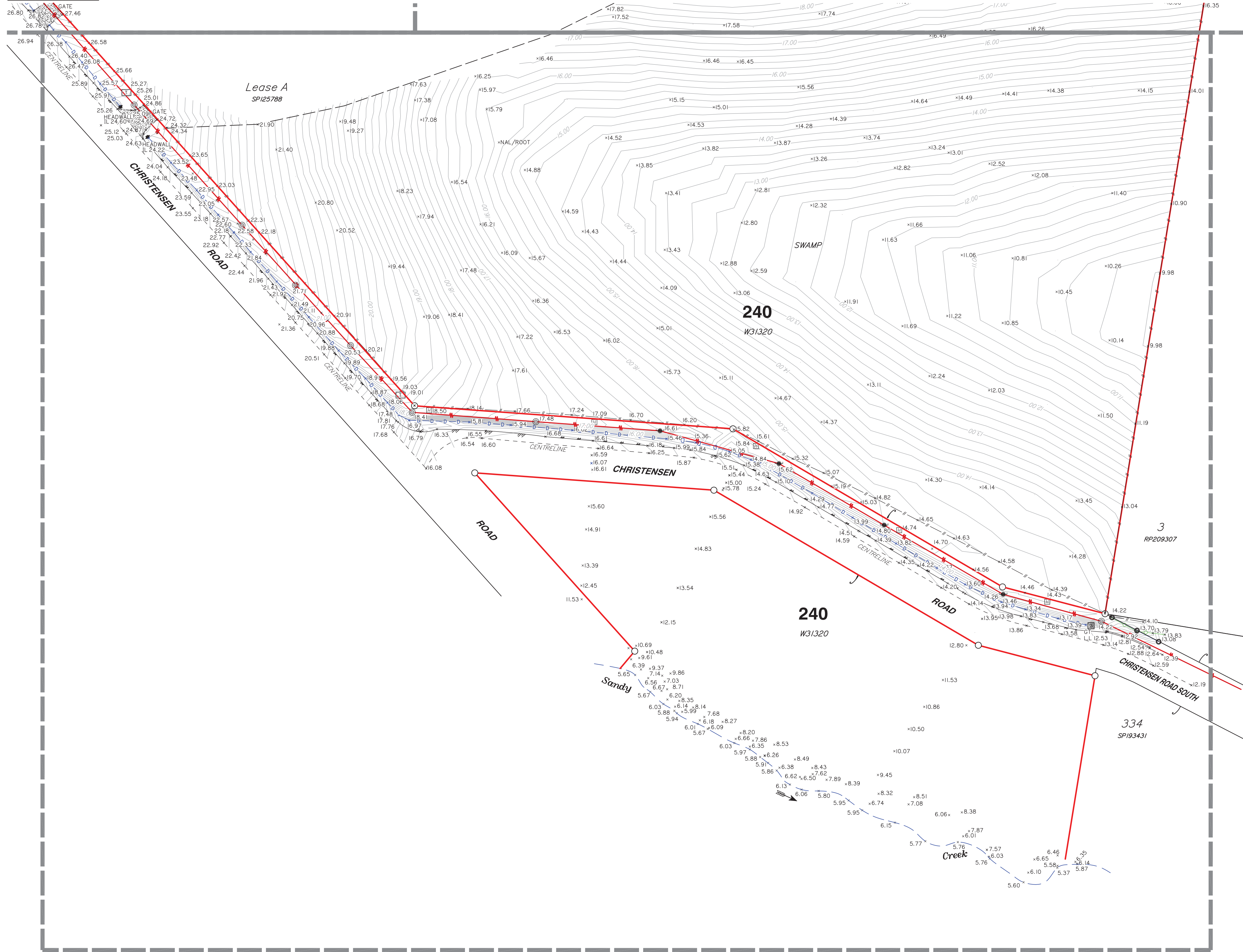
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SEE SHEET FIVE

SEE SHEET FOUR



LEGEND

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**CONTOUR AND DETAIL PLAN**

Over Lot 1 on RP6882 and Lot 240 on WD31320

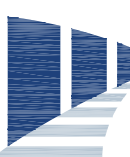
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|------------------|------------|---------------|--------------|
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| F.B.             | No         | Date Drafted  | 02-02-2011   |
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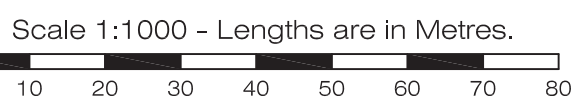
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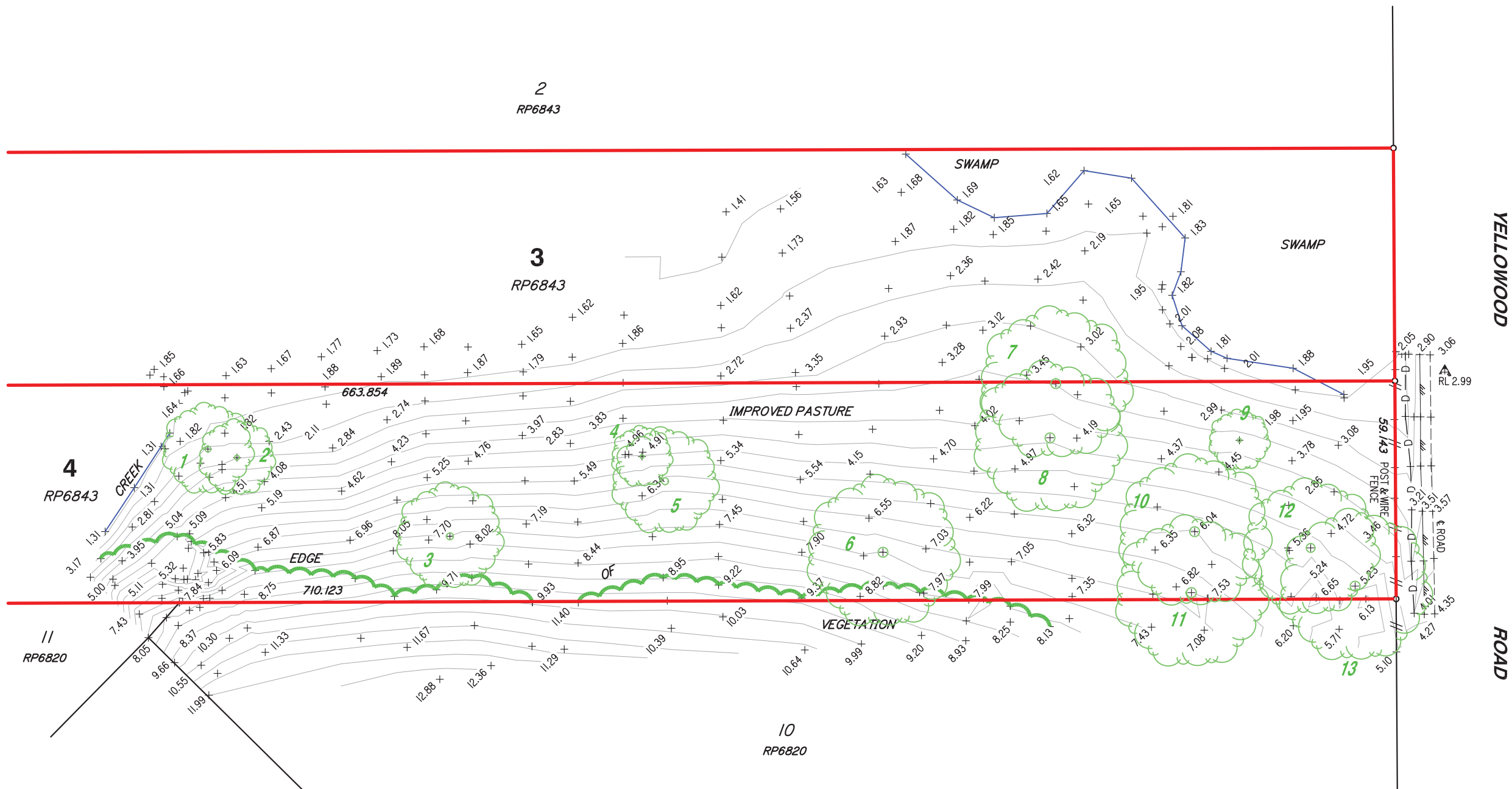


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#### LEGEND

- BENCH MARK
- OPEN DRAIN
- EDGE OF BITUMEN
- FENCE

#### TREE TABLE

| TREE No. | Ø    | SPREAD | HEIGHT |
|----------|------|--------|--------|
| 1        | 0.4Ø | 12m    | 14m    |
| 2        | 0.4Ø | 10m    | 14m    |
| 3        | 1.0Ø | 14m    | 20m    |
| 4        | 0.3Ø | 8m     | 10m    |
| 5        | 0.6Ø | 14m    | 12m    |
| 6        | 0.8Ø | 20m    | 10m    |
| 7        | 1.0Ø | 20m    | 20m    |
| 8        | 1.0Ø | 20m    | 20m    |
| 9        | 0.4Ø | 8m     | 8m     |
| 10       | 1.5Ø | 20m    | 26m    |
| 11       | 1.5Ø | 20m    | 26m    |
| 12       | 0.6Ø | 16m    | 20m    |
| 13       | 1.2Ø | 20m    | 26m    |

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**CONTOUR AND DETAIL PLAN**

**BORROW SITE**

on Part of Lots 3 & 4 on RP6843

Parish of **ALBERT**

County of **Ward**

Local Govt **GOLD COAST CITY COUNCIL**

|                  |           |               |            |
|------------------|-----------|---------------|------------|
| Level Datum      | A.H.D.    | Date Surveyed | 21-07-2011 |
| Meridian         | RP6843    | Surveyor      | S. White   |
| Contour Interval | 0.5       | Drawn         | S. Holt    |
| F.B.             | No        | Date Drafted  | 22-07-2011 |
| Origin           | PSM130468 | Checked       |            |
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REFERENCE No. **5093-11**

PLAN No. **5093 S CD 03**

Scale 1:1250 - Lengths are in Metres.



## Appendix B – Pre and Post Development Catchment Plans





## Appendix C – Design of Stormwater Quantity and Quality Basin

Client:

KS8 Pty. Ltd.

Site Address:

60 STAPLYTON JACOBS  
WELL ROAD, STAPLYTON

RPD:

Lot / Plan: 1 on RP6882  
240 on W31320  
4 on RP6843

Parish: Albert  
County: Ward  
Local Authority: City of Gold Coast  
Council

Level Datum: AHD  
Meridian: IS216853  
Contour Interval: -  
PSM:  
RL:

ISSUED FOR APPROVAL  
NOT FOR CONSTRUCTION

DRAWING TO BE READ IN CONJUNCTION WITH GENERAL NOTES

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### DRAWING TITLE

CONSTRUCTION PHASE  
SEDIMENT BASIN 1  
LAYOUT PLAN AND  
DETAILS SHEET 1 OF 2

| Issue | Date     | Description                          | DRN | CHK |
|-------|----------|--------------------------------------|-----|-----|
| C     | 30-08-18 | FURTHER INFORMATION REQUEST RESPONSE | IG  | MG  |
| B     | 30-05-18 | ISSUED FOR TENDER                    | GCP | MG  |
| B     | 11-05-18 | INFORMATION REQUEST RESPONSE         | GCP | MG  |
| A     | 09-02-18 | ORIGINAL ISSUE                       | GCP | MG  |

SCALE IN METRES

AS SHOWN

Scale at A1: AS SHOWN

|           |                                                                                       |
|-----------|---------------------------------------------------------------------------------------|
| Designed: | IG                                                                                    |
| Drafted:  | GCP                                                                                   |
| Approved: | MG                                                                                    |
| RPEQ:     | 16939                                                                                 |
| Signed:   |  |
| Date:     | 30-08-18                                                                              |

Drawing No: 5738 ENG BE1 026 Rev. No: C

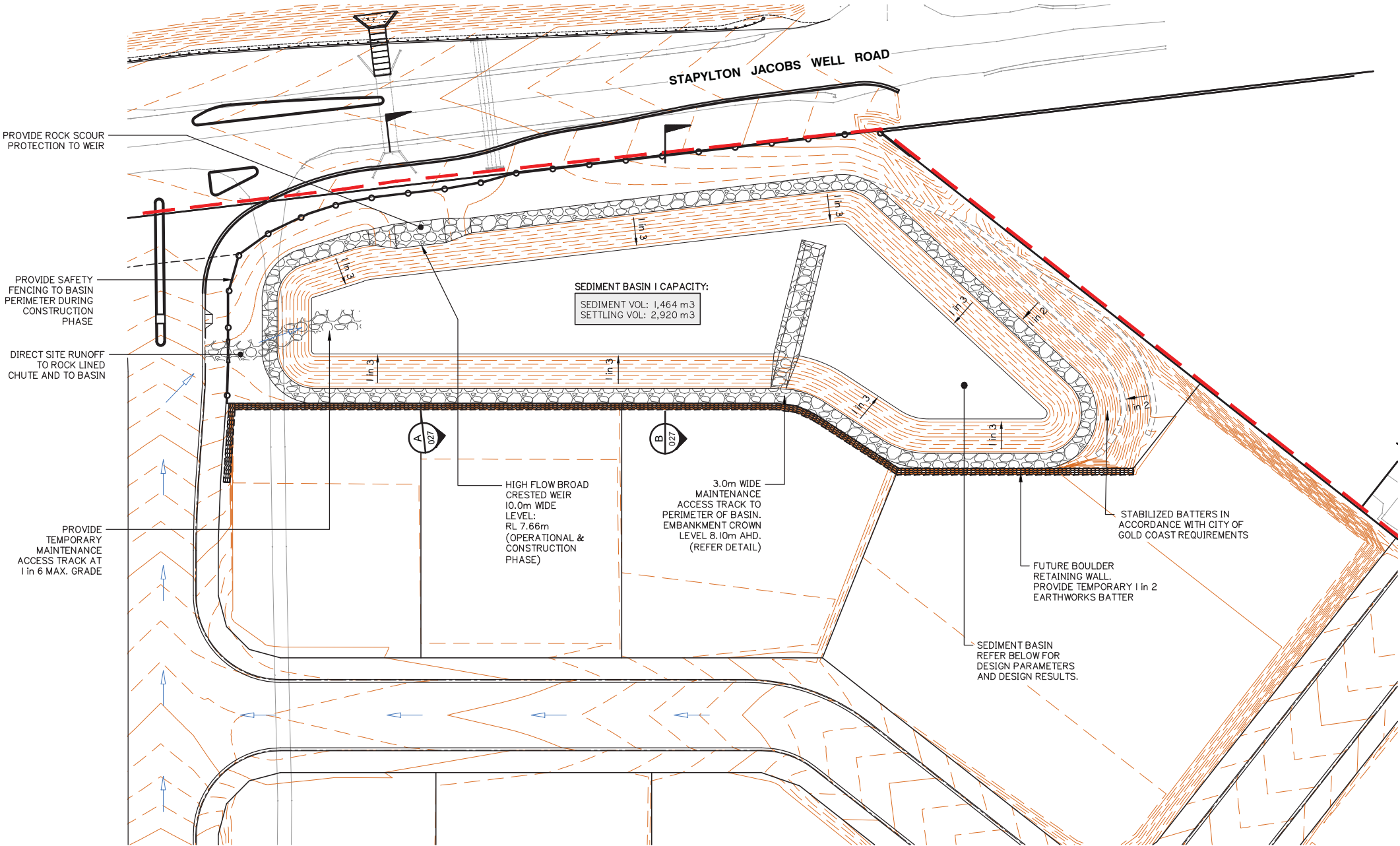


### NOTES

- ALL ALLOTMENTS TO GRADE TOWARDS THE ROAD AT MINIMUM 1:150.
- SEDIMENT AND EROSION CONTROL PLAN IS INDICATIVE ONLY. THE CONTRACTOR MUST TAKE ADDITIONAL MEASURES IF REQUIRED ONSITE DURING CONSTRUCTION AND MAINTENANCE PERIODS.
- CONTRACTOR EROSION AND SEDIMENT CONTROL PLAN SHOULD COMPLY WITH ALL COUNCIL AND STATE REQUIREMENTS AND BE IN LINE WITH IECA BEST PRACTICE GUIDELINES.
- CONTRACTOR TO OBTAIN SEDIMENT AND EROSION CONTROL PLAN APPROVAL FROM RELEVANT AUTHORITY BEFORE THE COMMENCEMENT OF WORKS.

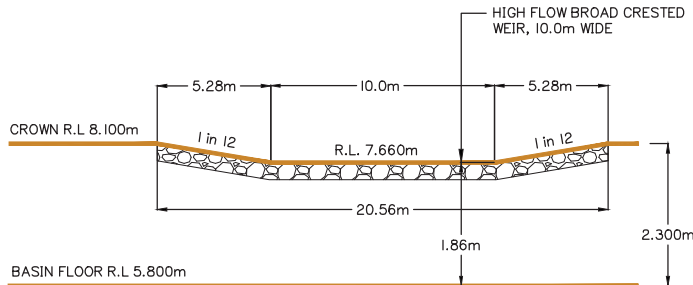
### LEGEND

|  |                           |
|--|---------------------------|
|  | LOT BOUNDARY              |
|  | LIMIT OF WORKS            |
|  | EXISTING CONTOURS (MINOR) |
|  | EXISTING CONTOURS (MAJOR) |
|  | DESIGN CONTOURS (MINOR)   |
|  | DESIGN CONTOURS (MAJOR)   |
|  | OVERLAND FLOW PATH        |



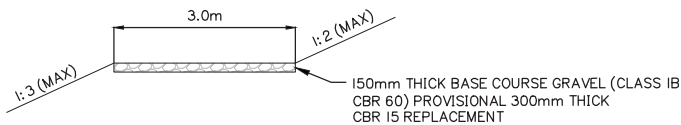
SEDIMENT BASIN 1 – LAYOUT PLAN

I: 500 @ A1



WEIR / SPILLWAY – TYPICAL ELEVATION

N.T.S



MAINTENANCE ACCESS TRACK – TYPICAL SECTION

N.T.S

### BASIN 1 – DESIGN PARAMETERS

|                         |        |
|-------------------------|--------|
| I(1YR, 120hr)           | 1.46   |
| K1                      | 33.5   |
| K2                      | 14.2   |
| R(ys, 5-DAY)            | 63.11  |
| Cv                      | 0.29   |
| A (Ha)                  | 15.882 |
| Settling Zone Vol: Vs   | 2907   |
| Sediment Zone Vol: Vsed | 1453   |

### BASIN 1 – DESIGN RESULTS

| SEDIMENT ZONE                          |  |      |    | SETTLING ZONE                          |  |      |    |
|----------------------------------------|--|------|----|----------------------------------------|--|------|----|
| 1:3 Batter Calc                        |  |      |    | 1:3 Batter Calc                        |  |      |    |
| INPUT NOMINATED BASIN BASE AREA        |  | 2886 |    | INPUT NOMINATED BASE AREA              |  | 3351 |    |
| INPUT NOMINATED SEDIMENT HEIGHT        |  | 0.47 |    | INPUT NOMINATED SETTLING HEIGHT        |  | 0.78 |    |
| INPUT OUTSIDE BOUNDARY LENGTH OF BASIN |  | 326  |    | INPUT OUTSIDE BOUNDARY LENGTH OF BASIN |  | 335  |    |
| SEDIMENT VOLUME CHECK, Vsed =          |  | 1464 | OK | SETTLING VOLUME CHECK, Vs =            |  | 2920 | OK |





KS8 Pty. Ltd.

60 STAPLYTON JACOBS  
WELL ROAD, STAPYLTON

Lot / Plan: 1 on RP6882  
240 on W31320  
4 on RP6843

Parish: Albert  
County: Ward  
Local Authority: City of Gold Coast Council

Level Datum: AHD  
Meridian: IS216853  
Contour Interval: -  
PSM:  
RL:

ISSUED FOR APPROVAL  
NOT FOR CONSTRUCTION

DRAWING TO BE READ IN CONJUNCTION WITH GENERAL NOTES

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DRAWING TITLE  
CONSTRUCTION PHASE  
SEDIMENT BASIN 2  
LAYOUT PLAN AND  
DETAILS SHEET 1 OF 2

|       |          |                              |     |     |
|-------|----------|------------------------------|-----|-----|
|       |          |                              |     |     |
|       |          |                              |     |     |
|       |          |                              |     |     |
|       |          |                              |     |     |
|       |          |                              |     |     |
|       |          |                              |     |     |
|       |          |                              |     |     |
|       |          |                              |     |     |
| B     | 11-05-18 | INFORMATION REQUEST RESPONSE | GCP | MG  |
| A     | 09-02-18 | ORIGINAL ISSUE               | GCP | MG  |
| Issue | Date     | Description                  | DRN | CHK |

AS SHOWN

Scale at A1: AS SHOWN

|           |    |
|-----------|----|
| Designed: | IG |
|-----------|----|

|          |     |
|----------|-----|
| Drafted: | GCP |
|----------|-----|

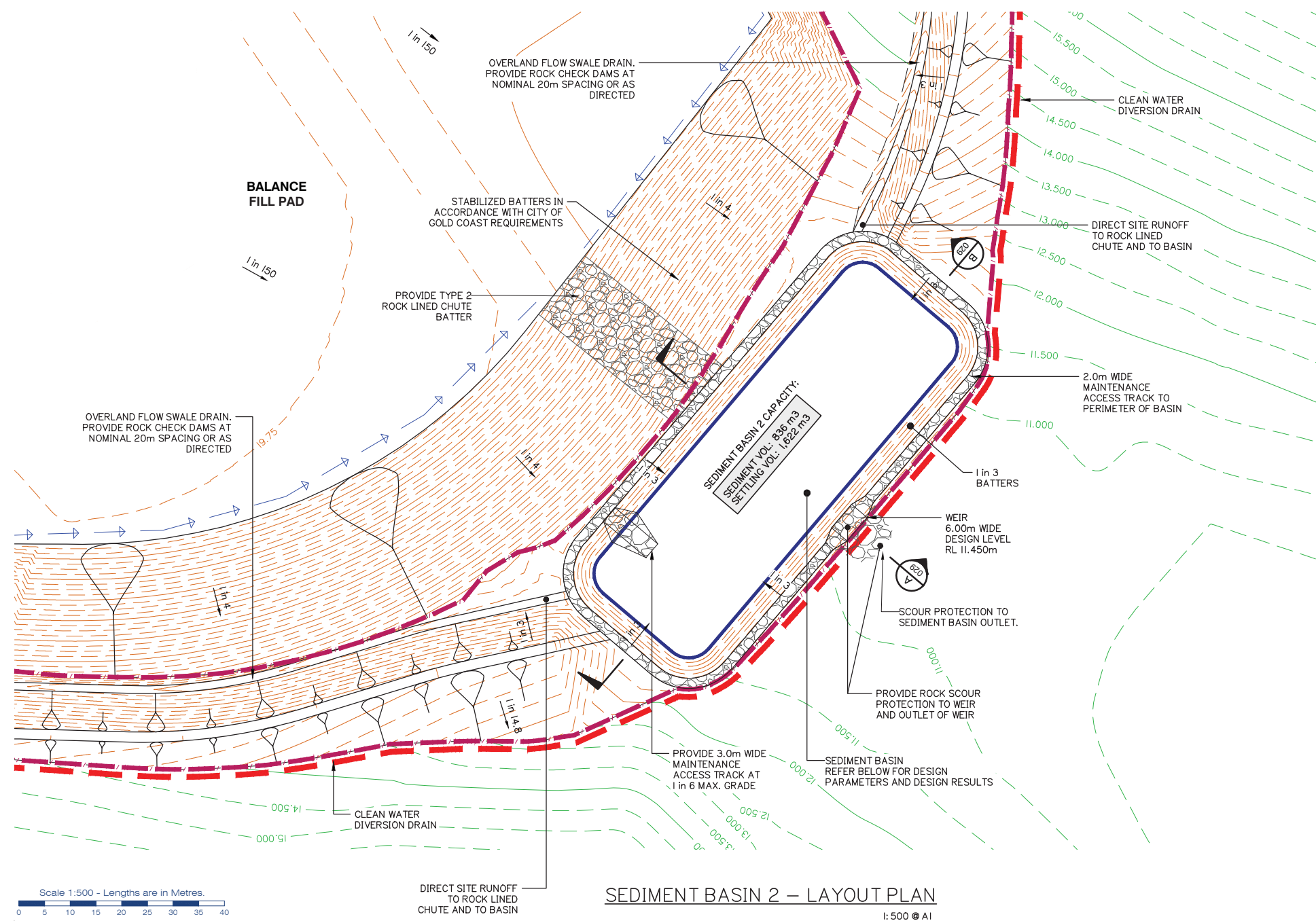
|           |    |
|-----------|----|
| Approved: | MG |
|-----------|----|

|       |      |
|-------|------|
| RPEQ: | 1693 |
|-------|------|

|         |  |
|---------|--|
| Signed: |  |
|---------|--|

Date: 11-0

|                  |          |
|------------------|----------|
| Drawing No:      | Rev. No: |
| 5738 ENG BE1 028 | B        |

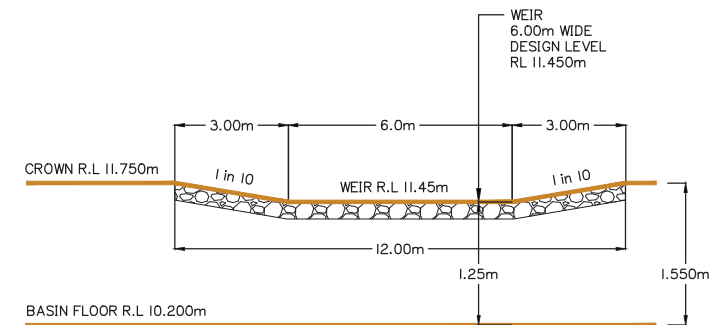


## BASIN 2 – DESIGN PARAMETERS

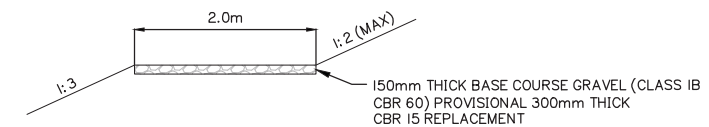
|                         |       |
|-------------------------|-------|
| I (LYR, 120hr)          | 1.46  |
| K1                      | 33.5  |
| K2                      | 14.2  |
| R(y%, 5-DAY)            | 63.11 |
| Cv                      | 0.29  |
| A (Ha)                  | 8.175 |
| Settling Zone Vol: Vs   | 1496  |
| Sediment Zone Vol: Vsed | 748   |

## BASIN 2 – DESIGN RESULTS

| SEDIMENT ZONE                          |      |    | SETTLING ZONE                          |      |    |
|----------------------------------------|------|----|----------------------------------------|------|----|
| 1:3 Batter Calc                        |      |    | 1:3 Batter Calc                        |      |    |
| INPUT NOMINATED BASIN BASE AREA        | 2274 |    | INPUT NOMINATED BASE AREA              | 2490 |    |
| INPUT NOMINATED SEDIMENT HEIGHT        | 0.35 |    | INPUT NOMINATED SETTLING HEIGHT        | 0.6  |    |
| INPUT OUTSIDE BOUNDARY LENGTH OF BASIN | 219  |    | INPUT OUTSIDE BOUNDARY LENGTH OF BASIN | 237  |    |
| SEDIMENT VOLUME CHECK, $V_{SED} =$     | 836  | OK | SETTLING VOLUME CHECK, $V_s =$         | 1622 | OK |



OVERFLOW WEIR – TYPICAL ELEVATION



MAINTENANCE ACCESS TRACK – TYPICAL SECTION



Client:

KS8 Pty. Ltd.

Site Address:

60 STAPLYTON JACOBS  
WELL ROAD, STAPYLTON

RPD:

Lot / Plan: 1 on RP6882  
240 on W31320  
4 on RP6843

Parish: Albert  
County: Ward  
Local Authority: City of Gold Coast  
Council

Level Datum: AHD  
Meridian: IS216853  
Contour Interval: -  
PSM: -  
RL: -

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## DRAWING TITLE

OPERATIONAL PHASE  
BIO RETENTION BASIN  
LAYOUT PLAN AND DETAILS  
SHEET 1 OF 2

SCALE IN METRES

AS SHOWN

Scale at A1: AS SHOWN

Designed: IG

Drafted: GCP

Approved: MG

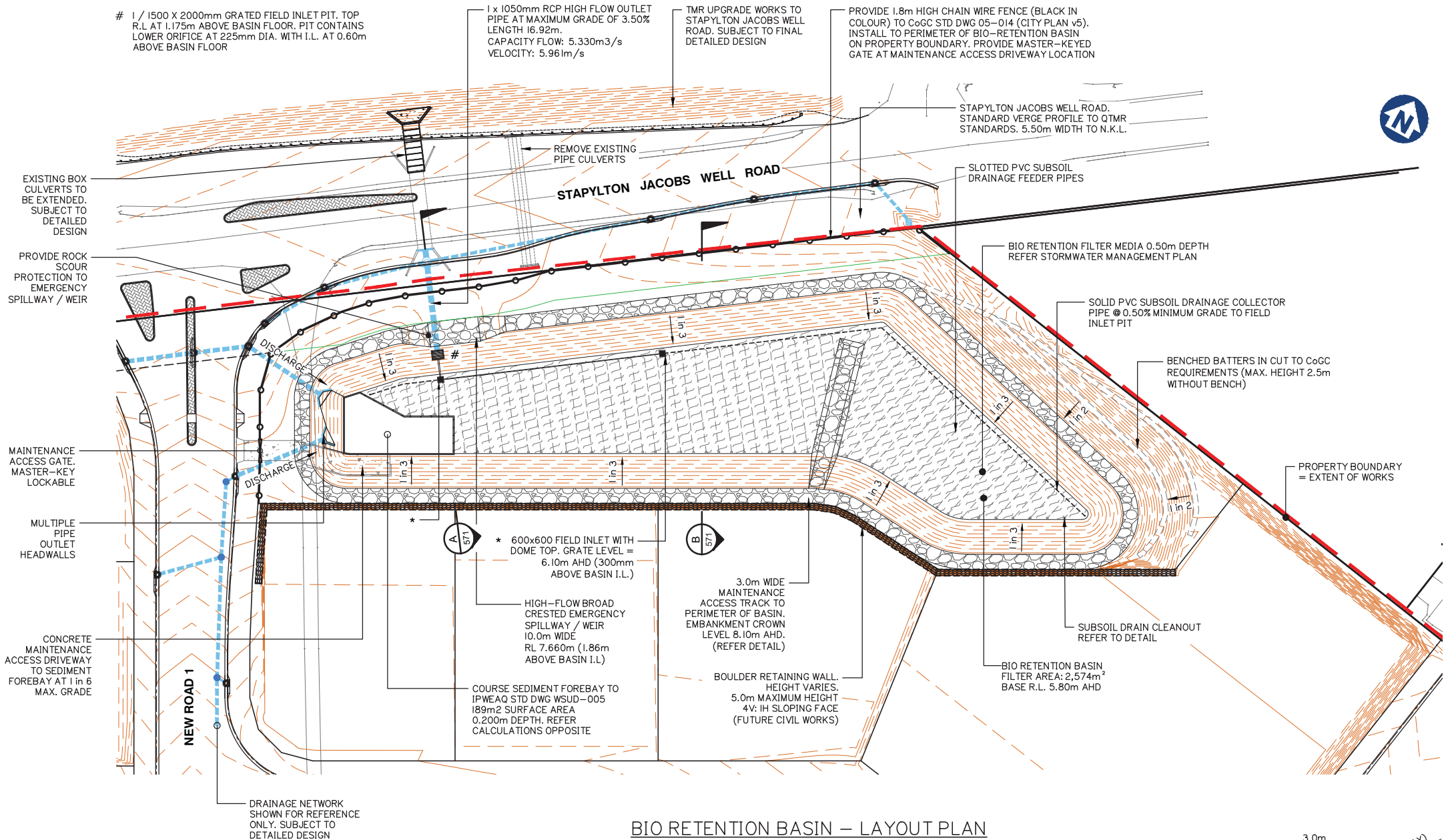
RPEQ: 16939

Signed: 

Date: 30-08-18

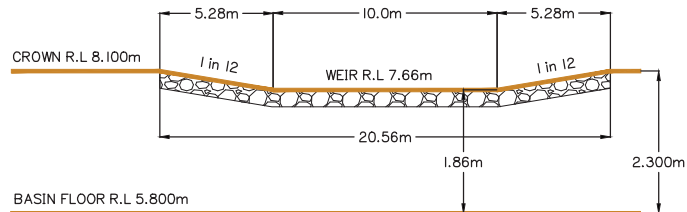
Drawing No:  
5738 ENG BE1 570

Rev. No:  
C



BIO RETENTION BASIN - LAYOUT PLAN

I:500 @ A1

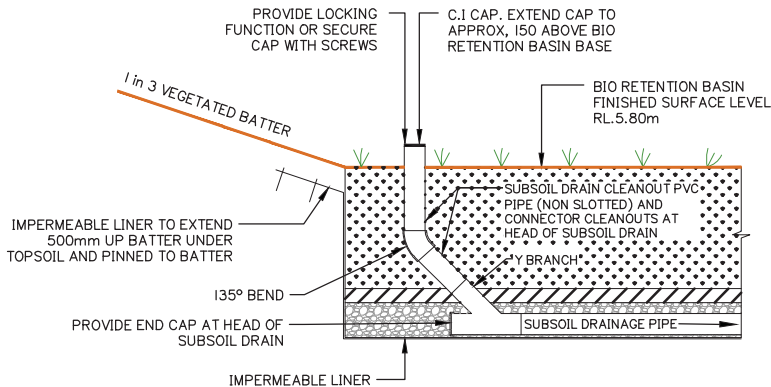


OVERFLOW WEIR - TYPICAL ELEVATION

N.T.S

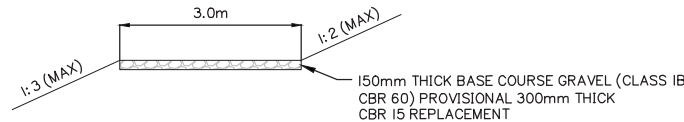
### LEGEND

- LOT BOUNDARY
- LIMIT OF WORKS
- DESIGN CONTOURS (MINOR)
- DESIGN CONTOURS (MAJOR)



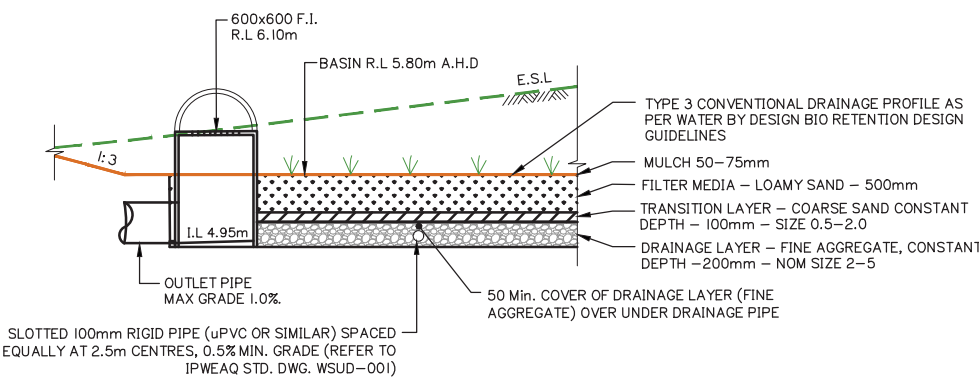
SUBSOIL DRAIN CLEANOUT - IN BASIN

N.T.S



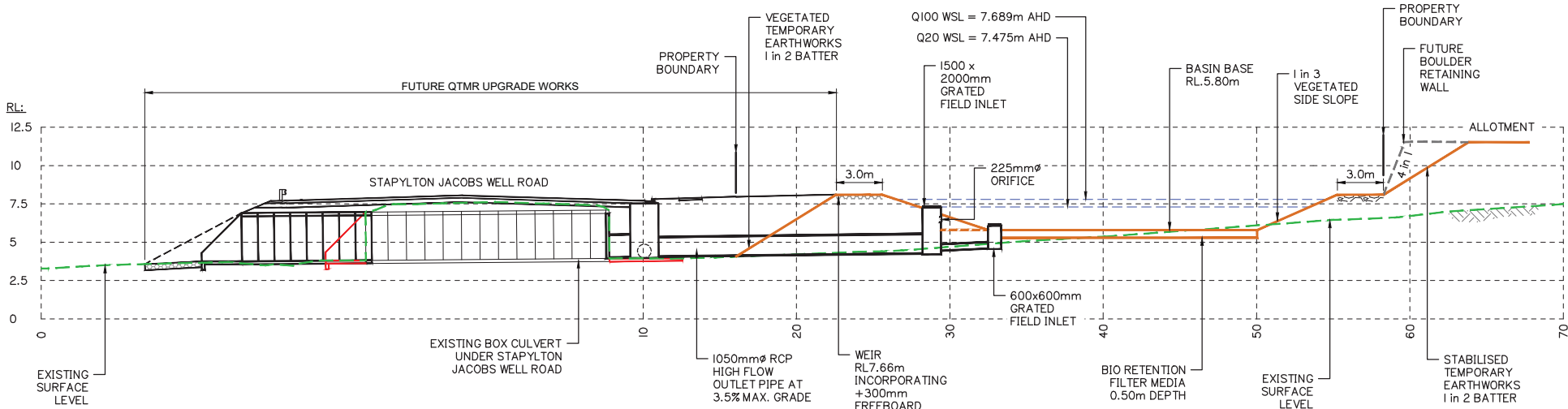
MAINTENANCE ACCESS TRACK - TYPICAL SECTION

N.T.S

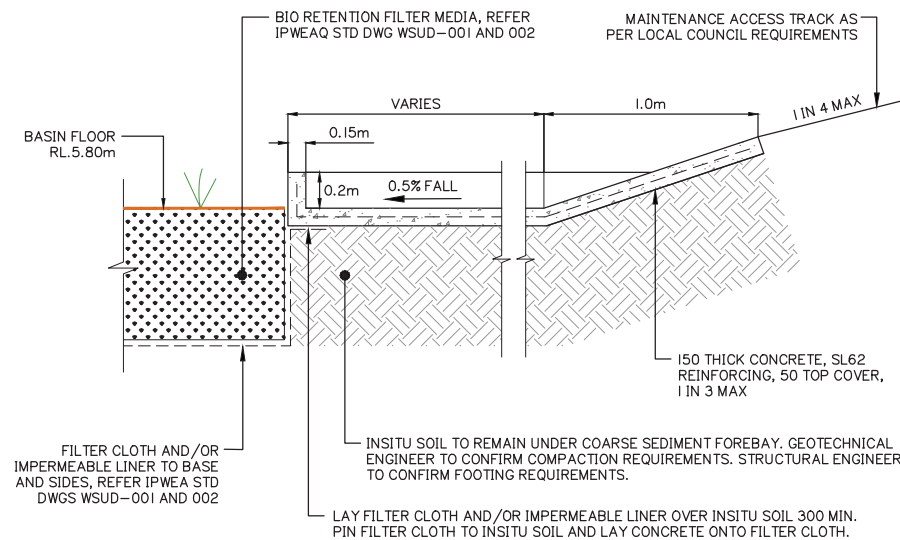


TYPICAL BIO-RETENTION BASIN DETAIL

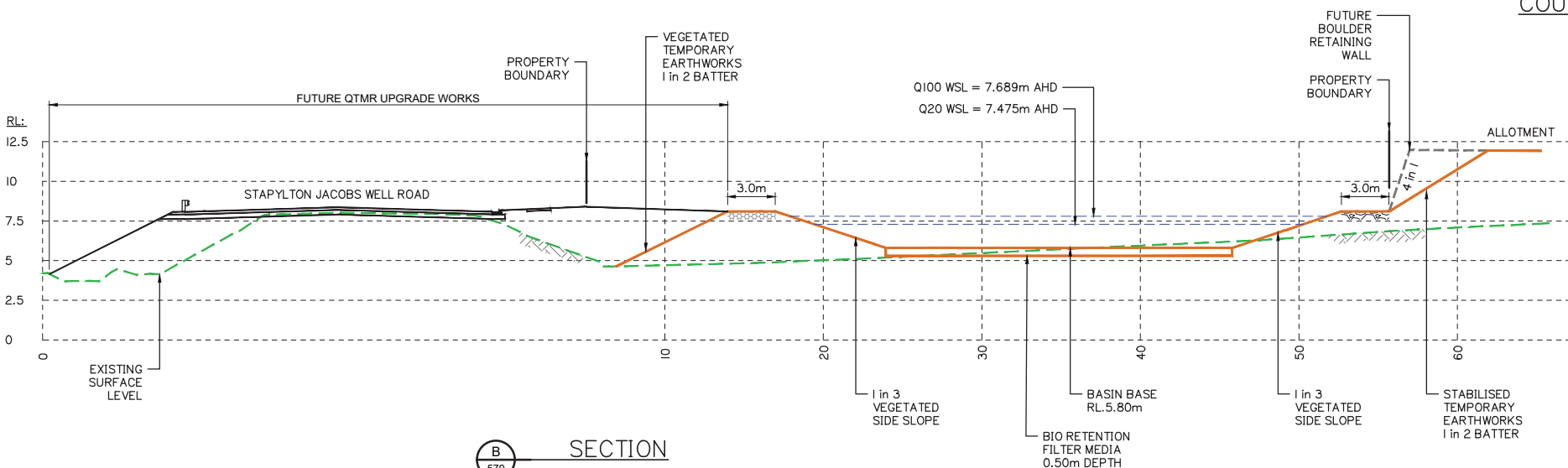
N.T.S



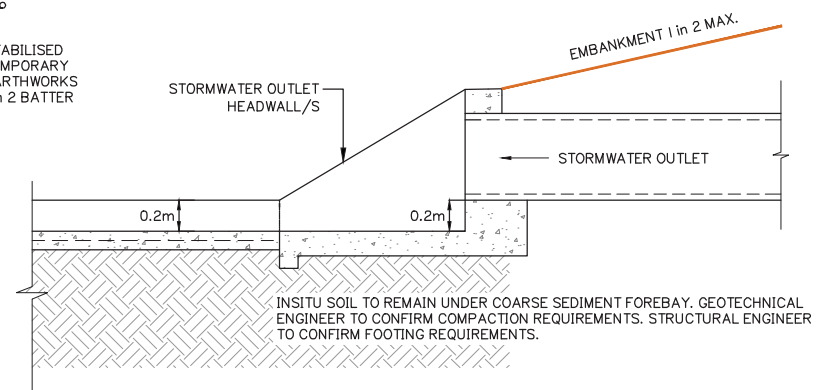
SECTION A 570 NTS



COURSE SEDIMENT FOREBAY TYPICAL SECTION N.T.S



SECTION B 570 NTS



TYPICAL STORMWATER OUTLET TO SEDIMENT FOREBAY N.T.S

Client: KS8 Pty. Ltd.

Site Address: 60 STAPYLTON JACOBS WELL ROAD, STAPYLTON

RPD: Lot / Plan: 1 on RP6882, 240 on W31320, 4 on RP6843
Parish: Albert
County: Ward
Local Authority: City of Gold Coast Council
Level Datum: AHD
Meridian: IS216853
Contour Interval: -
PSM: -
RL: -

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DRAWING TITLE
OPERATIONAL PHASE
BIO RETENTION BASIN
LAYOUT PLAN AND DETAILS
SHEET 2 OF 2

Table with 4 columns: Issue, Date, Description, and a column for initials (IG, MG, GCP, DRN, CHK). It contains revision history entries.

SCALE IN METRES

AS SHOWN

Scale at A1: AS SHOWN

Table with 2 columns: Field (Designed, Drafted, Approved, RPEQ, Signed, Date) and Value (IG, GCP, MG, 16939, signature, 30-08-18).

Drawing No: 5738 ENG BE1 571 Rev. No: B

## Appendix D – Balance Earthworks Below Defined Flood Event Level



KS8 Pty. Ltd.

60 STAPLYTON JACOBS  
WELL ROAD, STAPYLTON

Lot / Plan: 1 on RP6882  
240 on W31320  
4 on RP6843

Parish: Albert  
County: Ward  
Local Authority: City of Gold Coast

|                   |          |
|-------------------|----------|
| Level Datum:      | Council  |
| Meridian:         | AHD      |
| Contour Interval: | AS216853 |
| PSM:              | -        |
| RL:               |          |

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## DRAWING TITLE

PRE DEVELOPED  
Q100 FLOOD STORAGE  
VOLUME ASSESSMENT

|       |          |                                      |     |     |  |
|-------|----------|--------------------------------------|-----|-----|--|
|       |          |                                      |     |     |  |
|       |          |                                      |     |     |  |
|       |          |                                      |     |     |  |
|       |          |                                      |     |     |  |
|       |          |                                      |     |     |  |
|       |          |                                      |     |     |  |
|       |          |                                      |     |     |  |
| C     | 30-08-16 | FURTHER INFORMATION REQUEST RESPONSE | JG  | MG  |  |
| B     | 30-05-16 | ISSUED FOR TENDER                    | GOP | MG  |  |
| B     | 11-05-16 | INFORMATION REQUEST RESPONSE         | GCP | MG  |  |
| A     | 09-02-16 | ORIGINAL ISSUE                       | GCP | MG  |  |
| Issue | Date     | Description                          | DPI | CHK |  |

SCALE IN METRES



1:400 (FULL SIZE A1)  
1:800 (HALF SIZE A3)

Scale at A1: 1:400

|           |    |
|-----------|----|
| Designed: | IG |
|-----------|----|

|          |     |
|----------|-----|
| Drafted: | GCP |
|----------|-----|

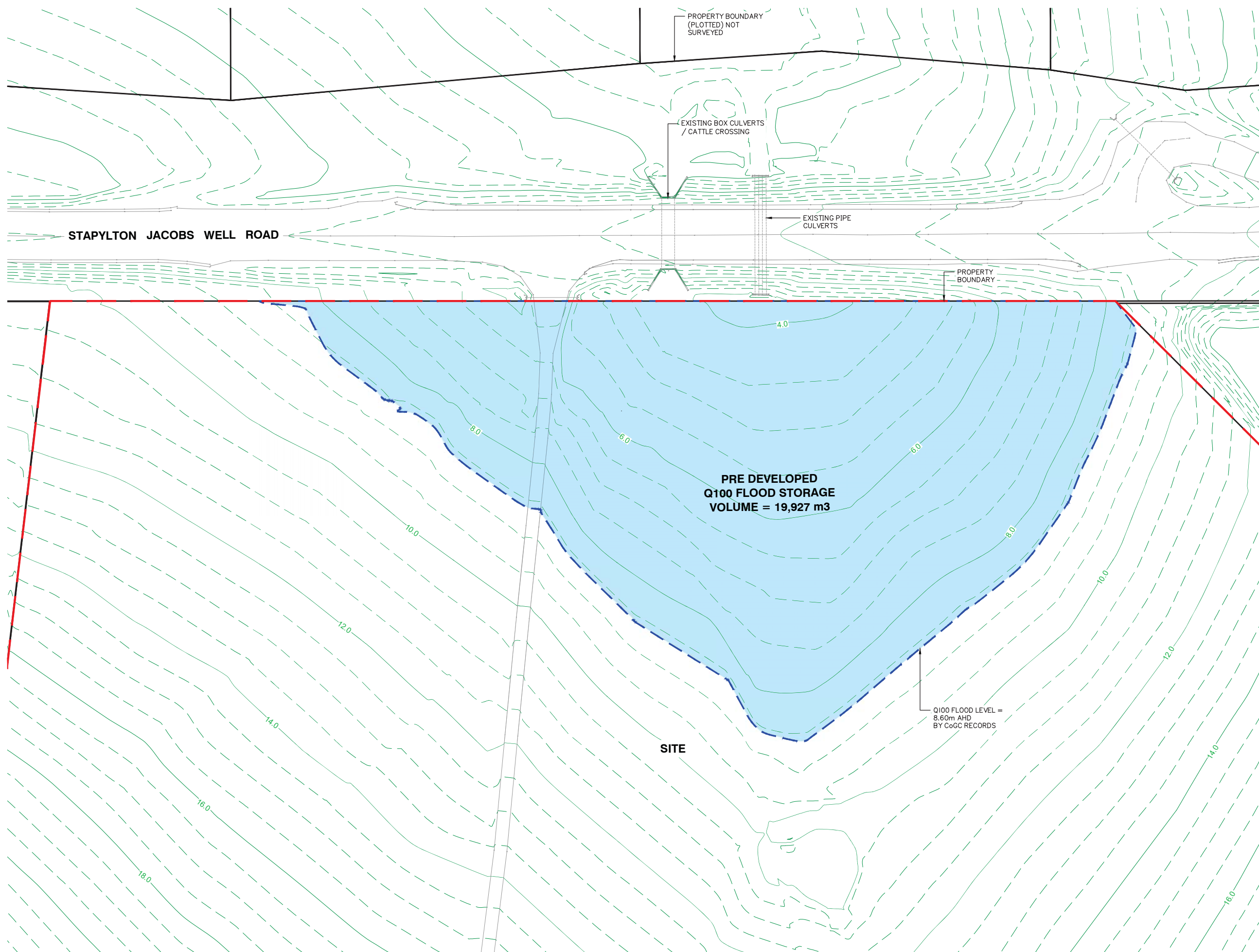
|           |    |
|-----------|----|
| Approved: | MG |
|-----------|----|

|       |       |
|-------|-------|
| RPEQ: | 16939 |
|-------|-------|

|         |                                                                                       |
|---------|---------------------------------------------------------------------------------------|
| Signed: |  |
|---------|---------------------------------------------------------------------------------------|

|       |          |
|-------|----------|
| Date: | 30-08-18 |
|-------|----------|

|                  |          |
|------------------|----------|
| Drawing No:      | Rev. No: |
| 5738 ENG BE1 422 | C        |



## PRE DEVELOPED Q100 FLOOD STORAGE VOLUME ASSESSMENT



KS8 Pty. Ltd.

60 STAPLYTON JACOBS  
WELL ROAD, STAPYLTON

Lot / Plan: 1 on RP6882  
240 on W31320  
4 on RP6843

Parish: Albert  
County: Ward  
Local Authority: City of Gold Coast

|                   |          |
|-------------------|----------|
| Level Datum:      | AHD      |
| Meridian:         | IS216853 |
| Contour Interval: | -        |
| PSM:              |          |
| RL:               |          |

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## DRAWING TITLE

## POST DEVELOPED Q100 FLOOD STORAGE VOLUME ASSESSMENT

[illegible]

SCALE IN METRES



1:400 (FULL SIZE A1)  
1:800 (HALF SIZE A3)

|              |       |
|--------------|-------|
| Scale at A1: | 1:400 |
|--------------|-------|

|           |    |
|-----------|----|
| Designed: | IC |
|-----------|----|

|          |     |
|----------|-----|
| Drafted: | GCP |
|----------|-----|

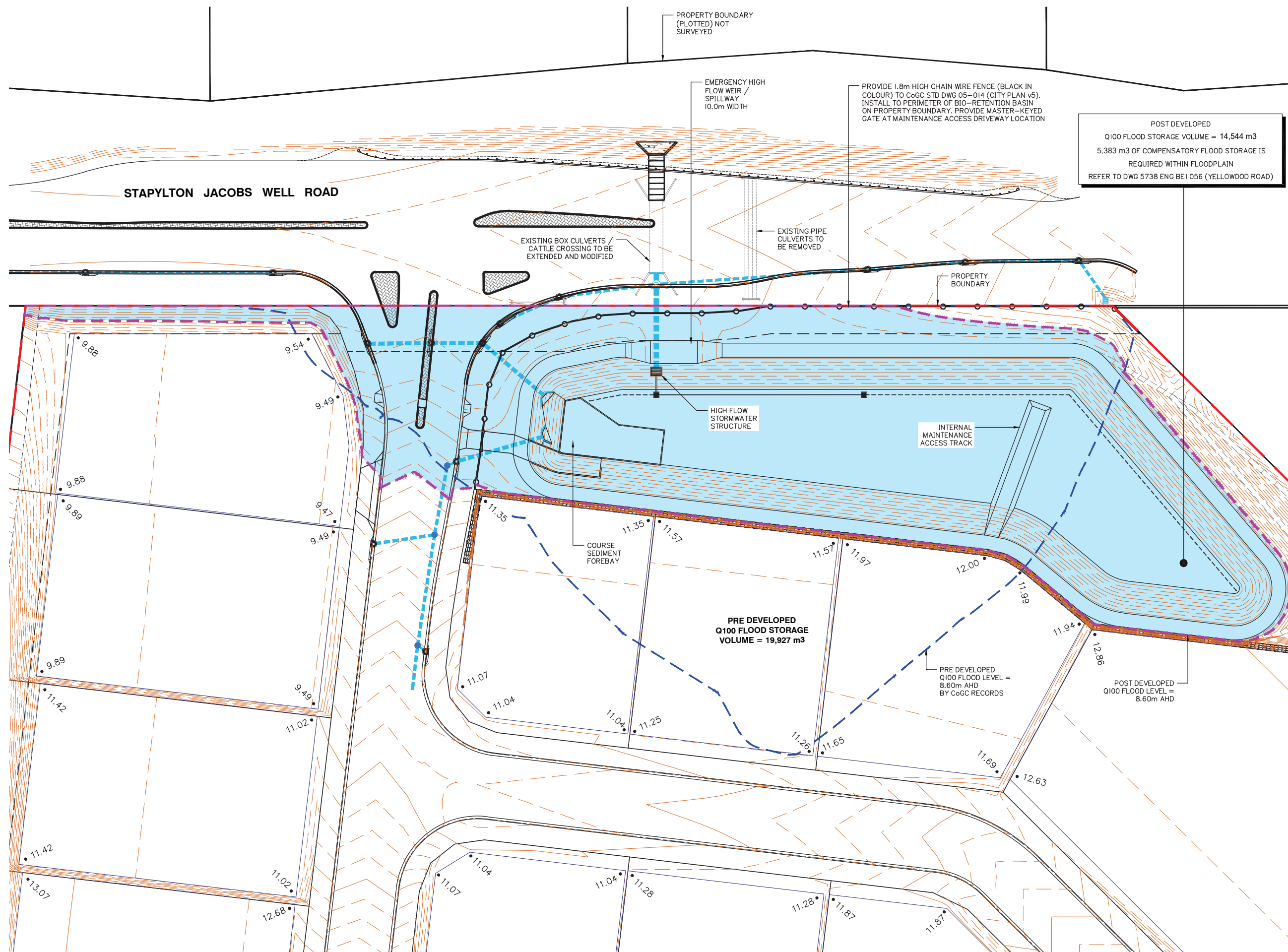
|           |    |
|-----------|----|
| Approved: | MG |
|-----------|----|

|       |      |
|-------|------|
| RPEQ: | 1693 |
|-------|------|

|         |                                                                                       |
|---------|---------------------------------------------------------------------------------------|
| Signed: |  |
|---------|---------------------------------------------------------------------------------------|

|       |          |
|-------|----------|
| Date: | 30-08-18 |
|-------|----------|

|                  |          |
|------------------|----------|
| Drawing No:      | Rev. No: |
| 5738 ENG BE1 423 | C        |



## POST DEVELOPED Q100 FLOOD STORAGE VOLUME ASSESSMENT



## Appendix E – MUSIC Catchment Plan



PROPOSED BIO-RETENTION BASIN DETAILS

- 1 in 3 INTERNAL BATTER SLOPE
- 189m<sup>2</sup> COURSE SEDIMENT FOREBAY PROVIDED AT PIPE OUTLETS
- MAINTENANCE BUND WHERE AREA EXCEEDS 800m<sup>2</sup>
- 3.0m WIDE MAINTENANCE ACCESS TO PERIMETER
- 2,574m<sup>2</sup> FILTER AREA
- 0.50m FILTER DEPTH
- 300mm EXTENDED DETENTION
- 2,905m<sup>2</sup> EXTENDED DETENTION SURFACE AREA
- 4.962m<sup>3</sup>/s HIGH FLOW BYPASS (MITIGATED DISCHARGE)
- 180mm/hr HYDRAULIC CONDUCTIVITY
- 800mg/kg TN CONTENT OF FILTER MEDIA
- 40mg/kg ORTHOPHOSPHATE CONTENT OF FILTER MEDIA
- BASE OF BASIN IS LINED
- BASIN IS VEGETATED WITH EFFECTIVE NUTRIENT REMOVAL PLANTS
- 10.0m BROAD CRESTED EMERGENCY SPILLWAY / WEIR (HIGH FLOW)
- PERFORATED AND SOLID UNDER DRAINAGE IS PRESENT
- PROVIDE 1.80m HIGH CHAIN WIRE FENCING TO BASIN PERIMETER TO CoGC STD DWG 05-014 (CITY PLAN v5), COLOURED: BLACK

EMERGENCY  
HIGH FLOW  
WEIR /  
SPILLWAY

WELL  
ROAD

INTERNAL MAINTENANCE TRACK

JACOBS

COURSE  
SEDIMENT  
FOREBAY  
189m<sup>2</sup>

STAPYLTON

EMERI STREET EXT.

ROAD 3

ROAD 3

ROAD 7

ROAD 4

ROAD 1

SWALE 01

CONSTRUCTION PHASE  
SEDIMENT BASIN

OVERLAND FLOW PATH SWALE  
DRAINING TO SEDIMENT BASIN

SWALE 02

CLEAN WATER DIVERSION  
DRAIN / EARTH BUND

Lease B  
SP264740



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Gold Coast & Logan | 76 Business Street, Yatala QLD | PO Box 392, Beenleigh 4207  
Brisbane | Level 8, 97 Creek Street, Brisbane QLD 4000 GPO Box 999, Brisbane 4000

Client:

KS8 Pty. Ltd.

Site Address:

60 STAPYLTON JACOBS WELL  
ROAD, STAPYLTON

RPD:

Lot / Plan: 1 / RP6882  
240 / W31320  
Parish: Albert  
County: Ward  
Local Authority: City of Gold Coast  
Council  
Level Datum: AHD  
Meridian: IS216853  
Contour Interval: .  
RL: .

Associated Consultants:

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DRAWING TITLE:

MUSIC CATCHMENT PLAN

LEGEND

CONTRIBUTING CATCHMENTS FOR MUSIC  
MODELLING, INDICATED IN RED BOUNDARY



LANDSCAPE (10% IMPERVIOUS)  
INCLUDING FILTER MEDIA AREA  
0.873 Ha

LOTS (70% ROOF, 30% GROUND)  
TOTAL: 12.209 Ha  
ROOF 70% SPLIT: 8.546 Ha  
GROUND 30% SPLIT: 3.663 Ha

ROAD (90% IMPERVIOUS)  
2.800 Ha

NOTE:

IMPERVIOUS VALUES PER POLLUTANT GENERATOR NODE HAVE BEEN CALIBRATED  
TO ENSURE 90% OVERALL IMPERVIOUS AREA IS ACHIEVED FOR MUSIC MODELLING

SCALE IN METRES



1:1500 (FULL SIZE A1)  
1:3000 (HALF SIZE A3)

Scale at A1: 1:1500

Designed: IG

Drafted: IG

Approved: MG

RPEQ: 16939

Signed:

Date: 30-08-18

Drawing No: 5738 ENG SMP1 003  
Rev. No: C

MUSIC CATCHMENT PLAN

## Appendix F – MUSIC Link Report

## MUSIC-link Report

| Project Details                 |                                    | Company Details |                                                            |
|---------------------------------|------------------------------------|-----------------|------------------------------------------------------------|
| <b>Project:</b>                 | CoGC: M38 Industrial Park, Yatala  | <b>Company:</b> | KS8 Pty. Ltd. c/o Gassman Development Perspectives Pty Ltd |
| <b>Report Export Date:</b>      | 22/08/2018                         | <b>Contact:</b> | Mitchell Gassman                                           |
| <b>Catchment Name:</b>          | 5738 CoGC M38 Industrial Park      | <b>Address:</b> | 76 Business Street Yatala QLD 4207                         |
| <b>Catchment Area:</b>          | 15.882ha                           | <b>Phone:</b>   | 0738073333                                                 |
| <b>Impervious Area*:</b>        | 91.12%                             | <b>Email:</b>   | mitchell@gassman.com.au                                    |
| <b>Rainfall Station:</b>        | 40406 BEENLEIGH                    |                 |                                                            |
| <b>Modelling Time-step:</b>     | 6 Minutes                          |                 |                                                            |
| <b>Modelling Period:</b>        | 1/01/1990 - 31/12/1999 11:54:00 PM |                 |                                                            |
| <b>Mean Annual Rainfall:</b>    | 1105mm                             |                 |                                                            |
| <b>Evapotranspiration:</b>      | 1492mm                             |                 |                                                            |
| <b>MUSIC Version:</b>           | 6.2.1                              |                 |                                                            |
| <b>MUSIC-link data Version:</b> | 6.22                               |                 |                                                            |
| <b>Study Area:</b>              | City of Gold Coast (North)         |                 |                                                            |
| <b>Scenario:</b>                | City of Gold Coast (North)         |                 |                                                            |

\* 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: LPoD-5                  | Reduction | Node Type          | Number | Node Type         | Number |
| <b>Flow</b>                   | 4.55%     | Bio Retention Node | 1      | Urban Source Node | 4      |
| <b>TSS</b>                    | 89.4%     |                    |        |                   |        |
| <b>TP</b>                     | 70.7%     |                    |        |                   |        |
| <b>TN</b>                     | 57.5%     |                    |        |                   |        |
| <b>GP</b>                     | 99.9%     |                    |        |                   |        |

### Comments

- 1 in 3 INTERNAL BATTER SLOPE
- 189m2 COURSE SEDIMENT FOREBAY PROVIDED AT PIPE OUTLETS
- INTERNAL MAINTENANCE BUND WHERE AREA EXCEEDS 800m2
- 3.0m WIDE MAINTENANCE ACCESS TO PERIMETER
- 2,574m2 FILTER AREA, 0.50m FILTER DEPTH
- 300mm EXTENDED DETENTION, 2,905m2 EXTENDED DETENTION SURFACE AREA
- 4.962m3/s HIGH FLOW BYPASS (MITIGATED DISCHARGE)
- 180mm/hr HYDRAULIC CONDUCTIVITY
- 800mg/kg TN CONTENT OF FILTER MEDIA
- 40mg/kg ORTHOPHOSPHATE CONTENT OF FILTER MEDIA
- BASE OF BASIN IS LINED, BASIN IS VEGETATED WITH EFFECTIVE NUTRIENT REMOVAL PLANTS
- 10.00m OVERFLOW BROAD CRESTED WEIR WIDTH, UNDER DRAINAGE IS PRESENT

### Passing Parameters

| Node Type | Node Name                                       | Parameter                                | Min  | Max  | Actual |
|-----------|-------------------------------------------------|------------------------------------------|------|------|--------|
| Bio       | Bio-Retention Basin Stg 1 (2_574 m2 Filter)     | Exfiltration Rate (mm/hr)                | None | None | 0      |
| Bio       | Bio-Retention Basin Stg 1 (2_574 m2 Filter)     | Extended detention depth (m)             | None | 1    | 0.3    |
| Bio       | Bio-Retention Basin Stg 1 (2_574 m2 Filter)     | Filter depth (m)                         | 0.4  | 1    | 0.5    |
| Bio       | Bio-Retention Basin Stg 1 (2_574 m2 Filter)     | Hi-flow bypass rate (cum/sec)            | None | None | 4.962  |
| Bio       | Bio-Retention Basin Stg 1 (2_574 m2 Filter)     | Orthophosphate Content in Filter (mg/kg) | None | None | 40     |
| Bio       | Bio-Retention Basin Stg 1 (2_574 m2 Filter)     | PET Scaling Factor                       | 2.1  | 2.1  | 2.1    |
| Bio       | Bio-Retention Basin Stg 1 (2_574 m2 Filter)     | Saturated Hydraulic Conductivity (mm/hr) | 50   | 200  | 180    |
| Bio       | Bio-Retention Basin Stg 1 (2_574 m2 Filter)     | Total Nitrogen Content in Filter (mg/kg) | None | None | 800    |
| Receiving | LPoD-5                                          | % Load Reduction                         | None | None | 4.55   |
| Receiving | LPoD-5                                          | GP % Load Reduction                      | 90   | None | 99.9   |
| Receiving | LPoD-5                                          | TN % Load Reduction                      | 45   | None | 57.5   |
| Receiving | LPoD-5                                          | TP % Load Reduction                      | 60   | None | 70.7   |
| Receiving | LPoD-5                                          | TSS % Load Reduction                     | 80   | None | 89.4   |
| Urban     | CoGC - Drainage Reserve Buffer Stg 1 (0.873 Ha) | Area Impervious (ha)                     | None | None | 0.088  |
| Urban     | CoGC - Drainage Reserve Buffer Stg 1 (0.873 Ha) | Area Pervious (ha)                       | None | None | 0.784  |
| Urban     | CoGC - Drainage Reserve Buffer Stg 1 (0.873 Ha) | Total Area (ha)                          | None | None | 0.873  |
| Urban     | CoGC - Industrial GROUND Stg 1 (3.663 Ha)       | Area Impervious (ha)                     | None | None | 3.308  |
| Urban     | CoGC - Industrial GROUND Stg 1 (3.663 Ha)       | Area Pervious (ha)                       | None | None | 0.354  |
| Urban     | CoGC - Industrial GROUND Stg 1 (3.663 Ha)       | Total Area (ha)                          | None | None | 3.663  |
| Urban     | CoGC - Industrial ROAD Stg 1 (2.800 Ha)         | Area Impervious (ha)                     | None | None | 2.529  |
| Urban     | CoGC - Industrial ROAD Stg 1 (2.800 Ha)         | Area Pervious (ha)                       | None | None | 0.270  |
| Urban     | CoGC - Industrial ROAD Stg 1 (2.800 Ha)         | Total Area (ha)                          | None | None | 2.8    |
| Urban     | CoGC - Industrial ROOF Stg 1 (8.546 Ha)         | Area Impervious (ha)                     | None | None | 8.546  |
| Urban     | CoGC - Industrial ROOF Stg 1 (8.546 Ha)         | Area Pervious (ha)                       | None | None | 0      |
| Urban     | CoGC - Industrial ROOF Stg 1 (8.546 Ha)         | Total Area (ha)                          | None | None | 8.546  |

Only certain parameters are reported when they pass validation

## Appendix G – WSUD Bio Retention Basin Maintenance Checklists

| BIORETENTION BASIN CONSTRUCTION INSPECTION CHECKLIST            |  |         |   |              |                       |                                                                                                       |  |         |   |              |   |
|-----------------------------------------------------------------|--|---------|---|--------------|-----------------------|-------------------------------------------------------------------------------------------------------|--|---------|---|--------------|---|
| Asset I.D.                                                      |  |         |   |              | Inspected By:         |                                                                                                       |  |         |   |              |   |
| Site:                                                           |  |         |   |              | Date:                 |                                                                                                       |  |         |   |              |   |
|                                                                 |  |         |   |              | Time:                 |                                                                                                       |  |         |   |              |   |
| Constructed By:                                                 |  |         |   |              | Weather:              |                                                                                                       |  |         |   |              |   |
|                                                                 |  |         |   |              | Contact During Visit: |                                                                                                       |  |         |   |              |   |
| Items inspected                                                 |  | Checked |   | Satisfactory |                       | Items inspected                                                                                       |  | Checked |   | Satisfactory |   |
|                                                                 |  | Y       | N | Y            | N                     |                                                                                                       |  | Y       | N | Y            | N |
| <b>DURING CONSTRUCTION &amp; ESTABLISHMENT</b>                  |  |         |   |              |                       |                                                                                                       |  |         |   |              |   |
| <b>A. FUNCTIONAL INSTALLATION</b>                               |  |         |   |              |                       | <b>Structural components</b>                                                                          |  |         |   |              |   |
| <b>Preliminary Works</b>                                        |  |         |   |              |                       | 15. Location and configuration of inflow systems as designed                                          |  |         |   |              |   |
| 1. Erosion and sediment control plan adopted                    |  |         |   |              |                       | 16. Location and levels of overflow pits as designed                                                  |  |         |   |              |   |
| 2. Temporary traffic/safety control measures                    |  |         |   |              |                       | 17. Under-drainage connected to overflow pits as designed                                             |  |         |   |              |   |
| 3. Location same as plans                                       |  |         |   |              |                       | 18. Concrete and reinforcement as designed                                                            |  |         |   |              |   |
| 4. Site protection from existing flows                          |  |         |   |              |                       | 19. Set down to correct level for flush kerbs (streetscape applications only)                         |  |         |   |              |   |
| <b>Earthworks and Filter Media</b>                              |  |         |   |              |                       | 20. Kerb opening width as designed                                                                    |  |         |   |              |   |
| 5. Bed of basin correct shape and slope                         |  |         |   |              |                       |                                                                                                       |  |         |   |              |   |
| 6. Batter slopes as plans                                       |  |         |   |              |                       | <b>B. SEDIMENT &amp; EROSION CONTROL (IF REQUIRED)</b>                                                |  |         |   |              |   |
| 7. Dimensions of bioretention area as plans                     |  |         |   |              |                       | 21. Stabilisation immediately following earthworks and planting of terrestrial landscape around basin |  |         |   |              |   |
| 8. Confirm surrounding soil type with design                    |  |         |   |              |                       | 22. Silt fences and traffic control in place                                                          |  |         |   |              |   |
| 9. Confirm filter media specification in accordance with Step 4 |  |         |   |              |                       | 23. Temporary protection layers in place                                                              |  |         |   |              |   |
| 9. Provision of liner (if required)                             |  |         |   |              |                       |                                                                                                       |  |         |   |              |   |
| 10. Under-drainage installed as designed                        |  |         |   |              |                       | <b>C. OPERATIONAL ESTABLISHMENT</b>                                                                   |  |         |   |              |   |
| 11. Drainage layer media as designed                            |  |         |   |              |                       | 24. Temporary protection layers and associated silt removed                                           |  |         |   |              |   |
| 12. Transition layer media as designed (if required)            |  |         |   |              |                       | <b>Vegetation</b>                                                                                     |  |         |   |              |   |
| 14. Extended detention depth as designed                        |  |         |   |              |                       | 25. Planting as designed (species and densities)                                                      |  |         |   |              |   |
|                                                                 |  |         |   |              |                       | 26. Weed removal and watering as required                                                             |  |         |   |              |   |
| <b>FINAL INSPECTION</b>                                         |  |         |   |              |                       |                                                                                                       |  |         |   |              |   |
| 1. Confirm levels of inlets and outlets                         |  |         |   |              |                       | 6. Check for uneven settling of banks                                                                 |  |         |   |              |   |
| 2. Confirm structural element sizes                             |  |         |   |              |                       | 7. Under-drainage working                                                                             |  |         |   |              |   |
| 3. Check batter slopes                                          |  |         |   |              |                       | 8. Inflow systems working                                                                             |  |         |   |              |   |
| 4. Vegetation as designed                                       |  |         |   |              |                       | 9. Maintenance access provided                                                                        |  |         |   |              |   |
| 5. Bioretention filter media surface flat and free of clogging  |  |         |   |              |                       |                                                                                                       |  |         |   |              |   |
| <b>COMMENTS ON INSPECTION</b>                                   |  |         |   |              |                       |                                                                                                       |  |         |   |              |   |
|                                                                 |  |         |   |              |                       |                                                                                                       |  |         |   |              |   |
| <b>ACTIONS REQUIRED</b>                                         |  |         |   |              |                       |                                                                                                       |  |         |   |              |   |
|                                                                 |  |         |   |              |                       |                                                                                                       |  |         |   |              |   |
| Inspection officer signature:                                   |  |         |   |              |                       |                                                                                                       |  |         |   |              |   |

| BIORETENTION BASIN MAINTENANCE CHECKLIST                |                |                |                           |  |
|---------------------------------------------------------|----------------|----------------|---------------------------|--|
| Inspection Frequency:                                   | 1 to 6 monthly | Date of Visit: |                           |  |
| Location:                                               |                |                |                           |  |
| Description:                                            |                |                |                           |  |
| Asset I.D.                                              |                |                |                           |  |
| Site Visit by:                                          |                |                |                           |  |
| INSPECTION ITEMS:                                       | Y              | N              | Action Required (details) |  |
| Sediment accumulation at inflow points?                 |                |                |                           |  |
| Litter within basin?                                    |                |                |                           |  |
| Erosion at inlet or other key structures?               |                |                |                           |  |
| Traffic damage present?                                 |                |                |                           |  |
| Evidence of dumping (e.g. building waste)?              |                |                |                           |  |
| Vegetation condition satisfactory (density, weeds etc)? |                |                |                           |  |
| Watering of vegetation required?                        |                |                |                           |  |
| Replanting required?                                    |                |                |                           |  |
| Mowing/slashing required?                               |                |                |                           |  |
| Clogging of drainage points (sediment or debris)?       |                |                |                           |  |
| Evidence of ponding?                                    |                |                |                           |  |
| Damage/vandalism to structures present?                 |                |                |                           |  |
| Surface clogging visible?                               |                |                |                           |  |
| Drainage system inspected?                              |                |                |                           |  |
| Resetting of system required?                           |                |                |                           |  |
| COMMENTS                                                |                |                |                           |  |
|                                                         |                |                |                           |  |

| BIORETENTION BASIN ASSET TRANSFER CHECKLIST                                            |          |          |  |
|----------------------------------------------------------------------------------------|----------|----------|--|
| Asset I.D.                                                                             |          |          |  |
| Asset Location:                                                                        |          |          |  |
| Construction by:                                                                       |          |          |  |
| 'On-maintenance' Period:                                                               |          |          |  |
| <b>TREATMENT</b>                                                                       | <b>Y</b> | <b>N</b> |  |
| System appears to be working as designed visually?                                     |          |          |  |
| No obvious signs of under-performance?                                                 |          |          |  |
| <b>MAINTENANCE</b>                                                                     | <b>Y</b> | <b>N</b> |  |
| Maintenance plans and indicative maintenance costs provided for each asset?            |          |          |  |
| Vegetation establishment period completed (2 years)?                                   |          |          |  |
| Inspection and maintenance undertaken as per maintenance plan?                         |          |          |  |
| Inspection and maintenance forms provided?                                             |          |          |  |
| <b>ASSET INSPECTED FOR DEFECTS AND/OR MAINTENANCE ISSUES AT TIME OF ASSET TRANSFER</b> | <b>Y</b> | <b>N</b> |  |
| Sediment accumulation at inflow points?                                                |          |          |  |
| Litter within basin?                                                                   |          |          |  |
| Erosion at inlet or other key structures?                                              |          |          |  |
| Traffic damage present?                                                                |          |          |  |
| Evidence of dumping (e.g. building waste)?                                             |          |          |  |
| Vegetation condition satisfactory (density, weeds etc)?                                |          |          |  |
| Watering of vegetation required?                                                       |          |          |  |
| Replanting required?                                                                   |          |          |  |
| Mowing/slashing required?                                                              |          |          |  |
| Clogging of drainage points (sediment or debris)?                                      |          |          |  |
| Evidence of ponding?                                                                   |          |          |  |
| Damage/vandalism to structures present?                                                |          |          |  |
| Surface clogging visible?                                                              |          |          |  |
| Drainage system inspected?                                                             |          |          |  |
| <b>COMMENTS/ACTIONS REQUIRED FOR ASSET TRANSFER</b>                                    |          |          |  |
|                                                                                        |          |          |  |
| <b>ASSET INFORMATION</b>                                                               | <b>Y</b> | <b>N</b> |  |
| Design Assessment Checklist provided?                                                  |          |          |  |
| As constructed plans provided?                                                         |          |          |  |
| Copies of all required permits (both construction and operational) submitted?          |          |          |  |
| Proprietary information provided (if applicable)?                                      |          |          |  |
| Digital files (e.g. drawings, survey, models) provided?                                |          |          |  |
| Asset listed on asset register or database?                                            |          |          |  |