CONCEPTUAL STORMWATER INVESTIGATION

Fraser Coast Regional Council

Project No: FC-17-054

East Street, Howard Stormwater Mitigation

Date: November 2017

'Clients – Service – Solutions'

Document Control Record

Prepared by:	[redacted]		Approved by:	[redacted]
Position:	[redacted]		Position:	[redacted]

REVISION STATUS

Revision No.	Description of Revision	Date	Approved
A	Initial Issue	5th October, 2017	
B	Revised following review	30th November, 2017	

Recipients are responsible for eliminating all superseded documents in their possession.

Engineering Solutions Qld Pty Ltd
ACN: 163 915 160

HERVEY BAY OFFICE

4/31 Main Street
PIALBA QLD 4655

PO Box 1050
Hervey Bay Qld 4659

Telephone: +61 7 4194 1550
Email: admin@engineeringsolutionsqld.com.au

SUNSHINE COAST OFFICE

10/160 Mudjimba Beach Road
MUDJIMBA QLD 4655

PO Box 9598
Pacific Paradise Qld 4564

Telephone: +61 410 308 714

Executive Summary

Engineering Solutions Qld have been engaged by FCRC to undertake an investigation of the stormwater drainage conveyance in the East Street catchment, at Howard. This area has historically been problematic in terms of water ponding for extended durations, with residents noting mosquito breeding and an impact on the amenity of the area. Locations of specific interest for the investigation were:

- the Bruce Highway catchment;
- the depression on the corner of the Bruce Highway and Thomas Street;
- East Street residential properties;
- the outlet channel to the culverts under East Street;
- the rail bund and culvert structure; and
- the outlet to the rail culverts.

The investigation highlighted some problems related to the above, including:

1. LiDAR data indicates there is a depression on the corner of the Bruce Highway and Thomas Street. The relative culvert invert levels for the Bruce Highway and Thomas Street culvert structures mean that some of the Bruce Highway catchment currently adds to the flows from the East Street catchment. Furthermore, the water in the bottom of the depression doesn't have an outlet which results in water ponding in this location following extended rainfall.

2. LiDAR data indicates [redacted] a depressed area toward the rear of the properties and there is potential for property ponding to occur. LiDAR and detailed survey of road drainage assets confirms that the table drains in Thomas and East Streets are at a lower level and are able to drain the properties, [redacted]

3. LiDAR data indicates that the outlet channel for the culverts under East Street, which conveys flows downstream to the large dam [redacted], has a very flat longitudinal slope and is currently poorly defined.

4. [redacted] Constraints caused by the ground levels along the rear of properties, and the proximity of the dam wall ultimately limits the flow of water through this section, resulting in a trapped sag along the rear of lots.

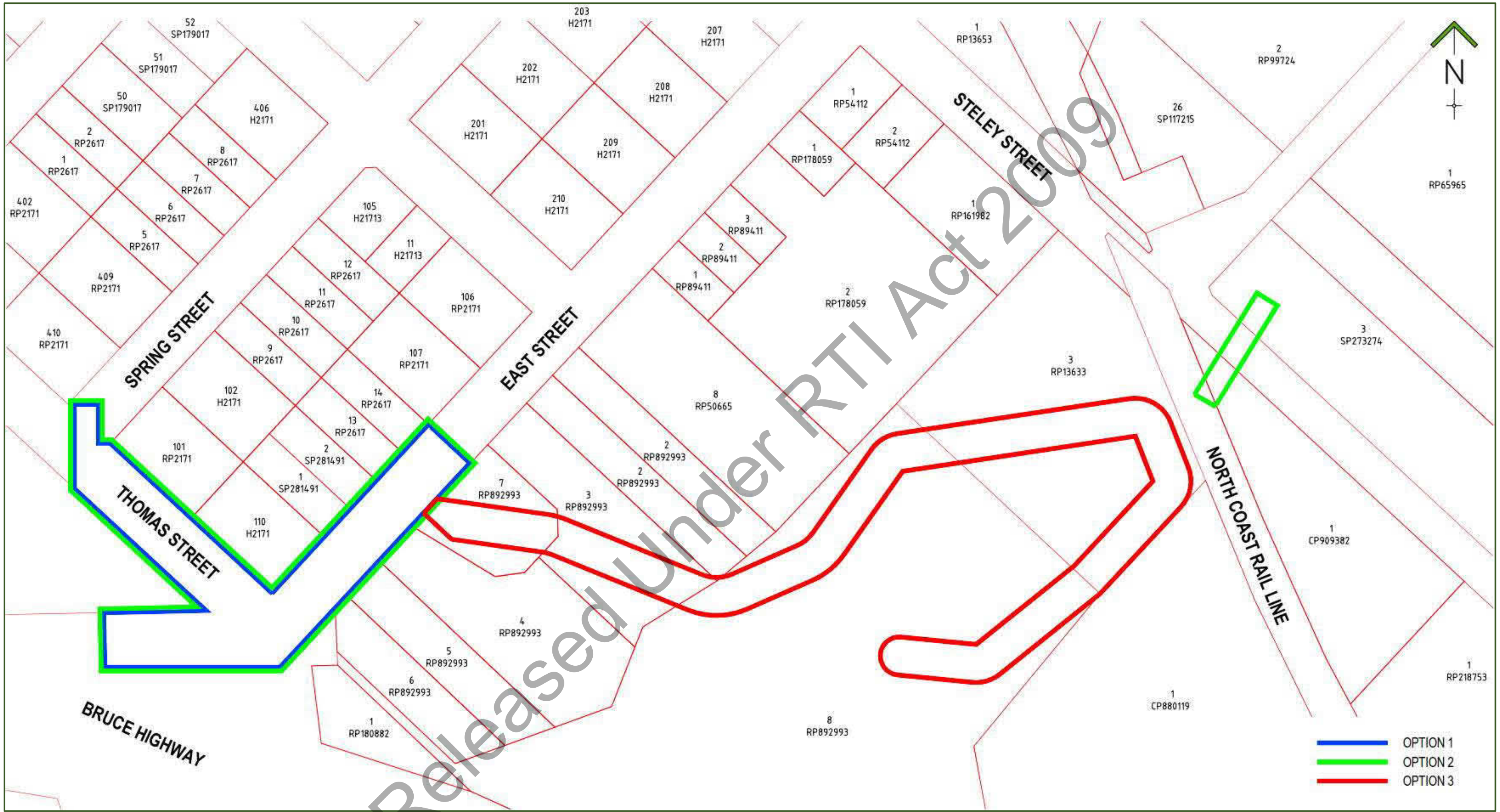
5. LiDAR data indicates that the outlet area downstream of the existing RCBC rail structure is very constrained by ground levels and a small culvert [redacted] and ultimately causes the area upstream of the rail line to detain runoff.

Stormwater Quantity Management

Three (3) options were investigated as part of this study, to attempt to resolve the extended ponding durations. The options investigated were:

- OPTION 1 – Diversion bund along Thomas Street and various culvert upgrades/replacement;
- OPTION 2 – Option 1 plus an improved outlet to the rail culverts; and
- OPTION 3 – Cleaning out and better definition of the outlet channel for the East Street culverts, cleaning out and better definition of the spillway outlet channel for the large dam [redacted] and excavating an outlet drain [redacted] and
- OPTION 4 – A combination of Options 1 to 3.

[redacted]



Options Works Areas

OPTION SUMMARY TABLE – Existing Developed Case

OPTION	DESCRIPTION	ARI	MITIGATION PROVIDED	DISADVANTAGES	OPINION OF COST
1	Inclusion of a diversion bund along the southern side of Thomas Street. Upgrade and replace the culvert structure under Thomas Street. Upgrade and replace the culvert structure under Spring Street. Upgrade the culvert structures under East Street. Upgrade and replace the driveway culvert for [redacted].	[redacted]	• [redacted]; • [redacted] [redacted]; and • [redacted]	• [redacted] [redacted] [redacted].	Approx. [redacted]
2	As per Option 1 but including improvement to the outlet for the rail culvert structure and upgrade of the culverts under Steley Street	[redacted]	• [redacted].	• [redacted]	Approx. [redacted]

OPTION	DESCRIPTION	ARI	MITIGATION PROVIDED	DISADVANTAGES	OPINION OF COST
3	Clean out and regrade existing open channel downstream of the East Street culverts. Clean out and regrade the weir overflow channel from the large dam on [redacted] Excavate small outlet channel around the north western corner of the dam on [redacted].	[redacted]	• [redacted]	• [redacted]	Approx. [redacted]*
4	Combination of the above three options	[redacted]	• [redacted]; • [redacted]	• [redacted]	Approx. [redacted]

*** Refer to Appendix G for an itemised breakdown of the conceptual opinion of cost.*

Qualifications & Limitations

This report: Conceptual Stormwater Investigation – East Street Howard, has been prepared by ESQ for the Fraser Coast Regional Council (FCRC) and may only be used and relied on by the FCRC for the purpose agreed between ESQ and the FCRC as set out in all sections of this report.

ESQ otherwise disclaims responsibility to any person other than FCRC arising in connection with this report. ESQ also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by ESQ in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report. The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. ESQ has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by ESQ described in this report. ESQ disclaims liability arising from any of the assumptions being incorrect.

ESQ has prepared this report on the basis of information provided by FCRC, which ESQ has not independently verified or checked beyond the agreed scope of work. ESQ does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

Flood event frequency, depth, velocity and behaviour vary temporally and spatially within any particular floodplain or floodway. Estimates of flood characteristics provided in this report are only approximations of actual flood behaviour. Flood events of greater magnitude than those discussed in this report can and will occur, and flood impacts greater than those indicated are possible.

The flood modelling presented in this report has been undertaken for a local drainage assessment only, and does not represent a total catchment flood model. Modelled rainfall was applied only to the investigation area, and some areas outside the mapped flood extents (i.e. part of the total catchment over Howard) will be subject to inundation during storm events.

All computer models, results, maps, digital files and other information associated with this report are subject to the limitations outlined in this report and no use of or reliance upon any such information is permitted by ESQ if separated from this document. No use of any digital files associated with this report (including flood surfaces) for design or other purposes within computer software packages is permitted, if not accompanied by this report.

Contents

Figures

Tables

Appendices

1 Introduction

Engineering Solutions Qld have been engaged by FCRC to undertake an investigation of the stormwater drainage conveyance in the East Street catchment, at Howard. This area has historically been problematic in terms of water ponding for extended durations in private property, with residents noting mosquito breeding and an impact on the amenity of the area.

1.1 Scope

Specifically, this report details the following:

1. Overview of the current drainage network and catchment characteristics;
2. Examination of existing catchment modelling; and
3. Examination of potential mitigation measures to determine their effectiveness.

1.2 Objective

Residents around East Street at Howard have raised concerns about the duration of water ponding in the area following storm events, with the water eventually stagnating and facilitating mosquito breeding. The objective of this report is to review the existing catchment and drainage network, examine the modelling results and investigate potential options for mitigation of pond depth and/or duration.

1.3 Existing situation

The East Street catchment investigated as part of this report is approx. 30Ha. in size. The catchment extends from the William Street in the West to the Rail Line in the East, with the catchment limits shown in Figure 1.1 below. The upper catchment typically has steeper slopes, with the lower catchment below East Street being typically flat with poorly defined flow paths.

[redacted] Residents have noted extended ponding in the following locations:

- the corner of the Bruce Highway and Thomas Street;
- [redacted]
- downstream of the East Street culverts, through the easement;
- [redacted]; and
- upstream of the rail culverts.

These areas therefore formed key locations for the investigation carried out for this report.

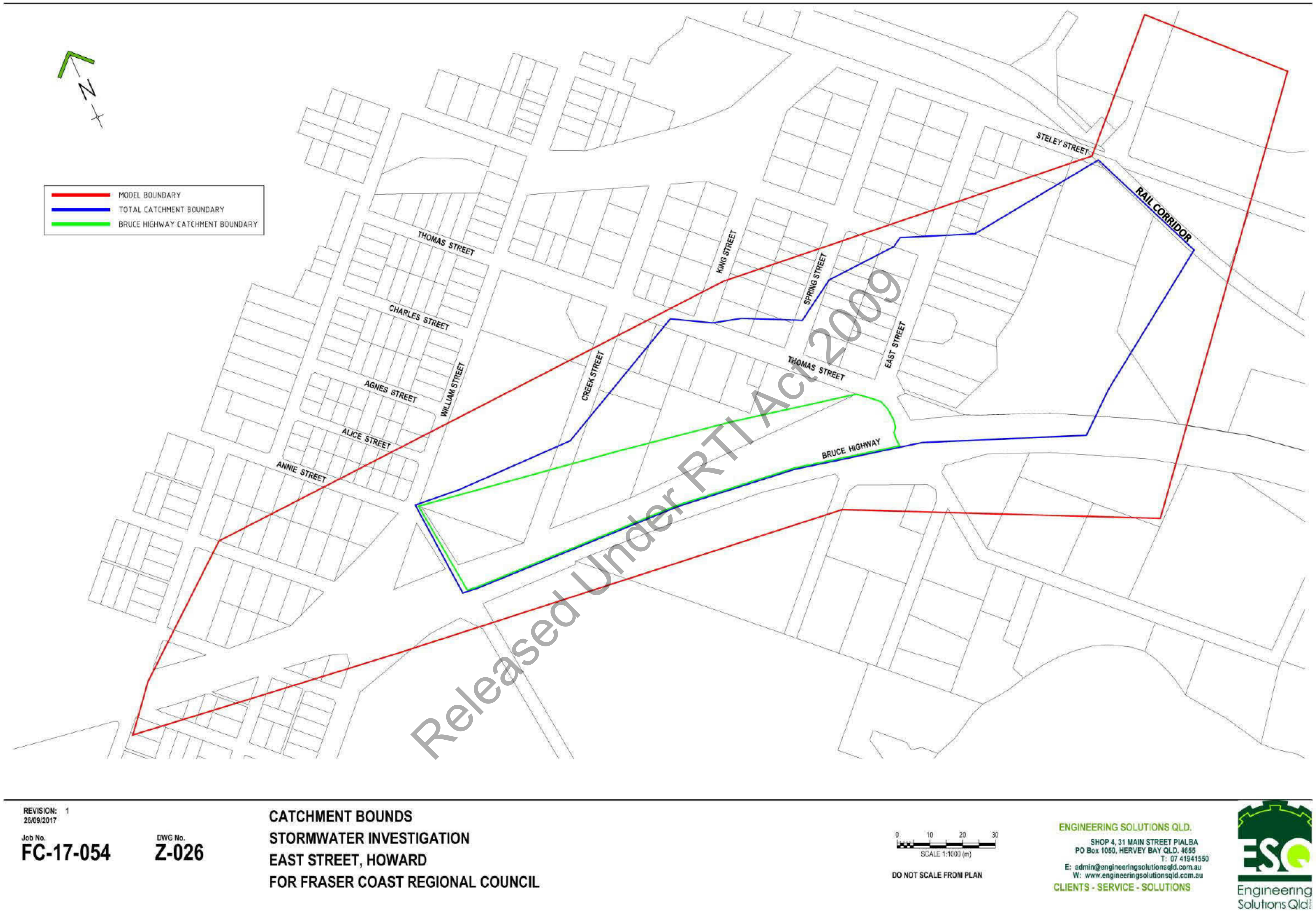


Figure 1.1 Total Catchment, Model Boundary and Bruce Highway catchment

2 Stormwater Management – Options Analysis

2.1 Introduction

The existing scenario was examined, using invert levels obtained from GIS and site survey at various locations. There were several controls found for the overall catchment drainage regime, namely:

1. The outlet to the rail culverts downstream of the large dam [redacted]
2. A large depression on the north-western corner of the Bruce Highway and Thomas Street and the culvert structure under the Bruce Highway.
3. The outlet channel to the culverts under East Street.
4. The western bund for the large dam [redacted]

2.2 Modelling

This investigation was undertaken with a combination of 1-Dimensional (1D) and 2-Dimensional (2D) modelling, with the surface flows handled by the 2D engine and pipe flows handled by the 1D engine. 12d Model (V12C1j) was adopted as it has both 1D and 2D capability, using TUFLOW as the 2D engine.

TUFLOW models flows across a surface – in this case LiDAR survey – with the surface roughness assigned as a Manning's n value. A preliminary review of the LiDAR contours suggested that the major surface features were included and the surface would therefore be suitable for use. The time of concentration for a catchment does not need to be explicitly calculated, except as a check, because the time for the flows to reach the outlet will be dependent on the surface shape and roughness.

A grid of cells was established over the catchment to facilitate the exports to the TUFLOW engine. For this investigation, a cell size of 5m x 5m was adopted as it was expected to provide a reasonable level of accuracy without excessive calculation times.

2.2.1 Model Parameters

The current Fraser Coast Planning Scheme (FCPS) establishes rainfall loss parameters to be used for flood modelling as follows:

Table 2.1 – FCPS Rainfall Losses

Surface Condition	Initial Rainfall Loss (IL)	Continuing Rainfall Loss (CL)
Impervious Surfaces	0 mm	0 mm/hr
Pervious Surfaces (non-sand)	15 mm	2.5 mm/hr
Pervious Surfaces (sand)	35 mm	2.5 mm/hr

Source: FCPS Section 6.3.5.2 (3) "Flood studies"

As the soil across the catchment is a clay-based material, the non-sand loss parameters outlined in Table 2.1 were adopted for the model. A default manning's n of 0.1 was adopted across the entire TUFLOW grid. This was then replaced by the value for each of the sub-areas defined. Areas for existing roadways, bushland, grassland, and dam footprints were established from aerial imagery (Fraser Coast Regional Council online mapping) as shown on sketch plan FC-17-054-Z01 in Appendix A. The relevant parameters adopted for modelling are summarised in Table 2.2 below.

A sensitivity check was run for both Manning's values and loss parameters. The model did not appear to be particularly sensitive to either the Manning's values or loss parameters. This is likely due to the nature of the lower end of the catchment and problem areas, with flow restriction being responsible for the areas of extended ponding and the large storage volume available upstream of the rail corridor preventing large changes in storage depth with changes in volume.

Table 2.2 – Existing Developed Case Surface modelling parameters

Surface Type	Manning's n	Impervious Area %	Initial Loss mm	Continuing Loss mm/hr
Road	0.022	50	15	2.5
Water Body	0.030	0	0	0
Low Density Residential < 1000 m^2	0.100	40	15	2.5
Low Density Residential > 1000 m^2	0.100	30	15	2.5
Undeveloped	0.08	0	15	2.5

Refer to sketch plan FC-17-054-Z01 in Appendix A for extents of above Manning's regions.

Data provided by FCRC for this investigation was sourced from the following:

- LiDAR 2010 data capture;
- FCRC Stormwater Asset Database indicating pipe/culvert locations, sizes and invert levels; and
- detailed site survey of stormwater infrastructure, table drain invert levels and outlet drain invert levels for East Street (May and October, 2017).

The existing stormwater network layout is shown on sketch plan FC-17-054-Z20 and Z21 in Appendix A for reference.

An ultimate developed case was also investigated to determine the performance of the network in a fully developed scenario, with the land uses in accordance with the current FCPS mapping. The roughness areas adopted for the ultimate developed case are summarised in Table 2.3 below and indicated on sketch plan FC-17-054-Z02 in Appendix A.

Fraser Coast Regional Council identified which models should be run for the existing developed and ultimate developed cases respectively.

Table 2.3 – Ultimate Developed Case Surface modelling parameters

Surface Type	Manning's n	Impervious Area %	Initial Loss mm	Continuing Loss mm/hr
Road	0.017	90	15	2.5
Water Body	0.030	0	0	0
Low Density Residential < 1000 m^2	0.100	60	15	2.5
Low Density Residential > 1000 m^2	0.100	40	15	2.5
Rural	0.08	0	15	2.5
District Centre	0.015	100	0	0
Community Facilities	0.015	100	0	0
Rural Res. >2 ha.	0.1	10	15	2.5
Open Space	0.06	0	15	2.5
Sport and Recreation	0.045	1	15	2.5
Medium Impact Industry	0.1	100	0	0
Environment and Conservation	0.15	0	15	2.5

Refer to sketch plan FC-17-054-Z02 in Appendix A for extents of above Manning's regions.

2.3 Modelling Results

2.3.1 Existing Network

As a result of residential feedback, Fraser Coast Regional Council identified the need to provide mitigation of peak minor-storm ponding issues as the primary goal, with major-storm ponding a secondary goal. The existing model was run for a 2-year Average Recurrence Interval (ARI) along with a 10-year ARI to determine problem areas throughout the catchment. Both the existing developed case and the ultimate developed cases were examined for both the 2-year and 10-year ARI.

A range of temporal rainfall patterns, as outlined in Australian Rainfall and Runoff (AR&R 1987) were run to find the peak storm event for the catchment. The existing network model was run for both the existing developed and ultimate developed case.

Modelling suggested that the peak 2-year ARI storm duration is the 9-hour (540min), while the peak 10-year ARI storm duration is the 18 hour (1080min). The results of the modelling for both the 2-year and 10-year ARI peak storms are included in Appendix B

The modelling suggested problem areas exist in both ARI as follows:

- the corner of the Bruce Highway and Thomas Street
- [redacted]
- downstream of the East Street culverts, through the easement;
- [redacted]; and
- upstream of the rail culverts.

These problem areas agree with the locations identified by residents. In reviewing the model outputs, several points were noted relating to the above locations.

1. LiDAR data indicates there is a depression on the corner of the Bruce Highway and Thomas Street. Figure 2.1 below shows an analysis of the LiDAR surface data. Areas with a higher surface level are shown as green, with the colours grading down to blue in the lower areas. This pictorial representation of the LiDAR surface clearly shows the trapped nature of the depression on this corner. The large culvert structure under the Bruce Highway, which discharges toward the Burrum River to the South, has an invert level which is approx. 400mm higher than the bottom of the depression; however, LiDAR data indicates there is a limited flow path to the culverts from the depression. The existing culvert structure under Thomas Street, just to the north of this depression has an invert level which is approx. 100mm higher than the bottom of the depression. Consequently, the Bruce Highway catchment currently contributes flows to the East Street catchment through the Thomas Street culvert. Furthermore, because the water in the bottom of the depression doesn't have an outlet, and the flow paths to the culverts are restricted, there will always be water which is unable to drain away in this location following extended rainfall.

2. [redacted]). The lowest level interrogated from the LiDAR data in the depression is approx. RL16.14. The minimum level along the Thomas Street [redacted] is approx. RL16.3 and the minimum level along the East Street property boundary is RL16.4. An examination of the existing table drains [redacted] indicates that the minimum level in the bottom of the table drain is approx. RL16.1. While there is potential for the ponding [redacted] internal allotment levels appear to prevent conveyance to the table drain/s in East and Thomas Streets. [redacted]

3. LiDAR data indicates that the outlet channel for the culverts under East Street, which conveys flows downstream to the large dam [redacted], has a very flat longitudinal slope and is currently poorly defined. There is little work that can be done to improve the longitudinal grade of the channel, however, better definition and cleaning of the base of the channel should provide some level of improvement to the conveyance of flows from East Street to the dam.

4. LiDAR data indicates that the existing fall of the land [redacted] Constraints caused by the ground levels along the rear of properties, and the proximity of the dam wall ultimately limits the flow of water through this section, resulting in a trapped sag along the rear of lots [redacted].

5. A review of the asset data information provided by FCRC, in conjunction with the LiDAR dataset indicated that the rail culverts (2/1200x900 RCBC) outlet to a single 450mm dia. [redacted] Modelling suggests that the 450mm dia. culvert is effectively creating a detention basin upstream of the rail bund, by restricting the outflow rate and raising the water level required to overflow to the Steley Street culverts. This would indicate that improving the outlet to the rail culvert structure may assist in alleviating the ponding seen in the model, upstream of the rail bund.

[redacted]

[redacted]

2.3.2 Mitigation Options Analysis

The existing case results were reviewed and discussed with FCRC, to determine mitigation options for investigation which may provide the best catchment response.

The options identified for investigation were as follows.

- **OPTION 1** – Installation of an earth bund along the southern side of the lower reaches of Thomas Street, with the intention of preventing flows from the Bruce Highway catchment from entering the East Street conveyance network. Upgrade various culverts around Spring Street, and Thomas Street [redacted]
- **OPTION 2** – In addition to Option 1, upgrade the outlet to the rail culverts.
- **OPTION 3** – Reshaping and regrading the existing open channel downstream of the East Street culverts. Reshaping and regrading the overflow channel from the large dam to provide a cleaner flow path from East Street to the rail culverts.
- **OPTION 4** – Combination of Options 1 to 3.

[redacted]

2.3.2.1 Option 1 – DIVERSION BUND AND VARIOUS CULVERT UPGRADES

Option 1 was run for the existing developed case only. A summary of the adopted controls for this option follows.

1. Provision of an earth bund along the southern side of Thomas Street to prevent flows from the Bruce Highway catchment from entering the East Street catchment;
2. Take up and remove the existing 450mm dia. culvert under Thomas Street and replace with a 900x375 RCBC, discharging to the eastern side of East Street (refer to Appendix A for network layout);
3. Take up and remove the existing 375mm dia. culvert under Spring Street and replace with 600x300 RCBC, discharging to the southern side of Thomas Street;
4. [redacted]
5. Replacement of existing culverts under East Street with 900x375 RCBCs

[redacted]

[redacted]

[redacted]

Additionally, modelling suggests that the bund along Thomas Street appears to be effective at limiting the throughflow from the Bruce Highway catchment. As discussed in section 2.3.1 above, this area is unable to drain in the existing case due to the relative levels of the culverts and the bottom of the depression. While the peak pond depth only increased by approx. 60mm with the bund, the extended pond depth was increased by approx. 370mm (refer Figure 2.5). This is due to the Thomas Street culvert structure currently providing the primary outlet point because of its invert level.

[redacted]

Approximately 530m^3 (subject to detailed survey) of Imported fill would be required in this area to reshape the ground to direct runoff to the culvert structure under the Bruce Highway, thereby preventing the extended ponding depth greater than 400mm which would result in vegetation death, mosquito breeding and loss of amenity. While the bund in Thomas Street would be within Council jurisdiction, any work occurring in the Bruce Highway road reserve or potentially impacting the current drainage regime would require discussion with, and approval from the Department of Transport and Main Roads (DTMR).

Ultimately, modelling suggests that this option would provide improvements to both the upper catchment reaches as well as the area upstream of the rail culverts. This is due to a reduction of the inflow volume from the Bruce Highway catchment, of approximately 5,500 m^3 (5.5 million litres) in a 9-hour duration 2-year ARI design storm.

[redacted]

2.3.2.2 Option 2 – OPTION 1 + IMPROVED OUTLET TO RAIL CULVERTS

This option was run for the existing developed case only. Option 2 was an additional improvement to the mitigation options outlined for Option 1 above, and involved improving the outlet to the existing rail culvert structure. As discussed in Section 2.3.1 of this report, the outlet to the existing RCBC rail structure is very constrained and ultimately causes the area upstream of the rail line to detain runoff. Figure 2.6 shows the LiDAR analysis over the outlet to the culverts, which clearly indicates the limited conveyance currently in place.

[redacted]

A summary of the adopted controls for this option follows.

1. All the controls from Option 1;
2. A channel linking the rail culverts to the culvert structure under Steley Street; and
3. Upgraded culverts under Steley Street to a 2/750mm dia culvert structure to cater for the increased flows.

[redacted]

[redacted]

[redacted]. [redacted]

[redacted]

[redacted]

2.3.2.3 Option 3 – IMPROVED DEFINITION OF OPEN CHANNELS

[redacted]

A summary of the adopted controls for this option follows.

1. Clean out the base of the outlet channel for the East Street culvert structure and redefine the channel, [redacted];
2. Clean out and regrade/redefine the overflow channel from the spillway of the large dam [redacted]
3. Excavate a small open channel around the north-western corner of the dam wall [redacted] and
4. Remove the existing 375mm dia. culvert under the access bund [redacted] upstream of the rail culverts, to allow this area free-draining to the rail culvert structure. Modify the levels of the access bund to be free-draining and construct a concrete invert crossover rather than a culvert.

[redacted]

[redacted]

[redacted]

[redacted]

From the results of all three options, it was clear that no single option would provide an improvement for all of the problem areas identified. However, each of the options presented fairly unique solutions to different problem areas. It was decided that a combined model option, which included all of the treatment options should be run for the catchment to determine the level of mitigation which could be achieved overall.

2.3.2.4 Option 4 - COMBINED OPTIONS 1 TO 3

The combined options model was run for both the existing developed case and the ultimate developed case. The constraints of all of the options outlined above were combined to determine the overall improvement for the catchment.

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

REVISION: 1
26/09/2017

Job No.
FC-17-054

DWG No.
Z-030

GRAPH LOCATIONS
STORMWATER INVESTIGATION
EAST STREET, HOWARD
FOR FRASER COAST REGIONAL COUNCIL

0 10 20 30
SCALE 1:1000 (m)

DO NOT SCALE FROM PLAN

ENGINEERING SOLUTIONS QLD.
SHOP 4, 31 MAIN STREET PIALBA
PO Box 1050, HERVEY BAY QLD. 4655
T: 07 41941550
E: admin@engineeringsolutionsqld.com.au
W: www.engineeringsolutionsqld.com.au
CLIENTS - SERVICE - SOLUTIONS

ESQ
Engineering Solutions Qld

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

3 Conclusions

This study has considered three potential options for treatment of the stormwater conveyance problem raised by residents around East Street, at Howard. The study examined the existing catchment in a 2-year ARI and 10-year ARI. Each of the mitigation options was then examined individually in the 2-year ARI and combined in both the 2-year and 10-year ARI.

Based on this study the following conclusions have been drawn:

- Problem areas were identified in the following locations:
  - the corner of the Bruce Highway and Thomas Street;
  - [redacted];
  - downstream of the East Street culverts, through the easement;
  - [redacted] and
  - upstream of the rail culverts.
- A significant volume of water is being contributed to the East Street catchment from the Bruce Highway catchment. This is partly due to the Thomas Street culvert invert level being lower than the major cross road drainage culvert under the Bruce Highway;
- [redacted] Private allotment work would be required in each of the allotments to facilitate a drainage path;
- [redacted]
- [redacted].

[redacted]

[redacted]

[redacted]

[redacted]

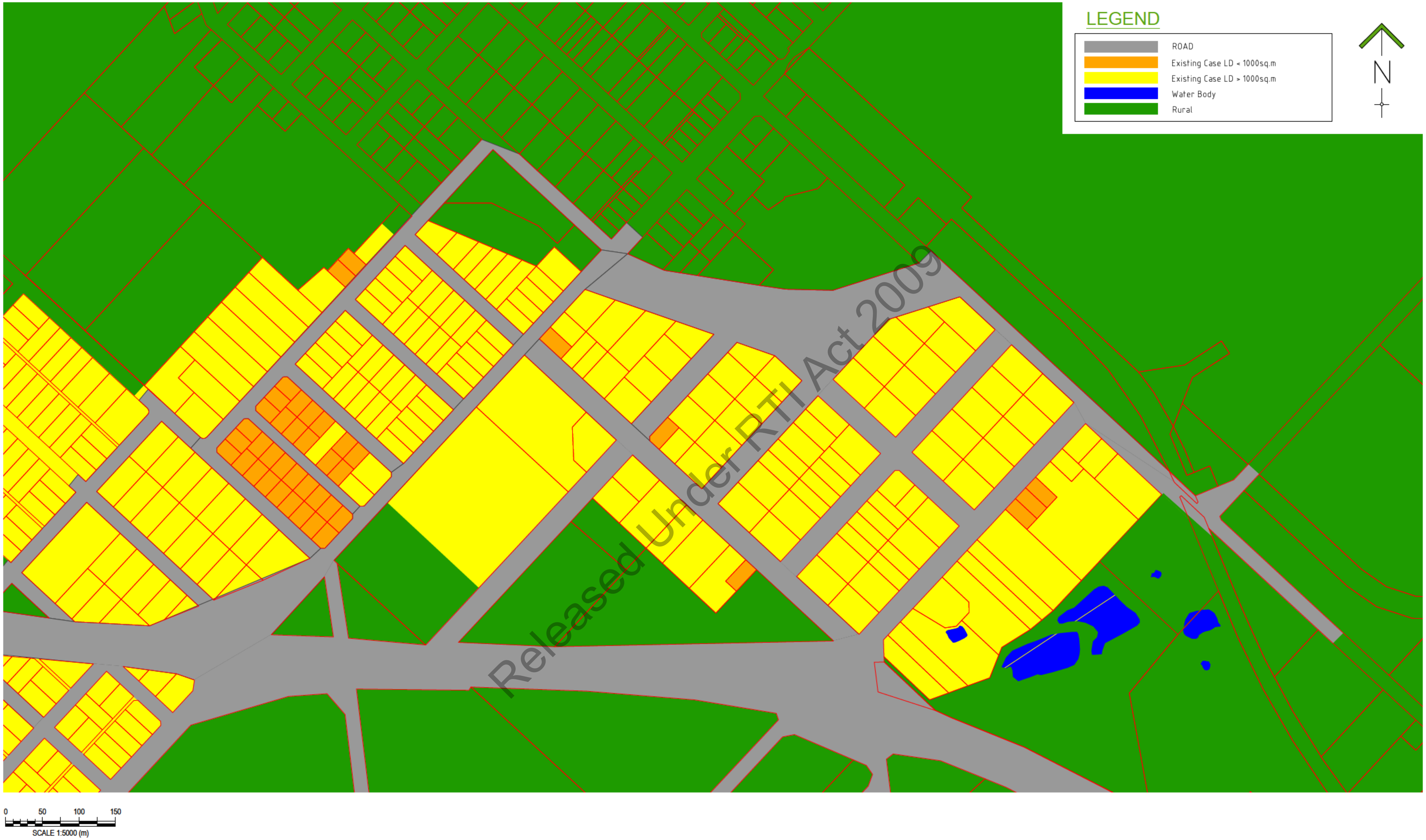
These mitigation options have been developed for Council's consideration for future works in this location, with specific attention drawn to the dependence on consultation and agreement with other external parties (DTMR, private residents) for works which fall within State Government or private land.

4 Reference

The information presented herein has been prepared with reference to the following:

1. Fraser Coast Regional Council, 2014. *Fraser Coast Planning Scheme*, January 2014.
2. Institute of Public Works Engineering Australia, 2013. *Queensland Urban Drainage Manual* – Third edition 2013 – provisional.
3. The Institution of Engineers, Australia, 1987, *Australian Rainfall and Runoff – A Guide to Flood Estimation*. Revised Edition, 1987
4. GHD, 2015. *Fraser Coast Regional Council – Howard Drainage Assessment,* March 2015.

Appendix A – Manning's areas and Network Layouts



REVISION: A
22/09/2017

FC-17-054-Z01

TITLE:

EXISTING DEVELOPED CASE MANNING'S n
EAST STREET, HOWARD
FOR FRASER COAST REGIONAL COUNCIL

DRAWN: BMO
DESIGNED: MDP

ENGINEERING SOLUTIONS QLD.
SHOP 4, 31 MAIN STREET PIALBA
PO Box 1050, HERVEY BAY QLD. 4655
T: 07 41941550
E: admin@engineeringsolutionsqld.com.au
W: www.engineeringsolu ionsqld.com.au
CLIENTS - SERVICE - SOLUTIONS

Engineering Solutions Qld

REVISION: A
22/09/2017

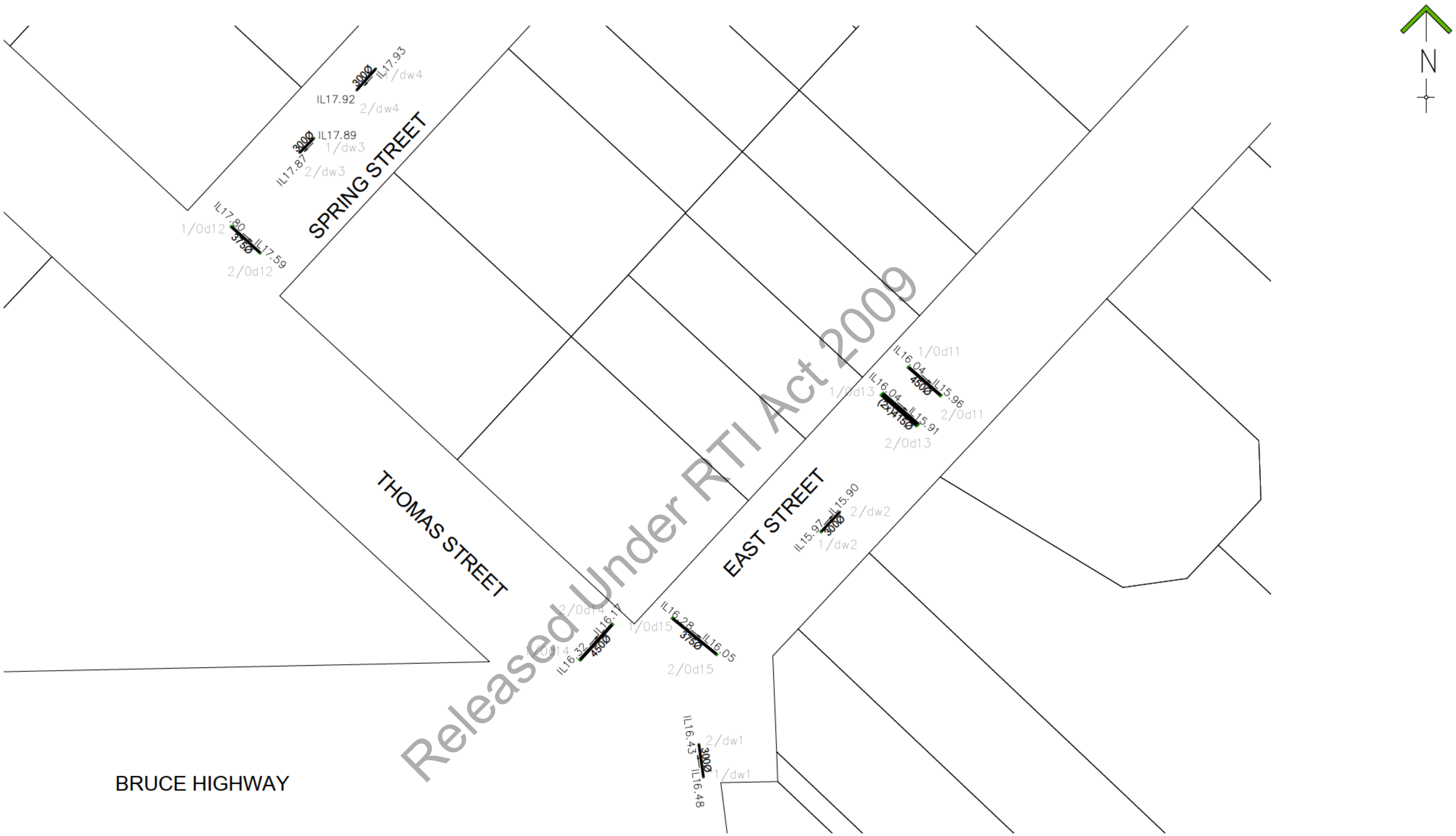
FC-17-054-Z02

DRAWN: BMO
DESIGNED: MDP

TITLE:

ULTIMATE DEVELOPED CASE MANNING'S n
EAST STREET, HOWARD
FOR FRASER COAST REGIONAL COUNCIL

ENGINEERING SOLUTIONS QLD.
SHOP 4, 31 MAIN STREET PIALBA
PO Box 1050, HERVEY BAY QLD. 4655
T: 07 41941550
E: admin@engineeringsolutionsqld.com.au
W: www.engineeringsolu ionsqld.com.au
CLIENTS - SERVICE - SOLUTIONS
Engineering Solutions Qld



REVISION: 1
26/09/2017

Job No.
FC-17-054

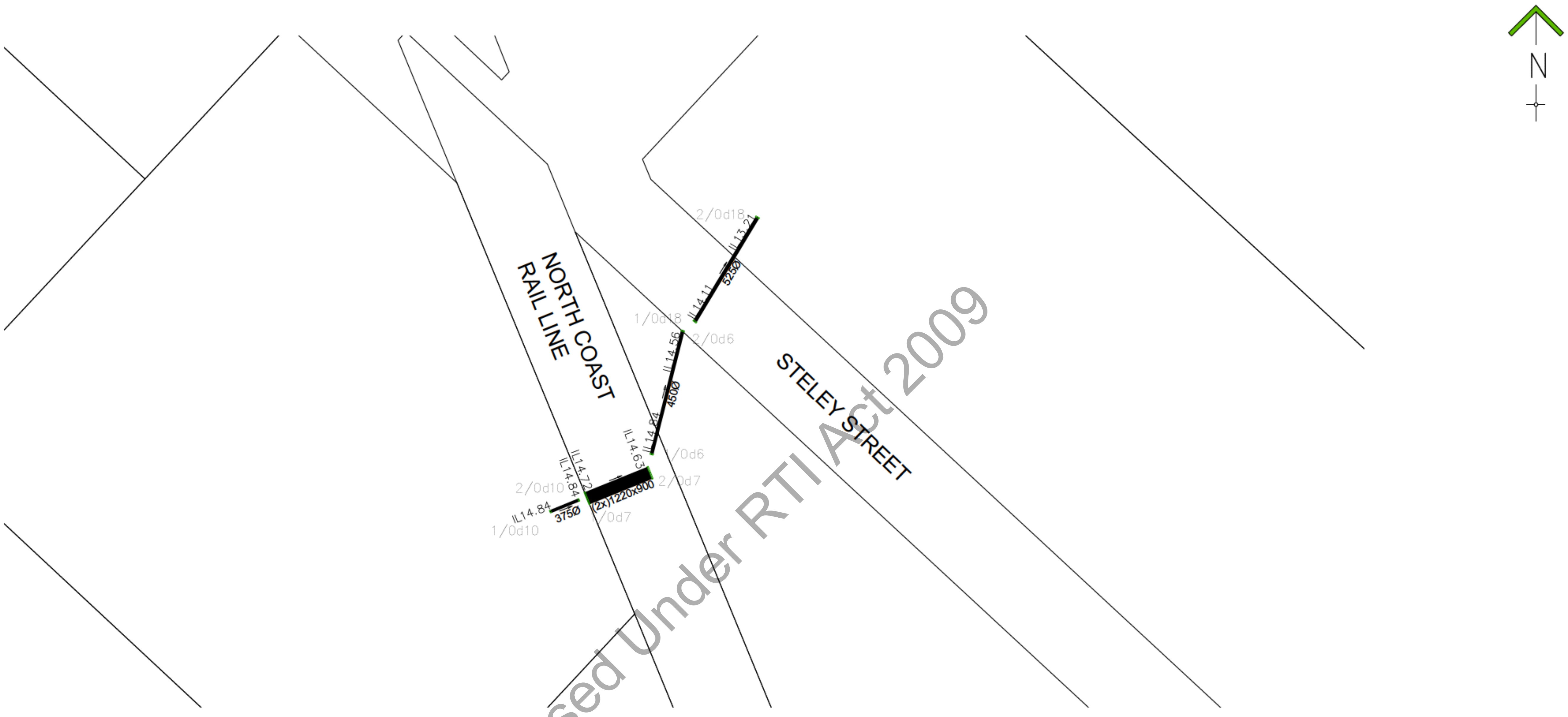
DWG No.
Z-020

EXISTING NETWORK PLAN - SHEET 1
STORMWATER INVESTIGATION
EAST STREET, HOWARD
FOR FRASER COAST REGIONAL COUNCIL

0 10 20 30
SCALE 1:1000 (m)

DO NOT SCALE FROM PLAN

ENGINEERING SOLUTIONS QLD.
SHOP 4, 31 MAIN STREET PIALBA
PO Box 1050, HERVEY BAY QLD. 4655
T: 07 41941550
E: admin@engineeringsolutionsqld.com.au
W: www.engineeringsolutionsqld.com.au
CLIENTS - SERVICE - SOLUTIONS



REVISION: 1
26/09/2017

Job No.
FC-17-054

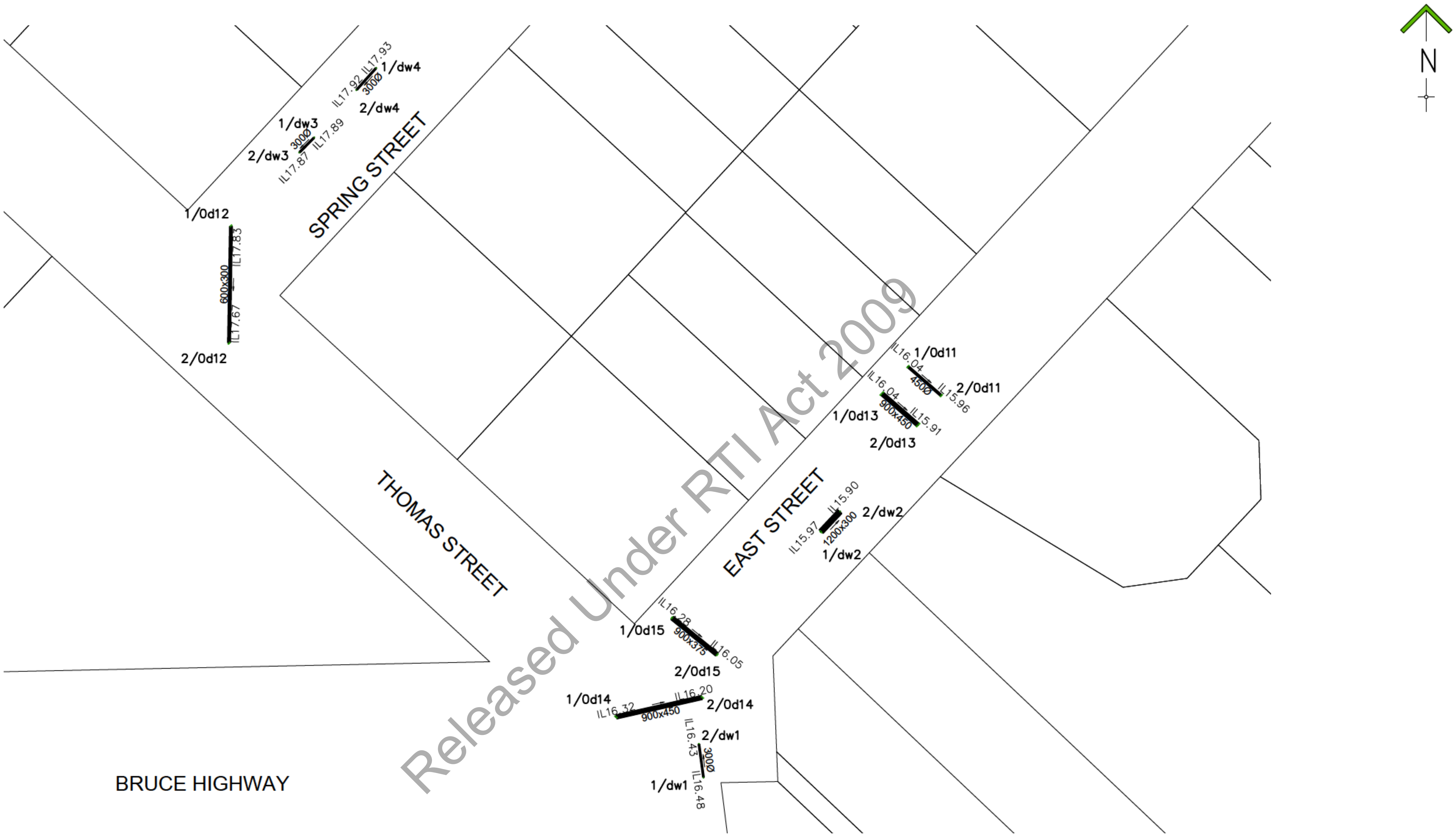
DWG No.
Z-021

EXISTING NETWORK PLAN - SHEET 2
STORMWATER INVESTIGATION
EAST STREET, HOWARD
FOR FRASER COAST REGIONAL COUNCIL

0 10 20 30
SCALE 1:1000 (m)

DO NOT SCALE FROM PLAN

ENGINEERING SOLUTIONS QLD.
SHOP 4, 31 MAIN STREET PIALBA
PO Box 1050, HERVEY BAY QLD. 4655
T: 07 41941550
E: admin@engineeringsolutionsqld.com.au
W: www.engineeringsolutionsqld.com.au
CLIENTS - SERVICE - SOLUTIONS



REVISION: 2
29/11/2017

Job No.
FC-17-054

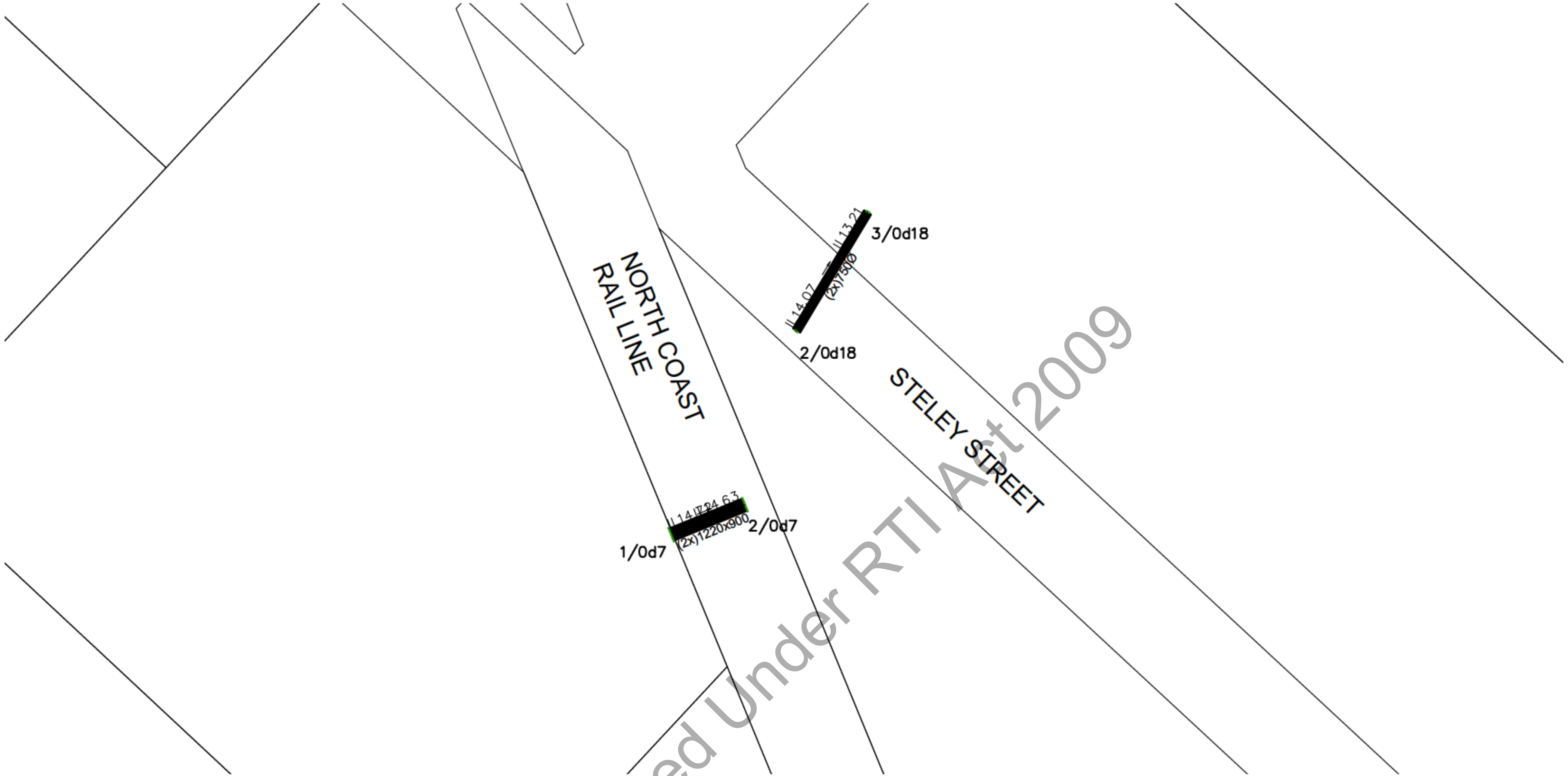
DWG No.
Z-022

OPTION 1 & 2 NETWORK PLAN - SHEET 1
STORMWATER INVESTIGATION
EAST STREET, HOWARD
FOR FRASER COAST REGIONAL COUNCIL

0 10 20 30
SCALE 1:1000 (m)

DO NOT SCALE FROM PLAN

ENGINEERING SOLUTIONS QLD.
SHOP 4, 31 MAIN STREET PIALBA
PO Box 1050, HERVEY BAY QLD. 4655
T: 07 41941550
E: admin@engineeringsolutionsqld.com.au
W: www.engineeringsolutionsqld.com.au
CLIENTS - SERVICE - SOLUTIONS



N

REVISION: 2
29/11/2017

Job No.
FC-17-054

DWG No.
Z-023

OPTION 1 & 2 NETWORK PLAN - SHEET 2
STORMWATER INVESTIGATION
EAST STREET, HOWARD
FOR FRASER COAST REGIONAL COUNCIL

0 10 20 30
SCALE 1:1000 (m)

DO NOT SCALE FROM PLAN

ENGINEERING SOLUTIONS QLD.
SHOP 4, 31 MAIN STREET PIALBA
PO Box 1050, HERVEY BAY QLD. 4655
T: 07 41941550
E: admin@engineeringsolutionsqld.com.au
W: www.engineeringsolutionsqld.com.au
CLIENTS - SERVICE - SOLUTIONS

Engineering Solutions Qld

[redacted]

[redacted]

[redacted]

ENGINEERING SOLUTIONS QLD.

SHOP 4, 31 MAIN STREET PIALBA
PO Box 1050, HERVEY BAY QLD. 4655
T: 07 41941550
E: admin@engineeringsolutionsqld.com.au
W: www.engineeringsolu ionsqld.com.au

CLIENTS - SERVICE - SOLUTIONS

Engineering Solutions Qld.

[redacted]

[redacted]

ENGINEERING SOLUTIONS QLD.

SHOP 4, 31 MAIN STREET PIALBA
PO Box 1050, HERVEY BAY QLD. 4655
T: 07 41941550
E: admin@engineeringsolutionsqld.com.au
W: www.engineeringsolu ionsqld.com.au

CLIENTS - SERVICE - SOLUTIONS

Engineering Solutions Qld.

[redacted]

[redacted]

ENGINEERING SOLUTIONS QLD.

SHOP 4, 31 MAIN STREET PIALBA
PO Box 1050, HERVEY BAY QLD. 4655
T: 07 41941550
E: admin@engineeringsolutionsqld.com.au
W: www.engineeringsolu ionsqld.com.au

CLIENTS - SERVICE - SOLUTIONS

ESQ
Engineering
Solutions Qld

[redacted]

[redacted]

ENGINEERING SOLUTIONS QLD.

SHOP 4, 31 MAIN STREET PIALBA
PO Box 1050, HERVEY BAY QLD. 4655
T: 07 41941550
E: admin@engineeringsolutionsqld.com.au
W: www.engineeringsolu ionsqld.com.au

CLIENTS - SERVICE - SOLUTIONS

Engineering Solutions Qld

[redacted]

[redacted]

[redacted]

[redacted]

[redacted] [redacted]

[redacted]:

[redacted]

ENGINEERING SOLUTIONS QLD.
SHOP 4, 31 MAIN STREET PIALBA
PO Box 1050, HERVEY BAY QLD. 4655
T: 07 41941550
E: admin@engineeringsolutionsqld.com.au
W: www.engineeringsolu ionsqld.com.au
CLIENTS - SERVICE - SOLUTIONS

Engineering Solutions Qld

[redacted]

[redacted]

[redacted]

[redacted] [redacted]

[redacted]

[redacted]

ENGINEERING SOLUTIONS QLD.

SHOP 4, 31 MAIN STREET PIALBA
PO Box 1050, HERVEY BAY QLD. 4655
T: 07 41941550
E: admin@engineeringsolutionsqld.com.au
W: www.engineeringsolu ionsqld.com.au

CLIENTS - SERVICE - SOLUTIONS

ESQ
Engineering
Solutions Qld

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

ENGINEERING SOLUTIONS QLD.
SHOP 4, 31 MAIN STREET PIALBA
PO Box 1050, HERVEY BAY QLD. 4655
T: 07 41941550
E: admin@engineeringsolutionsqld.com.au
W: www.engineeringsolu ionsqld.com.au
CLIENTS - SERVICE - SOLUTIONS

Engineering Solutions Qld

[redacted]

[redacted]

[redacted]: [redacted]

TITLE:

[redacted]

ENGINEERING SOLUTIONS QLD.
SHOP 4, 31 MAIN STREET PIALBA
PO Box 1050, HERVEY BAY QLD. 4655
T: 07 41941550
E: admin@engineeringsolutionsqld.com.au
W: www.engineeringsolu ionsqld.com.au
CLIENTS - SERVICE - SOLUTIONS

Engineering Solutions Qld

[redacted]

[redacted]

REVISION: B
29/11/2017

[redacted]

[redacted] [redacted]

TITLE:

[redacted]

ENGINEERING SOLUTIONS QLD.

SHOP 4, 31 MAIN STREET PIALBA
PO Box 1050, HERVEY BAY QLD. 4655
T: 07 41941550
E: admin@engineeringsolutionsqld.com.au
W: www.engineeringsolu ionsqld.com.au

CLIENTS - SERVICE - SOLUTIONS

Engineering Solutions Qld

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

ENGINEERING SOLUTIONS QLD.
SHOP 4, 31 MAIN STREET PIALBA
PO Box 1050, HERVEY BAY QLD. 4655
T: 07 41941550
E: admin@engineeringsolutionsqld.com.au
W: www.engineeringsolu ionsqld.com.au
CLIENTS - SERVICE - SOLUTIONS

Engineering Solutions Qld

[redacted]

[redacted]

[redacted]

[redacted]

ENGINEERING SOLUTIONS QLD.

SHOP 4, 31 MAIN STREET PIALBA
PO Box 1050, HERVEY BAY QLD. 4655
T: 07 41941550
E: admin@engineeringsolutionsqld.com.au
W: www.engineeringsolu ionsqld.com.au
CLIENTS - SERVICE - SOLUTIONS

Engineering Solutions Qld.

[redacted]

[redacted]

[redacted]

ENGINEERING SOLUTIONS QLD.
SHOP 4, 31 MAIN STREET PIALBA
PO Box 1050, HERVEY BAY QLD. 4655
T: 07 41941550
E: admin@engineeringsolutionsqld.com.au
W: www.engineeringsolu ionsqld.com.au
CLIENTS - SERVICE - SOLUTIONS

Engineering Solutions Qld

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

ENGINEERING SOLUTIONS QLD.

SHOP 4, 31 MAIN STREET PIALBA
PO Box 1050, HERVEY BAY QLD. 4655
T: 07 41941550
E: admin@engineeringsolutionsqld.com.au
W: www.engineeringsolu ionsqld.com.au
CLIENTS - SERVICE - SOLUTIONS

[redacted]

[redacted]

[redacted]

[redacted]

ENGINEERING SOLUTIONS QLD.

SHOP 4, 31 MAIN STREET PIALBA
PO Box 1050, HERVEY BAY QLD. 4655
T: 07 41941550
E: admin@engineeringsolutionsqld.com.au
W: www.engineeringsolu ionsqld.com.au
CLIENTS - SERVICE - SOLUTIONS

ESQ Engineering Solutions Qld

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

ENGINEERING SOLUTIONS QLD.

SHOP 4, 31 MAIN STREET PIALBA
PO Box 1050, HERVEY BAY QLD. 4655
T: 07 41941550
E: admin@engineeringsolutionsqld.com.au
W: www.engineeringsolu ionsqld.com.au
CLIENTS - SERVICE - SOLUTIONS

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

FOR FRASER COAST REGIONAL COUNCIL

ENGINEERING SOLUTIONS QLD.
SHOP 4, 31 MAIN STREET PIALBA
PO Box 1050, HERVEY BAY QLD. 4655
T: 07 41941550
E: admin@engineeringsolutionsqld.com.au
W: www.engineeringsolu ionsqld.com.au
CLIENTS - SERVICE - SOLUTIONS

Engineering Solutions Qld

[redacted]

[redacted]

[redacted]

[redacted]

ENGINEERING SOLUTIONS QLD.

SHOP 4, 31 MAIN STREET PIALBA
PO Box 1050, HERVEY BAY QLD. 4655
T: 07 41941550
E: admin@engineeringsolutionsqld.com.au
W: www.engineeringsolu ionsqld.com.au
CLIENTS - SERVICE - SOLUTIONS

[redacted]

[redacted]

[redacted]:

[redacted]

ENGINEERING SOLUTIONS QLD.
SHOP 4, 31 MAIN STREET PIALBA
PO Box 1050, HERVEY BAY QLD. 4655
T: 07 41941550
E: admin@engineeringsolutionsqld.com.au
W: www.engineeringsolu ionsqld.com.au
CLIENTS - SERVICE - SOLUTIONS

[redacted]

Fraser Coast Regional Council
CONCEPT ESTIMATE
EAST STREET DRAINAGE
EAST STREET, HOWARD
OPTION 1

Account:
Plan No's:
Date:
Est:
Chk'd:

Item	Task Code	Description	[redacted]
		QUALITY CONTROL REQUIREMENTS	
QCP1	003	Quality Verification and Control	
		GENERAL	
101(b)	009	Supply Digital As Constructed Information	
CCTV		Supply of CCTV of all new Stormwater Drainage Pipes	
		CONTROL OF TRAFFIC	
201(a)	006	Control of Traffic	
		CONTROL OF EROSION AND SEDIMENTATION	
211(a)	007	Temporary Erosion and Sediment Control	
		CLEARING AND GRUBBING	
212(a)(i)	008	Clearing and Grubbing (Vegetation)	
212(a)(ii)	008	Clearing and Grubbing (Drainage Structures)	
		EARTHWORKS	
213(b)	010	General Earthworks - Cut to Fill	
213(b)	010	General Earthworks - Import Material	
		DRAINAGE CULVERTS	
222(a)(iii)	015	In-Situ Base Slab (1200mm Width)	
222(b)(iii)	015	1200 x 300 RCBC	
222(b)(iii)	015	1200 x 375 RCBC	
222(b)(iii)	015	1200 x 450 RCBC	
		DRAINAGE STRUCTURES	
223(a)(i)	020	Precast Concrete Headwalls, Aprons and Wingwalls - 1200 x 300 RCBC	
223(a)(ii)	020	Precast Concrete Headwalls, Aprons and Wingwalls - 1200 x 375 RCBC	
223(a)(iii)	020	Precast Concrete Headwalls, Aprons and Wingwalls - 1200 x 450 RCBC	
		FLEXIBLE PAVEMENTS	
242(a)	030	Supply, Spread and Compact Subbase Course - Type 2.5	
242(a)	030	Supply, Spread and Compact Subbase Course - Type 2.3	
242(b)	030	Supply, Spread and Compact Base Course - Type 2.1	
242(g)	030	Preparation of Subgrade	
		SPRAYED BITUMINOUS SURFACING	
244(b)	035	Supply and Spray Binder - Class 170 Bitumen (Incl. Adhesion Agent) [1.4 l/m2]	
244(d)	035	Supply, Incorporate and Spray Cutter Oil in Primer, Primerbinder or Binder [3%]	
244(f)(iv)	035	Supply, Precoat and Apply Aggregate - 14mm Aggregate (Precoated) [95 m2/m3]	
		LANDSCAPING	
		VEGETATION OF SLOPES 1 ON 3 OR FLATTER	
273(a)(i)	116	Grass - Seeding	
273(a)(iii)	116	Watering	
		SUB TOTAL	
	001	Service Locations and Soil Tests	
	009	Survey	
	002	Design	
	002	Design Administration	
	005	Supervision	
		Contingencies	
		TOTAL PROJECT ESTIMATE	

NOTES:
1. The TOTAL PROJECT ESTIMATE includes all overhead costs plus the cost of all *Provisional Items*. The SUB TOTAL is the cost of works without overhead costs and *Provisional Items*.
2. This estimate is based on the estimate provided by <CONSULTANT_NAME> - Docs #

Fraser Coast Regional Council
CONCEPT ESTIMATE
EAST STREET DRAINAGE
EAST STREET, HOWARD
OPTION 2

Account:
Plan No's:
Date:
Est:
Chk'd:

Item	Task Code	Description	[redacted]
		QUALITY CONTROL REQUIREMENTS	
QCP1	003	Quality Verification and Control	
		GENERAL	
101(b)	009	Supply Digital As Constructed Information	
CCTV		Supply of CCTV of all new Stormwater Drainage Pipes	
		CONTROL OF TRAFFIC	
201(a)	006	Control of Traffic	
		CONTROL OF EROSION AND SEDIMENTATION	
211(a)	007	Temporary Erosion and Sediment Control	
		CLEARING AND GRUBBING	
212(a)(i)	008	Clearing and Grubbing (Vegetation)	
212(a)(ii)	008	Clearing and Grubbing (Drainage Structures)	
		EARTHWORKS	
213(b)	010	General Earthworks - Cut to Spoil	
213(b)	010	General Earthworks - Import Material (CBR 15 material)	
		DRAINAGE PIPES	
221(a)	014	2/750mm dia (RRJ/FJ) Class 3 RCP	
		DRAINAGE CULVERTS	
222(a)(iii)	015	In-Situ Base Slab (1200mm Width)	
222(b)(iii)	015	1200 x 300 RCBC	
222(b)(iii)	015	1200 x 375 RCBC	
222(b)(iii)	015	1200 x 450 RCBC	
		DRAINAGE STRUCTURES	
223(a)(i)	020	Precast Concrete Headwalls, Aprons and Wingwalls - 1200 x 300 RCBC	
223(a)(ii)	020	Precast Concrete Headwalls, Aprons and Wingwalls - 1200 x 375 RCBC	
223(a)(iii)	020	Precast Concrete Headwalls, Aprons and Wingwalls - 1200 x 450 RCBC	
223(a)(iii)	020	Precast Concrete Headwalls, Aprons and Wingwalls - 2/750mm dia.	
		FLEXIBLE PAVEMENTS	
242(a)	030	Supply, Spread and Compact Subbase Course - Type 2.5	
242(a)	030	Supply, Spread and Compact Subbase Course - Type 2.3	
242(b)	030	Supply, Spread and Compact Base Course - Type 2.1	
242(g)	030	Preparation of Subgrade	
		SPRAYED BITUMINOUS SURFACING	
244(b)	035	Supply and Spray Binder - Class 170 Bitumen (Incl. Adhesion Agent) [1.4 l/m2]	
244(d)	035	Supply, Incorporate and Spray Cutter Oil in Primer, Primerbinder or Binder [3%]	
244(f)(iv)	035	Supply, Precoat and Apply Aggregate - 14mm Aggregate (Precoated) [95 m2/m3]	
		LANDSCAPING	
		VEGETATION OF SLOPES 1 ON 3 OR FLATTER	
273(a)(i)	116	Grass - Seeding	
273(a)(ii)	116	Grass - Turfing	
273(a)(iii)	116	Watering	
		MISCELLANEOUS	
902(a)		Resumption of land for use as drainage reserve	
		SUB TOTAL	
	001	Service Locations and Soil Tests	
	009	Survey	
	002	Design	
	002	Design Administration	
	005	Supervision	
		Contingencies	
		TOTAL PROJECT ESTIMATE	

NOTES:
1. The TOTAL PROJECT ESTIMATE includes all overhead costs plus the cost of all *Provisional Items*. The SUB TOTAL is the cost of works without overhead costs and *Provisional Items*.
2. This estimate is based on the estimate provided by <CONSULTANT_NAME> - Docs #

Fraser Coast Regional Council
CONCEPT ESTIMATE
EAST STREET DRAINAGE
EAST STREET, HOWARD
OPTION 3

Account:
Plan No's:
Date:
Est:
Chk'd:

Item	Task Code	Description	[redacted]
		QUALITY CONTROL REQUIREMENTS	
QCP1	003	Quality Verification and Control	
		GENERAL	
101(b)	009	Supply Digital As Constructed Information	
		CONTROL OF EROSION AND SEDIMENTATION	
211(a)	007	Temporary Erosion and Sediment Control	
		CLEARING AND GRUBBING	
212(a)(i)	008	Clearing and Grubbing (Vegetation)	
		EARTHWORKS	
213(b)	010	General Earthworks - Cut to Spoil	
		LANDSCAPING	
		VEGETATION OF SLOPES 1 ON 3 OR FLATTER	
273(a)(i)	116	Grass - Seeding	
273(a)(ii)	116	Grass - Turfing	
273(a)(iii)	116	Watering	
		SUB TOTAL	
	001	Service Locations and Soil Tests	
	009	Survey	
	002	Design	
	002	Design Administration	
	005	Supervision	
		Contingencies	
		TOTAL PROJECT ESTIMATE	

NOTES:
1. The TOTAL PROJECT ESTIMATE includes all overhead costs plus the cost of all *Provisional Items*. The SUB TOTAL is the cost of works without overhead costs and *Provisional Items*.
2. This estimate is based on the estimate provided by <CONSULTANT_NAME> - Docs #