APPENDIX H

Flood Impact Assessment prepared by NCE

NORTHERN CONSULTING engineers

CIVIL & STRUCTURAL ENGINEERS

FLOOD IMPACT ASSESSMENT

PRECINCT 4 – STAGE 12A
SOMERS & HERVEY ESTATE, RASMUSSEN
RESIDENTIAL DEVELOPMENT

FOR
URBEX PTY LTD

JOB No: **URB0001-P4**

Doc Ref: **URB0001-P4-Stage12A-FIA**

Phone: 07 4725 5550
Fax: 07 4725 5850
Email: mail@nceng.com.au
50 Punari Street Currajong Qld 4812
Milton Messer & Associates Pty Ltd
ACN 100 817 356 ABN 34 100 817 356

DOCUMENT CONTROL

Rev	Author	Reviewed	Approved		Date	Issued To:	Purpose
A	Brendan Blair	Andrew Wallace	Andrew Wallace (RPEQ 6743)		19/12/2025	Urbex	To support DA application

EXECUTIVE SUMMARY

Northern Consulting Engineers (NCE) has been commissioned by Urbex Pty Ltd, to undertake a flood impact assessment (FIA) for the proposed Somers & Hervey Estate, Rassmussen, Precinct 4, Stage 12A. The proponent is seeking to subdivide the land into residential lots. The objective of this assessment is to assess the impacts associated with the proposed development in a manner that demonstrates compliance with the Townsville City Council Planning Scheme.

The assessment was completed with the development of a fine scale 2D hydraulic model using TUFLOW software, utilising the sub grid sampling (SGS) feature, to generate high resolution results.

The results of the assessment have demonstrated that the development can be carried out in accordance with Townsville City Council's planning scheme including PO6 and PO7 of the flood hazard overlay code. There are highly isolated areas showing minor, non-actionable afflux which are considered inconsequential and not considered further. Any generated afflux is generally contained within roadways or drainage infrastructure and do not alter the flood hazard classification. NCE note that any impacts will likely be resolved by future development stages as future development will redirect flows to the north.

Peak 100-year ARI flood levels have been identified at all locations throughout the model. All allotments were demonstrated to be immune in the 100-year ARI flood event. Where ponding reaches the edge of a proposed lot, any habitable FFL will be set a minimum of 300mm above the 1% AEP WSL in both the adjacent major drains and the local runoff within the internal roads.

A sensitivity assessment was undertaken to investigate the potential impacts on the local development site associated with the potential for culverts being 100% blocked. The findings of this assessment that the worst-case blockage resulted in minimal impact to the flooding outcomes and minimal impact on controlling flood levels within the development site.

This report demonstrates that the proposed development can comply with the Townsville City Council's flood hazard overlay and flood hazard planning scheme policy. The development is not expected to increase the risk to life, property, community, economic activity or increase the potential for flood damage on-site or to adjacent and downstream properties. Furthermore, the development is not anticipated to be significantly impacted or significantly impact adjacent properties by future climate change.

GLOSSARY

AEP	Annual Exceedance Probability - the probability of an event being equalled or exceeded within a year.
Afflux	Defined as the relative change in a flooding characteristic (eg. WSL , Velocity)
AHD	Australian Height Datum
AIDR	Australian Institute for Disaster Resilience
ARI	Average Recurrence Interval
ARR 2019	Australian Rainfall and Runoff (2019)
BoM	Bureau of Meteorology
CC	Climate Change
DEM	Digital Elevation Model
DFE	Defined Flood Event
EY	Average number of Exceedances per Year - 1EY is exceeded on average once per year
FFL	Finished Floor Level
FIA	Flood Impact Assessment
HAT	Highest Astronomical Tide – The highest level of water that can be predicted to occur under average meteorological conditions and any combination of astronomical condition
IFD	Intensity-Frequency-Duration
LiDAR	Light Detection and Ranging (Aerial Laser Survey)
Mannings n	Measure of resistance to flow in a channel influenced by the physical roughness of the surface
MHWS	Mean High Water Springs
NCE	Northern Consulting Engineers
PMF	Probable Maximum Flood
PO	Performance Outcome
QSpatial	Queensland Spatial Catalogue - Queensland Government geospatial data and information
QUDM	Queensland Urban Drainage Manual
RAFTS / XP-RAFTS	An urban and rural runoff-routing hydrologic model
RD	Renewable Diesel
ROG	Rain on Grid – Applies rainfall directly to the model domain
SGS	Sub-grid Sampling
TCC	Townsville City Council
TUFLOW	Two-dimensional Unsteady Flow – Flood hydraulic modelling software
WSE	Water Surface Elevation
WSL	Water Surface Level (interchangeable with WSE)

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

APPENDICES

APPENDIX A

General Flood Model Mapping

APPENDIX B

Afflux Mapping – All Events WSL and Velocity Afflux

APPENDIX C

Depth Mapping 100- and 2- year ARI

APPENDIX D

Velocity Mapping – 100- and 2-year ARI

APPENDIX E

WSL Mapping – 100- and 2-year ARI

APPENDIX F

Hazard Mapping – 100-year ARI only

APPENDIX G

Development Staging Assessment – Stage 1 Mapping

APPENDIX H

Sensitivity and Climate Change Mapping – WSL Afflux and Depth for select cases

APPENDIX I

Stage 12a Development Plan

APPENDIX J

Yumba Meta Development Approved Plans

APPENDIX K

Stage 12a DFE Flood Levels

1.0 INTRODUCTION

1.1 Background

Northern Consulting Engineers (NCE) has been commissioned by Urbex Pty Ltd to undertake a flood impact assessment (FIA) for the proposed Somers & Hervey Estate, Rasmussen, Precinct 4, Stage 12A.

This report is prepared in support of the proposed development application (DA) associated with subdividing the land into residential lots. The objective of this assessment is to update the baseline of model developed as part of Precinct 1 of the development (URB0001-FIA) and assess the impacts associated with the proposed development in a manner that demonstrates compliance with the Townsville City Council (TCC) Planning Scheme.

In reference to the Flood Hazard Overlay Map OM-6.1 of the Townsville City Council (TCC) Planning Scheme, it has been identified that the proposed development site is generally overlaid by the low and medium hazard mapping. Refer to **Figure 1-3**. Therefore, as per the Flood Hazard Overlay Code 8.2.6, the development must not generate off-site impacts and in particular Performance Outcomes (PO) PO2 and PO3.

To undertake this study, NCE have updated the TUFLOW model previously developed as part of Precinct 2 to assess the potential impacts associated with the proposed development as discussed in **Section 2.0**.

As this model has been developed utilising inflows from the historical Upper-Middle Bohle Flood Study (2014) for consistency, the new model also adopts the ARR 87 ARI (average concurrence interval) as the rainfall event frequency and naming convention.

NCE note that the baseline model has been updated to align with the most up-to-date version of TUFLOW and the associated best-practice procedures. Further updates have been applied to the baseline model where detailed on-site assessments of local catchments have been conducted and approved developments have been completed. Updates to the baseline model are outlined in **Section 3.2**.

1.2 Proposed Development

It is proposed that the site will be further subdivided into 1 englobo housing development and 5 freehold lots. The development is separated into Stage 1 which contains the englobo housing lots and Stage 2 which contains the freehold land parcels. The proposed development will include the following:

- **Stage 1 / Lot 907:**
  - 1 Lot at approximately 1.714 hectares.
  - To be developed further as an englobo parcel with 44 dwellings.
  - Inclusive of private internal roadways to connect dwellings to Pinnacle Drive to the east.
  - Tee head turn about connection to Resolution Street to provide turn about for emergency and larger vehicles.
  - Internal drains along the northern boundary to connect drainage from Pinnacle Drive and upstream catchments from the east to the downstream existing drainage to the west that eventually outlets at the Beck Drive culverts contained in Precinct 1 of the Somers and Hervey Estate.
  - 10m wide drain with 3.6m base width generally.
  - Internal drain along the south-western boundary to drain from internal roads and Resolution Street to the downstream existing drainage to the west as outlined above.
  - 5m wide drain with 2m base width generally.

- **Pinnacle Drive Connection to Sorghum Street:**
  - Connection of Pinnacle Drive to the north to Sorghum Steet to the south.
  - Narrowing of roadway profile to align with the width of Sorghum Street.
  - Culverts under road extension to provide outlet to upstream catchments.
  - Sag point to grade runoff from the road into the adjacent drains as part of Stage 1 and 2 and remove the need for kerb inlets.
  - If Stage 2 lots are to be constructed separately, table drains along the eastern side of the Pinnacle Drive extension will be required to ensure no ponding against the roadway and free draining of upstream catchments.

- **Stage 2:**
  - 5 lots at approximately 5,510m^2 in total.
  - Drainage easements along the back of the lots (east) and through the middle to connect upstream catchments to the culvert under Pinnacle Drive and into the Stage 1 drains.
  - 15m wide drains with 5m base width generally.

The precincts are based on the expected progression of the estate aligning with the construction intent of the proponent. The development plan for Stage 12A of Precinct 4 forming the basis of this FIA is shown in **Figure 1-1** but included in full in **Appendix I** for reference.

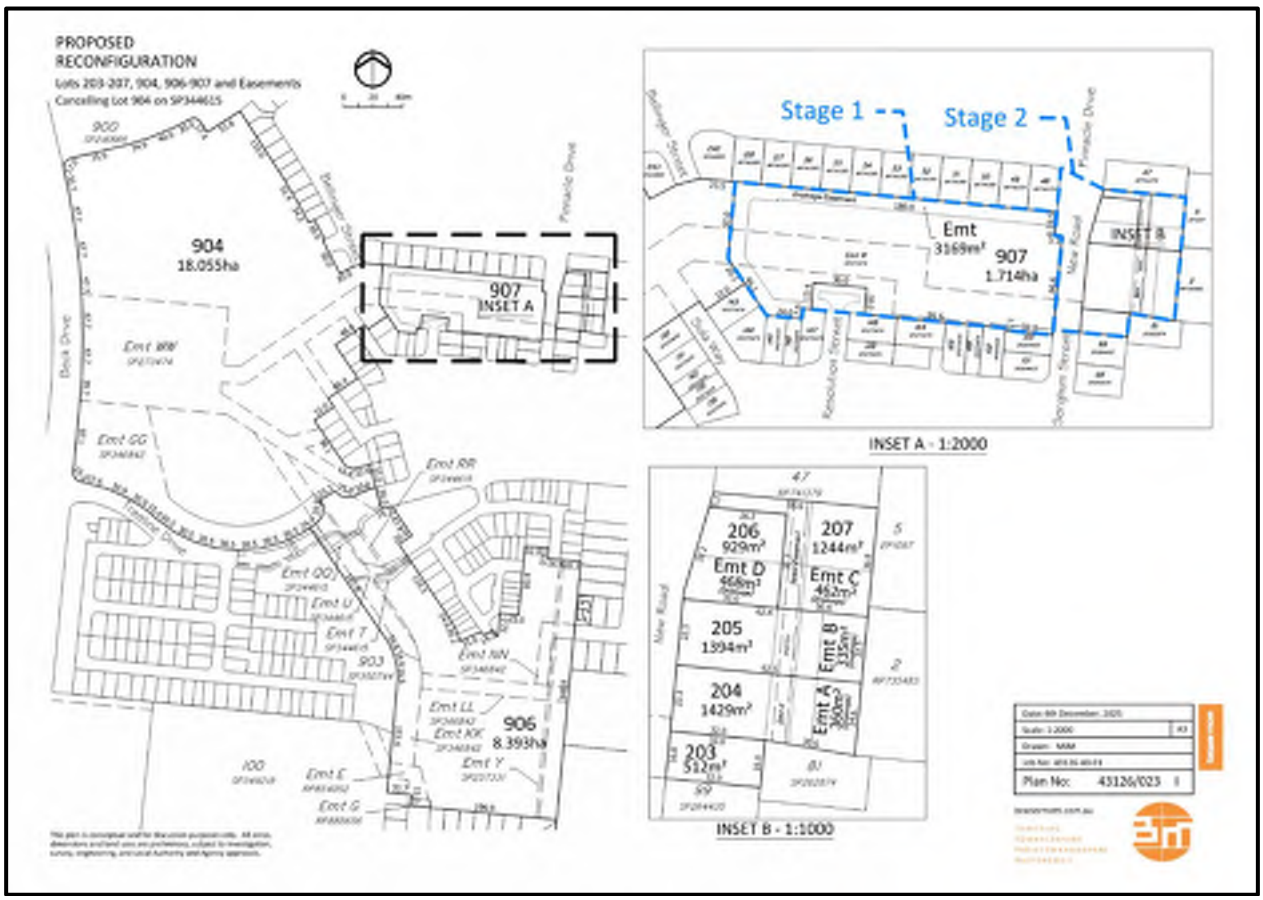


Figure 1-1 Development layout

1.3 Study Area

The study area is located approximately 15km south-west of Townsville's CBD, at Beck Drive, Rasmussen. Proposed Precinct 2 of Bluewattle Estate is located on land described as Lot 904 on SP344615, hereinafter referred to as the site. The site for Precinct 4 is located to the east of the balance lot between the existing development to the north, east and south. In particular Stage 12A encompasses the area to the east of

Bellinger Street and Sida Way, south of Stephanie Street and north of Resolution and Accord Street. Stage 12A covers an area of approximately 2.56ha, which is to be reconfigured to generally residential allotments including the lot 907 englobo parcel. The site and development extent are depicted in **Map A01** and **Figure 1-2**. The site is located approximately 1km east of the Bohle River, however it is expected that flows from the Bohle River will not result in significant impacts on the development but may control tailwater conditions for drains proposed as part of the development. This is discussed and addressed further in **Section 1.5**.

1.4 Purpose of Report and Scope of Works

The flood model development and assessment has been undertaken in consideration of the proposed development application for the expected residential subdivision.

The assessment has been carried out in accordance with the current Council standards and is based on lots, outside of the drainage easements, being fully immune in the 100-year ARI event which is Councils current definition of the Defined Flood Event (DFE).

The report and modelling has been completed with respect to the currently approved development Precincts 1 & 2 and other construction works in place including but not limited to, Precinct 3 preliminary earthworks and soil erosion and sediment control measures. Previously approved stages have not been modelled as part of the baseline scenario to ensure any cumulative flood impacts from the whole development are accounted for. NCE have not conducted further assessment of the previously accepted baseline model and has adopted it as fit for use for the purpose of modelling Stage 12A.

Based on advice from TCC Planning and Development, the baseline and developed models have been assessed for all events from the major (100-year ARI) to the minor (2-year ARI). Sensitivity and climate assessments have been undertaken for the major flood event only.

Figure 1-2 Study area locality

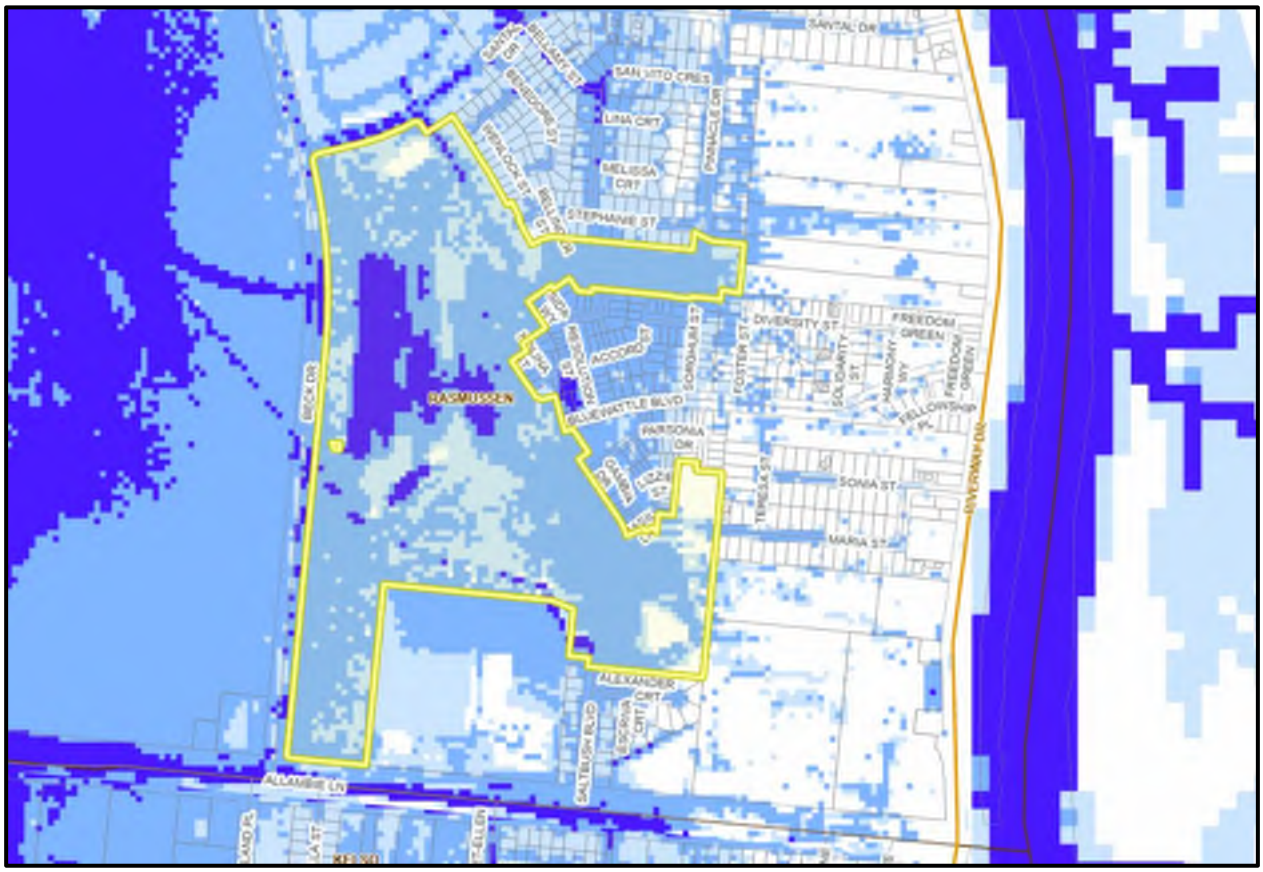


Figure 1-3 Existing flood hazard extents within the proposed development area

1.5 Existing Site Drainage

The Somers and Hervey residential subdivision development site is located in the upper eastern reaches of the streams and drains of the Middle Bohle River flood study. The split between the Middle and Upper Bohle River flood studies occurs roughly 600 metres to the south of the development site. The Stage 12A development area generally falls from east to west towards Beck Drive via sheet flow or overland drains and into the culvert north of the constructed Precinct 1 of the development. The culvert drains into the upper ends of a tributary of the Bohle River this outlet tributary has a stream order of 1. The existing drainage for the Stage 12A development inclusive of the approved Precinct 1 and 2 is shown in **Figure 1-4**. In the current and proposed scenarios all runoff will be directed to the existing sediment basin upstream of the Beck Drive culvert. NCE note that as part of the master planned development, flows from Precinct 4 will be directed to the north via a major drain in the future Precinct 3. Any future redirection of flows will be designed to ensure no impacts to both upstream and downstream areas.

The Stage 12A development area has multiple upstream catchments that flow through the site as outlined below:

- The adjacent Riverway Drive lots to the east drain generally from east to west towards the Stage 12A development. Flows are generally overland sheet flows into the Stage 12A area and continues to overland flow until it concentrates into the existing drain adjacent to Sida Way.

- The southern most section of Pinnacle Drive in particular the eastern kerb grades southward into Stage 12A which then sheet flows overland to the west into the existing drain adjacent to Sida Way.

- The northern most section of Resolution Street grades to the north into Stage 12A which then sheet flows overland to the west into the existing drain adjacent to Sida Way.

The general grade of the existing Stage 12A land is 0.15% on average from east to west with uneven ground recorded in the survey resulting in ponding across some areas. The baseline DEM is shown in **Map A05** and in the **Figure 1-4** below.

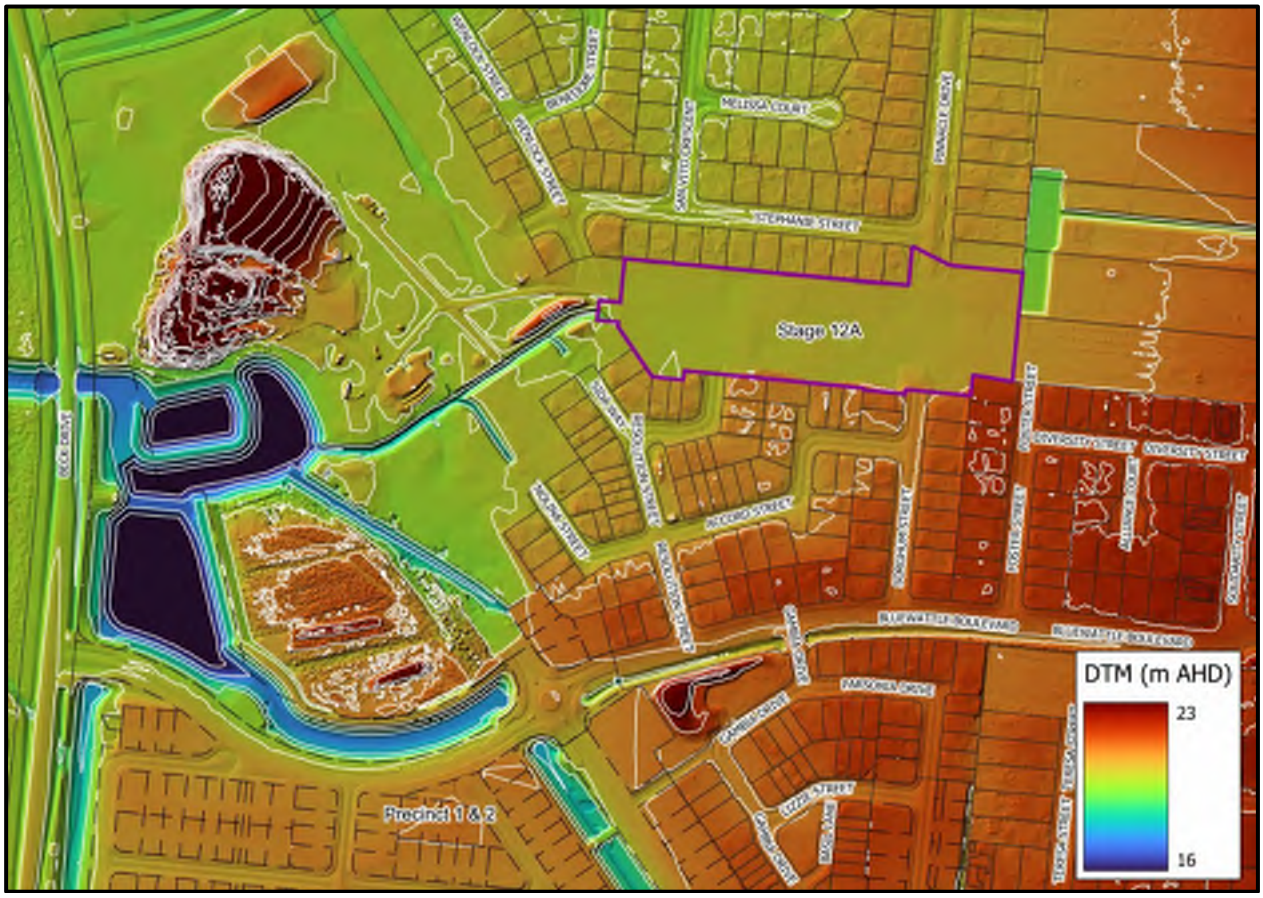


Figure 1-4 Base-line DEM inclusive of approved Precinct 1 and 2 developments (1m contours)

1.6 Limitations

Preparation of the models necessary to undertake this assessment have been conducted in accordance with good engineering practices however, is bound by the practical limitations of the accuracy of information and data used for the modelling, and the software. The information produced in this report is accurate at the time of issue and is based on the information available at the time of the analysis. It is also noted that this report does not identify any funding sources or mechanisms associated with any of the works identified.

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

The services undertaken by NCE in connection with preparing this report were limited to those specifically detailed in the scope and limitations of the report.

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

NCE has prepared this assessment on the basis of information provided by 3rd parties, which NCE has not independently verified or checked beyond the agreed scope of work. NCE does not accept liability in connection with such unverified information, including errors and omissions in the supplied.

2.0 AVAILABLE DATA

2.1 Topographic Information

A Digital Elevation Model (DEM) based on LiDAR survey data over the entire model extent was captured as part of the Townsville City Council 2019 LiDAR project and source from the Open Data portal. The sourced data has a 1m grid resolution that was read into TUFLOW. As some potential issues were noted with the 2019 LiDAR data, a comparison was carried out between the 2012 and 2019 LiDAR datasets and survey data. The comparison with 2012 data was completed to help compare to the current flood study in the surrounding area (Upper-Middle Bohle Flood Study 2014). This review found that where the survey overlapped the LiDAR, the survey was generally lower except through drains. This is not unexpected as the LiDAR can often pick up on higher points in areas that are densely vegetated.

A comparison between the 2019 and 2012 LiDAR indicates that the 2019 LiDAR is generally higher in developed areas and through the development site and lower through the undeveloped open areas. The 2019 LiDAR seemingly has better definition through the Bohle River channel and picks up on recently developed areas and changes to the surface over time.

Whilst the survey is not as fine scale and does not pick up on some narrower existing channels through the developed area, the more accurate definition and better tie in to the development surface models is the reason it has been adopted through the development area. The 2019 LiDAR was found to have good correlation and was adopted as the basis for the digital elevation model (DEM) outside of the surveyed development area.

Some areas within or adjacent to Stage 12A were noted as potentially incorrect where survey levels indicated existing lot levels were significantly lower than the LiDAR data. These survey DEM was excluded from these areas to ensure that flood results did not misrepresent the actual topography of the area.

Additionally, adjacent developments to the north-east of Stage 12A were found to be resulting in changes to the baseline flood conditions that were not represented in the modelling. Approved design plans were sourced from the online TCC planning portal and were utilised to represent the works completed on adjacent lots.

2.2 Spatial Data

The following data was acquired to undertake this assessment:

- TCC supplied 2012 and 2019 LiDAR.
- Cadastral data and other various data sources (i.e. watercourses, property extents, roads, stormwater infrastructure, etc) of the site and surrounding area, sourced from the TCC Open Data portal and Queensland Government's QSpatial catalogue.
- Survey of existing lot and partial survey of adjacent lots and roads.
- Final design terrain for precincts 1 & 2 provided by Empower Engineers.
- LiDAR drone survey for Stage 6 earthworks provided by Empower Engineers.

- Preliminary design surface for Stage 12A provided by Empower Engineers.
- Additional culvert survey under Beck Drive and Allambie Lane.
- Site visit to determine local catchment hydraulic control measures including culverts not included in survey or TCC data, high points or impervious fences that directly impact on the local catchment flows.

2.3 Aerial Imagery

The following sources of aerial imagery have been utilised in this assessment:

- TCC's 2019 aerial photography, sourced from the TCC Open Data portal.
- Google satellite imagery, sourced from the Quick Map Services Plugin in QGIS.
- Queensland Globe online mapping service satellite imagery.

The above imagery has been utilised for roughness / land use mapping and flood results mapping. The site was also attended on the 21st of March 2024 to confirm roughness / land use as well as the above important hydraulic controls / features.

3.0 MODELLING METHODOLOGY

In reference to the previous FIA (URB0001-P2_FIA) NCE have maintained the pre-existing hydraulic model developed for the purpose of addressing the Flood Hazard Overlay code for the development of Precinct 1 & 2.

In reference to the Flood Hazard Overlay Map discussed in **Section 1.1** and lack of detailed flood information, to address the hydrological processes and stormwater drainage components of the Healthy Water Code 9.3.2, a 2D hydraulic model has been developed.

The modelling approach utilised for this study included the development of a detailed fine scale 2D rain-on-grid (ROG) hydraulic model, for the purpose of defining and understanding the flooding characteristics of the site and whether the proposed development has any impacts on surrounding properties. The ROG method was adopted in conjunction with hydrograph inflows due to the upstream flows from the Bohle River and Spring Creek contributing to the flooding over the modelled catchment. The ROG approach has been used extensively for flooding assessment and is a standard industry and local government authority (LGA) approach.

The modelling methodology as outlined in the Precinct 2 flood impact assessments (URB0001-P2-FIA) has been adopted for the continuation of the estate. The specific modelling features utilised for Precinct 2 have not been altered for the modelling of Precinct 4 Stage 12A. The assessment of TUFLOW modelling capabilities and the cell-size convergence testing is contained within the original FIA and the outcomes remain unchanged for the Precinct 4 modelling. ARR87 hydrologic methodology has been adopted as NCE have continued to use the model as accepted for the Precinct 1 RAL.

3.1 TUFLOW

The TUFLOW (Two-dimensional Unsteady FLOW) modelling software was utilised to undertake the hydraulic modelling required for this flood level assessment. TUFLOW is a powerful computational engine that allows the ROG method to be applied directly to the 2D hydraulic model which provides 1D and 2D solutions of the

free-surface flow equations to simulate flood and tidal wave propagation. TUFLOW is specifically oriented towards establishing flow and inundation patterns in floodplains, coastal waters, estuaries, rivers and urban areas where the flow behaviour is essentially 2D in nature and cannot or would be onerous to represent using a 1D model. Subsequently, TUFLOW is ideally suited for this assessment.

TUFLOW currently incorporates two (2) grid-based solvers:

- TUFLOW Classic: A second order semi-implicit solution available for computations using CPU hardware on a single core; and
- TUFLOW HPC (Heavily Parallelised Compute): A second order explicit solver. TUFLOW HPC can run a simulation using multiple CPU cores, or alternately GPU hardware for high-speed execution without sacrificing model accuracy.

Outputs from TUFLOW include GIS compatible maps of flood depths, water surface levels (WSL), velocities and inundation extents.

For this assessment, a site specific 2D TUFLOW model has been developed which has adopted the HPC solver. Where applicable, 1D elements have been incorporated in the model.

3.2 Baseline Model

NCE have generally utilised the approved baseline model as developed as part of the Precinct 2 FIA (URB0001-P2-FIA). An approved development to the north-east of the Stage 12A development has been incorporated into the baseline modelling to ensure the impacts on the flow regime are mirrored within the 2d modelling. The approved development is the initial stages of the Yumba Meta which are depicted below in **Figure 3-1**. The full set of approved design plans are provided in **Appendix J** which have been extracted from the TCC Planning online portal.

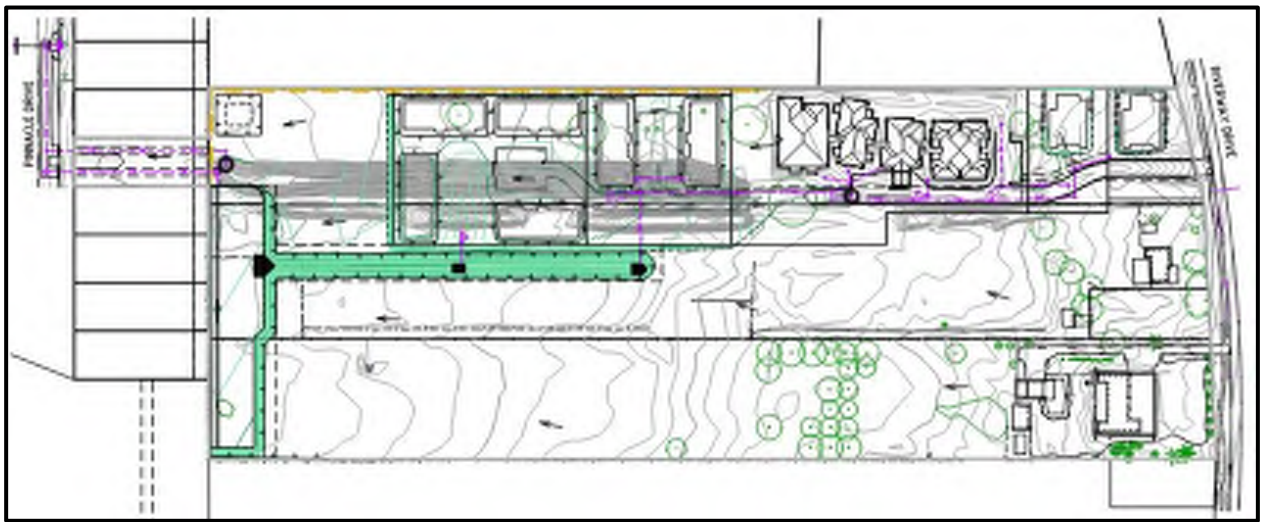


Figure 3-1 Yumba Meta stage 1 development

The location of the Yumba Meta development in comparison to the different stages and precincts is shown in **Figure 3-2** below for reference.

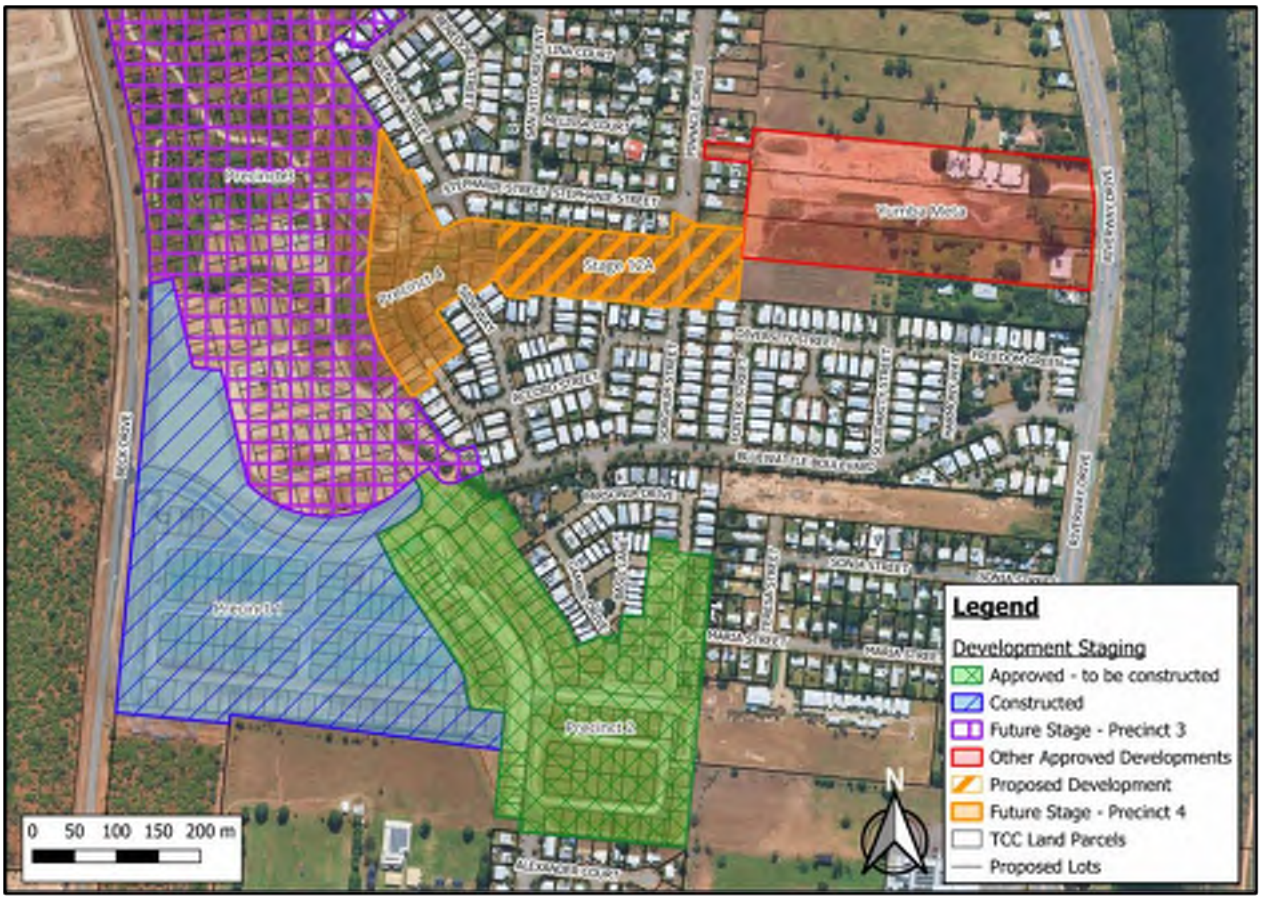


Figure 3-2 Development locations comparisons

The Yumba Meta development captures all runoff to the west within the drain and detention basin and then provides an underground pit and pipe connection into Pinnacle Drive to create a legal point of discharge. The drain and basin topography updates can be seen in **Figure 1-4**. The shapefiles and culverts specific to the Yumba Meta development can be seen in **Figure 3-3**.

Additional edits to the baseline surface have been utilised to revert select areas of surveyed levels back to 2019 LiDAR levels as they extended into existing residential areas and inaccurately depicted lot levels. These areas have only been specifically updated surrounding the Stage 12A development to ensure results mapping does not inaccurately depict flood conditions on adjacent lots. The areas where the site survey has been excluded can be seen in in **Figure 3-3** as well.

Figure 3-3 Yumba Meta development shapefiles

3.3 Developed Model

Given the nature of the assessment, the modelling to identify the development layout was an iterative process, where one set of results was used to inform or refine the subsequent simulation. This iterative process also extended to the identification of mitigation measures. With this in mind, the following approach was used:

- Assess the design Digital Terrain Model (DTM) provided by Empower Engineers.
- Modify the DTM to better fit/tie into the base-line model to account for proposed drainage, roads, earthworks and culverts.
- Identify and assess the development impacts through an iterative process of various flood mitigation measures to ensure non-worsening conditions beyond the extent of the proposed development.
- Stage 12A of development was refined to ensure a suitable outcome which aligned with the ultimate outcomes.
- Modelling of interim staging which mirrors the expected construction programming. This includes the modelling of temporary drainage measures and other requirements during the construction. Given this staging is temporary NCE have mainly focused on the resolution of the major (1% AEP) and minor (0.5EY) events.
- Climate change scenario and complete blockage scenario to assess the robustness of the development and the worst-case development impacts.

In addition to demonstrating compliance with the objectives of **Section 1.4**, the modelling works are anticipated to provide confirmation of the expected flood levels within the development. NCE note that the future removal of the HESB will occur and new drainage paths will be required to be cut to ensure drainage to the Beck Drive culvert. Additionally, the future master planned estate will capture flows from Stage 12A and divert them to the north via a diversion drain as part of Precinct 3 any impacts generated by diverting the flows to the north must be addressed as part of future modelling as part of the Precinct 3 FIA.

3.4 Proposed Development Site Drainage

The proposed development site drainage is represented in **Figure 3-4** and generally consists of the following components:

- The fully completed development of Precinct 1 as approved as part of the original FIA (URB0001-FIA).
- The fully completed development of Precinct 2 as approved as part of the Precinct 2 FIA (URB0001-P2-FIA).
- Stage 6 earthworks as approved by the Precinct 1 FIA addendum (220914-URB0001-03-Addendum_01).
- Filling for proposed allotments to align with adjacent developments, provide appropriate grade and bring development above 1% AEP.
- Trapezoidal open channels to provide drainage to development runoff and upstream catchments and mitigate flood impacts.
- Extension of Pinnacle Drive and Sorghum Street to connect through. Raised sealed urban roads acting as embankments.
- Culvert under road extension to connect open channels.
- Low-flow weirs with culverts through the downstream existing stormwater drain connecting to the sediment basin to detain flows in the minor events within the existing drainage infrastructure.
- Significant earthworks are proposed to natural land fall for the developed allotments to maintain immunity in the DFE.
- The outlet discharge locations from the site are consistent with the existing flows with the runoff conveyed and mitigated via channels, flow diversions and flow restrictions. The primary flow discharge locations at the western boundary are based on the existing drainage channel in place on the balance lot which directs flows to the sediment basin and Beck Drive culvert.
- The intent is for flows to be sufficiently mitigated before reaching the sedimentation basin to ensure no additional impacts downstream. Therefore, all mitigation measures are contained within the Stage 12A development extent or within the existing drainage channel connecting Stage 12A to the sediment basin.

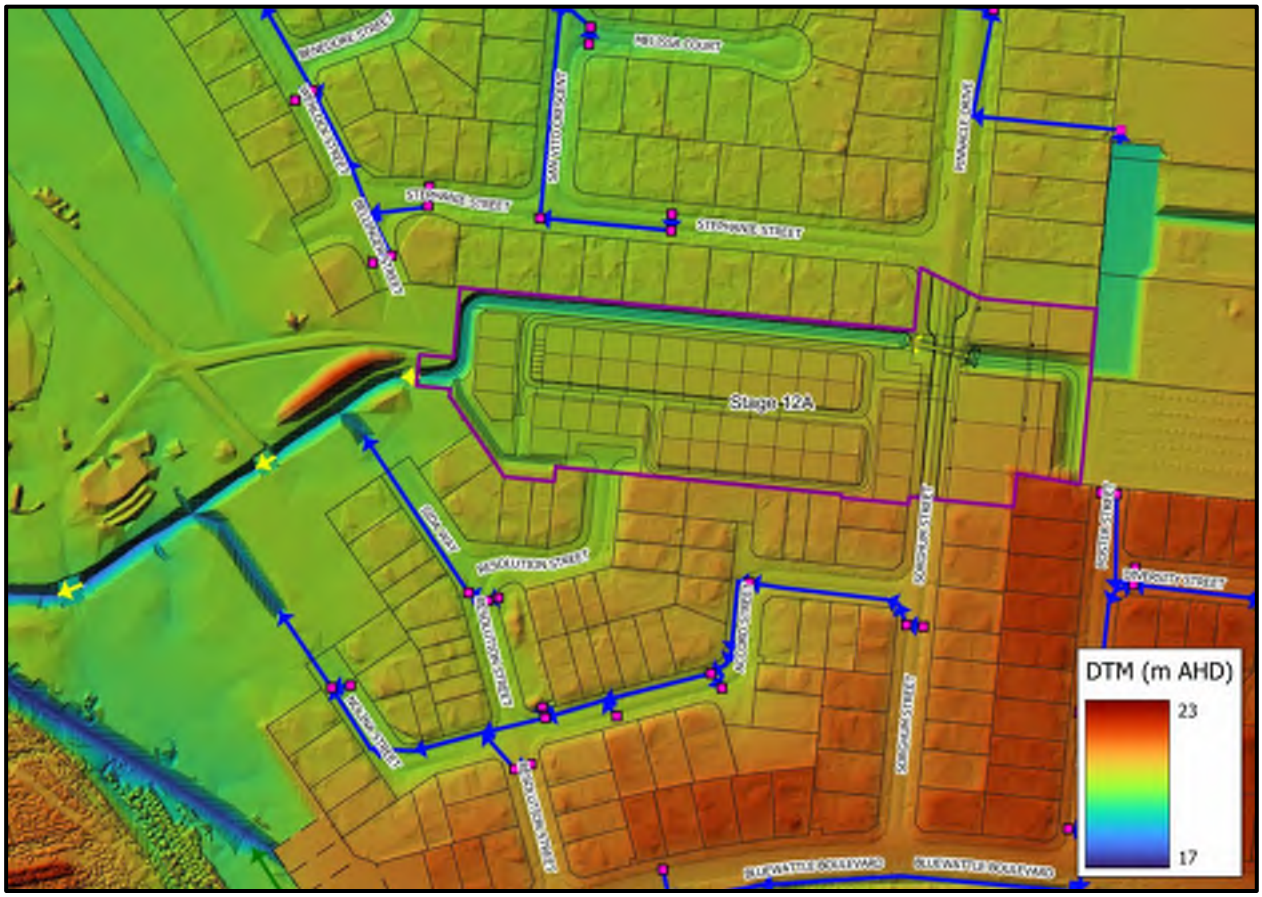


Figure 3-4 Proposed development site drainage

3.5 Development Staging

The development is intended to be split between two stages as depicted in **Figure 1-1**. The stages are as outlined in **Section 1.2**. For the construction Stage 1 the new road connecting Pinnacle Drive and Sorghum Street will be required for access to the development. To ensure that flows upstream of the road extension are adequately captured a v-cut table drain is to be installed along the eastern batter of the road to direct flows into the culvert under the road extension and into the drainage paths through Stage 1. Downstream low flow weirs must also be installed as part of Stage 1 of the development.

4.0 HYDROLOGIC ASSESSMENT

As discussed in the preceding sections, the hydrology has been primarily based on the rain-on-grid (ROG) method and upstream inflows with input parameters based on the ARR1987 temporal pattern ensembles for each event and duration. No alterations have been made to the hydrologic methodology adopted as part of the original FIA.

4.1 Rain-on-grid (ROG)

The same rain-on-grid and materials/land-use approach has been adopted as per the previous FIA (URB0001-P2-FIA).

Land use / imperviousness maps (**Map A03** and **Map A04**) have been developed for each scenario (base-line and developed respectively) corresponding with the relevant imperviousness and roughness which has been categorised as per **Table 4-1**. Depth varying Mannings values have been adopted for some land uses as it generates runoff that is more accurate to real life conditions. Depth varying values are listed in the order

y1, n1, y2 and n2. Y1 is the depth below which n1 is applied. Whereas y2 is the depth above which n2 is applied. Values in between these depths are linearly interpolated.

Table 4-1 Land use summary

Land use type	Mannings n	Fraction Impervious	Description
1	0.03	0	Bohle River bed upstream
2	0.04	0	Bohle River bed downstream
3	0.02,0.1,0.1,0.04	0	Parkland
4	0.03,0.1,0.1,0.06	0	Vegetation (light) / Open Space / Vegetated Channel
5	0.05,0.12,0.1,0.08	0	Vegetation (medium)
6	0.1	0	Vegetation (dense)
7	0.05	0.1	Rural
8	0.04	0.2	Rural Roads
9	0.04	0.2	Sports & Recreation
10	0.03	0.5	Urban Roads
11	0.06	0.65	Low Density Residential
12	0.06	0.7	Residential
13	0.03,0.02,0.1,0.05	0.9	Commercial/Industrial
14	0.018	1	Concrete Channels / Impervious
15	0.025	1	Water
16	0.15	0	Downstream portion of Bohle River
17	0.12	0	Downstream portion of Bohle River
18	0.1	0	Wetland
19	0.08	0	Linear Wetland
20	0.03	0	Developed – cleared areas

The Mannings values provided above have been adopted from one of the following three technical guidelines/documents, in the following order of precedence; TCC City Plan SC6.7.4, Australian Rainfall and Runoff (ARR2019), Queensland Urban Drainage Manual (QUDM).

The existing residential allotments were assessed from aerial imagery to determine a rough percent imperviousness. This resulted in the newer development areas adopting a fraction impervious of 0.7 whilst older low density residential zoned areas have adopted a value of 0.65 as is outlined in the TCC City Plan.

5.0 HYDRAULIC ANALYSIS

The hydraulic analysis has been carried out using a fine scale 2D model identifying the flooding depths, velocities and inundation extent of the base-line and developed case models as well as assessing and mitigating the impacts associated with the proposed development. NCE have generally utilised the existing model developed as part of the Precinct 2 assessment (URB0001-P2-FIA), any updates to this model are outlined in the following sections.

5.1 Model Setup and Boundary Conditions

There are no changes to the model extents or adopted boundary conditions.

5.2 Topography

NCE have utilised the previously conducted survey in conjunction with the 2019 LiDAR data for the unchanged baseline topography. Minor updates are noted in **Section 3.2**.

For the developed scenario, the baseline topography was modified to include the filling for the proposed lots, the construction of open channels, extension of existing roads and flow mitigation measures such as low flow weirs. The development topography is depicted in **Figure 3-4**. The proposed development site drainage is outlined in **Section 3.4**. NCE note that additional stockpile material is also represented by the model directly to the north of the previous stockpile location.

5.3 1D Stormwater Drainage Structures

In TUFLOW pipes and culverts are modelled as 1D structures. The existing infrastructure as recorded in TCC's online infrastructure mapping has already been included in the previous hydraulic model. Minor changes to the existing network are due to the inclusion of the Yumba Meta development. Culverts have been modelled as per the long sections and information provided in the design plans contained in **Appendix J**.

Further, major culverts included as part of the proposed development scenario (additional to those utilised in URB0001-FIA-P2 for Precinct 1 & 2) are outlined in **Table 5-1**.

The spatial representation of each pit, pipe and culvert not included in TCC's online infrastructure mapping is shown in the attached maps.

Table 5-1 Developed culvert structures

Culvert ID	Type	Size
Stage_12A_P01	RCBC	3/1200x300
STAGE_12A_LOW_FLOW_1	RCP	Ø375
STAGE_12A_LOW_FLOW_2	RCP	Ø375
STAGE_12A_LOW_FLOW_3	RCP	Ø375

It should be noted that there is no internal drainage for Stage 12A with the intent that all runoff will be discharged through overland drainage paths.

5.4 Hydraulic Roughness

The hydraulic roughness is a measure of the resistance to flow and is typically defined as the Manning's n value. **Map A03** and **Map A04** depict the Manning's n values and land use applied to the various surface types for the base-line and developed cases respectively. These roughness values and areas have been defined via aerial imagery and through site visits with reference to the guidelines outlined in **Section 4.1**.

5.5 Drying & Flooding Depths

Drying and flooding depths of 0.0002 m were adopted. These values were selected in order to mitigate the risk of mass errors and are compliant with TUFLOW modelling guidelines for SGS modelling.

5.6 Critical Duration Assessment

The critical duration assessment was conducted as part of the original Precinct 1 FIA (URB0001-FIA). NCE have continued to adopt the long and short critical durations. To reduce the number of maps presented as part of this report, the maximum results for the two durations has been calculated, where differences between the durations are noted and are important to distinguish for the impact assessment, NCE have provided

specific commentary. NCE note that whilst the development site is generally contained within the short critical duration area the inclusion of the development has resulted in peak WSLs being generated in the long critical duration in some areas such as through the upstream drainage paths.

5.7 Sensitivity Analysis

NCE have not rerun the sensitivity analysis that were conducted as part of the previous FIA. The climate change and 100% blockage scenarios have been modelled to assess the robustness of the development to worst-case scenarios. The outcomes of those assessments are provided in **Section 6.0**.

6.0 FINDINGS, RESULTS AND DISCUSSION

Due to the nature of ROG results and to provide some clarity, the final maps have been filtered such that areas predicted to experience water depths less than 0.05 m and water velocities less than 0.5 m/s are shown free from flooding. This aligns with TCC's historical filtering requirements.

Table 6-1 below summarises results of the hydraulic modelling that have been mapped and provided in the following appendices:

- Appendix A – General Flood Model Mapping
- Appendix B –Afflux Mapping (All Events WSL, Velocity Afflux)
- Appendix C – Depth Mapping (100- and 2-year ARI)
- Appendix D – Velocity Mapping (100- and 2-year ARI)
- Appendix E – WSL Mapping (100- and 2-year ARI)
- Appendix F – Hazard Mapping (100-year ARI only)

Table 6-2 below summarises the results of the staged hydraulic modelled that have been mapped and provided in the following appendices. For each stage scenario the 100-year and 2-year ARI WSL afflux and depth results have been provided. NCE note that interim events are not required as each stage is considered temporary and the impacts are to be resolved as part of the final development.

- Appendix G – Stage 1 Mapping

Table 6-3 below summarises the sensitivity results from the hydraulic modelling that have been mapped and provided in the following appendix:

- Appendix H – Sensitivity and Climate Change Mapping (WSL Afflux and Depth for select cases)

NCE note that provided results are "low-resolution" results and therefore the extent of inundation may be overstated due to the cell size utilised. Low-resolution results are utilised as TUFLOW cannot process the full set of high-resolution results and thus post-processing of results such as filtering cannot be completed.

Table 6-1 Result map plots

Scenario	Event (ARI)	Flood Characteristic			
		WSL	Depth	Velocity	Hazard
Baseline	100	✓	✓	✓	✓
	50	x	x	x	x
	20	x	x	x	x
	10	x	x	x	x
	5	x	x	x	x
	2	✓	✓	✓	x
Developed	100	✓	✓	✓	✓
	50	x	x	x	x
	20	x	x	x	x
	10	x	x	x	x
	5	x	x	x	x
	2	✓	✓	✓	x
Afflux	100	✓	x	✓	x
	50	✓	x	x	x
	20	✓	x	x	x
	10	✓	x	x	x
	5	✓	x	x	x
	2	✓	x	✓	x

Table 6-2 Staged assessment

Scenario	Event (ARI)	Flood Characteristic	
		Depth	Afflux (WSL)
Stage 1	100	✓	✓
	2	✓	✓

Table 6-3 Sensitivity result map plots

Scenario	Event (ARI)	Flood Characteristic	
		WSL Afflux	Depth
100% Blockage	100	x	✓
Climate Change	100	✓	✓

6.1 Development Mitigation

All measures additional to the mitigation provided as part of the Precincts 1 & 2 development are outlined below, inclusive of any alterations to the originally required mitigation. The development mitigation is contained within the surface model created by Empower which has been iteratively altered by NCE to achieve a non-worsening outcome for all events. The combined mitigation measures are as follows:

- Back of lot drain connecting through to the Pinnacle Drive / Sorghum Street road extension. Drain runs south to north along the back of proposed lots 204 and 205. Drain connects through to east to west drain through lot 206 and 207 connecting through to the new road.
    - Back of lot drain at 15 wide with a 5m wide base, grades at approximately 0.65%.
    - Through lot drain at 15m wide with a 5m wide base, grades at approximately 0.65%.

- Extension of Pinnacle Drive / Sorghum Street to create new road connection.
    - Sag point aligning with development drainage to discharge road runoff into adjacent drains.

  - Sag point also allows for minor overtopping over road to relieve flows in the major event.
  - Culverts under sag point 3/1200x300 modelled at 20% blockage.

- North drainage channel connecting the culverts under the Pinnacle Drive / Sorghum Street connection to the existing drainage path downstream. Drain extends the full length of the northern boundary.
  - Approximately 9.5m wide drain with a 3.5m wide base, grades at 0.3%.
  - Minor overtopping of the drain occurs during major events which extends into the adjacent private road allowing for additional conveyance / storage.
  - The adjacent minor road has one-way crossfall to direct runoff into the adjacent drain.

- Southern minor drainage channel connecting Resolution Street tee-head and internal roads to the existing drainage path downstream. Drain extents from Resolution Street along the south-western boundary to the northern drainage channel on the western boundary of Lot 907.
  - Approximately 10m wide drain (varies with batter height) 2m wide base, grades at 0.3%.
  - Extend drain eastward towards the tee head to provide sufficient capacity for flows from Resolution Street.

- Internal private roads in Lot 907 are utilised to direct overland flows into adjacent drains and to provide storage for direct runoff. No internal pit and pipe systems is provided with the intent that all flows are free draining overland.

- 3 downstream flow restriction weirs with DN375 low flow pipes:
  - Flow restriction 1 – directly downstream of Lot 907. 19.75m AHD (~0.9m tall) weir level.
  - Flow restriction 2 – located directly between Sida Way and Nolina Street overland flow drain connections. 19.45m AHD (~0.95m tall) weir level.
  - Flow restriction 3 – upstream of the Precinct 1 sediment basin. 18.95m AHD (~0.9m tall) weir level.

The proposed mitigation measures and any details can be seen in **Map A07**. Following an extensive series of model iterations with a combination of the above measures, mitigation of the increase in run-off from the altered developed flow configuration for all events has been achieved. NCE note that some minor, highly isolated afflux which is considered inconsequential are generated by directing flows to west to Beck Drive. It is noted that future development stages will redirect flows to the north alleviating any minor interim afflux.

6.2 WSL Afflux

Afflux is defined as the relative change in a flooding characteristic, namely water surface level (WSL) or velocity, between the baseline and developed scenario. This is determined by subtracting the baseline peak results from the developed peak results, where a positive value represents an increase in the flood characteristic and a negative value is a decrease. The afflux results for each AEP event are provided in **Appendix B**. It is noted that due to the high-resolution results output by the SGS model, flood mapping quality is enhanced allowing a more accurate assessment of the site.

Map B01 depicts the extent of WSL afflux for the 100-year ARI event, this includes the peak WSLs from the 60-minute and 6-hour durations. The afflux generated by the development is contained to within the development site. Generally, the developed lots through precinct one is mapped as “Was wet now dry” which indicates the immunity of the lots to the DFE. Some areas internal to both lot 907 and the lots to the east of the proposed road contain afflux, these values are generally contained to private roads and drainage easements and will not impact on proposed dwellings. The internal roads of Lot 907 also show an increase in WSL where water flows through the roads, however these values are exaggerated due to the level of fill across the development compared to existing surface. WSL decreases are noted upstream of Precinct 4 to

the east on the adjacent lot and to the north-east through the adjacent sections of Pinnacle Drive and Stephanie Street. The main drains through the upstream lots and along the north and south of Lot 907 result in local decreases to WSLs as the drains are in cut. Some minor localised increases in afflux are noted across the development which are considered non-actionable and are inconsequential and not considered further. These are noted on the adjacent lot to the northeast along Pinnacle Drive where existing water ponds on an undeveloped lot, this would be resolved upon development of the lot. Further impacts are noted at the end of Sida Way although are only generated within the roadway and do not alter the flood hazard level within the existing road reserve.

Map B06 depicts the extent of afflux for the 2-year ARI event. The combined WSLs from both of the minor event durations shows some minor afflux downstream of Beck Drive through the drain. Afflux is minor, localised and contained within the drain and is therefore considered non-actionable. Additionally, NCE note that the downstream afflux will be resolved once flows are directed to the north as part of future development stages.

Across all other interim events and durations NCE consider that development does not generate any actionable afflux. Other highly isolated areas show minor, non-actionable afflux which are inconsequential and not considered further. NCE note that any minor afflux noted will likely be resolved as part of future development stages which will supersede the temporary downstream mitigation measures.

While it is acknowledged that there are some minor isolated increases in WSL, there is generally no actionable impacts offsite. The outcome is considered to achieve all the objectives of the City Plan flood hazard planning scheme policy SC6.7.

6.3 Flood Depth and Inundation Extent

Appendix C contains the flooding depth and inundation extent for the base-line and developed case scenario for the major and minor (100- and 2-year ARI respectively) events. The most critical depths for the development are from the 100-year ARI event, shown in **Map C02**.

The developed depth mapping in the 100-year ARI shows that the inundation across the development site is generally restricted to the open drains and through the minor roads. Generally, NCE have attempted minimise the extent and magnitude of ponding through the new development areas and note that no underground pit and pipe network is proposed as part of the development. All areas are graded to flow freely overland to the proposed open drains inclusive of the proposed new road. The depth of ponding across the development site and internal roads does not exceed ~240mm in the worst-case scenario at the Resolution Street tee head. Internal private roads and the proposed connection of Pinnacle Drive and Sorghum Street do not exceed depths of 200mm. No ponding occurs across the development site that does not have stormwater infrastructure to provide drainage to the area. The intent is to ensure that all lots are free from any inundation caused by ponding through internal roads and that the lots have been built to a level that is at or above the 100-year ARI flood level. Where ponding reaches the edge of a proposed lot, any habitable FFL will be set a minimum of 300mm above the 1% AEP WSL in both the adjacent major drains and the local runoff within the internal roads.

NCE note that due to the 5m grid resolution of results some lots appear to be inundated in the major flood event in particular due to flooding of the internal roads in Lot 907. Interrogation of water levels in these areas indicates that lots are free of inundation and flooding indicated in mapping is due to the coarse flood model grid size.

6.4 Peak Velocity

Appendix D contains the peak velocity for the baseline and developed case scenarios for the major and minor storms. In reference to the 100-year ARI base-line assessment (**Map D01**), it is evident that the velocity is generally <0.5m/s through the areas of sheet flow whereas the existing table drains and open drains exceed 0.6m/s in some areas.

As expected, the average velocities in the developed case (**Map D02**) are generally less than 0.5m/s in areas of ponding. The table drains and open drains are still higher with values up to 0.6m/s generally. Similar observations have been made for the other storm durations and for the minor event scenarios. NCE note that generally no significant afflux is noted around or adjacent to the development. Some localised peaks in flood velocity are noted at the downstream low flow weirs where overtopping occurs in major events, velocities peak at approximately 1m/s at the furthest downstream weir. NCE note the temporary nature of the low-flow weirs suggests that scour protection may not be necessary despite the velocity being around 1m/s. The inclusion of scour protection is at the discretion of the design engineers with all channels and locations of high velocity subject to a separate erosion, scour and stability assessment as part of the operational works.

6.5 Change in Velocity

The change in the peak velocities is shown in **Appendix B** and has been determined by subtracting the base-line velocity results from the developed scenario results.

The criteria adopted for changes beyond the extents of the proposed development for this assessment is as follows:

- Any change below 0.1 m/s has no cause for concern and is an acceptable outcome;
- 0.1 m/s to 0.3 m/s is generally acceptable may be considered unacceptable following a review of the pre and post velocities;
- 0.3 m/s to 0.5 m/s may require further investigation to determine if additional mitigation measures are required;
- Above 0.5 m/s requires an in-depth investigation into the potential erosion impacts as well identifying mitigation measures.

Map B07 depicts the extent of velocity afflux for the 100-year ARI event. There are generally no significant increases off-site, however, there are some slight increases noted at the very upstream end of the development to the east and at the boundary with the existing portion of section of Pinnacle Drive to the north. These increases are very minor in both extent and magnitude and are isolated while values do not exceed an increase of 0.2m/s. Additionally, these values do not align with any increases in flood depth, nor do they correlate with a change in the hazard classification. Therefore, NCE consider these impacts to be non-actionable and inconsequential and fully acceptable.

6.6 Peak Flood Levels

Appendix E contains the peak water surface levels (WSL) for the base-line and developed case scenarios. The 100-year ARI flood levels vary with the natural topography of the site.

To ensure immunity to the defined flood event (100-year ARI as nominated in TCC's planning scheme), each lot is required to have a portion of the site at or above the 100-year ARI flood level. As the lots are free from inundation in any event the intent is for the proposed lots finished levels to be at or above the maximum WSL in the 100-year ARI event through the open drains and roads.

Table 6-4 provides a summary of the 100-year ARI flood levels through the adjacent open drains and roads at the locations indicated in **Map A07**. These are the minimum levels the adjacent lots and roads need to be designed to in order to comply with TCC's planning scheme. Note that all flood levels are taken at Stage 2 of the development as this is considered to be the worst-case scenario and considered the fully complete scenario. All provided levels are in metres AHD and rounded to the nearest 10mm. Some areas are noted as without flooding as they have been filtered out to in accordance with TCC standard procedure, these areas are indicated in the below table with a Not Applicable (N.A.) label.

Table 6-4 Peak flood level summary at key locations

Location	100yr ARI MAX WSL
Road Extension 01	20.48
Road Extension 02	20.46
Road Extension 03	20.47
Road Extension 04	20.63
Road Extension 05	N.A.
Stage 1 Internal Road 01	20.16
Stage 1 Internal Road 02	20.25
Stage 1 Internal Road 03	20.23
Stage 1 Internal Road 04	20.38
Stage 1 Internal Road 05	20.45
Stage 1 Internal Road 06	20.57
Stage 1 Internal Road 07	N.A.
Stage 1 Internal Road 08	N.A.
Stage 1 Internal Road 09	20.55
Stage 1 Internal Road 10	20.73
Stage 1 Internal Road 11	N.A.
Stage 1 Main Drain 01	20.12
Stage 1 Main Drain 02	20.13
Stage 1 Main Drain 03	20.14
Stage 1 Main Drain 04	20.15
Stage 1 Main Drain 05	20.18
Stage 1 Main Drain 06	20.21
Stage 1 Main Drain 07	20.26
Stage 1 Main Drain 08	20.29
Stage 1 Side Drain 01	20.14
Stage 1 Side Drain 02	20.20
Stage 1 Side Drain 03	20.27
Stage 2 Main Drain 01	20.47
Stage 2 Main Drain 02	20.50
Stage 2 Main Drain 03	20.52
Stage 2 Main Drain 04	20.56
Stage 2 Main Drain 05	20.59

All finished floor levels (FFL's) are to be calculated as the adjacent 100-year WSL plus 300mm of freeboard or where there is no adjacent flooding a minimum of 300mm above the finished surface level (FSL) of the lot. Flood model WSL results rasters can be provided upon request to help define exact adjacent WSLs.

6.7 Hazard Assessment (VD Product)

A safety hazard assessment has been undertaken, primarily focusing on the velocity x depth (VD) product across the development. Flood hazard results have been mapped as per the ARR2019 General Flood Hazard Curves – Figure 6.7.9. For reference to the thresholds and levels of safety provided by the ratings refer to the **Figure 6-1** which shows the curves and their description.

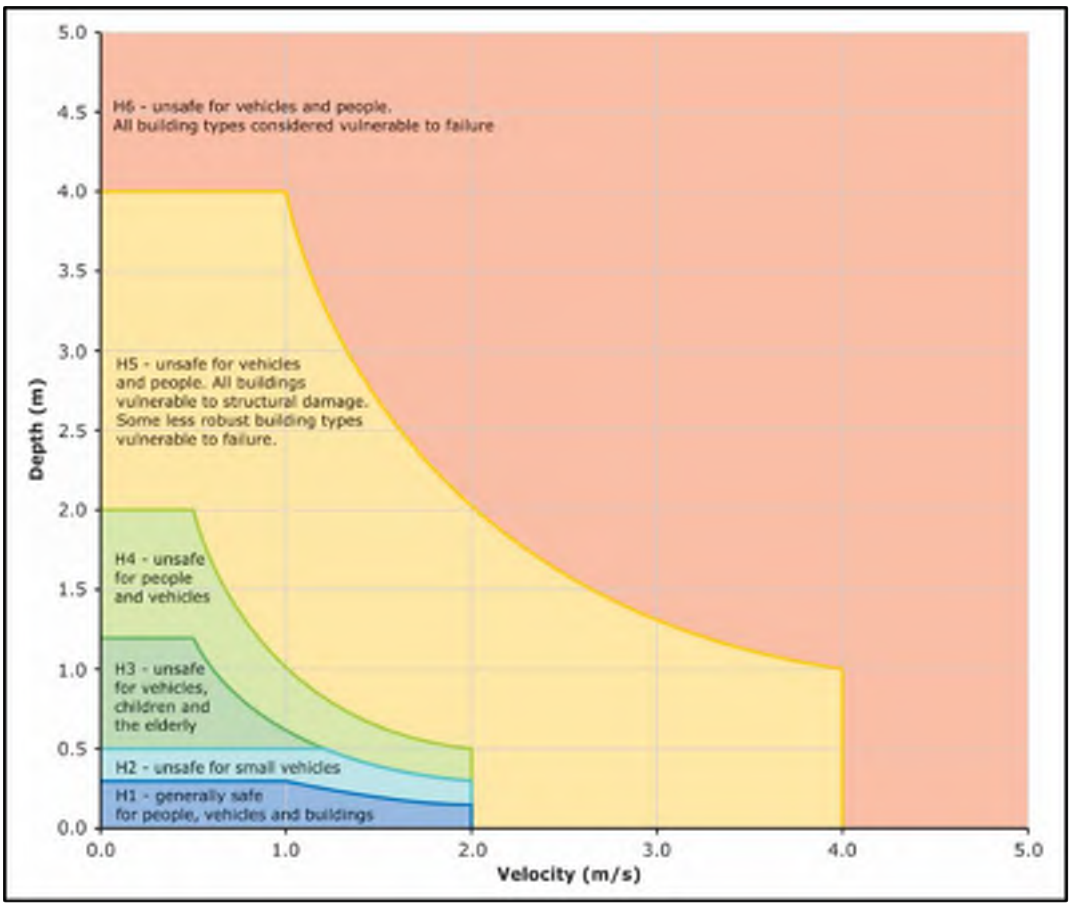


Figure 6-1 ARR2019 Figure 6.7.9 excerpt – combined flood hazard curves

Map F02 depicts the flood hazard classifications for the worst-case 100-year ARI event. It was observed in the 1% AEP event that the VD product generally remains within acceptable limits.

In reference to **Figure 6-1**, it can be seen that the maximum VD product for all trafficable areas, lots and pedestrian pathways does not exceed the limits for H1 – indicating it is generally safe for people, vehicles and buildings. The only areas that exceed the limits for H2 are the open drains where flows are significantly deeper. NCE note that some areas of the drainage easements exceed H2 and these areas will need to ensure appropriate safety measures are in place to maintain safety for people and vehicles during major events.

6.8 Staged Development Assessment

All of the above information is provided in relation to the expected full development. The following section provides information specifically in relation to the interim Stage 1 development as shown in **Figure 1-1**.

6.8.1 Stage 1

All mapping in reference to Stage 1 of the development is contained within **Appendix G**. The Stage 1 extent and development is outlined in **Map A07**.

Stage 1 essentially excludes the residential subdivision to the east of the proposed road extension. The road is excluded from Stage 1 in the provided plans however, to provide access to the new allotment the road extension will be required. In order to facilitate the future subdivision as part of Stage 2 and to direct flows west under the proposed road connection the major culvert under the road will need to be installed as part of Stage 1. Additionally, drainage will be required along the eastern side of the road to ensure no runoff from upstream catchments ponds against the roadway. NCE have modelled a v-cut table drain with 1 in 5 batters along the eastern edge of the road. The longitudinal grade modelled is at a minimum of 0.5% but does increase up to approximately 1.75% to match existing falls an ensure the table drain is not too deep. The topography can be seen in **Map A07**. It is noted that the downstream low flow restrictions are to be installed as start of the initial stage as well.

Afflux mapping in **Appendix G** shows afflux for both the major (100 year ARI) and minor (2 year ARI) events shows no additional afflux generated off site in comparison to the fully developed event. Afflux is generated upstream in the major event due to the limited drainage of the v-cut table drain. However, any generated afflux is limited to within the development lot and does not impact on any adjacent lots. NCE consider this acceptable and not no actionable afflux is generated.

involves the development / extension of the existing Gambia Drive, Parsonia Drive and Maria Street to facilitate the development of a further 24 residential lots. The development of Stage 3C will generally utilise the approved earthworks development of Precinct 2 for mitigation measures. The development of Stage 3C will provide additional internal stormwater pit and pipe network to drain the proposed road extensions. Back of lot drainage is required for the new lots to be developed along the Parsonia Drive extension. This drainage is required as an existing sump along the back of the Teresa Street lots is proposed to be filled to facilitate the development of additional lots. The culverts under Maria Street and back of lot drains provide sufficient drainage to ensure no afflux is generated on the existing Maria Street / Teresa Street lots. NCE note there is afflux generated downstream of Beck Drive in the minor 2-year ARI event as a result of the additional development area and updates to the downstream basin. NCE consider this acceptable as it is the minor event and is generally contained within the drainage channel and by the final stage of development this afflux will be resolved.

6.9 Blockage Sensitivity

NCE have assessed the sensitivity of the proposed development to the blockage of the developed culvert structures by modelling the combined maximum flood depths with 100% blockage of development culvert structures. The combined maximum flood depth for the 100-year ARI is shown in **Map H01**.

Flooding as a result of overtopping generated by the blockage of the internal pipe network is generally contained to within adjacent roadways and drains. Overtopping of the Pinnacle Drive and Sorghum Street connection occurs over the top of the proposed culvert. Due to the free draining design, flood depths do not exceed ~220mm in the roadway. Overtopping of major drainage channels does not result in flooding over any proposed or existing lots and does not alter the flood hazard on roadways or pedestrian paths above the allowable level.

6.10 Climate Change

The climate change assessment was carried out for the 100-year ARI combined maximum duration storm as it is the critical DFE. As per the 2020 “Review of Hydrological Methods for the Townsville Region” Phase 4 report, the climate change assessment has been based on a Representative Concentration Pathway (RCP) 8.5 scenario for the year 2090. A 15% increase to present-day rainfall and upstream inflows has been applied in this scenario.

The outcomes of these assessments are shown in **Map H02** and **Map H03** which show the climate change flood depths and the afflux from the climate change developed WSL scenario minus the climate change baseline WSL scenario respectively. These maps demonstrate that whilst there are increased water levels and flood extents generally across the entire model, there is very little difference in flood outcomes overall and the increase in WSL through the development results in little to no change in immunity for the lots. Impacts on the site due to climate change are generally restricted to flow corridors with increases through the internal roads.

Afflux generated by the development in the climate change scenario generally does not generate impacts on any adjacent lots with only very minor afflux generated on the adjacent Pinnacle Drive lot to the north-east and through Resolution Street. The proposed development shows good immunity to future increases in flooding due to climate change and does not negatively impact on the resilience of the community to impacts of climate change.

6.11 Flood Hazard Overlay Code 8.2.6

The purpose to this is to manage development in flood hazard areas so that risk to life, property, community, economic activity and the environment during future flooding events is minimised and to minimise potential damage on-site or to adjacent properties.

Results from this assessment indicate that the proposed development is not expected to cause any adverse flooding impacts to adjacent or downstream properties. This is supported by the results and discussions in **Section 6.0**.

Table 6-5 below has been provided to demonstrate that the proposed development complies (where applicable) with the performance outcomes (PO) of TCC's flood hazard overlay code 8.2.6.

Table 6-5 TCC flood hazard overlay code (8.2.6) assessment

Performance Outcome (PO)	Acceptable Outcome (AO)	Compliance with PO
PO1 Development in medium and high hazard areas is designed and located to minimise susceptibility to and potential impacts of flooding.	**AO1.1** Where the development is located within an area shown on overlay map OM-06.1 or 06.2 as medium hazard — further investigation area, new buildings containing habitable rooms: a) are sited on a part of the site which is outside the medium hazard — further investigation area; or b) are sited on the highest part of the site. OR **AO1.2** Where development is located within another hazard area shown on overlay map OM-06.1 or 06.2: a) floor levels of all habitable rooms are a minimum of 300mm above the defined flood level;	The development is primarily located within the medium hazard area. The proposal is based on the City Plan provision and includes earthworks with final development levels that allow compliance with AO1.2. **Performance Outcome achieved**

Performance Outcome (PO)	Acceptable Outcome (AO)	Compliance with PO
	b) floor levels of all non-habitable rooms (other than class 10 buildings) are above the defined flood event; c) car parking spaces associated with non-residential development are located outside the high hazard areas identified on overlay map OM-06.1 or 06.2; and d) underground car parks are designed to prevent the intrusion of flood waters by the incorporation of a bund or similar barrier with a minimum height of 300mm above the defined flood level.	
PO2 Development in high hazard areas does not significantly impede the flow of flood waters through the site or worsen flood flows external to the site.	**AO2.1** Development in high hazard areas do not involve: a) filling with a height greater than 150mm; or b) block or solid walls or solid fences; or c) garden beds or other structures with a height more than 150mm; or d) the planting of dense shrub hedges.	There are no works proposed in high hazard areas. **Performance Outcome achieved**
PO3 Development does not intensify use in high hazard areas, in order to avoid risks to people and property.	**AO3.1** New buildings are located outside high hazard areas identified on overlay map OM-06.1 or 06.2. **AO3.2** New lots or roads are not created within high hazard areas identified on overlay map OM-06.1 or 06.2. **AO3.3** Sites for non-permanent accommodation such as tents, cabins or caravans (whether intended for short or long-term accommodation) are located outside the high hazard areas identified on overlay map OM-06.1 or 06.2.	There are no works proposed in high hazard areas. **Performance Outcome achieved**
PO4 Siting and layout of development maintains the safety of people and property in medium hazard areas.	**On existing lots** **AO4.1** Floor levels for residential buildings are 300mm above the defined flood level.	The proposed development layout maintains the safety of people and property. The Velocity x Depth product mapping is provided herein and demonstrates the

Performance Outcome (PO)	Acceptable Outcome (AO)	Compliance with PO
	AO4.2 Floor levels of non-residential buildings (other than class 10 buildings) are above the defined flood level. **AO4.3** Underground car parks are designed to prevent the intrusion of flood waters by the incorporation of a bund or similar barrier with a minimum height of 300mm above the defined flood level. **AO4.4** Development for non-permanent accommodation such as tents, cabins or caravans (whether intended for short or long-term accommodation) are located outside the medium hazard areas identified on overlay map OM-06.1 or 06.2. **Where reconfiguring a lot** **AO4.5** Where reconfiguring a lot, new lots contain designated building envelopes (whether or not for residential purposes) outside the medium hazard areas identified on overlay map OM-06.1 or 06.2 and those building envelopes are of a sufficient size to accommodate buildings associated with the development **AO4.6** In new subdivisions, arterial, sub-arterial or major collector roads are located above the 2% AEP flood level. **AO4.7** Reconfiguration of lots does not involve cul-de-sacs or dead end streets within medium hazard areas identified on overlay map OM-06.1 or 06.2.	flooding remains within acceptable limits. All new allotments will be located above the DFE extent or will ensure a building envelope above the DFE. Public roads maintain trafficability in all extents and flood depths are limited to acceptable levels. There are no cul-de-sacs located in areas with lots that are not above the DFE. There are no public dead end streets to be constructed. **Performance Outcome achieved**
PO5 Signage is provided within high and medium hazard areas to alert residents and visitors to the flood hazard	**AO5** Signage is provided on-site (regardless of whether land will be public or private ownership) to indicate depth at key hazard points, such as at floodway crossings, entrances to low-lying reserves or car parks.	The proposed development does not result in flooding in excess of the appropriate overlay code or flood hazard PSP acceptable design criteria relating to flooding. No signage is warranted.

Performance Outcome (PO)	Acceptable Outcome (AO)	Compliance with PO
		Not applicable
PO6 Development within high and medium hazard areas ensures any changes to the depth, duration, velocity of flood waters are contained within the site.	No acceptable outcome is nominated.	Results indicate a non-worsening outcome. Refer to the report and VD Mapping results. **Performance Outcome achieved**
PO7 Development within high and medium hazard areas does not directly, indirectly or cumulatively worsen flood characteristics outside the development site, having regard to: a) increased scour and erosion; or b) loss of flood storage; or c) loss of or changes to flow paths; or d) flow acceleration or retardation; or e) reduction in flood warning times	No acceptable outcome is nominated.	Results indicate that the proposed development does not directly, indirectly or cumulatively worsen flood characteristics outside the development site. Furthermore, changes in flood storage have been accounted for demonstrating a non-worsening outcome outside the development site and without impact on the flood warning times. Additionally, NCE note that further updates to the development will provide further benefit as flows will be directed to the north. **Performance Outcome achieved**
PO8 Facilities with a role in emergency management and vulnerable community services are able to function effectively during and immediately after flood events.	**AO8** The development is provided with the level of flood immunity set out in Table 8.2.6.3(b).	No community or emergency management services are proposed within the development. Furthermore, access by emergency services to each lot is maintained during a 1% AEP event as compliance with the safety hazard criteria (VD product) has been demonstrated. **Performance Outcome achieved**
PO9 Public safety and the environment are not adversely affected by the detrimental	**AO9.1** Development does not involve the manufacture or storage of hazardous materials within a high flood	No manufacture or storage of hazardous materials proposed with the development.

Performance Outcome (PO)	Acceptable Outcome (AO)	Compliance with PO
impacts of flooding on hazardous materials manufactured or stored in bulk	hazard area identified on overlay map OM-06.1 or 06.2. **AO9.2** Within the low or medium flood hazard area identified on overlay map OM-06.1 or 06.2, structures used for the manufacture or storage of hazardous materials in bulk are designed to prevent the intrusion of flood waters up to at least a 0.2% AEP flood event.	**Not applicable**

7.0 SUMMARY AND CONCLUSION

A flood impact assessment (FIA) has been undertaken for the proposed Somers & Hervey Estate, Rassmussen, Precinct 4, Stage 12A. The assessment was completed with the development of a fine scale 2D model using TUFLOW software.

With the inclusion of the open channels, detention storage and low-level weirs, the increase in run-off associated with the channelisation and change in impervious area of the development can be adequately mitigated to provide a non-worsening / non-actionable outcome.

The WSL and flows adjacent to the development in all directions, are generally reduced but shown to increase solely in the 50-year and 2-year ARI event. These observations are attributed to the fine model scale, increased detention incorporated into the developed model and flow diversions / restrictions. The afflux results indicated the only afflux offsite is generally only immediately downstream of Beck Drive and maintained within the existing drainage channel. Other areas of afflux are noted but are considered highly isolated, minor, non-actionable which are inconsequential and have not been considered further. It is also noted that future development will direct flows to the north and likely resolve any minor afflux. **Table 6-4** provides a summary of the flood levels in the drains and roads adjacent to the development which control the required FFL for the proposed lots and dwellings as depicted in **Appendix K**.

A hazard assessment was undertaken which demonstrated suitable outcomes at all roads and allotment areas during the 100-year ARI. The velocity*depth (VD) product criteria were adopted and resulted in flood hazard classifications acceptable for the proposed development roads, pathways and lots. Some areas of the open channels within proposed drainage reserves are subject to higher values as expected.

As part of the operational works design, all mitigation measures, levels and culvert sizing will be assessed and confirmed to ensure they appropriately address the outcomes of this FIA.

Areas with high velocities will be subject to a separate erosion, scour and stability assessment with stabilisation measures incorporated to ensure compliance with TCC revegetation requirements.

Based on the discussion above and the findings within **Section 6.0,** this report has demonstrated that the proposed development complies with the Townsville City Council's flood hazard overly code. The proposed development is not expected to increase the risk to life, property, community, economic activity or increase the potential for flood damage on-site or to adjacent and downstream properties. Furthermore, the development is not anticipated to be significantly impacted by increased rainfall intensity due to climate change. **Table 7-1** provides a summary of the FIA flood mapping.

Table 7-1 Summary of the FIA flood mapping

Map Number	Description
Appendix A	
Map A01	BASELINE LAND USE AND ROUGHNESS
Map A02	DEVELOPED LAND USE AND ROUGHNESS
Map A03	BASELINE DIGITAL TERRAIN MODEL (DTM)
Map A04	DEVELOPED DIGITAL TERRAIN MODEL (DTM)
Map A05	DEVELOPED CONFIGURATION AND MITIGATION MEASURES
Map A06	DEVELOPED WSL RESULTS POINTS
Map A07	DEVELOPMENT STAGE 1 MODEL
Appendix B	
Map B01	100yr ARI WSL AFFLUX
Map B02	50yr ARI WSL AFFLUX
Map B03	20yr ARI WSL AFFLUX
Map B04	10yr ARI WSL AFFLUX
Map B05	5yr ARI WSL AFFLUX
Map B06	2yr ARI WSL AFFLUX
Map B07	100yr ARI VELOCITY AFFLUX
Map B08	2yr ARI VELOCITY AFFLUX
Appendix C	
Map C01	100yr ARI BASELINE FLOOD DEPTHS
Map C02	100yr ARI DEVELOPED FLOOD DEPTHS
Map C03	2yr ARI BASELINE FLOOD DEPTHS
Map C04	2yr ARI DEVELOPED FLOOD DEPTHS
Appendix D	
Map D01	100yr ARI BASELINE FLOOD VELOCITY
Map D02	100yr ARI DEVELOPED FLOOD VELOCITY
Map D03	2yr ARI BASELINE FLOOD VELOCITY
Map D04	2yr ARI DEVELOPED FLOOD VELOCITY
Appendix E	
Map E01	100yr ARI BASELINE FLOOD WSL
Map E02	100yr ARI DEVELOPED FLOOD WSL
Map E03	2yr ARI BASELINE FLOOD WSL
Map E04	2yr ARI DEVELOPED FLOOD WSL
Appendix F	
Map F01	100yr ARI BASELINE FLOOD HAZARD
Map F02	100yr ARI DEVELOPED FLOOD HAZARD
Appendix G	
Map G01	100yr ARI FLOOD DEPTH – STAGE 3C
Map G02	2yr ARI FLOOD DEPTH – STAGE 3C
Map G03	100yr ARI WSL AFFLUX – STAGE 3C
Map G04	2yr ARI WSL AFFLUX – STAGE 3C
Appendix H	
Map H01	100% BLOCKAGE DEVELOPED SCENARIO – FLOOD DEPTH
Map H02	CLIMATE CHANGE DEVELOPED SCENARIO – 100yr ARI WSL AFFLUX
Map H03	CLIMATE CHANGE DEVELOPED SCENARIO – FLOOD DEPTH

8.0 REFERENCES

Townsville City Council, 2014, Townsville City Plan.

Ball J, Babister M, Nathan R, Weeks W, Weinmann E, Retallick M, Testoni I, (Editors), 2019

Australian Rainfall and Runoff: A Guide to Flood Estimation, © Commonwealth of Australia (Geoscience Australia).

Australian Institute for Disaster Resilience, Attorney-General's Department, 2017, *Australian Disaster Resilience Handbook Collection, Flood Hazard*, Guideline 7-3, Australian Institute for Disaster Resilience, Knowledge Hub, Melbourne.

APPENDIX A

General Flood Model Mapping

Land Use (% Impervious)

- Bohle River Bed Upstream (0%)
- Bohle River Bed Downstream (0%)
- Parkland (0%)
- Vegetation (light) / Open Space / Vegetated Channel (0%)
- Vegetation (medium) (0%)
- Vegetation (dense) (0%)
- Rural (10%)
- Rural Roads (20%)
- Sports & Recreation (20%)
- Urban Roads (50%)
- Low Density Residential (65%)
- Residential (70%)
- Commercial / Industrial (90%)
- Concrete Channels / Impervious (100%)
- Wetland (0%)
- Linear Wetland (0%)
- Developed - cleared areas (0%)

NORTHERN CONSULTING engineers

Civil | Structural | Forensic
Traffic | Flood Modelling

TOWNSVILLE | SUNSHINE COAST | BRISBANE
GLADSTONE | NEW ZEALAND

T: +617 4725 5550 E: mail@nceng.com.au
W: www.nceng.com.au

In Association With:

URBEX PTY LTD

0 10 20 30 40 50 m

1:1,000

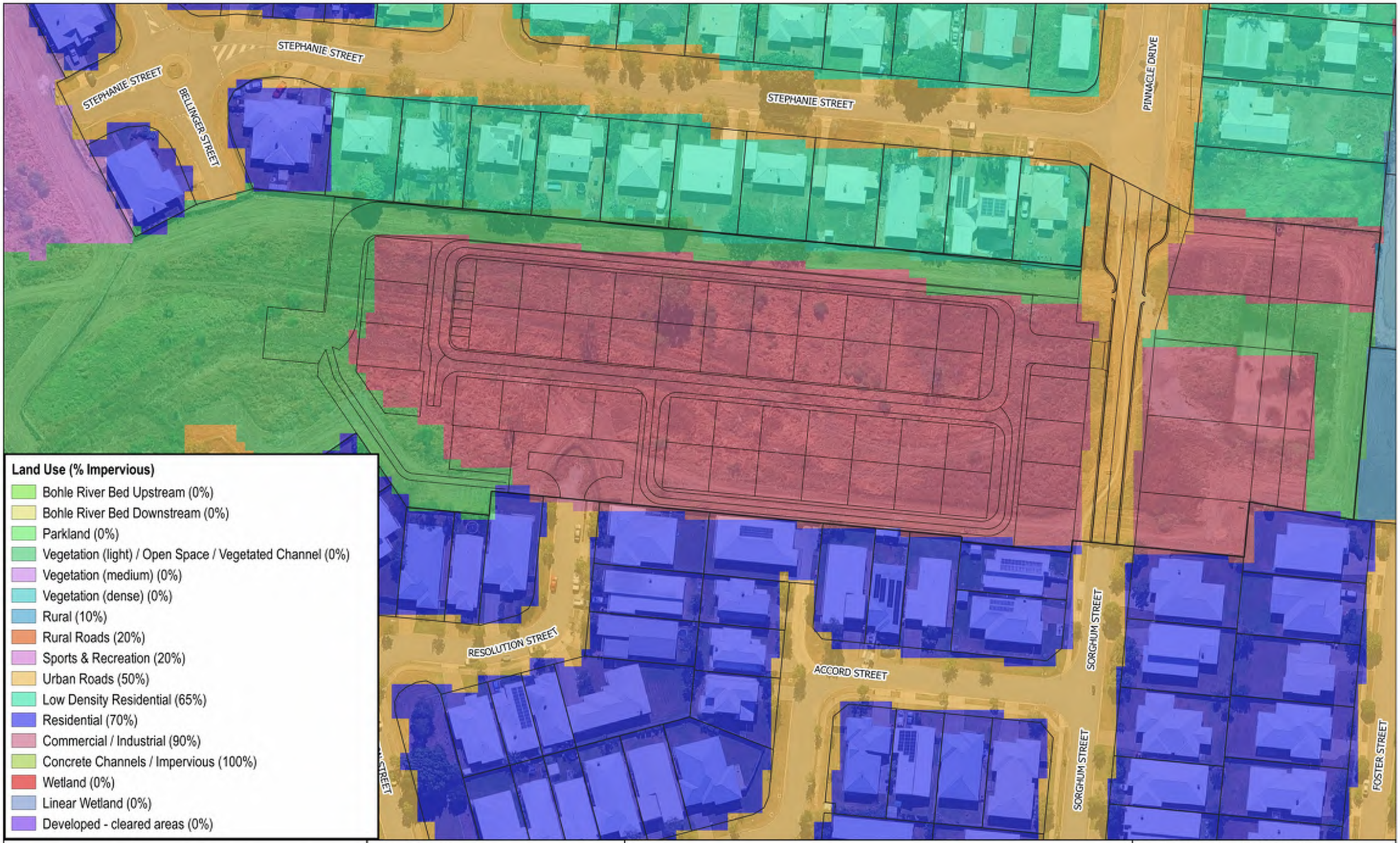
N

Legend

TCC Land Parcels — Development Area

SOMERS & HERVEY ESTATE
PRECINCT 4 - STAGE 12A
BASELINE LAND USE AND ROUGHNESS

Prepared By: BB	Date: 18/12/2025	Size	Map
Reviewed by: AW	Revision: A	A3	A01
	NCE Ref: URB0001-P4		



NORTHERN CONSULTING engineers
Civil | Structural | Forensic
Traffic | Flood Modelling
TOWNSVILLE | SUNSHINE COAST | BRISBANE
GLADSTONE | NEW ZEALAND
T: +617 4725 5550 E: mail@nceng.com.au
W: www.nceng.com.au

In Association With:
URBEX PTY LTD

0 10 20 30 40 50 m
1:1,000

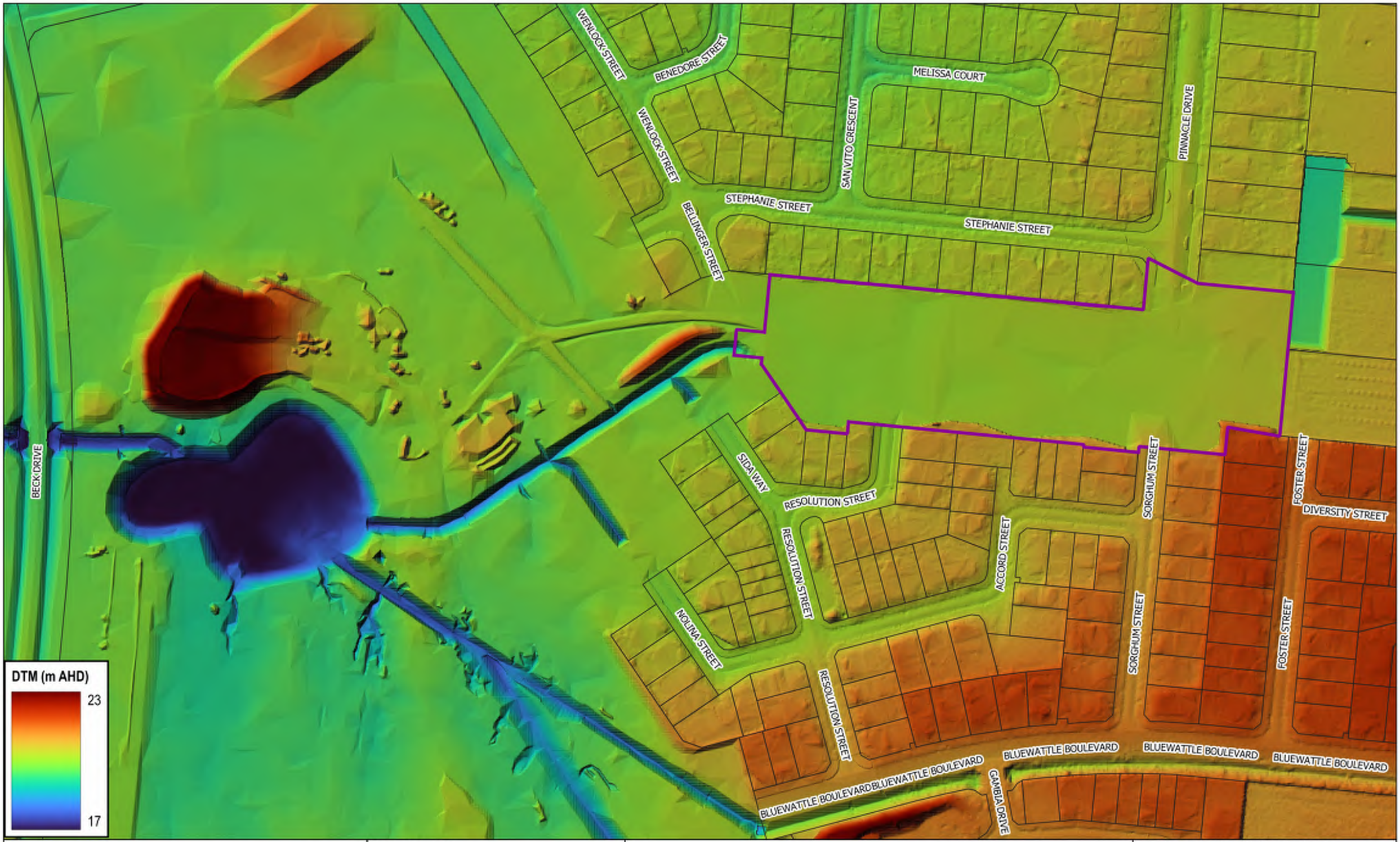
N

Legend
TCC Land Parcels
Stage 12 Lots

SOMERS & HERVEY ESTATE
PRECINCT 4 - STAGE 12A

DEVELOPED LAND USE AND ROUGHNESS

Prepared By: BB	Date: 18/12/2025	Size	Map
Reviewed by: AW	Revision: A	A3	A02
	NCE Ref: URB0001-P4		



NORTHERN CONSULTING engineers

Civil | Structural | Forensic
Traffic | Flood Modelling

TOWNSVILLE | SUNSHINE COAST | BRISBANE
GLADSTONE | NEW ZEALAND
T: +617 4725 5550 E: mail@nceng.com.au
W: www.nceng.com.au

In Association With:

URBEX PTY LTD

0 25 50 75 100 m

1:2,000

N

Legend

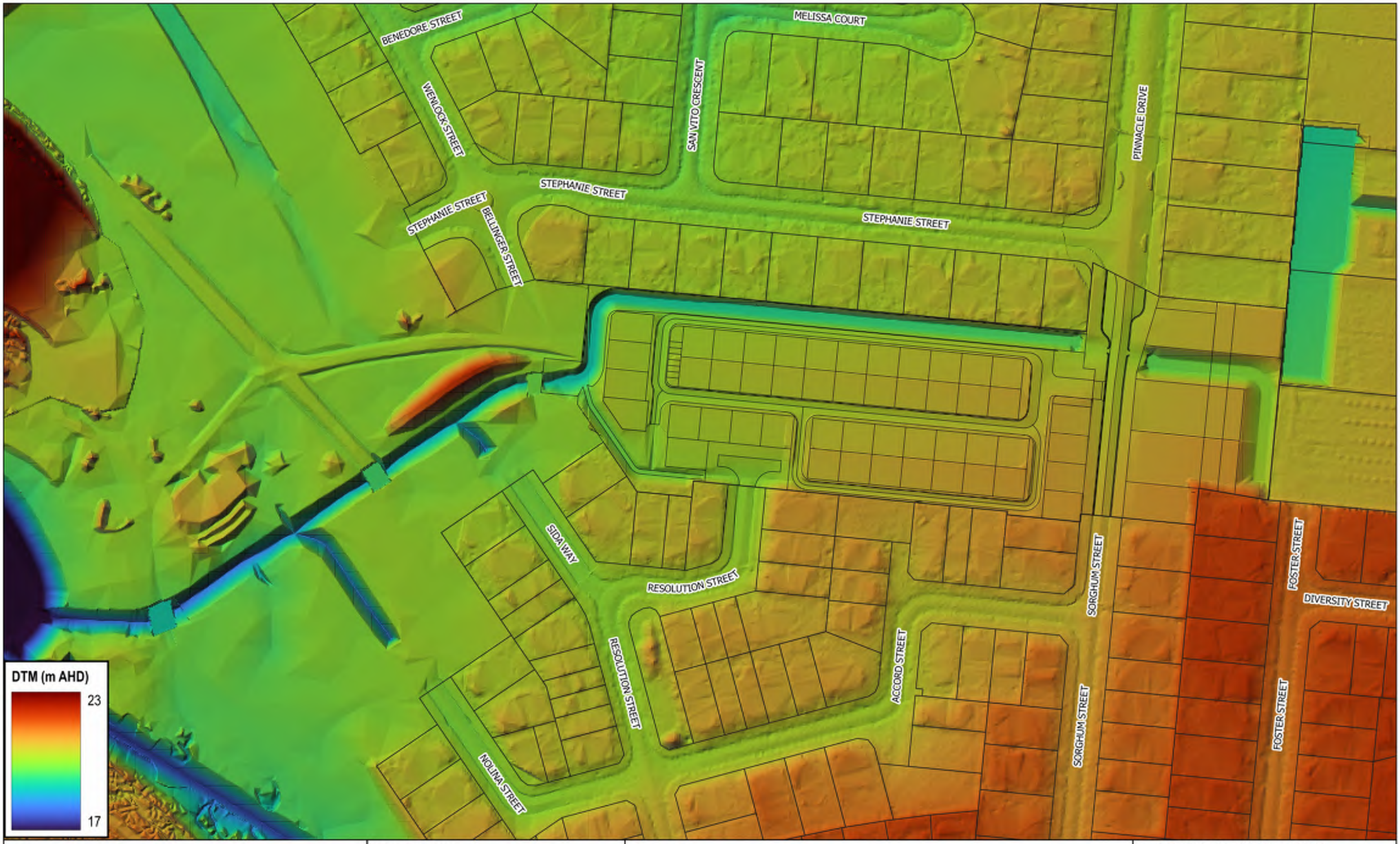
TCC Land Parcels

Development Area

SOMERS & HERVEY ESTATE
PRECINCT 4 - STAGE 12A

BASELINE DIGITAL TERRAIN MODEL (DTM)

Prepared By: BB Reviewed by: AW	Date: 18/12/2025 Revision: A NCE Ref: URB0001-P4	Size A3	Map A03



NORTHERN CONSULTING engineers
Civil | Structural | Forensic
Traffic | Flood Modelling
TOWNSVILLE | SUNSHINE COAST | BRISBANE
GLADSTONE | NEW ZEALAND
T: +617 4725 5550 E: mail@nceng.com.au
W: www.nceng.com.au

In Association With:
URBEX PTY LTD

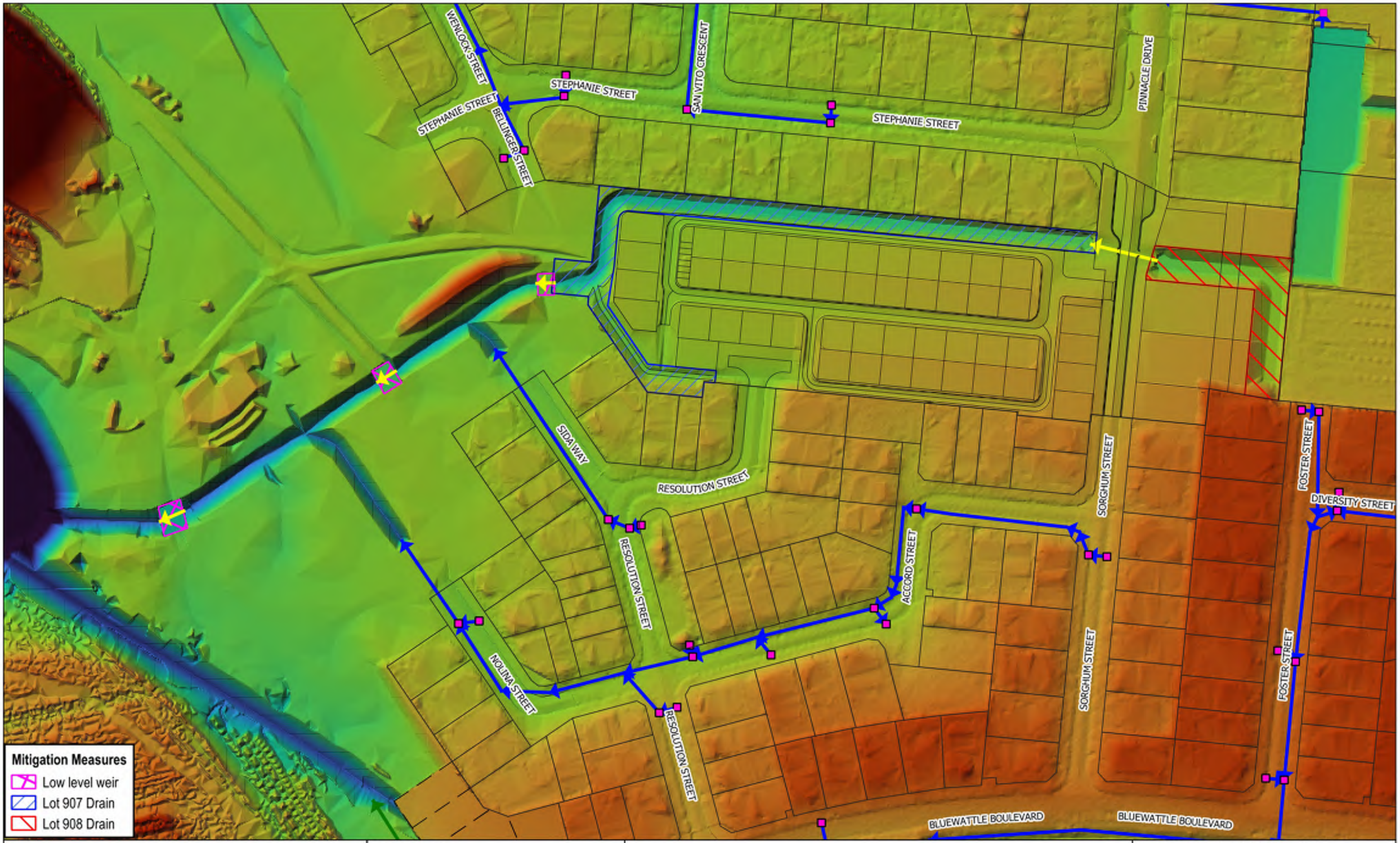
0 20 40 60 80 m
1:1,500

N

Legend
TCC Land Parcels
Stage 12 Lots

SOMERS & HERVEY ESTATE
PRECINCT 4 - STAGE 12A
DEVELOPED DIGITAL TERRAIN MODEL (DTM)

Prepared By: BB	Date: 18/12/2025	Size	Map
Reviewed by: AW	Revision: A		
	NCE Ref: URB0001-P4	A3	A04



NORTHERN CONSULTING engineers
Civil | Structural | Forensic
Traffic | Flood Modelling
TOWNSVILLE | SUNSHINE COAST | BRISBANE
GLADSTONE | NEW ZEALAND
T: +617 4725 5550 E: mail@nceng.com.au
W: www.nceng.com.au

In Association With:
URBEX PTY LTD

0 20 40 60 80 m
1:1,500

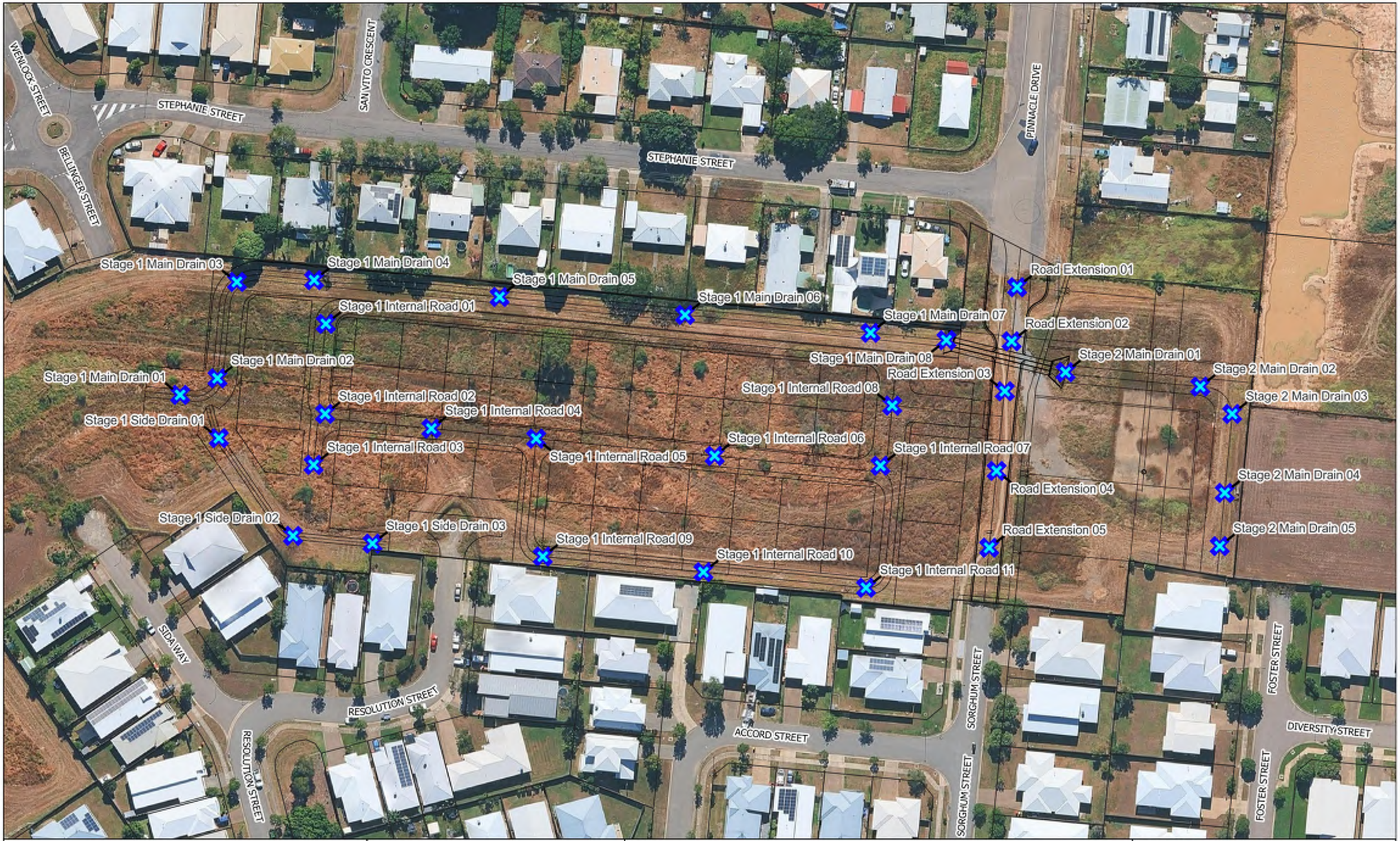
N

Legend

- TCC Land Parcels
- Stage 12 Lots
- Existing Pits
- Existing Culverts
- Previous Development Pits
- Previous Development Culverts
- Proposed Development Culverts

SOMERS & HERVEY ESTATE
PRECINCT 4 - STAGE 12A
DEVELOPED CONFIGURATION AND MITIGATION MEASURES

Prepared By: BB Reviewed by: AW	Date: 18/12/2025 Revision: A NCE Ref: URB0001-P4	Size A3	Map A05



NORTHERN CONSULTING engineers

Civil | Structural | Forensic
Traffic | Flood Modelling

TOWNSVILLE | SUNSHINE COAST | BRISBANE
GLADSTONE | NEW ZEALAND
T: +617 4725 5550 E: mail@nceng.com.au
W: www.nceng.com.au

In Association With:

URBEX PTY LTD

0 10 20 30 40 50 m

1:1,000

N

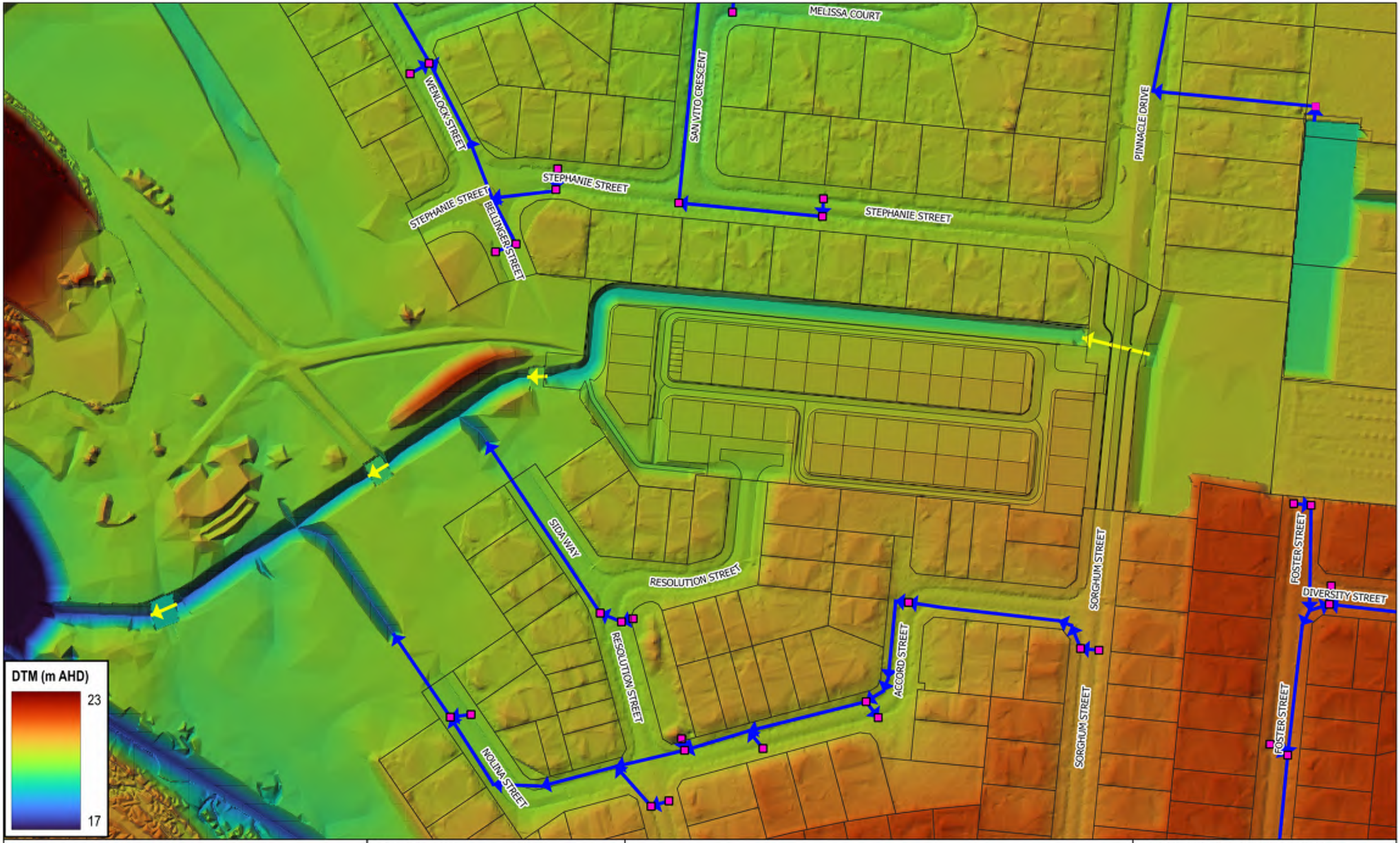
Legend

TCC Land Parcels

SOMERS & HERVEY ESTATE
PRECINCT 4 - STAGE 12A

DEVELOPED WSL RESULTS POINTS

Prepared By: BB	Date: 18/12/2025	Size	Map
Reviewed by: AW	Revision: A	A3	A06
	NCE Ref: URB0001-P4		



NORTHERN CONSULTING engineers

Civil | Structural | Forensic
Traffic | Flood Modelling

TOWNSVILLE | SUNSHINE COAST | BRISBANE
GLADSTONE | NEW ZEALAND
T: +617 4725 5550 E: mail@nceng.com.au
W: www.nceng.com.au

In Association With:

URBEX PTY LTD

0 20 40 60 80 m

1:1,500

N

Legend

- TCC Land Parcels
- Stage 12A - Stage 1 Lots
- Existing Pits
- Existing Culverts
- Previous Development Pits
- Previous Development Culverts
- Proposed Development Culverts

SOMERS & HERVEY ESTATE
PRECINCT 4 - STAGE 12A

DEVELOPMENT STAGE 1 MODEL

Prepared By: BB	Date: 18/12/2025	Size	Map
Reviewed by: AW	Revision: A	A3	A07
	NCE Ref: URB0001-P4		

APPENDIX B

Afflux Mapping – All Events WSL and Velocity Afflux

NORTHERN CONSULTING engineers
Civil | Structural | Forensic
Traffic | Flood Modelling
TOWNSVILLE | SUNSHINE COAST | BRISBANE
GLADSTONE | NEW ZEALAND
T: +617 4725 5550 E: mail@nceng.com.au
W: www.nceng.com.au

In Association With:
URBEX PTY LTD

0 20 40 60 80 m
1:1,500

N

Legend
- TCC Land Parcels
- Stage 12 Lots
- Existing Pits
- Existing Culverts
- Previous Development Pits
- Previous Development Culverts
- Proposed Development Culverts

SOMERS & HERVEY ESTATE
PRECINCT 4 - STAGE 12A

100yr ARI WSL AFFLUX

Prepared By: BB
Reviewed by: AW
Date: 18/12/2025
Revision: A
NCE Ref: URB0001-P4
Size: A3
Map: B01

NORTHERN CONSULTING engineers
Civil | Structural | Forensic
Traffic | Flood Modelling
TOWNSVILLE | SUNSHINE COAST | BRISBANE
GLADSTONE | NEW ZEALAND
T: +617 4725 5550 E: mail@nceng.com.au
W: www.nceng.com.au

In Association With:
URBEX PTY LTD

0 20 40 60 80 m
1:1,500

N

Legend
- TCC Land Parcels
- Stage 12 Lots
- Existing Pits
- Existing Culverts
- Previous Development Pits
- Previous Development Culverts
- Proposed Development Culverts

SOMERS & HERVEY ESTATE
PRECINCT 4 - STAGE 12A

50yr ARI WSL AFFLUX

Prepared By: BB	Date: 18/12/2025	Size	Map
Reviewed by: AW	Revision: A	A3	B02
	NCE Ref: URB0001-P4		

NORTHERN CONSULTING engineers
Civil | Structural | Forensic
Traffic | Flood Modelling
TOWNSVILLE | SUNSHINE COAST | BRISBANE
GLADSTONE | NEW ZEALAND
T: +617 4725 5550 E: mail@nceng.com.au
W: www.nceng.com.au

In Association With:
URBEX PTY LTD

0 20 40 60 80 m
1:1,500

N

Legend
- TCC Land Parcels
- Stage 12 Lots
- Existing Pits
- Existing Culverts
- Previous Development Pits
- Previous Development Culverts
- Proposed Development Culverts

SOMERS & HERVEY ESTATE
PRECINCT 4 - STAGE 12A

20yr ARI WSL AFFLUX

Prepared By: BB
Reviewed by: AW
Date: 18/12/2025
Revision: A
NCE Ref: URB0001-P4
Size: A3
Map: B03

NORTHERN CONSULTING engineers
Civil | Structural | Forensic
Traffic | Flood Modelling
TOWNSVILLE | SUNSHINE COAST | BRISBANE
GLADSTONE | NEW ZEALAND
T: +617 4725 5550 E: mail@nceng.com.au
W: www.nceng.com.au

In Association With:
URBEX PTY LTD

0 20 40 60 80 m
1:1,500

N

Legend
- TCC Land Parcels
- Stage 12 Lots
- Existing Pits
- Existing Culverts
- Previous Development Pits
- Previous Development Culverts
- Proposed Development Culverts

SOMERS & HERVEY ESTATE
PRECINCT 4 - STAGE 12A

10yr ARI WSL AFFLUX

Prepared By: BB	Date: 18/12/2025	Size	Map
Reviewed by: AW	Revision: A	A3	B04
	NCE Ref: URB0001-P4		

NORTHERN CONSULTING engineers

Civil | Structural | Forensic
Traffic | Flood Modelling

TOWNSVILLE | SUNSHINE COAST | BRISBANE
GLADSTONE | NEW ZEALAND
T: +617 4725 5550 E: mail@nceng.com.au
W: www.nceng.com.au

In Association With:

URBEX PTY LTD

0 20 40 60 80 m

1:1,500

N

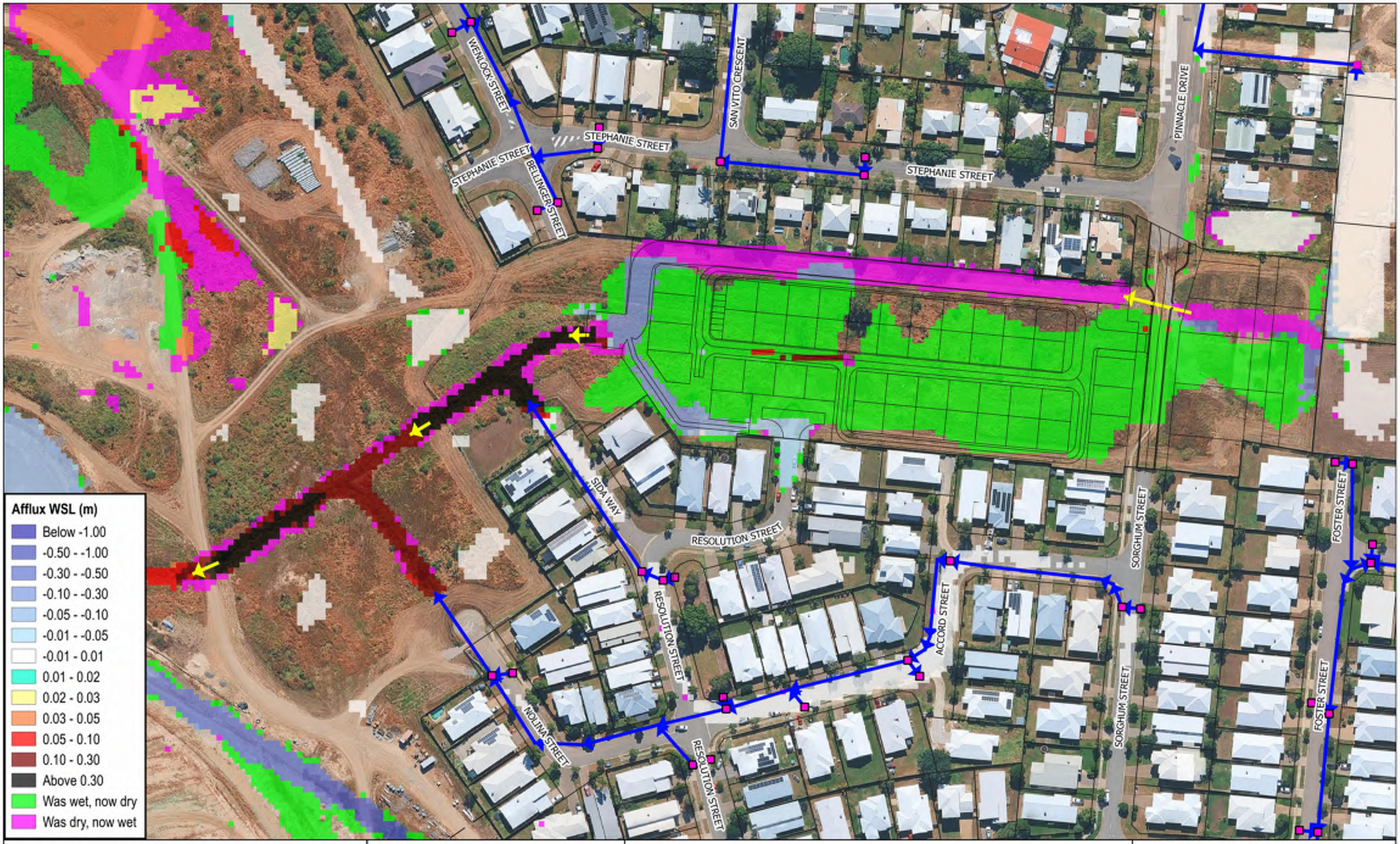
Legend

- TCC Land Parcels
- Stage 12 Lots
- Existing Pits
- Existing Culverts
- Previous Development Pits
- Previous Development Culverts
- Proposed Development Culverts

SOMERS & HERVEY ESTATE
PRECINCT 4 - STAGE 12A

5yr ARI WSL AFFLUX

Prepared By: BB Reviewed by: AW	Date: 18/12/2025 Revision: A NCE Ref: URB0001-P4	Size A3	Map B05



NORTHERN CONSULTING engineers
Civil | Structural | Forensic
Traffic | Flood Modelling
TOWNSVILLE | SUNSHINE COAST | BRISBANE
GLADSTONE | NEW ZEALAND
T: +617 4725 5550 E: mail@nceng.com.au
W: www.nceng.com.au

In Association With:
URBEX PTY LTD

0 20 40 60 80 m
1:1,500

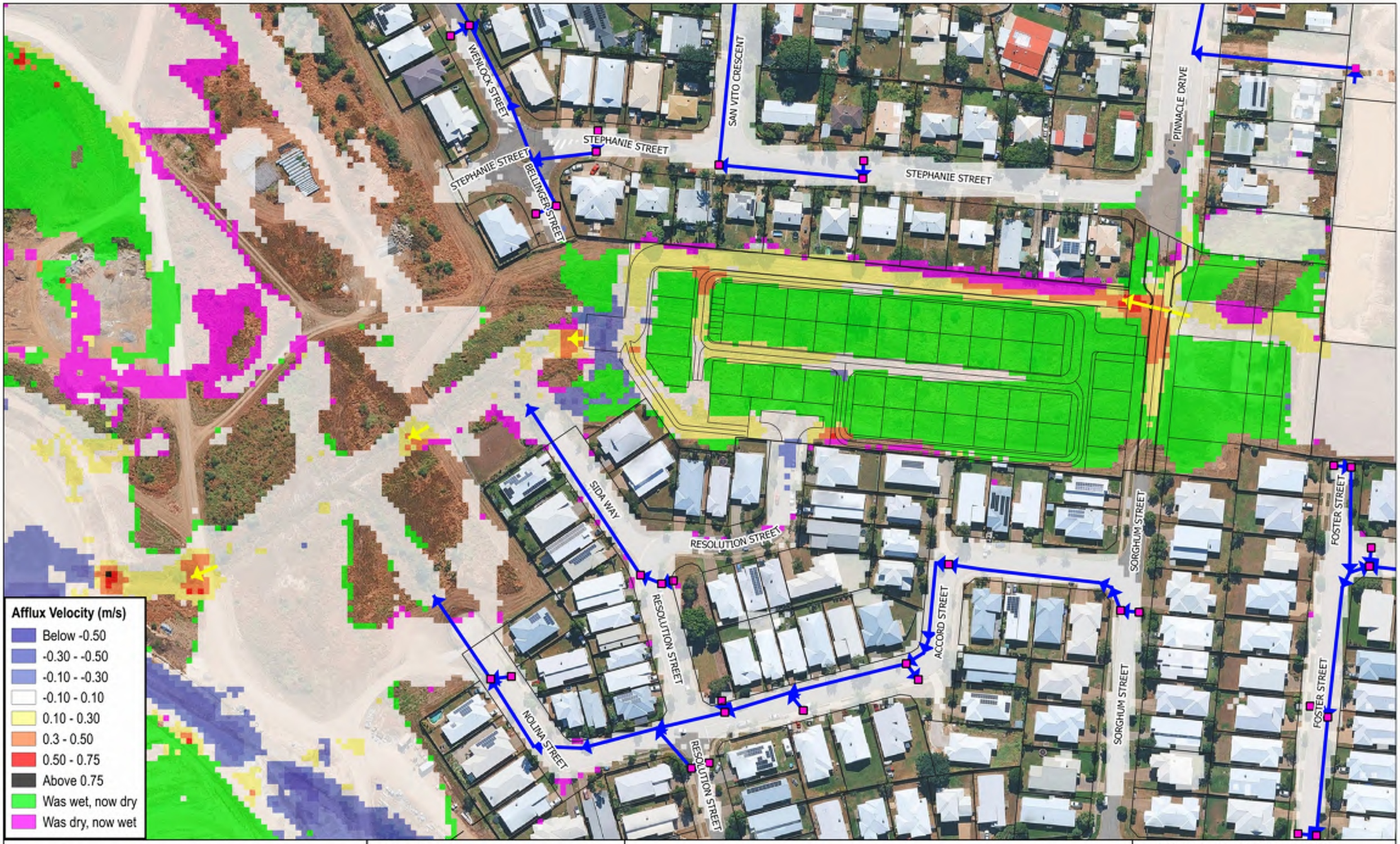
N

Legend
- TCC Land Parcels
- Stage 12 Lots
- Existing Pits
- Existing Culverts
- Previous Development Pits
- Previous Development Culverts
- Proposed Development Culverts

SOMERS & HERVEY ESTATE
PRECINCT 4 - STAGE 12A

2yr ARI WSL AFFLUX

Prepared By: BB Reviewed by: AW	Date: 18/12/2025 Revision: A NCE Ref: URB0001-P4	Size A3	Map B06



NORTHERN CONSULTING engineers
Civil | Structural | Forensic
Traffic | Flood Modelling
TOWNSVILLE | SUNSHINE COAST | BRISBANE
GLADSTONE | NEW ZEALAND
T: +617 4725 5550 E: mail@nceng.com.au
W: www.nceng.com.au

In Association With:
URBEX PTY LTD

0 20 40 60 80 m
1:1,500

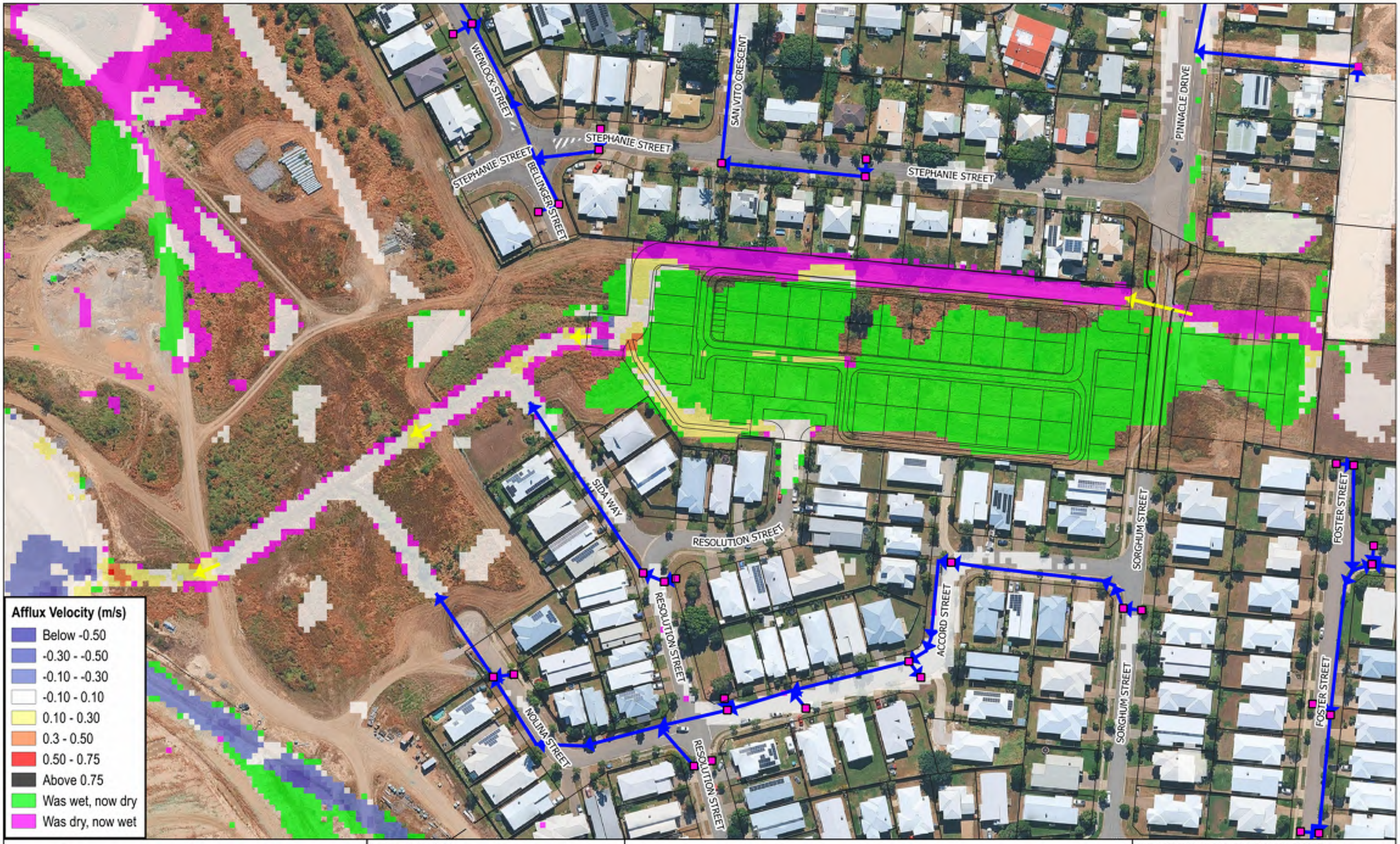
N

Legend
- TCC Land Parcels
- Stage 12 Lots
- Existing Pits
- Existing Culverts
- Previous Development Pits
- Previous Development Culverts
- Proposed Development Culverts

SOMERS & HERVEY ESTATE
PRECINCT 4 - STAGE 12A

100yr ARI VELOCITY AFFLUX

Prepared By: BB	Date: 18/12/2025	Size	Map
Reviewed by: AW	Revision: A	A3	B07
	NCE Ref: URB0001-P4		



NORTHERN CONSULTING engineers
Civil | Structural | Forensic
Traffic | Flood Modelling
TOWNSVILLE | SUNSHINE COAST | BRISBANE
GLADSTONE | NEW ZEALAND
T: +617 4725 5550 E: mail@nceng.com.au
W: www.nceng.com.au

In Association With:
URBEX PTY LTD

0 20 40 60 80 m
1:1,500

N

Legend
- TCC Land Parcels
- Stage 12 Lots
- Existing Pits
- Existing Culverts
- Previous Development Pits
- Previous Development Culverts
- Proposed Development Culverts

SOMERS & HERVEY ESTATE
PRECINCT 4 - STAGE 12A

2yr ARI VELOCITY AFFLUX

Prepared By: BB	Date: 18/12/2025	Size	Map
Reviewed by: AW	Revision: A	A3	B08
	NCE Ref: URB0001-P4		

APPENDIX C

Depth Mapping 100- and 2- year ARI

NORTHERN CONSULTING engineers
Civil | Structural | Forensic
Traffic | Flood Modelling
TOWNSVILLE | SUNSHINE COAST | BRISBANE
GLADSTONE | NEW ZEALAND
T: +617 4725 5550 E: mail@nceng.com.au
W: www.nceng.com.au

In Association With:
URBEX PTY LTD

0 20 40 60 80 m
1:1,500

N

Legend
- TCC Land Parcels
- Existing Culverts
- Existing Pits

SOMERS & HERVEY ESTATE
PRECINCT 4 - STAGE 12A

100yr ARI BASELINE FLOOD DEPTHS

Prepared By: BB	Date: 19/12/2025	Size	Map
Reviewed by: AW	Revision: A	A3	C01
	NCE Ref: URB0001-P4		

NORTHERN CONSULTING engineers
Civil | Structural | Forensic
Traffic | Flood Modelling
TOWNSVILLE | SUNSHINE COAST | BRISBANE
GLADSTONE | NEW ZEALAND
T: +617 4725 5550 E: mail@nceng.com.au
W: www.nceng.com.au

In Association With:
URBEX PTY LTD

0 20 40 60 80 m
1:1,500

N

Legend
- TCC Land Parcels
- Stage 12 Lots
- Existing Pits
- Existing Culverts
- Previous Development Pits
- Previous Development Culverts
- Proposed Development Culverts

SOMERS & HERVEY ESTATE
PRECINCT 4 - STAGE 12A

100yr ARI DEVELOPED FLOOD DEPTHS

Prepared By: BB	Date: 19/12/2025	Size	Map
Reviewed by: AW	Revision: A	A3	C02
	NCE Ref: URB0001-P4		

NORTHERN CONSULTING engineers
Civil | Structural | Forensic
Traffic | Flood Modelling
TOWNSVILLE | SUNSHINE COAST | BRISBANE
GLADSTONE | NEW ZEALAND
T: +617 4725 5550 E: mail@nceng.com.au
W: www.nceng.com.au

In Association With:
URBEX PTY LTD

0 20 40 60 80 m
1:1,500

N

Legend
- TCC Land Parcels
- Existing Culverts
- Existing Pits

SOMERS & HERVEY ESTATE
PRECINCT 4 - STAGE 12A

2yr ARI BASELINE FLOOD DEPTHS

Prepared By: BB	Date: 19/12/2025	Size	Map
Reviewed by: AW	Revision: A	A3	C03
	NCE Ref: URB0001-P4		

NORTHERN CONSULTING engineers
Civil | Structural | Forensic
Traffic | Flood Modelling
TOWNSVILLE | SUNSHINE COAST | BRISBANE
GLADSTONE | NEW ZEALAND
T: +617 4725 5550 E: mail@nceng.com.au
W: www.nceng.com.au

In Association With:
URBEX PTY LTD

0 20 40 60 80 m
1:1,500

N

Legend
- TCC Land Parcels
- Stage 12 Lots
- Existing Pits
- Existing Culverts
- Previous Development Pits
- Previous Development Culverts
- Proposed Development Culverts

SOMERS & HERVEY ESTATE
PRECINCT 4 - STAGE 12A

2yr ARI DEVELOPED FLOOD DEPTHS

Prepared By: BB	Date: 19/12/2025	Size	Map
Reviewed by: AW	Revision: A	A3	C04
	NCE Ref: URB0001-P4		

APPENDIX D

Velocity Mapping – 100- and 2-year ARI

NORTHERN CONSULTING engineers
Civil | Structural | Forensic
Traffic | Flood Modelling
TOWNSVILLE | SUNSHINE COAST | BRISBANE
GLADSTONE | NEW ZEALAND
T: +617 4725 5550 E: mail@nceng.com.au
W: www.nceng.com.au

In Association With:
URBEX PTY LTD

0 20 40 60 80 m
1:1,500

N

Legend
- TCC Land Parcels
- Existing Pits
- Existing Culverts

SOMERS & HERVEY ESTATE
PRECINCT 4 - STAGE 12A

100yr ARI BASELINE FLOOD VELOCITY

Prepared By: BB	Date: 19/12/2025	Size	Map
Reviewed by: AW	Revision: A	A3	D01
	NCE Ref: URB0001-P4		

NORTHERN CONSULTING engineers
Civil | Structural | Forensic
Traffic | Flood Modelling
TOWNSVILLE | SUNSHINE COAST | BRISBANE
GLADSTONE | NEW ZEALAND
T: +617 4725 5550 E: mail@nceng.com.au
W: www.nceng.com.au

In Association With:
URBEX PTY LTD

0 20 40 60 80 m
1:1,500

N

Legend
- TCC Land Parcels
- Stage 12 Lots
- Existing Pits
- Existing Culverts
- Previous Development Pits
- Previous Development Culverts
- Proposed Development Culverts

SOMERS & HERVEY ESTATE
PRECINCT 4 - STAGE 12A

100yr ARI DEVELOPED FLOOD VELOCITY

Prepared By: BB	Date: 19/12/2025	Size	Map
Reviewed by: AW	Revision: A	A3	D02
	NCE Ref: URB0001-P4		

NORTHERN CONSULTING engineers
Civil | Structural | Forensic
Traffic | Flood Modelling
TOWNSVILLE | SUNSHINE COAST | BRISBANE
GLADSTONE | NEW ZEALAND
T: +617 4725 5550 E: mail@nceng.com.au
W: www.nceng.com.au

In Association With:
URBEX PTY LTD

0 20 40 60 80 m
1:1,500

N

Legend
- TCC Land Parcels
- Existing Pits
- Existing Culverts

SOMERS & HERVEY ESTATE
PRECINCT 4 - STAGE 12A

2yr ARI BASELINE FLOOD VELOCITY

Prepared By: BB	Date: 19/12/2025	Size	Map
Reviewed by: AW	Revision: A	A3	D03
	NCE Ref: URB0001-P4		

NORTHERN CONSULTING engineers
Civil | Structural | Forensic
Traffic | Flood Modelling
TOWNSVILLE | SUNSHINE COAST | BRISBANE
GLADSTONE | NEW ZEALAND
T: +617 4725 5550 E: mail@nceng.com.au
W: www.nceng.com.au

In Association With:
URBEX PTY LTD

0 20 40 60 80 m
1:1,500

N

Legend

- TCC Land Parcels
- Stage 12 Lots
- Existing Pits
- Existing Culverts
- Previous Development Pits
- Previous Development Culverts
- Proposed Development Culverts

SOMERS & HERVEY ESTATE
PRECINCT 4 - STAGE 12A
2yr ARI DEVELOPED FLOOD VELOCITY

Prepared By: BB Reviewed by: AW	Date: 19/12/2025 Revision: A NCE Ref: URB0001-P4	Size A3	Map D04

APPENDIX E

WSL Mapping – 100- and 2-year ARI

NORTHERN CONSULTING engineers
Civil | Structural | Forensic
Traffic | Flood Modelling
TOWNSVILLE | SUNSHINE COAST | BRISBANE
GLADSTONE | NEW ZEALAND
T: +617 4725 5550 E: mail@nceng.com.au
W: www.nceng.com.au

In Association With:
URBEX PTY LTD

0 20 40 60 80 m
1:1,500
N

Legend
- TCC Land Parcels
- Existing Pits
- Existing Culverts

SOMERS & HERVEY ESTATE
PRECINCT 4 - STAGE 12A

100yr ARI BASELINE FLOOD WATER SURFACE LEVELS

Prepared By: BB Reviewed by: AW	Date: 19/12/2025 Revision: A NCE Ref: URB0001-P4	Size A3	Map E01

0° NORTHERN CONSULTING engineers

Civil | Structural | Forensic
Traffic | Flood Modelling

TOWNSVILLE | SUNSHINE COAST | BRISBANE
GLADSTONE | NEW ZEALAND

T: +617 4725 5550 E: mail@nceng.com.au
W: www.nceng.com.au

Disclaimer:
All information noted on this plan is INDICATIVE only, therefore any reference and/or deconstruction of the data not soley related to the documents'purpose shall be at the user's risk. NCE shall bare no responsibility or liability for any errors, faults, defects, or omissions in the information.

In Association With:

URBEX PTY LTD

0 20 40 60 80 m

1:1,500

N

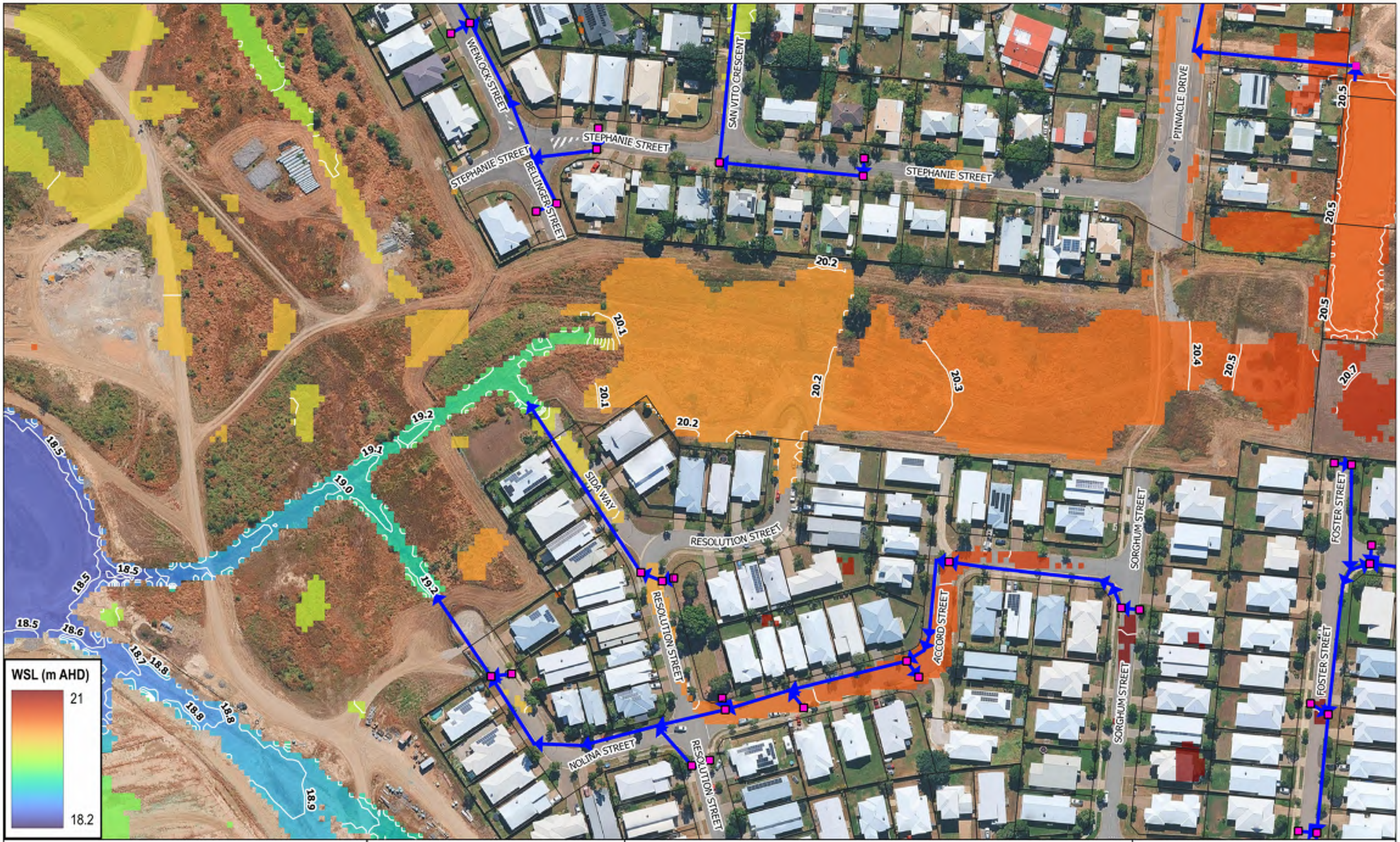
Legend

- TCC Land Parcels
- Stage 12 Lots
- Existing Pits
- Existing Culverts
- Previous Development Pits
- Previous Development Culverts
- Proposed Development Culverts

SOMERS & HERVEY ESTATE
PRECINCT 4 - STAGE 12A

100yr ARI DEVELOPED FLOOD WATER SURFACE LEVELS

Prepared By: BB Reviewed by: AW	Date: 19/12/2025 Revision: A NCE Ref: URB0001-P4	Size A3	Map E02



NORTHERN CONSULTING engineers

Civil | Structural | Forensic
Traffic | Flood Modelling

TOWNSVILLE | SUNSHINE COAST | BRISBANE
GLADSTONE | NEW ZEALAND

T: +617 4725 5550 E: mail@nceng.com.au
W: www.nceng.com.au

Disclaimer:
All information noted on this plan is INDICATIVE only, therefore any reference and/or deconstruction of the data not solely related to the documents'purpose shall be at the user's risk. NCE shall bare no responsibility or liability for any errors, faults, defects, or omissions in the information.

In Association With:

URBEX PTY LTD

0 20 40 60 80 m

1:1,500

N

Legend

- TCC Land Parcels
- Existing Culverts
- Existing Pits

SOMERS & HERVEY ESTATE
PRECINCT 4 - STAGE 12A

2yr ARI BASELINE FLOOD WATER SURFACE LEVELS

Prepared By: BB Reviewed by: AW	Date: 19/12/2025 Revision: A NCE Ref: URB0001-P4	Size A3	Map E03

NORTHERN CONSULTING engineers

Civil | Structural | Forensic
Traffic | Flood Modelling

TOWNSVILLE | SUNSHINE COAST | BRISBANE
GLADSTONE | NEW ZEALAND

T: +617 4725 5550 E: mail@nceng.com.au
W: www.nceng.com.au

In Association With:

URBEX PTY LTD

0 20 40 60 80 m

1:1,500

N

Legend

- TCC Land Parcels
- Stage 12 Lots
- Existing Pits
- Existing Culverts
- Previous Development Pits
- Previous Development Culverts
- Proposed Development Culverts

SOMERS & HERVEY ESTATE
PRECINCT 4 - STAGE 12A

2yr ARI DEVELOPED FLOOD WATER SURFACE LEVELS

Prepared By: BB	Date: 19/12/2025	Size	Map
Reviewed by: AW	Revision: A	A3	E04
	NCE Ref: URB0001-P4		

APPENDIX F

Hazard Mapping – 100-year ARI only

NORTHERN CONSULTING engineers

Civil | Structural | Forensic
Traffic | Flood Modelling

TOWNSVILLE | SUNSHINE COAST | BRISBANE
GLADSTONE | NEW ZEALAND

T: +617 4725 5550 E: mail@nceng.com.au
W: www.nceng.com.au

Disclaimer:
All information noted on this plan is INDICATIVE only, therefore any reference and/or deconstruction of the data not soley related to the documents purpose shall be at the user's risk. NCE shall bare no responsibility or liability for any errors, faults, defects, or omissions in the information.

In Association With:

URBEX PTY LTD

0 20 40 60 80 m

1:1,500

N

Legend

- TCC Land Parcels
- Existing Culverts
- Existing Pits

SOMERS & HERVEY ESTATE
PRECINCT 4 - STAGE 12A

100yr ARI BASELINE FLOOD HAZARD

Prepared By: BB Reviewed by: AW	Date: 19/12/2025 Revision: A NCE Ref: URB0001-P4	Size A3	Map F01

NORTHERN CONSULTING engineers
Civil | Structural | Forensic
Traffic | Flood Modelling
TOWNSVILLE | SUNSHINE COAST | BRISBANE
GLADSTONE | NEW ZEALAND
T: +617 4725 5550 E: mail@nceng.com.au
W: www.nceng.com.au

In Association With:
URBEX PTY LTD

0 20 40 60 80 m
1:1,500

N

Legend
- TCC Land Parcels
- Stage 12 Lots
- Existing Pits
- Existing Culverts
- Previous Development Pits
- Previous Development Culverts
- Proposed Development Culverts

SOMERS & HERVEY ESTATE
PRECINCT 4 - STAGE 12A
100yr ARI DEVELOPED FLOOD HAZARD

Prepared By: BB Reviewed by: AW	Date: 19/12/2025 Revision: A NCE Ref: URB0001-P4	Size A3	Map F02

APPENDIX G

Development Staging Assessment – Stage 1 Mapping

NORTHERN CONSULTING engineers
Civil | Structural | Forensic
Traffic | Flood Modelling
TOWNSVILLE | SUNSHINE COAST | BRISBANE
GLADSTONE | NEW ZEALAND
T: +617 4725 5550 E: mail@nceng.com.au
W: www.nceng.com.au

In Association With:
URBEX PTY LTD

0 20 40 60 80 m
1:1,500

N

Legend
- TCC Land Parcels
- Stage 12 Lots
- Existing Pits
- Existing Culverts
- Previous Development Pits
- Previous Development Culverts
- Proposed Development Culverts

SOMERS & HERVEY ESTATE
PRECINCT 4 - STAGE 12A

100yr ARI STAGE 1 FLOOD DEPTHS

Prepared By: BB	Date: 19/12/2025	Size	Map
Reviewed by: AW	Revision: A	A3	G01
	NCE Ref: URB0001-P4		

NORTHERN CONSULTING engineers
Civil | Structural | Forensic
Traffic | Flood Modelling
TOWNSVILLE | SUNSHINE COAST | BRISBANE
GLADSTONE | NEW ZEALAND
T: +617 4725 5550 E: mail@nceng.com.au
W: www.nceng.com.au

In Association With:
URBEX PTY LTD

0 20 40 60 80 m
1:1,500

N

Legend
- TCC Land Parcels
- Stage 12 Lots
- Existing Pits
- Existing Culverts
- Previous Development Pits
- Previous Development Culverts
- Proposed Development Culverts

SOMERS & HERVEY ESTATE
PRECINCT 4 - STAGE 12A

2yr ARI STAGE 1 FLOOD DEPTHS

Prepared By: BB	Date: 19/12/2025	Size	Map
Reviewed by: AW	Revision: A	A3	G02
	NCE Ref: URB0001-P4		

NORTHERN CONSULTING engineers

Civil | Structural | Forensic
Traffic | Flood Modelling

TOWNSVILLE | SUNSHINE COAST | BRISBANE
GLADSTONE | NEW ZEALAND
T: +617 4725 5550 E: mail@nceng.com.au
W: www.nceng.com.au

In Association With:

URBEX PTY LTD

0 20 40 60 80 m

1:1,500

N

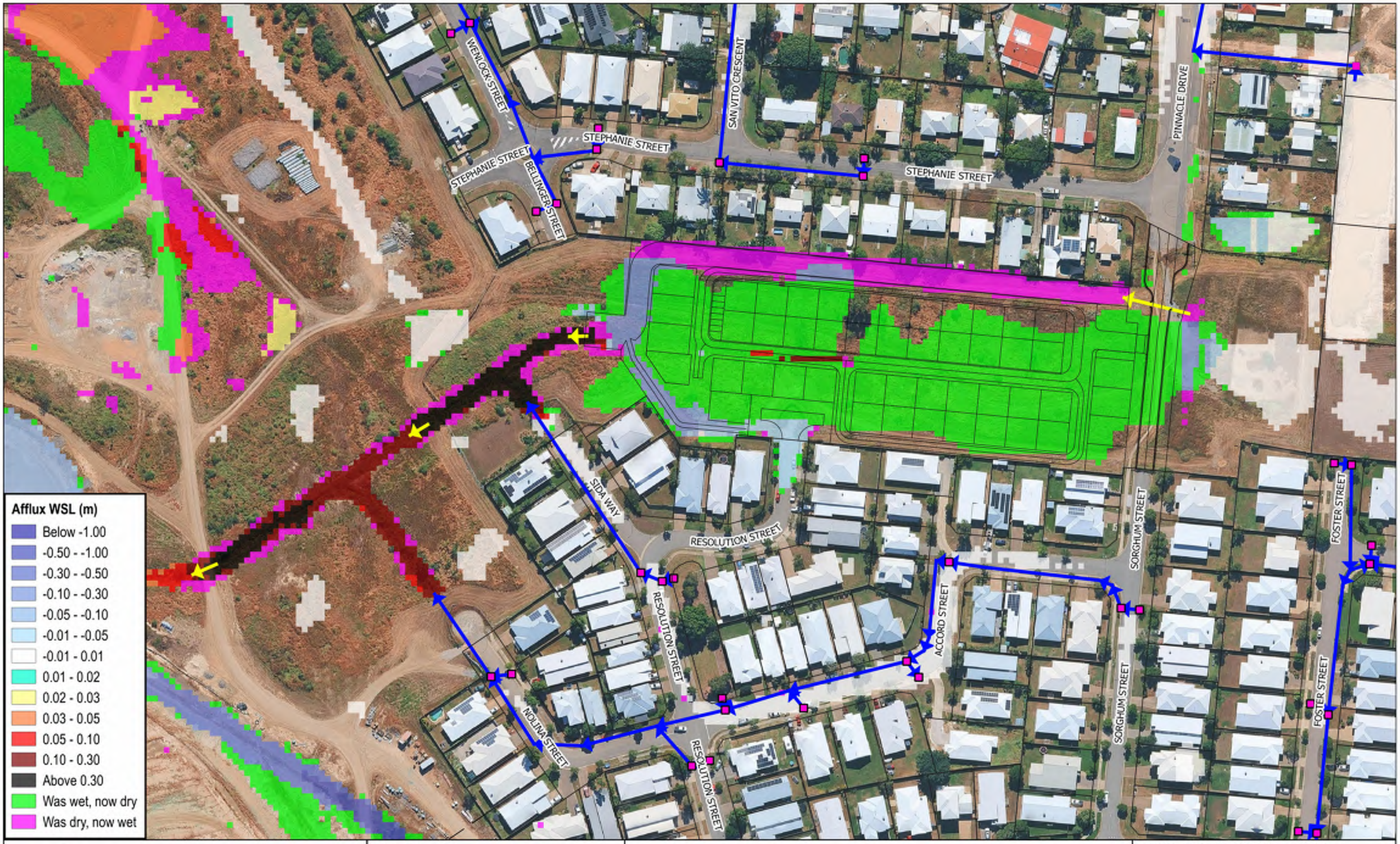
Legend

- TCC Land Parcels
- Stage 12 Lots
- Existing Pits
- Existing Culverts
- Previous Development Pits
- Previous Development Culverts
- Proposed Development Culverts

SOMERS & HERVEY ESTATE
PRECINCT 4 - STAGE 12A

100yr ARI STAGE 1 WSL AFFLUX

Prepared By: BB Reviewed by: AW	Date: 19/12/2025 Revision: A NCE Ref: URB0001-P4	Size A3	Map G03



NORTHERN CONSULTING engineers
Civil | Structural | Forensic
Traffic | Flood Modelling
TOWNSVILLE | SUNSHINE COAST | BRISBANE
GLADSTONE | NEW ZEALAND
T: +617 4725 5550 E: mail@nceng.com.au
W: www.nceng.com.au

In Association With:
URBEX PTY LTD

0 20 40 60 80 m
1:1,500

N

Legend
- TCC Land Parcels
- Stage 12 Lots
- Existing Pits
- Existing Culverts
- Previous Development Pits
- Previous Development Culverts
- Proposed Development Culverts

SOMERS & HERVEY ESTATE
PRECINCT 4 - STAGE 12A
2yr ARI STAGE 1 WSL AFFLUX

Prepared By: BB
Reviewed by: AW
Date: 19/12/2025
Revision: A
NCE Ref: URB0001-P4
Size: A3
Map: G04

APPENDIX H

Sensitivity and Climate Change Mapping – WSL Afflux and Depth for select cases

NORTHERN CONSULTING engineers
Civil | Structural | Forensic
Traffic | Flood Modelling
TOWNSVILLE | SUNSHINE COAST | BRISBANE
GLADSTONE | NEW ZEALAND
T: +617 4725 5550 E: mail@nceng.com.au
W: www.nceng.com.au

In Association With:
URBEX PTY LTD

0 20 40 60 80 m
1:1,500

N

Legend
- TCC Land Parcels
- Stage 12 Lots
- Existing Pits
- Existing Culverts
- Previous Development Pits
- Previous Development Culverts
- Proposed Development Culverts

SOMERS & HERVEY ESTATE
PRECINCT 4 - STAGE 12A

100yr ARI DEVELOPED FLOOD DEPTHS - 100% BLOCKAGE

Prepared By: BB	Date: 19/12/2025	Size	Map
Reviewed by: AW	Revision: A	A3	H01
	NCE Ref: URB0001-P4		

NORTHERN CONSULTING engineers
Civil | Structural | Forensic
Traffic | Flood Modelling
TOWNSVILLE | SUNSHINE COAST | BRISBANE
GLADSTONE | NEW ZEALAND
T: +617 4725 5550 E: mail@nceng.com.au
W: www.nceng.com.au

In Association With:
URBEX PTY LTD

0 20 40 60 80 m
1:1,500

N

Legend
- TCC Land Parcels
- Stage 12 Lots
- Existing Pits
- Existing Culverts
- Previous Development Pits
- Previous Development Culverts
- Proposed Development Culverts

SOMERS & HERVEY ESTATE
PRECINCT 4 - STAGE 12A

2yr ARI DEVELOPED FLOOD DEPTHS - CLIMATE CHANGE

Prepared By: BB Reviewed by: AW	Date: 19/12/2025 Revision: A NCE Ref: URB0001-P4	Size A3	Map H02

NORTHERN CONSULTING engineers
Civil | Structural | Forensic
Traffic | Flood Modelling
TOWNSVILLE | SUNSHINE COAST | BRISBANE
GLADSTONE | NEW ZEALAND
T: +617 4725 5550 E: mail@nceng.com.au
W: www.nceng.com.au

In Association With:
URBEX PTY LTD

0 20 40 60 80 m
1:1,500

N

Legend

- TCC Land Parcels
- Stage 12 Lots
- Existing Pits
- Existing Culverts
- Previous Development Pits
- Previous Development Culverts
- Proposed Development Culverts

SOMERS & HERVEY ESTATE
PRECINCT 4 - STAGE 12A

100yr ARI WSL AFFLUX - CLIMATE CHANGE

Prepared By: BB Reviewed by: AW	Date: 19/12/2025 Revision: A NCE Ref: URB0001-P4	Size A3	Map H03

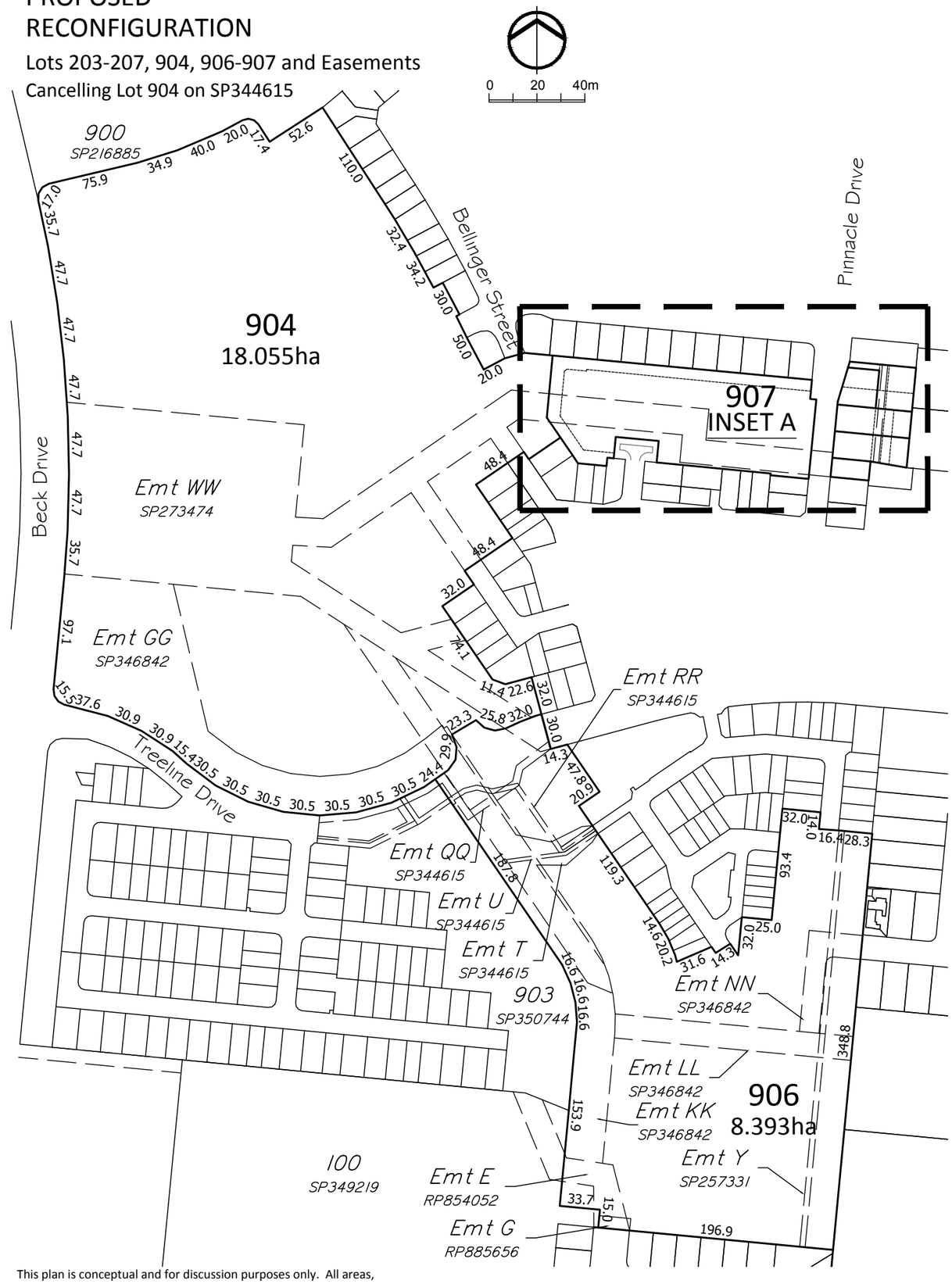
APPENDIX I

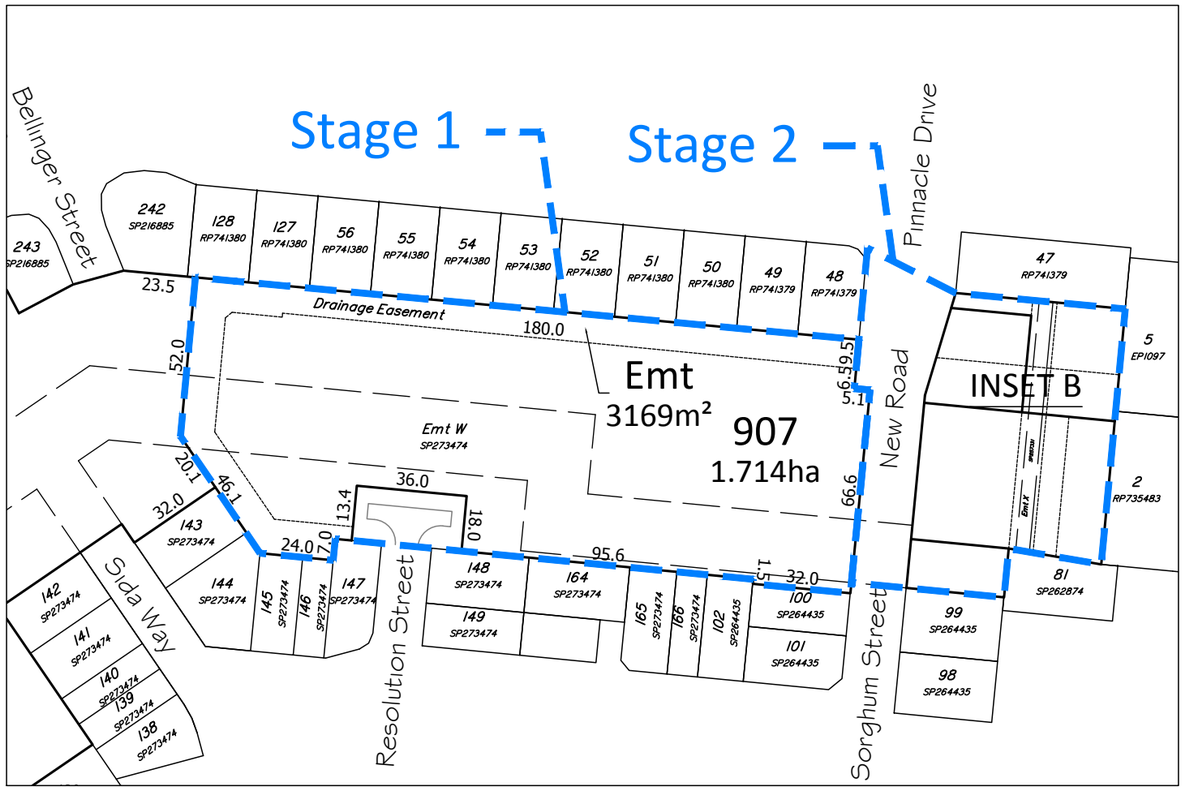
Stage 12a Development Plan

PROPOSED RECONFIGURATION

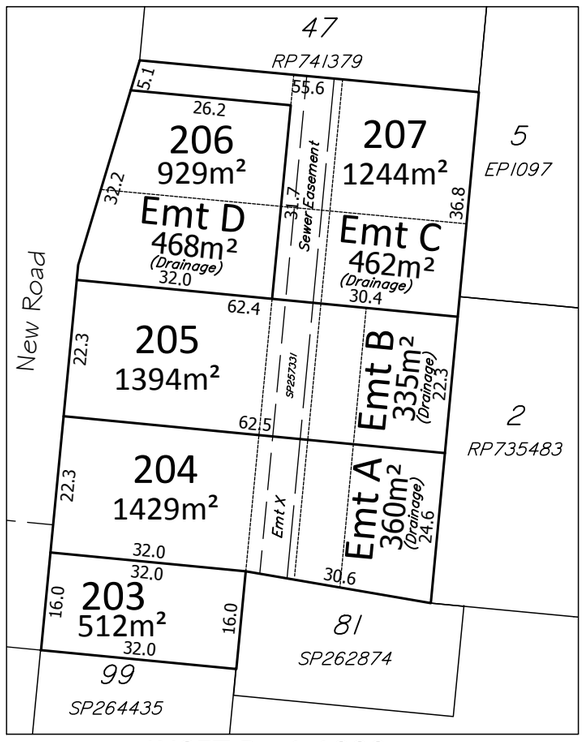
Lots 203-207, 904, 906-907 and Easements

Cancelling Lot 904 on SP344615





INSET A - 1:2000



INSET B - 1:1000

This plan is conceptual and for discussion purposes only. All areas, dimensions and land uses are preliminary, subject to investigation, survey, engineering, and Local Authority and Agency approvals.

Date: 4th December, 2025	
Scale: 1:2000	A3
Drawn: MJM	
Job No: 43126-40-01	
Plan No: 43126/023 I	

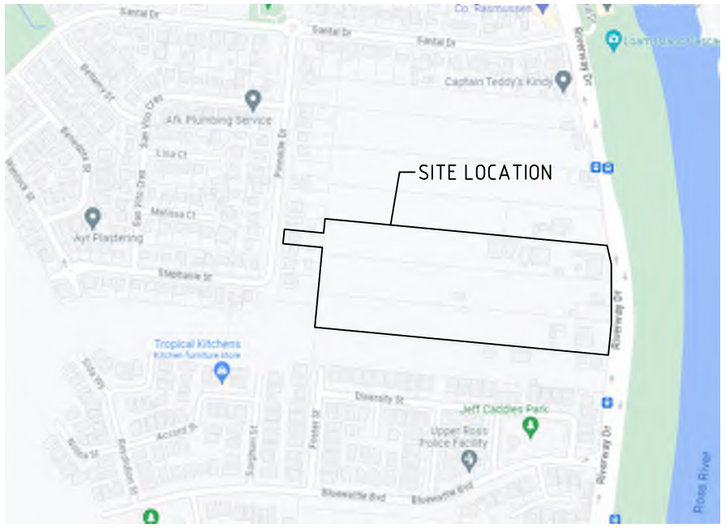
braziermotti.com.au

SURVEYING
TOWNPLANNING
PROJECTMANAGEMENT
MAPPING&GIS

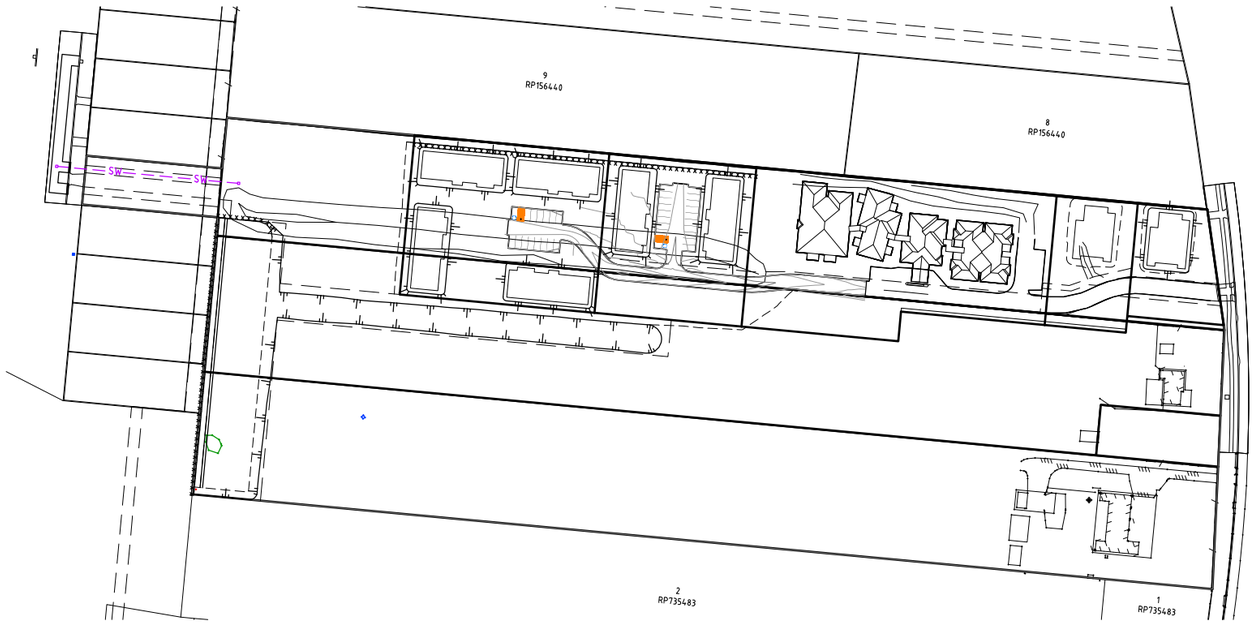
APPENDIX J

Yumba Meta Development Approved Plans

YUMBA-META DEVELOPMENT
AT
1145, 1151 & 1155 RIVERWAY DRIVE RASMUSSEN



LOCALITY PLAN
NOT TO SCALE



LAYOUT PLAN
SCALE 1:1250 AT A1

TOWNSVILLE CITY COUNCIL STANDARD DRAWINGS

ROADWORKS

SD-020	CONCRETE KERBING
SD-060	TRAFFIC SIGN INSTALLATION

STORMWATER

SD-200	PRECAST GRATED KERB INLET SYSTEM AND CAST INSITU STORMWATER MANHOLE
SD-205	STORMWATER MANHOLE DETAILS
SD-210	PRECAST STORMWATER MANHOLE- SLAB TOP DETAILS
SD-215	RAISED GRATE FIELD INLET MANHOLE

CTM STANDARD DRAWINGS

WATER RETICULATION

SEQ-WAT-1102-1	TYPICAL MAINS CONSTRUCTION RETICULATION MAIN ARRANGEMENT
SEQ-WAT-1103-1	TYPICAL MAINS CONSTRUCTION DISTRIBUTION AND TRANSFER MAIN ARRANGEMENTS
SEQ-WAT-1105-2	TYPICAL CONNECTION TO EXISTING MAINS
SEQ-WAT-1200-2	EMBEDMENT & TRENCH FILL TYPICAL ARRANGEMENT
SEQ-WAT-1201-1	STANDARD EMBEDMENT TYPICAL FLEXIBLE & RIGID PIPES
SEQ-WAT-1204-1	TYPICAL TRENCH AND BEDDING DETAILS WITH IN EXISTING ROADS TYPE K TO N
SEQ-WAT-1205-1	TYPICAL THRUST BLOCK DETAILS MASS CONCRETE
SEQ-WAT-1206-1	TYPICAL THRUST AND ANCHOR BLOCKS FOR VALVES
SEQ-WAT-1207-1	TYPICAL THRUST AND ANCHOR BLOCKS FOR VERTICAL BENDS
SEQ-WAT-1300-1	TYPICAL VALVE, HYDRANT AND WATER MAIN ROAD CROSSING ROAD AND PAVEMENT MARKERS
SEQ-WAT-1300-2	TYPICAL VALVE AND HYDRANT IDENTIFICATION MARKER POSTS
SEQ-WAT-1301-1	TYPICAL VALVE AND HYDRANT INSTALLATION VALVE ARRANGEMENT
SEQ-WAT-1302-1	TYPICAL VALVE AND HYDRANT INSTALLATION HYDRANT ARRANGEMENT

CTM STANDARD DRAWINGS

SEWERAGE RETICULATION

SEW-1102-1	DESIGN LAYOUTS CONNECTION TO EXISTING SEWER TYPICAL SCHEDULE OF WORKS
SEW-1103-1	RIGSS PIPELAYING TYPICAL ARRANGEMENTS
SEW-1103-2	NUSEWER PIPELAYING TYPICAL ARRANGEMENTS
SEW-1104-1	SEWERAGE HOUSE CONNECTION TYPICAL CONSTRUCTION DETAILS RIGSS-SHEET1
SEW-1105-1	SEWERAGE HOUSE CONNECTION TYPICAL CONSTRUCTION DETAILS RIGSS-SHEET2
SEW-1106-3	PE NUSEWERS TYPICAL PROPERTY CONNECTION TYPE A3, A4 STANDARD & EXTENDED
SEW-1106-5	PE NUSEWERS TYPICAL PROPERTY CONNECTION TYPE C1 TO C4 VERTICAL RISER
SEW-1200-2	EMBEDMENT & TRENCH FILL TYPICAL ARRANGEMENT
SEW-1201-1	TYPICAL STANDARD EMBEDMENT FLEXIBLE & RIGID PIPES
SEW-1300-1	MAINTENANCE HOLES < DN300 SEWER TYPES P1, P2 & P3 TYPICAL PRE-CAST
SEW-1301-1	CAST IN-SITU MAINTENANCE HOLE TYPICAL COPING & ANCHOR BRACKET DETAILS
SEW-1301-2	"G"TYPE-PE NUSEWERS TYPICAL MAINTENANCE HOLE DETAILS
SEW-1301-3	"G"TYPE- PE NUSEWERS TYPICAL MAINTENANCE HOLE AND SLAB DETAILS
SEW-1301-4	"F"TYPE- PE NUSEWERS TYPICAL MAINTENANCE HOLE DETAILS
SEW-1301-5	"F"TYPE PE NUSEWER TYPICAL MAINTENANCE HOLE AND SLAB DETAILS
SEW-1302-1	MAINTENANCE HOLES CAST IN-SITU & PRECAST TYPICAL PIPE CONNECTION DETAILS
SEW-1303-1	MAINTENANCE HOLES SEWERS < DN300 TYPICAL CHANGES IN LEVEL DETAILS
SEW-1304-1	MAINTENANCE HOLES SEWERS <DN300 TYPICAL CHANNEL ARRANGEMENTS
SEW-1305-1	MAINTENANCE HOLES TYPICAL CHANNEL DETAILS
SEW-1306-1	MAINTENANCE HOLES TYPICAL ALTERNATIVE DROP CONNECTIONS
SEW-1308-1	TYPICAL MAINTENANCE HOLE COVER & SURROUND DETAIL
SEW-1313-1	MAINTENANCE HOLE SEWER CONNECTION DETAILS ALL PIPE MATERIALS
SEW-1314-1	MAINTENANCE STRUCTURES FOR DN225 AND SMALLER RIGSS TYPICAL ARRANGEMENT DETAILS

DEPARTMENT OF TRANSPORT AND MAIN ROADS STANDARD DRAWINGS

DRAINAGE, RETAINING STRUCTURES AND PROTECTIVE TREATMENTS

SD1260	R C BOX CULVERTS AND SLAB LINK BOX CULVERTS - CULVERTS HEIGHT = 375 TO 600

TOWNSVILLE CITY COUNCIL DEVELOPMENT MANUAL PLANNING SCHEME

SC6.4.5	ROAD TRANSPORT NETWORK
SC6.4.5.2	TRAFFIC IMPACT ASSESSMENTS (TIA)
SC6.4.5.4	CAR PARKING
SC6.4.6	ROAD WORKS AND TRAFFIC CONTROL
SC6.4.6.1	GEOMETRIC ROAD DESIGN
SC6.4.6.2	PAVEMENT DESIGN & SEAL DESIGN
SC6.4.6.5	MASS CONCRETE PAVEMENT SUB-BASE
SC6.4.6.6	PLAIN AND REINFORCED CONCRETE PAVEMENT BASE
SC6.4.6.11	STABILISATION
SC6.4.6.16	BOUNDARY FENCING
SC6.4.6.17	CONTROL OF TRAFFIC
SC6.4.7	CLEARING, GRUBBING AND EARTHWORKS
SC6.4.8	STORMWATER MANAGEMENT
SC6.4.9	STORMWATER QUANTITY
SC6.4.9.11	CONSTRUCTION GENERAL
SC6.4.9.12	DRAINAGE STRUCTURES (CONSTRUCTION)
SC6.4.9.13	PIPE DRAINAGE (CONSTRUCTION)
SC6.4.9.14	PRECAST BOX CULVERTS
SC6.4.9.16	OPEN DRAINS
SC6.4.10	STORMWATER QUALITY
SC6.4.11	WATER AND SEWERAGE
SC6.4.11.1	WATER AND SEWERAGE INFRASTRUCTURE
SC6.4.11.2	WATER SUPPLY PLANNING AND DESIGN GUIDELINES
SC6.4.11.3	WATER SUPPLY CONSTRUCTION
SC6.4.11.4	SEWERAGE PLANNING AND DESIGN GUIDELINES
SC6.4.11.5	SEWERAGE SYSTEM CONSTRUCTION
SC6.4.12	LANDSCAPING AND OPEN SPACE
SC6.4.13	IRRIGATION
SC6.4.16	GEOTECHNICAL INVESTIGATIONS
SC6.4.18	CONCRETE WORKS
SC6.4.19	NOISE AND VIBRATION
SC6.4.22	WASTE MANAGEMENT
SC6.4.23	CONSTRUCTION MANAGEMENT, QUALITY MANAGEMENT, INSPECTION AND TESTING
SC6.4.24	ACCEPTANCE OF COMPLETED WORKS

Townsville City Council

Accepted Subject to Conditions

OPW23/0071
24/10/2023

DRAWING SCHEDULE

Sheet Number	Sheet Title
C01	COVER SHEET
C02	NOTES - SHEET 1
C03	NOTES - SHEET 2
C04	SAFETY IN DESIGN - SHEET 1
C05	SAFETY IN DESIGN - SHEET 2
C06	EARTHWORKS PLAN - SHEET 1
C07	EARTHWORKS PLAN - SHEET 2
C08	EARTHWORKS PLAN - SHEET 3
C09	SERVICES PLAN - SHEET 1
C10	SERVICES PLAN - SHEET 2
C11	SERVICES PLAN - SHEET 3
C12	ROADWORKS PLANS - SHEET 1
C13	ROADWORKS PLANS - SHEET 2
C14	ROADWORKS PLANS - SHEET 3
C15	ROADWORKS SETOUT TABLES
C16	CONCRETE JOINTS PLAN - SHEET 1
C17	CONCRETE JOINTS PLAN - SHEET 2
C18	CONCRETE JOINTS PLAN - SHEET 3
C19	DETAILS - SHEET 1
C20	DETAILS - SHEET 2
C21	CATCHMENT PLAN & CALCULATIONS
C22	SOIL EROSION & SEDIMENT CONTROL PLAN
C23	SOIL EROSION & SEDIMENT CONTROL DETAILS

SAFETY IN DESIGN INFORMATION
THERE MAY BE ADDITIONAL HAZARDS/RISKS NOT NORMALLY ASSOCIATED WITH THE TYPES OF WORK SHOWN ON THIS DRAWING. REFER TO THE SAFETY IN DESIGN REPORT.

-25 0 25 50
SCALE OF METRES 1:1250 AT A1 & 1:2500 AT A3

B	ISSUE FOR APPROVAL	DEJ	21/07/23
A	ORIGINAL ISSUE	SLT	14/07/23
REVISION		APP'D	DATE

FOR APPROVAL

JAS-ANZ ISO 9001 www.intlcert.com

LCJ ENGINEERS
LCJ Engineers Pty Ltd
ABN 54 131 516 446
601 Flinders Street, Townsville QLD 4810
PO Box 1498, Aitkenvale QLD 4814
Tel: (07) 4721 5800
townsville@lcjengineers.com.au
www.lcjengineers.com.au

DRAWN	DESIGNED
SLT	SLT
APPROVED	DATE
D.E.JOHNSTONE	21/07/23
RPEQ:	

CLIENT
YUMBA-META HOUSING ASSOCIATION LTD

PROJECT
YUMBA-META DEVELOPMENT STAGE 1

1145, 1151 & 1155 RIVERWAY DRIVE RASMUSSEN

DRAWING
COVER SHEET

NUMBER	SHEET NO.	REVISION
ROSE001	C01	B

Plot Date:25/07/2023 9:20 AM User: SThorburn File Name: J:\ROSE\ROSE001 Yumba Meta Development, Rasmussen\CAD\Civil\ROSE001-COVER

GENERAL NOTES

1. THIS SET OF DRAWINGS SHALL BE READ IN CONJUNCTION WITH ALL OTHER CONSULTANTS' DRAWINGS AND SPECIFICATIONS AND WITH OTHER WRITTEN INSTRUCTIONS OR SKETCHES THAT MAY BE ISSUED.
2. ALL DISCREPANCIES SHALL BE REFERRED TO THE SUPERINTENDENT FOR A DECISION BEFORE PROCEEDING WITH THE WORK.
3. ALL DIMENSIONS RELEVANT TO SETTING OUT AND OFF-SITE WORK SHALL BE VERIFIED BY THE CONTRACTOR BEFORE CONSTRUCTION AND FABRICATION IS COMMENCED. THE ENGINEERS DRAWINGS SHALL NOT BE SCALED.
4. THE CONTRACTOR SHALL DETERMINE THE CORRECT LOCATIONS OF ALL EXISTING SERVICES ON SITE PRIOR TO COMMENCEMENT OF WORKS.
5. NO SUBSTITUTIONS SHALL BE MADE WITHOUT OBTAINING THE APPROVAL OF THE ENGINEER. THE APPROVAL OF A SUBSTITUTION FROM THE ENGINEER SHALL NOT BE AN AUTHORISATION FOR AN EXTRA. ANY EXTRA INVOLVED SHALL BE RESOLVED WITH THE SUPERINTENDENT BEFORE THE WORK COMMENCES.
6. ALL MATERIALS AND WORKMANSHIP SHALL BE IN ACCORDANCE WITH THE RELEVANT CURRENT AUSTRALIAN STANDARDS CODES AND THE BY-LAWS, ORDINANCES AND REQUIREMENTS OF THE RELEVANT AUTHORITIES EXCEPT WHERE VARIED BY THE PROJECT SPECIFICATION AND CONTRACT DOCUMENTS.
7. ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE. ALL CHAINAGES AND LEVELS ARE EXPRESSED IN METRES UNLESS NOTED OTHERWISE.
8. DURING CONSTRUCTION THE CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING THE WORKS IN A STABLE CONDITION AND ENSURING NO PART SHALL BE OVERSTRESSED UNDER CONSTRUCTION ACTIVITIES.
9. NO HOLES, RECESSES OR CHASES OTHER THAN THOSE SHOWN ON THE DRAWINGS SHALL BE MADE WITHOUT PRIOR APPROVAL OF THE ENGINEER.
10. ALL MATERIALS AND ELEMENTS SHALL BE FIXED IN STRICT ACCORDANCE WITH THE MANUFACTURERS SPECIFICATIONS FOR THE NOMINATED LOADING CONDITIONS AND THE SUPPORTING STRUCTURE SHOWN ON THESE DRAWINGS.
11. THE CONTRACTOR SHALL ALLOW IN HIS TENDER FOR APPROVED SUBSTITUTIONS DUE TO NON AVAILABILITY OF NOMINATED ITEMS.
12. ALL EXISTING LEVELS AT CONNECTIONS TO EXISTING PIPES & PITS TO BE VERIFIED PRIOR TO COMMENCEMENT OF CONSTRUCTION.
13. ANY DAMAGE CAUSED TO EXISTING SERVICES WILL BE MADE GOOD AT THE CONTRACTORS EXPENSE.
14. EXPLOSIVES SHALL NOT BE USED FOR WORK UNDER THIS CONTRACT.
15. THE SITE MAY CONTAIN HAZARDOUS MATERIAL (INCLUDING BUT NOT LIMITED TO ASBESTOS). THE CONTRACTOR SHALL IDENTIFY ALL HAZARDOUS MATERIALS AND TREAT/REMOVE IN ACCORDANCE WITH THE RELEVANT REGULATIONS, ACTS AND STANDARDS.
16. THE CONTRACTOR IS TO PROVIDE A GUARANTEE, GUARANTEEING THE WORKMANSHIP AND ENSURING THAT THE WORKS ARE CONSTRUCTED IN ACCORDANCE WITH OUR DESIGNS AND DOCUMENTATION AS APPROVED BY COUNCIL FOR CONSTRUCTION.
17. SURVEY CONDUCTED BY:
    - 17.1. RPS SURVEY AND MAPPING ON 4th AUGUST 2020 DRAWING NO. 147582-001.
    - 17.2. VISION SURVEYS ON 12th AUGUST 2019 DRAWING NO. 19452-CD-01.
    - 17.3. VISION SURVEYS ON 13th APRIL 2021 DRAWING NO. 20323-ASC-01.
18. THE CONTRACTOR IS RESPONSIBLE FOR ESTABLISHING ANY TEMPORARY BENCHMARKS REQUIRED AND REINSTATING ANY PERMANENT BENCHMARKS DISTURBED.

EARTHWORKS NOTES

1. EARTHWORKS SHALL GENERALLY BE CARRIED OUT IN ACCORDANCE WITH TOWNSVILLE CITY COUNCIL CITY PLAN UNLESS NOTED OTHERWISE.
2. EXISTING SURFACES UNDER NEW WORKS ARE TO BE STRIPPED OF ALL VEGETATION, TOPSOIL AND UNCONTROLLED FILL TO A MINIMUM DEPTH OF 75mm. ALL TREE STUMPS AND ROOTS SHALL BE CHASED OUT AND REMOVED. IF DECLARED WEEDS ARE ENCOUNTERED THE CONTRACTOR IS TO ADVISE THE SUPERINTENDENT AND DISPOSE OF THEM IN AN APPROVED MANNER.
3. GRUBBING OPERATIONS SHALL BE CARRIED OUT TO A DEPTH OF 0.5m BELOW THE NATURAL SURFACE OR 1.5m BELOW THE FINISHED SURFACE LEVEL, WHICHEVER IS THE LOWER.
4. CHIPPING OF CLEARED VEGETATION THE CONTRACTOR SHALL:
   - PRODUCE A WOODCHIP MULCH DERIVED FROM CROWNS OF TREES AND BRANCHES OF SHRUBS CLEARED.
   - THE WOOD CHIP MULCH PRODUCED SHALL BE STOCKPILED FOR SUBSEQUENT USE OR FOR USE AT OTHER LOCATIONS AS APPROPRIATE, WHERE A BIOSECURITY RISK HAS NOT BEEN IDENTIFIED.
   - THE WOODCHIP MULCH SHALL BE PRODUCED FROM BRANCHES HAVING A MAXIMUM DIAMETER OF 100mm AND THE CHIPPED MATERIAL PRODUCED SHALL NOT HAVE TWO ORTHOGONAL DIMENSIONS EXCEEDING 75mm AND 50mm.
5. FILL MATERIAL IS TO BE PLACED IN LAYERS NOT EXCEEDING 200mm LOOSE THICKNESS AND COMPACTED TO 98% OF THE STANDARD COMPACTION TEST. UNO EXCEPT AREAS BENEATH LANDSCAPING THAT ARE GREATER THAN 600mm AWAY FROM EITHER:
   - PAVEMENT EDGE;
   - SHOULDER EDGE; OR
   - BUILDING PLATFORM

   AND ARE NOT ON A BATTER, WHICH SHALL BE COMPACTED TO 85% OF THE STANDARD COMPACTION TEST
6. GRADE EVENLY BETWEEN LEVELS SHOWN

PAVEMENT NOTES

1. ASSUMED SUBGRADE CBR HAVE BEEN SHOWN ON PAVEMENT SECTIONS. PAVEMENT MAKEUP MAY BE ALTERED, SUBJECT TO THE DESIGN ENGINEERS APPROVAL IF THE EXPOSED SUBGRADE CONDITIONS VARY FROM THE VALUES ASSUMED FOR DESIGN.
2. PAVEMENT TESTING SHALL BE IN ACCORDANCE WITH THE REQUIREMENT SECTION SC6.4.6 OF THE CITY PLAN. MINIMUM 25% OF TESTS TO BE LOCATED 0.3m FROM KERB LIP.

LINE MARKING NOTES

1. LINE MARKING IN ACCORDANCE WITH THE DEPARTMENT OF TRANSPORT AND MAIN ROADS QUEENSLAND MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES (MUTCD).
2. LINE MARKING PAINT SHALL COMPLY WITH MAIN ROADS TECHNICAL STANDARD MRTS 45-ROAD SURFACE DELINEATION (REFLECTIVE TYPE).
3. LINE MARKING DIMENSIONS ARE TO THE CENTRE OF THE LINE INDICATED
4. ALL PARKING LINES UNLESS NOTED OTHERWISE TO BE UNBROKEN 100mm WIDE WHITE LINES

FORMWORK

1. ALL MATERIALS AND WORKMANSHIP SHALL COMPLY WITH AS 3610 AND AS 3600.
2. THE DESIGN, CERTIFICATION, CONSTRUCTION AND PERFORMANCE OF THE FORMWORK AND FALSEWORK IS THE RESPONSIBILITY OF THE CONTRACTOR.
3. EXPOSED FORMED SURFACES SHALL HAVE A CLASS 3 SURFACE FINISH AND A 20mm CHAMFER UNLESS NOTED OTHERWISE. OBTAIN SIZES AND LOCATIONS OF PENETRATIONS FROM WORKSHOP DRAWINGS APPROVED BY THE ENGINEER. SIZES MUST NOT EXCEED DIMENSIONS WHERE SHOWN ON THE DRAWINGS.
4. FORMWORK STRIPPING AND BACK PROPPING OF SOFFITS SHALL BE IN ACCORDANCE WITH AS 3610 AND SHALL OCCUR NO SOONER THAN:
   - FORMWORK STRIPPING: 4 DAYS
   - REMOVAL OF SHORES OR BACKPROPS: 12 DAYS

   OR WHEN 25MPa CONCRETE STRENGTH HAS BEEN REACHED. CONCRETE STRENGTH IS TO BE CONFIRMED BY A COMPRESSIVE STRENGTH TEST.

REINFORCEMENT

1. REINFORCEMENT SYMBOLS
   R - GRADE 230R PLAIN ROUND BARS TO AS/NZS4671
   N - GRADE 500 DEFORMED BARS TO AS/NZS4671
   L - GRADE 500 HARD DRAWN WELDED WIRE FABRIC TO AS/NZS4671
   W - HARD DRAWN PLAIN WIRE TO AS/NZS4671
2. REINFORCEMENT IS SHOWN DIAGRAMMATICALLY AND NOT NECESSARILY IN TRUE PROJECTION.
3. REINFORCEMENT SHALL BE SUPPLIED AND BENT IN ACCORDANCE WITH AS3600. REBENDING OF REINFORCEMENT WITH OR WITHOUT HEATING IS NOT PERMITTED WITHOUT THE APPROVAL OF THE ENGINEER.
4. SPLICES TO REINFORCEMENT SHALL ONLY BE MADE IN POSITIONS SHOWN OR AS APPROVED OTHERWISE BY THE ENGINEER.
5. REINFORCEMENT SPLICES SHALL BE FULL STRENGTH TENSION SPLICES WITH LAPS AS FOLLOWS UNLESS NOTED OTHERWISE.

	fc'	MIN. COVER	N12	N16	N20
ALL HORIZONTAL AND VERTICAL BARS U.N.O	25MPa	30mm	480	750	1030
	32MPa	40mm	390	590	840
	40MPa	45mm	350	530	750
	50MPa	50mm	350	460	610
HORIZONTAL BARS WITH >300 CONCRETE BELOW BAR	25MPa	30mm	630	970	1340
	32MPa	40mm	500	770	1090
	40MPa	45mm	450	650	930
	50MPa	50mm	450	600	800

6. THE MINIMUM FABRIC LAP SHALL BE TWO CROSS WIRES PLUS 25mm. STAGGER SHEETS TO AVOID EXCESSIVE THICKNESS AT LAPS.

7. USE MECHANICAL SPLICES ONLY WHERE SPECIFIED OR APPROVED BY THE ENGINEER.
8. DO NOT WELD REINFORCEMENT WITHOUT THE APPROVAL OF THE ENGINEER.
9. PROVIDE 3-N12 DIAGONAL BARS x 2000 LONG IN THE TOP LAYER AT ALL RE-ENTRANT CORNERS. 100 MIN. SPACING.
10. REINFORCING BARS SHALL NOT BE CUT TO CLEAR PENETRATIONS NOT DETAILED ON THE DRAWINGS BUT BE DISPLACED TO CLEAR THEM. ADDITIONAL REINFORCING CONSISTENT WITH THE REINFORCEMENT MAT SPACING IS TO BE PROVIDED IN LINE WITH THE BLOCKOUTS.
11. SUPPORT ALL REINFORCEMENT SECURELY IN ITS CORRECT POSITION DURING CONCRETING BY SECURELY TYING WITH 1.25mm WIRE TO APPROVED PLASTIC TIPPED BAR CHAIRS, SPACERS OR SUPPORT BARS. SUPPORT SPACINGS SHALL BE SUCH AS TO POSITION AND MAINTAIN THE REINFORCEMENT TO THE TOLERANCES OF AS3600 AND SHALL BE AT 800mm MAXIMUM CENTRES IN SLABS. BAR CHAIRS SHALL COMPLY WITH AS/NZS 2425. PLASTIC TIPPED STEEL BAR CHAIRS SHALL NOT BE USED FOR EXTERNAL WORK.

ESCP & TMP

1. THE CONTRACTOR IS RESPONSIBLE FOR THE IMPLEMENTATION & MAINTENANCE OF THE SOIL EROSION & SEDIMENT CONTROL MEASURES DURING CONSTRUCTION AS PER TOWNSVILLE CITY COUNCIL GUIDELINES AND APPLICABLE CATCHMENTS AND CREEKS FIELD GUIDES
2. THE OWNER IS RESPONSIBLE FOR THE IMPLEMENTATION & MAINTENANCE OF THE SOIL EROSION & SEDIMENT CONTROL POST CONSTRUCTION.
3. DURING CONSTRUCTION ALL CONTRACTOR VEHICLES THAT ARE NOT ABLE TO BE CONTAINED ON SITE MUST ONLY UTILISE SPACES WITHIN THE ROAD RESERVE THAT DIRECTLY FRONTS THE SUBJECT ALLOTMENT, UNLESS OTHERWISE APPROVED BY COUNCIL. VEHICLES MUST NOT AT ANY TIME OBSTRUCT FOOTPATH AREAS OR SIGHT LINES WITHIN THE VICINITY OF THE DEVELOPMENT.
4. ALL MATERIAL AND MACHINERY TO BE USED DURING THE CONSTRUCTION PERIOD ARE TO BE WHOLLY STORED ON THE SITE UNLESS OTHERWISE AGREED IN WRITING BY COUNCIL.

CONCRETE

1. ALL MATERIALS AND WORKMANSHIP SHALL COMPLY WITH AS 3600 EXCEPT WHERE VARIED BY THE CONTRACT DOCUMENTS.
2. THE CONTRACTOR SHALL ALLOW FOR AND GIVE TWO FULL WORKING DAYS NOTICE FOR ALL INSPECTIONS.
3. CONCRETE GRADES AND COVER TO REINFORCEMENT SHALL BE AS FOLLOWS UNLESS SPECIFIED OTHERWISE:

ELEMENT		EXPOSURE	COVER	GRADE
CULVERT BASE SLABS, HEAD & WING WALLS	- AGAINST GROUND	A2	75	N40
	- FINISHED	B1	40	N40
PITS	- EXTERNAL	B1	40	N32
	- INTERNAL	A1	40	N32
KERBS	SHALL COMPLY WITH AS2876. MANUALLY PLACED CONCRETE SHALL BE GRADE N32. MACHINE-PLACED CONCRETE SHALL HAVE A MINIMUM OF, OR EQUIVALENT OF 320kg OF CEMENT PER CUBIC METRE OF CONCRETE			

   MINIMUM CONCRETE GRADES OF MINOR ELEMENTS ARE INDICATED ON THE DESIGN DRAWINGS, WHERE NO GRADE IS SPECIFIED CONCRETE SHALL BE GRADE N32
4. ALL CONCRETE SUPPLIED SHALL HAVE A SLUMP OF 80+/-15mm AND A MAXIMUM NOMINAL AGGREGATE SIZE OF 20mm UNLESS SPECIFIED OTHERWISE .
5. CONCRETE SAMPLING AND TESTING SHALL BE BY PROJECT ASSESSMENT TO AS3600 AND AS1379 UNLESS SPECIFIED OTHERWISE.
6. SHOULD CONDITIONS OTHER THAN THOSE DESCRIBED ABOVE BE ENCOUNTERED THEN REFER TO THE ENGINEER FOR POSSIBLE FOOTING REDESIGN.
7. ALL STRUCTURES CAST AGAINST GROUND SHALL BE LAID ON AN APPROVED VAPOUR BARRIER, OR A 50mm THICK N15 BLINDING LAYER EXCEPT FOR FOOTINGS.
8. PROPERLY FORM ALL CONSTRUCTION JOINTS AND LOCATE THEM ONLY WHERE SHOWN OR SPECIFICALLY APPROVED BY THE ENGINEER.
9. PIPES OR CONDUITS SHALL NOT BE PLACED WITHIN THE CONCRETE COVER TO REINFORCEMENT WITHOUT THE APPROVAL OF THE ENGINEER.
10. ALL CHEMICAL & EXPANSIVE ANCHORS IN CONCRETE OR REINFORCED BLOCKWORK SHALL BE NOT DIPPED GALVANISED AND HILTI OR RAMSET PRODUCTS OR AN APPROVED EQUIVALENT. UNLESS NOTED OTHERWISE, EPOXY FOR CHEMICAL ANCHORS SHALL BE RAMSET REO 502. MINIMUM INSTALLATION REQUIREMENTS SHALL BE AS FOLLOWS.

SIZE	MINIMUM EDGE DISTANCE	MINIMUM SPACING	MINIMUM EMBEDMENT DEPTH
M12	100	100	110
M16	125	125	125
M20	150	150	140

11. NO ADMIXTURES SHALL BE USED WITHOUT THE WRITTEN APPROVAL OF THE ENGINEER EXCEPT IN STANDARD CONTROLLED GRADE CONCRETE. CALCIUM CHLORIDE ADMIXTURES WILL NOT BE PERMITTED UNDER ANY CIRCUMSTANCES.
12. COMPACT ALL CONCRETE DURING PLACEMENT USING HIGH FREQUENCY MECHANICAL VIBRATORS.
13. CURE ALL CONCRETE SURFACES EXPOSED WITHIN 7 DAYS OF INITIAL SET USING A METHOD APPROVED BY AS3799 OR THE STRUCTURAL ENGINEER. COMMENCE CURING WITHIN 1 HOUR OF INITIAL SET OR FIRST EXPOSURE AND CONTINUE FOR AT LEAST 7 DAYS AFTER POURING CONCRETE.
14. THE PROCEDURES OUTLINED IN THE FOLLOWING DATA SHEETS,"CURING OF CONCRETE", "AVOID EARLY CRACKING" AND "HOT-WEATHER CONCRETING", SHALL BE FOLLOWED TO REDUCE THE RISK OF PLASTIC SHRINKAGE CRACKING.
15. MAINTAIN SPECIFIED COVER AT CHAMFERS, DRIP GROOVES, REGLETS AND OTHER MINOR CONCRETE SURFACE TREATMENTS.
16. CONCRETE TO BE BROOM FINISHED
17. UNLESS NOTED OTHERWISE TOLERANCES SHALL COMPLY WITH REQUIREMENTS SET OUT IN THE TABLE BELOW:

ELEMENT	POSITION/ SIZE	SURFACE QUALITY
SLABS AND DISH DRAINS	MAX. DEVIATION FROM ANY SPECIFIED HEIGHT, PLAN OR CROSS-SECTIONAL DIMENSION TO BE THE GREATER OF 1/200 TIMES SPECIFIED DIMENSIONS OR 5mm. SURFACE LEVEL TO BE WITHIN ±10mm OF SPECIFIED LEVEL	EXPOSED EDGES TO BE CLASS 3. FLATNESS- MAX. DEVIATION FROM A 3m STRAIGHTEDGE PLACED ANYWHERE ON THE SURFACE: 5mm.

Townsville City Council

Accepted Subject to Conditions

OPW23/0071
24/10/2023

SAFETY IN DESIGN INFORMATION
THERE MAY BE ADDITIONAL HAZARDS/RISKS NOT NORMALLY ASSOCIATED WITH THE TYPES OF WORK SHOWN ON THIS DRAWING. REFER TO THE SAFETY IN DESIGN REPORT.

B	ISSUE FOR APPROVAL	DEJ	21/07/23
A	ORIGINAL ISSUE	SLT	14/07/23
REVISION		APP'D	DATE

FOR APPROVAL

LCJ ENGINEERS
LCJ Engineers Pty Ltd
ABN 54 131 516 446
601 Flinders Street, Townsville QLD 4810
PO Box 1498, Aitkenvale QLD 4814
Tel: (07) 4721 5800
townsville@lcjengineers.com.au
www.lcjengineers.com.au

DRAWN	DESIGNED
SLT	SLT
APPROVED	DATE
D.E.JOHNSTONE	21/07/23
RPEQ:	

CLIENT
YUMBA-META HOUSING ASSOCIATION LTD

PROJECT
YUMBA-META DEVELOPMENT STAGE 1

1145, 1151 & 1155 RIVERWAY DRIVE RASMUSSEN

DRAWING
NOTES - SHEET 1

NUMBER	SHEET NO.	REVISION
ROSE001	C02	B

STORMWATER DRAINAGE

1. STORMWATER DRAINAGE PIPES TO BE
   1.1. PVC WITH SOLVENT CEMENT JOINTS
   1.2. BLACKMAX WITH SPIGOT AND SOCKET JOINTS.
   1.3. ALL REINFORCED CONCRETE STORMWATER DRAINAGE PIPES ARE TO BE MINIMUM CLASS 3, HAVE BELLED - SOCKET RUBBER RING JOINTS AND LAID ON H2 BEDDING IN ACCORDANCE WITH AS3725 UNO.
2. SITE STORMWATER DRAINAGE SHALL BE FREE OF LEAKS WHEN SUBJECTED TO THE WATER TEST REQUIREMENTS OF AS/NZS 3500.3.
3. ALL STORMWATER PIPEWORK IS TO BE LAID WITH THE SOCKET FACING UPSTREAM. ALL WORKS ARE TO COMMENCE AT THE OUTLET END OF EACH LINE.
4. THE CONTRACTOR IS TO ORGANISE AND STAGE CONSTRUCTION WORK AND UNDERTAKE ANY DIVERSION WORKS, TO PROTECT WORKS IN PROGRESS UNTIL SUCH A TIME AS THE WORKS ARE IN A FINISHED AND STABLE CONDITION AND TO ENSURE EXISTING DRAINS ARE ABLE TO CONVEY ALL STORMWATER FLOWS THAT MAY OCCUR DURING THE PERIOD OF THE CONSTRUCTION WORKS.
5. ANY DAMAGE TO THE WORKS DUE TO STORMWATER FLOWS OR FLOODING DURING THE CONSTRUCTION PERIOD IS AT THE CONTRACTORS RISK.
6. SETOUT POINT FOR STORMWATER STRUCTURES IS AS INDICATED IN THE DRAWINGS UNLESS NOTED OTHERWISE.
7. STORMWATER STRUCTURES ARE TO BE CONSTRUCTED PERPENDICULAR TO THE INCOMING PIPEWORK UNLESS NOTED OTHERWISE.
8. PITS TO BE:
   8.1. PVC/PRECAST/CAST IN SITU UP TO 600mm DEEP TO HAVE 450x450 INTERNAL OPENING
   8.2. PVC/PRECAST/CAST IN SITU UP TO 900mm DEEP TO HAVE 600x600 INTERNAL OPENING
   8.3. PRECAST/ CAST IN SITU WHERE GREATER THAN 900mm DEEP TO HAVE 900x900 INTERNAL OPENING UNLESS NOTED OTHERWISE.
9. PROVIDE MASS CONCRETE BENCHING IN STORMWATER ACCESS CHAMBERS TO ALLOW MINIMUM 30mm FALL ACROSS PITS. ADJUST BENCHING IN EXISTING MANHOLES AND PITS THAT ARE BEING MODIFIED OR ADJUSTED TO SUIT NEW STORMWATER DRAINAGE.
10. GRATES AND FRAMES SHALL COMPLY WITH THE DRAWINGS AND BE INSTALLED IN ACCORDANCE WITH AS 3996 AND THE MANUFACTURERS RECOMMENDATIONS. GRATES TO BE GALV. STEEL GRATES (CLASS B UNO) WITH LOCKING MECHANISM. GRATES SHALL BE SLIP RESISTANT, BICYCLE AND HEEL SAFE UNLESS APPROVED OTHERWISE BY THE SUPERINTENDENT.
11. CONCRETE DESIGN FOR STORMWATER STRUCTURES HAS BEEN BASED ON THE USAGE OF THE DRAINAGE SYSTEM FOR FRESH WATER ONLY.
12. ALL EXPOSED EDGES ON STORMWATER PITS TO BE ROUNDED TO 5mm RADIUS.
13. THE CONTRACTOR MAY ELECT TO SUBSTITUTE PRECAST PITS FOR CAST INSITU PITS SHOWN ON THE DRAWINGS. DETAILS OF ANY PROPOSED PRECAST ELEMENTS MUST BE SUBMITTED TO THE SUPERINTENDENT PRIOR TO USE.
14. PRECAST COMPONENTS SHALL BE CONNECTED BY MEANS OF 12mm DOWEL PINS EPOXIED IN DRILLED Ø14-16mm HOLES. THESE PINS TO BE MANUFACTURED FROM GRADE 250 STEEL BAR TO AS3679.1 HOT-DIPPED GALVANISED TO COMPLY WITH THE REQUIREMENTS OF AS/NZS4680.
15. DOWEL EPOXY TO BE APPROVED BY THE SUPERINTENDENT PRIOR TO USE.
16. HORIZONTAL JOINT SPACE (~10mm) SHALL BE FILLED WITH A 3:1 SAND:CEMENT MORTAR.
17. VERTICAL JOINTS BETWEEN PRECAST COMPONENTS SHALL BE SEALED WITH AN APPROVED PRODUCT FIXED TO THE EXTERNAL FACE OF THE JOINT. APPLICATION OF EPOXY TO BE AS PER MANUFACTURER'S INSTRUCTIONS OR TECHNICAL DATA SHEETS. INSTALLATION TO BE COMPLETED WITHIN THE POT LIFE OF THE EPOXY PRODUCT.
18. WATER RUN OFF DURING CONSTRUCTION SHALL BE COLLECTED AND CHANNELED AWAY FROM THE BUILDING SITE. WATER SHALL NOT BE ALLOWED TO POND IN TRENCHES.
19. SUBSURFACE DRAINS SHALL NOT BE USED WITHIN 1.5m OF THE BUILDING UNLESS APPROVED BY THE ENGINEER. DRAINS SHALL BE PROTECTED BY FILTERS AND/OR GEOTEXTILES AND SHALL BE ABLE TO BE INSPECTED AND MAINTAINED.
20. THE MAXIMUM AND MINIMUM PIPE GRADES SHALL CONFIRM WITH THE FOLLOWING:

PIPE DIAMETER (mm)	MAXIMUM GRADE (%)	MINIMUM GRADE (%)
300	20.0	0.50
375	15.0	0.40
450	11.0	0.30
525	9.0	0.25
600	7.5	0.20
675	6.5	0.18
750	5.5	0.15
900	4.5	0.12
1050	3.5	0.10
1200	3.0	0.10

SEWER NOTES

1. THESE DRAWINGS ARE READ IN CONJUNCTION WITH THE RELEVANT STD DRAWINGS, CONSTRUCTION SPECIFICATIONS AND ADDENDUM TO WSA.
2. SEWER MAINS ARE CONSTRUCTED ON A 1.5m ALIGNMENT FROM PROPERTY BOUNDARIES UNO.
3. SEWER GRAVITY MAINS TO BE U-PVC, CLASS SN8 (UNLESS NOTED OTHERWISE).
4. ALL SEWER PIPES TO BE RUBBER RING JOINTED UNLESS NOTED OTHERWISE.
5. MANHOLES (MH) TO BE STANDARD SEWER MANHOLES Ø1050. MAINTENANCE SHAFTS TO COMPLY WITH COUNCIL STANDARDS AND MANUFACTURERS SPECIFICATIONS. COVERS TO BE CLASS D UNLESS NOTED OTHERWISE.
6. ALL CONNECTIONS TO MAINTENANCE HOLES SHALL BE AT A SHORT CONNECTOR 450 MIN. TO 600 MAX. LONG.
7. UNDERLAY, SIDE SUPPORT AND OVERLAY MATERIAL SHALL BE IN ACCORDANCE WITH TECHNICAL SPECIFICATION.
8. TRENCH WIDTHS SPECIFIED ARE MINIMUM WIDTHS THAT ARE REQUIRED TO A LEVEL OF 300mm ABOVE THE OBVERT OF THE PIPE. TRENCH WIDTHS ABOVE THIS LEVEL MAY BE WIDENED TO SUIT SAFETY REQUIREMENTS.
9. MINIMUM COVER TO SEWER PIPES AT MAINTENANCE HOLES TO BE 1200mm. AT INTERMEDIATE LOCATIONS MINIMUM COVER TO BE 750mm WITHOUT CONCRETE SURROUND. MAXIMUM COVER TO BE 5000mm
10. CONCRETE TO BE GRADE S32 SULPHIDE RESISTANT.
11. UNLESS OTHERWISE APPROVED FOR PARTICULAR SITE CONDITIONS, SHORT PIPES (500mm MAX.) TO BE FLEXIBLY JOINTED TO ALL SECTIONS BEDDED ON OR SURROUNDED WITH CONCRETE. MAXIMUM FALL ACROSS MAINTENANCE HOLE SHALL BE 150mm, UNLESS A DROP INLET IS USED.
12. SUBCONTRACTOR TO CONFIRM LOCATION OF BUILDING DRAIN CONNECTIONS PRIOR TO CONSTRUCTION.
13. BUILDING DRAIN BRANCH TERMINATION LOCATION TO BE IDENTIFIED WITH APPROVED MARKER TAPE. TAPE SHALL BE SECURED TO END AND BROUGHT TO THE SURFACE ATTACHED TO A MARKER STAKE.
14. CONNECTION TO EXISTING SEWERAGE TO BE CARRIED OUT BY CONTRACTOR UNDER COUNCIL SUPERVISION.

WATER RETICULATION NOTES

1. THESE DRAWINGS ARE READ IN CONJUNCTION WITH THE RELEVANT STD DWGS, CONSTRUCTION SPECIFICATIONS AND ADDENDUM TO WSA.
2. COVER TO WATER MAINS TO BE 600mm UNO.
3. PROVIDE COVER BOXES AT ALL VALVES AND HYDRANTS.
4. DUCTILE IRON FITTINGS ARE TO BE USED WITH PVC PIPE. FITTINGS MAY BE FBE COATED AND LINED OR CEMENT LINED WITH A BITUMINOUS EXTERNAL COATING.
5. ALL POTABLE AND FIRE WATER TO BE M-PVC PN16 UNLESS NOTED OTHERWISE. BUILDING WATER SERVICE BRANCH CONNECTIONS TO BE PE PN12.5 UNLESS NOTED OTHERWISE.
6. VALVES TO BE LOCATED BY PAINTING A WHITE ENAMEL "V" ON A 300mm LONG BLACK ENAMEL BACKGROUND ON FACE AND TOP OF KERB OPPOSITE FITTING.
7. IF COVER TO VALVE SPINDLE IS GREATER THAN 350mm THEN AN EXTENSION SPINDLE SHALL BE INSTALLED TO ACHIEVE COVER REQUIREMENTS.
8. USE PRE-TAPPED CONNECTORS ON DN100 & DN150 NEW MAIN INSTALLATIONS.
9. ALL BENDS, TEES AND FITTINGS TO BE D.I.C.L. SOCKET END UNLESS NOTED OTHERWISE.
10. ALL FITTINGS TO BE PROVIDED WITH THRUST ANCHOR OF MIN. AREA AGAINST SOLID GROUND TO TRANSFER UNBALANCED FORCES FROM FITTINGS TO SOLID GROUND.
11. SINGLE PIPELINE THRUST BLOCKS TO BE IN ACCORDANCE WITH WSA-REQUIREMENTS AND MINIMUM THRUST AREA. FOR MULTIPLE PIPES SHALL BE CONFIRMED DURING THE SCHEMATIC DESIGN.
12. PERMANENT ANCHORS TO BE 25MPa CONCRETE. TEMPORARY ANCHORS MAY BE APPROVED TIMBER TOMS.
13. VALVES TO BE SUPPORTED ON CONCRETE PADS TO CARRY WEIGHT OF VALVE.
14. CROSSES TO BE ANCHORED AS FOR TEES WHERE ONE OR MORE BRANCHES CLOSED OFF.
15. MINIMUM AREA OF ANCHORS FOR REDUCERS/TAPERS TO BE EQUAL TO DIFFERENCE IN AREA FOR DEAD END ANCHORS OF DIAMETERS OF EACH END OF REDUCER.
16. MAXIMUM SIZE OF DRILLED HOLES FOR SERVICE CONNECTIONS IN PVC PIPE TO BE 30% DN OR 50 (LOWER VALUE TO BE USED) LARGER HOLES CAN BE USED FOR UNDER PRESSURE TAPPING.
17. FINISH THRUST BLOCKS APPROXIMATELY 100mm ABOVE THE TOP OF THE FITTING OR BEARING PAD AND EXTEND TO THE FLOOR OF THE TRENCH OR DEEPER IF NECESSARY TO ACHIEVE THE REQUIRED THRUST AREA. MAXIMUM ENCASEMENT TO BE 180°
18. THE MANUFACTURERS RECOMMENDED PRACTICE FOR THE ANCHORING OF BENDS, TEES, CROSSES, VALVES AND REDUCERS ETC. SHALL BE FOLLOWED.
19. WHEN SETTING PIPES IN CONCRETE A MEMBRANE OF POLYTHENE, P.V.C. OR FELT SHALL SURROUND THE PIPE AND THE FITTINGS TO PERMIT MOVEMENT.
20. CONNECTION TO EXISTING WATER MAINS EXTERNAL TO THE SITE SHALL BE CARRIED OUT BY THE CONTRACTOR UNDER COUNCIL SUPERVISION. ANY COUNCIL FEES ASSOCIATED WITH THE CONNECTION SHALL BE PAID FOR BY THE CONTRACTOR.

Townsville City Council

Accepted Subject to Conditions

OPW23/0071
24/10/2023

UTILITIES

1. EXISTING SERVICES INDICATED ON THE DRAWINGS ARE INDICATIVE ONLY AND MAY NOT INCLUDE ALL SERVICES PRESENT. IT IS THE CONTRACTORS RESPONSIBILITY TO CHECK THE POSITION OF ALL SERVICES WITH ALL SERVICES AUTHORITIES, AND ESTABLISH THE POSITION LEVEL AND SIZE OF THE UTILITY SERVICES IN THE FIELD PRIOR TO PROCEEDING WITH ANY CONSTRUCTION OR EXCAVATION WORK.
2. WHERE THE CONTRACT REQUIRES THE CONTRACTORS TO ADJUST, REMOVE, DIVERT, CUT INTO OR CUT OFF ANY SERVICE, THE CONTRACTORS SHALL ARRANGE FOR THE NECESSARY WORK TO BE EXECUTED AT THEIR COST. WHERE THE CONTRACT WORK DOES NOT NOMINATE THE CONTRACTOR TO CARRY OUT SUCH WORK, THE CONTRACTOR SHALL ADVISE THE SUPERINTENDENT.
3. ANY SERVICE MODIFIED OR CONNECTED TO IS TO HAVE ITS CONDITION EVALUATED TO ENSURE IT WILL MAINTAIN ITS SERVICEABILITY FOR THE DESIGN LIFE
4. ALL CONCRETE ENCASEMENT OF SEWER PIPES AND WATER MAINS SHALL BE CARRIED OUT IN ACCORDANCE WITH THE WATER SERVICES ASSOCIATION'S SEWERAGE CODE OF AUSTRALIA: WSA-02 & WSA-03.
5. MINIMUM VERTICAL CLEARANCES AT CROSSINGS ARE TO BE ACHIEVED BY JOINT DEFLECTIONS WHERE POSSIBLE. OTHERWISE, WHERE THIS CANNOT BE ACHIEVED CONTACT THE SUPERINTENDENT FOR ADVICE.

ROCK PROTECTION

1. ROCK PROTECTION TO BE CARRIED OUT IN ACCORDANCE WITH QUEENSLAND DEPARTMENT OF TRANSPORT AND MAIN ROADS TECHNICAL SPECIFICATIONS "MRTS03 - DRAINAGE, RETAINING STRUCTURES AND PROTECTIVE TREATMENTS, EXCEPT WHERE VARIED BY THESE DOCUMENTS.
2. ROCK MATERIAL SHALL BE PRODUCED OR DERIVED FROM DENSE, HARD DURABLE AND CLEAN ROCK. IT SHALL BE RESISTANT TO WEATHERING AND SHALL BE FREE FROM OVERBURDEN, SPOIL, SHALE AND ORGANIC MATTER. ROCK PORTIONS THAT IS CRACKED, FRACTURED, LAMINATED, POROUS OR CONTAINS OTHER STRUCTURAL DEFECTS WHICH MAY REDUCE ITS MECHANICAL STRENGTH OR RESISTANCE TO WEATHERING SHALL NOT BE USED.
3. THE BREADTH OR THICKNESS OF A SINGLE STONE SHALL NOT BE LESS THAN ONE-THIRD OF ITS LENGTH.
4. UNLESS NOTED OTHERWISE, ROCK WITHIN THE GROUND SURFACE TREATMENT AND ROCK PROTECTION TO THE CULVERTS SHALL BE A UNIFORM SIZE. THE NOMINAL SIZE OF ROCK USED IN PROTECTION SHALL BE 200mm. MINUS 19mm GRAVEL SHALL COMPLY WITH THE FOLLOWING GRADING.

SIEVE SIZE (mm)	MASS OF SAMPLE PASSING (%)
26.5	100
19.0	85-100
13.2	-
9.50	0-20
6.70	-
4.75	0-5
2.36	-
0.075	0-2

5. PADS BENEATH CULVERTS AND PAVEMENTS SHALL BE COMPACTED BY THE COMPACTED LAYER METHOD UNTIL THERE IS NO PERCEPTIBLE SURFACE DEFORMATION OR SPRINGING DURING ROLLING.
6. ALL MATERIAL SHALL BE PLACED AND COMPACTED IN UNIFORM LAYERS.
7. THE PLACING OPERATIONS SHALL MINIMISE THE CHANCES OF MATERIAL RUNNING LOOSE AND DAMAGING ADJACENT AREAS.
8. THE FINISHED SURFACE SHALL HAVE A UNIFORM APPEARANCE OVERALL AND SHALL NOT HAVE NOTICEABLE IRREGULARITIES IN HORIZONTAL OR VERTICAL ALIGNMENTS.

GEOTEXTILES

1. THE GEOTEXTILE SHALL BE BIDIM A39 OR AN EQUIVALENT APPROVED BY THE ENGINEER. IT SHALL BE PLACED FOR THE EXTENTS SHOWN ON THE PLAN AND BENEATH ALL ROCK PROTECTION WORKS.
2. ALTERNATIVE GEOTEXTILES SHALL ONLY BE CONSIDERED IF:
   a) THEY ARE NON-WOVEN, NEEDLE PUNCHED STAPLE FIBRE.
   b) THEY HAVE AN EQUIVALENT OPENING SIZE SUFFICIENT TO RETAIN THE SOIL BELOW WHILE PASSING WATER WITHOUT A SIGNIFICANT RISE IN HEAD.
   c) IT CAN BE DEMONSTRATED THAT CLOGGING OF THE OPENINGS BY FINE PARTICLES AND CONSEQUENTLY A REDUCTION IN PERMEABILITY HAS BEEN AGREED AS NOT BEING AND ISSUE.
   d) THEY HAVE THE FOLLOWING PROPERTIES AS DEFINED BY THE QUEENSLAND DEPARTMENT OF MAIN ROADS AND TRANSPORT SPECIFICATIONS MRTS27.
      - STRENGTH CLASS = D
      - FILTRATION CLASS = IV
3. THE GEOTEXTILES SHALL BE INSTALLED ONTO THE PREPARED SURFACE ACCORDING TO THE MANUFACTURER'S SPECIFICATIONS.
4. PLACEMENT OF THE GEOTEXTILE SHALL INCORPORATE THE FOLLOWING:
   a) GEOTEXTILES SHALL BE LAID LOOSELY, FREE OF WRINKLES, CREASES AND FOLDS. IT SHALL BE PLACED IN A MANNER THAT ALLOWS THE FABRIC TO CONFORM TO IRREGULARITIES IN THE SOIL WHEN HEAVIER MATERIALS ARE PLACED ON THE FABRIC. PLACING THE GEOTEXTILE IN A STRETCHED CONDITION UNDER TENSILE STRESS SHALL BE AVOIDED.
   b) FABRIC PLACEMENT ON SLOPES SHALL BEGIN AT THE SLOPE TOE AND PROCEED UPSLOPE WITH THE UPSLOPE PANEL OVERLAPPING THE DOWNSLOPE PANEL.
   c) STEEL SECURING PINS (WHERE REQUIRED) SHALL BE 5mm IN DIAMETER AND HAVE A HEAD CAPABLE OF RETAINING A STEEL WASHER HAVING A 38mm OUTSIDE DIAMETER. PIN LENGTH SHALL BE A MINIMUM OF 450mm FOR MEDIUM TO HIGH DENSITY SOIL AND LONGER FOR LOOSER SOILS. PIN SPACING ALONG THE OVERLAP SHALL BE A MAXIMUM OF 0.6m FOR SLOPES STEEPER THAN 1 ON 3, 1.0m FOR SLOPES BETWEEN 1 ON 3 AND 1 ON 4, AND 1.5m FOR SLOPES FLATTER THAN 1 ON 4. ADDITIONAL PINS SHALL BE USED AS NECESSARY TO PREVENT GEOTEXTILE SLIPPAGE.
   d) OVERLAPS SHALL BE AT LEAST 450mm.
   e) CARE SHALL BE EXERCISED IN PLACING OVERLYING STONE TO AVOID PUNCTURING THE GEOTEXTILE.
5. MINOR CONSTRUCTION DAMAGE TO GEOTEXTILE FILTERS SHALL BE REPAIRED BY TRIMMING OUT THE DAMAGED SECTION AND REPLACING WITH A SECTION OF FABRIC THAT PROVIDES A MINIMUM OF 600mm OVERLAP IN ALL DIRECTIONS. THE EDGES OF THE REPLACEMENT FABRIC SHALL BE PLACED UNDER THE UNDAMAGED GEOTEXTILE. IF REQUIRED, OVERLAYING STONE LAYERS MUST FIRST BE REMOVED TO EXPOSE THE DAMAGED FILTER CLOTH.

SAFETY IN DESIGN INFORMATION
THERE MAY BE ADDITIONAL HAZARDS/RISKS NOT NORMALLY ASSOCIATED WITH THE TYPES OF WORK SHOWN ON THIS DRAWING. REFER TO THE SAFETY IN DESIGN REPORT.

B	ISSUE FOR APPROVAL	DEJ	21/07/23
A	ORIGINAL ISSUE	SLT	14/07/23
REVISION		APP'D	DATE

FOR APPROVAL

LCJ ENGINEERS
LCJ Engineers Pty Ltd
ABN 54 131 516 446
601 Flinders Street, Townsville QLD 4810
PO Box 1498, Aitkenvale QLD 4814
Tel: (07) 4721 5800
townsville@lcjengineers.com.au
www.lcjengineers.com.au

DRAWN	DESIGNED
SLT	SLT
APPROVED	DATE
D.E.JOHNSTONE	21/07/23
RPEQ:	

CLIENT
YUMBA-META HOUSING ASSOCIATION LTD

PROJECT
YUMBA-META DEVELOPMENT STAGE 1

1145, 1151 & 1155 RIVERWAY DRIVE RASMUSSEN

DRAWING
NOTES - SHEET 2

NUMBER	SHEET NO.	REVISION
ROSE001	C03	B

SAFETY IN DESIGN REPORT

1. THE WORK HEALTH AND SAFETY ACT 2011 REQUIRES DESIGNERS PROVIDE A WRITTEN REPORT OUTLINING THE HAZARDS IDENTIFIED BY THE DESIGNER, ACTIONS TAKEN TO REDUCE THOSE RISKS AND ANY OTHER REMAINING HAZARDS.
2. HAZARDS OUTLINED IN THIS REPORT ARE STRUCTURAL AND CIVIL ENGINEERING IN NATURE, WHICH HAVE BEEN IDENTIFIED SO FAR AS REASONABLE AND PRACTICABLE. OTHER DESIGNERS MAY IDENTIFY ADDITIONAL HAZARDS AND RELEVANT PERSONS MUST REVIEW ALL DESIGNERS' SAFETY IN DESIGN REPORTS.
3. THE ASSET OWNER, CLIENT, CONTRACTOR AND MAINTENANCE CONTRACTOR MUST ENSURE THAT ALL RELEVANT PERSONS ARE MADE AWARE OF THE PROVISIONS OF THE REPORT.
4. THIS REPORT APPLIES TO ALL STAGES OF THE ASSET LIFE INCLUDING CONSTRUCTION, MAINTENANCE, USE AND DEMOLITION.
5. RISKS NOTED AT EACH LIFECYCLE STAGE MAY APPLY TO OTHER STAGES. RELEVANT PERSONS SHALL REVIEW ALL STAGES.

CONTROL MEASURES

1. HAZARDS ARE CONTROLLED THROUGH RISK CONTROL MEASURES AS FOLLOWS:
   ELIMINATION – REMOVE THE HAZARD THROUGH DESIGN MEASURES
   ENGINEERING – PROVIDE AN ENGINEERING SOLUTION TO CONTROL THE RISK
   ADMINISTRATION- USE OF ADMINISTRATION CONTROLS TO INFLUENCE PEOPLE

DESIGN BASIS

1. THIS WORKS HAVE BEEN DESIGNED IN ACCORDANCE WITH THE RELEVANT AUSTRALIAN STANDARDS LISTED ON THE FORM 15.
2. THE FOLLOWING TESTING HAS BEEN UNDERTAKEN:
   - GEOTECHNICAL TESTING – REFER SES GEOTECHNICAL REPORT NO: TS23350

Townsville City Council

Accepted Subject to Conditions

OPW23/0071
24/10/2023

LIFECYCLE STAGE: CONSTRUCTION

HAZARDS		CONTROL MEASURE	CONTROL			PERSON RESPONSIBLE FOR CONTROL	ADDITIONAL NOTES
			ELIMINATION	ENGINEERING	ADMINISTRATION		
FALLS, SLIPS AND TRIPS	WORK AT HEIGHT	PROVIDE SCAFFOLDING AS REQUIRED			✓	CONTRACTOR	CONTRACTOR TO ENSURE ADEQUATE ACCESS AND FALL PROTECTION IS PROVIDED
		PROVIDE EDGE PROTECTION			✓	CONTRACTOR	
		FOLLOW PROVISIONS OF CODE OF PRACTICE: PREVENTION OF FALLS IN GENERAL CONSTRUCTION			✓	CONTRACTOR	
	UNEVEN SURFACES	WHERE APPLICABLE, LEVELS DESIGNED TO MINIMISE UNEXPECTED STEPS AND FALLS		✓		ENGINEER	STEPS AND RAMPS TO BE TO AUSTRALIAN STANDARDS
	EXPOSED REINFORCING BARS	PROVIDE HOOKS TO TOP OF BARS WHERE POSSIBLE		✓		ENGINEER	ENSURE EXPOSED REINFORCEMENT IS TREATED TO REDUCE POTENTIAL HAZARD
		PROVIDE SAFETY CAPS TO UNHOOKED BARS			✓	CONTRACTOR	
WORK ON EXISTING STRUCTURES	STRUCTURE COLLAPSE	OBTAIN EXISTING STRUCTURAL DRAWINGS WHERE POSSIBLE	✓			ENGINEER/CONTRACTOR	SOME EXISTING DRAWINGS WERE AVAILABLE FOR THIS STRUCTURE
		FULLY PROP ANY LOAD BEARING ELEMENTS DURING CONSTRUCTION			✓	CONTRACTOR	MAINTAIN STRUCTURE IN A STABLE CONDITION
LOADS ON PARTIAL STRUCTURES		ENSURE DESIGN LOADS ARE NOT APPLIED TO PARTIALLY CONSTRUCTED STRUCTURE			✓	CONTRACTOR	MAINTAIN STRUCTURE IN A STABLE CONDITION
		WHERE POSSIBLE, DESIGN STRUCTURE FOR PARTIALLY CONSTRUCTED STATE		✓		ENGINEER	ENSURE ALL STAGES OF CONSTRUCTION ARE CONSIDERED IN DESIGN
		CONTRACTOR MUST CONSULT ENGINEER IF DESIGN LOADS WILL BE APPLIED TO PARTIAL STRUCTURES			✓	CONTRACTOR	TEMPORARY USE/ STORAGE OF EQUIPMENT/ GOODS OR MACHINERY ON PARTIAL STRUCTURES TO BE APPROVED BY THE ENGINEER
		TEMPORARILY PROP STRUCTURES AS REQUIRED DURING CONSTRUCTION			✓	CONTRACTOR	TEMPORARY PROPPING IS REQUIRED FOR THIS STRUCTURE
FALLING OBJECTS	STRUCTURAL COMPONENTS	PROVIDE CLEARLY MARKED LIFTING POINTS		✓		ENGINEER	DOCUMENT LIFTING POINTS ON THE COMPONENTS TO BE LIFTED
		CREATE EXCLUSION ZONES			✓	CONTRACTOR	ENSURE NO ACCESS WHERE THERE IS A POTENTIAL FOR FALLING OBJECTS
		ENSURE TEMPORARY PROPS ARE ADEQUATELY DESIGNED AND SECURED		✓		ENGINEER/CONTRACTOR	CONTRACTOR TO PROVIDE TEMPORARY WORK DESIGN
	LOOSE OBJECTS	PROVIDE FLOOR FALL THOUGH PROTECTION WHERE > 1500mm CLEARANCE TO FLOOR BELOW		✓		CONTRACTOR	ENSURE ITEMS CANNOT FALL THROUGH FLOOR
CRUSHING COLLAPSE OF STACKED MATERIALS	HEAVY CONSTRUCTION MATERIALS	PROVIDE EXCLUSION ZONES WHEN MOVING MATERIALS, ENSURE MATERIALS ARE STABLE BEFORE MOVING PLANT			✓	ENGINEER/CONTRACTOR	ENSURE PERSONNEL, EQUIPMENT AND MACHINERY CANNOT INTERACT WHEN MOVING HEAVY MATERIALS
SERVICES	RUPTURE OF SERVICE, POSSIBLE ELECTROCUTION	IDENTIFY AND DOCUMENT EXISTING SERVICES			✓	ENGINEER	WHERE KNOWN, EXISTING SERVICES HAVE BEEN NOTED ON PLANS
		DIAL BEFORE YOU DIG			✓	CONTRACTOR	CONTRACTOR RESPONSIBLE TO CONTACT DIAL BEFORE YOU DIG PRIOR TO BEGINNING WORK.
		PROVIDE LOAD PATH AROUND SERVICES		✓		ENGINEER	ENSURE SERVICES ARE COORDINATED DURING DESIGN &/OR SUFFICIENT SUPPORTS PROVIDED SUCH THAT THE STRUCTURE IS STABLE AROUND SERVICES
		ISOLATE SERVICE PRIOR TO CONSTRUCTION	✓			CONTRACTOR	
	OVERHEAD POWERLINES	ENSURE ADEQUATE CLEARANCE TO OVERHEAD POWERLINES			✓	CONTRACTOR	CONTRACTOR TO CONTACT SERVICE PROVIDER AND FOLLOW APPROPRIATE PROCEDURES AS NECESSARY
		ENSURE APPROPRIATE SERVICE PROVIDERS ARE NOTIFIED AND HAZARD FLAGGING IS INSTALLED		✓	✓	CONTRACTOR	
EARTHWORKS	WORK NEAR SHAFTS OR EXCAVATIONS	WHERE POSSIBLE, DESIGN FOR INSTALLATION WITHOUT ENTERING EXCAVATION	✓			ENGINEER	
		WHERE POSSIBLE, PROVIDE EXCAVATION SIDE SUPPORT, OR BENCHES/BATTERS		✓		ENGINEER/CONTRACTOR	PROVIDE SAFE ACCESS AND MAINTAIN A STABLE CONDITION.
		CREATE EXCLUSION ZONES AROUND EXCAVATIONS			✓	CONTRACTOR	PROVIDE CONTROLS TO MINIMISE ACCESS
	EROSION AND SEDIMENT CONTROL	COMPLY WITH EROSION AND SEDIMENT CONTROL PLAN			✓	CONTRACTOR	
	CONSTRUCTION OF AND AROUND STEEP BATTERS	WHERE POSSIBLE FLATTEN BATTERS TO LESS THAN 1 VERTICAL TO 3 HORIZONTAL		✓		ENGINEER/CONTRACTOR	CONTRACTOR TO PROVIDE METHOD STATEMENT FOR BATTERS STEEPER THAN 1 VERTICAL IN 3 HORIZONTAL
	SLOPE STABILITY	OBTAIN A GEOTECHNICAL REPORT AND COMPLY WITH RECOMMENDATIONS	✓		✓	CONTRACTOR	CONTRACTOR RESPONSIBLE FOR ENSURING EXCAVATIONS REQUIRED TO CONTRUCT THE WORK ARE STABLE
TRAFFIC MANAGEMENT	WORK INVOLVING PUBLIC ROADWAYS, RAILWAYS OR SHIPPING LANES	PROVIDE A TRAFFIC MANAGEMENT PLAN IN ACCORDANCE WITH THE MUTCD WHERE APPLICABLE – (INSTALL SIDE TRACKS WHERE NECESSARY)		✓		CONTRACTOR	A TRAFFIC MANAGEMENT PLAN WAS NOT PREPARED FOR THIS PROJECT FOR DESIGN. CONTRACTOR TO PROVIDE TRAFFIC MANAGEMENT PLAN AS REQUIRED FOR CONSTRUCTION
		PROVIDE OFF STREET CARPARKING, ADEQUATE SITE ACCESS AND MATERIAL STORAGE AREAS	✓		✓	CONTRACTOR	CONTRACTOR TO PROVIDE APPROPRIATE OFF STREET LAYDOWN/ STORAGE/ PARKING AREAS AS REQUIRED
WATER BODIES	DROWNING	ISOLATE OR DRAIN WATER BODY WHERE POSSIBLE			✓	CONTRACTOR	
		PROVIDE APPROPRIATE PPE			✓	CONTRACTOR	
	ELECTROCUTION	AVOID ELECTRICAL WORK NEAR WATER BODIES			✓	CONTRACTOR	ENSURE APPROPRIATE CONTROLS ARE IN PLACE
	CAVE INS	CONTRACTOR TO PROVIDE DEWATERING EQUIPMENT AS REQUIRED AND ENSURE THAT THE DEWATERING PROCESS DOES NOT COMPROMISE THE STABILITY OF ADJACENT WORKS			✓	CONTRACTOR	MAINTAIN A STABLE CONDITION
PLANT	OVERTURNING/COLLISION	FOLLOW PROVISIONS OF CODE OF PRACTICE: MANAGING RISKS OF PLANT AT THE WORKPLACE			✓	CONTRACTOR	ENSURE APPROPRIATE PROVISIONS ARE IN PLACE BEFORE MOVING OR WORKING WITH PLANT
	LOADS ON STRUCTURE OR EARTHWORKS	EXCLUDE PLANT FROM EXCAVATION/RETAINING STRUCTURE/BATTER ZONE OF INFLUENCE			✓	CONTRACTOR	ENSURE PLANT CANNOT ACCESS EXCAVATIONS/ RETAINING STRUCTURES/ BATTER ZONE OF INFLUENCE
		DESIGN STRUCTURE FOR APPROPRIATE PLANT LOADS		✓		ENGINEER	ENSURE STRUCTURE HAS BEEN DESIGNED FOR APPROPRIATE CONSTRUCTION LOADS
	COLLISIONS	PROVIDE EXCLUSION ZONES AROUND OPERATING PLAN			✓	CONTRACTOR	ENSURE PERSONNEL, EQUIPMENT AND MACHINERY CANNOT INTERACT WHEN MOVING HEAVY MATERIALS.
HAZARDOUS SUBSTANCES	ASBESTOS	NOMINATE KNOWN LOCATIONS OF ASBESTOS CONTAMINATION			✓	CONTRACTOR	ENSURE ASBESTOS MATERIAL IS IDENTIFIED, TREATED, STORED AND DISPOSED OF AS MANDATED
		DO NOT DISTURB POSSIBLE ASBESTOS MATERIAL			✓	CONTRACTOR	
		TEST POSSIBLE ASBESTOS MATERIALS PRIOR TO DISTURBING			✓	CONTRACTOR	
	TREATED TIMBER	USE APPROPRIATE PPE WHEN CUTTING, SANDING OR DRILLING			✓	CONTRACTOR	ENSURE TREATED TIMBER IS IDENTIFIED, TREATED, STORED AND DISPOSED OF AS MANDATED.
		DO NOT BURN TREATED TIMBER			✓	CONTRACTOR	
	VOLATILE ORGANIC COMPOUNDS	KEEP AREAS WELL VENTILATED WHEN USING GLUES, SOLVENTS AND PAINTS			✓	CONTRACTOR	ENSURE APPROPRIATE CONTROLS ARE IN PLACE
	SYNTHETIC MINERAL FIBRE	USE APPROPRIATE PPE WHEN HANDLING FIBREGLASS, ROCKWOOL OR SIMILAR PRODUCTS			✓	CONTRACTOR	ENSURE APPROPRIATE TREATMENTS/ INSTALLATION METHODS ARE USED FOR THESE PRODUCTS
	CONTAMINATED LAND	REMOVE / CONTAIN SUBSTANCE PRIOR TO CONSTRUCTION			✓	CONTRACTOR	ENSURE CONTAMINATED LAND IS IDENTIFIED, TREATED, STORED AND DISPOSED OF AS MANDATED.

SAFETY IN DESIGN INFORMATION
THERE MAY BE ADDITIONAL HAZARDS/RISKS NOT NORMALLY ASSOCIATED WITH THE TYPES OF WORK SHOWN ON THIS DRAWING. REFER TO THE SAFETY IN DESIGN REPORT.

B	ISSUE FOR APPROVAL	DEJ	21/07/23
A	ORIGINAL ISSUE	SLT	14/07/23
REVISION		APP'D	DATE

FOR APPROVAL

LCJ ENGINEERS
LCJ Engineers Pty Ltd
ABN 54 131 516 446
601 Flinders Street, Townsville QLD 4810
PO Box 1498, Aitkenvale QLD 4814
Tel: (07) 4721 5800
townsville@lcjengineers.com.au
www.lcjengineers.com.au

DRAWN	DESIGNED
SLT	SLT
APPROVED	DATE
D.E.JOHNSTONE	21/07/23
RPEQ:	

CLIENT
YUMBA-META HOUSING ASSOCIATION LTD

PROJECT
YUMBA-META DEVELOPMENT STAGE 1

1145, 1151 & 1155 RIVERWAY DRIVE RASMUSSEN

DRAWING
SAFETY IN DESIGN - SHEET 1

NUMBER	SHEET NO.	REVISION
ROSE001	C04	B

Townsville City Council

Accepted Subject to Conditions

OPW23/0071
24/10/2023

LIFECYCLE STAGE: MAINTENANCE

HAZARDS		CONTROL MEASURE	CONTROL			PERSON RESPONSIBLE FOR CONTROL	ADDITIONAL NOTES
			ELIMINATION	ENGINEERING	ADMINISTRATION		
TRAFFIC INCIDENTS	MAINTENANCE CONTRACTOR SAFETY	PROVIDE A TRAFFIC CONTROL PLAN WHERE APPLICABLE WHEN PERFORMING MAINTENANCE		✓	✓	MAINTENANCE CONTRACTOR	
FALLS, SLIPS AND TRIPS	WORK AT HEIGHT	WHERE POSSIBLE, PLACE ITEMS OF REGULAR MAINTENANCE AT LOW HEIGHT	✓			ENGINEER	CONSIDER MAINTENANCE ACTIVITES DURING DESIGN
		WHERE APPROPRIATE, PROVIDE SAFE ACCESS TO ITEMS AT HEIGHT, INCLUDING ANCHOR POINTS OR FIXED LADDERS		✓		ENGINEER	
CONFINED SPACE	ENCLOSED SPACES	MINIMISE THE REQUIREMENT TO ENTER CONFINED SPACES FOR MAINTENANCE	✓			ENGINEER	CONSIDER ALTERNATE SOLUTIONS
		FOLLOW THE PROVISIONS OF CODE OF PRACTICE: CONFINED SPACES			✓	CONTRACTOR	COMPLY WITH REQUIREMENTS
		PROVIDE WARNING SIGNS			✓	ARCHITECT	
	STORMWATER DEVICES	PROVIDE INFRASTRUCTURE THAT CAN BE MAINTAINED WITHOUT CONFINED SPACE ENTRY		✓		ENGINEER/ARCHITECT	CONSIDER ALTERNATE SOLUTIONS
ACCESS	ACCESS TO PITS AND MANHOLES	WHERE POSSIBLE ACCESS MANHOLES AND PITS HAVE BEEN PLACED IN PUBLIC PROPERTY AND NOT WITHIN PRIVATE LOTS OR TRAFFIC LANES	✓	✓		ENGINEER	
MATERIAL SELECTION AND DESIGN	MATERIAL DURABILITY	SELECT MATERIALS WHICH REQUIRE MINIMAL MAINTENANCE DURING DESIGN LIFE		✓		ENGINEER	CONSIDER DURABILITY OF MATERIALS
	LOADS ON STRUCTURE	DESIGN SURFACE FOR APPROPRIATE MAINTENANCE LOADS - ELEVATED WORK PLATFORMS ETC.		✓		ENGINEER	ENSURE MAINTENANCE LOADS ARE CONSIDERED IN DESIGN
		WHERE POSSIBLE PROVIDE LEVEL WORKING SURFACE FOR MAINTENANCE		✓		ENGINEER	CONSIDER ACCESS REQUIREMENTS
RETAINING STRUCTURES	TRENCHING/PAVEMENT MAINTENANCE	DESIGN ALLOWS FOR REMOVAL OF PAVEMENT UP TO 500mm DEEP FOR MAINTENANCE		✓		ENGINEER	
MANUAL TASKS	LIFTING OF MATERIALS	PROVIDE MECHANICAL LIFTING DEVICES OR LIFTING POINTS WHERE APPROPRIATE		✓		ENGINEER	
		PROVIDE TRAINING FOR WORKERS			✓	CLIENT	
HAZARDOUS SUBSTANCES	SKIN/EYE IRRITATION	PROVIDE EYE WASH STATION AND SAFETY SHOWER WHERE APPROPRIATE			✓	ENGINEER/ARCHITECT	

LIFECYCLE STAGE: USE FOR INTENDED PURPOSE

HAZARDS		CONTROL MEASURE	CONTROL			PERSON RESPONSIBLE FOR CONTROL	ADDITIONAL NOTES
			ELIMINATION	ENGINEERING	ADMINISTRATION		
GENERAL ARRANGEMENT	TYING INTO EXISTING INFRASTRUCTURE	ENSURE NEW WORKS TIE INTO EXISTING AS PER CURRENT DESIGN STANDARDS WHERE ABLE. IF UNABLE, ENSURE CONSISTENCY WITH SURROUNDING ENVIRONMENT AND ENSURE RESIDUAL RISK IS CONVEYED TO THE STAKEHOLDER.		✓		ENGINEER	RESIDUAL RISKS: - NO PEDESTRIAN/ BIKE PATH AS PER EXISTING CONDITIONS - EXISTING CULVERT DOES NOT SUIT CURRENT SM1600 LOADING REQUIREMENTS
	PROJECT RESTRAINTS (eg BUDGET, REGULATORY, PROPERTY, EXISTING CONDITIONS) MAY PREVENT AN IDEAL DESIGN FROM BEING COMPLETED	THE ASSET OWNER MAY BE REQUIRED TO PROVIDE MORE MAINTENANCE THAN PROJECTS WITHOUT RESTRAINTS			✓	ASSET OWNER / CLIENT / MAINTENANCE CONTRACTOR	WHOLE OF LIFE COSTS MAY BE HIGHER IF PROJECT CONSTRAINTS ARE IN PLACE
PAVEMENT DETERIORATION	ROUTINE AND PREVENTATIVE MAINTENANCE	ENSURE SCHEDULED MAINTENANCE WORKS ARE IN ACCORDANCE WITH STANDARD ROAD MAINTENANCE PRACTICES BUT ARE AT LEAST SUFFICIENT TO MAINTAIN THE SKID RESISTANCE, SHAPE, PROFILE AND AMENITY OF THE PAVEMENT AND PREVENT AQUAPLANING			✓	MAINTENANCE CONTRACTOR / ASSET OWNER	ENSURE MAINTENANCE IS SCHEDULED APPROPRIATELY
DRAINAGE STRUCTURES	ROUTINE AND PREVENTATIVE MAINTENANCE	ENSURE SCHEDULED MAINTENANCE WORK ARE IN ACCORDANCE WITH STANDARD MAINTENANCE PRACTICES FOR DRAINAGE BUT ARE AT LEAST SUFFICIENT TO MAINTAIN THE HYDRAULIC PERFORMANCE OF DRAINAGE STRUCTURES AND PREVENT PIPING AND/OR EROSION OF TRENCH BACKFILL			✓	MAINTENANCE CONTRACTOR / ASSET OWNER	ENSURE MAINTENANCE IS SCHEDULED APPROPRIATELY
LINEMARKING / SIGNAGE	FADING	REPLACE WHEN REFLECTIVITY AND / OR LUMINOSITY DOES NOT COMPLY WITH MINIMUM REQUIREMENTS			✓	MAINTENANCE CONTRACTOR / ASSET OWNER	ENSURE MAINTENANCE IS SCHEDULED APPROPRIATELY
FALLS, SLIPS AND TRIPS	ELEVATED PATHS AND WALKWAYS	PROVIDE ADEQUATE BALUSTRADES		✓		ENGINEER / CONTRACTOR	COMPLY WITH PROVISIONS OF ACCESS STANDARDS/ REGULATIONS
	UNEVEN SURFACES	WHERE APPLICABLE, LEVELS DESIGNED TO ELIMINATE UNEXPECTED STEPS AND FALLS		✓		ENGINEER / CONTRACTOR	
	SLIPPERY SURFACES	PROVIDE ADEQUATE DRAINAGE TO ALL SURFACES		✓		ENGINEER / CONTRACTOR	
FALLING OBJECTS	LOOSE OBJECTS	BALUSTRADES AND BARRIERS TO COMPLY WITH ASSET OWNERS REQUIREMENTS		✓		ENGINEER	PROVIDE EXCLUSION ZONES IF THERE IS A POTENTIAL FOR FALLING OBJECTS
		RESTRICT ACCESS TO LOW LEVEL AREAS			✓	ASSET OWNER	ENSURE NO ACCESS WHERE THERE IS A POTENTIAL FOR FALLING OBJECTS
TRAFFIC MANAGEMENT	VEHICLES	DESIGN VEHICLE AND ROAD SAFETY MEASURES COMPLY WITH ASSET OWNERS REQUIREMENTS		✓		ENGINEER	
	PEDESTRIANS	PEDESTRIANS SEPARATED FROM TRAFFIC		✓		ENGINEER	NO SEPARATION HAS BEEN PROVIDED, BUT CONSISTENT WITH EXISTING DESIGN & ADJACENT SECTION OF ROAD
	CYCLISTS	SEPARATED FROM VEHICLE TRAFFIC, NO PINCH POINTS IN DESIGN AND NON-SLIP PAVEMENT MARKINGS ADOPTED WHERE WITHIN DESIGNATED CYCLE WAYS		✓		ENGINEER	NO SEPARATION HAS BEEN PROVIDED, BUT CONSISTENT WITH EXISTING DESIGN & ADJACENT SECTION OF ROAD
	WORKER AND TRAFFIC INTERACTION	SEPARATE TRAFFIC AND PEDESTRIANS WHERE POSSIBLE	✓			ENGINEER	NO SEPARATION HAS BEEN PROVIDED, BUT CONSISTENT WITH EXISTING DESIGN & ADJACENT SECTION OF ROAD
	EMERGENCY AND WASTE MANAGEMENT VEHICLE	ENSURE ADEQUATE ACCESS AND CLEARANCE FOR EMERGENCY AND WASTE MANAGEMENT VEHICLES		✓		ENGINEER / MAINTENANCE CONTRACTOR	ENSURE CLEARANCES INCLUDED IN DESIGN AND MAINTAINED
	UNEXPECTED OVERSIZED VEHICLES	CONSIDERED IN GEOMETRIC DESIGN OF ROAD	✓			ENGINEER	DESIGN IN ACCORDANCE WITH APPLICABLE STANDARDS/ REFERENCES
EROSION	LANDSCAPING AREAS	ENSURE WORKS ARE ESTABLISHED AT HANDOVER AND VEGETATION TYPE, SOIL TYPE AND PREPARATION IS SUITABLE TO ENSURE LANDSCAPING IS SUSTAINABLE			✓	MAINTENANCE CONTRACTOR	ENSURE AREAS ARE MAINTAINED AND PERIODICALLY INSPECTED FOR EROSION
	HARD LANDSCAPING AREAS	ENSURE WORKS ARE MAINTAINED DURING DESIGN LIFE TO ENSURE THAT EROSION DOES NOT COMPROMISE THE SAFETY OF USERS			✓	MAINTENANCE CONTRACTOR	
DISABLED ACCESS	ACCESS AND EGRESS	ENSURE DESIGN CATERS FOR PERSONS WITH DISABILITIES		✓		ENGINEER / ARCHITECT	

LIFECYCLE STAGE: DEMOLITION

HAZARDS		CONTROL MEASURE	CONTROL			PERSON RESPONSIBLE FOR CONTROL	ADDITIONAL NOTES
			ELIMINATION	ENGINEERING	ADMINISTRATION		
SEQUENCING	EARTH COLLAPSE	ENSURE EARTH IS STABLE BEFORE REMOVING STRUCTURE			✓	CONTRACTOR	
	STRUCTURE COLLAPSE	CLEARLY NOTE ANY CONSTRUCTION SEQUENCING REQUIREMENTS ON PLANS			✓	ENGINEER	PROVIDE STRUCTURE DEMOLITION PLANS AND SEQUENCING AS REQUIRED
		FULL SUPPORT STRUCTURE DURING DEMOLITION AND REMOVE IN METHODICAL FASHION			✓	CONTRACTOR	CONTRACTOR TO MAINTAIN STRUCTURE IN STABLE CONDITION DURING SEQUENCED DEMOLITION

SAFETY IN DESIGN INFORMATION
THERE MAY BE ADDITIONAL HAZARDS/RISKS NOT NORMALLY ASSOCIATED WITH THE TYPES OF WORK SHOWN ON THIS DRAWING. REFER TO THE SAFETY IN DESIGN REPORT.

B	ISSUE FOR APPROVAL	DEJ	21/07/23
A	ORIGINAL ISSUE	SLT	14/07/23
REVISION		APP'D	DATE

FOR APPROVAL

JAS-ANZ ISO 9001 www.imticert.com

LCJ ENGINEERS

LCJ Engineers Pty Ltd
ABN 54 131 516 446
601 Flinders Street, Townsville QLD 4810
PO Box 1498, Aitkenvale QLD 4814
Tel: (07) 4721 5800
townsville@lcjengineers.com.au
www.lcjengineers.com.au

DRAWN	DESIGNED
SLT	SLT
APPROVED	DATE
D.E.JOHNSTONE	21/07/23
RPEQ:	

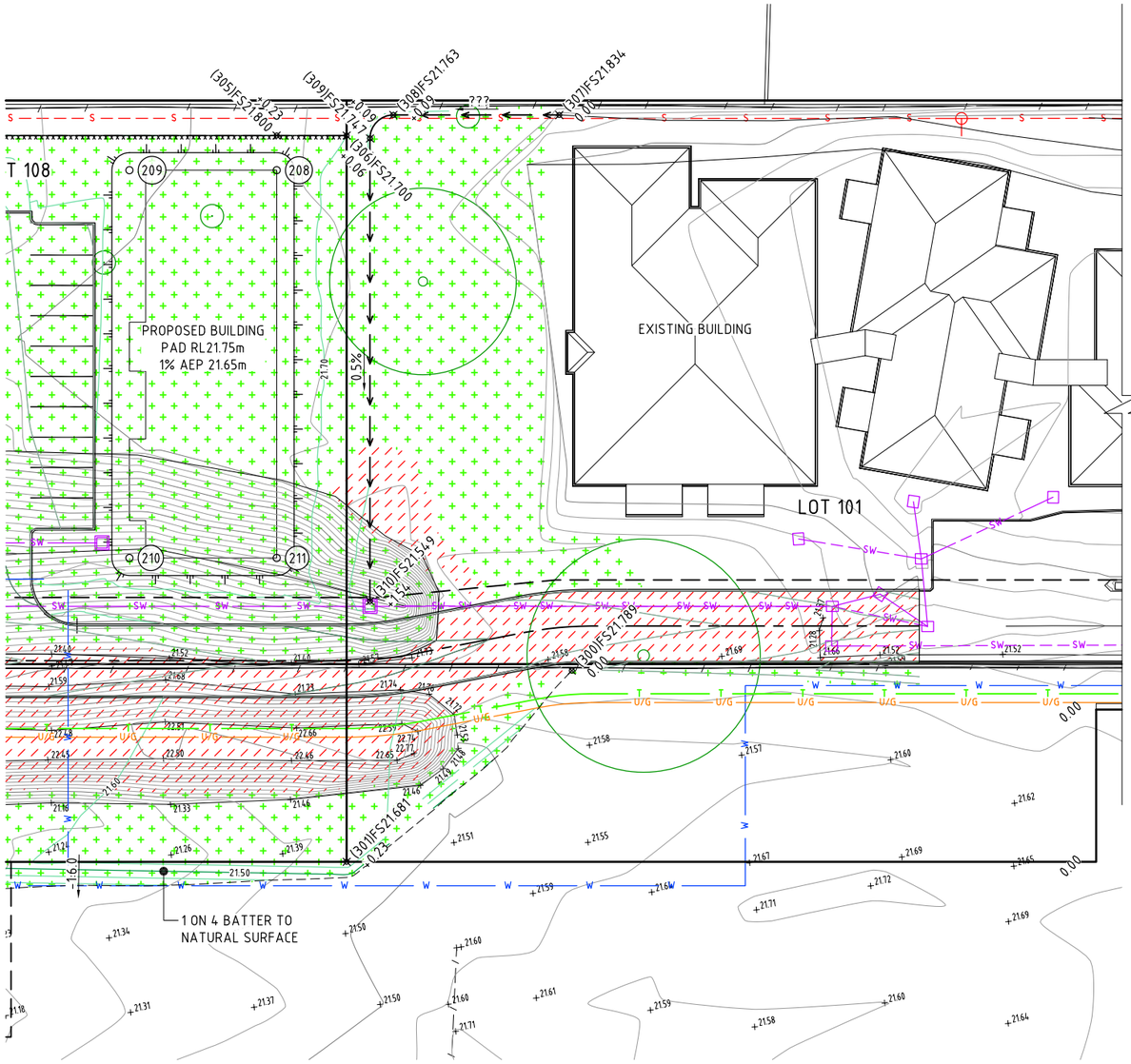
CLIENT
YUMBA-META HOUSING ASSOCIATION LTD

PROJECT
YUMBA-META DEVELOPMENT STAGE 1

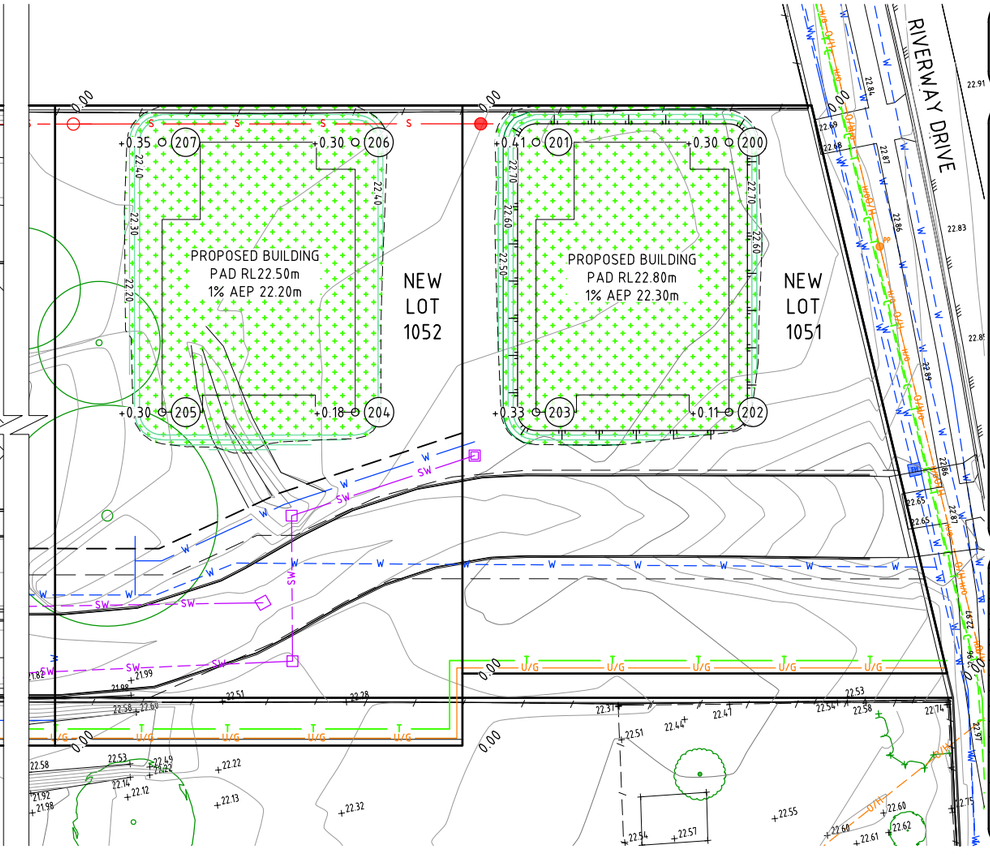
1145, 1151 & 1155 RIVERWAY DRIVE RASMUSSEN

DRAWING
SAFETY IN DESIGN - SHEET 2

NUMBER	SHEET NO.	REVISION
ROSE001	C05	B



PLAN
SCALE 1:250 AT A1



PLAN
SCALE 1:250 AT A1

Townsville City Council

Accepted Subject to Conditions

OPW23/0071
24/10/2023

LEGEND

- NATURAL SURFACE LEVEL
- NATURAL SURFACE CONTOURS (0.1m INTERVALS)
- (POINT NUMBER) FINISHED SURFACE LEVEL CUT (–) / FILL (+) DEPTH
- FINISHED SURFACE CONTOURS (0.1m INTERVALS)
- CUT AREA
- FILL AREA
- TOP OF BATTER
- BOTTOM OF BATTER
- RETAINING WALL
- BUILDING PAD SETOUT REFER DRG C08 FOR TABLES

SAFETY IN DESIGN INFORMATION
THERE MAY BE ADDITIONAL HAZARDS/RISKS NOT NORMALLY ASSOCIATED WITH THE TYPES OF WORK SHOWN ON THIS DRAWING. REFER TO THE SAFETY IN DESIGN REPORT.

-5 0 5 10
SCALE OF METRES 1:250 AT A1 & 1:500 AT A3

C	TCC RFI COMMENTS	DEJ	13/09/23
B	ISSUE FOR APPROVAL	DEJ	21/07/23
A	ORIGINAL ISSUE	SLT	14/07/23
REVISION		APP'D	DATE

FOR APPROVAL

JAS-ANZ ISO 9001 www.imticert.com

LCJ ENGINEERS
LCJ Engineers Pty Ltd
ABN 54 131 516 446
601 Flinders Street, Townsville QLD 4810
PO Box 1498, Aitkenvale QLD 4814
Tel: (07) 4721 5800
townsville@lcjengineers.com.au
www.lcjengineers.com.au

DRAWN	DESIGNED
SLT	SLT
APPROVED	DATE
D.E.JOHNSTONE	21/07/23
RPEQ:	

CLIENT
YUMBA-META HOUSING ASSOCIATION LTD

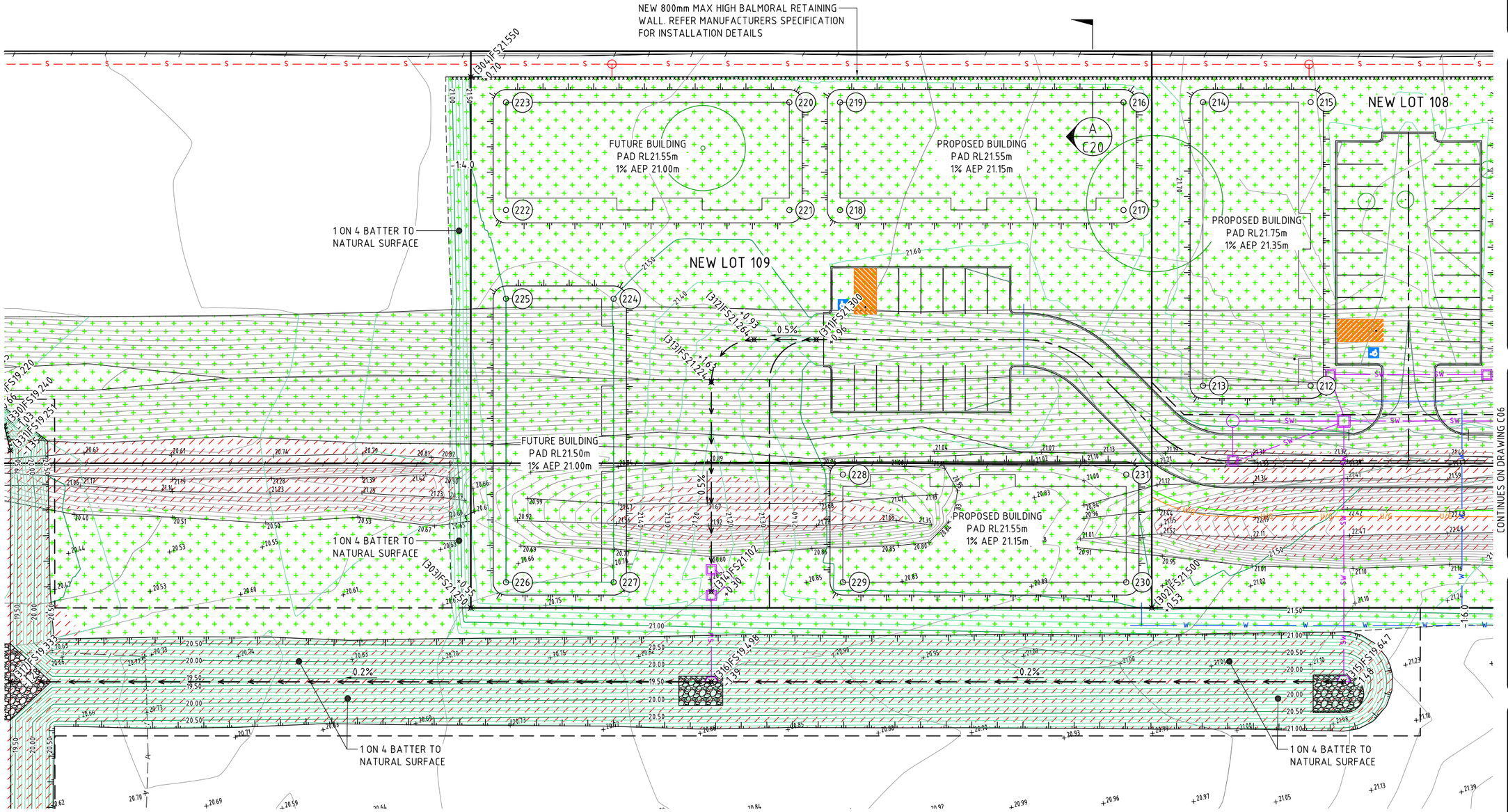
PROJECT
YUMBA-META DEVELOPMENT STAGE 1

1145, 1151 & 1155 RIVERWAY DRIVE RASMUSSEN

DRAWING
EARTHWORKS PLAN - SHEET 1

NUMBER	SHEET NO.	REVISION
ROSE001	C06	C

Plot Date:13/09/2023 3:51 PM User: SThorburn File Name: J:\ROSE\ROSE001 Yumba Meta Development, Rasmussen\CAD\Civil\ROSE001-EARTHWORKS



PLAN
SCALE 1:250 AT A1

Townsville City Council
Accepted Subject to Conditions
OPW23/0071
24/10/2023

LEGEND

- NATURAL SURFACE LEVEL
- NATURAL SURFACE CONTOURS (0.1m INTERVALS)
- (POINT NUMBER) FINISHED SURFACE LEVEL CUT (–) / FILL (+) DEPTH
- FINISHED SURFACE CONTOURS (0.1m INTERVALS)
- CUT AREA
- FILL AREA
- TOP OF BATTER
- BOTTOM OF BATTER
- RETAINING WALL
- BUILDING PAD SETOUT REFER DRG C08 FOR TABLES

SAFETY IN DESIGN INFORMATION
THERE MAY BE ADDITIONAL HAZARDS/RISKS NOT NORMALLY ASSOCIATED WITH THE TYPES OF WORK SHOWN ON THIS DRAWING. REFER TO THE SAFETY IN DESIGN REPORT.

-5 0 5 10
SCALE OF METRES 1:250 AT A1 & 1:500 AT A3

REVISION		APP'D	DATE
C	TCC RFI COMMENTS	DEJ	13/09/23
B	ISSUE FOR APPROVAL	DEJ	21/07/23
A	ORIGINAL ISSUE	SLT	14/07/23

FOR APPROVAL

LCJ ENGINEERS
LCJ Engineers Pty Ltd
ABN 54 131 516 446
601 Flinders Street, Townsville QLD 4810
PO Box 1498, Aitkenvale QLD 4814
Tel: (07) 4721 5800
townsville@lcjengineers.com.au
www.lcjengineers.com.au

DRAWN	DESIGNED
SLT	SLT
APPROVED	DATE
D.E.JOHNSTONE	21/07/23
RPEQ:	

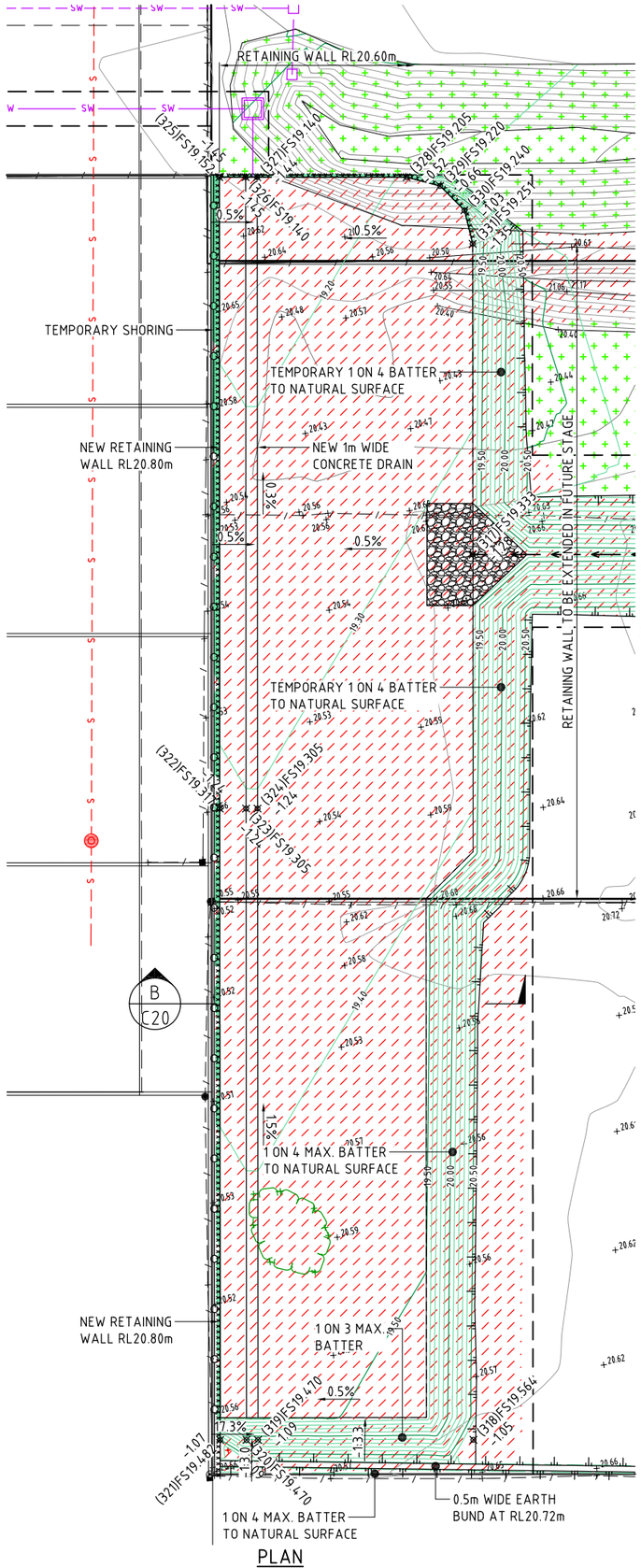
CLIENT
YUMBA-META HOUSING ASSOCIATION LTD

PROJECT
YUMBA-META DEVELOPMENT STAGE 1
1145, 1151 & 1155 RIVERWAY DRIVE RASMUSSEN

DRAWING
EARTHWORKS PLAN - SHEET 2

NUMBER	SHEET NO.	REVISION
ROSE001	C07	C

Plot Date:13/09/2023 3:51 PM User: SThorburn File Name: J:\ROSE\ROSE001 Yumba Meta Development, Rasmussen\CAD\Civil\ROSE001-EARTHWORKS



PLAN

SCALE 1:250 AT A1

Townsville City Council

Accepted Subject to Conditions

OPW23/0071
24/10/2023

EARTHWORKS SETOUTS

POINT TABLE			
POINT #	EASTING	NORTHING	LEVEL
300	471723.419	7859775.425	21.79
301	471702.690	7859760.918	21.68
302	471642.752	7859766.528	21.50
303	471563.301	7859773.958	21.25
304	471569.096	7859835.887	21.55
305	471702.513	7859823.411	21.80
306	471708.486	7859822.853	21.70
307	471726.785	7859822.903	21.83
308	471712.632	7859824.227	21.76
309	471710.455	7859822.422	21.75
310	471706.762	7859782.966	21.55
311	471606.534	7859801.474	21.30
312	471599.273	7859802.154	21.26
313	471593.829	7859797.642	21.22
314	471591.542	7859773.224	21.10
315	471664.347	7859755.809	19.65
316	471590.558	7859762.710	19.50
317	471508.779	7859770.357	19.33
318	471501.634	7859693.465	19.56
319	471482.915	7859695.204	19.47
320	471481.919	7859695.297	19.47
321	471479.629	7859695.508	19.48
322	471484.725	7859750.350	19.32
323	471487.015	7859750.137	19.31
324	471488.010	7859750.044	19.31
325	471489.821	7859805.192	19.15
326	471492.111	7859804.978	19.14
327	471493.106	7859804.885	19.14
328	471506.092	7859803.672	19.21
329	471508.930	7859802.632	19.22
330	471510.844	7859800.324	19.24
331	471511.287	7859797.347	19.25

BUILDING PAD SETOUTS

POINT TABLE			
POINT #	EASTING	NORTHING	LEVEL
200	471885.671	7859806.284	22.80
201	471869.999	7859807.751	22.80
202	471883.621	7859784.380	22.80
203	471867.950	7859785.846	22.80
204	471853.276	7859787.219	22.50
205	471837.604	7859788.685	22.50
206	471855.325	7859809.123	22.50
207	471839.654	7859810.589	22.50
208	471702.237	7859820.451	21.75
209	471689.680	7859821.626	21.75
210	471686.587	7859788.560	21.75
211	471699.143	7859787.385	21.75
212	471663.706	7859790.701	21.75
213	471651.150	7859791.875	21.75
214	471654.243	7859824.941	21.75
215	471666.800	7859823.767	21.75
216	471644.965	7859825.789	21.55
217	471643.790	7859813.233	21.55
218	471610.724	7859816.326	21.55
219	471611.899	7859828.882	21.55
220	471605.985	7859829.436	21.55
221	471604.810	7859816.879	21.55
222	471571.744	7859819.973	21.55
223	471572.919	7859832.529	21.55
224	471583.333	7859808.453	21.50
225	471570.777	7859809.628	21.50
226	471567.683	7859776.562	21.50
227	471580.240	7859775.387	21.50
228	471608.153	7859785.442	21.55
229	471606.979	7859772.885	21.55
230	471640.044	7859769.792	21.55
231	471641.219	7859782.348	21.55

LEGEND

- NATURAL SURFACE LEVEL
- NATURAL SURFACE CONTOURS (0.1m INTERVALS)
- (POINT NUMBER) FINISHED SURFACE LEVEL CUT (-) / FILL (+) DEPTH
- FINISHED SURFACE CONTOURS (0.1m INTERVALS)
- CUT AREA
- FILL AREA
- TOP OF BATTER
- BOTTOM OF BATTER
- RETAINING WALL
- BUILDING PAD SETOUT REFER DRG C08 FOR TABLES

SAFETY IN DESIGN INFORMATION
THERE MAY BE ADDITIONAL HAZARDS/RISKS NOT NORMALLY ASSOCIATED WITH THE TYPES OF WORK SHOWN ON THIS DRAWING. REFER TO THE SAFETY IN DESIGN REPORT.

-5 0 5 10

SCALE OF METRES 1:250 AT A1 & 1:500 AT A3

C	TCC RFI COMMENTS	DEJ	13/09/23
B	ISSUE FOR APPROVAL	DEJ	21/07/23
A	ORIGINAL ISSUE	SLT	14/07/23
REVISION		APP'D	DATE

FOR APPROVAL

JAS-ANZ ISO 9001 www.imlcert.com

LCJ ENGINEERS

LCJ Engineers Pty Ltd
ABN 54 131 516 446
601 Flinders Street, Townsville QLD 4810
PO Box 1498, Aitkenvale QLD 4814
Tel: (07) 4721 5800
townsville@lcjengineers.com.au
www.lcjengineers.com.au

DRAWN	DESIGNED
SLT	SLT
APPROVED	DATE
D.E.JOHNSTONE	21/07/23
RPEQ:	

CLIENT
YUMBA-META HOUSING ASSOCIATION LTD

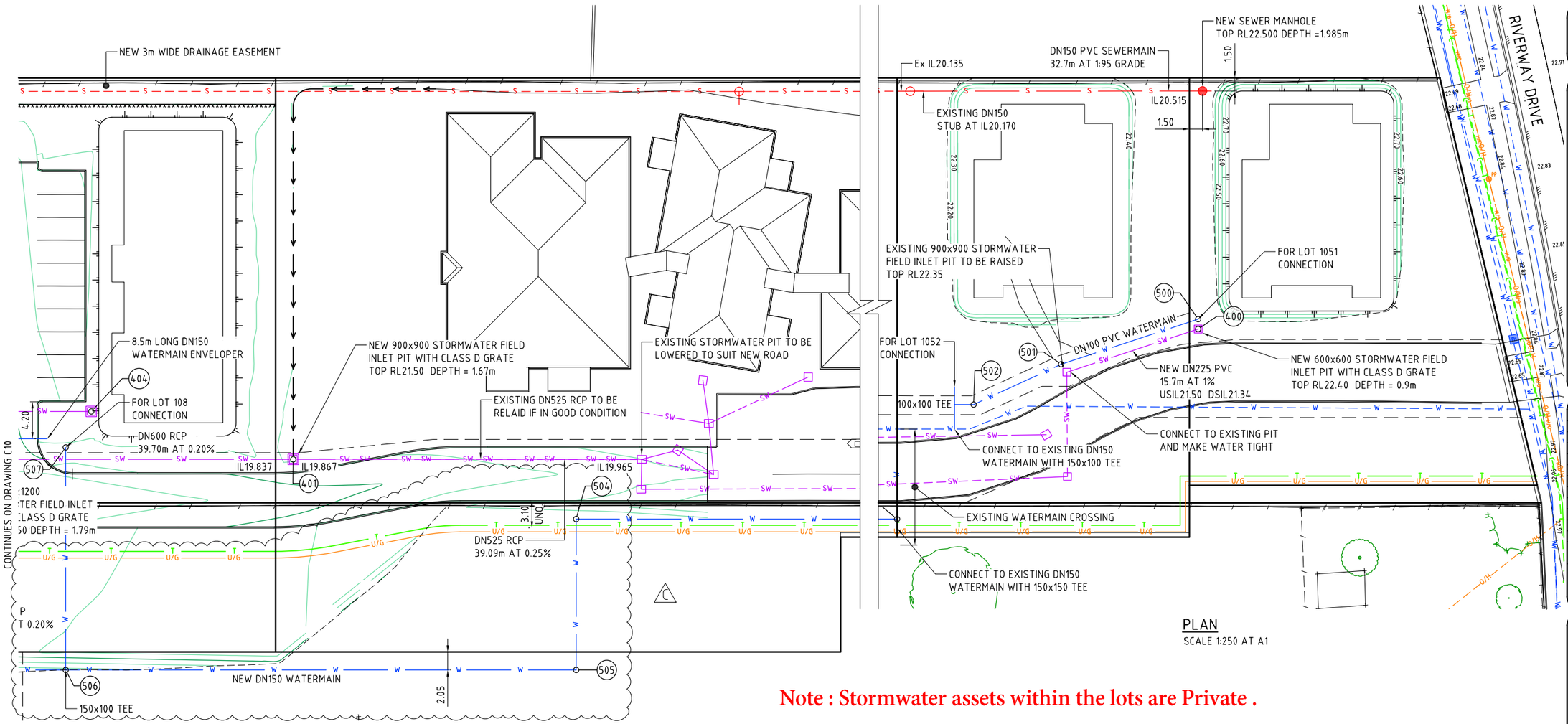
PROJECT
YUMBA-META DEVELOPMENT STAGE 1

1145, 1151 & 1155 RIVERWAY DRIVE RASMUSSEN

DRAWING
EARTHWORKS PLAN - SHEET 3

NUMBER	SHEET NO.	REVISION
ROSE001	C08	C

Plot Date:13/09/2023 3:51 PM User: SThorburn File Name: J:\ROSE\ROSE001 Yumba Meta Development, Rasmussen\CAD\Civil\ROSE001-EARTHWORKS



PLAN
SCALE 1:250 AT A1

PLAN
SCALE 1:250 AT A1

Note : Stormwater assets within the lots are Private .

STORMWATER POINT SETOUT TABLE

POINT NUMBER	PIT NUMBER	EASTING	NORTHING	TOP OF PIT LEVEL	PIT SIZE
400	Setout Point	471862.642	7859782.786	22.40	900x900
401	Setout Point	471706.720	7859782.518	21.50	900x900
402	Setout Point	471667.193	7859786.218	21.50	1200x1200
403	Setout Point	471666.156	7859791.778	21.78	900x900
404	Setout Point	471684.376	7859790.072	21.78	900x900
405	Setout Point	471664.412	7859756.515	19.65	OUTLET
406	Setout Point	471654.244	7859787.430	21.54	HYDROSYSTEM
407	Setout Point	471653.809	7859782.788	21.19	900x900
408	Setout Point	471591.780	7859775.763	21.11	900x900
409	Setout Point	471593.731	7859774.074	21.30	HYDROSYSTEM
410	Setout Point	471591.500	7859772.776	21.30	900x900
411	Setout Point	471590.610	7859763.272	19.50	OUTLET
412	Setout Point	471492.732	7859804.922	19.12	INLET
413	Setout Point	471493.287	7859810.864	20.40	1500x1500
414	Setout Point	471422.640	7859817.463	20.33	1500x1500
415	Setout Point	471427.609	7859869.512	20.16	1500x1500
416	Setout Point	471432.525	7859869.039	19.98	1500x900

WATERMAIN POINT SETOUT TABLE

POINT #	EASTING	NORTHING
500	471862.746	7859783.905
501	471846.773	7859780.257
502	471836.440	7859776.621
503	471826.562	7859764.482
504	471738.095	7859772.763
505	471736.496	7859755.692
506	471678.748	7859761.097
507	471681.105	7859786.276
508	471641.366	7859764.596

Townsville City Council

Accepted Subject to Conditions

OPW23/0071
24/10/2023

LEGEND

- FINISHED SURFACE CONTOURS (0.1m INTERVALS)
- SW — EXISTING STORMWATER
- SW — NEW STORMWATER
- W — NEW WATER MAIN
- E — NEW ELECTRICAL
- C — NEW COMMUNICATIONS
- TOP OF BATTER
- BOTTOM OF BATTER
- RETAINING WALL
- ROCK SCOUR PROTECTION REFER DRG C20 FOR DETAILS
- (218) STORMWATER SETOUT POINT

SAFETY IN DESIGN INFORMATION
THERE MAY BE ADDITIONAL HAZARDS/RISKS NOT NORMALLY ASSOCIATED WITH THE TYPES OF WORK SHOWN ON THIS DRAWING. REFER TO THE SAFETY IN DESIGN REPORT.

-5 0 5 10
SCALE OF METRES 1:250 AT A1 & 1:500 AT A3

REVISION		APP'D	DATE
C	TCC RFI COMMENTS	DEJ	13/09/23
B	ISSUE FOR APPROVAL	DEJ	21/07/23
A	ORIGINAL ISSUE	SLT	14/07/23

FOR APPROVAL

LCJ ENGINEERS
LCJ Engineers Pty Ltd
ABN 54 131 516 446
601 Flinders Street, Townsville QLD 4810
PO Box 1498, Aitkenvale QLD 4814
Tel: (07) 4721 5800
townsville@lcjengineers.com.au
www.lcjengineers.com.au

DRAWN	DESIGNED
SLT	SLT
APPROVED	DATE
D.E.JOHNSTONE	21/07/23
RPEQ:	

CLIENT
YUMBA-META HOUSING ASSOCIATION LTD

PROJECT
YUMBA-META DEVELOPMENT STAGE 1
1145, 1151 & 1155 RIVERWAY DRIVE RASMUSSEN

DRAWING
SERVICES PLAN - SHEET 1

NUMBER	SHEET NO.	REVISION
ROSE001	C09	C

IN

NEW 3m WIDE DRAINAGE EASEMENT

Townsville City Council

Accepted Subject to Conditions

OPW23/0071
24/10/2023

1.50

8.5m LONG DN150
WATERMAIN ENVELOPER

DN375 RCP 17.40m AT 0.5%
DSIL19.905 USIL19.995

DN375 RCP 4.66m AT 0.5%
DSIL19.800 USIL19.825

DN225 RCP 1.5m AT 0.5% MIN.

4.20

IL19.758

IL19.708

NEW 1200x1200
STORMWATER FIELD INLET
PIT WITH CLASS D GRATE
TOP RL21.50 DEPTH = 1.79m

NEW SPEL HYDROSYSTEM 1500
SHS.150D-1500C-04.225.PVC
OR APPROVED EQUIVALENT

DN225 RCP 1.5m AT 0.5% MIN.

NEW 900x900 STORMWATER WITH
CLASS D 'VEE' GRATE
TOP RL21.185 DEPTH = 1.03m

DN375 RCP
13.82m AT 0.5%
USIL20.15 DSIL19.945

FOR LOT 109
CONNECTION

DN600 RCP
29.23m AT 0.20%

NEW 900x900 STORMWATER FIELD
INLET PIT WITH CLASS D GRATE
TOP RL21.10 DEPTH = 1.38m

DN225 RCP 1.5m AT 0.5% MIN.

DN375 RCP 2.1m AT 1%
DSIL19.70 USIL 19.72

NEW SPEL HYDROSYSTEM 1500
SHS.150D-1500C-04.225.PVC
OR APPROVED EQUIVALENT

NEW 900x900 STORMWATER PIT
WITH CLASS D GRATE
TOP RL21.30 DEPTH = 1.65m

DN225 RCP 1.5m AT 0.5% MIN.

IL19.647

150x

DN375 RCP
9.66m AT 0.5%
USIL19.60 DSIL19.65

1m STUB FOR FUTURE
DEVELOPMENT

NEW DN600 RCP PRECAST
OUTLET HEADWALL

403 402 406 507 408 409 410 411 508 506 405 407

CONTINUES ON DRAWING C09

CONTINUES ON DRAWING C11

PLAN
SCALE 1:250 AT A1

Note : Stormwater assets within the lots are Private .

LEGEND

- FINISHED SURFACE CONTOURS (0.1m INTERVALS)
- SW — EXISTING STORMWATER
- SW — NEW STORMWATER
- W — NEW WATER MAIN
- E — NEW ELECTRICAL
- C — NEW COMMUNICATIONS
- TOP OF BATTER
- BOTTOM OF BATTER
- RETAINING WALL
- ROCK SCOUR PROTECTION REFER DRG C20 FOR DETAILS
- (218) STORMWATER SETOUT POINT

SAFETY IN DESIGN INFORMATION
THERE MAY BE ADDITIONAL HAZARDS/RISKS NOT NORMALLY ASSOCIATED WITH THE TYPES OF WORK SHOWN ON THIS DRAWING. REFER TO THE SAFETY IN DESIGN REPORT.

-5 0 5 10
SCALE OF METRES 1:250 AT A1 & 1:500 AT A3

REVISION		APP'D	DATE
C	TCC RFI COMMENTS	DEJ	13/09/23
B	ISSUE FOR APPROVAL	DEJ	21/07/23
A	ORIGINAL ISSUE	SLT	14/07/23

FOR APPROVAL

LCJ ENGINEERS
LCJ Engineers Pty Ltd
ABN 54 131 516 446
601 Flinders Street, Townsville QLD 4810
PO Box 1498, Aitkenvale QLD 4814
Tel: (07) 4721 5800
townsville@lcjengineers.com.au
www.lcjengineers.com.au

DRAWN	DESIGNED
SLT	SLT
APPROVED	DATE
D.E.JOHNSTONE	21/07/23
RPEQ:	

CLIENT
YUMBA-META HOUSING ASSOCIATION LTD

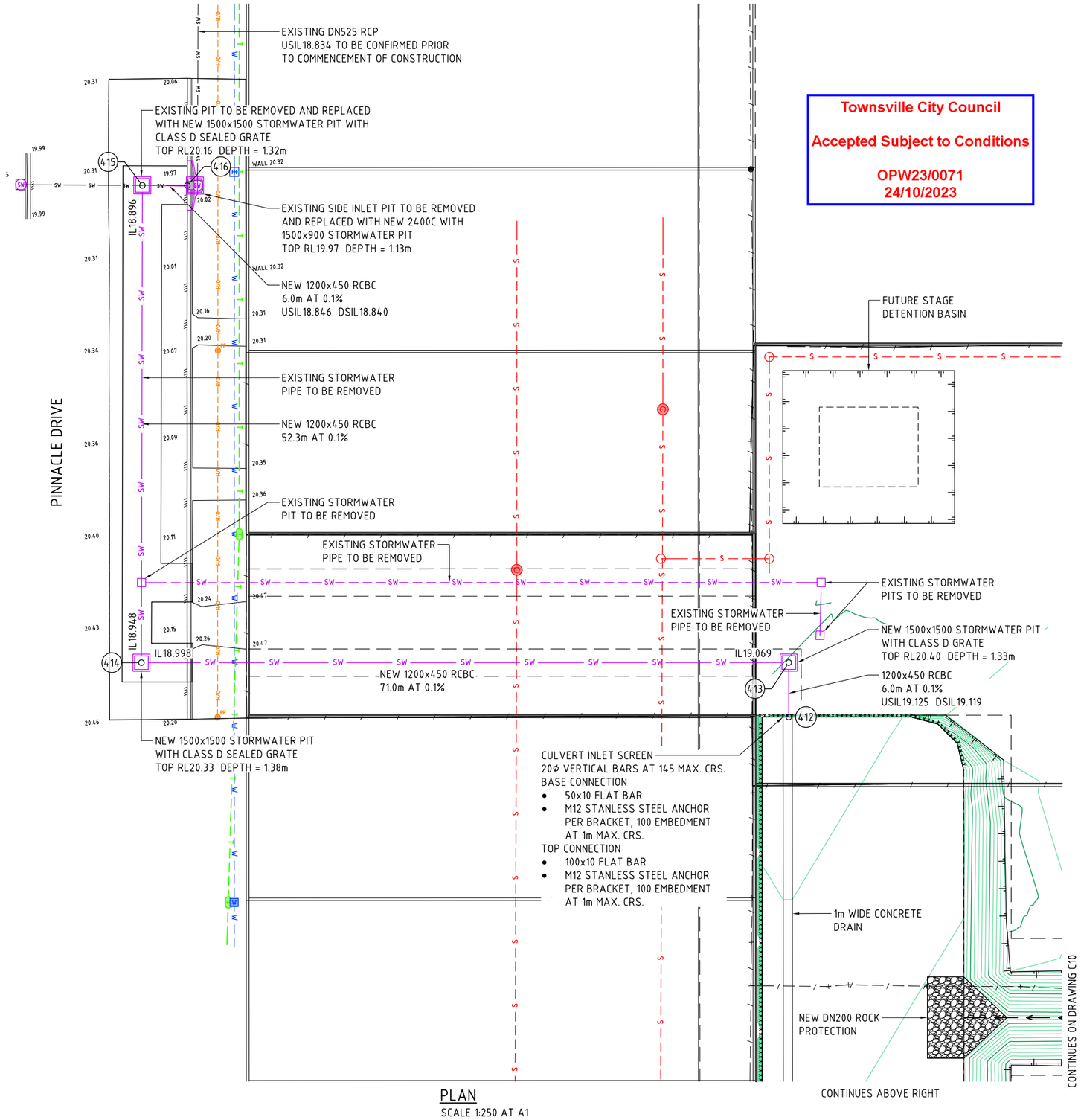
PROJECT
YUMBA-META DEVELOPMENT STAGE 1

1145, 1151 & 1155 RIVERWAY DRIVE RASMUSSEN

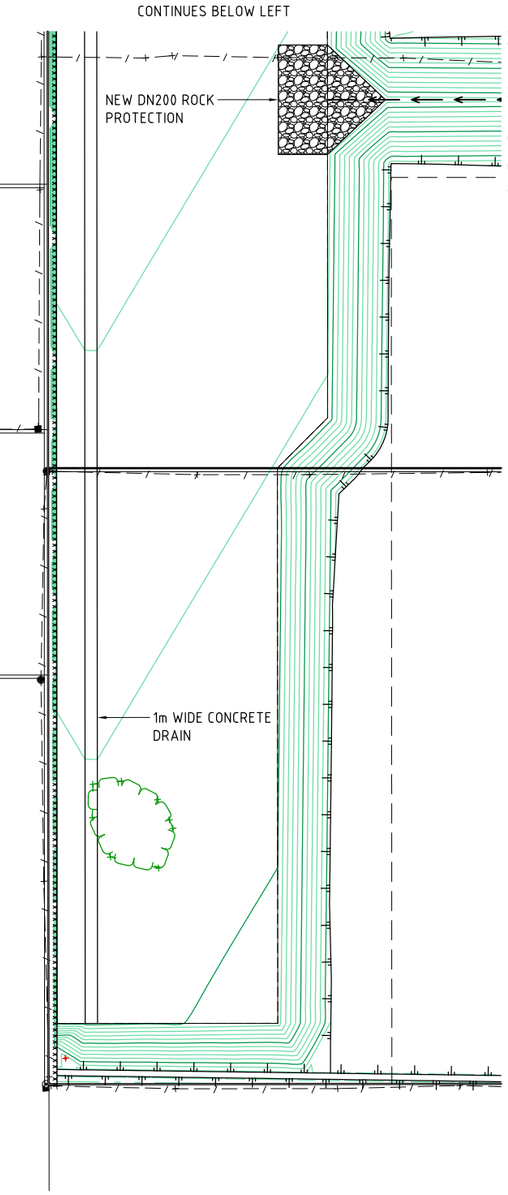
DRAWING
SERVICES PLAN - SHEET 2

NUMBER	SHEET NO.	REVISION
ROSE001	C10	C

Plot Date:13/09/2023 3:51 PM User: SThorburn File Name: J:\ROSE\ROSE001 Yumba Meta Development. Rasmussen\CAD\Civil\ROSE001-CIVIL WORKS



PLAN
SCALE 1:250 AT A1



PLAN
SCALE 1:250 AT A1

LEGEND

- FINISHED SURFACE CONTOURS (0.1m INTERVALS)
- SW — EXISTING STORMWATER
- SW — NEW STORMWATER
- W — NEW WATER MAIN
- E — NEW ELECTRICAL
- C — NEW COMMUNICATIONS
- TOP OF BATTER
- BOTTOM OF BATTER
- RETAINING WALL
- ROCK SCOUR PROTECTION REFER DRG C20 FOR DETAILS
- (218) STORMWATER SETOUT POINT

Townsville City Council

Accepted Subject to Conditions

OPW23/0071
24/10/2023

Note: Stormwater assets downstraem of the detension basin are Public.

SAFETY IN DESIGN INFORMATION
THERE MAY BE ADDITIONAL HAZARDS/RISKS NOT NORMALLY ASSOCIATED WITH THE TYPES OF WORK SHOWN ON THIS DRAWING. REFER TO THE SAFETY IN DESIGN REPORT.

-5 0 5 10
SCALE OF METRES 1:250 AT A1 & 1:500 AT A3

C	TCC RFI COMMENTS	DEJ	13/09/23
B	ISSUE FOR APPROVAL	DEJ	21/07/23
A	ORIGINAL ISSUE	SLT	14/07/23
REVISION		APP'D	DATE

FOR APPROVAL

LCJ ENGINEERS
LCJ Engineers Pty Ltd
ABN 54 131 516 446
601 Flinders Street, Townsville QLD 4810
PO Box 1498, Aitkenvale QLD 4814
Tel: (07) 4721 5800
townsville@lcjengineers.com.au
www.lcjengineers.com.au

DRAWN	DESIGNED
SLT	SLT
APPROVED	DATE
D.E.JOHNSTONE	21/07/23
RPEQ:	

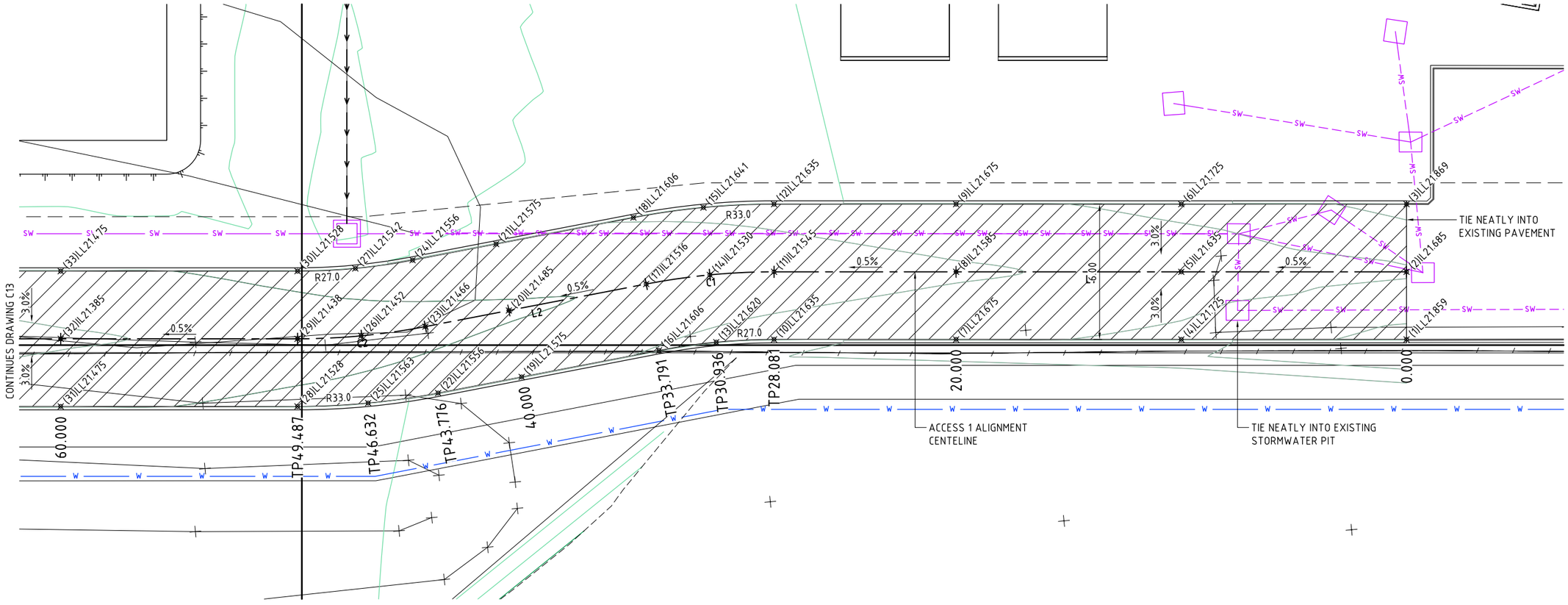
CLIENT
YUMBA-META HOUSING ASSOCIATION LTD

PROJECT
YUMBA-META DEVELOPMENT STAGE 1

1145, 1151 & 1155 RIVERWAY DRIVE RASMUSSEN

DRAWING
SERVICES PLAN - SHEET 3

NUMBER	SHEET NO.	REVISION
ROSE001	C11	C



ROADWORKS PLAN

SCALE 1:100 AT A1

ACCESS-1 ALIGNMENT SETOUT TABLE

Number	CHAINAGE	EASTING	NORTHING	Line/Chord Direction	Radius
L1	0+00.000 0+28.081	471753.403 471725.444	7859776.452 7859779.069	N84° 39' 09.23"W	
C1	0+28.081 0+33.791	471725.444 471719.742	7859779.069 7859779.058	S89° 53' 39.42"W	30.000
L2	0+33.791 0+43.776	471719.742 471709.804	7859779.058 7859778.091	S84° 26' 28.07"W	
C2	0+43.776 0+49.487	471709.804 471704.103	7859778.091 7859778.081	S89° 53' 39.42"W	30.000
L3	0+49.487 1+00.501	471704.103 471653.310	7859778.081 7859782.835	N84° 39' 09.22"W	
C3	1+00.501 1+09.926	471653.310 471645.190	7859782.835 7859787.125	N62° 09' 07.61"W	12.000
L4	1+09.926 1+20.064	471645.190 471638.720	7859787.125 7859794.931	N39° 39' 05.99"W	
C4	1+20.064 1+29.489	471638.720 471630.599	7859794.931 7859799.221	N62° 09' 07.61"W	12.000
L5	1+29.489 1+54.155	471630.599 471606.040	7859799.221 7859801.520	N84° 39' 09.22"W	
C5	1+54.155 1+62.009	471606.040 471600.596	7859801.520 7859797.008	S50° 20' 50.78"W	5.000
L6	1+62.009 1+88.432	471600.596 471598.134	7859797.008 7859770.700	S5° 20' 50.78"W	

ACCESS-2 ALIGNMENT SETOUT TABLE

Number	CHAINAGE	EASTING	NORTHING	Line/Chord Direction	Radius
L7	0+00.000 0+38.500	471674.325 471677.912	7859780.868 7859819.201	N5° 20' 42.11"E	

Townsville City Council

Accepted Subject to Conditions

OPW23/0071
24/10/2023

LEGEND

- NATURAL SURFACE CONTOURS (0.1m INTERVALS)
- (99)LL21425 — (POINT NUMBER) FINISHED SURFACE LEVEL; LL - LIP LEVEL; IL - INVERT LEVEL; CG - CHANGE OF GRADE
- FINISHED SURFACE CONTOURS (0.1m INTERVALS)
- NEW CONCRETE PAVEMENT REFER DRG C19 FOR DETAILS
- NEW ROAD REINSTATEMENT REFER DRG C19 FOR DETAILS
- SW — EXISTING STORMWATER
- SW — NEW STORMWATER
- W — NEW WATER MAIN
- E — NEW ELECTRICAL
- C — NEW COMMUNICATIONS
- TOP OF BATTER
- BOTTOM OF BATTER
- RETAINING WALL

SAFETY IN DESIGN INFORMATION
THERE MAY BE ADDITIONAL HAZARDS/RISKS NOT NORMALLY ASSOCIATED WITH THE TYPES OF WORK SHOWN ON THIS DRAWING. REFER TO THE SAFETY IN DESIGN REPORT.

-2 0 2 4

SCALE OF METRES 1:100 AT A1 & 1:200 AT A3

B	ISSUE FOR APPROVAL	DEJ	21/07/23
A	ORIGINAL ISSUE	SLT	14/07/23
REVISION		APP'D	DATE

FOR APPROVAL

LCJ ENGINEERS
LCJ Engineers Pty Ltd
ABN 54 131 516 446
601 Flinders Street, Townsville QLD 4810
PO Box 1498, Aitkenvale QLD 4814
Tel: (07) 4721 5800
townsville@lcjengineers.com.au
www.lcjengineers.com.au

DRAWN	DESIGNED
SLT	SLT
APPROVED	DATE
D.E.JOHNSTONE	21/07/23
RPEQ:	

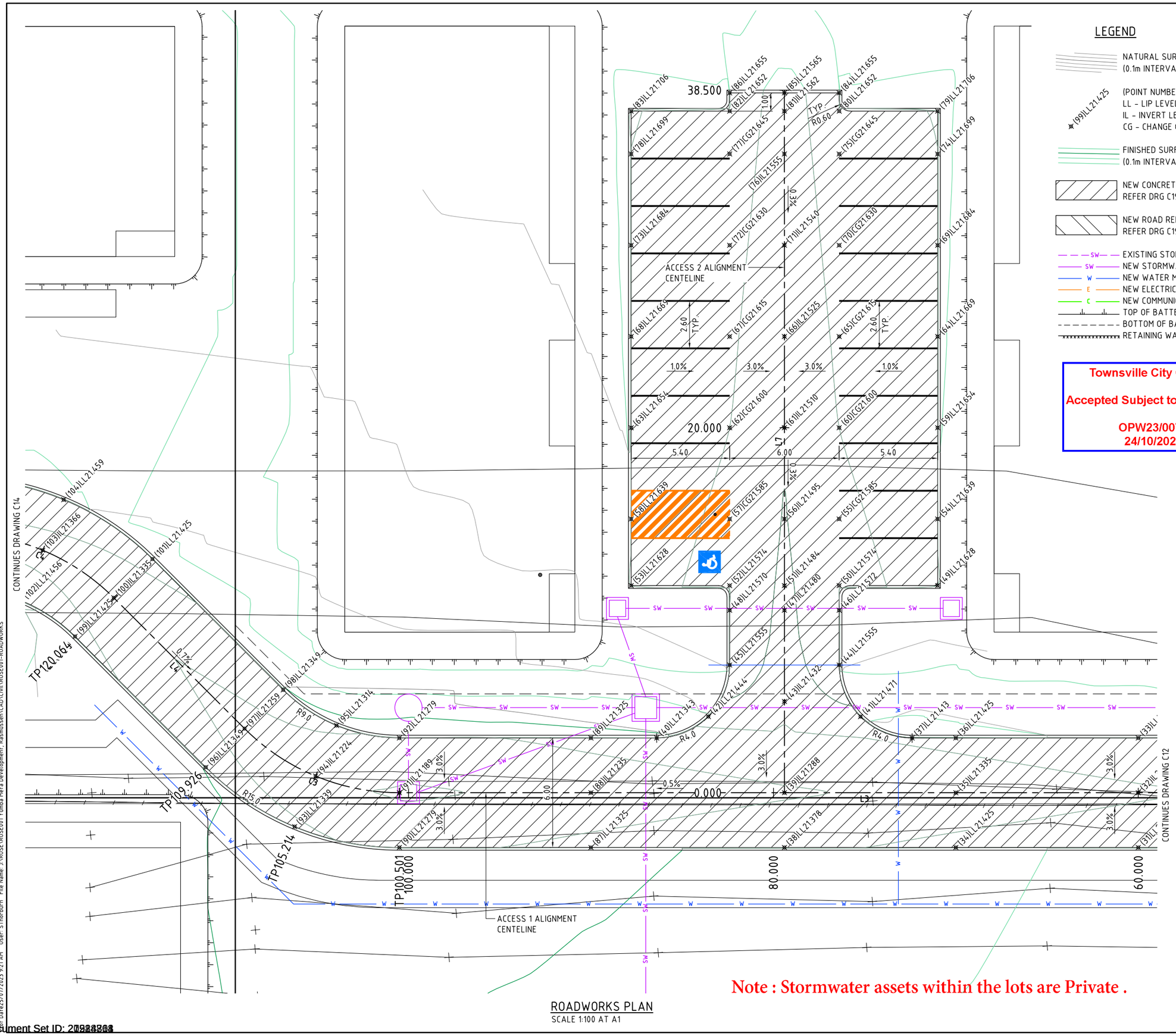
CLIENT
YUMBA-META HOUSING ASSOCIATION LTD

PROJECT
YUMBA-META DEVELOPMENT STAGE 1

1145, 1151 & 1155 RIVERWAY DRIVE RASMUSSEN

DRAWING
ROADWORKS PLANS - SHEET 1

NUMBER	SHEET NO.	REVISION
ROSE001	C12	B



ROADWORKS PLAN
SCALE 1:100 AT A1

Note : Stormwater assets within the lots are Private .

LEGEND

- NATURAL SURFACE CONTOURS (0.1m INTERVALS)
- (99)LL21425 (POINT NUMBER) FINISHED SURFACE LEVEL
  LL - LIP LEVEL
  IL - INVERT LEVEL
  CG - CHANGE OF GRADE
- FINISHED SURFACE CONTOURS (0.1m INTERVALS)
- NEW CONCRETE PAVEMENT REFER DRG C19 FOR DETAILS
- NEW ROAD REINSTATEMENT REFER DRG C19 FOR DETAILS
- SW EXISTING STORMWATER
- SW NEW STORMWATER
- W NEW WATER MAIN
- E NEW ELECTRICAL
- C NEW COMMUNICATIONS
- TOP OF BATTER
- BOTTOM OF BATTER
- RETAINING WALL

Townsville City Council

Accepted Subject to Conditions

OPW23/0071
24/10/2023

SAFETY IN DESIGN INFORMATION
THERE MAY BE ADDITIONAL HAZARDS/RISKS NOT NORMALLY ASSOCIATED WITH THE TYPES OF WORK SHOWN ON THIS DRAWING. REFER TO THE SAFETY IN DESIGN REPORT.

-2 0 2 4
SCALE OF METRES 1:100 AT A1 & 1:200 AT A3

B	ISSUE FOR APPROVAL	DEJ	21/07/23
A	ORIGINAL ISSUE	SLT	14/07/23
REVISION		APP'D	DATE

FOR APPROVAL

LCJ ENGINEERS
LCJ Engineers Pty Ltd
ABN 54 131 516 446
601 Flinders Street, Townsville QLD 4810
PO Box 1498, Aitkenvale QLD 4814
Tel: (07) 4721 5800
townsville@lcjengineers.com.au
www.lcjengineers.com.au

DRAWN	DESIGNED
SLT	SLT
APPROVED	DATE
D.E.JOHNSTONE	21/07/23
RPEQ:	

CLIENT
YUMBA-META HOUSING ASSOCIATION LTD

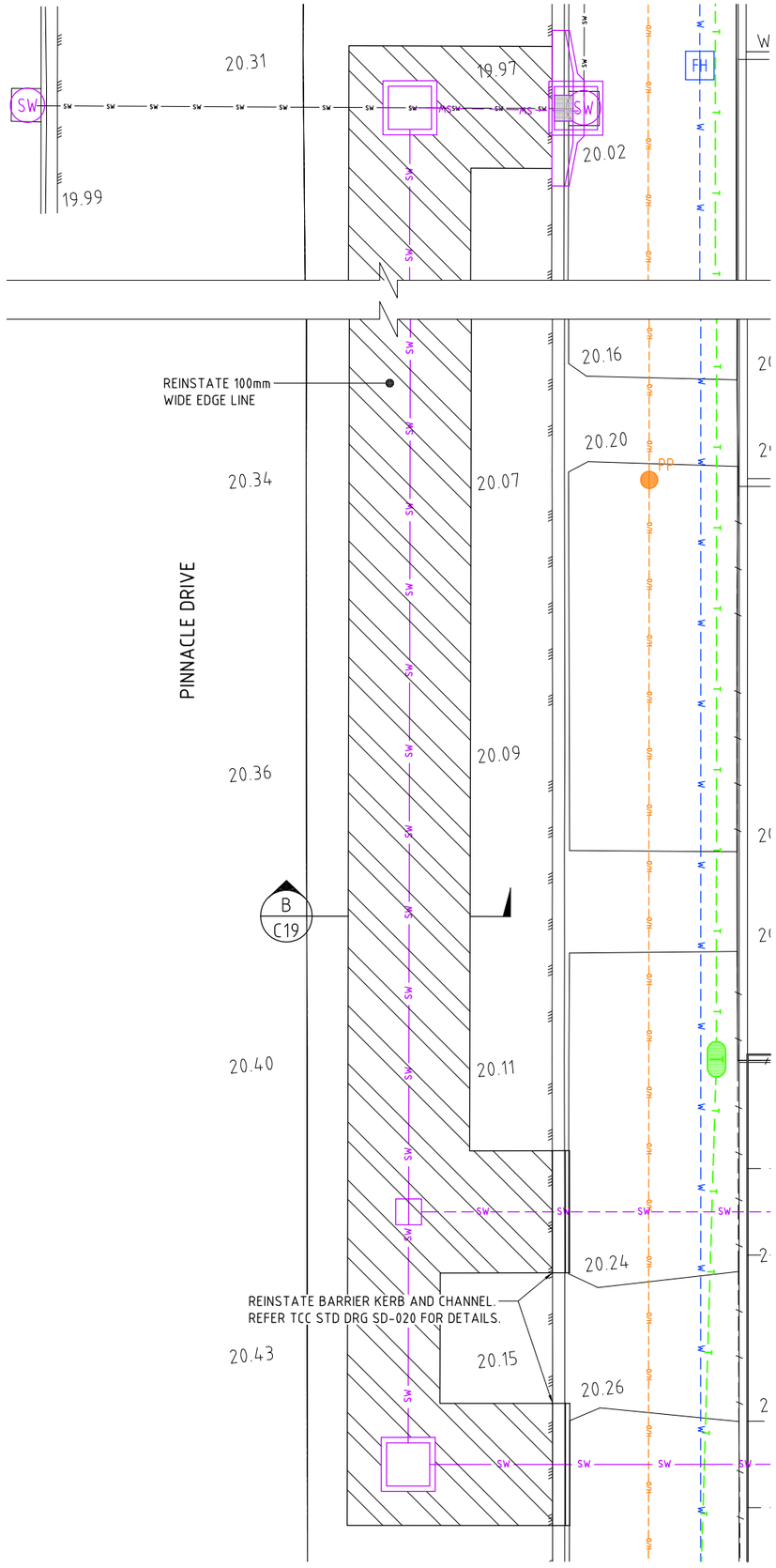
PROJECT
YUMBA-META DEVELOPMENT STAGE 1

1145, 1151 & 1155 RIVERWAY DRIVE RASMUSSEN

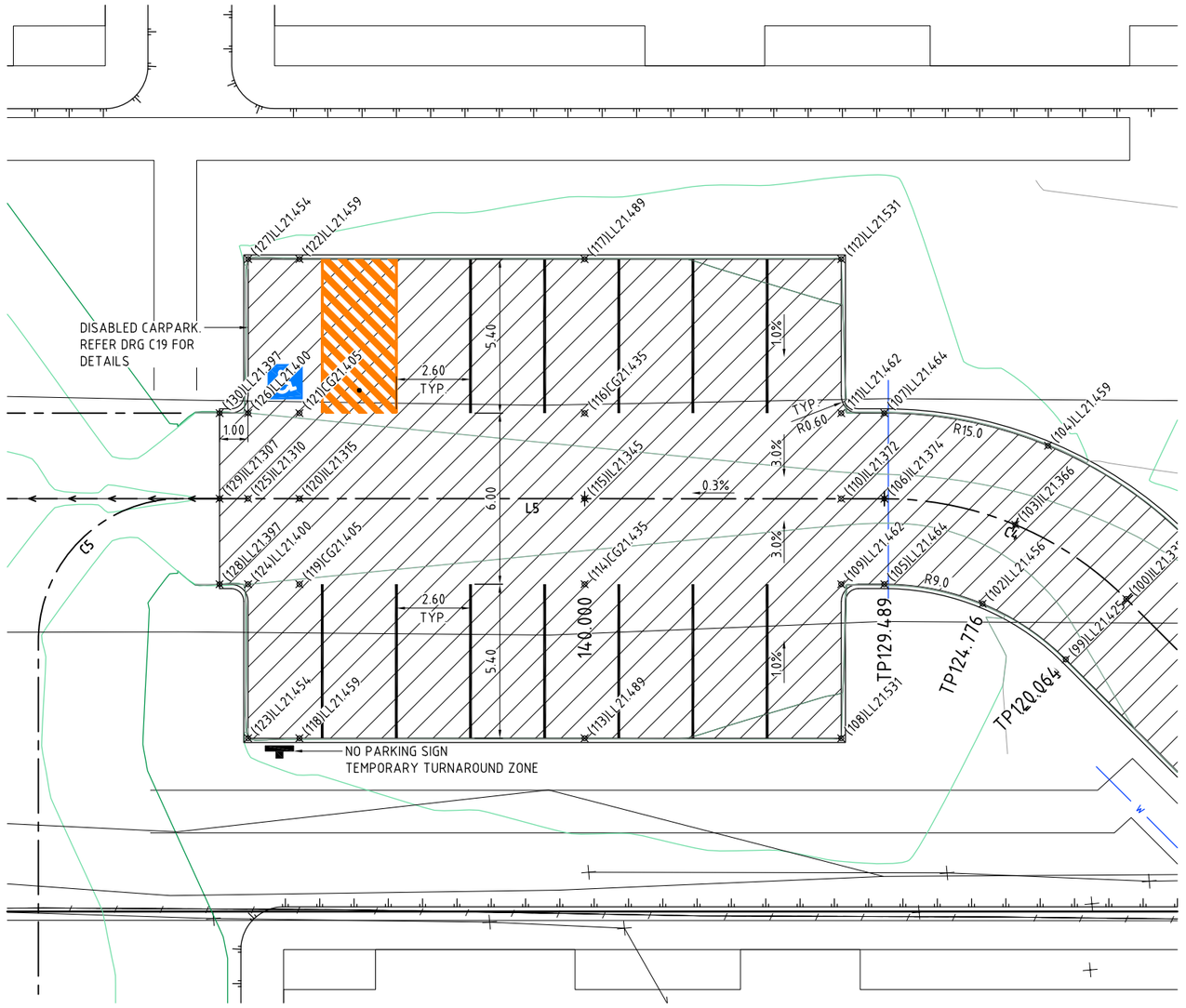
DRAWING
ROADWORKS PLANS - SHEET 2

NUMBER	SHEET NO.	REVISION
ROSE001	C13	B

Plot Date:25/07/2023 9:21 AM User: SThorburn File Name: J:\ROSE\ROSE001 Yumba Meta Development, Rasmussen\CAD\Civil\ROSE001-ROADWORKS



ROADWORKS PLAN
SCALE 1:100 AT A1



ROADWORKS PLAN
SCALE 1:100 AT A1

Townsville City Council

Accepted Subject to Conditions

OPW23/0071
24/10/2023

LEGEND

- NATURAL SURFACE CONTOURS (0.1m INTERVALS)
- (199)LL21.425 — (POINT NUMBER) FINISHED SURFACE LEVEL; LL - LIP LEVEL; IL - INVERT LEVEL; CG - CHANGE OF GRADE
- FINISHED SURFACE CONTOURS (0.1m INTERVALS)
- NEW CONCRETE PAVEMENT REFER DRG C19 FOR DETAILS
- NEW ROAD REINSTATEMENT REFER DRG C19 FOR DETAILS
- SW — EXISTING STORMWATER
- SW — NEW STORMWATER
- W — NEW WATER MAIN
- E — NEW ELECTRICAL
- C — NEW COMMUNICATIONS
- TOP OF BATTER
- BOTTOM OF BATTER
- RETAINING WALL

SAFETY IN DESIGN INFORMATION
THERE MAY BE ADDITIONAL HAZARDS/RISKS NOT NORMALLY ASSOCIATED WITH THE TYPES OF WORK SHOWN ON THIS DRAWING. REFER TO THE SAFETY IN DESIGN REPORT.

-2 0 2 4
SCALE OF METRES 1:100 AT A1 & 1:200 AT A3

B	ISSUE FOR APPROVAL	DEJ	21/07/23
A	ORIGINAL ISSUE	SLT	14/07/23
REVISION		APP'D	DATE

FOR APPROVAL

LCJ ENGINEERS
LCJ Engineers Pty Ltd
ABN 54 131 516 446
601 Flinders Street, Townsville QLD 4810
PO Box 1498, Aitkenvale QLD 4814
Tel: (07) 4721 5800
townsville@lcjengineers.com.au
www.lcjengineers.com.au

DRAWN	DESIGNED
SLT	SLT
APPROVED	DATE
D.E.JOHNSTONE	21/07/23
RPEQ:	

CLIENT
YUMBA-META HOUSING ASSOCIATION LTD

PROJECT
YUMBA-META DEVELOPMENT STAGE 1

1145, 1151 & 1155 RIVERWAY DRIVE RASMUSSEN

DRAWING
ROADWORKS PLANS - SHEET 3

NUMBER	SHEET NO.	REVISION
ROSE001	C14	B

Plot Date:25/07/2023 9:21 AM User: SThorburn File Name: J:\ROSE\ROSE001 Yumba Meta Development, Rasmussen\CAD\Civil\ROSE001-ROADWORKS

LIP LEVEL SETOUTS

POINT #	EASTING	NORTHING	LEVEL
1	471753.123	7859773.465	21.86
3	471753.683	7859779.439	21.87
4	471743.167	7859774.397	21.72
6	471743.726	7859780.371	21.73
7	471733.210	7859775.329	21.68
9	471733.770	7859781.303	21.68
10	471725.165	7859776.082	21.63
12	471725.724	7859782.056	21.63
13	471722.599	7859776.199	21.62
15	471722.588	7859782.199	21.64
16	471720.033	7859776.073	21.61
18	471719.452	7859782.044	21.61
19	471713.854	7859775.471	21.58
21	471713.272	7859781.443	21.58
22	471710.095	7859775.105	21.56
24	471709.514	7859781.077	21.56
25	471706.959	7859774.950	21.56
27	471706.948	7859780.950	21.54
28	471703.823	7859775.094	21.53
30	471704.382	7859781.068	21.53
31	471693.356	7859776.074	21.48
33	471693.915	7859782.047	21.48
34	471683.399	7859777.005	21.42
36	471683.958	7859782.979	21.42
37	471681.574	7859783.203	21.41
38	471674.046	7859777.881	21.38
40	471667.635	7859784.507	21.34
41	471678.867	7859784.633	21.47
42	471670.561	7859785.410	21.44
44	471677.964	7859787.558	21.56
45	471671.991	7859788.117	21.55
46	471678.244	7859790.545	21.57
48	471672.270	7859791.104	21.57
49	471683.746	7859791.386	21.63
50	471678.370	7859791.889	21.57
52	471672.393	7859792.448	21.57
53	471667.019	7859792.951	21.63
54	471684.086	7859795.020	21.64
58	471667.359	7859796.585	21.64
59	471684.552	7859799.999	21.65
63	471667.825	7859801.564	21.65
64	471685.017	7859804.977	21.67
68	471668.291	7859806.542	21.67
69	471685.483	7859809.955	21.68
73	471668.756	7859811.521	21.68
74	471685.949	7859814.933	21.70
78	471669.222	7859816.499	21.70
79	471686.168	7859817.273	21.71
80	471680.794	7859817.776	21.65
82	471674.817	7859818.335	21.65

LIP LEVEL SETOUTS

POINT #	EASTING	NORTHING	LEVEL
83	471669.441	7859818.838	21.71
84	471680.885	7859818.772	21.66
85	471677.898	7859819.051	21.57
86	471674.911	7859819.331	21.66
87	471663.486	7859778.869	21.32
89	471664.045	7859784.843	21.32
90	471653.031	7859779.848	21.28
92	471653.590	7859785.822	21.28
93	471647.422	7859781.520	21.34
95	471650.225	7859786.825	21.31
96	471642.880	7859785.211	21.35
98	471647.499	7859789.040	21.35
99	471636.411	7859793.016	21.43
101	471641.030	7859796.845	21.43
102	471633.685	7859795.231	21.46
104	471636.488	7859800.536	21.46
105	471630.320	7859796.234	21.46
107	471630.879	7859802.208	21.46
108	471628.312	7859790.999	21.53
109	471628.815	7859796.375	21.46
111	471629.375	7859802.349	21.46
112	471629.878	7859807.725	21.53
113	471619.351	7859791.837	21.49
117	471620.917	7859808.564	21.49
118	471609.395	7859792.769	21.46
122	471610.960	7859809.496	21.46
123	471607.603	7859792.937	21.45
124	471608.106	7859798.313	21.40
126	471608.665	7859804.287	21.40
127	471609.168	7859809.664	21.45
128	471607.110	7859798.407	21.40
130	471607.669	7859804.381	21.40

INVERT LEVEL SETOUTS

POINT #	EASTING	NORTHING	LEVEL
2	471753.403	7859776.452	21.69
5	471743.447	7859777.384	21.64
8	471733.490	7859778.316	21.59
11	471725.444	7859779.069	21.54
14	471722.593	7859779.199	21.53
17	471719.742	7859779.058	21.52
20	471713.563	7859778.457	21.49
23	471709.804	7859778.091	21.47
26	471706.929	7859777.950	21.45
29	471704.103	7859778.081	21.44
32	471693.635	7859779.060	21.39
35	471683.679	7859779.992	21.34
39	471674.326	7859780.868	21.29
43	471674.791	7859785.846	21.43
47	471675.257	7859790.824	21.48
51	471675.383	7859792.169	21.48
56	471675.723	7859795.803	21.50
61	471676.188	7859800.781	21.51
66	471676.654	7859805.760	21.53
71	471677.120	7859810.738	21.54
76	471677.586	7859815.716	21.56
81	471677.804	7859818.055	21.56
88	471663.766	7859781.856	21.24
91	471653.310	7859782.835	21.19
94	471648.823	7859784.172	21.22
97	471645.190	7859787.125	21.26
100	471638.720	7859794.931	21.34
103	471635.087	7859797.884	21.37
106	471630.599	7859799.221	21.37
110	471629.095	7859799.361	21.37
115	471620.134	7859800.201	21.35
120	471610.178	7859801.133	21.32
125	471608.386	7859801.300	21.31
129	471607.390	7859801.394	21.31

CHANGE OF GRADE SETOUTS

POINT #	EASTING	NORTHING	LEVEL
55	471678.710	7859795.523	21.59
57	471672.734	7859796.083	21.59
60	471679.176	7859800.502	21.60
62	471673.200	7859801.061	21.60
65	471679.643	7859805.480	21.62
67	471673.666	7859806.040	21.62
70	471680.109	7859810.458	21.63
72	471674.132	7859811.018	21.63
75	471680.575	7859815.437	21.65
77	471674.598	7859815.996	21.65
114	471619.854	7859797.214	21.44
116	471620.414	7859803.188	21.44
119	471609.898	7859798.146	21.41
121	471610.457	7859804.120	21.41

Townsville City Council

Accepted Subject to Conditions

OPW23/0071
24/10/2023

SAFETY IN DESIGN INFORMATION
THERE MAY BE ADDITIONAL HAZARDS/RISKS NOT NORMALLY ASSOCIATED WITH THE TYPES OF WORK SHOWN ON THIS DRAWING. REFER TO THE SAFETY IN DESIGN REPORT.

B	ISSUE FOR APPROVAL	DEJ	21/07/23
A	ORIGINAL ISSUE	SLT	14/07/23
REVISION		APP'D	DATE

FOR APPROVAL

LCJ ENGINEERS
LCJ Engineers Pty Ltd
ABN 54 131 516 446
601 Flinders Street, Townsville QLD 4810
PO Box 1498, Aitkenvale QLD 4814
Tel: (07) 4721 5800
townsville@lcjengineers.com.au
www.lcjengineers.com.au

DRAWN	DESIGNED
SLT	SLT
APPROVED	DATE
D.E.JOHNSTONE	21/07/23
RPEQ:	

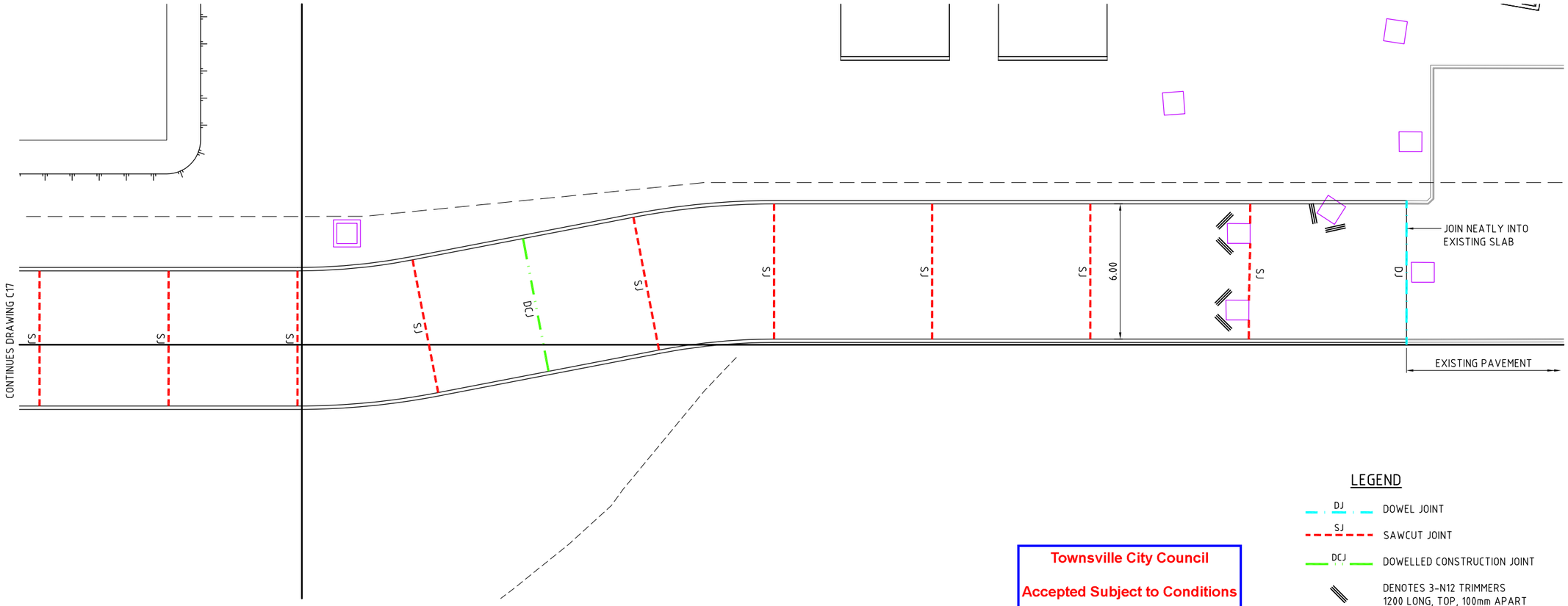
CLIENT
YUMBA-META HOUSING ASSOCIATION LTD

PROJECT
YUMBA-META DEVELOPMENT STAGE 1

1145, 1151 & 1155 RIVERWAY DRIVE RASMUSSEN

DRAWING
ROADWORKS SETOUT TABLES

NUMBER	SHEET NO.	REVISION
ROSE001	C15	B



JOINTS PLAN
SCALE 1:100 AT A1

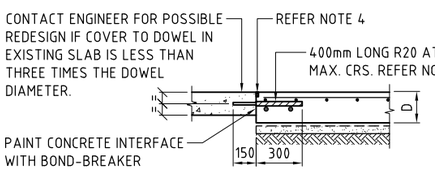
LEGEND

- DJ — DOWEL JOINT
- SJ — SAWCUT JOINT
- DCJ — DOWELLED CONSTRUCTION JOINT
- DENOTES 3-N12 TRIMMERS 1200 LONG, TOP, 100mm APART

Townsville City Council

Accepted Subject to Conditions

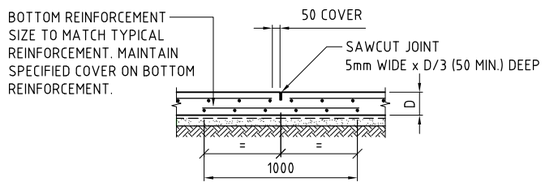
OPW23/0071
24/10/2023



NEW - EXIST. DOWEL JOINT (D.J.)
SCALE 1:20 AT A1

DOWEL NOTES:

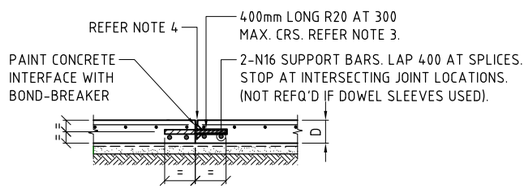
1. GALVANISE DOWELS IN EXTERNAL APPLICATIONS.
2. DOWELS SHALL BE SQUARE CUT (NOT SHEARED) PLACED HORIZONTALLY AND SQUARE TO THE JOINT U.N.O. DOWELS IN SKEWED JOINT MUST BE ALIGNED PARALLEL TO THE DIRECTION OF THE LONGITUDINAL JOINT.
3. PROVIDE 'DENSO' TAPE OR ALTERNATIVELY PROVIDE GREASE AND PVC SLEEVE TO EACH DOWEL ON ONE SIDE OF CONSTRUCTION JOINT. TAPE AND/OR GREASE TO EXTEND 25mm PAST CONCRETE INTERFACE ON NON-SLEEVED SIDE OF JOINT.
4. MAKE 10 WIDE x 20 DEEP GROOVE WHEN CONCRETE IS PLACED. FIT BACKING ROD AND 10x10 SILICONE SEALANT COMPLYING WITH TCC CITY PLAN SPECIFICATION TO SUIT PERMANENT SEALING.



SAWCUT JOINT (S.J.)
SCALE 1:20 AT A1

SAWCUT NOTES:

1. SAWCUT TIMING TO SUIT CONCRETE MIX, CONCRETE PLACEMENT TECHNIQUE, ENVIRONMENTAL CONDITIONS AT POURING, CURING AND ABILITY OF SLABS TO SUPPORT SAW CUTTING EQUIPMENT. NOTWITHSTANDING THE ABOVE, ALL SAW CUTTING SHALL BE COMPLETED WITHIN 12 HOURS OF PLACING CONCRETE IF CONVENTIONAL CUTTING IS USED. IF SOFF CUT EQUIPMENT IS USED CUT IN ACCORDANCE WITH OPERATING MANUAL GUIDELINES BUT NO LATER THAN 2 HOURS AFTER PLACEMENT.
2. WHERE SAWCUT CANNOT EXTEND TO FACE OF EXISTING STRUCTURES TROWEL THROUGH WET CONCRETE TO ENSURE NO AGGREGATE CROSSES THE JOINT.



DOWELLED CONSTRUCTION JOINT (D.C.J)
SCALE 1:20 AT A1

DOWEL NOTES:

1. GALVANISE DOWELS IN EXTERNAL APPLICATIONS.
2. DOWELS SHALL BE SQUARE CUT (NOT SHEARED) PLACED HORIZONTALLY AND SQUARE TO THE JOINT U.N.O. DOWELS IN SKEWED JOINT MUST BE ALIGNED PARALLEL TO THE DIRECTION OF THE LONGITUDINAL JOINT.
3. PROVIDE 'DENSO' TAPE OR ALTERNATIVELY PROVIDE GREASE AND PVC SLEEVE TO EACH DOWEL ON ONE SIDE OF CONSTRUCTION JOINT. TAPE AND/OR GREASE TO EXTEND 25mm PAST CONCRETE INTERFACE ON NON-SLEEVED SIDE OF JOINT.
4. MAKE 10 WIDE x 20 DEEP GROOVE WHEN CONCRETE IS PLACED. FIT BACKING ROD AND 10x10 SILICONE SEALANT COMPLYING WITH TCC CITY PLAN SPECIFICATION TO SUIT PERMANENT SEALING.

SAFETY IN DESIGN INFORMATION
THERE MAY BE ADDITIONAL HAZARDS/RISKS NOT NORMALLY ASSOCIATED WITH THE TYPES OF WORK SHOWN ON THIS DRAWING. REFER TO THE SAFETY IN DESIGN REPORT.

-2 0 2 4
SCALE OF METRES 1:100 AT A1
& 1:200 AT A3

B	ISSUE FOR APPROVAL	DEJ	21/07/23
A	ORIGINAL ISSUE	SLT	14/07/23
REVISION		APP'D	DATE

FOR APPROVAL

LCJ ENGINEERS
LCJ Engineers Pty Ltd
ABN 54 131 516 446
601 Flinders Street, Townsville QLD 4810
PO Box 1498, Aitkenvale QLD 4814
Tel: (07) 4721 5800
townsville@lcjengineers.com.au
www.lcjengineers.com.au

DRAWN	DESIGNED
SLT	SLT
APPROVED	DATE
D.E.JOHNSTONE	21/07/23
RPEQ:	

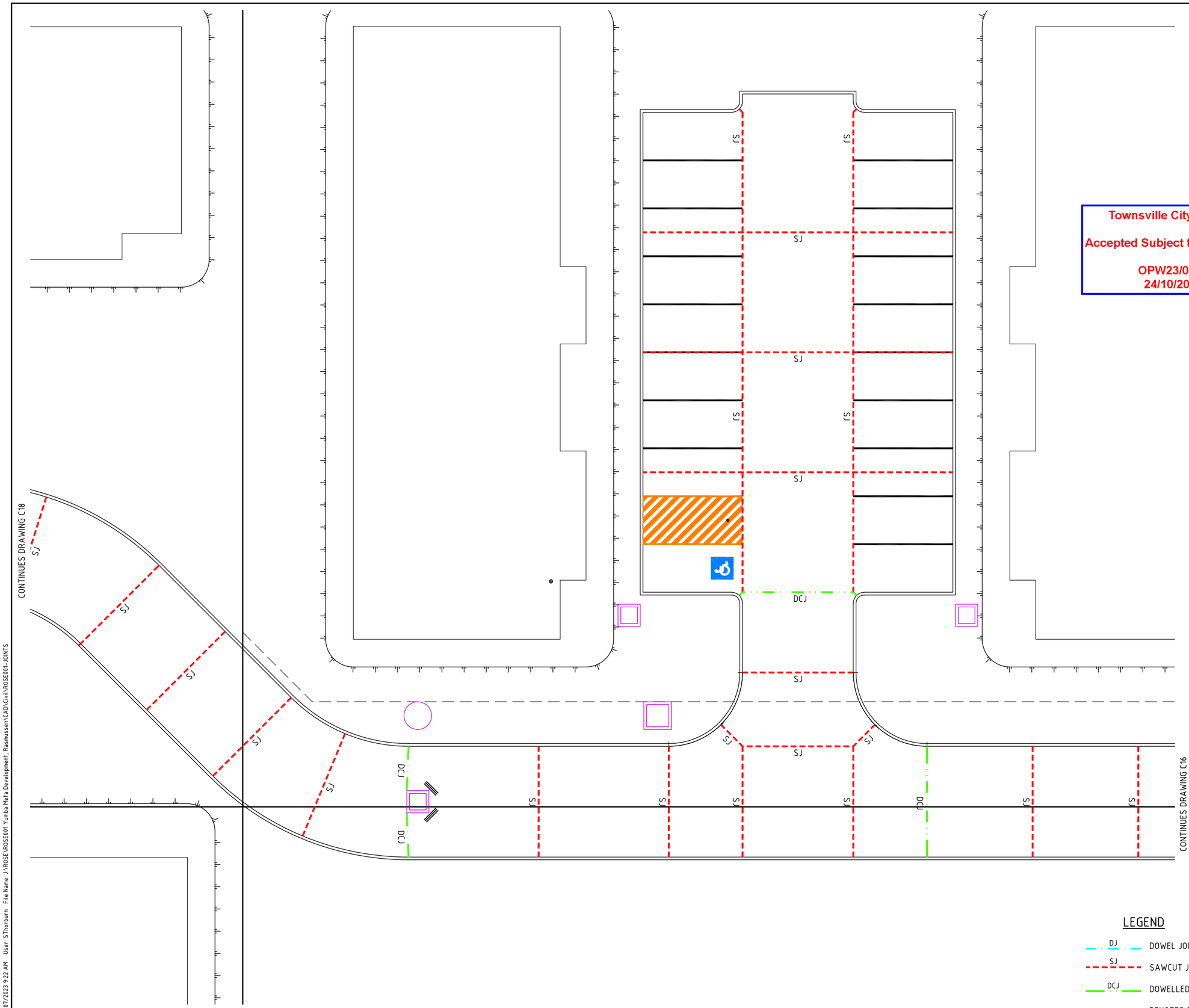
CLIENT
YUMBA-META HOUSING ASSOCIATION LTD

PROJECT
YUMBA-META DEVELOPMENT STAGE 1

1145, 1151 & 1155 RIVERWAY DRIVE RASMUSSEN

DRAWING
CONCRETE JOINTS PLAN - SHEET 1

NUMBER	SHEET NO.	REVISION
ROSE001	C16	B



JOINTS PLAN
SCALE 1:100 AT A1

LEGEND

- DJ — DOWEL JOINT
- SJ — SAWCUT JOINT
- DCJ — DOWELLED CONSTRUCTION JOINT
- DENOTES 3-N12 TRIMMERS 1200 LONG, TOP, 100mm APART

Townsville City Council

Accepted Subject to Conditions

OPW23/0071
24/10/2023

SAFETY IN DESIGN INFORMATION
THERE MAY BE ADDITIONAL HAZARDS/RISKS NOT NORMALLY ASSOCIATED WITH THE TYPES OF WORK SHOWN ON THIS DRAWING. REFER TO THE SAFETY IN DESIGN REPORT.

-2 0 2 4
SCALE OF METRES 1:100 AT A1
& 1:200 AT A3

B	ISSUE FOR APPROVAL	DEJ	21/07/23
A	ORIGINAL ISSUE	SLT	14/07/23
	REVISION	APP'D	DATE

FOR APPROVAL

LCJ ENGINEERS
LCJ Engineers Pty Ltd
ABN 54 131 516 446
601 Flinders Street, Townsville QLD 4810
PO Box 1498, Aitkenvale QLD 4814
Tel: (07) 4721 5800
townsville@lcjengineers.com.au
www.lcjengineers.com.au

DRAWN	DESIGNED
SLT	SLT
APPROVED	DATE
D.E.JOHNSTONE	21/07/23
RPEQ:	

CLIENT
YUMBA-META HOUSING ASSOCIATION LTD

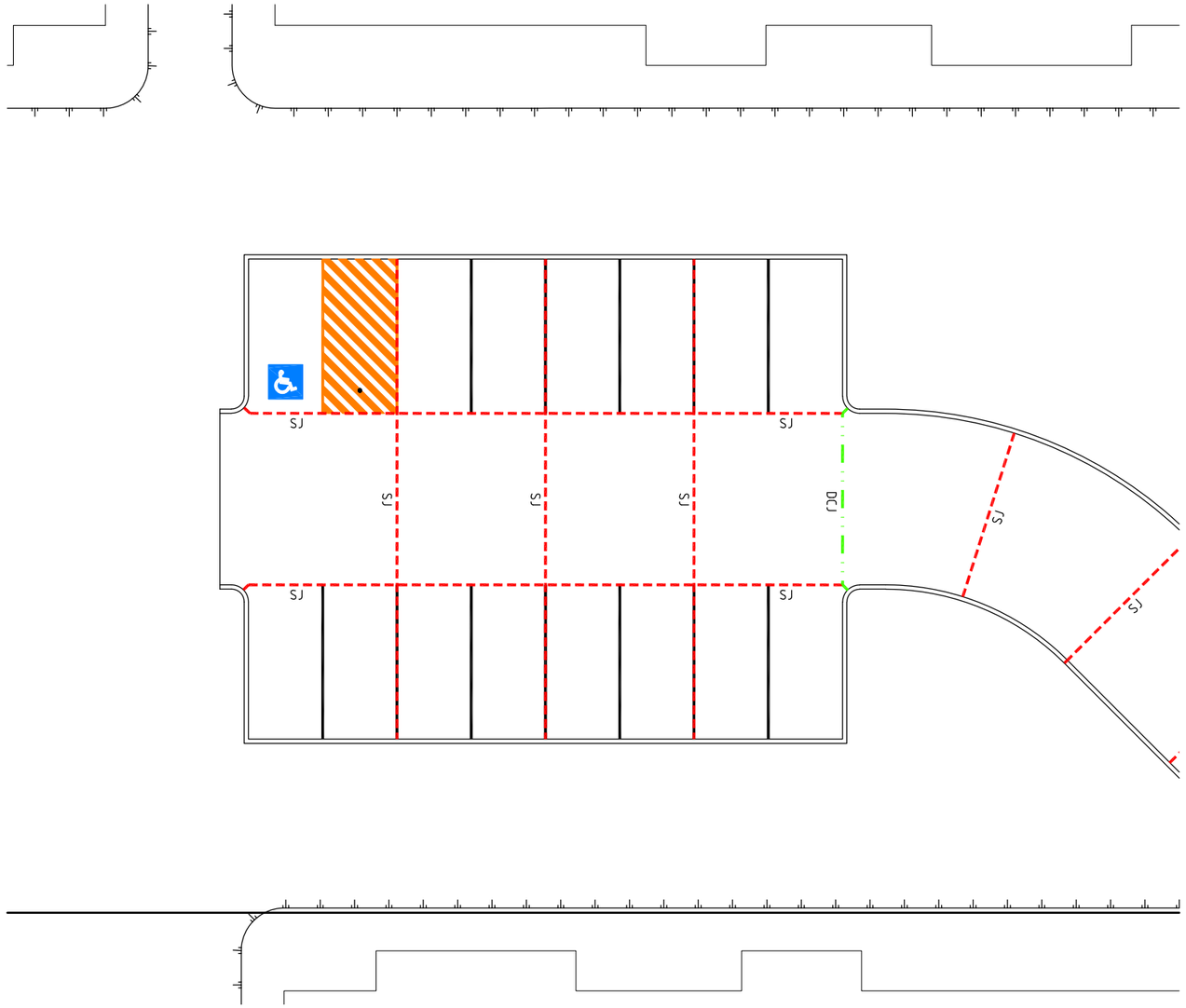
PROJECT
YUMBA-META DEVELOPMENT STAGE 1

1145, 1151 & 1155 RIVERWAY DRIVE RASMUSSEN

DRAWING
CONCRETE JOINTS PLAN - SHEET 2

NUMBER	SHEET NO.	REVISION
ROSE001	C17	B

Plot Date:25/07/2023 9:22 AM User: SThorburn File Name: J:\ROSE\ROSE001 Yumba Meta Development, Rasmussen\CAD\Civil\ROSE001-JOINTS



JOINTS PLAN
SCALE 1:100 AT A1

LEGEND

- DJ — DOWEL JOINT
- SJ — SAWCUT JOINT
- DCJ — DOWELLED CONSTRUCTION JOINT
- DENOTES 3-N12 TRIMMERS 1200 LONG, TOP, 100mm APART

Townsville City Council

Accepted Subject to Conditions

OPW23/0071
24/10/2023

SAFETY IN DESIGN INFORMATION
THERE MAY BE ADDITIONAL HAZARDS/RISKS NOT NORMALLY ASSOCIATED WITH THE TYPES OF WORK SHOWN ON THIS DRAWING. REFER TO THE SAFETY IN DESIGN REPORT.

-2 0 2 4
SCALE OF METRES 1:100 AT A1 & 1:200 AT A3

	REVISION	APP'D	DATE
B	ISSUE FOR APPROVAL	DEJ	21/07/23
A	ORIGINAL ISSUE	SLT	14/07/23

FOR APPROVAL

JAS-ANZ ISO 9001 www.imiicert.com

LCJ ENGINEERS
LCJ Engineers Pty Ltd
ABN 54 131 516 446
601 Flinders Street, Townsville QLD 4810
PO Box 1498, Aitkenvale QLD 4814
Tel: (07) 4721 5800
townsville@lcjengineers.com.au
www.lcjengineers.com.au

DRAWN	DESIGNED
SLT	SLT
APPROVED	DATE
D.E.JOHNSTONE	21/07/23
RPEQ:	

CLIENT
YUMBA-META HOUSING ASSOCIATION LTD

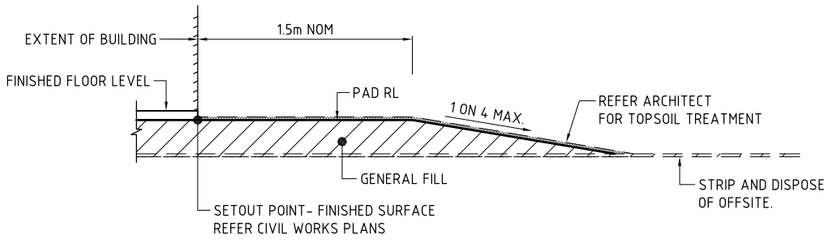
PROJECT
YUMBA-META DEVELOPMENT STAGE 1

1145, 1151 & 1155 RIVERWAY DRIVE RASMUSSEN

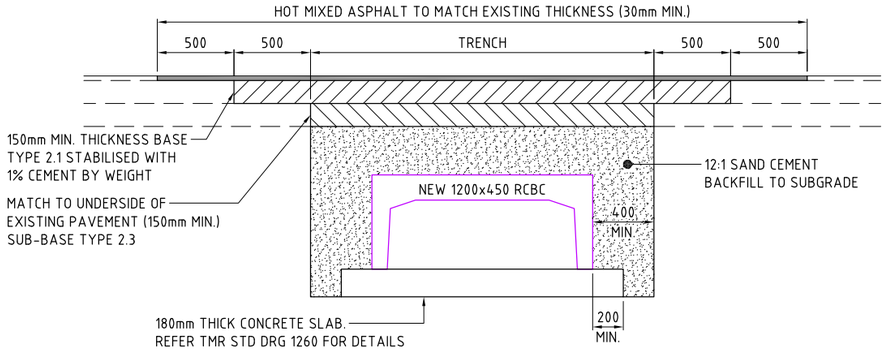
DRAWING
CONCRETE JOINTS PLAN - SHEET 3

NUMBER	SHEET NO.	REVISION
ROSE001	C18	B

Plot Date:25/07/2023 9:22 AM User: SThorburn File Name: J:\ROSE\ROSE001 Yumba Meta Development, Rasmussen\CAD\Civil\ROSE001-JOINTS



TYPICAL BUILDING PAD
SCALE: 1:50



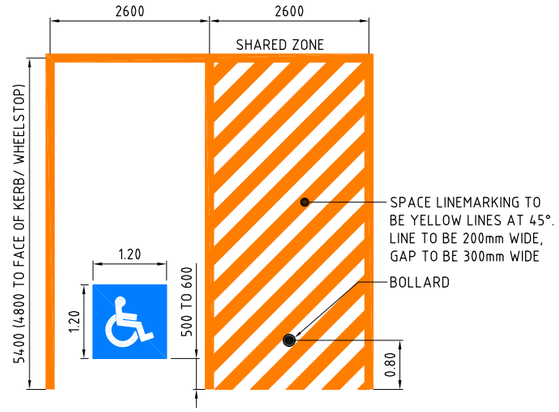
ROAD REINSTATEMENT DETAIL

SECTION B/C14
SCALE 1: 20

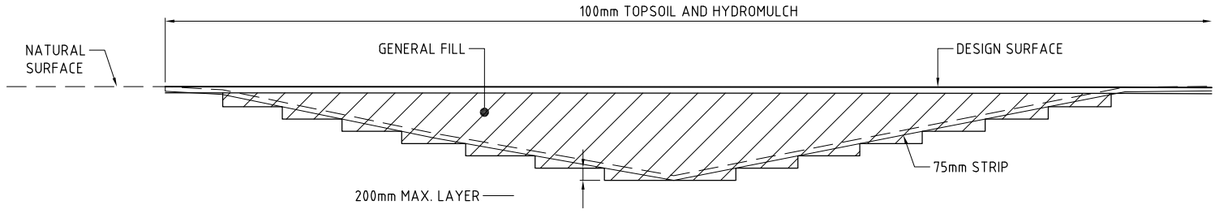
Townsville City Council

Accepted Subject to Conditions

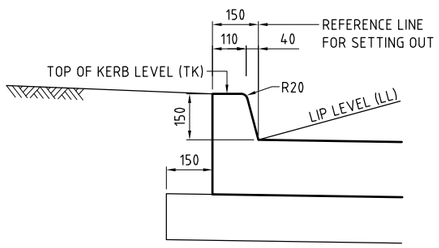
OPW23/0071
24/10/2023



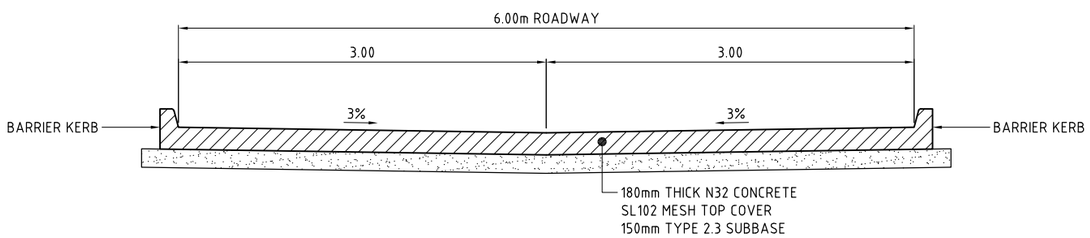
TYPICAL DISABLED PARKING DETAIL
SCALE 1:50 AT A1



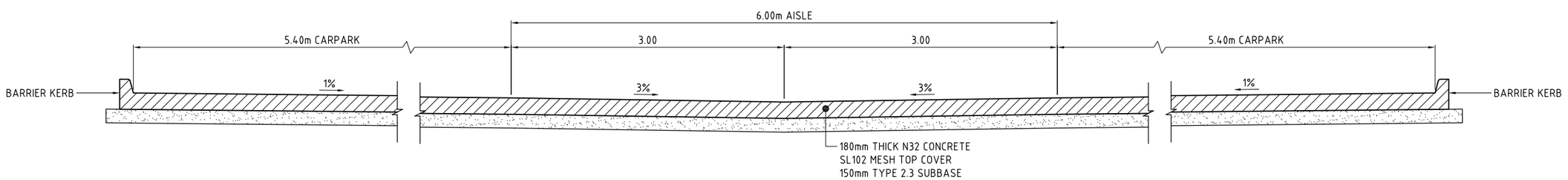
TYPICAL SWALE DRAIN BACKFILL DETAIL
SCALE 1:50 AT A1



BARRIER KERB
SCALE 1:10 AT A1



ROADWAY TYPE CROSS SECTION
SCALE 1:25 AT A1



CARPARK TYPE CROSS SECTION
SCALE 1:25 AT A1

SAFETY IN DESIGN INFORMATION
THERE MAY BE ADDITIONAL HAZARDS/RISKS NOT NORMALLY ASSOCIATED WITH THE TYPES OF WORK SHOWN ON THIS DRAWING. REFER TO THE SAFETY IN DESIGN REPORT.

-0.2 0 0.2 0.4
SCALE OF METRES 1:10 AT A1
& 1:20 AT A3

-0.4 0 0.4 0.8
SCALE OF METERS 1:20 AT A1
& 1:40 AT A3

-0.5 0 0.5 1
SCALE OF METRES 1:25 AT A1
& 1:50 AT A3

-1 0 1 2
SCALE OF METRES 1:50 AT A1
& 1:100 AT A3

B	ISSUE FOR APPROVAL	DEJ	21/07/23
A	ORIGINAL ISSUE	SLT	14/07/23
REVISION		APP'D	DATE

FOR APPROVAL

LCJ ENGINEERS
LCJ Engineers Pty Ltd
ABN 54 131 516 446
601 Flinders Street, Townsville QLD 4810
PO Box 1498, Aitkenvale QLD 4814
Tel: (07) 4721 5800
townsville@lcjengineers.com.au
www.lcjengineers.com.au

DRAWN	DESIGNED
SLT	SLT
APPROVED	DATE
D.E.JOHNSTONE	21/07/23
RPEQ:	

CLIENT
YUMBA-META HOUSING ASSOCIATION LTD

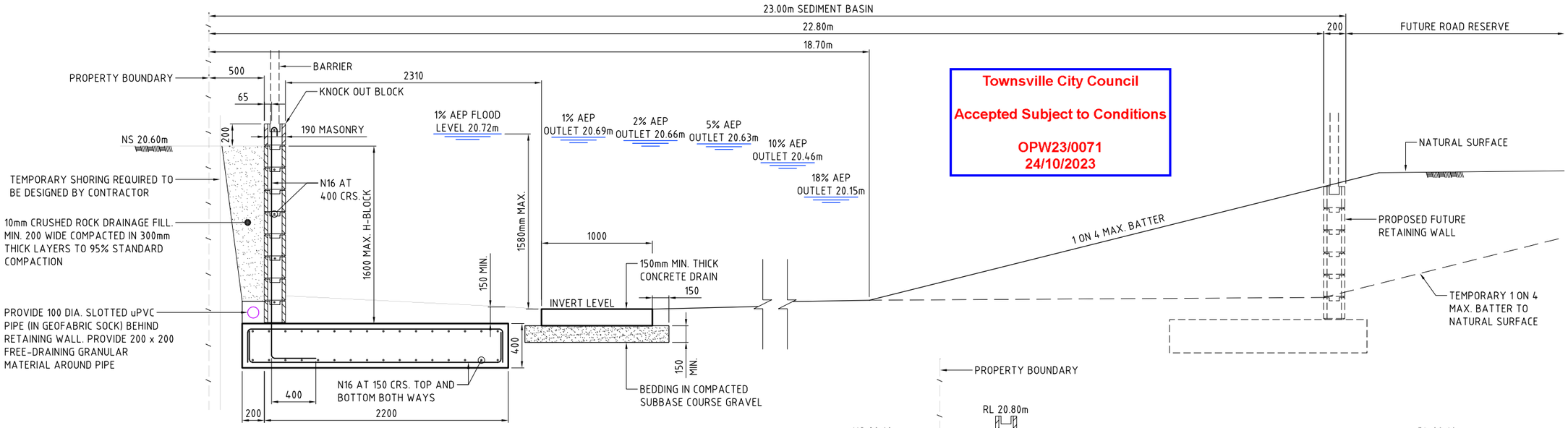
PROJECT
YUMBA-META DEVELOPMENT STAGE 1

1145, 1151 & 1155 RIVERWAY DRIVE RASMUSSEN

DRAWING
DETAILS - SHEET 1

NUMBER	SHEET NO.	REVISION
ROSE001	C19	B

Plot Date:25/07/2023 9:22 AM User: SThorburn File Name: J:\ROSE\ROSE001 Yumba Meta Development, Rasmussen\CAD\Civil\ROSE001-DETAILS



RETAINING WALL DETAIL

SECTION B / C11
SCALE 1: 20

Townsville City Council

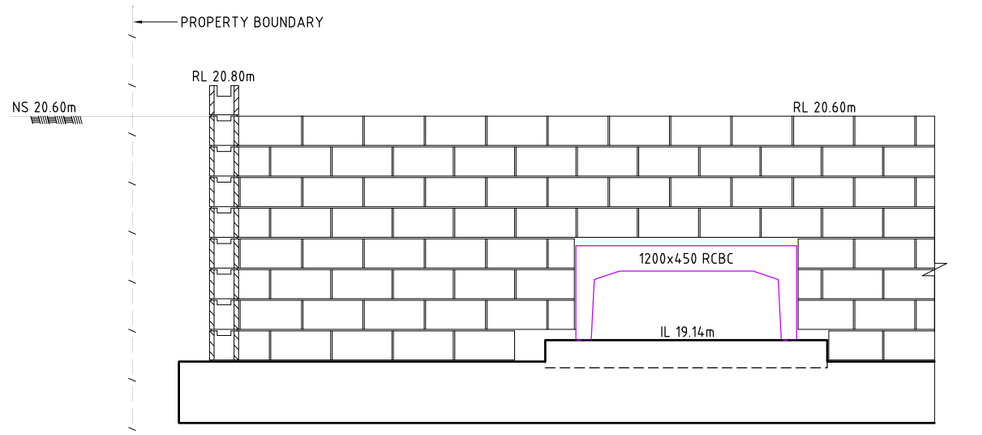
Accepted Subject to Conditions

OPW23/0071
24/10/2023

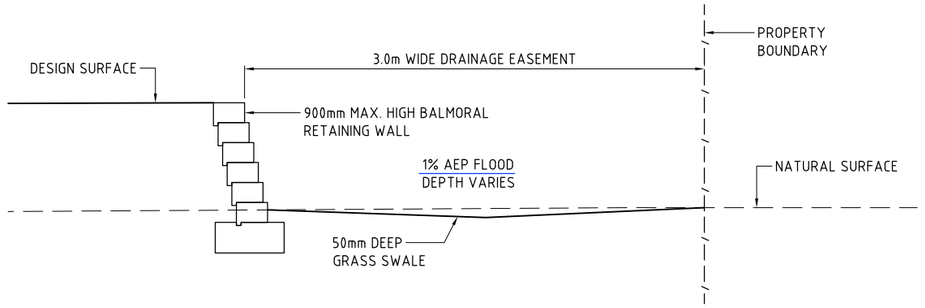
SAFETY IN DESIGN INFORMATION
THERE MAY BE ADDITIONAL HAZARDS/RISKS NOT NORMALLY ASSOCIATED WITH THE TYPES OF WORK SHOWN ON THIS DRAWING. REFER TO THE SAFETY IN DESIGN REPORT.

-0.2 0 0.2 0.4
SCALE OF METRES 1:10 AT A1 & 1:20 AT A3

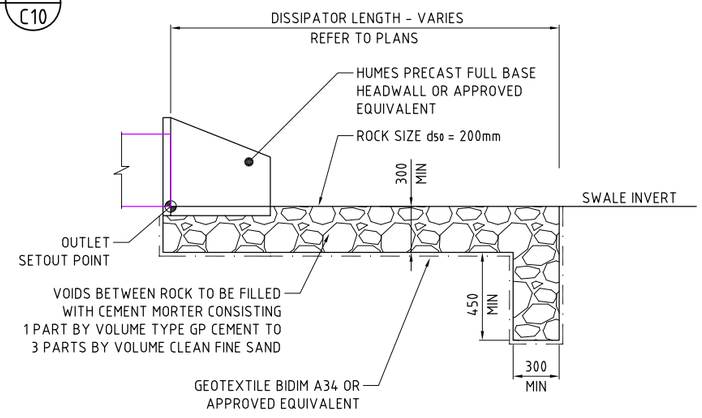
-0.4 0 0.4 0.8
SCALE OF METERS 1:20 AT A1 & 1:40 AT A3



SECTION C / –
SCALE 1: 20

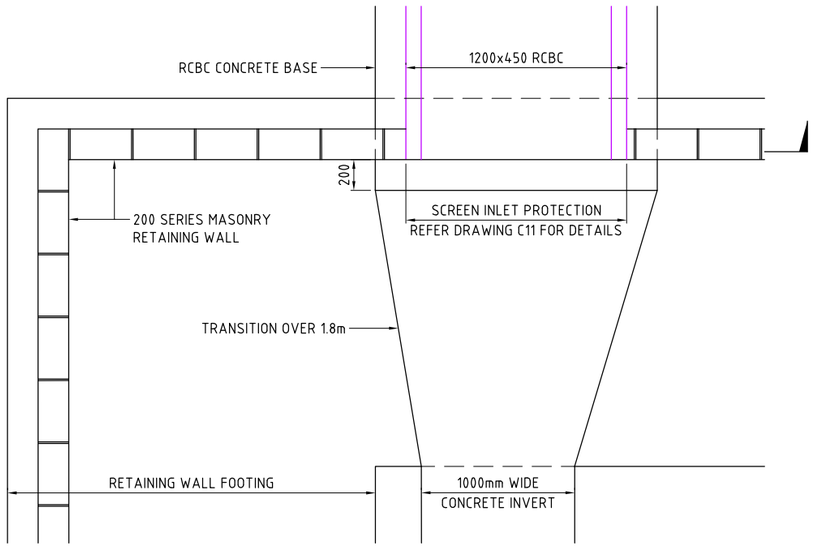


SECTION A / C10
SCALE 1: 20



TYPICAL SECTION
STORMWATER OUTLET PROTECTION
SCALE 1:20 AT A1

C / –



DETENTION BASIN OUTLET DETAIL
SCALE 1:20 AT A1

REVISION		APP'D	DATE
C	TCC RFI COMMENTS	DEJ	13/09/23
B	ISSUE FOR APPROVAL	DEJ	21/07/23
A	ORIGINAL ISSUE	SLT	14/07/23

FOR APPROVAL

JAS-ANZ ISO 9001 www.intlcert.com

LCJ ENGINEERS
LCJ Engineers Pty Ltd
ABN 54 131 516 446
601 Flinders Street, Townsville QLD 4810
PO Box 1498, Aitkenvale QLD 4814
Tel: (07) 4721 5800
townsville@lcjengineers.com.au
www.lcjengineers.com.au

DRAWN	DESIGNED
SLT	SLT
APPROVED	DATE
D.E.JOHNSTONE	21/07/23
RPEQ:	

CLIENT
YUMBA-META HOUSING ASSOCIATION LTD

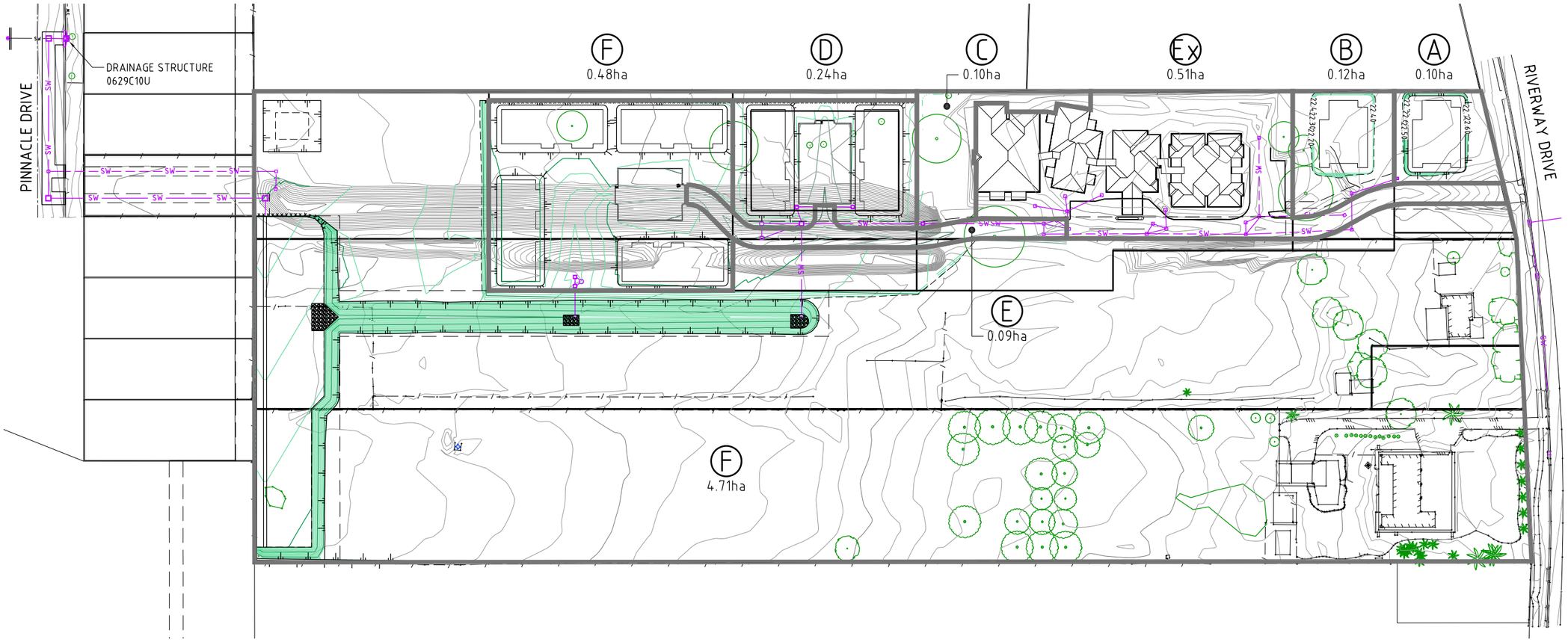
PROJECT
YUMBA-META DEVELOPMENT STAGE 1

1145, 1151 & 1155 RIVERWAY DRIVE RASMUSSEN

DRAWING
DETAILS - SHEET 2

NUMBER	SHEET NO.	REVISION
ROSE001	C20	C

Plot Date:13/09/2023 3:51 PM User: SThurburn File Name: J:\ROSE\ROSE001 Yumba Meta Development, Rasmussen\CAD\Civil\ROSE001-DETAILS



PLAN
SCALE 1:750 AT A1

Townsville City Council

Accepted Subject to Conditions

OPW23/0071
24/10/2023

LEGEND

- NATURAL SURFACE CONTOUR (0.1m INTERVAL)
- FINISHED SURFACE CONTOUR (0.1m INTERVAL)
- CATCHMENT BOUNDARY
- (F) 0.50ha — CATCHMENT NUMBER, CATCHMENT AREA

DRAINAGE CALCULATIONS - Return Period: 39% AEP

STRUCTURE No.	INLET DESIGN	FLOW IN K&C (INC. BYPASS)	INLET TYPE	INLET CURVE	FLOW TO INLET	FLOW DEPTH	DRAIN DESIGN	PIPE FLOW	REACH LENGTH	PIPE GRADE	PIPE SIZE	PIPE CLASS	FLOW VELOCITY	CAPACITY FLOW (MANNINGS)	CAPACITY FLOW (HGL)	DESIGN LEVELS	OBVERT LEVELS	DRAIN SECTION HGL	UPSTREAM H.G.L.	DOWNSTREAM H.G.L.	W.S.E.	SURFACE OR K&C INVERT LEVEL
		L/s			Qg L/s	m		Qp L/s	L m	S %	mm		V m/s	L/s	L/s		m	m	m	m	m	m
0629C10U		63	LLG-BK-2400-3.3%XF	SAG	63	0.038		207	128	0.137	525	Class 3 RRJ	0.98	153	201		19.361	19.371	19.479	19.186	20.002	20.002

DRAINAGE CALCULATIONS - Return Period: 1% AEP

STRUCTURE No.	INLET DESIGN	FLOW IN K&C (INC. BYPASS)	INLET TYPE	INLET CURVE	FLOW TO INLET	FLOW DEPTH	DRAIN DESIGN	PIPE FLOW	REACH LENGTH	PIPE GRADE	PIPE SIZE	PIPE CLASS	FLOW VELOCITY	CAPACITY FLOW (MANNINGS)	CAPACITY FLOW (HGL)	DESIGN LEVELS	OBVERT LEVELS	DRAIN SECTION HGL	UPSTREAM H.G.L.	W.S.E.	SURFACE OR K&C INVERT LEVEL
		L/s			Qg L/s	m		Qp L/s	L m	S %	mm		V m/s	L/s	L/s		m	m	m	m	m
0629C10U		253	LLG-BK-2400-3.3%XF	SAG	253	0.131		855	128	0.137	525	Class 3 RRJ	4.06	153	201		19.361	22.032	23.885	REFER TCC FLOOD MAPPING	20.002

HYDROLOGY TABLE

CATCHMENT ID	AREA ha	TIME min	C10	C2	I2 mm/hr	Q2 m^3/s	C100	I100 mm/hr	Q100 m^3/s
Ex	0.51	5.0	0.77	0.73	122	0.13	1.00	287	0.41
A	0.096	5.0	0.82	0.70	122	0.02	0.98	287	0.08
B	0.121	5.0	0.82	0.70	122	0.03	0.98	287	0.09
C	0.104	5.0	0.70	0.60	122	0.02	0.84	287	0.07
D	0.245	7.0	0.83	0.71	112	0.05	1.00	260	0.18
E	0.087	5.0	0.90	0.76	122	0.02	1.00	287	0.07
F	0.485	10.0	0.84	0.71	100	0.10	1.00	231	0.31
G	4.71	40.0	0.62	0.45	55	0.32	0.64	129	1.07

SAFETY IN DESIGN INFORMATION
THERE MAY BE ADDITIONAL HAZARDS/RISKS NOT NORMALLY ASSOCIATED WITH THE TYPES OF WORK SHOWN ON THIS DRAWING. REFER TO THE SAFETY IN DESIGN REPORT.

-15 0 15 30
SCALE OF METRES 1:750 AT A1 & 1:1500 AT A3

E	DRAINAGE CALC MODS	DEJ	19/10/23
D	TCC RFI COMMENTS	DEJ	17/10/23
C	TCC RFI COMMENTS	DEJ	13/09/23
B	ISSUE FOR APPROVAL	DEJ	21/07/23
A	ORIGINAL ISSUE	SLT	14/07/23
REVISION		APP'D	DATE

FOR APPROVAL

LCJ ENGINEERS
LCJ Engineers Pty Ltd
ABN 54 131 516 446
601 Flinders Street, Townsville QLD 4810
PO Box 1498, Aitkenvale QLD 4814
Tel: (07) 4721 5800
townsville@lcjengineers.com.au
www.lcjengineers.com.au

DRAWN	DESIGNED
SLT	SLT
APPROVED	DATE
D.E.JOHNSTONE	21/07/23
RPEQ:	

CLIENT
YUMBA-META HOUSING ASSOCIATION LTD

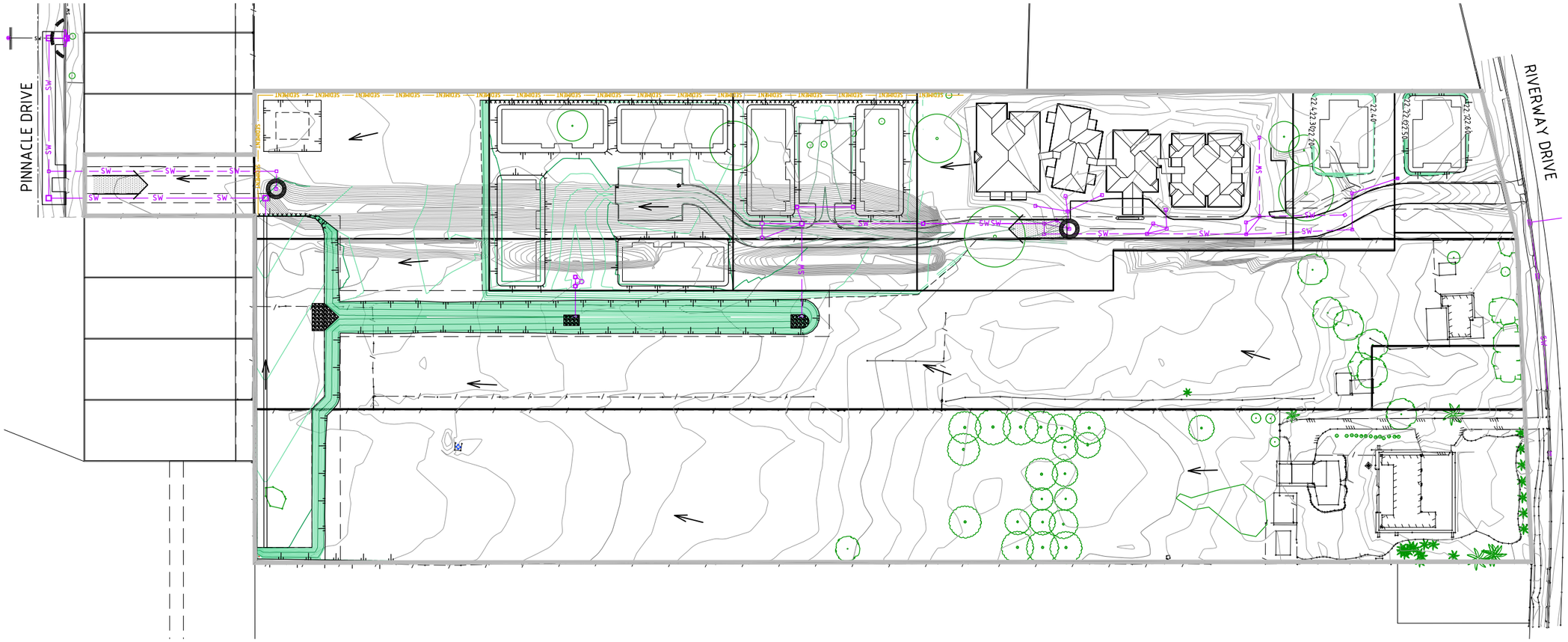
PROJECT
YUMBA-META DEVELOPMENT STAGE 1

1145, 1151 & 1155 RIVERWAY DRIVE RASMUSSEN

DRAWING
CATCHMENT PLAN & CALCULATIONS

NUMBER	SHEET NO.	REVISION
ROSE001	C21	E

Plot Date:19/10/2023 11:56 AM User: EHooper File Name: J:\ROSE\ROSE001 Yumba Meta Development, Rasmussen\CAD\Civil\ROSE001-CATCHMENT



PLAN
SCALE 1:750 AT A1

Townsville City Council

Accepted Subject to Conditions

OPW23/0071
24/10/2023

LEGEND

- NATURAL SURFACE CONTOUR (0.1m INTERVAL)
- FINISHED SURFACE CONTOUR (0.1m INTERVAL)
- SEDIMENT FENCE
- EXISTING STORMWATER
- NEW STORMWATER
- DRAIN FLOW DIRECTION
- ROCK PROTECTION REFER DRG C20
- SITE EXTENT
- TEMPORARY CONSTRUCTION ENTRY/EXIT
- SIDE INLET PIT PROTECTION
- FIELD INLET PIT PROTECTION
- SURFACE FLOW DIRECTION

NOTES

1. ALL EXPOSED EARTH TO BE HYDROMULCHED.
2. THE CONTRACTOR IS RESPONSIBLE FOR REVEGETATION AND ESTABLISHMENT OF DISTURBED AREAS DUE TO CONSTRUCTION ACTIVITIES BEYOND WHAT IS SHOWN IN THE DESIGN.

SAFETY IN DESIGN INFORMATION
THERE MAY BE ADDITIONAL HAZARDS/RISKS NOT NORMALLY ASSOCIATED WITH THE TYPES OF WORK SHOWN ON THIS DRAWING. REFER TO THE SAFETY IN DESIGN REPORT.

-15 0 15 30
SCALE OF METRES 1:750 AT A1 & 1:1500 AT A3

B	TCC RFI COMMENTS	DEJ	13/09/23
A	ORIGINAL ISSUE	DEJ	21/07/23
REVISION		APP'D	DATE

FOR APPROVAL

JAS-ANZ ISO 9001 www.imlcert.com

LCJ ENGINEERS
LCJ Engineers Pty Ltd
ABN 54 131 516 446
601 Flinders Street, Townsville QLD 4810
PO Box 1498, Aitkenvale QLD 4814
Tel: (07) 4721 5800
townsville@lcjengineers.com.au
www.lcjengineers.com.au

DRAWN	DESIGNED
SLT	SLT
APPROVED	DATE
D.E.JOHNSTONE	21/07/23
RPEQ:	

CLIENT
YUMBA-META HOUSING ASSOCIATION LTD

PROJECT
YUMBA-META DEVELOPMENT STAGE 1

1145, 1151 & 1155 RIVERWAY DRIVE RASMUSSEN

DRAWING
SOIL EROSION & SEDIMENT CONTROL PLAN

NUMBER	SHEET NO.	REVISION
ROSE001	C22	B

Plot Date:13/09/2023 3:52 PM User: SThorburn File Name: J:\ROSE\ROSE001 Yumba Meta Development, Rasmussen\CAD\Civil\ROSE001-ESCP

GENERAL

1. FOR CONSTRUCTION OF SOIL EROSIONS & SEDIMENT CONTROL DEVICES REFER DETAILS ON THIS PLAN.
2. TEMPORARY DRAINAGE CONTROL. FLOW SHOULD BE DIVERTED AROUND THE WORK SITE WHERE POSSIBLE.
3. ALL DRAINAGE, EROSION AND SEDIMENT CONTROLS TO BE INSTALLED AND BE OPERATIONAL BEFORE COMMENCING UP-SLOPE EARTHWORKS.
4. ALL CONTROL MEASURES TO BE INSPECTED AT LEAST WEEKLY AND AFTER SIGNIFICANT RUNOFF PRODUCING STORMS.
5. STRAW BALE SEDIMENT TRAPS ARE A SECONDARY OPTION WHICH GENERALLY SHOULD NOT BE USED IF OTHER OPTIONS ARE AVAILABLE.
6. NO PARKING OR STOCKPILING OF MATERIALS IS PERMITTED ON THE LOWER SIDE OF THE SEDIMENT FENCE.
7. GRASS VERGES SHALL BE MAINTAINED AS MUCH AS PRACTICAL TO PROVIDE A BUFFER ZONE TO THE CONSTRUCTION SITE.
8. ROOF DRAINAGE IS TO BE CONNECTED TO THE STORMWATER AS SOON AS PRACTICAL.
9. BUILDER SHALL ENSURE ALL CONSTRUCTION TRAFFIC ENTERING AND LEAVING THE SITE DO SO IN A FORWARD DIRECTION.
10. SAFETY ISSUES MUST BE CONSIDERED AT ALL TIMES & INCORPORATE TRAFFIC CONTROL DEVICES TO THE SATISFACTION OF THE SUPERINTENDENT.
11. PLANS TO BE READ IN CONJUNCTION WITH STORMWATER QUALITY MANAGEMENT PLAN FOR THE SITE.
12. THE CONTRACTOR WILL BE RESPONSIBLE FOR THE MAINTENANCE OF EROSION AND SEDIMENT CONTROL DEVICES FROM THE TIME OF SITE ESTABLISHMENT COMMENCES UNTIL THE SITE HAS ACHIEVED "OFF MAINTENANCE" STATUS OR UNTIL THE SITE HAS BEEN STABILISED TO THE SATISFACTION OF THE SUPERINTENDENT.
13. ADDITIONAL CONTROL DEVICES MAY BE REQUIRED BY THE SUPERINTENDENT.
14. CONTROL MEASURES MAY BE REMOVED WHEN ON-SITE EROSION IS CONTROLLED AND 70% PERMANENT SOIL COVERAGE IS OBTAINED OVER ALL UPSTREAM DISTURBED LAND.
15. IN AREAS WHERE RUNOFF TURBIDITY IS TO BE CONTROLLED, EXPOSED SURFACES TO BE EITHER MULCHED, COVERED WITH EROSION CONTROL BLANKETS OR TURFED IF EARTHWORKS ARE EXPECTED TO BE DELAYED FOR MORE THAN 14 DAYS.

CONSTRUCTION ENTRY/EXIT

CONSTRUCTION:

1. INSPECT WEEKLY AND AFTER ANY HEAVY RAIN EVENT & REPAIR AS NECESSARY.
2. SURFACE WATER FLOWING TO THE CONSTRUCTION EXIT SEDIMENT TRAP MUST BE PIPED UNDER THE TRAP OR A PERIMETER BANK SHOULD BE CONSTRUCTED TO DIRECT SURFACE FLOW AWAY FROM THE TRAP.
3. WASH-OFF TO BE DIRECTED TO A SEDIMENT TRAP OR BUFFER ZONE.
4. ONLY PROVIDE ONE CONSTRUCTION EXIT OFF THE SITE UNLESS SITE ACCESS OR TOPOGRAPHY REQUIRE MORE.
5. ENSURE THAT CONTAMINATED VEHICLES CANNOT BYPASS THE EXIT WHEN EXITING THE SITE.
6. WHEEL WASH OR SPRAY MAY BE REQUIRED IN WET WEATHER.

MAINTENANCE

1. REMOVAL OF SEDIMENT AND/OR ADDING EXTRA AGGREGATE.
2. REMOVE SEDIMENT TRANSPORTED ONTO ROADWAYS AND APPLY CORRECTIVE MEASURES TO ENSURE NO RE-OCCURENCE.
3. EXTEND THE LENGTH OF THE GRAVEL PAD IF EXCESSIVE SEDIMENT IS STILL BEING TRANSPORTED OFF SITE.

SEDIMENT BASINS

CONSTRUCTION

1. CONSTRUCT AT MOST DOWNSTREAM END OF A CONSTRUCTED AREA.
2. INLET AND OUTLETS SHOULD BE STABILISED AND SHOULD NOT CAUSE EROSION DOWN THE BASIN EMBANKMENT.

MAINTENANCE

1. INSPECT WEEKLY AND AFTER ANY HEAVY RAIN EVENT & REPAIR AS NECESSARY.
2. REMOVED SEDIMENT BUILD UPS WHEN STORAGE CAPACITY IS ACHIEVED.
3. DAMAGE TO THE SPILLWAY SHOULD BE REPAIRED IMMEDIATELY.
4. SCOUR DAME TO INLETS & OUTLETS SHOULD BE REPAIRED AND VEGETATION MAINTAINED IN A HEALTHY CONDITION.

SEDIMENT FENCES

CONSTRUCTION

1. SEDIMENT FENCES TO BE INSTALLED PARALLEL CONTOURS WHERE POSSIBLE WITH A MAXIMUM CATCHMENTS AREA OF APPROXIMATELY 0.6ha PER 100m OF LENGTH.
2. SEDIMENT FENCES ARE NOTE BE CONSTRUCTED IN AREAS OF CONCENTRATED FLOW.
3. SEDIMENT FENCES SHOULD BE INSTALLED AS A SERIES OF L SHAPED (TURN BACKS) TO PREVENT CONCENTRATIONS OF FLOW ALONG THE FENCE.
4. WOVEN FABRICS ARE PREFERRED, NON-WOVEN FABRICS MAY BE USED ON SMALL WORK SITES, WHERE OPERATIONAL PERIODS LESS THAN 6 MONTHS OR ON SITES AND/OR WHERE SIGNIFICANT SEDIMENT RUNOFF IS NOT EXPECTED.
5. FENCES AREA REQUIRED 2.0m MIN FROM STOCKPILES AND THE TOE OF CUT OR FILL BATTER, WHERE NOT PRACTICAL ONE FENCE CAN BE AT THE TOE WITH A SECOND FENCE 1.0m AWAY. FENCE SHOULD NOT BE LOCATED PARALLEL WITH TOE IF CONCENTRATION OF FLOW WILL OCCUR BEHIND THE FENCE.

MAINTENANCE

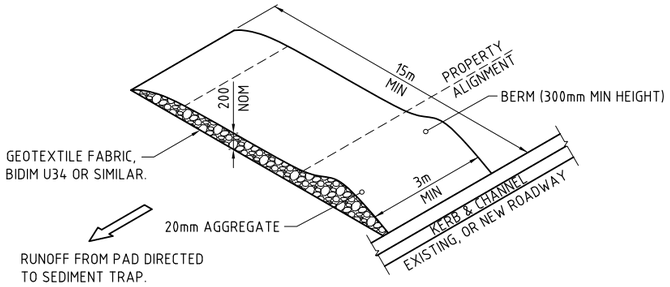
1. INSPECT WEEKLY AND AFTER ANY HEAVY RAIN EVEN & REPAIR AS NECESSARY.
2. ANY DAMAGED CAUSED BY SITE MOVEMENTS OF VEHICLES AND STOCKPILES TO BE REPAIRED IMMEDIATELY.
3. REMOVE SEDIMENT BUILD UPS AND INVESTIGATE THE SOURCE OF SEDIMENT AND IMPLEMENT SUITABLE MEASURES TO REDUCE SEDIMENT IMMEDIATELY.

WATER QUALITY MONITORING OF SEDIMENT BASINS

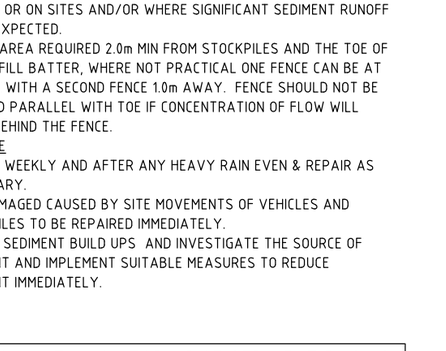
DAILY:
INSPECT SEDIMENT & SLUDGE TRAPPED IN BASIN.

WEEKLY:
INSPECT FOR RELEASE OF SEDIMENT OR OTHER CONTAMINANTS INTO THE DOWNSTREAM WATERWAY.

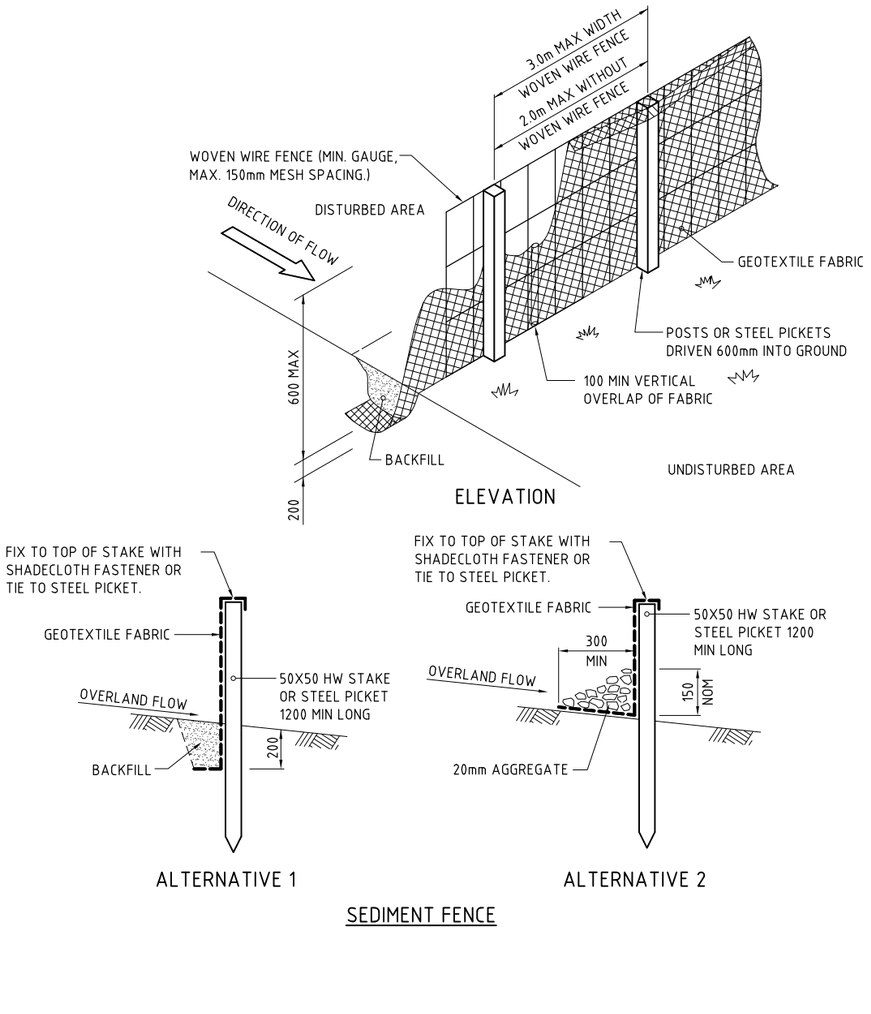
MONTHLY:
INSPECT FOR LARGE DEPOSITS OF SEDIMENT & GULLY EROSION.



TEMPORARY CONSTRUCTION ENTRY / EXIT



FIELD INLET SEDIMENT TRAP



SEDIMENT FENCE

Townsville City Council

Accepted Subject to Conditions

OPW23/0071
24/10/2023

SAFETY IN DESIGN INFORMATION
THERE MAY BE ADDITIONAL HAZARDS/RISKS NOT NORMALLY ASSOCIATED WITH THE TYPES OF WORK SHOWN ON THIS DRAWING. REFER TO THE SAFETY IN DESIGN REPORT.

A	ORIGINAL ISSUE	DEJ	21/07/23
REVISION		APP'D	DATE

FOR APPROVAL

JAS-ANZ ISO 9001 www.imticert.com

LCJ ENGINEERS
LCJ Engineers Pty Ltd
ABN 54 131 516 446
601 Flinders Street, Townsville QLD 4810
PO Box 1498, Aitkenvale QLD 4814
Tel: (07) 4721 5800
townsville@lcjengineers.com.au
www.lcjengineers.com.au

DRAWN	DESIGNED
SLT	SLT
APPROVED	DATE
D.E.JOHNSTONE	21/07/23
RPEQ:	

CLIENT
YUMBA-META HOUSING ASSOCIATION LTD

PROJECT
YUMBA-META DEVELOPMENT STAGE 1

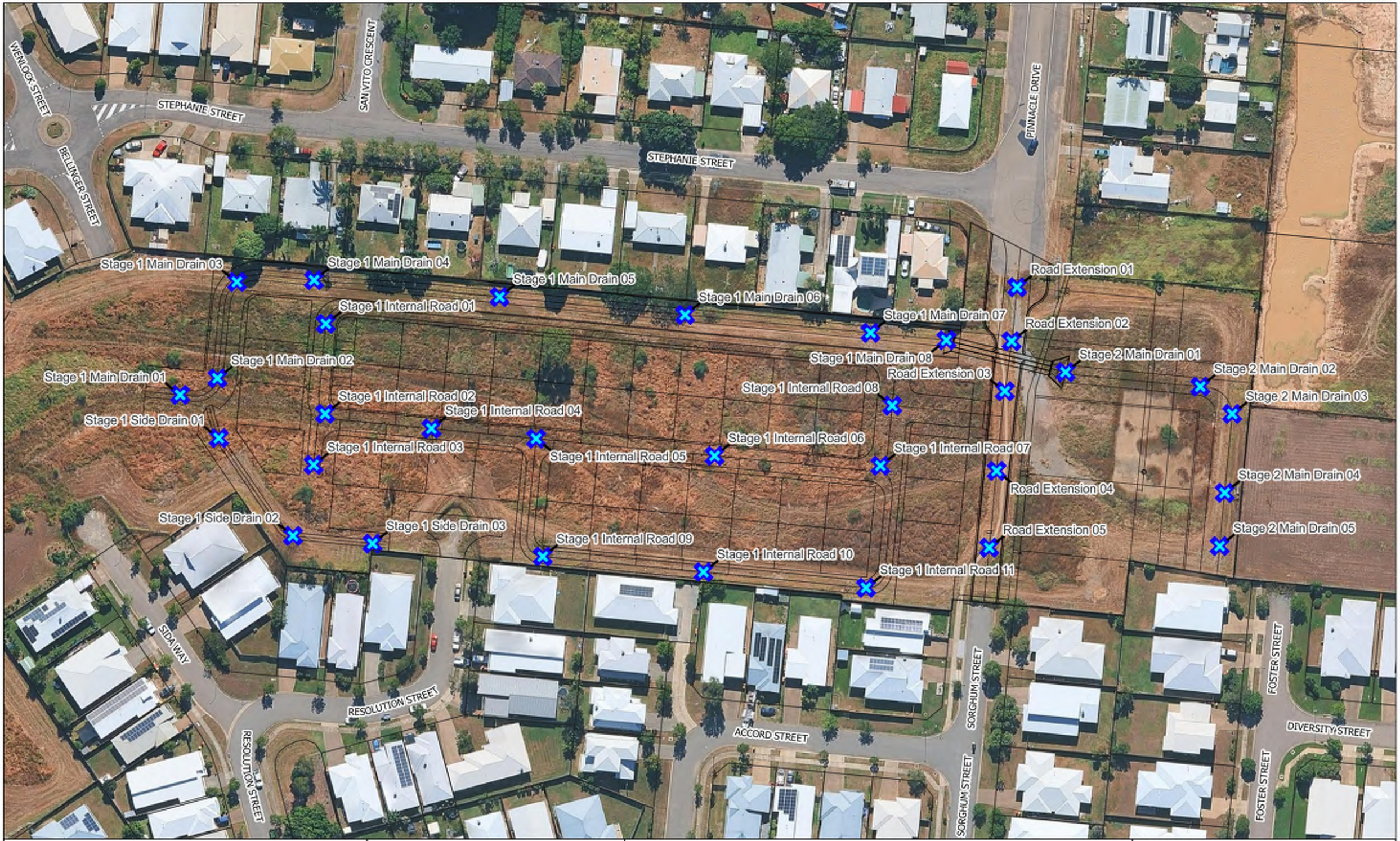
1145, 1151 & 1155 RIVERWAY DRIVE RASMUSSEN

DRAWING
SOIL EROSION & SEDIMENT CONTROL DETAILS

NUMBER	SHEET NO.	REVISION
ROSE001	C23	A

APPENDIX K

Stage 12a DFE Flood Levels



NORTHERN CONSULTING engineers

Civil | Structural | Forensic
Traffic | Flood Modelling

TOWNSVILLE | SUNSHINE COAST | BRISBANE
GLADSTONE | NEW ZEALAND
T: +617 4725 5550 E: mail@nceng.com.au
W: www.nceng.com.au

In Association With:

URBEX PTY LTD

0 10 20 30 40 50 m

1:1,000

N

Legend

TCC Land Parcels

SOMERS & HERVEY ESTATE
PRECINCT 4 - STAGE 12A

DEVELOPED WSL RESULTS POINTS

Prepared By: BB	Date: 18/12/2025	Size	Map
Reviewed by: AW	Revision: A	A3	A06
	NCE Ref: URB0001-P4		