

APPENDIX G

Flood Impact Assessment Report

Prepared by:

StormFlood Engineering Pty Ltd



FLOOD IMPACT ASSESSMENT REPORT

286 Lakeside Drive, Oonoonba, QLD 4811

Prepared for Bower Group Pty Ltd

Ref: SF-20-0070-002

Revision 1

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RPEQ Certification

As a Registered Professional Engineer of Queensland (RPEQ), engaged on behalf of StormFlood Engineering Pty Ltd, I certify that based on the provided data, and/or modelling undertaken as part of this projects requirements, that the assessment has been undertaken in accordance with the relevant assessment authorities, and in accordance with current engineering best practices.

RPEQ Name	RPEQ Number	Document Version	Signature
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1 Executive Summary

StormFlood Engineering Pty Ltd has been commissioned by Oonoonba Project Pty Ltd to prepare this Flood Impact Assessment (FIA) in support of a Material Change of Use (MCU) application for a proposed commercial development - comprising a service station, two food and drink outlets and an associated fuel dispensing forecourt - at 286 Lakeside Drive, Oonoonba (Lot 6000 on SP302846). The site is located within the Townsville City Council (TCC) Local Government Area and the Oonoonba Urban Development Priority Development Area (PDA), for which Economic Development Queensland (EDQ) is the assessment manager.

The site lies within the lower Ross River catchment and is mapped within the Low, Medium and High Hazard Area of the TCC Flood Hazard Overlay (OM-06.1/06.2) and the Storm Tide Inundation Area (OM-03.1). The assessment has been undertaken using a truncated and validated TUFLOW model derived from the Ross River Flood Study Base-line Flood Assessment (AECOM, 2021), comparing the pre-development and post-development flood behaviour for the 1% AEP climate change scenario – the Defined Flood Event. The downstream boundary adopts a static tidal tailwater inclusive of a 0.8 m sea-level-rise allowance, consistent with the Ross River Flood Model and the State Planning Policy (2017).

The assessment demonstrates the following key outcomes:

- **Flood immunity:** the proposed building pads (finished pavement level 4.50 m AHD) are set above the Defined Flood Event peak flood level (approximately 3.5 m AHD) and the Defined Storm Tide Event, providing in the order of 1.0 m of freeboard, with the building footprints immune from flooding up to and including the 1% AEP climate change event;
- **No worsening of flood impacts:** peak flood level increases external to the site are limited to no more than 10 mm, with increases greater than 10 mm confined within the subject site, the Channel 1 easement and the southern access; no material change occurs within the Ross River floodplain or the rail and road corridors; and, no significant increase in flow velocity occurs at the downstream railway and Abbott Street culverts;
- **Maintaining flow conveyance:** the re-graded Channel 1 easement, the proposed culvert crossings and the internal stormwater network maintain the existing overland flow regime; and
- **Safe evacuation:** the site access points and Lakeside Drive are modelled as flood hazard category H1 (trafficable) within the Queensland Urban Drainage Manual major-storm limits, with the slow-rise nature of Ross River flooding provides reasonable warning for early evacuation as the primary flood-response strategy.

On this basis, the proposed development is demonstrated to achieve flood immunity, to manage flood risk to occupants, and to avoid adverse flood impacts external to the site. A compliance assessment undertaken against the TCC Flood Hazard Overlay Code (Section 8.2.6) and Coastal Environment Overlay Code (Section 8.2.3), and the relevant State Development Assessment Provisions State Codes (State Code 1 – State-Controlled Road Environment, and State Code 2 – Railway Environment), confirms the development satisfies the relevant Acceptable and Performance Outcomes.

Based on the flood immunity, no-worsening and safe-evacuation outcomes demonstrated herein, the proposed development is considered acceptable on flood risk grounds and warrants approval by EDQ and TCC, subject to appropriate conditions.

2 Background

This Flood Impact Assessment (FIA) has been commissioned by Oonoonba Project Pty Ltd to investigate potential flooding impacts to support a Material Change of Use (MCU) application for a proposed commercial development - comprising a service station, food and drink premises and associated tenancies - at 286 Lakeside Drive, Oonoonba. The site is co-located within the Townsville City Council (TCC) Local Government Authority (LGA) and the Oonoonba Urban Development Priority Development Area (PDA), for which Economic Development Queensland (EDQ) is the assessment manager.

The site has been identified by TCC's Flood Hazard Overlay mapping as potentially flood affected, as it lies within the Ross River regional catchment. The existing TCC flood mapping is based on the Ross River Flood Study Base-line Flood Assessment prepared by AECOM (October 2021, Doc No: 60619726), referred to as the 'Ross River Flood Model' herein. The hydraulic TUFLOW model, developed as part of the Ross River Flood Model was adopted as the basis for the model development, and consequently, to undertake the flood impact assessment of the proposed development.

The flood impact assessment compares the pre-development and post-development flood behaviour to demonstrate that the proposed development works do not result in adverse flood impacts external to the site. This report updates and supersedes the previous Flood Study Report prepared for the site (StormFlood Engineering Pty Ltd, Ref SF-20-0070-002, Revision 1, June 2021).

It is noted that the site has been substantially modified by bulk earthworks - including filling and excavation, roadworks and stormwater drainage - undertaken as part of the Priority Development Area reconfiguration of a lot and operational works approval (EDQ Ref: DEV2015/725); the existing (pre-development) condition assessed within this report therefore reflects the as-constructed, filled site.

This assessment considers previous discussions with Townsville City Council and the Department of Transport and Main Roads (on behalf of EDQ), and responds to the matters raised in the EDQ Information Request (EDQ Ref: DEV2021/1199; TMR Ref: TMR21-033470).

This assessment is limited to the information provided by Oonoonba Project Pty Ltd, STP Consultants and Verve Design Group, as well as publicly available information by the Local Government Authority (TCC) and all other relevant authorities.

3 Site Information

3.1 Site Background

The subject site is located at 286 Lakeside Drive, Oonoonba, formally known as Lot 6000 on SP302846, and contains a lot size area of 0.8649 ha (Source: Verve Design Group Architectural Drawings, 19212-SK09, Revision P2). The site is located within the Community Facilities zone, under the Townsville City Council City Plan (2025/01).

The site forms part of the Ross River catchment, with a local tributary conveying flows eastward through the site toward Ross River. The site is surrounded by urban residential to the north, west and south, with rural residential to the south-east and wetlands to the east. The site is accessed by Lakeside Drive along the western perimeter, with this connected to Abbott Street, a State-Controlled Road, positioned along the eastern perimeter of the site. A railway line, operated by Queensland Rail and the QLD Department of Transport and Main Roads, is positioned between Abbott Street and the site. This warrants assessment against *State Code 1: Development in a State Controlled Road* and *State Code 2: Development in a Railway Environment of the Queensland State Development Assessment Provisions (SDAP)*.



Figure 1: Subject Site – Subject Site Locality Plan (Source: Townsville City Plan)

3.1.1 Townsville City Plan Flood Hazard Overlay (OM-06.1) and Stormtide Inundation Area (OM-03.1)

The subject site is mapped within the Townsville City Plan Flood Hazard Overlay (maps OM-06.1 and OM-06.2), which identifies Low, Medium and High Hazard Areas. The Flood Hazard Overlay is shown in Figure 2.

The site is impacted by the Low, Medium and High Hazard Area. Accordingly, an assessment of the flood and drainage behaviour under pre-development and post-development conditions is required, to demonstrate that the development achieves the required flood immunity (floor levels above the Defined Flood Event) and does not worsen flooding impacts external to the site.

The Flood Hazard Overlay (OM-06.1/06.2) reflects the flood hazard and flow behaviour predating the bulk earthworks and floodplain modifications since undertaken within the site, and therefore does not represent current site conditions.

In accordance with the Flood Hazard Overlay Code (Section 8.2.6), the Defined Flood Event is the 1% Annual Exceedance Probability (AEP) flood, mapped as the combined extent of the high and medium flood hazard areas on overlay maps OM-06.1 and OM-06.2. As Economic Development Queensland (EDQ) is the assessment manager for the Oonoonba PDA, the impacts of a changing climate are required to be assessed as per the State Planning Policy (2017). Accordingly, and adopting a conservative position, the 1% AEP climate change sensitivity event developed as part of the Ross River Flood Study has been adopted as the Defined Flood Event for this assessment.

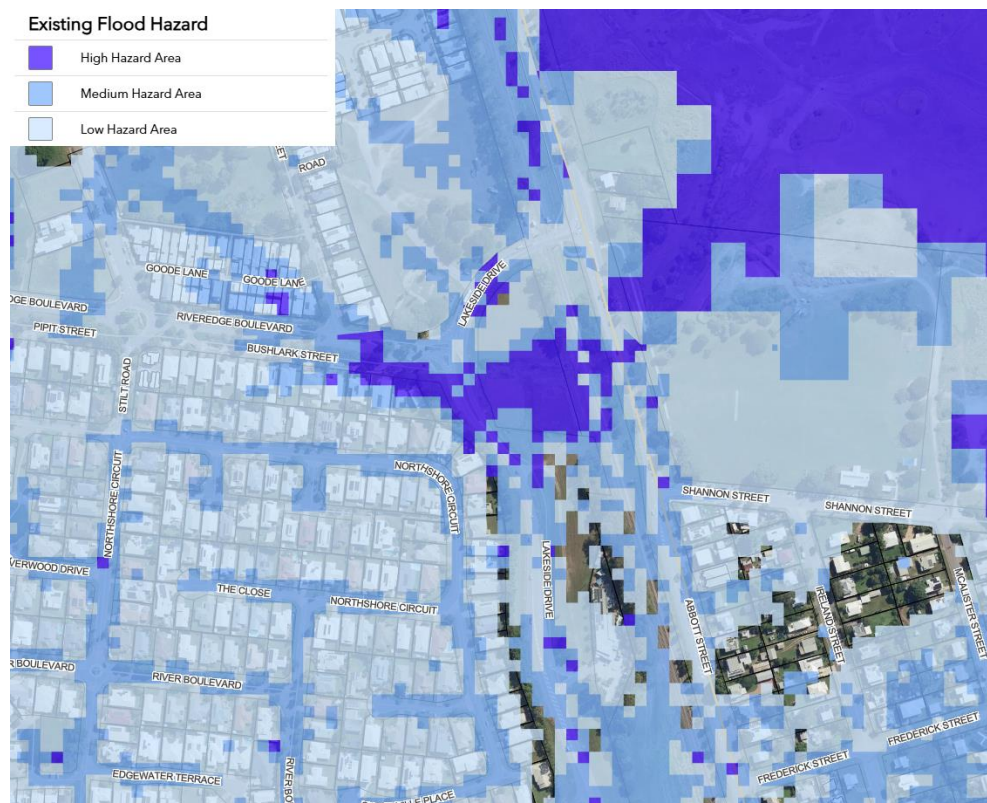


Figure 2 Townsville City Council Flood Hazard Overlay | OM-06.1/06.2 (Source: Townsville City Plan Planning Scheme (2025))

The site is impacted by the Stormtide Inundation Area as part of OM-03.1, as shown in Figure 3, therefore, assessment against the Coastal Environment Overlay Code (8.2.3) is required.

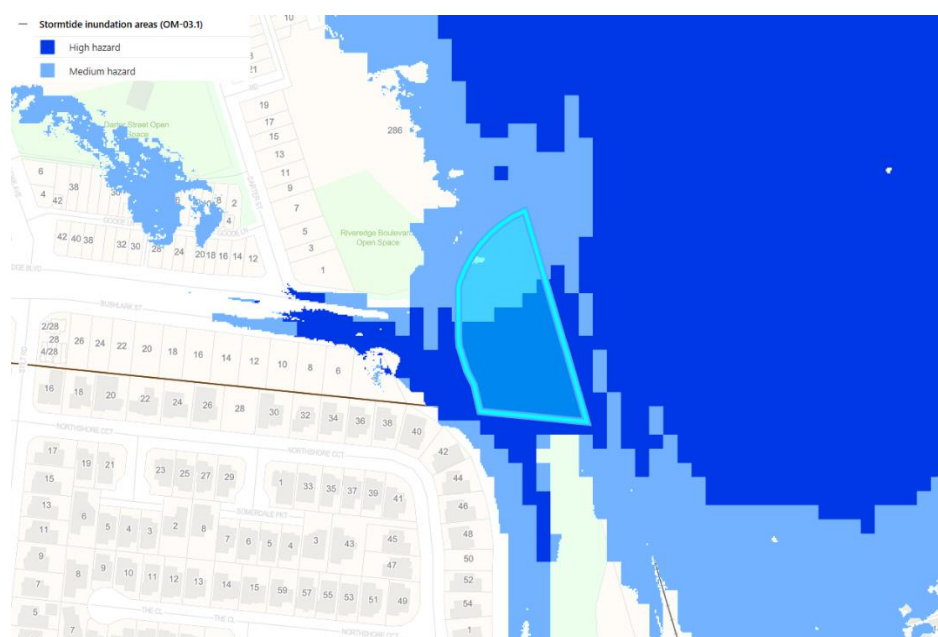


Figure 3 Townsville City Council Stormtide inundation Area (OM-03.1), as per the Townsville City Plan Planning Scheme (2025)

There is an existing stormwater network within the vicinity of the site, however during major regional flood events these networks are rendered secondary in routing flow through to Ross River; however, given the backwater impacts pertaining to the site, these are anticipated to function appropriately when fluvial (riverine) flooding or storm-tide impacts are negligible.

An aerial image of the site with surrounding trunk stormwater infrastructure has been shown in Figure 4 below, with context of the flooding impacts from Ross River, in the 1% AEP design event under climate change, from the Ross River Flood Model.



Figure 4: Subject Site - Aerial Imagery and TCC SW Infrastructure (Source: TCC) and 1% AEP Peak Flood under Climate Change from the Ross River Flood Model (Source: AECOM)

3.1.2 State Development Assessment Provisions (SDAP)

Given the site's relationship to the State transport network, the proposed development triggers assessment against the State Development Assessment Provisions (SDAP), administered by State Assessment and Referral Agency. The following State Codes are relevant to the flooding, stormwater and drainage matters addressed in this report.

State Code 1 – Development in a State-Controlled Road Environment

The purpose of State Code 1 is to protect the safety, function and efficiency of state-controlled roads. The site adjoins and takes access from the state-controlled road network (Abbott Street). The code requires that stormwater run-off and overland flow from the development do not worsen flooding or drainage conditions within the state-controlled road (SCR).

State Code 2 – Development in a Railway Environment

The purpose of State Code 2 is to protect the safety and operation of the railway and the safety of people using, living and working near it. The site adjoins the Queensland Rail corridor along its eastern boundary. The code requires that stormwater run-off and overland flow from the development do not worsen flooding,

stormwater or overland flow impacts within the railway corridor (and that drainage infrastructure is wholly contained within the site and able to be maintained).

3.1.3 TCC Flood Information Portal

TCC provides flood information to the public via its Flood Information Portal (flood.townsville.qld.gov.au). Figure 5 shows the peak flood depths for the 1% AEP design event obtained from the portal, which is understood to be derived from the Ross River Flood Study (AECOM, 2021).

The peak flood depths and levels obtained from the portal are consistent with the mapped outputs of the adopted Ross River Flood Model (refer to Section 4.1.5) confirming the model has been correctly reproduced for this assessment.

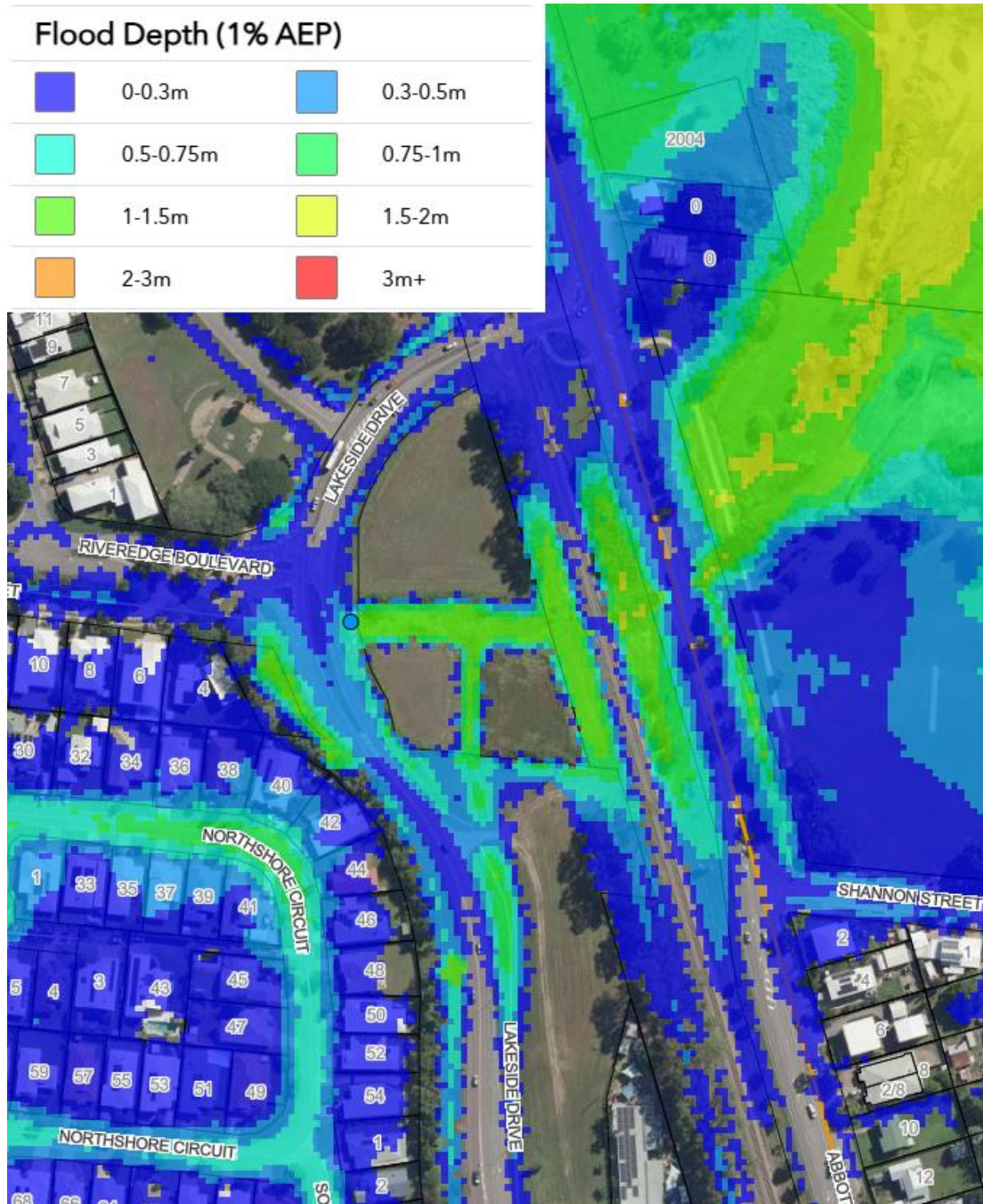


Figure 5 1% AEP Flood Depth Mapping, captured from the TCC Flood Information Portal.

3.2 Site Characteristics

The site frontage is to Lakeside Drive along the western and southern boundary, the Queensland Railway Line running north-south along the eastern boundary.

The site has been substantially modified by bulk earthworks undertaken under earlier PDA approvals (refer to Section 2) and now presents relatively flat filled pad areas, with a major drainage channel traversing the site west-east (Channel 1), and a minor channel (Channel 2) routing flows from the south to the major drainage channel. Based on the surveyed surface levels (Vision Surveys, Drawing No: 21337-CD-01, as part of Appendix A) and the 1 m LiDAR-derived terrain, existing ground levels across the site generally range between approximately 1.7 m AHD at the downstream outlet (eastern boundary) to 4.68 m AHD on the northern pad.

The site sits elevated above the Lakeside Drive road reserve along its western frontage - by up to approximately 1.0 m - with this level difference transitioning over a relatively short distance into the site. From the western frontage the site grades gently down toward the east, where it batters down to the rail corridor along the eastern boundary and is retained by a low retaining wall (in the order of 1 m high).

A drainage channel and associated easement (Channel 1) traverse the site and form the principal low point, conveying overland flows eastward toward Ross River (beneath the railway and Abbott Street via existing culverts). This channel is to be maintained and re-graded to achieve a minimum 1:250 longitudinal fall from west to east. Localised low points in the order of 1.72 m AHD occur along the channel/easement alignment, with the surrounding pad levels approaching 4.25 m AHD.

The site characteristics are illustrated below in Figure 6 (Lakeside Drive).

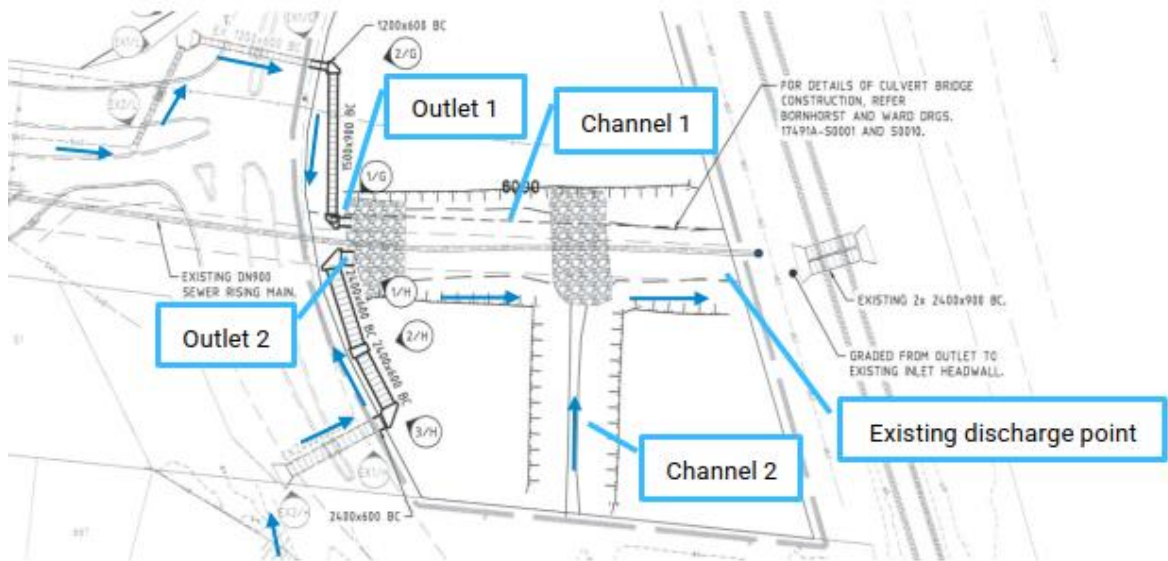


Figure 6: Stormwater Drainage As Constructed Plan (Source: STP Consultants Engineering and SMP (2026) & Calibre Consulting (2019))

3.3 Drainage Features

A drainage easement traverses the site and conveys overland flows eastward toward Ross River. Immediately downstream of the subject site:

- 2 x cell 2400 mm wide by 900 mm high RBCB is located downstream of the easement, conveying flows under the railway line.
- 3-cell x 900 mm RCP is located downstream of the railway line crossing, conveying flows under Abbott Street.
- A recently developed footpath and road crossing has been constructed, with this constructed after the development of the Ross River Flood Study (2021). Flows are assumed to be conveyed by a 3-cell x 900 mm RCP crossing, replicating the Abbott Street crossing located immediately upstream of the footpath. The number of cells (3) is validated via Google Street View.

In context with Ross River, the site is in the lower reaches of the catchment and is influenced by tailwater conditions near the estuary of the Ross River. The results from the Ross River Flood Study demonstrate that variances in the peak flood level downstream of the site are negligible; reinforcing the assumption that flood levels from the site are controlled by backwater impacts. The invert level of the drainage easement is less than the HAT level noted in the QLD Semidiurnal Tide Tables (2026). Pluvial (overland) flooding is not deemed to govern the site in terms of peak flood level impacts, and therefore, will not form part of this assessment.

Refer to Figure 7 for the regional topographical features within the vicinity of the site.



Figure 7: Regional Topography – Ross River Catchment (Source: LiDAR from Ross River Flood Model)

3.4.2 Proposed Drainage

The proposed stormwater drainage strategy comprises an internal pit and pipe network discharging to the existing drainage channel (Channel 1) within the sewer easement, which conveys flows eastward beneath the railway and Abbott Street to Ross River. The existing channel is to be re-graded and maintained as free-draining, with the longitudinal grade and outlet conveyance retained.

Several drainage crossings are proposed to convey runoff from the site and the external catchment to the west, including:

- Internal Access Road Crossing (routing flows west-east from Channel 1): 3-cell 3000 mm W x 1800 mm H reinforced concrete box culvert (RCBC)
- Northern Access Point Crossing: 1-cell 1200 mm W x 300 mm H reinforced concrete box culvert (RCBC).
- Southern Access Point Crossing: 1-cell 1200 mm W x 450 mm H reinforced concrete box culvert (RCBC).
- Internal Crossing (routing flows south-north, to Channel 1): 1-cell 2400 mm W x 900 mm H reinforced concrete box culvert (RCBC).

No on-site stormwater detention is proposed. Given the site is dominated by regional (Ross River) flood behaviour, the minor (piped) stormwater system is rendered negligible during the Defined Flood Event and does not materially influence the flood impact outcome for the site.

Water quality treatment is proposed via bioretention (Atlanvault) systems, with a separator (Puraceptor) capturing surface runoff from the bunded fuel forecourt area, consistent with the Concept Site Grading and Stormwater Layout Plan (refer to Drawing Set Job No.: STP26-0222, Drawing: SK-C002, as part of Appendix A).

3.5 Adopted Data

In order to provide an adequate pre and post-development hydraulic assessment for the site, the following data has been adopted for analysis:

- Ross River Flood Study Base-line Flood Assessment (the "Ross River Flood Model"), including the hydraulic TUFLOW model, prepared by AECOM (October 2021, Doc No: 60619726), provided via data agreement with Townsville City Council;
- TCC Flood Information Portal (flood.townsville.qld.gov.au) — peak flood depth and level mapping for the 1% AEP design event;
- Townsville City Council interactive mapping (TownsvilleMAPS).
- DA Engineering and Stormwater Management Report, prepared by STP Consultants (Doc Ref: STP26-0222) (Plans extracted and produced in Appendix A)
- Information Request (EDQ Ref: DEV2021/1199; TMR Ref: TMR21-033470), Department of Transport and Main Roads on behalf of EDQ, 10 February 2022 (Appendix B);
- Architectural Plans prepared by Verve Design Group (Dwg 19212-DA02, Revision J);
- Townsville City Plan Planning Scheme (Version 2025/01) prepared by Townsville City Council
- State Development Assessment Provisions, prepared by the QLD Government's Department of State Development, Infrastructure and Planning (Version 3.6, 2026)
- NearMap imagery and Google Street View;
- Digital cadastral data by the QLD Department of Resources; and
- Bureau of Meteorology Design Rainfall Data System (2016) for the subject site co-ordinates;
- 1 m LiDAR-derived terrain (captured in 2016, with 2019 survey for the subject site, QLD DNRM) and stormwater drainage data obtained from the Ross River Flood Study Base-Line Flood Assessment TUFLOW model;
- Semidiurnal Tidal Planes (2026), Maritime Safety Queensland, Department of Transport and Main Roads;

4 Hydraulic Assessment

4.1 Model Setup Overview

1D/2D hydraulic modelling was undertaken to provide an appropriate flood impact assessment of the pre- and post-development scenarios for the subject site and critical surrounding locations. The Ross River Flood Study Base-line Flood Assessment (AECOM, 2021) hydraulic TUFLOW model was adopted as the basis for the model development. The model was truncated and validated, then updated to reflect the pre-development and post-development conditions, to determine flood immunity and impacts.

The model was simulated for the 1% AEP design event under climate change conditions, adopted as the Defined Flood Event. The Ross River Flood Study adopts a climate change sensitivity based on the CSIRO Climate Futures Tool for the Representative Concentration Pathway (RCP) 8.5 scenario at the 2090 horizon, corresponding to a 15.4% increase in rainfall intensity, which forms the basis of design for this impact and flood planning assessment.

The modelling assumptions, amendments and outcomes are detailed in the following sub-sections.

4.1.1 Model Truncation and Validation

The model domain was truncated to encompass the local catchment, draining from west to east, and the interface (southern bank) of the Ross River floodplain (refer to Figure 9).

The truncated model adopted the following modifications:

- A static tailwater level along the eastern perimeter, adopting the peak flood level from the Ross River Flood Model outputs. The adopted level reflects the peak flood and backwater condition at the confluence with Ross River. The Ross River Flood Model accounts for the impacts of a changing climate, with a 0.8 m sea-level-rise allowance applied to the Mean High Water Springs (MHWS) level.
- A dynamic stage–discharge (HQ) boundary along the balance of the model perimeter, assuming free-draining conditions.
- For the 1% AEP climate change scenario, the design rainfall depths were magnified by 30% to align the peak flood levels of the truncated model with the Ross River Flood Model outputs.



Figure 9: Truncated Domain and Model Boundary Conditions (Source: QGIS)

The adoption of a static tailwater level along the eastern perimeter was considered reasonable, with backwater impacts appropriately represented. The critical storm event - the 60-minute duration storm, temporal pattern TP8530 - was determined from review of the Ross River Flood Study report and mapped outputs.

The truncated model was validated against the approved Ross River Flood Model outputs, achieving a peak flood level variance of less than 50 mm at and around the subject site for the 1% AEP climate change event, and less than 30 mm at the downstream boundary, demonstrating that the truncation and backwater representation are appropriate (refer to Figure 10).



Figure 10 Truncated Model Validation | Change in Peak Flood Level (Truncated (SF) Model - Ross River Flood Model)

4.1.2 Topography

The existing Digital Elevation Model (DEM) was retained for the existing-scenario model. The DTM for the truncated domain comprised:

- 2016 LiDAR (base layer); and,
- 2019 LiDAR capture, reflecting the operational works undertaken for the site (EDQ Ref: DEV2015/725/3) and for the adjacent 'The Village' Oonoonba masterplan development to the north-east.

Topographic amendments were undertaken to the existing-scenario surface, with the footpath and crossing located east of Abbott Street (running parallel to the road) represented within the model. To represent the footpath, the underlying surface was raised to 3.1 m AHD to reflect the constructed footpath/crossing embankment, and the associated road crossing (a 3-cell × 900 mm RCP, refer to Section 3.3) included within the model so that flow continues to be conveyed through the embankment.

In the absence of as-constructed drawings, the configuration of the footpath and crossing was inferred from inspection of Google Street View. Representing the footpath as a raised embankment is considered a conservative assumption; furthermore, given its position between the State-controlled road (Abbott Street) and the railway line, it is considered unlikely that the structure would have been approved or constructed in a manner that materially obstructs flood flows or causes adverse backwater. As the footpath is represented identically in both the pre-development and post-development scenarios, it has no bearing on the relative

flood impact assessment. On this basis, the assumption and design basis adopted are considered reasonable for the purposes of this assessment.

The pre-development surface utilised within the TUFLOW model has been demonstrated as shown below in Figure 11Figure 12.



Figure 11 Pre-Development Surface – TUFLOW Model (Source: QGIS)

For the post-development scenario, the following topographic amendments undertaken:

- The hardstand areas and internal access/egress to the north and south of the site were represented as filled blocks, in accordance with the concept plan (refer Drawing SK-C002, as part of Appendix A).
- Channel 1 was re-formed in accordance with the concept invert levels, maintaining flow conveyance along the south-eastern perimeter of the site.
- A drainage easement was applied between the southern access point and the T3 raised pad, with flows directed to the transverse drainage structure, routing to Channel 1.
- Swales along the western perimeter and east of the southern access point were represented as channel break-lines, conveying local flows to the drainage easement and to the existing channel along the eastern boundary.

The post-development surface utilised within the TUFLOW model has been demonstrated as shown below in Figure 12.



Figure 12: Post-Development Surface – TUFLOW Model (Source: QGIS)

4.1.3 Hydraulic Components

All hydraulic components were retained as per the baseline Ross River Flood Model.

As noted in Section 3.3, the recently developed footpath and crossing, east of Abbott Street, was included as part of the pre-development scenario.

As noted in Section 3.4.2, the proposed drainage channels were included in the post-development scenario.

4.1.4 2D Hydraulic Roughness and Infiltration Parameters

2D Manning's roughness values were retained for the baseline model, and as the underlying layer within the post-development model. Materials modifications (manning's n) were undertaken in the post-development scenario for the subject site:

- Hardstand areas have been modelled as $n = 0.08$ (Layer: 207, Buildings, gardens, fences combined (0.08 to 0.3) from the Ross River Flood Model)
- Drainage easement, including the perimeter swales, have been modelled as $n = 0.02$ (Layer: 302, Drainage Easements (TCC Black River Flood Study) from the Ross River Flood Model)

4.1.5 Peak Flood Map and Impact Assessment Results

2D peak flood mapping has been produced for peak water depth, velocity, depth-velocity product (DV) and hazard categorisation for the 1% AEP design event under climate change (1% AEP CC), for the pre-development and post-development scenarios. The peak flood mapping for the pre-development scenario is provided in Appendix C, and the peak flood model for the post-development scenario, change in peak flood level (afflux) and change in peak flow velocity mapping (as a percentage) is provided in Appendix D.

The subject site is located in the lower reaches of the Ross River catchment and, as established in Sections 3.3 and 4.1.1, peak flood levels across the site are governed by downstream tailwater (backwater) conditions rather than local pluvial runoff. Accordingly, the discussion below focuses on the riverine (1% AEP CC) Defined Flood Event (DFE).

Under pre-development conditions:

- Flows from the external catchment to the west are conveyed eastward through the site via the Channel 1 drainage easement toward Ross River, discharging beneath the railway line and Abbott Street through the existing culvert crossings.
- The existing filled pad areas of the site remain largely above the peak flood,
- Flow is concentrated within the Channel 1 easement, where peak depths range from approximately 0.50–1.00 m through the site, deepening to the order of 1.00–2.00 m toward the eastern outlet.
- The peak flood level across the site is approximately 3.5 m AHD near the Channel 1 inlet.
- Beyond the site to the east, within the Ross River floodplain and rail corridor, peak flood depths vary from 1.50 m to 3.00 m. The peak flood level near the railway and Abbott Street Road easement is approximately 3.4 m AHD.

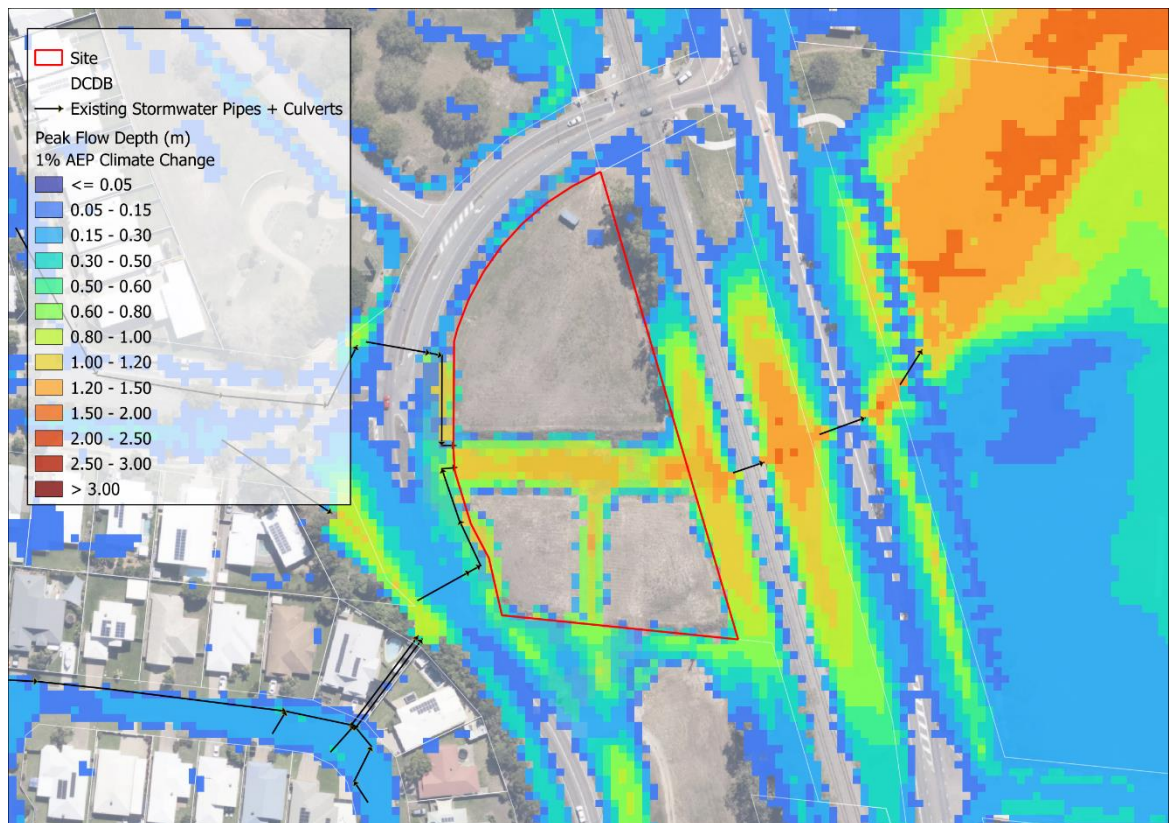


Figure 13 Peak Flood Mapping – 1% AEP under Climate Change - Peak Flow Depth – Pre-Development Scenario

Under post-development conditions:

- The proposed building pads are raised to a finished pavement level of 4.50 m AHD across all building footprints, which sits above the DFE peak flood level of approximately 3.5 m AHD. The raised pads remain dry (i.e. peak flow depth less than 0.05 m). The development therefore achieves flood immunity in both the 1% AEP and 1% AEP climate change events, with approximately 1.0 m of freeboard in the 1% AEP climate change event.
- Flow conveyance is maintained, with flows conveyed eastward toward Ross River via the re-graded Channel 1 easement as the dominant flow path traversing the site. Peak depths are in the vicinity of 0.50–2.00 m.
- The proposed culvert crossings are able to effectively convey flows up to and including the 1% AEP climate change event, with flows routed beneath the internal access linking the northern and southern pads, and through the northern and southern access crossings. This demonstrates that flow conveyance within and external to the site is maintained.
- No material change in the flow behaviour is observed near and within the railway corridor rail corridor, with no obstruction of the drainage easement. Peak flood depths within the broader Ross River floodplain to the east (in the order of 1.50 m to in excess of 3.00 m) are consistent between the pre- and post-development scenarios – confirming that the raised pads do not displace flow in a manner that worsens flood behaviour external to the site.

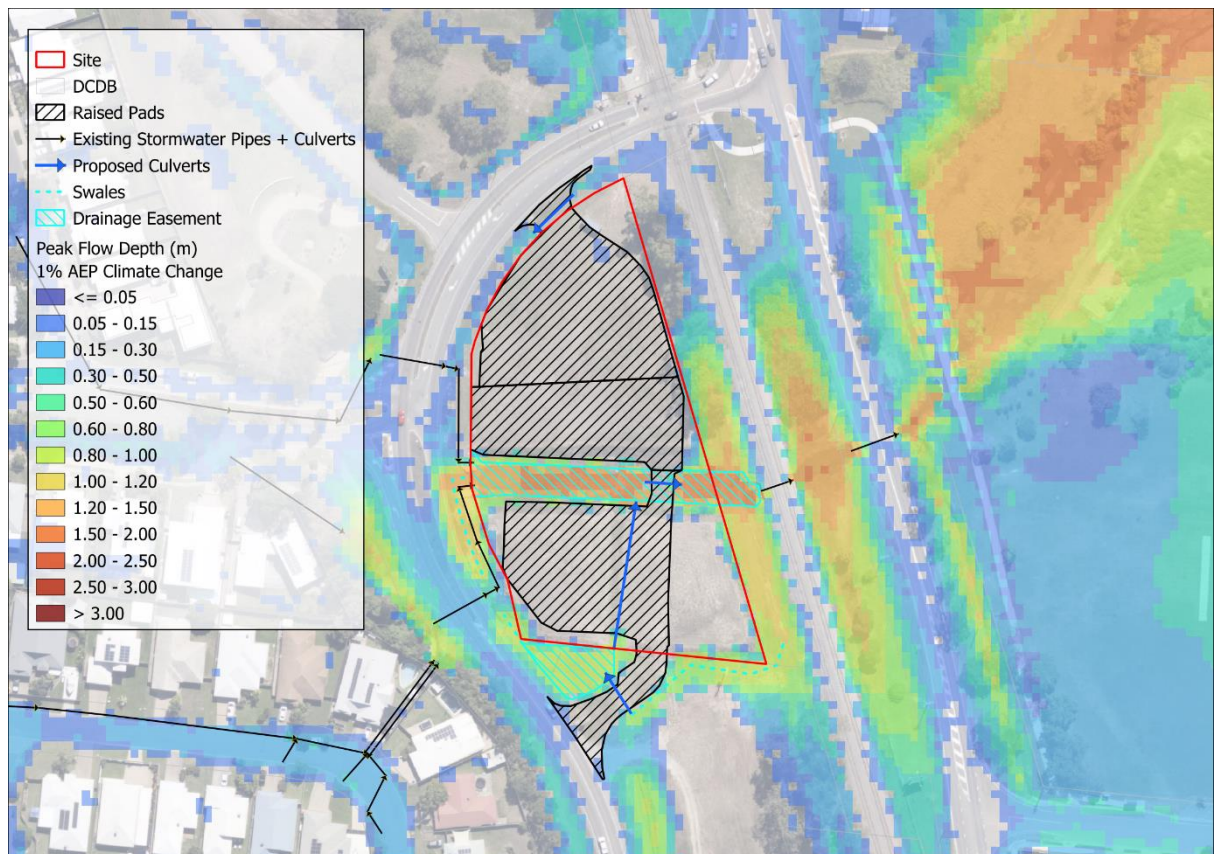


Figure 14 Peak Flood Mapping – 1% AEP under Climate Change - Peak Flow Depth – Post-Development Scenario

The change in peak flood level assessment demonstrates that:

- No material change in peak flood level is observed within the Ross River floodplain or the rail corridor to the east, confirming that the proposed development does not adversely affect the downstream regime or the rail and road corridors.
- Within the subject site, reductions in peak flood level of up to and exceeding 100 mm are observed across the raised building pads, reflecting the filling of those footprints above the flood.
- Localised increases in peak flood level, of up to and exceeding 100 mm, occur along the Channel 1 easement and immediately adjacent to the pads, where overland flow is redistributed around the development footprint.
- Decreases in the peak flood level up to 20mm are observed in the drainage easement south of the southern access road.
- Increases in peak flood level greater than 10 mm are confined within the subject site, the Channel 1 easement and the southern access road. This is considered an acceptable outcome, with these increases contained wholly within the development site and its drainage reserve, and no increased flood risk imposed on adjoining properties or road users.

On this basis, no material change to peak flood levels, flow paths, flood storage or flood warning times is observed external to the site, demonstrating that the proposal satisfies the no-worsening intent of the Flood Hazard Overlay Code.

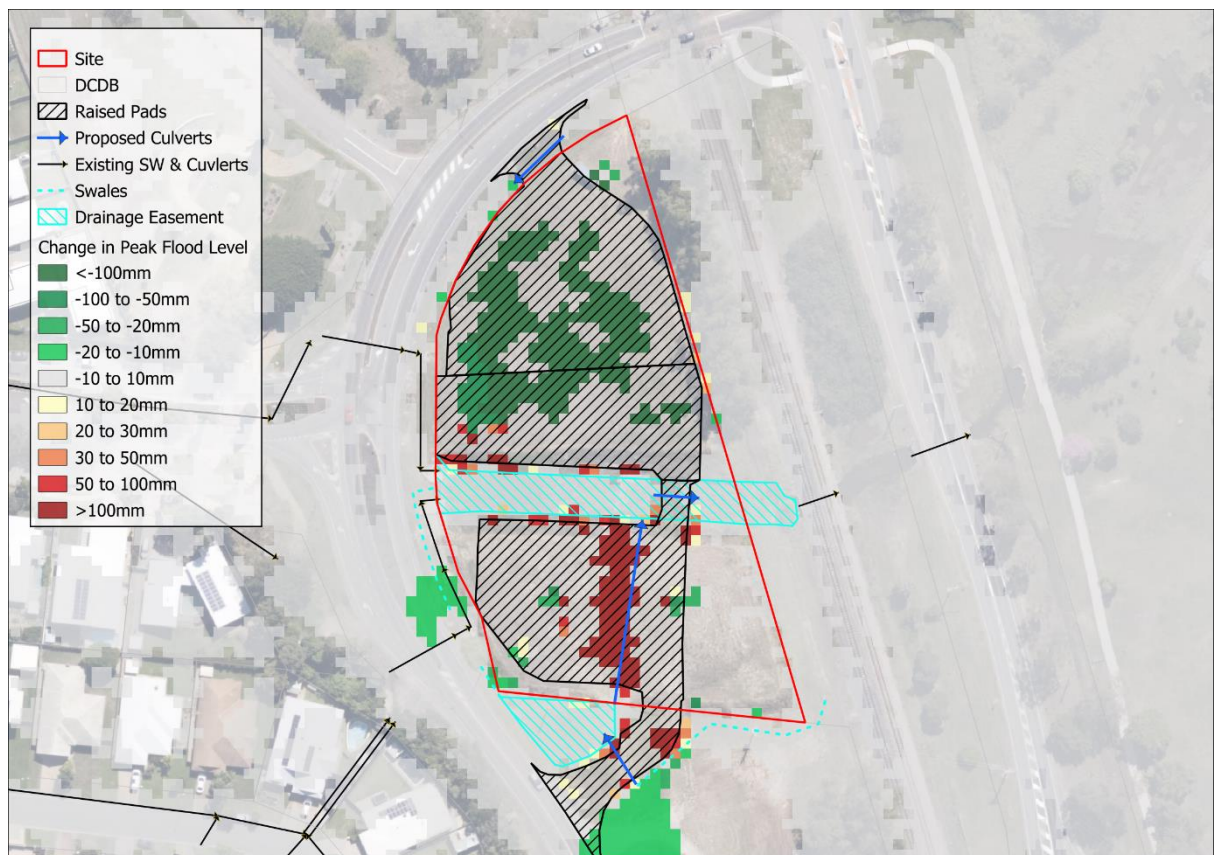


Figure 15 Peak Flood Mapping – 1% AEP under Climate Change – Change in Peak Flood Level

The change in peak flow velocity map confirms that the proposed works do not result in any significant increase in flow velocity within the Channel 1 easement, at the downstream railway and Abbott Street culverts, or external to the site, with the change in peak flow velocity less than 10% external to the site. Accordingly, the development does not increase the potential for scour or erosion of the channel, the easement, or the State transport (rail and road) infrastructure.

Increases in the peak flow velocity between 10 -20% are observed along the western perimeter, near the proposed drainage swale. These are anticipated to be contained to the drainage easement, with the drainage swales to be designed to manage flows up to and including the 1% AEP under climate change conditions.



Figure 16
Velocity

Peak Flood Mapping – 1% AEP under Climate Change – Change in Peak Flow

5 Flood Planning Assessment

5.1.1 Flood Planning Level Requirements

Minimum Building Level

In accordance with the Townsville City Plan Flood Hazard Overlay Code (8.2.6), the proposed development requires a minimum floor level above the Defined Flood Event, as per Acceptable Outcome AO1.2(b).

The proposed building pads adopt a finished pavement level of **4.50 m AHD** and are therefore above the DFE (1% AEP CC) peak flood level of approximately 3.50 m AHD within the site, providing in the order of 1.0 m of freeboard.

Egress

There are reasonable opportunities for evacuation from the site, and therefore the focus of flood risk safety is early evacuation as the primary response, with a shelter-in-place approach as a backup option (although this is highly unlikely to be required). The slow rate of rise of Ross River flooding permits staff and visitors to evacuate the site with reasonable notice. Egress is maintained across the northern and southern access points; however, preference would be given to the southern access, heading southward along Lakeside Drive.

The flood hazard rating along the access points and Lakeside Drive is modelled as H1 (generally safe for people, vehicles and buildings) under the ARR 2019 flood hazard categorisation. The modelled peak flow depth along the road is less than 300 mm, with a depth-velocity product of less than 0.4 m²/s. These conditions are within the major-storm trafficability limits of the Queensland Urban Drainage Manual (QUDM): the transverse-flow vehicle-safety limit at the access/crossing points (Table 7.4.5 – 300 mm and 0.45 m²/s, no risk to life), and the longitudinal-flow limit for evacuation southward along Lakeside Drive (Table 7.4.4 – 250 mm and 0.6 m²/s, no risk to life). The egress route is therefore deemed trafficable for the safe evacuation of pedestrians and vehicles in the lead-up to the peak of the Defined Flood Event.

Earthworks

The proposed development is established on the existing filled commercial pad created under the earlier PDA approvals (refer Section 2). The proposed earthworks comprise the filling of the building pads to a finished pavement level of 4.50 m AHD, a localised cut adjacent the existing east-west channel, retaining walls along the eastern (rail) boundary, and the re-grading of the Channel 1 drainage easement, together with perimeter swales.

The filling of the pads provides flood immunity to the building footprints, as detailed under Minimum Building Level above, with the pads set above the DFE peak flood level (approximately 3.5 m AHD) with in the order of 1.0 m of freeboard.

The earthworks have been designed to maintain the existing overland flow regime through the site. The Channel 1 easement is re-graded and retained as the principal eastward flow path (minimum 1:250 longitudinal fall, west to east), conveying flows to the existing downstream culverts beneath the railway and Abbott Street. A proposed culvert crossing conveys runoff from the development and the external catchment to the west beneath the internal access linking the northern and southern pads, and perimeter swales direct local flows to the easement.

The flood impact assessment (Section 4) confirms that the earthworks do not result in adverse flood impacts external to the site: increases in peak flood level external to the site are limited to no more than 10 mm, with increases greater than 10 mm confined within the subject site. No material change in peak flood level occurs within the Ross River floodplain or the rail corridor, and no significant increase in flow velocity occurs at the downstream culverts (no increased scour or erosion).

5.1.2 TCC Flood Hazard PSP Assessment

An assessment has been undertaken against the TCC Flood Hazard Overlay (Section 8.2.6), with responses to the Performance Outcomes provided below. The TCC Flood Hazard Overlay adopts the 1% AEP design event as the Defined Flood Event. As noted in Section 3.1.1, the 1% AEP climate change sensitivity event developed as part of the Ross River Flood Study has been adopted as the Defined Flood Event for this assessment, to account for the impacts of a changing climate, required as part of the QLD State Planning Policy (2017).

PO1 | AO1.2

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 300 mm above the defined flood level.*

StormFlood Response:

N/A – No habitable rooms are proposed (commercial development).

- b) *Floor levels of all non-habitable rooms (other than class 10 buildings) are above the defined flood event.*

StormFlood Response:

Complies with AO1.2 (b). Building pads are set to a finished pavement level of 4.50 m AHD, above the DFE (1% AEP CC ≈ 3.5 m AHD), providing approximately 1.0 m of freeboard. Building floor levels are therefore above the DFE (AO1.2(b) achieved).

- c) *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*

StormFlood Response:

A performance-based solution has been adopted for PO1.2(c), as the proposed car park is partly located within the high hazard area of OM-06.2. The post-development peak flood mapping demonstrates that the hardstand and car park areas are immune from Ross River flooding up to and including the Defined Flood Event, with the site subject only to shallow inundation from local flows. The flood hazard for the site and egress points is modelled as Trafficable (H1), supporting safe evacuation.

- 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 300 mm above the defined flood level.*

StormFlood Response:

N/A – No underground car parking is proposed.

PO2 | AO2.1

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 150 mm; or*
- b) *block or solid walls or solid fences; or*
- c) *garden beds or other structures with a height more than 150 mm; or*
- d) *the planting of dense shrub hedges.*

StormFlood Response:

A performance-based solution has been adopted for PO2, as the development involves filling of the building pads (greater than 150 mm) and retaining walls along the eastern (rail) boundary; AO2.1 is therefore not achieved. However, the hydraulic assessment (Section 4) demonstrates that overland flows are conveyed around the raised pads via the re-graded Channel 1 easement and the proposed culvert crossings, with no material increase in the peak flood level modelled external to the site (i.e. increases in the peak flood level are less than 10 mm). The development is therefore demonstrated not to significantly impede the flow of flood waters through the site, nor to worsen flood flows external to the site (refer to Appendix D).

PO3 | AO3.1, AO3.2, AO3.3

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.*

StormFlood Response:

A performance-based solution has been adopted for AO3.1/PO3.1, as the entire site is mapped as in the overlay map OM-06.1 and 06.2, and the proposed buildings cannot be located outside the high hazard area. Risk to people and property is minimised on the basis that:

- The building pads are set above the DFE and are flood-immune;
- The flood mechanism is slow-rise riverine / backwater flooding with a long warning time and modelled H1 (trafficable) egress, enabling safe early evacuation; and
- The proposed uses (including the service station and food and drink premises) were contemplated and approved in principle under the Oonoonba PDA Preliminary Approval (EDQ Ref: DEV2016/757).

AO3.2 *New lots or roads are not created within high hazard areas identified on overlay map OM-06.1 or 06.2.*

StormFlood Response:

Complies with AO3.2– the application is for a Material Change of Use only. No new lots or roads are created (Lot 6000 was created under EDQ Ref: DEV2015/725).

AO3.3 *Sites for non-permanent accommodation such as tents, cabins or caravans are located outside the high hazard areas.*

StormFlood Response:

N/A – No non-permanent accommodation is proposed.

PO4 | AO4.1 – AO4.7

PO4: *Siting and layout of development maintains the safety of people and property in medium hazard areas.*

AO4.1 *Floor levels for residential buildings are 300 mm above the defined flood level.*

StormFlood Response:

N/A – No residential buildings are proposed.

AO4.2 *Floor levels of non-residential buildings (other than class 10 buildings) are above the defined flood level.*

StormFlood Response:

Complies with AO4.2– non-residential floor levels (finished pavement level 4.50 m AHD) are above the defined flood level.

AO4.3 *Underground car parks are designed to prevent intrusion of flood waters (bund 300 mm above the defined flood level).*

StormFlood Response:

N/A – No underground car parking is proposed.

AO4.4 *Non-permanent accommodation is located outside the medium hazard areas.*

StormFlood Response:

N/A – No non-permanent accommodation is proposed.

AO4.5 – AO4.7 *Provisions applying where reconfiguring a lot.*

StormFlood Response:

N/A – No reconfiguration of a lot is proposed.

PO5 | AO5

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.*

StormFlood Response:

Complies with AO5. Flood-awareness signage will be provided on-site at key hazard points (site entrances and car park / hardstand areas) to indicate flood depth and risk to staff and visitors. It is recommended that this be secured by a condition of approval.

PO6

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.

StormFlood Response:

A performance-based solution has been adopted for PO6. The impact assessment (Section 4.1.5 and Appendix D) demonstrates that increases in peak flood level, depth and velocity greater than 10 mm are confined within the subject site and the Channel 1 easement, with changes external to the site within ± 10 mm.

PO7

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; (b) loss of flood storage; (c) loss of or changes to flow paths; (d) flow acceleration or retardation; (e) reduction in flood warning times.*

No acceptable outcome is nominated.

StormFlood Response:

A performance-based solution has been adopted for PO7. The assessment demonstrates external afflux of no more than 10 mm; no material change to flow paths; flood storage maintained in the drainage easement; no significant increase in flow velocity at the downstream railway and Abbott

Street culverts (and therefore no increased potential for scour or erosion of the channel, easement or State transport infrastructure); and, flood warning times retained (slow-rise riverine mechanism).

PO8 | AO8

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).*

StormFlood Response:

N/A – The proposed development (service station, food and drink premises) is not a facility with a role in emergency management, nor a vulnerable community service listed in Table 8.2.6.3(b).

PO9 | AO9.1, AO9.2

PO9: *Public safety and the environment are not adversely affected by the detrimental impacts of flooding on hazardous materials manufactured or stored in bulk.*

AO9.1 *Development does not involve the manufacture or storage of hazardous materials within a high flood hazard area identified on overlay map OM-06.1 or 06.2.*

AO9.2 *Within the low or medium flood hazard area, 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.*

StormFlood Response:

A performance-based solution has been adopted against PO9. The service station involves the underground storage of flammable and combustible liquids (hazardous materials) within a high flood hazard area; accordingly, AO9.1 is not achieved and PO9.2 does not apply, given the storage of hazardous materials is not considered to be in bulk.

Compliance is therefore demonstrated against PO9 - that public safety and the environment are not adversely affected by the detrimental impacts of flooding on hazardous materials stored in bulk. The underground fuel storage tanks and forecourt will be designed to prevent the intrusion of flood waters and the escape of contaminants during flood events, incorporating measures such as water-tight tank construction, anti-flotation design, fill and vent points set above the design flood level, and bunding of the forecourt with surface runoff captured via the proposed separator (Purceptor),

5.1.3 TCC Coastal Environment Overlay Code

An assessment has been undertaken against the TCC Coastal Environment Overlay Code (Section 8.2.3), with responses to the Performance Outcomes provided below. The Coastal Environment Overlay Code adopts the defined storm tide event level as the basis of design. This can be taken as RL 4.5m AHD, within 100m of the coastline or RL 3.9m AHD in other areas. The site is contained approximately 700 m from the Ross River, and approximately 3.6 km from coastline; therefore, the DTSE is 3.9 m AHD.

PO1 | AO1.1 – AO1.4 (Development in coastal hazard areas)

PO1: Development is designed and located to minimise susceptibility to, and the potential impacts of, storm tide inundation and erosion.

AO1.1 *Floor levels of all habitable rooms are above the defined storm tide event level.*

StormFlood Response:

N/A - No habitable rooms are proposed; notwithstanding, all floor levels are above the DSTE),

AO1.2 *Underground parking is designed to prevent the intrusion of storm tide waters (bund above the DSTE level).*

StormFlood Response:

N/A - no underground parking is proposed (AO1.2 not applicable).

AO1.3 *Buildings have open ground floors that allow for the flow-through of storm tide water and are not designed as slab on ground.*

StormFlood Response:

A performance-based solution has been adopted for PO1.3/AO1.3. The building pads are set to a finished pavement level of 4.50 m AHD, above the defined storm tide event (DSTE) level. The buildings are slab-on-ground commercial structures on raised pads; rather than providing open ground floors (AO1.3), flood immunity is achieved by setting the pads above the DSTE, addressed on a performance basis.

AO1.4 *Buildings are located outside the erosion prone area or, where impractical, do not extend further seaward than existing immediately adjacent buildings.*

StormFlood Response:

Complies with AO1.4. The development is located outside the erosion prone area (OM-03.3)

PO7 (Development in storm tide inundation areas)

PO7: Development is located outside high or medium storm tide inundation areas and erosion areas from sea level rise identified on overlay maps OM-03.1 and OM-03.2 unless it: (a) does not result in an increase in the intensity of development on the site; or (b) is located within the inner city area shown on Figure 8.1 and provides measures to ensure critical services remain operational up to the defined storm tide event; or (c) avoids any increase in risk to people or property from coastal hazard impacts (including impacts on the development's ongoing operation).

No acceptable outcome is nominated.

StormFlood Response:

A performance-based solution has been adopted for PO7. The site is mapped within the storm tide inundation area (OM-03.1) and the development cannot be located outside it; PO7(b) (inner city area) is not applicable. Compliance is demonstrated against PO7(c) – the development avoids any increase in risk to people or property from coastal hazard impacts, as the building pads are set

above the DSTE (flood-immune) and safe early evacuation is available via the trafficable (H1) access to Lakeside Drive during the Defined Flood Event.

PO8 | AO8.1, AO8.2

***PO8:** Development in storm tide inundation areas and erosion areas from sea level rise identified on overlay maps OM-03.1–OM-03.2 is located, designed, constructed and operated to: (a) ensure structures can sustain flooding from a defined storm tide event; and (b) maintain the safety of people living and working on the premises from a defined storm tide event.*

***AO8.1** Development within a high or medium storm tide inundation area ensures: (a) habitable rooms of built structures are located above the DSTE level; (b) underground parking is designed to prevent the intrusion of flood waters (bund above the DSTE level); and (c) where reconfiguring a lot, at least one evacuation route remains passable for emergency evacuations during a DSTE.*

***AO8.2:** Structures used for the manufacture or storage of hazardous materials in bulk are designed to prevent the intrusion of waters from a DSTE.*

StormFlood Response:

Complies with AO8.1.

AO8.1(a) No habitable rooms are proposed; notwithstanding, all building floor levels (finished pavement level 4.50 m AHD) are above the DSTE, ensuring the structures can sustain a defined storm tide event.

AO8.1(b) No underground parking is proposed.

AO8.1(c) No reconfiguration of a lot is proposed; notwithstanding, the southern access to Lakeside Drive remains passable (modelled as H1, trafficable) during the event, providing a safe evacuation route.

AO8.2 The service station's underground fuel storage tanks and forecourt are to be designed to prevent the intrusion of waters from a defined storm tide event, including water-tight tank construction, anti-flotation design, fill and vent points above the DSTE level, and bunding of the forecourt with runoff captured via the proposed separator, in accordance with AS 1940 and the relevant legislation.

5.1.4 SDAP State Code Responses

In accordance with the Information Request prepared by EDQ (Ref: DEV2021/1199), an assessment has been undertaken against the relevant State Codes as part of the State Development Assessment Provisions (SDAP), delineated in Section 3.1.2. The responses below are limited to the flooding, stormwater and drainage performance outcomes of the relevant State Codes.

5.1.4.1 *State Code 1 – Development in a State-Controlled Road Environment*

Purpose: to protect the safety, function and efficiency of state-controlled roads and associated transport infrastructure. The site adjoins and takes access from the state-controlled road network (Abbott Street / Lakeside Drive).

PO8: *Stormwater run-off or overland flow from the development site does not create or exacerbate a safety hazard for users of the state-controlled road.*

StormFlood Response:

A performance-based solution has been adopted for PO8. Surface flows from the development are conveyed by the internal stormwater network and the Channel 1 drainage easement to the existing downstream culverts; no concentrated discharge is directed to the state-controlled road carriageway and no safety hazard is created or exacerbated for road users.

PO9: *Stormwater run-off or overland flow from the development site does not result in a material worsening of the operating performance of the state-controlled road or road transport infrastructure.*

StormFlood Response:

A performance-based solution has been adopted for PO9. The flood impact assessment (Section 3) demonstrates peak flood level increases external to the site of no more than 10 mm for all events up to the 1% AEP; the operating performance of the state-controlled road is not materially worsened.

PO10: *Stormwater run-off or overland flow from the development site does not adversely impact the structural integrity or physical condition of the state-controlled road or road transport infrastructure.*

StormFlood Response:

A performance-based solution has been adopted for PO10. No significant increase in peak flow velocity occurs at the road and rail culverts, and therefore no increased potential for scour or erosion of the state-controlled road or its drainage infrastructure.

PO11 | AO11.1 – AO11.4

PO11: *Development ensures that stormwater is lawfully discharged.*

AO11.1: *No new points of discharge to a state-controlled road;*

AO11.2 *flows are not concentrated to a state-controlled road;*

AO11.3 *stormwater is discharged to a lawful point of discharge;*

AO11.4 *the condition of an existing lawful point of discharge is not worsened.*

StormFlood Response:

Complies with AO11.1 to AO11.4: Stormwater is discharged to the existing lawful point of discharge via the Channel 1 easement; no new points of discharge to the state-controlled road are created and flows are not concentrated to the road.

PO12 | AO12.1, AO12.2, AO12.3

PO12: *Development does not result in a material worsening of flooding impacts within a state-controlled road.*

AO12.1 For all flood events up to 1% AEP, negligible impacts (within ± 10 mm) to existing flood levels within a state-controlled road; **AO12.2** negligible impacts (up to 10% increase) to existing peak velocities; **AO12.3** negligible impacts (up to 10% increase) to time of submergence.

StormFlood Response:

Complies with AO12.1, AO12.2 and AO12.3 – the impact assessment demonstrates peak flood level increases external to the site of no more than 10 mm for all events up to the 1% AEP. The peak velocity and time-of-submergence changes within the state-controlled road are within the AO12.2 and AO12.3 thresholds (up to a 10% increase).

PO13 | AO13.1, AO13.2

PO13: Drainage infrastructure does not create a safety hazard for users in the state-controlled road.

AO13.1 Drainage infrastructure is wholly contained within the development site, except at the lawful point of discharge;

AO13.2 drainage infrastructure can be maintained without requiring access to a state-controlled road.

StormFlood Response:

Complies with AO13.1 and 13.2– the proposed drainage infrastructure is contained within the development site (other than at the lawful point of discharge) and can be maintained without requiring access to the state-controlled road.

PO14 (no acceptable outcome prescribed)

PO14: Drainage infrastructure associated with, or within, a state-controlled road is constructed and designed to ensure the structural integrity and physical condition of existing drainage infrastructure and the surrounding drainage network.

StormFlood Response:

A performance-based solution has been adopted for PO14. No new drainage infrastructure is proposed within the state-controlled road; existing road drainage infrastructure is not adversely affected by the development.

5.1.4.2 State Code 2 – Development in a Railway Environment

Purpose: to protect the safety and operation of the railway and the safety of people using, living and working near it. The site adjoins the Queensland Rail corridor along its eastern boundary.

PO12 (no acceptable outcome prescribed)

PO12: Stormwater run-off or overland flow from the development site does not create or exacerbate a safety hazard in a railway corridor.

StormFlood Response:

A performance-based solution has been adopted for PO12. Surface flows are conveyed eastward via the Channel 1 easement to the existing culverts beneath the railway; no concentrated discharge or new safety hazard is created within the railway corridor.

PO13: Stormwater run-off or overland flow from the development site does not result in a material worsening of operating performance of the railway corridor, rail transport infrastructure or other rail infrastructure.

StormFlood Response:

A performance-based solution has been adopted for PO13. The impact assessment demonstrates no material change in peak flood level within the railway corridor; the operating performance of the railway is not worsened.

PO14: *Stormwater run-off or overland flow from the development site does not interfere with the structural integrity or physical condition of the railway corridor, rail transport infrastructure or other rail infrastructure.*

StormFlood Response:

A performance-based solution has been adopted for PO14. No significant increase in flow velocity occurs at the railway culverts; there is no increased potential for scour or erosion, and the structural integrity and physical condition of the rail drainage infrastructure is not affected.

PO15: *Development does not result in a material worsening of flooding impacts within a railway corridor.*

StormFlood Response:

A performance-based solution has been adopted for PO15. No material change in peak flood level occurs within the railway corridor; increases in peak flood level greater than 10 mm are confined within the subject site and the Channel 1 easement (Section 3 and Appendix D).

PO16 | AO16.1, AO16.2

PO16: *Drainage infrastructure does not create a safety hazard in a railway corridor.*

AO16.1 *Drainage infrastructure is wholly contained within the development site;*

AO16.2 *drainage infrastructure can be maintained without requiring access to a railway corridor.*

StormFlood Response:

Complies with AO16.1 and AO16.2– all proposed drainage infrastructure is contained wholly within the development site and can be maintained without requiring access to the railway corridor; no drainage works are proposed within the rail corridor.

6 Conclusion

This Flood Impact Assessment (FIA) has been commissioned by Oonoonba Project Pty Ltd to investigate potential flooding impacts in support of a Material Change of Use (MCU) application for a proposed commercial development - comprising a service station, food and drink premises and associated tenancies - at 286 Lakeside Drive, Oonoonba. The site is co-located within the Townsville City Council (TCC) Local Government Authority (LGA) and the Oonoonba Urban Development Priority Development Area (PDA), for which Economic Development Queensland (EDQ) is the assessment manager.

The site lies within the Ross River regional catchment and is mapped within the Low, Medium and High Hazard Area of the TCC Flood Hazard Overlay (OM-06.1/06.2) and the Storm Tide Inundation Area (OM-03.1). The assessment has been undertaken using a truncated and validated TUFLOW model derived from the Ross River Flood Study Base-line Flood Assessment (AECOM, 2021), comparing the pre-development and post-development flood behaviour for the 1% AEP Climate Change scenario – the Defined Flood Event.

The assessment demonstrates the following key outcomes, which reinforce the development's compliance with the Flood Hazard Overlay Code (Section 8.2.6):

- **Flood immunity:** the proposed building pads (finished pavement level 4.50 m AHD) are set above the Defined Flood Event peak flood level (approximately 3.5 m AHD) and the Defined Storm Tide Event, providing in the order of 1.0 m of freeboard, with the building footprints immune from flooding up to and including the 1% AEP climate change event;
- **No worsening of flood impacts:** peak flood level increases external to the site are limited to no more than 10 mm, with increases greater than 10 mm confined within the subject site, the Channel 1 easement and the southern access; no material change occurs within the Ross River floodplain or the rail and road corridors; no significant increase in flow velocity occurs at the downstream railway and Abbott Street culverts;
- **Maintaining flow conveyance:** the re-graded Channel 1 easement, the proposed culvert crossings and the internal stormwater network maintain the existing overland flow regime; and
- **Safe evacuation:** the site access points and Lakeside Drive are modelled as flood hazard category H1 (trafficable) within the Queensland Urban Drainage Manual major-storm limits, with the slow-rise nature of Ross River flooding provides reasonable warning for early evacuation as the primary flood-response strategy.

A compliance assessment has been undertaken against the Flood Hazard Overlay Code (Section 8.2.6, Townsville City Plan), with responses to the Performance Outcomes provided in Section 5.1.2. Acceptable Outcomes are achieved where practicable, and the development is otherwise demonstrated to satisfy the relevant Performance Outcomes on a performance basis, consistent with the flood-immune and non-worsening outcomes established by the modelling.

It is highlighted that the proposed levels are preliminary in nature; the assessment provides a conservative basis to establish the minimum levels for the site, with detailed design to be confirmed at the Operational Works phase. It is recommended that flood-awareness signage be provided on-site, and that the operation of the site adopt standard monitoring of BOM / SES / Council flood warnings.

This assessment is limited to the information provided by Oonoonba Project Pty Ltd, Verve Design Group and STP Consultants, as well as publicly available information by the Local Government Authority (TCC) and all other relevant authorities.

7 Qualifications

Our analysis and overall approach has been specifically catered for the requirements of Oonoonba Project Pty Ltd and may not be applicable beyond this scope. For this reason, any other third parties are not authorised to utilise this report without further input and advice from StormFlood Engineering Pty Ltd.

StormFlood has relied on the information as outlined in Section 2 of this Report, and therefore any information provided within this Report is limited to the data provided. Any changes beyond the data noted may alter the outcomes of this report, and therefore StormFlood takes no responsibility for any data or plans that negatively impact the outcomes noted in this report. Accordingly, it is recommended that further advice or comment is sought from StormFlood, if there are changes to any of the noted adopted data.

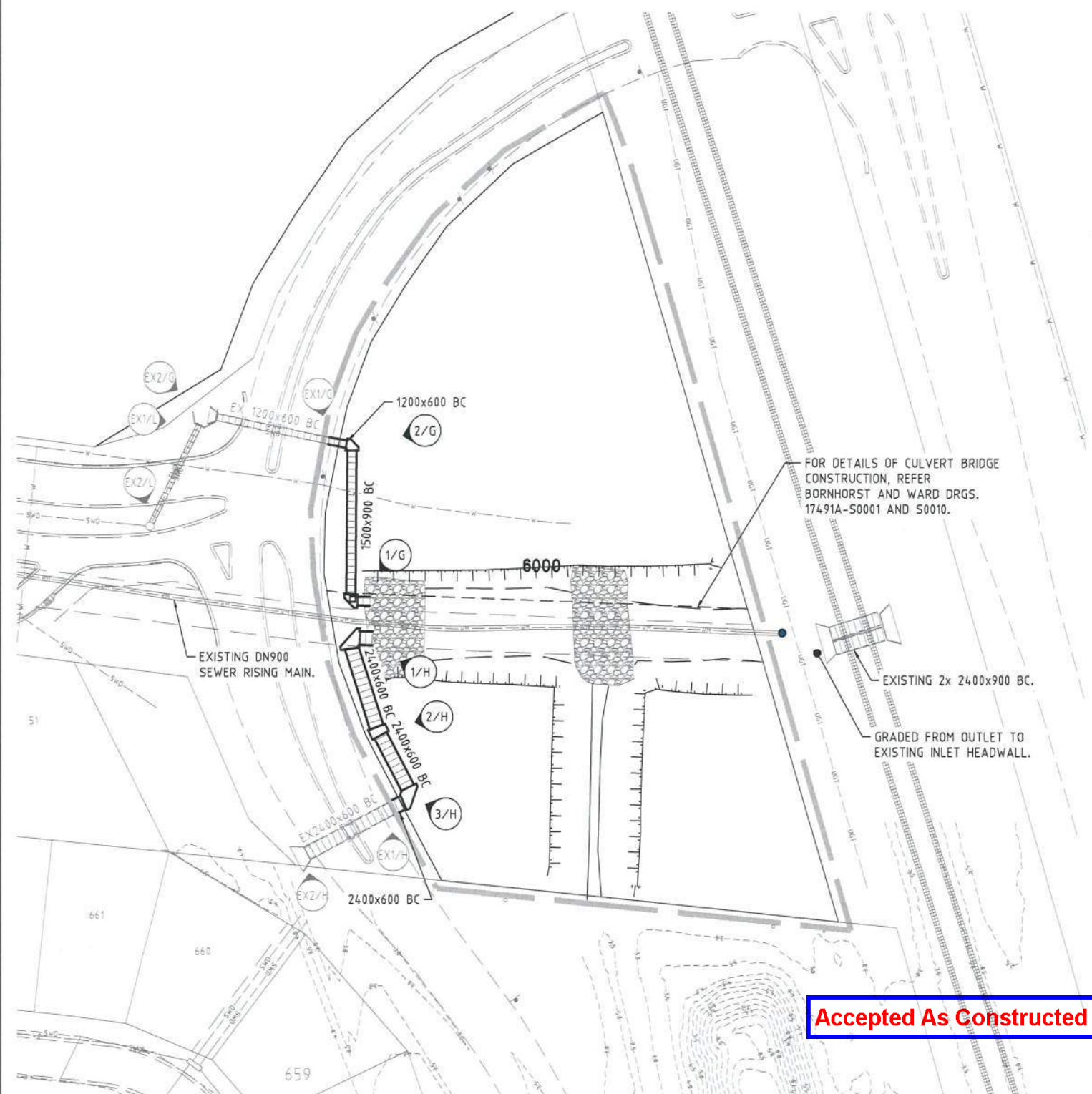
While StormFlood's Report assesses peak flows from design storms in accordance with best-practice and current industry standards and guidelines, future observed flows may vary from that predicted. For these reasons appropriate freeboards should be adopted.

Appendices

Appendix A	DA Engineering Plans, prepared by STP Consultants
Appendix B	Information Request (EDQ Ref: DEV2021/1199)
Appendix C	Pre-Development Scenario: Peak Flood Mapping
Appendix D	Post-Development Scenario: Peak Flood Mapping and Impact Assessment

Appendix A

DA Engineering Plans, prepared by STP Consultants



- LEGEND**
- STAGE BOUNDARY
 - EXISTING LAYBACK KERB AND CHANNEL
 - EXISTING LAYBACK KERB ONLY
 - STORMWATER DRAINAGE
 - DESIGN SURFACE CONTOUR (0.25m INTERVALS)
 - EXISTING SURFACE CONTOUR (0.5m INTERVALS)
 - SEWER RETICULATION
 - SWALE DRAIN
 - EXISTING SEWER RETICULATION
 - EXISTING SEWER RISING MAIN
 - WATER RETICULATION
 - EXISTING WATER RETICULATION
 - EXISTING STORMWATER DRAINAGE

- ROOFWATER NOTES**
- SET OUT POINT FOR DRAINAGE STRUCTURES IS TO THEIR GEOMETRIC CENTRE.
 - ROOFWATER HOUSE CONNECTIONS AND SETOUT REFER T.C.C. STANDARDS
 - UNLESS SHOWN OTHERWISE. FOR ROOFWATER PIT DETAILS REFER T.C.C. STORMWATER DRAINAGE DESIGN MANUAL D5.10.
 - ROOFWATER ALIGNMENT 0.6m OFF PROPERTY BOUNDARY UNLESS SHOWN OTHERWISE.
 - ROOFWATER DRAINLINES BEDDED AND SURROUNDED WITH SAND TO 100mm ABOVE THE CROWN OF PIPE.
 - HOUSE CONNECTIONS EXTEND A MINIMUM OF 1.0m PAST ADJACENT SEWER LINES.
 - ROOFWATER DRAINAGE PIPES MIN uPVC CLASS SN6, RCP OR FRC CLASS 2 WITH RUBBER RING JOINTS.
 - MINIMUM COVER TO PIPES 450mm AND TO SUIT FINISHED SURFACE LEVEL.
 - ENDS OF PIPES AND STUBS CAPPED.

- ROADWORKS AND DRAINAGE NOTES**
- ALL WORKS SHALL CARRIED OUT IN ACCORDANCE WITH CURRENT T.C.C. STANDARD DRAWINGS AND METHODS.
 - LEVELS FOR KERB AND CHANNELING CONSTRUCTION ARE AT EQUAL INTERVALS AT LIP OF CHANNEL UNLESS SHOWN OTHERWISE.
 - SIDE DRAINS CONSTRUCTED UNDER ALL KERBS AND ALL KERB AND CHANNEL AND IN LOCATIONS DIRECTED BY THE SUPERINTENDENT IN ACCORDANCE WITH T.C.C. STANDARDS.
 - ALL STORMWATER PIPES UNDER ROADWAYS AND FOOTPATHS RCP OR FRC CLASS 2.
 - ALL STORMWATER PIPES UP TO AND INCLUDING 600Ø R.R.J. STORMWATER PIPES GREATER THAN 600Ø INTERNAL FLUSH JOINTED WITH PROPRIETARY EXTERNAL BAND.
 - STEPIRONS ARE PROVIDED IN STORMWATER MANHOLES AND GULLIES GREATER THAN 1.20m DEEP.
 - STORMWATER PIPE BEDDING IN ACCORDANCE WITH T.C.C. STANDARDS.
 - CONDUITS IN ACCORDANCE WITH AS 3725 & AS 2032
 - ALL DIMENSIONS ARE IN METRES UNLESS SHOWN OTHERWISE.
 - ALL FOOTPATH PRAM RAMPS COMPLY TO COUNCILS STANDARD DRAWINGS AND LOCATED CLEAR OF FUTURE DRIVEWAYS
 - FOOTPATHS AND BATTERS HAVE MINIMUM OF 75mm TOPSOIL (AND GRASSING IF ORDERED).
 - ALL EXCAVATION AND FILLING COMPACTED TO THE REQUIREMENTS OF AS3798-2007 IN ACCORDANCE WITH THE LOCAL AUTHORITY REQUIREMENTS. LEVEL 1 SUPERVISION WAS REQUIRED.
 - THE STORMWATER PIPE CLASSES HAVE BE DESIGNED FOR SERVICE LOADS ONLY, AND THE CONTRACTOR SHALL ACCESS ANTICIPATED CONSTRUCTION LOADS AND UPGRADE THE PIPE CLASSES IF NECESSARY, IN ACCORDANCE WITH AS3725-2007.
 - RETAINING WALL SUBSOIL DRAINS CONNECT TO KERB AND CHANNEL SUBSOIL OR STORMWATER DRAINAGE STRUCTURES.

NOTE:
REFER DRG. No. 15-003077-513 TO 519 FOR STORMWATER MANHOLE SETOUT AND DETAILS.

AS CONSTRUCTED DETAILS
I CERTIFY ON BEHALF OF CALIBRE CONSULTING THAT THE "AS CONSTRUCTED" DETAILS SHOWN ON THIS PLAN ARE A TRUE AND ACCURATE RECORD OF THE WORKS.

SIGNED: _____ DATE: _____

DANIEL COLLINS RPEQ 18631

Accepted As Constructed



REV	DATE	BY	DESCRIPTION	DESIGN CHECK	SCALE (METRES)	PROJECT No.	SURVEYOR: BRAZIER MOTTI	CLIENT	DRAWING TITLE
1	14.03.16	AA	CULVERT ALIGNMENT REVISED, WATER DEPTH AND ALIGNMENT REVISED		1:500	15-003077	595 FLINDERS ST, TOWNSVILLE QLD 4810	ECONOMIC DEVELOPMENT QUEENSLAND	ROADWORKS AND DRAINAGE LAYOUT PLAN
2	30.03.17	AA	SWALE DRAIN ADDED		1:1000		P: (07) 4772 1144 E: townsville@braziermotti.com.au		
3	25.11.17	AA	DRAINAGE LINE J ADDED, BOX CULVERT SIZE REVISED						
4	09.02.18	AA	ISSUED FOR CONSTRUCTION						
5	24.05.18	AA	AS CONSTRUCTED ISSUE						

APPROVED: DANIEL COLLINS RPEQ 18631

FOR & ON BEHALF OF CALIBRE CONSULTING (QLD) PTY LTD

THE VILLAGE TOWNSVILLE FUEL SITE

Calibre Consulting (Qld) Pty Ltd

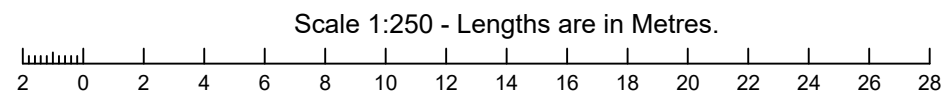
Level 4, 199 Grey Street, South Brisbane QLD Australia 4101

Telephone: 07 3895 3444 Facsimile: 07 3895 3400

Brisbane Cairns Melbourne Sydney Singapore Australia Coast

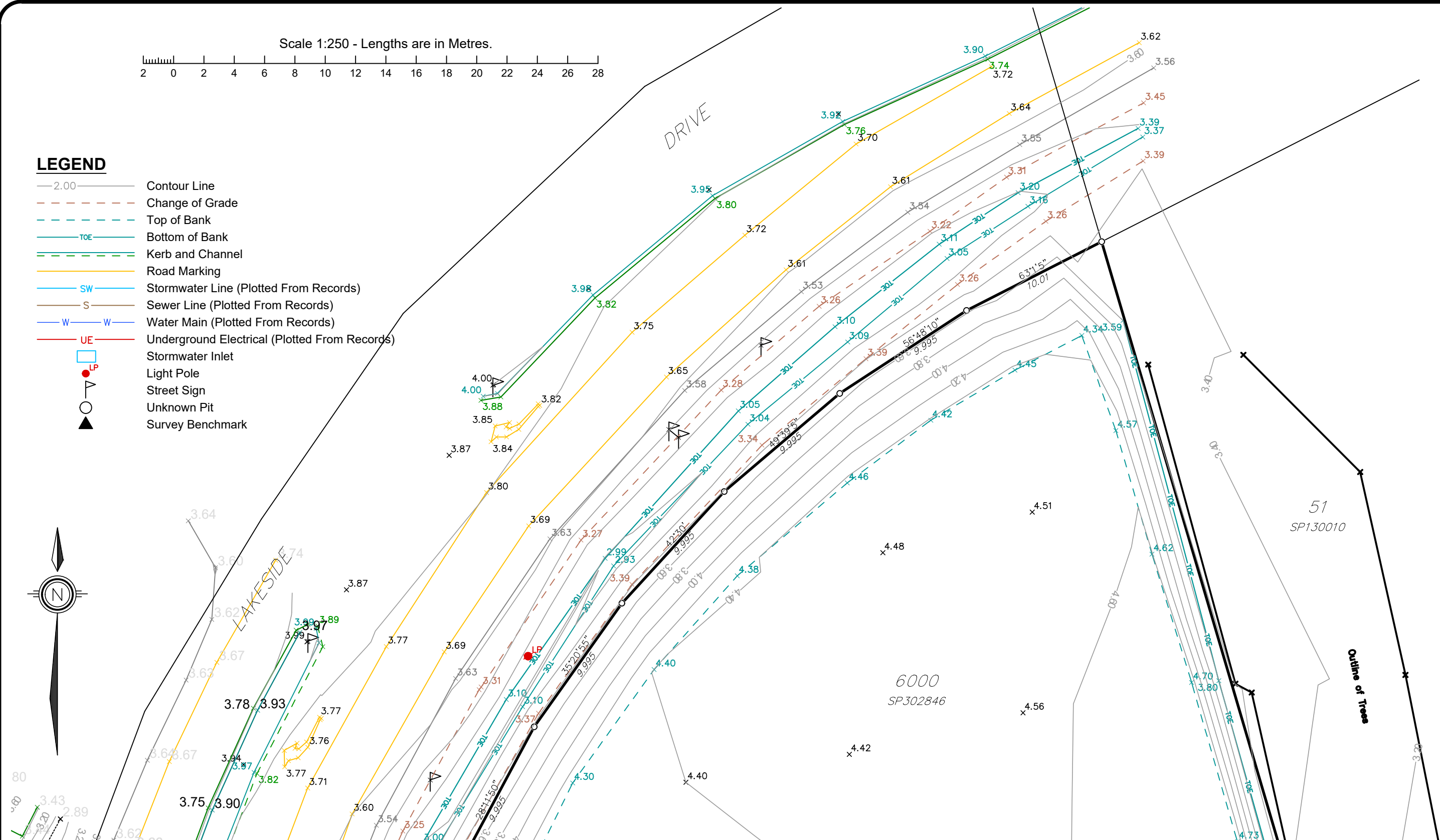
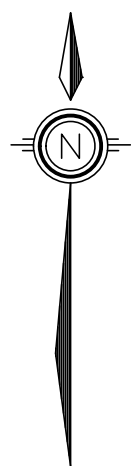
DRAWING NUMBER: 15-003077-501

ISSUE: 4



LEGEND

- 2.00— Contour Line
- - - Change of Grade
- - - Top of Bank
- TOE— Bottom of Bank
- - - Kerb and Channel
- Road Marking
- SW— Stormwater Line (Plotted From Records)
- S— Sewer Line (Plotted From Records)
- W—W— Water Main (Plotted From Records)
- UE— Underground Electrical (Plotted From Records)
- Stormwater Inlet
- LP Light Pole
- Street Sign
- Unknown Pit
- ▲ Survey Benchmark



B	Additional Survey and Services Investigation - see Sheets 4 and 5	DL	DL	04/11/2021
A	QR Culvert Added	DL	DL	08/06/2021
-	Original Issue	NL	DL	23/05/2021
Rev	Description	Drawn	Checked	Date

This plan is prepared from a combination of field survey and existing records for the purpose of designing new constructions on the land and should not be used for any other purpose. The title boundaries shown hereon were not marked by the author at the time of survey and have been determined by plan dimensions only and not by field measurement. Services shown hereon have been located where possible by field survey. If not able to be located, services may have been plotted from the records of relevant authorities where available. Prior to any demolition, excavation or construction on the site, the relevant authority should be contacted for possible location of further underground services and detailed locations of all services. This note is an integral part of this plan.

CONTOUR & DETAIL PLAN

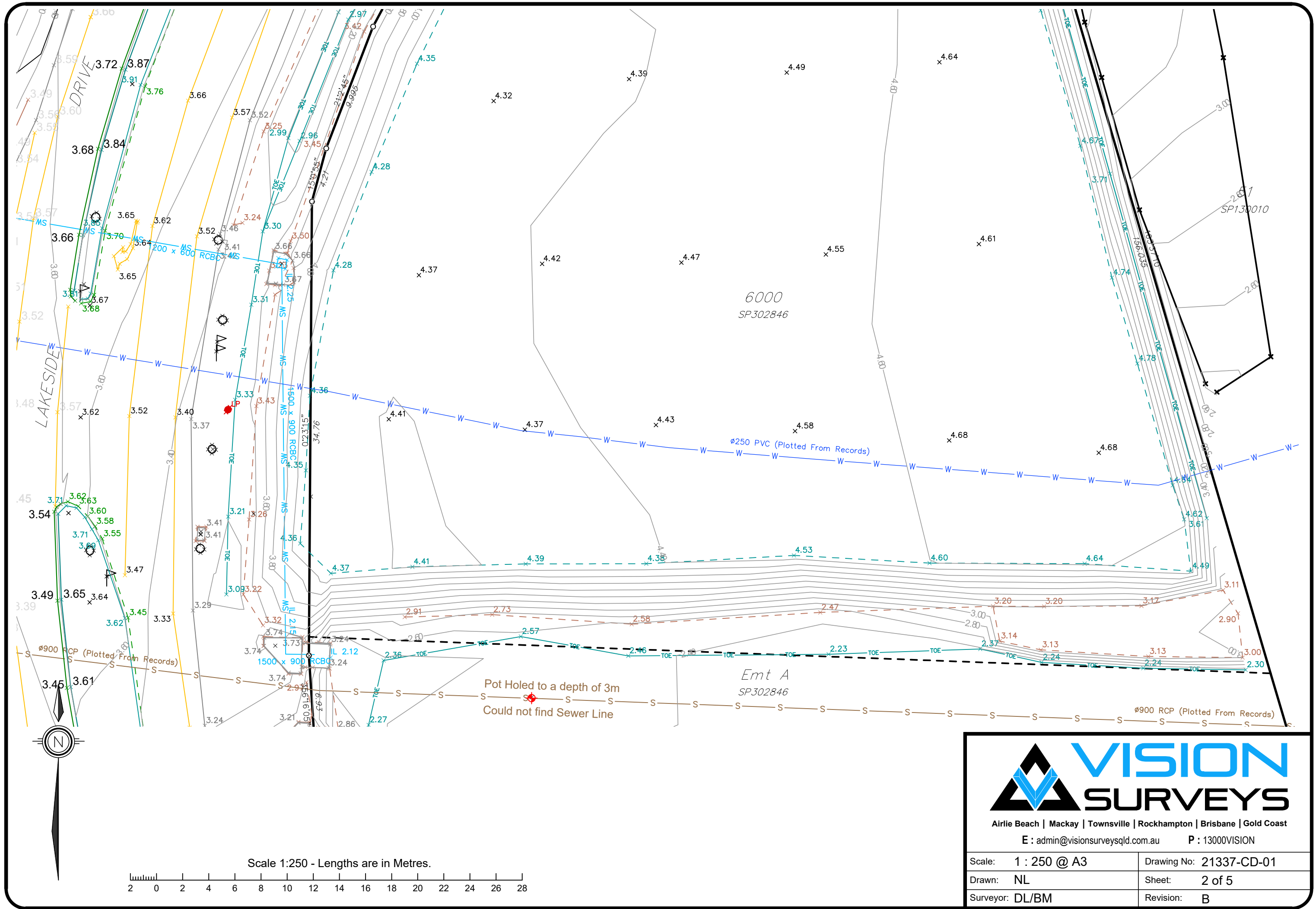
PROJECT: Site Survey	
LOCATION: 286 Lakeside Drive, Oonoonba	
Real Property Description: Lot 6000 on SP302846	
CLIENT: Spring Projects	
Horiz. Datum:	SP302846
Vert. Datum:	AHD vide PM 191469 RL3.565m
Local Authority:	Townsville City
Contour Interval:	0.20m



Airlie Beach | Mackay | Townsville | Rockhampton | Brisbane | Gold Coast

E : admin@visionsurveysqld.com.au P : 13000VISION

Scale:	1 : 250 @ A3	Drawing No:	21337-CD-01
Drawn:	NL	Sheet:	1 of 5
Surveyor:	DL/BM	Revision:	B



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E : admin@visionsurveysqld.com.au

P : 13000VISION

Scale: 1 : 250 @ A3

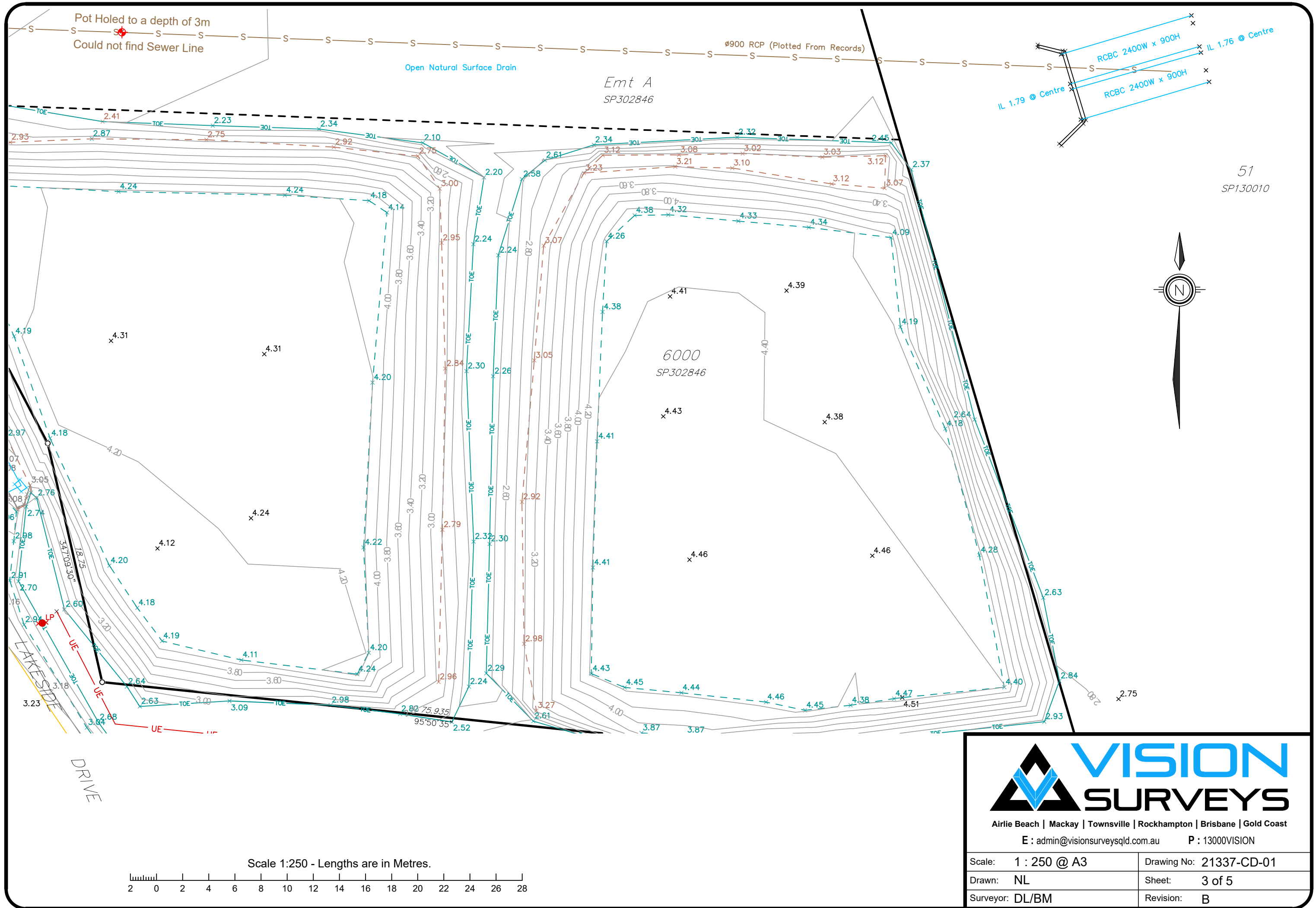
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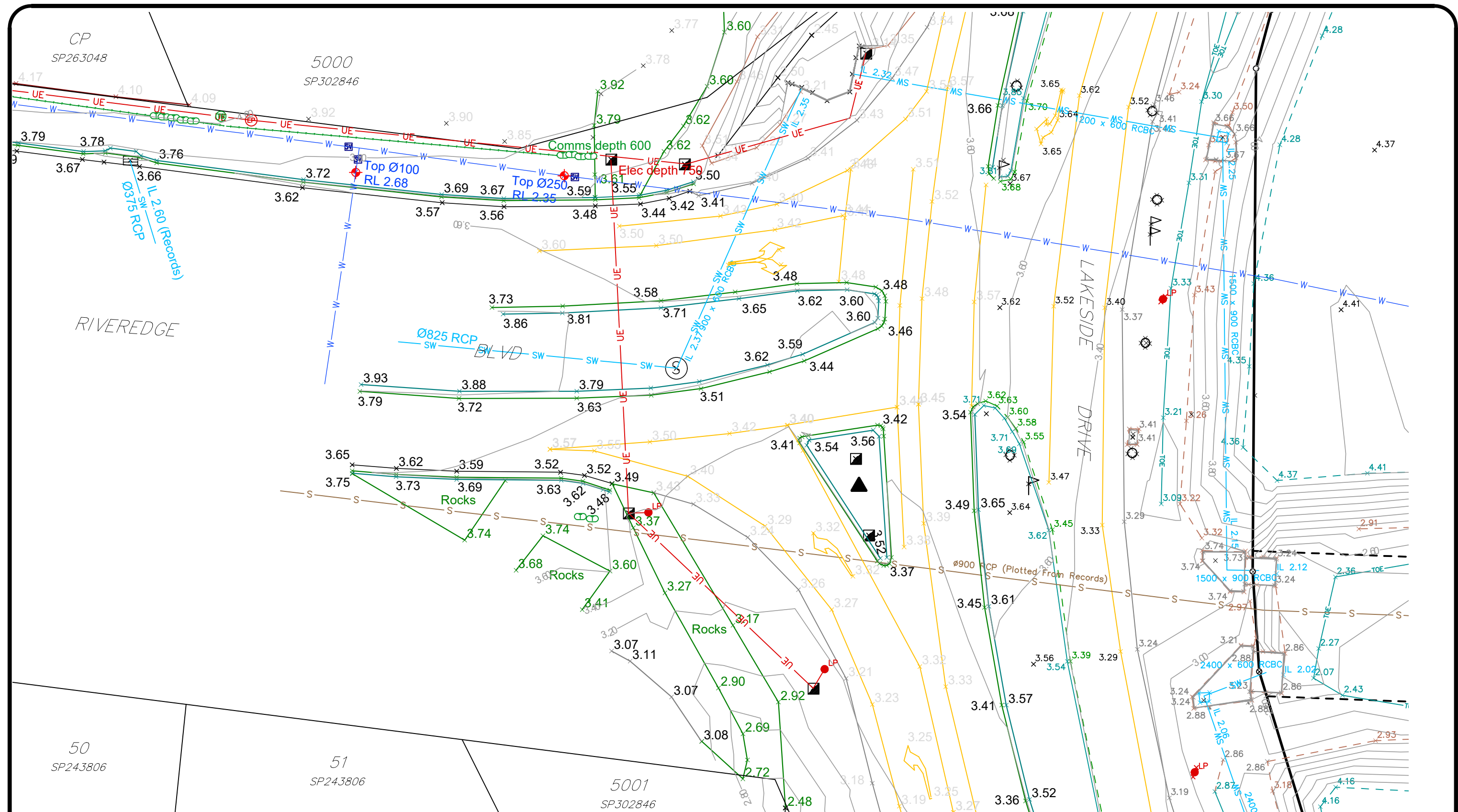
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Sheet: 2 of 5

Surveyor: DL/BM

Revision: B





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E : admin@visionsurveysqld.com.au

P : 13000VISION

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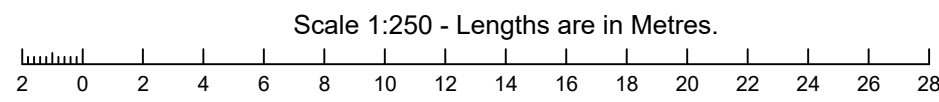
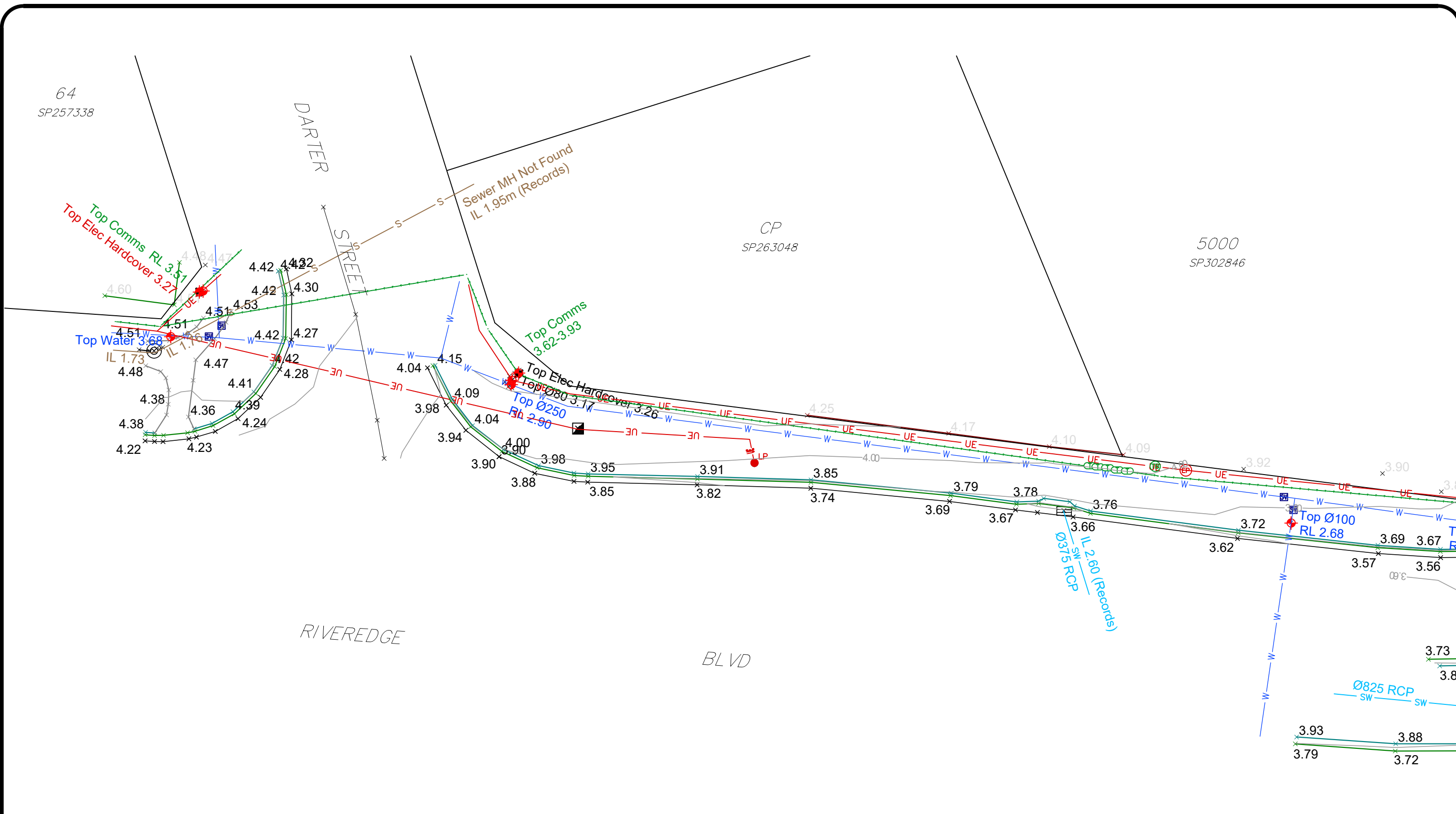
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Drawn: NL

Sheet: 4 of 5

Surveyor: DL/BM

Revision: B

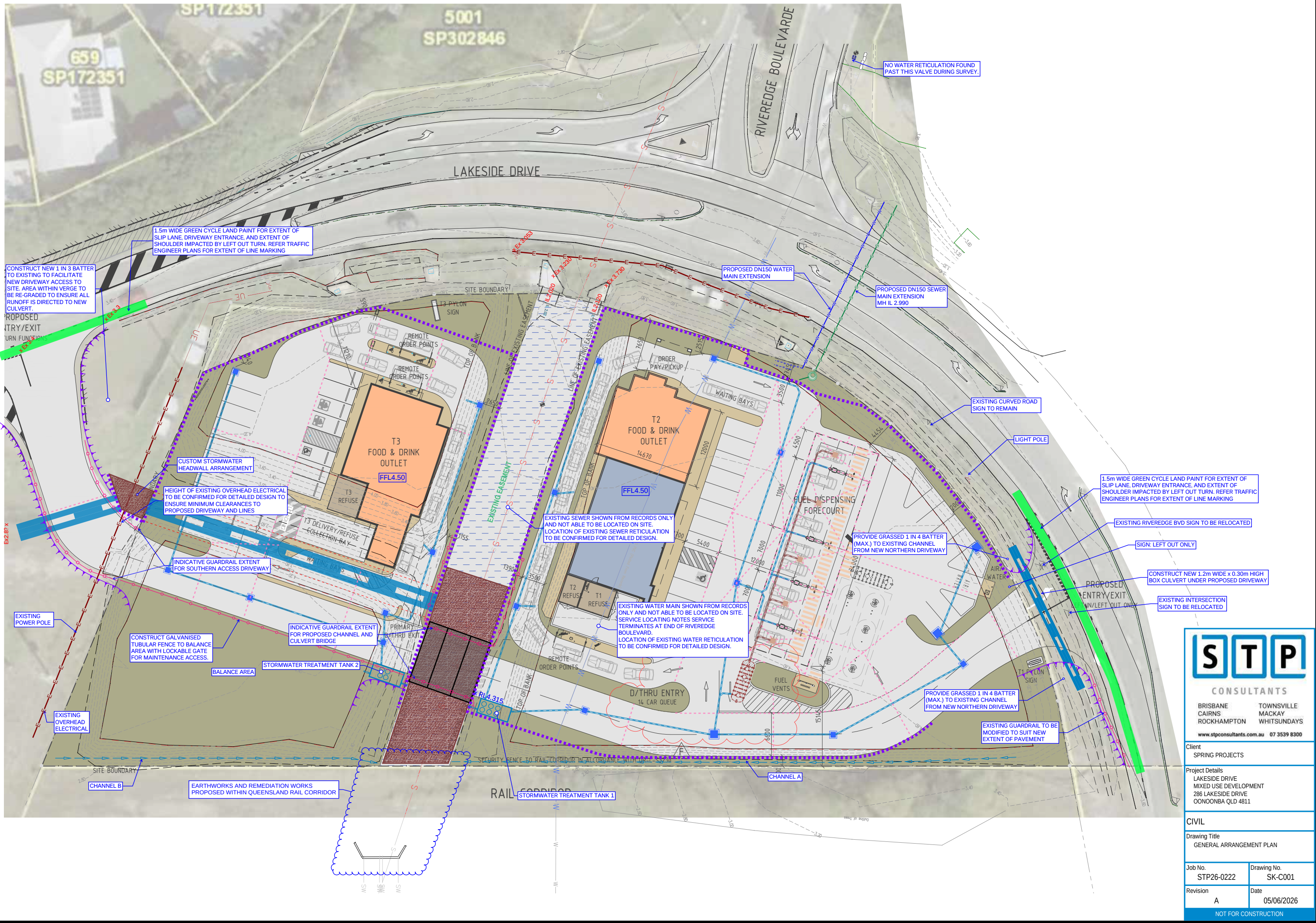


**VISION
SURVEYS**

Airlie Beach | Mackay | Townsville | Rockhampton | Brisbane | Gold Coast

E : admin@visionsurveysqld.com.au P : 13000VISION

Scale: 1 : 250 @ A3	Drawing No: 21337-CD-01
Drawn: NL	Sheet: 5 of 5
Surveyor: DL/BM	Revision: B



STP

CONSULTANTS

BRISBANE
CAIRNS
ROCKHAMPTON

TOWNSVILLE
MACKAY
WHITSUNDAYS

www.stpconsultants.com.au 07 3539 8300

Client

SPRING PROJECTS

Project Details

LAKESIDE DRIVE
MIXED USE DEVELOPMENT
286 LAKESIDE DRIVE
OONOOBA QLD 4811

CIVIL

Drawing Title

GENERAL ARRANGEMENT PLAN

Job No.

STP26-0222

Drawing No.

SK-C001

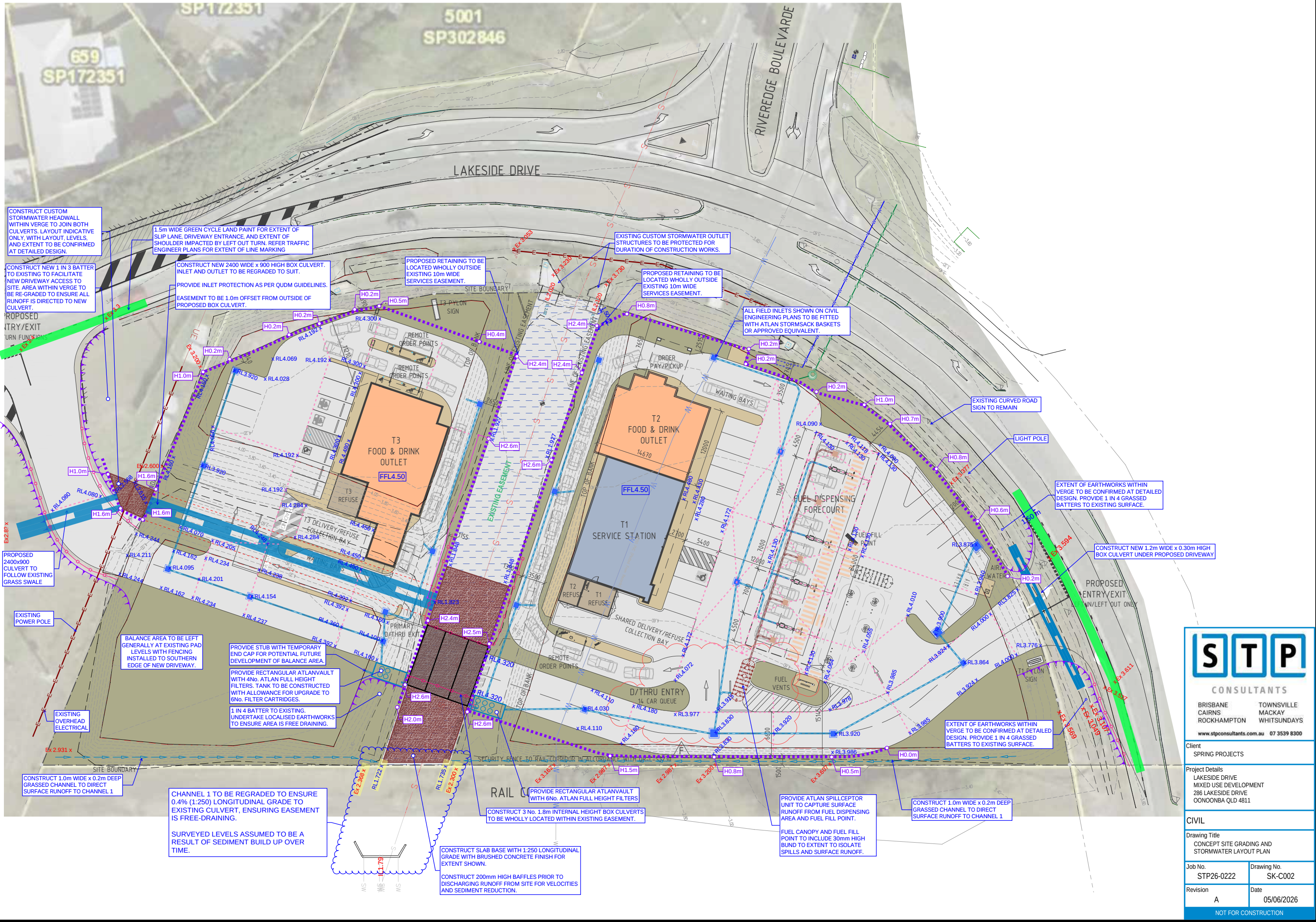
Revision

A

Date

05/06/2026

NOT FOR CONSTRUCTION



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BRISBANE
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TOWNSVILLE
MACKAY
WHITSUNDAYS

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Client
SPRING PROJECTS

Project Details
LAKESIDE DRIVE
MIXED USE DEVELOPMENT
286 LAKESIDE DRIVE
OONOOBWA QLD 4811

CIVIL

Drawing Title
CONCEPT SITE GRADING AND
STORMWATER LAYOUT PLAN

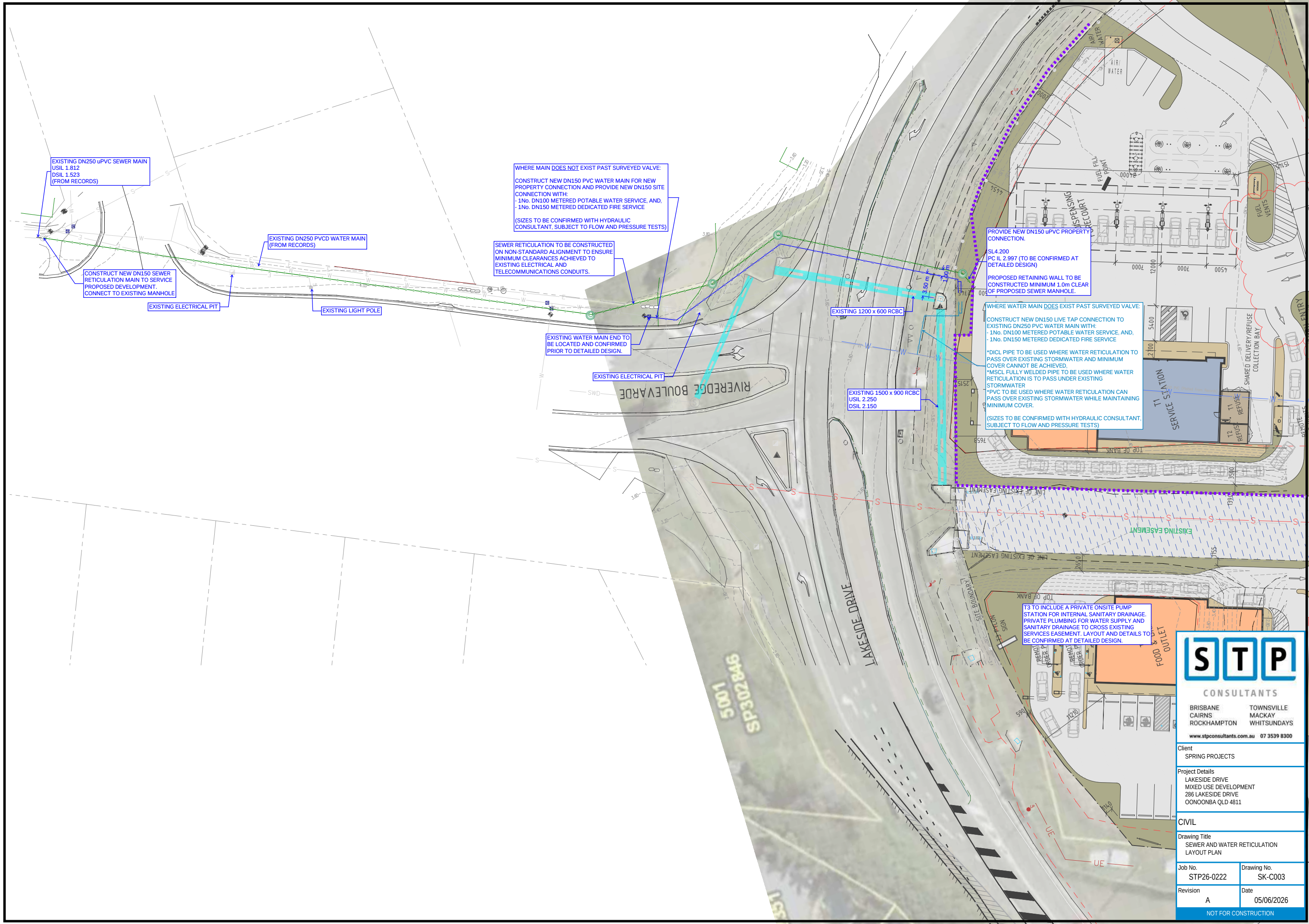
Job No.
STP26-0222

Drawing No.
SK-C002

Revision
A

Date
05/06/2026

NOT FOR CONSTRUCTION



EXISTING DN250 uPVC SEWER MAIN
USIL 1.812
DSIL 1.523
(FROM RECORDS)

CONSTRUCT NEW DN150 SEWER
RETICULATION MAIN TO SERVICE
PROPOSED DEVELOPMENT.
CONNECT TO EXISTING MANHOLE

EXISTING ELECTRICAL PIT

EXISTING DN250 PVCD WATER MAIN
(FROM RECORDS)

EXISTING LIGHT POLE

SEWER RETICULATION TO BE CONSTRUCTED
ON NON-STANDARD ALIGNMENT TO ENSURE
MINIMUM CLEARANCES ACHIEVED TO
EXISTING ELECTRICAL AND
TELECOMMUNICATIONS CONDUITS.

WHERE MAIN DOES NOT EXIST PAST SURVEYED VALVE:
CONSTRUCT NEW DN150 PVC WATER MAIN FOR NEW
PROPERTY CONNECTION AND PROVIDE NEW DN150 SITE
CONNECTION WITH:
- 1No. DN100 METERED POTABLE WATER SERVICE, AND,
- 1No. DN150 METERED DEDICATED FIRE SERVICE

(SIZES TO BE CONFIRMED WITH HYDRAULIC
CONSULTANT, SUBJECT TO FLOW AND PRESSURE TESTS)

EXISTING WATER MAIN END TO
BE LOCATED AND CONFIRMED
PRIOR TO DETAILED DESIGN.

EXISTING ELECTRICAL PIT

EXISTING 1200 x 600 RBCB

EXISTING 1500 x 900 RBCB
USIL 2.250
DSIL 2.150

PROVIDE NEW DN150 uPVC PROPERTY
CONNECTION.
SL 4.200
PC IL 2.997 (TO BE CONFIRMED AT
DETAILED DESIGN)

PROPOSED RETAINING WALL TO BE
CONSTRUCTED MINIMUM 1.0m CLEAR
OF PROPOSED SEWER MANHOLE.

WHERE WATER MAIN DOES EXIST PAST SURVEYED VALVE:
CONSTRUCT NEW DN150 LIVE TAP CONNECTION TO
EXISTING DN250 PVC WATER MAIN WITH:
- 1No. DN100 METERED POTABLE WATER SERVICE, AND,
- 1No. DN150 METERED DEDICATED FIRE SERVICE

*D/CIL PIPE TO BE USED WHERE WATER RETICULATION TO
PASS OVER EXISTING STORMWATER AND MINIMUM
COVER CANNOT BE ACHIEVED
*M/SCL FULLY WELDED PIPE TO BE USED WHERE WATER
RETICULATION IS TO PASS UNDER EXISTING
STORMWATER
*PVC TO BE USED WHERE WATER RETICULATION CAN
PASS OVER EXISTING STORMWATER WHILE MAINTAINING
MINIMUM COVER.

(SIZES TO BE CONFIRMED WITH HYDRAULIC CONSULTANT,
SUBJECT TO FLOW AND PRESSURE TESTS)

T3 TO INCLUDE A PRIVATE ONSITE PUMP
STATION FOR INTERNAL SANITARY DRAINAGE.
PRIVATE PLUMBING FOR WATER SUPPLY AND
SANITARY DRAINAGE TO CROSS EXISTING
SERVICES EASEMENT. LAYOUT AND DETAILS TO
BE CONFIRMED AT DETAILED DESIGN.

STP

CONSULTANTS

BRISBANE
CAIRNS
ROCKHAMPTON

TOWNSVILLE
MACKAY
WHITSUNDAYS

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Client SPRING PROJECTS	
Project Details LAKESIDE DRIVE MIXED USE DEVELOPMENT 286 LAKESIDE DRIVE OONONBA QLD 4811	
CIVIL	
Drawing Title SEWER AND WATER RETICULATION LAYOUT PLAN	
Job No. STP26-0222	Drawing No. SK-C003
Revision A	Date 05/06/2026
NOT FOR CONSTRUCTION	

Appendix B

Information Request (EDQ Ref: DEV2021/1199)

PRIORITY DEVELOPMENT AREA DEVELOPMENT APPLICATION
Response to Economic Development Queensland (EDQ)



Department of
Transport and Main Roads

Further information

EDQ reference: DEV2021/1199
EDQ contact: Marissa Bais
EDQ email: pdadevelopmentassessment@dsdmip.qld.gov.au
TMR reference: TMR21-033470
TMR contact: Alex Cramb
TMR email: (07) 3066 1419

Reference is made to your invitation to the Department of Transport and Main Roads (TMR) to provide comments on the development application described below.

1.0 Application details

Priority development area (PDA):	Ooononba PDA
Applicant:	Cylinder Cove Pty Ltd C/- Property Projects Australia Pty Ltd
PDA development approval for:	PDA Development Permit for a Material Change of Use
Proposed development:	Service Station and Fast-Food Premises
Site address:	286 Lakeside Drive, Ooononba QLD 4811
Real property description:	6000SP302846

2.0 Response

Having reviewed the application material, TMR has determined that additional information is needed before it can undertake a full assessment of the application on matters of state transport interest. TMR's comments and the nature and extent of information needed are provided below.

3.0 Considerations and assessment

3.1 Site history

Reconfiguring a Lot and Operational Works

- On 19 December 2016, the Minister for Economic Development Queensland (EDQ) granted a change to the Priority Development Area (PDA) development permit for reconfiguring a lot (1 into 3 lots) and operational works (filling and excavation, roadworks, stormwater drainage, water and sewer reticulation, electrical and telecommunication) (EDQ Ref: DEV2015/725/3).

- This created Lot 6000 (the site) and the easement for sewer (Easement A on SP302846).

Preliminary Approval

- On 07 April 2017, EDQ approved the PDA preliminary approval for a material change of use – business, fast food premises, indoor sport, entertainment and recreation, service industry, shop, service station (undefined use), utility installation and warehouse in accordance with a uses and development guidelines plan (EDQ Ref: DEV2016/757).
- On 01 February 2021, EDQ granted an extension to the currency period to 23 April 2023.

State-controlled Road

Buildings and Structures

Original Assessment

- All buildings are proposed to be located within the boundaries of the subject site; however it is noted retaining walls are proposed along parts of the sites boundary.
- TMR will recommend that an advice statement be included in any development approval, that no retaining structures are permitted within the state-controlled road, once the further information outlined in Section 4.1 has been provided.

Filling, Excavation and Retaining Structures

Original Assessment

- Bulk earthworks and clearing of significant vegetation have already been undertaken on the site as part of previous approvals.
- The Flood Study Report, prepared by Stormflood Engineering Pty Ltd, referenced SF20-0070-002, revision 1.1, dated 25 June 2021, states that "the site has been preliminarily prepared via bulk earthworks for future development within the site".
- It is considered that any additional fill to the site will be minimum and will be associated with building works. Damage to infrastructure or services within the state-controlled road is considered unlikely.

Stormwater and Drainage

Original Assessment

- It appears that the Engineering Services Report, prepared by Farr Engineers, referenced 221054, revisions 2, dated 5 July 2021, has not be signed by an RPEQ. It is recommended that a revised report be submitted that has been signed by an appropriately qualified and experienced RPEQ.
- The Engineering Report referenced above, indicates that it is proposed to provide an additional 300mm of fill on-site. This has not been reflected in the Flood Study Report, prepared by Stormflood Engineering Pty Ltd, referenced SF20-0070-002, revision 1.1, dated 25 June 2021. It is recommended that a revised Flood Study Report be submitted to includes the outcomes identified in the Engineering Report.
- The development proposes new Public Utility Plant (PUP) for water and sewerage. TMR will therefore recommended that as part of any development approval, an advice statement be included stating that the development approval does not constitute approval for any new PUP within the state-controlled road. Subsequent approvals under separate legislation (including

Transport Infrastructure Act 1994) will need to be obtained, prior to any works commencing. TMR will provide this statement once the further information outlined in Section 4.1 has been provided.

- The development proposes to provide a suspended slab as part of the development. It is recommended that the applicant provide details as to what measures have been taken to reduce the likelihood of blockages and how surcharge conditions be managed.
- Furthermore, there appears to be a building located over a culvert. This is generally not supported. As such, it is recommended that the applicant provide evidence that EDQ/Townsville City Council accepts this arrangement.
- The downstream boundary conditions do not appear to include the correct details in relation to the Highest Astronomical Tide (HAT). It is recommended that the applicant provide revised boundary conditions that reflects the correct HAT.
- The Flood Report prepared by Stormflood, referenced SF-20-0070-002, revision 1.1, dated 25 June 2021, clearly shows a worsening of flooding conditions during the Defined Flood Event (DFE). This is not supported. It is recommended that the applicant provide a revised flood study clearly demonstrating that any increases in velocity, flow and flood depth are contained entirely within the subject site.
- TMR recommended the further information be requested from the applicant in the response sent to EDQ on 28 July 2021.

Response to Information Request

Flooding

- In response to the further issues letter, the proposal was revised. Namely, the box culvert and the suspended structure over existing Channel 1 and easement (Stage 2) were removed.
- As such, a revised Civil Earthworks and Retaining Wall Layout Plan was provided, supported by Site Sections.
- This plan shows earthworks will extend into Channel 1 and into the easement.
- A revised Flood Study Report, however, was not provided to reflect this.
- Instead, Farr Engineers make reference to the revised Conceptual Stormwater Drainage and Site Layout Plan (drawing number CSK200 and issue 4) where outlet scour protection is proposed between the low flow outlet and the existing easement.
- TMR's Engineering and Technology Branch (Flooding) has advised:
 - o *the total flow towards this development was being reduced by virtue of the EDQ development and a reduced contributing catchment.*
 - o *TMR can look to accept the latest proposal – at the end of the day the development is for the northern part of the site only and there is minimal change to the central channel – by the time flows get to the rail corridor there will be negligible impact to existing velocities.*
 - o *TMR can therefore accept with a no worsening condition for flooding impacts.*
- Given the above TMR will recommends conditions in relation to flooding impacts to the state-controlled road once the information outlined in Section 4.1 have been provided by the applicant.
- An advice note is also recommended advising the applicant to reconsider the angle and orientation of the "Outlet Scour Protection", possibly rotate it to be more aligned with the flow direction within the channel. This has been included in Section 4.1.

Stormwater

- As mentioned above, the proposal has changed, with Channel 1 and Channel 2 to remain.
- However, the formation of Channel 1 will be altered by proposed earthworks.
- In particular, section D (drawing number CSK110 and issue 1) confirms that fill and a retaining wall will extend into the channel to facilitate the driveway and carpark associated with Stage 1.
- An analysis to demonstrate that Channel 1 will have sufficient capacity to accommodate the external catchment flows and any peak discharge from the development was not provided.
- It is also noted that this item was not included in EDQ's further issues letter dated 17 August 2021.
- TMR's Engineering and Technology Branch has advised:
It appears that the proposed suspended carpark and the retaining wall encroach into Channel 1 which will compromise the hydraulic capacity to some extent. Please request that the applicant provides a hydraulic analysis of Channel 1 to ensure no adverse impact on the railway corridor (at the culverts). The hydraulic analysis to allow for the pipe flows that are concentrated into Channel 1 in post development. Please request flow velocities at the culverts under the railway. If there are unacceptable flow velocities at the culvert, a solution to be provided to offset the impacts.
- TMR recommends the information outlined in Section 4.1 is requested from applicant to ensure no stormwater impacts to the state-controlled road and railway corridor.

Vehicular Access to a State-controlled road

Original Assessment

- The applicant has submitted the following *Traffic Engineering Report*, prepared by TTM, referenced 20BRT0472, revision 2, dated 25 June 2021.
- The proposed land uses will result in a significant increase in development generated traffic. This will subsequently result in a significant increase in vehicles entering and exiting the site via the Lakeside Drive / Riveredge Boulevard intersection.
- Access is proposed via a fourth leg to the Lakeside Drive / Riveredge Boulevard, which is proposed to be upgraded to be a signalised intersection as part of this development. The proposed upgrade to the Riveredge Boulevard / Lakeside Drive intersection, includes:
 - o upgrading the intersection to a four-way, signalised intersection, the southern leg will provide access to the development site;
 - o right turn lane on eastern and western approaches; and
 - o signalised pedestrian movements on slip lanes.
- The access provides for various scenarios; vehicles entering the service station for fuel, vehicles entering the site to purchase items from the 7 Eleven tenancy and vehicles entering the site to utilise the fast food outlet either as walk ins or via the drive through facility. The site plan exhibits limited traffic controls and clarity to individual drivers as to how to navigate through the site and who has priority.
- The layout of the development illustrates a potential conflict point in the location of the air/water space, the fuel bowers and the area identified as a keep clear area for vehicles entering the drive through facility. It is generally standard practice that sufficient space be provided at the bowers to accommodate 2 vehicles waiting to fill up with fuel (not including those parked at the pumps) behind each bowser. Therefore, should there be vehicles queued at the bowers and a vehicle in the air/water space, vehicles would not be able to enter the drive

through queue via that pinch point / conflict point. The proposed use will attract local and passing traffic, therefore a rationalisation and clearer demarcation is necessary within the site. To reduce the potential of vehicles queuing through the proposed intersection, it is recommended that the applicant provide a revised layout together with supporting documentation (i.e. swept paths), that improves the separation of conflicting movements within the site.

- The number of car parking spaces provided for the development is 15 (including 1 PWD and 1 water/air space). It could be argued that the water/air space should not be included in the total number of car parking spaces required for the development and as such, the development is not in accordance with the Oonoonba UDA Development Scheme as there is a shortfall of 2 car parking spaces.
- It is generally standard practice that waiting bays are provided for fast food outlets with a drive through facility, however none have been identified as part of this proposal.
- The submitted traffic report identifies that a 20% reduction has been applied in the AM peak to the fast food use. This has been based on reduced demands typically exhibited in the AM peak for these uses. Through experience there is a demand for morning coffee, etc from a fast food outlet, therefore it is recommended that the applicant provide further details as to how the 20% reduction has been formulated.
- The submitted traffic report applies a 10% reduction for shared trips across all stages (including future stages) of the development. No details have been provided of how this 10% has been formulated or how it applies to Stage 1, which is the subject of this application. It is recommended that the applicant provide further details as to how the 10% of shared trips has been formatted and how it relates to Stage 1.
- The submitted traffic report identifies that surveys of the Riveredge Boulevard / Lakeside Drive and Lakeside Drive / Abbott Street intersections were undertaken on Thursday, 25 March 2021, to determine the peak hour periods. However, the full survey was not provided as part of the traffic report. It is recommended that the applicant provide the full survey data for the Riveredge Boulevard / Lakeside Drive and Lakeside Drive / Abbott Street intersection undertaken on Thursday, 25 March 2021.
- The submitted traffic report identifies that the net delay assessment has been provided in accordance with TMR's Guide to Traffic Impact Assessment (GTIA) for both the Riveredge Boulevard / Lakeside Drive and Lakeside Drive / Abbott Street intersections. However, the assessment does not clearly articulate how the assessment has been undertaken in accordance with GTIA. It is recommended that the applicant provide further clarification as to how the Net Delay Assessment has been undertaken in accordance with the GTIA.
- The submitted traffic report includes surveys undertaken by RMS NSW to determine peak and daily traffic generation rates. However, no reasoning has been provided as to why this source is preferred over other sources identified in the GTIA, specifically relating to Queensland data. It is recommended that the applicant provide further justification as to why RMS NSW data was utilised instead of Queensland data.
- The location of the pedestrian access to the site is located around the subject site via the Lakeside Drive road reserve, and then enters the site at the beginning of the drive through facility. Pedestrian are more likely to take the most direct route, which in this instance would be through the subject site. It is recommended that the applicant give further consideration to the safety of pedestrians and the more vulnerable users of the state-controlled road and identify if further mitigation measures are area required to reduce the safety risk.

- The *Swept Path Analysis – BAV*, prepared by TTM, referenced 20BRT0472-02, dated 25 June 2021, does not illustrate where the vehicle will be located on-site while refueling is occurring or how vehicles can circulate throughout the site during this time. It is recommended that the applicant provide an amended swept path to demonstrate that vehicles can manoeuvre while the refueling vehicle is on-site.
- The *Swept Path Analysis - HRV*, prepared by TTM, referenced 20BRT0472-05, dated 25 June 2021, illustrates impacts on internal circulation, specifically the swept path associated with the service station that impacts use of the bowsters, the access to the drive through and the car parking area fronting the tenancies. It is also worth noting that when a development requires areas that would normally be landscaped or raised medians to be chevroned (area between the ingress and egress of the site and centrally on site and the raised trafficable island at the entrance) to allow vehicles to manoeuvre, it is usually a clear indication of overdevelopment of a site. It is recommended further consideration be given to the layout of the development.
- The *Swept Path Analysis – B99*, prepared by TTM, referenced 20BRT0472-06, dated 25 June 2021, could potentially be impacted on by queuing vehicles at the bowsters. In addition, the turn path does not show the complete manoeuvre for the vehicle queuing in the inside lane of the drive through facility. It is recommended that the applicant provide an amended swept path showing 2 vehicles queuing behind the vehicle at the bowser to demonstrate the manoeuvre can be achieved.
- Signage shown on the plans and landscaping in close proximity to the entrance of the development site has the potential to impact on the sight lines of vehicles entering and exiting the site. The submitted traffic report does not include a road safety review for the proposed access to the site, specifically in relation to sight lines and visibility due to the vertical distance between the site and the existing road level following the bulk earthworks being undertaken. It is recommended that the applicant provide a road safety review to demonstrate that the access will not cause a safety hazard or impact the operations of the state-controlled road.
- The concept plan submitted for the proposed intersection upgrade does not include dimensions. To ensure that the intersection can be accommodated within the existing road corridor without impacting on existing infrastructure, it is recommended that the applicant provide a scaled and sufficiently detailed plan that demonstrates that the standards of the Road Planning and Design Manual – 2nd Edition can be achieved.
- Overall, the applicant has not demonstrated that the proposed development will not compromise the safety or the operating performance of the state-controlled road.
- TMR recommended the further information be requested from the applicant in the response sent to EDQ on 28 July 2021.

Response to Information Request

- The plans submitted throughout the reports show both the old civil design and the newly proposed design with inconsistent line styles throughout the suite of plans, which makes the plans very confusing. In particular Drawing CSK800 included in Farr Engineer's response and other engineering plans should have the new civil design as per (19212-DA02, Rev E) not the old intersection design. All of the CSK drawings in the Farr Engineer's response including the updated sewer and water relocation/connection drawing show both the old civil design and the newly proposed design. It is therefore requested that the applicant be required to "space proof" the area of the proposed access area, to ensure that there is sufficient space to accommodate all relevant infrastructure works.

- The plans do not give a true indication in respect of the grade heights. The difference in grade height from Lakeside Drive to the existing and design levels in the development are significant. For example, the development is 1.5-2.0m higher, with the difference transitioning quickly from the existing road height into the development site. No detail has been provided to demonstrate how this is to be achieved.
- TTM's response to Item 7(h) only addressed the location of the pedestrian entrance to the site. TTM advised that "*on the elevation plans, prepared by Verve Architects, there are no grade changes between the site boundary and crossing points*". That may be the case at the site boundary however, it has not addressed the vertical grade from the road reserve to the level of the development site and how they intent to achieve the provisions of the *Disability Discrimination Act 1995* (DDA) for pedestrian access.
- TMR recommends the information outlined in Section 4.1. is requested from the application.

Planned Upgrades

Original Assessment

- A business case for the South Townsville Road Capacity Upgrade planning project has recently been completed. The proposed development is unlikely to impact on the planned upgrades as part of this project.
- This project includes a planned upgrade to the intersection of Lakeside Drive and Abbott Street. The department invites EDQ to meet with the department to discuss the findings of the Business Case in relation to the proposed development.

Network Impacts

Original Assessment

- The traffic report fails to sufficiently demonstrate what impact the traffic generated by the development will have on the state-controlled road network, in particular the potential impact of queuing within the Riveredge Boulevard / Lakeside Drive intersection and the impact the fourth leg of the intersection may have on the function of the state-controlled road, for example what impact the length of the slip lane may have on the Lakeside Drive / Abbott Street intersection.
- The plans do not provide signal details. Further information in regard to the signal design is required to be provided as part of this development application.
- Reference is made to the current 2019 TMR Safety Policy and its adoption of the "Safe Systems" approach. Points to note that are relevant to the proposed upgrades include:
 - o The slip lanes would need to have pedestrian activated crossings installed - signalised.
 - o While the use of metered slip lanes is permissible under the Safety Policy, in this situation (with likely high pedestrian volumes) and the fact that it is an entirely new signalised intersection, the preferred "Safety" approach is to remove slip lanes altogether and "stand the turn lane up into the intersection". This approach will have an impact on the intersection efficiency however it is deemed safer for vulnerable road users.
- It is recommended that the applicant provide further information to demonstrate that the proposed development will not impact on the safety and efficiency of the state-controlled road.
- TMR recommended the further information be requested from the applicant in the response sent to EDQ on 28 July 2021.

Response to Further Information

- The revised plans have not included a northern pedestrian crossing, which is the natural

desired line for pedestrians. Nor has the applicant provided adequate justification for the pedestrian crossing not to be provided. The low priority given to pedestrians and the removal of the northern Lakeside crossing is likely to result in vulnerable users (children/teenagers) choosing to cross the northern leg uncontrolled. The applicant is required to provide further consideration to this matter.

- With no dedicated southbound through lane at the intersection, given that the slip lane has been removed, it is highly likely that there would be a southbound left and right turning vehicle stopped at the intersection while the through is 'green'. This would have a significant impact on southbound through traffic, in particular in the PM peak. Or, is it the case that the 'green left arrow' into the development will only go 'red' on a pedestrian trigger, reducing the frequency of the left in getting stopped. The applicant is required to provide further clarification.
- The concept drawings only show an on-road line marked bicycle lane on the southern approach to the intersection, however as a result of the intersection upgrade, once you get through the intersection, the facilities for cyclists are no longer provided. Amended plans are required to include proposed bicycle lanes to all relevant legs of the intersection and demonstrate how they connect to the existing network.
- TMR recommends the information outlined in Section 4.1 is requested from the applicant.

Railway Corridor

Buildings and Structures

Original Assessment

- The proposed site plan (drawing number 19212-DA02 and revision A) shows tenancy 1 (service station) and tenancy 2 (food & drink outlet) will be setback 4.7m from the railway corridor boundary.
- Elevations North and South (drawing number DA05 and revision A) show an 'awning over pick up window' which is setback approximately 1.0m from the railway corridor boundary. In this setback, landscaping is illustrated.
- Further, the Concept Earthworks and Retaining Wall Layout Plan in Appendix C of the Engineering Report shows a 1.0m high retaining wall along the railway corridor boundary, approximately 61.35m long adjacent to the drive through.
- It is unclear how access to the rear of the site can be obtained without using the railway corridor.
- Similarly, the construction of the retaining wall will not be permitted from the railway corridor.
- TMR will recommend conditions once the information outlined in Section 4.1 has been provided by the applicant. In particular, the minimum setbacks of buildings and structures from the railway corridor should be conditioned. The footings of the retaining wall must be on the site and not in the railway corridor.

Response to Information Request

- A revised Concept Earthworks and Retaining Wall Layout Plan (drawing number CSK100 and issue 4) was submitted, with Site Sections (drawing number CSK110 and issue 1).
- This now shows a retaining wall (0.9m to 1.0m high) setback from the railway corridor and parallel to the drive through.
- In particular, Section A indicates that the proposed block retaining wall will be setback a

minimum of 750mm from the boundary.

- This will allow for construction to occur on-site and is also considered sufficient to allow for on-site maintenance
- TMR will recommend conditions in relation to setbacks once the information outlined in Section 4.1 has been provided by the applicant.

Filling and Excavation

Original Assessment

- Section 3.1 of the Engineering Report states that:
- To facilitate the proposed development, approximately 300mm of fill will be required on the existing building pads, and up to 2.0m of excavation on the southern portion of the site to reduce the stormwater impacts of the proposed development
- Retaining walls will be required within this development. The fuel station and food and drink outlet proposed on the northern portion of the site will require retaining to the Eastern boundary adjacent to the existing railway corridor. All retaining on the southern portion of the site will be incorporated into the structures.
- No earthworks or access shall occur within the Railway corridor.
- A comparison of the survey and engineering drawing indicates that the finished floor level will be approximately 4.5m AHD, and that the land will batter down to the railway corridor and be retained by a 1m high retaining wall.
- The retaining wall including its footings will need to be constructed on the site.
- TMR will recommend conditions in relation to filling and excavation once the information outlined in Section 4.1 has been provided by the applicant.

Response to Information Request

- A revised Engineering Report (dated 10 December) was submitted.
- Section 3.1 now states that:
To facilitate the proposed development, approximately 300mm of fill will be required on the existing building pad, up to 1.5m of fill to create a new pedestrian access on Lakeside Drive, and 1.0m of cut to reprofile the ground adjacent to the existing east-west channel. Retaining walls will be required for this development to the eastern boundary adjacent to the existing railway corridor, and along the southern extent of works to ensure no filling occurs within the existing east-west channel. All retaining and earthworks will be located wholly within the development site, with no earthworks or access occurring within the railway corridor.
- The revised Concept Earthworks and Retaining Layout Plan in Appendix C now shows the extent of earthworks proposed for Stage 1.
- This indicates that fill will extend to the north-east corner of the site, up to the railway corridor boundary.
- TMR will recommend conditions in relation to filling and excavation once the information outlined in Section 4.1 has been provided by the applicant.

Flooding

- TownsvilleMAPS Flooding indicates that the site is impacted by flooding.
- A Flood Study Report prepared by Stormflood Engineering Pty Ltd has been submitted.
- This indicates that the Council Flood Hazard Overlay is now redundant and refers to a flood investigation undertaken for 'The Village' (reference R B18717 003 05.docx and revision 05) which included floodplain modifications.

- Subsequent to the endorsement of this flood investigation for 'The Village', an application was approved for reconfiguring a lot and operational works (EDQ Ref: DEV2015/725) and consequently bulk earthworks were undertaken.
- As constructed plans prepared by Calibre Consulting and dated 10 July 2019 indicate that fill was undertaken across the site including within the Lakeside Drive road reserve.
- The certified finished surface levels appear to be similar to those shown on the Contour & Detail Plan in Appendix A of the Flood Study Report.
- The Flood Study Report for this development application appears to include the following drainage features: post fill earthworks pads (it is unclear if this includes existing fill), drainage channel with suspended slab (for Stage 2) and proposed 1200mm x 600mm RCBC.
- Mapped impacts are included in Appendix D for water level, depth and velocity for all design events up to a 1% AEP. Peak water level afflux is provided in Appendix E.
- TMR's Engineering and Technology Branch (Flooding) has reviewed the Flood Study Report and advised:
 - o The impact assessment demonstrates there are no adverse water level impacts to either the rail or road corridors.
 - o However velocity impact maps have not been provided (only depth x velocity, or hazard maps have been provided) which are required to assess whether the development causes an increased risk of scour – velocity impact maps are required for the full range of design events up to 1% AEP. TMR does not expect significant change to velocities in the rail corridor, however this needs to be demonstrated in order to complete the assessment.
- Given the above, TMR recommends the further information outlined in Section 4.1 is requested from the applicant.

Response to Information Request

- In response to the further issues letter, the proposal was revised. Namely, the box culvert and the suspended structure over existing Channel 1 and easement (Stage 2) were removed.
- As such, a revised Civil Earthworks and Retaining Wall Layout Plan was provided, supported by Site Sections.
- This plan shows earthworks will extend into Channel 1 and into the easement.
- A revised Flood Study Report however, was not provided to reflect this.
- Instead, Farr Engineers make reference to the revised Conceptual Stormwater Drainage and Site Layout Plan (drawing number CSK200 and issue 4) where outlet scour protection is proposed between the low flow outlet and the existing easement.
- TMR's Engineering and Technology Branch (Flooding) has advised:
 - o *the total flow towards this development was being reduced by virtue of the EDQ development and a reduced contributing catchment.*
 - o *TMR can look to accept the latest proposal – at the end of the day the development is for the northern part of the site only and there is minimal change to the central channel – by the time flows get to the rail corridor there will be negligible impact to existing velocities.*
 - o *TMR can therefore accept with a no worsening condition for flooding impacts.*
- TMR will recommend conditions in relation to flooding impacts once the information outlined in Section 4.1 has been provided by the applicant.

Stormwater and Drainage

Original Assessment

- Stage 1 (service station and fast-food premises) as well as Stage 2 will increase the impervious area and therefore peak discharge.
- No detention is proposed however, as stated in section 4.2 of the Engineering Report. This is because the site is affected by the 1% AEP rain event and because of the site's location within the greater catchment.
- The Concept Stormwater Drainage and Site Layout Plan in Appendix C of the report shows a proposed pit and pipe system that will outlet directly into the existing easement/ open drain (Channel 1 – existing 10m wide channel within easement).
- Stormwater from this channel is conveyed east, under the railway line and Abbott Street via existing culverts, before reaching the Ross River.
- The proposed driveway, carpark and footpath will be suspended above the 1% AEP flood event.
- Section 4.2 of the report also indicates that external catchments flow through the site via Channel 1 and Channel 2 (existing 1.2m wide channel).
- To accommodate these, minor landscaping works and scour protection are proposed within the easement and Channel 2 will be replaced with a 1200mm wide x 600mm high box culvert on the same channel alignment.
- As mentioned above, the site and easement were created as part of EDQ Ref: DEV2015/725). Compliance assessment was undertaken, with stormwater management quantity addressed as part of condition 11.
- Correspondence prepared by BMT WBM Pty Ltd dated 08 February 2017 and 29 March 2017 looked at contributing catchments to the west and to the south.
- Peak flows were assessed and determined to be reduced at the location of the railway culverts. Also, an impervious factor of 90% was applied for Lot 6000 to reflect future development of the site.
- However, this refers to design drawings that included proposed box culverts (1500 x 900 RCBC and 2400 x 600 RCBC) along the Channel 1 alignment and did not include Channel 2.
- The as constructed plans dated 11 September 2019 are significantly different. In that, the box culverts were replaced with two (2) channels. No evidence was found to indicate that a new site-based stormwater management plan was prepared/ endorsed.
- TMR's Engineering and Technology Branch (Stormwater) has reviewed the Engineering Report and relevant history and advised:
 - o No on-site detention is required for this site which is supported by the previous BMT report (this is fine).
 - o If the channels were approved at some point, TMR has no objection for them to go ahead with this proposal, otherwise the applicant needs to confirm that the proposed channel and box culvert can perform safely (safety of people and infrastructure) and adequately.
 - o In other words, if the development is introducing a channel or a box culvert, the applicant has to demonstrate capacity is adequate.
 - o Channel 1 capacity check is also required.
 - o The applicant should also demonstrate no adverse impact in terms of safety and no damage to TMR infrastructure (for example no scouring at railway culverts).
 - o The applicant should provide additional engineering drawings to clearly show the driveway and carpark are suspended to allow maintaining channel 1 in place.
- Given the above, TMR recommends the further information outlined is requested from the applicant.

Response to Information Request

- Given the above, TMR recommends the further information outlined is requested from the applicant.
- As mentioned above, the proposal has changed, with Channel 1 and Channel 2 to remain.
- However, the formation of Channel 1 will be altered by proposed earthworks.
- In particular, section D (drawing number CSK110 and issue 1) confirms that fill and a retaining wall will extend into the channel to facilitate the driveway and carpark associated with Stage 1.
- An analysis to demonstrate that Channel 1 will have sufficient capacity to accommodate the external catchment flows and any peak discharge from the development was not provided.
- It is also noted that this item was not included in EDQ's further issues letter dated 17 August 2021.
- TMR's Engineering and Technology Branch has advised:
It seems that the proposed suspended carpark and the retaining wall encroach into Channel 1 which will compromise the hydraulic capacity to some extent. Please request that the applicant provides a hydraulic analysis of Channel 1 to ensure no adverse impact on the railway corridor (at the culverts). The hydraulic analysis to allow for the pipe flows that are concentrated into Channel 1 in post development. Please request flow velocities at the culverts under the railway. If there are unacceptable flow velocities at the culvert, a solution to be provided to offset the impacts.
- TMR recommends the further information outlined in Section 4.1 is requested from the applicant.

Access – Fencing

Original Assessment

- The site is currently vacant.
- The Proposed Site Plan (drawing number 19212-DA02 and revision A) shows a drive through adjacent to the railway corridor boundary, setback 1.0m.
- Therefore, the development is increasing the risk of unauthorised access to the railway corridor.
- Aerial imagery indicates that the railway corridor is not currently fenced in this location.
- Elevations South (drawing number DA05 and revision A) includes the notation 'rail corridor fence to authority requirements.'
- Further, a 1.0m high retaining wall is proposed along the railway corridor boundary and adjacent to the drive through.
- Queensland Rail has advised that security fencing in accordance with QR-C-S3230 (without rails) is required in this location and for this use.
- TMR will recommend a fencing condition and advice statement regarding the approval requirements of section 255 of the *Transport Infrastructure Act 1994*, once the further information outlined in Section 4.1 has been provided.

Access – Rail Interface Barrier

Original Assessment

- A comparison on the survey and engineering drawing indicates that the finished floor level will be approximately 4.5m AHD, and that the land will batter down to the railway corridor and retained by a 1m high retaining wall.
- The level difference between the finished floor level and railway corridor is likely to be approximately 2m with this moderated through a batter and then the balance height retained.
- This means that cars circulating through the drive through facility will be higher than the railway

corridor, presenting the risk of intrusion, should cars misjudge the manoeuvre or lose control.

- A vehicle barrier is likely to be required at the corner of the drive through where cars turn towards the railway corridor.
- TMR will recommend a condition relating to a rail interface barrier once the further information outlined in Section 4.1 has been provided.

Network Safety

Original Assessment

- The development includes a service station.
- The Proposed Site Plan (drawing number 19212-DA02 and revision A) shows underground tanks adjacent to the fuel dispensing forecourt.
- A service station is a notifiable activity under Schedule 3 of the Environmental Protection Regulation 2008 and Section 320 of the Environmental Protection Act 1994.
- The safe storage and handling of flammable and combustible liquids is now covered by requirements in Chapter 7.1 (Hazardous Chemicals) of the Work Health and Safety Regulation 2011 which are regulated by Workplace Health and Safety Queensland.
- The fuel storage will be underground which will reduce risks to the railway corridor.
- Service stations are land uses which are likely to place a member of the public into contact with flammable and combustible liquids on a regular basis and therefore adequate safety measures are addressed through other applicable requirements.

Network Safety – Railway Crossing

Original Assessment

- There is a railway level crossing on Lakeside Drive (LXR: 01734) adjoining the north-east corner of the site. The railway level crossing is protected by active (flashing lights and boom gates) and passive controls (pavement marking, signage and railway width markers).
- The proposed development is for a service station and fast food premises, described as Stage 1.

Short stacking

Original Assessment

- A traffic report has been submitted which indicates that the maximum design vehicle is a 19m articulated vehicle for fuel delivery.

West of the railway level crossing

- Section 2.2 of the report indicates that the Riveredge Boulevard/ Lakeside Drive intersection will be upgraded to include signals and a new fourth leg with left turn islands, will provide access to/ from the site.
- The intersection is approximately 100m from the railway level crossing (cross hatching to the stop line on the western approach). The left-turn into the site (western approach on Lakeside Drive) as shown on the Proposed Site Plan (drawing number 19212-DA02 and revision A) is approximately 56m from the railway level crossing (cross hatching to start of slip lane). The SIDRA analysis indicates that the left turn will be 45m. This separation distance will prevent short stacking.

East of the railway level crossing

- The Lakeside Drive/Abbott Street intersection incorporates left-in and left-out turn lanes which may alleviate short stacking as they give priority to entering and exiting traffic, however, the right turn in from Abbott Street is subject to a limited clearance of around 21.75m, excluding the 5m from the edge running rail that is covered by the existing stop line and box marking.

- This indicates that the maximum design vehicle can keep clear of the railway corridor and Abbott Street.

Response to Information Request

- A revised Conceptual Signalised Intersection Functional Setout (drawing number 20BRT0472-03 and revision E) was submitted.
- This has removed the left-turn slip lane on the northern and western approaches.
- The shared through and left turn lane into the site (western approach on Lakeside Drive) as shown on the Proposed Site Plan (drawing number 19212-DA02 and revision E) is approximately 89m from the railway level crossing (cross hatching to start of through/ left-turn lane).
- This separation distance will prevent short stacking.

Development generated traffic

Original Assessment

- Lakeside Drive provides a main spine through the Oonoonba suburb located primarily west of the railway level crossing.
- Given the multiple directions in which traffic may travel and the level of protection at the level crossing, the development is likely to have a cumulative impact on railway level crossing safety.

4.0 Recommendations

4.1 Further information

TMR's technical assessment has established that the application lacks sufficient details on some matters for full assessment of the impacts of the proposed development on state transport interests. Therefore, TMR recommends to EDQ that the applicant be requested to provide further information as detailed in the following table:

No	Information required
State-controlled Road	
1.	Access to a state-controlled <i>Issue</i> The applicant has not demonstrated that the access arrangements proposed for the development will not result in a worsening of safety and operating conditions of the state-controlled road. 1. Plans submitted throughout the various reports are inconsistent, as they all show both the old civil design and the newly proposed design. This is good for reference on one plan not the full set of plans as there are inconsistent line styles throughout the suite of plans which makes it difficult to determine if all proposed infrastructure works, can actually be accommodated within the area identified in the new design. 2. The plans do not give a true indication of the respective grade heights. For example, the difference in the grade height from the Lakeside Drive road reserve to the design levels proposed for the development are significant, in that the development is 1.5-2.0m higher, with the difference transitioning quickly from the existing road height into the site. No

No	Information required
	details have been provided demonstrating how this is to be achieved. 3. The applicant's response to Item 7(h) only addressed the location of the pedestrian entrance to the site, not the vertical grade from the Lakeside Drive road reserve to the design height of the development for the purposes of pedestrian access. <i>Action</i> 1. The applicant is required to "space proof" the area of the new proposed design to ensure all infrastructure works can be accommodated, whilst meeting relevant design standards. 2. The applicant is required to provide details (including levels and cross sections) of how the access is to be provided from Lakeside Drive road pavement into the development site and tie into the submitted design. 3. The applicant is required to address how pedestrians will access the site in respect to the existing vertical grade from the Lakeside Drive road reserve to the design height of the development, and in doing so demonstrating compliant with the provisions of the <i>Disability Discrimination Act 1995 (DDA)</i>.
2.	Access to a state-controlled road <i>Issue</i> 1. The revised plans have not included a northern pedestrian crossing, which is the natural desired line for pedestrians. The low priority given to pedestrians and the removal of the northern Lakeside crossing is likely to result in vulnerable users (children/teenagers) choosing to cross the northern leg uncontrolled. 2. With no dedicated southbound through lane at the intersection, given that the slip lane has been removed, it is highly likely that there would be a southbound left and right turning vehicle stopped at the intersection while the through is 'green'. This would have a significant impact on southbound through traffic, in particular in the PM peak. Or, is it the case that the 'green left arrow' into the development will only go 'red' on a pedestrian trigger, reducing the frequency of the left turn into the development site getting stopped. 3. The concept drawings only show an on-road line marked bicycle lane on the southern approach to the intersection, however once you get through the intersection the proposed design of the upgraded intersection has removed the connection to the existing network along Lakeside Drive. <i>Action</i> 1. The applicant is required to include a northern pedestrian crossing or provide substantial justification for the pedestrian crossing not to be provided. 2. The applicant is required to provide further clarification in respect to the sequencing of the signals for pedestrians crossings, specifically in relation to the left turn movement into the development site and a northern pedestrian crossing. 3. Amended plans are required showing proposed bicycle lanes to all relevant legs of the intersection and demonstrate how they connect to the existing network.
Railway Corridor	
4.	<i>Stormwater Management</i> <i>Issue</i> 1. The Engineering Report, prepared by Farr Engineers Associates Pty Limited, dated 10

No	Information required
	December 2021, reference 221054, revision 6 has not adequately demonstrated that there will be a no worsening stormwater impact on the railway corridor. In particular: • Section 4.2 of the Engineering Report states that the development is not proposing to mitigate peak discharge. However, the information provided has not demonstrated that the existing and modified drainage channels have adequate capacity to accommodate this unmitigated peak discharge for all relevant design events. The Concept Earthworks and Retaining Wall Layout Plan in Appendix G shows fill, cut and retaining walls will encroach into the easement and Channel 1 which may compromise the hydraulic capacity. • The Concept Stormwater Drainage and Site Layout Plan will concentrate flows from Stage 1 into Channel 1, post-development. A hydraulic analysis has not been provided to demonstrate that the scour protection will be adequate to offset potential impacts at the railway culverts. <i>Action</i> 1. The Engineering Report should be revised to provide the following: • A hydraulic/hydrological analysis and calculations which demonstrate that Channel 1 will have sufficient capacity to accommodate the external catchment flows and any peak discharge from the development for all relevant design events up to a 1% AEP. • Provide flow velocities at the culverts under the railway corridor. If there are unacceptable flow velocities at the culvert, a solution should be provided to offset the impacts. 2. The revised Engineering Report should include details of the mitigation measures proposed to address any potential stormwater and flooding impacts of the proposed development. All mitigation measures must be located on the site and not in the railway corridor. <i>Advice</i> <u>Outlet Scour Protection in Channel 1</u> The applicant is advised to reconsider the angle and orientation of the "Outlet Scour Protection", and possibly rotate it to be more aligned with the flow direction within the channel.

5.0 Endorsement

Officer

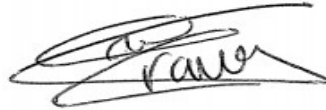
Alex Cramb

Senior Planner

(07) 3066 1419

development_integration@tmr.qld.gov.au

Approver



Alex Cramb

Senior Planner

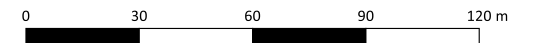
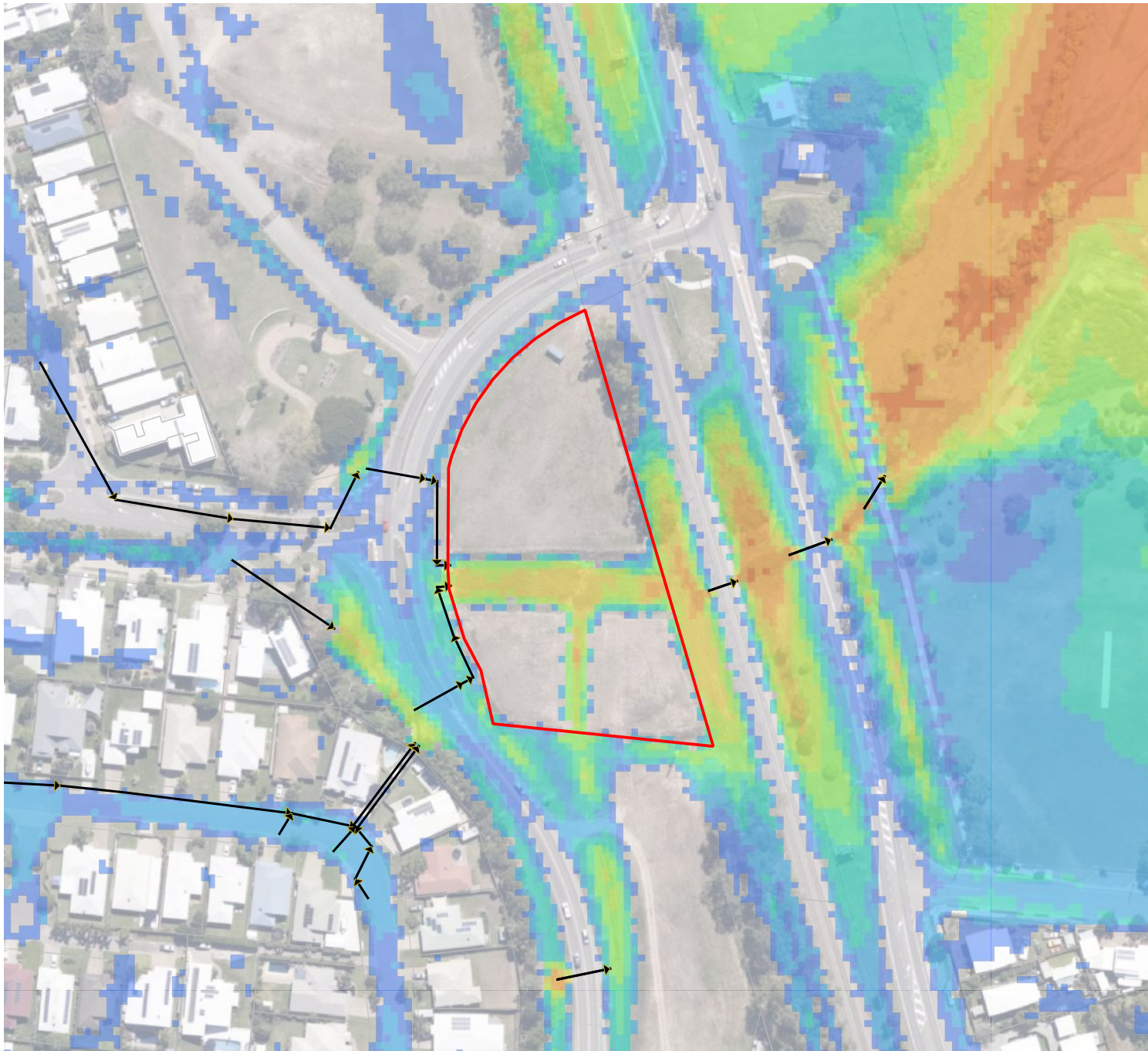
(07) 3066 1419

development_integration@tmr.qld.gov.au

10 February 2022

Appendix C

Pre-Development Scenario: Peak Flood Mapping



Legend

- Site
- DCDB
- Existing Pipes & Culverts

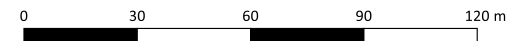
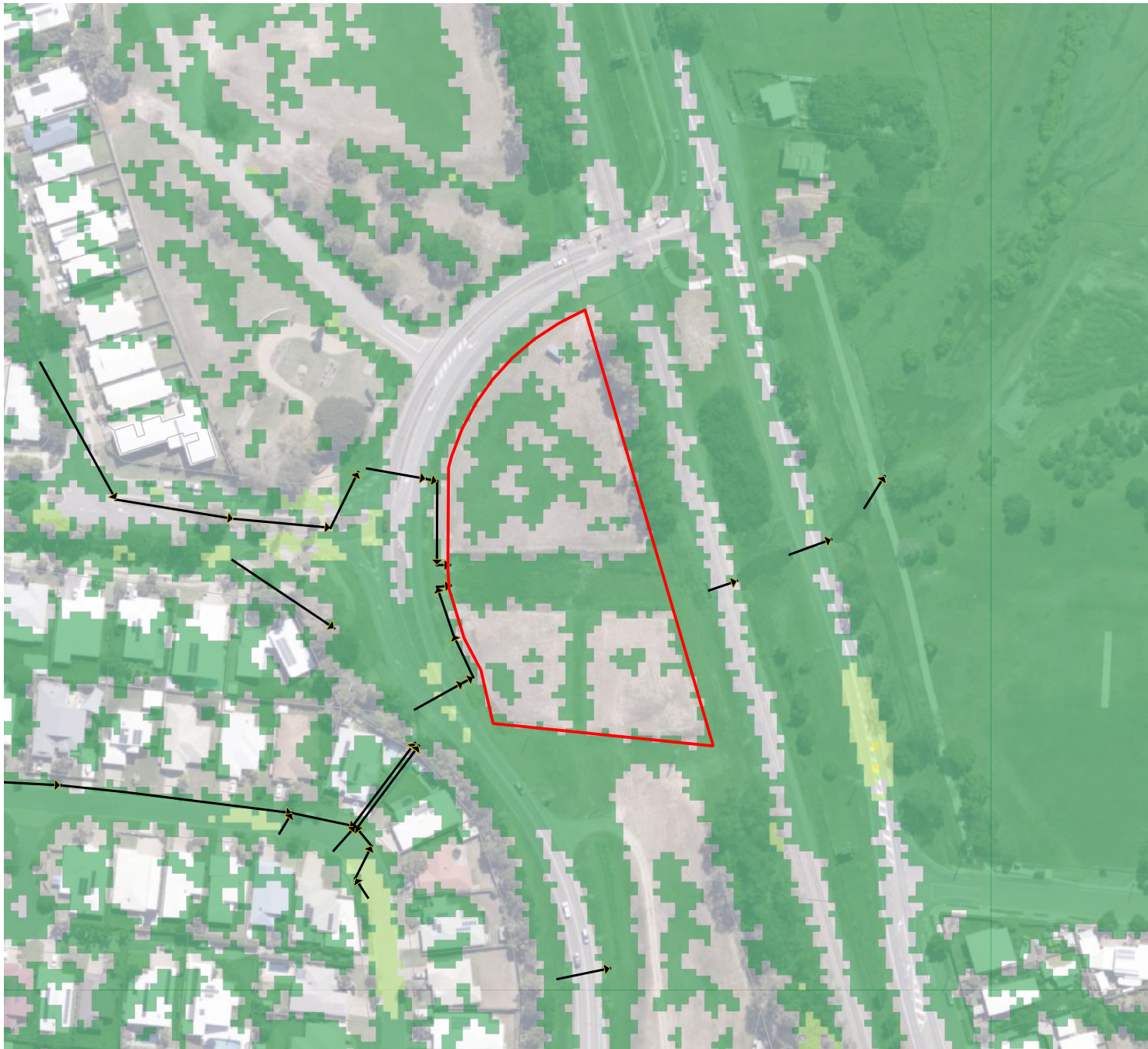
Peak Flow Depth (m)

- 0.05 - 0.15
- 0.15 - 0.30
- 0.30 - 0.50
- 0.50 - 0.60
- 0.60 - 0.80
- 0.80 - 1.00
- 1.00 - 1.20
- 1.20 - 1.50
- 1.50 - 2.00
- 2.00 - 2.50
- 2.50 - 3.00
- > 3.00

286 Lakeside Drive, Oonoonba Hydraulic Impact Assessment Peak Flow Depth | Pre-Development Scenario (D-1 of 4)

PROJECT: 286 Lakeside Drive, Oonoonba (SF-20-0070)
CLIENT: Oonoonba Project Pty Ltd

SOURCES: Queensland Globe (C)
MODEL NAME: E02
MAP REVISION: 01
DATE: 20/06/26
AUTHOR: D.E.
CHECKED: M. Roushani-Zarmehri



Legend

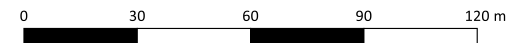
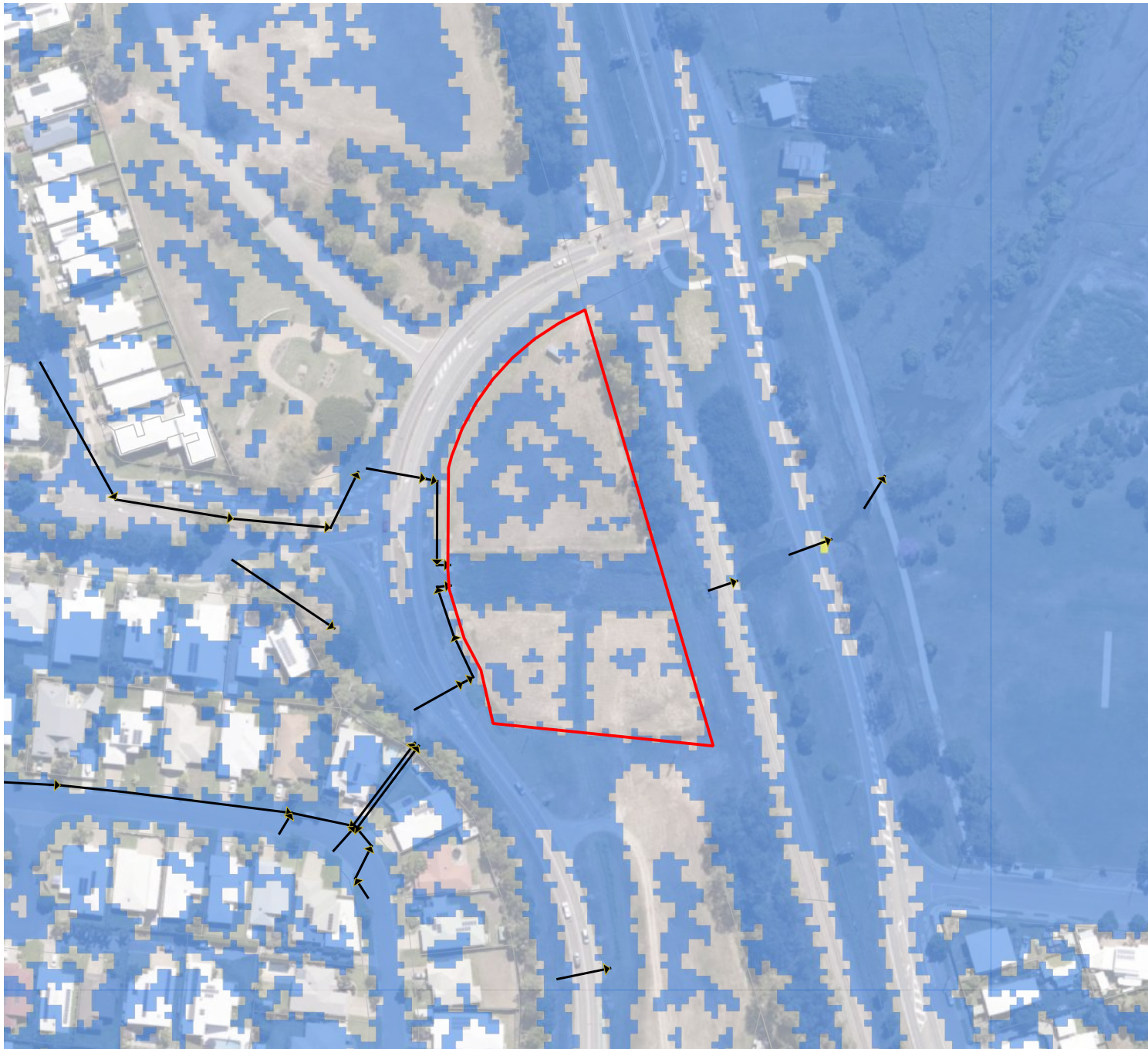
- Site
- DCDB
- Existing Pipes & Culverts
- Flood Velocity (m/s)
 - 0-0.5
 - 0.5-1.0
 - 1.0-2.0
 - 2.0-3.0
 - >3.0

286 Lakeside Drive, Oonoonba Hydraulic Impact Assessment

Peak Flow Velocity | Pre-Development Scenario (D-2 of 4)

PROJECT: 286 Lakeside Drive, Oonoonba (SF-20-0070)
CLIENT: Oonoonba Project Pty Ltd

SOURCES: Queensland Globe (C)
MODEL NAME: E02
MAP REVISION: 01
DATE: 20/06/26
AUTHOR: D.E.
CHECKED: M. Roushani-Zarmehri



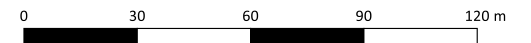
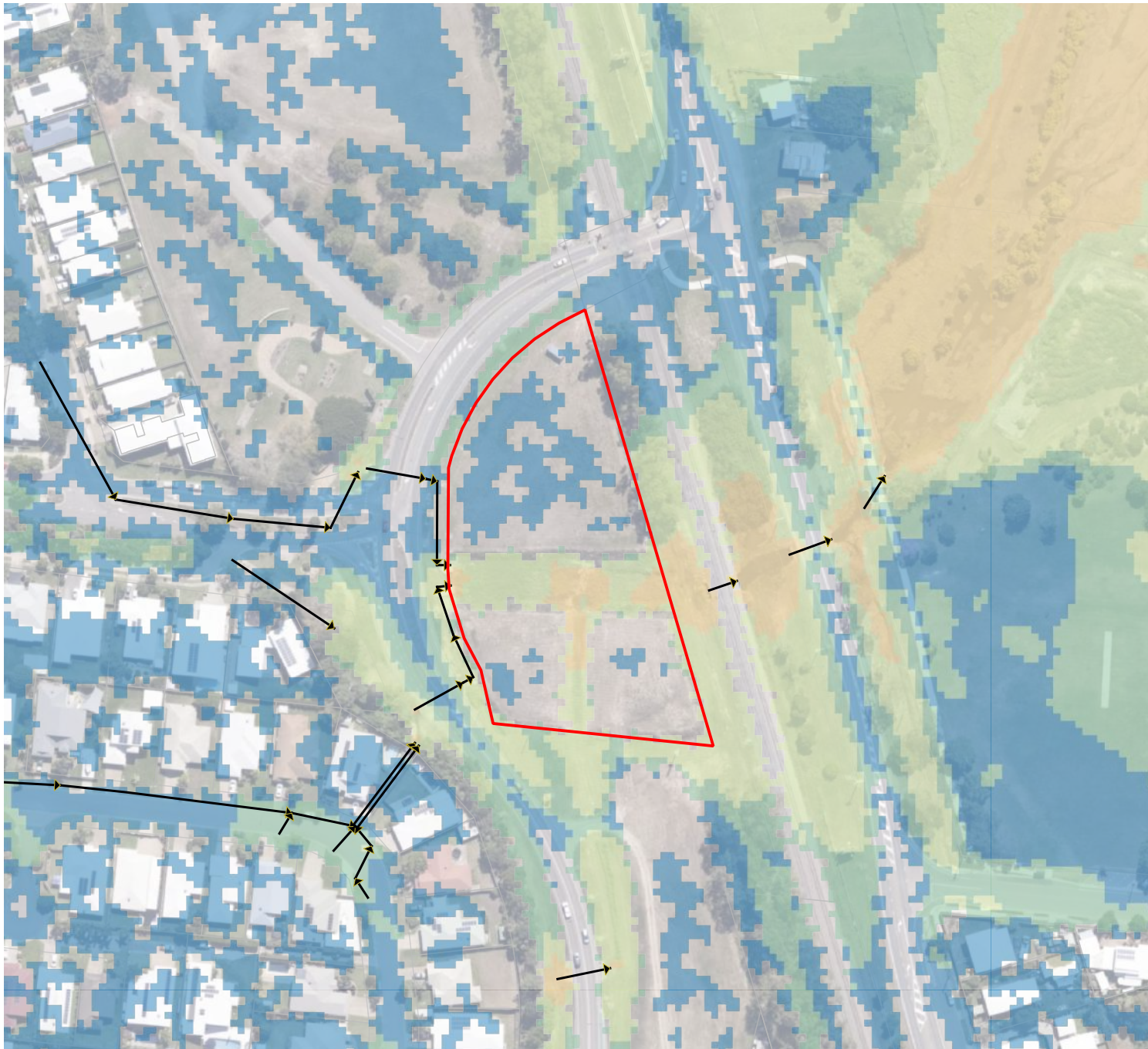
Legend

-  Site
-  DCDB
-  Existing Pipes & Culverts
- Vel. Depth Product (m^2/s)
-  ≤ 0.0
-  $0.0 - 0.4$
-  $0.4 - 0.6$
-  $0.6 - 1.2$
-  $1.2 - 10.0$

286 Lakeside Drive, Oonoonba Hydraulic Impact Assessment
Peak Hazard (Depth x Velocity Product) | Pre-Development
Scenario (D-3 of 4)

PROJECT: 286 Lakeside Drive, Oonoonba (SF-20-0070)
CLIENT: Oonoonba Project Pty Ltd

SOURCES: Queensland Globe (C)
MODEL NAME: E02
MAP REVISION: 01
DATE: 20/06/26
AUTHOR: D.E.
CHECKED: M. Roushani-Zarmehri



Legend

- Site
- DCDB
- Existing Pipes & Culverts
- Flood Hazard (AEMI)
 - H1
 - H2
 - H3
 - H4
 - H5
 - H6

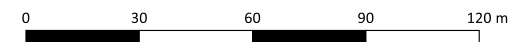
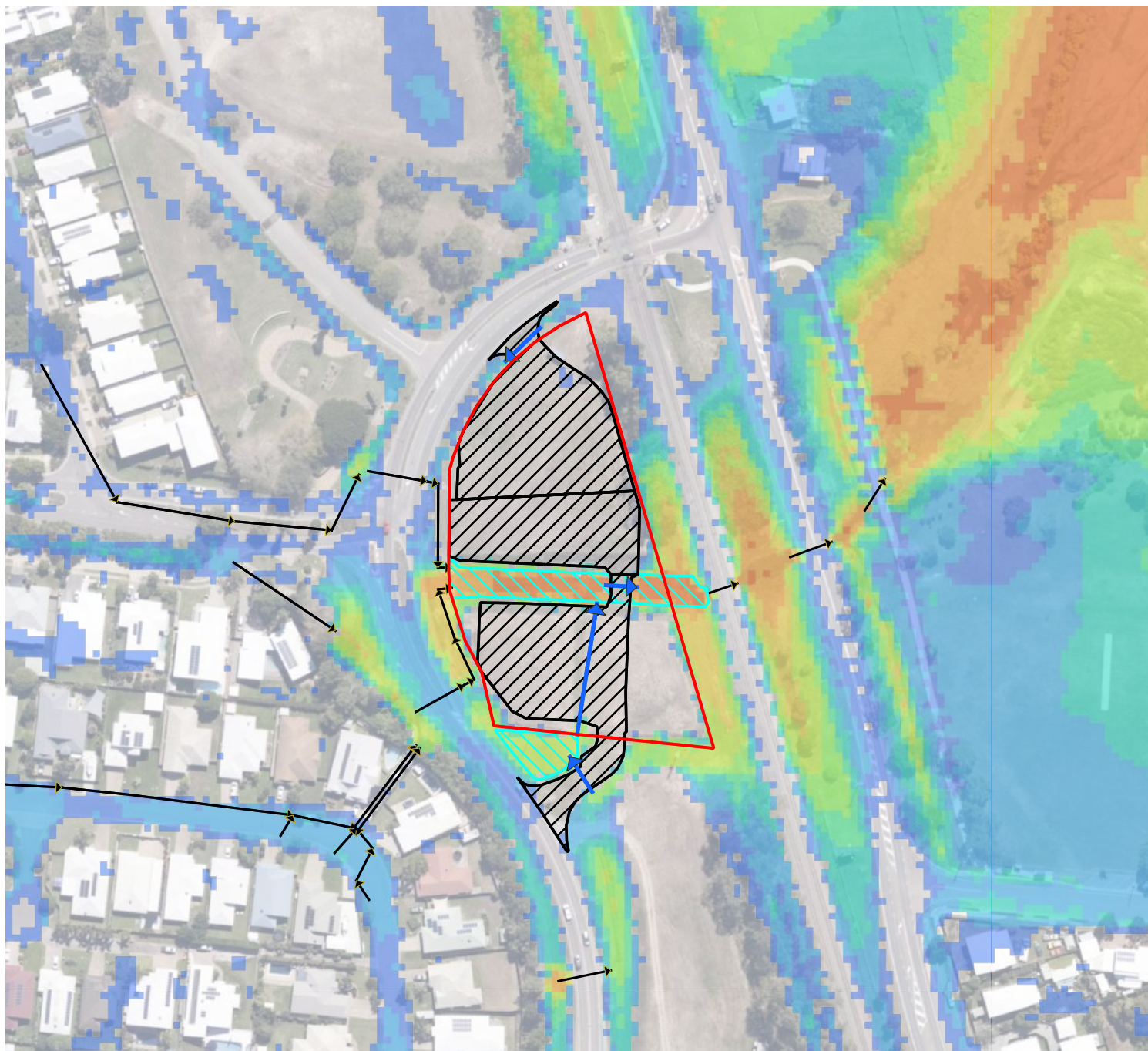
286 Lakeside Drive, Oonoonba Hydraulic Impact Assessment
Australian Emergency Management Institute Hazard Category |
Pre-Development Scenario (D-4 of 4)

PROJECT: 286 Lakeside Drive, Oonoonba (SF-20-0070)
CLIENT: Oonoonba Project Pty Ltd

SOURCES: Queensland Globe (C)
MODEL NAME: E02
MAP REVISION: 01
DATE: 20/06/26
AUTHOR: D.E.
CHECKED: M. Roushani-Zarmehri

Appendix D

Post-Development Scenario: Peak Flood Mapping & Impact Map



Legend

- Site
- DCDB
- Existing Pipes & Culverts
- Proposed Culverts
- Drainage Easement
- Raised Pads

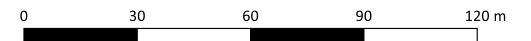
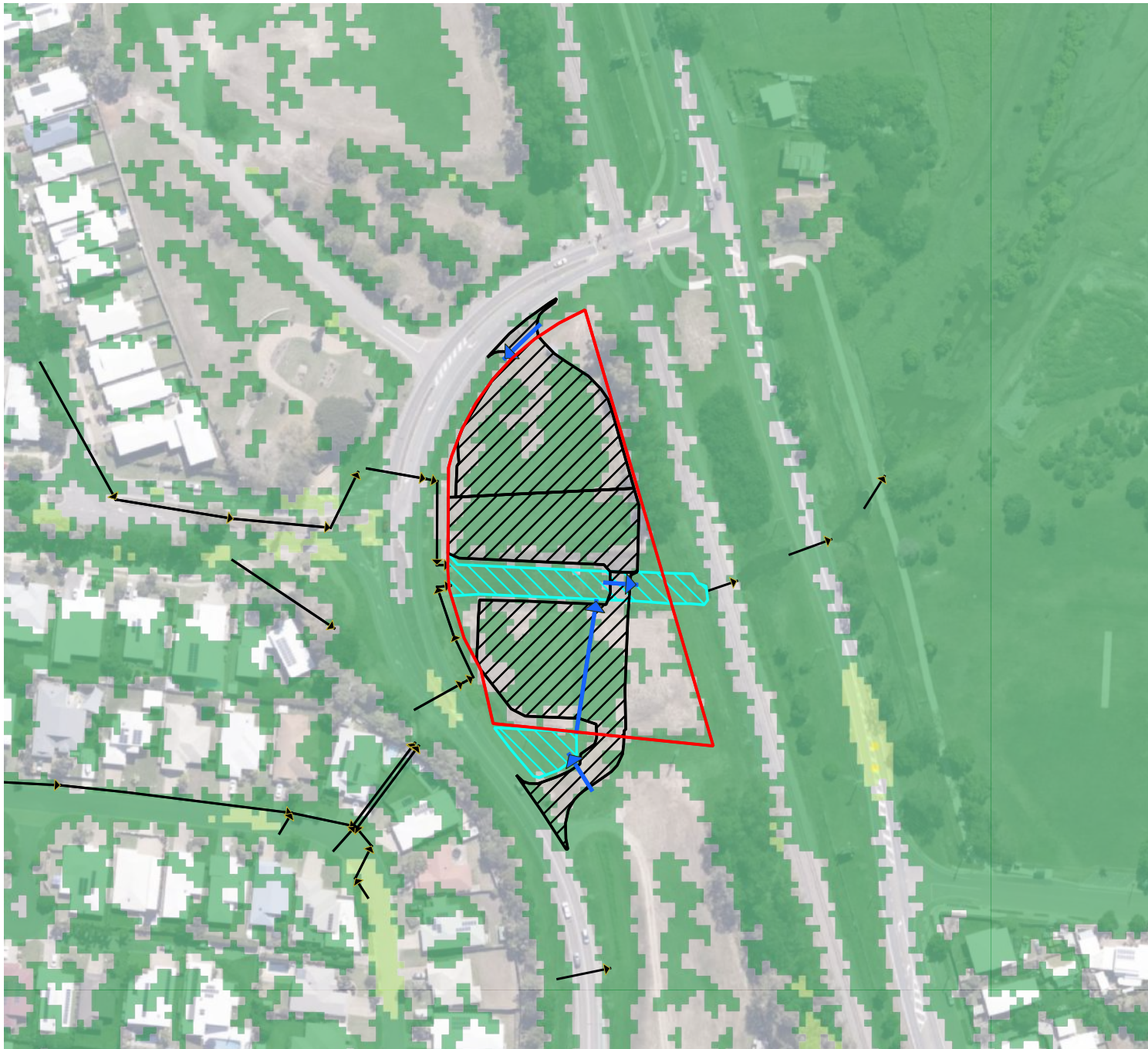
Peak Flow Depth (m)

- 0.05 - 0.15
- 0.15 - 0.30
- 0.30 - 0.50
- 0.50 - 0.60
- 0.60 - 0.80
- 0.80 - 1.00
- 1.00 - 1.20
- 1.20 - 1.50
- 1.50 - 2.00
- 2.00 - 2.50
- 2.50 - 3.00
- > 3.00

286 Lakeside Drive, Oonoonba Hydraulic Impact Assessment Peak Flow Depth | Post-Development Scenario (D-1 of 6)

PROJECT: 286 Lakeside Drive, Oonoonba (SF-20-0070)
CLIENT: Oonoonba Project Pty Ltd

SOURCES: Queensland Globe (C)
MODEL NAME: D06
MAP REVISION: 01
DATE: 20/06/26
AUTHOR: D.E.
CHECKED: M. Roushani-Zarmehri



Legend

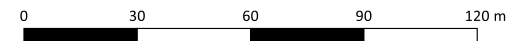
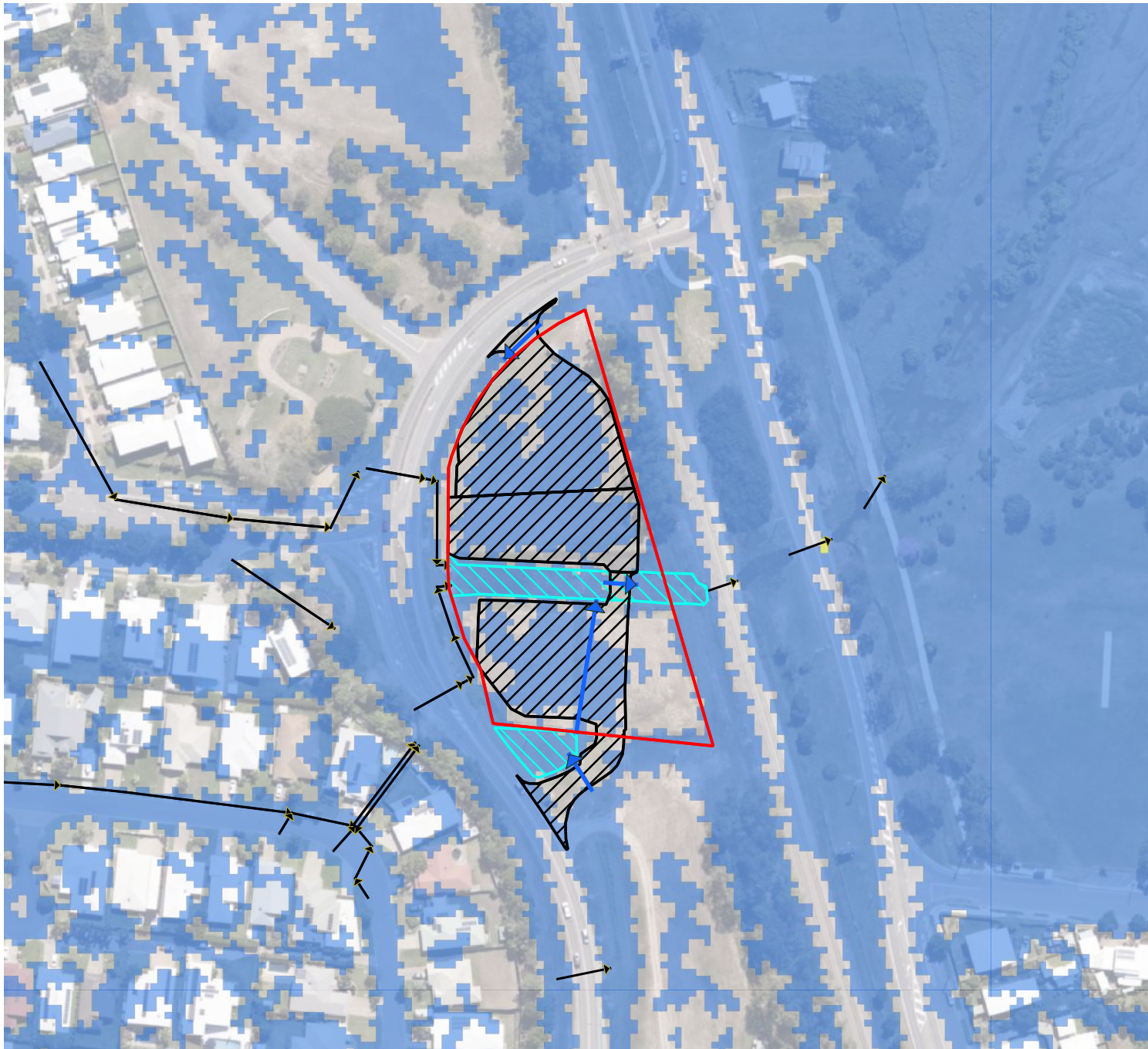
- Site
- DCDB
- Existing Pipes & Culverts
- Proposed Culverts
- Drainage Easement
- Raised Pads
- Flood Velocity (m/s)
 - 0-0.5
 - 0.5-1.0
 - 1.0-2.0
 - 2.0-3.0
 - >3.0

286 Lakeside Drive, Oonoonba Hydraulic Impact Assessment

Peak Flow Velocity | Post-Development Scenario (D-2 of 6)

PROJECT: 286 Lakeside Drive, Oonoonba (SF-20-0070)
CLIENT: Oonoonba Project Pty Ltd

SOURCES: Queensland Globe (C)
MODEL NAME: D06
MAP REVISION: 01
DATE: 20/06/26
AUTHOR: D.E.
CHECKED: M. Roushani-Zarmehri



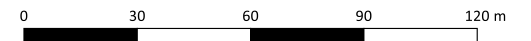
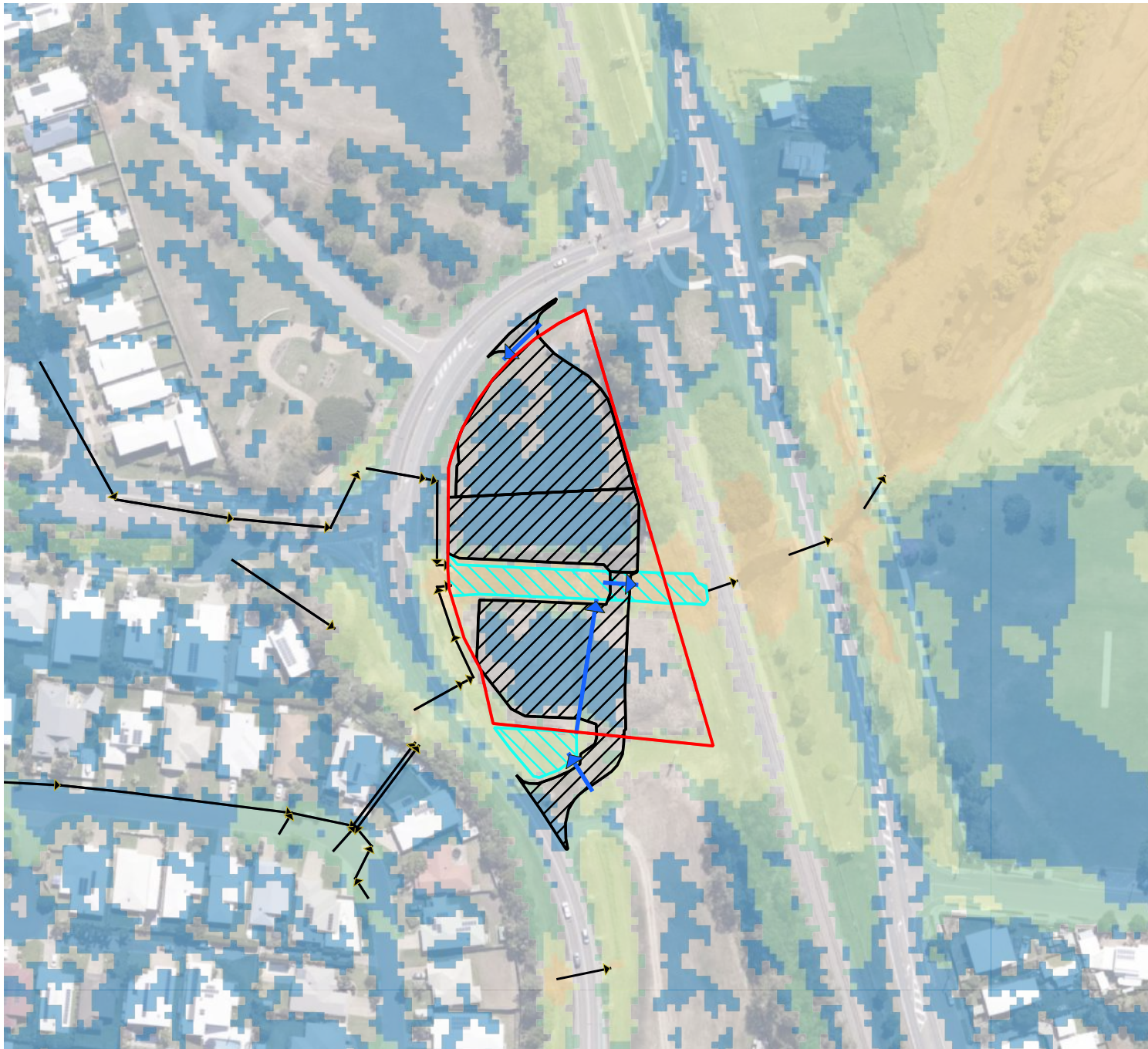
Legend

- Site
- DCDB
- Existing Pipes & Culverts
- Proposed Culverts
- Drainage Easement
- Raised Pads
- Vel. Depth Product (m^2/s)
 - ≤ 0.0
 - 0.0 - 0.4
 - 0.4 - 0.6
 - 0.6 - 1.2
 - 1.2 - 10.0

286 Lakeside Drive, Oonoonba Hydraulic Impact Assessment
Peak Hazard (Depth x Velocity Product) | Post-Development
Scenario (D-3 of 6)

PROJECT: 286 Lakeside Drive, Oonoonba (SF-20-0070)
CLIENT: Oonoonba Project Pty Ltd

SOURCES: Queensland Globe (C)
MODEL NAME: D06
MAP REVISION: 01
DATE: 20/06/26
AUTHOR: D.E.
CHECKED: M. Roushani-Zarmehri



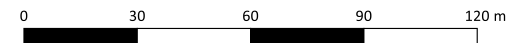
Legend

- Site
- DCDB
- Existing Pipes & Culverts
- Proposed Culverts
- Drainage Easement
- Raised Pads
- Flood Hazard (AEMI)
 - H1
 - H2
 - H3
 - H4
 - H5
 - H6

286 Lakeside Drive, Oonoonba Hydraulic Impact Assessment
Australian Emergency Management Institute Hazard Category |
Post-Development Scenario (D-4 of 6)

PROJECT: 286 Lakeside Drive, Oonoonba (SF-20-0070)
CLIENT: Oonoonba Project Pty Ltd

SOURCES: Queensland Globe (C)
MODEL NAME: D06
MAP REVISION: 01
DATE: 20/06/26
AUTHOR: D.E.
CHECKED: M. Roushani-Zarmehri



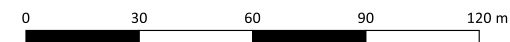
Legend

- Site
- DCDB
- Existing Pipes & Culverts
- Proposed Culverts
- Drainage Easement
- Raised Pads
- Change in Peak Flood Level
 - <-100mm
 - 100 to -50mm
 - 50 to -20mm
 - 20 to -10mm
 - 10 to 10mm
 - 10 to 20mm
 - 20 to 30mm
 - 30 to 50mm
 - 50 to 100mm
 - >100mm

286 Lakeside Drive, Oonoonba Hydraulic Impact Assessment
Change in Peak Flood Level | Post-Development Scenario (D-5 of 6)

PROJECT: 286 Lakeside Drive, Oonoonba (SF-20-0070)
CLIENT: Oonoonba Project Pty Ltd

SOURCES: Queensland Globe (C)
MODEL NAME: D06
MAP REVISION: 01
DATE: 20/06/26
AUTHOR: D.E.
CHECKED: M. Roushani-Zarmehri



Legend

- Site
- DCDB
- Existing Pipes & Culverts
- Proposed Culverts
- Drainage Easement
- Raised Pads
- Change in Peak Flow Velocity
 - More than -20% Decrease
 - Between -10% and -20% Decrease
 - Up to -10% Decrease
 - 0
 - Up to 10% Increase
 - Between 10% and 20% Increase
 - More than 10% Increase

286 Lakeside Drive, Oonoonba Hydraulic Impact Assessment
Change in Peak Flow Velocity | Post-Development Scenario (D-6 of 6)

PROJECT: 286 Lakeside Drive, Oonoonba (SF-20-0070)
CLIENT: Oonoonba Project Pty Ltd

SOURCES: Queensland Globe (C)
MODEL NAME: D06
MAP REVISION: 01
DATE: 20/06/26
AUTHOR: D.E.
CHECKED: M. Roushani-Zarmehri