Northern Quartz Campus

Surface water assessment - BESS, Substation and Transmission line

Prepared for Solquartz and Private Energy Partners

November 2025

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E231133 RP1

November 2025

Version	Date	Prepared by	Reviewed by	Comments
V1.0	1 August 2025	J Muller	N Barth	For Client review
V2.0	27 August 2025	J Muller	E Campbell	Final
V3.0	3 November 2025	L Norman	E Campbell	Response to RFI

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Executive Summary

ES1 Project

Solquartz and Private Energy Partners (PEP) are proposing to develop Northern Quartz Campus (NQC) within Townsville City Council's (TCC) Lansdown Eco- Industrial Precinct (LEIP), a high impact industrial area promoted as Australia's first environmentally sustainable industrial hub. NQC will ultimately result in the delivery of an industrial hub which provides metallurgical silicon and polysilicon.

This document contains a surface water impact assessment to support approvals relating to a several components of the overall project: a Battery Energy Storage System (BESS), transmission line and substation.

ES2 TCC Development Code compliance

The Townsville City Plan describes Zones, Overlays, and Development Codes. Those relevant to the assessment of surface water effects at the project site are:

- 6.5.3 High impact industry zone code (Lansdown high impact industry precinct)
- 8.2.6 Flood hazard overlay code (medium flood hazard zone)
- 9.3.2 Healthy waters code

The proposed development either complies with the relevant provisions, or intends to comply, with the performance outcomes to be adopted as design conditions.

Table ES1 Code compliance summary

Code	Summary of compliance (surface water aspects)
High impact industry zone	Complies with PO18, PO19, PO20
Flood hazard overlay	Complies with PO7, PO8
Healthy waters	Complies with PO1, PO3, PO5, PO7 Intent to Comply with PO6, PO8, PO9, PO10, PO11, PO12, PO13

ES3 Request for information response

A request for information issued from Townsville City Council (TCC) was received on 30 September 2025. Details of responses relevant to Appendix L are summarised in the Table below.

Table ES2 Responses relevant to Appendix L

Detail	Response	Additional information reference
Water resources assessment report		
The submitted report states that "the stormwater system would be designed so that it may be isolated from the natural environment (i.e. no discharge) in the event of a spill, fire, or contamination event." The applicant is requested to provide further details on how this is proposed to be achieved within the development.	Firefighting effluent will be retained on site under HIPAP 2 until such time that it is suitable for release into the environment (following treatment via a sediment pond) or trucked off site.	Refer Section 4.1.1

Detail	Response	Additional information reference
Sections are requested to be added to Figure 5.1. The submitted version shows blank plots.	Updated cross sections detailing the flood elevation levels against the existing and developed surface levels are provided in Section 5.4.1. The substation pad and BESS pad require elevation to meet their respective flood immunity requirements of 0.5% AEP and 0.2% AEP flood levels respectively. Figures 5.1 – 5.7 provide cross section elevations to show the flood immunity the development. These figures confirm the appropriate flood immunity of both the Substation Pad and the BESS Pad structures.	Refer Section 5.4.1
Flood report		
Peak water surface elevation plots are requested to be included in Appendix A, along with spot 1% AEP levels reported at key locations within and around the development.	Updated cross sections detailing the flood elevation levels against the existing and developed surface levels are provided in Section 5.4.1 of the Water Resources Assessment Report. Additional plots on the 1% AEP levels at key locations within and around the development have been provided within Section 5.4.2 of the Water Resources Assessment Report. This information is further analysed and presented in Attachment A Flood impact assessment.	Water Resources Assessment Report Section 5.4.2, and Attachment A Flood impact assessment report.
The scale of the peak depth and velocity plots contained in Appendix A is requested to be modified (zoomed-in) to show enhanced detail within the development site.	Attachment A Flood impact assessment report has been updated providing figures detailing a zoomed extent of key development features. Figures A1.1 – A1.12 (i.e. peak depth and peak velocity figures) have been updated.	Refer Annexure A Flood impact assessment report.
Confirmation is requested that the BESS containers, control room, diesel generator and auxiliary transformer will be provided with 1% AEP flood immunity. The submitted plans show these elements at ground level within and adjacent to a 1% AEP flood path.	Current design is conceptual level only and is subject to detailed design. 1% AEP flood immunity of these buildings will be met as part of the detailed design phase. Further details are provided in Section 5.4.2 of this report.	Refer Annexure A Flood impact assessment report Section 4.2.
The 10% and 1% AEP afflux plots show 50-100mm of afflux within the State controlled road corridor to the east of the development site. The applicant is requested to confirm State acceptance of these impacts.	Current concept design demonstrates impacts within road corridor. However, these impacts will be mitigated during detailed design to achieve zero impacts to the road corridor. This will include design updates to water storage basin, drainage design, water treatment train and pad footprint/elevations to achieve this. Flood modelling of the detailed design will be performed to quantify and confirm these outcomes.	Refer Appendix A Section 4.2.

ES4 Closing

This report provides an assessment of the development in relation to its design flood immunity, efficiency of the water sensitive urban design relating to water quality, and risk associated with the. On this basis the following has been summarised:

- The development lies within the TCC 'medium flood hazard' area. The substation and BESS will be elevated above the 0.2% AEP flood level. The bio-retention basin will occupy a section of the Four Mile Creek flood storage area, but will not worsen flood characteristics (see afflux mapping in). Shallow overland flow will be redirected around the development. The altered flow paths will be of relatively low flow rate, such that scour and erosion will not be increased.

- During operation of the site, the erosion potential of the soils from the site will not be increased from existing conditions due to the low velocities in the overland flow (max 0.3 m/s). This will be further reduced if the surface is re-vegetated as soon as practicable.

- MUSIC modelling indicates that the proposed stormwater treatment measures will be effective at reducing sediment and nutrients from the site both in comparison to the undeveloped grazing land use, and in comparison to the site developed without WSUD.

- The development will not cause impact to the Lake Ross drinking water supply in the case of a combustion of the asset. This was determined through a source-pathway-receptor risk assessment.

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1 Introduction

1.1 Report purpose

This report presents an assessment of the proposed project with respect to surface water resources.

1.2 Project overview

Solquartz and PEP are proposing to develop Northern Quartz Campus (NQC) within Townsville City Council's (TCC) Lansdown Eco- Industrial Precinct (LEIP), a high impact industrial area promoted as Australia's first environmentally sustainable industrial hub. NQC encompasses four major project components all of which culminate in the delivery of an industrial hub which powers and provides metallurgical silicon and polysilicon.

To support the overall program delivery, various components were defined and broken into a four package delivery based on project schedule drivers, investor confidence, and risk profiles:

1. BESS, transmission line and NQC substation (assessed within this report)
2. Biochar processing facility (Phase 1) (to be assessed within a future application to TCC)
3. A Metallurgical Silicon (MG-Si) plant and Biochar processing facility (Phase 2) (to be assessed within a future application to TCC)
4. Polysilicon plant (to be assessed within a future application to TCC).

The four project components will be sited within the *project area*, which comprises three allotments (part of Lot 19 on SP321818, Lot 34 on E124243 and part of Lot 87 on RP911426). Of this area, this application seeks to assess the *premises,* a smaller development footprint encompassing 86.63 ha. The premises are located in the centre of the project area. Table 1.1 describes the relationship between the project area and premises.

Table 1.1 Description of area terminology used in this application

Terminology	Description
Project area	The project area encompasses an area of approximately 339.2 hectares (ha) and is comprised of three adjoining allotments: • part of Lot 19 on SP321818 • Lot 34 on E124243 • part of Lot 87 on RP911426. The project area represents the extent of all land allocated to PEP within the LEIP precinct.
Premises	The premises is the area directly being assessed by this application. It consists of: • part of Lot 19 on SP321818 • part of Lot 87 on RP911426, • part of Lot 30 on SP321818 • part of Lot 55 on E124248 and • part of Lot 65 on E124264 and involves all the land required for the BESS, substation and transmission lines. Under Schedule 2 of the *Planning Act 2016,* 'premises' is defined as: • A building or other structure; or Land, whether or not a building or other structure is on land.

1.3 Assessment pathway

The Project has been determined to be assessable development subject to the provisions of the Townsville City Plan 2014. Further, the Project has been designated in this planning assessment as an *undefined use*. The Townsville City Plan (Schedule 1) defines an undefined use as *Any use not listed in Table SC1.1.1 (Use definitions) is an undefined use.*

Note, whilst not defined within the TCC Planning Scheme, the Planning Regulation 2017 has now been updated to include a 'battery storage facility'. A summary of the development application details is included in Table 1.2.

Table 1.2 Assessable development summary

Proposed development	**Detail**
Type of approval sought	• Development permit for Material Change of Use for an Undefined Use (BESS) • Development permit for Material Change of Use for major electricity infrastructure • Development permit for Material Change of Use for a Substation
Site address	132 Bidwilli Road, Calcium Townsville QLD, 4816
Real property description	• Part of Lot 19 SP321818 • Part of Lot 87 on RP911426 • part of Lot 30 on SP321818 • part of Lot 55 on E124248 and • part of Lot 65 on E124264
Defined area of 'premises'	See Figure 4.1
Assessment manager	Townsville City Council
Owner details	Townsville City Council
Applicant details	Private Energy Partners

The relevant planning instruments against which the Project will be assessed is provided in Table 1.3.

Table 1.3 Planning instrument details

Planning instrument	Detail
Regional plan	North Queensland Regional Plan (dated March 2020)
Planning scheme	Townsville City Plan (version 2024-01)
Zone	High Impact Industry
Level of assessment	Impact assessment
Applicable planning scheme overlays	OM-06.1 Flood Hazard
Applicable local codes	High impact industry code Flood hazard overlay code Healthy waters code Transport impact, access and parking code Works code Landscape code Telecommunications facility and utilities code

1.4 Approach and document hierarchy

A summary of relevant TCC development codes and assessment outcome against these codes is provided in Chapter 2. The basis for the code compliance assessment is provided in the following chapters, with:

- a description of the surface water environment (e.g. climate and watercourses) in Chapter 3
- a summary of the main elements of the proposed development in Chapter 4
- a summary of technical assessments in Chapter 5.6, with supporting reports as Appendices:
  - Flood assessment
  - Water quality Assessment
- impact assessment in Chapter 5
- tabulated avoidance and mitigation measures in Chapter 6.

2 Code compliance

The Townsville City Plan describes Zones, Overlays, and Development Codes. Those relevant to the assessment of surface water effects at the project site are:

- 6.5.3 High impact industry zone code (Lansdown high impact industry precinct)
- 8.2.6 Flood hazard overlay code (medium flood hazard zone)
- 9.3.2 Healthy waters code

A summary of the assessment against TCC codes is provided in Table 2.1

Table 2.1 Code compliance review

Performance objective	Acceptable Outcome	Response
High Impact industry zone code		
PO18 To maintain the natural environmental values ecological processes and the quality of waterways development does not establish within the areas identified as 'environmental corridors' and 'water resource catchment area' as shown on 'Figure - 6.164 Lansdown concept plan'.	No acceptable outcome is nominated.	**PO18 – Complies** Development is proposed only within the area identified as 'Developable Area' on Figure 6.164
PO19 Development does not discharge waste water into the Ross River Dam catchment.	No acceptable outcome is nominated.	**PO19 – Complies** No waste water (or stormwater) will be discharged to the Ross River Dam catchment
PO20 Development is supported by adequate infrastructure, including: a) provision of stormwater quality and quantity management systems b) on-site water quality treatment infrastructure or water detention basins located outside environmental corridors.	No acceptable outcome is nominated.	**PO20 – Complies** An adequate stormwater management system is proposed

Performance objective	Acceptable Outcome	Response
Flood hazard overlay code		
PO7 Development within high and medium hazard areas does not directly, indirectly or cumulatively worsen flood characteristics outside the development site, having regard to: a) increased scour and erosion; or b) loss of flood storage; or c) loss of or changes to flow paths; or d) flow acceleration or retardation; or e) reduction in flood warning times.	No acceptable outcome is nominated.	**PO7 – Complies** The development within a medium hazard area will interact with flood waters, but is not expected to worsen flood characteristics. Shallow overland flow will be redirected around the development. a) The altered flow paths will be of relatively low flow rate, such that scour and erosion will not be increased b) At rare AEPs, Four Mile Creek flood extent may impinge on the development footprint. Exclusion of flooding will resulting in minor loss of flood storage. Afflux mapping indicates that effects will be local, with negligible effects on adjacent or downstream infrastructure. c) Defined flow paths will be retained d) Flow will not be accelerated e) The development will not alter flood warning times Flood information is provided in Annexure A
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). Table 8.2.6.3(b)-Flood immunity for community services and facilities Development involving: c) major electricity infrastructure — 0.2% AEP event Development involving: e) substations — 0.5% AEP event	**AO8 - Complies** The development will be designed with flood immunity as per Table 8.2.6.3(b)- Flood information is provided in Annexure A

Performance objective	Acceptable Outcome	Response
Healthy waters code		
PO1 Development contributes to the protection of environmental values and water quality objectives of receiving waters to the extent practicable.	No acceptable outcome is nominated.	**PO1 – Complies** WSUD is proposed, incorporating swale and pond elements suitable at 'street scale' and 'precinct scale' (Table SC6.4.10.1) Oily water separators are proposed at the substation site The proposed pond will detain stormwater to treat and reduce peak flows during typical operating conditions, and will retain (capture) runoff in the event of emergency when atypical runoff conditions may occur
PO2 High environmental value waters and slightly disturbed waters (shown on Figure 9.1 — High environmental value waters and slightly disturbed waters) are protected from the impacts of development within their catchments. Existing water quality, habitat and biota values, flow regimes and riparian areas are maintained or enhanced.	Not applicable	**Not applicable** The site is not located in a mapped catchment
PO3 The entry of contaminants into, and transport of contaminants in, stormwater is avoided or minimised.	No acceptable outcome is nominated	**PO3 – Complies** WSUD is proposed, incorporating swale and pond elements suitable at 'street scale' and 'precinct scale' (Table SC6.4.10.1) Oily water separators are proposed at the substation site The proposed pond will detain stormwater to treat and reduce peak flows during typical operating conditions, and will retain (capture) runoff in the event of emergency when atypical runoff conditions may occur
PO4 Within the areas identified as potential acid sulfate soils on Figure 9.2 — Acid sulfate soils, the generation or release of acid and metal contaminants into the environment from acid sulfate soils is avoided by…	Not applicable	**Not applicable** The site is not located in a mapped area

Performance objective	Acceptable Outcome	Response
PO5 Construction activities for the development avoid or minimise adverse impacts on stormwater quality or hydrological processes	No acceptable outcome is nominated	**PO5 – Complies** A construction phase sediment and erosion management plan will be prepared and applied by the construction contractor, minimising the risk of sediment entering waterways
PO6 The stormwater management system: a) retains natural waterway corridors and drainage paths; and b) maximises the use of natural channel design in constructed components.	**AO6.1** All existing waterways and overland flow paths are retained. **AO6.2** The stormwater management system is designed in accordance with the Development manual planning scheme policy no. SC6.4 — SC6.4.10.2 Water Sensitive Urban Design.	**AO6.1 - Complies** All existing waterways and overland flow paths are retained. **AO6.2 – Intent to Comply** The stormwater management system will be designed in accordance with WSUD principles
PO7 The development is designed to minimise run-off and peak flows by: a) minimising large areas of impervious material; and b) maximising opportunities for capture and reuse.	No acceptable outcome is nominated	**PO7 – Complies** Peak flows will be minimized due to detention in the proposed bio retention basin
PO8 Stormwater management is designed to: a) protect in-stream ecosystems from the significant effects of increased run-off frequency by capturing the initial portion of run-off from impervious areas; and b) create conditions such that the frequency of hydraulic disturbance to in-stream ecosystems in developed catchments is similar to pre-development conditions.	**AO8** The stormwater management system is designed in accordance with the Development manual planning scheme policy no. SC6.4 - SC6.4.8 Stormwater Management, SC6.4.9 Stormwater Quantity and SC6.4.10 Stormwater Quality.	**AO8 – Intent to Comply** The stormwater management system will be designed in accordance with the Development manual The initial portion of runoff from impervious areas will be captured in the proposed bio retention basin
PO9 Stormwater management is designed to prevent exacerbated in-stream erosion downstream of a development site by controlling the magnitude and duration of sediment-transporting, erosion-causing flows.	**AO9** The stormwater management system is designed in accordance with the Development manual planning scheme policy no. SC6.4 — SC6.4.10.2 Water Sensitive Urban Design and SC6.4.8.10 Stormwater Management Plans.	**AO9 – Intent to Comply** The stormwater management system will be designed in accordance with the Development manual

Performance objective	Acceptable Outcome	Response
PO10 The proposed stormwater management system or site works does not adversely affect flooding or drainage characteristics of properties that are upstream, downstream or adjacent to the development site.	**AO10.1** The development does not result in an increase in flood level or flood duration on upstream, downstream or adjacent properties. **AO10.2** The stormwater management system is designed and constructed in accordance with the Development manual planning scheme policy SC6.4 –SC6.4.8 Stormwater Management, SC6.4.9 Stormwater Quantity; and SC6.4.10 Stormwater Quality.	**AO10.1 – Complies** The proposed stormwater management system will capture and detain flows to prevent increase in peak runoff **AO10.2 – Intent to Comply** The stormwater management system will be designed in accordance with the Development manual
PO11 Development does not cause ponding, or changes in flows and velocities such that the safety, use and enjoyment of nearby properties are adversely affected.	**AO11** The stormwater management system is designed and constructed in accordance with the Development manual planning scheme policy SC6.4 – SC6.4.8 Stormwater Management, SC6.4.9 Stormwater Quantity; and SC6.4.10 Stormwater Quality.	**PO11 – Intent to comply** The stormwater management system will be designed in accordance with the Development manual
PO12 The drainage network has sufficient capacity to safely convey stormwater run-off from the site.	**AO12** Development is undertaken in accordance with the Development manual planning scheme policy SC6.4 – SC6.4.8 Stormwater Management, SC6.4.9 Stormwater Quantity; and SC6.4.10 Stormwater Quality.	**PO12 – Intent to comply** The stormwater management system will be designed in accordance with the Development manual
PO13 The stormwater management system: a) provides for safe access and maintenance; and b) where relevant, provides for safe recreational use of stormwater management features.	No acceptable outcome is nominated	**PO13 – Intent to comply** The bio retention basin will be designed for safe access and maintenance

3 Existing environment

3.1 Climate

3.1.1 Observed rainfall trends

The subject site experiences a tropical climate, but due to its geographical location, rainfall totals are generally not as high as other tropical areas. Monsoonal rainfall from late December through until early April delivers most of the annual rainfall and the largest rainfall events. Approximately 80% of annual rainfall occurs during the four-month period from December through to March. This period is also the season that tropical cyclones can represent a severe risk of extreme winds and rainfall across the region.

Key information and statistical data for the three local rainfall gauges are provided in Table 3.1. Annual rainfall statistics are presented for the period July to June.

Table 3.1 Annual rainfall statistics

Statistic	Units	Townsville Aero (32040)	Lansdown CSIRO (33226)	Majors Creek (33151)
Rainfall record period		1940 – present	1964 – present	1934 – present
Distance from the study area		40 km north	4.8 km south	10 km east
Elevation	(m AHD)	4	60	28
Average rainfall	(mm/year)	1,123	885	1,198
Lowest rainfall	(mm/year)	381	289	320
5th percentile rainfall	(mm/year)	484	338	486
10th percentile rainfall	(mm/year)	524	486	583
Median rainfall	(mm/year)	1,058	752	1,070
90th percentile rainfall	(mm/year)	1,771	1,531	1,947
95th percentile rainfall	(mm/year)	2,087	1,722	2,219
Highest rainfall	(mm/year)	2,157	1,780	2,580

Source: BoM website (climate data online).

The annual rainfall totals shown in Table 3.1 indicate that rainfall totals at the Townsville Aero and Majors Creek gauges are similar. The average and median annual rainfall totals at the Lansdown CSIRO gauge are shown to be substantially less than the other two gauges. Examination of the rainfall record indicates that the rainfall statistics for Lansdown CSIRO have numerous data gaps where annual rainfall totals could not be calculated.

While the Lansdown CSIRO gauge is expected to be most representative of rainfall conditions at the Project, the Townsville Aero gauge provides the most complete record of long-term rainfall trends. Hence, the Townsville Aero gauge has been used to summarise seasonal and annual rainfall trends for the study area. Monthly rainfall distributions for the BoM rainfall station at Townsville Aero are presented in Figure 3.1.

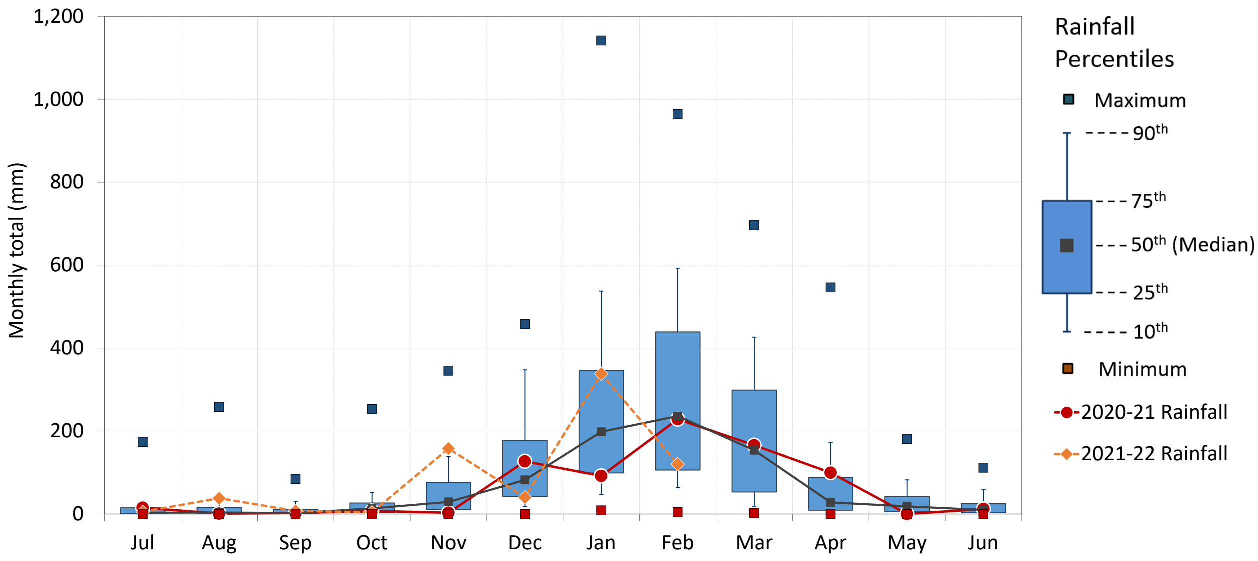


Figure 3.1 Monthly rainfall statistics (1961–2021) for Townsville Aero (gauge ref: 32040)

Based on Townsville Aero historical rainfall records, the average annual (July–June) rainfall for the 1940 to 2020 period is approximately 1,131 mm. Due to the variable nature of tropical lows and thunderstorms, and their significant influence on rainfall totals across the region, there is considerable inter-annual variability in rainfall. At the Townsville Aero gauge the highest recorded annual rainfall was 2,157 mm (in 1974) and the lowest annual rainfall was 381 mm (in 2015).

The highest daily rainfall recorded at the Townsville gauge was 549 mm which occurred on the night of 10 January 1998. This extreme rainfall event caused by result of ex-tropical cyclone Sid and resulted in significant damage and flooding across the greater Townsville region.

3.1.2 Design rainfall information

Design rainfall information for the subject site was sourced from the BoM Design Rainfall Data System (BoM 2016) website. This information can be used to inform an understanding of flood risk and calculate aspects of stormwater management systems. Design rainfall depths for a range of annual exceedance probability (AEP) events of varying durations is shown in Figure 3.2.

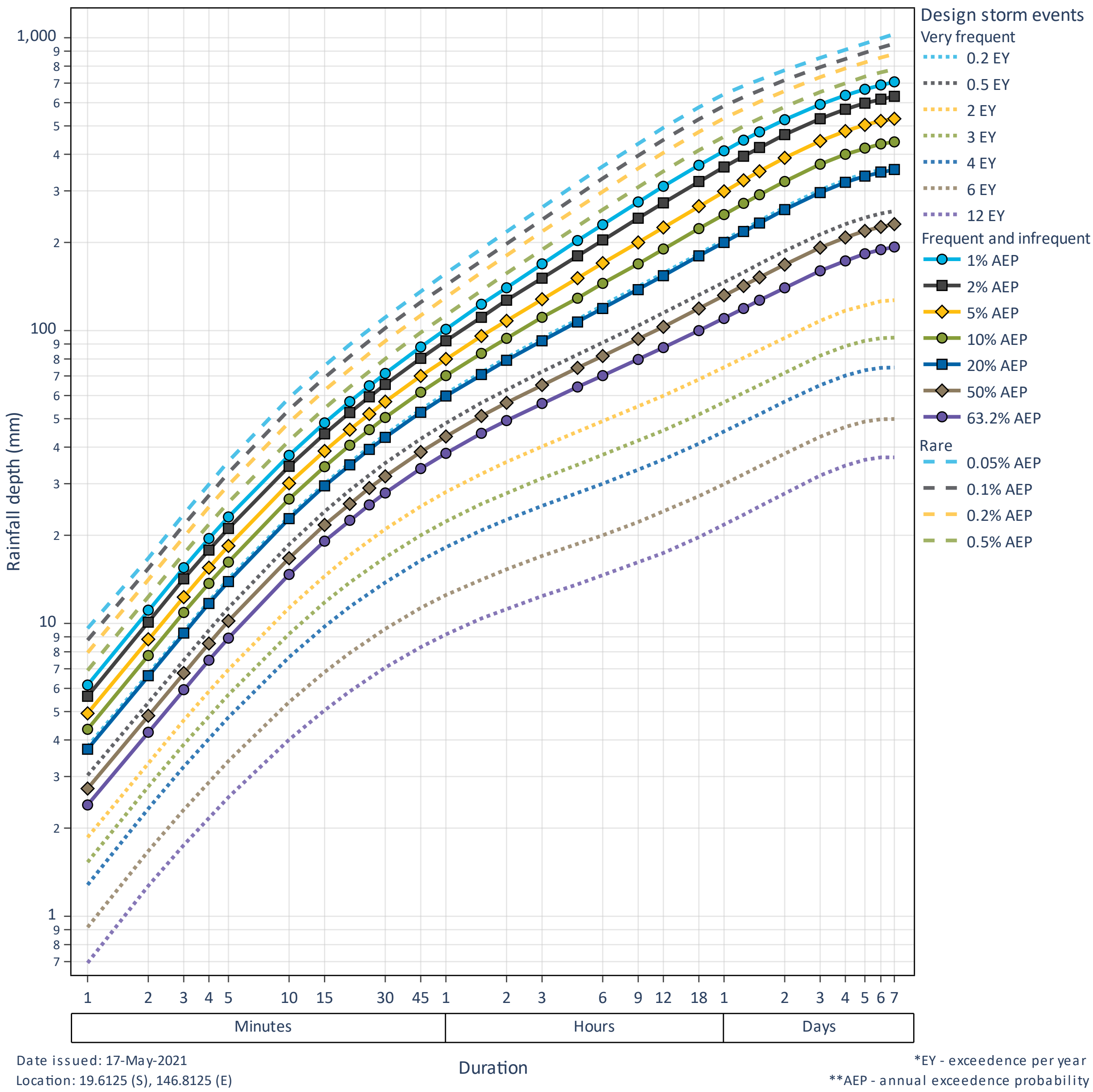


Figure 3.2 Design rainfall depth curves for Project area

3.1.3 Tropical cyclones

Tropical cyclones (TCs) are low pressure systems that form over warm tropical waters, typically forming when the sea-surface temperature is above 26.5 °C and have gale force winds (sustained winds of 63 km/h or greater and gusts in excess of 90 km/h) near the centre. The technical definition provided by the BoM (2021) is as follow:

> "A non-frontal low pressure system of synoptic scale developing over warm waters having organised convection and a maximum mean wind speed of 34 knots or greater extending more than half-way around near the centre and persisting for at least six hours."

TCs, and ex-TCs, have potential to cause significant physical impacts from extreme winds, heavy rainfall with flooding and damaging storm surge that can cause inundation of low-lying coastal areas. However, the frequency of tropical TCs is relatively rare, and even along the higher TC risk zones of northern Australian costal zones, the passage of a cyclone close to any given community is infrequent.

The BoM TC database indicates that since 1967 Queensland has experienced direct and indirect[1] effects of 146 cyclones of varying strength, duration and intensity (Category 1 to Category 5). The occurrence distribution of these events, presented in Table 3.2, highlight TC events shows a greater likelihood for TCs to impact Queensland from January through to April.

Table 3.2 Frequency and occurrence of TCs in Queensland (Queensland Government 2017)

Month	November	December	January	February	March	April	May
No. of events	2	17	43	33	34	16	1
Percentage of total events	1%	12%	29%	23%	23%	11%	1%

Although TCs pose a potentially significant risk to safety and infrastructure, particularly through water-related impacts such as flooding and storm surge, as indicated above the likelihood to directly impact a specific site is relatively low and they are not the only flooding related weather events that may potentially affect the subject site. Seasonal (wet season) rainfalls for the region are often significant and can be of high magnitude and/or high intensity.

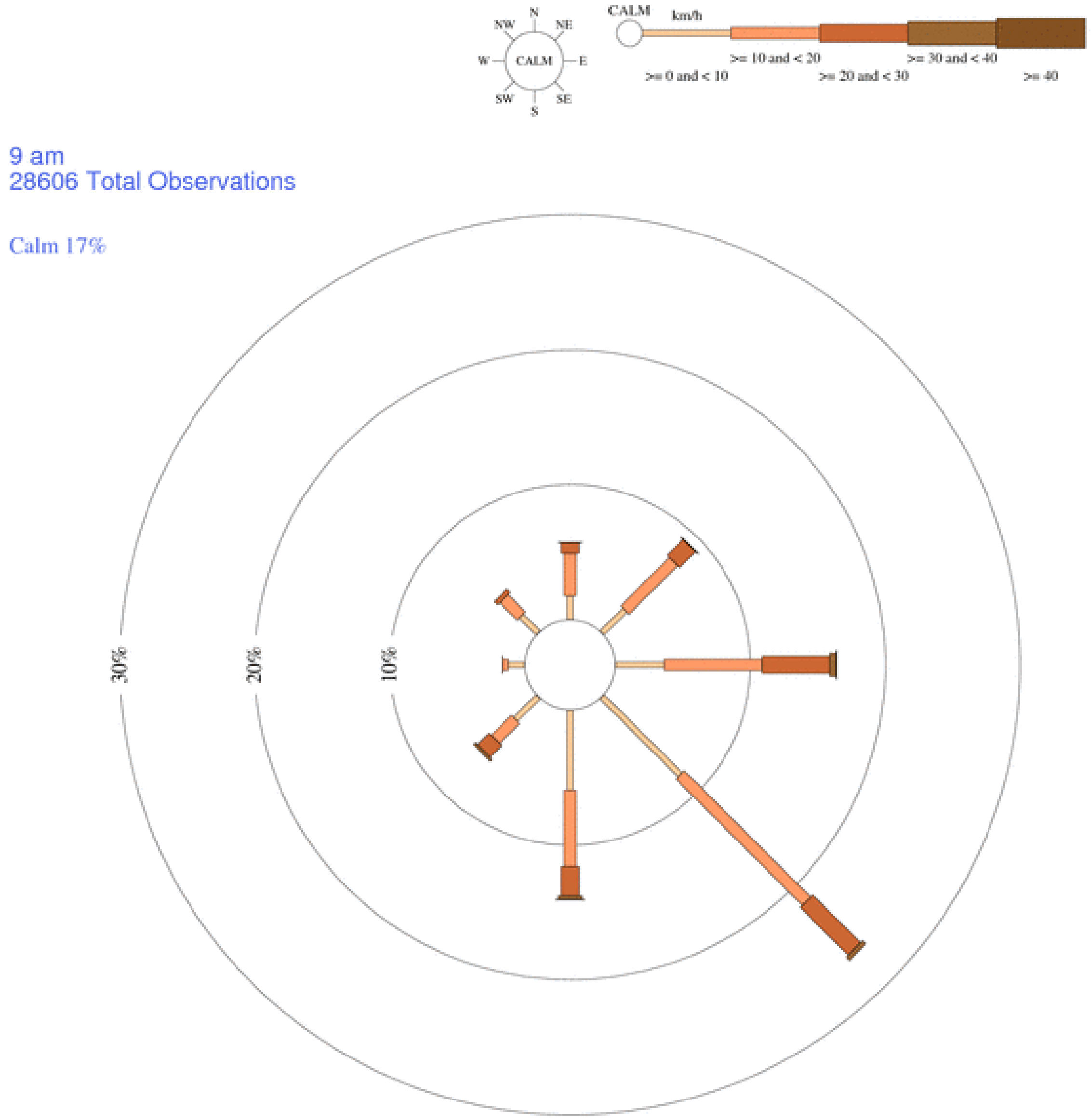
Design rainfalls developed by the BoM (refer to Section 3.1.2) are developed from an extensive database of rainfall station data and therefore, inherently include the influence of significant historic rainfall events, including those associated with historic TCs.

3.1.4 Wind

The Bureau of Meteorology publishes wind roses illustrating the frequency and occurrence of wind speed and direction at 812 locations around Australia, with the nearest to the site located at Townsville. Wind roses are available for 9 and, typically illustrating calmer winds, and 3 pm, typically illustrating more dynamic conditions such as sea breezes. Wind roses indicate the direction wind is coming from, i.e. are visually inverted from the behaviour of a windsock or weathervane

The 9 am wind rose indicates winds predominantly from the southeast, with speeds less than 20 km/hr (Figure 3.3). In the afternoon, winds are more typically from the northeast, and stronger at 20-30 km/hr (Figure 3.4).

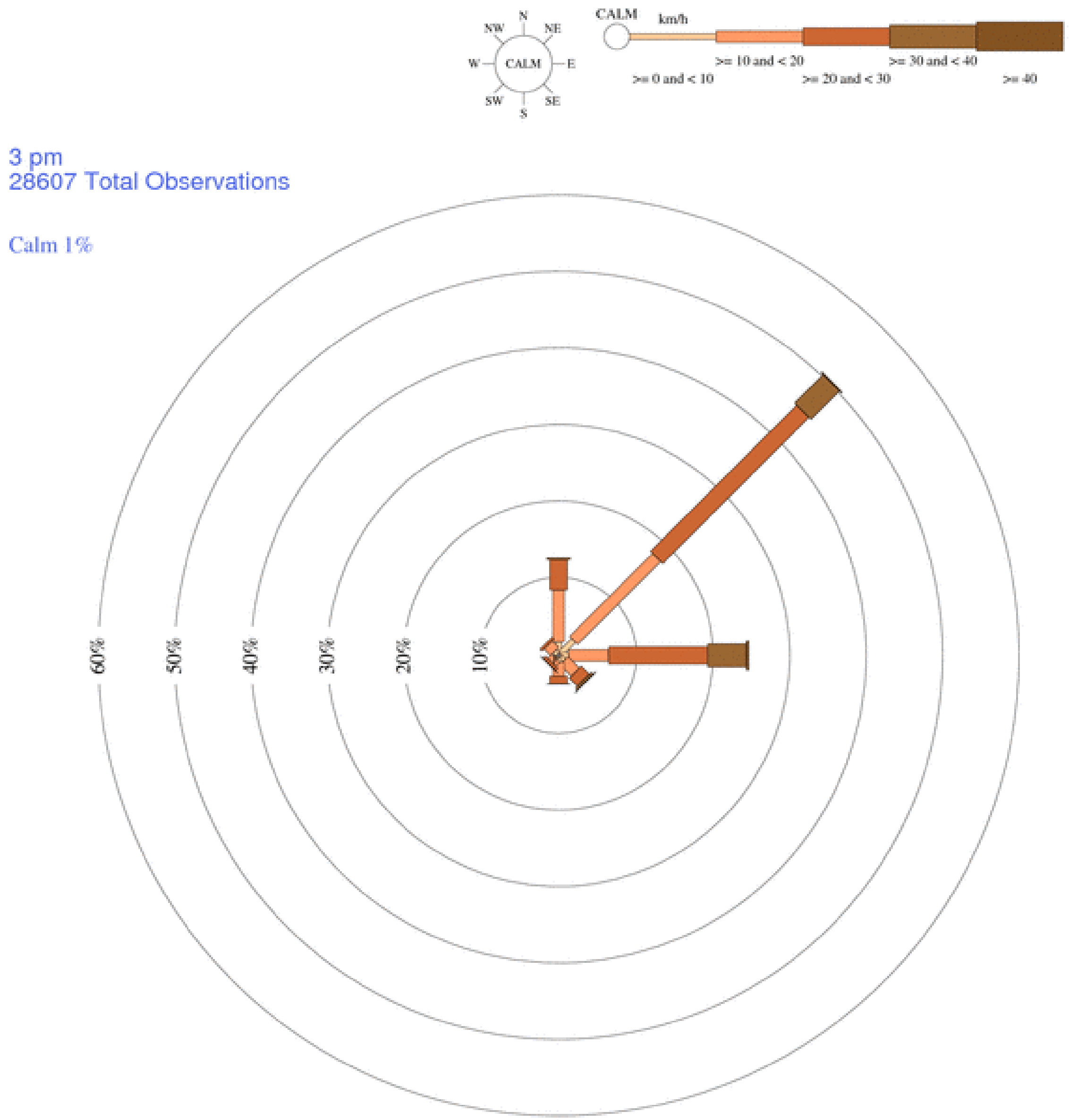
[1] assuming a 200 km buffer for indirect effects of TCs that do not make landfall in Queensland.



Wind roses indicate the frequency of wind FROM a certain direction

Frequency is indicated by the radial axis

Figure 3.3 Townsville 9 am wind rose (BoM, 2025)



Wind roses indicate the frequency of wind FROM a certain direction

Frequency is indicated by the radial axis

Figure 3.4 Townsville 3 pm wind rose (BoM, 2025)

3.2 Watercourses

The site lies immediately to the north of Four Mile Creek, an ephemeral first order waterway. Downstream from the site, Four Mile Creek traverses (via culverts) the Mount Isa rail line and Flinders Highway before flowing into Double Barrel Creek and Majors Creek. Majors Creek is a major tributary to the Haughton River which flows into the Pacific Ocean approximately 40 km north-east of the subject site.

Streamflow within the catchment rises rapidly during and immediately after significant rainfall, with quick flow processes contributing most of the streamflow volume. Runoff events are typically peaky in nature with streamflow recessions rapidly returning dry conditions shortly after a rainfall event. The majority of annual streamflow volumes in Four Mile Creek is experienced during summer and early autumn. Streamflow during the remainder of the year is typically very low or non-existent.

3.3 Reservoirs and water storages

The Ross River Dam, an earth and rock filled embankment across the Ross River, is located approximately 18 km north from the site. **Drainage from the site does not flow towards Ross River Dam.**

The dam was initially constructed between 1971 and 1974 (TCC 2020a) for flood attenuation and water supply (TCC n.d.). The Ross River Dam is a relatively shallow (i.e. generally less than 3 m deep when full) and 'leaky dam' that sits on alluvium over the Hervey Range plateau (DES 2018a).

The upstream catchment area for Lake Ross (the impoundment created by Ross River Dam) is approximately 750 km^2, consisting of two primary inflow tributaries, namely the Ross River, including the waterways of Central Creek, Fern Creek and Sandy Creek; and Five Head Creek, including the waterways of Sachs Creek, Antill Plains Creek and Lansdowne Creek.

Following an upgrade to the dam wall in 2007, when the three spillway gates were installed, the Ross River Dam has a design capacity at full supply level (FSL) of 233 gigalitres (GL) (TCC 2020a) and can retain up to 800 GL of water in flood mitigation (TCC n.d.). Water resources within Lake Ross can be supplement by inter-basin transfers from the BHWSS via the Haughton Pipeline and pumping station. The Haughton Pipeline can transfer up to 130 ML/day to the upstream end of Lake Ross (DEWS 2014).

A summary of daily average measured storage volume for the Ross River Dam, including the design maximum operating capacity (MOC) following the 2007 dam wall and spillway upgrade, is presented in Figure 3.5. It should be noted the MOC of the dam relates to the volume of usable water for water supply. The storage volume in the dam can occasionally exceed the MOC due to the additional 800 GL of flood mitigation storage above the MOC level.

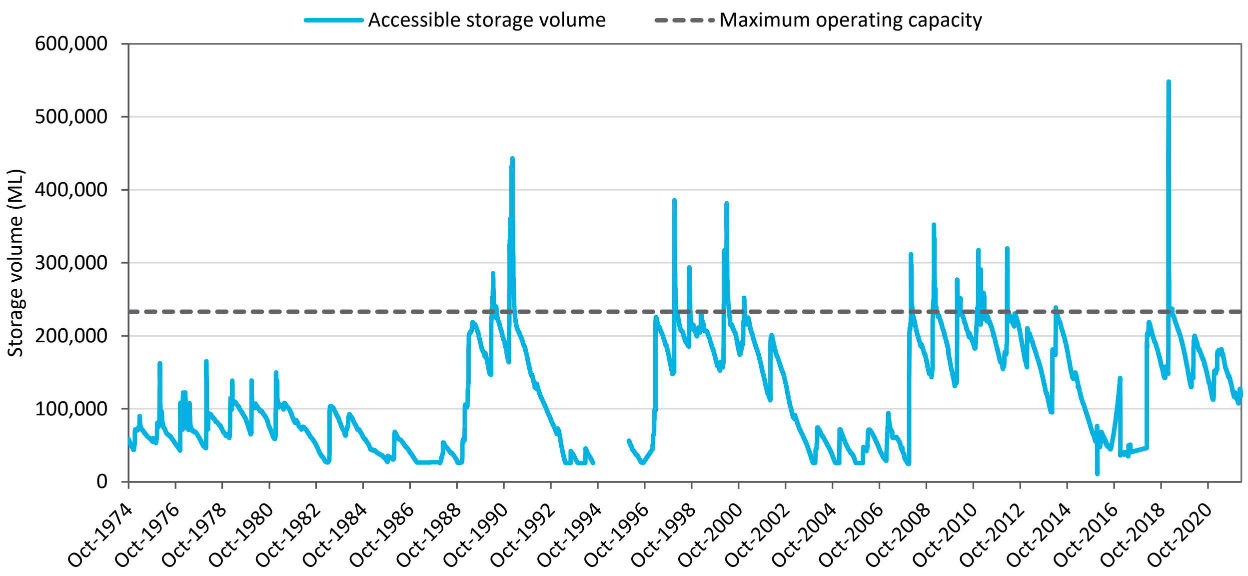


Figure 3.5 Ross River Dam storage volume

4 Development details

The Project involves the construction and operation of a 780 megawatt (MW) BESS and substation facility which will be supported by enabling infrastructure including roads, parking, switchgear, transformers, site offices and onsite storage areas. The BESS will provide firming for the electricity supply provided to the mgSi and PolySi manufacturing facilities as part of the larger PGP project. A 275 kilovolt (kV) transmission line is proposed between the PGP substation and the LEIP substation. The LEIP substation does not form part of this application.

4.1 Project components

4.1.1 Battery energy storage system

The BESS will have a capacity of up to 780 MW, with major components comprising of:

- batteries – lithium-ion technology
- inverters – bi-directional inverters to convert direct current to alternating current when exporting electricity, and vice versa when importing electricity
- transformers – transformers will be installed adjacent to each inverter to step up the voltage to the internal reticulation voltage of the plant.

The BESS components are full encased within a battery storage container similar to a shipping container, with approximate dimensions of 2.4 m wide, 6.1 m long, and 2.9 m high. The dimensions and number of containerised batteries is subject to the choice of provider.

The BESS will be developed in a three staged approach aligned with the development timeline and energy requirements of the manufacturing facilities. Each stage will reflect a 260 MW BESS construction staging which will culminate in a total of storage provision of 780 MW (6,240 megawatts per hours (MWh)) (8 hours).

Stormwater runoff from the BESS will be directed via an engineered stormwater drainage system to a stormwater detention pond. This pond will attenuate runoff, reducing peak discharge rates of treated stormwater to be consistent with pre-development conditions. The stormwater system would be designed so that it may be isolated from the natural environment (i.e. no discharge) in the event of a spill, fire, or contamination event. Firefighting effluent will be retained on site under HIPAP 2 until such time that it is suitable for release into the environment (following treatment via a sediment pond) or trucked off site.

4.1.2 Substation

The BESS will link in with the substation, which will include equipment such as switchgear and circuit breakers, protection and control systems and metering and communication systems.

Note, the tie in location of the transmission line into LEIP substation will be operated by Powerlink. Relevant approvals to facilitate the construction and operation of the LEIP substation (i.e. MCU DA and EPBC referral) do not form part of this application and will be sought by separately by TCC. The LEIP substation will facilitate the connection between the BESS and electricity grid and will include high-voltage transformers.

Stormwater runoff from the substation would undergo treatment via a SQIDEP verified oily-water separator installed within the substation boundary. Treated discharges from the separator would be directed to the BESS stormwater drainage system.

4.1.3 Laydown area

The laydown area will include provision for the operations and maintenance (O&M) building and temporary construction car parking. The O&M building provides storage space, a workshop and maintenance shed as well as desk space and amenities (toilets and potable water) for staff.

The car parking area will be accommodated within the laydown area, servicing 89 car parks for the construction workforce. Operational carparks for the BESS will be located on the eastern side of the BESS area and has the provision for 9 car parks.

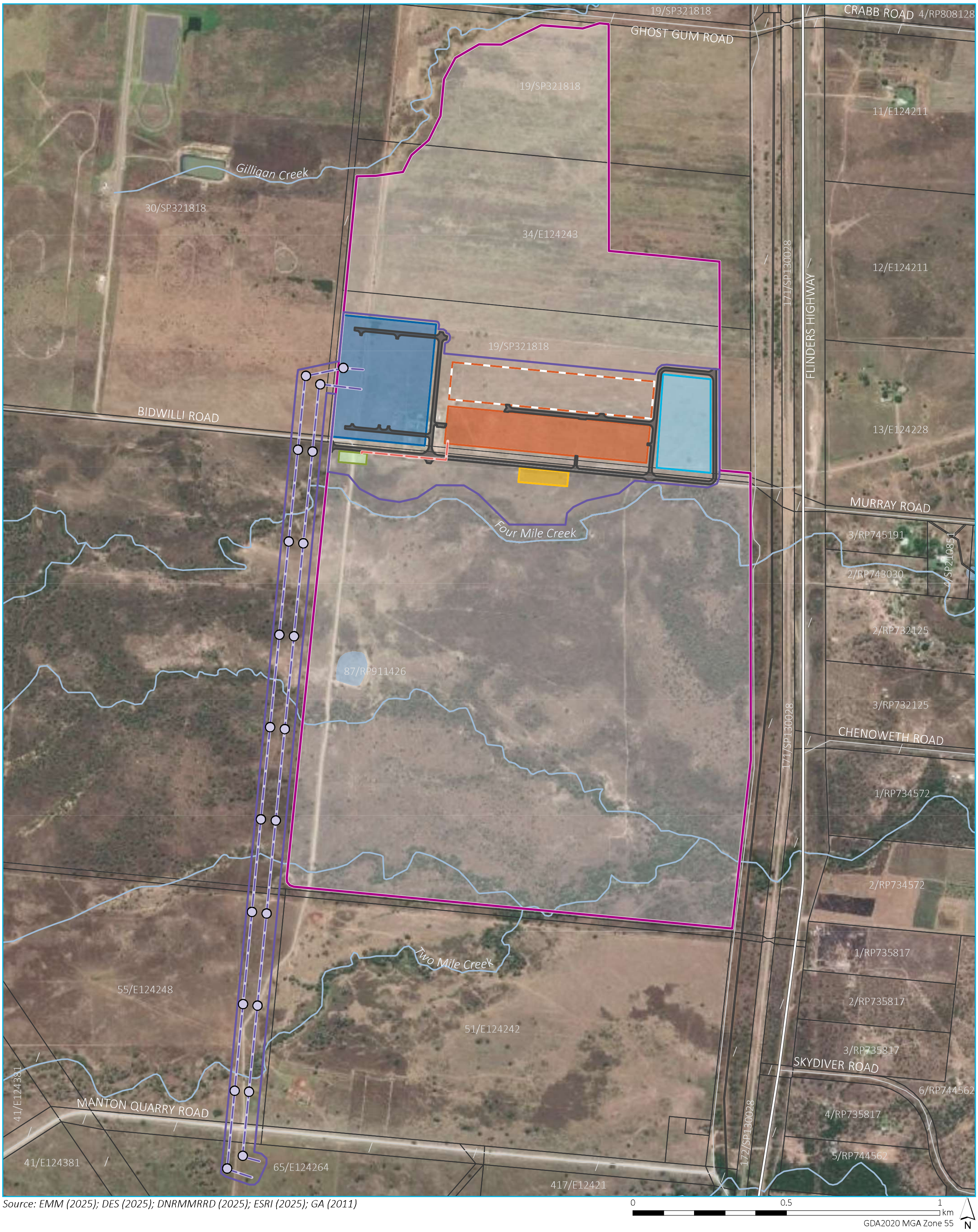
Site access is proposed from through the northern LEIP access via Jones Road.

Stormwater runoff from the laydown / O&M area will be directed to the BESS stormwater drainage.

4.1.4 275 kV transmission line

Construction of the transmission line may require vehicle movements off paved areas, and preparation of laydown areas, with the potential to increase soil erosion. These activities would be managed by a construction erosion management plan (CEMP).

The transmission line will not interact with surface water resources during operations.



Source: EMM (2025); DES (2025); DNRMMRRD (2025); ESRI (2025); GA (2011)

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KEY

Northern Quartz Campus
Package 1- Premises

Existing environment
Major road
Minor road
Watercourse/drainage line
Waterbody
Cadastral boundary

Package 1 proposed site layout
BESS
BESS expansion area
Substation
Construction laydown area
Water management area
Fire water pad
Internal road

Fire water pipeline
Transmission line
Transmission pole

Proposed site layout

Northern Quartz Campus
Package 1- BESS, transmission line and substation
Flood Impact Statement
Figure 4.1

EMM
creating opportunities

4.2 Project stages

4.2.1 Construction

Pending receipt of necessary project approvals and funding, construction is anticipated to commence in Q4 2026 for a period of 18 months total (6 months of earthworks and placement of infrastructure and an energisation period of 12 months). Works will generally be undertaken during standard construction hours. Works undertaken outside of standard hours will be limited to exceptional activities required to safely construct the Project.

During the construction phase, the workforce is anticipated to peak at approximately 93 workers. The staffing requirements for the construction phase is expected to follow a normal distribution, peaking approximately halfway through construction. Where practicable, workers will be sourced locally and where not possible, will be Drive In, Drive Out (DIDO) or Fly In, Fly Out (FIFO).

Key construction activities will be confirmed during detailed design and are expected to include:

- Site access and establishment, including temporary construction facilities, security fencing and laydown areas
- Excavation work, including ground preparation
- Civil works: clearing of the site, earthworks, limited grading, compaction, stormwater drainage and sediment controls
- Bulk earthworks and soil movement
- Establishment of sediment ponds.
- Installation of main drainage to sediments ponds
- Concrete delivery, formwork placement and concrete pouring
- Construction of the BESS, substation and ancillary infrastructure including installation of the foundation, underground cabling and containerised storage units
- Commissioning of BESS which includes testing of all equipment and commissioning tests required under the electrical connection agreement. Commissioning activities to be undertaken prior to construction.

4.2.2 Operation

The Project will be in operation 24 hours a day, 7 days a week, 365 days a year. It is expected a 30 year project life commencing in Q2 2028 and with 1-2 operational workforce.

The likely operational process for the Project involves the following activities:

- Weekly and monthly inspections (electrical, civil and environmental)
- Vegetation management (in line with various management plans)
- Testing and replacing of faulty plant components (fuses, etc.)
- Site safety and security includes CCTV and locked gate and fenced area
- Waste management, quantity, disposal, sewerage consideration

- Any other corrective actions within O&M and licensed activities scope.

4.2.3 Decommissioning

At the end of the BESS infrastructure asset life (20 years), the Project will be re-evaluated to determine if the Project infrastructure is to be:

- maintained, refurbished or include the replacement of certain components to extend the life of the existing infrastructure
- renewed to repower the site
- decommissioned along with rehabilitation of the site.

If repowering is not considered feasible or desirable at the end of the Project life, the site will be decommissioned. This will involve removing all above-ground infrastructure for sale, recycling or disposal. Access tracks and hardstand areas would be remediated in order to prepare a suitable soil profile for revegetation with an appropriate groundcover, rehabilitating the land to a state where continued agricultural use can recommence.

5 Impact assessment

5.1 Potential surface water impacts

During the construction, operation, and decommissioning phases the proposal may create risks to surface water environmental values. Identified risks are described in Table 5.5.

5.2 Assessment methodology

The potential for the identified risks to cause environmental effects/impacts was assessed via:

- Simulation of potential flood risk at the proposed site, and effect of development on flood behaviour (Annexure A)
- Simulation of the effectiveness of proposed stormwater treatment and management methods (Annexure B)
- Semi-quantitative source-pathway-receptor assessment of the risk to Lake Ross drinking water in the event of BESS fire
- Qualitative consideration of typical construction methodologies

A summary of the assessment results is provided below for each project stage.

5.3 Construction stage

During construction, site clearing and earthworks may create conditions which promote erosion. Erosion during a rainfall runoff event would have the potential to increase the sediment load in the nearby Four Mile Creek. Although sediments may be present during construction, low velocities in the overland flow (<0.1 to 0.3 metres per second (m/s)) will reduce the sediment load in any runoff. Good erosion and sediment control practices during construction should reduce the sediment load from the construction areas.

Prior to construction, a Construction Erosion Management Plan (CEMP) would be developed to address temporary and site-specific risks to water quality and drainage during the construction phase of the project.

5.4 Operation stage

5.4.1 Design flood levels

The development lies within the TCC 'medium flood hazard' area. The substation pad and BESS pad require elevation to meet their respective flood immunity requirements of 0.5% AEP and 0.2% AEP flood levels respectively. Figures Figure 5.1 – Figure 5.7 provide cross section elevations to show the flood immunity of each pad.

Flood level long section figures show design flood level matching the top of design structures. This is due to the rain-on-grid flood modelling approach. As such, flood immunity is indicated by flood levels adjacent to the structures rather than directly on top of them. On pad pit and pipe drainage has been proposed on these structures, as well as top of pad gradient to perimeter drainage features to manage surface catchment, this is subject to detailed design phase.

The bio-retention basin will occupy a section of the Four Mile Creek flood storage area, but will not worsen flood characteristics (see afflux mapping in Annexure A).

Shallow overland flow will be redirected around the development. The altered flow paths will be of relatively low flow rate, such that scour and erosion will not be increased.

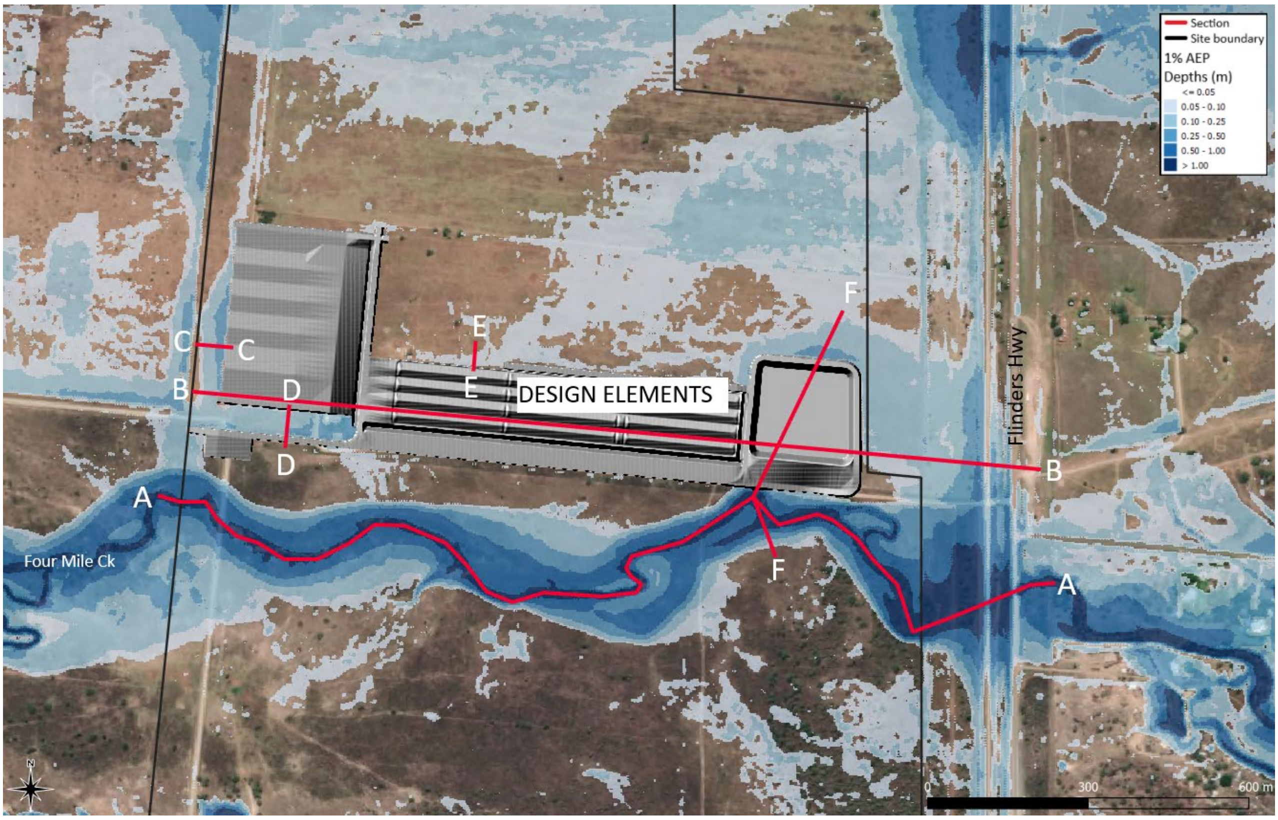

Figure 5.1 Longitudinal section locations – Plan view

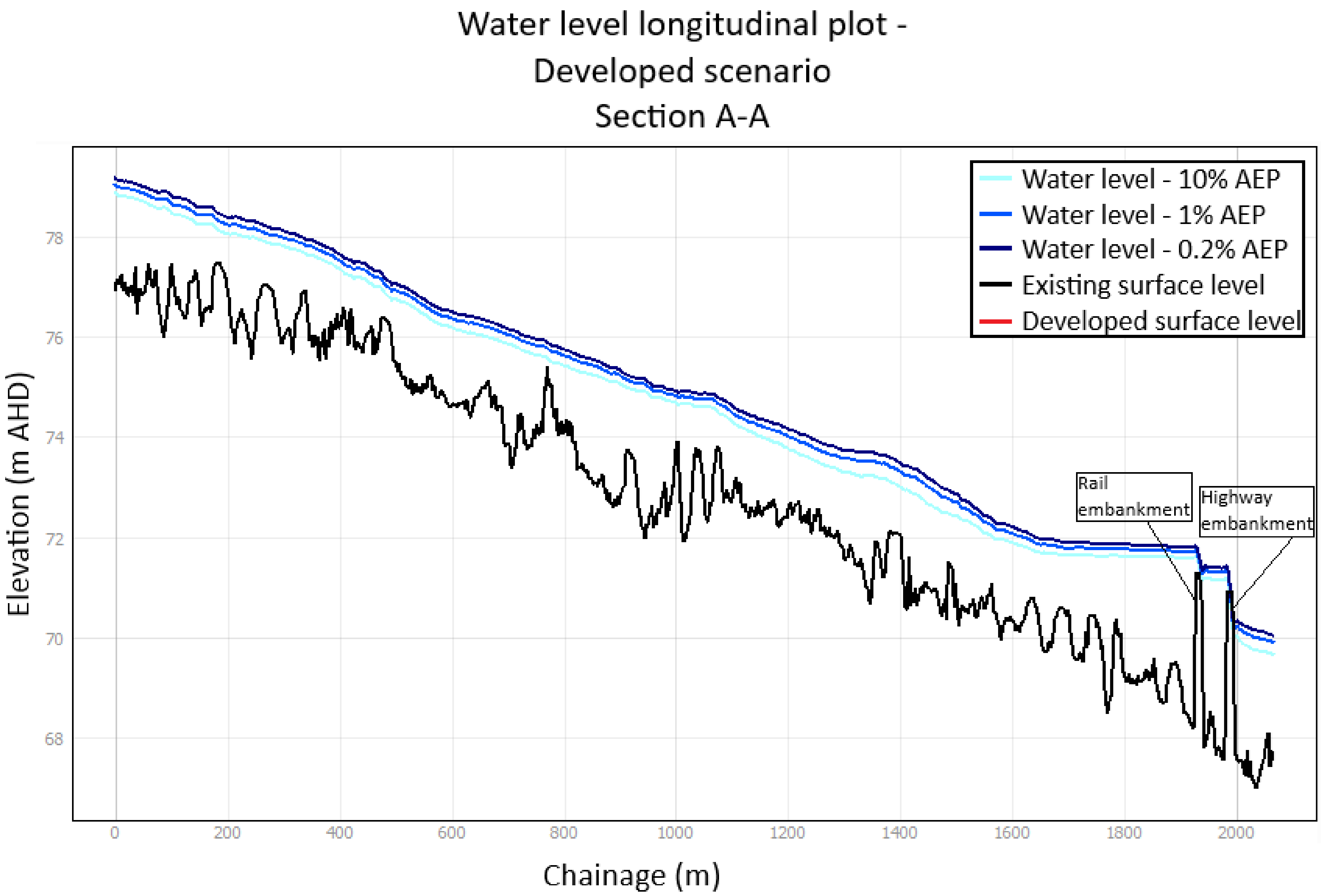

Figure 5.2 Water level longitudinal section – Section A-A

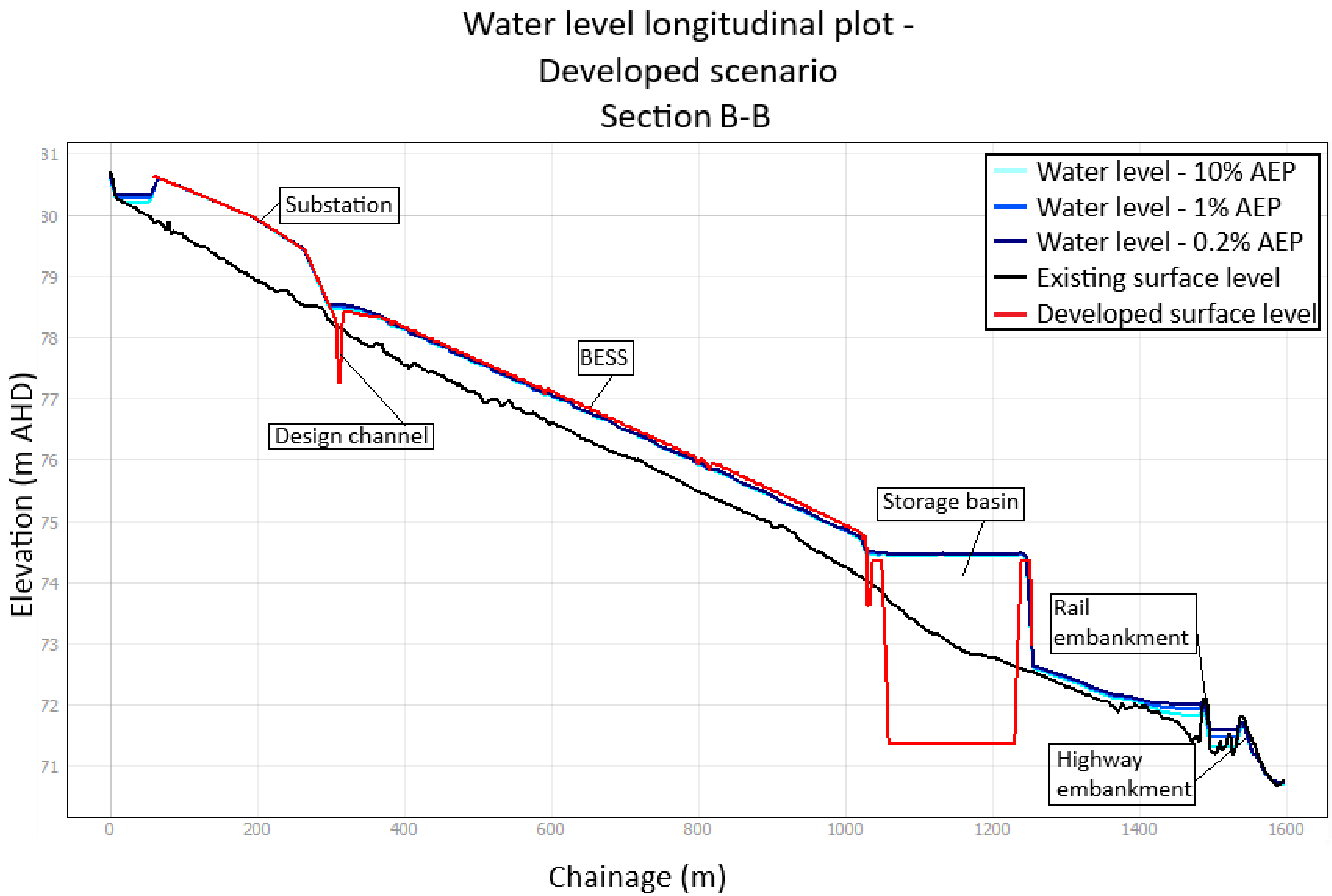

Figure 5.3 Water level longitudinal section – Section B-B

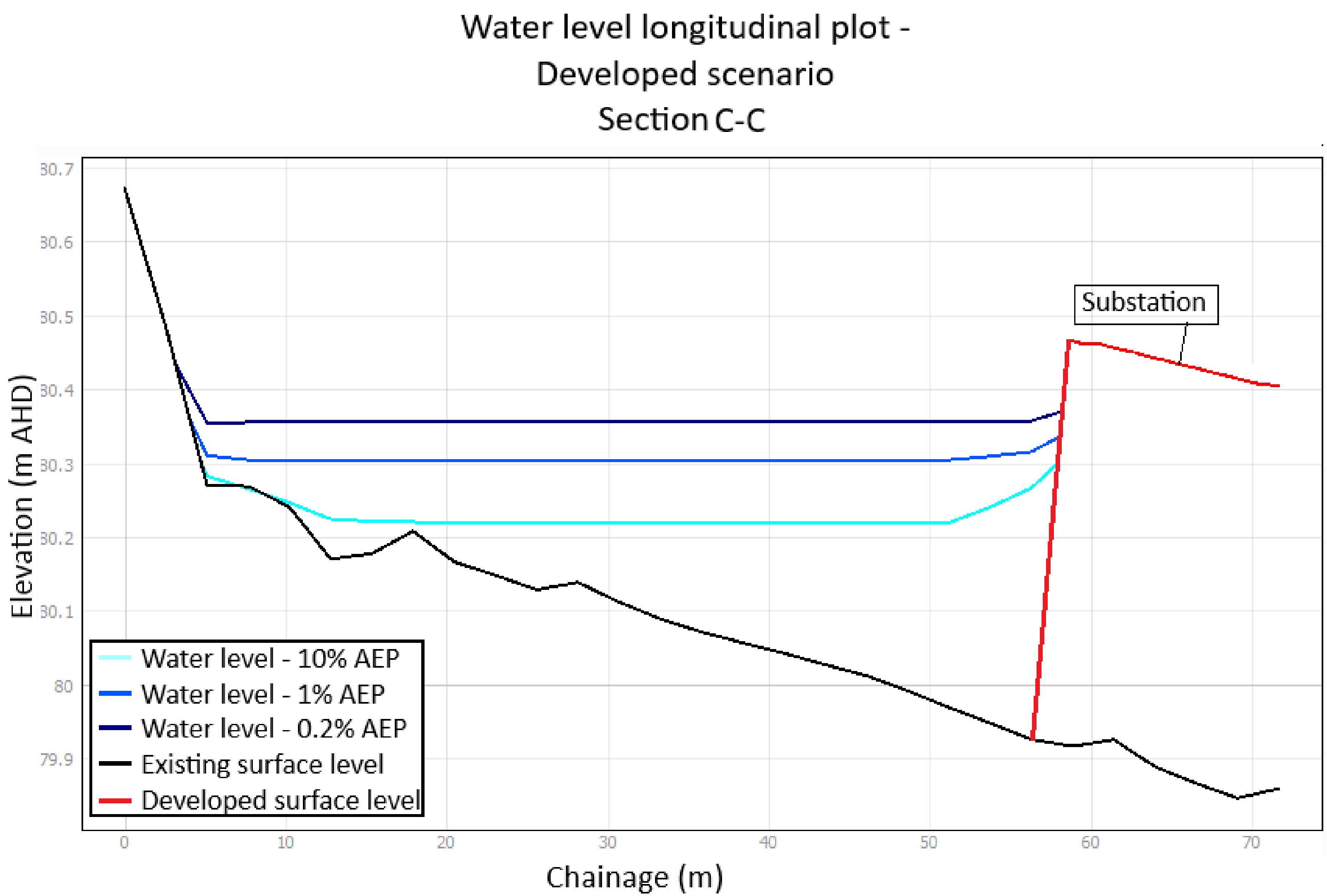

Figure 5.4 **Water level longitudinal section – Section C-C**

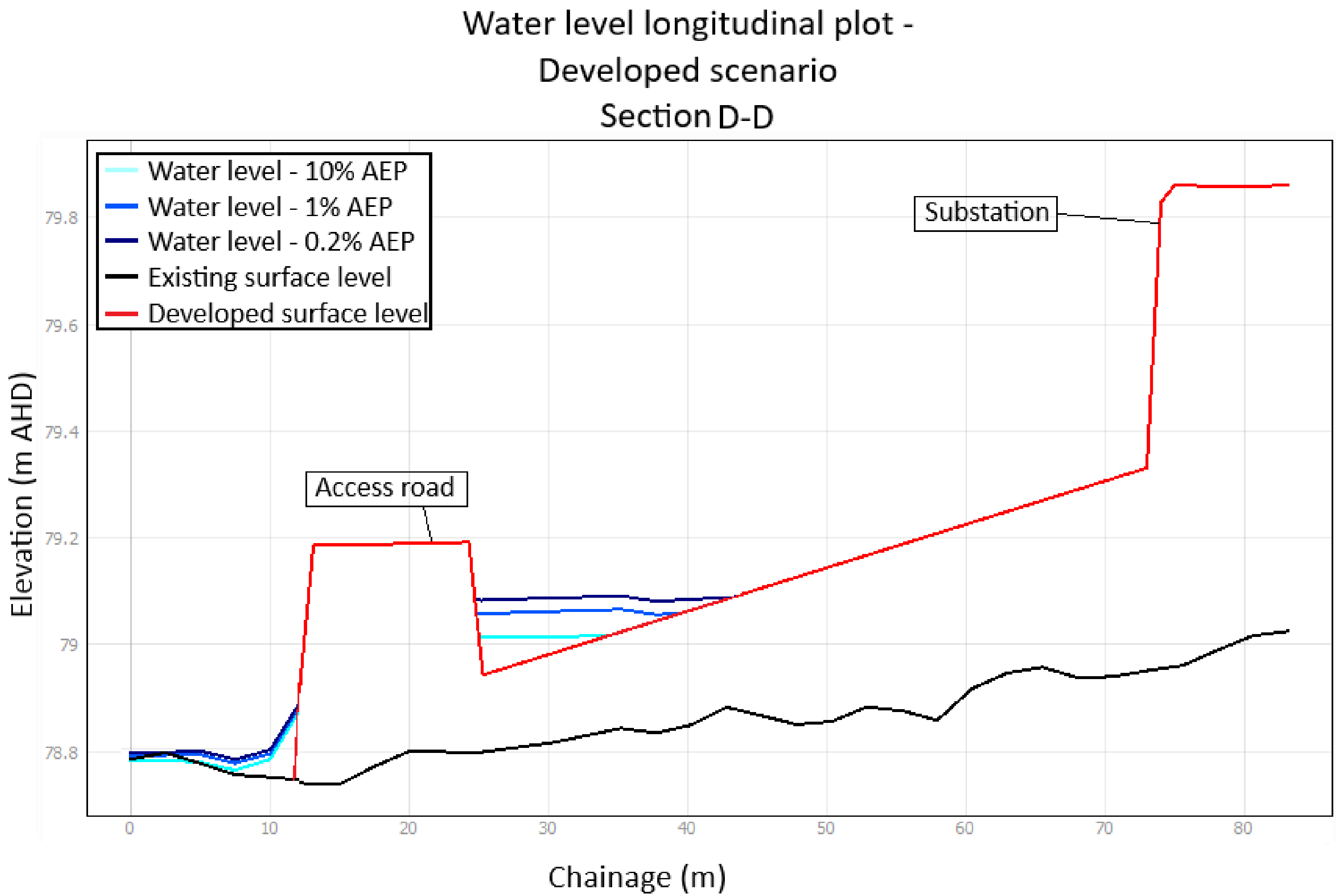

Figure 5.5 Water level longitudinal section – Section D-D

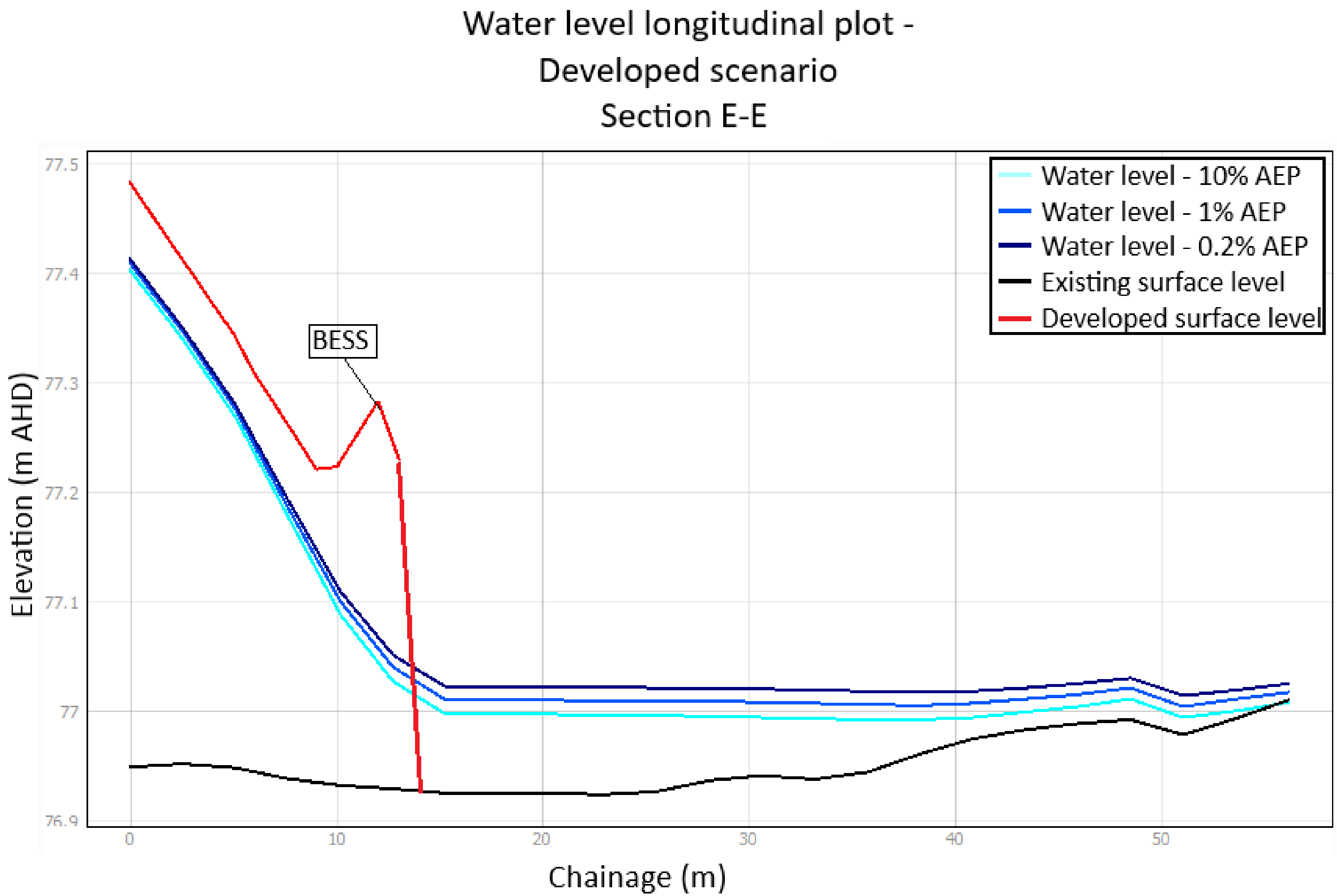

Figure 5.6 Water level longitudinal section – Section E-E

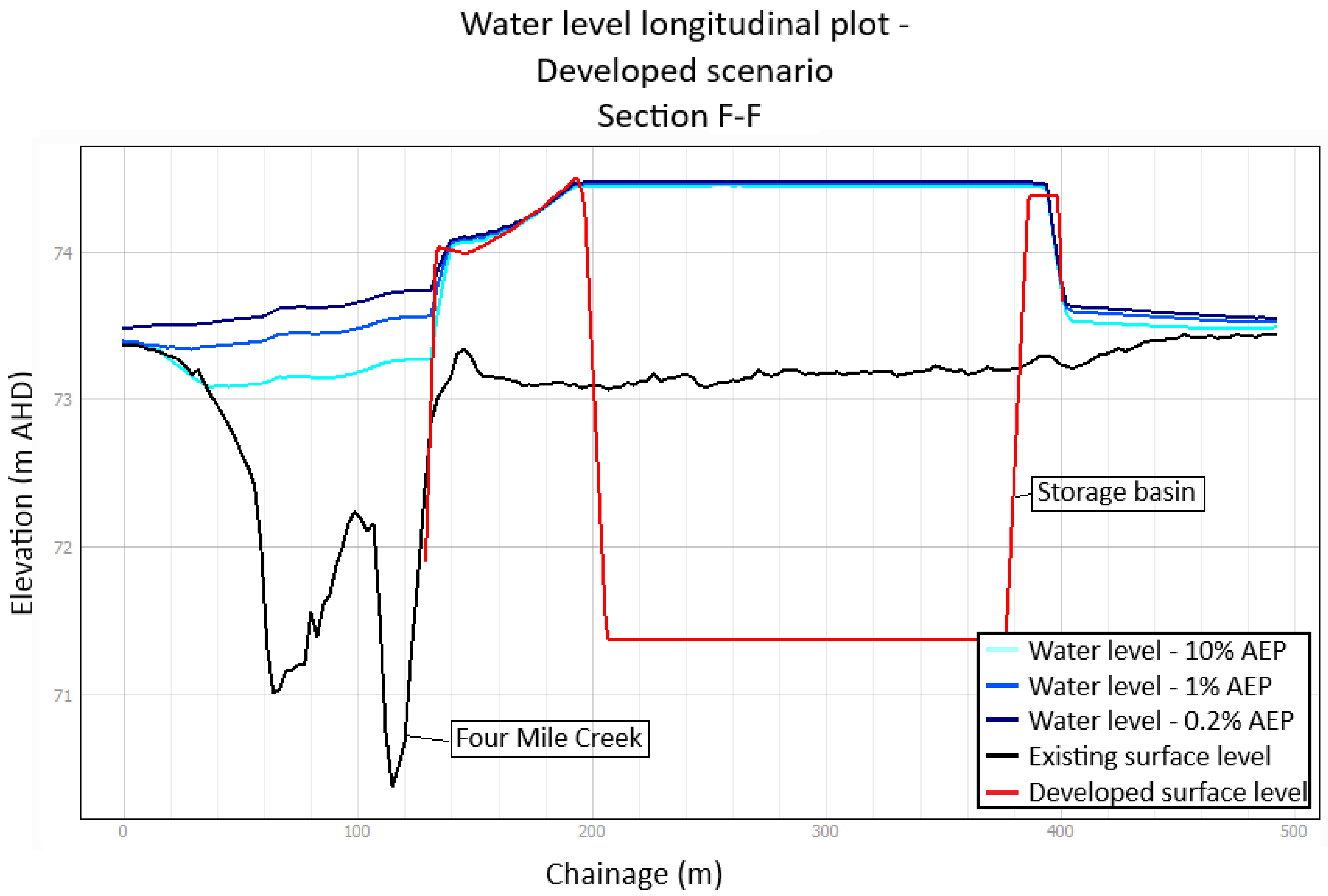

Figure 5.7 Water level longitudinal section – Section F-F

5.4.2 Flood immunity

Current design is conceptual level only and is subject to detailed design. 1% AEP flood immunity of these buildings will be met as part of the detailed design phase.

With the exception of the O&M Control Room, all infrastructure will be constructed atop the pad, which has 1% AEP flood immunity. The O&M Control Room will not be atop the pad, however will be constructed above the 1% AEP level with 500 mm freeboard. The 1% AEP water level at this location is 77.96 metres Australian Height Datum (m AHD) (as shown in Figure 5.8), therefore the design level for the O&M Control Room is 78.46 m AHD. This level will be attained during detailed design via a localised pad and/or piers to elevate the structure above the design floor level.

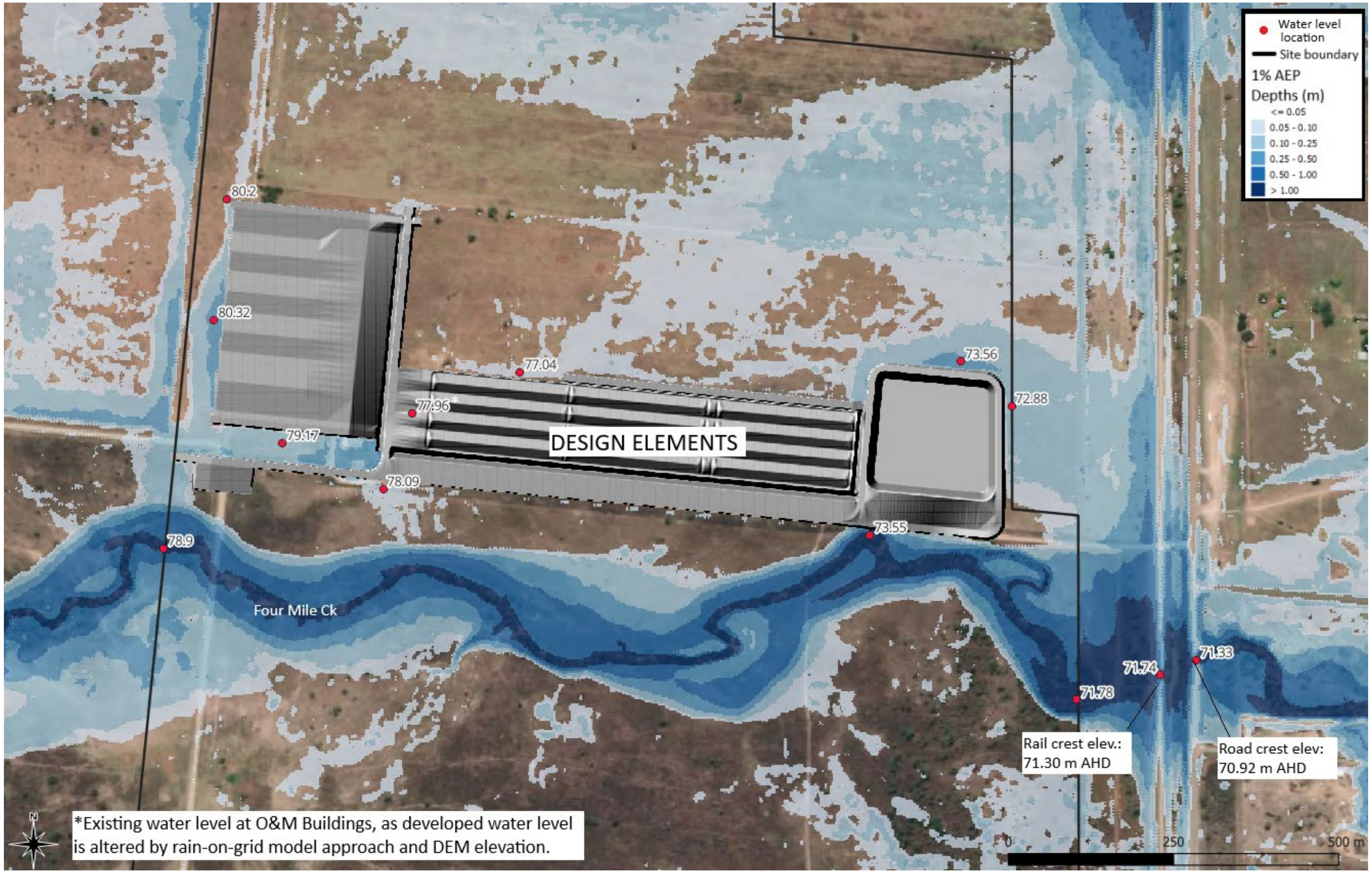

Figure 5.8 Spot water levels – 1% AEP – Proposed scenario

5.4.3 Stormwater management

Stormwater management at the substation and BESS will incorporate water sensitive urban design (WSUD) principles and industry specific water quality requirements. The expected effectiveness of WSUD elements was simulated using MUSIC software (Annexure B).

Treatment of oils (which may be spilled at the substation) and battery chemicals (which may be spilled at the BESS) is not addressed in MUSIC, were was considered in addition to standard MUSIC modelling.

i Stormwater catchments

The development includes the substation, O&M buildings, the BESS, access roads, vegetated areas. Runoff, and transport of sediment, nitrogen and phosphorus from these areas was simulated using the MUSIC software (Annexure B). A split node approach was used, whereby hardstands, vegetated areas, and roads were simulated as separate nodes (Figure 5.9).

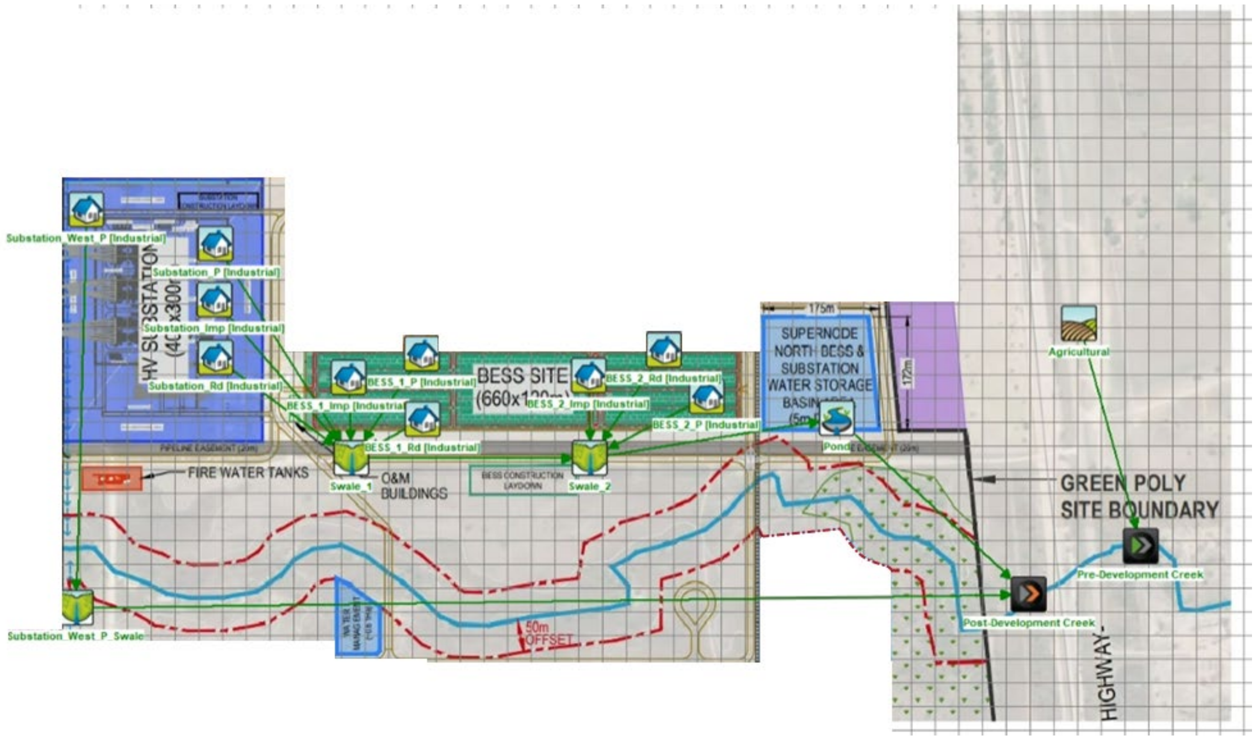

Figure 5.9 MUSIC model node arrangement

ii Stormwater treatment

The proposed treatment mechanisms for oil spilled at the substation include:

- a spills cleanup procedure will be in place during site operations
- areas containing oils will be bunded
- residual oils transported by rainfall runoff will be intercepted and treated via oily-water separators as per industry guidelines
- treated stormwater would be discharged to the BESS stormwater system, which provides the option for containment if required.

The proposed treatment mechanisms for metals and chemicals at the BESS include:

- a spills cleanup procedure will be in place during site operations
- stormwater runoff would be directed to a grassed swale, which will intercept and store particulate matter in the grass root zone during low flows
- the swale would discharge to a bio-retention basin with significant event storage volume. This basin would be designed such that discharge could be prevented when desirable, such as in the event of a spill. This will allow time for cleanup procedures to occur.

The bio-retention basin will have dimensions of approximately 170 m x 170 m x 5 m deep, with excavation occurring for the purpose of supplying fill material to enable construction of the BESS and substation pads, and the void then repurposed for stormwater management. The excavated depth of the pond would prevent passive drainage of the pond to Four Mile Creek.

To enable pond drainage, and to prevent the formation of stagnant water conditions (and the possibility of poor water quality developing), a pump will be installed to lift water from the pond to the elevation of the creek. The pump would be activated by the presence of water in the bio-retention pond, and would discharge to Four Mile Creek at a nominal rate of around 10 L/s (subject to detailed design).

This arrangement will:

- allow isolation of the pond in the case of a spill by switching off the pump
- result in sufficient detention time that stormwater treatment is expected to be effective.

During operation of the site, the erosion potential of the soils from the site will not be increased from existing conditions due to the low velocities in the overland flow (max 0.3 m/s). This will be further reduced if the surface is re-vegetated as soon as practicable.

MUSIC modelling indicates that the proposed stormwater treatment measures will be effective at reducing sediment and nutrients from the site (Table 5.1), both in comparison to the undeveloped grazing land use, and in comparison to the site developed without WSUD.

Table 5.1 Stormwater treatment (MUSIC model results)

Component	Stormwater runoff (ML/year)	Suspended solids (kg/year)	Total phosphorus (kg/year)	Total nitrogen (kg/year)	Gross pollutants (kg/year)
Existing (agriculture, equivalent area)	103	19,400	54	369	0
Site arrangement, no WSUD	198	38,400	84	462	2,120
Site arrangement with proposed WSUD	80	1,300	9	120	0
Treatment effectiveness	60%	97%	90%	74%	100%
Target effectiveness		>80%	>65%	>40%	>90%

5.4.4 Lake Ross

A Source-Pathway-Receptor framework was used to assess whether there is the potential for BESS fire to impact drinking water quality in Lake Ross. The Source (BESS fire), Pathway (wind), and Receptor (Lake Ross and downstream water customers) were considered individually, and potential linkages were confirmed.

Points of interest from this assessment include:

- small scale combustions tests indicate that in a battery fire:
  - The majority of lithium remains in-situ as residue, with residue contents being in the order of 20-30% lithium by mass
  - The portion of lithium transported via ash and smoke is small, with ash contents being in the order of 1% lithium by mass
- wind at the site typically does not blow towards the reservoir
- the reservoir contains sufficient volume to adequately dilute material transported from the BESS via ash.

From this assessment it was concluded that **the proposed BESS will not cause impact** to the Lake Ross drinking water supply.

5.5 Decommissioning stage

It is recommended that a rehabilitation and decommissioning plan is developed and submitted to TCC for approval at least one year prior to decommissioning. The plan will provide the level of detail required to guide the restoration of the site to a standard facilitating continued agricultural use. The plan will include performance criteria and an action plan for aspects such as the timing for remedial works, structure removal and weed, pest and animal control activities.

5.6 Impact assessment summary

Potential surface water impacts were considered through a risk lens (Table 5.2), considering:

- the initial Significance (Table 5.3) and Likelihood (Table 5.4) of the potential impact
- operational protocols, and standard mitigation measures

A revised or 'mitigated' risk rating was developed based on the Significance and Likilihood of the event with the proposed mitigation measures in place (Table 5.5). It is anticipated that the risk from each potential impact event will be reduced to 'low' via the proposed mitigation measures.

Table 5.2 Risk matrix

Likelihood	Significance				
	Negligible	Minor	Moderate	High	Severe
Rare	Low	Low	Low	Medium	Significant
Unlikely	Low	Low	Medium	Significant	High
Possible	Low	Medium	Significant	High	High
Likely	Low	Medium	Significant	High	Extreme
Almost Certain	Medium	Significant	High	Extreme	Extreme

Table 5.3 Classification of significance

Significance	Description
Severe	The impact is considered critical to the decision-making process. Impacts tend to be permanent or irreversible or otherwise long-term and can occur over large areas. Very high sensitivity of environmental receptors to impact.
High	The impact is considered likely to be important to decision-making. Impacts tend to be permanent or irreversible or otherwise long-term (>5 year recovery period). Impacts can occur over large or medium size areas. High to moderate sensitivity of environmental receptors to impact.
Moderate	The effects of the impact are relevant to decision-making including the development of environmental mitigation measures. Impacts can range from long-term to short-term in duration (1 to 4 year recovery period). Impacts occur mostly near the source, which is apparent and requires mitigation to be within limits of acceptability. Moderate sensitivity of environmental receptors to impact.
Minor	Impacts are recognisable/detectable but acceptable and may be contained on-site. These impacts are unlikely to be of importance in the decision-making process but are relevant in the consideration of standard mitigation measures. Impacts tend to be short-term (<12 month recovery period) or temporary and/or occur at a local scale.
Negligible	Minimal change to the existing situation. This could include for example impacts which are beneath the levels of detection, impacts that are within the normal bounds of variation or impacts that are within the margin of forecasting error.

Table 5.4 Classification of likelihood

Likelihood category	Description	Annual probability of occurrence
Almost Certain	A recurring event during the lifetime of an operation or project.	More than two occurrences per year
Likely	An event that will probably occur during the lifetime of an operation or project.	Around one occurrence per year
Possible	An event that may occur during the lifetime of an operation or project.	More than 10% annual probability of occurrence
Unlikely	An event that is unlikely to occur during the lifetime of an operation or project.	More than 1% annual probability of occurrence
Rare	An event with a low probability to occur during the lifetime of an operation or project.	Less than 1% annual probability of occurrence

Table 5.5 Potential surface water effects

Hazard					Unmitigated risk			Mitigation measures	Mitigated risk		
Description	Type	Source	Pathway	Receptor	Likelihood	Significance	Risk		Likelihood	Significance	Risk
Construction											
Erosion and sedimentation	Water quality	Cleared and prepared construction area	Rainfall runoff	Four Mile Creek	Possible	Minor	Medium	A Construction Erosion Management Plan (CEMP) would be developed	Unlikely	Minor	Low
Hydrocarbon spill	Water quality	Substation construction	Rainfall runoff	Four Mile Creek	Unlikely	Moderate	Medium	A spill cleanup procedure would be in place Oily water separators would be installed prior to construction of components containing cooling oils	Rare	Minor	Low
Operation											
Flood inundation of electricity supply plant	Flooding	Substation and BESS location	Flood hydraulics	Substation and BESS	Possible	Moderate	Significant	Earthworks, pad construction to above the nominated flood level	Rare	Moderate	Low
Flood afflux affects neighbouring or downstream properties	Flooding	Substation and BESS construction pad	Flood hydraulics	Neighbouring properties	Unlikely	Minor	Low	None proposed	Unlikely	Minor	Low
Hydrocarbon spill at the substation	Water quality	Substation cooling oil spill	Rainfall runoff	Four Mile Creek	Unlikely	Moderate	Medium	A spill cleanup procedure would be in place Oily water separators would be installed prior to construction of components containing cooling oils	Rare	Minor	Low
Chemical or metals spill at the BESS due to fire	Water quality	BESS fire	Rainfall runoff	Four Mile Creek	Rare	High	Medium	A spill cleanup procedure would be in place Containment of runoff in a basin	Rare	Minor	Low
Increase in stormwater runoff causes afflux at downstream culverts	Water quantity	Substation and BESS hardstands	Rainfall runoff	Mt Isa Rail, Flinders Highway	Likely	Minor	Medium	Detention and treatment of runoff via a WSUD treatment train	Unlikely	Minor	Low
Transport of lithium compounds via ash to Lake Ross following a BESS fire	Water quality	BESS fire	Wind	Lake Ross, Townsville water supply	Unlikely	Negligible	Low	Battery fire reduction systems	Rare	Negligible	Low
Decommissioning											
Erosion and sedimentation	Water quality	Cleared area	Rainfall runoff	Four Mile Creek	Possible	Minor	Medium	Rehabilitation and decommissioning plan is developed and submitted to TCC for approval at least one year prior to decommissioning	Unlikely	Minor	Low

6 Avoidance and mitigation

A summary of the proposed measures to manage and mitigate potential impacts to surface water is provided in Table 6.1.

Table 6.1 Management and mitigation measures

Management/mitigation measures	Timing
Stormwater management	
Address temporary and site-specific risks to surface water during construction through a CEMP. This will include the following: • Appropriately siting of proposed infrastructure within the development footprint, which will minimise disturbance to existing drainage lines and overland flow paths. • Required earthworks (cut/fill) in the BESS area will maintain fall towards the south-east and to a single discharge point • Provision of general surface drainage infrastructure comprising: – Diversion of upslope runoff around infrastructure. – Surface drainage measures as required to control runoff generated within the development footprint, minimise soil erosion potential and direct runoff towards receiving drainage lines. Sheet flow conditions will be maximised. – Suitable treatments will be used to armour earthwork batters and site drainage as needed for scour protection and to achieve stable discharge to waterways where flow concentrations cannot be avoided. – Maintain existing flow paths where possible and minimise catchment diversions with the objective of minimising changes to flow regimes in receiving watercourses. • Prompt stabilisation of disturbed areas and progressive rehabilitation as early as possible. • Maintaining drainage, erosion and sediment control measures. • Monitoring and adjustment protocols for drainage, erosion and sediment control practices to achieve the desired performance standard. • Implement procedures for hazardous material storage and spill management as defined in applicable state guidelines. • Maintain spill kits on-site at all times during construction and operation. • Weather preparedness and response planning. • Identify requirements for monitoring and maintenance of water management and drainage systems.	Pre-construction
Specific stormwater management measures for the BESS area will include the following: • Required earthworks (cut/fill) in the BESS area will maintain fall towards the south-east and to a single management point • Provision for secondary containment storage within the BESS area's drainage system to manage fire suppression runoff in the event of an emergency fire/spill scenario. Specific stormwater management measures for the substation will include: • Runoff from areas which could potentially come into contact with oils will be directed through SQIDEP approved oily-water separators	Pre-construction/ Operation
Update management plans to address ongoing site-specific risks to surface water during operations. This will address the following: • Rehabilitation of temporary works and construction disturbance areas not utilised for operations. • Continuation and maintenance of stabilised and vegetated surfaces, drainage and sediment and erosion control measures that will be retained for operations.	Operation
Erosion and sediment control	
Implementation of erosion and sediment control measures, including site rehabilitation and revegetation in accordance with industry guideline such as *Best Practice Erosion and Sediment Control* (IECA 2008).	Pre-construction / construction

Management/mitigation measures	Timing
Flood risk management	
Construction site planning at detailed design stage to: • Ensure appropriate placement of temporary works, plant, materials and workforce facilities, which gives due consideration to overland flow paths and mainstream flood risk. • Ensure that temporary works minimise off-site flooding impacts as far as practical.	Pre-construction / construction
As per current project layout, design and construction of permanent works to: • Locate BESS and substation infrastructure on high ground above 0.2% AEP event flood levels and avoid or otherwise divert local overland flow paths around infrastructure. • Ensure finished ground levels are constructed at-grade and not materially higher than existing levels in areas subject to existing mainstream flooding to minimise potential off-site flooding impacts, as far as practical. Where a change in ground level is proposed in areas, as part of future design stages or refinements, assessment of the change should be quantified to confirm off-site flooding impacts do not occur. If changes in the project layout or changes in the landform are required and there is a risk of flooding, then the project should undertake a remodelling exercise to confirm the flood behaviour due to the project.	Pre-construction / construction
Stormwater outlets/interfaces	
Stormwater outlets/interfaces will be designed and constructed to: • Minimise scour potential. • Minimise local flooding impacts. • Be consistent with relevant guidelines	Pre-construction / construction

7 Conclusion

Solquartz and PEP are seeking a development permit for the construction, operation and maintenance of a BESS, substation and transmission line. This water resources report supports the development application to seek a:

- Material Change of Use for an undefined use (BESS)
- Material Change of Use for a Substation
- Material Change of Use for Major Electricity Infrastructure (transmission line).

This report provides an assessment of the development in relation to its design flood immunity, efficiency of the water sensitive urban design relating to water quality, and risk associated with the. On this basis the following has been summarised:

- The development lies within the TCC 'medium flood hazard' area. The substation and BESS will be elevated above the 0.2% AEP flood level. The bio-retention basin will occupy a section of the Four Mile Creek flood storage area, but will not worsen flood characteristics (see afflux mapping in Annexure A). Shallow overland flow will be redirected around the development. The altered flow paths will be of relatively low flow rate, such that scour and erosion will not be increased.
- During operation of the site, the erosion potential of the soils from the site will not be increased from existing conditions due to the low velocities in the overland flow (max 0.3 m/s). This will be further reduced if the surface is re-vegetated as soon as practicable.
- MUSIC modelling indicates that the proposed stormwater treatment measures will be effective at reducing sediment and nutrients from the site both in comparison to the undeveloped grazing land use, and in comparison to the site developed without WSUD.
- The development will not cause impact to the Lake Ross drinking water supply in the case of a combustion of the asset. This was determined through a source-pathway-receptor risk assessment.

Annexure A

Flood assessment

Northern Quartz Campus

Flood Report - BESS, Transmission line and Substation

Prepared for Solquartz and Private Energy Partners

October 2025

Northern Quartz Campus

Flood Report - BESS, Transmission line and Substation

Solquartz and Private Energy Partners

E231133 RP1

October 2025

Version	Date	Prepared by	Reviewed by	Comments
V1	1 August 2025	L Norman	N Bartho	Draft for client comment
V2	28 August 2025	L Norman	N Bartho	For issue
V3	29 October 2025	L Norman	N Bartho	Response to RFI

Approved by

Ron Dela Pena
Associate Director – Major Projects and Approvals
29 October 2025

Level 1 87 Wickham Terrace
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Executive Summary

ES1 Request for information response

A request for information issued from Townsville City Council (TCC) was received on 30 September 2025. Responses that are relevant to the Flood Report are summarised in the Table below.

Table ES1 TCC RFI responses

Detail	Response	Additional information reference
Water resources assessment report		
The submitted report states that “the stormwater system would be designed so that it may be isolated from the natural environment (i.e. no discharge) in the event of a spill, fire, or contamination event.” The applicant is requested to provide further details on how this is proposed to be achieved within the development.	Addressed within the Water resources assessment report.	Refer Appendix L, Section 4.1.1.
Sections are requested to be added to Figure 5.1. The submitted version shows blank plots.	Updated cross sections detailing the flood elevation levels against the existing and developed surface levels are provided in Section 5.4.1 within the Water resources assessment report and Attachment A of this report. The substation pad and BESS pad require elevation to meet their flood immunity requirements of 0.5% annual exceedance probability (AEP) and 0.2% AEP, respectively. Figures 5.1–5.7 provide cross section elevations to show the flood immunity of the development. These figures confirm the appropriate flood immunity of both the Substation Pad and the BESS Pad structures.	Refer Appendix L Section 5.4.1 and Section 5.4.2, and Attachment A of this report
Flood report		
Peak water surface elevation plots are requested to be included in Appendix A, along with spot 1% AEP levels reported at key locations within and around the development.	Peak water level plots for the 10%, 1% and 0.2% AEP events (both existing and proposed scenarios) provided in Attachment A (Figures A2.1-A2.8), showing both ground surface and water surface elevations. Note: water level plots for developed scenario follow contours of design structures due to rain-on-grid results outputs. Plots show design water levels in surrounding water courses and surrounding design infrastructure. Spot water levels (1% AEP) are also provided in Attachment A.	Further discussion provided in Section 4.2. Figures updated in Attachment A.
The scale of the peak depth and velocity plots contained in Appendix A is requested to be modified (zoomed-in) to show enhanced detail within the development site.	Updated scale to zoom closer to site to provide more detail of results.	Further discussion provided in Section 4.2. Figures updated in Attachment A.

Detail	Response	Additional information reference
Confirmation is requested that the BESS containers, control room, diesel generator and auxiliary transformer will be provided with 1% AEP flood immunity. The submitted plans show these elements at ground level within and adjacent to a 1% AEP flood path.	Current design is conceptual level only and is subject to detailed design. 1% AEP flood immunity of these buildings will be met as part of the detailed design phase. Further details are provided in Chapter 5 of this report.	Further discussion provided in Section 5.
The 10% and 1% AEP afflux plots show 50-100mm of afflux within the State controlled road corridor to the east of the development site. The applicant is requested to confirm State acceptance of these impacts.	Current concept design demonstrates impacts within rail corridor. However, these impacts will be mitigated during detailed design to achieve zero offsite impacts for events up to and including 1% AEP. This will include design updates to water storage basin, drainage design, water treatment train and pad footprint/elevations to achieve this. Flood modelling of the detailed design will be performed to quantify and confirm these outcomes.	Further discussion provided in Section 5.

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1 Introduction

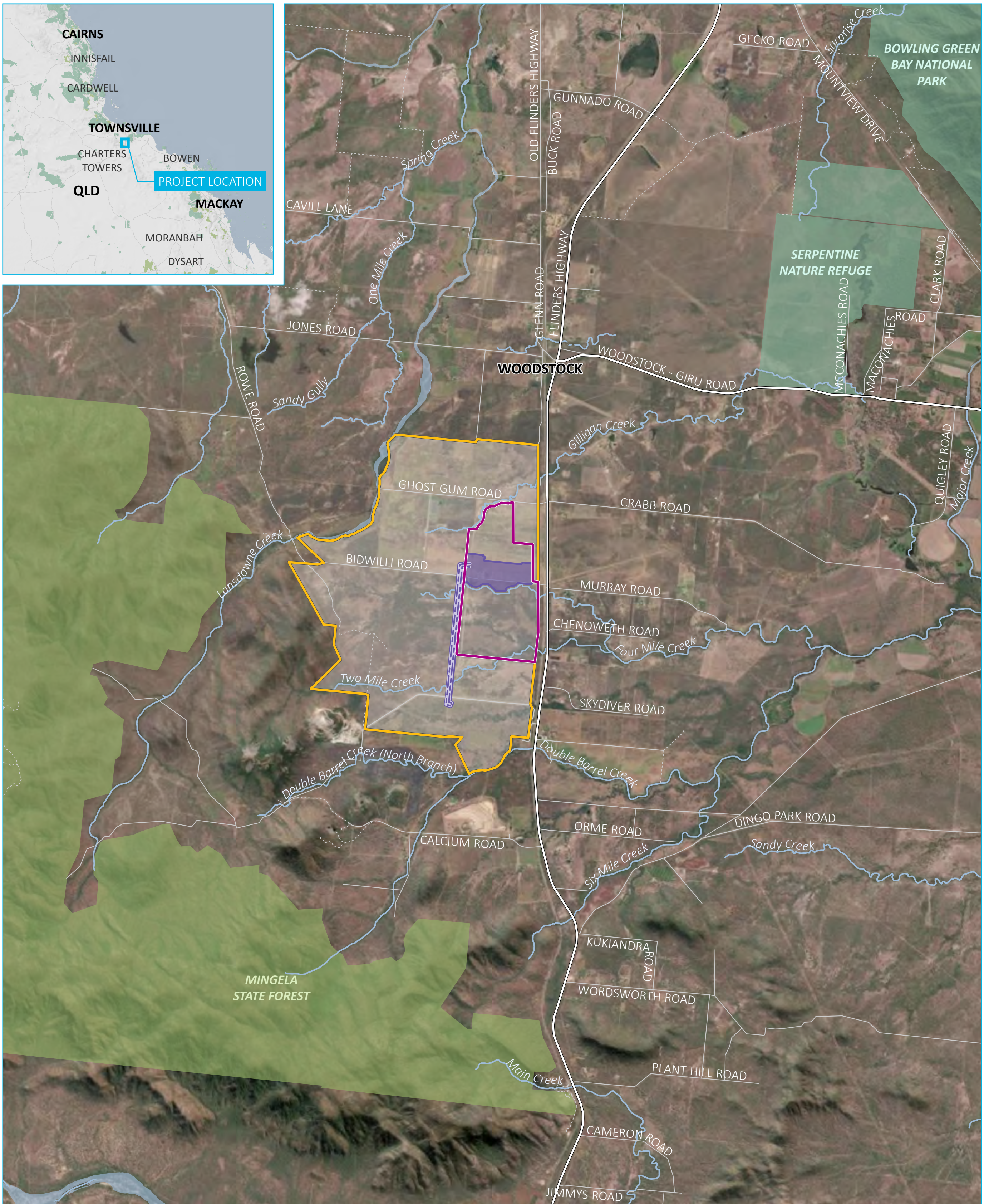
1.1 Background and purpose

EMM Consulting Pty Limited (EMM) has undertaken a flood impact assessment to support the Northern Quartz Campus (NQC) Package 1 BESS, Substation and transmission line development. Solquartz and Private Energy Partners (PEP) are proposing to develop a BESS, substation and transmission lines to facilitate electricity supply for future Metallurgical Silicon (MG-Si) and Polysilicon (PolySi) manufacturing facilities as part of the broader (NQC) project.

The Package 1 Project involves the construction and operation of a 780 megawatts (MW) BESS and substation facility which will be supported by enabling infrastructure including roads, parking, switchgear, transformers, site offices and onsite storage areas. The development includes the proposed overhead transmission line which traverses south along the western edge of the project premises towards the Calcium substation. The premises which form this application is on part of Lot 19 SP321818, part of Lot 87 on RP911426, Lot 30 on SP321818, Lot 55 on E124248 and Lot 65 on E124264 near Woodstock in TCC local government area. The project premises is shown on Figure 1.1. The proposed site layout is provided in Figure 1.2.

This assessment involved detailed hydraulic assessment of existing and design conditions for the proposed BESS and associated infrastructure, and forms an attachment to the Surface Water Assessment Report for the Project.

This report provides details of the modelling performed and results, including flood mapping for both existing and design scenarios.



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Source: EMM (2025); ABS (2021); DES (2025); DNRMMRRD (2025); ESRI (2025); GA (2011)

KEY

- Lansdown Eco-Industrial Precinct
- Northern Quartz Campus
- Package 1- Premises
- Package 1- Transmission line

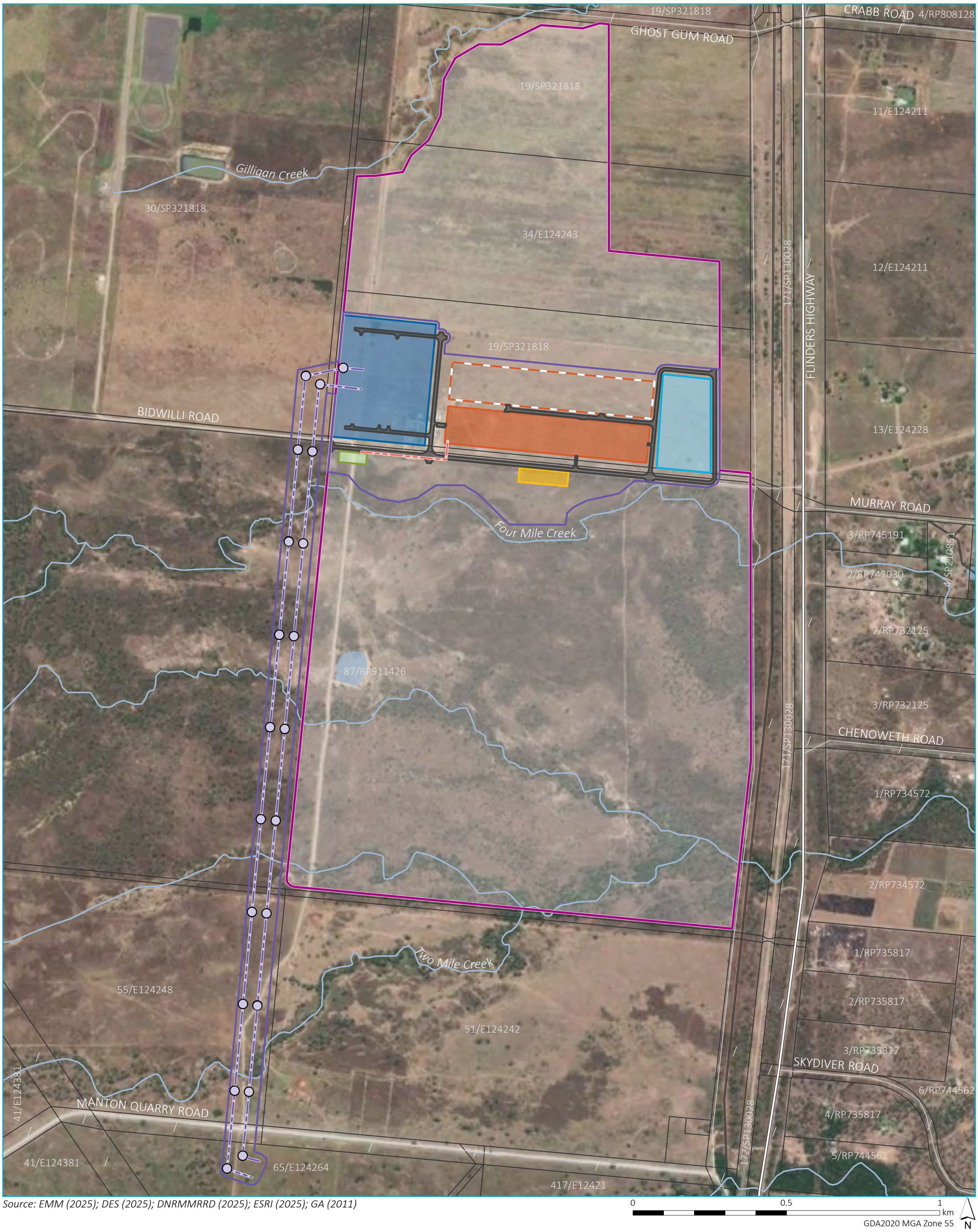
Existing environment

- Major road
- Minor road
- Vehicular track
- Named watercourse
- Named waterbody
- National park/nature reserve
- State forest

Regional context

Northern Quartz Campus
Package 1- BESS, transmission line and substation
Flood Impact Statement
Figure 1.1

EMM creating opportunities



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Source: EMM (2025); DES (2025); DNRMMRRD (2025); ESRI (2025); GA (2011)

KEY

Northern Quartz Campus
Package 1- Premises
Existing environment
Major road
Minor road
Watercourse/drainage line
Waterbody
Cadastral boundary

Package 1 proposed site layout
BESS
BESS expansion area
Substation
Construction laydown area
Water management area
Fire water pad
Internal road

Fire water pipeline
Transmission line
Transmission pole

Proposed site layout

Northern Quartz Campus
Package 1- BESS, transmission line and substation
Flood Impact Statement
Figure 1.2

2 Code compliance

The Townsville City Plan describes Zones, Overlays, and Development Codes. Those relevant to the assessment of flood impacts at the project site are:

- 8.2.6 Flood hazard overlay code (medium flood hazard zone).
- 9.3.2 Healthy waters code.

A summary of the assessment against TCC codes is provided in Table 2.1.

Table 2.1 Code compliance review

Performance objective	Acceptable Outcome	Response
Flood hazard overlay code		
PO7 Development within high and medium hazard areas does not directly, indirectly or cumulatively worsen flood characteristics outside the development site, having regard to: a) increased scour and erosion, or b) loss of flood storage, or c) loss of or changes to flow paths, or d) flow acceleration or retardation, or e) reduction in flood warning times.	No acceptable outcome is nominated.	**PO7 – Complies** The development within a medium hazard area will interact with flood waters, but is not expected to worsen flood characteristics. Shallow overland flow will be redirected around the development. a) The altered flow paths will be of relatively low flow rate, such that scour and erosion will not be increased. b) At rare AEPs, Four Mile Creek flood extent may impinge on the development footprint. Exclusion of flooding will result in minor loss of flood storage. Afflux mapping indicates that effects will be local, with negligible effects on adjacent or downstream infrastructure. c) Defined flow paths will be retained. d) Flow will not be accelerated. e) The development will not alter flood warning times. Flood information is provided in Attachment A.
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). Table 8.2.6.3(b)-Flood immunity for community services and facilities Development involving: c) major electricity infrastructure. — 0.2% AEP event Development involving: e) substations. — 0.5% AEP event	**AO8 – Complies** Flood immunity demonstrated up to and including 0.2% AEP event. Substation Pad achieves flood immunity of 0.5% AEP event, BESS Pad achieves flood immunity of 0.2% AEP event. Refer water level plots and flood maps provided in Attachment A.

Performance objective	Acceptable Outcome	Response
Healthy waters code		
PO5 Construction activities for the development avoid or minimise adverse impacts on stormwater quality or hydrological processes.	No acceptable outcome is nominated	**PO5 – Complies** A construction phase sediment and erosion management plan will be prepared and applied by the construction contractor, minimising the risk of sediment entering waterways.
PO6 The stormwater management system: a) retains natural waterway corridors and drainage paths b) maximises the use of natural channel design in constructed components.	**AO6.1** All existing waterways and overland flow paths are retained. **AO6.2** The stormwater management system is designed in accordance with the Development manual planning scheme policy no. SC6.4 — SC6.4.10.2 Water Sensitive Urban Design.	**AO6.1 - Complies** All existing waterways and overland flow paths are retained. **AO6.2 – Intent to Comply** The stormwater management system will be designed in accordance with WSUD principles.
PO11 Development does not cause ponding, or changes in flows and velocities such that the safety, use and enjoyment of nearby properties are adversely affected.	**AO11** The stormwater management system is designed and constructed in accordance with the Development manual planning scheme policy SC6.4–SC6.4.8 Stormwater Management, SC6.4.9 Stormwater Quantity; and SC6.4.10 Stormwater Quality.	**PO11 – Intent to comply** Localised afflux caused by the project dissipates downstream of rail alignment. The current conceptual level design results in afflux impacts of up to 140 mm on upstream side of rail alignment and 125 mm at upstream project boundary for the 1% AEP event. The next phase of engineering detailed design will identify and incorporate measures to mitigate all offsite impacts for events up to 1% AEP to meet the requirements of this PO11.

3 Hydrologic modelling

3.1 Overview and previous work

EMM had previously completed a flood impact assessment for the site adjacent to the Solquartz project boundary in September, 2021. This project, operated by Queensland Pacific Metals Pty Ltd, titled Townsville Energy Chemicals Hub (QPM TECH) lies within the same catchment area as NQC. As its hydrologic foundation, the QPM TECH flood impact assessment adopted an XP-RAFTS model that had originally been developed by AECOM, and was provided to EMM by TCC. This was a detailed, calibrated hydrologic model developed for the Lansdowne Creek catchment, and was subsequently adapted by EMM for the QPM TECH site. It was proposed that the same, calibrated hydrologic data could therefore be used for the NQC site where appropriate, complimented by a rain-on-grid approach that covers areas that the QPM TECH data could not adequately be applied. TCC agreed to this approach via email communication (16/9/2024, provided as Attachment B to this Flood Report).

Specifically, design inflows were therefore sourced from point flows via XP-RAFTS in locations whereby flowpaths could be isolated, and rain-on-grid hydrology for local sub-catchments adjacent to the project site. Rain-on-grid hydrology was of particular importance to Double Barrel Creek (north and south branches), Gilligan Creek, Six Mile Creek, Four Mile Creek and Two Mile Creek, providing a detailed understanding of flow paths, distribution and interaction between these creeks as they interact with the Project site. These watercourses are shown in Figure 1.1.

Based on this, the following hydrologic modelling approach was adopted:

- Hydrograph inflows for Lansdowne Creek via XP-RAFTS (refer yellow catchment area on Figure 3.1).
- Rain-on-grid for Gilligan, Double Barrel, Six Mile, Four Mile and Two Mile Creeks (refer red catchment area on Figure 3.1).

Calibrated inflows (Lansdowne Creek) and hydrologic parameters (all other watercourses) were adopted for NQC as described above.

These were then scaled to account for climate change, as detailed in Section 3.3 of this report.

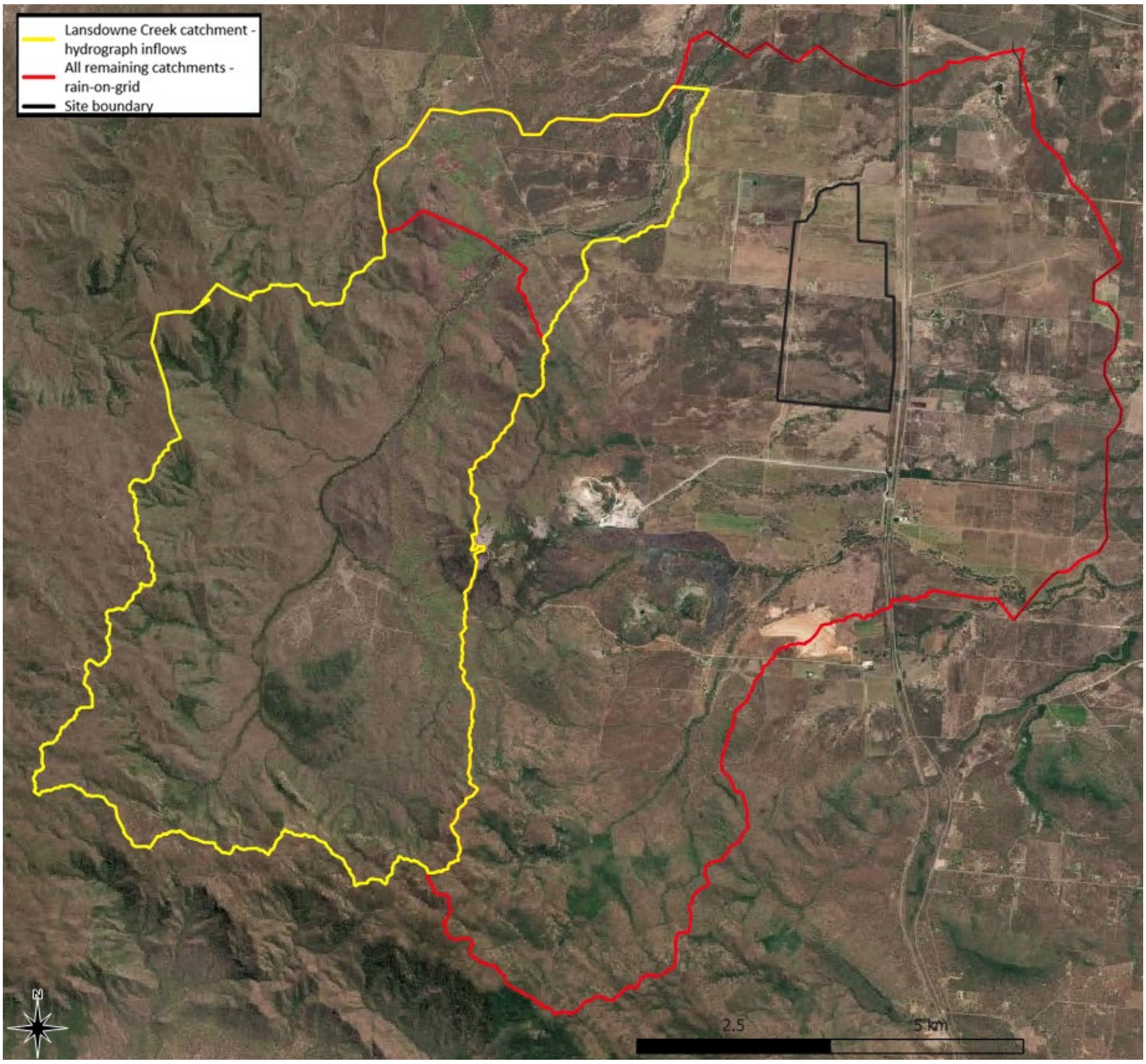


Figure 3.1 Hydrologic modelling approach

3.2 Design rainfall data

IFD data describes the relationship between rainfall intensity, storm frequency and storm duration and forms the basis of design storms for hydrologic modelling. Figure 3.2 shows the IFD curves typical for the project investigation area.

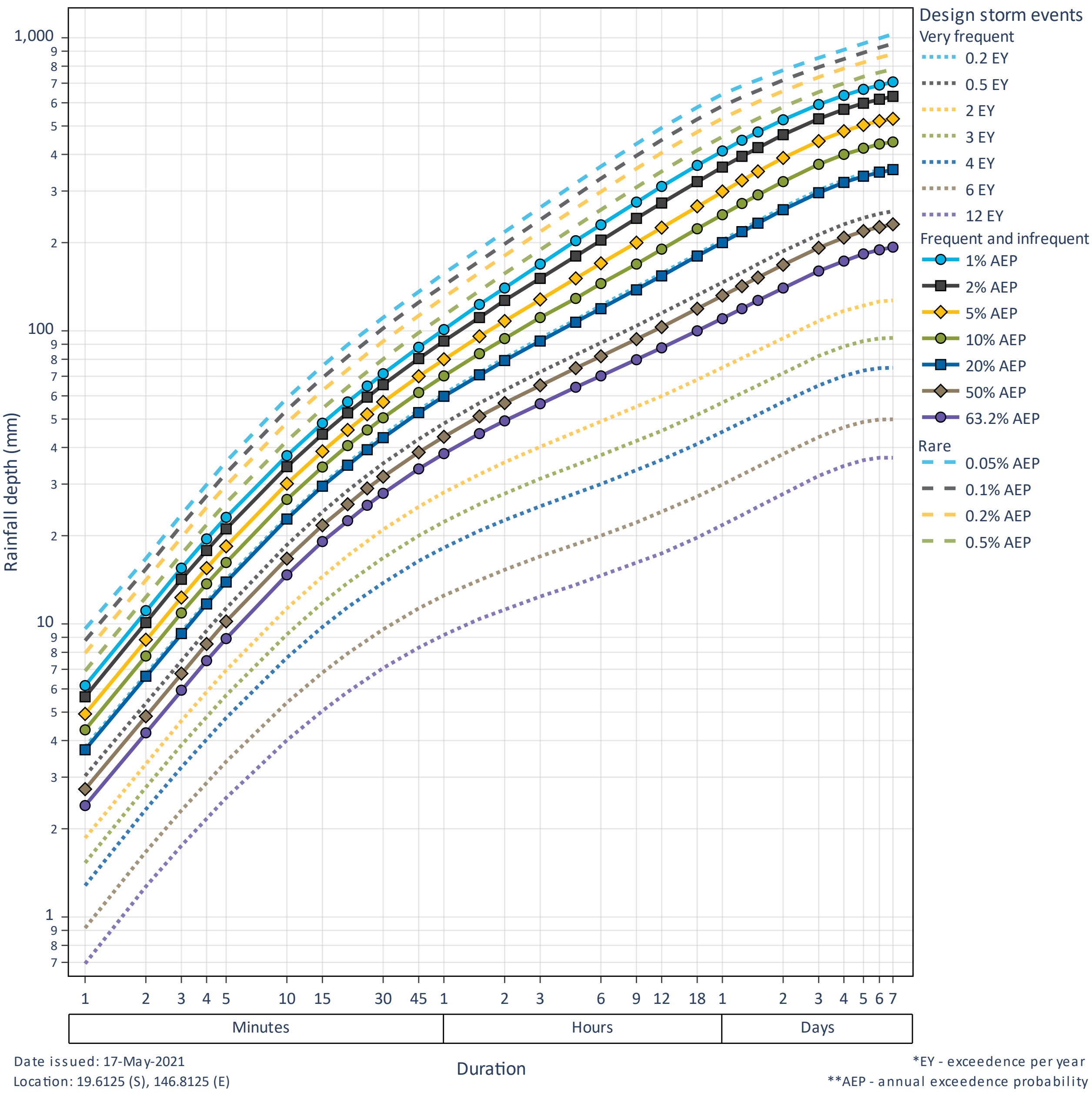


Figure 3.2 Design intensity-frequency-duration curves

3.3 Climate change

In August 2024, Australian Rainfall and Runoff (Ball et al 2019) (ARR) was updated to Version 4.2, which included significant changes to the ways in which climate change scaling factors are to be applied to hydrologic variables such as design rainfall depths. However, for this project, TCC has stipulated specific climate change scaling to be applied that does not reflect current ARR v4.2 guidelines. This confirmation was provided by TCC via email (14/11/2024). The required climate change scaling by TCC is as follows:

- Adopt an RCP8.5 climate future with a 2100 time horizon.
- Design rainfall depths to be increased by 15.4% across all design events.
- Adopt a 0.8 metre (m) sea-level rise (note: this has no impact on project hydrology).

Therefore, design rainfall depths derived from previous modelling were updated with this information for the Project. All design storm events were therefore modelled with a 15.4% increase in design rainfall depths to account for the RCP8.5, 2100 climate change scenario. It is recommended that climate change scaling factors be revisited for detailed design in light of ARR v4.2.

3.4 Critical storms

The site has several watercourses with which it interacts, therefore no single storm event can be isolated as the critical event. Instead, a full range of design storms were modelled and run (30 minutes – 1080 minutes), with critical outputs such as water levels, depths and velocities derived from the envelope of median temporal patterns and maximum storm durations.

This analysis identified the 120 minute duration storm as the most relevant design storm duration, as it is critical at the upstream (western) side of the site for Four Mile Creek, Two Mile Creek and Gilligan Creek. The 180-minuration storm is also relevant, critical within both Gilligan Creek and Two Mile Creek at some locations within and around the site boundary. Figure 3.3 shows the spatial distribution of the critical storm duration for the 1% AEP in the vicinity of the site.

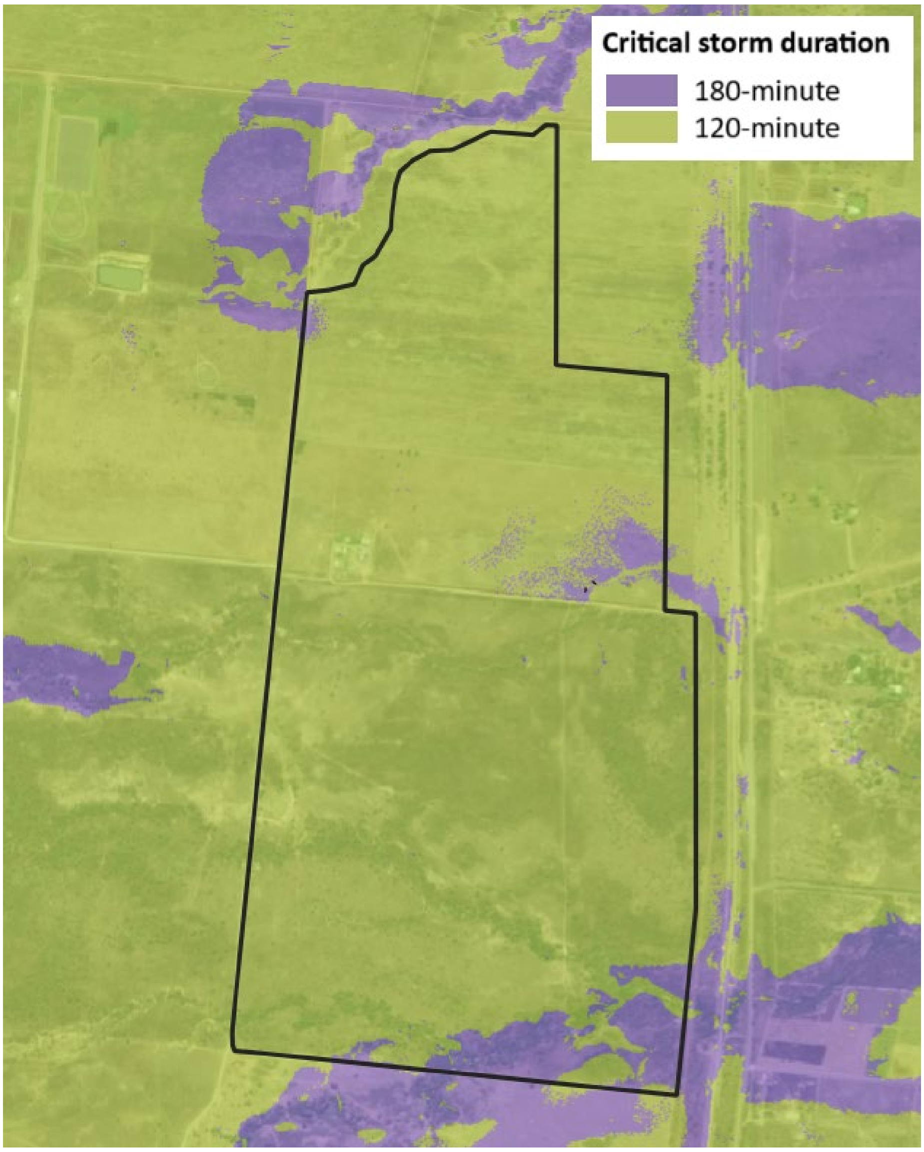


Figure 3.3 Critical storm duration – spatial distribution for 1% AEP

4 Hydraulic model development

This chapter outlines the development of TUFLOW hydraulic models. Results are presented and discussed in Chapter 5. The models were developed to:

- estimate peak flood extent, depth and velocity across the assessment area under existing conditions
- incorporate the design of Package 1, estimate peak flood extent, depth and velocity across the assessment area under these developed conditions
- identify and measure hydraulic impacts of this developed design case.

4.1 Modelling approach

Two hydraulic models were developed for the assessment area:

- Tier 1 model represents the broader catchment and includes inflows from Lansdowne Creek and rain-on-grid for all other catchments. It was used as a broad-scale hydrologic basis to derive flows and flow paths across all sub-catchments. Importantly, the terrain immediately upstream of the site is relatively flat, and interactions between watercourses occurs to varying degrees across different event magnitudes. The rain-on-grid approach allows for these interactions to be modelled accurately (when compared with a rainfall run-off model which provides point hydrographs).
- Tier 2 model is similar to the Tier 1 model, however it covers a smaller modelled area with a finer grid size, allowing for more accurate representation of model topography and hydraulic characteristics. Flows are captured via po_lines from the Tier 1 model and applied as hydrograph inflows to the Tier 2 model, with rain-on-grid also applied to all areas within the model domain.

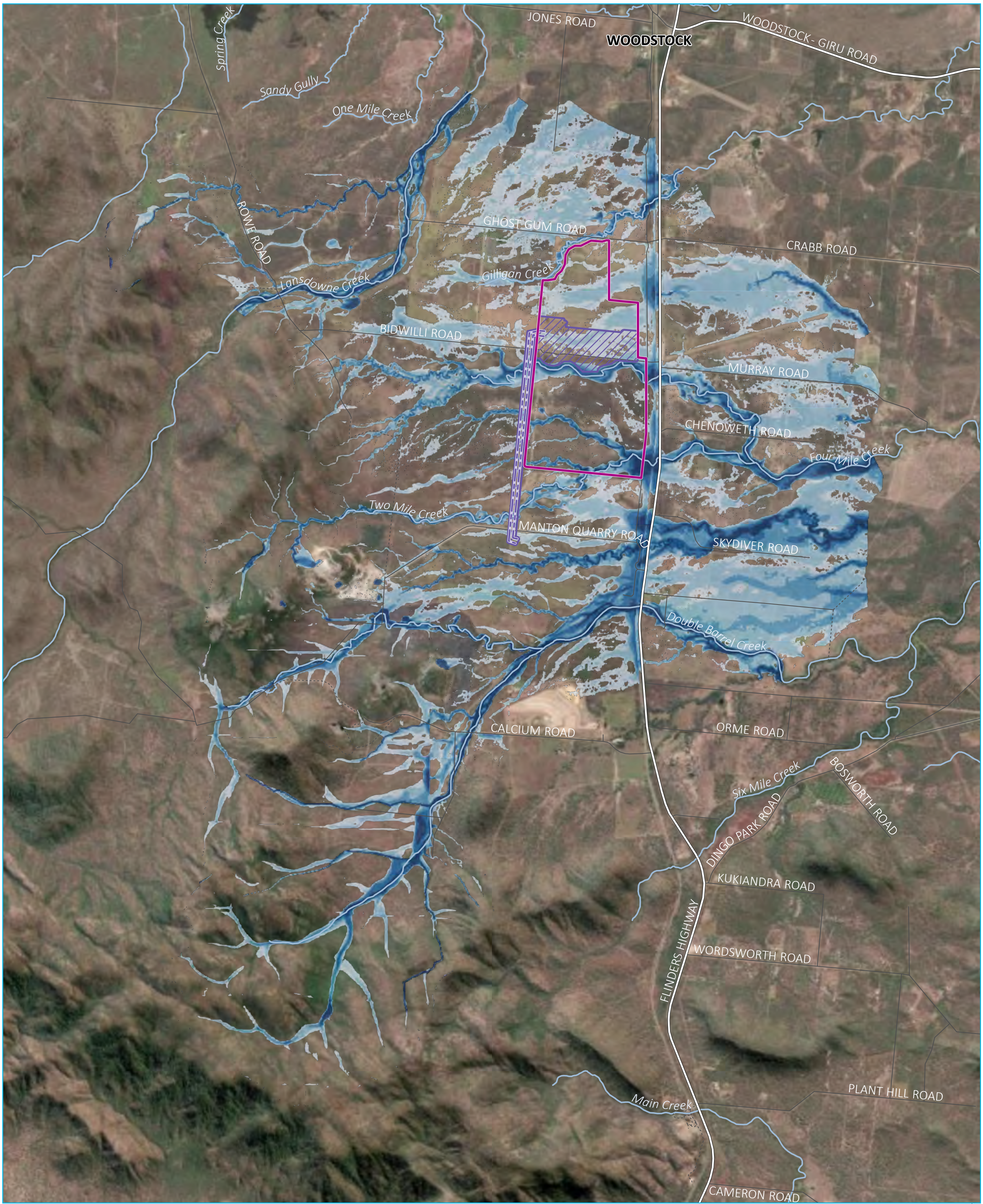
Both hydraulic models simulate design flood events for the 10%, 1% and 0.2% AEP events. The Tier 1 and Tier 2 models are established on a digital elevation model (DEM) that is informed by site survey and Light Detection and Ranging (LiDAR) survey both from site specific datasets and publicly available data.

The Tier 1 model was run for the existing scenario only, whereas the Tier 2 model was run for both existing and design scenarios, and used as the basis for the hydraulic impacts assessment.

4.2 Model domain, grid size and version

The model domain is shown in Figure 4.1.The modelled topography was represented entirely in two dimensions (2D) except for existing hydraulic structures (refer Section 4.6) with a model grid size of 12 m and 5 m for the Tier 1 and Tier 2 model respectively. This provided the optimal balance between simulation runtimes and model accuracy.

TUFLOW Heavily Parallelised Compute (HPC) (version 2025.0.2) was used with sub grid sampling implemented at 1 m spacing to provide a higher resolution of storage within the model.



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Source: EMM (2025); DES (2025); DNRMMRRD (2025); ESRI (2025); GA (2011)

0 1 2 km

GDA2020 MGA Zone 55

N

KEY

Northern Quartz Campus

Package 1- Premises

Package 1- Transmission line

Existing environment

Major road

Minor road

Vehicular track

Named watercourse

Peak flood depth (m)

< 0.05

0.05- 0.1

0.1- 0.25

0.25- 0.5

0.5- 1

> 1

Tier 1 flood model - Peak depths, 1%AEP

Northern Quartz Campus
Package 1- BESS, transmission line and substation
Flood Impact Statement
Figure 4.1

EMM creating opportunities

4.3 Model timestep

TUFLOW HPC uses an adaptive timestep approach to maintain unconditional stability during simulations. Timesteps are automatically adjusted during the simulation to maintain stability, based a range of criterion. Timesteps during model runs were typically in the order of 0.3 to 2 seconds.

4.4 Hydraulic roughness

The terrain within both the Tier 1 and Tier 2 model domains is highly variable. Different creek reaches exhibit a range of vegetation types and channel geometries.

Manning's n values were selected based on:

- land use mapping
- aerial imagery
- site inspection observations
- reference materials including ARR.

Land use categories and associated Manning's n values applied in the TUFLOW models are provided in Table 4.1.

The model domain generally consists of the following surface types:

- vegetation – from sparse cover to dense bushland
- built environment – dirt and paved roads (e.g. haul road), railway, and buildings
- channel – including local variations in shape and lining.

To assign hydraulic roughness, application of a base Manning's n of 0.04 was considered across the entire model domain, and this base Manning's n was then refined with spatially variable values based on land use, as shown in Table 4.1 and mapped in Figure 4.2.

Roughness zones were implemented as TUFLOW material layers alongside other key hydraulic features.

Table 4.1 Adopted Manning's n values for the hydraulic model domains

Manning's n value	Land use
0.06	Grassland/open Paddocks
0.033	Water bodies
3	Buildings
0.025	Dirt Roads
0.1	Thick Vegetation
0.02	Paved Roads, hardstand
0.05	Sparse Grass
0.04	Spillway riprap
0.025	Topsoil/spoil material
0.045	Grass
0.013	Concrete

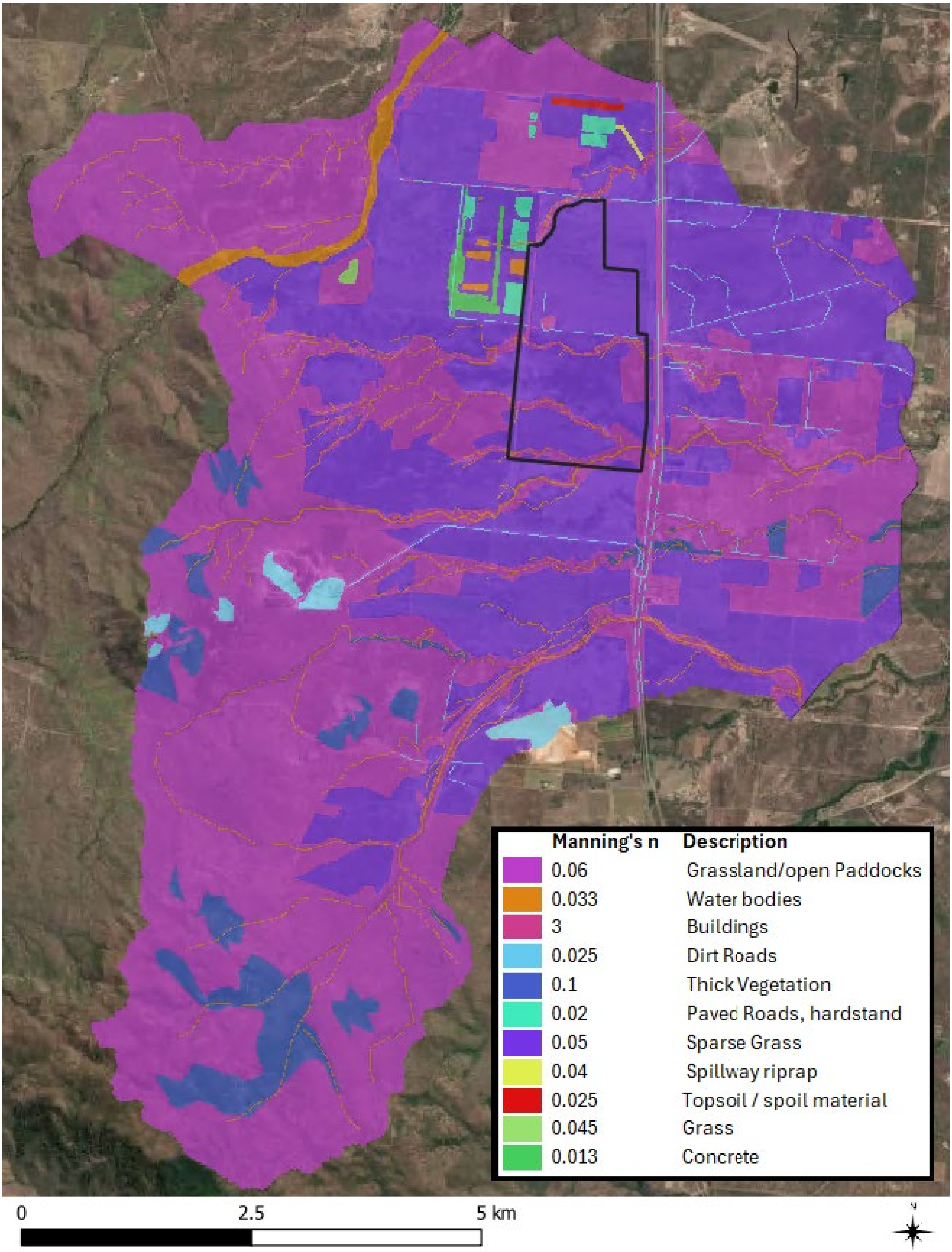

Figure 4.2 Manning's roughness discretisation

4.5 Topography

The primary source of topographical information was the LiDAR sourced from the "ELVIS" database (Geoscience Australia 2021). This dataset has a 1 m spacing, and was collected across both 2011 and 2018. Key hydraulic controls such as roads and rail embankments were further enforced using z-shape elements to ensure their correct interpretation within the model grid. Additional topographical data was included for the QPM TECH and DriveIT sites, as detailed in Section 4.8.

4.6 Culverts

Both Tier 1 and Tier 2 models used embedded one-dimensional (1D) culvert structures. These accept flow from the 2D domain at the upstream end and returned it downstream, providing a more accurate representation of flow paths and conveyance through key infrastructure such as highways and rail embankments.

Within the model 25 creek crossings were considered as culverts, four of which included multiple barrels. Culvert details such as invert levels, diameters, and arrangements were informed by the provision of this data via the original AECOM modelling performed in 2018, and subsequently updated after a site visit by Hydrobiology (on behalf of EMM) in March 2025.

Hydraulic modelling was performed with no blockage factors applied. It is recommended that detailed design hydraulic modelling incorporate blockage factors as a sensitivity check and/or base model update.

The locations of these culverts are shown in Figure 4.3, with structure details summarised in Table 4.2

Table 4.2 Culvert data

ID	Type	Length (m)	US_Invert (m AHD)	DS_Invert (m AHD)	Width / Dia (m)	Height (m)	Number of cells
Central Road Culvert	RCP	16.59	81.872	81.792	0.9	N/A	6
FH_Ch36.275_ID43546	RCP	20.10	67.57	67.53	1.8	N/A	5
FH_Ch37.300_ID38796	RCP	23.69	65.4	65.3	1.8	N/A	5
FH_Ch38.168_ID39581	RCP	17.25	68.4	68.36	0.75	N/A	4
FH_Ch38.430_ID38822	RCP	19.26	68.22	68.16	1.5	N/A	4
FH_Ch38.570_ID43547	RCP	18.82	69.66	69.56	0.75	N/A	1
FH_Ch39.850_ID43548	RCP	15.77	72.42	72.11	0.6	N/A	5
SkyDiverRd1	RCP	9.96	65.56	64.75	0.9	N/A	1
SkyDiverRd2	RCP	11.42	63.63	63.21	0.9	N/A	2
Manton Quarry Rd	RCP	40.08	93	91.8	0.9	N/A	1
C01	RCP	25.53	65.75	65.58	0.75	N/A	1
FH_Ch33.825_ID25908	RCBC	20.01	66.65	66.61	3.6	1.8	1
GNRL_Ch29.56	RCBC	16.66	67.19	66.622	1.5	1.8	2
FH_Ch34.069_ID25905	RCBC	19.98	66.5	66.4	3.6	1.8	2
GNRL_Ch29.8	RCBC	25.45	66.66	66.54	2.7	1.5	2

FH_Ch35.267_ID39580	RCBC	32.96	69.716	69.63	1.2	0.9	6
GNRL_Ch30.973	RCBC	16.87	70.313	69.934	1.8	1.2	2
GNRL_Ch35.56	RCBC	16.04	73.09	72.68	1.2	1.2	1
GNRL_Ch34.34	RCBC	13.76	70.24	70.01	1.2	1.2	1
GNRL_Ch34.12	RCBC	10.41	68.666	68.6	2.7	2.1	2
GNRL_Ch33.86	RCBC	12.95	68.8	68.68	1.2	1.2	1
GNRL_Ch33.11	RCBC	14.13	66.105	66.1	3	3	3
GNRL_Ch32.02	RCBC	11.72	68.215	67.888	2.7	2.1	2

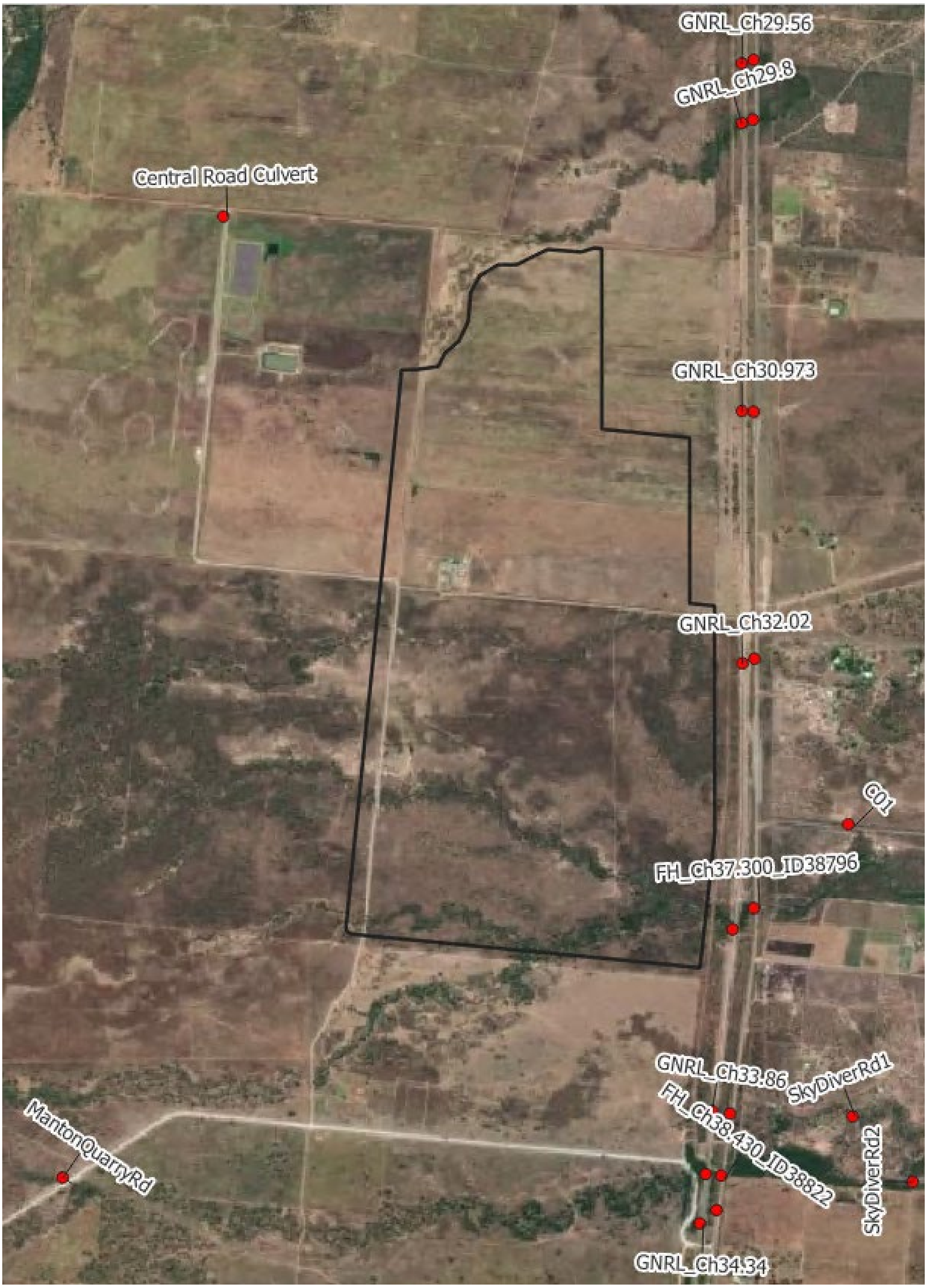

Figure 4.3 Culvert locations

4.7 Boundary conditions

Boundary conditions applied to both of the hydraulic models are outlined in Table 4.3.

Table 4.3 Model boundary conditions

Boundary condition	Type	Boundary assumptions
Tier 1 Hydraulic model		
Hydrograph inflows – Lansdowne Ck	QT boundary	Calibrated XP-RAFTS model, scaled for climate change
Rain-on-grid inflows	2d_rf	Incorporates losses and pre-burst values as per calibrated XP-RAFTS values, scaled for climate change
Downstream boundary	HQ	Hydraulic grade identified via initial model run iterations
Tier 2 Hydraulic model		
Hydrograph inflows – Lansdowne Ck	QT boundary	Calibrated XP-RAFTS model, scaled for climate change
Hydrograph inflows – additional creeks	QT boundary	Flows captured from Tier 1 model, applied to Tier 2 as inflow hydrograph
Rain-on-grid inflows	2d_rf	Incorporates losses and pre-burst values as per calibrated XP-RAFTS values, scaled for climate change
Downstream boundary	HQ	Hydraulic grade identified via initial model run iterations

4.8 Model scenarios

4.8.1 Existing scenario

The purpose of this model scenario is to represent existing site conditions. The existing scenario provides a baseline through which the hydraulic impacts of modifications to the topography can be assessed.

Importantly, the existing scenario includes approved developments including the QPM TECH site to the north of the Project, and DriveIT to the west of the Project. These were incorporated into the model topography via updates to the DEM using data provided for QPM TECH and the DriveIT site (provided by TCC via Northern Consulting Engineers (2019). These two sites and associated terrain adjustments to account for approved development are shown on Figure 4.4.

4.8.2 Design scenario

The purpose of this model scenario is to represent the Package 1 design, including the BESS, substation, transmission line and supporting works including drainage infrastructure. It should be noted that the modelling and impact assessment described in this report considers a concept water storage on the eastern side of the site, and assumes it is close to full at the beginning of the design storm event.

Topography (via a design DEM provided by Aurecon), proposed culverts, and Manning's roughness values were updated to reflect the design scenario. The extent of Package 1 design modifications are shown within the NQC Project Area boundary presented on Figure 4.4.

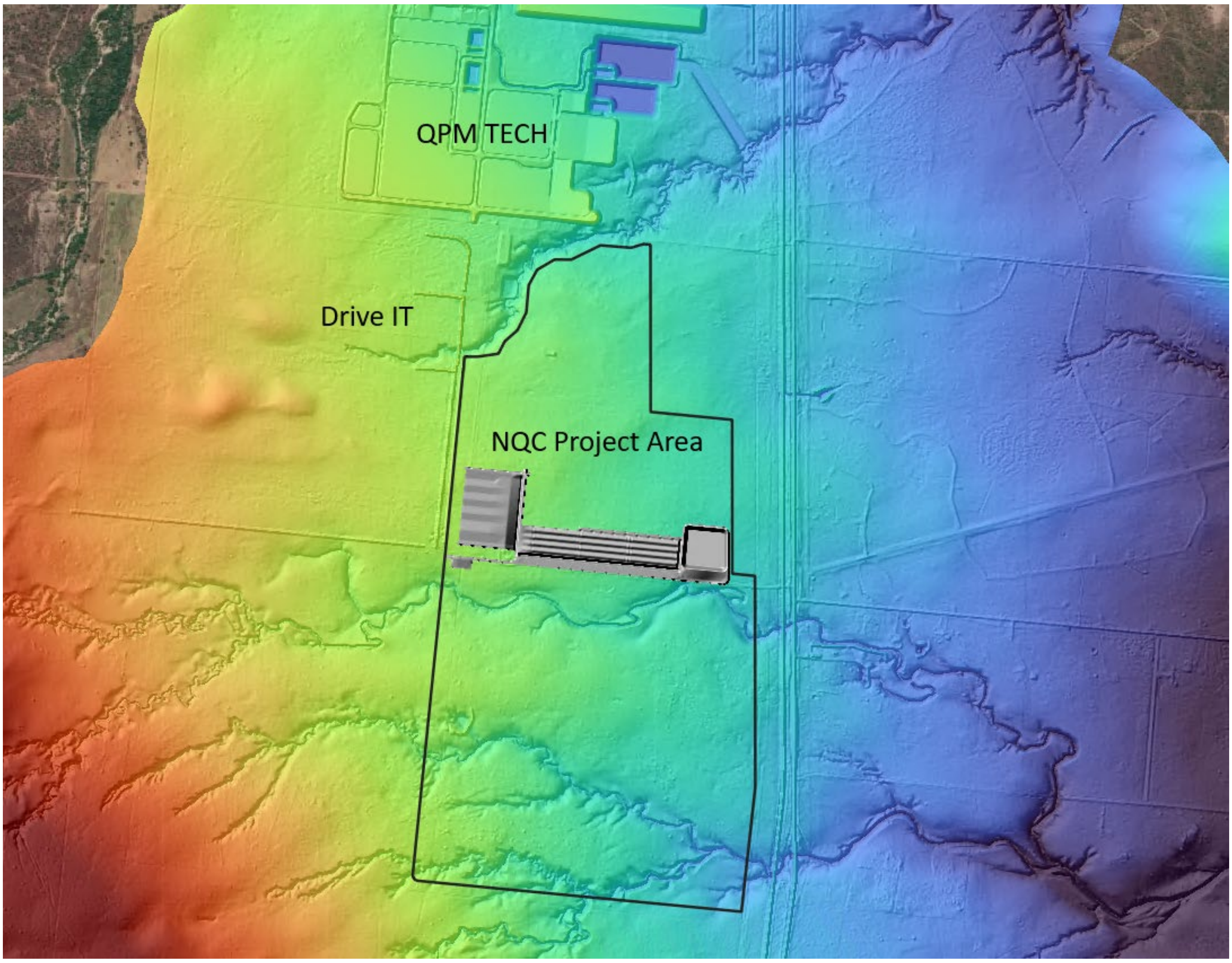

Figure 4.4 Modelled scenario topographies

5 Hydraulic model results

5.1 Analysis

The hydraulic models described in Chapter 4 were applied to establish existing scenario and design scenario flood characteristics at the site and its surrounding floodplain. Mapped flood model results for the 10%, 1% and 0.2% AEP events are included as Attachment A in this flood report. All results presented and discussed in this chapter and Attachment A relate to the Tier 2 model.

This includes existing and design scenario flood mapping for peak flood depths, and peak velocities. Difference maps showing the change in flood level under design scenario conditions are also provided. Relative difference was calculated as design flood depth (m) minus existing flood depth (m), that is, positive afflux indicates an increase in flood depth relative to the existing scenario.

Attachment A of this report provides longitudinal sections at various key locations across the site to demonstrate both existing and developed case peak water levels. These figures demonstrate compliance of flood immunity requirements for the project as per Flood Hazard Overlay Code P08. Note that the substation requires 0.5% AEP immunity, and achieves 0.2% AEP immunity as demonstrated in the figures in Attachment A.

5.2 Results

Afflux results overall demonstrate a relatively small impact caused by the proposed development. The development footprint lies outside the primary creek flow path (Four Mile Creek), which means major impacts are avoided. This is shown visually in Attachment A.

Impacts of the design scenario include the following:

- Impact to Four Mile Creek
    - The design imposes on the fringes of the Four Mile Creek flow path, which causes some afflux within the creek itself, with peak values of 10 mm, 40 mm and 80 mm for the 10%, 1% and 0.2% AEP events respectively. At its closest point, the design lies 20 m from the creek centerline, with interactions between the design surface and creek flows for all three modelled events. These changes to water level do not impact the immunity of the proposed design, and flood impacts will be mitigated during the detailed design phase.
- Impact to downstream road and rail corridor
    - The proposed development causes afflux at the road and rail corridor. In particular, the water storage has the most significant impact of each of the design elements, as it blocks some overland flow passing through the site, causing afflux downstream of the project boundary, extending as far as the rail embankment downstream. This results in 140 mm afflux at the site boundary, and 110 mm afflux at the rail embankment for the 1% AEP event. These impacts are based on the current conceptual design, and will be mitigated during the detailed design phase.
    - Downstream of the rail embankment, afflux returns to almost zero, as the rail embankment acts as a hydraulic control on the site. Freeboard to the top of the rail embankment is reduced from approximately 400 mm to approximately 290 mm under design 1% AEP conditions.

- Impact upstream of the development
    - Afflux occurs at the upstream western property boundary, however this is a localised impact only. This occurs due to the blockage of overland flow by the proposed substation, which, under existing conditions, flows without encumbrance. Afflux here reaches 125 mm for the 1% AEP event, but dissipates to 0 mm approximately 40 m beyond the property boundary. These impacts will be mitigated during the detailed design phase.

5.3 Recommendations

The identified hydraulic impacts reflect the current design philosophy of the site noting that the development is currently within its conceptual design phase. Several mitigation options are provided below for further investigation and consideration in detailed design phase. The proposed design recommendations to mitigate all offsite impacts identified above include:

- detailed design of the water storage dam to align with the development water balance philosophy and site drainage
- further design detail of the functionality of the water storages (to refine the initial water level assumptions and operating philosophy) is to be provided and included in detailed design development of the site. Detailed design information required to inform operational information regarding expected inflows and outflows. Currently, a conservative initial water level has been assumed for this structure, which therefore provides minimal flood mitigation
- modifications to the design terrain to reduce the encumbrance upon Four Mile Creek will be achieved through detailed design phase. These design detailed aim to reduce the impact to the cross-sectional capacity of the creek, thus reducing the afflux within the watercourse. These changes, along with other updates to site drainage, are proposed to be engineered for inclusion during detailed design to mitigate hydraulic impacts of the development.

6 Summary

Hydrologic and hydraulic modelling has been undertaken to assess the potential impacts of the proposed Package 1 – BESS, transmission line and substation development. The modelling builds on previous work completed within the catchment, capturing previous hydrologic calibration, as well as prescribed climate change scaling.

Design flood events ranging from the 10% AEP to the 0.2 % AEP were simulated using two TUFLOW models. The Tier 1 model assessed broader catchment interactions, and the Tier 2 model provided refined representation of the various watercourses and their interaction with the site and proposed infrastructure.

Results indicate that flood immunity requirements for the project can be achieved, however the project also generates some relatively small, localised hydraulic impacts on surrounding areas extending to the rail embankment downstream of the site. Mitigation options will be employed to avoid offsite impacts, and will be confirmed as part of detailed design. Several mitigation options are identified for consideration in this report.

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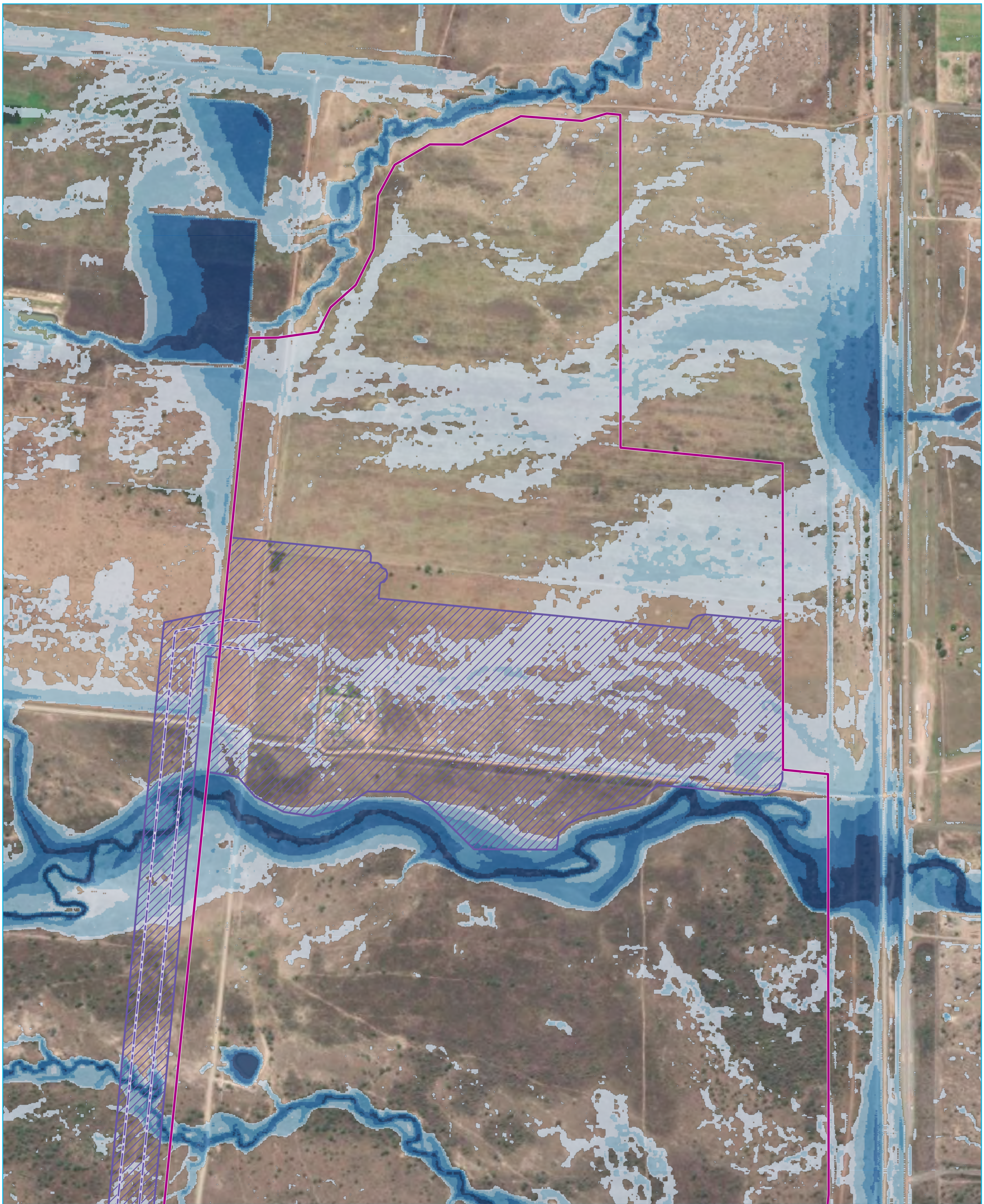
Attachment A

Flood mapping

EMM
creating opportunities



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Source: EMM (2025); DES (2025); DNRMMRRD (2025); ESRI (2025); GA (2011)

0 250 500 m

GDA2020 MGA Zone 55

N

KEY

Northern Quartz Campus

Package 1 - Premises

Package 1 - Transmission line

Existing environment

Major road

Minor road

Vehicular track

Named watercourse

Peak flood depth (m)

< 0.05

0.05 - 0.1

0.1 - 0.25

0.25 - 0.5

0.5 - 1

> 1

Peak depths - existing scenario - 10% AEP

Northern Quartz Campus

Package 1 - BESS, transmission line and substation

Flood Impact Statement

Figure A1.1

EMM creating opportunities

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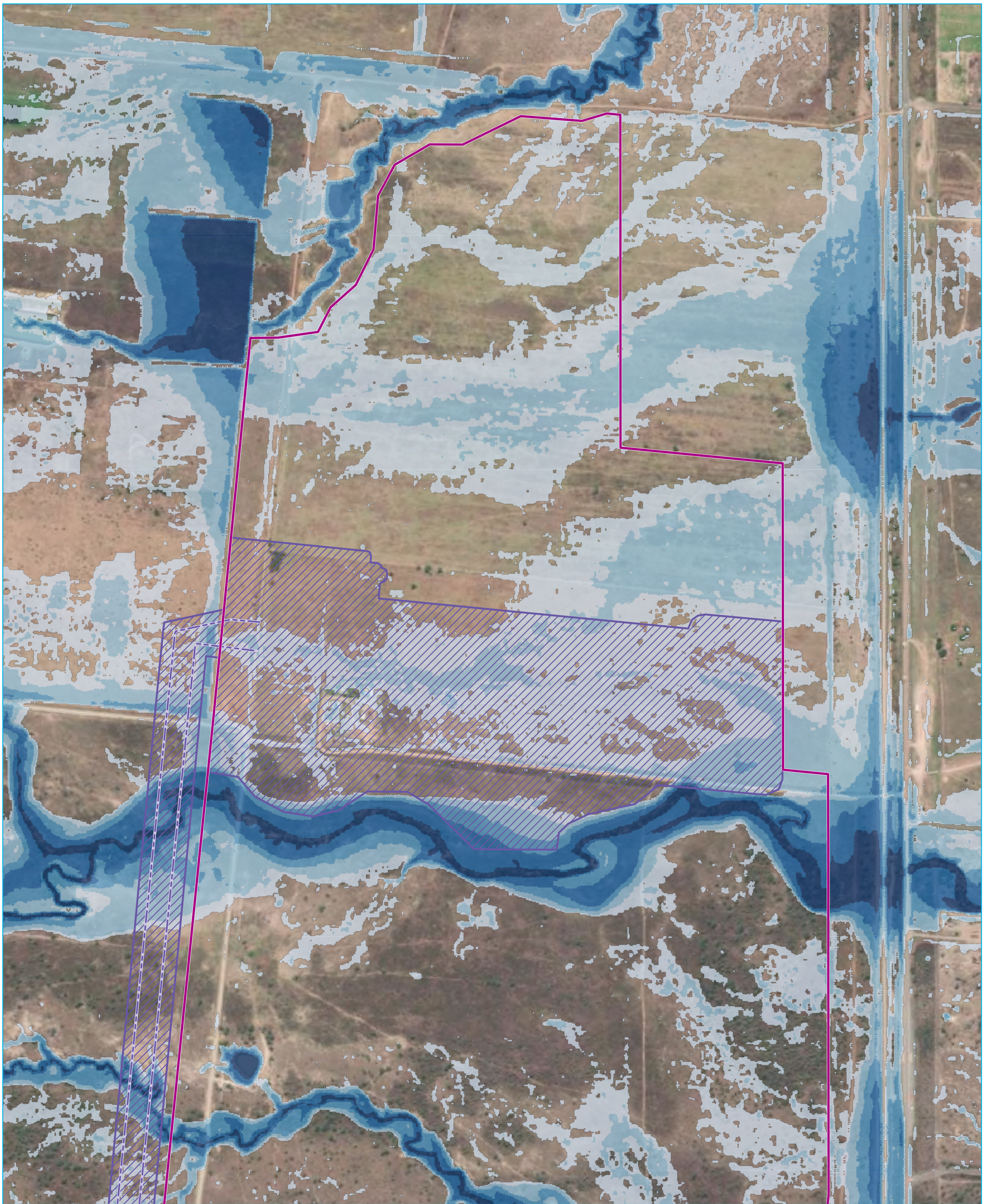

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0 250 500 m
GDA2020 MGA Zone 55
N

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KEY

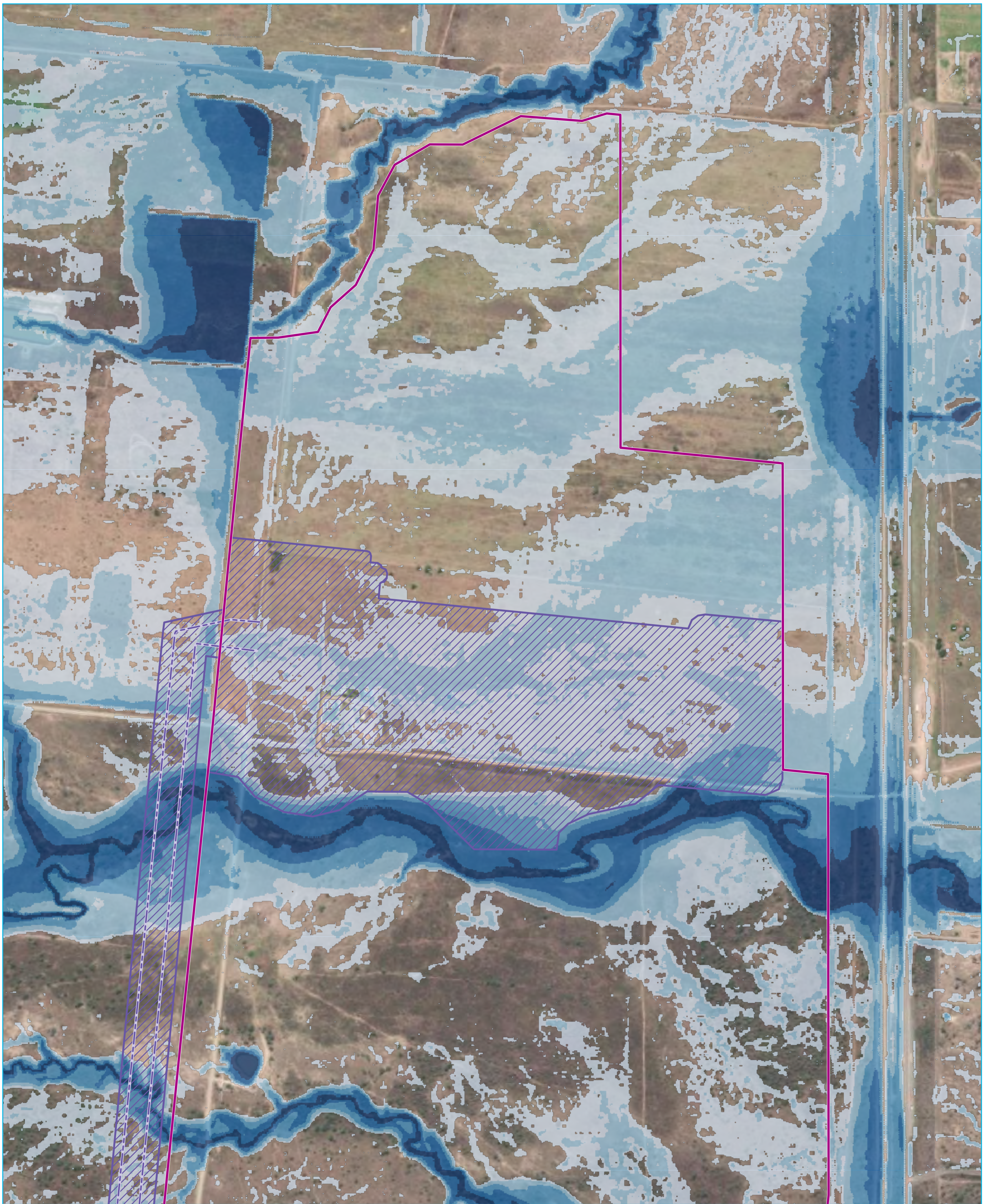
Northern Quartz Campus
Package 1 - Premises
Package 1 - Transmission line
Existing environment
Major road
Minor road
Vehicular track
Named watercourse

Peak flood depth (m)
< 0.05
0.05 - 0.1
0.1 - 0.25
0.25 - 0.5
0.5 - 1
> 1

Peak depths - existing scenario - 1% AEP

Northern Quartz Campus
Package 1 - BESS, transmission line and substation
Flood Impact Statement
Figure A1.2

EMM
creating opportunities



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0 250 500
m
GDA2020 MGA Zone 55
N

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KEY

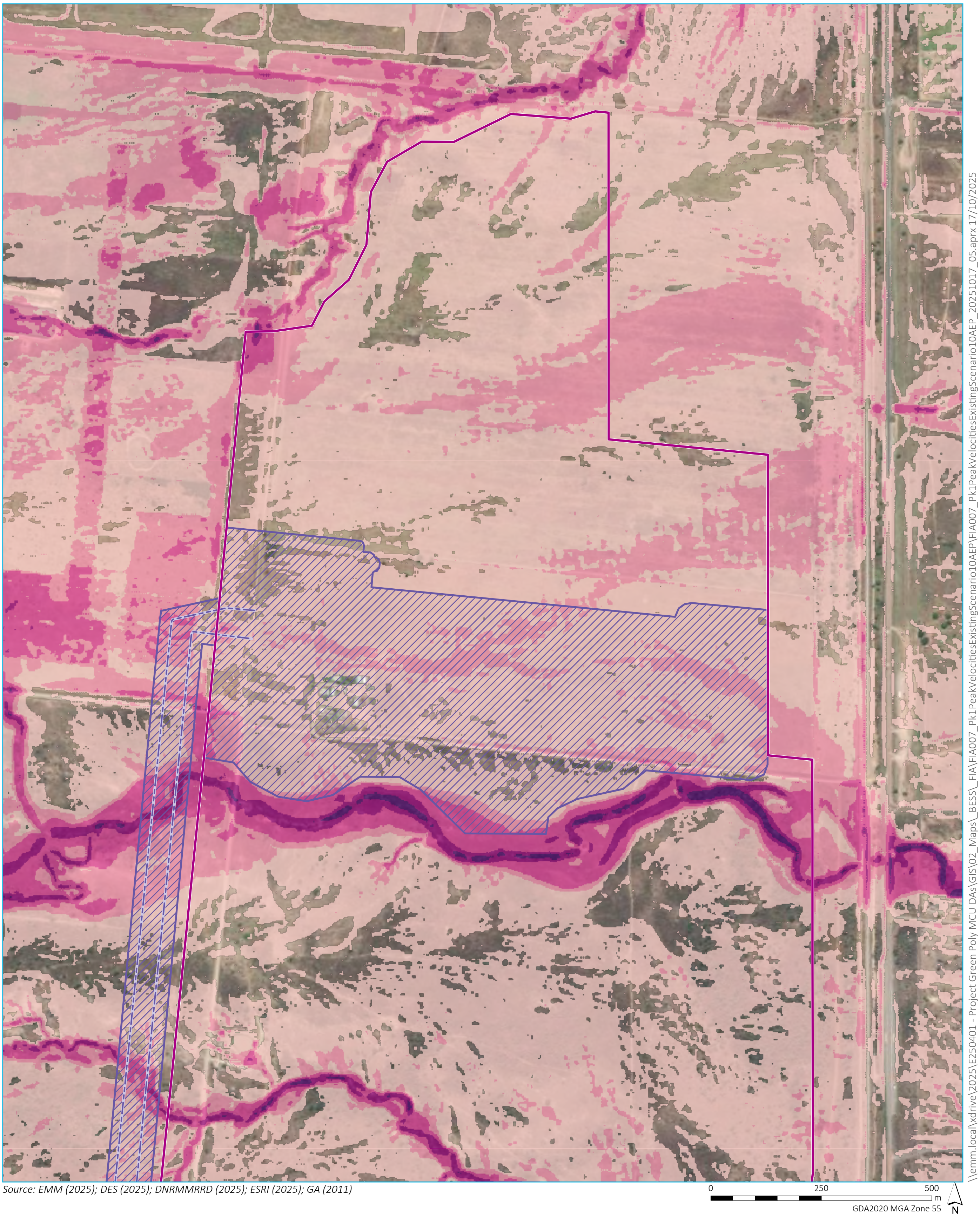
Northern Quartz Campus
Package 1 - Premises
Package 1 - Transmission line
Existing environment
Major road
Minor road
Vehicular track
Named watercourse

Peak flood depth (m)
< 0.05
0.05 - 0.1
0.1 - 0.25
0.25 - 0.5
0.5 - 1
> 1

Peak depths - existing scenario - 0.2% AEP

Northern Quartz Campus
Package 1 - BESS, transmission line and substation
Flood Impact Statement
Figure A1.3

EMM
creating opportunities



Source: EMM (2025); DES (2025); DNRMMRRD (2025); ESRI (2025); GA (2011)

KEY

Northern Quartz Campus

Package 1 - Premises

Package 1 - Transmission line

Existing environment

Major road

Minor road

Vehicular track

Named watercourse

Peak water velocity (m/s)

< 0.1

0.1 - 0.25

0.25 - 0.5

0.5 - 1

1 - 1.5

> 1.5

Peak velocities - existing scenario - 10% AEP

Northern Quartz Campus
Package 1 - BESS, transmission line and substation
Flood Impact Statement
Figure A1.4

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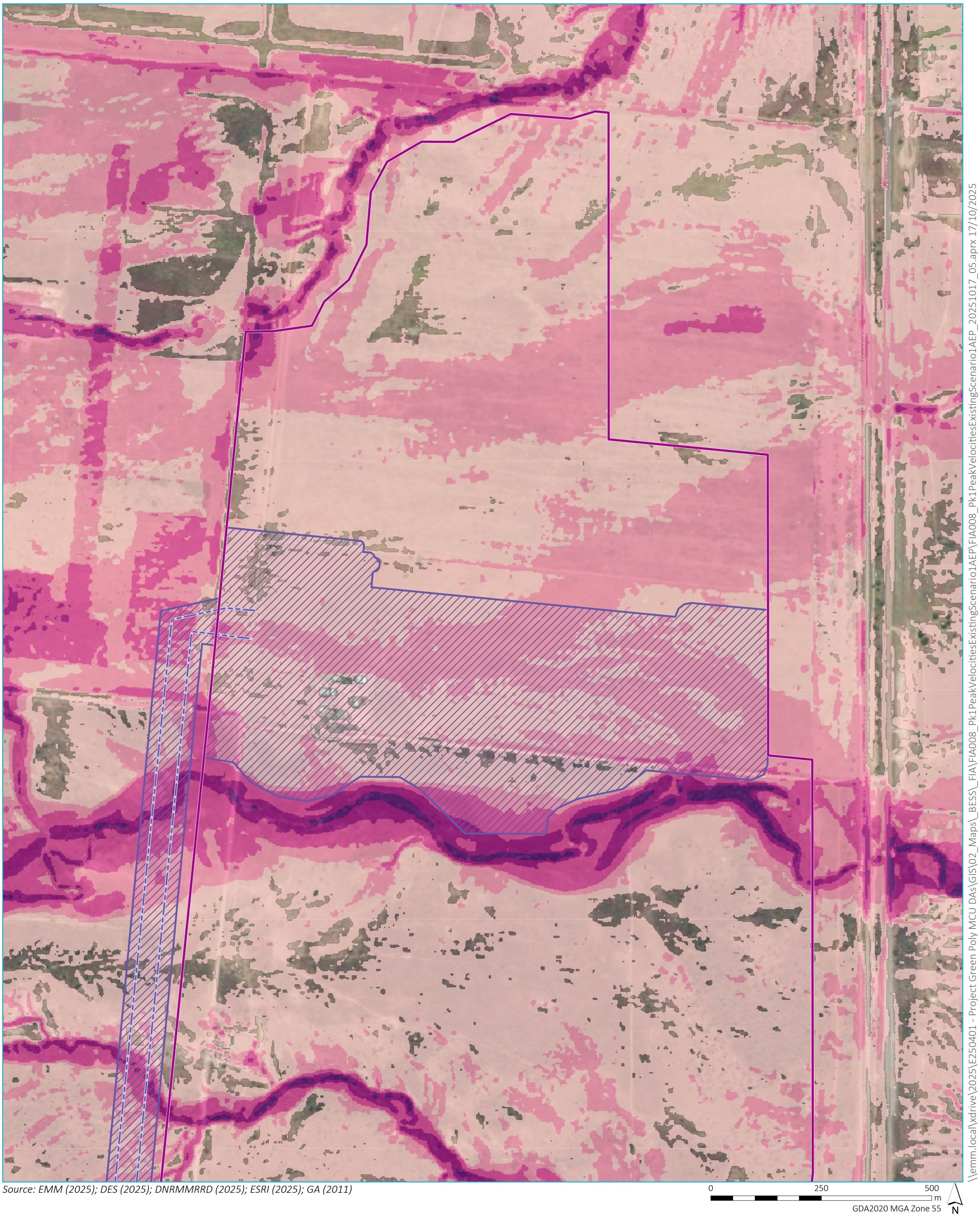


Source: EMM (2025); DES (2025); DNRMMRRD (2025); ESRI (2025); GA (2011)

KEY

Northern Quartz Campus

Package 1 - Premises

Package 1 - Transmission line

Existing environment

Major road

Minor road

Vehicular track

Named watercourse

Peak water velocity (m/s)

< 0.1

0.1 - 0.25

0.25 - 0.5

0.5 - 1

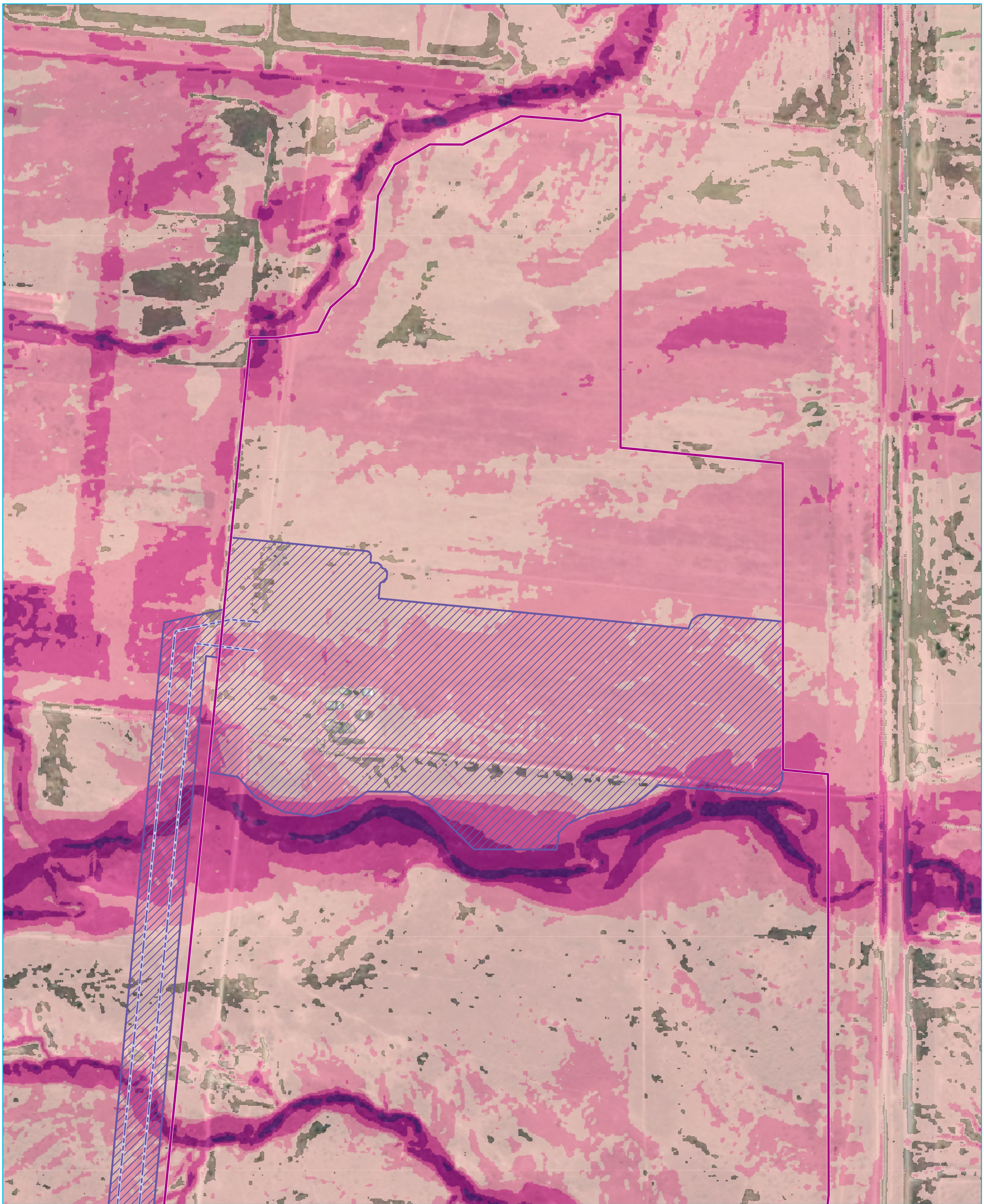
1 - 1.5

> 1.5

Peak velocities - existing scenario - 1% AEP

Northern Quartz Campus
Package 1 - BESS, transmission line and substation
Flood Impact Statement
Figure A1.5

EMM creating opportunities



Source: EMM (2025); DES (2025); DNRMMRRD (2025); ESRI (2025); GA (2011)

0 250 500 m

GDA2020 MGA Zone 55

N

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KEY

Northern Quartz Campus

Package 1 - Premises

Package 1 - Transmission line

Existing environment

Major road

Minor road

Vehicular track

Named watercourse

Peak water velocity (m/s)

< 0.1

0.1 - 0.25

0.25 - 0.5

0.5 - 1

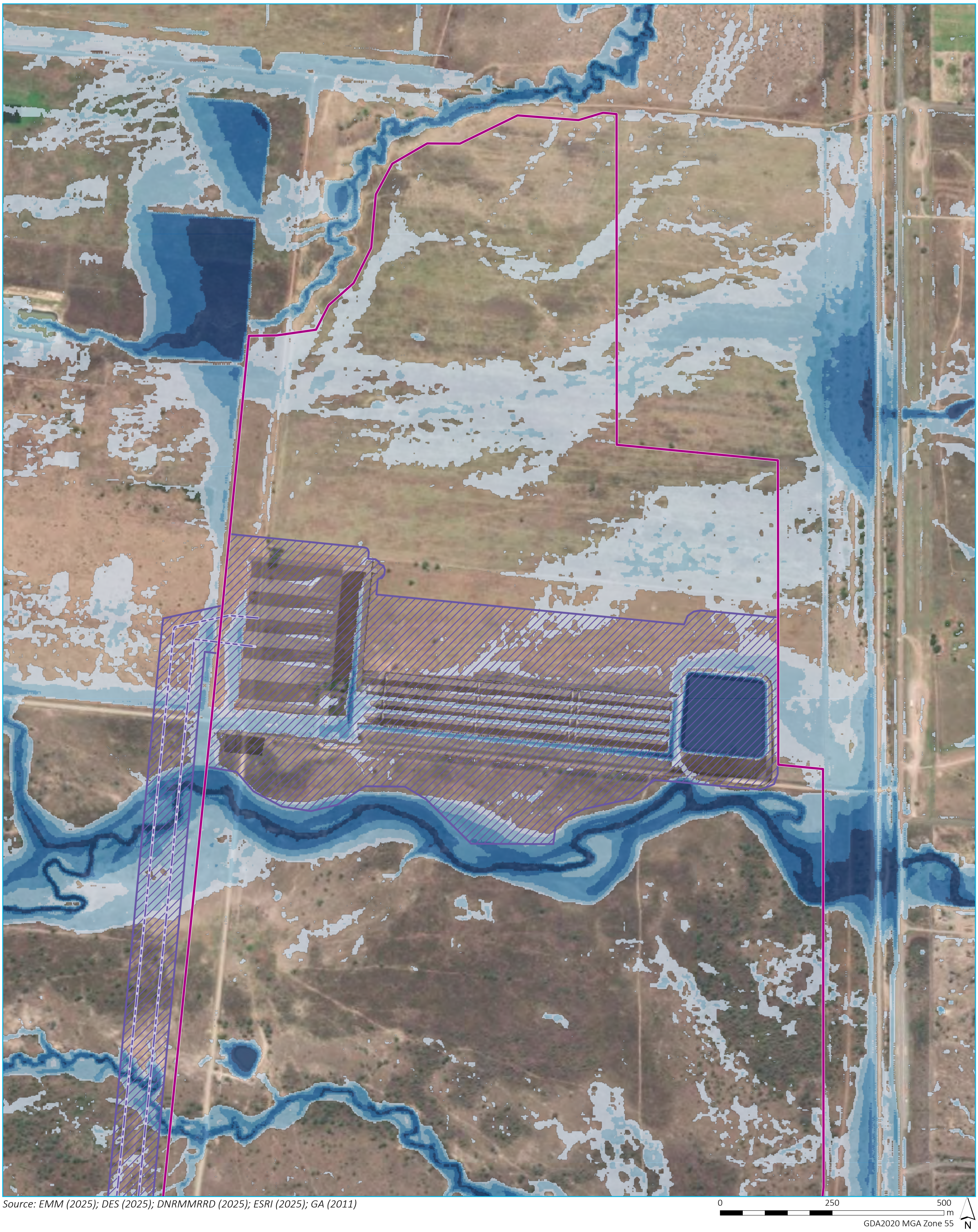
1 - 1.5

> 1.5

Peak velocities - existing scenario - 0.2% AEP

Northern Quartz Campus
Package 1 - BESS, transmission line and substation
Flood Impact Statement
Figure A1.6

creating opportunities



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KEY

Northern Quartz Campus

Package 1- Premises

Package 1- Transmission line

Existing environment

Major road

Minor road

Vehicular track

Named watercourse

Peak flood depth (m)

< 0.05

0.05- 0.1

0.1- 0.25

0.25- 0.5

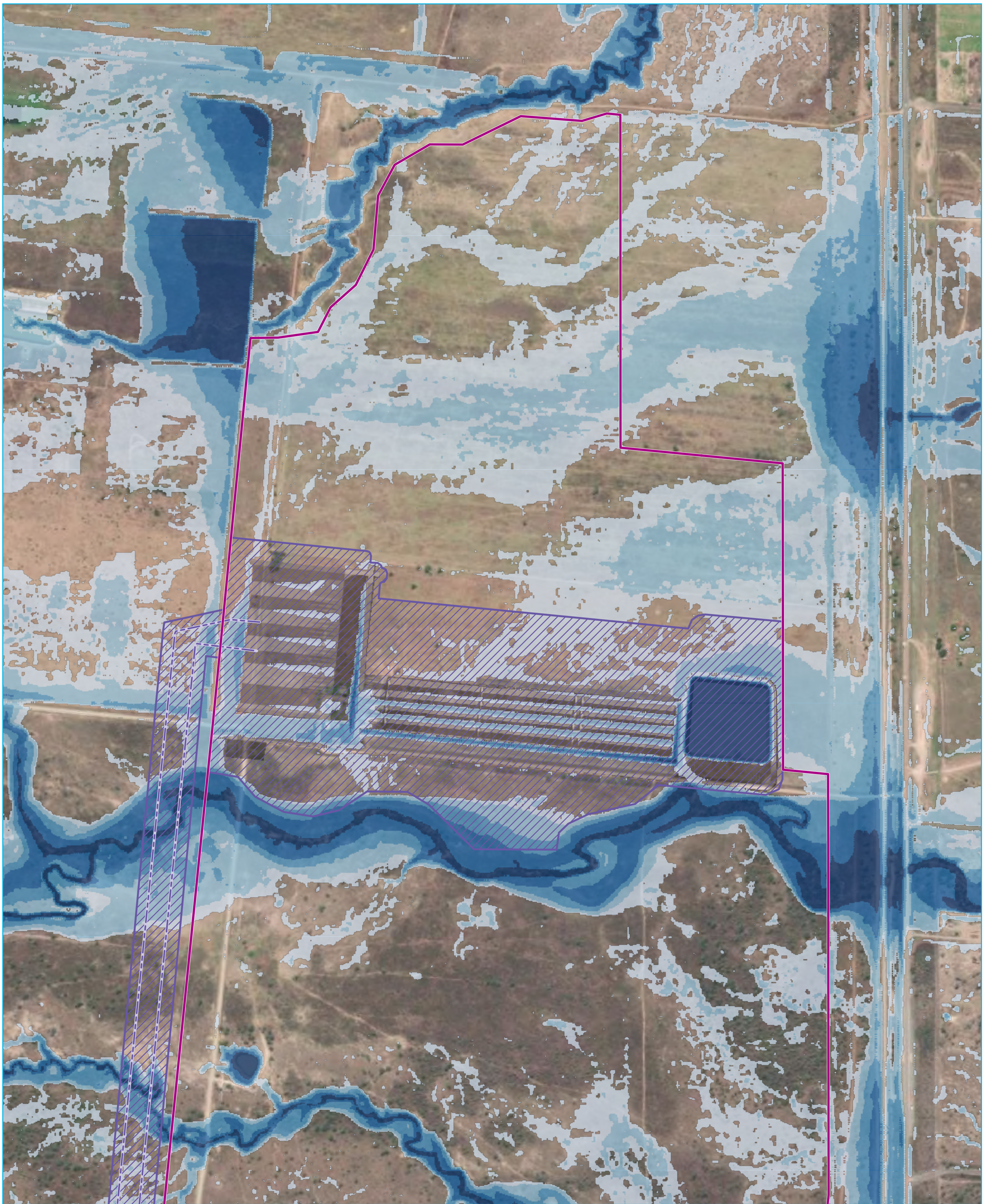
0.5- 1

> 1

Peak depths- proposed scenario- 10% AEP

Northern Quartz Campus
Package 1- BESS, transmission line and substation
Flood Impact Statement
Figure A1.7

EMM
creating opportunities



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0 250 500 m
GDA2020 MGA Zone 55
N

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KEY

Northern Quartz Campus
Package 1- Premises
Package 1- Transmission line

Existing environment
Major road
Minor road
Vehicular track
Named watercourse

Peak flood depth (m)
< 0.05
0.05- 0.1
0.1- 0.25
0.25- 0.5
0.5- 1
> 1

Peak depths- proposed scenario- 1% AEP

Northern Quartz Campus
Package 1- BESS, transmission line and substation
Flood Impact Statement
Figure A1.8

EMM
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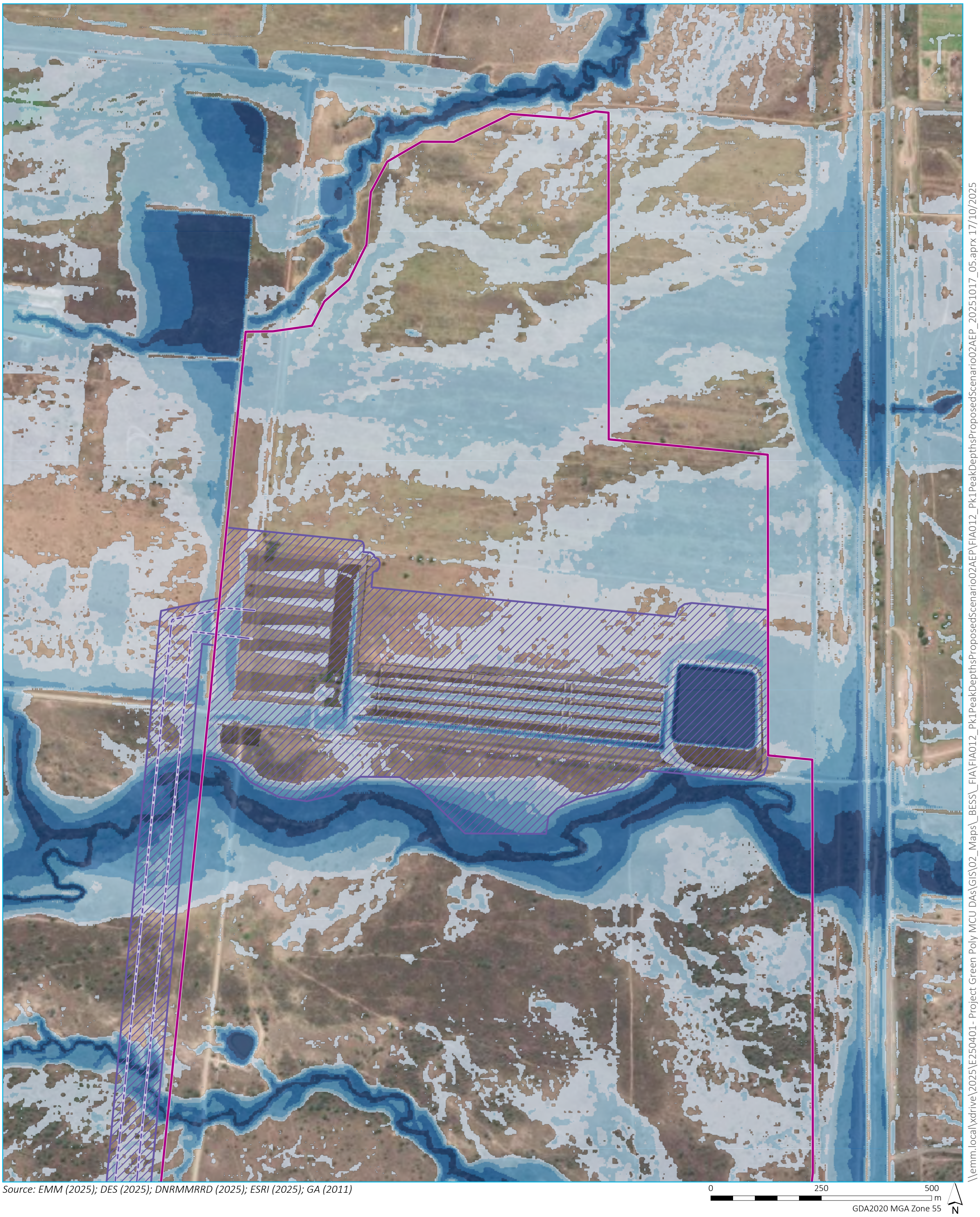

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KEY

Northern Quartz Campus

Package 1- Premises

Package 1- Transmission line

Existing environment

Major road

Minor road

Vehicular track

Named watercourse

Peak flood depth (m)

< 0.05

0.05- 0.1

0.1- 0.25

0.25- 0.5

0.5- 1

> 1

Peak depths- proposed scenario- 0.2% AEP

Northern Quartz Campus
Package 1- BESS, transmission line and substation
Flood Impact Statement
Figure A1.9

EMM creating opportunities

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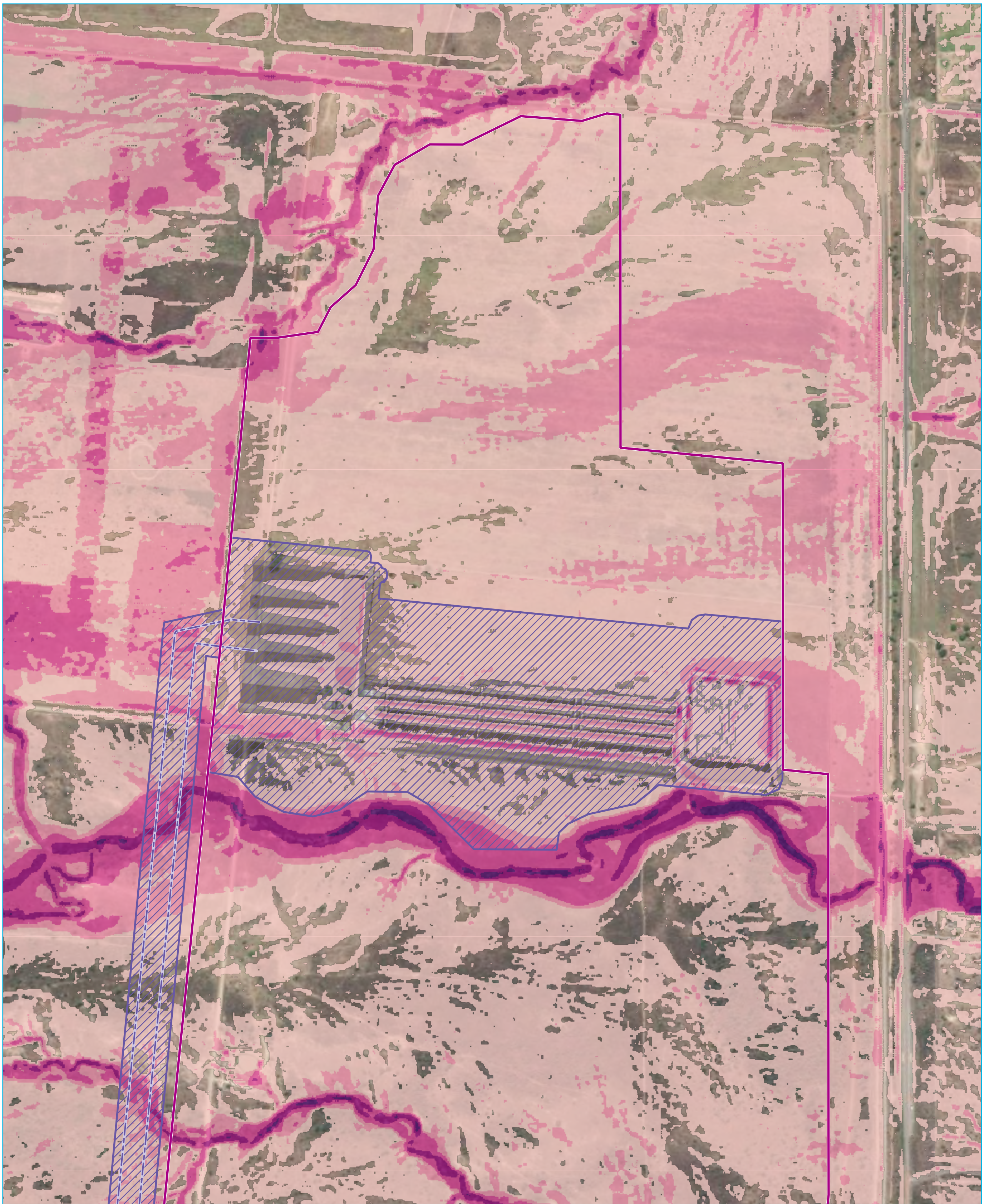

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0 250 500
m
GDA2020 MGA Zone 55
N

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KEY

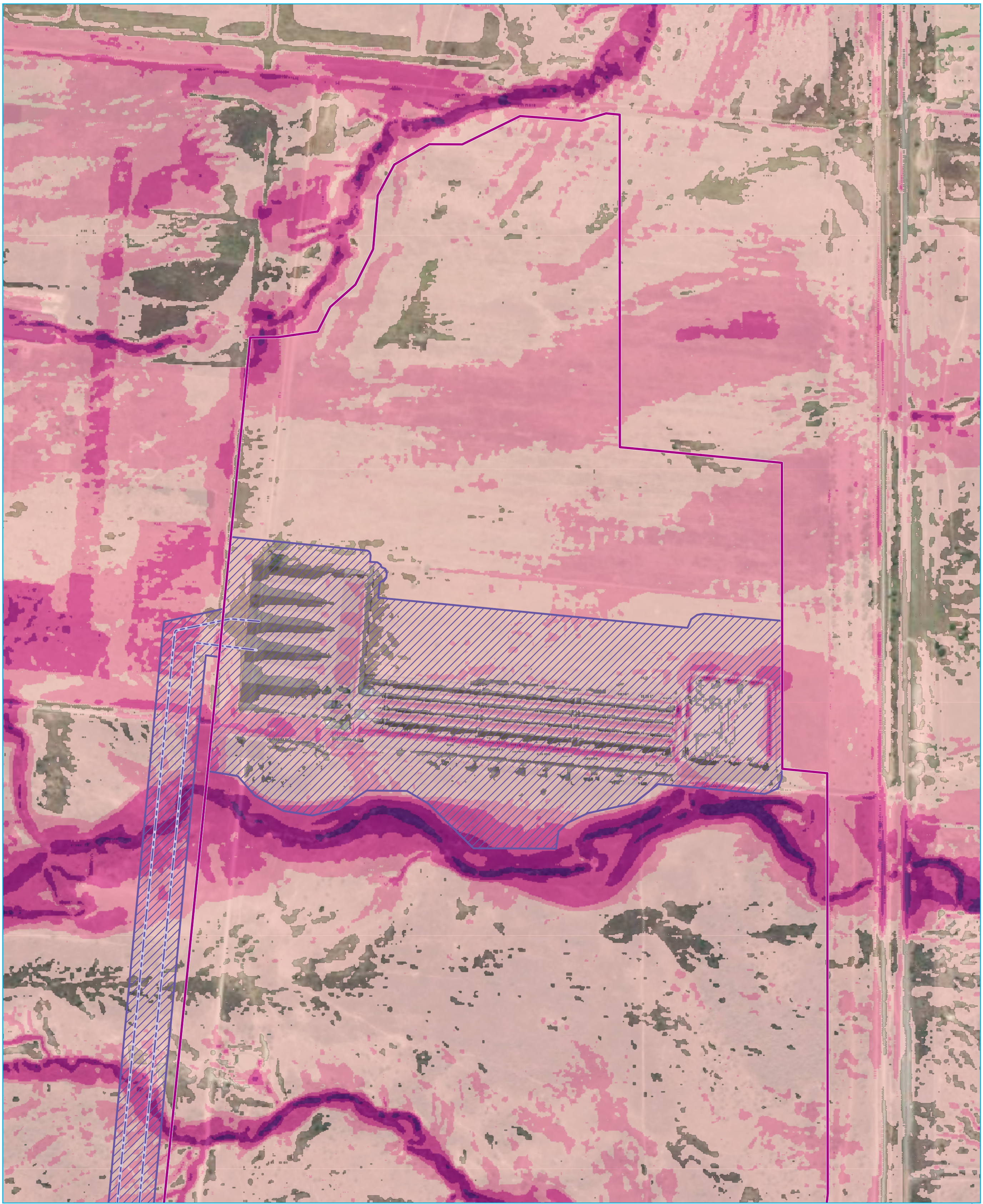
Northern Quartz Campus
Package 1 - Premises
Package 1 - Transmission line
Existing environment
Major road
Minor road
Vehicular track
Named watercourse

Peak water velocity (m/s)
< 0.1
0.1 - 0.25
0.25 - 0.5
0.5 - 1
1 - 1.5
> 1.5

Peak velocities - proposed scenario - 10% AEP

Northern Quartz Campus
Package 1 - BESS, transmission line and substation
Flood Impact Statement
Figure A1.10

EMM
creating opportunities



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KEY

Northern Quartz Campus

Package 1 - Premises

Package 1 - Transmission line

Existing environment

Major road

Minor road

Vehicular track

Named watercourse

Peak water velocity (m/s)

< 0.1

0.1 - 0.25

0.25 - 0.5

0.5 - 1

1 - 1.5

> 1.5

Peak velocities - proposed scenario - 1% AEP

Northern Quartz Campus
Package 1 - BESS, transmission line and substation
Flood Impact Statement
Figure A1.11

EMM
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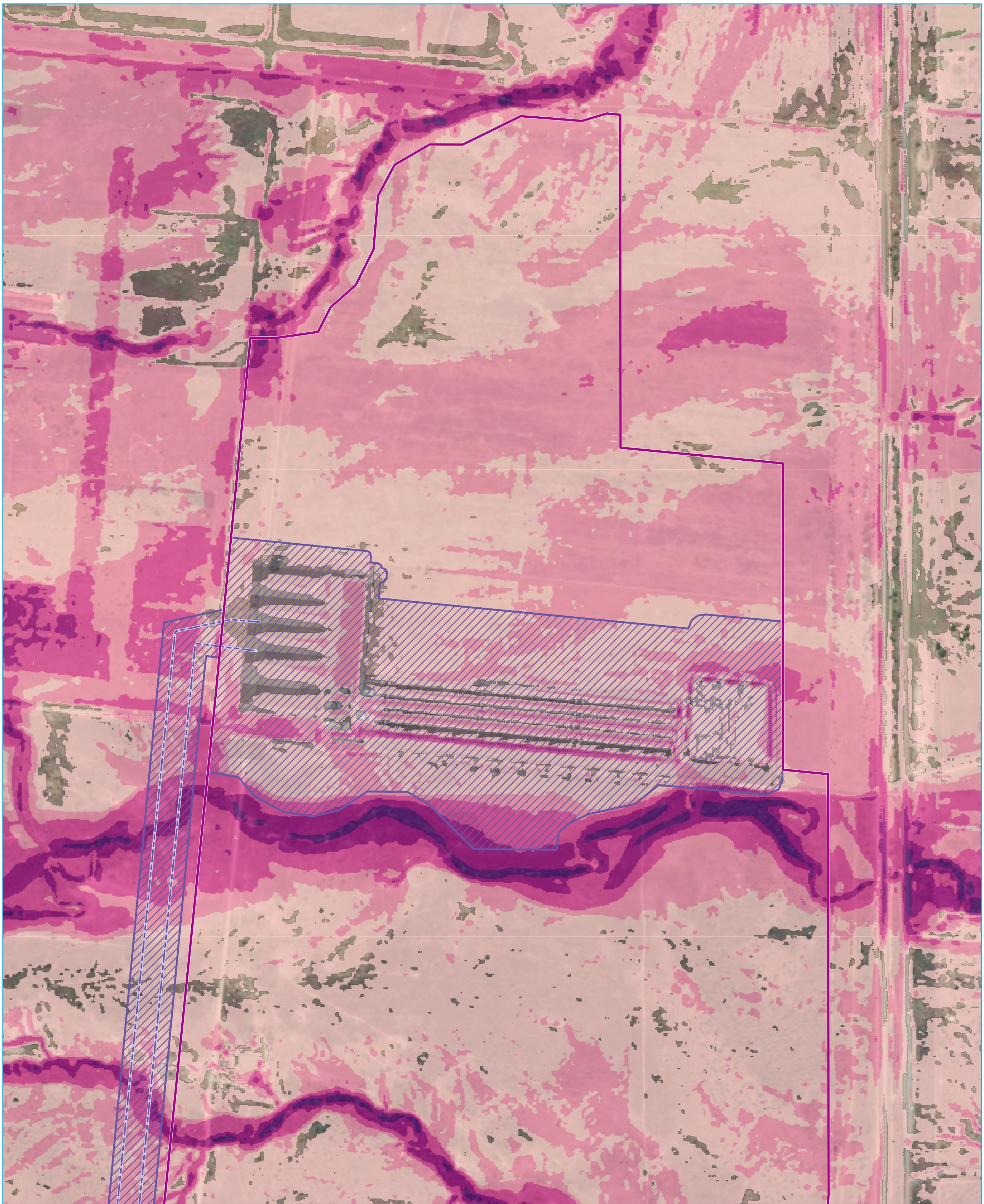

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KEY

Northern Quartz Campus

Package 1 - Premises

Package 1 - Transmission line

Existing environment

Major road

Minor road

Vehicular track

Named watercourse

Peak water velocity (m/s)

< 0.1

0.1 - 0.25

0.25 - 0.5

0.5 - 1

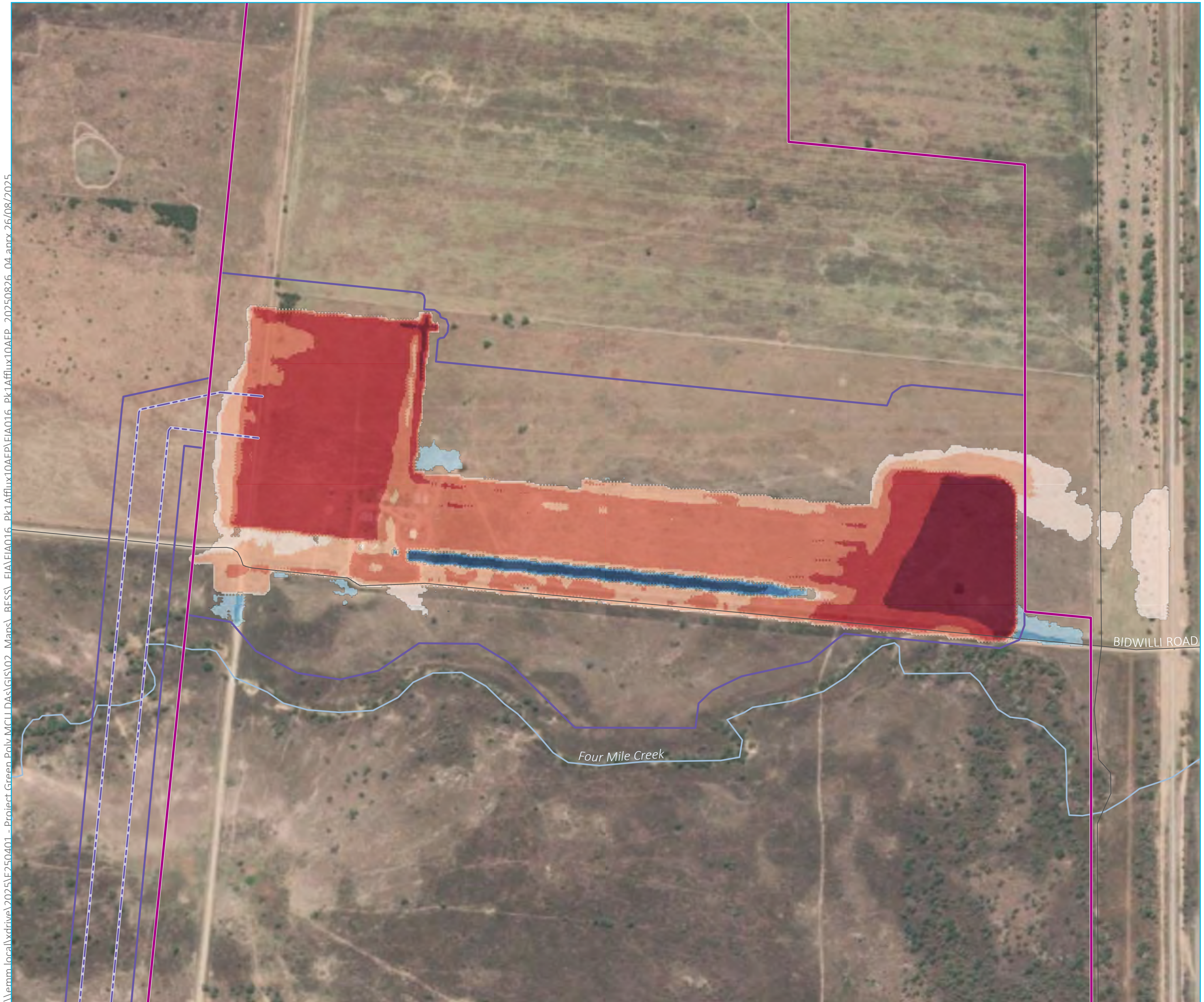
1 - 1.5

> 1.5

Peak velocities - proposed scenario - 0.2% AEP

Northern Quartz Campus
Package 1 - BESS, transmission line and substation
Flood Impact Statement
Figure A1.12

EMM creating opportunities



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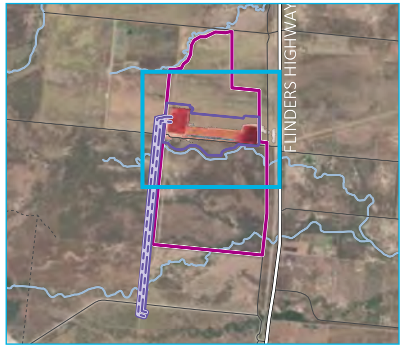

KEY

Northern Quartz Campus

Package 1 - Premises

Package 1 - Transmission line

Change in peak flood level (m)

< -0.5

-0.5 - -0.25

-0.25 - -0.1

-0.1 - -0.05

-0.05 - 0.05

0.05 - 0.1

0.1 - 0.25

0.25 - 0.5

0.5 - 1

> 1

Existing environment

Major road

Minor road

Vehicular track

Named watercourse

Afflux - 10% AEP

Northern Quartz Campus
Package 1
BESS, transmission line and substation
Flood Impact Statement
Figure A1.13

EMM creating opportunities

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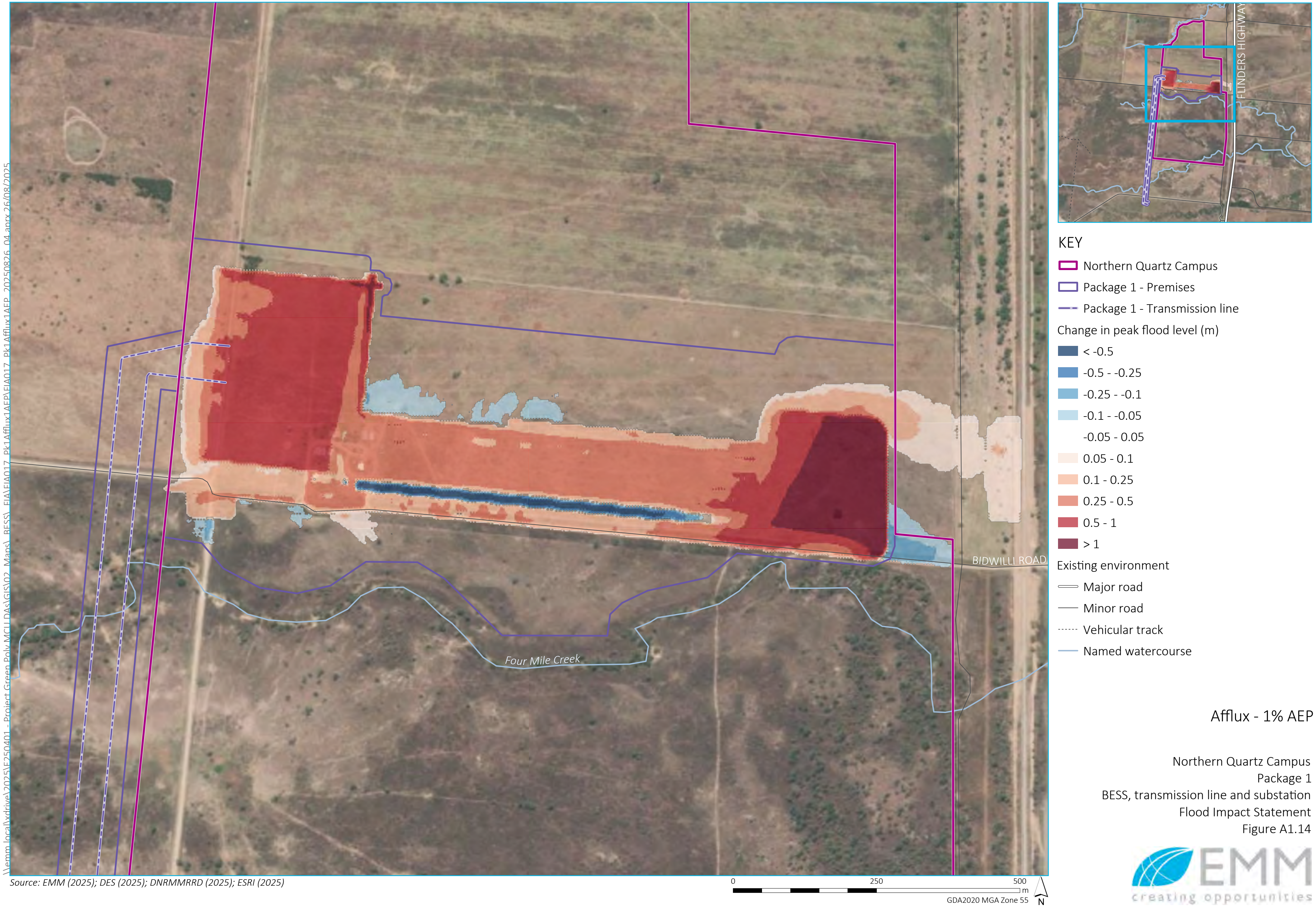
Version: 1, Version Date: 12/11/2025



Source: EMM (2025); DES (2025); DNRMMRRD (2025); ESRI (2025)

KEY

- Northern Quartz Campus
- Package 1 - Premises
- Package 1 - Transmission line

Change in peak flood level (m)

- < -0.5
- -0.5 - -0.25
- -0.25 - -0.1
- -0.1 - -0.05
- -0.05 - 0.05
- 0.05 - 0.1
- 0.1 - 0.25
- 0.25 - 0.5
- 0.5 - 1
- > 1

Existing environment

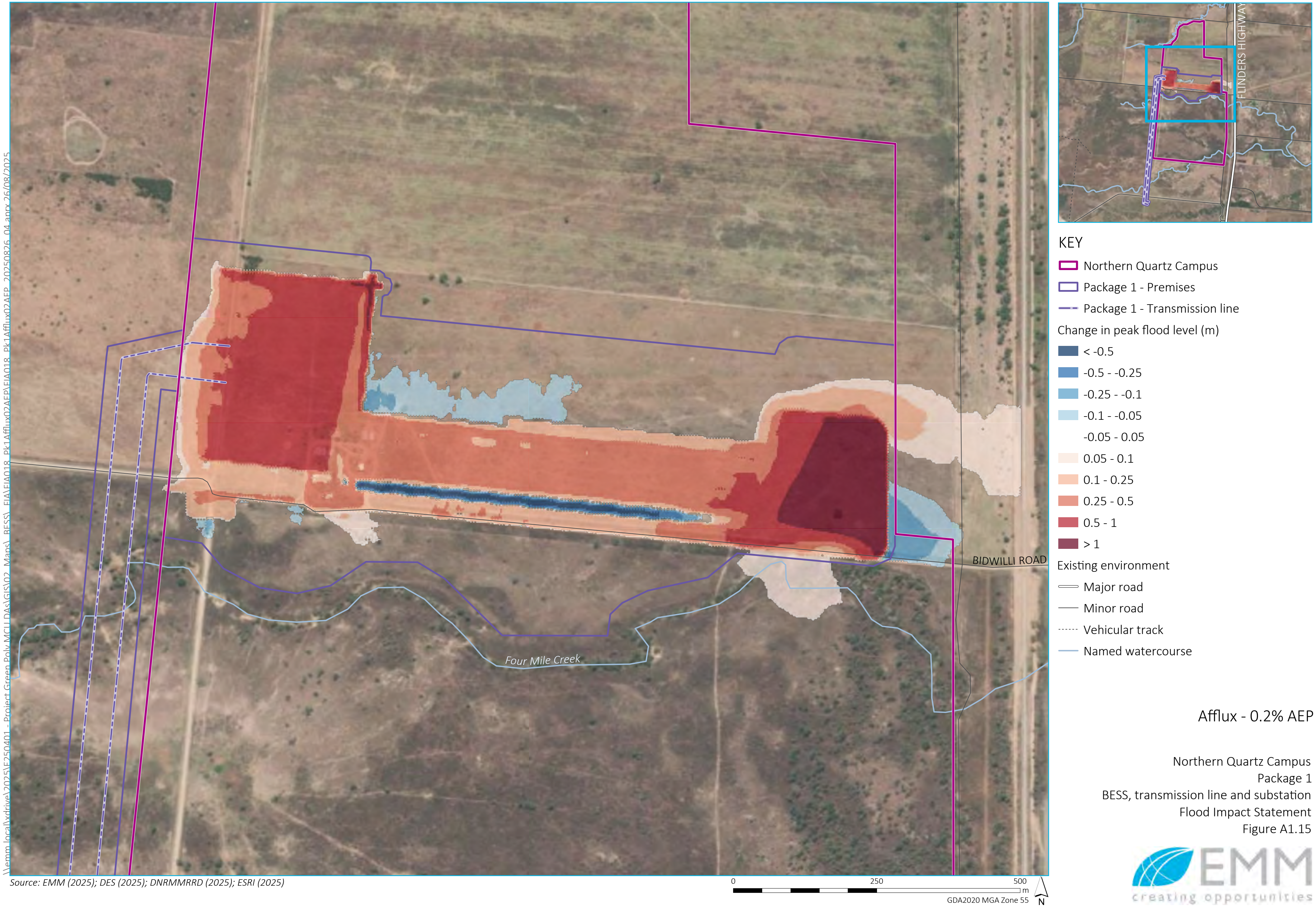
- Major road
- Minor road
- Vehicular track
- Named watercourse

Afflux - 1% AEP

Northern Quartz Campus
Package 1
BESS, transmission line and substation
Flood Impact Statement
Figure A1.14

creating opportunities

Document Set ID: 27757248
Version: 1, Version Date: 12/11/2025



KEY

Northern Quartz Campus
Package 1 - Premises
Package 1 - Transmission line

Change in peak flood level (m)

< -0.5
-0.5 - -0.25
-0.25 - -0.1
-0.1 - -0.05
-0.05 - 0.05
0.05 - 0.1
0.1 - 0.25
0.25 - 0.5
0.5 - 1
> 1

Existing environment

Major road
Minor road
Vehicular track
Named watercourse

Source: EMM (2025); DES (2025); DNRMMRRD (2025); ESRI (2025)

Afflux - 0.2% AEP

Northern Quartz Campus
Package 1
BESS, transmission line and substation
Flood Impact Statement
Figure A1.15

EMM
creating opportunities

Document Set ID: 27757248
Version: 1, Version Date: 12/11/2025

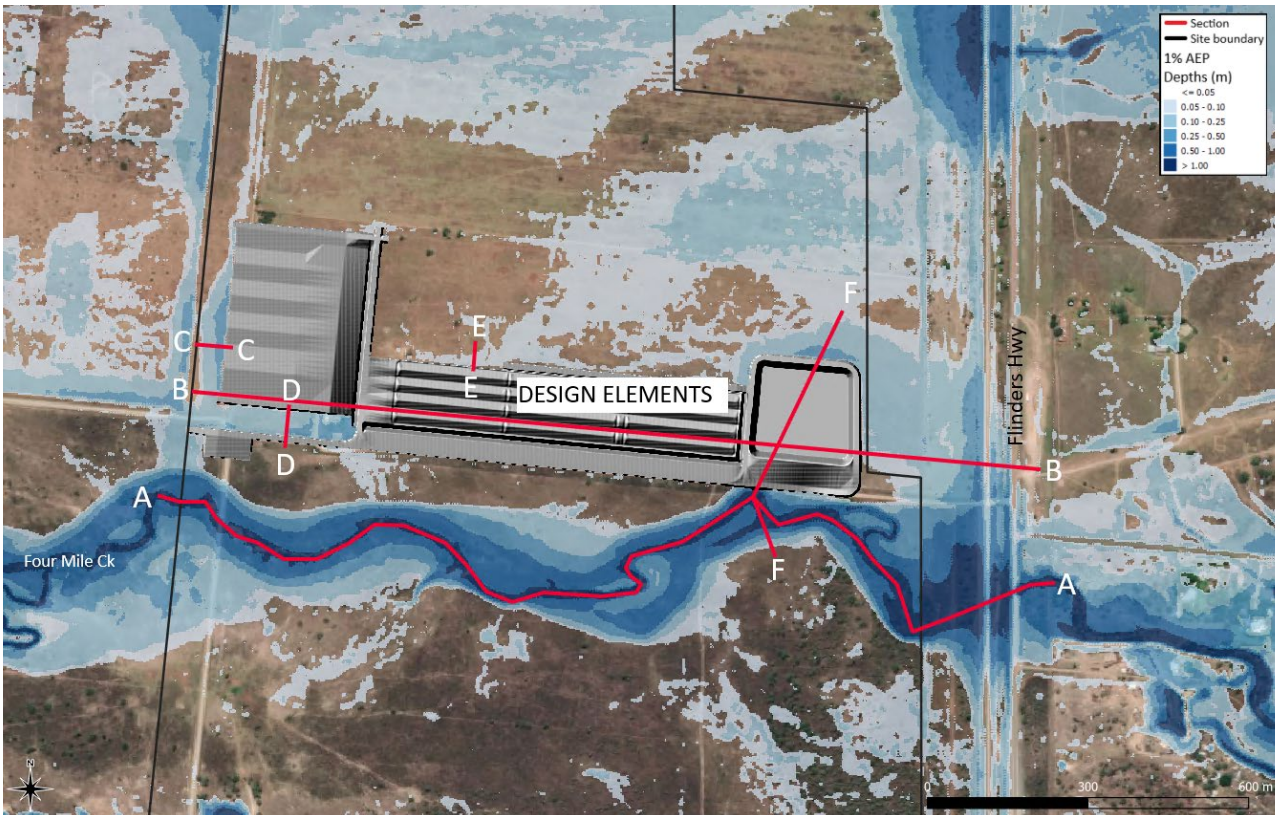


Figure A2.1 Longitudinal section locations – Plan view

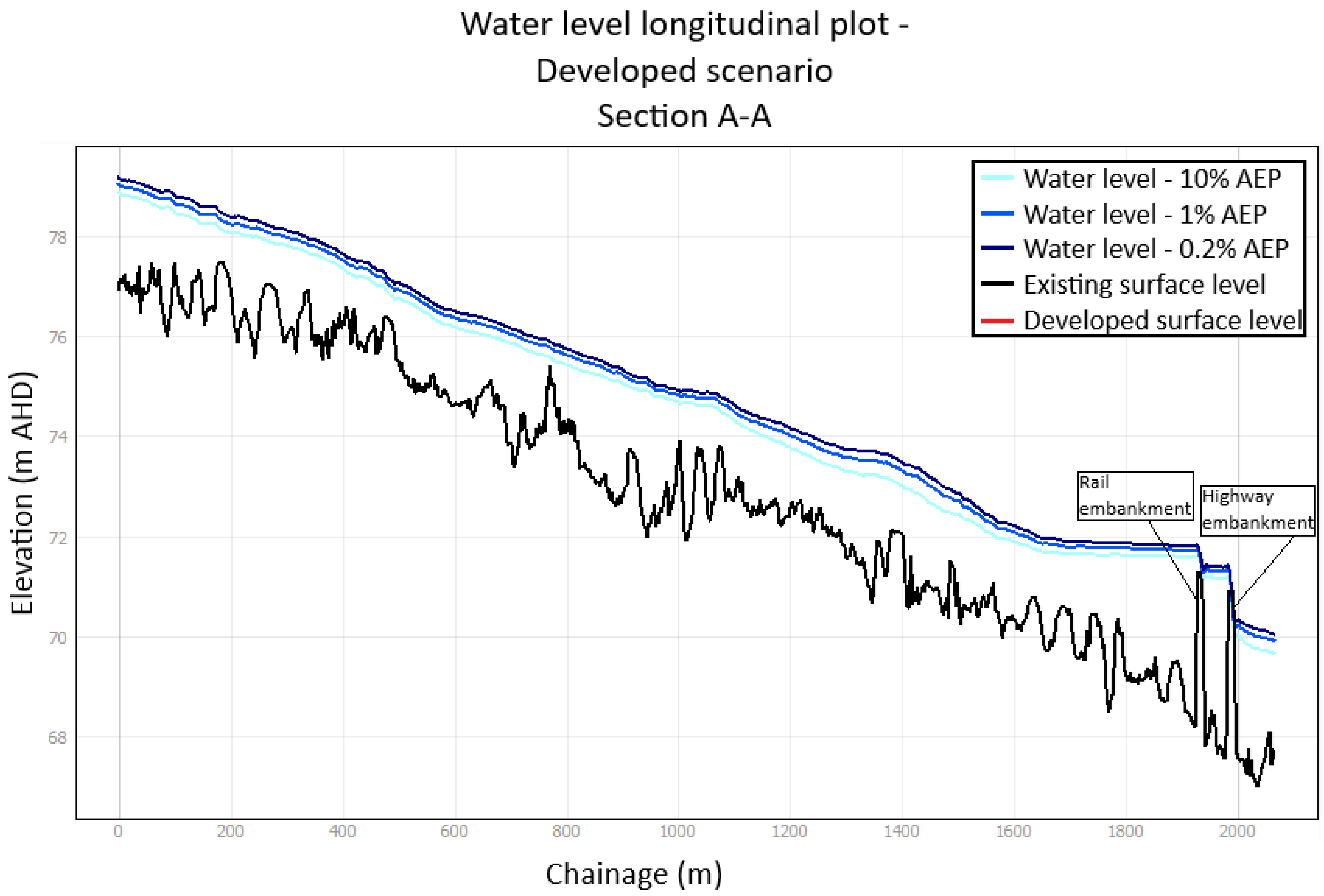


Figure A2.2 Water level longitudinal section – Section A-A

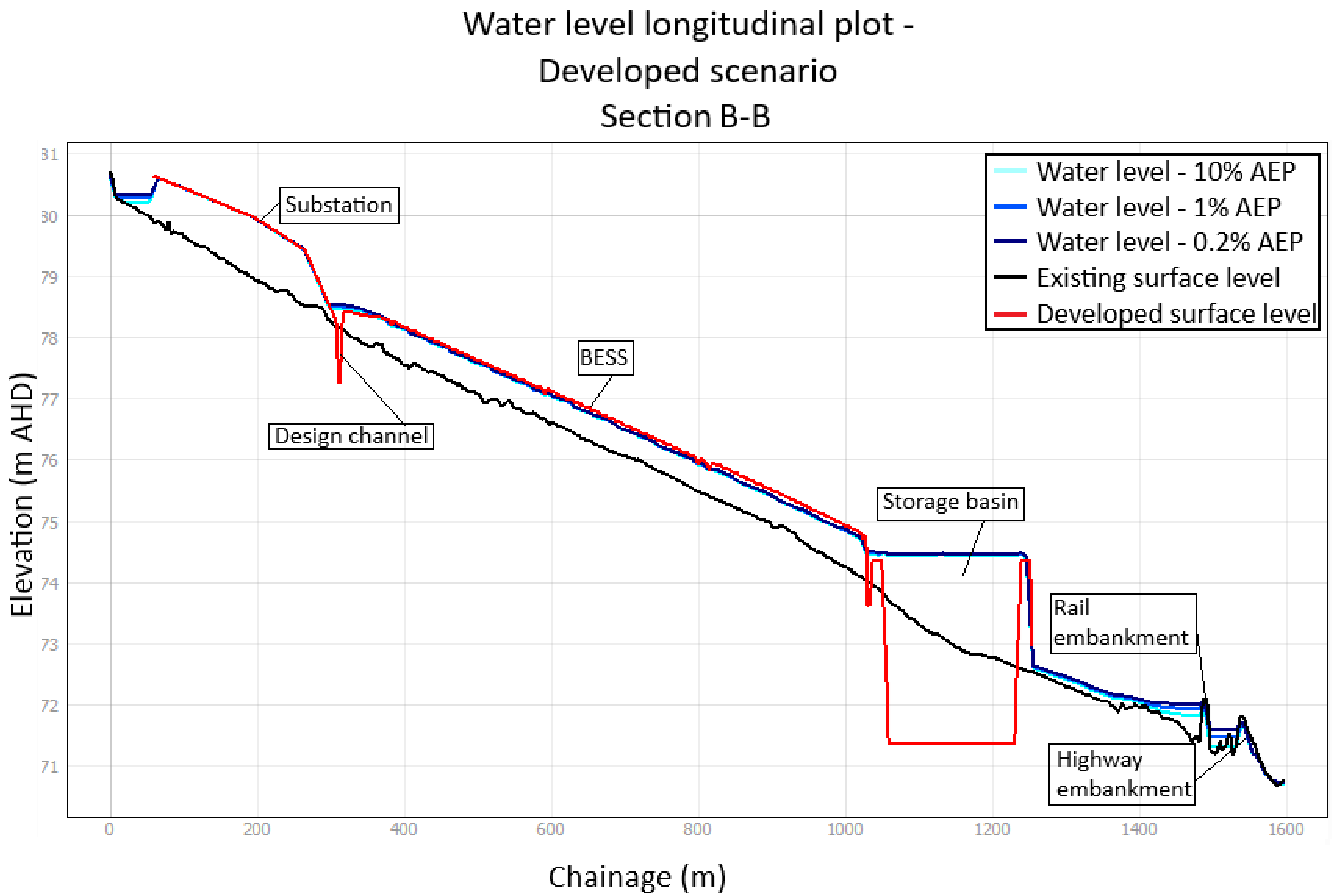


Figure A2.3 Water level longitudinal section – Section B-B

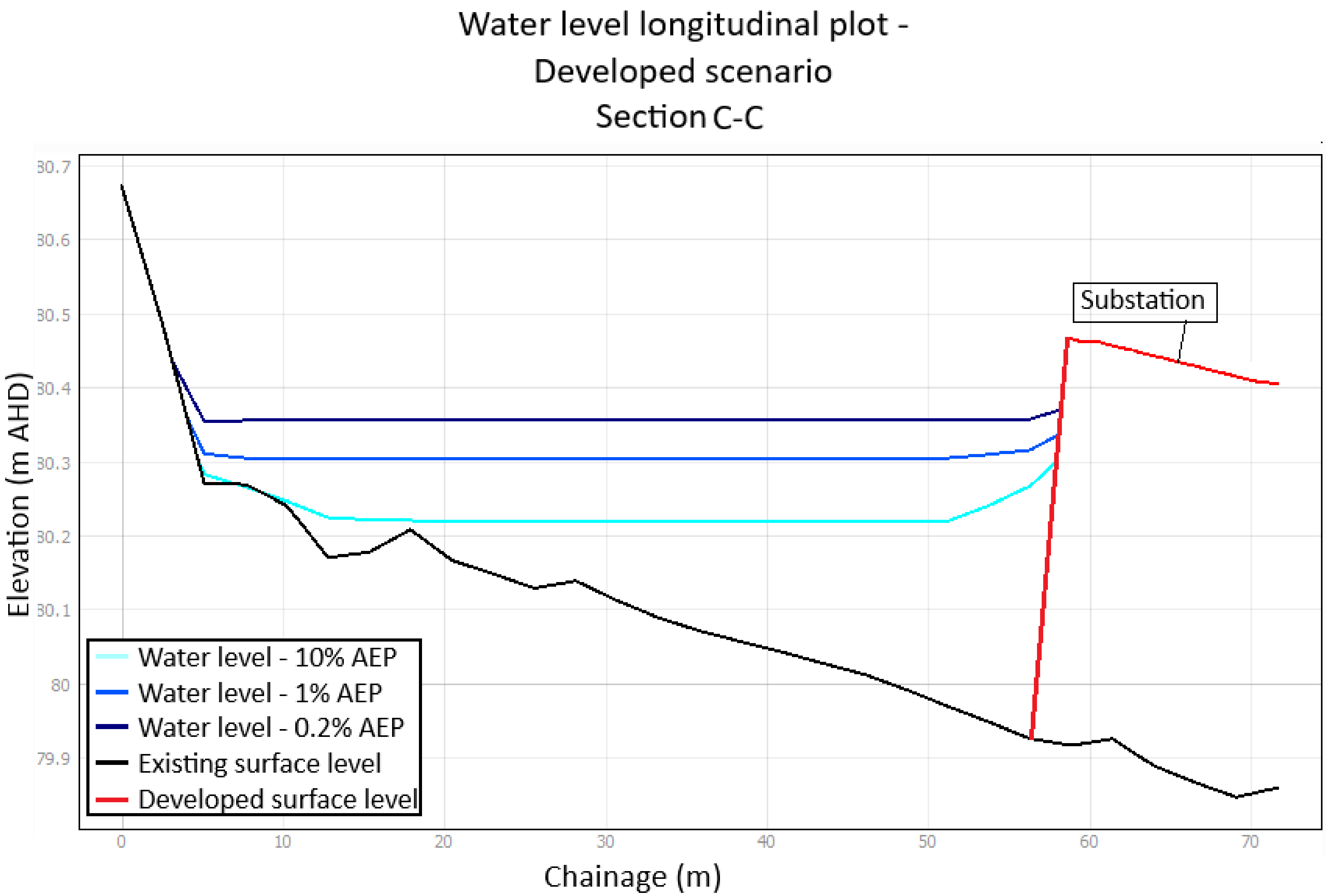


Figure A2.4 **Water level longitudinal section – Section C-C**

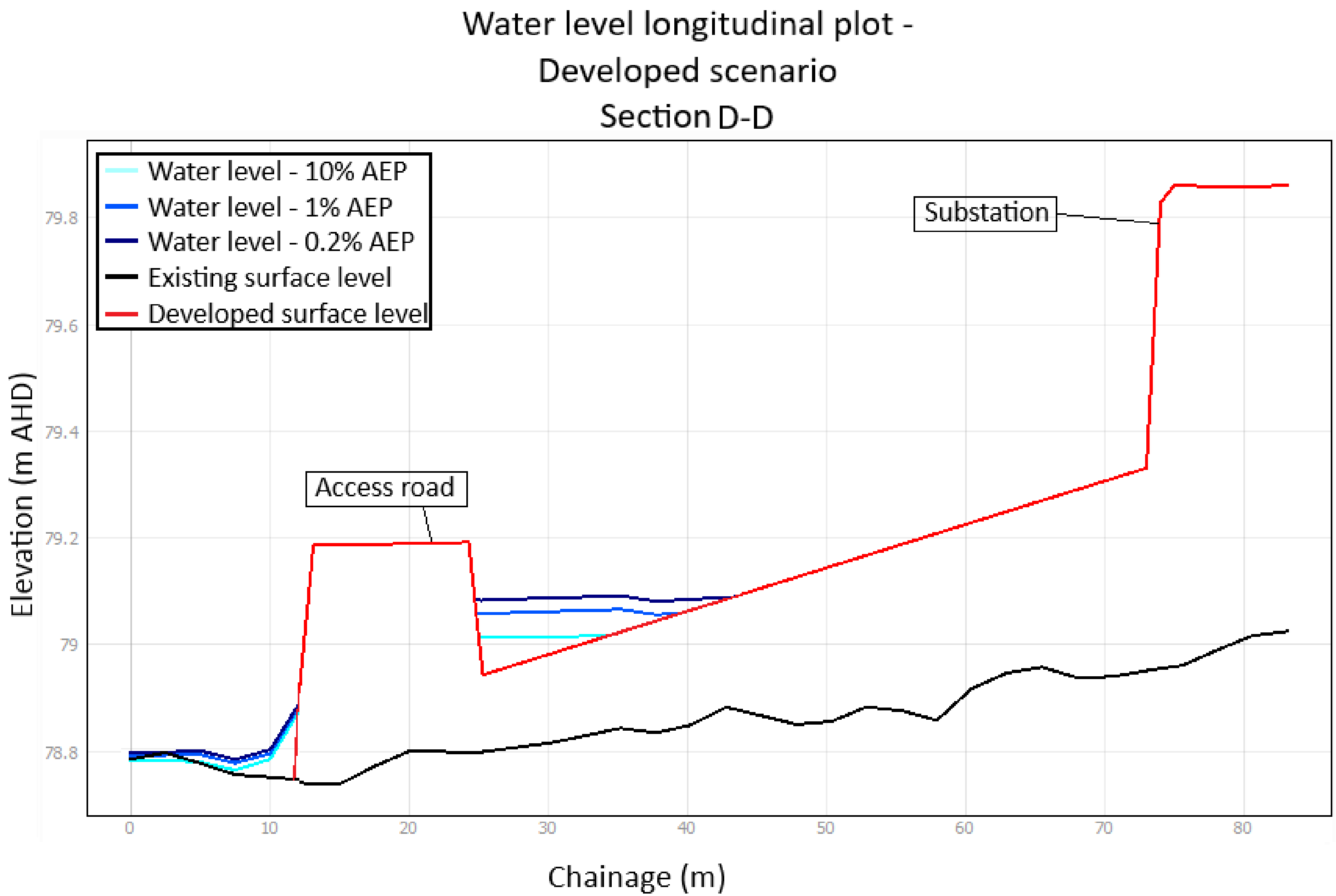


Figure A2.5 Water level longitudinal section – Section D-D

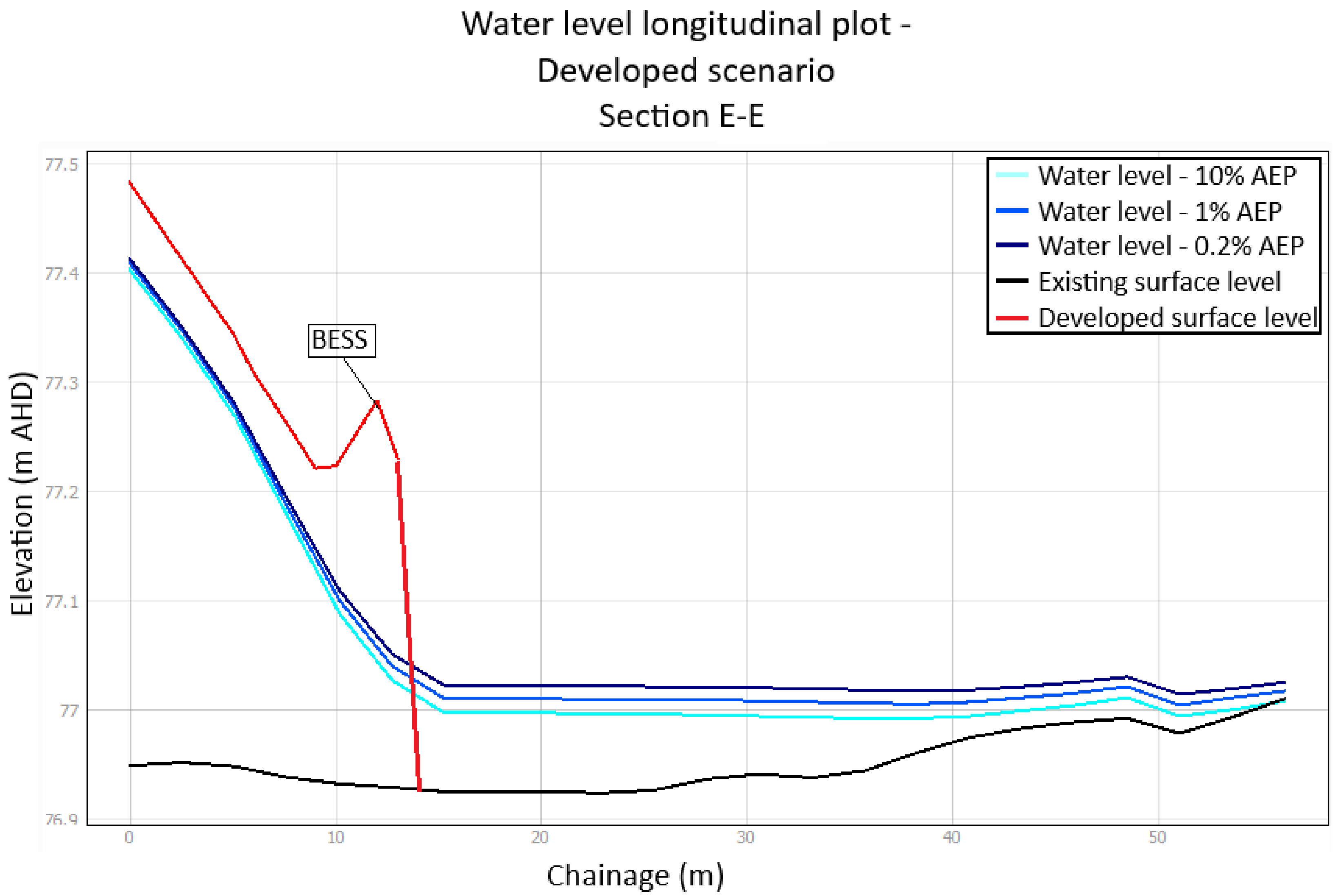


Figure A2.6 Water level longitudinal section – Section E-E

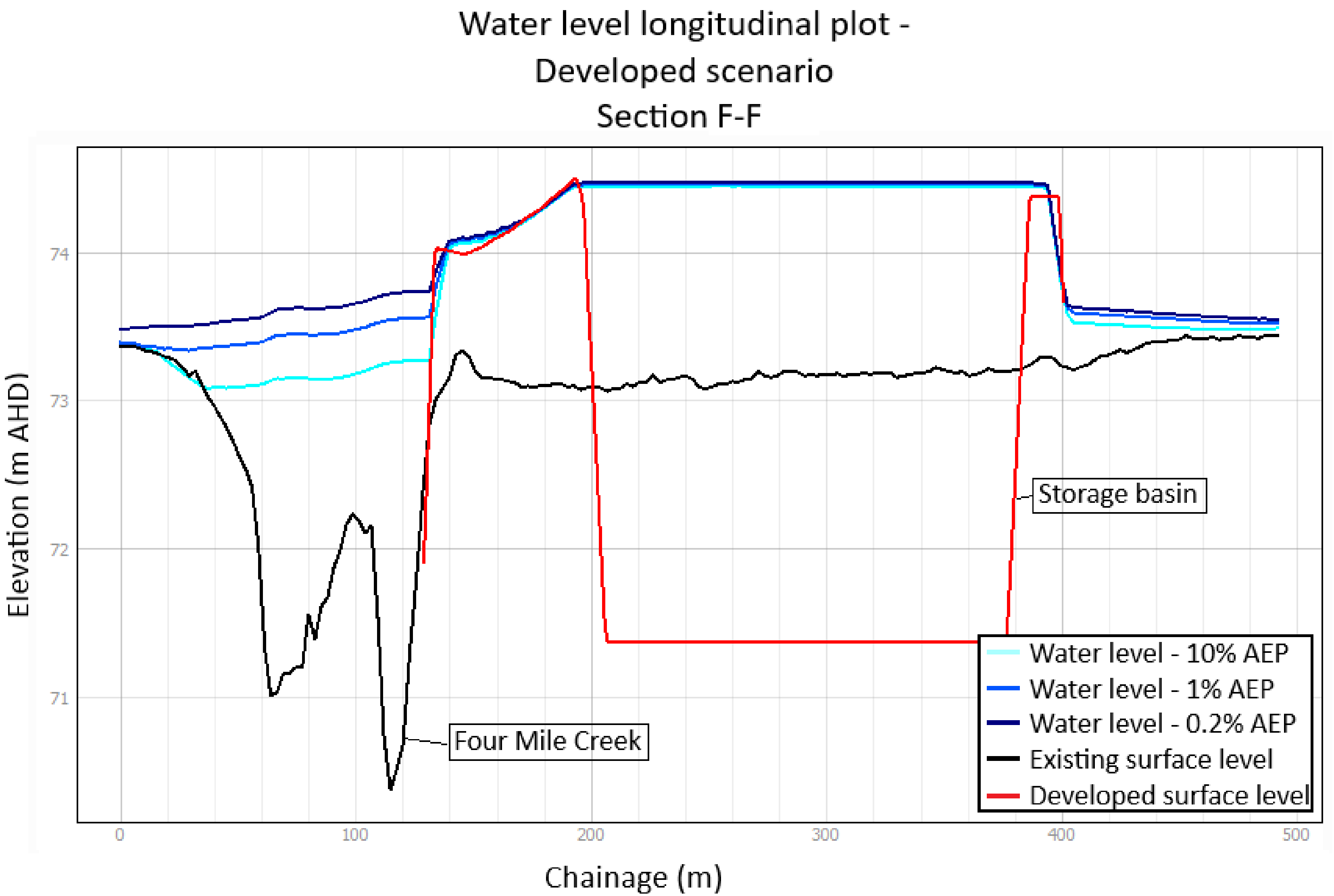


Figure A2.7 Water level longitudinal section – Section F-F

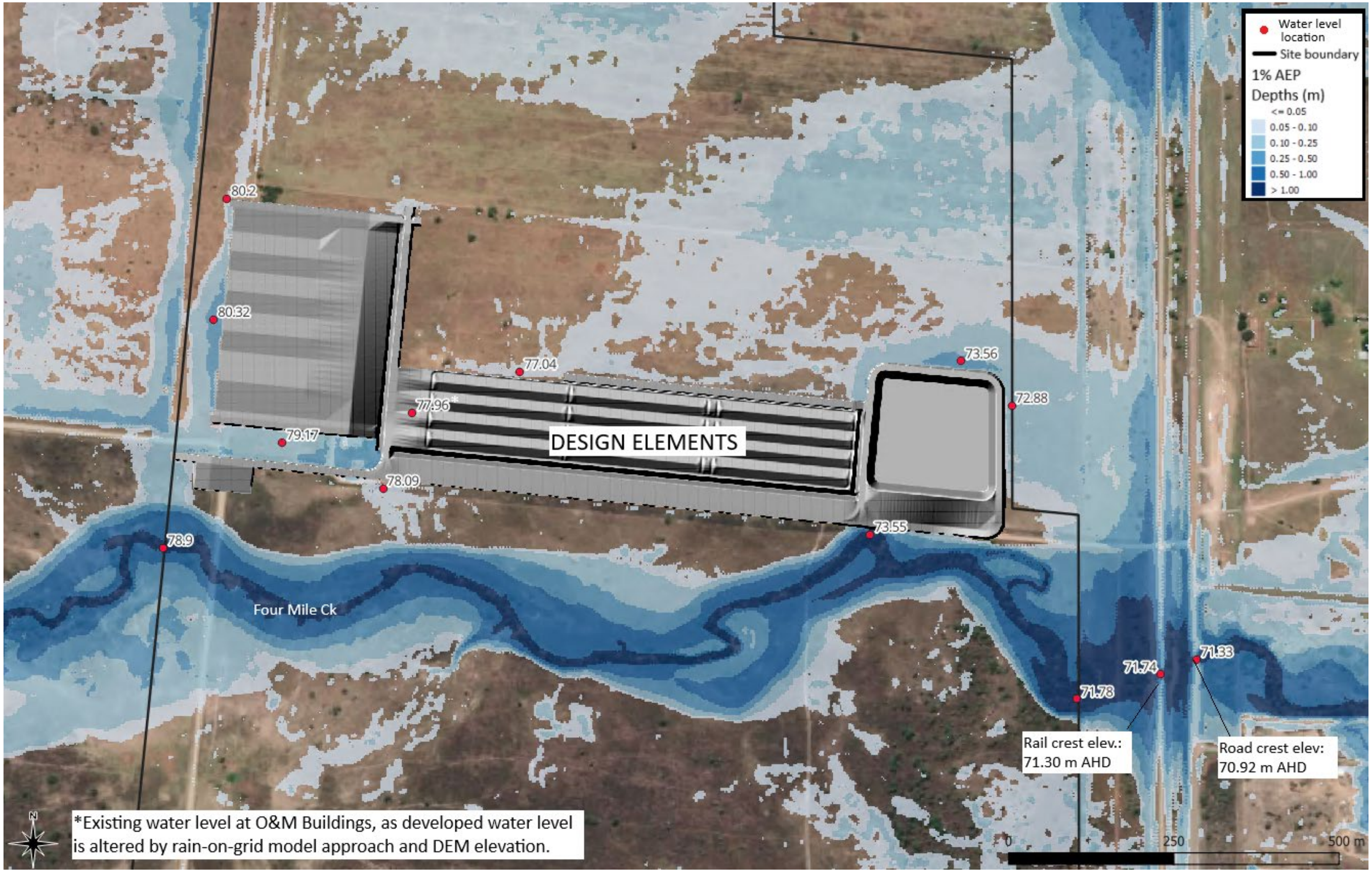


Figure A2.8 Spot water levels – 1% AEP – Proposed scenario

Attachment B

TCC Communication

creating opportunities

Level 1 87 Wickham Terrace
Spring Hill QLD 4000
ABN: 28 141 736 558

07 3648 1200

www.emmconsulting.com.au

30 August 2024

Taryn Pace
Senior Planning Officer
Townsville City Council
143 Walker Street
Townsville QLD 4810

Re: Project Green Poly - Request for confirmation on Surface Water assessment assumptions

Dear Taryn,

This letter relates to the assumptions associated with the surface water technical assessment for Project Green Poly (PGP) at the Lansdown Eco-Industrial Precinct (LEIP).

EMM Consulting (EMM) is conducting environmental baseline studies on behalf of Private Energy Partners (PEP) and seeks guidance and confirmation from Townsville City Council (TCC) on several key assumptions for inclusion in the assessment. Specifically, EMM requests TCC's review and feedback on the points outlined below:

Hydrology: **Adoption of the calibrated hydrology outputs from the TCC model**.

- The adoption of hydrology outputs has been validated, calibrated, and incorporated in XP-RAFTS. Based on our previous use of this data in the QPM assessment, EMM are well placed to continue using this data and (where appropriate) undertaking additional hydrology assessment in XP-RAFTS. Additional hydrology derived from rain-on-grid approach within Tuflow, with final design inflows sourced from point flows via XP-RAFTS in locations whereby flowpaths can be isolated and/or runtimes can be optimised, and rain-on-grid hydrology for local sub-catchments adjacent to the project site. Rain-on-grid hydrology will be of particular importance to Four Mile and Two Mile Creeks. Currently, XP-RAFTS modelling bundles these two sub-catchments into a single node, whereas rain-on-grid will provide a detailed understanding of flow paths, distribution and interaction between these two creeks, which is relevant for the PGP site.

Hydraulics: **Adoption of Tuflow hydraulic modelling software**.

- Learnings from technical assessment from QPM identified Tuflow as the superior modelling software over MIKE. EMM's software adoption of Tuflow is supported by industry as it is current best practice. Some key factors to support the use of Tuflow in this assessment are as follows:

  - Tuflow allows faster runtimes compared with MIKE, which in-turn allows for either greater accuracy (via smaller grid size) or greater efficiency (via lower modelling costs).

- Accuracy will be further optimised by the use of sub-grid-sampling (SGS) and quadtree (where applicable); both features are available in Tuflow but not in MIKE.

- Where appropriate, 1D culvert information to be extracted from the MIKE model and converted to Tuflow format. This conversion maintains accuracy with input data unchanged (unless subsequent survey data supersedes existing culvert data).

Model inputs assumptions: **LEIP Adjacent properties and developments.**

- Please provide clarification on the preferred approach when considering adjacent properties and proposed neighboring development. Confirmation of these inputs is important to establish the 'base case' scenario e.g. impervious areas, changes in run-off characteristics, and any other relevant changes that may affect inflows to PGP site. Please provide comment on the below as appropriate:

  - Drive IT - Noting that Drive IT has progressed into construction of their lot. Is it preferred to adopt the as approved plans, or are there specific considerations that are to be adopted in this case?

  - QPM – Noting that QPM has not progressed into construction, would council prefer the model to reflect this Lot's current or proposed land use (i.e. based on the as approved plans or in its current state).

Model inputs assumptions: **Digital Elevation Model.**

- EMM proposes the use of the following DEM data sets in hydrology and hydraulic modelling. Based on the below listed DEM data sets, there is appropriate LiDAR data to satisfy hydraulic modelling to a 1 m grid. Does TCC have any objection to the use of this combined dataset?

  - TCC provided DEM (Rowlands Surveys – Project Green Poly – Extracted LiDAR data)

  - ELVIS 1 m DEM (https://elevation.fsdf.org.au/)

Please do not hesitate to reach out to myself (0413 897 691) or to Luke Norman (07 3748 1270) with any questions or clarifications.

Yours sincerely

ECampbell

Elise Campbell
Senior Environmental Engineer
ecampbell@emmconsulting.com.au
Reviewed NC 29.8.24

Outlook

RE: Project Green Poly - Request for confirmation on Surface Water assessment assumptions

From Taryn Pace <taryn.pace@townsville.qld.gov.au>
Date Mon 16/09/2024 2:37 PM
To Elise Campbell <ecampbell@emmconsulting.com.au>
Cc Nick Currey <ncurrey@emmconsulting.com.au>; Sigrid Pembroke <spembroke@emmconsulting.com.au>; Derek Chapman <dch@private-energypartners.com>; Luke Norman <lnorman@emmconsulting.com.au>

1 attachment (175 KB)

PGP Surface water assumptions - Clarification request to TCC.pdf;

Some people who received this message don't often get email from taryn.pace@townsville.qld.gov.au. Learn why this is important

CAUTION: This email originated outside of the Organisation.

Good Afternoon Elise,

Thank you for your email.

Please see below in response to each of your queries relating to the technical assessment of Surface Water reporting relating to Project Green Poly (PGP) at the LEIP site.

1. Hydrology and Hydraulics
   Council is agreeable to the assumptions made for the hydrology and hydraulics components.
2. Adjacent Properties and developments
   It is confirmed that the model should be based on the approved ultimate development scenario for all sites within the LEIP (including DriveIT and QPM) currently benefited by development approval.
3. Digital Elevation Model
   The LiDAR used in the Mike Model uses a 1m grid but is from 2011 and 2012. It is suggested you compare this against the data available through Elvis, to determine a reliable DEM for your assessment.

Any further queries, please do not hesitate to contact me.

Thank you,
Taryn

Taryn Pace
Acting Coordinator Planning Assessment - Planning and Development
Executive Office

P 07 4727 9426 **E** taryn.pace@townsville.qld.gov.au

Level 1, 143 Walker Street, Townsville QLD 4810 | PO Box 1268, Townsville QLD 4810

From: Elise Campbell <ecampbell@emmconsulting.com.au>
Sent: Friday, August 30, 2024 11:22 AM
To: Taryn Pace <taryn.pace@townsville.qld.gov.au>
Cc: Nick Currey <ncurrey@emmconsulting.com.au>; Sigrid Pembroke <spembroke@emmconsulting.com.au>; Derek Chapman <dch@private-energypartners.com>; Luke Norman <lnorman@emmconsulting.com.au>
Subject: Project Green Poly - Request for confirmation on Surface Water assessment assumptions

Good morning Taryn,

I am reaching out to confirm some assumptions regarding the philosophy we plan to adopt for our technical assessment of Project Green Poly (PGP) at the LEIP site.

This query specifically relates to the Surface Water assessment of the PGP block at LEIP. If it is most suitable, could you please pass the attached letter onto the appropriate person.

I am happy for you to forward on my colleague's contact information (Luke Norman phone; 07 3748 1270 or email: lnorman@emmconsulting.com.au) else feedback via email will be sufficient.

Thank you Taryn,

Kindly
Elise

Elise Campbell
Senior Environmental Engineer – Environmental Planning & Approvals
T 07 3648 1264
M 0413 897 691
LI Connect on LinkedIn
emmconsulting.com.au
BRISBANE | Yuggera/Turrbal Country, Level 1, 87 Wickham Terrace, Spring Hill QLD 4000

Outlook

RE: PGP climate change scenarios

From Dale Armbrust <dale.armbrust@townsville.qld.gov.au>
Date Thu 14/11/2024 11:22 AM
To Luke Norman <lnorman@emmconsulting.com.au>
Cc Elise Campbell <ecampbell@emmconsulting.com.au>; Sigrid Pembroke <spembroke@emmconsulting.com.au>; Derek Chapman <dch@private-energypartners.com>; Nick Currey <ncurrey@emmconsulting.com.au>; Taryn Pace <taryn.pace@townsville.qld.gov.au>

CAUTION: This email originated outside of the Organisation.

Hi Luke,

That is correct.

Kind Regards,

Dale Armbrust
Senior Development Engineer – Development Assessment
Planning & Development

P 4727 9351 **E** dale.armbrust@townsville.qld.gov.au

143 Walker Street, Townsville QLD 4810 | PO Box 1268, Townsville QLD 4810

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Townsville City Council acknowledges the Wulgurukaba of Gurambilbarra and Yunbenun, Bindal, Gugu Badhun and Nywaigi as the Traditional Owners of this land. We pay our respects to their cultures, their ancestors and their Elders, past, present, and all future generations.

From: Luke Norman <lnorman@emmconsulting.com.au>
Sent: Thursday, 14 November 2024 10:18 AM
To: Dale Armbrust <dale.armbrust@townsville.qld.gov.au>
Cc: Elise Campbell <ecampbell@emmconsulting.com.au>; Sigrid Pembroke <spembroke@emmconsulting.com.au>; Derek Chapman <dch@private-energypartners.com>; Nick Currey <ncurrey@emmconsulting.com.au>; Taryn Pace <taryn.pace@townsville.qld.gov.au>
Subject: RE: PGP climate change scenarios

This Message Is From an External Sender
This message came from outside Townsville City Council. Please think carefully before clicking links or responding if you weren't expecting this email.

Hi again,

To clarify, that's 15.4% on the 2016 IFDs?

Thanks
Luke

Luke Norman
Associate Water Resources Engineer | Surface Water and Land

M 0451 308 875

www.emmconsulting.com.au

From: Luke Norman
Sent: Thursday, 14 November 2024 9:26 AM
To: Dale Armbrust <dale.armbrust@townsville.qld.gov.au>

Cc: Elise Campbell <ecampbell@emmconsulting.com.au>; Sigrid Pembroke <spembroke@emmconsulting.com.au>; Derek Chapman <dch@private-energypartners.com>; Nick Currey <ncurrey@emmconsulting.com.au>; Taryn Pace <taryn.pace@townsville.qld.gov.au>
Subject: RE: PGP climate change scenarios

Hi Dale,

Ok, no problem. We'll adopt a blanket 15.4% increase in IFDs, and leave the continuing and initial losses unadjusted.

Thanks for the clarification.

Cheers
Luke

Luke Norman
Associate Water Resources Engineer | Surface Water and Land

M 0451 308 875

www.emmconsulting.com.au

From: Dale Armbrust <dale.armbrust@townsville.qld.gov.au>
Sent: Thursday, 14 November 2024 9:13 AM
To: Luke Norman <lnorman@emmconsulting.com.au>
Cc: Elise Campbell <ecampbell@emmconsulting.com.au>; Sigrid Pembroke <spembroke@emmconsulting.com.au>; Derek Chapman <dch@private-energypartners.com>; Nick Currey <ncurrey@emmconsulting.com.au>; Taryn Pace <taryn.pace@townsville.qld.gov.au>
Subject: RE: PGP climate change scenarios

CAUTION: This email originated outside of the Organisation.

Hi Luke,

Council's Senior Floodplain & Coastal Engineer has confirmed that the following can be adopted for your climate change runs:

Rainfall:
- 15.4% increase in Intensity-Frequency-Duration (IFD) for RCP8.5.

Sea Level Rise:
- 0.8 m (the projected sea-level-rise adopted by the Queensland Government for RCP8.5)

Kind Regards,

Dale Armbrust
Senior Development Engineer – Development Assessment
Planning & Development

P 4727 9351 **E** dale.armbrust@townsville.qld.gov.au

143 Walker Street, Townsville QLD 4810 | PO Box 1268, Townsville QLD 4810

From: Luke Norman <lnorman@emmconsulting.com.au>
Sent: Monday, 11 November 2024 10:28 AM
To: Dale Armbrust <dale.armbrust@townsville.qld.gov.au>
Cc: Elise Campbell <ecampbell@emmconsulting.com.au>; Sigrid Pembroke <spembroke@emmconsulting.com.au>; Derek Chapman <dch@private-energypartners.com>; Nick Currey <ncurrey@emmconsulting.com.au>; Taryn Pace <taryn.pace@townsville.qld.gov.au>
Subject: RE: PGP climate change scenarios

This Message Is From an External Sender

Additionally, SC6.7.4.4.7 in the Townsville City Plan cites a scaling factor of 1.15 :

Luke Norman
Associate Water Resources Engineer | Surface Water and Land

M 0451 308 875

www.emmconsulting.com.au

From: Luke Norman
Sent: Monday, 11 November 2024 10:21 AM
To: Dale Armbrust <dale.armbrust@townsville.qld.gov.au>
Cc: Elise Campbell <ecampbell@emmconsulting.com.au>; Sigrid Pembroke <spembroke@emmconsulting.com.au>; Derek Chapman <dch@private-energypartners.com>; Nick Currey <ncurrey@emmconsulting.com.au>; Taryn Pace <taryn.pace@townsville.qld.gov.au>
Subject: RE: PGP climate change scenarios

Hi Dale,

Thanks for clarifying, and for the flood modelling chat on Thursday.

As discussed, the SSP5-8.5 2100 is the worst-case climate scenario , which is to be applied to all pre and post scenario runs in place of all non-climate change scenarios.

For reference, this will scale design rainfall depths by a factor of 1.64 based on my quick calculations below:

ARR Ver 4.2, Book 1, Chapter 6

Eq. 1.6.1

Where
α = 12.8 (Table 1.6.5, critical duration = 2hr)
ΔT = 4.1 degrees C (Table 1.6.2, SSP5-8.5, 2100)

= 1.64

This is a massive increase in design rainfall depths – can you confirm this is correct? I know you mentioned it had been closer to 1.15 in some of your previous work on other projects.

Thanks again,
Luke

Luke Norman
Associate Water Resources Engineer | Surface Water and Land

M 0451 308 875

www.emmconsulting.com.au

From: Dale Armbrust <dale.armbrust@townsville.qld.gov.au>
Sent: Wednesday, 6 November 2024 4:56 PM
To: Luke Norman <lnorman@emmconsulting.com.au>
Cc: Elise Campbell <ecampbell@emmconsulting.com.au>; Sigrid Pembroke <spembroke@emmconsulting.com.au>; Derek Chapman <dch@private-energypartners.com>; Nick Currey <ncurrey@emmconsulting.com.au>; Taryn Pace <taryn.pace@townsville.qld.gov.au>
Subject: RE: PGP climate change scenarios

Hi Luke,

Please see below for responses to your queries in yellow.

Kind Regards,

Dale Armbrust
Senior Development Engineer – Development Assessment
Planning & Development

P 4727 9351 **E** dale.armbrust@townsville.qld.gov.au

143 Walker Street, Townsville QLD 4810 | PO Box 1268, Townsville QLD 4810

From: Luke Norman <lnorman@emmconsulting.com.au>
Sent: Tuesday, 5 November 2024 3:51 PM
To: Taryn Pace <taryn.pace@townsville.qld.gov.au>
Cc: Elise Campbell <ecampbell@emmconsulting.com.au>; Sigrid Pembroke <spembroke@emmconsulting.com.au>; Derek Chapman <dch@private-energypartners.com>; Nick Currey <ncurrey@emmconsulting.com.au>
Subject: PGP climate change scenarios

Hi Taryn!

Thanks again for the Project Green Poly info so far. We've got the latest QPM and Drive IT plans built into the base case flood model for PGP, so it's all looking good.

The only remaining unknown at this stage is the hydrologic approach to climate change that you'd like us to adopt.

You're probably aware of the very recent updates to ARR (Version 4.2) that bring climate change from sensitivity testing to fundamentally included in the hydrology and flood hydraulics processes. We're incorporating those changes into our flood modelling. Are you able to confirm the following for PGP please?

- ARR Ver 4.2 stipulates a 'present day' climate change scaling factor be applied to rainfall intensities and losses based on the warming that has occurred up to 2024. We have included these in the base case flood modelling runs for all magnitudes – is this correct?
  So that the FIA is comparing like-for-like, the pre- and post-development scenarios should be based on 2100 climate change conditions. Present-day (2024) climate change scaling is not required.
- What other future climate scenarios are we required to run? ARR recommends two additional scenarios – SSP2-4.5 and SSP3-7.0. Assuming these would be for 2100?
  The climate change scenarios are to be based on RCP8.5 (or SSP5-8.5) for 2100, and no additional RCPs, SSPs or years need to be considered.
- What scenarios and magnitudes will be used for impacts assessment? For example, are we assessing hydraulic impacts for the 1%AEP (including the aforementioned 'present day' climate change scaling), and only providing base case hydraulic information for other events?
  The pre- and post-development scenarios should be based on 2100 climate change conditions, and the full range of standard design storm AEPs (up to the DFE) are to be assessed as part of the FIA.

Thanks again,

Luke

Luke Norman B Eng. M Soc Dev. B Bus. NER RPEQ
Associate Water Resources Engineer – Surface Water and Land
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Annexure B

Water quality Assessment

Northern Quartz Campus

Water Quality Assessment - BESS, Substation and Transmission Line

Prepared for Solquartz Private Energy Partners

August 2025

Northern Quartz Campus

Water Quality Assessment - BESS, Substation and Transmission Line

Solquartz Private Energy Partners

E231133 RP1

August 2025

Version	Date	Prepared by	Reviewed by	Comments
V1-0	8/08/25	M Bull	J Muller	For client review
V2-0	28/08/25	M Bull	J Muller	For use

Approved by

JMuller

Jarrah Muller
Senior Associate Civil and Environmental Engineer
28 August 2025

Level 4 74 Pirie Street
Adelaide SA 5000
ABN: 28 141 736 558

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1 Overview

1.1 Introduction

Solquartz and Private Energy Partners (PEP) is proposing to develop Northern Quartz Campus (NQC) within Townsville City Council's (TCC) Lansdown Eco- Industrial Precinct (LEIP). EMM Consulting Pty Ltd (EMM) was engaged by Private Energy Partners (PEP) to complete a surface water assessment (SWA) for the BESS, transmission line and substation components of NQC. This water quality assessment was completed as part of the SWA to analyse the post-development stormwater quality exiting site and the extent to which potential adverse impacts are mitigated.

As a part of the assessment, a treatment train was conceptualised using Water Sensitive Urban Design principles and modelled using the eWater MUSIC software (MUSIC) to verify performance. The assessment was undertaken in accordance with the:

- Townsville City Plan (City of Townsville, 2024)
- Queensland MUSIC modelling guidelines (Healthy Land and Water, 2018)
- State Planning Policy (Department of Infrastructure, Local Government and Planning, 2017)

1.2 Existing site

The site for the BESS, transmission line and substation components of NQC is located approximately 40 km south of Townsville CBD and consists of part of Lot 19 on SP321818, part of Lot 87 on RP911426, part of Lot 19 on SP321818, part of Lot 87 on RP911426, part of Lot 30 on SP321818, part of Lot 55 on E124248 and part of Lot 65 on E124264. Currently, the site is used for grazing farmland.

The site lies immediately north of Four Mile Creek, an ephemeral first order waterway. Downstream of the site, Four Mile Creek flows into Double Barrel Creek and Majors Creek, which is a major tributary to the Haughton River. The Haughton River flows into the Pacific Ocean approximately 40 km north-east of the site. Flows from site do not drain towards Ross River Dam.

1.3 Proposed development and stormwater management

The proposed development includes the construction and operation of a 780 MW BESS and substation facility enabled by supporting infrastructure including roads, parking, switchgear, transformers, offices and storage areas.

Stormwater runoff from the BESS will be conveyed via an engineered stormwater drainage system (i.e. a swale) to a stormwater detention pond. The pond will attenuate runoff such that peak discharge rates of treated stormwater are consistent with pre-development conditions.

Stormwater runoff from the substation would undergo treatment to separate oils within the substation boundary. Treated discharges from the separator would be directed to the BESS drainage system. Runoff beyond the western substation security fence will not require the same level of treatment and would be discharge directly to Four Mile Creek via an engineered stormwater drainage system.

2 Stormwater quality assessment

2.1 Methodology

Post-development pollutant loads were determined using the 'Model for Urban Stormwater Improvement Conceptualisation' (MUSIC) software (version 6.3). The proposed treatment train was represented in a MUSIC model and a stormwater quality analysis completed to investigate its predicted performance. Model inputs were tailored to the site based on site-specific data and local guidelines to ensure the model was suitable representing the BESS development.

2.2 Stormwater quality objectives

Pollutant load reduction targets for the project were taken from the Townsville City Plan (City of Townsville, 2024) and are outlined in Table 2.1. These values are consistent with the *Water Sensitive Urban Design for the Coastal Dry Tropics (Townsville)* guidelines (Townsville City Council, 2011) and State Planning Policy (Department of Infrastructure, Local Government and Planning, 2017).

Table 2.1 Pollutant load reduction targets – Dry Tropics

Parameter	Minimum reduction in mean annual load[1] (%)
Total suspended solids (TSS)	80
Total phosphorus	65
Total nitrogen	40
Gross pollutants	90

1. Relative to untreated stormwater runoff

2.3 MUSIC model inputs

2.3.1 Climate data

Six-minute rainfall data and monthly evapotranspiration data from the Townsville Aero station (032040) packaged with the MUSIC software was used in the analysis. All available data was used, spanning a period of 3/03/1953 to 30/03/2010, with a six-minute model timestep.

2.3.2 Catchment breakdown

Catchment areas were split into separate land use categories of impervious, pervious, and roads as per the Queensland MUSIC modelling guidelines (Healthy Land and Water, 2018). These areas were delineated based on the site plan (Aurecon, 2025) and included all areas between the smelter area and pipeline easement, as shown Figure 2.1. The substation area modelled included the undesignated area east of the substation extending up to the BESS site (including the O&M buildings). The BESS site as modelled included all other areas except for the water storage basin.

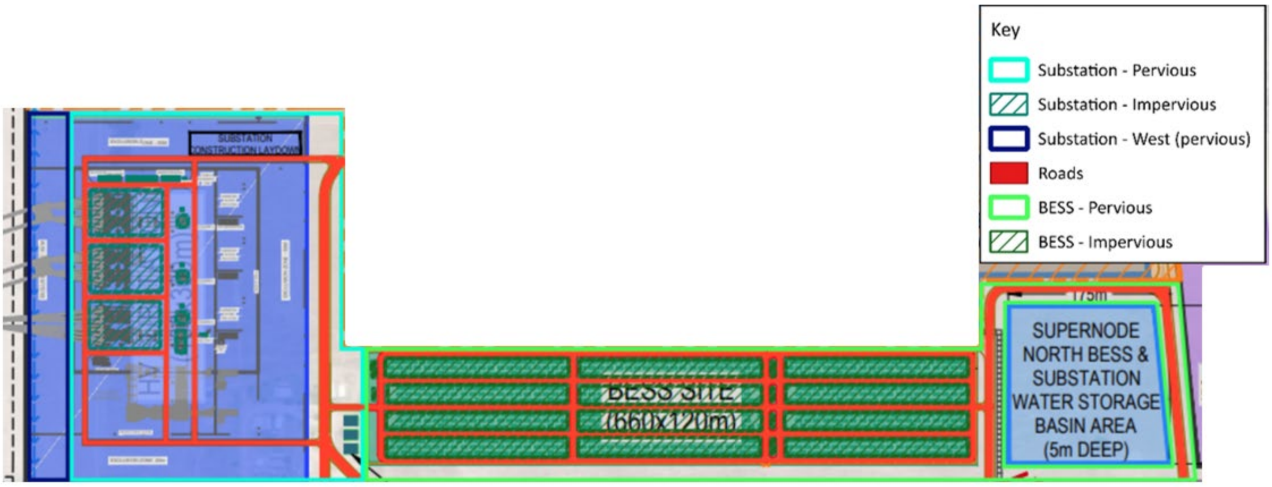

Figure 2.1 Catchment areas as modelled

Areas beneath large electrical infrastructure in the substation area were assumed to be impervious along with the work sheds, vehicle parking, amenities building, water tank, supernodes and smelter. Similarly, areas containing batteries in the BESS site were assumed to be impervious.

The modelled source areas are summarised in Table 2.2. Flows from the BESS site will be directed to a swale directly south, so the BESS site was split into two equal areas in the model to simulate the different treatment times experienced by flows along its length (see Section 2.5.2).

Table 2.2 Modelled source areas

Land use	Total area (ha)	% Impervious
Substation – impervious (inc. O&M buildings)	1.6	100
Substation – pervious	9.1	0
Substation – roads	1.5	100
Substation – west pervious area	1.9	0
BESS 1 – impervious	3.1	100
BESS 1 – pervious	1.5	0
BESS 1 – roads	1.1	100
BESS 2 – impervious	3.1	100
BESS 2 – pervious	1.5	0
BESS 2 – roads	1.1	100
Total	25.5	

The rainfall-runoff parameters recommended for industrial land use areas in the Queensland MUSIC modelling guidelines (Healthy Land and Water, 2018) were applied to all source areas. The parameters used are shown in Table 2.3.

Table 2.3 Industrial rainfall-runoff parameters

Parameter	Value
Impervious area – rainfall threshold (mm/day)	1
Pervious area – Soil storage capacity (mm)	18
Pervious area – initial storage (% of capacity)	10
Pervious area – field capacity (mm)	80
Pervious area – infiltration capacity exponent ‘a’	243
Pervious area – infiltration capacity exponent ‘b’	0.6
Groundwater properties – initial depth (mm)	50
Groundwater properties – daily recharge rate (%)	0
Groundwater properties – daily baseflow rate (%)	31
Groundwater properties – daily deep seepage rate (%)	0

2.4 Pollutant parameters

Modelled pollutant parameters were derived from the Queensland MUSIC modelling guidelines (Healthy Land and Water, 2018) which provide stormflow and baseflow parameters for roof, road, and ground level surfaces. For all post-development nodes, parameters were taken from the industrial category. As the roofed portion of the impervious areas was unknown, the most conservative value (ground level) was used. The pre-development node was modelled as an agricultural node with parameters from the Brisbane pollutant export modelling guidelines (Brisbane City Council, 2003).

The pollutant parameters used are summarised in Table 2.4.

Table 2.4 Pollutant parameter summary

Flow type	Surface type	TSS log_{10} values		Total phosphorous log_{10} values		Total nitrogen log_{10} values	
		Mean	St. dev	Mean	St. dev	Mean	St. dev
Baseflow	Roads	0.78	0.45	-1.11	0.48	0.14	0.2
	Impervious /pervious	0.78	0.45	-1.11	0.48	0.14	0.2
	Agricultural	1.4	0.31	-0.88	0.13	0.074	0.13
Stormflow	Roads	2.43	0.44	-0.3	0.36	0.25	0.32
	Impervious /pervious	1.92	0.44	-0.59	0.36	0.25	0.32
	Agricultural	2.3	0.31	-0.27	0.3	0.59	0.26

2.5 Proposed treatment train

The proposed treatment train for modelled pollutants at the BESS consists of:

- Grassed swales to convey stormwater runoff and intercept/store particulate matter in the grass root zone during low flows

- A bio-retention basin with significant event storage volume to capture flows for a sufficient detention time before draining to Fields Creek.

The treatment train as modelled in MUSIC is shown in Figure 2.2. Design details and MUSIC model inputs for these components are outlined below.

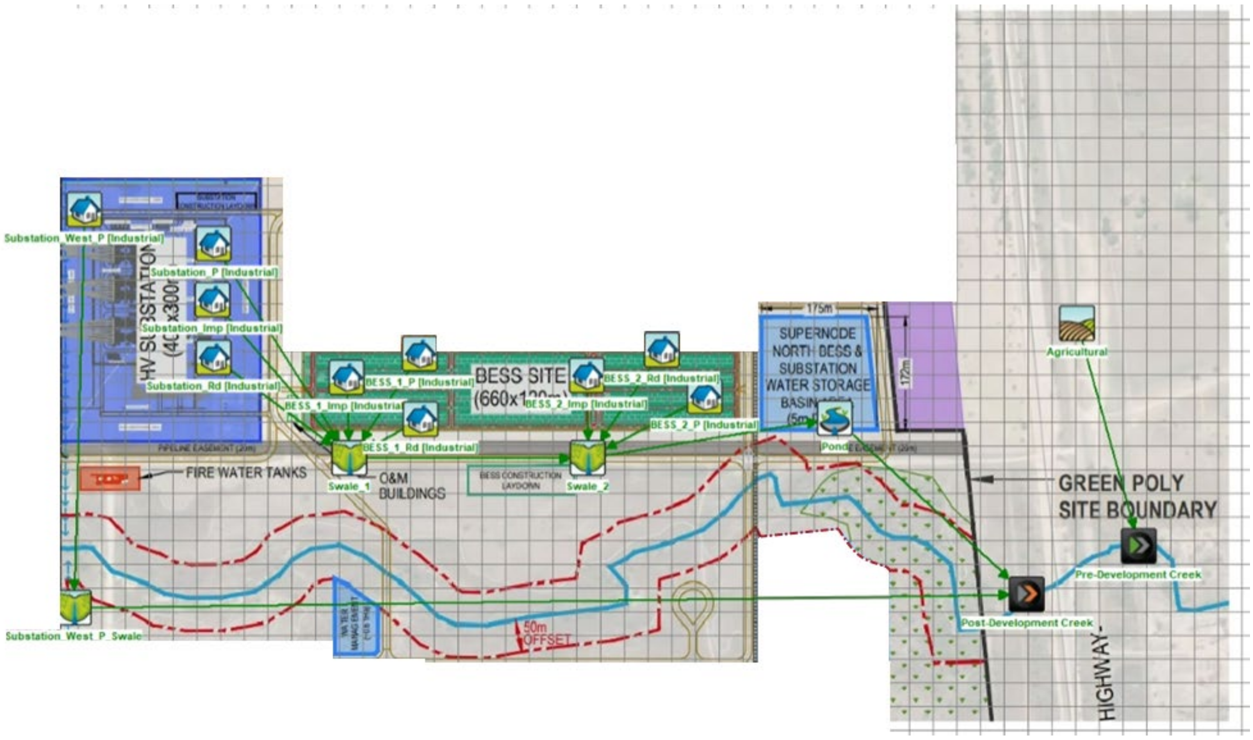

Figure 2.2 MUSIC model of proposed treatment train

2.5.1 Bio-retention basin

The bio-retention basin will have dimensions of 175 m x 172 m x 5 m deep, with excavated material used to supply fill material for construction of pads on site. The excavated depth of the pond would prevent passive drainage of the pond to Four Mile Creek without a significant (>3 m) permanent pond depth. Based on a prior review of landholder bores in the project area (EMM, 2021), the bio-retention basin is not expected to intercept groundwater.

To enable pond drainage and prevent the formation of stagnant water conditions (and the possibility of poor water quality developing), a pump would be required to lift water from the pond to the elevation of the creek (approximately 3 m from the bottom the basin to the bottom of the creek). The pump would be activated by the presence of water in the bio-retention pond, and would discharge to Four Mile Creek at a nominal rate of around 10 L/s (subject to detailed design). This arrangement will enable:

- Isolation of the pond in the case of a spill by switching off the pump
- Sufficient detention time such that stormwater treatment is expected to be effective.

An example of a suitable pump is the RVS900A pump which provides approximately 5 m of head at a pump rate of 10 L/s with dimensions of 497 mm x 221 mm x 607 mm (L x W x H) (Reefe Pumps Australia, 2025). This specific pump is not being recommended for or against but is highlighted to show suitable commercially available pumps exist and to provide an approximate size.

The design details of the bio-retention basin, as modelled in MUSIC, are shown in Table 2.5. An exfiltration rate of 0 mm/hr was used to ensure a conservative approach to losses without site-specific testing. Soil mapping from the Queensland Department of Resources (2022) indicates that soils on site are likely heavy clays with possible overlying sandy loams. The MUSIC software (eWater, 2018) recommends an exfiltration rate of 0 to 0.36 mm/hr for heavy clays.

Table 2.5 Bio-retention basin MUSIC inputs

Parameters	Values
Surface area (m^2)	30,100
Extended detention depth (m)	4.5
Permanent pool depth (m)	0.5
Initial volume (m^3)	0
Exfiltration rate (mm/hr)	0
Evaporative loss as % of PET	100
Outflow pump rate (L/s)	10

2.5.2 Swales

Two swales are proposed to convey stormwater flows:

- A swale running parallel to the BESS site carrying flows from the substation and BESS to the bio-retention basin (the 'primary swale')
- A swale along the western edge of the substation area, carrying flows from the western portion of the substation area beyond the security fence directly to the creek (the 'substation swale')

The BESS site and primary swale nodes were split in two to simulate the reduction in treatment effectiveness for flows entering the swale further along its length. Flows from the first BESS node were treated by the entire 700 m swale length, whilst flows from the second node were only treated by the last 350 m.

The design parameters of the primary swales and the substation swale as modelled in MUSIC are shown in Table 2.6 and Table 2.7 respectively. Design parameters were based on the site layout (Aurecon, 2025), LiDAR digital elevation model and available guidelines. As with the bio-retention basin, an exfiltration rate of 0 mm/hr was used to ensure a conservative approach to losses without site-specific testing. The proposed swale dimensions are nominal and subject to detailed design.

Table 2.6 Primary swale design details

Parameter	Values
Length (m)	350 [1]
Bed slope (%)	0.55
Base width (m)	0
Top width (m)	6
Depth (m)	1
Vegetation height (m)	0.25

Parameter	Values
Exfiltration rate (mm/hr)	0

Note 1. Length applied to each of the two swale nodes, i.e. a combined swale length of 700 m

Table 2.7 Substation swale design details

Parameter	Values
Length (m)	560
Bed slope (%)	0.55
Base width (m)	0
Top width (m)	6
Depth (m)	1
Vegetation height (m)	0.25
Exfiltration rate (mm/hr)	0

3 Results

The results of the MUSIC model are shown in Table 3.1 and indicate that the proposed treatment train will be effective at reducing sediment and nutrients from the site in comparison to both the undeveloped grazing land use, and in comparison to the developed site without the treatment train. Additionally, downstream flows are not expected to increase relative to existing conditions despite a significant increase in impervious area due to the attenuation provided by the bio-retention basin.

Table 3.1 MUSIC model results

	Stormwater runoff (ML/year)	Suspended Solids (kg/year)	Total phosphorus (kg/year)	Total nitrogen (kg/year)	Gross pollutants (kg/year)
Existing (agricultural, equivalent area)	103	19,400	53.4	372	0
Site arrangement, no treatment	198	38,300	84	459	2120
Site arrangement, proposed treatment	81	1,310	9	121	0
Treatment effectiveness	59%	97%	90%	74%	100%
Target effectiveness		>80%	>65%	>40%	>90%

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