CopperString 2032

Stormwater Management Plan for temporary construction camp and laydown area at Hughenden, QLD

Prepared for
UGL CPB JV

Client representative
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Revision History

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02*	Minor edits	DW	AB	AB	23/2/2024
Commencement of detailed design stage					
03	Initial issue – detailed design stage	DW	AB	AB	30/4/2024

* *Revisions 00, 01 and 02 were conducted under superseded pitt&sherry project number P.22.1540*

1. Introduction

1.1 Context

UGL CPB JV has engaged pitt&sherry to develop the detailed design of the Hughenden camp for the construction of the CopperString 2032 project.

This stormwater management plan has been requested to support the approvals and execution process and has been developed as an extension of a preliminary concept design phase already conducted.

This stormwater management plan report addresses the proposed temporary Camp and Laydown Areas at Hughenden, Queensland, which will remain on location for about five years.

1.2 Objectives

The objectives of this Stormwater Management Plan report are to demonstrate that the design intent of the temporary Camp and Laydown Areas complies with the Planning Framework, which is described further in Section 2.

1.3 Construction and operation phases of temporary camps

Many of the guidelines, standards and planning instruments relate to permanent infrastructure in its operational phase, with the implied assumption that the construction phase is relatively short, and the operational phase extends into an indefinite future. In this case, it is proposed to construct temporary infrastructure that is expected to operate up to about five years. For the purposes of this Stormwater Management Plan, the following definitions are applied:

- The construction phase refers to the construction or initial set-up of the temporary infrastructure; and
- The operation phase follows the construction phase of the temporary infrastructure and extends to the decommissioning of the infrastructure, which is expected in a timeframe of about five years.

The temporary camps, laydown areas, etc. are therefore defined as permanent infrastructure for the purposes of interpreting the various planning requirements and conditions.

2. Planning Framework

2.1 State Planning Policy 2017 – Construction Phase Stormwater Management Design Objectives

Appendix 2 of the State Planning Policy 2017 includes Stormwater Management Design Objectives for drainage control, which are reproduced in Appendix A, Table 4 and Figure 5.

Table 4 has been extended to show the proposed design responses to each of the desired outcomes.

Part 2 of the State Planning Policy 2017 requires drainage structures to be designed for 10%AEP (10-year ARI). Part 3 requires emergency spillways to basins to be designed for 2%AEP.

2.2 State Planning Policy 2017 – Post Construction Phase Stormwater Management Design Objectives

Appendix 2 of the State Planning Policy 2017 includes Stormwater Management Design Objectives for reductions in mean annual load from unmitigated development. The design objectives for Western Queensland are reproduced in Appendix A, Table 5 which has been expanded to include the proposed design responses.

2.3 Coordinator General's Evaluation Report on the EIS

The Coordinator General's Evaluation Report on the EIS recommends conditions for approval conditions, which include stormwater management, erosion and sediment control.

Condition 27 is summarised in Appendix A, Table 6, which has been expanded to show the proposed design response outlined in this report.

Condition 28 refers to an Erosion and Sediment Control Plan (ESCP), which is the subject of a separate report.

Condition 29 refers to stormwater and flooding at the existing railway corridor. An existing railway corridor exists at this site in the form of the Great Northern Railway, which passes south of the Camp. This railway is protected by proposed drains. Points of discharge from the Camp are directed to the waterway, which follows an established path across the rail corridor via existing railway culverts or bridges.

2.4 Project EIS

The Project EIS has been published on the web portal of the State Development Infrastructure, Local Government and Planning (www.statedevelopment.qld.gov.au/coordinator-general/assessments-and-approvals/coordinated-projects/completed-projects/copperstring-project/copperstring-projects-eis-documents). Volume 2 Chapter 9 refers to Water resources and water quality. The EIS's recommendations and actions that refer to temporary camps and laydown areas are summarised in Appendix A, Table 7 which has been expanded to show the proposed design response in this Stormwater Management Plan.

2.5 Shire of Flinders Planning Scheme 2017

The local planning scheme is the Shire of Flinders Planning Scheme 2017, which is available through Council's web portal (www.flinders.qld.gov.au/downloads/file/257/shire-of-flinders-planning-scheme---v11---28-february-2018pdf).

The requirements of the local planning scheme that refer to temporary camps and laydown areas are summarised in Appendix A, Table 8 which has been expanded to show the proposed design response in this Stormwater Management Plan.

3. Site description

3.1 Location

The site is located within Flinders Shire, Queensland.

The facility at Hughenden comprises a temporary Camp and associated facilities adjacent Flinders Highway to the east, as shown in Appendix C Figure 01.

An unnamed drainage feature (the waterway) passes through the Hughenden Camp before flowing into the Hughenden Recreational Lake downstream. The waterway is a tributary to Station Creek, which is a tributary to the Flinders River.

3.2 Current land use

Current land use comprises undeveloped land. An aerial image with 1m contours of the current landform is shown in Appendix C Figure 02.

3.3 Climate

According to the Bureau of Meteorology[1] for Hughenden Post Office (Site number 030024, 20.84°S 144.20°E), the site is subject to increased rainfall over the summer period from December to March. Average monthly rainfalls reduce considerably through the dry season between April and October. The yearly annual rainfall is 491.0mm. The average monthly rainfall and temperature are plotted in Figure 1, below.

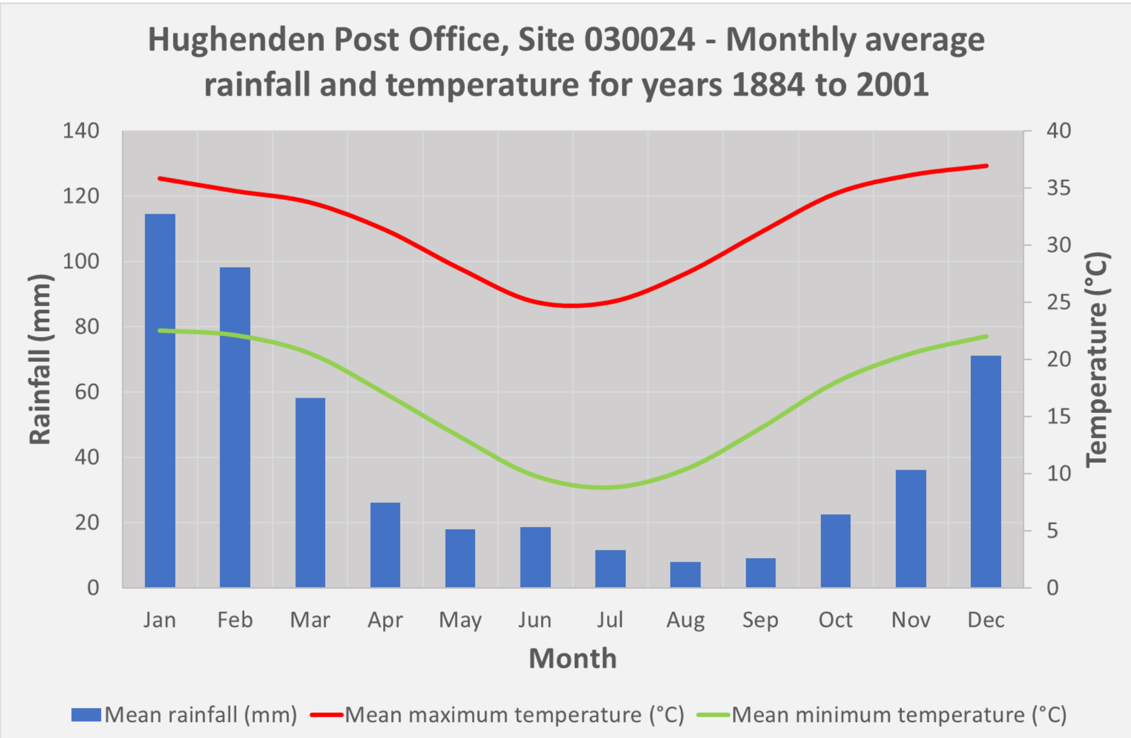

Figure 1: Monthly average rainfall and temperature

[1] Climate statistics for Australian locations (bom.gov.au) accessed 14-08-2023

3.4 Topography and drainage

The topography shown in Figures 2 and 3 in Appendix C was derived from the digital elevation model (DEM) data downloaded from the ELVIS web portal, using the SRTM data (the best available). The SRTM data is derived from Shuttle Radar imagery and has a vertical accuracy of about ±9.5m, which only provides a coarse approximation of true ground levels. More detailed investigations for Hughenden must include further, more detailed survey, such as low-level LiDAR.

The current ground surface slopes in a southerly direction at a slope of about 2%.

3.5 Project works

Subject to additional land requests, the project works comprise the following:

- Temporary Camp which occupies part of an area of about 17.1 ha
- A waterway crossing over the waterway
- Temporary Laydown Area, which occupies a portion of the camp area
- Access roads to local roads; and
- Associated services and utilities.

4. Stormwater management

4.1 Hydrology

4.1.1 Site specific rainfall data

Site specific rainfall data were acquired from the Bureau of Meteorology's web portal. The 2016 intensity-frequency-duration (IFD) data for the site are summarised in Appendix B.

4.1.2 Catchment runoff

Catchments for the Camp and Laydown areas were delineated by using 5-metre survey data and likely points of discharge to receiving drainage paths and watercourses, as shown in Figure 03 in Appendix C. The sizes of detention basins at each of the points of discharge were estimated by using the Swinburne method with peak flows estimated from the Rational Method according to the Queensland Urban Drainage Manual. The parameters in Table 1 were used.

The runoff coefficient used for the existing areas relates to undeveloped land, although much of the truck parking area comprises compacted gravel. There are no clear guidelines on what value to assign to the runoff coefficient for compacted gravel, which could be as low as undeveloped land. The strategy adopted for this analysis is to use the lowest likely value for the existing areas as this will result in the greatest difference between existing and developed (with Temporary Camp and Laydown Area) and so yield the largest likely required volume for the detention basins.

Existing catchment hydrology is preserved by controlling interaction of site runoff with nearby tributaries. This is achieved through the proposed drainage network and water quality treatment measures, described below.

No allowance has been made for Climate change in the calculations for catchment runoff because the full effects of Climate change will not eventuate within the lifespan of the temporary camp. It is acknowledged that partial effects may eventuate, but they are expected to be much less than the limits of accuracy in the calculations.

Table 1: Drainage design parameters

Parameter	Value
Design storm	10%AEP
Time of concentration for all areas	5.0 minutes
Existing areas	
Fraction impervious for all areas	0.0
C_{10} runoff coefficient for all areas	0.7
Camp and Laydown areas	
Fraction impervious for all areas	0.9
C_{10} runoff coefficient for all areas	1.0

4.2 Stormwater management measures

4.2.1 Diversion of external catchments

Runoff from upslope areas in external catchments will be diverted around the site by external diversion drains so that stormwater runoff from these areas will not enter the site.

The external diversion drains will generally comprise channels. The drainage system will be designed with appropriate hydraulic capacity and the surface treatment of the drains will be checked for sufficient scour protection. The drainage system will be designed for 10%AEP flows. A generic design is described in Section 4.2.8

In flat terrain, channels will be generally excavated below adjacent ground levels to improve the drainage to the off-site land adjacent to the site. Bunds may be used for stormwater management in areas where elevation and geotechnical constraints prevent channel excavation.

Concept arrangements for diversion channels at the site perimeters are shown in Figure 2.

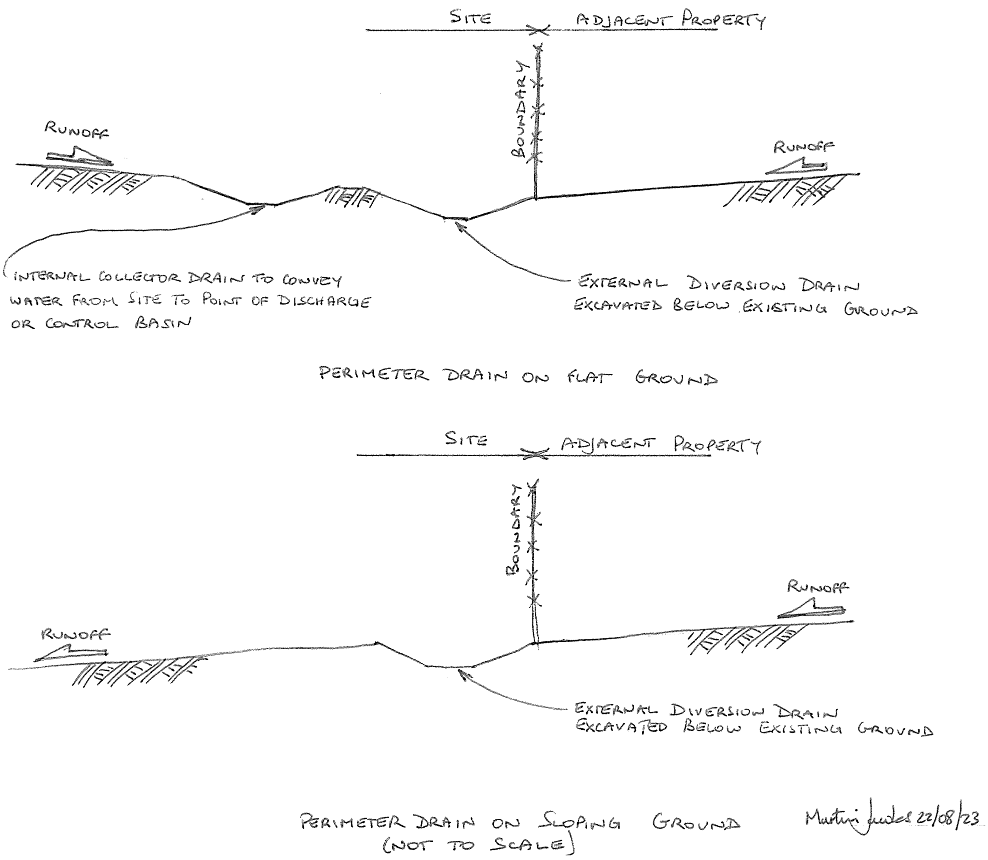

Figure 2: Concept design for diversion channels at site perimeters

4.2.2 Control of stormwater pollutants at source

Pollutants will be controlled at source by the following strategies and practices:

- Use appropriate surface sealing (e.g. road gravels, vegetation, bitumen etc) to cover ground
- Use grass-lined channels for internal drainage where possible
- Provide porous check dams in internal drainage channels to trap silt and litter
- Use appropriate means to collect and dispose of litter
- Use water of adequate water quality for dust suppression
- Treat dirty water captured in first flush sumps and washdowns etc. prior to use on site
- Contain runoff from areas with a high risk of spillage to prevent unauthorised release to the environment
- Maintain the facilities and their drainage in good condition by applying the site inspection and monitoring measures described in Section 4.2.3; and

4.2.3 Vehicle refuelling

Vehicle refuelling will be carried out in specially engineered facilities that will be paved and bunded for the containment and capture of spillages. Fuel and oil spillages will be captured in blind sumps with oil-water separators. Wastes to be removed and disposed of at an appropriate disposal facility. No fuel or oil will be allowed to escape into receiving drainage or creek systems.

Fuel tanks should be stored on impervious surfaces with bunds to contain spills. The storage facility should be engineered to provide safe access and sufficient structural/geotechnical bearing capacity during spill events, whether storage is above or below ground.

4.2.4 Waste storage area

The camp hub waste storage area will have concrete bunded slabs to contain waste matter and incidental seepage. The bunded areas will include diversion drains to exclude external runoff.

4.2.5 Maintenance workshops

Maintenance workshops will include roofed structures for shade and reduction of rainfall catchment. Any fuel and oil spillages will be contained within a bunded concrete slab and runoff diverted to blind sumps with oil-water separators. Wastes are to be pumped out and disposed of at an appropriate disposal facility. No fuel or oil will be allowed to escape into receiving drainage or creek systems.

4.2.6 Vehicle washdown

Vehicle washdown will be carried out in specially engineered proprietary facilities that will be paved and bunded for the containment, capture and reuse of washdown water. Experience suggests that these facilities will require a net import of water and they will not be permitted to overflow into receiving drainage or creek systems. Washdown sumps will be cleaned by excavating accumulated silt and mud, which will be disposed of in an appropriate manner, such as controlled stockpiling on site.

4.2.7 Site inspection and monitoring

Site inspections and monitoring should be carried out during the construction and operational phases of the temporary camp as follows:

- Daily site inspections

    - Check all drainage and sediment control measures
    - Check for excessive accumulation of sediment, and clean out as required
    - Check all points of discharge
- Weekly site inspections, in addition to daily inspections
    - Check oil, fuel and chemical storage facilities
- Within 24 hours of forecast or expected rain
    - Check all drainage and sediment control measures
    - Check all temporary flow diversion works
- After rainfall that produces runoff
    - Check all drainage and sediment control measures; and
    - Check for excessive accumulation of sediment, and clean out as required.

4.2.8 Internal drainage

An internal drainage system will convey stormwater runoff to the points of discharge for end-of-line treatment. Most of the system will comprise open channels, bunds and pipes.. The internal drainage system will be designed with appropriate hydraulic capacity and the surface treatment of the drains will be checked for sufficient scour protection. The internal drainage system will be designed for 10%AEP flows.

A generic design for the drainage channels was developed for a conceptual drain with the highest 10%AEP flow and a typical gradient. Several linings were tested, which affected the roughness (and size of channel) and velocities or bed shear stresses. It was found that bare earth was likely to be scoured. The smallest stone size that would provide the required shear resistance was gravel with D50 = 60mm. The outcomes of the calculations are summarised in Table 2.

Table 2: Design of drainage channel with highest 10%AEP flows

Parameter	Value	Notes
Design flow case	10%AEP	Set by State Planning Policy 2017
Design flow	1.08 m^3/s	
Channel gradient	0.007 m/m	
Channel side slopes	1 in 4	
Channel bed width	1.0 m	
Required lining	Gravel D50 = 60mm	Shear stress resistance = 38N/m^2
Manning's n for lining	0.028	Calculated from gravel grading and depth of flow
Channel velocity	1.13 m/s	
Bed shear stress	24 N/m^2	Less than shear resistance of lining

4.2.9 End-of-line control basins

Control basins are proposed at the points of discharge around the perimeter of the Camp and Laydown Area. The functions of the control basins include the following:

- Mitigation of peak flows
- Sedimentation of suspended solids and entrapment of litter
- Distribution of flows into receiving drainage systems or watercourses to reduce the risk of scour; and
- End-of-line entrapment of fuel, oil or chemicals that could be spilled within the site.

Control basins will be repurposed from IECA (International Erosion Control Association) Type B Sediment Basins built during the construction phase. Control basins may be augmented with upstream grass swales, designed to provide additional water quality treatment and peak flow mitigation. This would reduce the requirement for basin storage volume, which may be necessary in flatter parts of the site where achieving minimum drainage grades is difficult. Control basins may also be equipped with pollutant traps and geotextile lining. A typical type B basin is shown in Figure 3. These basins are not designed to drain under gravity, and any contained water will require drainage through vacuum extraction trucking for construction reuse, or via natural evaporation.

Rational Method calculations for each of the existing and developed (with temporary camp and laydown areas) catchments are included in Appendix C. The sizes of the control basins were estimated using the Swinburne Method (by Bruce Bowditch and Dr. Donald Phillips at the Swinburne University of Technology) and a summary of the outcomes is shown in Table 3. It should be noted that this method is used for the design of stormwater quantity control basins. At the site, construction phase sediment basins are larger than stormwater quantity control basins, and thus will dictate the volume of the control basins.

The details of the control basins, including the designs of emergency spillways may be developed further in the detailed design stage of the works. It is noted that the emergency spillways must be designed for 2%AEP (50-year ARI) flows.

Control basins will generally discharge into existing stormwater drainage and natural drainage paths.

Table 3: Summary of results of Swinburne Calculation for control basins

Point of discharge	Catchment area (ha)	Critical duration (min)	Max inflow (m^3/s)	Required volume of basin (m^3)	Assumed depth of basin (m)	Required area of basin (m^2)
Basin01	1.48	20	0.463	165	0.5	330
Basin02	2.32	20	0.725	271	0.5	542
Basin03	1.4	20	0.438	158	0.5	316

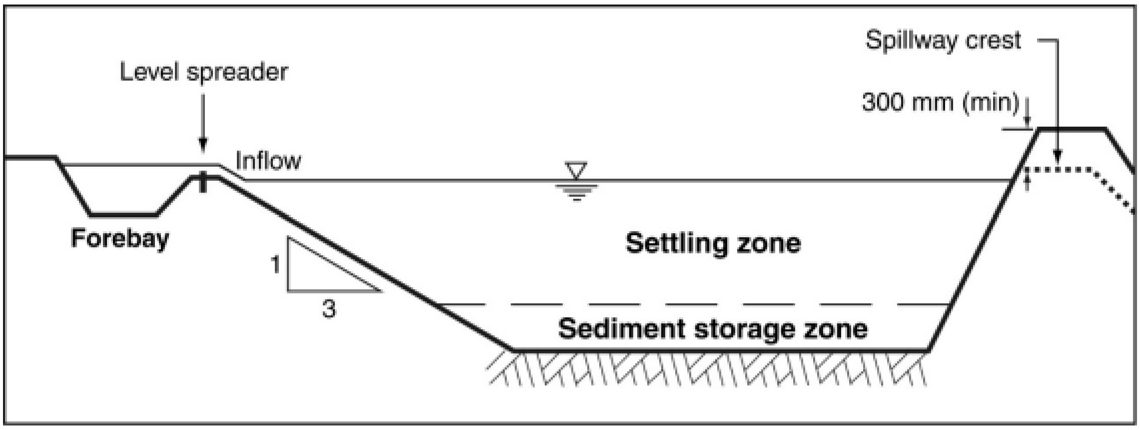

Figure 3: Long section of a typical Type B Basin. Figure reproduced from Appendix B of the International Erosion Control Association (2016)

4.2.10 Protection of upstream railway

The Great Northern Railway passes by the southern end of site and could be impacted by the development. The following measures are planned to control any adverse impacts on the railway embankment:

- Restrict camp site embankment fill earthworks to areas above the 1% AEP flood elevation to reduce the likelihood and severity of backwater impacts.
- Design waterway crossings from the northern side of the site to the southern side of the site such that the likelihood and severity of backwater impacts to the railway corridor is minimised. This may include bed level and low flow culverts or bed level only crossings. Locate culvert waterway crossings as far downstream of the rail embankment as practicable.
- Direct Drain 012 away from the rail embankment, and outlet it in an easterly direction away from the railway embankment and into the waterway traversing the camp site. Augment Drain 012 as necessary with geofabric, check-dams and/or rocks as applicable to prevent scour at new discharge points and reduce associated risks. Energy dispersion measures will also aid in controlling flow quantities and preserving existing catchment hydrology.
- Control increased runoff through the site with basins as necessary. The construction phase of the project will require Type B sedimentation basins and these can be retained as stormwater management features during the operational life of the camp site. Refer to Appendix C Figure 04 for a preliminary catchment plan showing nominal catchments and drainage flow paths.
- Prior to detailed design and construction, complete a water quantity assessment and apply mitigation measures as required to ensure no net worsening. A post development hydraulic analysis will be carried out to determine any controls or design alterations needed.

A separate post development Flood Impact Assessment will be undertaken to assess potential impacts the development may have on the railway embankment and corridor and other adjacent land areas. Where practicable, recommended control measures described in this assessment will be deployed at site or the camp design will be altered.

4.3 Stormwater quality management

An erosion and sediment control plan (ESCP) will be described in a separate report for the purpose of managing earthworks during construction of the camp.

The proposed Camp and Laydown Areas are temporary facilities that will operate for the construction phase of the CopperString 2032 project. However, for the purposes of this stormwater management plan, the facilities are regarded as permanent development.

The Coordinator General's condition 27 requires *pre-treatment measures prior to discharge of surface water runoff*.

The State Planning Policy 2017 sets out water quality objectives (WQOs) for the region of Western Queensland as summarised in Appendix A, Table 5.

A Water Sensitive Urban Design (WSUD) system would be needed to achieve these WQOs, which would typically include vegetated systems for the removal of pollutants, particularly dissolved nutrients. However, the practical difficulties in providing effective vegetated systems include the following:

- The time required for the vegetated systems to become established
- The establishment of vegetation requires sufficient rain after planting, which may not be available if the camp is constructed in the dry season; and
- The flat terrain does not allow for the hydraulic gradients needed for vertical infiltration through bio-retention systems and other common forms of water quality improvement measures.

Considering these difficulties, the proposed stormwater quality management strategy is to adopt industry best practice management.

4.4 Deployment of stormwater management measures at this site

A concept plan of the stormwater management measures is shown in Appendix C Figure 03.

Diversion drains are required along the northern perimeter to intercept stormwater runoff approaching the site from high ground to the north. These are diversion Drains 011 and 012, as shown in the concept drainage layout, and convey runoff from external catchments around the site to the waterway.

Internal drains are required to convey stormwater runoff from internal areas to control basins before release into the waterway.

5. Extents of creek and river flooding

Flood modelling for a range of storms was undertaken by WMA Consulting Engineers. The 1% AEP flood extents for the existing case were adopted as the limit of earthworks at the site to ensure no loss of flood storage area, which could have adverse impacts on the upstream railway embankment and corridor. This boundary is visible in the concept drainage layout, and in Figure 4, below.

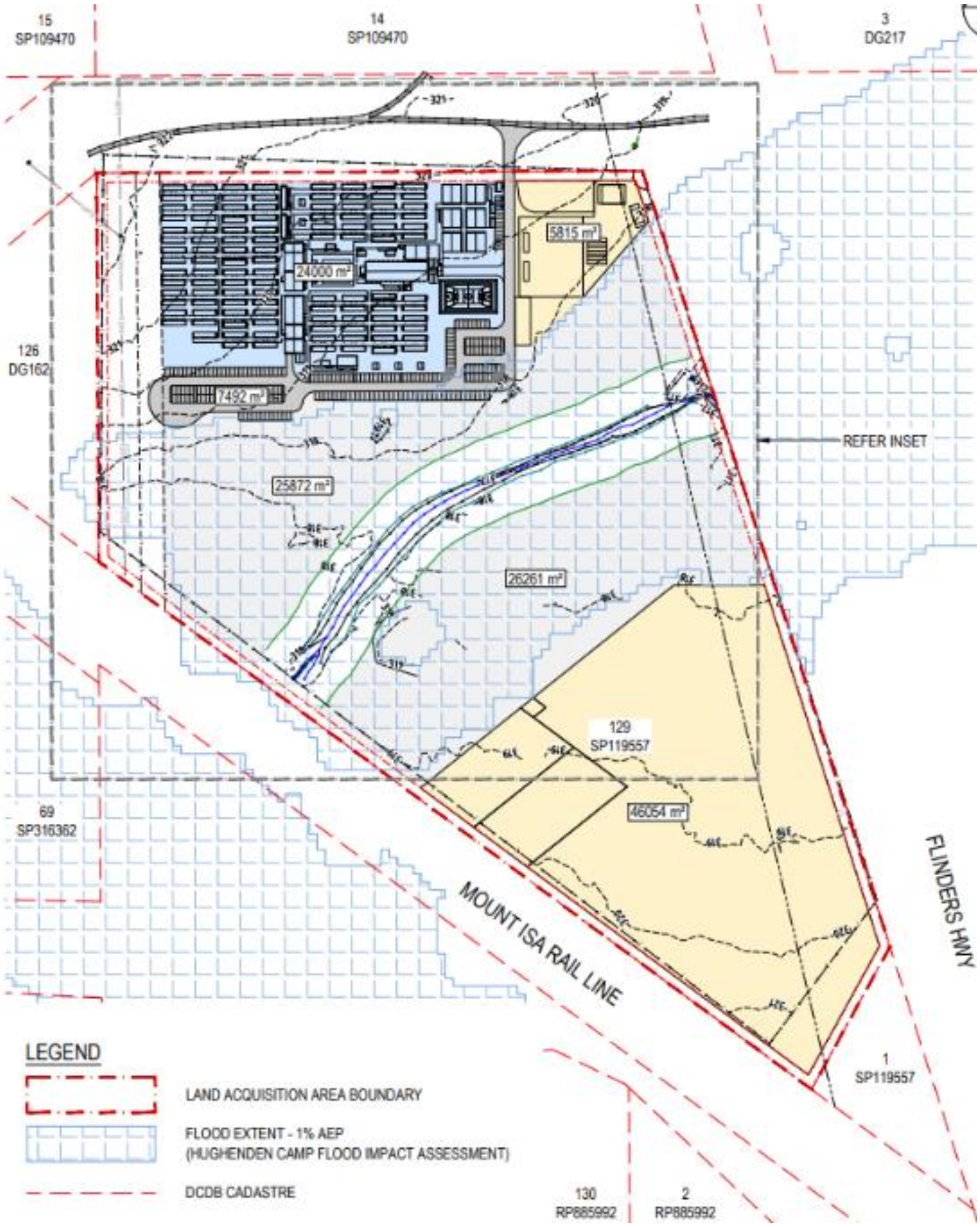

Figure 4: 1% AEP flood extents (blue blocked area) during the pre-development case. Flood extents extracted from WMA Consulting Engineer's flood impact report.

The Shire of Flinders Planning scheme includes a map of the 100 year ARI flood hazard area around Hughenden (Overlay Map FL-001). However, during the planning phase, WMA's refined flood assessment was carried out to better determine flood extents.

6. Conclusions

This stormwater management plan report describes concept practices and engineered works that will ensure that the proposed development complies with the requirements for stormwater quantity and quality management set out in the planning framework, and applies measures to avoid adverse impacts to adjacent property, including transport and railway infrastructure.

7. Certification

This report has been prepared by a Registered Professional Engineer of Queensland (RPEQ) and reviewed in accordance with the internal QA procedures of pitt&sherry.

Important information about your report

In some circumstances the scope of services may have been limited by a range of factors such as time, budget, access and/or site disturbance constraints. The Report may only be used and relied on by the Client for the purpose set out in the Report. Any use which a third party makes of this document, or any reliance on or decisions to be made based on it, is the responsibility of the Client or such third parties.

The services undertaken by pitt&sherry in connection with preparing the Report were limited to those specifically detailed in the report and are subject to the restrictions, limitations and exclusions set out in the Report. The Report's accuracy is limited to the time period and circumstances existing at the time the Report was prepared. The opinions, conclusions and any recommendations in the Report are based on conditions encountered and information reviewed at the date of preparation of the Report. pitt&sherry has no responsibility or obligation to update the Report to account for events or changes occurring after the date that the report was prepared. If such events or changes occurred after the date that the report was prepared render the Report inaccurate, in whole or in part, pitt&sherry accepts no responsibility, and disclaims any liability whatsoever for any injury, loss or damage suffered by anyone arising from or in connection with their use of, reliance upon, or decisions or actions based on the Report, in whole or in part, for whatever purpose.

Planning Framework

Appendix A

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Table 4: State Planning Policy 2017 Appendix 2 Stormwater management design objectives for drainage control

Issue	Desired outcomes	Design response
Drainage control	1. Manage stormwater flows around or through areas of exposed soil to avoid contamination.	Minimise areas of exposed soil by using appropriate surface treatments. Use interception or diversion drainage channels to divert up-slope runoff from entering the Camp and Laydown areas. Construct detention basins, as required, to mitigate outflows from Camp and Laydown areas.
	2. Manage sheet flows in order to avoid or minimise the generation of rill or gully erosion.	Construct adequate drainage within Camp and Laydown areas.
	3. Provide stable concentrated flow paths to achieve the construction phase stormwater management design objectives for temporary drainage works (part 2).	Design drainage channels and outlets to detention basin with appropriate linings to prevent scour
	4. Provide emergency spillways for sediment basins to achieve the construction phase stormwater management design objectives for emergency spillways on temporary sediment basins (part 3)	Design emergency spillways for 2%AEP (50 year ARI) outflows, as required in Part 3.

Part 2: Construction phase – stormwater management design objectives for temporary drainage works

Temporary drainage works	Anticipated operation design life and minimum design storm event		
	‹ 12 months	12–24 months	› 24 months
Drainage structure	1 in 2 year ARI/39% AEP	1 in 5 year ARI/18% AEP	1 in 10 year ARI/10% AEP
Where located immediately up-slope of an occupied property that would be adversely affected by the failure or overtopping of the structure	1 in 10 year ARI/10% AEP		
Culvert crossing	1 in 1 year ARI/63% AEP		

Part 3: Construction phase – stormwater management design objectives for emergency spillways on temporary sediment basins

Drainage structure	Anticipated operation design life and minimum design storm event		
	‹ 3 months	3–12 months	› 12 months
Emergency spillways on temporary sediment basins	1 in 10 year ARI/10% AEP	1 in 20 year ARI/5% AEP	1 in 50 year ARI/2% AEP

Note: Refer to IECA 2008 Best Practice Erosion and Sediment Control (as amended) for details on the application of the Construction Phase requirements. Advice should be obtained from a suitably qualified person e.g. Certified Practitioner in Erosion and Sediment Control, or Registered Professional Engineer Queensland, with appropriate knowledge and experience in erosion and sediment control design and implementation.

Figure 5: State Planning Policy Appendix 2 Parts 2 and 3

Table 5: State Planning Policy 2017 Appendix 2 Stormwater management design objectives for water quality

Climatic region	Design Objectives – Reductions in mean annual load	Design response
Western Queensland	TSS = 85% reduction TP = 60% reduction TN = 45% reduction GP (>5mm) = 90% reduction	See Section 4.3
	Waterway stability; limit the peak 1-year ARI event discharge within the receiving waterway to pre-development peak 1-year ARI discharge	Attenuation of peak flows is achieved by the construction of end-of-line control basins, which are described in Section 4.2.

Table 6: Coordinator General's recommended conditions for stormwater management

Issue	Desired outcomes	Design response
Stormwater management, erosion and sediment control; Condition 27	(a) Prior to commencement of works at each location/for each stage, prepare a Stormwater Drainage Management Plan (SDMP) for the location/stage, certified by a Registered Professional Engineer of Queensland.	This report comprises the SDMP for this site, and it is certified by an RPEQ.
	(b) The SDMP must be consistent with stormwater quality and quantity management measures detailed in the project EIS and any required updates during detailed design, and must demonstrate the following:	See Section 2.4 for Project EIS.
	(I) A stormwater drainage strategy	The stormwater drainage strategy is outlined in this report.
	(II) Detail of the stormwater drainage system including any proposed pre-treatment measures prior to discharge of surface water runoff	This report provides a concept design that includes pre-treatment measures prior to discharge.
	(III) No actionable nuisance to adjoining and downstream properties	This report provides a concept design that includes mitigation measures for actionable nuisance.
	(IV) Compliance with the State Planning Policy (SPP) water quality benchmarks	This report provides a concept design that includes water quality treatment.
	(c) Submit a copy of the SDMP to DSDILGP (infrastructuredesignation@dsdilgo.qld.gov.au)	To be actioned following the completion of this report.
	(d) Implement best practice stormwater quantity and quality measures in accordance with the SDMP	To be actioned by the Constructor.

Table 7: Recommendations of EIS that relate to temporary camps and laydown areas

Source	Recommendation	Design response
Table 9-11 Potential water resource and water quality impacts	Temporary camps/laydowns Erosion and sedimentation from exposed soils causing elevated turbidity and total suspended solids (TSS) in surface water.	Addressed in Erosion and Sediment Control Plan, which is a separate document.
Table 9-11 Potential water resource and water quality impacts	Temporary camps/laydowns Modification/removal of surface water feature terrestrial and aquatic fauna habitat due to deposition of sediment as a result of erosion and sedimentation.	Construction of control basins at points of discharge, where necessary to mitigate the risk
Table 9-11 Potential water resource and water quality impacts	Temporary camps/laydowns Surface/groundwater contamination from accidental spills/leaks from plant and equipment.	Construction of control basins at points of discharge, where necessary to mitigate the risk
Table 9-11 Potential water resource and water quality impacts	Temporary camps/laydowns Surface/groundwater contamination from poor quality water used in dust suppression.	Source control, see Section 4.2
Table 9-11 Potential water resource and water quality impacts	Temporary camps/laydowns Acute and chronic effects on terrestrial and aquatic flora and fauna due to degradation of downstream or underling water quality (e.g. elevated turbidity, contaminants) (i.e. environmental values and water quality objectives).	Provide water quality treatment at control basins at points of discharge, where necessary to mitigate the risk
Table 9-11 Potential water resource and water quality impacts	Temporary camps/laydowns Flood/stormwater damage to temporary camps/laydowns e.g., refuelling, storage, waste, wash bay area resulting in offsite surface water and/or underlying groundwater contamination.	Design engineered drainage systems with adequate capacity and resistance to scour.
Table 9-11 Potential water resource and water quality impacts	Temporary camps/laydowns Alteration of existing flood/stormwater behaviours (e.g., concentration of flows) impacting local or State controlled roads and railways or other adjoining properties and their buildings and infrastructure.	Design engineered drainage systems with adequate capacity and resistance to scour.
Table 9-11 Potential water resource and water quality impacts	Temporary camps/laydowns Surface/groundwater water contamination from improper treated effluent irrigation from construction camp STPs.	Waste water treatment is addressed in a separate report.

Source	Recommendation	Design response
Table 9-11 Potential water resource and water quality impacts	Surface water use in construction and temporary camps. Altered surface water flow regimes (volumes and quality) for surface water features affecting existing user rights (e.g., local Council and its customers, landholders, and industry).	Flow regimes in creeks and rivers are unlikely to be affected. For example, the temporary camps are unlikely to affect flows into current water storages and reservoirs.
Table 9-11 Potential water resource and water quality impacts	Surface water use in construction and temporary camps. Altered surface water flow regimes (volumes and quality) for surface water features affecting ecological processes and cultural values (i.e., environmental values and water quality objectives)	Flow regimes in creeks and rivers are unlikely to be affected. For example, the temporary camps are unlikely to affect flows into major creeks and rivers.
Table 9-13 Summary of mitigation and management measures	Construction and operations Clean construction camp/laydown stormwater captured on site will be reused for irrigation, dust suppression or passed through appropriately sized sediment basins before being discharged. Dirty water captured in first flush/sumps/washdowns will not be used in for irrigation or dust suppression unless passed through appropriate treatment facilities and tested prior to reuse or disposed offsite as regulated waste.	Tanks will be used to capture roof-water. Dirty water captured in sumps etc will be treated prior to use on site, see Section 4.2.
Table 9-13 Summary of mitigation and management measures	Construction and operations Laydowns will include designated refuelling and washdown areas such that potential contaminating activities and substances are appropriately contained and to prevent unauthorised release to the environment. General wash bay design criteria are provided in Volume 3 Appendix U Concept Biosecurity Plan.	Runoff from high-risk areas will be contained and captured, see Section 4.2. Appendix U simply states, in Section 1.4.3 *Temporary cleandown facilities shall be designed and constructed to ensure adequate separation of vehicle treads with the material being washed down, an adequate drainage system to contain all cleandown materials as well as enabling cleandown material to be periodically cleaned out and disposed*
Table 9-14 Risk assessment summary	Temporary camps/laydowns high unmitigated risk Flood/stormwater damage to temporary camps/laydowns e.g., refuelling, storage, waste, wash bay area resulting in offsite surface water and/or underlying groundwater contamination.	Design engineered drainage systems with adequate capacity and resistance to scour.
Conclusions	Design temporary and permanent infrastructure with industry standard stormwater management controls.	Design engineered drainage systems with adequate capacity and resistance to scour. Include control basins at points of discharge

Table 8: Requirements of the Shire of Flinders Planning Scheme that relate to temporary camps and laydown areas

Source	Recommendation	Design response
Section 8.2.3 Flood hazard overlay code Table 8.2.3.1 Assessment benchmarks for assessable development and requirements for accepted development	PO 1 Building floors and essential infrastructure such as electricity supply, telecommunications and water supply are protected against the ingress of floodwater and maintain personal safety at all times. AO 1.1 The minimum floor level for: • buildings and extensions to buildings; and • essential infrastructure such as electricity supply, telecommunications and water supply. is 300 millimetres above the 1 in 100 year annual recurrence interval (ARI).	Parts of the site are affected by Flood Hazard Areas (100 year ARI), as shown in the mapping for the Shire of Flinders Planning Scheme. The proposed camp will include corridors to convey overland flow through the site. It is typical practice to raise the floors of temporary accommodation buildings above ground level, which should be sufficient to achieve the required clearance above flood levels. Further hydrological and hydraulic modelling is needed to determine the extents and depths of 1%AEP (100 year ARI) flooding.
Section 8.2.3 Flood hazard overlay code Table 8.2.3.1 Assessment benchmarks for assessable development and requirements for accepted development	PO 2 Development maintains: a) the flood characteristics and storage capacity of the subject site; and b) is resilient to flood events by ensuring that design and construction account for the potential risks of flooding. AO 2.2 Where development does occur within the 1 in 100 year annual recurrence interval (ARI), the development does not increase the volume, velocity, concentration or flow path alignment of stormwater flow across sites upstream, downstream or in the general vicinity of the subject site.	Parts of the site are affected by Flood Hazard Areas (100 year ARI), as shown in the mapping for the Shire of Flinders Planning Scheme. The proposed camp will include corridors to convey overland flow through the site. It is typical practice to raise the floors of temporary accommodation buildings above ground level, which should be sufficient to achieve the required clearance above flood levels. Further hydrological and hydraulic modelling is needed to determine the extents and depths of 1%AEP (100 year ARI) flooding. Control basins are provided at points of discharge to mitigate the risks of increased volume, velocity and concentration of stormwater discharge into receiving drainage paths and channels.

Source	Recommendation	Design response
Section 8.2.3 Flood hazard overlay code Table 8.2.3.1 Assessment benchmarks for assessable development only	PO 1 Development must not directly, indirectly or cumulatively result in increased adverse flood impacts on sites upstream, downstream or in general vicinity of the subject site.	The proposed camp will include corridors to convey overland flow through the site. Control basins are provided at points of discharge to mitigate the risks of increased volume, velocity and concentration of stormwater discharge into receiving drainage paths and channels.
Section 8.2.3 Flood hazard overlay code Table 8.2.3.1 Assessment benchmarks for assessable	PO 2 Development must not obstruct the free passage of water through a property.	The proposed camp will include corridors to convey overland flow through the site.
Section 8.2.3 Flood hazard overlay code Table 8.2.3.1 Assessment benchmarks for assessable	PO 4 Excavation and filling must not directly, indirectly or cumulatively result in increased adverse flood impacts on sites upstream, downstream or in general vicinity of the subject site.	The proposed camp will include corridors to convey overland flow through the site. Control basins are provided at points of discharge to mitigate the risks of increased volume, velocity and concentration of stormwater discharge into receiving drainage paths and channels.

IFD

(Intensity Frequency Duration data)

Appendix B

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IFD Design Rainfall Intensity (mm/h)								
Issued:	#########							
Location L	Hughenden							
Requeste	Latitude	-20.8594	Longitude	144.1985				
Nearest g	Latitude	20.8625 (S	Longitude	144.1875 (E)				
		Annual Exceedance Probability (AEP)						
Duration	Duration i	63.20%	50%	20%	10%	5%	2%	1%
1 min	1	126	146	205	243	279	325	359
2 min	2	109	126	178	212	244	285	315
3 min	3	102	118	166	198	228	265	293
4 min	4	96.8	112	158	187	215	251	277
5 min	5	92.6	107	151	179	206	239	264
10 min	10	77.2	89.2	125	149	171	199	219
15 min	15	66.5	76.9	108	128	147	172	189
20 min	20	58.6	67.7	95.3	113	130	151	167
25 min	25	52.5	60.7	85.4	101	117	136	150
30 min	30	47.6	55	77.5	92	106	123	136
45 min	45	37.4	43.2	60.9	72.4	83.2	97	107
1 hour	60	31	35.8	50.4	59.9	68.9	80.2	88.6
1.5 hour	90	23.3	26.8	37.7	44.8	51.5	60	66.2
2 hour	120	18.8	21.6	30.3	36	41.3	48.1	53.1
3 hour	180	13.7	15.8	22	26.1	29.9	34.8	38.4
4.5 hour	270	9.93	11.4	15.8	18.7	21.5	25	27.6
6 hour	360	7.89	9.05	12.5	14.8	17	19.8	21.8
9 hour	540	5.73	6.55	9.07	10.7	12.3	14.3	15.8
12 hour	720	4.58	5.24	7.25	8.57	9.82	11.5	12.7
18 hour	1080	3.37	3.86	5.35	6.34	7.29	8.57	9.54
24 hour	1440	2.73	3.12	4.36	5.18	5.97	7.04	7.87
30 hour	1800	2.32	2.66	3.73	4.45	5.14	6.09	6.83
36 hour	2160	2.03	2.34	3.3	3.94	4.57	5.43	6.11
48 hour	2880	1.66	1.91	2.72	3.27	3.81	4.55	5.13
72 hour	4320	1.24	1.44	2.07	2.51	2.94	3.54	4.01
96 hour	5760	0.995	1.16	1.69	2.06	2.42	2.92	3.31
120 hour	7200	0.833	0.976	1.43	1.74	2.05	2.47	2.8
144 hour	8640	0.714	0.839	1.23	1.5	1.77	2.13	2.4
168 hour	10080	0.622	0.732	1.08	1.31	1.54	1.84	2.07

Figures

Appendix C

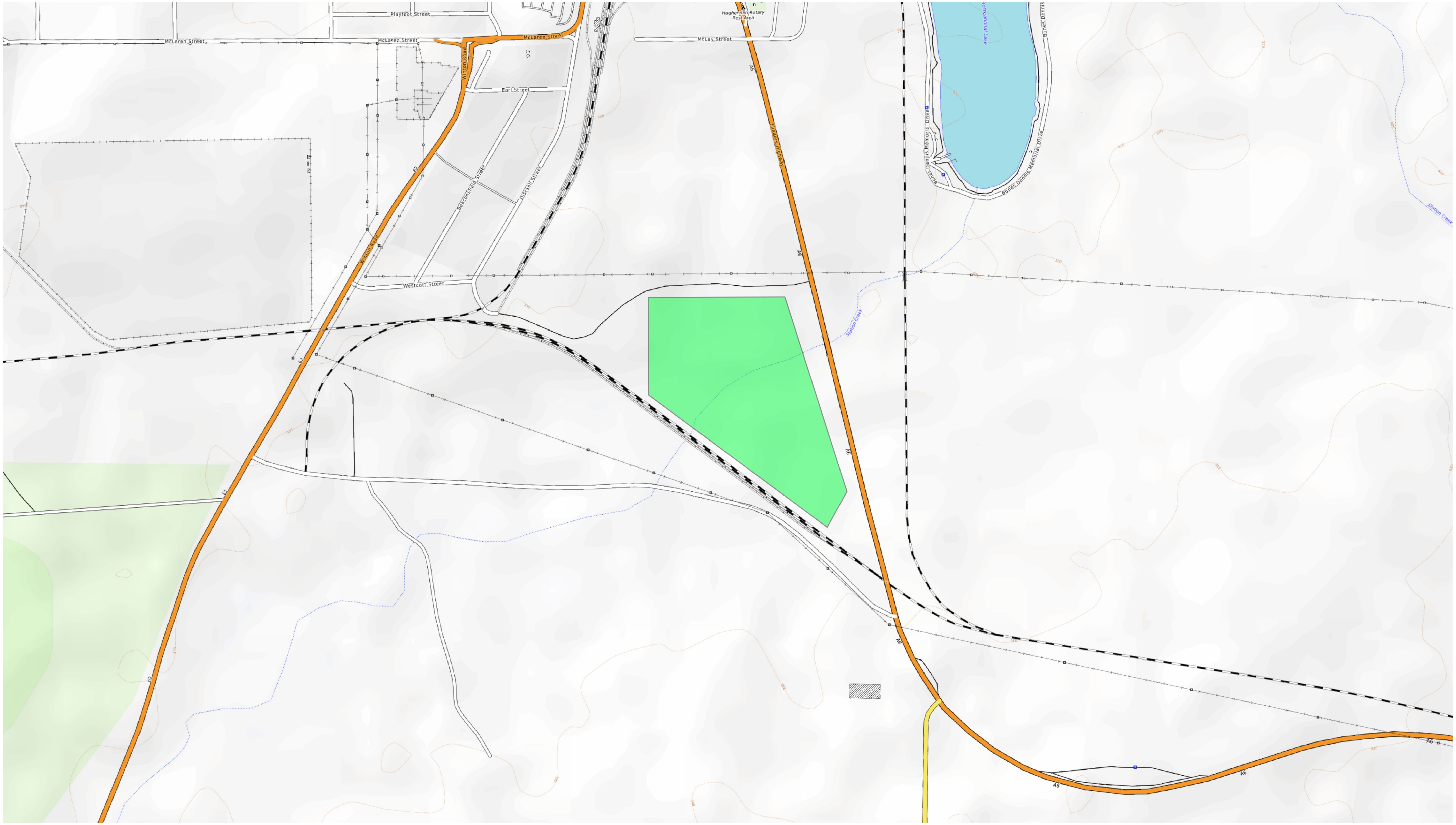


Figure 01: Hughenden Camp Location

LEGEND — Hughenden Footprint

COPPERSTRING 2023 CAMPS
STORMWATER MANAGEMENT PLAN

pitt&sherry

MAP REF: P.23.1073.qgz
AUTHOR: DWilson
REVISION: A
DATE: 30/04/2024

DATA SOURCES: Base map - Open Topo Map

0 200 400 600 800 m

N

COORDINATE SYSTEM: GDA2020 / MGA zone 55
SCALE @ A3: 1:9500

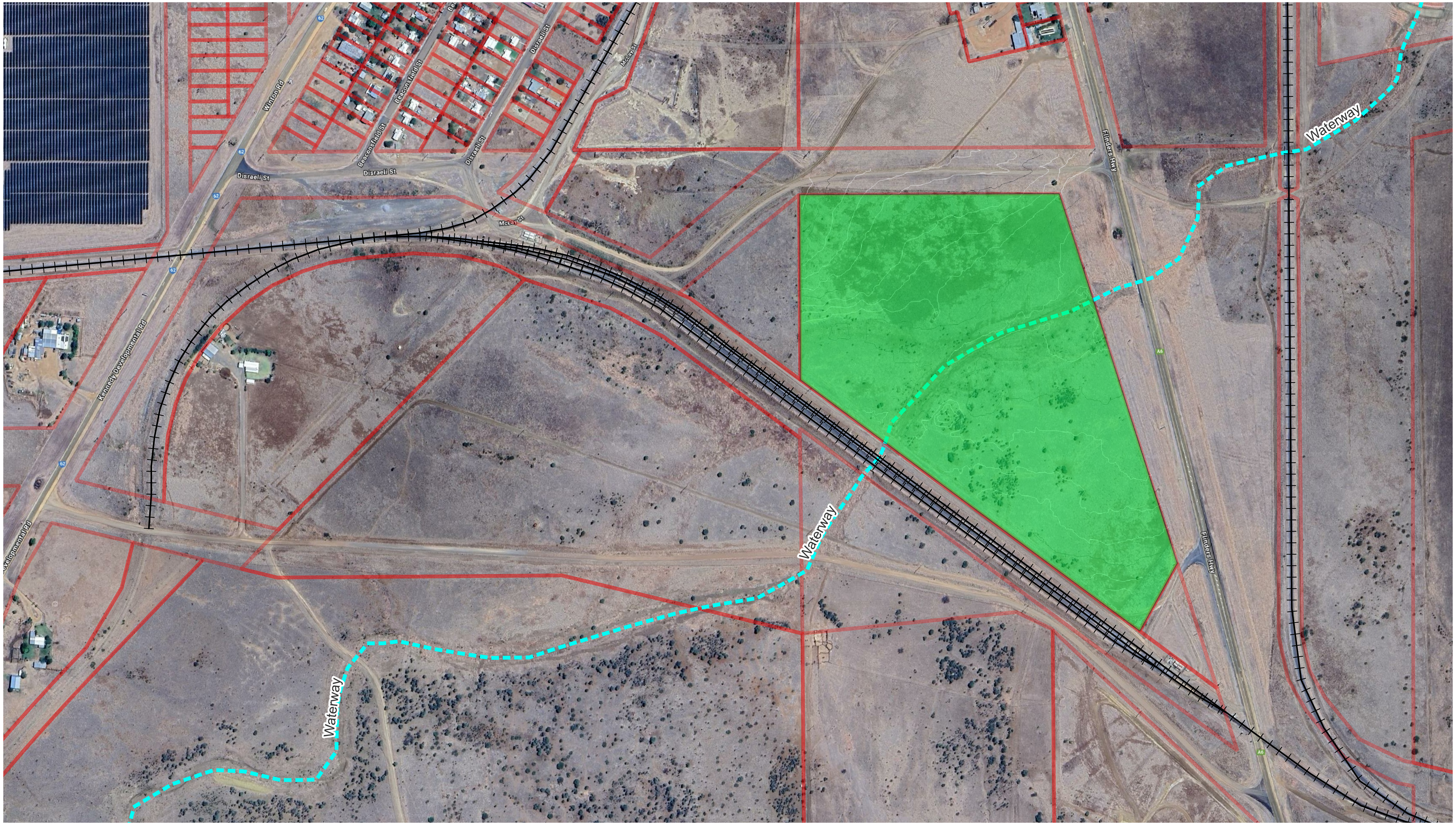


Figure 02: Hughenden Land Use

LEGEND
- Hughenden Footprint
- Rail Corridor
- BOUNDARIES
- Waterway

Hughenden 5-metre Survey
0.5
2

COPPERSTRING 2023 CAMPS
STORMWATER MANAGEMENT PLAN

pitt&sherry

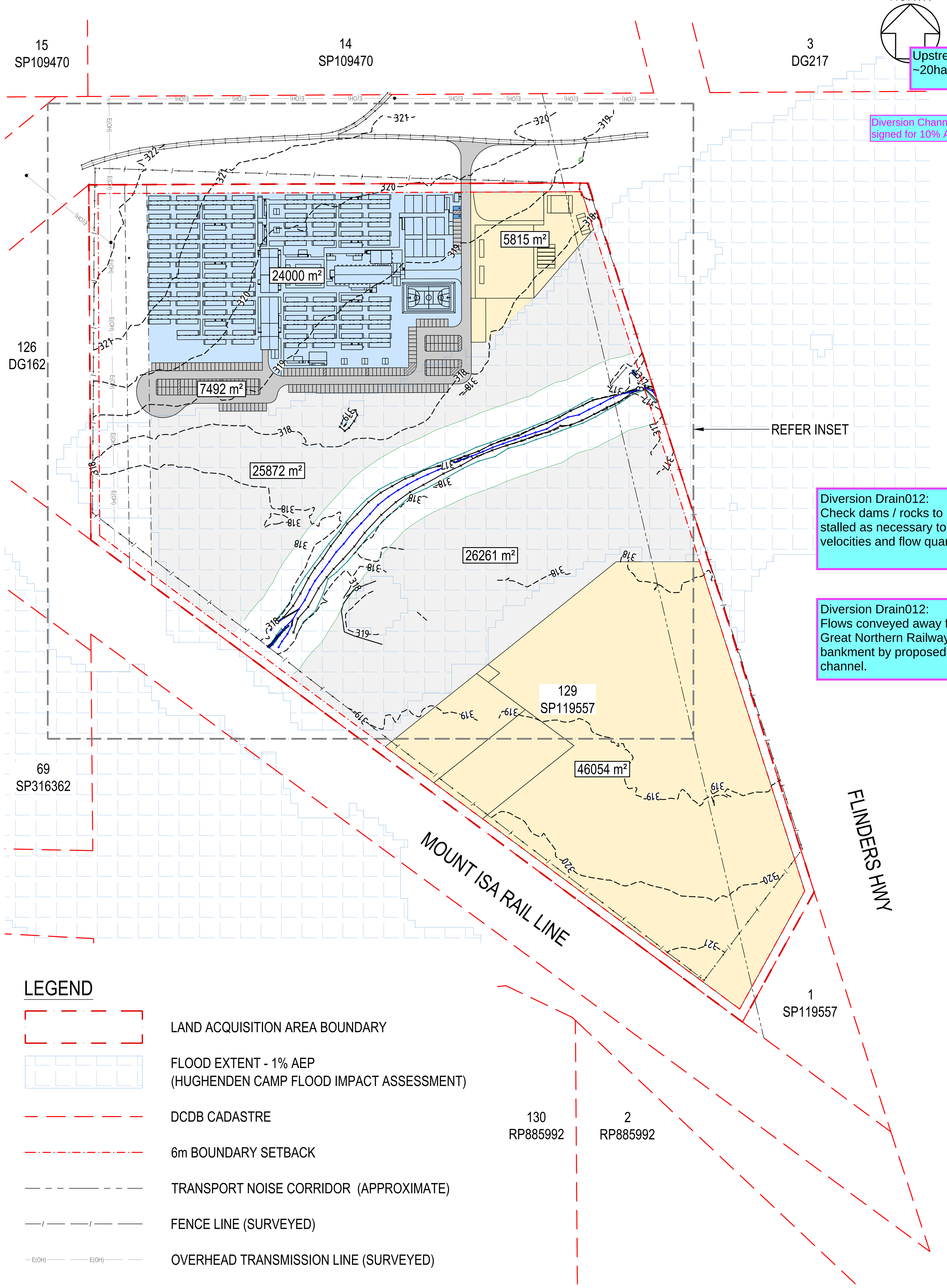
MAP REF:	P.23.1073.qgz
AUTHOR:	DWilson
REVISION:	A
DATE:	30/04/2024

DATA SOURCES: Base map - Google Terrain Hybrid,

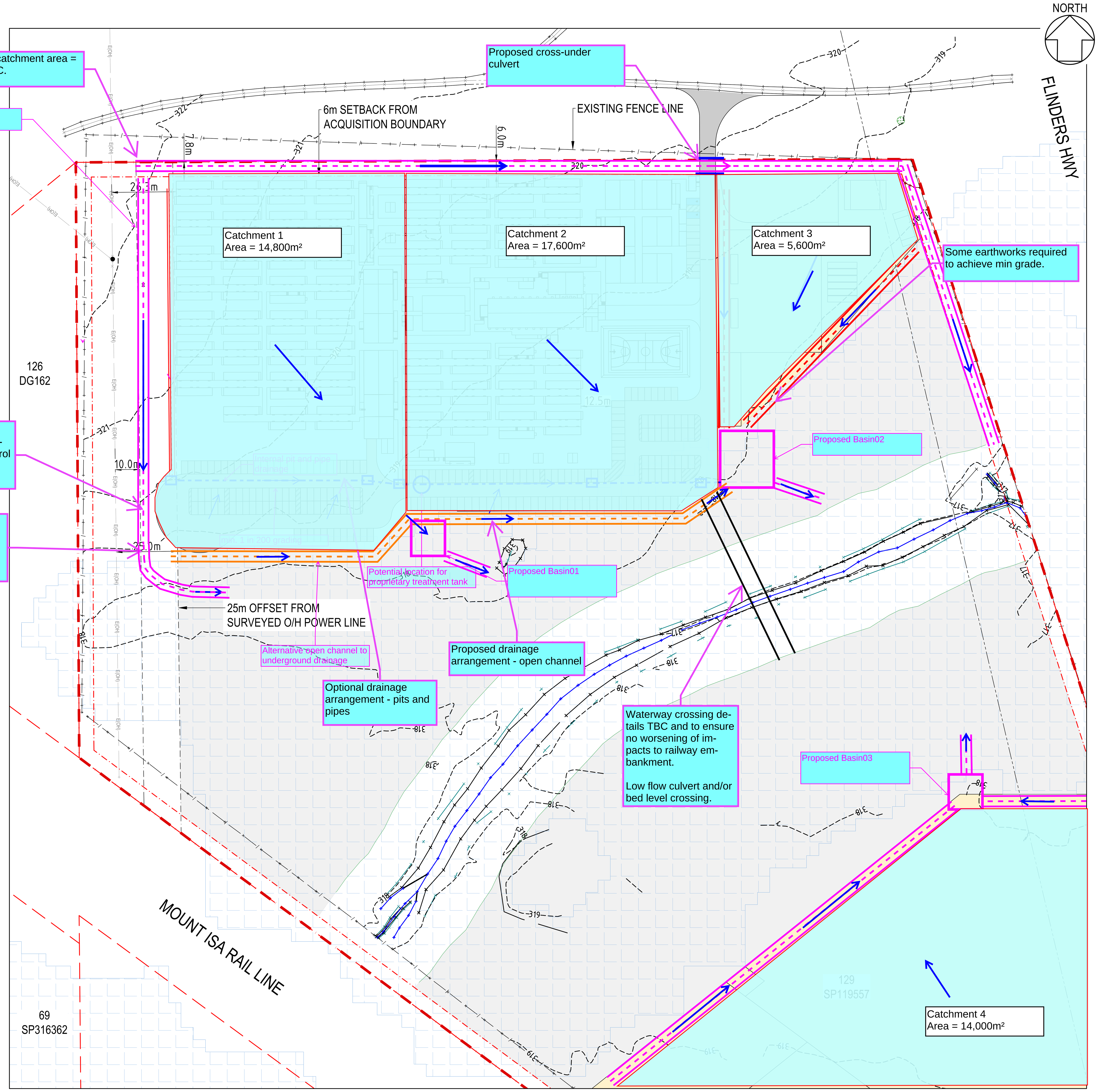
0 100 200 300 400 m

N

COORDINATE SYSTEM: GDA2020 / MGA zone 55
SCALE @ A3: 1:5000



SITE LAYOUT
SCALE 1:2000 (m)



INSET
SCALE 1:1000 (m)

LEGEND

- LAND ACQUISITION AREA BOUNDARY
- FLOOD EXTENT - 1% AEP (HUGHENDEN CAMP FLOOD IMPACT ASSESSMENT)
- DCDB CADASTRE
- 6m BOUNDARY SETBACK
- TRANSPORT NOISE CORRIDOR (APPROXIMATE)
- FENCE LINE (SURVEYED)
- OVERHEAD TRANSMISSION LINE (SURVEYED)
- OVERHEAD TRANSMISSION LINE 25m OFFSET
- WATERCOURSE - SURVEYED
- VEGETATION SETBACK 25m EITHER SIDE
- EXISTING MAJOR CONTOURS - 1m INTERVAL

CARPARKS		
TYPE	AMOUNT	
REGULAR	180	5.4m x 2.7m
PWD	2	5.4m x 2.8m
MINIBUS	30	5.8m x 3m

REFERENCE FILES ATTACHED: CU2-HU00-XRF-PAS-100-1155; CU2-HU00-XRF-PAS-100-1950; CU2-HU00-XRF-PAS-100-1500; CU2-HU00-XRF-PAS-100-1120 EX; CU2-HU00-XRF-PAS-100-1115; CU2-HU00-XRF-PAS-100-1850

P&S FORM DRG-A1 REV 29

DRAWING REVISION HISTORY

No.	DESCRIPTION	DRAWN	DESIGNED	REVIEWED	DATE	APPROVED
A	LAYOUT UPDATED	DPM			24/04/2024	ORIGINAL COPY ON FILE "e" SIGNED BY
		DPM			18/04/2024	SIGNED / DATE

SCALE (PLOTTED FULL SIZE): AS SHOWN
SHEET SIZE: A1

SCALE IN METRES - 1:1000 (20 0 20 40 60 80)
SCALE IN METRES - 1:2000 (40 0 40 80 120 160)

pitt&sherry
pittsh.com.au Phone 1300 748 874 ABN 67 140 184 309

CLIENT: UGL / CPB JV
CONTRACT TITLE: COPPERSTRING 2032 HUGHENDEN CAMP - DETAILED DESIGN
STATUS: INFORMATION ONLY
DRAWING TITLE: 03 - CONCEPT DRAINAGE PLAN
DATUMS: GDA20-MGA55
CLIENT No. CU2-HU00
DRAWING No. CU2-HU00-SKT-PAS-100-0011
REVISION: A
PRINT IN COLOUR

Apr. 24, 24 - 11:35:35 Name: CU2-HU00-SKT-PAS-100-0011.dwg Updated By: David McKenzie

Calculations

Appendix D

pitt&sherry

pitt&sherry		**Job No.**	P.23.1073	**Date**	30/04/2024
		Job Name	Copperstring Hughenden		
		Subject	Stormwater Management		
		By	Drew Wilson		
Calculation		**Checked**	Arthur Bool		
User inputs are in yellow cells		**Verified**	Arthur Bool		

Estimation of runoff by Rational Method in accordance with QUDM
https://www.dews.qld.gov.au/__data/assets/pdf_file/0008/78128/qudm2013-provisional.pdf

Catchment area

Sub-catchment	**Area (ha)**	**F_i**	**Area x f_i**
C01 Existing	1.480	0%	0.000
TOTAL	**1.480**	**0.00**	**0.000**

C_{10} Values

Pervious area land description

Light cover bushland, or poor grass cover, or low density pasture, or low cover bare fal

Pervious soil permeability	Low		
1 hour 10 yr rainfall intensity	59.9	mm/hr	From IFD data

Time of concentration

Components				**t_c (mins)**
Standard inlet time				
Road surfaces and paved areas				5.0
Overland sheet flow (Friend's Equation)				
Oveland sheet flow path length		0	m	
Horton's n	n = 0.045 Average grassed surface		0.045	
Slope of surface (%)		3.0%		0.0
Channel or pipe flow time				
Channel or pipe length	0	m		
Mean velocity	0.70	m/s		
Channel or pipe length	0	m		
Mean velocity	1.00	m/s		0.0
TOTAL (minutes)				**5.0**
TOTAL (hours)				**0.083**

Rational Method Calculation

Flow case	**C_{10}**	**F_y**	**C_y**	**i (mm/hr)**	**A (ha)**	**Q (m^3/s)**
Q001	0.70	0.80	0.56	92.60	1.480	0.21
Q002	0.70	0.85	0.60	107.00	1.480	0.26
Q005	0.70	0.95	0.67	151.00	1.480	0.41
Q010	0.70	1.00	0.70	179.00	1.480	0.52
Q020	0.70	1.05	0.74	206.00	1.480	0.62
Q050	0.70	1.15	0.81	239.00	1.480	0.79
Q100	0.70	1.20	0.84	264.00	1.480	0.91

pitt&sherry	Job No.	P.23.1073	Date	30/04/2024
	Job Name	Copperstring Hughenden		
	Subject	Stormwater Management		
	By	Drew Wilson		
Calculation	Checked	Arthur Bool		
User inputs are in yellow cells	Verified	Arthur Bool		

Estimation of runoff by Rational Method in accordance with QUDM
https://www.dews.qld.gov.au/__data/assets/pdf_file/0008/78128/qudm2013-provisional.pdf

Catchment area

Sub-catchment	Area (ha)	F_i	Area x f_i
C01 Dev	1.480	90%	1.332
TOTAL	**1.480**	**0.90**	**1.332**

C_{10} Values

Pervious area land description

Light cover bushland, or poor grass cover, or low density pasture, or low cover bare fa

Pervious soil permeability	Low		
1 hour 10 yr rainfall intensity	59.9	mm/hr	From IFD data

Time of concentration

Components				t_c (mins)
Standard inlet time				
Road surfaces and paved areas				5.0
Overland sheet flow (Friend's Equation)				
Oveland sheet flow path length		0	m	
Horton's n	n = 0.013 Concrete or asphalt high		0.013	
Slope of surface (%)		3.0%		0.0
Channel or pipe flow time				
Channel or pipe length	0	m		
Mean velocity	0.70	m/s		
Channel or pipe length	0	m		
Mean velocity	1.00	m/s		0.0
TOTAL (minutes)				**5.0**
TOTAL (hours)				**0.083**

Rational Method Calculation

Flow case	C_{10}	F_y	C_y	i (mm/hr)	A (ha)	Q (m^3/s)
Q001	0.87	0.80	0.70	92.60	1.480	0.26
Q002	0.87	0.85	0.74	107.00	1.480	0.33
Q005	0.87	0.95	0.83	151.00	1.480	0.51
Q010	0.87	1.00	0.87	179.00	1.480	0.64
Q020	0.87	1.05	0.91	206.00	1.480	0.77
Q050	0.87	1.15	1.00	239.00	1.480	0.98
Q100	0.87	1.20	1.00	264.00	1.480	1.09

pitt&sherry	Job No.	P.23.1073	Date	30/04/2024
	Job Name	Copperstring Hughenden		
	Subject	Stormwater Management		
	By	Drew Wilson		
Calculation	Checked	Arthur Bool		
User inputs are in yellow cells	Verified	Arthur Bool		

Estimation of runoff by Rational Method in accordance with QUDM
https://www.dews.qld.gov.au/__data/assets/pdf_file/0008/78128/qudm2013-provisional.pdf

Catchment area

Sub-catchment	Area (ha)	F_i	Area x f_i
C02 Existing	1.760	0%	0.000
TOTAL	**1.760**	**0.00**	**0.000**

C_{10} Values

Pervious area land description
Light cover bushland, or poor grass cover, or low density pasture, or low cover bare fa
Pervious soil permeability: Low
1 hour 10 yr rainfall intensity 59.9 mm/hr From IFD data

Time of concentration

Components			t_c (mins)
Standard inlet time			
Road surfaces and paved areas			5.0
Overland sheet flow (Friend's Equation)			
Oveland sheet flow path length	0	m	
Horton's n	n = 0.045 Average grassed surface	0.045	
Slope of surface (%)	3.0%		0.0
Channel or pipe flow time			
Channel or pipe length	0	m	
Mean velocity	0.70	m/s	
Channel or pipe length	0	m	
Mean velocity	1.00	m/s	0.0
TOTAL (minutes)			**5.0**
TOTAL (hours)			**0.083**

Rational Method Calculation

Flow case	C_{10}	F_y	C_y	i (mm/hr)	A (ha)	Q (m^3/s)
Q001	0.70	0.80	0.56	92.60	1.760	0.25
Q002	0.70	0.85	0.60	107.00	1.760	0.31
Q005	0.70	0.95	0.67	151.00	1.760	0.49
Q010	0.70	1.00	0.70	179.00	1.760	0.61
Q020	0.70	1.05	0.74	206.00	1.760	0.74
Q050	0.70	1.15	0.81	239.00	1.760	0.94
Q100	0.70	1.20	0.84	264.00	1.760	1.08

pitt&sherry	Job No.	P.23.1073	Date	30/04/2024
	Job Name	Copperstring Hughenden		
	Subject	Stormwater Management		
	By	Drew Wilson		
Calculation	Checked	Arthur Bool		
User inputs are in yellow cells	Verified	Arthur Bool		

Estimation of runoff by Rational Method in accordance with QUDM
https://www.dews.qld.gov.au/__data/assets/pdf_file/0008/78128/qudm2013-provisional.pdf

Catchment area

Sub-catchment	Area (ha)	F_i	Area x f_i
C02 Dev	1.760	90%	1.584
TOTAL	**1.760**	**0.90**	**1.584**

C_{10} Values

Pervious area land description
Light cover bushland, or poor grass cover, or low density pasture, or low cover bare fa
Pervious soil permeability: Low
1 hour 10 yr rainfall intensity 59.9 mm/hr From IFD data

Time of concentration

Components			t_c (mins)
Standard inlet time			
Road surfaces and paved areas			5.0
Overland sheet flow (Friend's Equation)			
Oveland sheet flow path length	0	m	
Horton's n	n = 0.045 Average grassed surface	0.045	
Slope of surface (%)	3.0%		0.0
Channel or pipe flow time			
Channel or pipe length	0	m	
Mean velocity	0.70	m/s	
Channel or pipe length	0	m	
Mean velocity	1.00	m/s	0.0
TOTAL (minutes)			**5.0**
TOTAL (hours)			**0.083**

Rational Method Calculation

Flow case	C_{10}	F_y	C_y	i (mm/hr)	A (ha)	Q (m^3/s)
Q001	0.87	0.80	0.70	92.60	1.760	0.32
Q002	0.87	0.85	0.74	107.00	1.760	0.39
Q005	0.87	0.95	0.83	151.00	1.760	0.61
Q010	0.87	1.00	0.87	179.00	1.760	0.76
Q020	0.87	1.05	0.91	206.00	1.760	0.92
Q050	0.87	1.15	1.00	239.00	1.760	1.17
Q100	0.87	1.20	1.00	264.00	1.760	1.29

pitt&sherry	Job No.	P.23.1073	Date	30/04/2024
	Job Name	Copperstring Hughenden		
	Subject	Stormwater Management		
	By	Drew Wilson		
Calculation	Checked	Arthur Bool		
User inputs are in yellow cells	Verified	Arthur Bool		

Estimation of runoff by Rational Method in accordance with QUDM
https://www.dews.qld.gov.au/__data/assets/pdf_file/0008/78128/qudm2013-provisional.pdf

Catchment area

Sub-catchment	Area (ha)	F_i	Area x f_i
C03 Existing	0.560	0%	0.000
TOTAL	**0.560**	**0.00**	**0.000**

C_{10} Values

Pervious area land description

Light cover bushland, or poor grass cover, or low density pasture, or low cover bare fal

Pervious soil permeability	Low		
1 hour 10 yr rainfall intensity	59.9	mm/hr	From IFD data

Time of concentration

Components				t_c (mins)
Standard inlet time				
Road surfaces and paved areas				5.0
Overland sheet flow (Friend's Equation)				
Oveland sheet flow path length	0	m		
Horton's n	n = 0.045 Average grassed surface		0.045	
Slope of surface (%)	3.0%			0.0
Channel or pipe flow time				
Channel or pipe length	0	m		
Mean velocity	0.70	m/s		
Channel or pipe length	0	m		
Mean velocity	1.00	m/s		0.0
TOTAL (minutes)				**5.0**
TOTAL (hours)				**0.083**

Rational Method Calculation

Flow case	C_{10}	F_y	C_y	i (mm/hr)	A (ha)	Q (m^3/s)
Q001	0.70	0.80	0.56	92.60	0.560	0.08
Q002	0.70	0.85	0.60	107.00	0.560	0.10
Q005	0.70	0.95	0.67	151.00	0.560	0.16
Q010	0.70	1.00	0.70	179.00	0.560	0.19
Q020	0.70	1.05	0.74	206.00	0.560	0.24
Q050	0.70	1.15	0.81	239.00	0.560	0.30
Q100	0.70	1.20	0.84	264.00	0.560	0.34

pitt&sherry	Job No.	P.23.1073	Date	30/04/2024
	Job Name	Copperstring Hughenden		
	Subject	Stormwater Management		
	By	Drew Wilson		
Calculation	Checked	Arthur Bool		
User inputs are in yellow cells	Verified	Arthur Bool		

Estimation of runoff by Rational Method in accordance with QUDM
https://www.dews.qld.gov.au/__data/assets/pdf_file/0008/78128/qudm2013-provisional.pdf

Catchment area

Sub-catchment	Area (ha)	F_i	Area x f_i
C03 Dev	0.560	90%	0.504
TOTAL	**0.560**	**0.90**	**0.504**

C_{10} Values

Pervious area land description

Light cover bushland, or poor grass cover, or low density pasture, or low cover bare fal

Pervious soil permeability: Low

1 hour 10 yr rainfall intensity 59.9 mm/hr From IFD data

Time of concentration

Components			t_c (mins)
Standard inlet time			
Road surfaces and paved areas			5.0
Overland sheet flow (Friend's Equation)			
Oveland sheet flow path length	0	m	
Horton's n	n = 0.045 Average grassed surface	0.045	
Slope of surface (%)	3.0%		0.0
Channel or pipe flow time			
Channel or pipe length	0	m	
Mean velocity	0.70	m/s	
Channel or pipe length	0	m	
Mean velocity	1.00	m/s	0.0
TOTAL (minutes)			**5.0**
TOTAL (hours)			**0.083**

Rational Method Calculation

Flow case	C_{10}	F_y	C_y	i (mm/hr)	A (ha)	Q (m^3/s)
Q001	0.87	0.80	0.70	92.60	0.560	0.10
Q002	0.87	0.85	0.74	107.00	0.560	0.12
Q005	0.87	0.95	0.83	151.00	0.560	0.19
Q010	0.87	1.00	0.87	179.00	0.560	0.24
Q020	0.87	1.05	0.91	206.00	0.560	0.29
Q050	0.87	1.15	1.00	239.00	0.560	0.37
Q100	0.87	1.20	1.00	264.00	0.560	0.41

pitt&sherry	Job No.	P.23.1073	Date	30/04/2024
	Job Name	Copperstring Hughenden		
	Subject	Stormwater Management		
	By	Drew Wilson		
Calculation	Checked	Arthur Bool		
User inputs are in yellow cells	Verified	Arthur Bool		

Estimation of runoff by Rational Method in accordance with QUDM
https://www.dews.qld.gov.au/__data/assets/pdf_file/0008/78128/qudm2013-provisional.pdf

Catchment area

Sub-catchment	Area (ha)	F_i	Area x f_i
C04 Existing	1.400	0%	0.000
TOTAL	**1.400**	**0.00**	**0.000**

C_{10} Values

Pervious area land description

Light cover bushland, or poor grass cover, or low density pasture, or low cover bare fa

Pervious soil permeability	Low		
1 hour 10 yr rainfall intensity	59.9	mm/hr	From IFD data

Time of concentration

Components				t_c (mins)
Standard inlet time				
Road surfaces and paved areas				5.0
Overland sheet flow (Friend's Equation)				
Oveland sheet flow path length		0	m	
Horton's n	n = 0.045 Average grassed surface		0.045	
Slope of surface (%)		3.0%		0.0
Channel or pipe flow time				
Channel or pipe length		0	m	
Mean velocity		0.70	m/s	
Channel or pipe length		0	m	
Mean velocity		1.00	m/s	0.0
TOTAL (minutes)				**5.0**
TOTAL (hours)				**0.083**

Rational Method Calculation

Flow case	C_{10}	F_y	C_y	i (mm/hr)	A (ha)	Q (m^3/s)
Q001	0.70	0.80	0.56	92.60	1.400	0.20
Q002	0.70	0.85	0.60	107.00	1.400	0.25
Q005	0.70	0.95	0.67	151.00	1.400	0.39
Q010	0.70	1.00	0.70	179.00	1.400	0.49
Q020	0.70	1.05	0.74	206.00	1.400	0.59
Q050	0.70	1.15	0.81	239.00	1.400	0.75
Q100	0.70	1.20	0.84	264.00	1.400	0.86

pitt&sherry	Job No.	P.23.1073	Date	30/04/2024
	Job Name	Copperstring Hughenden		
	Subject	Stormwater Management		
	By	Drew Wilson		
Calculation	Checked	Arthur Bool		
User inputs are in yellow cells	Verified	Arthur Bool		

Estimation of runoff by Rational Method in accordance with QUDM
https://www.dews.qld.gov.au/__data/assets/pdf_file/0008/78128/qudm2013-provisional.pdf

Catchment area

Sub-catchment	Area (ha)	F_i	Area x f_i
C04 Dev	1.400	90%	1.260
TOTAL	**1.400**	**0.90**	**1.260**

C_{10} Values

Pervious area land description

Light cover bushland, or poor grass cover, or low density pasture, or low cover bare fal

Pervious soil permeability	Low		
1 hour 10 yr rainfall intensity	59.9	mm/hr	From IFD data

Time of concentration

Components				t_c (mins)
Standard inlet time				
Road surfaces and paved areas				5.0
Overland sheet flow (Friend's Equation)				
Oveland sheet flow path length		0	m	
Horton's n	n = 0.045 Average grassed surface		0.045	
Slope of surface (%)		3.0%		0.0
Channel or pipe flow time				
Channel or pipe length	0	m		
Mean velocity	0.70	m/s		
Channel or pipe length	0	m		
Mean velocity	1.00	m/s		0.0
TOTAL (minutes)				**5.0**
TOTAL (hours)				**0.083**

Rational Method Calculation

Flow case	C_{10}	F_y	C_y	i (mm/hr)	A (ha)	Q (m^3/s)
Q001	0.87	0.80	0.70	92.60	1.400	0.25
Q002	0.87	0.85	0.74	107.00	1.400	0.31
Q005	0.87	0.95	0.83	151.00	1.400	0.49
Q010	0.87	1.00	0.87	179.00	1.400	0.61
Q020	0.87	1.05	0.91	206.00	1.400	0.73
Q050	0.87	1.15	1.00	239.00	1.400	0.93
Q100	0.87	1.20	1.00	264.00	1.400	1.03

pitt&sherry

CopperString 2032

Stormwater Management Plan for temporary construction camp and laydown area at Hughenden, QLD

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