

# **Appendix F**

## **Surface Water Management Plan**



# Collie Steel Mill


## Surface Water Management Plan

Green Steel of WA Collie Pty Ltd

15 December 2023

→ **The Power of Commitment**



<b>Project name</b>	Collie Steel Mill Owners Engineer						
<b>Document title</b>	Collie Steel Mill   Surface Water Management Plan						
<b>Project number</b>	12609060						
<b>Document number</b>	12609060-PA-RPT-005						
<b>File name</b>	12609060-PA-PT-005_Surface Water Management Plan.docx						
Status Code	Revision	Author	Reviewer		Approved for issue		
			Name	Signature	Name	Signature	Date
S4	Rev 0	Shafiqul Alam	Nick Deeks	 PP 19/12/23	Ian Fanton		21/12/23

**GHD Pty Ltd ABN 39 008 488 373**

999 Hay Street, Level 10

Perth, Western Australia 6000, Australia

**T** +61 8 6222 | **F** +61 8 6222 8555 | **E** [permail@ghd.com](mailto:permail@ghd.com) | **ghd.com**

© GHD 2023

This document is and shall remain the property of GHD. The document may only be used for the purpose for which it was commissioned and in accordance with the Terms of Engagement for the commission. Unauthorised use of this document in any form whatsoever is prohibited.

# Contents

<b>Abbreviations</b>	<b>1</b>
<b>1. Introduction</b>	<b>2</b>
1.1 Project Background	2
1.2 Purpose of this report	2
1.3 Scope and limitations	2
1.4 Assumptions	2
1.5 Site description	2
<b>2. Site characteristics</b>	<b>4</b>
2.1 Land use and zoning	4
2.2 Climate	4
2.3 Topography	4
2.4 Bushfire prone areas	7
2.5 Geology and soils	7
2.6 Acid sulfate soils	10
2.7 Groundwater	10
2.8 Environmental and Heritage	11
2.8.1 Flora and Fauna	11
2.8.2 Heritage	12
2.9 Flood Mapping	14
2.9.1 Topography	14
2.9.2 Bed Roughness	14
2.9.3 Rainfall	15
2.9.3.1 Rainfall Depths	15
2.9.3.2 Temporal Patterns	16
2.9.3.3 Pre-burst Depths	16
2.9.3.4 Regional Losses	16
2.9.4 Flood Mapping Results	16
2.9.4.1 Regional model	16
2.9.4.2 Local model	17
<b>3. Stormwater Management</b>	<b>21</b>
3.1 Surface Water Management Measures	21
3.2 General Design Principles	24
3.3 Catchments and Hydrology	24
3.3.1 Design Rainfall	24
3.3.2 Catchments	24
3.3.3 Losses	24
3.4 Stormwater Modelling and Basin Design	25
3.4.1 Detention Water Volume	25
3.4.2 Post-development	25
3.4.3 Conceptual Basin Design	26
3.5 Stormwater quality management	26
3.6 Monitoring and implementation	27
<b>4. References</b>	<b>29</b>

## Table index

Table 1	Monthly rainfall (mm) statistics for Collie East station (009994)	4
Table 2	Geological units occurring in the site	7
Table 3	Soil classification for the site	7
Table 4	Vegetation associations recorded within the current study site	11
Table 5	Assigned Manning's n values	14
Table 6	IFD Design Rainfall Depths	16
Table 7	Catchment Areas for Local Runoff	24
Table 8	Pre-development Runoff Values	25
Table 9	Post-development Model Parameters	25
Table 10	Post-development Runoff and Detention Water Volume	25
Table 11	Summary of Basin Design	26

## Figure index

Figure 1	Site Location	3
Figure 2	Site Topography	6
Figure 3	Bushfire Prone Areas	8
Figure 4	Geological Map	9
Figure 5	Soil Landscape Map	10
Figure 6	Groundwater levels recorded at the reference site 61200019	11
Figure 7	Heritage Site Locations	13
Figure 8	DEA Land Cover Map used for the TUFLOW model setup	14
Figure 9	1% AEP Flood Depth Map for the regional model	18
Figure 10	1% AEP Flood Depth Map for the Proposed Site	19
Figure 11	Pre-development sub-catchments for the Proposed Site	20
Figure 12	Proposed Site Layout	22
Figure 13	Conceptual Drainage Arrangement	23
Figure 14	Biofilter specification	27

# Abbreviations

Abbreviation	Term referred
AEP	Annual Exceedance Probability
AHD	Australian Height Datum
BPS	Bluewaters Power Station
CIE	Coolangatta Industrial Estate
DFES	Department of Fire and Emergency Services
DPLH	Department of Planning, Lands and Heritage
EAF	Electric Arc Furnace
EPA	Environmental Protection Authority
EP Act	<i>Environmental Protection Act 1986 (WA)</i>
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999 (Cth)</i>
GSWA	Green Steel WA
LPS6	Shire of Collie Local Planning Scheme No. 6
MRWA	Main Roads Western Australia
PD Act	<i>Planning and Development Act 2005</i>
RDAP	Regional Development Assessment Panel
SIA	Strategic Industrial Area
SWMP	Surface Water Management Plan
SPP	State Planning Policy
WA	Western Australia
WAPC	Western Australian Planning Commission

# 1. Introduction

## 1.1 Project Background

Green Steel of WA Collie Pty Ltd (GSWA) proposes to establish the Collie Green Steel Mill at Lot 2 (No. 154) Boys Home Road, Palmer. The proposed Collie Green Steel Mill will be located to the west of the existing Collie Power Station (CPS) facility, and to the southeast of the existing Bluewaters Power Station (BPS).

The Collie Steel Mill involves the establishment of a 450 kTPA electric arc furnace (EAF) steel mill that will process local scrap metal to produce re-enforcing bar (rebar) for local consumption and export (the Proposal).

GHD has prepared this Surface Water Management Plan (SWMP) to aid in the design of surface water management system of the proposed steel mill.

## 1.2 Purpose of this report

The purpose of this report is to document the approach to surface water management for the Proposal. This report outlines the methodology and results of the flood risk assessment and the stormwater management measures for the Proposal.

## 1.3 Scope and limitations

*This report has been prepared by GHD for Green Steel of WA Collie Pty Ltd and may only be used and relied on by Green Steel of WA Collie Pty Ltd for the purpose agreed between GHD and Green Steel of WA Collie Pty Ltd as set out in section 1.2 of this report.*

*GHD otherwise disclaims responsibility to any person other than Green Steel of WA Collie Pty Ltd arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.*

*The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.*

*The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.*

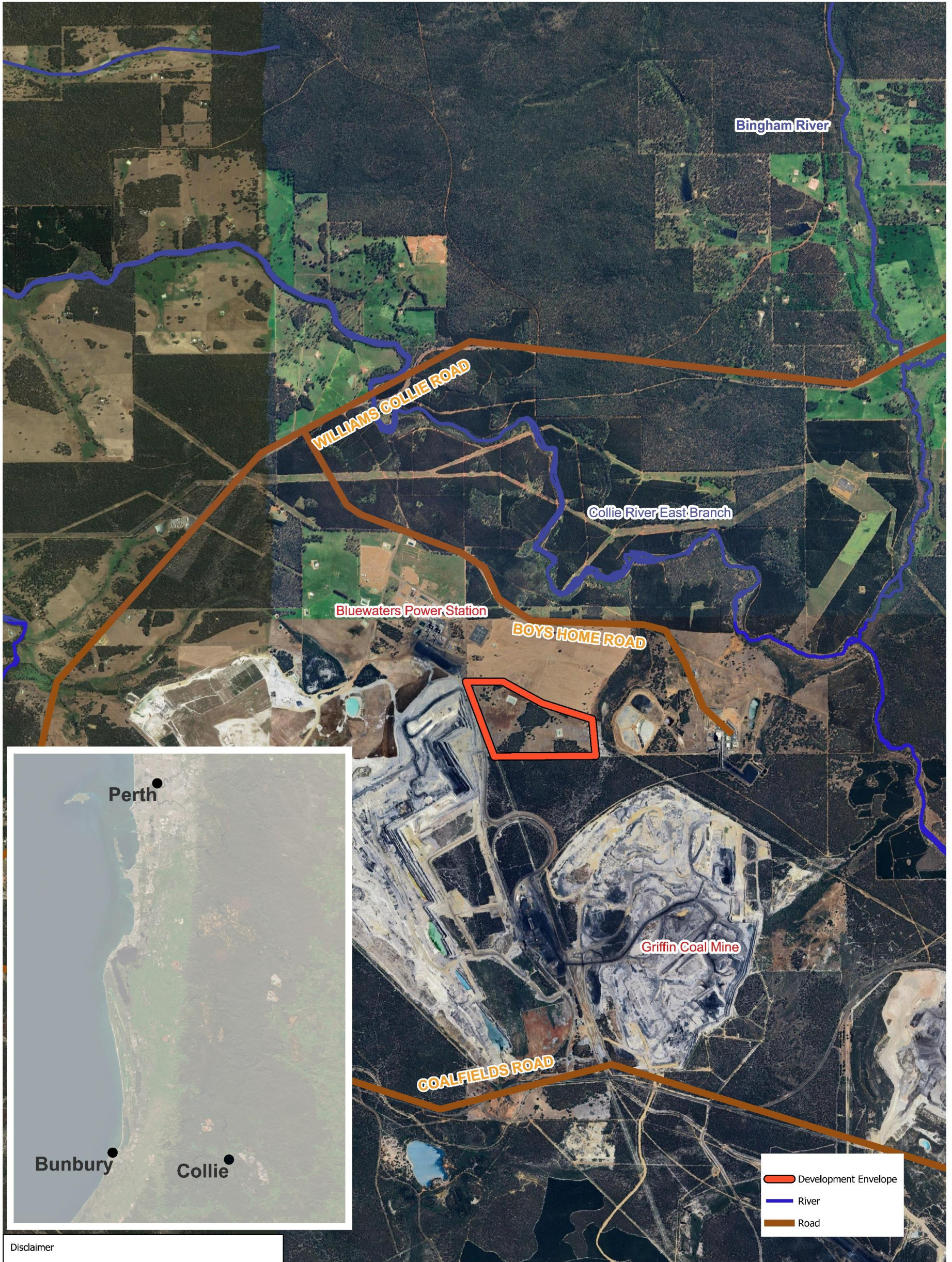
*The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described throughout this report and in section 1.4. GHD disclaims liability arising from any of the assumptions being incorrect.*

## 1.4 Assumptions

GHD has prepared this SWMP for the site relying on the information provided by GSWA (proposed development layout) and government databases. GHD has not independently verified or checked this beyond the agreed scope of work and it is assumed that all information provided is reliable and accurate.

## 1.5 Site description

The proposed development is in Collie, Western Australia, approximately 200 km southeast of Perth. The site is located within the Coolangatta Industrial Estate (CIE), adjacent to the existing Bluewaters Power Station. The site is a private land within the area of Lot 2 (No. 154) Boys Home Road, Palmer. It is located to the southeast corner of Lot 2 and comprises approximately 74.4 hectares. It is located approximately 2 km northwest of Griffin Coal Mine. The location of the site is shown in Figure 1.



**Disclaimer**

© 2023. Whilst every care has been taken to prepare this map, GHD and ESRI make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.

<p>0 200 400 600 800 m</p>		<p><b>GSWA</b></p> <p>GSWA COLLIE SITE SURFACE WATER MANAGEMENT PLAN</p> <p><b>SITE LOCATION</b></p>	<p>Project No. 12609060 Revision No. A Date 14/11/2023</p>
<p>Map Projection: Transverse Mercator Horizontal Datum: GDA 1994 Grid: GDA 1994 MGA Zone 50</p>			
<p>Data Source: ESRI: World Imagery (Imagery Date: 2023; Date Extracted: 10/11/2023) Created by: S. Alam</p>			

Figure 1 Site Location

## 2. Site characteristics

### 2.1 Land use and zoning

The site is zoned 'Industrial Development' under the Shire of Collie's Local Planning Scheme No. 6. The site is subject to the Coolangatta Industrial Estate Structure Plan (Tecon Australia, 2019). The site is currently being used for agricultural purposes, in particular grazing. It is located to the west of the existing Collie Power Station and to the southeast of the existing Bluewaters Power Station. It is located on a parcel of land identified as Lot 2 (No. 154) Boys Home Road, Palmer. The site is approximately 1 km south of the Collie River which is reserved 'Drainage/Waterway' under the Shire's LPS6. At the southern end, the site is adjacent to the Collie State Forest reserved as 'State Forest' according to the Shire's LPS6. The site is located within the Collie River Irrigation District area, but not within Public Drinking Water Source Area (PDWSA). The Harris River Dam Catchment Area is identified as the closest PDWSA which is located approximately 13 km north of the site. The proposed site is located within the proclaimed Collie Groundwater Area. A groundwater license is required to consider the groundwater reserve as a source of water for usage purposes. However, it has been clarified by GSWA that the proposed development would not require groundwater for usage purposes.

### 2.2 Climate

The site has a Mediterranean type climate with hot, dry summers and cool, wet winters. The average annual rainfall is 726.6 mm. About 73% of annual rainfall takes place during the months of May to September. Table 1 shows the monthly statistics of rainfall for the closest weather station to the site (Collie East Station, Station Number 009994).

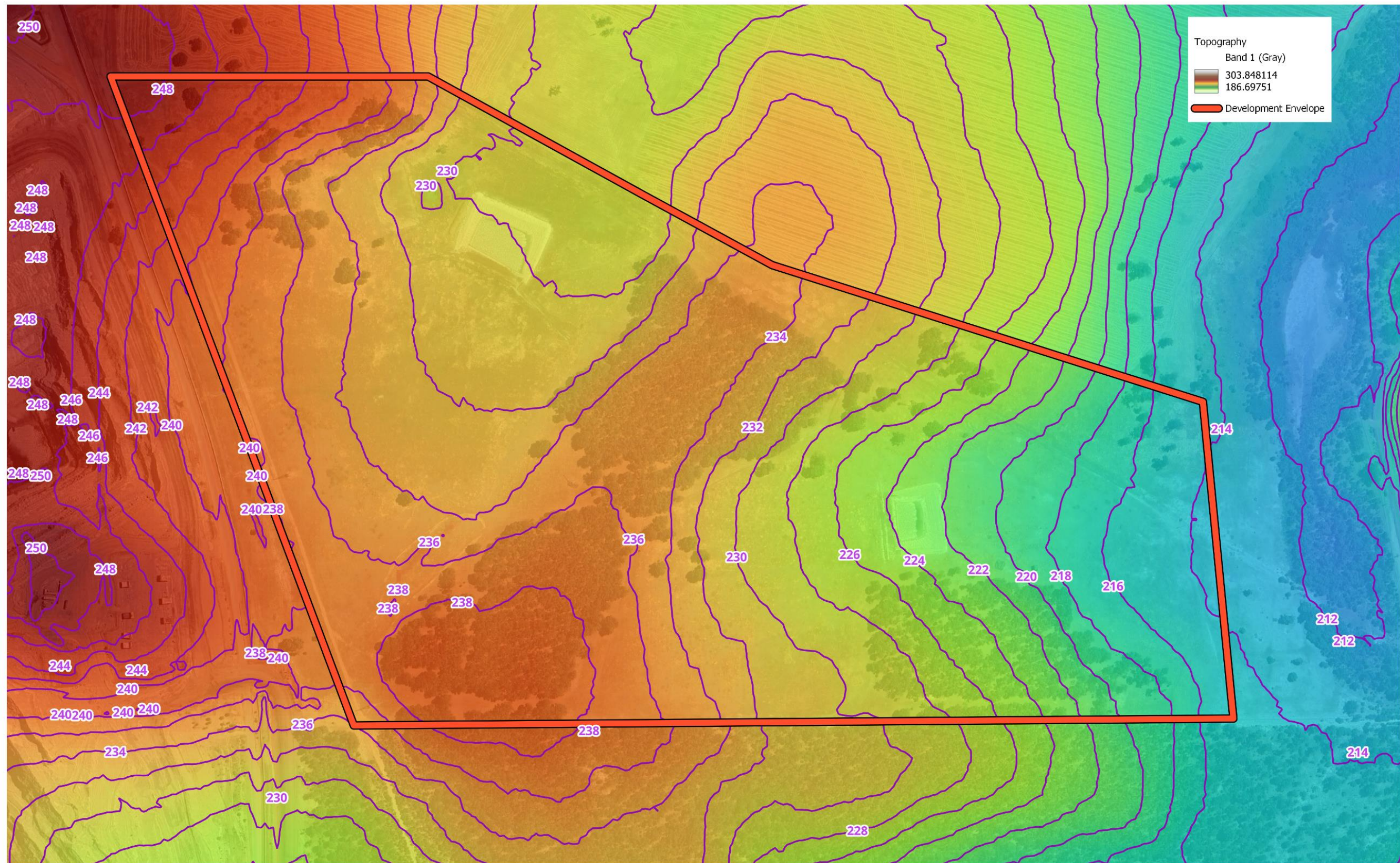
Table 1 Monthly rainfall (mm) statistics for Collie East station (009994)

Month	Mean	Lowest	Highest
January	17.1	0.0	90.4
February	12.1	0.0	89.6
March	19.2	0.0	84.4
April	41.7	0.0	142.4
May	92.2	24.4	213.6
June	102.6	21.2	254.4
July	133.2	39.2	257.2
August	112.8	14.2	216.2
September	88.8	20.8	218.8
October	39.0	2.4	82.2
November	25.5	4.0	74.0
December	18.8	0.6	155.0
<b>Annual</b>	<b>726.6</b>	<b>390.0</b>	<b>930.0</b>

### 2.3 Topography

Overall, the site is elevated in the southern and western portion. A ridge is located at the centre of the site which runs from southwest to northeast and bisects the site into two drainage catchment areas. The western boundary represents the higher region of the site and elevations along this perimeter vary from approximately 249 mAHD (north-western corner) to 233 mAHD (south-west corner). The site does have an external catchment to the west which was delineated based on modelling-based outcome and presented in Figure 11. The site elevation ranges

from approximately 249 m AHD along the northwestern boundary to approximately 214 m AHD along the eastern boundary. The topography of the site is shown in Figure 2.



Disclaimer

© 2023. Whilst every care has been taken to prepare this map, GHD and ESRI make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.

0 200 400 600 800 m  
 Map Projection: Transverse Mercator  
 Horizontal Datum: GDA 1994  
 Grid: GDA 1994 MGA Zone 50



**GSWA**  
 GSWA COLLIE SITE SURFACE WATER  
 MANAGEMENT PLAN  
**Site Topography**

Project No. 12609060  
 Revision No. A  
 Date 14/12/2023

Data Source:DataWA. Created by: S. Alam

Figure 2 Site Topography

## 2.4 Bushfire prone areas

The Bush Fire Prone Areas 2021 dataset (OBRM-019) identifies approximately half of the proposed development site as bush fire prone areas as designated by the Fire and Emergency Services (FES) Commissioner on 11 December 2021. Figure 3 shows the extent of the bushfire prone areas as identified in OBRM-019 dataset. The State Planning Policy 3.7 – Planning in Bushfire Prone Areas ("SPP 3.7") seeks to guide the implementation of effective risk-based development planning to reduce the impact of bushfire on property, infrastructure, and life. As the proposed site being identified as bushfire prone, the principles and objectives of SPP 3.7 need to be considered as part of the development planning process. However, the proposal will result in significant, non-vegetated earthworked area that will result in a massive reduction in bushfire threat. The surface water management plan section of this report proposed two detention basins for the site and both are proposed to be placed outside of the identified bushfire prone areas.

## 2.5 Geology and soils

The published 1:250,000 scale geological map from Geological Survey of WA, and Geoscience Australia is sourced and shown in Figure 4 for the site. The only two types of geological units occur in the site. The description of the geological unit is provided in Table 2.

Table 2 Geological units occurring in the site

Unit Code	Narrative	Age
Czl	Laterite – chiefly massive, but includes overlying pisolithic gravel and minor lateritized sand	Cainozoic
Ta	Sandy alluvium forming terraces to Nakin Formation, locally lateritized	Cainozoic

The soil landscape mapping for the site and its surroundings is shown in Figure 5. This is derived from the published *Soil Landscape Mapping – Western Australia* layer (DPIRD-076). The mapping indicates that mapped soils comprise of semi-wet soil, wet soil and duplex sandy gravel across the site. The description of soil types are provided in Table 3.

Table 3 Soil classification for the site

Soil type	Characteristics	Occurrence
Semi-wet soil	Lower part of profile (30-80 cm) saturated for the major part of the year Often with dark grey, brown or black topsoil Sands, loams and clays	This is mapped across the eastern portion of the site.
Wet soil	Most of the profile (<30 cm) saturated for the major part of the year Dark grey, brown or black topsoil Sands, loams and clays May be organic in swamps	This is mapped across the western portion of the site.
Duplex sandy gravel	Yellow, grey or brown in top 30 cm Over clay loam to clay or reticulite (mottled sandy loam to sandy clay loam) at 30-80 cm High gravel content (>20%, but often much higher) Native vegetation, especially proteaceous species	This is mapped across the site from south to north, and the small portion of the western end.



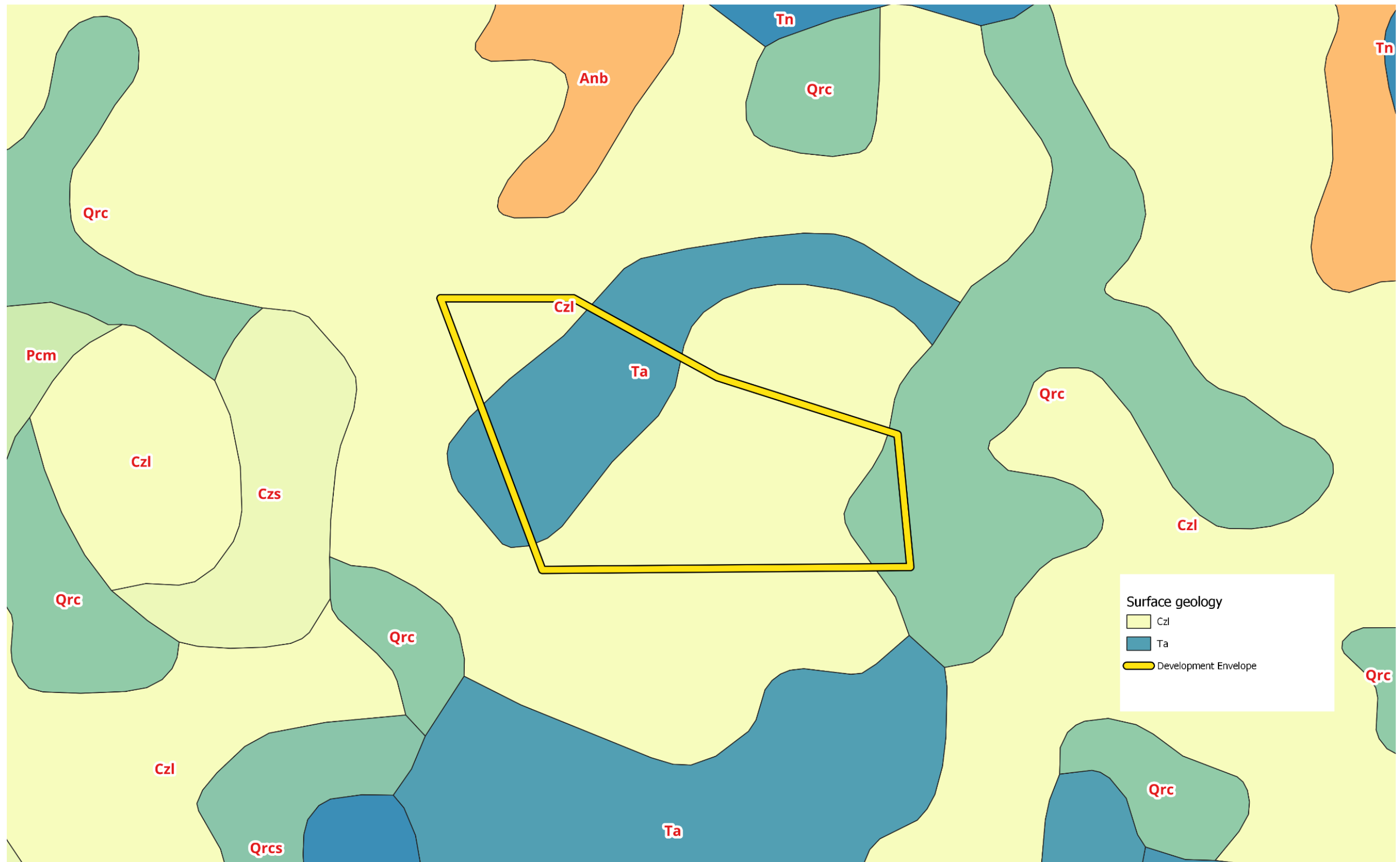
Development Envelope  
 Bush Fire Prone Areas 2021 (OBRM-019)  
 Development Footprint  
 Basin Proposed

Disclaimer

© 2023. Whilst every care has been taken to prepare this map, GHD and ESRI make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.

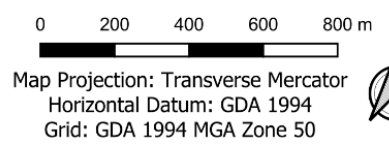
<p>0 200 400 600 800 m</p> <p>Map Projection: Transverse Mercator Horizontal Datum: GDA 1994 Grid: GDA 1994 MGA Zone 50</p>		<p><b>GSWA</b></p> <p><b>GSWA COLLIE SITE SURFACE WATER MANAGEMENT PLAN</b></p> <p><b>Bushfire Prone Areas</b></p>	<p>Project No. 12609060 Revision No. A Date 14/12/2023</p>
Data Source: DataWA. Created by: S. Alam			

Figure 3 Bushfire Prone Areas



Disclaimer

© 2023. Whilst every care has been taken to prepare this map, GHD and ESRI make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.



**GSWA**  
**GSWA COLLIE SITE SURFACE WATER**  
**MANAGEMENT PLAN**  
**Surface Geology Map**

Project No. 12609060  
 Revision No. A  
 Date 14/11/2023

Data Source:DataWA. Created by: S. Alam

Figure 4 Geological Map

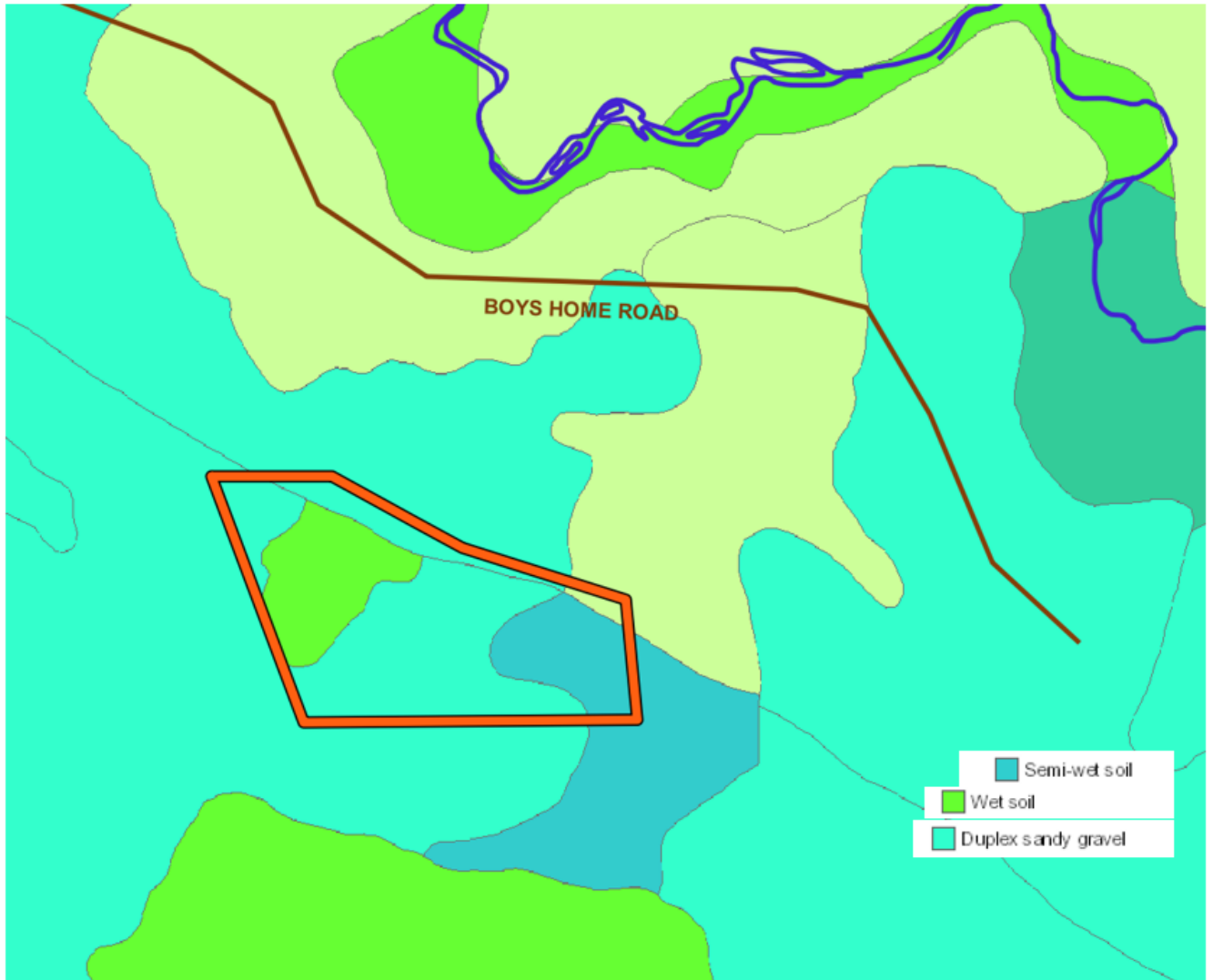


Figure 5 Soil Landscape Map

## 2.6 Acid sulfate soils

The CSIRO Acid Sulphate Soils Risk Mapping available in Geoscience Australia Portal (<https://portal.ga.gov.au>) was review for the site. The mapping indicated that the probability of occurrence of acid sulphate soil within the site is low.

## 2.7 Groundwater

The Water Information Reporting website (<https://wir.water.wa.gov.au>) of the Department of Water and Environmental Regulation was used to investigate the groundwater levels nearby the site. The nearest borehole (Reference 61200019) is located approximately 500 m east of the site. The maximum groundwater level over the 8-year record period is 214.5 m AHD. The reported ground level is 227.84 m AHD. This indicates the maximum recorded groundwater level is approximately 13.4 m below the ground level for the reference site.

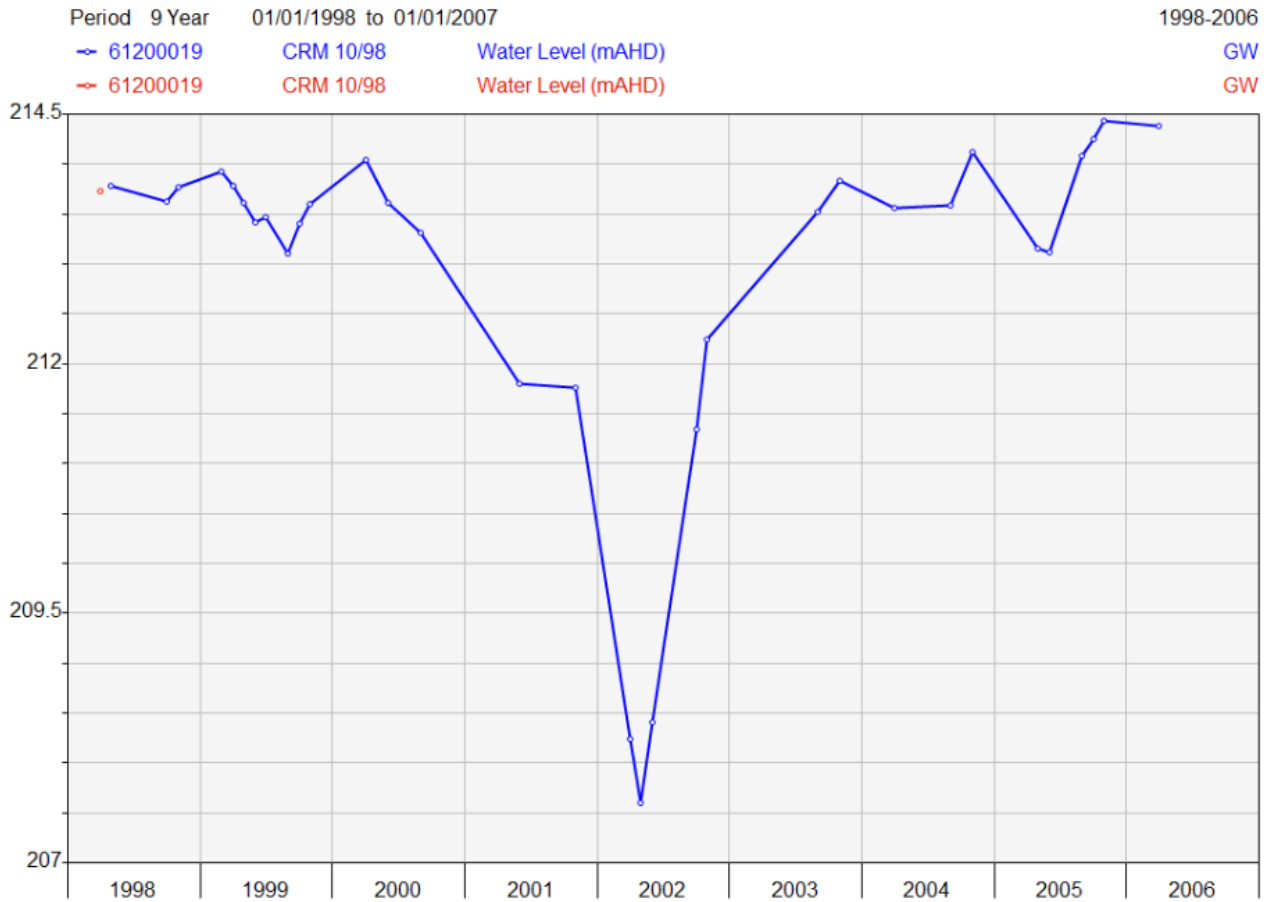


Figure 6 Groundwater levels recorded at the reference site 61200019

## 2.8 Environmental and Heritage

### 2.8.1 Flora and Fauna

Maunsell Australia Pty Ltd conducted a flora and fauna survey of the Bluewaters Power Station site which is located 1 km northwest of the site. The survey area covers approximately 363 Ha which includes this study site. After reviewing the survey report (Maunsell, 2003), it was found that a total of 3 vegetation associations was mapped for this study site. They are mentioned in Table 4.

Table 4 Vegetation associations recorded within the current study site

Vegetation Association	Description
EmCcAf	Open forest of <i>Eucalyptus marginata</i> – <i>Corymbia calophylla</i> – <i>Allocasuarina fraseriana</i> with some <i>Banksia grandis</i> and <i>Persoonia longifolia</i> over low understorey of shrubs and sedges on sandy gravels.
SS	Seasonal Sedge Swamp.
Cleared	Agriculture

The review of conservation significance of the flora and vegetation recorded implies that this study site has:

- No species of threatened flora occur within the current study site.
- No Threatened Ecological Communities (TECs) or associations of conservation significance located within the current study site.

Maunsell Australia (Maunsell, 2013) conducted a review of conservation significance of fauna as a desktop exercise. It reported that the low numbers of threatened fauna identified from the adjacent Ewington I deposit, a site located approximately 3 km south of this study site. Onshore Environmental (Onshore, 2023) conducted a targeted fauna survey utilising ten motion sensor camera traps established throughout the study area related to the proposed development. The survey was conducted following recommendations provided within the EPA technical guidance for terrestrial vertebrate fauna surveys for environmental impact assessment (EPA, 2020). A total of 96 fauna observations from 16 fauna species across the three species groups (birds, mammals, and reptiles) was recorded over a 28-night duration between the 11<sup>th</sup> of October 2023 and 8<sup>th</sup> of November 2023. One of the vertebrate fauna species recorded were listed under the Commonwealth EPBC Act. One species recorded on 14 occasions was listed as Conservation Dependant under THE Western Australian BC Act: Brush-tailed Phascogale. One species recorded on three occasions was listed as Priority 4 by the DBCA: Western Brush Wallaby.

## 2.8.2 Heritage

The site is located on the traditional lands of the Wiilman, Noongar people. According to the Department of Planning, Lands and Heritage's *Aboriginal Heritage Inquiry System*, there are three (3) identified Aboriginal cultural heritage places within 3 km radius of the Proposal, but none of them are within the proposed development site (see Figure 7).

- Site 16713 Collie River Waugal: located outside the northern boundary
- Site 15331 Shotts Graves: located approximately 2 km away from the southeast boundary
- Site 5303 Griffin Coal Mining Lease: located approximately 1 km away from the southwest boundary

A search of the State Office's Register of Heritage Places confirms that the site contains no buildings or landmarks considered to be of European heritage significance.

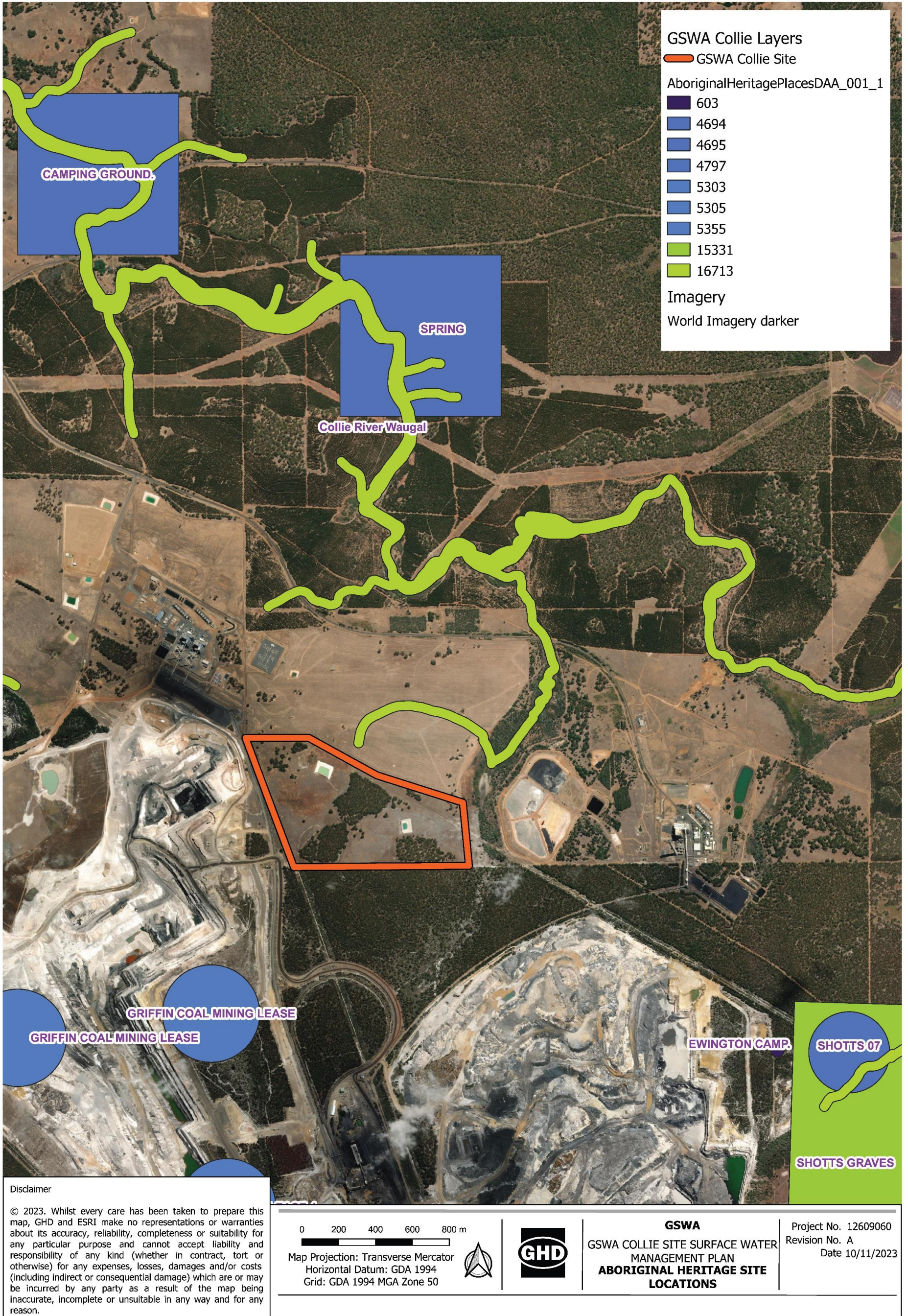


Figure 7 Heritage Site Locations

## 2.9 Flood Mapping

### 2.9.1 Topography

A direct rainfall (rain-on-grid) hydraulic model was developed using TUFLOW HPC with 5 m cell size. A 5 m Digital Elevation Model (Geoscience Australia, 2015)

### 2.9.2 Bed Roughness

The detailed Digital Earth Australia (DEA) Land Cover Dataset (2020) for the site location was retrieved and used as a basis for assigning different roughness values to the model. Figure 8 shows the raw land cover map.

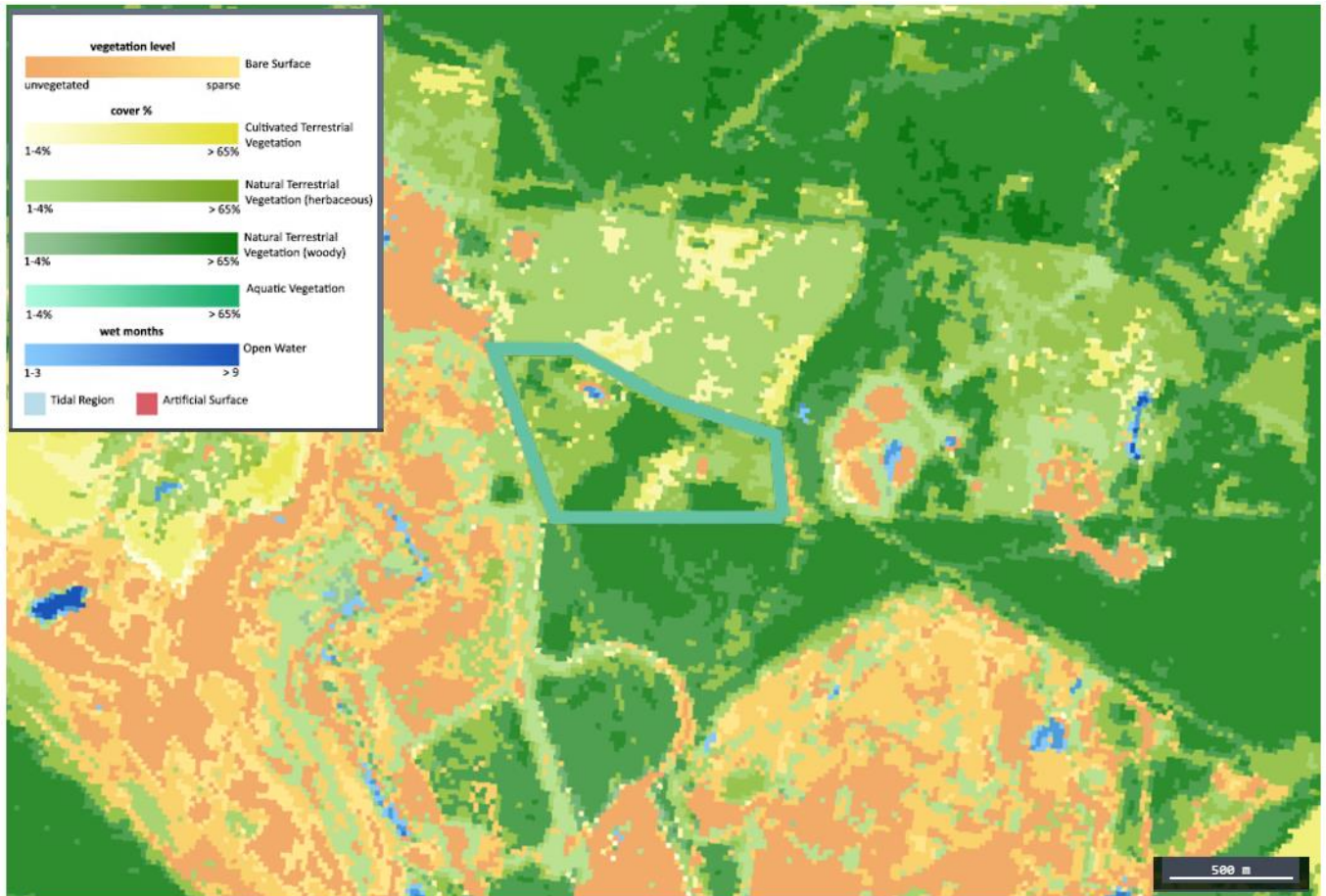


Figure 8 DEA Land Cover Map used for the TUFLOW model setup

The Manning's (n) values were estimated using Table 6.2.2 from Valid Manning 'n' Ranges for Different Land Use Types of the Australian Rainfall and Runoff 2019 (Ball et al., 2019), as listed in Table 5.

Table 5 Assigned Manning's n values

ID	Manning's (n)	DEA Land Cover Description
14	0.065	Cultivated Terrestrial Vegetated: Herbaceous Closed (> 65%)
15	0.06	Cultivated Terrestrial Vegetated: Herbaceous Open - 40 to 65%
16	0.05	Cultivated Terrestrial Vegetated: Herbaceous Open - 15 to 40%
17	0.04	Cultivated Terrestrial Vegetated: Herbaceous Sparse - 4 to 15%

ID	Manning's (n)	DEA Land Cover Description
18	0.03	Cultivated Terrestrial Vegetated: Herbaceous Scattered - 1 to 4 %
27	0.065	Natural Terrestrial Vegetated: Woody Closed - > 65 %
28	0.06	Natural Terrestrial Vegetated: Woody Open - 40 to 65 %
29	0.05	Natural Terrestrial Vegetated: Woody Open - 15 to 40 %
30	0.04	Natural Terrestrial Vegetated: Woody Sparse - 4 to 15 %
31	0.03	Natural Terrestrial Vegetated: Woody Scattered - 1 to 4 %
32	0.065	Natural Terrestrial Vegetated: Herbaceous Closed (> 65 %)
33	0.06	Natural Terrestrial Vegetated: Herbaceous Open - 40 to 65 %
34	0.05	Natural Terrestrial Vegetated: Herbaceous Open - 15 to 40 %
35	0.04	Natural Terrestrial Vegetated: Herbaceous Sparse - 4 to 15 %
36	0.03	Natural Terrestrial Vegetated: Herbaceous Scattered - 1 to 4 %
69	0.045	Natural Aquatic Vegetated: Woody Open (15 to 40 %)
84	0.045	Natural Aquatic Vegetated: Herbaceous Open (15 to 40 %)
93	0.025	Artificial Surface
94	0.03	Natural Surface
95	0.05	Natural Surface: Sparsely vegetated
96	0.04	Natural Surface: Very sparsely vegetated
97	0.03	Natural Surface: Bare areas, unvegetated
99	0.02	Water: Water
100	0.02	Water: (Water) Tidal area
101	0.025	Water: Water - Perennial - > 9 months
102	0.03	Water: (Water) Non-perennial (7 to 9 months)
103	0.035	Water: Water - Non-perennial - 4 to 6 months
104	0.04	Water: Water - Non-perennial - 1 to 3 months

## 2.9.3 Rainfall

### 2.9.3.1 Rainfall Depths

Intensity-Frequency-Duration (IFD) rainfall depth for the 1% Annual Exceedance Probability (AEP) were sourced from the Bureau of Meteorology, issued 21 October 2023, and are listed in Table 6. No areal reduction factors were applied or changes in depths for climate change factors.

Table 6 IFD Design Rainfall Depths

Duration	Annual Exceedance Probability	Duration	Annual Exceedance Probability
	1%		1%
5 min	13.9	9 hour	100.0
15 min	25.0	12 hour	114
30 min	32.2	24 hour	150
45 min	36.7	30 hour	161
1 hour	40.3	36 hour	170
2 hour	51.5	48 hour	182
3 hour	60.7	72 hour	196
4.5 hour	72.6	96 hour	204
6 hour	82.8	120 hour	211

### 2.9.3.2 Temporal Patterns

Point temporal patterns for the site were obtained from the Australia Rainfall and Runoff (ARR) Data Hub. The corresponding data were for Southern and South Western Flatlands (West).

### 2.9.3.3 Pre-burst Depths

Median pre-burst depths were obtained from the ARR Data Hub. The pre-burst depths were subtracted from the Storm Initial Losses following the equation: *Initial Loss = Storm Loss – Pre-burst*.

### 2.9.3.4 Regional Losses

The Initial – Continuing Loss (ILCL) method was used for TUFLOW, with the following global storm losses:

- Storm Initial Loss = 26 mm
- Storm Continuing Loss = 4.5 mm/hr

The values adopted were sourced from the ARR Data Hub for approximate centroid (Longitude 116.239, Latitude 33.341) of the proposed site.

## 2.9.4 Flood Mapping Results

### 2.9.4.1 Regional model

A TUFLOW model was developed for the site and its surroundings to determine the extents of floodplain, identify major overland flow paths and upper catchment contributions to the site (if any). For this modelling exercise, the 1% AEP storm event was chosen, and a floodplain map was developed to show the critical event flood depths at each cell of the model, as the objective was to show all possible floodplain extents within and around the proposed site.

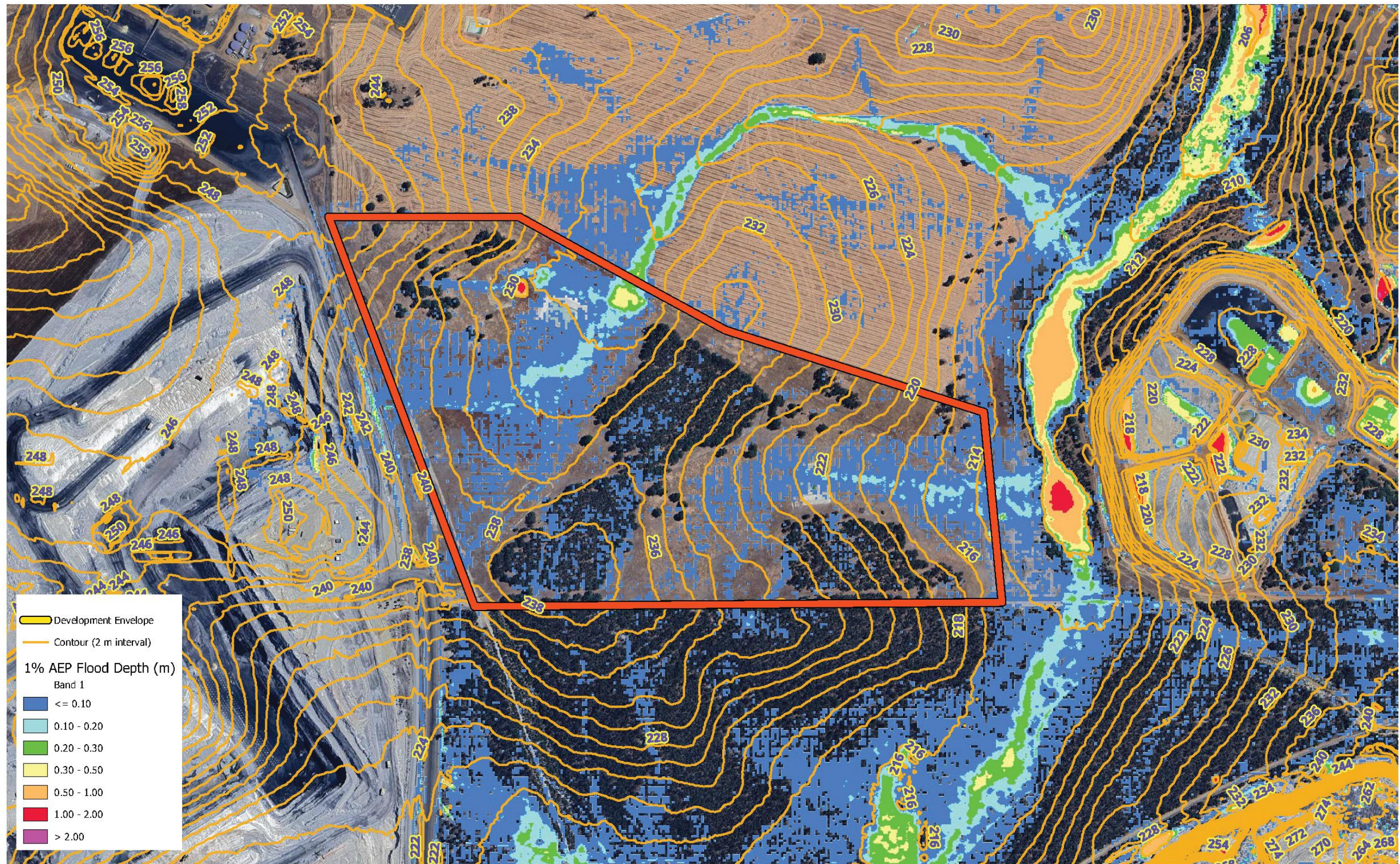
The developed floodplain map is shown in Figure 9. It indicates that a watercourse runs along the eastern boundary originated from the hilly area south of the site. The maximum water level within the watercourse was predicted to be 212 m AHD for the 1% AEP event, whereas the elevation of the eastern end of the proposed site is approximately 213.8 m AHD or higher. This implies that the watercourse would not have enough flood height to ingress the proposed site under a 1% AEP event. The eastern portion of the site drains towards the east and contributes to the watercourse. The western portion of the site drains in the northern direction and the overland flow path connects to the watercourse that runs along the eastern boundary. An external catchment is identified to the western boundary of the site.

#### **2.9.4.2 Local model**

Based on the identified floodplain as shown in Figure 9 a separate TUFLOW model was developed later for the extent of the site with the area allowing the external catchment to the western side.

The purpose of developing the model was to define the floodplains and delineate catchments to support the DRAINS modelling by providing sub-catchment extents within the proposed site. Figure 10 shows the 1% AEP flood depth results for the site. There are two major floodplains are identified within the proposed development extent. Based on that, pre-development sub-catchments are delineated and are shown in Figure 11.

The delineated pre-development sub-catchments were used in DRAINS modelling exercise to simulate the pre-development flow rates. The post-development flow rates are required to be attenuated to the respective pre-development flow rates through the provision of adequate detention storages/basins onsite.



**Disclaimer**

© 2023. Whilst every care has been taken to prepare this map, GHD and ESRI make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.

0 200 400 600 800 m

Map Projection: Transverse Mercator  
Horizontal Datum: GDA 1994  
Grid: GDA 1994 MGA Zone 50



**GSWA**  
GSWA COLLIE SITE SURFACE WATER  
MANAGEMENT PLAN

**1% AEP Flood Depth Map**

Project No. 12609060  
Revision No. A  
Date 14/11/2023

Data Source: DataWA. Created by: S. Alam

Figure 9 1% AEP Flood Depth Map for the regional model

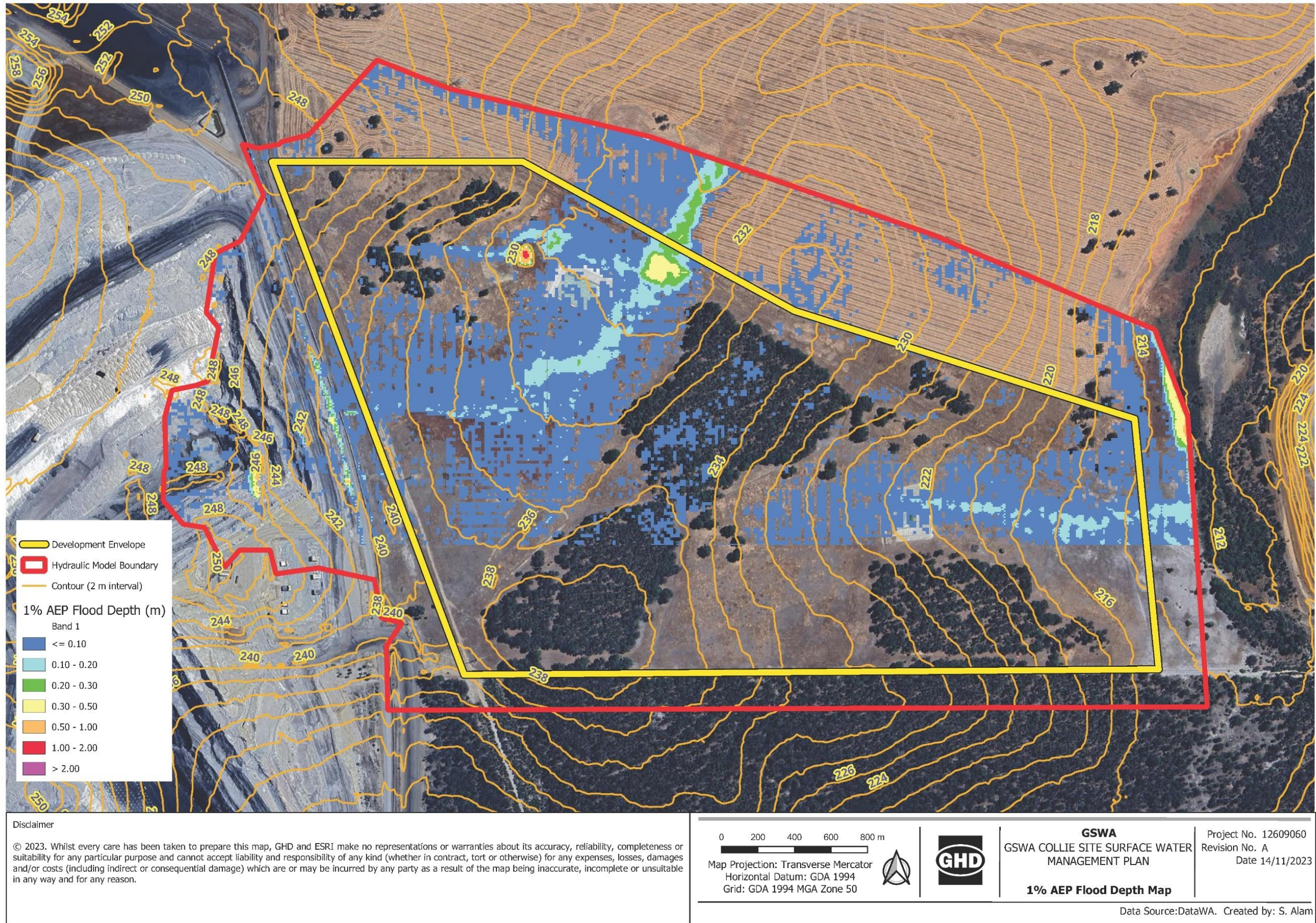


Figure 10 1% AEP Flood Depth Map for the Proposed Site

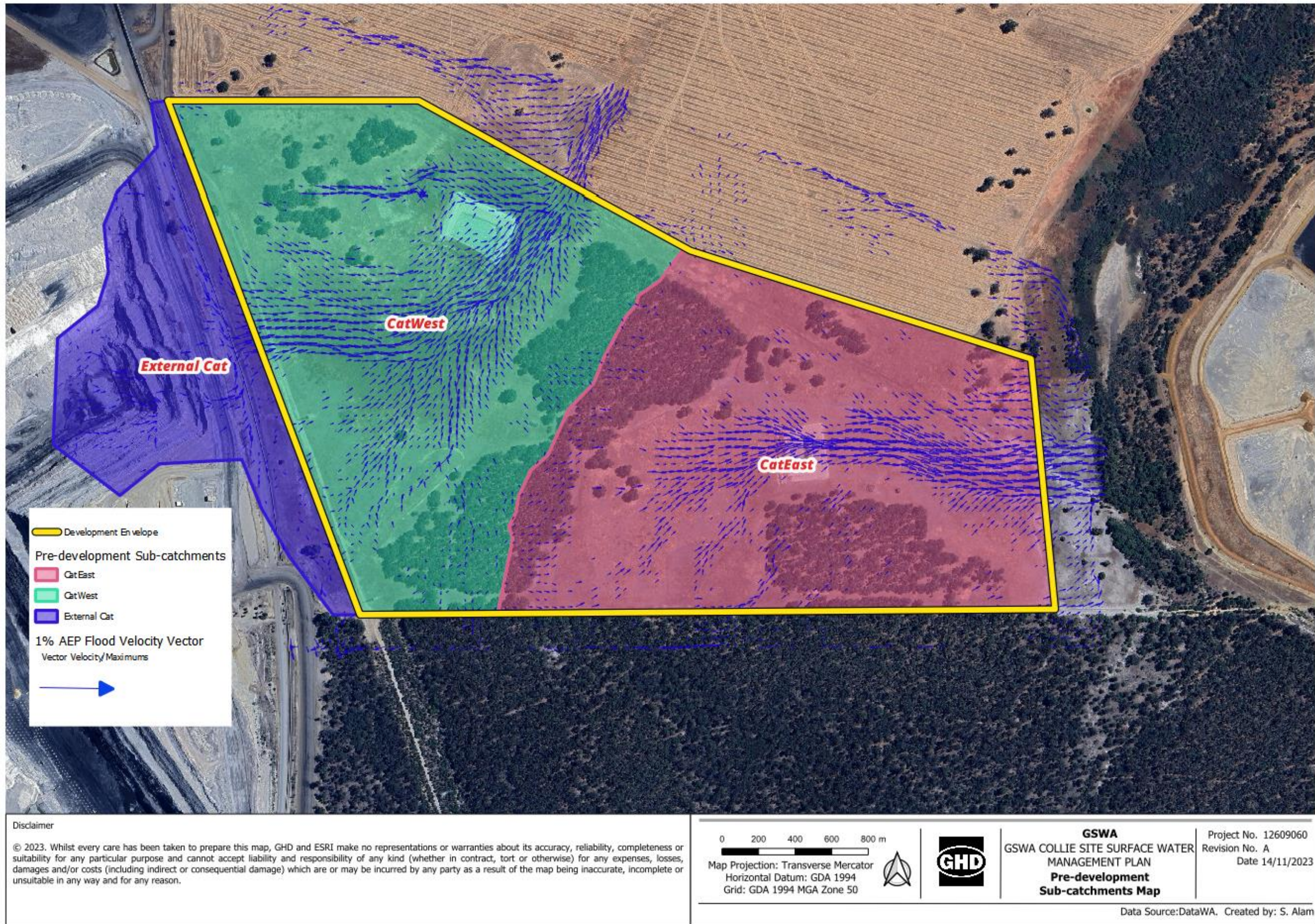


Figure 11 Pre-development sub-catchments for the Proposed Site

## 3. Stormwater Management

### 3.1 Surface Water Management Measures

The proposed site layout is shown in Figure 12 and the conceptual drainage arrangement is shown in Figure 13. Both construction and operational activities of the proposed development have the potential to impact stormwater volume, peak flows and quality. Minimal works are proposed for the western side of the lot, and therefore runoff generated from this side of the proposed site is managed differently from runoff generated from the central/eastern catchment. Based on this, a conceptual drainage arrangement was developed as follows:

- Runoff from the developed central/eastern catchment: Internal lined swales or pits and pipes, unlined basins and bioswales to manage the discharge from the facility;
- Runoff from the western undeveloped catchment: Drains and swales designed to separate developed and undeveloped catchment runoff; and
- Runoff from the entrance, car parks, warehouse and administrative building (Prog. Nr. 01, 02, 03, and 04 as shown in Figure 12): Internal lined swales or pits and pipes, unlined basins and bioswales to manage the discharge.

The conceptual design of surface water management features was developed based on the following principles:

- Drains are to follow the natural topography wherever possible;
- Basin is to be placed at low elevation; and,
- Catchment areas are to be minimised using diversion swales for external runoff.

The conceptual layout of the surface water management features is shown in Figure 13.

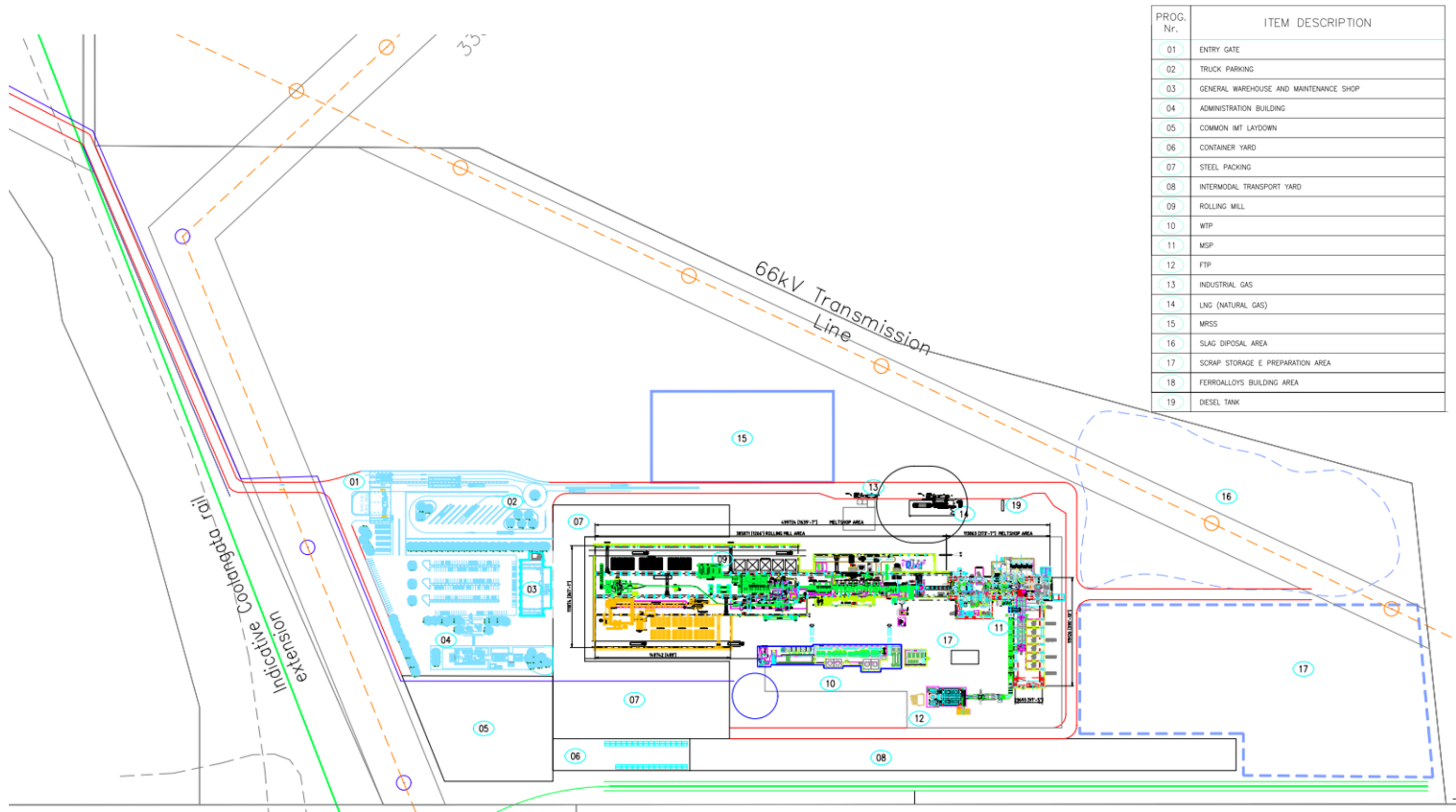
Any stormwater within the proposed development area is considered to be potentially contaminated with sediments and hydrocarbons. This implies the requirement of pre-treatment of the stormwater runoff before discharging to the environment, Stormwater treatment will be via a treatment train to capture, filter, or treat pollutants using the following steps:

- For the proposed developed site, water shall pass through a primary treatment gross pollutant trap (GPT) in order to screen solids or sediments before discharging into the proposed basin. The proposed GPTs are required to be installed in order to reduce quantities of litter, debris and coarse sediments from discharging to the downstream proposed basins. Remaining sediments will also settle in the basin. The conceptual locations of GPTs are shown in Figure 13. The GPTs require regular maintenance, hence installation should consider the ease of site access and the disposal of any waste from the treatment process.
- The basin is proposed to control discharge prior to the off-site discharge from the northeast corner of the proposed development.
- The basin shall comprise of a vegetated layer to improve the quality of stormwater. The vegetated basin is designed to target the management of nutrients during smaller frequent events as the proposed GPTs upstream of the basin are not expected to provide the level of nutrient removal desired. The base area of the basin was designed to have footprints more than 2% of effective impervious area following one the guideline as mentioned in (DoW, 2011).

The basin is proposed to have a multi-stage outlet, with a low-level outlet and an emergency overflow weir. The low-level outlet controls stormwater discharge maintaining the outflows to be less than the pre-development flow rates. The high-level spillway is for major event discharge with the emergency weir potentially activate in the event of extreme events. All design of the basin and its controls are subject to detailed design.

Wherever possible, stormwater runoff management measures should be guided by *Stormwater Management Manual of Western Australia (2023)*.

Prior to the commencement of construction or ground disturbance activities, erosion and sediment control measures (such as sediment fences or other appropriate sediment control measure) will be installed around the perimeter of the site and on slopes subject to runoff to prevent the transport of soil and silt particles to the downstream watercourse.



PROG. Nr.	ITEM DESCRIPTION
01	ENTRY GATE
02	TRUCK PARKING
03	GENERAL WAREHOUSE AND MAINTENANCE SHOP
04	ADMINISTRATION BUILDING
05	COMMON IMT LAYDOWN
06	CONTAINER YARD
07	STEEL PACKING
08	INTERMODAL TRANSPORT YARD
09	ROLLING MILL
10	WTP
11	MSP
12	FTP
13	INDUSTRIAL GAS
14	LNG (NATURAL GAS)
15	MRSS
16	SLAG DIPOSAL AREA
17	SCRAP STORAGE E PREPARATION AREA
18	FERROALLOYS BUILDING AREA
19	DIESEL TANK

Figure 12 Proposed Site Layout

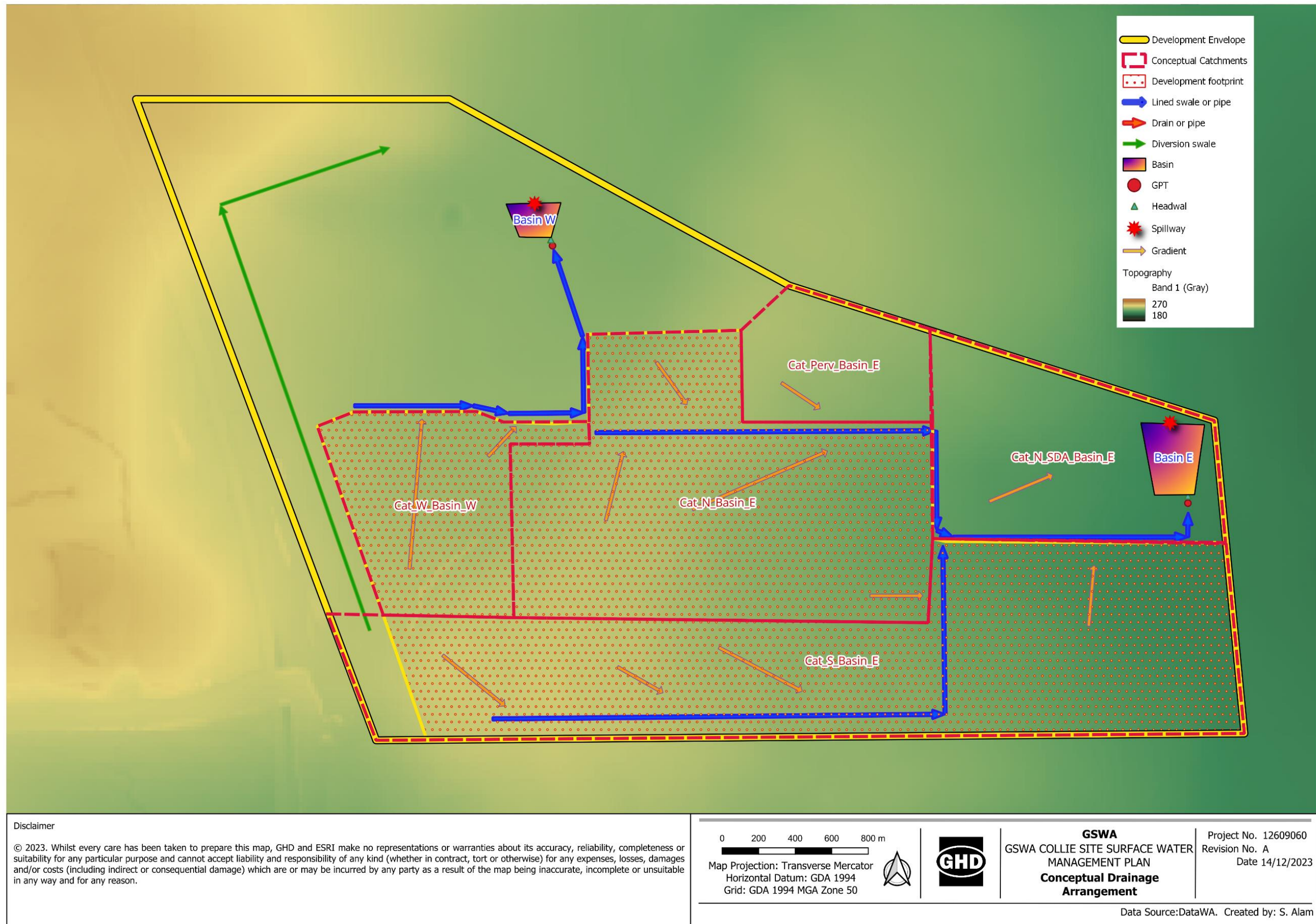


Figure 13 Conceptual Drainage Arrangement

## 3.2 General Design Principles

The proposed development would entail lesser pervious areas and increased runoff (peak and volumetrically) if it was not controlled prior to discharge. The objective is to minimize environmental impact by ensuring that the post-development peak flows (m<sup>3</sup>/s) into receiving waterways will be maintained at a pre-development rate. It is noted that volumetrically runoff from the site will be increased from pre-development volumes given the significant increase in impervious surface areas reducing the potential for onsite infiltration to almost zero.

The basin shall be designed to store, infiltrate and treat stormwater runoff. Pre-development runoff values for a 1% AEP critical event were calculated using a one-dimensional hydrologic model DRAINS which employed which employed an initial and continuing loss hydrologic model. The minimum detention water volumes were determined by ensuring post-development runoff peak flows were equal or less than the pre-development peak flows.

## 3.3 Catchments and Hydrology

### 3.3.1 Design Rainfall

With reference to *Section 2.9.3*, the same Intensity-Frequency-Duration (IFD) data, point temporal patterns, and pre-burst depths for a 1% AEP rainfall event were sourced from the Bureau of Meteorology (2023).

### 3.3.2 Catchments

Catchments for the local runoff were estimated based on the existing topography and the proposed earthworks levels for the site. There were modelled in DRAINS. One basin was assigned to the area of low elevations adjacent to the pads. As the pad is proposed to be developed on a uniform gradient from west to east, the post-development catchment would drain to the low elevations of the northeastern end of the site, where the basin is proposed to manage runoff at the pre-development rates. Sub-catchment areas were also minimised by placing conceptual pipes and swales at strategic locations that would control flows within the pads and divert any approaching runoff.

A total of three catchments were modelled for the pre-development conditions, namely: ExternalCat, CatWest and CatEast, with their respective areas listed in Table 7. The extents of the catchments are shown in Figure 11. The modelling purpose, ExternalCat and CatWest are grouped together as ExternalCat acts as an upper catchment for CatWest.

Table 7 Catchment Areas for Local Runoff

Catchment	ExternalCat	CatWest	CatEast
Area (Ha)	14.38	37.50	37.09

### 3.3.3 Losses

The initial Loss – Continuing Loss (ILCL) method was used for DRAINS, with the following losses:

- For impervious areas representing roads and buildings – Initial Loss: 1 mm, Continuing Loss: 0 mm/hr
- For pervious areas – Initial Loss: 26 mm, Continuing Loss: 4.5 mm/hr

The pervious area losses were sourced from ARR Data Hub for approximate centroid (longitude 116.239 Latitude 33.341). The impervious losses are the normal approach taken for urban catchment roadways.

## 3.4 Stormwater Modelling and Basin Design

### 3.4.1 Detention Water Volume

The model parameters used for pre-development catchments are as follows:

- Areas: as listed in Table 7
- Area classification: all 100% pervious as the site is generally undeveloped
- Retardance coefficient,  $n$ : 0.08 to mimic runoff across the vegetated surface of the site
- Flow path lengths and slopes: estimated for each catchment based on available topographical information
- Outlets: at existing catchment discharge points

An ensemble run was done on DRAINS for the pre-development catchments and the critical 1% AEP storm runoff values are listed in Table 8.

Table 8 Pre-development Runoff Values

Catchment	ExternalCat+CatWest	CatEast
Area (Ha)	51.88	37.09
Pre-dev. Runoff (m <sup>3</sup> /s)	4.98	4.06
Pre-dev. Runoff (m <sup>3</sup> /s/Ha)	0.096	0.109

### 3.4.2 Post-development

Post-development catchments areas were classified into three (3) categories – Impervious Area, Road and Pervious Area. Preliminary detention basins were modelled to accept the post-development runoff volumes in order to estimate the required detention water volumes for a 1% AEP critical storm event. The parameters used for post-development catchments are listed in Table 9.

Table 9 Post-development Model Parameters

Land Use Type	Impervious	Road	Pervious
Area	Estimated for each surface per land use type		
Area Classification	100% Effective Impervious Area (EIA)	100% Effective Impervious Area (EIA)	100% Pervious Area (PA)
Flow path lengths and slopes	Estimated based on the proposed development footprint		
Retardance coefficient, $n$	0.015	0.013	0.08

The detention basins were configured in DRAINS with discharge pipes of 10 m length and 1% slope. The outlet pipes at the basins are placed keeping a 300 mm clearance from the ground allowing the low flow runoffs to be treated and infiltrated locally. The basins were designed to be 2 m deep, and a spillway for each basin was placed at 1.7 m above from the basin ground surface. The elevations adopted are indicative only to support the conceptual design of the basin and needs to be rectified at the detail design stage. Using the *pre-development* ≤ *post-development discharge principle*, the minimum detention volume was determined for each basin and summarized in Table 10. Further development of this design is expected to occur during detailed design, but a similar approach shall be used.

Table 10 Post-development Runoff and Detention Water Volume

Parameter	Basin E	Basin W
Post-Dev. Runoff (m <sup>3</sup> /s)	9.43	2.82

Parameter	Basin E	Basin W
Detention Water Volume (m <sup>3</sup> )	6,730	1,270

### 3.4.3 Conceptual Basin Design

The conceptual basin design is summarized in Table 11 and is shown in Figure 13. It is expected that during detailed design some refinement of this volume and area of the basin will occur however the overall approach shall be applied for the basin to manage the stormwater runoff from the receiving catchment before discharging into the respective downstream watercourses.

Table 11 Summary of Basin Design

Basin	Basin E	Basin W
Contributing Catchment Area (Ha)	42.28	5.44
Total Basin Volume (m <sup>3</sup> )	7,776	1,302
Total Basin Volume with Freeboard (m <sup>3</sup> )	9,399	1,639
Storage required (m <sup>3</sup> )	6,730	1,270
Basin bottom area (m <sup>2</sup> )	3,900	500
Basin water surface area (m <sup>2</sup> )	5,244	1,051
Basin freeboard area (m <sup>2</sup> )	5,544	1,184
Depth of water in 1% AEP event (m)	1.45	1.67

## 3.5 Stormwater quality management

Any stormwater with the proposed development areas is considered to be potentially contaminated with sediments and hydrocarbons, thus, requiring pre-treatment before discharging to the environment. Stormwater treatment will be via a treatment train to capture, filter, or treat pollutants using the following steps:

- For each catchment, water shall pass through a primary treatment gross pollutant trap (GPT) in order to screen solids and some sediments before discharging into the basins. Remaining sediments will also settle in each basin. The conceptual locations of GPTs are shown in Figure 13.
- The stormwater runoff within the slag disposal area (see Figure 12) has the potential to permeate steel slag deposits. Steel slag deposits are often associated with highly alkaline leachate and elevated concentrations of dissolved metals in the leachate, potentially causing local and downstream environmental impacts. Chemical analysis of the slag is required to understand the leachate risk and management measures. If polluted leachate is predicted and the interaction between the rainwater and slag can't be avoided, measure to treat elevated metals and pH is required before releasing the runoff to the drainage system. Bunding of the slag disposal site is required to perform the treatment to ensure the surrounding areas are not impacted.
- It is understood by consulting with GSWA that there will be no facilities within the proposed development that could be considered as potential source of contamination such as washdown facilities, chemical stores or stockpiles.
- Areas where there is possible risk of contamination from oil, an oil and water separator, a tertiary treatment is proposed. Common proprietary devices used in include the Purceptor, located downstream of the bunded contaminant area.
- Basins are proposed to control discharge prior to any off facility discharge. These basins are to be vegetated to allow final treatment of stormwater. The vegetation species should be native, have a high nutrient uptake should be able to survive in a dry weather condition, and not increase the bushfire risk. The basins should be sized to function correctly. Additional information is provided in *The Adoption Guidelines for Stormwater Biofiltration*

Systems (Payne et al., 2014). The recommended specification for preparing the ground surface of basins with amended soils is shown in Figure 14.

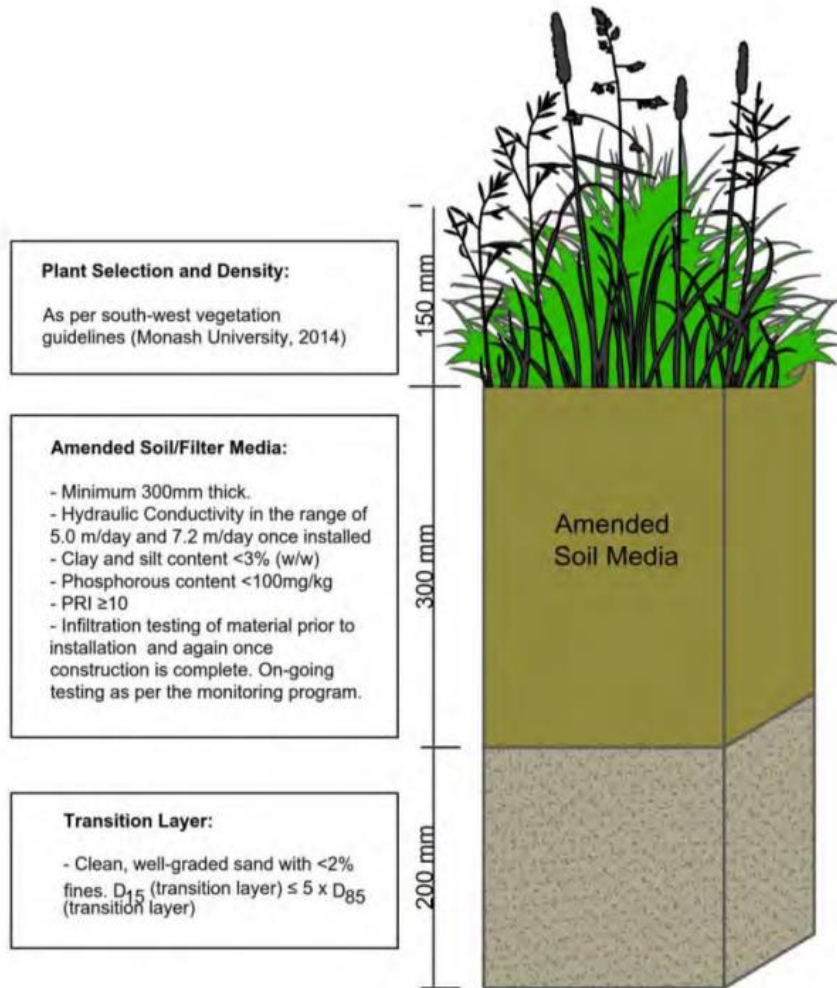


Figure 14 Biofilter specification

### 3.6 Monitoring and implementation

The performance monitoring of drainage elements is required to be completed to ensure the system is working efficiently. Key elements to be monitored include:

- Inlet and outlet structures are required to be ensured free of debris;
- Sediment build up is not impeding the drainage performance;
- Vegetation cover of the basins is to be maintained;
- Erosion process is not active;
- Litter is required to be removed;
- Weeds need to be controlled;
- Excessive hydrocarbons are not present in the drainage system;
- Soils are not compacted;
- Infiltration of stormwater is maintained;
- Flows are not excessively detained;

- Stormwater pipes are flowing freely.

Maintenance inspections should be conducted after a significant storm event. The inspections should also focus on ponding time for basins and scouring. During the construction phase, the key focus should be on the control of litter and sediment that is often generated.

The following is a summary of the process to achieve implementation:

- Complete detail design before the construction phase.
- Geotechnical assessments and Acid Sulphate soil investigations.
- Develop and implement Construction and Sediment Control reports.
- The planting of vegetation within the basins with appropriate locally native plants and regular maintenance of the plants until handover to the Local Authority.
- Undertake monitoring of the drainage basins to assess their performance and respond accordingly within the required monitoring period.

## 4. References

- Ball et al. (Editors). (2019). *Australian Rainfall and Runoff: A Guide to Flood Estimation*. Commonwealth of Australia.
- Bureau of Meteorology. (2016). *Design Rainfall Data System (2016)*. Retrieved from <http://www.bom.gov.au/water/designRainfalls/revise-ifd/>
- Department of Water (DoW). (2011). *Water Sensitive Urban Design – Biofilters*. Retrieved from <https://www.wa.gov.au/system/files/2022-07/Water-sensitive-urban-design-Biofilters.pdf>
- Geoscience Australia. (2015). *Digital Elevation Model (DEM) of Australia derived from LiDAR 5 Metre Grid*. Retrieved from <https://doi.org/10.26186/89644>.
- Maunsell Australia Pty Ltd. (2013). *Bluewaters Power Station Flora and Fauna Survey*. A report prepared for Griffin Energy.
- Onshore Environmental. (2023). *Targeted Camera Trap Fauna Survey Collie Green Steel Recycling Mill*. A report prepared for Green Steel WA Pty Ltd.
- Payne et al. (2014). *Vegetation Guidelines for Stormwater Biofilters in the South-West of Western Australia*. Monash Water for Liveability Centre, Monash University. November 2014.
- Tecon Australia. (2019). *Coolangatta Industrial Estate Structure Plan*.

