

3 December 2024

Your Ref:
Our Ref: H24068Av1

G & G Corp
1/219 Midland Rd
Hazelmere WA 6055
ATTENTION: David Woo

Dear David,

RE: LOT 1 CORIO RD RAVENSWOOD HYDROLOGICAL REPORT

Hyd2o was commissioned by G&G Corp in October 2024 to prepare a hydrological report for Lot 1 Corio Road Ravenswood (the site) to estimate site groundwater levels in support of the establishment of an extractive industries design level for the property.

This report outlines the installation of groundwater bores at the site and provides average annual maximum groundwater level and maximum groundwater levels (AAMGL and MGL) calculations and contour mapping based on winter 2024 groundwater levels.

The report also discusses the local hydrology and wetlands in the site vicinity and proposes a sand extraction design level based on hydrological findings.

1. MONITORING PROGRAMME

Four groundwater monitoring bores were installed via auger by Hyd2o in the superficial aquifer at the site on 10 October 2024, with bores located strategically to provide coverage of the site.

Bores were constructed suitable for water level monitoring and were surveyed to Australian Height Datum by MNG. Soil profile logs for each bore were completed by Hyd2o and are contained in Appendix A. The bore profiles were generally dark grey to grey, fine to coarse sand, sub-angular and sub-rounded, with medium organic content within the topsoil. The findings are consistent with Gozzard (1978) environmental geology mapping.

Water level monitoring was undertaken on 10 October 2024 at the four installed bores, and one Department of Water and Environmental Regulation (DWER) bore within close proximity to the site. The monitored DWER bore (HS94A) has been recorded since 2008 which allows for onsite groundwater measurements to be referenced to long term local groundwater records for consistency and calculation of the average annual maximum groundwater level (AAMGL) for the site.

A plan showing the location of all groundwater monitoring bores is provided as Figure 1.

2. MONITORING RESULTS AND AAMGL/MGL CALCULATION

The groundwater levels recorded at each monitored bore are shown in Table 1. The AAMGL and MGL for the DWER bore with long term record (HS94A) are presented in Table 2 and Table 3 respectively for the extent of its record (2008-2024) which is considered representative of current climate conditions.

The 10 October 2024 groundwater reading for bore HS94A was compared against its calculated AAMGL and MGL values for the period 2008-2024. The result of the comparison is shown in Tables 2 and 3 respectively. The difference between the 2024 winter reading and the calculated AAMGL/MGL was then used to estimate AAMGL/MGL groundwater levels for site bores, and these adjusted values are presented in Table 4.

The AAMGL ranges from 12.00 mAHD at bore GW3 to 12.68 mAHD at bore GW1. Similarly, the MGL at the site bores ranges from 12.23 mAHD to 12.91 mAHD. Figure 2 shows the site AAMGL contour map based on the calculated values for each site bore, with regional groundwater flow generally towards the low-lying areas to the west of the site.

Using LiDAR DTM data from DWER and a topographic survey conducted by MNG, the clearance above the calculated AAMGL and MGL at the site varies significantly across the site (Figure 3). In the southwestern corner, the AAMGL and MGL is approximately at natural surface, while in the elevated central region, the AAMGL clearance ranges up to 3.6m.

It should be noted the Department of Water 2015 Selection of Future Climate Projections for Western Australia report indicates further annual rainfall reduction in the region of approximately 10% from current levels is expected to 2050 (median climate projection), indicating future groundwater levels are likely to be lower than estimated in this report.

Table 1: Groundwater Level Monitoring Results

Bore	Installed	Easting	Northing	Top of Casing mAHD	Natural Surface mAHD	Groundwater Level 10/10/2024 mAHD
GW1	Hyd2o	394743	6397440	13.86	13.58	12.72
GW2	Hyd2o	394685	6397621	13.32	12.90	12.43
GW3	Hyd2o	394394	6397368	12.92	12.52	12.04
GW4	Hyd2o	394740	6397036	13.33	12.96	12.41
HS94A	DWER	394982	6397627	14.41	13.82	12.83

Table 2: DWER Bore AAMGL

DWER Bore	Monitoring Period	Groundwater Level (m AHD) 10/10/2024	AAMGL (2008-2024) (m AHD)	Correction Factor for Site Bores to AAMGL (m)
HS94A	2008-2024	12.83	12.79	-0.04

Table 3: DWER Bore MGL

DWER Bore	Monitoring Period	Groundwater Level (m AHD) 10/10/2024	MGL (2008-2024) (m AHD)	Correction Factor for Site Bores to MGL (m)
HS94A	2008-2024	12.83	13.02	+0.19

Table 4: Estimated Site Bore AAMGLs and MGLs

Bore	Natural Surface (m AHD)	Groundwater Levels 10/10/2024 (m AHD)	AAMGL (m AHD)	MGL (m AHD)
GW1	13.58	12.72	12.68	12.91
GW2	12.90	12.43	12.39	12.62
GW3	12.52	12.04	12.00	12.23
GW4	12.96	12.41	12.37	12.60

3. ESTABLISHMENT OF MINE FLOOR LEVEL

Water Quality Protection Note 15: Basic Raw Materials Extraction (DWER, 2019) requires an adequate vertical separation to be provided between the base of extraction and the highest groundwater level to protect water quality and prevent evaporation loss, during and after extraction. It is stated that this vertical separation distance will be determined in the planning and approval process, and as such will be supported by this report.

Setting of any mining excavation level also requires consideration of any future land use following the completion of mining works. As such considerations should be made based on the zoning of the site as 'rural' in the Shire of Murray's latest planning scheme.

Given Hyd2o have previously received DWER advice for a 0.3m separation to MGL requirement based on sand mining works over land with similar relevant considerations, and given a difference for the nearby DWER bore of approximately 0.2m from AAMGL to MGL, a 0.5m clearance above AAMGL is considered appropriate to adopt for the site in relation to establishing a suitable mine floor level.

4. WETLAND PROTECTION

The site is covered partially by multiple use wetlands on its north, west and south boundaries. Conservation category wetlands are located adjacent to the site boundaries at northwest, southwest and northeast (Figure 4).

The mining area will be separated from the conservation category wetlands by the required buffers, with no buffer requirements for the multiple use wetlands.

Given the sandy profile of the site it is likely that water is infiltrated at source and there is little surface runoff contribution currently directed to the wetlands. This, along with mapped groundwater levels, would indicate that the mapped wetlands are primarily expressions of groundwater, and as such the post mining topographic levels of the development area will not have any adverse effect on the hydrology of the surrounding wetlands.

5. CONCLUSIONS/RECOMMENDATIONS

This report has been prepared by Hyd2o to support the establishment of extractive industries (sand) mine floor level at Lot 1 Corio Rd.

The data collected from the site’s monitoring bores in winter 2024 and adjacent DWER long term bore HS94A, has enabled the AAMGL and the MGL to be mapped across the site. The calculated AAMGL ranged from 12.00 mAHD at bore GW3 to 12.68 mAHD at bore GW1, with the MGL ranging from 12.23 mAHD to 12.91 mAHD.

The establishment of a mine floor level at 0.5 m above the mapped AAMGL is considered appropriate based on agency guideline documentation and the sites rural zoning.

It is recommended that ongoing groundwater monitoring be undertaken during the mine life and this data be used to refine groundwater mapping to reflect current climate conditions and with a view to optimising resource extraction and protecting groundwater resources and wetlands.

6. REFERENCES

Department of Water and Environmental Regulation, 2019. Water Quality Protection Note 15: Basic Raw Materials Extraction.

Department of Water and Environmental Regulation, 2024. Water Information Reporting. Accessed online November 2024.

Department of Water 2015, Selection of Future Climate Projections for Western Australia, Water Science Technical Series, Report no. 72, Department of Water, Western Australia.

Gozzard, J.R., 1978. Pinjarra Sheet 2032 I, Environmental Geology Series. Geological Survey of Western Australia, Department of Minerals and Energy, Perth.

Should you have any queries regarding this report, please do not hesitate to contact Andre Righetti or Sasha Martens of this office.

Yours sincerely,



Andre Righetti
Environmental Hydrologist

Attachments

Figure 1: Groundwater Bore Locations

Figure 2: AAMGL Mapping

Figure 3: Depth from Natural Surface to AAMGL + 0.50 m

Figure 4: Wetlands Plan

Appendix A: Lithological Logs

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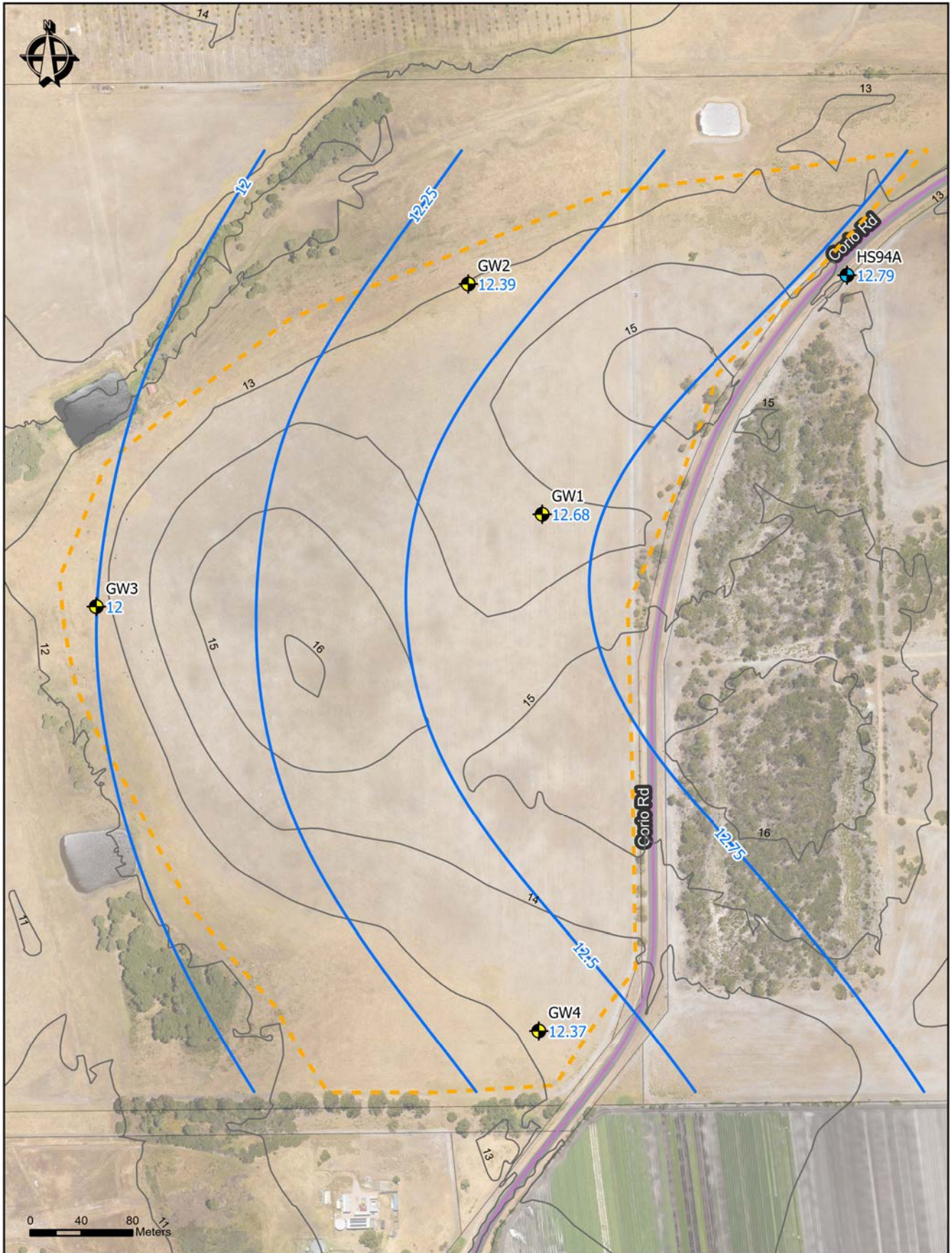
Hyd2o recognise site conditions change and contain varying degrees of non-uniformity that cannot be fully defined by field investigation. Measurements and values obtained from sampling and testing in this document are indicative within a limited timeframe, and unless otherwise specified, should not be accepted as conditions on site beyond that timeframe.






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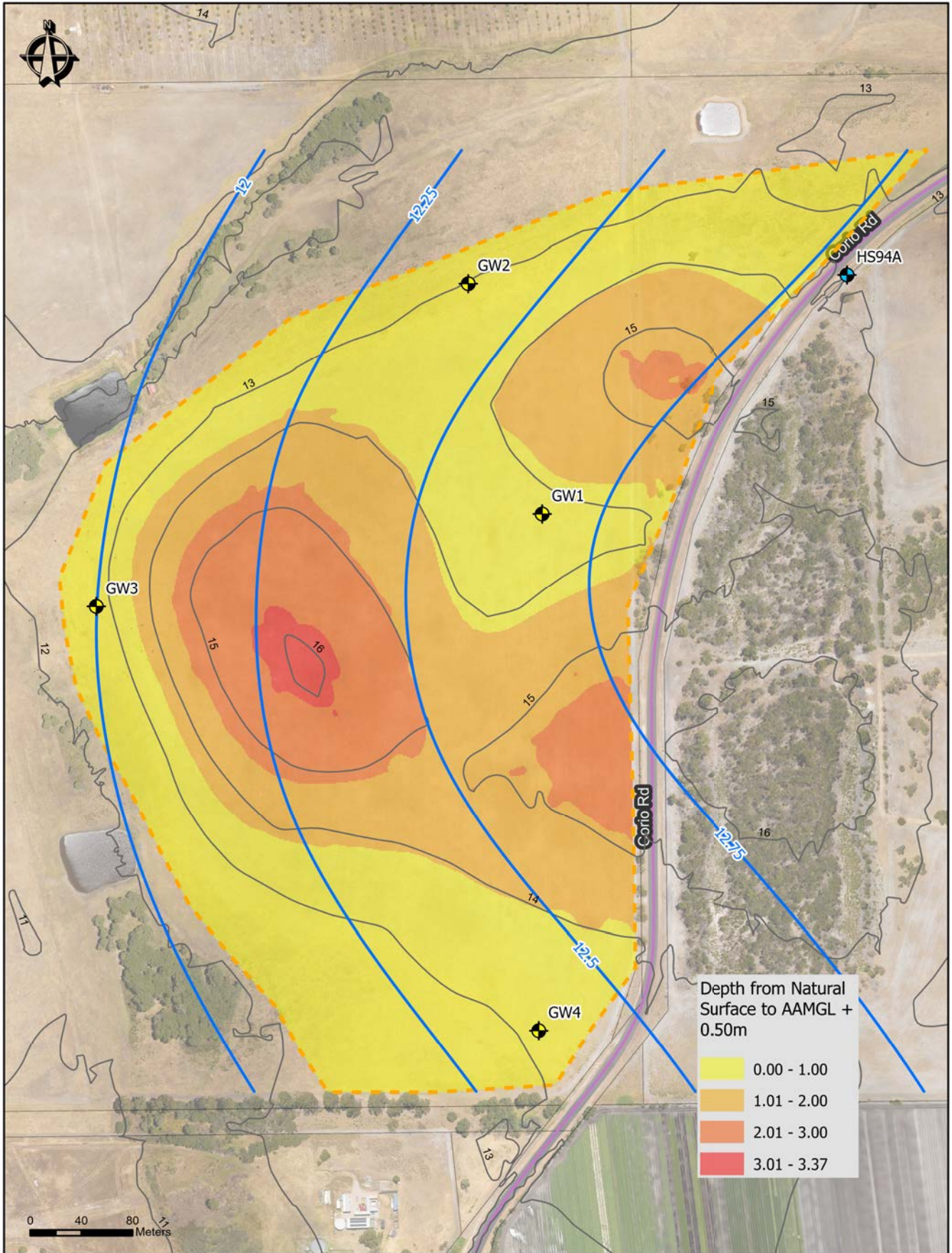
FIGURES



- Site Boundary
- Groundwater Monitoring Bores
- DWER Groundwater Monitoring Bore



-  Site Boundary
-  Groundwater Monitoring Bores
-  DWER Groundwater Monitoring Bore
-  DWER Topography Contour (mAHD)
-  AAMGL Contour (mAHD)



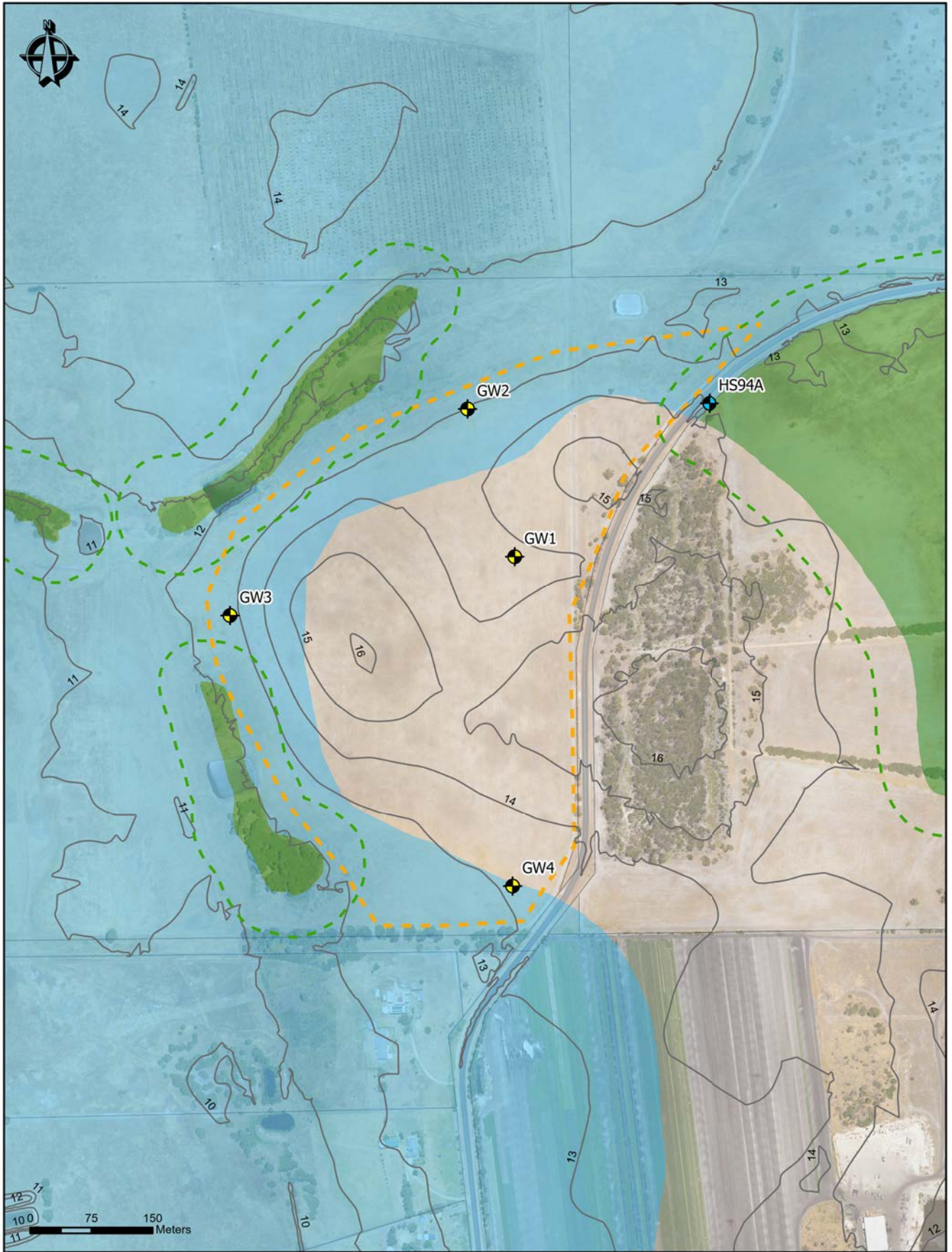
- Site Boundary
- Groundwater Monitoring Bores
- DWER Groundwater Monitoring Bore
- DWER Topography Contour (mAHD)
- AAMGL Contour (mAHD)

hyd2o

Lot 1 Corio Rd Hydrological Report

Depth from Natural Surface to AAMGL + 0.50 m

Figure 3



- Site Boundary
- Groundwater Monitoring Bores
- DWER Groundwater Monitoring Bore
- DWER Topography Contour (mAHD)
- Geomorphic Wetlands of SCP
- Conservation Category Wetlands
- Multiple Uses Wetlands
- 50m CCW Buffer

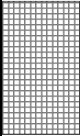

ATTACHMENT A
Lithological Logs

Date : 10/10/2024
 Client : G&G Corp
 Project : Lot 1 Corio Rd
 Easting : 394742.8687
 Northing : 6397440.312
 Datum : GDA94
 Drill type : Auger
 Hole diameter : 8 cm

Job Number : H24068
 Start Hole : 10:00
 End Hole : 11:00
 Logged by : AFR
 Total Depth : 1.5
 RL Top of Casing : 13.863
 RL Nat Surface : 13.583

Bore Name

GW1

support	backfill	water	Slot / Screen Depth	Depth (metres)	Soil Characteristics					
					Colour	Particle Size	Texture	Organic Content	Moisture	Comment
PVC (Class 9)		▽		0.5m	Dark Grey	Medium to Coarse	Sand	Medium	Dry	
				1.0m	Grey Light Grey			None	Moist	
				1.5m			Saturated	end of hole at 1.50 m		
				2.0m						
			2.5m							
			3.0m							
			3.5m							
			4.0m							
			4.5m							
			5.0m							

COLOUR : Black, White, Beige
 Dark/Medium/Light : Brown, Red, Orange, Yellow, Grey, Blue
 Composition : Solid, Blemish, Mottle

PARTICLE SIZE : Fine, Medium, Course

TEXTURE : Sand, Loamy Sand, Clayey Sand
 Silt, Loam, Sandy Loam, Clayey Loam
 Clay, Sandy Clay

ORGANICS : High, Medium, Low

MOISTURE : Dry, Slightly Moist, Moist, Saturated

Static Water Level

Date : 10/10/2024

Stickup above NS (m) : _____

Water Level bTOC (m) : _____

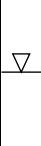
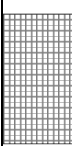

Water Level bNS (m) : _____

Date : 10/10/2024
 Client : G&G Corp
 Project : Lot 1 Corio Rd
 Easting : 394685.048
 Northing : 6397620.514
 Datum : GDA94
 Drill type : Auger
 Hole diameter : 8 cm

Job Number : H24068
 Start Hole : 11:10
 End Hole : 12:00
 Logged by : AFR
 Total Depth : 1.0
 RL Top of Casing : 13.319
 RL Nat Surface : 12.896

Bore Name

GW2

support	backfill	water	Slot / Screen Depth	Depth (metres)	Soil Characteristics					
					Colour	Particle Size	Texture	Organic Content	Moisture	Comment
PVC (Class 9)				0.5m	Dark Grey Black	Fine to Medium	Sand	High	Dry	
					Grey	Medium to Coarse		None	Moist	some clay content
				1.0m					Saturated	end of hole at 1.0 m
				1.5m						
			2.0m							
			2.5m							
			3.0m							
			3.5m							
			4.0m							
			4.5m							
			5.0m							

COLOUR : Black, White, Beige
 Dark/Medium/Light : Brown, Red, Orange, Yellow, Grey, Blue
 Composition : Solid, Blemish, Mottle

PARTICLE SIZE : Fine, Medium, Course

TEXTURE : Sand, Loamy Sand, Clayey Sand
 Silt, Loam, Sandy Loam, Clayey Loam
 Clay, Sandy Clay

ORGANICS : High, Medium, Low

MOISTURE : Dry, Slightly Moist, Moist, Saturated

Static Water Level

Date : 10/10/2024

Stickup above NS (m) : _____

Water Level bTOC (m) : _____

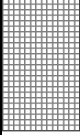
Water Level bNS (m) : _____

Date : 10/10/2024
Client : G&G Corp
Project : Lot 1 Corio Rd
Easting : 394394.0654
Northing : 6397367.665
Datum : GDA94
Drill type : Auger
Hole diameter : 8 cm

Job Number : H24068
Start Hole : 12:10
End Hole : 13:00
Logged by : AFR
Total Depth : 1.1
RL Top of Casing : 12.919
RL Nat Surface : 12.515

Bore Name

GW3

support	backfill	water	Slot / Screen Depth	Depth (metres)	Soil Characteristics					
					Colour	Particle Size	Texture	Organic Content	Moisture	Comment
PVC (Class 9)		▽		0.5m	Dark Grey Black	Fine to Medium	Sand	High	Slightly Moist	some clay content
					Dark Grey			Low	Moist	
				1.0m	Grey	Fine to Coarse		None	Saturated	end of hole at 1.1 m
				1.5m						
				2.0m						
				2.5m						
				3.0m						
				3.5m						
				4.0m						
				4.5m						
				5.0m						



COLOUR : Black, White, Beige
Dark/Medium/Light : Brown, Red, Orange, Yellow, Grey, Blue
Composition : Solid, Blemish, Mottle

PARTICLE SIZE : Fine, Medium, Course

TEXTURE : Sand, Loamy Sand, Clayey Sand
Silt, Loam, Sandy Loam, Clayey Loam
Clay, Sandy Clay

ORGANICS : High, Medium, Low

MOISTURE : Dry, Slightly Moist, Moist, Saturated

Static Water Level

Date : 10/10/2024

Stickup above NS (m) : _____

Water Level bTOC (m) : _____

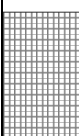

Water Level bNS (m) : _____

Date : **10/10/2024**
 Client : **G&G Corp**
 Project : **Lot 1 Corio Rd**
 Easting : **394740.232**
 Northing : **6397035.765**
 Datum : **GDA94**
 Drill type: **Auger**
 Hole diameter: **8 cm**

Job Number : **H24068**
 Start Hole : **13:45**
 End Hole : **14:30**
 Logged by : **AFR**
 Total Depth : **1.1**
 RL Top of Casing : **13.334**
 RL Nat Surface : **12.958**

Bore Name

GW4

support	backfill	water	Slot / Screen Depth	Depth (metres)	Soil Characteristics					
					Colour	Particle Size	Texture	Organic Content	Moisture	Comment
PVC (Class 9)		▽		0.5m	Dark Grey Black	Fine to Coarse	Sand	Medium	Dry	
				1.0m	Grey	Medium to Coarse		None	Moist Saturated	
end of hole at 1.1 m										
										
				1.5m						
				2.0m						
				2.5m						
				3.0m						
				3.5m						
				4.0m						
				4.5m						
				5.0m						

COLOUR : Black, White, Beige
 Dark/Medium/Light : Brown, Red, Orange, Yellow, Grey, Blue
 Composition : Solid , Blemish, Mottle

PARTICLE SIZE : Fine, Medium, Course

TEXTURE : Sand, Loamy Sand, Clayey Sand
 Silt, Loam, Sandy Loam, Clayey Loam
 Clay, Sandy Clay

ORGANICS : High, Medium, Low

MOISTURE : Dry, Slightly Moist, Moist, Saturated

Static Water Level

Date : **10/10/2024**

Stickup above NS (m) : _____

Water Level bTOC (m) : _____

Water Level bNS (m) : _____