Albany Motorsport Park – Development Application

Site and Soil Evaluation for Onsite Wastewater Management

City of Albany

19 August 2021

→ The Power of Commitment

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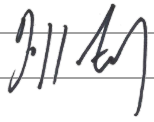
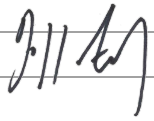
S3	A	J. Foley/ V. Davies	J. Foley		J. Foley		16/08/2021
S4	0	J. Foley/ V. Davies	J. Foley		J. Foley		19.08.21

Executive summary

The City of Albany (CoA) has engaged GHD to prepare a Site and Soil Evaluation for Onsite Wastewater Management report for the staged construction of the Albany Motorsport Park (AMP) at Lot 5780 (No. 54) Down Road South, Drome (the Site) (Figure 1, Appendix A). The project Proponent is the Great Southern Motorplex Group Inc. (GSMG).

Due to the scale and nature of the proposed development, the works have been broken down into two key stages which comprise the following:

– Stage 1:
  - Stage 1A: Construction of motocross track and 4WD driver training, ATV area and associated infrastructure.
  - Stage 1B: Construction of racetrack and associated infrastructure (subject to funding).
– Future Development: Construction and replacement of final permanent structures to support the function of the motorsports complex (subject to funding). Stage 2 will be addressed as a separate Development Application.

This Site and Soil Evaluation for Onsite Wastewater Management report has been developed as per the Department of Health, Western Australia (DOHWA) template report based on the *Health (Treatment of Sewage and Disposal of Effluent and Liquid Waste) Regulations 1974*, Government Sewerage Policy 2019, State Planning Policy 2.9, AS/NZS 1547 and other supporting documentation (DOHWA, 2021).

The purpose of this Site and Soil Evaluation (SSE) report is to outline the site, soil and groundwater conditions at the proposed AMP site with regarding to suitability for onsite effluent disposal during operation of the AMP. This report provides supporting information for the Development Application for the Stage 1 of the Site.

Based on an assessment of the soil physical and chemical results for the six test pit locations, it is recommended that the LAAs for the Race Track Precinct and Motocross Precinct are located at TP01 and TP06, respectively. The sizing for a wastewater treatment system and LAA has been developed in this SSE report for Stage 1A in the Motocross Precinct only.

The proposed clubhouse within the Motocross Precinct will be constructed in Stage 1A of the development. It is anticipated that this will be an unlicenced facility (15 L/ person/ day) however provision has been made for anticipated wastewater volumes for a licenced facility (35 L/ person/ day), to allow for possible increased loading at the site if it were to become a licenced facility.

The Motocross Precinct clubhouse is expected to have intermittent use throughout the Motocross season and on a weekly basis, with up to 300 patrons on Sunday or Saturday followed by minimal usage during the week and off-season downtime. Therefore, for the purpose of calculating anticipated wastewater volumes it is assumed that there is an average of 100 people/ day.

In order to accommodate spikes in wastewater volumes on event days when there is up to 300 patrons using the Motocross Precinct clubhouse facilities, it is proposed to install a 15,000 L holding tank, to balance storage over the course of a typical week.

The results of a water balance for the Motocross Precinct, for an average of 100 persons/day, indicate that 1,100 m^2 will be required for the sub-soil irrigation area. There is adequate area of land available within the vicinity of TP01 to accommodate the site of the required LAA.

As per the requirements of the Department of Water *WQPN 100* (DoW, 2007) and the *Government Sewerage Policy* (DPLH, 2019) a ‘Secondary’ wastewater treatment plant, with engineering certification to meet effluent quality of Biological Oxygen Demand (BOD) < 20 mg/L; Total Suspended Solids (TSS) < 30 mg/L; Total Nitrogen (TN) < 10 mg/L; Total Phosphorus (TP) < 1 mg/L; and *Escherichia coli* < 10 cfu/100mL is required in a Priority 2 PDWSA.

It is recommended that a DOHWA approved ‘Secondary’ treatment system, certified to AS1546.3:2008, is selected and installed for the Motocross Precinct during Stage 1A of development.

At time of writing, an onsite effluent disposal system was not proposed to be installed in the Race Track Precinct. All liquid waste from transportable buildings, toilets and washdown facilities is proposed to be removed offsite, as required, by an approved contractor. If onsite effluent disposal is proposed in the future is it expected a similar system, with holding tank, will be utilised to manage spikes in wastewater volumes for events and off-season downtime.

This report is subject to, and must be read in conjunction with, the limitations set out in section 1.2 and the assumptions and qualifications contained throughout the Report.

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1. Introduction

1.1 Background

The City of Albany (CoA) has engaged GHD to prepare a Site and Soil Evaluation for Onsite Wastewater Management report for the staged construction of the Albany Motorsport Park (AMP) at Lot 5780 (No. 54) Down Road South, Drome (the Site) (Figure 1, Appendix A). The project Proponent is the Great Southern Motorplex Group Inc. (GSMG).

The Great Southern Motorplex Group Inc. (GSMG), the Proponent, in partnership with the City of Albany, intend to develop the site as a regional motorsport facility. In October 2018, the City of Albany Council resolved to purchase the site and settlement of the land purchase was concluded in 2019. Once constructed, the AMP will be operated and managed by Albany Motorsport Venue Incorporated (AMV Inc.).

The proposed AMP forms part of the CoA's strategy to expand upon its existing motorsports facilities within the greater Albany area. The AMP is to be the largest facility of its kind in Western Australia and will support the local economy.

1.2 Purpose of this report

This Site and Soil Evaluation for Onsite Wastewater Management report has been developed as per the Department of Health, Western Australia (DOHWA) template report based on the *Health (Treatment of Sewage and Disposal of Effluent and Liquid Waste) Regulations 1974*, Government Sewerage Policy 2019, State Planning Policy 2.9, AS/NZS 1547 and other supporting documentation (DOHWA, 2021).

The purpose of this Site and Soil Evaluation (SSE) report is to outline the site, soil and groundwater conditions at the proposed AMP site with regarding to suitability for onsite effluent disposal during operation of the AMP. This report provides supporting information for the Development Application for the Stage 1 of the Site.

1.3 Evaluator's qualifications, experience and professional indemnity

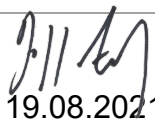
The SSE has been undertaken by Dr Jeff Foley who is a Chemical Engineer with 20 years' technical experience specialising in the areas of wastewater treatment and recycling and integrated water management. His involvement in water cycle projects has ranged from policy and planning, concept design and process modelling, through to detailed design, construction, commissioning and process optimisation.

GHD's site evaluation has been supported in the field by Great Southern Geotechnics (GSG), who specialise in high-quality testing of construction materials and consultancy services to the civil construction, agriculture, environmental, mining and resources industries across WA's Great Southern region. GSG operates an independent NATA Accredited Construction Materials Testing Laboratory, in compliance with AS ISO/IEC 17025 and ISO 9001.

Dr Foley is suitably qualified to provide interpretation of site, soil and climate conditions, undertake water balances, selection and design of appropriate wastewater treatment systems, disposal and reuse options. A summary of the Dr Foley's site evaluator details has been provided in Table 1 and a copy of his CV and qualifications can be provided on request.

A copy of GHD's Professional Indemnity Insurance certificate is included in Appendix C.

Table 1 Site Evaluator Details

Site evaluator details	
Name Company	Dr Jeff Foley, Technical Director – Wastewater process engineering GHD Pty Ltd
Phone Email	(08) 9840 5101 Jeff.Foley@ghd.com
Qualification Knowledge, skills and practical experience	MIEAust, BE(Chem) (Hons I), BA, PhD (UQ) – *Life cycle assessment of wastewater treatment systems* Employed as a wastewater process designer (inc. on-site systems) by GHD 2001 – 2021.
Date of site assessment	16/08/2021
Signature Date	 19.08.2021

1.4 Scope and limitations

This report: has been prepared by GHD for City of Albany and may only be used and relied on by City of Albany for the purpose agreed between GHD and City of Albany as set out in section 1.2 of this report.

GHD otherwise disclaims responsibility to any person other than City of Albany 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 in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

Site conditions (including the presence of hazardous substances and/or site contamination) may change after the date of this Report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change.

GHD has prepared this report on the basis of information provided by City of Albany and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

2. Site development description

The AMP is proposed to be developed at Lot 5780 Down Road South, Drome which is located approximately 20 km to the north of the Albany CBD and is 192.34 ha in size. The AMP comprises 141.7 ha (including 0.2 ha for crossovers) in the eastern portion of the Site. Two areas within Lot 5780 are excluded from the AMP development and include 49.47 ha at the western end of the Site which is covered with native vegetation and a dam area (1.37 ha) on the northern boundary which is subleased to Plantation Energy.

The Site is zoned as 'Special Use – SU26' under Local Planning Scheme No. 1, Scheme Amendment No. 35.

At full development, the proposed AMP will consist of:

- Sealed, configurable multi-use track (3.5 km long × 12 m wide) for motor car racing, motorcycle racing, drifting, driver training and cycling:
  - Designed to comply with Motorsport Australia *Track Operator's Safety Guide* (CAMS, 2012) and Motorcycling Australia (MA) *Track Guidelines* (MA, 2011)
  - To be licensed by Motorsport Australia for Fédération Internationalé de l'Automobile (FIA) Grade 2 and Fédération Internationalé Motocyclisme (FIM) Grade B (i.e. up to second-tier international motor racing)
- A motocross circuit designed and constructed in association with MA guidelines.
- An off-road four-wheel drive (4WD) and all-terrain vehicle (ATV) training area.
- Associated buildings and infrastructure.

2.1 Staging of the development

Due to the scale and nature of the proposed development, the works have been broken down into two key stages which comprise the following:

- Stage 1:
  - Stage 1A: Construction of motocross track and 4WD driver training, ATV area and associated infrastructure.
  - Stage 1B: Construction of racetrack and associated infrastructure (subject to funding).
- Future Development: Construction and replacement of final permanent structures to support the function of the motorsports complex (subject to funding). Stage 2 will be addressed as a separate Development Application.

A Master Plan, which illustrates the various aspects of the Site and staging areas, has been developed by the GSMG and CoA to support the Development Application for the AMP (Figure 2, Appendix A).

2.2 Anticipated wastewater volumes

The proposed clubhouse within the Motocross Precinct will be constructed in Stage 1A of the development. It is anticipated that this will initially be an unlicenced facility (15 L/ person/ day) however provision has been made for anticipated wastewater volumes for a licenced facility (35 L/ person/ day), to allow for possible increased loading at the site if it were to become a licenced facility.

The Motocross Precinct clubhouse is expected to have intermittent use throughout the Motocross season (approx. March to October) and on a weekly basis, with up to 300 patrons on Sunday or Saturday followed by minimal usage (max. 20 persons per day) during the week and off-season downtime. Therefore, for the purpose of calculating anticipated wastewater volumes (Table 2) it is assumed that there is an average of 100 people/ day (Appendix B).

In order to accommodate spikes in wastewater volumes on event days when there is up to 300 patrons using the Motocross Precinct clubhouse facilities, it is proposed to install a 15,000 L holding tank, to balance out wastewater flows over the course of a typical week. The holding tank will also help store effluent during the off-season period.

At this stage, an onsite effluent disposal system is not proposed to be installed in the Race Track Precinct. All liquid waste from transportable buildings, toilets and washdown facilities is proposed to be removed offsite, as required, by an approved contractor. If onsite effluent disposal is proposed in the future is it expected a similar system, with holding tank, will be utilised to manage spikes in wastewater volumes for events and off-season downtime.

Table 2 Anticipated wastewater volumes

Type	Input volume	Load per person	Daily flow (L/day)
Stage 1A – Motocross Precinct			
Permanent building (5 x sinks, 4 x toilet pans, urinal)	Up to 300 persons (average 100 persons/day)	35 L/person/day	3,500 L/day (average)
Transportable toilets	One permanent block and additional transportables for special events	35 L/person/day	Liquid waste to be removed offsite by an approved contractor, as required
Washdown area	Variable	-	
Total			**3,500 L/day (average)**
Stage 1B – Racetrack Precinct			
Transportable building	500 persons	35 L/person/day	Liquid waste to be removed offsite by an approved contractor, as required
Transportable toilets	Special events	35 L/person/day	
Washdown area	Variable	-	
Total			

2.3 Site development description

The AMP site development description is outlined in Table 3.

Table 3 Description of the development

Development characteristic	Description		
Site address	Lot 5780 (No. 54) Down Road South, Drome		
Owner/ developer	City of Albany		
Proponent	Great Southern Motorplex Group (GSMG)		
Postal address	PO Box 484, ALBANY WA 6331		
Contact for SSE	Ph: 9840 5101	Mob: 0410 541 971	Email: jeff.foley@ghd.com
Date of field work	25 June 2021		
Local Government	City of Albany		
Zoning	Special Use		
Lot size	192.34 ha		
Proposal	Albany Motorsport Park		
Water supply	Bore and rainwater		
Availability of sewer	Unavailable		
Development located within:	Public drinking water source area: Yes – Priority 2 PDWSA	Sewage sensitive areas Yes – Sewerage Category (f) Within 1 km of significant wetlands	
Anticipated wastewater volume:	Sewage (L): Motocross Precinct 3,500 L/day (average)	Trade waste (L): Zero	

3. Site and soil assessment

3.1 Site assessment

GHD have undertaken a number of site walkovers for the AMP site from 2018 to 2021 and are very familiar with the existing site conditions. In addition, an intrusive field investigation was undertaken, by Great Southern Geotechnics, on 25 June 2021. This investigation involved excavating six test pits to a depth of 2500 mm below ground level (bgl), using a mini excavator with a 300 mm auger. Soil types, profiles and groundwater levels were then visually assessed and recorded onsite at time of site investigation, as per the DOHWA (2021) SSE template guidelines (Great Southern Geotechnics, 2021).

The findings of the desktop and field assessment, level of constraint and proposed mitigation measures, for the proposed Motocross Precinct and Race Track Precinct onsite effluent disposal locations, have been summarised in Table 4.

Table 4 Key site characteristics, level of constraint and proposed mitigation measures for the proposed Motocross Precinct and Race Track Precinct effluent disposal areas

<table>
<tr><th>Site characteristics</th><th>Investigations and reporting</th><th>Level of constraint</th><th>Mitigation measures</th></tr>
<tr><td>Climate</td><td>Albany is located on the south coast of Western Australia and the climate is broadly described as Mediterranean, with warm dry summers and mild wet winters. The nearest Bureau of Meteorology (BoM) official recording station that has mean daily evaporation data (1968 to 2012) is the Albany Airport Comparison weather station (Site number 9741) (BoM, 2021).
Mean monthly rainfall levels at the Albany Airport Comparison weather station (BoM, 2021) and pan evaporation data (DPIRD, 1987) are presented below. This shows that mean monthly evaporation exceeds mean monthly rainfall for seven months of the year, from November to April.
<table>
<tr><th>Month</th><th>Jan</th><th>Feb</th><th>Mar</th><th>Apr</th><th>May</th><th>Jun</th><th>Jul</th><th>Aug</th><th>Sep</th><th>Oct</th><th>Nov</th><th>Dec</th></tr>
<tr><td>Mean Rainfall (mm)</td><td>23.6</td><td>22.3</td><td>33.6</td><td>61.3</td><td>89.8</td><td>108.0</td><td>119.3</td><td>106.3</td><td>88.5</td><td>70.8</td><td>47.0</td><td>27.8</td></tr>
<tr><td>Evap. (mm)</td><td>220</td><td>171</td><td>150</td><td>91</td><td>63</td><td>47</td><td>49</td><td>67</td><td>84</td><td>106</td><td>150</td><td>199</td></tr>
<tr><td>Evap. Exceeds Rainfall</td><td>Yes</td><td>Yes</td><td>Yes</td><td>Yes</td><td>No</td><td>No</td><td>No</td><td>No</td><td>No</td><td>Yes</td><td>Yes</td><td>Yes</td></tr>
</table>
</td><td>High</td><td>Divert stormwater from upslope around sub-soil irrigation area</td></tr>
<tr><td>Exposure</td><td>The proposed Land Application Areas (LAA) within the Race Track and Motocross Precincts have a high exposure to sun, with no shade cover and good ventilation.</td><td>Nil to Low</td><td>Not required</td></tr>
</table>

Site characteristics	Investigations and reporting	Level of constraint	Mitigation measures
Vegetation	The majority of the Site has been previously cleared for agriculture with isolated stands of trees (112.9 ha). The proposed Land Application Area (LAA) is open grassland. Refer to site photographs in the Great Southern Geotechnics (2021) Site Investigation report (Appendix D).	Nil to Low	Maintain grassed area within the LAA
Landform and drainage	The Site is mapped as the following Department of Primary Industries and Regional Development (DPIRD) landscape mapping units (Figure 3, Appendix A): TP01-TP03 – 242KgDMc Sands on laterite on elongate crests. TP04-TP05 – 242ReDMc Sands on laterite on elongate crests. TP06 – Broad valleys in sedimentary in sedimentary rocks; 30 m relief, smooth slopes. Deep sands and iron podzols on slopes.	Nil to Low	Not required
Slope	Slope of land within the site investigation areas for the Race Track Precinct and Motocross Precinct is approximately 6% (Figure 4, Appendix A).	Nil to Low	Diversion of stormwater from upslope around sub-soil irrigation area proposed
Fill (imported)	No imported fill was encountered during the site investigation	Nil to Low	Not required
Surface gravel and rock outcrops	During the Site Investigation, the soil profile (to 2500 mm blg) was generally found to have Topsoil over Sandy GRAVEL over Sandy CLAY. No rock outcrops were observed within the test pit location areas and gravel soils had approximately 10% coarse fragments (Great Southern Geotechnics, 2021)	Nil to Low	Not required
Erosion potential	The water erosion risk mapped by DPIRD indicates that for test pit locations TP01 – TP05 "*<3% of map unit has a high to extreme water erosion risk*". TP06 is mapped as "*3-10% of map unit has a high to extreme water erosion risk*" (Figure 5, Appendix A). The test pit locations within the Site are currently grassed and considered likely to be Nil or low if sub-soil irrigation is installed and grassed surface is maintained. Refer to photos in the Site Investigation report (Appendix D).	Nil to Low	Maintain as grassed area and divert stormwater from upslope around sub-soil irrigation area to maintain Nil or Low risk rating
Separation from groundwater	During the Site Investigation, undertaken in late June (Appendix D), ground water was not intercepted at 2500 mm bgl at any of the six test pit locations (Figure 4, Appendix A). These locations meet the vertical separation of greater than 2 m separation to groundwater in PDWSA.	Nil to Low	Not required
Public Drinking Water Source Area (PDWSA) and Sewage Sensitive Area (SSA)	The Site is located in a Priority 2 PDWSA – Marbellup Brook Catchment Area and SSA (<1 km from conservation category wetland) (Figure 4, Appendix A).	High	Maintain >2 m vertical separation to groundwater

Site characteristics	Investigations and reporting	Level of constraint	Mitigation measures
Surface waters and separation from water resources	All sub-soil irrigation areas will be located >100 m to Protected Exclusion Area and Marbelup Flats (Conservation Class wetland) (Figure 3, Appendix A).	Nil to Low	Not required
Rainfall run-off and seepage	The test pit location areas, in both the Race Track Precinct and Motocross Precinct, are located on waxing upperslope (UX) (National Committee on Soil and Terrain, 2009). No evidence of evidence of water pooling on the surface or seepage was observed during the Site Investigation (Great Southern Geotechnics, 2021) or during site walkovers undertaken by GHD.	Nil to Low	Diversion of stormwater from upslope around sub-soil irrigation area proposed
Flood potential	The flood erosion risk mapped by DPIRD indicates that test pit locations TP01 – TP05 that "*<3% of map unit has a moderate to high flood risk*". TP06 is mapped as "*3-10% of map unit has a moderate to high flood risk*" (Figure 9, Appendix A).	Nil to Low	Not required
Horizontal setback distances	All sub-soil irrigation areas will be setback >100 m to site boundaries, Protected Exclusion Area and Marbelup Flats (Conservation Class wetland) (Figure 3, Appendix A).	Nil to Low	Not required
Available Land Application Area (LAA)	Sufficient land is available within the Race Track and Motocross Precinct area for sub-soil irrigation of wastewater.	Nil to Low	Not required

3.2 Soil assessment

During the Site Investigation, undertaken by Great Southern Geotechnics, three test pits were excavated in each of the Motocross Track Area and Race Track Area. Table 5 includes a summary of the soil physical and chemical characteristics (Appendix E) for SSE at the six test pit locations.

Table 5 Summary of soil physical and chemical characteristics for SSE of the AMP site

Location	Layer depth (mm)	Sample depth (mm)	Soil strata	Depth to GW	Coarse fragments (%)	Soil colour & mottling	Soil field texture	Soil structure	Indicative soil permeability (m/d) (Ksa^{-1})	Design loading rate (DLR) (mm/d) Trenches and beds			pH	EC (dS/m)	Sodicity (ESP) (%)	Phosphate Sorption Capacity (mg P sorbed/kg)
										Primary treated effluent		Secondary treated effluent				
										Conservative rate	Maximum rate					
Race Track Precinct																
TP01	0-180		(Topsoil) SAND with silt	Not intercepted	Roots and root fibres	Dark grey	Sand - Fine to medium	Structureless	>3.0	20	35	50	-	-	-	-
TP01	180-490		Sandy GRAVEL		Contains approximately 10% Cobbles and Boulders in excess of 250 mm diameter	Brown	Gravel and sand - Fine to coarse, sub-rounded to sub-angular, (F:20% / M:20% / C:15%)	Structureless	>3.0	20	35	50	-	-	-	-
TP01	550-2500	900-1100	Sandy CLAY		NA	Brown/red mottled Light brown/orange (40%)	Light Clay - Low to medium plasticity	Massive	<0.06	NA	NA	8	6.1	0.022	5.8	688
TP02	0-140		(Topsoil) SAND with silt	Not intercepted	Roots and root fibres	Dark grey	Sand - Fine to medium	Structureless	>3.0	20	35	50	-	-	-	-
TP02	140-400		Sandy GRAVEL		Contains approximately 10% Cobbles and Boulders in excess of 400 mm diameter	Brown	Gravel and sand - Moderately cemented - Fine to coarse, sub-rounded to sub-angular, (F:20% / M:20% / C:15%)	Structureless	>3.0	20	35	50	-	-	-	-
TP02	400-1400	500-900	Sandy CLAY		NA	Light brown	Low to medium plasticity	Massive	<0.06	NA	NA	8	6.1	0.025	4.8	1650
TP02	1400-2500		Sandy CLAY		NA	Brown/red mottled Light brown/orange (40%)	Low to medium plasticity	Massive	<0.06	NA	NA	8	-	-	-	-
TP03	0-250		(Topsoil) SAND with silt	Not intercepted	Roots and root fibres	Dark grey to grey	Sand - Fine to medium	Structureless	>3.0	20	35	50	-	-	-	-
TP03	250-830	300-600	Sandy GRAVEL		Contains approximately 10% Cobbles and Boulders in excess of 400 mm diameter	Brown	Gravel and sand - Fine to medium, sub-rounded to sub-angular, (F:30% / M:30%)	Structureless	>3.0	20	35	50	5.7	0.028	5.7	3660
TP03	830-1600		Sandy CLAY		NA	Light brown	Low to medium plasticity	Massive	<0.06	NA	NA	8	-	-	-	-
TP03	1600-2500		Sandy CLAY		NA	Brown/red mottled Light brown/grey (30%)	Low to medium plasticity	Massive	<0.06	NA	NA	8	-	-	-	-

Location	Layer depth (mm)	Sample depth (mm)	Soil strata	Depth to GW	Coarse fragments (%)	Soil colour & mottling	Soil field texture	Soil structure	Indicative soil permeability (m/d) (Ksa^{-1})	Design loading rate (DLR) (mm/d) Trenches and beds			pH	EC (dS/m)	Sodicity (ESP) (%)	Phosphate Sorption Capacity (mg P sorbed/kg)
										Primary treated effluent		Secondary treated effluent				
										Conservative rate	Maximum rate					
Motocross Precinct																
TP04	0-220		(Topsoil) SAND with silt	Not intercepted	Roots and root fibres	Dark grey	Sand - Fine to medium	Structureless	>3.0	20	35	50	-	-	-	-
TP04	220-1250	400-800	Sandy GRAVEL		Contains approximately 10% Cobbles and Boulders in excess of 400 mm diameter	Brown	Gravel and sand - Fine to coarse, sub-rounded to sub-angular, (F:25% / M:20% / C:10%)	Structureless	>3.0	20	35	50	5.8	0.028	6.2	3000
TP04	1250-1750		Sandy CLAY		NA	Light brown/ orange	Low to medium plasticity	Massive	<0.06	NA	NA	8	-	-	-	-
TP04	1750-2500		Sandy CLAY		NA	Grey mottled red (30%) & orange (10%).	Low to medium plasticity	Massive	<0.06	NA	NA	8	-	-	-	-
TP05	0-230		(Topsoil) SAND with silt	Not intercepted	Roots and root fibres	Dark grey	Sand - Fine to medium	Structureless	>3.0	20	35	50	-	-	-	-
TP05	230-880	400-800	SAND with silt		NA	Grey	Sand - Fine to medium	Structureless	>3.0	20	35	50	5.4	0.004	<0.1	<250
TP05	880-2500		Sandy GRAVEL		Contains approximately 10% Cobbles and Boulders in excess of 400 mm diameter	Brown	Gravel and sand - Fine to coarse, sub-rounded to sub-angular, (F:15% / M:30% / C:10%).	Structureless	>3.0	20	35	50	-	-	-	-
TP06	0-350		(Topsoil) SAND with silt	Not intercepted	Roots and root fibres	Dark grey	Sand - Fine to medium	Structureless	>3.0	20	35	50	-	-	-	-
TP06	350-1200	500-800	Sandy GRAVEL		Contains approximately 10% Cobbles and Boulders in excess of 400 mm diameter	Brown	Gravel and sand - Fine to coarse, sub-rounded to sub-angular, (F:20% / M:20% / C:10%)	Structureless	>3.0	20	35	50	5.9	0.02	1.4	966
TP06	1200-1800		Sandy GRAVEL			Brown	Gravel and sand - Fine to coarse, sub-rounded to sub-angular, (F:20% / M:30% / C:10%)	Structureless	>3.0	20	35	50	-	-	-	-
TP06	1800-2500		Sandy GRAVEL			Brown	Gravel and sand - Fine to coarse, sub-rounded to sub-angular, (F:40% / M:20%)	Structureless	>3.0	20	35	50	-	-	-	-

3.3 Site assessment results

Based on an assessment of the soil physical and chemical results for the six test pit locations in Table 5, it is recommended that the LAAs for the Race Track and Motocross Precincts are located at TP01 and TP06, respectively.

– Motocross Precinct (TP06):
  - AS1547 soil type = Gravel
  - Indicative soil permeability (Ksat) = > 3.0 m/d
  - Design irrigation rate = 5 mm/d
– Race Track Precinct (TP01):
  - AS1547 soil type = Light clay
  - Indicative soil permeability (Ksat) = < 0.06 m/d
  - Design irrigation rate = 3 mm/d

As per the DOHWA (2021) guidance, a Level of Constraint (Low, Moderate or High) is determined by applying a risk assessment to each site characteristic and the following mitigation measures may be applied:

– Nil or Low
  - *If all constraints are Low, standard designs are generally satisfactory and no mitigation measures are required.*
– Moderate
  - *For each Moderate constraint an appropriate mitigation measure or design modification over and above that of a standard design, should be outlined.*
– High
  - *Any High constraint might prove an impediment to successful on-site wastewater management, or alternatively will require in-depth investigation and incorporation of sophisticated mitigation measures in the design to permit compliant onsite wastewater management.*

A summary of site assessment results, including the level of constraint for each characteristic, within the Motocross Precinct in Table 6 and Race Track Precinct is outlined in Table 7.

3.3.1 Motocross Precinct

A summary of site assessment results for SSE for the recommended LAA within the Motocross Precinct (TP06) has been provided in Table 6.

Table 6 Summary of site assessment results for SSE of the proposed LAA within the Motocross Precinct (TP06)

Characteristic	Level of Constraint			Results for TP06	Assessed Level of Constraint for Site
	Nil or Low	Moderate	High		
General Characteristics					
Climate (difference between average annual rainfall and average pan evaporation, mm/year)	Excess of evaporation over rainfall in the wettest months	Rainfall approximates to evaporation	Excess of rainfall over evaporation in the wettest months	Rainfall in excess of evaporation from May to September	**High**
Exposure to sun and wind	Full sun and/or high wind or minimal shading and North / North-East	Dappled light East / West / South-East / South-West aspect	Limited patches of light and little wind to heavily shaded all day and South aspect	Full sun	**Nil or Low**

Characteristic	Level of Constraint			Results for TP06	Assessed Level of Constraint for Site
	Nil or Low	Moderate	High		
	/North-West aspect				
Vegetation coverage over the site	Plentiful vegetation with healthy growth and good potential for nutrient uptake Turf or pasture	Limited variety of vegetation	Sparse vegetation or no vegetation, dense forest with little understorey	Good cover of existing pasture	**Nil or Low**
Landslip (or landslip potential)	Nil	Low to moderate	High or Severe	No landslip evident	**Nil or Low**
Slope Form (affects water shedding ability)	Hill crests, convex or divergent side-slopes and plains	Straight side-slopes and footslopes	Floodplains, concave or convergent side-slopes and incised channels	Straight waxing upperslope (UX)	**Moderate**
Site Drainage (qualitative)	No visible signs or likelihood of dampness, even in wet season	Some signs or likelihood of dampness Moist soil but no standing water in soil pit	Wet soil, moisture-loving plants, standing water in pit; water ponding on surface	No visible signs or likelihood of dampness, even in wet season	**Nil or Low**
Slope gradient (%)					
(a) for absorption trenches and beds	<5%	5-15%	>15%	Approximately 6%	**Moderate**
(b) for surface/ subsurface irrigation	<10%	10-20%	>20%	Approximately 6%	**Nil or Low**
Erosion (or potential for erosion)	Nil or Low	Moderate	Severe	Good cover of existing pasture, upslope stormwater diversion and sub-surface irrigation proposed	**Nil or Low**
Fill (imported)	No fill at present or fill is good quality topsoil or minimal fill required	Moderate coverage and good quality fill	Extensive poor-quality fill and variable quality fill	No fill at present	**Nil or Low**
Flood frequency (AEP)	Less than 1 in 100 years	Between 100 and 20 years	More than 1 in 20 years	Less than 1 in 100 years	**Nil or Low**
Private bore used for household/drinking water purposes	No bores onsite or on neighbouring properties	>30 m to the nearest private bore	<30 m to the nearest private bore	APEC bores located >30 m	**Moderate**
Proximity to water resources	>100 m	<100 m but reduced setback is supported (refer to Section 5.2.2 of the GSP)	<100 m and reduced setback is not supported (refer to Section 5.2.2 of the GSP)	>100 m to Protected Exclusion Area and Marbellup Flats	**Nil or Low**

Characteristic	Level of Constraint			Results for TP06	Assessed Level of Constraint for Site
	Nil or Low	Moderate	High		
Public Drinking Water Source Areas (PDWSA) and Sewage Sensitive Areas (SSA)	Site not located within a PDWSA or SSA	Site located within a PDWSA or SSA	Site located within both a PDWSA and SSA	Priority 2 PDWSA – Marbellup Brook Catchment Area SSA (<1 km from conservation category wetland)	**High**
Groundwater (wettest time of the year)	>2 m	2.0 – 0.6 m need for fill to achieve setbacks listed in Appendix 1	<0.6 m fill is not practical to achieve setbacks listed in Appendix 1	Groundwater not intercepted >2.5 m	**Nil or Low**
Land area available for LAA	Exceeds the minimum required LAA size of AS1547 or Schedule 2 of the GSP	Meets the minimum required LAA size of AS1547 or Schedule 2 of the GSP	Insufficient area available for LAA as per AS1547 or Schedule 2 of the GSP	550 m^2 available for sub-surface irrigation	**Nil or Low**
Rock outcrops (% of surface)	<10%	10-20%	>20%	No rock outcrops observed	**Nil or Low**
Site Drainage (qualitative)	No visible signs or likelihood of dampness, even in wet season	Some signs or likelihood of dampness Moist soil but no standing water in soil pit.	Wet soil, moisture-loving plants, standing water in pit; water ponding on surface	No visible signs or likelihood of dampness, even in wet season	**Nil or Low**
Stormwater run-on/run-off	Low likelihood of stormwater run-on/run-off	Moderate likelihood of stormwater run-on/run-off, need for diversionary structures	High likelihood of inundation by stormwater run-on/run-off, diversion not practical	Upslope stormwater diversion proposed	**Nil or Low**
Soil profile characteristics					
Soil permeability Category (AS1547)	2 and 3	4 and 5	1 and 6	1	**High**
Profile depth	>2 m	2.0-1.0	< 1.0 m	2.5 m bgl	**Nil or Low**
Hardpan or bedrock	>1.5 m	1.5-0.6 m Special design requirements and distribution techniques or soil modification will be necessary, depends on quality of treated wastewater and type of LAS	<0.6 m	Sandy GRAVEL encountered to 2.5 m bgl	**Nil or Low**
Presence of mottling	None	Moderate	Extensive	None	**Nil or Low**
Coarse fragments	< 10%	10-40%	>40%	10% Cobbles and boulders in excess of 400 mm diameter	**Nil or Low**

Characteristic	Level of Constraint			Results for TP06	Assessed Level of Constraint for Site
	Nil or Low	Moderate	High		
pH	6.0 - 8.0	4.5 – 6.0	<4.5, >8	5.9 - pH between <5 and >8 therefore likely to be suitable for plant growth	**Moderate**
Electrical Conductivity (ECe)(dS/m)	<0.3	0.3 - 2	>2	0.02	**Nil or Low**
Sodicity ESP%	<3	3.0 - 8.0	>8	1.4	**Nil or Low**
Phosphorus adsorption (mg/kg)	>500	200-500	<200	966	**Nil or Low**

3.3.2 Race Track Precinct

A summary of site assessment results for SSE for the recommended LAA within the Race Track Precinct (TP01) has been provided in Table 7.

Table 7 Summary of site assessment results for SSE of the proposed LAA within the Race Track Precinct (TP01)

Characteristic	Level of Constraint			Results for TP01	Assessed Level of Constraint for Site
	Nil or Low	Moderate	High		
General Characteristics					
Climate (difference between average annual rainfall and average pan evaporation, mm/year)	Excess of evaporation over rainfall in the wettest months	Rainfall approximates to evaporation	Excess of rainfall over evaporation in the wettest months	Rainfall in excess of evaporation from May to September	**High**
Exposure to sun and wind	Full sun and/or high wind or minimal shading and North / North-East /North-West aspect	Dappled light East / West / South-East / South-West aspect	Limited patches of light and little wind to heavily shaded all day and South aspect	Full sun	**Nil or Low**
Vegetation coverage over the site	Plentiful vegetation with healthy growth and good potential for nutrient uptake Turf or pasture	Limited variety of vegetation	Sparse vegetation or no vegetation, dense forest with little understorey	Good cover of existing pasture	**Nil or Low**
Landslip (or landslip potential)	Nil	Low to moderate	High or Severe	No landslip evident	**Nil or Low**
Slope Form (affects water shedding ability)	Hill crests, convex or divergent side-slopes and plains	Straight side-slopes and footslopes	Floodplains, concave or convergent side-slopes and incised channels	Straight waxing upperslope (UX)	**Moderate**

Characteristic	Level of Constraint			Results for TP01	Assessed Level of Constraint for Site
	Nil or Low	Moderate	High		
Site Drainage (qualitative)	No visible signs or likelihood of dampness, even in wet season	Some signs or likelihood of dampness Moist soil but no standing water in soil pit	Wet soil, moisture-loving plants, standing water in pit; water ponding on surface	No visible signs or likelihood of dampness, even in wet season	**Nil or Low**
Slope gradient (%)					
(a) for absorption trenches and beds	<5%	5-15%	>15%	Approximately 6%	**Moderate**
(b) for surface/ subsurface irrigation	<10%	10-20%	>20%	Approximately 6%	**Nil or Low**
Erosion (or potential for erosion)	Nil or Low	Moderate	Severe	Good cover of existing pasture, upslope stormwater diversion and sub-surface irrigation proposed	**Nil or Low**
Fill (imported)	No fill at present or fill is good quality topsoil or minimal fill required	Moderate coverage and good quality fill	Extensive poor-quality fill and variable quality fill	No fill at present	**Nil or Low**
Flood frequency (AEP)	Less than 1 in 100 years	Between 100 and 20 years	More than 1 in 20 years	Less than 1 in 100 years	**Nil or Low**
Private bore used for household/drinking water purposes	No bores onsite or on neighbouring properties	>30 m to the nearest private bore	<30 m to the nearest private bore	APEC bores located >30 m	**Moderate**
Proximity to water resources	>100 m	<100 m but reduced setback is supported (refer to Section 5.2.2 of the GSP)	<100 m and reduced setback is not supported (refer to Section 5.2.2 of the GSP)	>100 m to Protected Exclusion Area and Marbellup Flats	**Nil or Low**
Public Drinking Water Source Areas (PDWSAs) and Sewage Sensitive Areas (SSA)	Site not located within a PDWSA or SSA	Site located within a PDWSA or SSA	Site located within both a PDWSA and SSA	Priority 2 PDWSA – Marbellup Brook Catchment Area and SSA (<1 km from conservation category wetland)	**High**
Groundwater (wettest time of the year)	>2 m	2.0 – 0.6 m need for fill to achieve setbacks listed in Appendix 1	<0.6 m fill is not practical to achieve setbacks listed in Appendix 1	Groundwater not intercepted >2.5 m	**Nil or Low**
Land area available for LAA	Exceeds the minimum required LAA size of AS1547 or Schedule 2 of the GSP	Meets the minimum required LAA size of AS1547 or Schedule 2 of the GSP	Insufficient area available for LAA as per AS1547 or Schedule 2 of the GSP	Sufficient area available for sub-surface irrigation	**Nil or Low**
Rock outcrops (% of surface)	<10%	10-20%	>20%	No rock outcrops observed	**Nil or Low**

Characteristic	Level of Constraint			Results for TP01	Assessed Level of Constraint for Site
	Nil or Low	Moderate	High		
Site Drainage (qualitative)	No visible signs or likelihood of dampness, even in wet season	Some signs or likelihood of dampness Moist soil but no standing water in soil pit.	Wet soil, moisture-loving plants, standing water in pit; water ponding on surface	No visible signs or likelihood of dampness, even in wet season	**Nil or Low**
Stormwater run-on/run-off	Low likelihood of stormwater run-on/run-off	Moderate likelihood of stormwater run-on/run-off, need for diversionary structures	High likelihood of inundation by stormwater run-on/run-off, diversion not practical	Upslope stormwater diversion proposed	**Nil Low**
Soil profile characteristics					
Soil permeability Category (AS1547)	2 and 3	4 and 5	1 and 6	5	**Moderate**
Profile depth	>2 m	2.0-1.0	< 1.0 m	2.5 m bgl	**Nil or Low**
Hardpan or bedrock	>1.5 m	1.5-0.6 m Special design requirements and distribution techniques or soil modification will be necessary, depends on quality of treated wastewater and type of LAS	<0.6 m	Sandy CLAY intercepted at 550 mm bgl	**High**
Presence of mottling	None	Moderate	Extensive	Sandy CLAY mottled	**Moderate**
Course fragments	< 10%	10-40%	>40%	10% Cobbles and boulders in excess of 250 mm diameter	**Nil or Low**
pH	6.0 - 8.0	4.5 – 6.0	<4.5, >8	6.1	**Nil or Low**
Electrical Conductivity (ECe)(dS/m)	<0.3	0.3-2	>2	0.022	**Nil or Low**
Sodicity Exchangeable sodium percentage (ESP%)	<3	3.0 - 8.0	>8	5.8 – no evidence of dispersion, slaking, or structural decline	**Moderate**
Phosphorus adsorption (mg/kg)	>500	200-500	<200	688	**Nil or Low**

3.3.3 Mitigation measures

The majority of constraints assessed in 3.3.1 and 3.3.1 were found to be Nil or Low, however several key constraints were found to be High or Moderate. Proposed mitigation measures for the aspects which are considered to have a High or Moderate constraint within the Race Track Precinct and Motocross Precinct are included in Table 8.

Table 8 Proposed mitigation measures for High and Moderate constraints

Constraints		
Race Track Precinct	**Motocross Precinct**	**Proposed mitigation measures**
High		
Climate - Rainfall in excess of evaporation from May to September		Diversion of stormwater from upslope around sub-soil irrigation area
Priority 2 PDWSA – Marbellup Brook Catchment Area and SSA (<1 km from conservation category wetland)		The proposed LAA achieves a 2 m vertical separation to groundwater
Hardpan or bedrock <0.6 m - Sandy CLAY intercepted at 550 mm bgl	-	Amend soils in LAA
-	Soil permeability Category (AS1547) – (1) Gravels and sands	Accommodate permeability via Design Loading Rates (DLRs) and Design Irrigation Rates (DIRs)
Moderate		
Slope Form (affects water shedding ability) – Straight waxing upperslope		Diversion of stormwater from upslope around sub-soil irrigation area
Slope gradient (%) (a) for absorption trenches and beds – 5-15%		No absorption trenches or beds proposed
APEC bores located >30 m		APEC bore located 250 m away – no modification considered necessary
Presence of mottling - Sandy CLAY mottled	-	Amend soils in potential LAA
Soil permeability Category (AS1547) – (5) Light clay	-	Accommodate permeability via Design Loading Rates (DLRs) and Design Irrigation Rates (DIRs)
Sodicity ESP – 5.8%	-	No evidence of dispersion, slaking or structural decline in the soils on or near the potential LAA
-	pH 5.9	No evidence of scald or bare areas on or near the potential LAA

4. Wastewater management system type and design

4.1 Specific assessment SSE – Sizing for treatment system and land application area

The sizing for a wastewater treatment system and LAA has been developed in this SSE report for Stage 1A in the Motocross Precinct only.

As per the requirements of the Department of Water *WQPN 100* (DoW, 2007) and the *Government Sewerage Policy* (DPLH, 2019) a 'Secondary' wastewater treatment plant, with engineering certification to meet effluent quality of Biological Oxygen Demand (BOD) < 20 mg/L; Total Suspended Solids (TSS) < 30 mg/L; Total Nitrogen (TN) < 10 mg/L; Total Phosphorus (TP) < 1 mg/L; and *Escherichia coli* < 10 cfu/100mL is required in a Priority 2 PDWSA.

It is recommended to install a 'Secondary' treatment system, with nutrient removal such as Aquarius Wastewater Systems Pty Ltd, which provide DOHWA approved systems. An example of the type of system that would meet the requirement of a 'Secondary' treatment system is provided in Appendix F. These systems have a nutrient reduction capability of which includes reduction of TN to < 10 mg/L and TP to < 1 mg/L and are certified to AS1546.3:2008.

4.1.1 Water balance

A water balance has been developed for the operation of the wastewater system, as per the water balance in the DOHWA (2021) guidance, for Stage 1A of the AMP development in the Motocross Precinct and included in Appendix B.

The water balance has been developed based on the following:

– A design wastewater flow of 3,500 L/day (average of 100 persons and 15,000 L storage tank)
– Design irrigation rate for sub-surface irrigation of 5.0 mm/day
– Rainfall run-off factor of 0.9
– Mean monthly rainfall levels at the Albany Airport Comparison weather station (BoM, 2021)
– Pan evaporation data (DPIRD, 1987)

The results of the water balance for the Motocross Precinct, for an average of 100 persons/day, indicate that 1,100 m^2 will be required for the sub-soil irrigation area. There is adequate area of land available within the vicinity of TP06 to accommodate the site of the required LAA.

4.2 Siting and configuration of the Land Application Area

4.2.1 Setback distances

Based on an assessment of the soil physical and chemical results for the six test pit locations in Table 5, it is recommended that the LAAs for the Race Track and Motocross Precincts are located at TP01 and TP06, respectively.

All sub-soil irrigation areas will be located >100 m to Protected Exclusion Area and Marbelup Flats (Conservation Class wetland) (Figure 3, Appendix A).

The sub-soil irrigation area will be fenced and will be separate from the activities within the Precinct to maintain public amenity.

4.2.2 Stormwater management

Stormwater management will include diversion drains, water treatment areas and attenuation basins to control stormwater across the Race Track Precinct and Motocross Precinct as per the Stormwater Management Plan (GHD, 2021) prepared for the Development Application for the AMP.

5. Monitoring, operation and maintenance

Baseline groundwater and surface water quality sampling of the Site was undertaken by Bio Diverse Solutions in 2018 and 2019 (Bio Diverse Solutions, 2018). DWER has been consulted during the development of the Site Local Water Management Strategy (LWMS) (GHD, 2021) as part of the Scheme Amendment process. The following surface and groundwater pre-development, construction and post-development monitoring is outlined as per the approved LWMS.

5.1 Surface water monitoring

5.1.1 Pre-development and construction monitoring

Ongoing quarterly monitoring of existing Site surface water conditions shall be continued prior to development, and during construction of the AMP as per the Local Water Management Strategy approved by DWER as part of the Scheme Amendment process.

In combination with the existing 2018 and 2019 data, the ongoing monitoring will be used as a baseline for ongoing assessment of the potential impact of the development on shallow groundwater and surface water quality. Additionally, pre-development water monitoring data will be used to identify water quality trigger levels at which a response is required.

For surface water monitoring during the construction phase of the development, a CEMP shall be prepared by the Contractor which will include erosion and sedimentation control measures, as well as drainage and dewatering systems (if required) in order to minimise potential pollution impacts and prevent contamination to surface water and groundwater.

5.1.2 Post-development monitoring

Ongoing monthly monitoring of surface water conditions shall be continued post-development (for the duration of the operation of the facility), with continued monitoring at sites CS01 and CS02, and establishment of a new upstream monitoring location. Additional sampling shall also be undertaken in response to any spill events.

The post-development monitoring program will also involve the collection of grab samples from the compensating basins. Sampling of basins should comprise 3-4 events per year, during or immediately following significant rainfall events (1EY, 1 year ARI event). It is assumed the first flush events will have the highest level of nutrients and chemicals, therefore sampling should occur at the time/after the first significant rainfall event of each wet season, and after extended dry periods. Field notes should include details of the rainfall events, site conditions, time of sampling and time of sample testing.

Monitoring of the compensation basin inlet and outlet water quality will be used to assess performance of the basins in improving stormwater quality.

Annual water monitoring reports shall be submitted to DWER and the Water Corporation. A water quality response and contingency plan will be prepared and provided to the Water Corporation, City of Albany and DWER for advice.

5.1.3 Monitoring program summary

The recommended monitoring parameters for the ongoing pre-development, construction and post-development monitoring program are outlined in Table 9.

Table 9 Summary of surface water monitoring

Site	Frequency	Duration	Parameters
Surface water - Upstream of the site (TBC) - Mid-stream (CS02) - Downstream of the site (CS01)	Monthly	Ongoing, with annual reporting	In-situ: pH, EC, temperature Unfiltered sample: pH, EC, TN, FRP, TKN, ammonia, TP, TRH, PAH, BTEXN, Surfactants, microbial analysis Filtered sample: Filtered total nitrogen and filtered total phosphorus (to quantify organic component), NO_2/NO_3, PO_4, dissolved heavy metals (As, Cd, Cr, Cu, Pb, Ni, Zn, Hg)
Compensating basin - Inlet (4 No.) - Outlet (4 No.)	3-4 events per year following 1EY rainfall events		

5.2 Groundwater monitoring

5.2.1 Pre-development and construction monitoring

Ongoing monitoring of existing Project Site shallow groundwater conditions shall be continued prior to development, and during construction of the AMP. In combination with the existing 2018 and 2019 data, the ongoing monitoring will be used as a baseline for ongoing assessment of the potential impact of the development on shallow groundwater and surface water quality.

Additionally, pre-development water monitoring data will be used to identify water quality trigger levels at which a response is required.

5.2.2 Post-development monitoring

A groundwater monitoring network should be established post development, the locations of which will be based on groundwater monitoring strategy.

Ongoing monitoring of the groundwater monitoring bores shall be conducted for the duration of the operation of the facility and in accordance with the groundwater monitoring program in Table 10.

Annual water monitoring reports will be submitted to DWER and the Water Corporation.

A water quality response and contingency plan will be prepared and provided to the Water Corporation, City of Albany and DWER for advice.

In addition if the development proposal seeks a licence to take water and approval to install a production bore for abstraction of groundwater as a water supply source for the development, then six-monthly groundwater monitoring for water levels and salinity will be a required.

5.2.3 Monitoring program summary

The program and parameters outlined in Table 10 will provide a suitable representation of groundwater quality at the site. The groundwater bores established for pre-development monitoring will be used for construction phase and incorporated into the post-development monitoring network.

Table 10 Summary of groundwater monitoring

Site	Frequency	Duration	Parameters
Monitoring bores Production bore	Monthly	Pre-development, during construction, on-going throughout the life of development.	Water level
			In-situ: pH, EC, temperature Unfiltered sample: pH, EC, TN, FRP, TKN, ammonia, TP, TRH, PAH, BTEXN, Surfactants, microbial analysis Filtered sample: Filtered total nitrogen and filtered total phosphorus (to quantify organic component), NO_2/NO_3, PO_4, dissolved heavy metals (As, Cd, Cr, Cu, Pb, Ni, Zn, Hg)

5.2.4 Contingency measures

Pre-development water monitoring data shall be used to identify water quality trigger levels at which a management response is required. A water quality response and contingency plan shall be included in the surface and groundwater monitoring plans.

In the event of a major water quality incident at the Site, it is recommended that increased monitoring be undertaken to quantify if there is any impact to surface and groundwater quality. Contingency monitoring and response measures shall be developed in consultation with DWER and documented in the post-development monitoring program.

Potential incidents due to system failure and/ or mechanical breakdown during operation and maintenance of the installed system shall be addressed, as required, as per the manufacturer and installation instructions.

6. Conclusion and recommendations

The SSE report for the AMP site involved evaluation of site and soil, physical and chemical properties, to identify appropriate onsite effluent disposal LAAs within the Race Track Precinct and Motocross Precinct. Based on an assessment of the soil physical and chemical results for the six test pit locations, it is recommended that the LAAs for the Race Track Precinct and Motocross Precinct are located at TP01 and TP06, respectively.

The sizing for a wastewater treatment system and LAA has been developed in this SSE report for Stage 1A in the Motocross Precinct only.

The proposed clubhouse within the Motocross Precinct will be constructed in Stage 1A of the development. It is anticipated that this will be an unlicenced facility (15 L/ person/ day) however provision has been made for anticipated wastewater volumes for a licenced facility (35 L/ person/ day), to allow for possible increased loading at the site if it were to become a licenced facility.

The Motocross Precinct clubhouse is expected to have intermittent use throughout the Motocross season and on a weekly basis, with up to 300 patrons on Sunday or Saturday followed by minimal usage during the week and off-season downtime. Therefore, for the purpose of calculating anticipated wastewater volumes it is assumed that there is an average of 100 people/ day.

In order to accommodate spikes in wastewater volumes on event days when there is up to 300 patrons using the Motocross Precinct clubhouse facilities, it is proposed to install a 15,000 L holding tank, to balance storage over the course of a typical week.

The results of a water balance for the Motocross Precinct, for an average of 100 persons/day, indicate that 1,100 m^2 will be required for the sub-soil irrigation area. There is adequate area of land available within the vicinity of TP06 to accommodate the site of the required LAA.

As per the requirements of the Department of Water *WQPN 100* (DoW, 2007) and the *Government Sewerage Policy* (DPLH, 2019) a 'Secondary' wastewater treatment plant, with engineering certification to meet effluent quality of Biological Oxygen Demand (BOD) < 20 mg/L; Total Suspended Solids (TSS) < 30 mg/L; Total Nitrogen (TN) < 10 mg/L; Total Phosphorus (TP) < 1 mg/L; and *Escherichia coli* < 10 cfu/100mL is required in a Priority 2 PDWSA.

It is recommended that a DOHWA approved 'Secondary' treatment system, certified to AS1546.3:2008, is selected and installed for the Motocross Precinct during Stage 1A of development.

At time of writing, an onsite effluent disposal system was not proposed to be installed in the Race Track Precinct. All liquid waste from transportable buildings, toilets and washdown facilities is proposed to be removed offsite, as required, by an approved contractor. If onsite effluent disposal is proposed in the future is it expected a similar system, with holding tank, will be utilised to manage spikes in wastewater volumes for events and off-season downtime.

In addition it is recommended, as per the DOHWA (2021) guidelines, that the following is undertaken:

- *Have a suitably qualified maintenance contractor service the secondary and advanced secondary treatment system every three months, as required by Council under the approval to operate.*
- *Annual inspections should be undertaken on treatment tanks and desludging undertaken on annual, two yearly or four yearly cycles depending on the size of the tank installed.*
- *All land application systems should be sited in an area that will not be frequented by vehicle or foot traffic or will not be built on or covered with paved over.*
- *Any subsurface irrigation areas should be vegetated (i.e. with grass that can be mown regularly) to encourage growth and maximise nutrient uptake.*
- *Irrigation lines should be maintained as per manufacturer's instructions (e.g. flushing).*
- *Stormwater and surface run-on should be diverted around, or away from, land application areas.*

- *Landowners should be cognisant of the operation of their system and monitor the treatment and land application area to identify any potential issues (e.g. insufficient septic treatment, clogging of the system, pooling of treated effluent).*
- *The volume of wastewater produced should remain the same and not exceed the operational capacity of the system, it will ensure the effective long-term operation of the systems*
- *Chemicals, large quantities of cleaning products, fats, oils and grease, and food scraps should not be discharged to the wastewater treatment and disposal system, as they risk overloading or interfering with the functioning of the system.*

7. References

Bio Diverse Solutions. (2018). *Surface water and Groundwater Monitoring.* Unpublished report for City of Albany.

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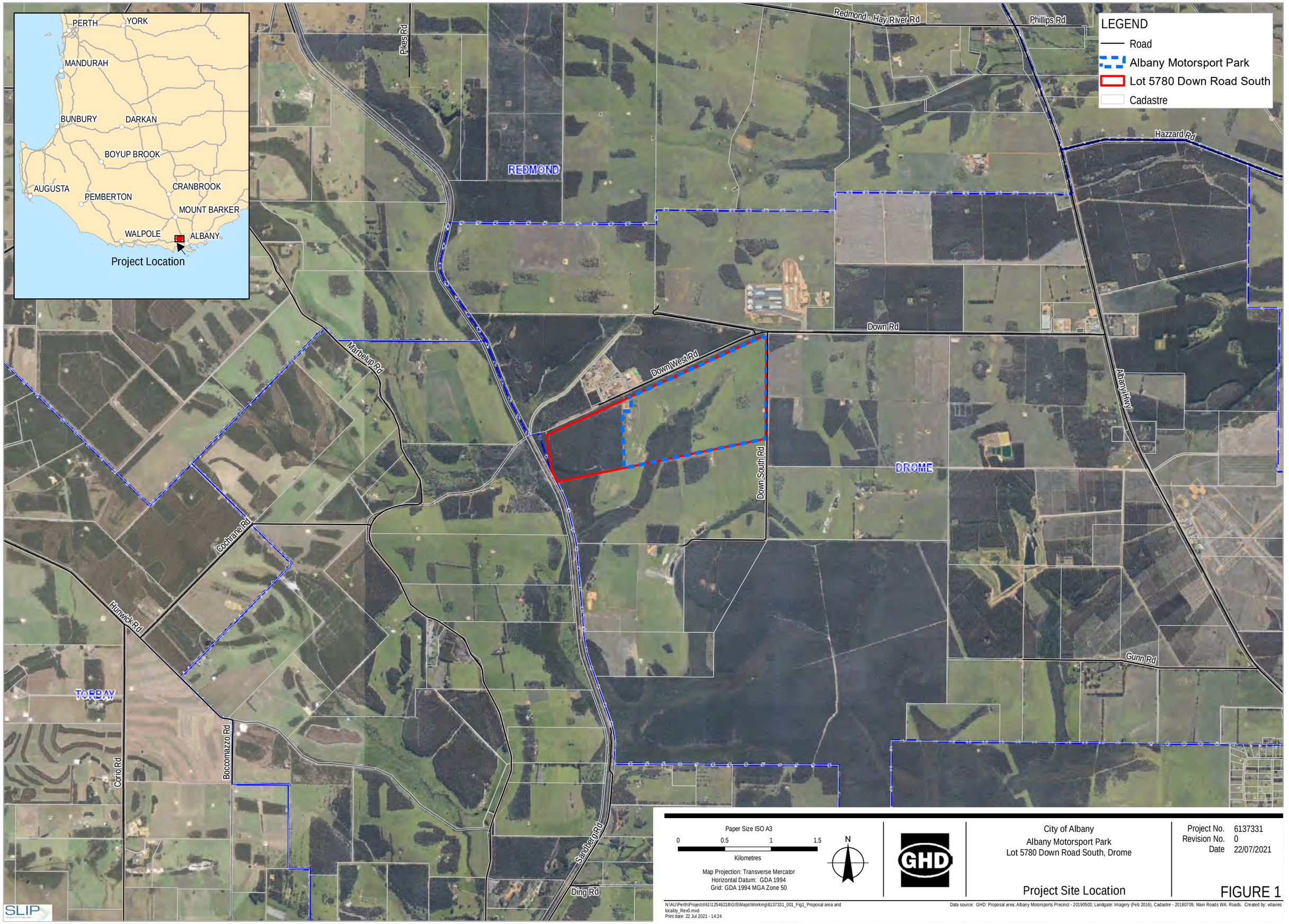
Appendix A

Figures



Paper Size ISO A3

0 0.5 1 1.5

Kilometres

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

N

GHD

City of Albany
Albany Motorsport Park
Lot 5780 Down Road South, Drome

Project Site Location

Project No.	6137331
Revision No.	0
Date	22/07/2021

FIGURE 1

N:\AU\Perth\Projects\61\12546218\GIS\Maps\Working\6137331_001_Fig1_Proposal area and locality_Rev0.mxd
Print date: 22 Jul 2021 - 14:24

Data source: GHD: Proposal area; Albany Motorsports Precinct - 20190503; Landgate: Imagery (Feb 2016), Cadastre - 20180709; Main Roads WA: Roads. Created by: vdavies

LEGEND

STAGE 1A

STAGE 1B

MB - MONITORING BORE

DMB - DEEP MONITORING BORE

DOWN ROAD

RT ROAD 7m GRAVEL WITH 2m WIDE VERGES

BOUNDARY AND PRECINCT FENCING - 1.8m HIGH

PROPOSED LEFT TURN LANE OFF DOWN ROAD

ENTRY / EXIT TO PARK

SECURE GATE

SECURITY FENCE

FUTURE RACE TRACK GATEHOUSE

7m WIDE GRAVEL EMERGENCY EXIT (GATED 8m)

POTENTIAL LOCATION WATER SUPPLY FOR FIRE FIGHTING - 110,000L / OR SIMILAR SUITABLE SOURCE

7m WIDE GRAVEL EMERGENCY EXIT (GATED 8m)

POTENTIAL EFFLUENT SYSTEM LOCATION

TRIALS TRACK

BUNDED CONCRETE RE-FUELING & WASHDOWN AREA WITH WASTE WATER TRAP & WATER TANK

AREA FOR SELF-CONTAINED TEMPORARY FOOD VANS

TRANSPORTABLE TOILETS ZONE

PROPOSED SINGLE STOREY MULTIPURPOSE BUILDING (FIRST AID, SCRUTINEERING & STORAGE) BUILDING (~250m² - WOODLAND GREY) WITH WATER TANK & ADJACENT DISABLED BAYS AS REQUIRED

EXISTING DAM

JUNIOR MOTOCROSS AREA

GATE

COVERED CONCRETE BUNDED AREAS FOR GENERATOR (FUEL)

OPEN AIR EMERGENCY MUSTER AREA

NATIVE BUSH

EXISTING FENCE

FENCE - 1.8m HIGH

4WD DRIVER TRAINING & ATV PRECINCT

4m FIRE ACCESS TRACK (GRAVEL) WITH 1m HARDENED SHOULDERS

BOUNDARY

PEDESTRIAN ACCESS

OVERFLOW PARKING SPECTATOR ZONE

MOTOCROSS TRACK 2.1km x 8m WIDE

MOTOCROSS PRECINCT

FENCE - 1.8m HIGH

GRASSED AREA - LOW FUEL MAINTAINED

WETLAND FENCING - 1.2m HIGH

50m WIDE LOW FUEL BUFFER

PROTECTED EXCLUSION AREA

EXISTING VEGETATED CREEK ZONE NO PROPOSED WORK

FUTURE MOTOCROSS GATEHOUSE

4m FIRE ACCESS TRACK (GRAVEL) WITH 1m HARDENED SHOULDERS

WETLAND FENCED IN STAGE 1A

4m FIRE ACCESS TRACK (GRAVEL) WITH 1m HARDENED SHOULDERS

RE-VEGETATED CREEK ZONE

PROTECTED EXCLUSION AREA

GRASSED AREA - LOW FUEL MAINTAINED

GRASSED AREA - LOW FUEL MAINTAINED

RACE TRACK PRECINCT

3.5km x 12m RACE TRACK

TURN 1

TURN 2

TURN 3

TURN 4

TURN 5

TURN 6

TURN 7

TURN 8

TURN 9

TURN 10

TURN 11

SECTION DETAIL REFER A-02

SEALED RECOVERY AREA

GRAVEL BED RUN-OFF

GRAVEL BED RUN-OFF

CONCRETE BARRIER & SAFETY FENCE

SPECTATOR VIEWING AREA (GRASSED & TREES - LOW FUEL)

SPECTATOR PARKING HARDSTAND (250 BAYS) AND FUTURE OVERFLOW PARKING AREA

OVERFLOW PARKING

BOUNDARY (FENCE)

DOWN ROAD SOUTH (GRAVEL)

TRANSPORTABLE SINGLE STOREY CLUBROOMS & TOILETS ~350m²

POTENTIAL EFFLUENT SYSTEM LOCATION

EMERGENCY MUSTER AREA (BITUMEN)

DRIFT TRAINING AREA

COVERED PIT LANE STRUCTURE & HARD STAND

EXISTING WESTERN POWER AERIAL POWER LINE

TRANSPORTABLE FIRST AID / AMBULANCE CONTROL ROOM ~50m²

COMPETITOR PARKING / MARSHALLING

EXISTING GRAVEL ROAD

FUTURE STORAGE SHEDS - NO FUEL OR COMBUSTIBLE MATERIALS STORAGE

WATER SUPPLY FOR FIRE FIGHTING - 110,000L

WATER BORE

TREES ONLY STAGE 1A

EARTH BACKED TYRE / CONCRETE BARRIER AND TREE LINED SHELTER BELT

4m FIRE ACCESS TRACK (GRAVEL) WITH 1m HARDENED SHOULDERS

7m WIDE GRAVEL EMERGENCY EXIT (GATED 8m)

MB

DMB

MASTERPLAN

SCALE 1:2500 @ A1

SCALE 1:5000 @ A3

rev	date	description
A	15-04-2021	ISSUED FOR CLIENT REVIEW
B	27-04-2021	ISSUED FOR CLIENT REVIEW
C	12-05-2021	ISSUED FOR CLIENT REVIEW
D	26-05-2021	ISSUED FOR CLIENT REVIEW
E	05-07-2021	ISSUED FOR DA

p.o. box 1502, albany, western australia 6331
telephone: (08) 9841 5455
email: admin@rgarchitects.com.au

Roberts Gardiner Architects

project
Albany Motorsport Park
Lot 5780 Down Rd, Drome, WA 6330
client
City of Albany

Masterplan - Stage 1

cad file

drawn CB

project number 21-002

scale 1:2500 @A1

date JULY 2021

dwg no. A-01

rev. E

Soil Landscape Mapping

242KgDMc - Sands and laterite on elongate crests; Jarrah-Albany Blackbutt-Marri forest.

242KgS7f - Footslopes and swampy valley floors of minor valleys

242KgS7h - Broad valleys in sedimentary rocks; 30 m relief; smooth slopes. Deep sands and iron podzols on slopes; Albany Blackbutt-jarrah-sheoak woodland. Podzols and yellow duplex soils on floors; paperbark woodland, teatree heath.

242ReDMc - Sands and laterite on elongate crests; Jarrah-Albany Blackbutt-Marri forest.

242ReRD - Broadly undulating plateau; scattered lakes and depressions. Yellow duplex soils and laterite on plains. Marri-Jarrah-Albany Blackbutt forest. Yellow solonetzic soils in depressions; Paperbark woodland.

LEGEND

Project Site

Cadastre

Test Pit Locations

242ReRD

Down Rd

242ReDMc

Down West Rd

242KgS7h

242KgDMc

TP04

TP05

TP06

TP01

TP02

TP03

Down South Rd

242KgS7h

242KgS7h

242KgS7f

242KgS7h

242KgDMc

SLIP

Paper Size ISO A3

0 100 200 300

Metres

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

N

GHD

City of Albany
Albany Motorsport Park
Lot 5780 Down Road South, Drome

DPIRD Soil Landscape Mapping Units and Test Pit Locations

Project No. 12546218
Revision No. 0
Date 02/08/2021

FIGURE 3

Data source: GHD: Project Site - 20180702; Landgate: Imagery (Feb 2016), Cadastre, Roads - 20180709; DPIRD: Soil Landscape Mapping (Best Available) - 20171220. Created by: vdavies

Paper Size ISO A3

0 50 100 150 200

Metres

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

N

GHD

City of Albany
Albany Motorsport Park

Groundwater Conditions, Topography and Test Pit Locations

Project No. **12546218**
Revision No. **0**
Date **2/08/2021**

FIGURE 4

N:\AU\Perth\Projects\61\12546218\GIS\Maps\Working\12546218\12546218_Effluent disposal.aprx\12546218_SMP_GroundwaterConditions_RevA
Print date: 02 Aug 2021 - 23:41

Data source: Landgate_Subscription_Imagery\WANow: Landgate / SLIP. Created by: vdavies

Paper Size ISO A3

0 50 100 150 200

Metres

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

GHD

City of Albany
Albany Motorsport Park

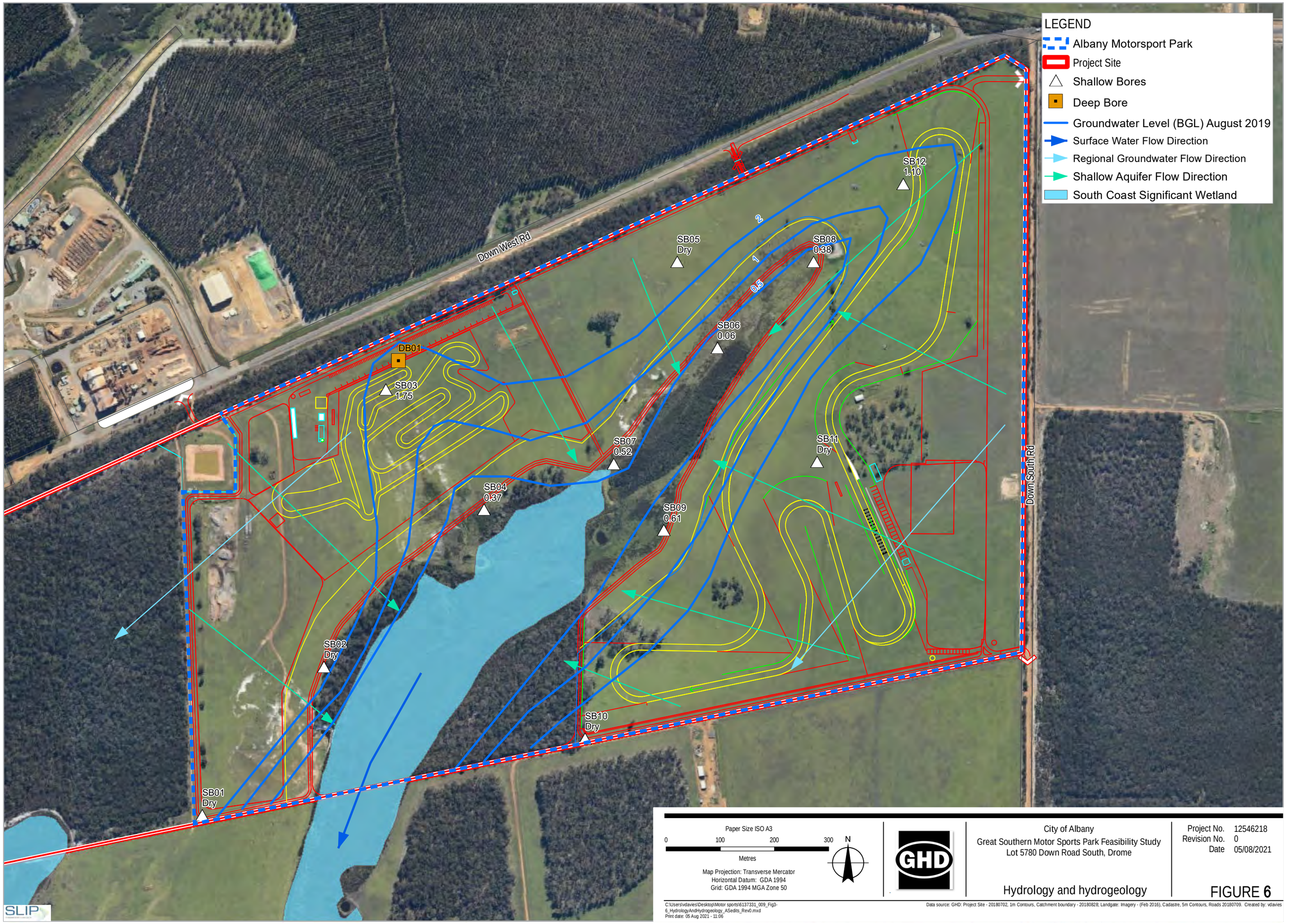
Water Erosion Risk (DPIRD-013)

Project No. **12546218**
Revision No. **0**
Date **4/08/2021**

Figure 5

C:\Users\vdavies\Desktop\Motor sports\12546218_Effluent disposal.aprx\12546218_SMP_SSE_Water Erosion Risk_Rev0
Print date: 04 Aug 2021 - 22:41

Data source: Landgate_Subscription_Imagery\WANow: Landgate / SLIP. Created by: vdavies



Paper Size ISO A3

0 100 200 300

Metres

N

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

GHD

City of Albany
Great Southern Motor Sports Park Feasibility Study
Lot 5780 Down Road South, Drome

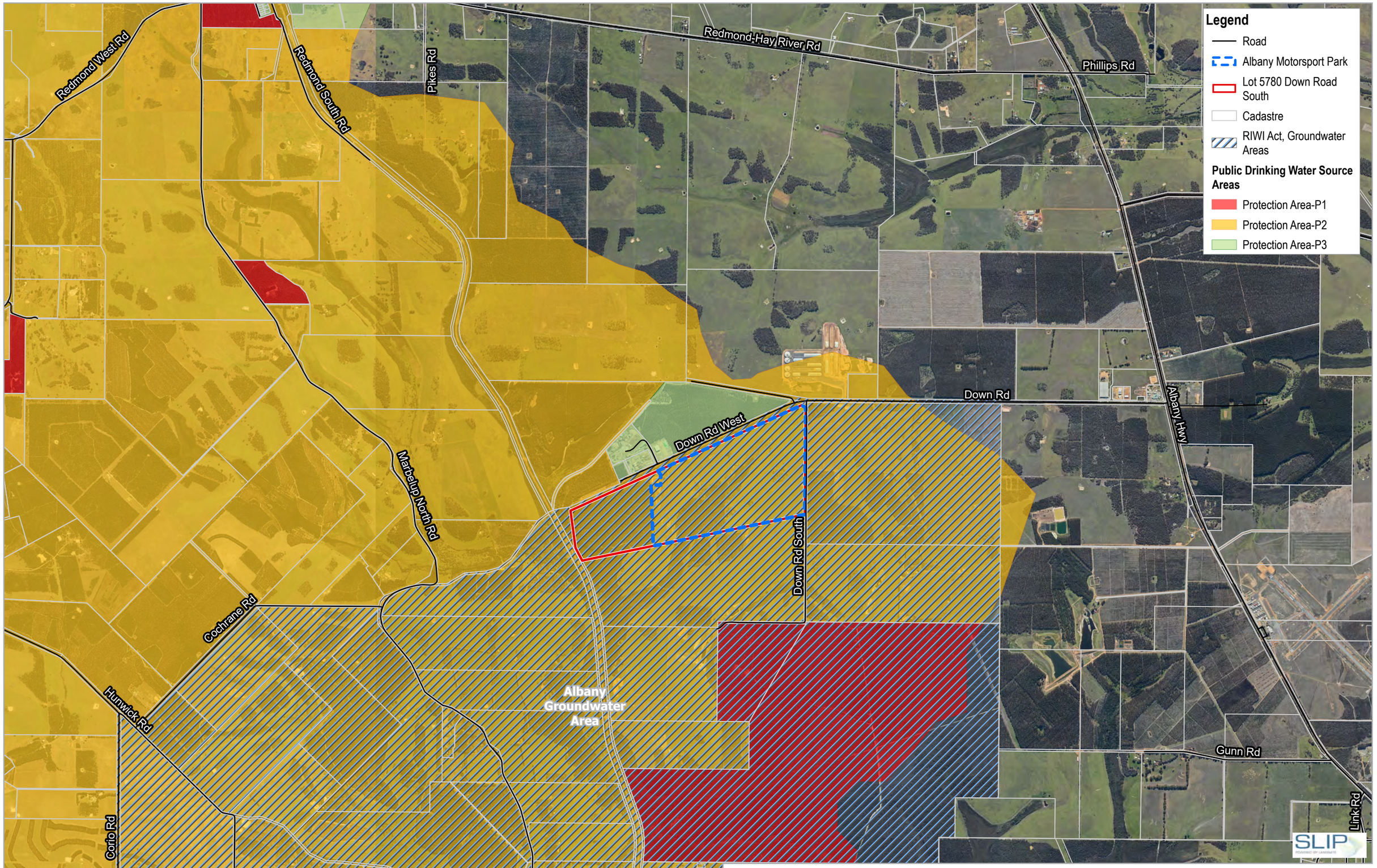
Hydrology and hydrogeology

Project No.	12546218
Revision No.	0
Date	05/08/2021

FIGURE 6

C:\Users\vdavies\Desktop\Motor sports\6137331_009_Fig3-6_HydrologyAndHydrogeology_ASedits_RevO.mxd
Print date: 05 Aug 2021 - 11:06

Data source: GHD: Project Site - 20180702, 1m Contours, Catchment boundary - 20180828; Landgate: Imagery - (Feb 2016), Cadastre, 5m Contours, Roads 20180709. Created by: vdavies



Paper Size ISO A3

0 250 500 750 1,000

Metres

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

N

GHD

City of Albany
Albany Motorsport Park

PDWSA and Water Management Areas

Project No. **12546218**
Revision No. **0**
Date **23/07/2021**

FIGURE 7

N:
\AU\Perth\Projects\61\12546218\GIS\Maps\Working\12546218\12546218_StormwaterManagementPlan\12546218_StormwaterManagementPlan.aprx\12546218
Print date: 23 Jul 2021 - 11:25

Data source: Landgate_Subscription_Imagery\WANow: Landgate / SLIP. Created by: vdavies

Paper Size ISO A3

0 50 100 150 200

Metres

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

N

GHD

City of Albany
Albany Motorsport Park

Master Plan - 100 m setback to Protected Exclusion Area and Marbellup Flats (Conservation Class)

Project No. **12546218**
Revision No. **0**
Date **5/08/2021**

FIGURE 8

C:\Users\vdavies\Desktop\Motor sports\12546218_Effluent disposal.aprx\12546218_SMP_SSE_Setbacks_RevA
Print date: 05 Aug 2021 - 09:37

Data source: Landgate_Subscription_Imagery\WANow: Landgate / SLIP. Created by: vdavies

Paper Size ISO A3

0 50 100 150 200

Metres

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

GHD

City of Albany
Albany Motorsport Park

Flood Risk (DPIRD-007)

Project No. **12546218**
Revision No. **0**
Date **4/08/2021**

FIGURE 9

C:\Users\vdavies\Desktop\Motor sports\12546218_Effluent disposal.aprx\12546218_SMP_SSE_Flood Risk_Rev0
Print date: 04 Aug 2021 - 22:35

Data source: Landgate_Subscription_Imagery\WANow: Landgate / SLIP. Created by: vdavies

Appendix B

Water balance

Albany Motorsport Park

Motocross - Effluent Disposal Water Balance

Hydraulic loading: 35 L/person/d

Section 29 of *Health (Treatment of Sewage and Disposal of Effluent and Liquid Waste) Regulations 1974*

Activity	**Mon**	**Tues**	**Wed**	**Thu**	**Fri**	**Sat**	**Sun**			
Training - attendees	20	20	20	20	20					
Club event - attendees						300	300			
Flow	700	700	700	700	700	10500	10500	**24,500**	L/week (total)	
								3,500	L/d (average)	
									100	persons
Cum. IN	700	1400	2100	2800	3500	14000	24500			
Cum. OUT	3,500	7,000	10,500	14,000	17,500	21,000	24,500			
	11,200	8,400	5,600	2,800	0	7,000	14,000		Tank size:	14,000

Water Balance for Zero Storage

Site Address:	**Lot 5780 Down Road South, Drome**		
Date:	Thursday, 12 August 2021	**Assessor:**	Jeff Foley

INPUT DATA

Design Wastewater Flow	Q	3,500	L/day	Based on maximum potential occupancy and derived from the Supplement to Regulation 29 and Schedule 9 - Wastewater system loading rates
Design Irrigation Rate	DIR	5.0	mm/day	Based on soil texture class/permeability and derived from Table M1 of AS/NZS 1547:2012
Nominated Land Application Area	L	1100	m^2	[1]
Crop Factor	C	0.8-1.0	unitless	Estimates evapotranspiration as a fraction of pan evaporation; varies with season and crop type[2]
Rainfall Runoff Factor	RF	0.9	untiless	Proportion of rainfall that remains onsite and infiltrates, allowing for any runoff
Mean Monthly Rainfall Data	om.gov.au/climate/averages/tables/cw_009			BoM Station and number
Mean Monthly Pan Evaporation Data	Albany - Agric reference			BoM Station and number or data from the Evaporation Data for Western Australia Report (https://researchlibrary.agric.wa.gov.au/cgi/viewcontent.cgi?article=1058&context=rmtr

Parameter	Symbol	Formula	Units	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Days in month	D		days	31	28	31	30	31	30	31	31	30	31	30	31	**365**
Rainfall	R		mm/month	23.6	22.3	33.6	61.3	89.8	108	119.3	106.8	88.5	70.8	47	27.8	**798.8**
Evaporation	E		mm/month	220	171	150	91	63	47	59	67	84	106	150	199	**1407**
Crop Factor	C		unitless	1.00	1.00	0.90	0.90	0.80	0.80	0.80	0.80	0.90	1.00	1.00	1.00	
OUTPUTS																
Evapotranspiration	ET	ExC	mm/month	220	171	135	82	50	38	47	54	76	106	150	199	**1327.3**
Percolation	B	DIRxD	mm/month	155.0	140	155.0	150.0	155.0	150.0	155.0	155.0	150.0	155.0	150.0	155.0	**1825.0**
Outputs		ET+B	mm/month	375.0	311	290.0	231.9	205.4	187.6	202.2	208.6	225.6	261.0	300.0	354.0	**3152.3**
INPUTS																
Retained Rainfall	RR	RxRF	mm/month	20.06	18.955	28.56	52.105	76.33	91.8	101.405	90.78	75.225	60.18	39.95	23.63	**678.98**
Applied Effluent	W	(QxD)/L	mm/month	98.6	89.1	98.6	95.5	98.6	95.5	98.6	98.6	95.5	98.6	95.5	98.6	**1161.4**
Inputs		RR+W	mm/month	118.7	108.0	127.2	147.6	175.0	187.3	200.0	189.4	170.7	158.8	135.4	122.3	**1840.3**
STORAGE CALCULATION																
Storage remaining from previous month			mm/month	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Storage for the month	S	(RR+W)-(ET+B)	mm/month	-256.3	-203.0	-162.8	-84.3	-30.4	-0.3	-2.2	-19.2	-54.9	-102.2	-164.6	-231.7	
Cumulative Storage	M		mm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Maximum Storage for Nominated Area	N		mm	0.00												
	V	NxL	L	0												
LAND AREA REQUIRED FOR ZERO STORAGE			m^2	306	336	415	584	841	1096	1076	921	698	540	404	328	

MINIMUM AREA REQUIRED FOR ZERO STORAGE: **1097** m^2

CELLS

	Please enter data in blue cells
XX	Enter available Land Application Area
XX	Data in yellow cells is calculated by the spreadsheet, DO NOT ALTER THESE CELLS

NOTES

[1] This value should be the largest of the following: land application area required based on the most limiting nutrient balance or minimum area required for zero storage

[2] Values selected are suitable for grass in WA

Appendix C

GHD Pty Ltd Professional Indemnity Insurance Certificate

Willis Towers Watson

Telephone: +61 2 9285 4000
Fax: +61 2 9995 7297
Website: www.willistowerswatson.com.au
Direct Line: +61 2 9285 4060
Email: tanya.stevenson@willistowerswatson.com

Issue Date: 24 November 2020

To Whom It May Concern

Certificate of Placement – Professional Indemnity

In our capacity as Insurance Broker to the Named Insured shown below, we confirm having arranged the following insurance, the details of which are correct as at the Issue Date:

Named Insured:	GHD Group Limited and Subsidiaries including GHD Pty Ltd
Form:	Civil Liability Wording which includes coverage for the Trade Practices Act and the Competition and Consumer Act
Policy Number:	B080113856P20
Limit of Indemnity:	AUD2,000,000 any one claim and in the aggregate
Period of Insurance:	1 December 2020 at 4.00pm to 1 December 2021 at 4.00pm
Insurer:	Certain Underwriters at Lloyd's of London

Signed for and on behalf of
Willis Australia Ltd ("Willis Towers Watson")

Appendix D

Albany Motorsport Park Development - Site Investigation Report 4626/1 (Great Southern Geotechnics, 2021)

GREAT SOUTHERN GEOTECHNICS

CONSTRUCTION MATERIALS TESTING

Site Investigation

Report 4626/1

Monday, 28 June 2021

GHD

Albany Motorsport Park Development

GREAT SOUTHERN GEOTECHNICS

1.0 INTRODUCTION

As authorised by GHD
an investigation for the proposed Albany Motorsport Park Development adjacent to Down Rd, Mirambeena was performed on the 25/06/2021

2.0 GENERAL

The intent of the investigation was to determine the following:

- Soil types and profiles.
- Groundwater levels at time of investigation.

3.0 SITE INVESTIGATION

Site conditions and test pit locations were recorded and are displayed in Appendix A - Maps.
Test pits logs/ soil profiles are noted in Appendix B - Test Pit Logs

The field investigation consisted of 6 Boreholes excavated on-site to depths of up to 2.5 meters using a Kubota KX41-3V mini excavator with a 300mm Auger.

Test pits were spread across the extent of the proposed development and locations were predetermined by GHD.
All soil layers encountered were visually assessed and classified on-site.

Samples gathered from site were the taken back to Great Southern Geotechnics Albany Laboratory then

IMPORTANT NOTE: The test pits have been spread so that they are representative of the subsurface materials across the intended reconstruction area, however, soil conditions may change dramatically over short distances and our investigations may not locate all soil variations across the site.

4.0 LABORATORY TESTING

No laboratory testing have been undertaken at Great southern Geotechnics laboratory.
Sampled taken have been transported by freight to Eurofins Scientific for further analysis.
Testing requirements will be confirmed by GHD post review of investigation findings.

This report and associated documentation was undertaken for the specific purpose described in the report and shall not be relied on for other purposes.

This report was prepared solely for the use by GHD any reliance assumed by other parties on this report shall be at such parties own risk.

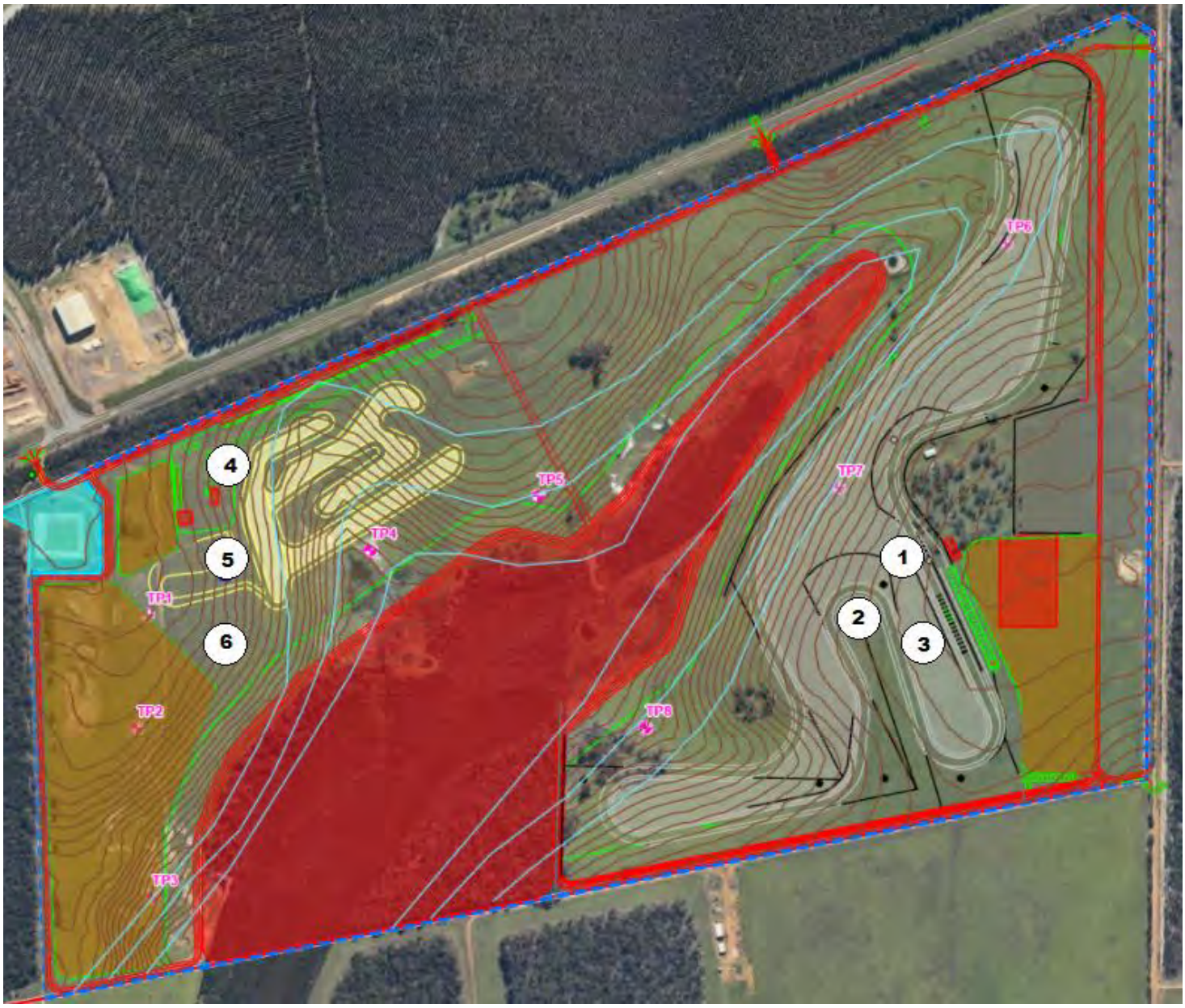
Appendix A

Maps

Figure 1

Test Pits 1 to 6

Test Pit Locations



GREAT SOUTHERN GEOTECHNICS
CONSTRUCTION MATERIALS TESTING

Job No: 4626
Client: GHD
Project: Albany Motorsport Park Development

Appendix B

Test Pit Logs

GREAT SOUTHERN GEOTECHNICS
CONSTRUCTION MATERIALS TESTING

Job No	Test Pit No.	Sample No.	Sheet		
4626	1	4626G1	1	of	12

Client:	GHD	**Date Commenced**	**Operator/Contractor:**	GSG
Project:	Albany Motorsport Park Development	25/06/2021	**Equipment type:**	Kubota KX41-3V
Project No.	QU-0498	**Logged By**	**Excavation Method :**	300mm Auger
Location:	34°55'55.6"S 117°44'53.0"E	M.Coffey	**Position:**	Refer to site plan

Depth Below Surface (mm)	Layer Depth (mm)	Material Description SOIL TYPE, Plasticity, Colour, Particle characteristics, Secondary and other minor components	Moist. Condition	Consistency / Strength	Cementation	Water Table	Classification Symbol	Sample/Test
						No water table encountered.		
0 - 180	180	**(Topsoil) SAND with silt:** Dark grey, fine to medium. Roots and root fibres.	M	L-MD				
180 - 490	310	**Sandy GRAVEL:** Brown, fine to coarse, sub-rounded to sub-angular,	M	MD-D				#
		(F:20% / M:20% / C:15%). Fine to medium grained sand.						
		Contains approximately 10% Cobbles & Boulders in excess of 250mm diameter.						
550 - 2500	1950	**Sandy CLAY:** Low to medium plasticity, Brown/red mottled Light brown/orange (40%).	M	F				#
		Fine to medium grained sand.						

Samples Taken			
TP1 - 180mm to 490mm	Target Depth	✓	2500
TP1 - 900mm to 1100mm	Cave In		
	Refusal		
	Near Refusal		
	Flooding		
	Lack of Reach		

Cohesive	Non-Cohesive	Rock	Cementation
VS - Very Soft	VL - Very Loose	EL - Extremely Low	IN - Indurated
S - Soft	L - Loose	VL - Very Low	PC - Poorly Cemented
F - Firm	MD - Medium Dense	L - Low	
St - Stiff	D - Dense	M - Medium	MC - moderately Cemented
VSt - Very Stiff	VD - Very Dense	H - High	
H - Hard	CO - Compact	VH - Very High	WC - Well Cemented
		EH - Extremely High	

General

D - Dry M - Moist W - Wet
N/A - Not Applicable
N/D - Not Determined

Test Pit No.1

Excavation

Spoil

GREAT SOUTHERN GEOTECHNICS CONSTRUCTION MATERIALS TESTING	**Job No:** 4626 **Client:** GHD **Project:** Albany Motorsport Park Development	**Sheet** 2 **of** 12

GREAT SOUTHERN GEOTECHNICS
CONSTRUCTION MATERIALS TESTING

Job No	Test Pit No.	Sample No.	Sheet		
4626	2	4626G2	3	of	12

Client:	GHD	**Date Commenced**	**Operator/Contractor:**	GSG
Project:	Albany Motorsport Park Development	25/06/2021	**Equipment type:**	Kubota KX41-3V
Project No.	QU-0498	**Logged By**	**Excavation Method :**	300mm Auger
Location:	34°55'58.3"S 117°44'50.2"E	M.Coffey	**Position:**	Refer to site plan

Depth Below Surface (mm)	Layer Depth (mm)	Material Description SOIL TYPE, Plasticity, Colour, Particle characteristics, Secondary and other minor components	Moist. Condition	Consistency / Strength	Cementation	Water Table	Classification Symbol	Sample/Test
						No water table encountered.		
0 - 140	140	**(Topsoil) SAND with silt:** Dark grey, fine to medium. Roots and root fibres.	M	L-MD				
140 - 400	260	**Sandy GRAVEL:** Brown, fine to coarse, sub-rounded to sub-angular,	M	VD	MC			
		(F:20% / M:20% / C:15%). Fine to medium grained sand.						
		Contains approximately 10% Cobbles & Boulders in excess of 400mm diameter.						
400 - 1400	1000	**Sandy CLAY:** Low to medium plasticity, Light brown.	M	F				#
		Fine to medium grained sand.						
1400 - 2500	1100	**Sandy CLAY:** Low to medium plasticity, Brown/red mottled Light brown/orange (40%).	M	F				#
		Fine to medium grained sand.						

Samples Taken		
TP2 - 500mm to 900mm	Cave In	
TP2 - 1700mm to 2000mm	Refusal	
	Near Refusal	
	Flooding	
	Lack of Reach	

Target Depth	✓	2500

Cohesive	Non-Cohesive	Rock	Cementation
VS - Very Soft	VL - Very Loose	EL - Extremely Low	IN - Indurated
S - Soft	L - Loose	VL - Very Low	PC - Poorly Cemented
F - Firm	MD - Medium Dense	L - Low	
St - Stiff	D - Dense	M - Medium	MC - moderately Cemented
VSt - Very Stiff	VD - Very Dense	H - High	
H - Hard	CO - Compact	VH - Very High	WC - Well Cemented
		EH - Extremely High	

General

D - Dry M - Moist W - Wet

N/A - Not Applicable

N/D - Not Determined

Test Pit No.2

Excavation

Spoil

GREAT SOUTHERN GEOTECHNICS CONSTRUCTION MATERIALS TESTING	**Job No:** 4626 **Client:** GHD **Project:** Albany Motorsport Park Development	**Sheet** 4 **of** 12

GREAT SOUTHERN GEOTECHNICS
CONSTRUCTION MATERIALS TESTING

Job No	Test Pit No.	Sample No.	Sheet		
4626	3	4626G3	5	of	12

Client:	GHD	**Date Commenced**	**Operator/Contractor:**	GSG
Project:	Albany Motorsport Park Development	25/06/2021	**Equipment type:**	Kubota KX41-3V
Project No.	QU-0498	**Logged By**	**Excavation Method :**	300mm Auger
Location:	34°55'59.6"S 117°44'56.4"E	M.Coffey	**Position:**	Refer to site plan

Depth Below Surface (mm)	Layer Depth (mm)	Material Description SOIL TYPE, Plasticity, Colour, Particle characteristics, Secondary and other minor components	Moist. Condition	Consistency / Strength	Cementation	Water Table	Classification Symbol	Sample/Test
						No water table encountered.		
0 - 250	250	**(Topsoil) SAND with silt:** Dark grey to grey, fine to medium. Roots and root fibres.	M	L-MD				
250 - 830	580	**Sandy GRAVEL:** Brown, fine to medium, sub-rounded to sub-angular**,**	M	MD-D				#
		(F:30% / M:30%). Fine to medium grained sand.						
		Contains approximately 10% Cobbles & Boulders in excess of 400mm diameter.						
830 - 1600	770	**Sandy CLAY:** Low to medium plasticity, Light brown.	M	F				#
		Fine to medium grained sand.						
1600 - 2500	900	**Sandy CLAY:** Low to medium plasticity, Brown/red mottled Light brown/grey (30%).	M	F				#
		Fine to medium grained sand.						

Samples Taken			
TP3 - 300mm to 600mm			
TP3 - 900mm to 1200mm			
TP3 - 1600mm to 2000mm			

Target Depth	✓	2500
Cave In		
Refusal		
Near Refusal		
Flooding		
Lack of Reach		

Cohesive	Non-Cohesive	Rock	Cementation
VS - Very Soft	VL - Very Loose	EL - Extremely Low	IN - Indurated
S - Soft	L - Loose	VL - Very Low	PC - Poorly Cemented
F - Firm	MD - Medium Dense	L - Low	
St - Stiff	D - Dense	M - Medium	MC - moderately Cemented
VSt - Very Stiff	VD - Very Dense	H - High	
H - Hard	CO - Compact	VH - Very High	WC - Well Cemented
		EH - Extremely High	

General

D - Dry M - Moist W - Wet

N/A - Not Applicable

N/D - Not Determined

Test Pit No.3

Excavation

Spoil

GREAT SOUTHERN GEOTECHNICS CONSTRUCTION MATERIALS TESTING	**Job No:** 4626 **Client:** GHD **Project:** Albany Motorsport Park Development	**Sheet** 6 **of** 12

GREAT SOUTHERN GEOTECHNICS
CONSTRUCTION MATERIALS TESTING

Job No	Test Pit No.	Sample No.	Sheet		of	
4626	4	4626G4	7		12	

Client:	GHD	**Date Commenced**	**Operator/Contractor:**	GSG	
Project:	Albany Motorsport Park Development	25/06/2021	**Equipment type:**	Kubota KX41-3V	
Project No.	QU-0498	**Logged By**	**Excavation Method :**	300mm Auger	
Location:	34°55'51.5"S 117°44'17.6"E	M.Coffey	**Position:**	Refer to site plan	

Depth Below Surface (mm)	Layer Depth (mm)	Material Description SOIL TYPE, Plasticity, Colour, Particle characteristics, Secondary and other minor components	Moist. Condition	Consistency / Strength	Cementation	Water Table	Classification Symbol	Sample/Test
						No water table encountered.		
0 - 220	220	**(Topsoil) SAND with silt:** Dark grey, fine to medium. Roots and root fibres.	M	L-MD				
220 - 1250	1030	**Sandy GRAVEL:** Brown, fine to coarse, sub-rounded to sub-angular,	M	D				#
		(F:25% / M:20% / C:10%). Fine to medium grained sand.						
		Contains approximately 10% Cobbles & Boulders in excess of 400mm diameter.						
1250 - 1750	500	**Sandy CLAY:** Low to medium plasticity, Light brown/orange.	M	F				#
		Fine to medium grained sand.						
1750 - 2500	750	**Sandy CLAY:** Low to medium plasticity, grey mottled red (30%) & orange (10%).	M	F				#
		Fine to medium grained sand.						

Samples Taken			
TP4 - 400mm to 800mm			
TP4 - 1350mm to 1650mm			
TP4 - 1800mm to 2200mm			

Target Depth	✓	2500
Cave In		
Refusal		
Near Refusal		
Flooding		
Lack of Reach		

Cohesive	Non-Cohesive	Rock	Cementation
VS - Very Soft	VL - Very Loose	EL - Extremely Low	IN - Indurated
S - Soft	L - Loose	VL - Very Low	PC - Poorly Cemented
F - Firm	MD - Medium Dense	L - Low	
St - Stiff	D - Dense	M - Medium	MC - moderately Cemented
VSt - Very Stiff	VD - Very Dense	H - High	
H - Hard	CO - Compact	VH - Very High	WC - Well Cemented
		EH - Extremely High	

General

D - Dry M - Moist W - Wet

N/A - Not Applicable

N/D - Not Determined

Test Pit No.4

Excavation

Spoil

GREAT SOUTHERN GEOTECHNICS
CONSTRUCTION MATERIALS TESTING

Job No	Test Pit No.	Sample No.	Sheet		
4626	5	4626G5	9	of	12

Client:	GHD	**Date Commenced**	**Operator/Contractor:**	GSG
Project:	Albany Motorsport Park Development	25/06/2021	**Equipment type:**	Kubota KX41-3V
Project No.	QU-0498	**Logged By**	**Excavation Method :**	300mm Auger
Location:	34°55'55.6"S 117°44'17.5"E	M.Coffey	**Position:**	Refer to site plan

Depth Below Surface (mm)	Layer Depth (mm)	Material Description SOIL TYPE, Plasticity, Colour, Particle characteristics, Secondary and other minor components	Moist. Condition	Consistency / Strength	Cementation	Water Table	Classification Symbol	Sample/Test
						No water table encountered.		
0 - 230	230	**(Topsoil) SAND with silt:** Dark grey, fine to medium. Roots and root fibres.	M	L-MD				
230 - 880	650	**SAND with silt:** Grey, fine to medium.	M	MD				#
880 - 2500	1620	**Sandy GRAVEL:** Brown, fine to coarse, sub-rounded to sub-angular,	M	MD-D				#
		(F:15% / M:30% / C:10%). Fine to medium grained sand.						
		Contains approximately 10% Cobbles & Boulders in excess of 400mm diameter.						

Samples Taken			
TP5 - 400mm to 800mm	Target Depth	✓	2500
TP5 - 1200mm to 1500mm	Cave In		
	Refusal		
	Near Refusal		
	Flooding		
	Lack of Reach		

Cohesive	Non-Cohesive	Rock	Cementation
VS - Very Soft	VL - Very Loose	EL - Extremely Low	IN - Indurated
S - Soft	L - Loose	VL - Very Low	PC - Poorly Cemented
F - Firm	MD - Medium Dense	L - Low	
St - Stiff	D - Dense	M - Medium	MC - moderately Cemented
VSt - Very Stiff	VD - Very Dense	H - High	
H - Hard	CO - Compact	VH - Very High	WC - Well Cemented
		EH - Extremely High	

General

D - Dry M - Moist W - Wet

N/A - Not Applicable

N/D - Not Determined

Test Pit No.5

Excavation

Spoil

GREAT SOUTHERN GEOTECHNICS CONSTRUCTION MATERIALS TESTING	**Job No:** 4626 **Client:** GHD **Project:** Albany Motorsport Park Development	**Sheet** 10 **of** 12

GREAT SOUTHERN GEOTECHNICS
CONSTRUCTION MATERIALS TESTING

Job No	Test Pit No.	Sample No.	Sheet		of	
4626	6	4626G6	11		12	

Client:	GHD	**Date Commenced**	**Operator/Contractor:**	GSG
Project:	Albany Motorsport Park Development	25/06/2021	**Equipment type:**	Kubota KX41-3V
Project No.	QU-0498	**Logged By**	**Excavation Method :**	300mm Auger
Location:	34°55'59.9"S 117°44'17.4"E	M.Coffey	**Position:**	Refer to site plan

Depth Below Surface (mm)	Layer Depth (mm)	Material Description SOIL TYPE, Plasticity, Colour, Particle characteristics, Secondary and other minor components	Moist. Condition	Consistency / Strength	Cementation	Water Table	Classification Symbol	Sample/Test
						No water table encountered.		
0 - 350	350	**(Topsoil) SAND with silt:** Dark grey, fine to medium. Roots and root fibres.	M	L-MD				
350 - 1200	850	**Sandy GRAVEL:** Brown, fine to coarse, sub-rounded to sub-angular,	M	D-VD				#
		(F:20% / M:20% / C:10%). Fine to medium grained sand.						
		Contains approximately 10% Cobbles & Boulders in excess of 400mm diameter.						
1200 - 1800	600	**Sandy GRAVEL:** Light brown, fine to coarse, sub-rounded to sub-angular,	M	D				#
		(F:20% / M:30% / C:10%). Fine to medium grained sand.						
1800 - 2500	700	**Sandy GRAVEL:** Brown/orange, fine to medium, sub-rounded to sub-angular,	M	MD-D				#
		(F:40% / M:20%). Fine to medium grained sand.						

Samples Taken		
TP6 - 500mm to 800mm	Cave In	
TP6 - 1300mm to 1600mm	Refusal	
TP6 - 2000mm to 2300mm	Near Refusal	
	Flooding	
	Lack of Reach	

Target Depth	✓	2500

Cohesive	Non-Cohesive	Rock	Cementation
VS - Very Soft	VL - Very Loose	EL - Extremely Low	IN - Indurated
S - Soft	L - Loose	VL - Very Low	PC - Poorly Cemented
F - Firm	MD - Medium Dense	L - Low	
St - Stiff	D - Dense	M - Medium	MC - moderately Cemented
VSt - Very Stiff	VD - Very Dense	H - High	
H - Hard	CO - Compact	VH - Very High	WC - Well Cemented
		EH - Extremely High	

General

D - Dry M - Moist W - Wet

N/A - Not Applicable

N/D - Not Determined

Test Pit No.6

Excavation

Spoil

GREAT SOUTHERN GEOTECHNICS CONSTRUCTION MATERIALS TESTING	**Job No:** 4626 **Client:** GHD **Project:** Albany Motorsport Park Development	**Sheet** 12 **of** 12

GREAT SOUTHERN GEOTECHNICS
CONSTRUCTION MATERIALS TESTING

COLOURS

BLACK – BROWN (bk)	BLUE (bl)	ORANGE (or)
BROWN (br)	BLUE – GREEN (bl/gr)	RED (rd)
GREY – BROWN (gy/br)	GREEN (gr)	RED – BROWN (rd/br)
GREY (gy)	YELLOW (yl)	PINK (pk)
BLUE – GREY (bl/gy)	YELLOW – BROWN (yl/br)	PURPLE (pr)

MOISTURE CONDITION OF SOIL

TERM	DESCRIPTION
Dry	Cohesive soils; hard and friable or powdery, well dry of plastic limit. Granular soils; cohesionless and free-running.
Moist	Soil feels cool, darkened in colour. Cohesive soils can be moulded. Granular soils tend to cohere.
Wet	Soil feels cool, darkened in colour. Cohesive soils usually weakened and free water forms on hands when handling. Granular soils tend to cohere and free water forms on hands when handling.

PARTICLE SHAPES

ANGULAR	SUB-ANGULAR	SUB-ROUNDED	ROUNDED




PARTICLE SIZES

BOULDERS	COBBLES	COARSE GRAVEL	MEDIUM GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	SILT	CLAY
>200mm	63-200mm	20-63mm	6-20mm	2.36-6mm	0.6-2.36mm	0.2-0.6mm	0.075-0.2mm	0.002-0.075mm	<0.002mm

GRAIN SIZE

SOIL TYPE (ABBREV.)	CLAY (CL)	SILT (SI)	←	SAND (SA)	→	←	GRAVEL (GR)	→	COBBLES (CO)
SIZE	< 2µm	2–75µm	Fine 0.075-0.2mm	Medium 0.2-0.6mm	Coarse 0.6-2.36mm	Fine 2.36-6mm	Medium 6-20mm	Coarse 20-63mm	63-200mm
SHAPE & TEXTURE	Shiny	Dull	← angular or sub angular or sub rounded or rounded →						
FIELD GUIDE	Not visible under 10x	Visible under 10x	Visible by eye	Visible at < 1m	Visible at < 3m	Visible at < 5m	Road gravel	Rail ballast	Beaching

GREAT SOUTHERN GEOTECHNICS
CONSTRUCTION MATERIALS TESTING

CLASSIFICATION CHART

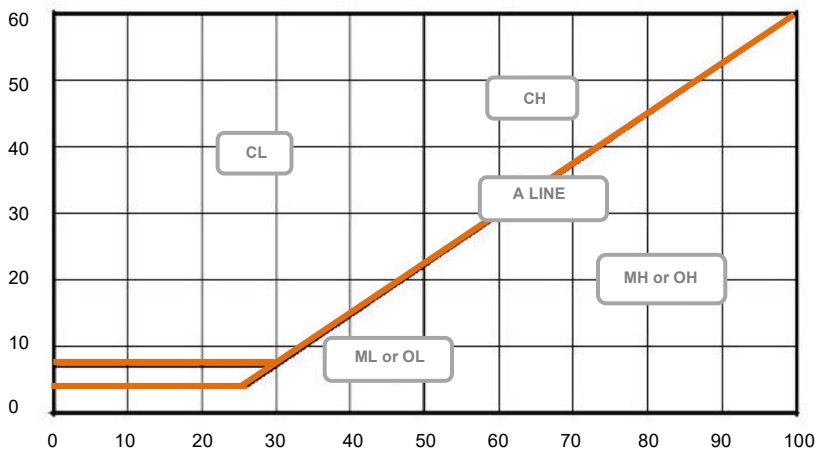
FIELD IDENTIFICATION PROCEDURES (Excluding particles larger than 60mm and basing fractions on estimated mass)				GROUP SYMBOLS	TYPICAL NAMES
COARSE GRAINED SOILS More than 50% of material less than 63 mm is larger than 0.075 mm	GRAVELS More than 50% of coarse fraction is larger than 2.36mm	CLEAN GRAVELS (Little or no fines)	Wide range in grain size and substantial amounts of all intermediate sizes, not enough fines to bind coarse grains, no dry strength	GW	Well graded gravels, gravel-sand mixtures, little or no fines
			Predominantly one size or range of sizes with some intermediate sizes missing, not enough fines to bind coarse grains, no dry strength	GP	Poorly Graded gravels and gravel-sand mixtures, little or no fines, uniform gravels
		GRAVELS WITH FINES (Appreciable amount of fines)	Dirty' materials with excess of non-plastic fines, zero to medium dry strength	GM	Silty gravels, gravel-sand-silt mixtures
			'Dirty' materials with excess of plastic fines, medium to high dry strength	GC	Clayey gravels, gravel-sand-clay mixtures
	SANDS More than 50% of coarse fraction is smaller than 2.36mm	CLEAN SANDS (Little or no fines)	Wide range in grain size and substantial amounts of all intermediate sizes, not enough fines to bind coarse grains, no dry strength	SW	Well graded sands, gravelly sands, little or no fines
			Predominantly one size or range of sizes with some intermediate sizes missing, not enough fines to bind coarse grains, no dry strength '	SP	Poorly graded sands and gravelly sands; little or no fines, uniform sands
		SANDS WITH FINES (Appreciable amount of fines)	Dirty' materials with excess of non-plastic fines, zero to medium dry strength	SM	Silty sands, sand-silt mixtures
			'Dirty' materials with excess of plastic fines, medium to high dry strength	SC	Clayey sands, sand-clay mixtures

FINE GRAINED SOILS More than 50% of material less than 63 mm is smaller than 0.075 mm	IDENTIFICATION PROCEDURES ON FRACTIONS <0.2mm					
		DRY STRENGTH	DILATANCY	TOUGHNESS		
	SILTS AND CLAYS Liquid limit less than 50	None to low	Quick to slow	None	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands with low plasticity. Silts of low to medium Liquid Limit.
		Medium to high	None to very slow	Medium	CL, CI	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays.
		Low to medium	Slow	Low	OL	Organic silts and organic silt-clays of low to medium plasticity.
	SILTS AND CLAYS Liquid limit greater than 50	Low to medium	Slow to none	Low to medium	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, silts of high Liquid Limit.
		High to very high	None	High	CH	Inorganic clays of high plasticity.
		Medium to high	None to very slow	Low to medium	OH	Organic clays of high plasticity

HIGHLY ORGANIC SOILS	Readily identified by colour, odour, spongy feel and frequently by fibrous texture	Pt	Peat and other highly organic soils

PLASTICITY CHART

For laboratory classification of fine grained soils



GREAT SOUTHERN GEOTECHNICS
CONSTRUCTION MATERIALS TESTING

PLASTICITY

DESCRIPTIVE TERM	OF LOW PLASTICITY	OF MEDIUM PLASTICITY	OF HIGH PLASTICITY
Range Of Liquid Limit (%)	≤ 35	> 35 ≤ 50	> 50

DESCRIPTION OF ORGANIC OR ARTIFICIAL MATERIALS

PREFERRED TERMS	SECONDARY DESCRIPTION
Organic Matter	Fibrous Peat/ Charcoal/ Wood Fragments/ Roots (greater than approximately 2mm diameter)/ Root Fibres (less than approximately 2mm diameter)
Waste Fill	Domestic Refuse/ Oil/ Bitumen/ Brickbats/ Concrete Rubble/ Fibrous Plaster/ Wood Pieces/ Wood Shavings/ Sawdust/ Iron Filings/ Drums/ Steel Bars/ Steel Scrap/ Bottles/ Broken Glass/ Leather

CONSISTENCY - Cohesive soils

TERM	VERY SOFT	SOFT	FIRM	STIFF	VERY STIFF	HARD
Symbol	VS	S	F	St	VSt	H
Undrained Shear Strength (kPa)	< 12	12 - 25	25 - 50	50 - 100	100 - 200	> 200
SPT (N) Blowcount	0 - 2	2 - 4	4 - 8	8 - 15	15 - 30	> 30
Field Guide	Exudes between the fingers when squeezed	Can be moulded by light finger pressure	Can be moulded by strong finger pressure	Cannot be moulded by fingers. Can be indented by thumb nail	Can be indented by thumb nail	Can be indented with difficulty with thumb nail

CONSISTENCY - Non-cohesive soils

TERM	VERY LOOSE	LOOSE	MEDIUM DENSE	DENSE	VERY DENSE	COMPACT
Symbol	VL	L	MD	D	VD	CO
SPT (N) Blowcount	0 - 4	4 - 10	10 - 30	30 - 50	50 - 100	> 50/150 mm
Density Index (%)	< 15	15 - 35	35 - 65	65 - 85	85 - 95	> 95
Field Guide	Ravels	Shovels easily	Shovelling very difficult	Pick required	Pick difficult	Cannot be picked

MINOR COMPONENTS

TERM	TRACE	WITH
% Minor Component	Coarse grained soils: < 5% Fine grained soils: <15%	Coarse grained soils: 5 – 12% Fine grained soils: 15 – 30%
Field Guide	Presence just detectable by feel or eye, but soil properties little or no different to general properties of primary components	Presence easily detectable by feel or eye, soil properties little different to general properties of primary component

GREAT SOUTHERN GEOTECHNICS
CONSTRUCTION MATERIALS TESTING

GEOLOGICAL ORIGIN

	TYPE	DETAILS
TRANSPORTED SOILS	Aeolian Soils	Deposited by wind
	Alluvial Soils	Deposited by streams and rivers
	Colluvial Soils	Deposited on slopes
	Lacustrine Soils	Deposited by lakes
	Marine Soils	Deposited in ocean, bays, beaches and estuaries
FILL MATERIALS	Soil Fill	Describe soil type, UCS symbol and add 'FILL'
	Rock Fill	Rock type, degree of weathering, and word 'FILL'.
	Domestic Fill	Percent soil or rock, whether pretrucible or not.
	Industrial Fill	Percent soil, whether contaminated, particle size & type of waste product, ie brick, concrete, metal

STRENGTH OF ROCK MATERIAL

TERM	SYMBOL	IS(50)	(MPA)	FIELD GUIDE TO STRENGTH
Extremely Low	EL	≤0.03		Easily remoulded by hand to a material with soil properties.
Very Low	VL	>0.03	≤0.1	Material crumbles under firm blows with sharp end of pick; can be peeled with knife; too hard to cut a triaxle sample by hand. Pieces up to 3 cm thick can be broken by finger pressure.
Low	L	>0.1	≤0.3	Easily scored with a knife; indentations 1 mm to 3 mm show in the specimen with firm blows of the pick point; has dull sound under hammer. A piece of core 150 mm long by 50 mm diameter may be broken by hand. Sharp edges of core may be friable and break during handling.
Medium	M	>0.3	≤1.0	Readily scored with a knife; a piece of core 150 mm long by 50 mm diameter can be broken by hand with difficulty.
High	H	>1	≤3	A piece of core 150 mm long by 50 mm diameter cannot be broken by hand but can be broken by a pick with a single firm blow; rock rings under hammer.
Very High	VH	>3	≤10	Hand specimen breaks with pick after more than one blow; rock rings under hammer.
Extremely High	EH	>10		Specimen requires many blows with geological pick to break through intact material; rock rings under hammer.

ROCK MATERIAL WEATHERING CLASSIFICATION

TERM	SYMBOL	DEFINITION
Residual Soil	RS	Soil developed on extremely weathered rock; the mass structure and substance fabric are no longer evident; there is a large change in volume but the soil has not been significantly transported
Extremely Weathered Rock	XW	Rock is weathered to such an extent that it has 'soil' properties, i.e. it either disintegrates or can be remoulded, in water.
Distinctly Weathered Rock	DW	Rock strength usually changed by weathering. Rock may be highly discoloured, usually be iron staining. Porosity may be increased by leaching or may be decreased due to deposition of weathering products in pores.
Slightly Weathered Rock	SW	Rock is slightly discoloured but shows little or no change of strength from fresh rock.
Fresh Rock	FR	Rock shows no sign of decomposition or staining.

Appendix E

Laboratory results

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EP2107544**	Page	: 1 of 4
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Perth
Contact	: MS VICKI DAVIES	Contact	: Nick Courts
Address	: 999 HAY STREET PERTH WA, AUSTRALIA 6000	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: ----	Telephone	: +61-8-9406 1301
Project	: 12546218 Albany Motorsports Park DA	Date Samples Received	: 01-Jul-2021 13:30
Order number	: 12546218	Date Analysis Commenced	: 02-Jul-2021
C-O-C number	: ----	Issue Date	: 13-Jul-2021 13:47
Sampler	: ----		
Site	: ----		
Quote number	: EP/444/21		
No. of samples received	: 15		
No. of samples analysed	: 6		

ilac-MRA NATA
Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- Phosphorus Sorption Index + Capacity conducted by ALS Sydney, NATA accreditation no. 825, site no 10911.
- ED007 and ED008: When Exchangeable Al is reported from these methods, it should be noted that Rayment & Lyons (2011) suggests Exchange Acidity by 1M KCl - Method 15G1 (ED005) is a more suitable method for the determination of exchange acidity (H+ + Al3+).

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	TP1 - 900mm to 1100mm	TP2 - 500mm to 900mm	TP3 - 300mm to 600mm	TP4 - 400mm to 800mm	TP5 - 400mm to 800mm
			Sampling date / time	25-Jun-2021 00:00	25-Jun-2021 00:00	25-Jun-2021 00:00	25-Jun-2021 00:00	25-Jun-2021 00:00
Compound	CAS Number	LOR	Unit	EP2107544-002	EP2107544-003	EP2107544-005	EP2107544-008	EP2107544-011
				Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	**6.1**	**6.1**	**5.7**	**5.8**	**5.4**
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	**22**	**25**	**28**	**24**	**4**
ED007: Exchangeable Cations								
Exchangeable Calcium	----	0.1	meq/100g	**0.8**	**0.8**	**1.6**	**0.8**	<0.1
Exchangeable Magnesium	----	0.1	meq/100g	**0.5**	**1.0**	**0.2**	**0.2**	<0.1
Exchangeable Potassium	----	0.1	meq/100g	<0.1	<0.1	<0.1	<0.1	<0.1
Exchangeable Sodium	----	0.1	meq/100g	<0.1	<0.1	**0.1**	<0.1	<0.1
Cation Exchange Capacity	----	0.1	meq/100g	**1.4**	**1.9**	**2.0**	**1.1**	**0.1**
Exchangeable Sodium Percent	----	0.1	%	**5.8**	**4.8**	**5.7**	**6.2**	<0.1
EK072: Phosphate Sorption Capacity								
Phosphate Sorption Capacity	----	250	mg P sorbed/kg	**688**	**1650**	**3660**	**3000**	<250
Phosphate Sorption Index	----	1	mgkg-1/log10 ugL-1	**60**	**157**	**289**	**244**	<1

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	TP6 - 500mm to 800mm	----	----	----	----
			Sampling date / time	25-Jun-2021 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	EP2107544-013	--------	--------	--------	--------
				Result	----	----	----	----
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	**5.9**	----	----	----	----
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	**20**	----	----	----	----
ED007: Exchangeable Cations								
Exchangeable Calcium	----	0.1	meq/100g	**1.0**	----	----	----	----
Exchangeable Magnesium	----	0.1	meq/100g	**0.2**	----	----	----	----
Exchangeable Potassium	----	0.1	meq/100g	<0.1	----	----	----	----
Exchangeable Sodium	----	0.1	meq/100g	<0.1	----	----	----	----
Cation Exchange Capacity	----	0.1	meq/100g	**1.3**	----	----	----	----
Exchangeable Sodium Percent	----	0.1	%	**1.4**	----	----	----	----
EK072: Phosphate Sorption Capacity								
Phosphate Sorption Capacity	----	250	mg P sorbed/kg	**966**	----	----	----	----
Phosphate Sorption Index	----	1	mgkg-1/log10 ugL-1	**62**	----	----	----	----

Inter-Laboratory Testing

Analysis conducted by ALS Sydney, NATA accreditation no. 825, site no. 10911 (Chemistry) 14913 (Biology).

(SOIL) EK072: Phosphate Sorption Capacity

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **EP2107544**	Page	: 1 of 3
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Perth
Contact	: MS VICKI DAVIES	Contact	: Nick Courts
Address	: 999 HAY STREET PERTH WA, AUSTRALIA 6000	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: ----	Telephone	: +61-8-9406 1301
Project	: 12546218 Albany Motorsports Park DA	Date Samples Received	: 01-Jul-2021
Order number	: 12546218	Date Analysis Commenced	: 02-Jul-2021
C-O-C number	: ----	Issue Date	: 13-Jul-2021
Sampler	: ----		
Site	: ----		
Quote number	: EP/444/21		
No. of samples received	: 15		
No. of samples analysed	: 6		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EA002: pH 1:5 (Soils) (QC Lot: 3770355)									
EP2107544-002	TP1 - 900mm to 1100mm	EA002: pH Value	----	0.1	pH Unit	6.1	6.1	0.0	0% - 20%
EA010: Conductivity (1:5) (QC Lot: 3770356)									
EP2107544-002	TP1 - 900mm to 1100mm	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	22	22	0.0	0% - 20%
ED007: Exchangeable Cations (QC Lot: 3780436)									
EP2107521-057	Anonymous	ED007: Exchangeable Sodium Percent	----	0.1	%	2.9	3.0	3.6	0% - 20%
		ED007: Exchangeable Calcium	----	0.1	meq/100g	16.8	14.7	13.3	0% - 20%
		ED007: Exchangeable Magnesium	----	0.1	meq/100g	0.4	0.4	0.0	No Limit
		ED007: Exchangeable Potassium	----	0.1	meq/100g	<0.1	<0.1	0.0	No Limit
		ED007: Exchangeable Sodium	----	0.1	meq/100g	0.5	0.5	0.0	No Limit
		ED007: Cation Exchange Capacity	----	0.1	meq/100g	17.8	15.6	13.1	0% - 20%
EK072: Phosphate Sorption Capacity (QC Lot: 3776718)									
EP2107544-002	TP1 - 900mm to 1100mm	EK072: Phosphate Sorption Capacity	----	250	mg P sorbed/kg	688	409	50.9	No Limit
		EK072: Phosphate Sorption Index	----	1	mgkg-1/log10ug L-1	60	60	0.0	0% - 20%

Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA002: pH 1:5 (Soils) (QCLot: 3770355)								
EA002: pH Value	----	----	pH Unit	----	4 pH Unit	100	70.0	130
				----	7 pH Unit	100	70.0	130
EA010: Conductivity (1:5) (QCLot: 3770356)								
EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	1412 µS/cm	99.6	93.6	106
ED007: Exchangeable Cations (QCLot: 3780436)								
ED007: Exchangeable Calcium	----	0.1	meq/100g	<0.1	21.6 meq/100g	91.0	82.9	117
ED007: Exchangeable Magnesium	----	0.1	meq/100g	<0.1	1.76 meq/100g	91.3	78.4	119
ED007: Exchangeable Potassium	----	0.1	meq/100g	<0.1	1 meq/100g	107	87.9	129
ED007: Exchangeable Sodium	----	0.1	meq/100g	<0.1	0.9 meq/100g	103	92.9	132
ED007: Cation Exchange Capacity	----	0.1	meq/100g	<0.1	25.3 meq/100g	92.0	84.7	117
ED007: Exchangeable Sodium Percent	----	0.1	%	<0.1	----	----	----	----

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

- **No Matrix Spike (MS) or Matrix Spike Duplicate (MSD) Results are required to be reported.**

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EP2107544**	Page	: 1 of 4
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Perth
Contact	: MS VICKI DAVIES	Telephone	: +61-8-9406 1301
Project	: 12546218 Albany Motorsports Park DA	Date Samples Received	: 01-Jul-2021
Site	: ----	Issue Date	: 13-Jul-2021
Sampler	: ----	No. of samples received	: 15
Order number	: 12546218	No. of samples analysed	: 6

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **NO Matrix Spike outliers occur.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **NO Analysis Holding Time Outliers exist.**

Outliers : Frequency of Quality Control Samples

- **NO Quality Control Sample Frequency Outliers exist.**

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA002: pH 1:5 (Soils)							
Snap Lock Bag (EA002)							
TP3 - 300mm to 600mm, TP4 - 400mm to 800mm, TP5 - 400mm to 800mm, TP6 - 500mm to 800mm	**25-Jun-2021**	**02-Jul-2021**	02-Jul-2021	✓	**02-Jul-2021**	02-Jul-2021	✓
Soil Glass Jar - Unpreserved (EA002)							
TP1 - 900mm to 1100mm, TP2 - 500mm to 900mm	**25-Jun-2021**	**02-Jul-2021**	02-Jul-2021	✓	**02-Jul-2021**	02-Jul-2021	✓
EA010: Conductivity (1:5)							
Snap Lock Bag (EA010)							
TP3 - 300mm to 600mm, TP4 - 400mm to 800mm, TP5 - 400mm to 800mm, TP6 - 500mm to 800mm	**25-Jun-2021**	**02-Jul-2021**	02-Jul-2021	✓	**02-Jul-2021**	30-Jul-2021	✓
Soil Glass Jar - Unpreserved (EA010)							
TP1 - 900mm to 1100mm, TP2 - 500mm to 900mm	**25-Jun-2021**	**02-Jul-2021**	02-Jul-2021	✓	**02-Jul-2021**	30-Jul-2021	✓
ED007: Exchangeable Cations							
Snap Lock Bag (ED007)							
TP3 - 300mm to 600mm, TP4 - 400mm to 800mm, TP5 - 400mm to 800mm, TP6 - 500mm to 800mm	**25-Jun-2021**	**08-Jul-2021**	23-Jul-2021	✓	**08-Jul-2021**	23-Jul-2021	✓
Soil Glass Jar - Unpreserved (ED007)							
TP1 - 900mm to 1100mm, TP2 - 500mm to 900mm	**25-Jun-2021**	**08-Jul-2021**	23-Jul-2021	✓	**08-Jul-2021**	23-Jul-2021	✓
EK072: Phosphate Sorption Capacity							
Soil Glass Jar - Unpreserved (EK072)							
TP1 - 900mm to 1100mm, TP2 - 500mm to 900mm, TP3 - 300mm to 600mm, TP4 - 400mm to 800mm, TP5 - 400mm to 800mm, TP6 - 500mm to 800mm	**25-Jun-2021**	**----**	----	----	**06-Jul-2021**	22-Dec-2021	✓

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Electrical Conductivity (1:5)	EA010	1	6	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Exchangeable Cations	ED007	1	8	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
P Sorption Index & P Sorption Capacity	EK072	1	6	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
pH (1:5)	EA002	1	6	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Electrical Conductivity (1:5)	EA010	1	6	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Exchangeable Cations	ED007	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
pH (1:5)	EA002	2	6	**33.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Electrical Conductivity (1:5)	EA010	1	6	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Exchangeable Cations	ED007	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
pH (1:5)	EA002	SOIL	In house: Referenced to Rayment and Lyons 4A1 and APHA 4500H+. pH is determined on soil samples after a 1:5 soil/water leach. This method is compliant with NEPM Schedule B(3).
Electrical Conductivity (1:5)	EA010	SOIL	In house: Referenced to Rayment and Lyons 3A1 and APHA 2510. Conductivity is determined on soil samples using a 1:5 soil/water leach. This method is compliant with NEPM Schedule B(3).
Exchangeable Cations	ED007	SOIL	In house: Referenced to Rayment & Lyons Method 15A1. Cations are exchanged from the sample by contact with Ammonium Chloride. They are then quantitated in the final solution by ICPAES and reported as meq/100g of original soil. This method is compliant with NEPM Schedule B(3).
P Sorption Index & P Sorption Capacity	EK072	SOIL	In house: Referenced to Rayment & Lyons Method 9H1 & 9I1 Soil is bought to equilibrium with a solution of P at known concentration. P absorbed, released is determined by FIA analysis of the final solution.

Preparation Methods	Method	Matrix	Method Descriptions
Exchangeable Cations Preparation Method	ED007PR	SOIL	In house: Referenced to Rayment & Lyons method 15A1. A 1M NH4Cl extraction by end over end tumbling at a ratio of 1:20. There is no pretreatment for soluble salts. Extracts can be run by ICP for cations.
1:5 solid / water leach for soluble analytes	EN34	SOIL	10 g of soil is mixed with 50 mL of reagent grade water and tumbled end over end for 1 hour. Water soluble salts are leached from the soil by the continuous suspension. Samples are settled and the water filtered off for analysis.

CHAIN OF CUSTODY RECORD AND ANALYSIS REQUEST

GHD House 999 Hay Street Perth WA 6000
PO Box Y3106 Perth WA 6832
Telephone 08 6222 8222 Facsimile 08 6222 8555

COC No.

Project Albany Motorsports Park DA		**Laboratory:** ~~Eurofins | mgt~~ redirected to ALS	
Client City of Albany	**Job No.** 12546218	**Address:** ~~46-48 Banksia Road, WELSHPOOL, WA 6106~~	
		Laboratory Contact:	
Laboratory Quote No. EP/444/21	**Turnaround Time** Standard		
Job Manager (Invoice) Vicki.Davies@ghd.com & GHD accounts	**Email Address (Results)** Vicki.Davies@ghd.com		

Sample ID	Laboratory Sample ID	Date	Time	Sample Matrix S-Soil/ SL-Sludge/ W-Water/ A-Air	Container: Type B-Bottle/J-Jar/V-Vial/Bag/G-Glass/P-Plastic	Container: Preservative Unpreserved/ HCl/ H2SO4/HNO3/Other	Container: No	Container: Total Volume (mL)	Analyses: pH plus EC (1:5)	Analyses: CEC/ Exchangeabe Cations (ED007) - Default Parameters	Analyses: P Sorption Index & P Sorption Capacity	Analyses: HOLD	Remarks
TP1 - 180mm to 490mm	1	25/06/2021		S								✔	
TP1 - 900mm to 1100mm	2	25/06/2021		S					✔	✔	✔		
TP2 - 500mm to 900mm	3	25/06/2021		S					✔	✔	✔		
TP2 - 1700mm to 2000mm	4	25/06/2021		S								✔	
TP3 - 300mm to 600mm	5	25/06/2021		S					✔	✔	✔		
TP3- 900mm to 1200mm	6	25/06/2021		S								✔	
TP3 - 1600mm to 2000mm	7	25/06/2021		S								✔	
TP4 - 400mm to 800mm	8	25/06/2021		S					✔	✔	✔		
TP4 - 1350mm to 1650mm	9	25/06/2021		S								✔	
TP4 - 1800mm to 2200mm	10	25/06/2021		S								✔	
TP5 - 400mm to 800mm	11	25/06/2021		S					✔	✔	✔		
TP5 - 1200mm to 1500mm	12	25/06/2021		S								✔	
TP6 - 500mm to 800mm	13	25/06/2021		S					✔	✔	✔		
TP6 - 1300mm to 1600mm	14	25/06/2021		S								✔	
TP6 - 2000mm to 2300mm	15	25/06/2021		S								✔	
				S									
				S									
				S									

Sampled by: Great Southern Geotechnics	Date/Time:	Relinquished by: Great Southern Geotechnics	Date/ Time:
Received by:	Date/Time:	Relinquished by:	Date/ Time:
Received by Lab: SP	Date/Time: 630 1/7/21	Courier/ Transport Company:	
Sample Conditions:	Remarks:		

Environmental Division
Perth
Work Order Reference
EP2107544

Telephone : +61-8-9406 1301

Appendix F

Aquarius Wastewater Systems Pty Ltd

AQUARIUS® Systems

1 – 5 Bedrooms	O-3 ATU	O-2 NR ATU	O-2 ATU
6 – 9 Bedrooms	O-3 3KL ATU	O-2 NR 3KL ATU	O-2 3KL ATU
Commercial	AQUARIUS® Standard or Custom Designed Commercial Systems Please speak to our Sales Consultant		

Specifications

	O-3	**O-2 NR**	**O-2**
System Features Poly/Duralen Plastic or Concrete Tank Construction	✓	✓	✓
Nutrient Retentive (Phosphorous removal)	✓	✓	
Ozone Disinfection	✓		
Recycles all wastewater through irrigation into gardens, orchards, etc.	✓	✓	✓
Supplied complete with irrigation components, electrical components and pumps	✓	✓	✓
Footprint required approx 6m x 2.5m x 2m**	✓	✓	✓
Low Energy use	✓	✓	✓
Irrigation Area Above Ground Dripper Irrigation Sub-Surface Dripper Irrigation Irrigation area in sandy soil conditions – *150m^2	 ✓ ✓ ✓	 ✓ ✓	 ✓ ✓
Other Disposal options Leach Drains / Soakwells / Aquasafe Drains	✓	✓	✓
Maintenance Service calls per year as per DoH WA requirements	2	2	2
Manufacturers Warranties Poly/Duralen Plastic Tanks 15 years Orange Pumps 1 year Irrigation and Electrical components 1 year	 ✓ ✓ ✓	 ✓ ✓ ✓	 ✓ ✓ ✓
Approvals Fully approved by the WA Department of Health	✓	✓	✓
Australian Standards approved AS/NZS 1546.3	✓	✓	✓
Why choose Aquarius Wholly owned West Australian Company	✓	✓	✓
Manufactured in Western Australia	✓	✓	✓
Extensive Support Network covering all of WA	✓	✓	✓
Local Agents fully trained and registered with Department of Health WA	✓	✓	✓

*Subject to local authority approval

**Subject to configuration of ATU

Treatment Process

	O-3	O-2 NR	O-2
Primary Tank Retains the solids and uses aerobic and anaerobic bacteria to breakdown the BOD_5 levels in the sewage.	✓	✓	✓
Alum Tank Doses the Clarifying chamber of the Treatment tank with Alum. Alum acts as a flocculent to remove the nutrients and suspended solids and settle them to the bottom of the tank for further aerobic bacteria breakdown.	✓	✓	
Treatment Tank **Secondary / Aeration Chamber** Incorporates aeration to further break down BOD_5 and nitrates.	✓	✓	✓
Clarifying Chamber The Clarifying Chamber provides a settling and clarifying period for the water prior to discharge.	✓	✓	✓
Discharge Chamber The Discharge chamber contains the Discharge Pump to pump the treated water out to irrigation or other disposal methods.	✓	✓	✓
Ozonation Pump Ozone is a powerful disinfectant, many times more effective than chlorine and kills all bacteria.	✓		
DoH WA ATU Water Quality Criteria			
<20mg/L BOD_5	✓	✓	✓
<30mg/L suspended solids	✓	✓	✓
<10 E.coli/100ml	✓		
>3mg/L Ozone concentration	✓		
<1mg/L (98.5%) TP (% removal)	✓	✓	
<10mg/L (97.8%) TN (% removal)	✓	✓	✓

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The Power of Commitment