Hydrogeological Review

WA13 Langwarrin

Report for Hanson Construction Materials

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Glossary

Acronym	Explanation
AHD	Australian Height Datum
DO	Dissolved oxygen concentration
EC	Electrical conductivity
Eh	Redox potential
EPA	Environment Protection Authority
ERR	Earth Resources Regulation
NATA	National Association of Testing Authorities
RWL	Reduced Water Level
SRW	Southern Rural Water
SWL	Standing Water Level
TOC	Top of Casing
WA	Work Authority
WMIS	Water Management Information System

1 Introduction

Ricardo Energy Environment & Planning (Ricardo) has been commissioned by Hanson Construction Materials Pty Ltd (Hanson) to prepare a hydrogeological review as part of the Work Plan Variation Application documentation.

The existing site's sand reserves are already exhausted, so Hanson is seeking to increase the area available for quarrying. Hanson purchased the site at 60 Valley Road Langwarrin (Valley Road site) which directly abuts the WA13 area (Langwarrin Quarry site). Since Hanson owns both sites it is now proposed to extract the sand from the buffer area along the shared border and into the newly acquired site.

Hanson Construction Materials purchased the Langwarrin Quarry site from Rocla in 2016, who had in turn had purchased it from Amatek in 2005. Prior to quarrying operations, the Langwarrin Quarry site was owned by the Turner family and was used for market gardens. The first quarrying operations commenced under the trading name of Mukadilla Sands.

As part of the approvals process regulatory stakeholders were invited to an initial site meeting on 28th August 2018 to identify aspects to be addressed in the application. At this meeting SRW identified that a hydrogeological review be undertaken of the current Dredge Pond in order to identify the volume of water which is effectively extracted by the sand processing.

1.1 Location

The Valley Road site is adjacent to Hanson's existing Langwarrin Quarry site operations. Hanson wishes to quarry sand from the Valley Road site for processing at the plant on the existing Langwarrin quarry site.

The site is approximately 4 km from the Skye Road exit of the Peninsula Link freeway (**Figure 1-1**).

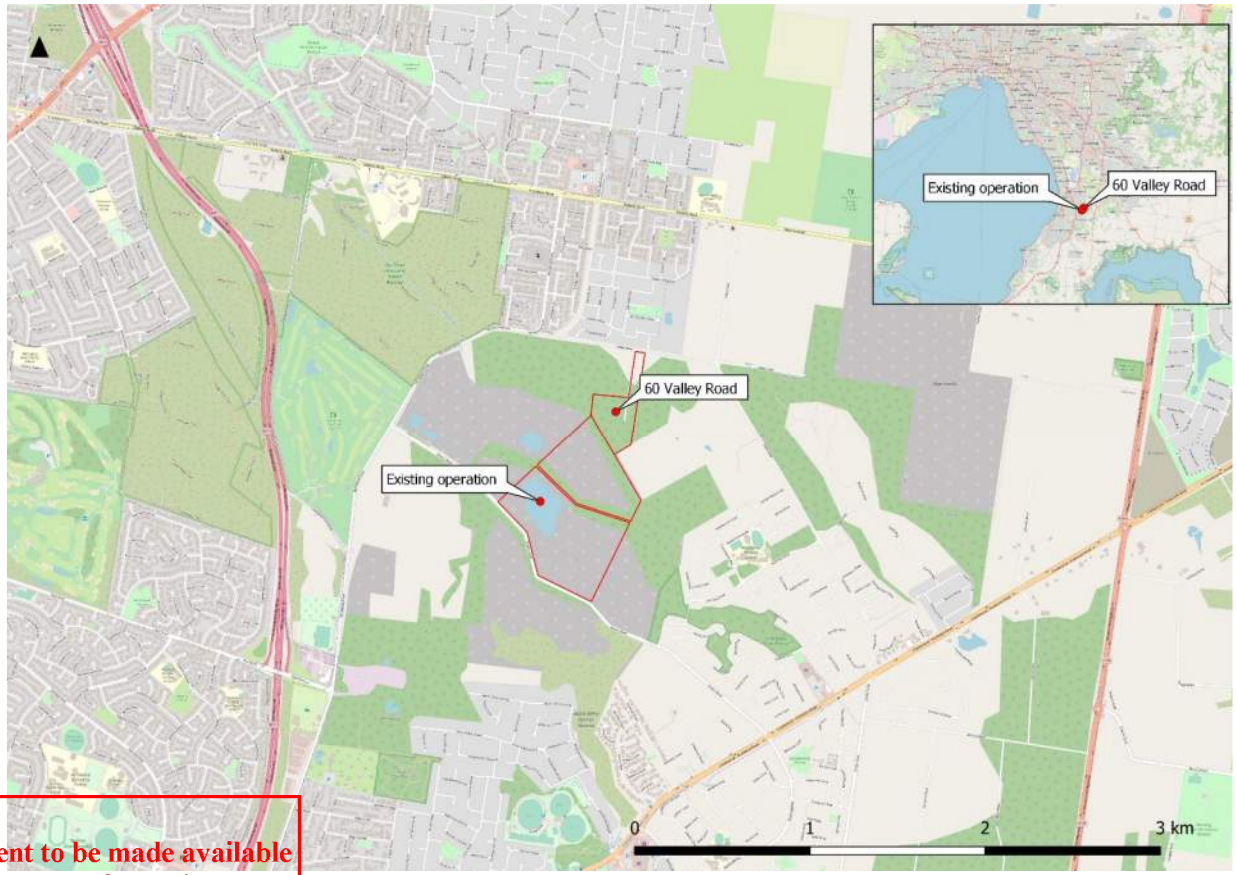


Figure 1-1 Location

1.2 Scope and Objectives

The initial site meeting as required by Earth Resources Regulation (ERR) was held in August 2018. The meeting was attended by relevant regulatory agencies as identified by ERR. The need to undertake a hydrogeological review was identified as one of a suite of further studies that was needed to support the application.

The objective of this review is to:

- Document the geology and hydrogeology of the sites; and
- Quantify the proportions of groundwater and surface water exported with sand to confirm the adequacy of the existing licence.

Work has been undertaken based on existing and publicly available datasets. Three bores were drilled as part of the recent geotechnical assessment. The bores were subsequently constructed to serve as groundwater monitoring bores.

Volumetric assessment of groundwater volumes exported with the sand has been determined using a water balance calculation, including:

- data inputs from current and previous investigations undertaken at the Langwarrin Quarry site; and
- publicly available datasets.

Further recommendations are made regarding future monitoring at the sites.

1.3 Site Description

A plan of the site's surrounds is presented in **Figure 1-2**. The Langwarrin Quarry site is accessed from Quarry Rd, which forms the southern boundary of WA13. The Valley Road site will be an extension of the existing Hanson quarry, adjoining the existing extraction area through a common boundary.

There are several other approved extraction sites to the east and south of the sites, with rural residential areas bordering the Valley Road site to the north and northwest. Boggy Creek runs through the Langwarrin Quarry site from southeast to northwest along a narrow strip of land which bisects the Langwarrin Quarry site.

Figure 1-2 Site surrounds

The features of the Langwarrin and Valley Road sites are shown in **Figure 1-3**.

Figure 1-3 Site features

Processing facilities are located on the southern edge of the Langwarrin Quarry site near Quarry Road as shown on **Figure 1-4**. This figure also shows the location of the main access gates and the offices.

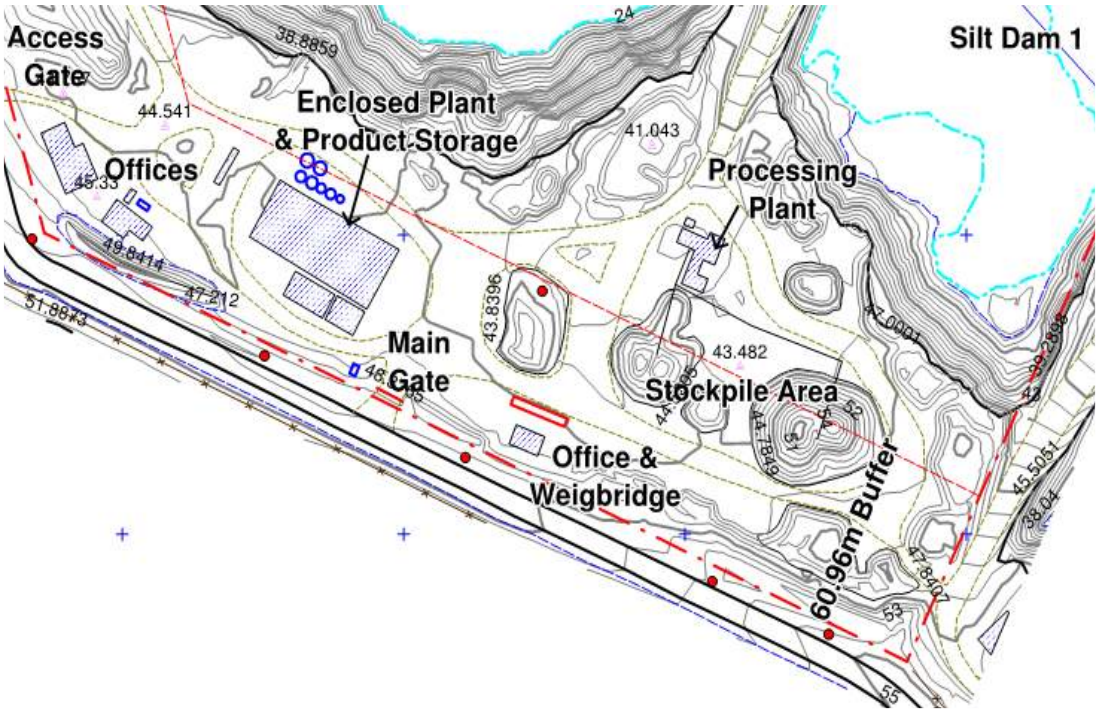


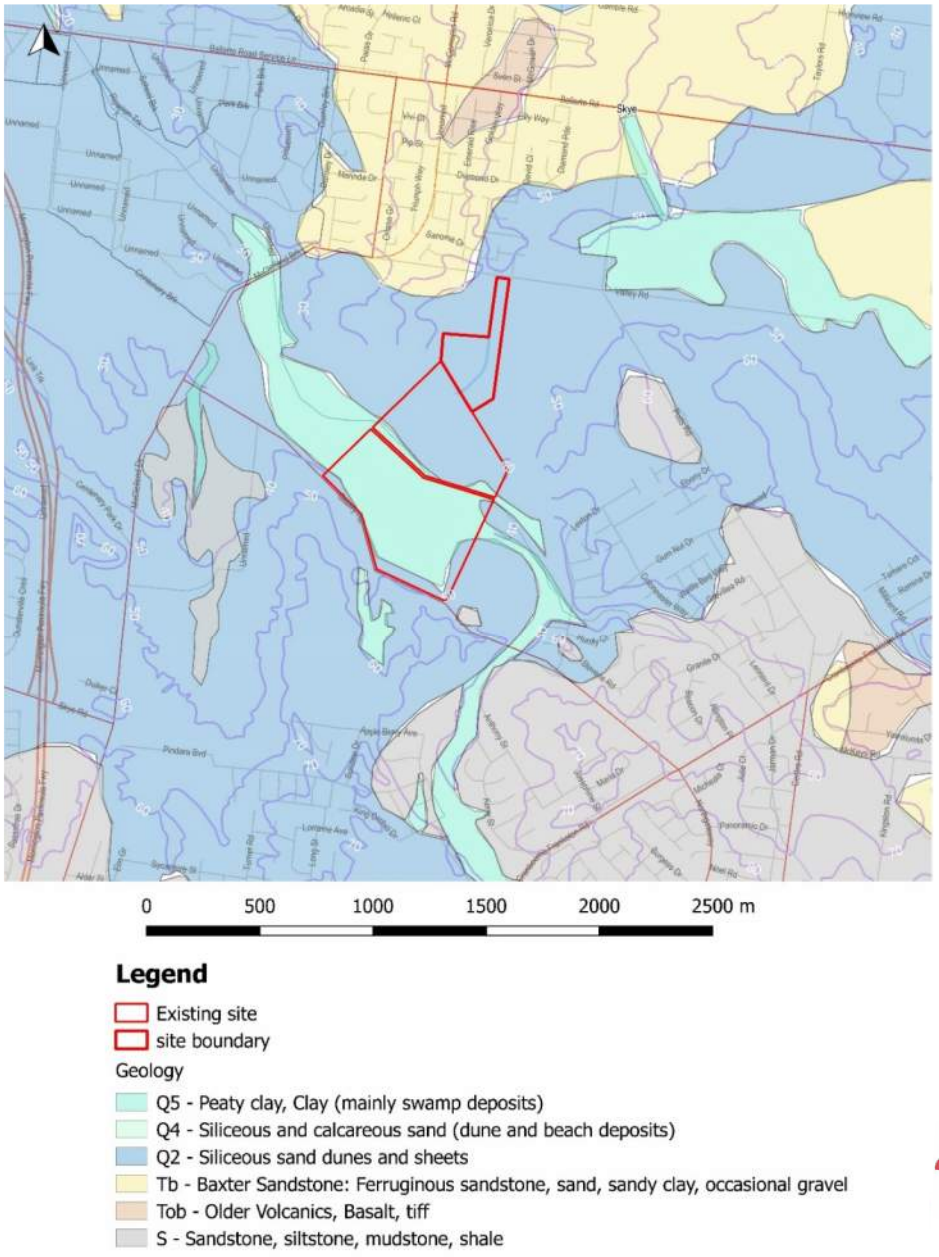
Figure 1-4 Processing area layout

2 Information Sources

2.1 Regional Geology and Hydrogeology

The sites are is situated on the north western side of a north east to south west trending bedrock high which outcrops approximately 700 m east of the site. Bedrock consists of Silurian aged metasediments. Erosion of the bedrock high has created a number of sediment infilled valleys which trend in a generally northeasterly direction. The sites are on the northern edge of one of these subterranean valleys.

The geology from the 1:63,360 scale Cranbourne geological mapsheet presents the most detailed map of the geology of the site and surrounding area (**Figure 2-1)**.



Source: 1:63,360 Cranbourne Geological mapsheet

Figure 2-1 Pre-quarrying geology

From the top down the regional geological units at the site comprises:

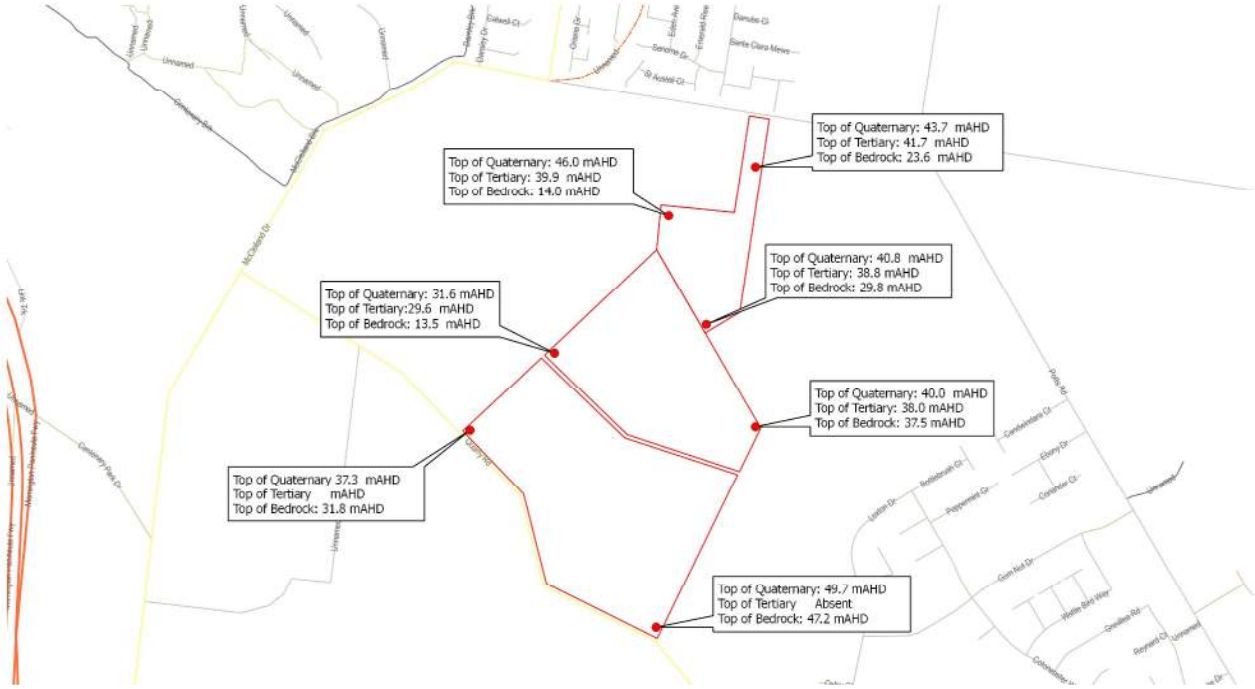
- Recent aged Peaty clay, clay (swamp deposits);
- Pleistocene aged Siliceous sand dunes and sheets;
- Miocene aged Baxter Sandstone (now referred to as the Sandringham Sandstone); and
- Silurian aged Sandstone, siltstone, mudstone, shale (bedrock)

In the Langwarrin quarry site, the quarrying operations have targeted, and largely removed, the Baxter Sandstone and overlying Quaternary deposits.

The Victorian Aquifer Framework (VAF) datasets contain Geographic Information System (GIS) coverages for the major geological units across the State. The dataset is broad scale and does not account for recent quarry operations. As such, they are representative of pre-quarry conditions of the site and surrounds.

Approximate formation intersection elevations from the VAF are shown in **Figure 2-2.**

The Quaternary (Recent and Pleistocene) deposits form a thin covering over the infilled valley. The Quaternary sediments are thicker on the north-western corner of the Valley Road site. Tertiary sediments are thin to absent adjacent to Quarry Road.



Source: Victorian Aquifer Framework

Figure 2-2 VAF Formation intersections

2.2 Groundwater users

Available information from the Water Management Information System (WMIS) was reviewed. The location of bores is shown in **Figure 2-3**. Most of the analytical data related to investigations undertaken as part of the construction of Peninsula Link and was considered too remote to inform this review. Registered bores within the area around Peninsula Link were considered too remote to be of any relevance and have thus been excluded from the scope of this report. Many of these bores predate urban development and are unlikely to still be in use.

There are no bores in the vicinity of the site which are recorded as being actively monitored[1].

[1] https://www.vvg.org.au/vvg_map.php?agreement=Agree+and+Continue

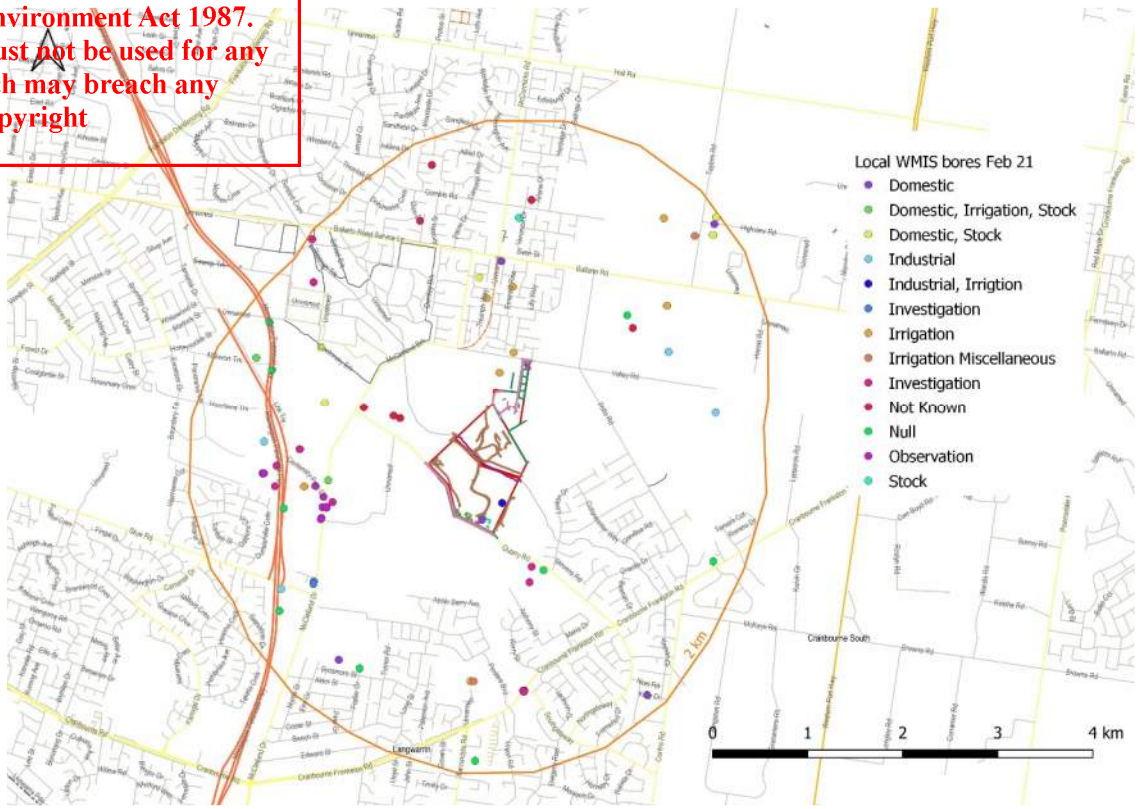


Figure 2-3 Registered groundwater users

There is a small cluster of irrigation bores north of the proposed extension area. The land north of Valley Road has now been subdivided so irrigation is not occurring.

There is one bore with a registered use of irrigation located in one of the blocks bordering the north boundary of the proposed extension site. These blocks are rural residential and are not used for large scale irrigation.

2.3 Local Groundwater and surface water monitoring

The spatial surface geology coverage was sourced from the 1:250,000 coverage collated by the Geological Survey of Victoria using the most recent data issued in August 2014. The dataset is less detailed than the older mapping but represents the best available electronic dataset. The geology map presented in **Figure 2-1** has been digitised from the 1:63,360 scale maps.

Local groundwater and surface water investigations have been previously conducted in 2002 and 2004 by URS Pty Ltd on behalf of then owners Rocla Quarry Products (Rocla) dated 2003 and 2004 respectively. Preliminary drilling and sampling of groundwater was also undertaken in the adjacent quarries at Quarry Road, Langwarrin; owned by Monk Quarries to the east and QRR and Burdett to the west.

Drilling was undertaken to assess the geological and hydrogeological conditions as well as provide baseline data for surface water and groundwater quality as part of a suite of investigations undertaken in relation to a proposed relocation of Boggy Creek, (URS 2003). The water samples were analysed by NATA Accredited Laboratory's EML in 2002 and ALS Environmental in 2004. While the proposed creek relocation didn't proceed, the data collected from these assessments are useful for this report.

The hydrogeological assessments undertaken by URS included installation of 6 groundwater bores across the Langwarrin Quarry site and adjacent quarry sites by Aqua Drilling during November 2002, the locations of which are shown in **Figure 2-4**.

Slug tests were also undertaken on these bores at this time, which has provided some information on aquifer parameters.

WRK039045 is a production bore located within the drying plant.

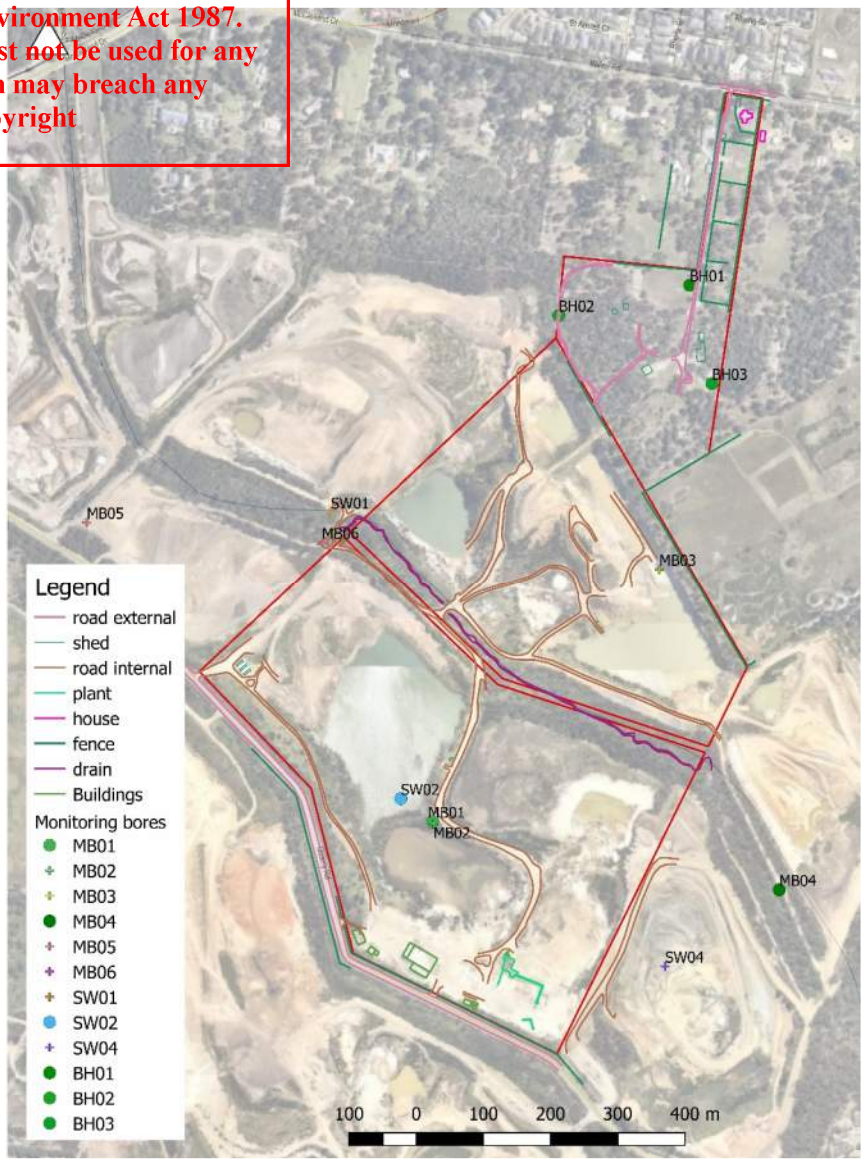


Figure 2-4 Monitoring locations

An inspection was undertaken by Ricardo on 8th May 2019 to determine which of the above monitoring locations was still viable:

- Bores MB01, MB02 and MB04 were located;
- Bore MB02 had damaged headworks;
- MB04 was dry; and
- MB01 is completed in the Bedrock Aquifer so will not inform current watertable groundwater elevations.

Three new bores were installed by CMW Geosciences as part of geotechnical studies supporting this application. The bores are located on the western, northern and eastern sides of the Valley Road site. These bores provide the only recent data available but are ideally located to monitor groundwater response when quarrying works are under way.

The bore details and their current status is shown in **Table 2-1**.

Table 2-1 Monitoring bore status

Bore	Easting	Northing	RL (TOC)	Drilled date	Drilled depth (mbgl)	Constructed depth (mbgl)	Screen (mbgl)	Headworks	Lithology	Status
MB01	341494	5777699	26.02	6/11/2002	37	36	30-36	Standpipe	0-0.7m sandy clay 0.7-3m sandy clay to clayey sand 3-14m sand 14-37m siltstone	Active
MB02	341495	5777696	26.06	11/11/2002	12	11.8	6-11.8	Standpipe	0-1m sandy clay 1-2m sandy clay 2-12m white sand	Active
MB03	341824	5778081	41.68	11/11/2002	22	21	15-21	Standpipe	0-0.5m silty sand 0.5-3m grey sand 3-22m white sand	Destroyed
MB04	342012	5777608	43.27	12/11/2002	16.5	16	10-16	Standpipe	0-1.8m fill, 1.8-3.5m grey sand 3.5-4m clay 4-8m clayey sand 8-16.5m sand	Active
MB05	340970	5778134	32.47	13/11/2002	6	5	2-5	Standpipe	0-1m silty sand, 1-3m grey sand, 5-6m siltstone	Lost/buried
MB06	341321	5778111	33.99	13/11/2002	19	14.8	8.8-14.8	Standpipe	0-1m silty sand, 1-4m grey sand, 4-11m white sand, 11-15m clayey sand	Lost/buried
GW Pump* WRK039045				31/12/1970						Equipped
BH01	341861	5778503		12/10/2020	50				0-0.5 topsoil 0.5-1 sand and sandy clay 1-2.5 Clayey sand 2.5-37.5 silty sand 37.5-40.5 clay and silt	Active

Bore	Easting	Northing	RL (TOC)	Drilled date	Drilled depth (mbgl)	Constructed depth (mbgl)	Screen (mbgl)	Headworks	Lithology	Status
BH02	341667	5778454		14/10/2020	50.5				0-0.7 topsoil 0.7-1 silty sand 1-1.65 Sand 1.65-11 silty sand 11-20.8 sand 20.8-36.45 silty sand 36.41.7 silty sands and clays 41.7-45.85 silty clay 45.85-49.5 gravelly clays and silts 49.4-50.5 Siltstone	Active
BH03	341897	5778358		19/10/2020	40.5				0-0.6 topsoil 0.6-1.2 silty sand 1.2-1.9 sandy clay 1.9-18.8 silty sand 18.8-20 sand 20-20.6 silty sand 20.6-28.1 sand 28.1-31.05 silty sand 31.05-38.5 gravelly clay and clayey gravel 38.5—39.7 siltstone 39.7-42.5 gravelly clay	Active

* Note:WMIS location is incorrect

2.4 Meteorological data

The nearest weather stations were Cranbourne Botanic Gardens and Cranbourne South, respectively 7.5 km and 5.4 km from the sites. A longer rainfall record is available from the Cranbourne South station, whilst a greater range of meteorological parameters was available from the Cranbourne Botanic Gardens station. Consequently, data has been used from both weather stations.

The meteorological data has been sourced from the Cranbourne South weather station (no. 086244) from the Bureau of Meteorology (BOM) website. The summary of monthly average weather conditions can be seen in

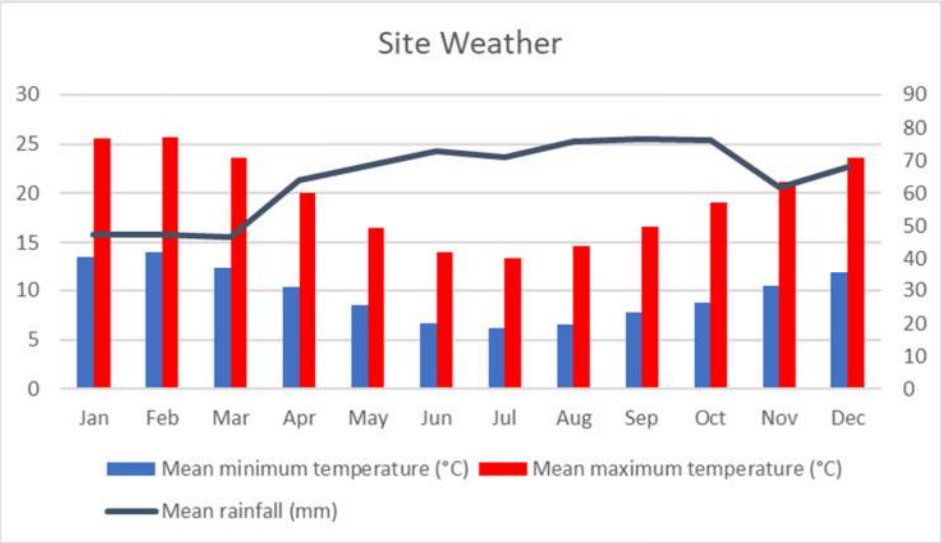


Figure 2-5. The average maximum and minimum temperatures peak in February at 25.7 °C and 14 °C respectively, while they reach their lowest in July at 13.4 °C and 6.2 °C respectively.

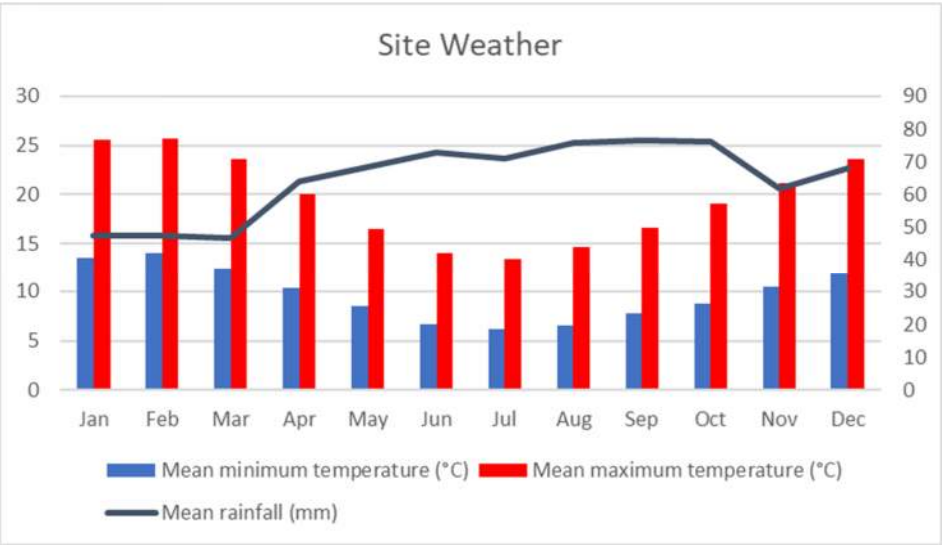


Figure 2-5 Monthly weather conditions

Evaporation and precipitation are shown in **Figure 2-6**. Evaporation (surface water) exceeds rainfall between October and May.

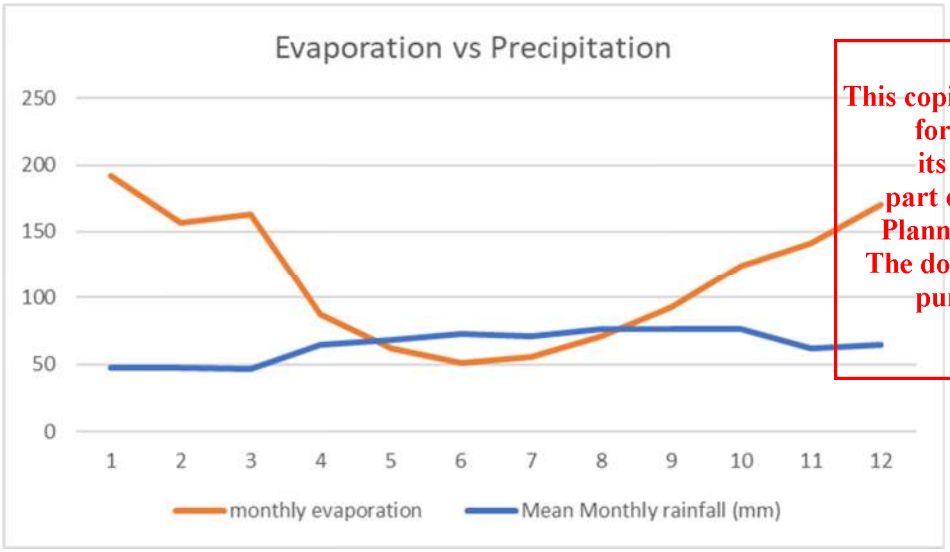


Figure 2-6 Monthly evaporation and precipitation

The Accumulative Monthly Residual Rainfall (AMRR) is commonly used for the interpretation of climatic trends. The AMRR displays an accumulated value representing surplus or deficit of rainfall compared to the long-term average. Importantly, the slopes depict current rainfall trends when compared to the long-term average. The graph in **Figure 2-7** indicates the sites have been experiencing below average rainfall since 2010.

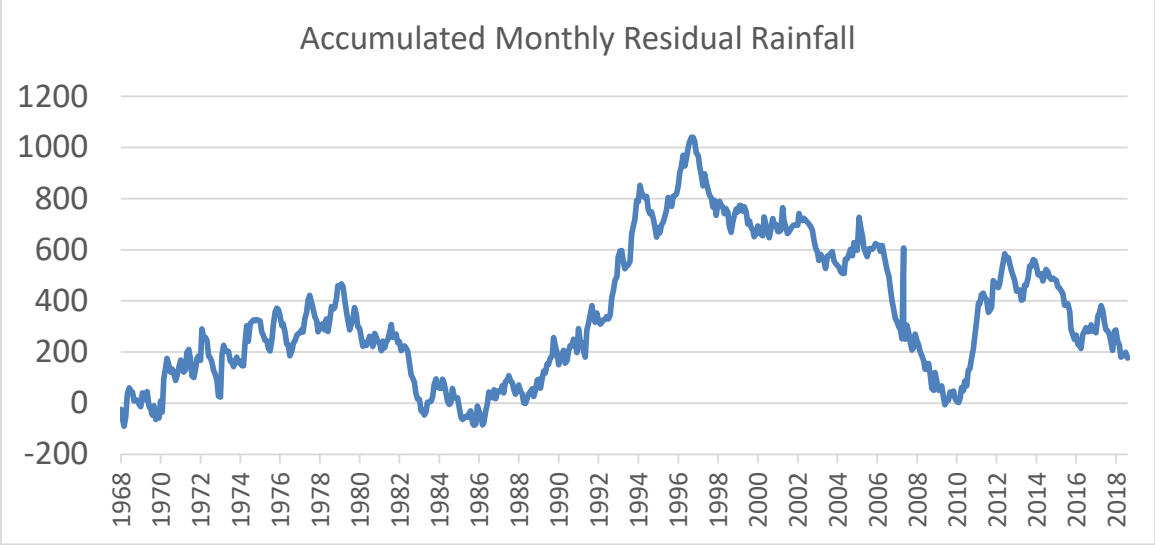


Figure 2-7 Accumulative Monthly Residual Rainfall

2.5 Topographic data

Publicly available sources of topographic data included:

- 10m topographic contours (Vicmap);
- 1 Sec Digital Elevation Model;
- Site 1m Contours – Landair survey (July 2018)

A SW-NE cross section of the topography is shown in **Figure 2-8**. Topographic contours are presented in **Figure 2-9**.

Boggy Creek now flows along a reconfigured watercourse approximating the original alignment of the waterway. It is understood from discussions with neighbours that the creek was more of a floodway

through a swamp originally, but this was redirected to a constructed channel on the current alignment at some time prior to 1960. It is understood this was done so that market gardens could be established on the former swampland.

Quarrying activities subsequently replaced the market gardens. Quarrying activities have lowered the elevation of the ground surface by approximately 20 m leaving Boggy Creek flowing on a 'pillar' between the quarry excavations.

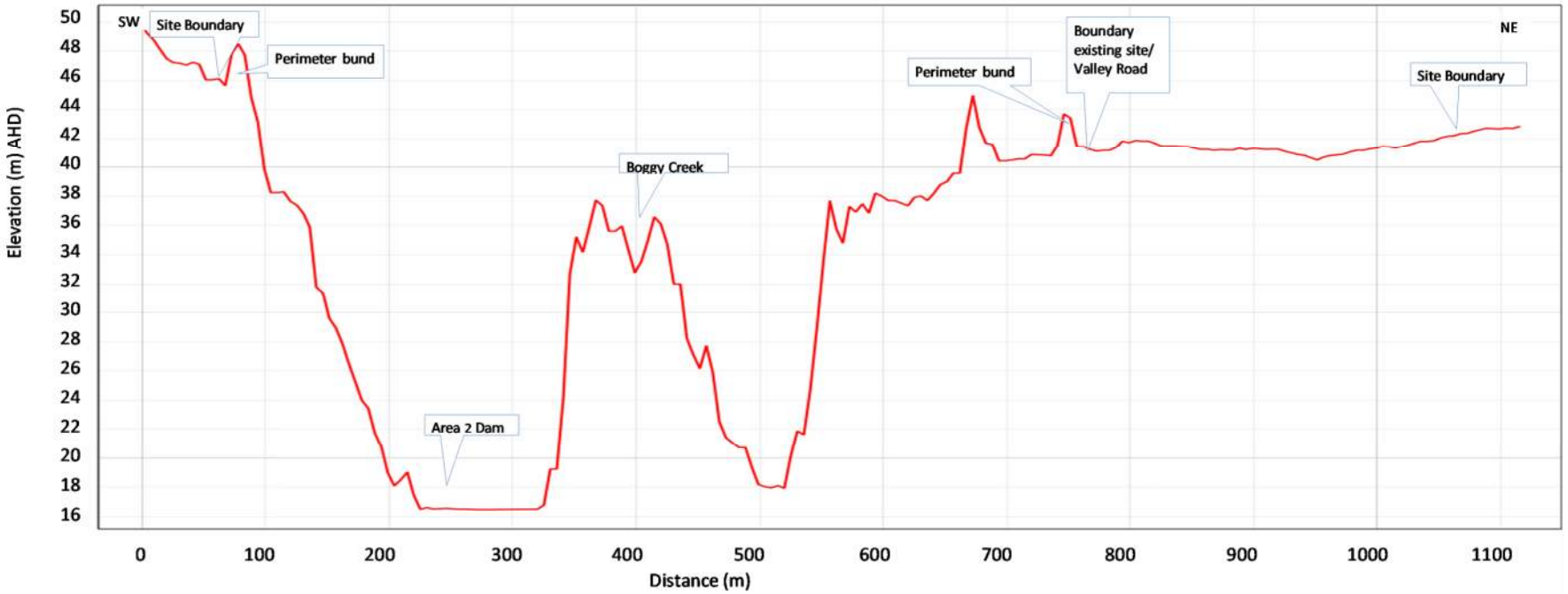


Figure 2-8 SW-NE topographic cross section

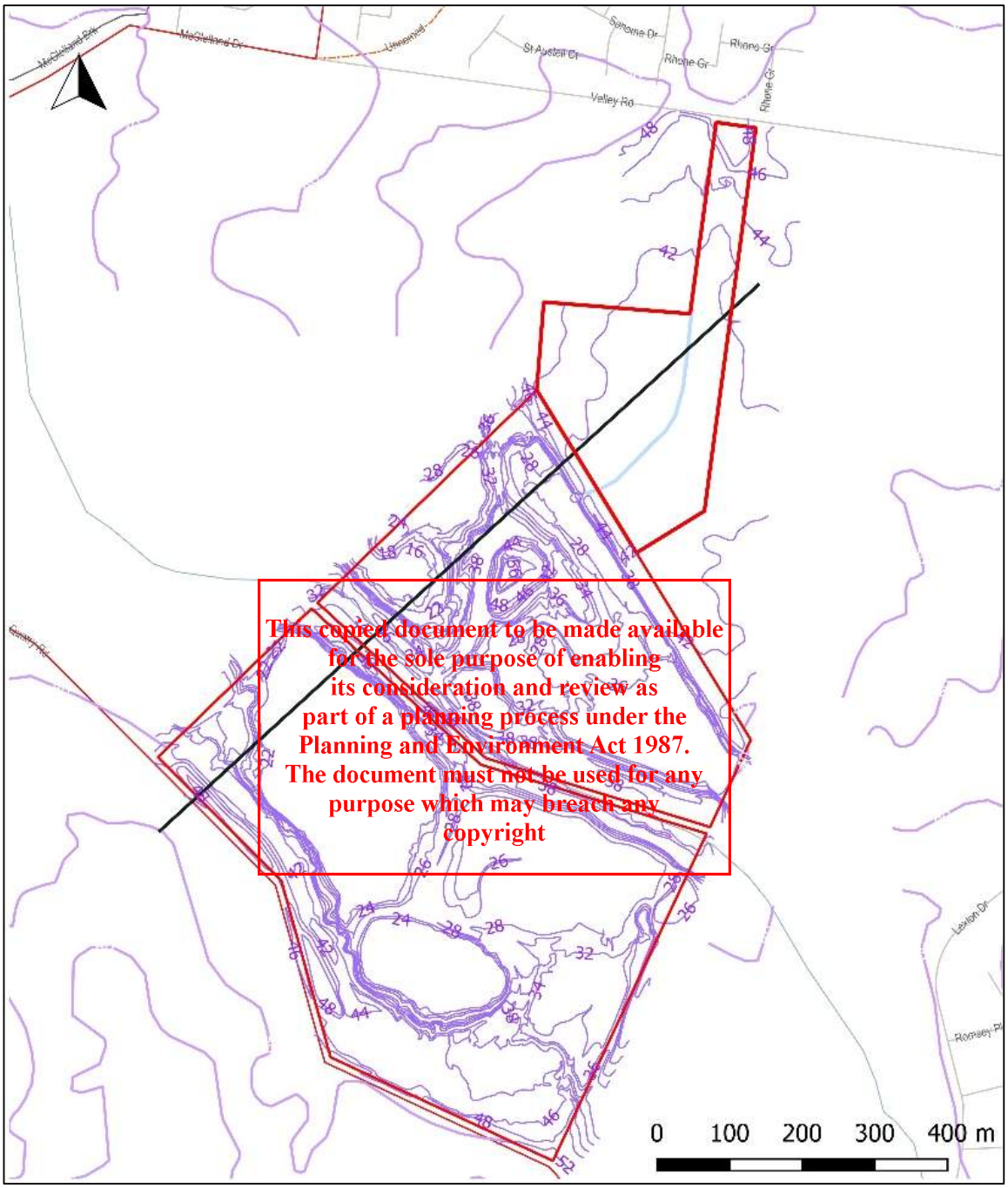


Figure 2-9 Site topography

The Tertiary sand deposits have been worked out of the existing Langwarrin Quarry site. Near the processing plant the original pits have been filled with slimes which are now mostly dried (Silt Dam 1 and Silt Dam 2), locations shown in **Figure 1-3.**

When operating, sand from the north side of the pits on Boggy Creek was pumped as a water slurry from a dredge to the processing plant on the south side of Boggy Creek. The slimes from the processing plant were discharged into Silt Dam 3 where the solids mostly settle out. The uppermost fraction discharged over a weir into the Area 2 dam. It is proposed to operate the extension area in the same manner.

2.6 Groundwater Dependent Ecosystems

The location of mapped Groundwater Dependent Ecosystems is presented in **Figure 2-10**.

The Terrestrial GDEs include all of the remnant vegetation in the area. Boggy Creek is identified as an aquatic groundwater dependent ecosystem.

Figure 2-10 Groundwater Dependent Ecosystems

3 Results

3.1 Field data

Sampling of groundwater and surface water was conducted over four days, 26 & 27-Nov-2002 and 10 & 11-Jun-04. An inspection of the bores installed by URS was undertaken by Ricardo in 2019. Samples were collected from all available monitoring bores in February 2021. The field parameters and water levels for groundwater are presented in **Table 3-1**. Field parameters for surface waters are presented in **Table 3-2**.

Table 3-1 Groundwater levels and field parameters

Well No.	Date Measured	Total Well Depth (mbgs)	Top-of-Casing Elevation (mAHD)	Depth to Water (mTOC)	Groundwater Elevation (mAHD)	TOC to GL	Electrical Conductivity (mS/cm)	Estimated TDS* (mg/L)	Lab TDS	Dissolved Oxygen (mg/L)	Redox Potential (mv)	Field pH	Lab pH	Temp (oC)	Comments
MB01	26-Nov-02	37.0	26.02	4.37	21.65	0.75	1463	951		3.73	69	7.93		18.0	Slightly cloudy white. Clear. Dry @100L.
	10-Jun-04			3.81	22.21		1425	926	732	11.64	10	8.17	8.51	MAL	
	8-May-19			3.22	22.8		1323			6.22	77	4.77		17.2	
	19-Feb-21			2.78	23.24		1355		726	3.18	-94.8	7.91		16.7	Turbid, no odour, odour or sheen
MB02	26-Nov-02	12.0	26.06	5.96	20.1	0.74	1284	835		2.4	25	6.49		16.3	Orange/brown, turbid.
	10-Jun-04			4.89	21.18		740	481	4760	5.08	59	6.02	6.54	MAL	Yellow/brown, turbid.
	8-May-19														Blocked
	19-Feb-21			2.385	23.675		1432		837	5.35	28.7	4.63		16.5	Turbid, no colour, no sheen.
MB03	26-Nov-02	22.5	41.68	16.16	25.52	0.87		240		-1.28	85	5.54		15.5	White, cloudy.
	10-Jun-04		41.68	16.47	25.21		387	252	9580	3.28	6	5.56	4.5	13.8	
	8-May-19														Lost
MB04	26-Nov-02	16.5	43.27	10.02	33.25	0.81	1182	768		3.29	74	5.71		15.1	Grey/brown, cloudy.
	10-Jun-04		43.27	10.19	33.08		1203	782	686	3.65	78	5.58	5.93	12.2	
	8-May-19														Dry
MB05	27-Nov-02	06.0	32.47	4.19	28.28	~1	1446	940		7.36	174	4.57		14.5	White, cloudy.

Well No.	Date Measured	Total Well Depth (mbgs)	Top-of-Casing Elevation (mAHD)	Depth to Water (mTOC)	Groundwater Elevation (mAHD)	TOC to GL	Electrical Conductivity (mS/cm)	Estimated TDS* (mg/L)	Lab TDS	Dissolved Oxygen (mg/L)	Redox Potential (mv)	Field pH	Lab pH	Temp (oC)	Comments
	10-Jun-04		32.47	5.17	27.3		3050	1983	2490	3.77	194	5.58	6.46	13.2	Light cream/grey, turbid. Dry @4L.
	8-May-19														Lost
MB06	27-Nov-02	15.0	33.99	13.5	20.49	-0.8	651	423		4.89	135	10.19		15.0	-
	10-Jun-04		33.99	10.88	23.11		1122	729	1070	5.17	82	5.85	5.9	12.9	Brown/orange, turbid.
	8-May-19														Lost
GW PUMP	27-Nov-02		-	-	-	-	59	38		-0.26	22	MAL		15.2	Clear
	11-Jun-04		-	-	-	-	400	260	216	7.86	70	7.60	8.23	08.3	Clear
BH01	19-Feb-21	25	41.07	17.62	23.45		904	587	2380	2.3	-340	7.05		18.2	Turbid, grey, no odour or sheen.
BH02	19-Feb-21	30	44.69	21.35	21.04		623	405	954	2.2	-150.9	7.27		21.3	Turbid, dark grey/black.
BH03	19-Feb-21	30	40.47	17.21	23.26		771	501	874	3.42	-53.2	7.2		18	Turbid grey, no odour or sheen

Reduced groundwater levels (to AHD) are presented in **Figure 3-1** and **Figure 3-2** for the 2002 and 2004 monitoring events. Groundwater levels did not vary significantly between 2002 and 2004.

Water levels on the Valley Road site varied from 21.04 mAHD in BH02 to 23.45mAHD at BH01. These values are estimated based on the ground elevation from the aerial survey undertaken in 2018 and the “stick up” of the bore casing recorded at the time of sampling. The top of bore casing needs to be formally surveyed so these water table elevations should be viewed as indicative only.

The field parameters for MB01 reported in 2019 are broadly consistent with historical values. The value for pH (4.77 pH units) reported in 2019 was lower than historical values. This was not repeated in the most recent monitoring round which reported a pH value of 7.91 pH units. The historic data for surface water sampling is shown in **Table 3-2.**

Table 3-2 Surface water field parameters

ID	Date Measured	Electrical Conductivity (mS/cm)	Estimated TDS* (mg/L)	Lab TDS	Lab SS	Dissolved Oxygen (mg/L)	Redox Potential (mV)	Field pH	Lab pH	Temp (oC)	Comments
SW01	27-Nov-02	475	309			10.11	505	11.64		14.0	Clear
	10-Jun-04	308	200	242	28	11.6	54	7.4	7.5	10.9	Light yellow, cloudy
SW02	27-Nov-02	833	541			6.5	19	10.7		17.6	Clear
	10-Jun-04	931	605	530	12	12.1	207	4.7	5.1	MAL	Clear
	8-May-19	1263				8.14	114	5.96		14.3	
SW03	27-Nov-02	390	254			7.8	97	7.2		14.8	Clear
	11-Jun-04	445	289	240	8	9.2	54	7.1	7.5	7.0	Clear
SW04	27-Nov-02	935	608			3.7	99	9.0		16.6	Clear
	10-Jun-04	2008	1305	1010	7	6.7	229	7.3	8.3	10.9	Clear
SW05	8-May-19	1124				8.5	124	4.44		14.4	

3.2 Groundwater level

Reduced groundwater levels (to AHD) are presented in **Figure 3-1** and **Figure 3-2** for the 2002 and 2004 monitoring events. Groundwater levels did not vary significantly between 2002 and 2004.

Water levels on the Valley Road site varied from 21.04 mAHD in BH02 to 23.45mAHD at BH01. These values are estimated based on the ground elevation from the aerial survey undertaken in 2018 and the “stick up” of the bore casing recorded at the time of sampling. The top of bore casing needs to be formally surveyed so these water table elevations should be viewed as indicative only.

Figure 3-1 2002 Groundwater elevations (mAHD)

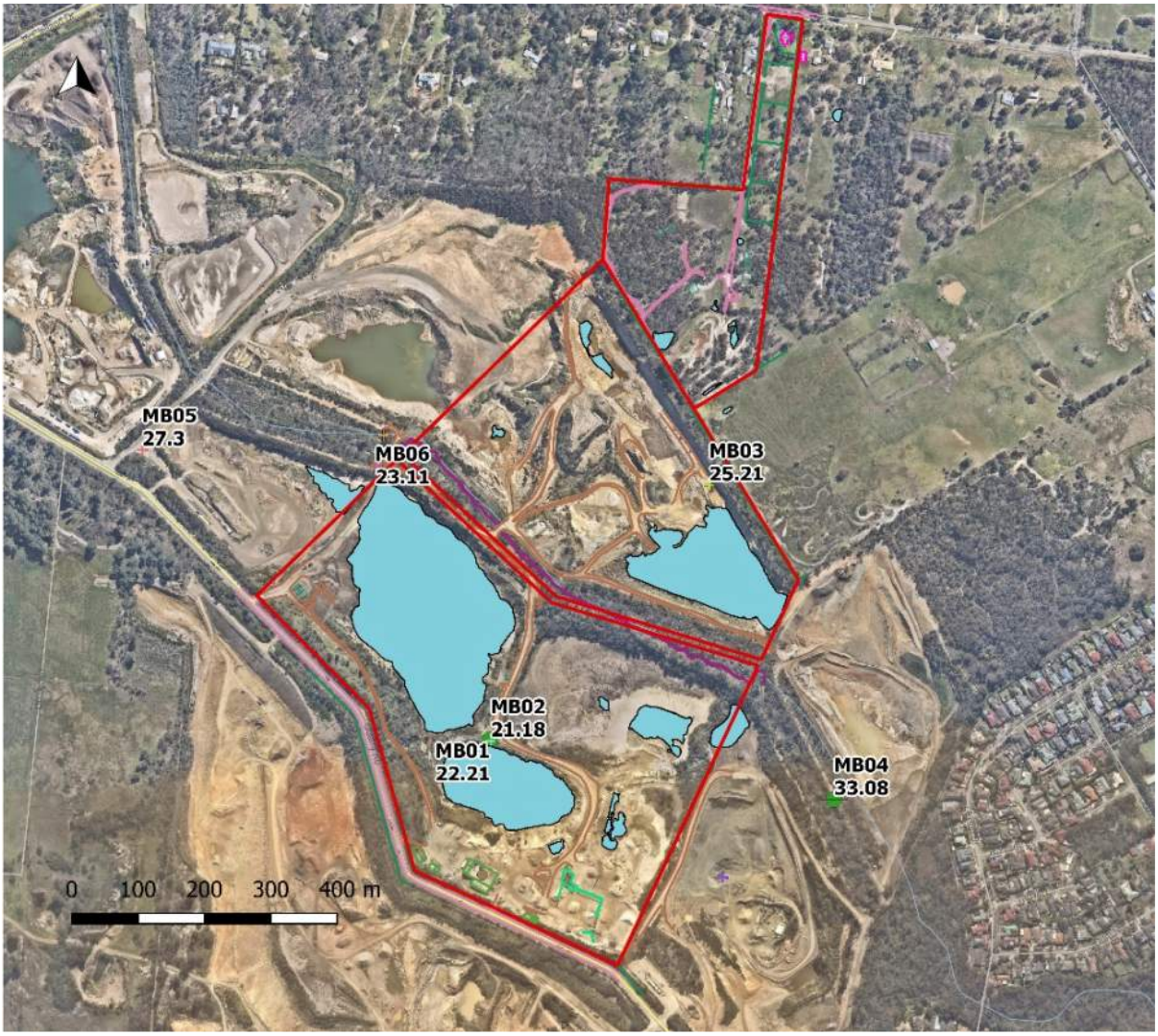


Figure 3-2 2004 Groundwater elevations (mAHD)

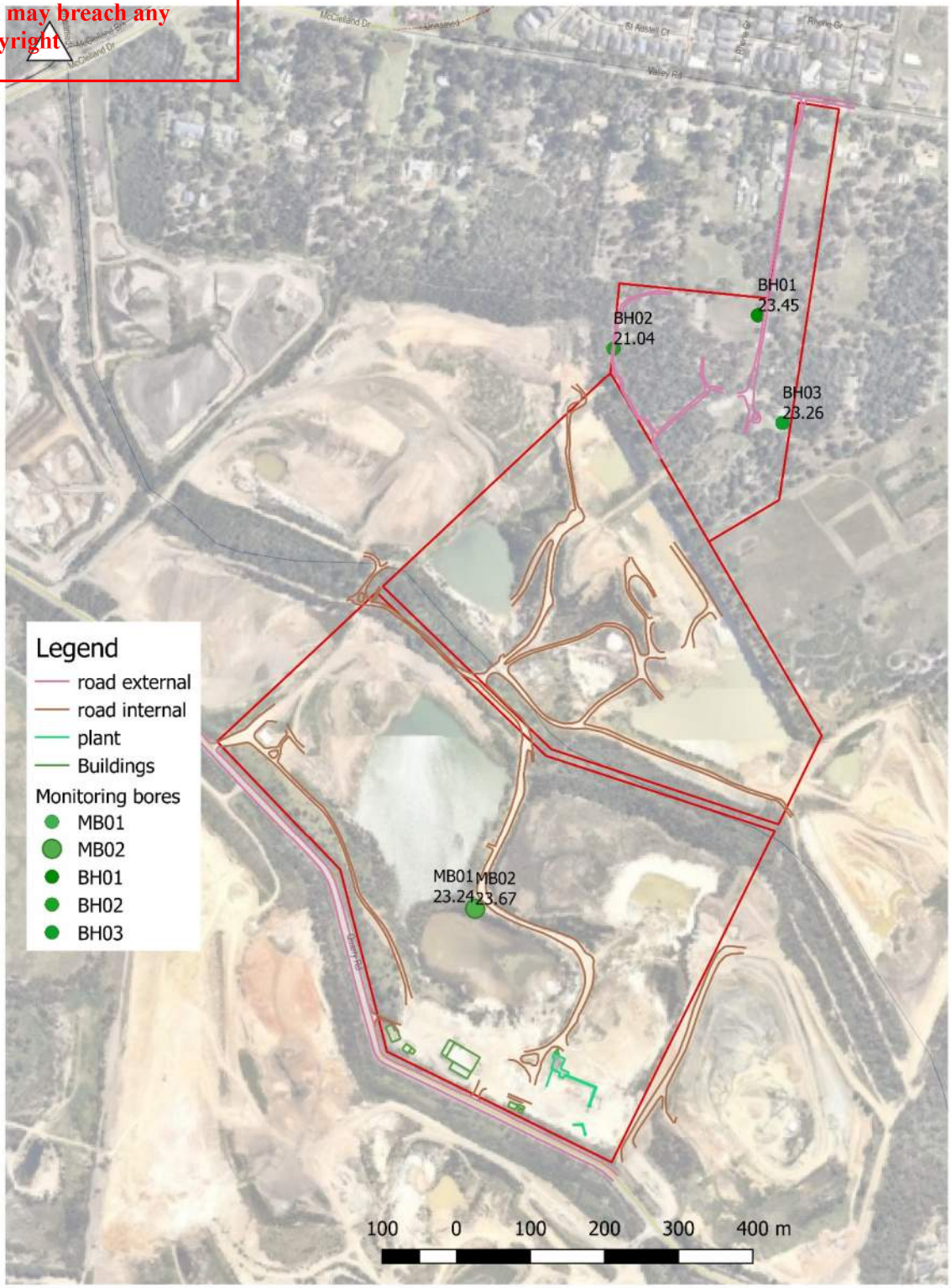


Figure 3-3 Water levels Feb 2021 (mAHD)

The only level available in 2019 is from MB01. A reduced level of 22.8mAHD is slightly higher than the 2002 and 2004 values. A reduced level of 23.24 mAHD was reported in the February 2021 monitoring event which suggests the water levels are now recovering south of Boggy Creek.

In summary, the limited data available limits the conclusions that can be made. The main outcomes are:

- The plots show an inwards hydraulic gradient towards the pits; and
- Groundwater levels are recovering,

3.3 Groundwater quality

Groundwater and surface water samples were analysed in 2002 and 2004. The results are presented in **Table 3-3**.

Table 3-3 Analytical results

Parameter	Units	MB01 2002*	MB01 2004*	MB01 2021	MB02 2002*	MB02 2004*	MB02 2021	MB03 2002*	MB03 2004*	MB04 2002*	MB04 2004*	MB05 2004*	MB06 2002*	MB06 2004*	BH01 2021	BH02 2021	BH03 2021	GWPUMP 2002*	GWPUMP 2004*	SW01*	SW01*	SW02*	SW02*	SW
		26/11/02	10/6/04	19/02/21	26/11/02	10/6/04	19/02/21	26/11/02	10/6/04	28/11/02	11/6/04	11/6/04	27/11/02	10/6/04	19/02/21	19/02/21	19/02/21	27/11/02	11/6/04	27/11/02	10/6/04	27/11/02	10/6/04	27/
pH		8	8.5		6.7	6.54		4.9	4.5	5.6	5.93	6.46	5.4	5.9				7.6	8.23	7.7.	7.50	6.5.	5.10	7
Total Dissolved Solids	mg/L	690	732	726	676	4760	837	240	9580	600	686	2490	490	1070	2380	954	874	230	216	250	242 .	380	530	2
Conductivity at 25 degC	uS/cm	-	-		490	-		-	-	-		-	-	-					-					
Suspended Solids	mg/L																			3	28	8	12	
Cations and Anions																								
Calcium	mg/L	12	12	7	5.8	11	14	2.8	3	11	12	12	6.9	9	15	15	8	5.1	4	15	10	8	14	
Magnesium	mg/L	6.3	8	4	13	20	32	4.6	6	24	26	115	24	29	2	4	6	4.0	4	9.6.	6	19	26	
Sodium	mg/L	260	222	231	69	78	192	44	51	150	131	300	110	118	190	104	125	69	67	56	32	97	98	
Potassium	mg/L	5.5	13	6	4.5	4	2	1.6	1	2.3	3	3	2.6	3	3	5	5	2.5	3	3.2.	3	3.2.	5	3
Total Alkalinity as CaCO3	mg/L	380	-	397	51	-	<1	<4	-	17	-	-	9	-	409	235	238	120	-	47		9		
Bicarbonate Alkalinity as CaCO3	mg/L	460	316	397	62	26	<1	<5	<1	20	10	43	11	9	409	235	238	140	123	57	36	11	<1	
Carbonate Alkalinity as CO3	mg/L	0	24	<1	0	<1	<1	0	<1	0	<1	<1	0	<1				0	<1	0	<1	0	<1	
Sulphate	mg/L	<20	1	1	<20	100	276	42	51	55	39	21	32	31	31	2	28	<20	9	<20	15	110	173	<
Chloride	mg/L	180	189	228	97	114	320	55	70	280	295	830	240	278	49	92	115	35	38	90	45	130	144	1
Total Anions	*meq/L*			*14.4*			*14.8*								*10.2*	*7.33*	*8.58*							
Total Cations	*meq/L*			*10.9*			*11.7*								*9.25*	*5.73*	*6.46*							
Ionic Balance	*%*			*13.9*			*11.5*								*4.86*	*12.3*	*14.1*							
Nutrient Parameters																								
Ammonia Nitrogen as N	mg/L	<0.4	0.1		<0.4	0.1		<0.6	0.21	<0.6	0.05	<0.01	<0.6	0.04				<0.6	0	<0.6	0.09	<0.6	0.01	<
Kjeldahl Nitrogen as N	mg/L	0.8			0.9	-		1.1		0.8	-	-	0.8					0.8		1.1.		1.4.		
Total Nitrogen as N	mg/L	0.8	0.1		1.2	0.2		1.1	0.2	0.8	<0.1	0.3	0.8	0.7				0.8	<0.1	1.1.	1.3.	1.4.	<0.1	
Total Phosphorus as P	mg/L	0.32	0.14		0.85	0.81		0.36	0.22	0.12	0.03	0.2	0.21	1.12				0.36	0.3	0.032	0.04	0.019	<0.01	0.
C.O.D.	mg/L	23	-		27	-		69	-	23	-	-	34					<4	-	26		8		
Total Organic Carbon	mg/L	2.1.	9		10	19		28	33	7.9.	4	13	3.6.	34				1.0	<1	9.4.	11	2.4.	<1	
Nitrite as N	mg/L	<0.2	<0.01		0.25	<0.01		<0.2	<0.01	<0.2	<0.01	<0.01	<0.2	<0.01				<0.2	<0.01	<0.2	0.08	<0.2	<0.01	<
Nitrate as N	mg/L	<0.007	<0.01		0.010	<0.01		<0.007	<0.01	<0.007	<0.01	0.02	<0.007	<0.01				<0.007	<0.01	<0.007	0.64	<0.007	<0.01	<0
Metals																								
Total Lead as Pb	mg/L	<0.06	----		<0.06	----		<0.06	----	<0.06	----	----	<0.06	----				<0.06	----	<0.06	0.003	<0.06	0.001	<0
Lead-Filtered			<0.001			<0.001			<0.001		<0.001	0.002		<0.001					<0.001		----			

Parameter	Units	MB01 2002*	MB01 2004*	MB01 2021	MB02 2002*	MB02 2004*	MB02 2021	MB03 2002*	MB03 2004*	MB04 2002*	MB04 2004*	MB05 2004*	MB06 2002*	MB06 2004*	BH01 2021	BH02 2021	BH03 2021	GWPUMP 2002*	GWPUMP 2004*	SW01*	SW01*	SW02*	SW02*	SW
Total Copper as Cu	mg/L	<0.01	----		<0.01	----		<0.01	----	<0.01	----	---	<0.01	----				<0.01	----	<0.01	0.004	<0.01	0.017	<0
Copper - Filtered			<0.001			0.001			0.001		0.001	0.003		<0.001					0.003		----		----	
Total Zinc as Zn	mg/L	<0.02	----		0.02	----		0.04	----	0.14	----	----	0.04	----				0.04	----	0.02	0.034	0.06	0.194	<0
Zinc - Filtered			0.010			0.032			0.035		0.052	0.037		0.024					0.877		---		----	
Total Iron as Fe	mg/L	0.02	----		0.10	----		0.04	---	3.8.	----	--	1.5.	----				0.24	---	0.70	2.53.	0.14	0.45	0
Iron - Filtered			<0.01			7.64.			6.36.		7.40	<0.01		8.69.					0.55		----		----	
Total Manganese as Mn	mg/L	0.01	--		0.07	----		0.02		0.20	----	----	0.22	----				0.03	----	<0.01	0.017	0.07	0.247	0
Manganese - Filtered			0.005			0.227			0.011		0.254	0.070		0.277					0.037		---		----	
Total Arsenic as As	mg/L	-	----		-	----		-	---	-	----	...	-						---		0.002		<0.001	
Arsenic - Filtered			0.002			0.006			0.004		0.003	<0.001		<0.001					<0.001		----			
Total Mercury as Hg	mg/L	-	----			----		-	----		----	----	-	----					----		<0.0001		<0.0001	
Mercury - Filtered			<0.0001			<0.0001			<0.0001		<0.0001	<0.0001		<0.0001					<0.0001		----		----	

*Source: URS 2002 and 2004

Piper trilinear plots from these monitoring events are reproduced in and .

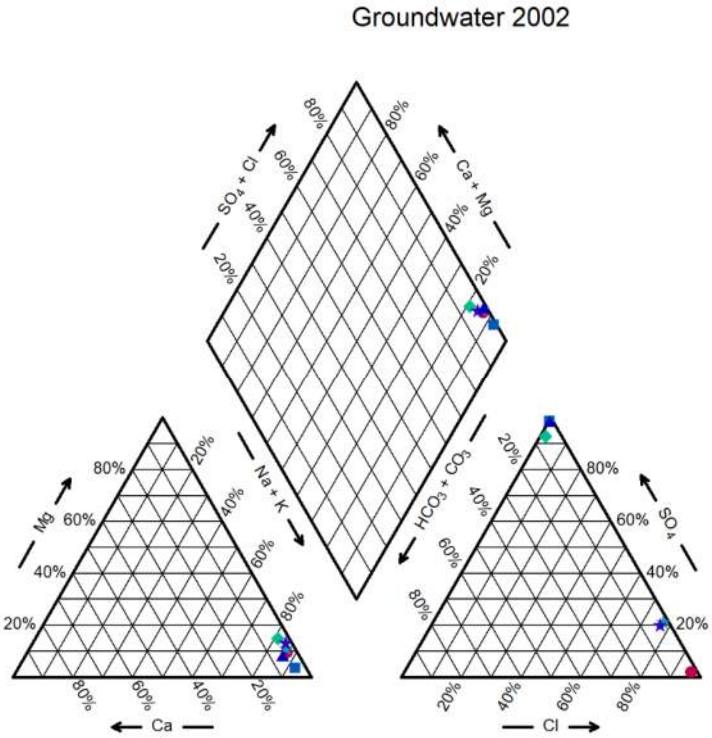


Figure 3-4 Piper trilinear diagram - groundwater 2002

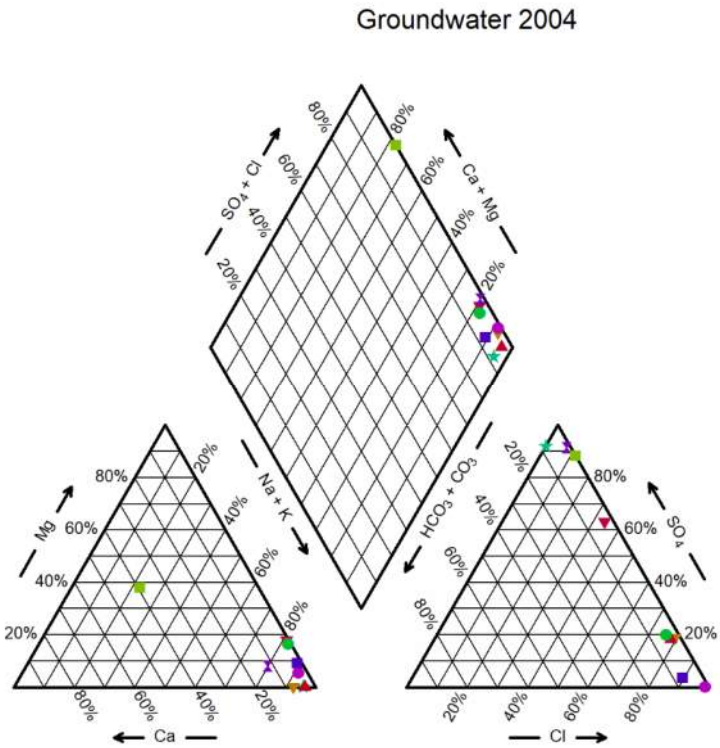


Figure 3-5 Piper trilinear diagram - groundwater 2004

The piper plot for the February 2021 sampling event is presented in **Figure 3-6.**

The Piper plots show that the major ion chemistry from the bedrock aquifer is distinct from the groundwater in the overlying sands. The bedrock groundwater shows a chemistry which is more akin to seawater. The samples from MB02 and MB03 (close to the pits) show higher sulphate concentrations than those that are distant to the pits, which is likely to be a result of the oxidation and dissolution of pyrite in the sand resulting from dewatering.

The TDS concentration reported by the laboratory for the most recent monitoring event in February 2021 is higher than what would have been expected from the reported field electrical conductivity. The TDS concentration is also inconsistent with the sum of the individual major ion constituents and is therefore considered to be incorrect. The TDS concentration used in the Piper plots is a value calculated from the electrical conductivity.

It was also noted that the reported bicarbonate concentration of <1 mg/L for MB02 appears to be low for a watertable aquifer which is hydraulically connected to a surface water body receiving surface water runoff. The bicarbonate concentration was confirmed by the analytical laboratory. These values will need to be confirmed by subsequent monitoring and more comprehensive quality assurance. It was noted that the samples from the new boreholes were very turbid and this is likely to have impacted the results. It is recommended that the bores be redeveloped prior to the next sampling.

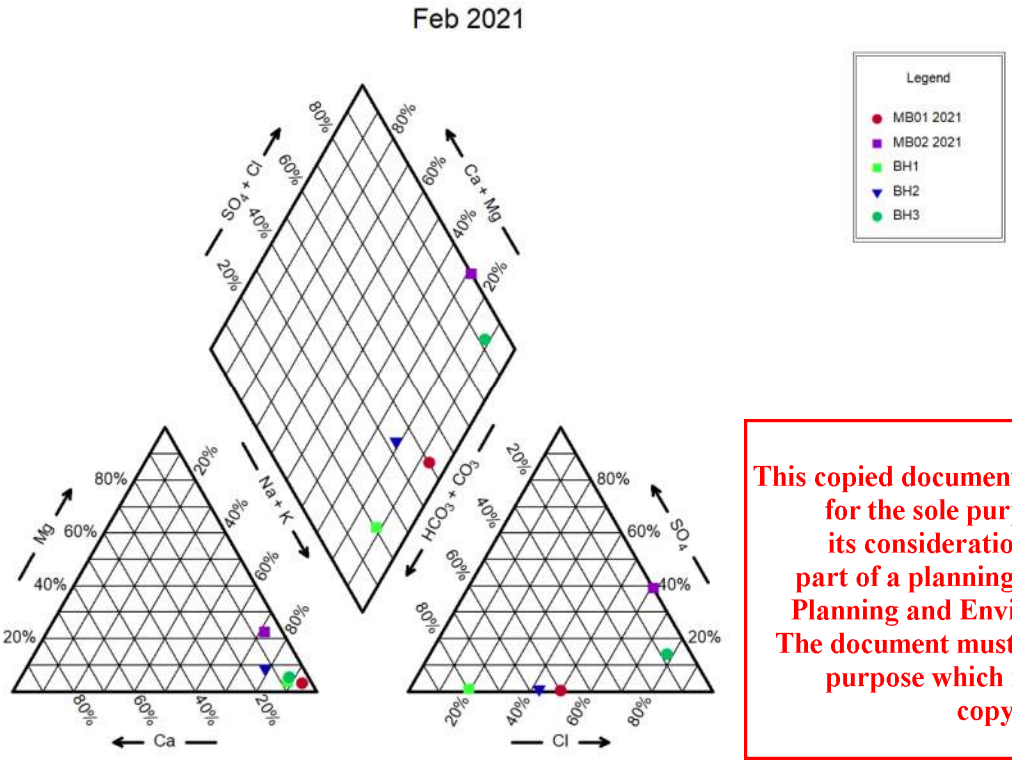


Figure 3-6 Piper Trilinear diagram - groundwater Feb 2021

Piper plots of surface water samples are presented in **Figure 3-7** and **Figure 3-8**. No conclusions can be drawn from these results. The monitoring network has recently been expanded to address this data gap.

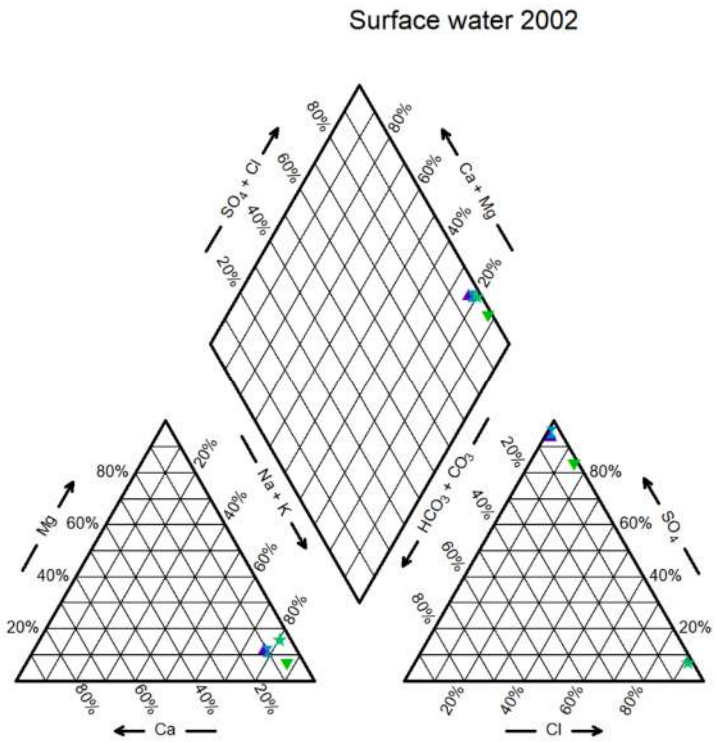


Figure 3-7 Piper Trilinear Diagram - Surface water 2002

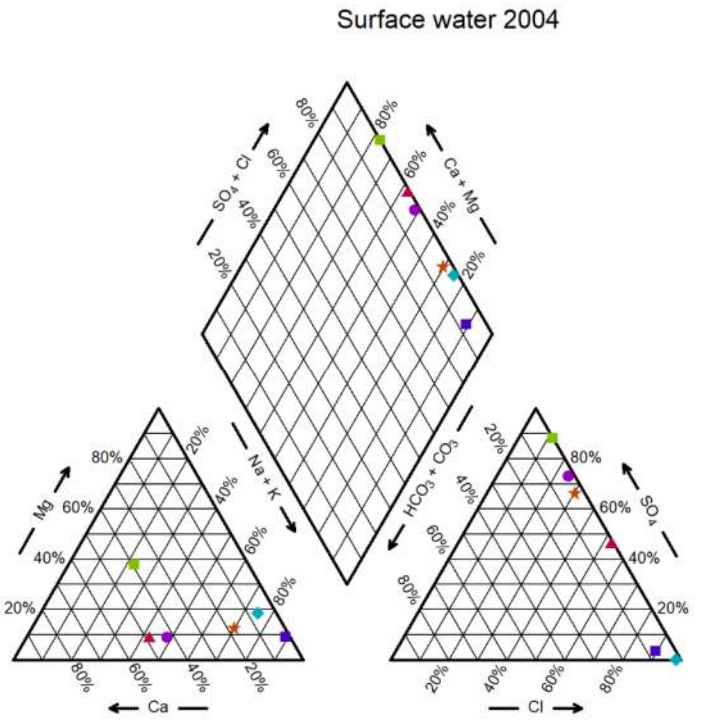


Figure 3-8 Piper Trilinear diagram - surface water 2004

4 Water balance

The water balance documented in this section is based on the pond configuration at a point in time. The groundwater regime is not a steady state scenario so should only be considered indicative. The model does however demonstrate that the inflows and outflows can balance depending on the water transfers, so there is confidence that water management is practical and achievable.

4.1 Inputs

4.1.1 Meteorological data

The rainfall data has been sourced from the Cranbourne South weather station (no. 086244) from the Bureau of Meteorology (BOM) website. Evaporation data was sourced from BoM's Gridded Dataset.

4.1.2 Pond areas

Pond areas were estimated using QGIS for the ponds (based on a 2018 aerial photo):

- north of Boggy Creek the pondage covered 2.09 ha; and
- south of Boggy Creek the area of dams was 7.27 ha.

4.1.3 Inflow pumped from South of Boggy Creek

To counter water losses from dredging operations, water is pumped from the ponds south of Boggy Creek to the ponds north of Boggy Creek. These estimates were verified by the quarry manager.

4.1.4 Runoff

The Langwarrin Quarry site topography has been extensively modified by quarrying operations. The original landscape was gently undulating with the land surface grading to Boggy Creek. Boggy Creek is now an elevated berm rising 10m above the surrounding quarry excavations. Given the topography of the area, it is estimated that the catchment area for the dredge pond (ie north of Boggy Creek) is approximately 117 ha. South of Boggy Creek, most of the site is occupied by Pond A leaving a remaining catchment area of 11 ha. Only a very small portion of the catchment is sealed so an assumed runoff coefficient (0.25) has been used. Catchment areas are shown in **Figure 4-1**.

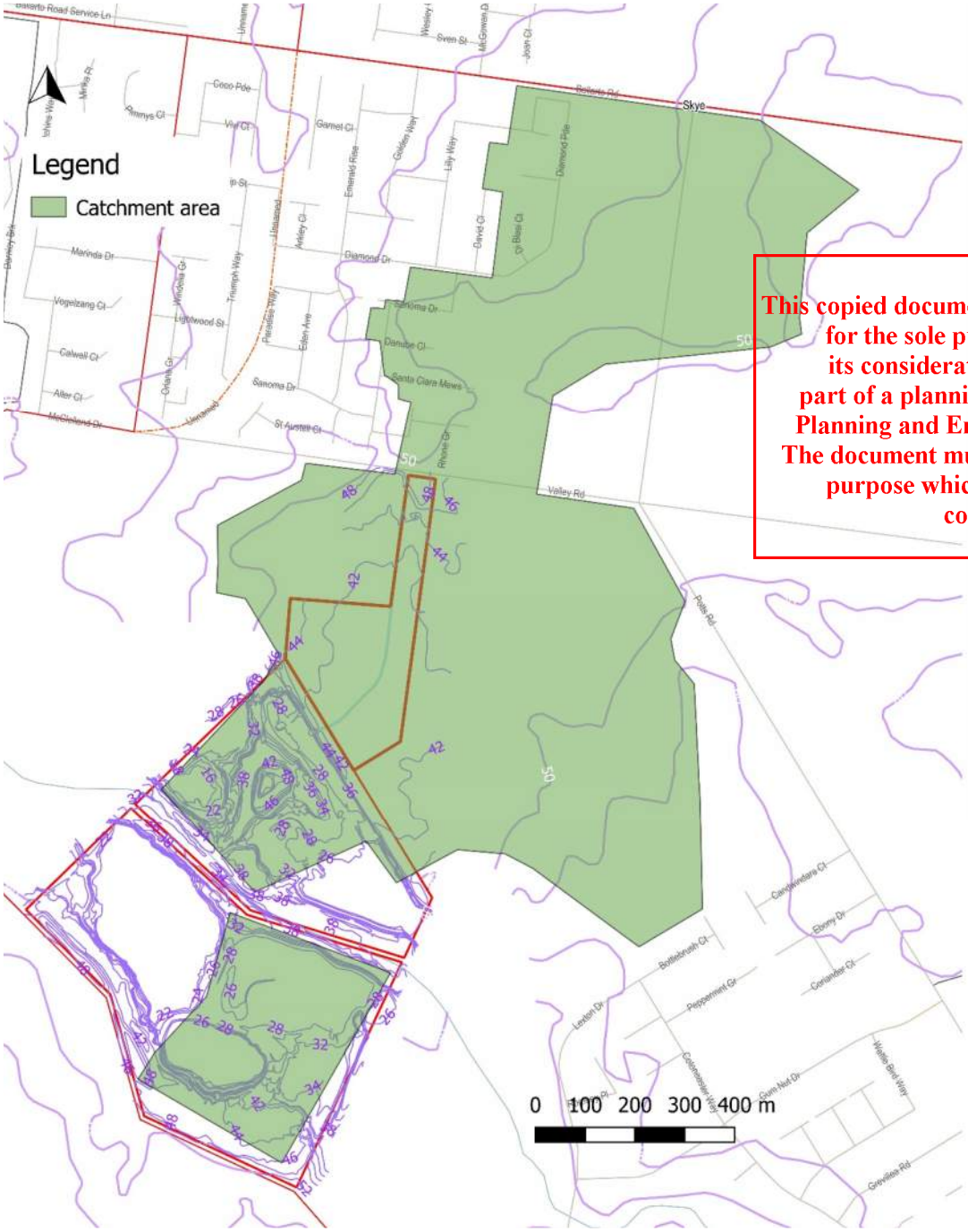


Figure 4-1 Catchment areas

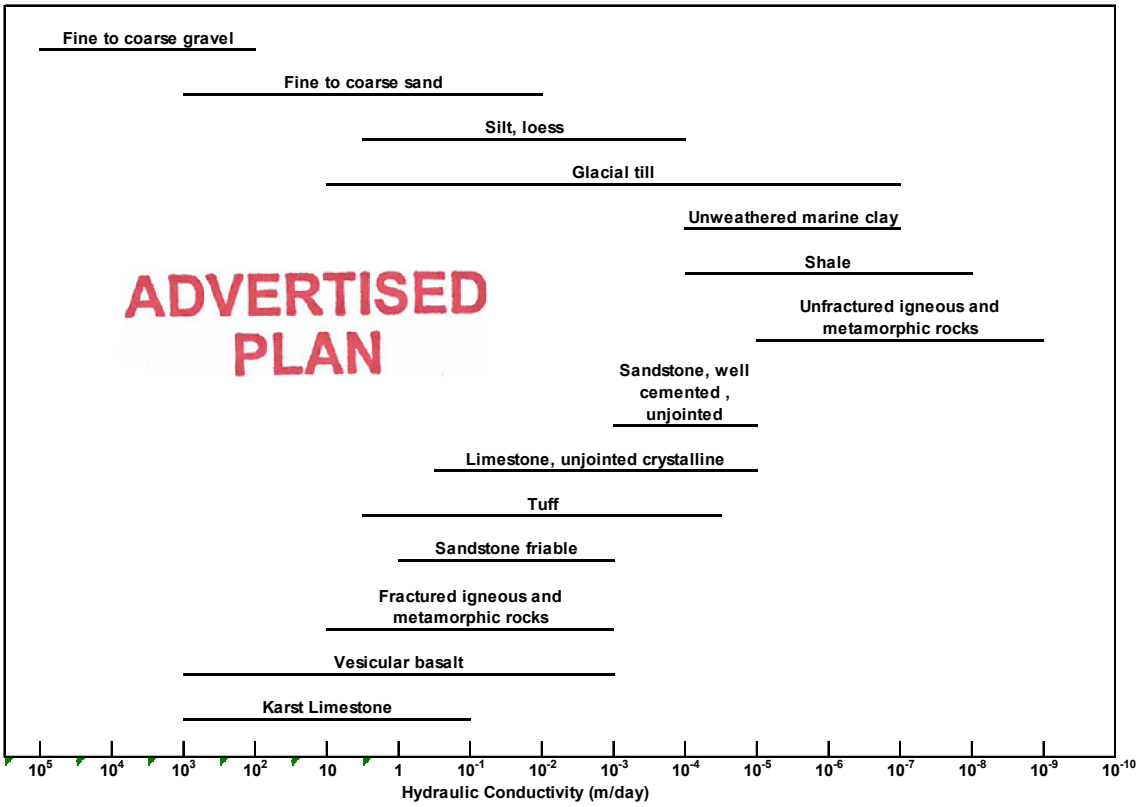
4.1.5 Groundwater outflow

Groundwater levels are now rebounding, in part because of inflow from the pond. The pond receives all the stormwater from the Valley Road drain. Groundwater outflow was calculated using a spreadsheet[2]

[2] https://www.google.com.au/url?sa=t&rct=j&q=&esrc=s&source=web&cd=11&ved=2ahUKEwic_YXk6LjkAhWm73MBHQwJAdgQFjAKegQICBAC&url=http%3A%2F%2Fwww.wsdot.wa.gov%2Fpublications%2Ffulltext%2FHydraulics%2FStormSHED%2FInfiltrationCalc.Spreadsheet.xls&usg=AOvVaw0oairxrpz1kTF-TVsA1ndk&cshid=1567656992590430

model. It should be noted that the pond dimensions, which are key inputs to this model, are variable given the pond levels are currently transient.

Hydrogeological conductivity was calculated from the Transmissivity values from the historic pump test data and the thickness of saturated screen from the borelogs from the URS investigations (**Table 4-1**). This correlates well with typical values reported in the literature (Driscoll 1987) as shown in **Figure 4-2**.



Source Driscoll 1987

Figure 4-2 Typical hydraulic conductivity values

Table 4-1 Calculation of hydraulic conductivity (k)

	Transmissivity (m^2/d)	Thickness	Hydraulic conductivity
MB02	86.37	7	12.39
MB03	133.69	6	22.28
MB04	1.78	7	0.254
MB05	2.85	2	1.425
Average k= 9.08			

4.1.6 Dredge and sand loss

Dredge loss is the volume of water extracted with the sand and pumped to the processing plant. Sand loss is the water which is removed from site contained within the washed sand product. This was estimated from the expected volume of sand (400,000 m^3/a), number of working days and the saturation of the sand (7%).

4.2 Results

The water balance for the Langwarrin Quarry site north of Boggy Creek is presented in **Table 4-2**.

Table 4-2 Water Balance

Inputs

Length of pond	160	m	
Width of pond	120	m	
Area of pond	19200	m^2	
Area of catchment*	1170963	m^2	
Runoff coefficient	0.25		
Infiltration rate	0.034263	m/day	
Daily GW outflow	658	m^3/d	(assumes pond is on average 3m deep)
Tonnage of sand	400,000	tpa	
Sand density	0.5	m^3/t	
Volume of sand	200,000	m^3/a	
Saturation	7%		
Daily return transfer	400	m^3/day	0.4 ML/day
Dredge loss	363.64	m^3/d	
Water loss with sand	14,000	m^3/a	
Daily water loss with sand	50.91	m^3/d	

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Days in month		31	28	31	30	31	30	31	31	30	31	30	31	
Work days in month		23	22	22	21	25	21	25	24	22	25	23	22	275
Evaporation $_{surface\ water}$	mm	144.15	156.8	163.4	87	62	51	55.8	71.3	93	124	141	170.5	
Mean Monthly rainfall (mm)	mm	47.3	47.4	46.7	64.1	68.4	72.7	70.9	75.9	76.6	76.2	61.9	64.1	
Inflow to ponds														
Incident rainfall into pond	m^3	908	910	897	1231	1313	1396	1361	1457	1471	1463	1188	1231	
Runoff	m^3	13847	13876	13671	18765	20023	21282	20755	22219	22424	22307	18121	18765	
Transfer from southern ponds	m^3	12400	11200	12400	12000	12400	12000	12400	12400	12000	12400	12000	12400	
Total inflow	m^3	**27155**	**25986**	**26968**	**31995**	**33737**	**34678**	**34517**	**36076**	**35895**	**36170**	**31309**	**32395**	**386881**
Outflow from ponds														
Pond evaporation	m^3	2768	3011	3137	1670	1190	979	1071	1369	1786	2381	2707	3274	
Groundwater outflow	m^3	20393	18420	20393	19735	20393	19735	20393	20393	19735	20393	19735	20393	
Dredge loss	m^3	8364	8000	8000	7636	9091	7636	9091	8727	8000	9091	8364	8000	
Loss with sand	m^3	1171	1120	1120	1069	1273	1069	1273	1222	1120	1273	1171	1120	
Total outflow	m^3	**32696**	**30550**	**32651**	**30111**	**31947**	**29420**	**31828**	**31711**	**30641**	**33138**	**31977**	**32787**	**379458**

5 Groundwater Management

Anecdotal accounts from long term residents in the area indicate that prior to quarrying the area was swampy suggesting a high watertable was present.

Extractive works at the Existing Site and at neighbouring sites have created a localised cone of depression in the watertable drawing in water from neighbouring properties. Site observations indicate the watertable is currently in the vicinity of 24 mAHD. The design of the pit layout incorporates consideration of the watertable elevation in the geotechnical assessment (presented as an Appendix of the Work Plan).

The Existing Site is currently being rehabilitated by refilling the voids to return the land surface to an elevation close to the original ground surface. As the surface area of the ponds decreases so does the volume of water lost to evaporation. Over time (subject to activities in surrounding properties) the watertable is expected recover to a new natural elevation that is expected to be similar to the original configuration.

The rate of watertable recovery will depend on:

- The rate of filling;
- Activities on neighbouring properties; and
- Aquifer properties of the local geology

Monitoring of the watertable elevation is required so that potential impacts on operations can be identified. Discussions with Southern Rural Water (29 January 2020) addressed the scope of the monitoring works required. These requirements are collated into a site-specific Groundwater Management Plan which is contained in **Appendix C**.

The three groundwater monitoring bores installed on the western, northern and eastern side of the pit are to be monitored for groundwater levels and quality for the duration of quarrying and rehabilitation of the site. Slug testing is to be undertaken on each of the bores, followed by a two day pump test on the northern bore to determine aquifer parameters.

The elevation of the monitoring point (top of casing, TOC) and ground level are to be surveyed relative to the Australian Height Datum (AHD) as soon as practicable.

The monitoring strategy is to collect a body of data early in the project to confirm the current hydrogeological model, followed by a regular monitoring program to identify changes.

5.1 Licensing

The Existing Site has a groundwater licence (BEE024907) for 102.4 ML with an operating Licence WLE038553 associated with bore WRK039045 near the processing plant. SRW have advised that this will need to be amended to include the new parcel of land. This will be undertaken once the Work Plan Variation is approved.

The application will include a groundwater impact assessment including consideration of impacts on neighbouring groundwater and surface water beneficial uses, including the environment and existing groundwater bores. The report will present a site conceptual model based on all available data including data from neighbouring sites where available, and a sensitivity analysis of key water balance parameters.

6 Discussion and conclusions

Limited hydrogeological data is available for the site. Monitoring bores installed approximately 20 years ago were not monitored subsequently and most have since been lost.

There is a high degree of uncertainty in the inputs to the water balance presented above, mainly in the area of the outflow from the ponds into the aquifer given the transient nature of the current situation. Ongoing works being undertaken by ResourceCo daily reduce the pond volumes which increases the water levels in the pond causing outflow into the surrounding geology. North of Boggy Creek the runoff from the large catchment area similarly results in outflows from the pond.

Notwithstanding the above, it is considered that there is a higher reliability in the sand loss figures, and this confirms that the extraction (14 ML) is well within the licensed allocation of 102.4 ML.

Following completion of this report and endorsement of the Work Plan regular monitoring will commence to confirm and enhance the existing hydrogeological model.

7 References

Driscoll, F. G. (1986). *Groundwater and Wells.* Minnesota: Johnson Division.

EPA Victoria. (2000). *Groundwater Sampling Guidelines.* EPA Publication 669.

EPA Victoria. (2009). *Sampling and analysis of Waters, Wastewaters, Soils and Wastes.* EPA Publication IWRG 701.

URS. (August 2004). *Groundwater and surface water sampling at Rocla and Aidan Graham Sites, Quarry Road, Langwarrin - Final Report.* letter report.

URS. (February 2003). *Site Investigations at Rocla and Aiden Graham Sites, Quarry Road, Langwarrin.*

Victorian Government. (2018). *State Environment Protection Policy (Waters).*

Appendix A Bore Logs

URS

MONITORING WELL MB01

URS Australia Ltd
658 Church St, Richmond, Vic
Phone (03) 9279 2888
Fax (03) 2979 2850

Drilling Contractor: AQUA DRILLING & GROUTING

Project Reference: Rocla Quarry Products
Project No.: 28628-008-5002

Client: Rocla
Location: Langwarrin

Logged By: CLS
Checked By:
Date Started: 06-11-02
Date Finished: 08-11-02

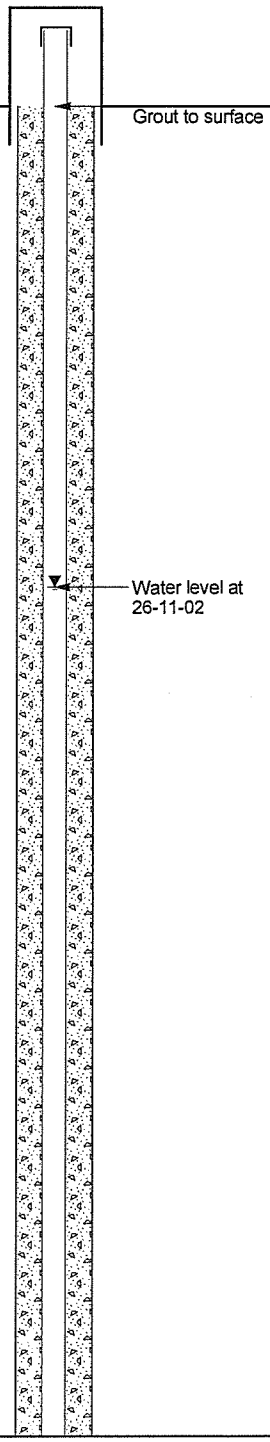
Bore Size: 170-100 mm
Total Depth: 37.00 m
Casing Size: 50 mm

Relative Level: mRL
Coordinates: mN
mE
Permit No:

Drill Type: Solid stem auger/Mud Rotary/ Air Down Hole Hammer
Drill Model: UDR-650
Drill Fluid: Mud/Air

Sample Interval / PID (ppm)	Sample ID	Legend	Classification	USC DESCRIPTION OF STRATA (Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), moisture content, consistency / density, and additional observations)	Moisture	Depth (m)
	Solid Stem Auger		CH	sandy CLAY; silty with fine grained quartz sand, dark brown, grey, medium to high plasticity, firm, moist	M	0
			SC	sandy CLAY to clayey SAND; fine grained quartz sand, dark grey, medium plasticity, soft, moist, trace black organic material	M	1
				clayey SAND; fine grained quartz sand, lighter grey, medium-low plasticity, soft, moist	M	2
			SP	SAND; clean white/grey fine to medium grained quartz sand, grains are rounded and well sorted, loose, moist	M	3
				very moist, slightly coarser grained than above		4
				light grey, very moist - wet	M/W	5
	Mud Rotary			with trace orange and grey clay	W	6
						7
						8
						9

WELL CONSTRUCTION DETAILS



URS

MONITORING WELL MB01

URS Australia Ltd
658 Church St, Richmond, Vic
Phone (03) 9279 2888
Fax (03) 9279 2850

Project No.: 28628-008-5002

Project Reference: Rocla Quarry Products

Sample Interval PID (ppm)	Sample ID	Legend	Classification	USC DESCRIPTION OF STRATA Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), moisture content, consistency / density, and additional observations	Moisture	Depth (m)	WELL CONSTRUCTION DETAILS
			SP-SC	SAND with clay; fine quartz sand with grey clay	W	10	
				as above, grey clay content increasing, trace siltstone fragments up to 0.5cm across		11	
				clay and siltstone content increasing		12	
				SAND; fine to medium quartz sand and orange siltstone fragments up to 0.5cm across	W	13	
			SILTST	SILTSTONE; EW-HW siltstone, drilling becoming harder, consists of soft clay and sand fragments of grey siltstone and harder orange very fine grained sandstone to siltstone, trace fine sand	W	14	
	Air Down Hole Hammer			dark grey, moist, firm to soft clay with some hard siltstone, loose	M	16	
				lighter grey, dry-moist, loose, medium to high strength siltstone grading to darker grey and slightly drier with depth	D/M	17	
				alternating light grey and dark grey siltstone bands, slightly more moist	M	19	
						20	
						21	

URS

MONITORING WELL MB01

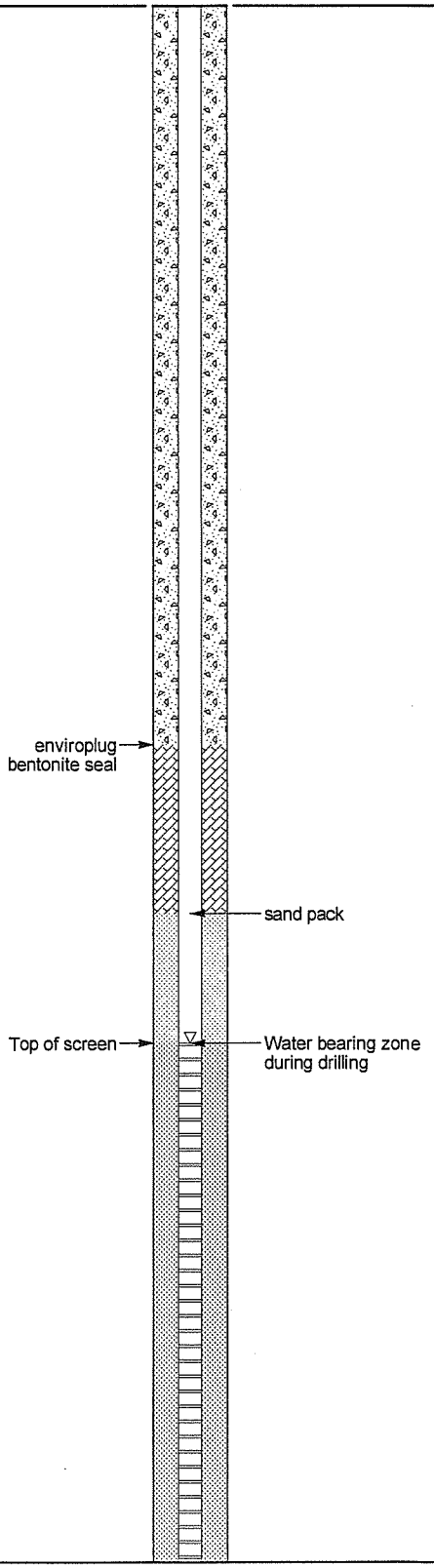
URS Australia Ltd
658 Church St, Richmond, Vic
Phone (03) 9279 2888
Fax (03) 9279 2850

Project No.: 28628-008-5002

Project Reference: Rocla Quarry Products

Sample Interval PID (ppm)	Sample ID	Legend	Classification	USC DESCRIPTION OF STRATA Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), moisture content, consistency / density, and additional observations	Moisture	Depth (m)
				dark grey-brown, moist to very moist		22
						23
				light brown to dark grey and brown, becoming more moist with depth		24
						25
						26
						27
						28
				moist to wet	M/W	29
				drier than above, slightly lighter grey changing to alternating dark grey and light grey siltstone bands with depth	M	30
						31
						32
						33

WELL CONSTRUCTION DETAILS



URS

MONITORING WELL MB01

URS Australia Ltd
658 Church St, Richmond, Vic
Phone (03) 9279 2888
Fax (03) 9279 2850

Project No.: 28628-008-5002

Project Reference: Rocla Quarry Products

Sample Interval PID (ppm)	Sample ID	Legend	Classification	USC DESCRIPTION OF STRATA Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), moisture content, consistency / density, and additional observations	Moisture	Depth (m)	WELL CONSTRUCTION DETAILS
				dark grey, very moist		34 35 36 37 38 39 40 41 42 43 44 45	sand base →

URS

MONITORING WELL MB02

URS Australia Ltd
658 Church St, Richmond, Vic
Phone (03) 9279 2888
Fax (03) 2979 2850

Drilling Contractor: AQUA DRILLING & GROUTING

Logged By: CLS
Checked By:
Date Started: 11-11-02
Date Finished: 11-11-02

Bore Size: 200 mm
Total Depth: 12.00 m
Casing Size: 50 mm

Project Reference: Rocla Quarry Products
Project No.: 28628-008-5002

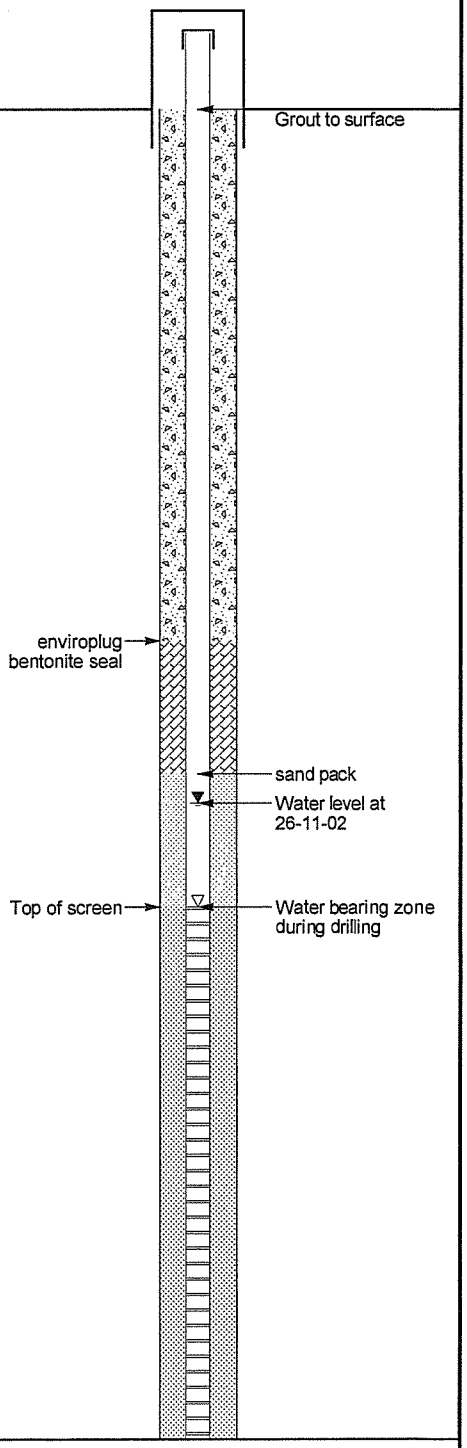
Relative Level: mRL
Coordinates: mN
mE
Permit No:

Client: Rocla
Location: Langwarrin

Drill Type: Hollow stem auger
Drill Model: UDR-650
Drill Fluid: water

Sample Interval PID (ppm)	Sample ID	Legend	Classification	USC DESCRIPTION OF STRATA (Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), moisture content, consistency / density, and additional observations)	Moisture	Depth (m)
			CH	sandy CLAY; fine grained quartz sand, orange brown, medium to high plasticity, soft to firm, moist	M	0
			SC	sandy CLAY to clayey SAND; fine grained quartz sand, dark grey brown, medium to high plasticity, soft, moist, trace black organic material	M	1
			SP	SAND; clean white/grey fine to medium grained quartz sand, grains are sub-rounded and well sorted, loose, moist, with some mottled orange grey colour with depth	M	2
						3
				light grey, very moist - wet	M/W	4
						5
				wet	W	6
						7
						8
						9

WELL CONSTRUCTION DETAILS



URS

MONITORING WELL MB02

URS Australia Ltd
658 Church St, Richmond, Vic
Phone (03) 9279 2888
Fax (03) 9279 2850

Project No.: 28628-008-5002

Project Reference: Rocla Quarry Products

Sample Interval PID (ppm)	Sample ID	Legend	Classification	USC DESCRIPTION OF STRATA Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), moisture content, consistency / density, and additional observations	Moisture	Depth (m)	WELL CONSTRUCTION DETAILS
						10	
						11	
						12	sand base
						13	
						14	
						15	
						16	
						17	
						18	
						19	
						20	
						21	

URS

MONITORING WELL MB03

URS Australia Ltd
658 Church St, Richmond, Vic
Phone (03) 9279 2888
Fax (03) 2979 2850

Drilling Contractor: AQUA DRILLING & GROUTING

Project Reference: Rocla Quarry Products
Project No.: 28628-008-5002

Client: Rocla
Location: Langwarrin

Logged By: CLS
Checked By:
Date Started: 11-11-02
Date Finished: 11-11-02

Bore Size: 200 mm
Total Depth: 22.00 m
Casing Size: 50 mm

Relative Level: mRL
Coordinates: mN
mE
Permit No:

Drill Type: Hollow stem auger
Drill Model: UDR-650
Drill Fluid: water

Sample Interval PID (ppm)	Sample ID	Legend	Classification	USC DESCRIPTION OF STRATA (Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), moisture content, consistency / density, and additional observations)	Moisture	Depth (m)
			SM	silty SAND; orange brown mottled, dry, loose	D	0
			SP-SC	SAND with clay/silt; light grey brown fine sand with trace clay or silt, moist, loose	M	
				slightly darker grey	M	1
				grey white, more moist, slightly less clay/silt	M	2
			SP	SAND; light grey to white, fine grained, very moist, loose, trace clay/silt content decreasing to zero with depth	M	3
	MB03_7m					4
						5
						6
						7
						8
						9

WELL CONSTRUCTION DETAILS

Grout to surface

WELL LOGS.GPJ WCC_AUS.GDT 05/03/03

URS

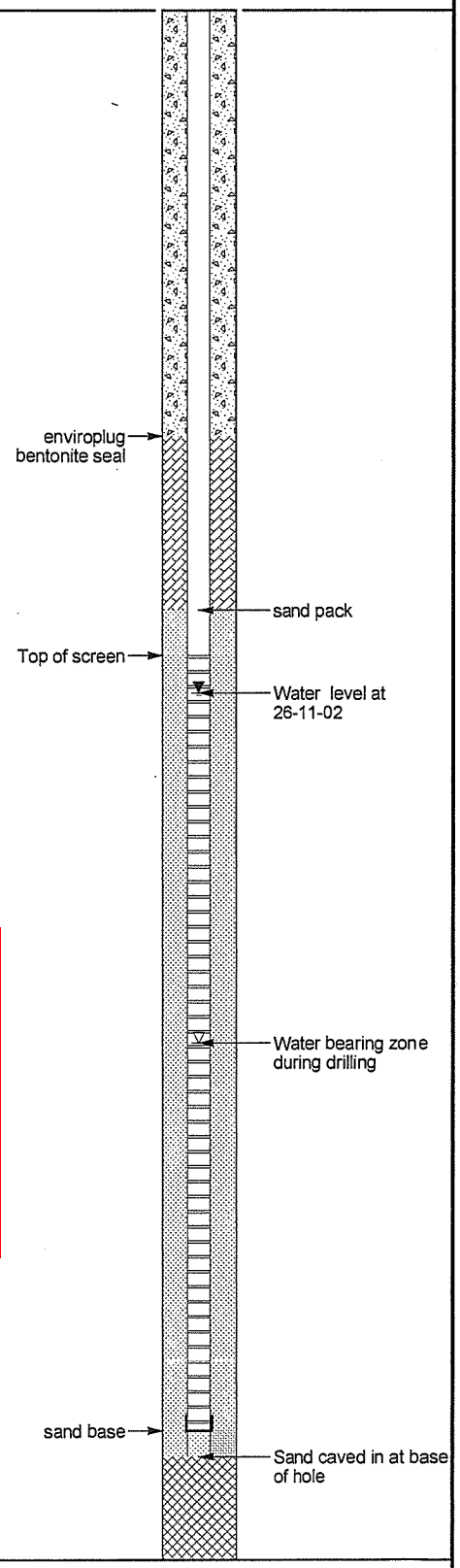
MONITORING WELL MB03

URS Australia Ltd
658 Church St, Richmond, Vic
Phone (03) 9279 2888
Fax (03) 9279 2850

Project No.: 28628-008-5002

Project Reference: Rocla Quarry Products

Sample Interval PID (ppm)	Sample ID	Legend	Classification	USC DESCRIPTION OF STRATA Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), moisture content, consistency / density, and additional observations	Moisture	Depth (m)	WELL CONSTRUCTION DETAILS
	MB03_12					12	
	MB03_18			wet	W	18	



URS

MONITORING WELL MB04

URS Australia Ltd
658 Church St, Richmond, Vic
Phone (03) 9279 2888
Fax (03) 2979 2850

Drilling Contractor: AQUA DRILLING & GROUTING

Project Reference: Rocla Quarry Products
Project No.: 28628-008-5002

Client: Rocla
Location: Langwarrin

Logged By: CLS
Checked By:
Date Started: 12-11-02
Date Finished: 12-11-02

Bore Size: 200 mm
Total Depth: 16.50 m
Casing Size: 50 mm

Relative Level: mRL
Coordinates: mN
mE
Permit No:

Drill Type: Hollow stem auger
Drill Model: UDR-650
Drill Fluid: water

Sample Interval PID (ppm)	Sample ID	Legend	Classification	USC DESCRIPTION OF STRATA (Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), moisture content, consistency / density, and additional observations)	Moisture	Depth (m)
			FILL	FILL; road base: grey yellow siltstone aggregate and a pale orange pink silty sand to clayey silt dry to progressively moist matrix	D/M	0
				becoming more clayey with orange white mottles, dry - moist, firm, moderate plasticity, and some siltstone aggregate gravel	D/M	1
			SP	SAND; light grey pink, fine grained, dry, loose	D	2
				slightly darker, with trace silt/clay	D	3
			CH	CLAY; light grey, firm, moist, high plasticity	M	
			SC	Clayey SAND; colour changes from pink yellow to grey pink with depth, fine grained sand with trace silt, moist, low to very low plasticity, loose	M	4
						5
						6
						7
			SP	SAND; grey pink to grey white with depth, trace to no clay with depth, moist to very moist, loose	M	8
						9

WELL CONSTRUCTION DETAILS

Grout to surface
enviroplug bentonite seal
sand pack
water level at 26-11-02

URS

MONITORING WELL MB04

URS Australia Ltd
658 Church St, Richmond, Vic
Phone (03) 9279 2888
Fax (03) 9279 2850

Project No.: 28628-008-5002

Project Reference: Rocla Quarry Products

Sample Interval PID (ppm)	Sample ID	Legend	Classification	USC DESCRIPTION OF STRATA Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), moisture content, consistency / density, and additional observations	Moisture	Depth (m)	WELL CONSTRUCTION DETAILS
				SAND; wet, grey white, loose	W	10	Top of screen
						11	
						12	Water bearing zone during drilling
						13	
						14	
						15	
						16	Caved in material
						17	
						18	
						19	
						20	
						21	

URS

MONITORING WELL MB05

URS Australia Ltd
658 Church St, Richmond, Vic
Phone (03) 9279 2888
Fax (03) 2979 2850

Drilling Contractor: AQUA DRILLING & GROUTING

Logged By: CLS
Checked By:
Date Started: 13-11-02
Date Finished: 13-11-02

Bore Size: 200 mm
Total Depth: 6.00 m
Casing Size: 50 mm

Project Reference: Rocla Quarry Products
Project No.: 28628-008-5002

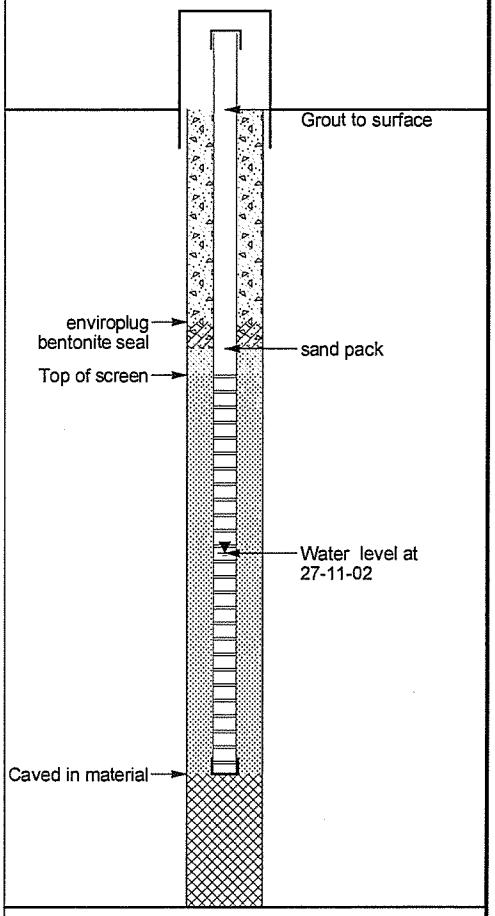
Relative Level: mRL
Coordinates: mN
mE
Permit No:

Client: Rocla
Location: Langwarrin

Drill Type: Hollow stem auger
Drill Model: UDR-650
Drill Fluid: water

Sample Interval PID (ppm)	Sample ID	Legend	Classification	USC DESCRIPTION OF STRATA (Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), moisture content, consistency / density, and additional observations)	Moisture	Depth (m)
			SM	silty SAND; dark grey, dry at suface to slightly moist with depth, lose, some organic matter	D/M	0
			SP	SAND; dark grey, and white mottled moist sand. Loose, some organic matter	M	1
				SAND; light grey, moist.	M	2
			SC	clayey SAND; light grey moist (much less clay than above and much moister than above)	M	3
				clayey SAND; As above, lighter grey yellow, clay content decreasing slightly moister than above.	M/W	4
			SILTST	EW SILTSTONE; light grey/white, less moist than above, harder to drill, crumbles to loose - vv low plasticity clay clods.	M	5
				REFUSAL: SILTSTONE; harder to drill, light grey/yellow, highly weathered siltstone/sandstone. Dry to slightly moist.	D/M	6
						7
						8
						9

WELL CONSTRUCTION DETAILS



URS

MONITORING WELL MB06

URS Australia Ltd
658 Church St, Richmond, Vic
Phone (03) 9279 2888
Fax (03) 2979 2850

Project Reference: **Rocla Quarry Products**
Project No.: **28628-008-5002**

Client: **Rocla**
Location: **Langwarrin**

Drilling Contractor: **AQUA DRILLING & GROUTING**

Logged By: **CLS**
Checked By:
Date Started: **13-11-02**
Date Finished: **13-11-02**

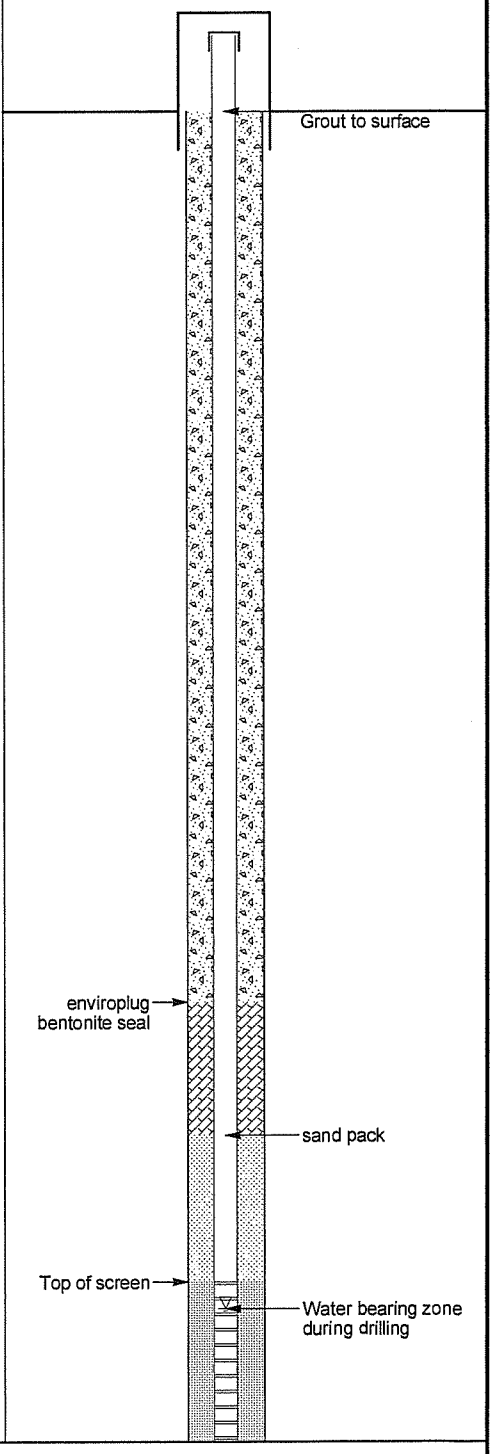
Bore Size: **200 mm**
Total Depth: **15.00 m**
Casing Size: **50 mm**

Relative Level: **mRL**
Coordinates: **mN**
mE
Permit No:

Drill Type: **Hollow stem auger**
Drill Model: **UDR-650**
Drill Fluid: **water**

Sample Interval / PID (ppm)	Sample ID	Legend	Classification	USC DESCRIPTION OF STRATA (Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), moisture content, consistency / density, and additional observations)	Moisture	Depth (m)
			SM	silty SAND; orange/brown, loose dry, becoming darker with road aggregate.	D	0
				silty SAND; lighter than above	D	
			SC	SAND; loose and dry to very slightly moist. Light brown/grey to darker more organic brown.	D/M	1
				clayey SAND; slightly moister, light pink grey loose containing harder grey/orange clayey sand clods and firmer texture	D/M	2
				clayey SAND; white/grey and light pink. Clay content is slightly less than above and white grey sand very loose and with trace clay.	D/M	3
				SAND; loose white and slightly moist with trace clays	D/M	4
				SAND; pale pink/grey & white/yellow. Moist and loose with trace clay.	M	5
				SAND; slightly darker pink orange. Loose and moist	M	6
						7
				SAND; light grey pink. moist to very moist and loose	M	8
				SAND; grey white sand. Very moist.	M/W	9

WELL CONSTRUCTION DETAILS



WELL_LOGS.GPJ WCC_AUS.GDT 05/03/03

URS

MONITORING WELL MB06

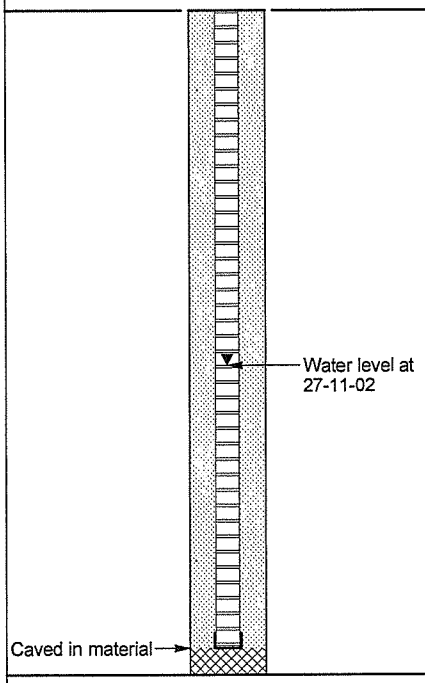
URS Australia Ltd
658 Church St, Richmond, Vic
Phone (03) 9279 2888
Fax (03) 2979 2850

Project No.: 28628-008-5002

Project Reference: Rocla Quarry Products

Sample Interval PID (ppm)	Sample ID	Legend	Classification	USC DESCRIPTION OF STRATA Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), moisture content, consistency / density, and additional observations	Moisture	Depth (m)
						10
			SC	clayey SAND; wet.	W	11
						12
						13
				clayey SAND; light grey white sand to clayey sand.	W	14
						15
						16
						17
						18
						19
						20
						21

WELL CONSTRUCTION DETAILS



BOREHOLE LOG BH01

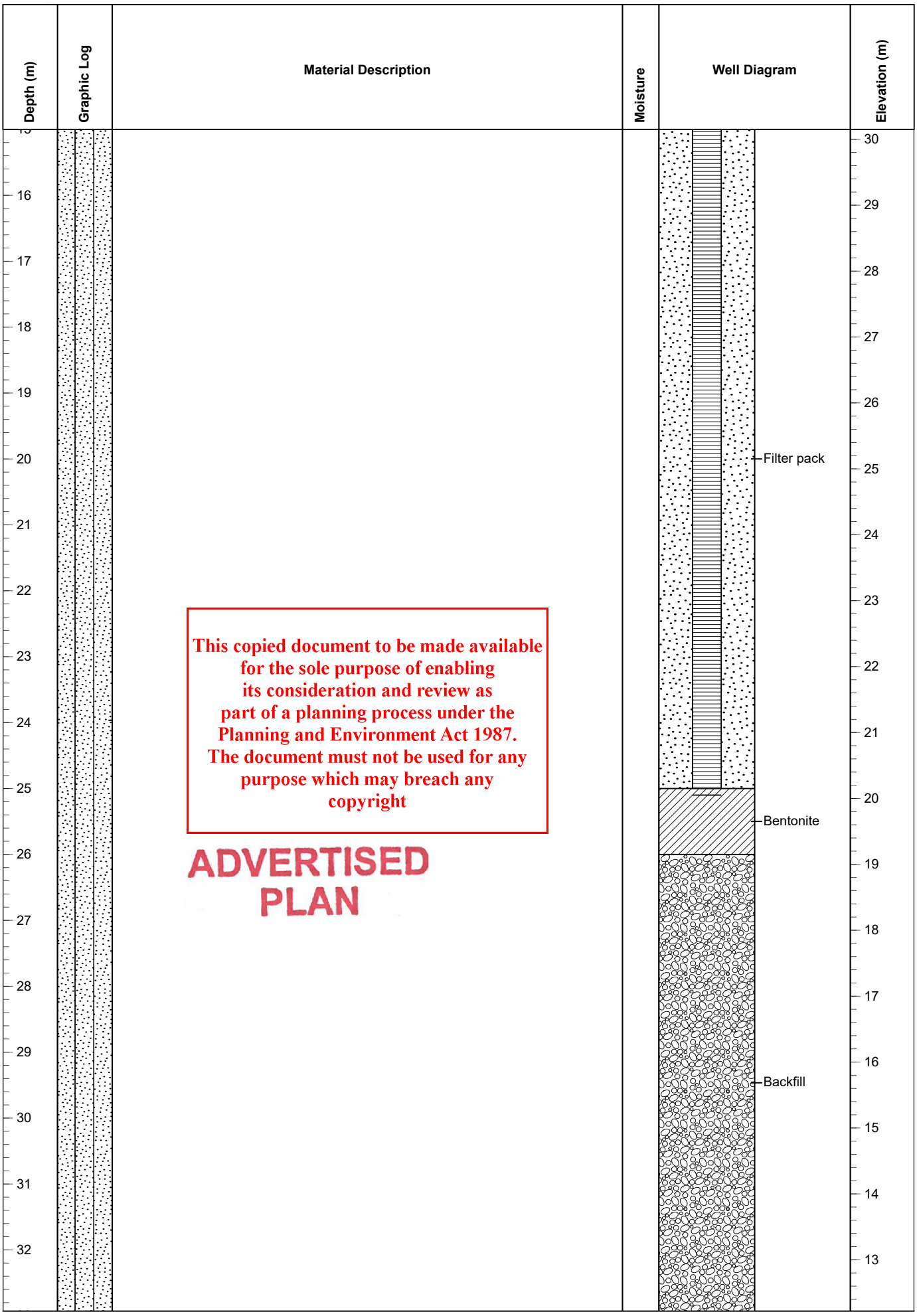
PROJECT NUMBER 30277	**DRILLING DATE** 12/10/2021	**COORDINATES** E.341861m N.5778503m
PROJECT NAME Langwarrin Hydro	**TOTAL DEPTH** 50m	**COORD SYS** UTM
CLIENT Hanson	**DIAMETER** 150mm	**COMPLETION** 12/10/21
ADDRESS 60 Valley Road, Langwarrin	**CASING** 50mm uPVC	**SURFACE ELEVATION** 40.278m
LICENCE NO. WRK122941	**SCREEN** uPVC Factory Slotted	**WELL TOC** 41.078m

COMMENTS Drilled by Star Drilling. Logged by CMW Geosciences

LOGGED BY SK
CHECKED BY PC

Depth (m)	Graphic Log	Material Description	Moisture	Well Diagram	Elevation (m)
0		TOPSOIL: Gravelly Clay: MIXTURE OF SOIL AND COBBLES, sub rounded, flat, very hard; medium plasticity, dark grey with black,; gravel, fine to coarse grained, angular to subangular.	PL	Filter pack	45
1		SAND: fine grained, angular to subangular, pale brown; trace clay; trace fine to medium grained gravel.	M		44
		SANDY CLAY: medium plasticity, dark brown black, sand, fine grained, angular to subangular with silt.	PL		
2		CLAYEY SAND: fine to medium grained, angular to subangular, pale grey mottled orange brown; clay, low plasticity; with silt.	W		43
3		SILTY SAND: fine to medium grained, angular to rounded, pale grey white; silt, low plasticity.			42
4					41
5				Grout	40
6					39
7					38
8					37
9				Bentonite	36
10					35
11					34
12				Filter pack	33
13					32
14					31
15					

BOREHOLE LOG BH01



BOREHOLE LOG BH01

Depth (m)	Graphic Log	Material Description	Moisture	Well Diagram	Elevation (m)
33					12
34					11
		SAND: fine to coarse grained, angular to rounded, pale grey white with pale brown; trace gravel, fine grained.			
35		SILTY SAND: fine to medium grained, angular to rounded, pale brown; silt, low plasticity; trace clay.			10
36		SILTY SAND: fine to medium grained, angular to rounded, pale white streaked pale brown; silt, low plasticity.			9
37		SAND: fine to coarse grained, angular to rounded, pale grey white; with silt.			8
		SANDY CLAY: medium plasticity, pale brown mottled pale grey; sand, file to medium grained, angular to rounded; with silt.	PL		
38		SILTY CLAY: high plasticity, pale brown speckled pale grey; trace sand, fine grained.			7
		SILT: low plasticity, pale grey; with clay; trace fine grained sand.			
39					6
40		SANDY SILT: low plasticity, pale grey; sand, fine grained, angular.			5
41		SILTY SAND: fine to medium grained, angular to rounded, pale grey mottled pale brown; silt, low plasticity.	W	Backfill	4
42		SILTY SAND: medium to coarse grained, angular, grey with grey black; silt, low plasticity; with clay.			3
43		SAND: coarse grained, angular; grey black, with silt; with fine to medium grained gravel, angular.			2
		SILTY SAND: medium to coarse grained, angular, grey black; silt, low plasticity; with clay.			
44		CLAYEY SAND: medium to coarse grained, angular to rounded, grey black; clay, low plasticity; with gravel; fine to coarse grained; with silt.			1
45					0
46					-1
47					-2
48		GRAVELLY CLAY: low plasticity, grey with pale grey; gravel, dine to medium grained, angular; trace fine to medium grained sand.	PL		-3
49					-4
		BASALT: grey.			
50		CLAYEY GRAVEL: medium to coarse grained, angular, pale brown with pale grey; clay, low plasticity; with sand; fine to medium grained sand.	W		-5
		Termination Depth at:50 m			

BOREHOLE LOG BH02

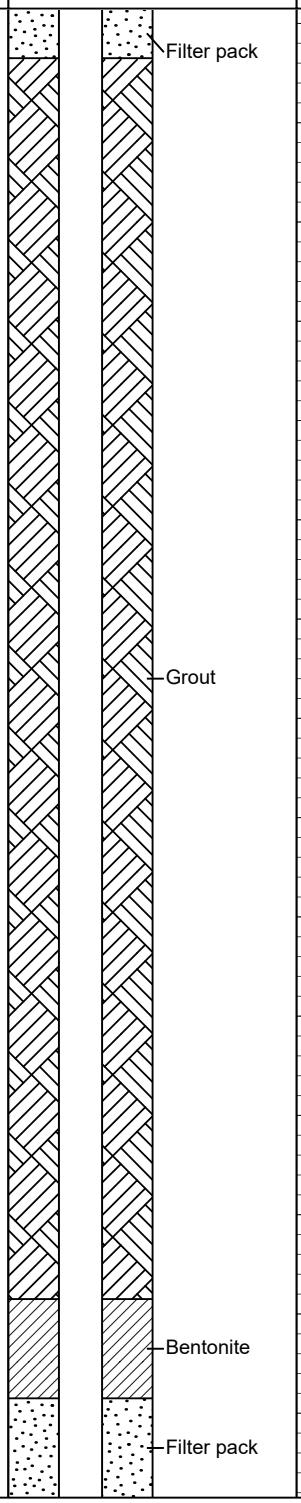
PROJECT NUMBER 30277	**DRILLING DATE** 14/10/2021	**COORDINATES** E.341667m N.5778454m
PROJECT NAME Langwarrin Hydro	**TOTAL DEPTH** 50.5m	**COORD SYS** UTM
CLIENT Hanson	**DIAMETER** 150mm	**COMPLETION** 14/10/21
ADDRESS 60 Valley Road, Langwarrin	**CASING** 50mm uPVC	**SURFACE ELEVATION** 43.896m
LICENCE NO. WRK122940	**SCREEN** uPVC Factory Slotted	**WELL TOC** 44.696m

COMMENTS Drilled by Star Drilling. Logged by CMW Geosciences

LOGGED BY SK
CHECKED BY PC

Depth (m)	Material Description	Moisture	Elevation (m)
0	TOPSOIL: SILTY SAND: fine grained, angular to rounded, pale brown; silt, low plasticity; with clay; trace roots.	M	45
1	SILTY SAND: fine grained, angular, grey; silt, low plasticity; with clay.		44
	SAND: fine to medium grained, angular, pale grey white; with silt, low plasticity.		
2	SILTY SAND: fine to medium grained, angular to subangular, orange brown; silt, low plasticity, with clay; with fine to medium grained gravel.		43
3	SILTY SAND: fine to medium grained, angular to subangular, orange brown mottled white; silt, low plasticity; with clay; trace fine gravel.		42
4			41
5	SILTY SAND: fine to medium grained, angular to subangular, dark orange brown mottled grey; silt, low plasticity; trace clay.		40
6	SILTY SAND: fine to medium grained, angular to subangular, orange brown mottled white; silt, low plasticity; with clay; trace fine grained gravel.		39
7			38
8	SILTY SAND: fine to medium grained, angular to subangular, pale brown black; silt, low plasticity.		37
9			36
10			35
11	SAND: fine to medium grained, angular to subangular, pale brown streaked pale grey; with silt.		34
12			33
13			32
14			31
15			

Well Diagram



BOREHOLE LOG BH02

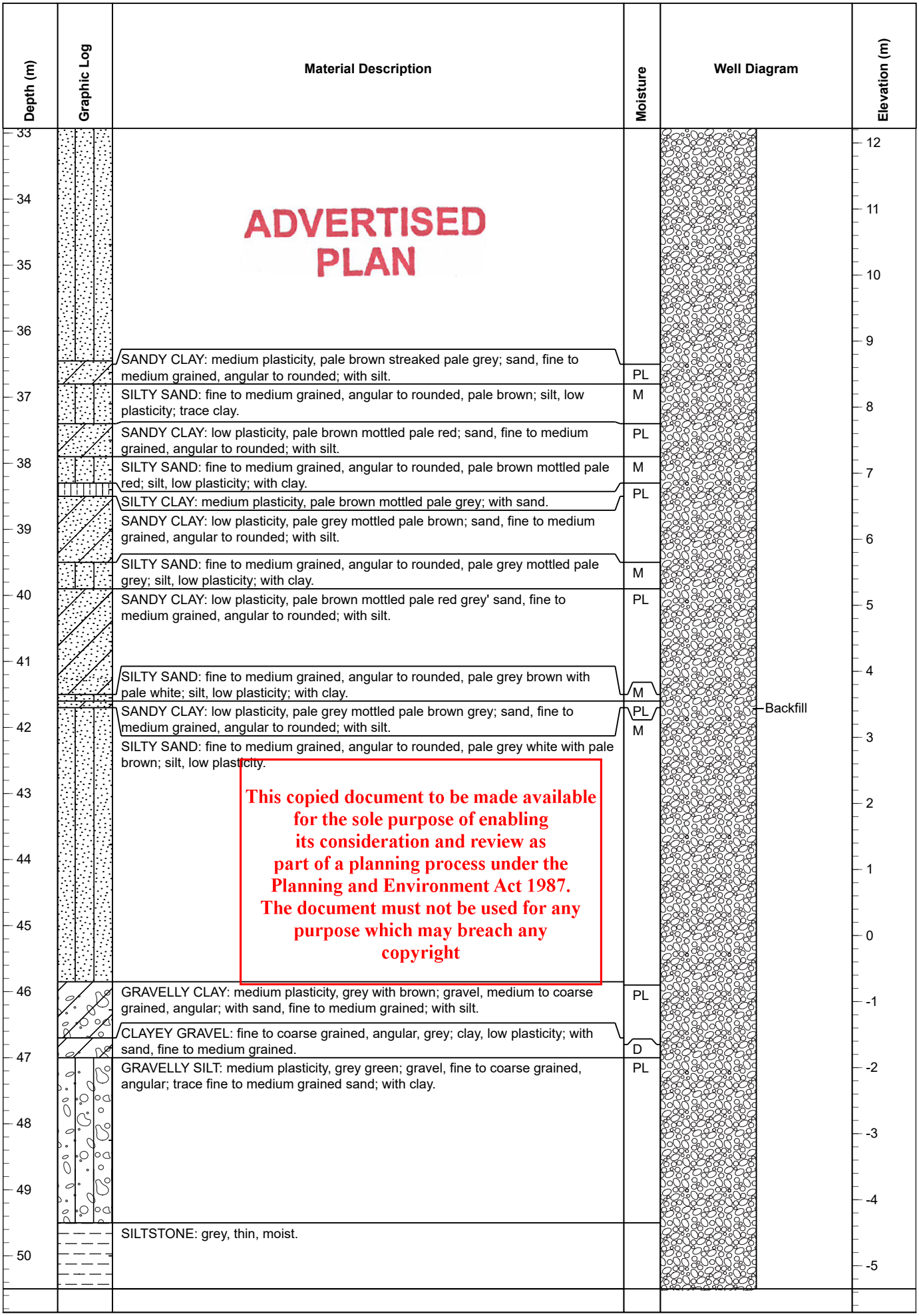
Depth (m)	Graphic Log	Material Description	Moisture	Well Diagram	Elevation (m)
16					29
17					28
18					27
19					26
20					25
21		SILTY SAND: fine to medium grained, angular to rounded, pale red brown; silt, low plasticity; trace clay.			24
22					23
23					22
24					21
25					20
26					19
27					18
28					17
29					16
30			M to W		15
31					14
32					13

Filter pack

Bentonite

Backfill

BOREHOLE LOG BH02



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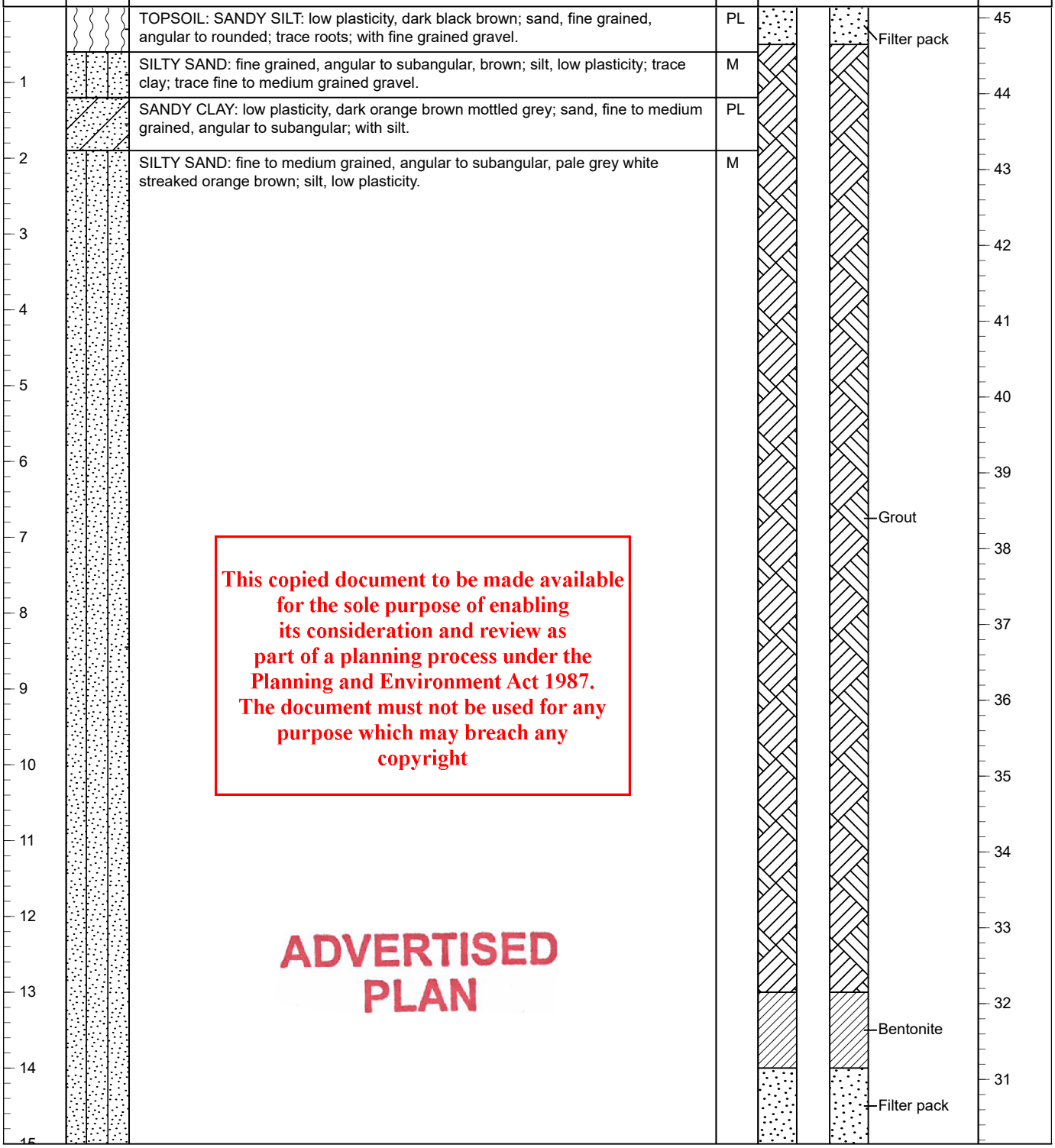
BOREHOLE LOG BH03

PROJECT NUMBER 30277	**DRILLING DATE** 19/10/2021	**COORDINATES** E.341897m N.5778358m
PROJECT NAME Langwarrin Hydro	**TOTAL DEPTH** 50.5m	**COORD SYS** UTM
CLIENT Hanson	**DIAMETER** 150mm	**COMPLETION** 19/10/21
ADDRESS 60 Valley Road, Langwarrin	**CASING** 50mm uPVC	**SURFACE ELEVATION** 39.675m
LICENCE NO. WRK122939	**SCREEN** uPVC Factory Slotted	**WELL TOC** 40.475m

COMMENTS Drilled by Star Drilling. Logged by CMW Geosciences

LOGGED BY SK
CHECKED BY PC

Depth (m)	Material Description	Moisture
0	TOPSOIL: SANDY SILT: low plasticity, dark black brown; sand, fine grained, angular to rounded; trace roots; with fine grained gravel.	PL
1	SILTY SAND: fine grained, angular to subangular, brown; silt, low plasticity; trace clay; trace fine to medium grained gravel.	M
	SANDY CLAY: low plasticity, dark orange brown mottled grey; sand, fine to medium grained, angular to subangular; with silt.	PL
2	SILTY SAND: fine to medium grained, angular to subangular, pale grey white streaked orange brown; silt, low plasticity.	M



BOREHOLE LOG BH03

Depth (m)	Graphic Log	Material Description	Moisture	Well Diagram	Elevation (m)
16		ADVERTISED PLAN			30
17					29
18					28
19		SAND: fine to medium grained, angular to subangular; pale white speckled pale grey, with silt.			27
20		SILTY SAND: fine to medium grained, angular to subangular, pale grey white with brown; silt, low plastcity.			26
21		SAND: fine to coarse grained, angular to subangular; pale white speckled pale grey with silt.			25
22					24
23		This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright		Filter pack	23
24					22
25					21
26					20
27					19
28					18
29		SILTY SAND: fine to medium grained, angular to subangular, pale white grey speckled pale brown; silt, low plasticity.			17
30					16
31		SILTY CLAY: medium plasticity, grey; trace fine to medium grained sand.	PL	Bentonite	15
		GRAVELLY CLAY: high plasticity, grey mottled orange brown; gravel, fine to medium grained, angular; trace sand.			14
32		SILTY CLAY: high plasticity, grey; with gravel, dine to medium grained; trace fine to medium grained sand.		Backfill	13
		GRAVELLY CLAY: high plasticity, grey mottled orange brown; gravel, fine to medium grained, angular; trace sand.			

BOREHOLE LOG BH03

Depth (m)	Graphic Log	Material Description	Moisture	Well Diagram	Elevation (m)
33					12
		CLAYEY GRAVEL: fine to coarse grained, angular, pale brown; clay, low plasticity; with sand, fine to medium grained; with medium strength siltstone fragments.	M		
34		GRAVELLY CLAY: medium plasticity, orange brown mottled pale grey brown; gravel, fine to medium grained, angular; trace sand.	PL		11
35					10
36					9
37					8
38		CORE LOSS		Backfill	7
39		SILTSTONE: grey mottled orange brown, thin, moist.			6
40		GRAVELLY CLAY: medium plasticity, pale brown with pale grey brown; gravel, fine to medium grained, angular; with sand, fine to medium grained.			5
41		SANDY CLAY: low plasticity, pale grey mottled pale brown grey; sand, fine to medium grained, angular to rounded; with silt.			4
42					3
43					2
44					1
45					0
46					-1
47					-2
48					-3
49					-4
50					-5

Appendix B Data from Feb 2021 Monitoring

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EM2102805**	Page	: 1 of 4
Client	: **Ricardo Energy, Environment & Planning**	Laboratory	: Environmental Division Melbourne
Contact	: KATHY MACINNES	Contact	: Customer Services EM
Address	: L4, 3 BOWEN CRESCENT MELBOURNE 3004	Address	: 4 Westall Rd Springvale VIC Australia 3171
Telephone	: ----	Telephone	: +61-3-8549 9600
Project	: 30277	Date Samples Received	: 22-Feb-2021 14:45
Order number	: ----	Date Analysis Commenced	: 24-Feb-2021
C-O-C number	: ----	Issue Date	: 01-Mar-2021 12:32
Sampler	: ----		
Site	: ----		
Quote number	: ME/222		
No. of samples received	: 8		
No. of samples analysed	: 7		

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*
Arenie Vijayaratnam	Non-Metals Team Leader	Melbourne Inorganics, Springvale, VIC
Dilani Fernando	Senior Inorganic Chemist	Melbourne Inorganics, Springvale, VIC

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.

- ED093F:EM2102805 # 3, 4 and 5 have been confirmed for major cations by re-preparation and re-analysis.
- EA015H: EM2102805 #3-6: TDS by method EA-015 may bias high due to the presence of fine particulate matter, which may pass through the prescribed GF/C paper.
- Ionic Balance out of acceptable limits for sample #2 and #4 due to analytes not quantified in this report.
- Ionic Balance out of acceptable limits for sample #1 due to analytes not quantified in this report.
- Ionic Balance out of acceptable limits for sample #4 and #5 due to analytes not quantified in this report.
- Ionic balances were calculated using: major anions - chloride, alkalinity and sulfate; and major cations - calcium, magnesium, potassium and sodium.
- ED045G: The presence of thiocyanate can positively contribute to the chloride result, thereby may bias results higher than expected. Results should be scrutinised accordingly.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	MW01	MW02	BH01	BH02	BH03
			Sampling date / time	19-Feb-2021 00:00	19-Feb-2021 00:00	19-Feb-2021 00:00	19-Feb-2021 00:00	19-Feb-2021 00:00
Compound	CAS Number	LOR	Unit	EM2102805-001	EM2102805-002	EM2102805-003	EM2102805-004	EM2102805-005
				Result	Result	Result	Result	Result
EA015: Total Dissolved Solids dried at 180 ± 5 °C								
Total Dissolved Solids @180°C	----	10	mg/L	726	837	2380	954	874
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	397	<1	409	235	238
Total Alkalinity as CaCO3	----	1	mg/L	397	<1	409	235	238
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	1	276	31	2	28
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	228	320	49	92	115
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	7	14	15	15	8
Magnesium	7439-95-4	1	mg/L	4	32	2	4	6
Sodium	7440-23-5	1	mg/L	231	192	190	104	125
Potassium	7440-09-7	1	mg/L	6	2	3	5	5
EN055: Ionic Balance								
ø Total Anions	----	0.01	meq/L	14.4	14.8	10.2	7.33	8.58
ø Total Cations	----	0.01	meq/L	10.9	11.7	9.25	5.73	6.46
ø Ionic Balance	----	0.01	%	13.9	11.5	4.86	12.3	14.1

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	QC01	QC03	----	----	----
			Sampling date / time	19-Feb-2021 00:00	19-Feb-2021 00:00	----	----	----
Compound	CAS Number	LOR	Unit	EM2102805-006	EM2102805-008	--------	--------	--------
				Result	Result	----	----	----
EA015: Total Dissolved Solids dried at 180 ± 5 °C								
Total Dissolved Solids @180°C	----	10	mg/L	**2110**	<10	----	----	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**384**	<1	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	**384**	<1	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**28**	<1	----	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**48**	<1	----	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**16**	<1	----	----	----
Magnesium	7439-95-4	1	mg/L	**2**	<1	----	----	----
Sodium	7440-23-5	1	mg/L	**193**	<1	----	----	----
Potassium	7440-09-7	1	mg/L	**3**	<1	----	----	----
EN055: Ionic Balance								
ø Total Anions	----	0.01	meq/L	**9.61**	<0.01	----	----	----
ø Total Cations	----	0.01	meq/L	**9.43**	<0.01	----	----	----
ø Ionic Balance	----	0.01	%	**----**	<0.01	----	----	----
ø Ionic Balance	----	0.01	%	**0.92**	**----**	----	----	----

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **EM2102805**	Page	: 1 of 5
Client	: **Ricardo Energy, Environment & Planning**	Laboratory	: Environmental Division Melbourne
Contact	: KATHY MACINNES	Contact	: Customer Services EM
Address	: L4, 3 BOWEN CRESCENT MELBOURNE 3004	Address	: 4 Westall Rd Springvale VIC Australia 3171
Telephone	: ----	Telephone	: +61-3-8549 9600
Project	: 30277	Date Samples Received	: 22-Feb-2021
Order number	: ----	Date Analysis Commenced	: 24-Feb-2021
C-O-C number	: ----	Issue Date	: 01-Mar-2021
Sampler	: ----		
Site	: ----		
Quote number	: ME/222		
No. of samples received	: 8		
No. of samples analysed	: 7		

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*
Arenie Vijayaratnam	Non-Metals Team Leader	Melbourne Inorganics, Springvale, VIC
Dilani Fernando	Senior Inorganic Chemist	Melbourne Inorganics, Springvale, VIC

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: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EA015: Total Dissolved Solids dried at 180 ± 5 °C (QC Lot: 3527789)									
EM2102627-001	Anonymous	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	14600	15100	3.01	0% - 20%
EM2102753-006	Anonymous	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	1020	938	8.47	0% - 20%
EA015: Total Dissolved Solids dried at 180 ± 5 °C (QC Lot: 3527792)									
EM2102805-004	BH02	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	954	918	3.85	0% - 20%
EM2102809-004	Anonymous	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	29500	29300	0.442	0% - 20%
ED037P: Alkalinity by PC Titrator (QC Lot: 3528529)									
EM2102805-001	MW01	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	397	401	0.928	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	397	401	0.928	0% - 20%
EM2102796-005	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	746	753	0.925	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	746	753	0.925	0% - 20%
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 3528139)									
EM2102805-002	MW02	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	276	279	1.09	0% - 20%
EM2102625-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	16	18	15.7	0% - 50%
ED045G: Chloride by Discrete Analyser (QC Lot: 3528140)									
EM2102729-001	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	5	5	0.00	No Limit
EM2102729-014	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	6	6	0.00	No Limit
ED045G: Chloride by Discrete Analyser (QC Lot: 3528141)									
EM2102805-006	QC01	ED045G: Chloride	16887-00-6	1	mg/L	48	48	0.00	0% - 20%
ED093F: Dissolved Major Cations (QC Lot: 3527460)									
EM2102796-002	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	152	154	1.65	0% - 20%

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
ED093F: Dissolved Major Cations (QC Lot: 3527460) - continued									
EM2102796-002	Anonymous	ED093F: Magnesium	7439-95-4	1	mg/L	382	389	1.65	0% - 20%
		ED093F: Sodium	7440-23-5	1	mg/L	1320	1340	1.90	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	15	15	0.00	0% - 50%
EM2102805-003	BH01	ED093F: Calcium	7440-70-2	1	mg/L	15	15	0.00	0% - 50%
		ED093F: Magnesium	7439-95-4	1	mg/L	2	2	0.00	No Limit
		ED093F: Sodium	7440-23-5	1	mg/L	190	190	0.00	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	3	3	0.00	No Limit

Method Blank (MB) and Laboratory Control Spike (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 Spike (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: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA015: Total Dissolved Solids dried at 180 ± 5 °C (QCLot: 3527789)								
EA015H: Total Dissolved Solids @180°C	----	10	mg/L	<10	2000 mg/L	98.7	91.0	110
				<10	293 mg/L	101	91.0	110
EA015: Total Dissolved Solids dried at 180 ± 5 °C (QCLot: 3527792)								
EA015H: Total Dissolved Solids @180°C	----	10	mg/L	<10	2000 mg/L	101	91.0	110
				<10	293 mg/L	108	91.0	110
ED037P: Alkalinity by PC Titrator (QCLot: 3528529)								
ED037-P: Total Alkalinity as CaCO3	----	----	mg/L	----	200 mg/L	110	85.0	116
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 3528139)								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	107	85.8	117
				<1	500 mg/L	109	80.0	120
ED045G: Chloride by Discrete Analyser (QCLot: 3528140)								
ED045G: Chloride	16887-00-6	1	mg/L	<1	10 mg/L	108	85.0	115
				<1	1000 mg/L	105	85.0	122
ED045G: Chloride by Discrete Analyser (QCLot: 3528141)								
ED045G: Chloride	16887-00-6	1	mg/L	<1	10 mg/L	110	85.0	115
				<1	1000 mg/L	108	85.0	122
ED093F: Dissolved Major Cations (QCLot: 3527460)								
ED093F: Calcium	7440-70-2	1	mg/L	<1	5 mg/L	104	88.2	117
ED093F: Magnesium	7439-95-4	1	mg/L	<1	5 mg/L	102	85.6	114
ED093F: Sodium	7440-23-5	1	mg/L	<1	50 mg/L	102	90.0	114
ED093F: Potassium	7440-09-7	1	mg/L	<1	50 mg/L	102	82.8	115

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.

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 3528139)							
EM2102625-005	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	100 mg/L	77.9	70.0	130
ED045G: Chloride by Discrete Analyser (QCLot: 3528140)							
EM2102729-003	Anonymous	ED045G: Chloride	16887-00-6	400 mg/L	131	70.0	142

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
ED045G: Chloride by Discrete Analyser (QCLot: 3528141)							
EM2102805-008	QC03	ED045G: Chloride	16887-00-6	400 mg/L	123	70.0	142

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EM2102805**	Page	: 1 of 4
Client	: **Ricardo Energy, Environment & Planning**	Laboratory	: Environmental Division Melbourne
Contact	: KATHY MACINNES	Telephone	: +61-3-8549 9600
Project	: 30277	Date Samples Received	: 22-Feb-2021
Site	: ----	Issue Date	: 01-Mar-2021
Sampler	: ----	No. of samples received	: 8
Order number	: ----	No. of samples analysed	: 7

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: **WATER**

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
EA015: Total Dissolved Solids dried at 180 ± 5 °C							
Clear Plastic Bottle - Natural (EA015H)							
MW01, MW02, BH01, BH02, BH03, QC01, QC03	**19-Feb-2021**	**----**	----	----	**24-Feb-2021**	26-Feb-2021	✓
ED037P: Alkalinity by PC Titrator							
Clear Plastic Bottle - Natural (ED037-P)							
MW01, MW02, BH01, BH02, BH03, QC01, QC03	**19-Feb-2021**	**----**	----	----	**24-Feb-2021**	05-Mar-2021	✓
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA							
Clear Plastic Bottle - Natural (ED041G)							
MW01, MW02, BH01, BH02, BH03, QC01, QC03	**19-Feb-2021**	**----**	----	----	**24-Feb-2021**	19-Mar-2021	✓
ED045G: Chloride by Discrete Analyser							
Clear Plastic Bottle - Natural (ED045G)							
MW01, MW02, BH01, BH02, BH03, QC01, QC03	**19-Feb-2021**	**----**	----	----	**24-Feb-2021**	19-Mar-2021	✓
ED093F: Dissolved Major Cations							
Clear Plastic Bottle - Natural (ED093F)							
MW01, MW02, BH01, BH02, BH03, QC01, QC03	**19-Feb-2021**	**----**	----	----	**24-Feb-2021**	26-Feb-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: **WATER**

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)							
Alkalinity by PC Titrator	ED037-P	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	3	28	**10.71**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	4	40	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Alkalinity by PC Titrator	ED037-P	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	4	28	**14.29**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	4	40	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Chloride by Discrete Analyser	ED045G	2	28	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	2	40	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Chloride by Discrete Analyser	ED045G	2	28	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	20	**5.00**	**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
Total Dissolved Solids (High Level)	EA015H	WATER	In house: Referenced to APHA 2540C. A gravimetric procedure that determines the amount of `filterable` residue in an aqueous sample. A well-mixed sample is filtered through a glass fibre filter (1.2um). The filtrate is evaporated to dryness and dried to constant weight at 180+/-5C. This method is compliant with NEPM Schedule B(3)
Alkalinity by PC Titrator	ED037-P	WATER	In house: Referenced to APHA 2320 B This procedure determines alkalinity by automated measurement (e.g. PC Titrate) on a settled supernatant aliquot of the sample using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM Schedule B(3)
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	WATER	In house: Referenced to APHA 4500-SO4. Dissolved sulfate is determined in a 0.45um filtered sample. Sulfate ions are converted to a barium sulfate suspension in an acetic acid medium with barium chloride. Light absorbance of the BaSO4 suspension is measured by a photometer and the SO4-2 concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM Schedule B(3)
Chloride by Discrete Analyser	ED045G	WATER	In house: Referenced to APHA 4500 Cl - G.The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride.in the presence of ferric ions the librated thiocynate forms highly-coloured ferric thiocynate which is measured at 480 nm APHA seal method 2 017-1-L
Major Cations - Dissolved	ED093F	WATER	In house: Referenced to APHA 3120 and 3125; USEPA SW 846 - 6010 and 6020; Cations are determined by either ICP-AES or ICP-MS techniques. This method is compliant with NEPM Schedule B(3) Sodium Adsorption Ratio is calculated from Ca, Mg and Na which determined by ALS in house method QWI-EN/ED093F. This method is compliant with NEPM Schedule B(3) Hardness parameters are calculated based on APHA 2340 B. This method is compliant with NEPM Schedule B(3)
Ionic Balance by PCT DA and Turbi SO4 DA	* EN055 - PG	WATER	In house: Referenced to APHA 1030F. This method is compliant with NEPM Schedule B(3)

CHAIN OF CUSTODY RECORD

Ricardo Energy, Environment & Planning (Formerly PLC Consulting)
Level 4, 3 Bowen Crescent
Melbourne 3004
Ph: (03) 9978 7823

RICARDO

Contact Name: Kathy MacInnes	Lab Quote ID:	Page: 1 of 1	**ALS Environmental** 2-4 Westall Road
Project Manager: Kathy MacInnes	Project Number: 30277	Purchase Order:	Springvale VIC 3171, Australia
email for results: kathy.macinnes@ricardo.com jacob.reid@ricardo.com	Project Name: Langwarrin Hydro		Ph 03 8549 9600 Fax: 03 8549 9601 Contact: Shirley LeCornu

Special Comments/Directions

ADVERTISED PLAN

Analytes

Lab ID	Sample ID	Date/Time	Matrix	Container	TDS, Mg, Ca, Na, K, Cl, SO4 and alkalinity	HOLD
1	MB01 MW01	19-Feb-21	W	2B	X	
2	MB02 MW02	19-Feb-21	W	2B	X	
3	BH01	19-Feb-21	W	2B	X	
4	BH02	19-Feb-21	W	2B	X	
5	BH03	19-Feb-21	W	2B	X	
6	QC01	19-Feb-21	W	2B	X	
7	QC02	19-Feb-21	W	2B		X
8	QC03	19-Feb-21	W	2B	X	
				TOTAL	0	0

Environmental Division
Melbourne
Work Order Reference
EM2102805

Telephone : + 61-3-8549 9600

1. Relinquished By: Jacob Reid	LAB Received By:	Turn around time: 24hr 48hr 5day Standard
Date & Time: 22/02/2021	Date & Time:	
Signature:	Signature:	Method of Shipment: Courier Hand Delivered
2. Received By:	Report Number:	
Date & Time:	Laboratory Comments:	
Relinquished By:		
Date & Time:		
Signature:		

Received: 22/2, 14.45 Carrier:
C/note:
Temp: 1-3°C Seal: Y/N
Ice / Icebricks / NA

ALS

Ranil Weerakkody

From: Shirley LeCornu
Sent: Monday, 22 February 2021 12:30 PM
To: COC Melbourne
Subject: PLCCON - incoming samples
Attachments: 30277_Ricardo_COC Form_ALS.pdf

Follow Up Flag: Follow up
Flag Status: Flagged

Categories: COC for incoming samples

FYI

Shirley LeCornu
Client Services Coordinator – Springvale
Environmental

T +61 3 8549 9600 D +61 3 8549 9630
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2-4 Westall Rd
Springvale Vic 3171
Australia

EnviroMail™ 127 – Bacterial Diversity Profiling in NGS
EnviroMail™ 128 – Revised PFAS Bottle Requirements
EnviroMail™ 123 Re-Release – Leaching Environmental Assessment Framework
EnviroMail™ 00 - All EnviroMails™ in one convenient library.

From: Reid, Jacob <Jacob.Reid@ricardo.com>
Sent: Monday, 22 February 2021 11:19 AM
To: Shirley LeCornu <shirley.lecornu@alsglobal.com>
Subject: [EXTERNAL] - Cooler Collection Courier

Good morning Shirley,

Could you please arrange for the collection of 1 cooler from 44 Wright Street Clifton Hill, 3068? Collection later this afternoon if possible.

Thanks!

Jacob Reid

Consultant | Environment
Ricardo Energy, Environment & Planning

Email: jacob.reid@ricardo.com
Mobile: +61 (0)412 930 862
Office: +61 3 9978 7823

Ricardo Energy, Environment & Planning
Level 4, 3 Bowen Crescent, Melbourne, Victoria 3004
PO Box 33298 Melbourne 3004
Website: www.plcconsulting.com.au | www.ricardo.com

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The registered office of Ricardo plc is Shoreham Technical Centre, Shoreham-by Sea, West Sussex, BN43 5FG.

Equipment Calibration Form
YSI ProPlus

Enqip #: 13512
Company: Ricardo Energy Environment & Planning
Consultant: Jacob Reid
PO #: 30277
Certificate #: 19744

INSTRUMENT IDENTIFICATION

Model Number: 6050000
Serial Number: 16E101393
Instrument Type: YSI ProPlus

INSPECTION RECORD

Batteries Checked:	PASS	**Date & Time:**	PASS
Electrodes Cleaned/Checked:	PASS	**Temperature:**	PASS

CALIBRATION DETAILS

Sensor	Cal Solution	Value	Reading
pH	Buffer 4.00	4.00 pH	4.00 pH
	Buffer 7.00	7.00 pH	7.00 pH
Redox	Standard ORP	228.0 mV @ 25 °C	228.0 mV
O_2	Zero Dissolved Oxygen	0.0 %	0.0 %
	Air	100.0 %	100.0 %
Conductivity	Standard Conductivity	2.76 mS/cm	2.76 mS/cm

Calibration Successful: YES

Calibrated By: Luke Adams **Test Date:** 18/02/2021

enqip
116 Thistlethwaite St, South Melbourne 3205
P 1300 218 987
E info@enqip.com.au | W www.enqip.com.au

Appendix C Groundwater Management Plan

C1 Purpose

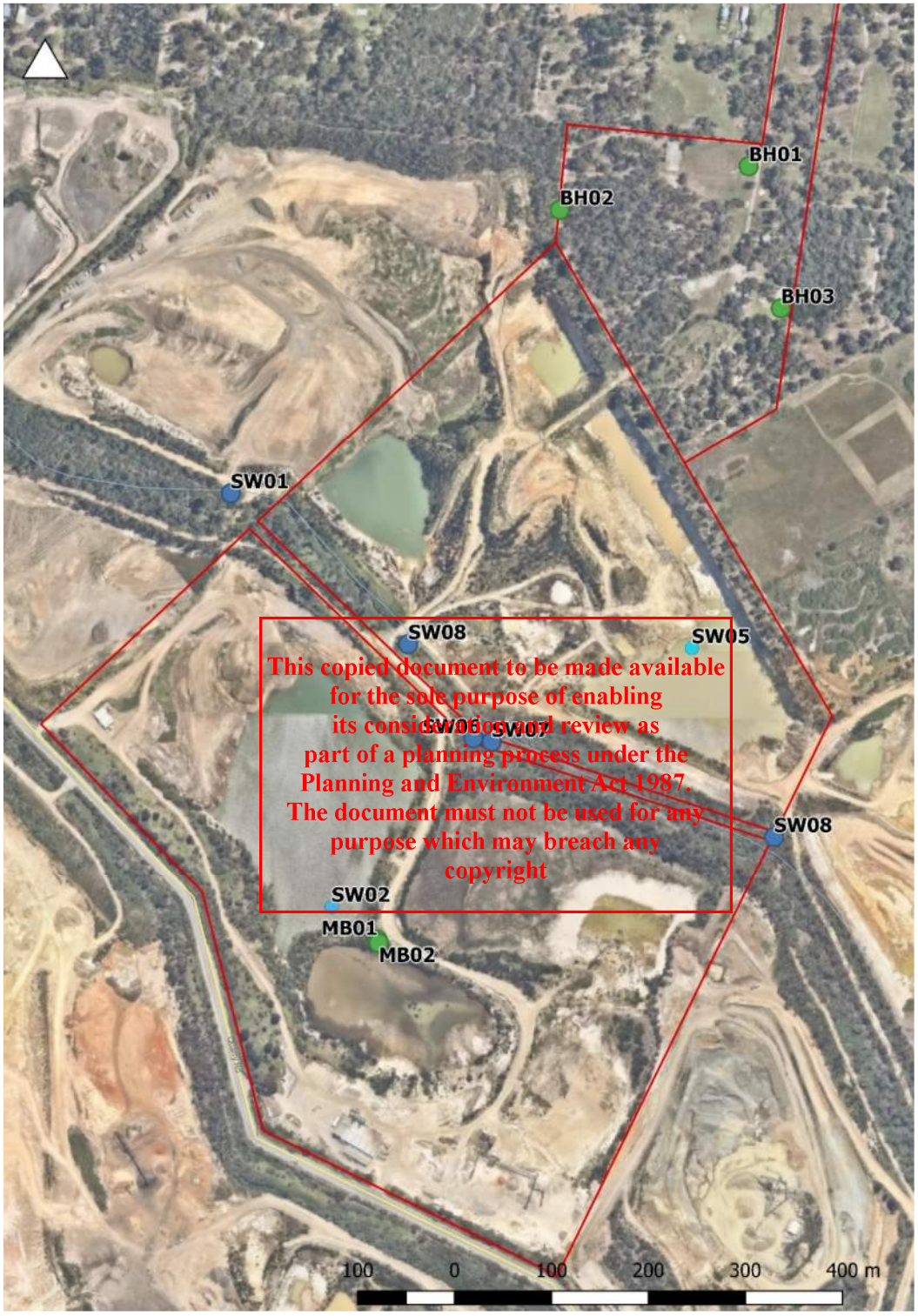
The objectives of the Groundwater Management Plan are to:

- Increase the understanding of the site conceptual model
- Provide groundwater level information for ongoing site management and tracking of groundwater rebound
- Provide groundwater quality data to identify potential impacts on the beneficial uses of groundwater

C2 Monitoring locations

The remaining monitoring bores MB01, MB02 and the new bores noted above (BH1, BH2 and BH3) will comprise the groundwater monitoring network.

In accordance with a request from SRW two additional bores will be installed in the sand aquifer at the southern margin of the site along Quarry Road when the Work Plan Variation is approved. These will be added to the monitoring program outlined below.



C3 Monitoring program

C3.1 Baseline and Years 1 and 2

Groundwater level

Monthly readings recorded as Standing Water Level (SWL) which is the depth of watertable below monitoring point. Reduced levels (RWL) is to be calculated from the SWL and the surveyed elevation of the monitoring point (TOC).

Groundwater quality

Groundwater samples are to be collected quarterly in accordance with Groundwater Sampling Guidelines (EPA Publication 669) and Sampling and Analysis of Waters Wastewaters, soils and wastes (EPA Publication IWRG 701).

Field parameters to be recorded during sampling and purging of bores includes:

- pH,
- electrical conductivity (EC),
- dissolved oxygen concentration (DO),
- temperature and
- redox potential (Eh).

Laboratory analysis for

- Total Dissolved Solids (TDS), major cations (Ca, Mg, Na, K), major anions (Cl, SO, alkalinity)
- Metals (total and soluble): Fe, Mn, Cu, Pb, Zn, Al, and As

Data quality samples including duplicates, field blanks and rinsates are to be analysed for the same analyte suite as the samples.

C3.2 Year 3 and subsequent years

Groundwater level

Quarterly readings recorded as Standing Water Level (SWL) which is the depth of watertable below monitoring point. Reduced levels (RWL) is to be calculated from the SWL and the surveyed elevation of the monitoring point (TOC).

Groundwater quality

Groundwater samples are to be collected annually in accordance with *Groundwater Sampling Guidelines* (EPA Publication 669) and *Sampling and Analysis of Waters Wastewaters, Soils and wastes* (EPA Publication IWRG 701).

Field parameters to be recorded during sampling and purging of bores includes:

- pH,
- electrical conductivity (EC),
- dissolved oxygen concentration (DO),
- temperature and
- redox potential (Eh).

Laboratory analysis for

- Total Dissolved Solids (TDS), major cations (Ca, Mg, Na, K), major anions (Cl, SO, alkalinity).
- Metals (total and soluble): Fe, Mn, Cu, Pb, Zn, Al, and As

Data quality samples including duplicates, field blanks and rinsates are to be analysed for the same analyte suite as the samples.

C3.3 Post Rehabilitation

Following rehabilitation the frequency of groundwater level monitoring shall reduce to annual. Groundwater quality sampling as outlined above will be undertaken biennially (every 2 years). Reporting will be undertaken biennially also.

C4 Reporting

A report will be prepared annually (year) presenting

- New collected since the previous annual report
- An assessment of the data quality for new data
- Additional data from neighbouring sites, if available
- An assessment of water level trends
- Identification of water quality trends
- Evaluation of impacts to beneficial uses of groundwater

The report will be provided to regulatory agencies upon request.

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ENVIRONMENT PROTECTION AUTHORITY VICTORIA

APPROVALS PROPOSAL PATHWAY FORM

PURPOSE

This form is for applicants seeking approval for new works, new research or for current licence holders, seeking amendment to their current licence. The different pathways available for proponents are; (1) no approval requirement, (2) general exemptions, (3) exemptions under the Act, (4) research, development and demonstration projects (RD&D); (5) licence amendment, (6) fast track works approval and (7) standard – works approval.

HOW TO COMPLETE THIS FORM

Guidance on how to complete this form is provided in *EPA publication 1560 Approvals proposal pathway – Guidelines*. If you require further clarification you may contact EPA by email approvals.applications@epa.vic.gov.au or on phone 1300 EPA VIC (1300 372 842).

Once you have completed the form, forward it to approvals.applications@epa.vic.gov.au or for hardcopy to Environment Protection Authority (GPO Box 4395, Melbourne 3001). At this stage no application fees apply. Please note that incomplete forms will be returned to the applicant with a request to provide further information.

STRUCTURE

The form is divided into three parts; (1) **Proposal form** which is a general information part and explains what documents to include with the proposal. (2) **Key questions** which together with (3) **Engagement/consultation** will help the EPA make a pathway decision.

The person completing this form must have the authority to make this submission on behalf of the applicant.

APPLICANT STATEMENT

I declare that to the best of my knowledge the information in this form is true and correct:

Position held:	Divisional Landfill & Development Manager
Full name:	Daniel Fyfe
Signature:	
Date:	

1. PROPOSAL FORM

1.1 General information

Individual/Company name (Legal)	Hanson Construction Materials Pty Ltd
ABN/ACN	90 009 679 734
Registered Office address	Sydney NSW 2000
Billing address	600 Doncaster Rd, Doncaster 3108
Relevant current EPA Approval/licence number*	3307

* For existing Approval/licence holders.

CEO contact details

Name	Phil Schacht
+61 2 9323 4002	+61 2 9323 4000
Email	Phil.Schacht@hanson.com.au

Premises

Premises address	60 Valley Road, Langwarrin

Please note EPA expects that Landowner consent has been granted.

1.2 Primary company contact details

Name	Daniel Fyfe
Position	Divisional Landfill & Development Manager
Phone	0428 942 672
Email	daniel.fyfe@hanson.com.au
Postal address	600 Doncaster Rd, Doncaster 3108

If a Consultant/Environmental Auditor has been engaged, please provide details:

Name	Kathy Mac Innes
Position & Company	Technical Principal, PLC Consulting Pty ltd
Phone	0437 401 554
Email	Kathy.macinnes@plcconsulting.com.au

1.3 Works details

Project/Works Name	Langwarrin Quarry Extension
Cost of Works	Estimated to be $300,000, excludes vegetation offsets, artefact salvage and a swale drain bridge structure

1.4 What type of business is the premise?

(see Appendix 1 in the guidelines for category of scheduled premise)

C01 Extractive industry and Mining

1.5 Describe what you are planning to do in the expandable box below

Expand the existing quarry at 150 Quarry Road Langwarrin (operating under WA13) into an adjacent property that has recently been purchased by Hanson. The Initial Site Meeting for the Work Plan variation was attended by two EPA representatives: Megan Vallas and Martin OShaughnessy.

Documentation to be included

Please provide the following information with your proposal form and pathway documentation. Documents supporting answers given in section 2 and section 3 needs to be included. Further details are provided in ***EPA Publication 1560*** *Approvals proposal pathway – Guidelines.*

Administrative:

- Certificate of Incorporation (Company); or
- Certificate of Registration (Business) as appropriate

Maps:

- Site plan
- Locality plan
- Planning zone map
- Attach a map of any sensitive receptors in the area.

Engagement / consultation:

- Evidence of engagement / consultation
- Any templates and supporting information used to the form. Templates can be found in guidance document.

Supporting Documents:

Please submit any documents you may have supporting the information provided in this form.

Commercial in confidence

Commercially confidential material should only be submitted where it is pertinent to the proposal and should be: (a) provided only within a separate appendix and not within the proposal and (b) be clearly marked 'commercial in confidence'. EPA prefers to receive any commercial in confidence document as hard copy rather than electronic copies. This material will be filed separately to ensure security.

2. KEY QUESTIONS

In answering the questions in this section and section 3 you must provide the EPA with sufficient information to determine which pathway is suitable for the proposed work.

Please insert your answers in the expandable text boxes below or in cross referenced appendices where appropriate (i.e. for modelling results, emissions data or estimations etc.). Applicants must not submit false or misleading information.

2.1 What changes in emissions, discharge or other impacts to the environment do you expect as a result of the proposal?

To where (air, land, water, odour and noise), as what (what type of substances), from where (incinerator, waste treatment etc.) and quantity (per day, per week, per month, per year)?
Quarrying and processing of sands is already being undertaken in WA13. The proposed extension will only change the duration of the site's operations, there will not be any change to the current methods of processing or quarrying. Therefore no changes in emissions or discharges is anticipated.

2.2 Please explain why your proposal and its inherent changes should be considered best practice.

For some pathways the proponent will need to demonstrate that the proposed work has a low impact on the environment, as well as on the community. The impact on the environment can be reduced by using *best practice technology*. Further information and guidance on demonstrating best practice can be found at: http://www.epa.vic.gov.au/business-and-industry/guidelines/demonstrating-best-practice or through contacting the EPA.
Quarry design and management practices are in accordance with the requirements of Earth Resources Regulation who are the relevant regulator for quarry sites. The Work Plan for the existing site and the variation site contains a risk assessment which evaluates inherent risk and the impact of proposed control measures and quantifying the residual risk. This is consistent with EPA's preferred approach for managing potential impacts. The Work Plan also contains a Rehabilitation Plan and Community Engagement Plan. Relevant technical advice has been sought for key areas.

2.3 Please explain how your proposal will incorporate waste minimisation principles and how you have sought to minimise impact of the environment.

A way of reducing your environmental impact is to use EPA guideline documents related to your specific scheduled premises. If you have reduced your impact of the environment, please describe in what way and refer to the information used. For more information, please look in the guidelines to this document.

Slimes is the main waste material generated by sand excavation and processing. Slimes material is retained onsite and is being used for the rehabilitation of worked out areas. Slimes management is undertaken in accordance with ERR requirements. Beneficial ruse of the material is contributing to the rehabilitation of the worked out areas.

2.4 If waste is handled, generated or stored on the premise, please describe the nature of this waste, the expected quantities and management of these waste streams.

Slimes material is the fine silt and clay fractions remaining once the sand has been extracted. The material is generated as a slurry. Slimes are discharged to dams south of Boggy Creek. The volume of slimes stored on site is estimated to be approximately 400,000 m^3. The slimes dams will be infilled with other materials as part of the rehabilitation of the site which has already commenced.

2.5 Is the proposal related to technology development?

This could be that it relates to research, development or testing of a new technology, process or plant. If these conditions apply, please refer to EPA publication 1369 Guidelines for Research, Development and Demonstration Approvals, and provide relevant information i.e. the purpose of the RD&D project, its scale and duration.

No

2.6 Will there be changes to your current licence?

(this question is only applicable for current licence holders)

Highlight the proposed changes in the relevant existing condition of your licence and provide supporting evidence to demonstrate how the proposed change will affect/not affect the environment.

The boundary of the Work Authority (under the MRSD Act) will be amended and the Work Plan will be updated. There will be no changes to existing EPA licences.

2.7 Are there special circumstances that apply?

For example is there other legislation related to the project or other approvals (i.e. planning permits) that are still pending?
Quarries are managed under the Mineral Resources (Sustainable Development) Act and subordinate legislation. Amendments to the existing Work Authority, Work Plan and Council Permit will need to be obtained. This application to EPA will be used to support the update to the Work Plan which is the first step in the approval process for quarries which falls under the Earth Resources Regulation (ERR) branch of the Department of Jobs, Precincts and Regions.

3. ENGAGEMENT / CONSULTATION

For your application to be accepted, you must have done engagement / consultation or be able to clearly demonstrate it is not applicable because there is no risk and no concern to human health or the environment. To find out how to do engagement / consultation see the guide to this form. If you decide to not do this, there is no evidence whether the proposed work will have a high or low impact and end up in a different pathway. Do not forget to attach the supporting documents for this with the proposal.

3.1 Have you identified potential impacted / interested stakeholders?

EPA wants to know if you have identified surrounding stakeholders that potentially will have an opinion of the proposal (for information about this see appendix 3, 4 and 5 in the guidelines).
Yes, please refer to the attached Community Engagement Plan.

3.2 Describe the engagement / consultation with stakeholders you have done.

What type, with whom, have you met on multiple occasions etc.
Regulatory Stakeholders (including EPA) attended an onsite meeting and site tour on August 28th 2018. Liaison with relevant referral agencies, and in particular Council, has occurred subsequently. The most recent community meeting was held on Saturday November 10th 2018 whereby residents in the immediate vicinity of the site were invited to a presentation, discussion and on-site tour. This community meeting was attended by representatives from ERR.

3.3 What was the response from the stakeholders?

Provide EPA with evidence that stakeholders know about your proposal, what their concerns are (if any) and how these were addressed. For verification purposes include stakeholder contact information (e.g. scanned attendance list with contact information).
The regulatory stakeholders were positive and identified areas that needed further clarification (including this). The adjacent residents were generally supportive., but the residents at 70 Valley Road expressed concerns. Refer to the attached Community Engagement Plan (CEP) for details.

FEEDBACK

Please provide any feedback concerning this form or the guidelines to this form:
[insert text here]

PROCESS AFTER THE FORM IS SUBMITTED

Following submission of your proposal form and any required supporting information, a decision will be made within two weeks concerning which pathway is suited for the proposal. The procedure after this depends on the specific timelines for the different pathways (shown in Table 1). For more information please read the guidelines to this document.

Table 1 – The different pathways have different timeframes for pathway decision until the final decision is made.

Pathway	Pathway proposal decision	Further stages	Final decision
No approval requirement	2 weeks	No	–
General exemption	2 weeks	No	–
Exemption under the Act	2 weeks	No	2 weeks after pathway proposal decision*
Research Development & Demonstration	2 weeks	Application process	30 days after application has been accepted
Licence amendment	2 weeks	Assessment process	60 days after application has been accepted
Fast track Works approval	2 weeks	Application process	6 weeks after application has been accepted
Standard works approval	2 weeks	Assessment process	3 months after application has been accepted

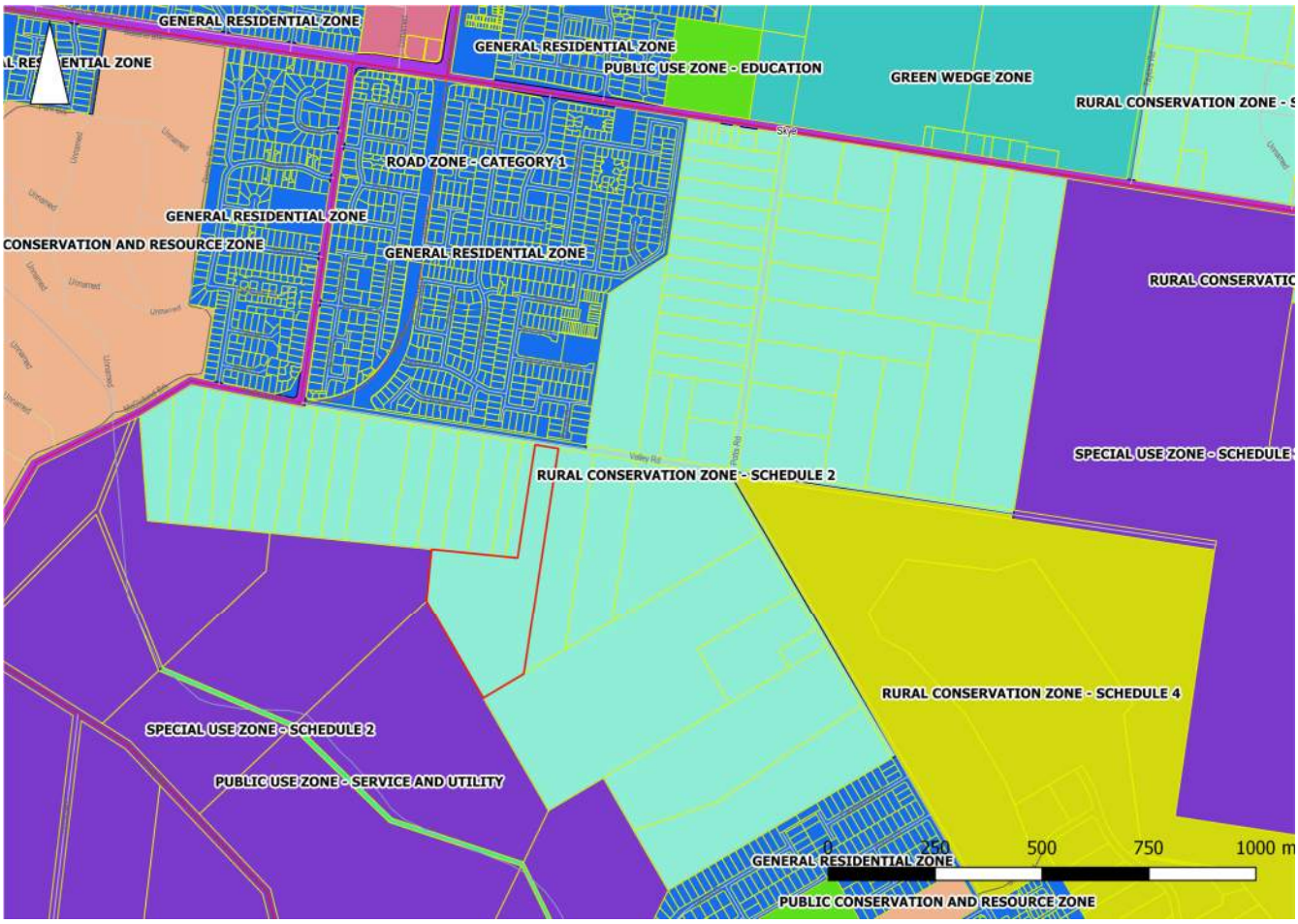
* could be changed if additional information is required.

MAPS

Site plan

Locality plan

Planning zone map



Sensitive receptors

HANSON AUSTRALIA PTY LIMITED
Level 6
35 Clarence Street
SYDNEY NSW 2000

Remove this top section if desired before framing

Certificate of Registration on Change of Name

This is to certify that

PIONEER CONSTRUCTION MATERIALS PTY LIMITED

Australian Company Number 009 679 734

did on the first day of July 2004 change its name to

HANSON CONSTRUCTION MATERIALS PTY LTD

Australian Company Number 009 679 734

The company is a proprietary company.

The company is limited by shares.

The company is taken to be registered under the Corporations Act 2001 in Queensland and the date of commencement of registration is the twenty-second day of March, 1957.

Issued by the
Australian Securities and Investments Commission
on this first day of July, 2004.

Jeffrey Lucy
Acting Chairman

CERTIFICATE

3. ENGAGEMENT / CONSULTATION

3.1 Have you identified potential / impacted stakeholders?

EPA wants to know if you have identified surrounding stakeholders that potentially will have an opinion of the proposal

The Hanson Langwarrin Quarry is located in the suburb of Langwarrin in the City of Frankston, approximately 42 kilometres from Melbourne. The site is about three (3) kilometres from the Skye Road exit of the Peninsula Link Freeway, with the quarry entrance located in Quarry Road.

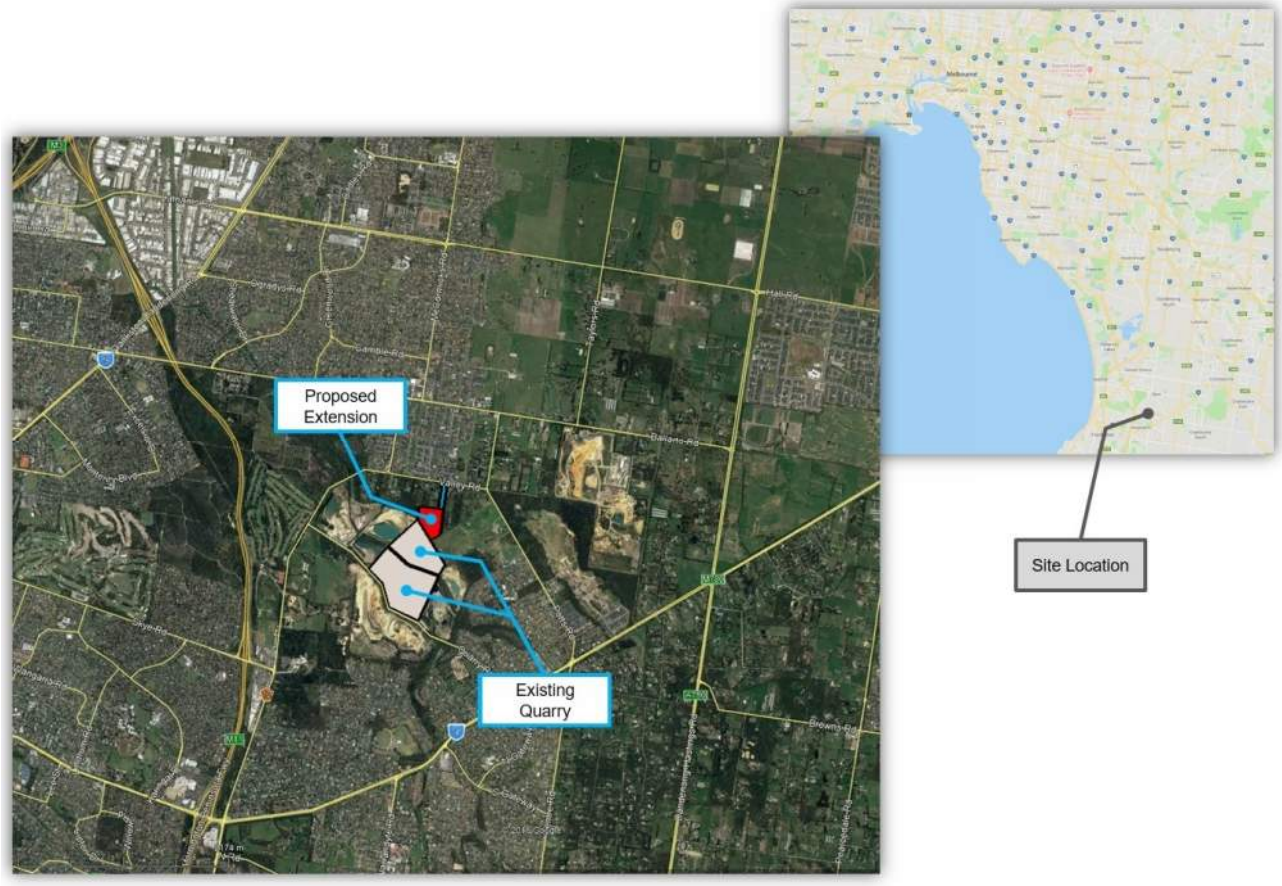


Figure 3-1: Site location

The location of the Hanson Langwarrin Quarry places it amongst six other quarries and a number of other industrial operations**. Hanson took ownership of the site in 2016**, although the **site has operated as a quarry for more than 35 years**. During this period, stakeholder engagement has been primarily conducted with neighbouring industries.

Within the one kilometre buffer zone, there are 12 properties located on Valley Road, including the proposed area, which share a boundary with the current quarry. North of Valley Road, there is a residential estate bound by McClelland Drive (west), Ballarto Road (north) and Potts Road (east) with approximately

419 residences. To the south and east, there are approximately 1,017 residences. Each of the estates have been developed within the past few decades, growing around the established extraction sites.

Properties located in Valley Road bordering Hanson's north eastern boundary are generally long-term residents, while the estate north of the site was developed in 2011 and the majority of the residences south east of the site have been in situ for some decades.

Hanson has not received any complaints, but has been proactive in their engagement of the local community by responding immediately to any direct engagement.

Figure 3-2: Buffer zones

Hanson has not received any complaints, but has been proactive in their engagement of the local community by responding immediately to any direct engagement.

A range of stakeholders that may impact, or be impacted by, the proposed quarry development have been identified.

The Stakeholder Register (**Table 3-1**) identifies and analyses stakeholders, with each listing including the names, contact details, community identification, concerns, expectations and an analysis of the stakeholder's influence (legitimacy, interests and power) and potential level of impact. The applicable classification for level of engagement according to the International Association of Public Participation's **Spectrum of Public Participation**[1] is then applied.

To ensure evidence of consultation, community input and Hanson's willingness to address community concerns, this information is entered into the Community Contact Database (CCD) which responds specifically to the community engagement requirements defined in:

- Environment Protection Act 1970;
- Environment Effects Act 1978;

[1] IAP2 International Federation, IAP2 Spectrum of Public Participation, 2018,
Source: https://cdn.ymaws.com/www.iap2.org/resource/resmgr/pillars/Spectrum_8.5x11_Print.pdf

- Planning and Environment Act 1987;
- Mineral Resource (Sustainable Development) Act 1990;
- Mineral Resource (Sustainable Development) (Extractive Industries) Regulations 2013;
- Environment Protection Amendment Act 2018;
- Community Engagement Guidelines for Mining and Mineral Exploration in Victoria; and
- EPA Works Approval application process community engagement requirements.

The CCD is consistently maintained and will continue to be updated with contact information as stakeholders are identified, and consultation activity is undertaken.

Stakeholder	**Community** P= Place I= Interest S= Standing	**Issues** *(assumption only)*	**Risk Rating** 1= High 2= Medium 3= Low	**Reason**
Ms Jaclyn Symes MLC Minister for Resources	S	Benefit to Victoria Compliance to all regulation.	3	Impact on constituency.
Mr Neale Burgess Member for Hastings	S	Benefit to Electorate Compliance to all regulation.	3	Impact on constituency.
Crown Land Minister	S	Compliance to regulation	3	Ensuring process is conducted to regulation.
Department of Economic Development, Jobs, Transport and Resources	S	Compliance to Earth Resources Regulation.	3	Ensuring process is conducted to regulation.
Earth Resources Regulation	S	Compliance to regulation, including *Mineral Resources (Sustainable Development) 1990*and *Mineral Resources (Sustainable Development) (Extractive Industries) Regulations 2010.*	3	Ensuring process is conducted to regulation.
Department of Environment, Land, Water and Planning	S	Compliance to regulation, including *Flora and Fauna Guarantee Act 1988* and *Environment Protection and Biodiversity Conservation Act 1999*.	3	Ensuring process is conducted to regulation.

Stakeholder	Community P= Place I= Interest S= Standing	Issues *(assumption only)*	Risk Rating 1= High 2= Medium 3= Low	Reason
EPA Victoria	S	Compliance to regulation, including *Environment Protection Act 1970* and *Environment Protection Amendment Act 2018.*	3	Ensuring process is conducted to regulation.
Heritage Victoria	S	Compliance to *Heritage Act 1995.*	3	Ensuring process is conducted to regulation.
Frankston City Council	S	Benefit to community Compliance to regulation, including *Planning and Environment Act 1987.*	3	Impact on community. Ensuring process is conducted to regulation.
Southern Rural Water	S	Compliance in accordance with *Water Act 1989.*	2	Responsible use and management of surface and groundwater.
Melbourne Water	S	Compliance in accordance with *Catchment and Land Protection Act 1994.*	2	Responsible use and management of surface and groundwater.
Bunurong Land Council Aboriginal Corporation	S	Compliance to regulation, including *Aboriginal Heritage Act 2006* and in accordance with the *Aboriginal Heritage Regulations 2018.*	2	Respond to cultural concerns.
WorkSafe Victoria	S	Compliance to regulation, including *Occupational Health and Safety Standards Act 2004.*	3	Site is managed in compliance with WorkSafe licence.
Country Fire Authority South East Region District 8	S	Compliance to fire safety regulations	2	Site is managed in compliance with fire safety regulation
Residents of Valley Road *(between McClelland Drive and Potts Road)* 12	P	Environment Property Value Lifestyle.	1	Social and environmental impacts.

Stakeholder	Community P= Place I= Interest S= Standing	Issues *(assumption only)*	Risk Rating 1= High 2= Medium 3= Low	Reason
Residents north of Valley Road *(bordered by Valley Road, McClelland Drive, Ballarto Road and Diamond Parade)* ≈ 419	P	Environment Property Value Lifestyle.	1	Social and environmental impacts.
Residents south and east of Hanson Langwarrin Quarry *(bordered by Quarry Road, Cranbourne-Frankston Road, Potts Road and a quarry facility)* ≈ 1,017	P	Environment Property Value Lifestyle.	1	Social and environmental impacts.

Table 3-1: Stakeholder Identification and Analysis

Community Consultation Plan (CCP)

The key activities of the CCP (refer **Table 3-2 Community Consultation Plan**) are designed to respond to the community engagement requirements described in the *EPA Approvals proposal pathway* Guidelines[2] and the *EPA Approvals Pathway Application Form* engagement / consultation requirements[3] ensuring that:

- Relevant stakeholders, stakeholder attitudes, expectations and concerns are identified;
- Analysis of each stakeholder is undertaken to establish the most appropriate mechanism for engagement;
- A framework for stakeholder engagement is developed and undertaken throughout the Works Approval process, including descriptions of the type of engagement to be undertaken;
- An outline of engagement undertaken to date, listing concerns raised, how those concerns were addressed and the resultant impacts, if any, on project planning; and
- An outline of the mechanisms developed to ensure inputs from stakeholders are recorded, considered and addressed, including assessments of the value and effectiveness of the CEP.

The CCP will utilise the relationships established with the Valley Road residents, representatives of Frankston City Council and other local extractive industry facilities.

A transparent process will be followed to reassure stakeholders that all regulatory requirements will be met and that any concerns are given due consideration. Hanson will accommodate stakeholder concerns as far as practicable in the proposed variation and ongoing operation of the site.

However, the proposed variation to the quarry's operation may require assessments and decisions on a variety of topics relevant to a range of regulatory and non-regulatory authorities. There will be items that are flexible and open for debate and hence negotiable for stakeholder influence. There will also be items that are pre-determined or compulsory and hence are not negotiable. These items will be identified and clarified with the stakeholders during the EPA Approvals process.

[2] Approval proposal pathway, EPA Victoria, Publication 1560.2, June 2017, pages 8 to 10

[3] https://www.epa.vic.gov.au/business-and-industry/guidelines/licensing-and-works-approvals/how-to-apply-for-a-wa#Howtoapply, 3. Engagement / Consultation, page 6

Key methods and tools for **informing** and **consulting** with stakeholders include:

- Website
- Email / letter distribution
- Personalised email / letter in response to query or request for information
- Fact Sheets.

Key methods and tools for **involving** with stakeholders include:

- Community contact database
- Personal one-on-one visits
- Information sessions and site tours.

Hanson will engage with stakeholders utilising a variety of consultation tools. All communication will be kept clear, concise and culturally appropriate. The proposed schedule of engagement incorporates various methods planned to deliver a range of communication options.

Activity	Time-frame	Communities	Level of Engagement[4]	Comments
Community Information Session / Site Tour	As required	Community members Earth Resources Regulation	Inform Consult Involve	Should include presentations by Hanson and statutory authority representatives.
Ministers, elected State representatives and City of Frankston Councillors	As required	Politicians	Inform Consult Involve	Should include latest information re operational activities undertaken and future planning / operational strategies.
Community Contact Database (CCD)	Real time	Community Community organisations Government Regulatory Authorities Non-Regulatory Authorities Media	Inform Consult Involve	Utilised for real time information distribution and issue / query registration. Process includes recording of contact details, issue / query management, investigation and report feedback and report generation.
Personal meetings	As required	Politicians Community organisations Community members	Inform Consult Involve	Utilised in direct response to contact with Hanson.

[4] IAP2 Public Participation Spectrum, Community Engagement Guidelines for Mining and Mineral Exploration in Victoria, Step 5, Levels of Engagement

Activity	Time-frame	Communities	Level of Engagement[4]	Comments
Website	Regularly monitored	Politicians Statutory Authorities Community organisations Community members Media	Inform Consult	Utilised for distribution of updates and real time information. Also utilised as Community Contact Database registration, issues / query management and complaints process mechanism.

Table 3-2: Community Consultation Plan (CCP)

Utilising all activities outlined above, Hanson will ensure all stakeholders are aware of their involvement in the EPA Works Approval process. Clear messaging will appear on the Hanson website and in all relevant publications, including promotion of CCD registration details.

Example of messaging:
Strong community stakeholder relationships are integral to Hanson's endeavour to be a responsible corporate citizen. The value of community engagement is recognised at every level of Hanson and we consider our neighbouring communities and businesses, non-government organisations and all levels of government, to be key participants in our planning for the future.

An important aspect of Hanson's business plan is our commitment to seek input from our community, ensuring consistent performance improvement.

Hanson will always investigate issues raised by our community and, where possible, find solutions that balance community and customer expectations with business needs and regulatory requirements.

The CCP is not a fixed document. It will be consistently reviewed to reflect any change in circumstances.

Formally, the role and progress of the CCP will be reviewed regularly by Hanson executive and operational management and at times when significant aspects of the project arise. The ongoing CCP will be reviewed at yearly intervals during the operating life of the site.

3.2 Describe the engagement / consultation you have done.

What type, with whom, have you met on multiple occasions, etc.

As described in **3.1** above, Hanson took ownership of the site in 2016, although the site has operated as a quarry for more than 35 years. During this period, stakeholder engagement has been primarily conducted with neighbouring industries.

To improve access to the wider community, **Hanson actively participated in the *Frankston City Council Green Wedge Management Plan* workshop**. Through this process, Hanson representatives met and interacted with local community members, responding to their queries and providing information. **Since that workshop, no community members have contacted Hanson for further information**.

However, following the departure of the tenants of the subject property in Valley Road, Hanson was made aware of residents' concerns about the expansion of the quarry. The concerns were driven by information / claims provided by the departing tenants.

Maintaining their commitment to proactive engagement, Hanson conducted a **door knock campaign of all neighbouring Valley Road residents** on Thursday 25 October 2018 to discuss their concerns and invite them to **a tour of the Hanson Langwarrin Quarry**. The tour, conducted on Saturday 10 November 2018, included a presentation of Hanson's plan for the Valley Road property *(refer* **APPENDIX A***)* and an opportunity for community members to meet Hanson management and an Earth Resources Regulation representative.

Community members were also offered the opportunity to register with the Hanson Langwarrin Quarry Community Contact Database which, apart from maintaining a record of all engagement, is utilised by Hanson as a proactive engagement tool.

The site tour was attended by 12 residents of Valley Road, with a further two parties unable to attend the event, briefed by Hanson over the following days.

While attendees' names cannot be provided without their express permission, residents from the following properties were in attendance:

- 14 Valley Road, Langwarrin (2)
- 40 Valley Road, Langwarrin (2)
- 44 Valley Road, Langwarrin
- 50 Valley Road, Langwarrin
- 70 Valley Road, Langwarrin (2)
- 80 Valley Road, Langwarrin
- 85 Valley Road, Langwarrin
- 205 Potts Road, Langwarrin (2)

Residents of the following properties were provided with a brief following the meeting:

- 34 Valley Road, Langwarrin
- 55 Valley Road, Langwarrin

Upon departure, attendees were invited to take copies of:

- Hanson Langwarrin Quarry Fact Sheet *(refer* **APPENDIX B***)*
- State Government of Victoria Extractive Resources in Victoria: Demand and Supply Study 2025-2050
- State Government of Victoria Helping Victoria Grow: Extractive Resources in Victoria Demand and Supply Study to 2050
- State Government of Victoria Joint Ministerial Statement: Extractive Resources.

Following the site tour, all attendees were sent a letter *(refer* **APPENDIX C***)* thanking them for their time, encouraging them to stay in touch and providing them with links to further information as requested.

3.3 What was the response from the stakeholders?

Provide EPA with evidence that stakeholders know about your proposal, what their concerns are (if any) and how these were addressed. For verification purposes include stakeholder contact information (eg scanned attendance list with contact information).

The key issues raised by community members were predominantly associated with zoning and end use of the site, with **a strong implication of distrust in both government and corporate planning processes**.

The zoning discussion led to the community's concern regarding how the quarry will be left and what would be the end use of the property, including its benefits to the community and the environment.

Hanson advised that it supported the Frankston City Council's *Economic Development Strategy 2016*-2022, in which the Council identifies a key economic development drivers that require attention as being new employment opportunities via strategic land use planning**.** Hanson's submission to Council seeking consideration of the site and surrounding land as a 'Potential Future Employment Precinct' was included in the presentation to community members *(refer* **APPENDIX A***)* and not met with any objection by those community members in attendance at the event.

Attendees were invited to complete a CCD registration form and to seek any additional information they feel they may require. Not all in attendance chose to submit any information. However, of those received, the following was recorded:

Comments / Queries / Issues	Method to reply to concern
Will signage on Valley Road be put up to let locals know about this?	As the property at 60 Valley Road will be utilised for maintenance and emergency vehicles only, no major signage will be required. However, Hanson will put an identification sign at the entrance to the site advising no entry unless authorised.
Please provide information by mail - no computer.	Request has been noted in the CCD.
Concern about the monitoring of the security of the area.	
Concern about current holes in fences where children are getting on site.	Quarry Manager to review and repair.
Concern about the end water quality and quantity of Boggy Creek and other water courses.	The surface water study and any additional hydrology studies required by ERR will provide this information.
What is the legacy your company will leave in terms of the community and the environment?	Community will be involved in development of Rehabilitation Plan.
Can we get paid for native vegetation offsets? If so, how?	Links to information and brokers included in letter sent following site tour.

Table 3-3: Stakeholder comments registered

Mitigation measures established by the approved Work Plan will be implemented, managed, monitored and reported as defined by the plan and associated conditions. These measures will be cross-referenced with stakeholders registered on the CCD and relevant advice provided accordingly.

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Hanson Langwarrin Quarry

Community Information Session

Saturday 10th November 2018

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Agenda

- Introductions
- Safety
- Hanson's intentions
- Regulatory Authorities
- Residents' Opportunities to Respond
- Site Conditions & Time Lines
- The Need for Quarry Products
- Hanson Contacts
- Site Tour
- Questions & Lunch

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Site Welcome & Health and Safety

Welcome & Introductions

Earth Resources Regulation (ERR)
Gerard Lynch, Inspector
Metro Regulatory Compliance

Hanson Team
Daniel Fyfe
Mark Morse
Jack Jaskolowski
Rob Francis

PLC Consulting
Kathy Mac Innes

LH Strategic Communication
Lyndel Hunter

Community Members
Optional self introduction invited

Site Welcome & Health and Safety

Site Health and Safety

Jack Jaskolowski,
Quarry Manager, Hanson

Sign Visitors Register

Follow Supervisors' directions

Appropriate PPE required

Stay on the bus during site tour

High Viz Vest

Enclosed Shoes

Hard Hat
(if leaving bus)

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Community Engagement

Hanson Approach

- *Hanson is pro-active with engaging local communities.*
- *Hanson won the Victorian CCAA 2018 Innovation Award for Community Leadership*

Left to right.
Bruce Webster, Lysterfield Quarry Manager
Trevor Harley, CRG member
Hon. Tim Pallas MP, Resources Minister & Treasurer
Virginia Bright, CRG Member
Daniel Fyfe, Hanson Development Manager

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Site Background

History

- Amatek (Rocla) purchased the "Mukadilla Sands" quarry from J&R Turner in 1988.
- Hanson Quarry acquired the site in 2016.
- Current quarrying life:
  - less than 1 year (estimated)
- Proposed quarrying life:
  - 4 – 6 years (estimated)
- Rehabilitation time frame:
  - 10 – 15 years after quarrying (estimated)

Other operators

- Burdett
- QRR (Fleet)
- ResourceCo (filling for Hanson)
- Monk
- Graham Quarries

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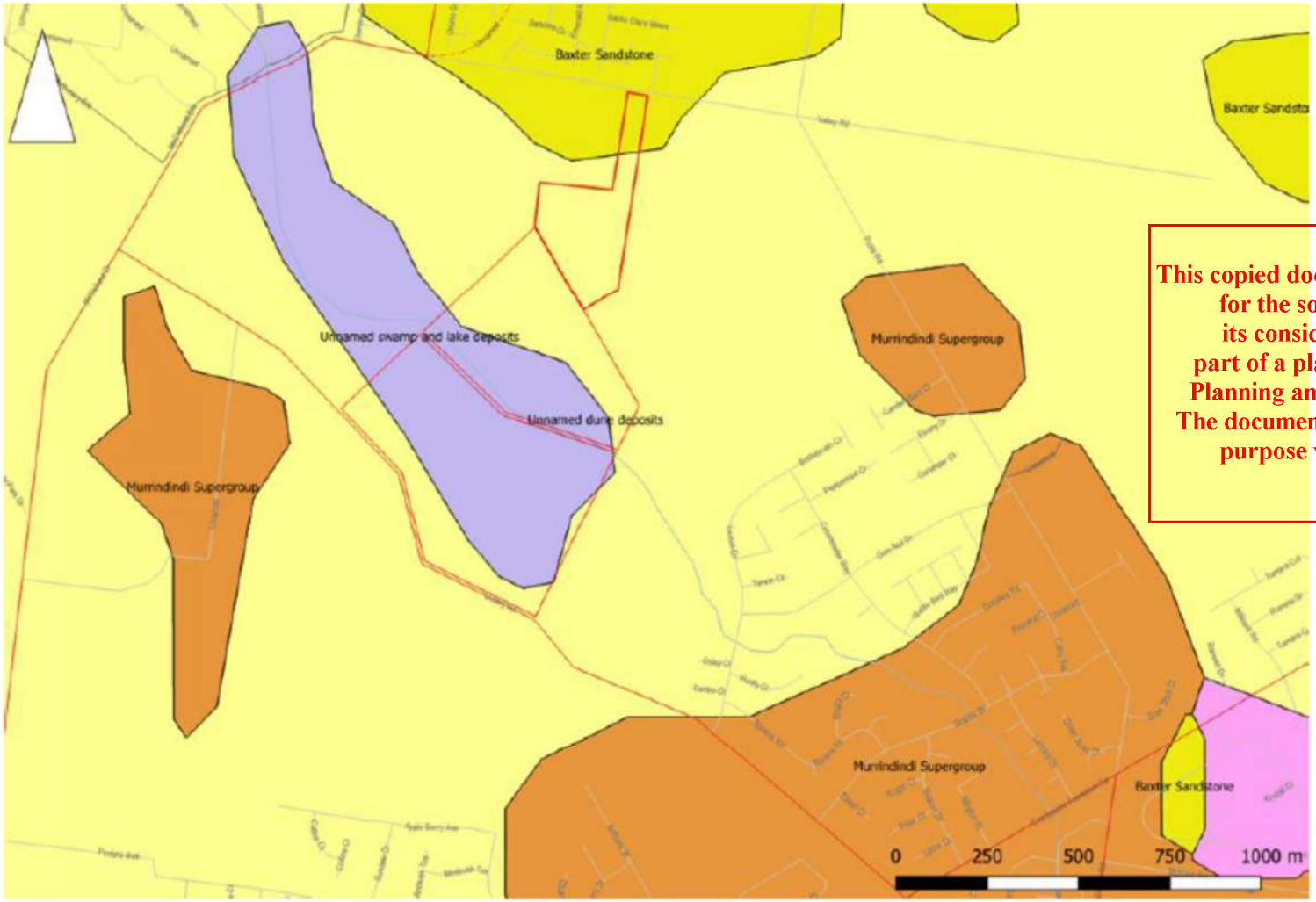
Geology



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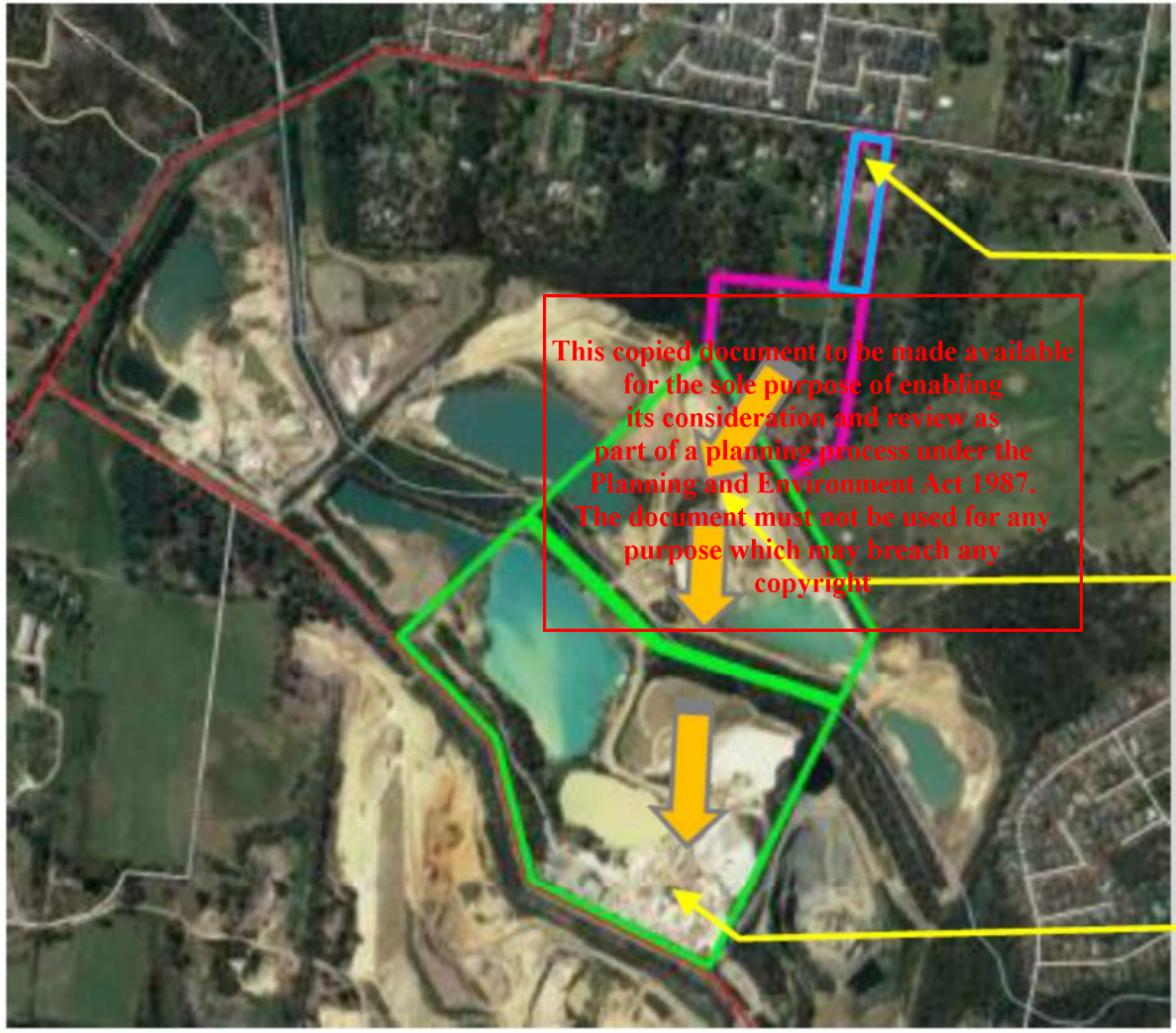
Proposed Quarry Extension



No heavy vehicle access via Valley Road

Sand to be extracted via current dredge

Sand processing plant to remain at Quarry Rd

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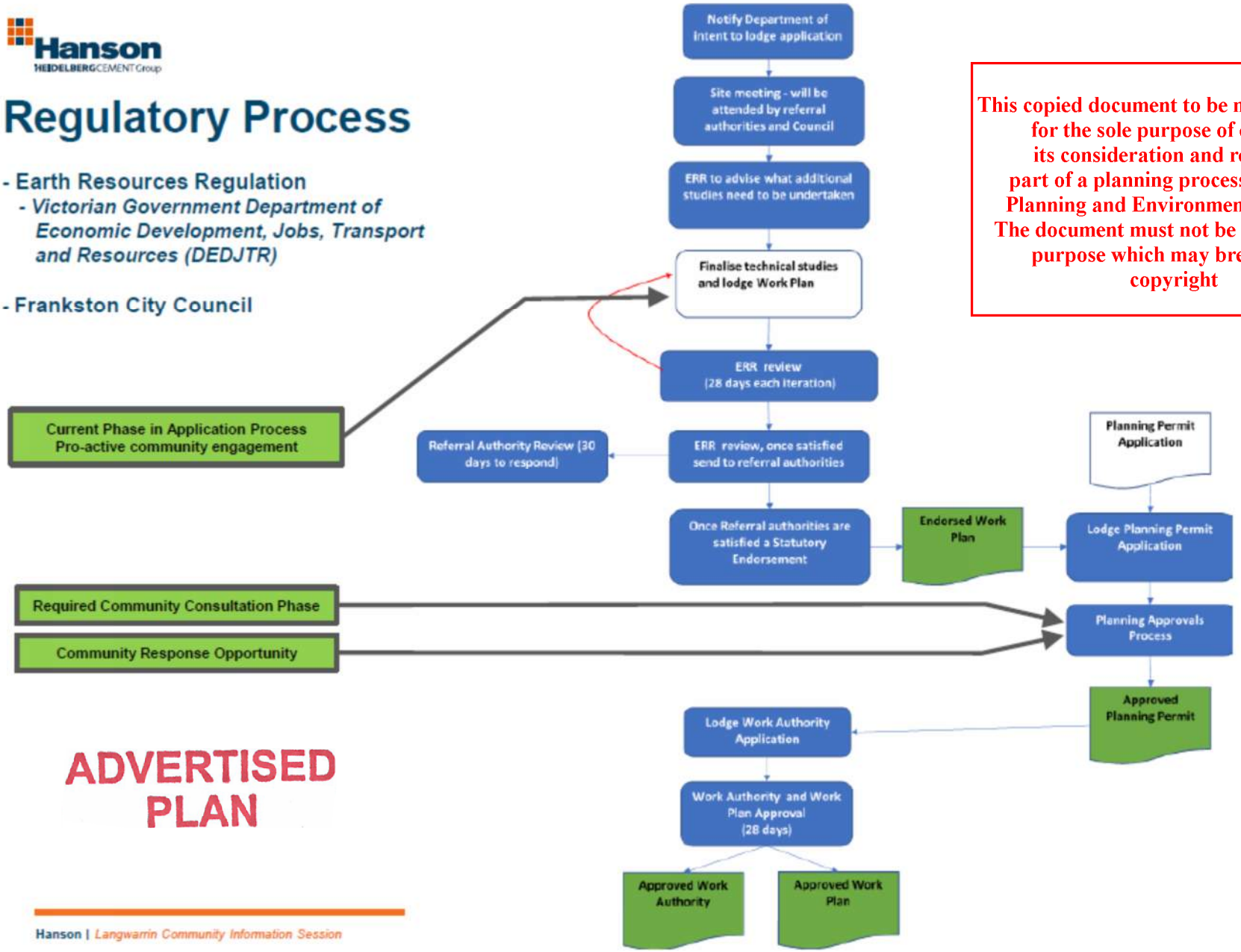
Regulatory Process

- Earth Resources Regulation
  - *Victorian Government Department of Economic Development, Jobs, Transport and Resources (DEDJTR)*
- Frankston City Council



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Specialist studies

- Geotechnical
- Cultural Heritage
- Flora and Fauna
- Surface Water
- Bushfire

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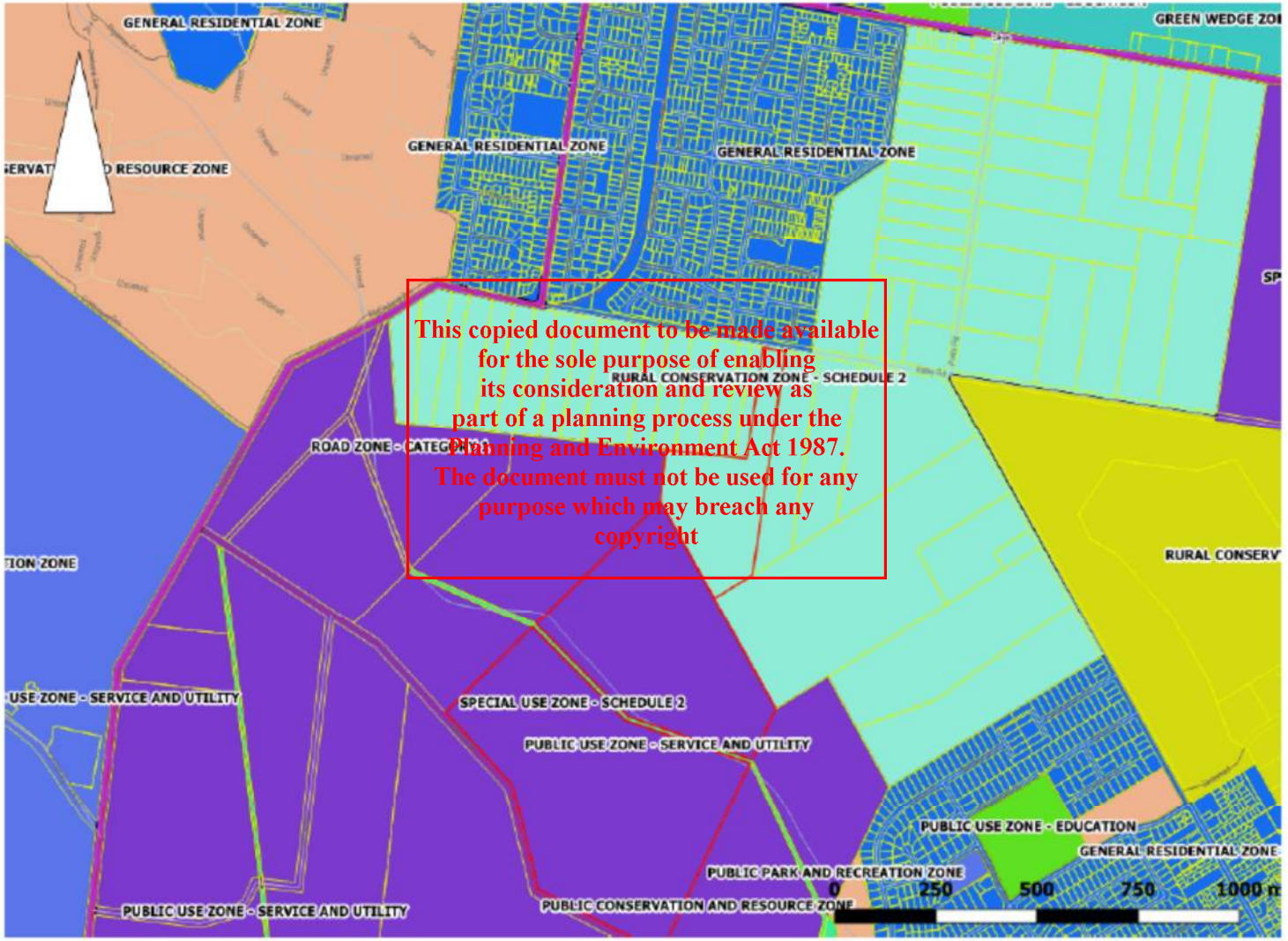
Planning zones



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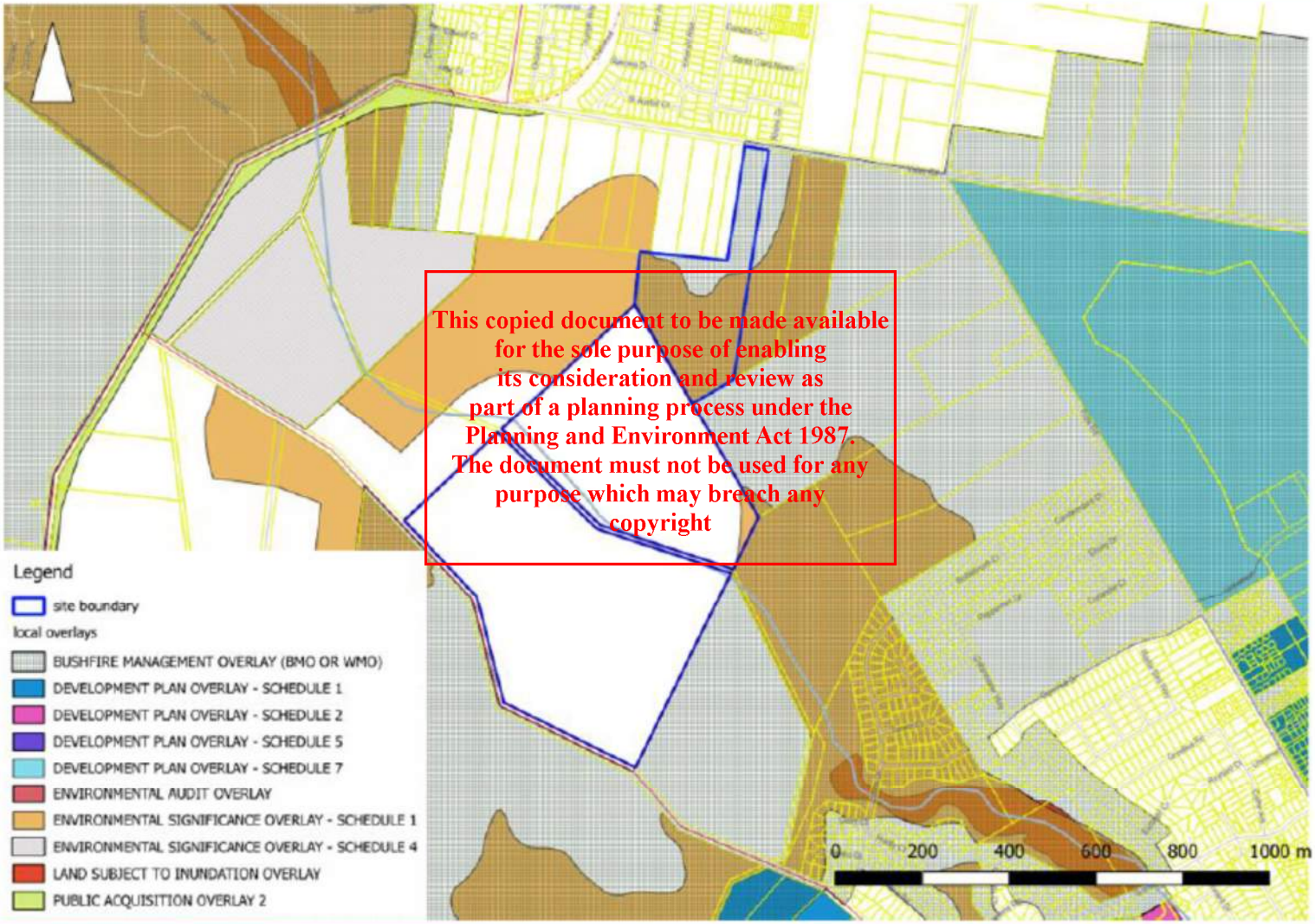
Planning overlays



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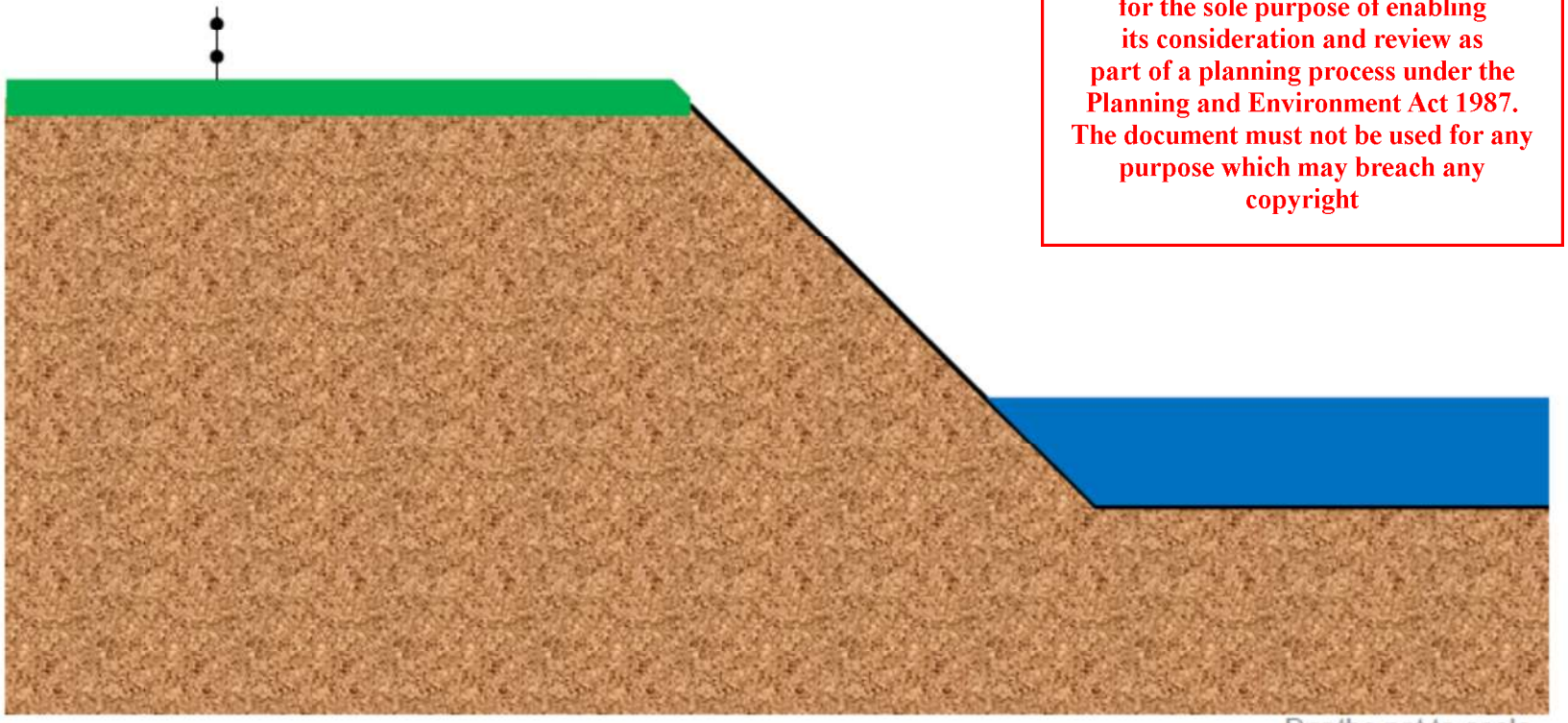
Current Rehabilitation Plan

Includes:

- 1:1 Batter Slopes (45 degrees)
- Safe fencing



Depths not to scale

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Future Use

From Frankston City Council's website...

https://www.frankston.vic.gov.au/Business/Policies_and_Strategies_for_Economic_Development/Economic_Strategies

4. Identify opportunities for future employment land

Utilise the Green Wedge Management Plan to identify opportunities:

- Industrial
- Horticulture
- Agriculture
- Food
- Recreation
- Tourism

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State Needs

On 15 June 2018,
Minister for Resources, Tim Pallas launched the Victorian Government's strategy to ensure availability of resources.

"We need to make sure our quarries can keep up with the demand"

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State Needs

State Government Priorities

- Long term planning of resources, land use and transport
- Ensure communities are informed and included
- Long term rehabilitation
- Improvements to ERR

Growth and Demand

- Proximity of construction materials to infrastructure projects will directly influence construction costs.
- It is important to maximise the resources available at existing quarries.

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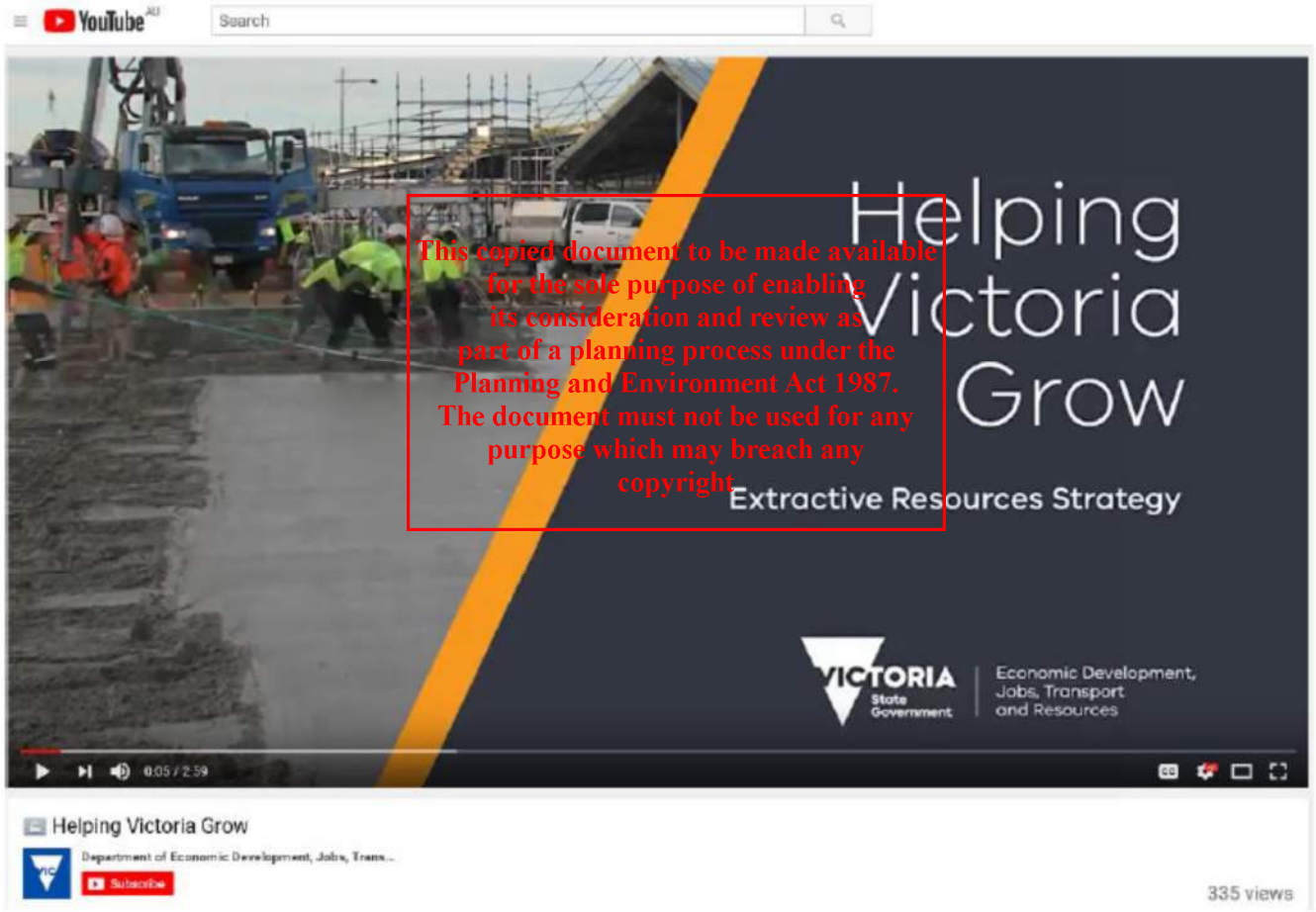
State Needs

Helping Victoria Grow video...

https://www.youtube.com/watch?v=88WHVOb6P5s



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Hanson Langwarrin Quarry

Hanson Construction Materials Pty Ltd is one of Australia's leading suppliers of heavy building materials to the construction industry. We produce aggregates, including crushed rock, sand, gravel, crusher dust and road base, and a high quality premixed concrete range.

Surface water pond near south-western boundary of the Valley Road site

Hanson's general and speciality sand products include specified sands for concrete, mortar, plaster, fill and specialised dried sands for glass manufacture, used in foundries, sports surfaces and many other manufacturing uses.

Hanson has owned and operated the quarry located at 150 Quarry Road, Langwarrin since 2016, although the site has operated as a quarry for more than 35 years. The quarry, including the property at 60 Valley Road, has a total site area of 53.86 hectares. Current assessments indicate a potential quarry extraction lifespan of approximately 6 years.

The site has a 20 metre buffer zone along the northern boundary of the existing quarry site and a 60 m buffer bordering Quarry Road ensuring enhanced protection from dust and noise while offering a view of local flora.

WHAT WE DO

Langwarrin Quarry contains proven reserves of Tertiary aged Baxter Sands (recently renamed the Sandringham Sandstone) which is extracted and processed on site. Quarrying activity comprises extracting sand and transporting it to an onsite plant, then stockpiling the processed sand for sale. The quarry supplies markets in the surrounding southern and eastern suburbs and the CBD with high quality sand for building and infrastructure projects.

ABOUT THE SITE

Access to the Hanson Langwarrin Quarry is from Quarry Road, which forms the southern boundary of the site. The processing plant and site offices are also located on the southern edge of the site.

There are several other approved extraction industry sites to the east and south of the site, with residential areas to the north and west.

Site surrounds

HOW WE MANAGE THE SITE

Management of the Langwarrin Quarry is more than ensuring the day-to-day business is conducted effectively. Environmental management is a primary element of the operation, ensuring progressive site rehabilitation and minimal impact to facility neighbours and the community.

The operation of the quarry is subject to a range of legislative and statutory regulations managed by state and local government agencies including the Earth Resources Regulation division of the Department of Economic Development, Jobs, Transport and Resources; the Department of Transport, Planning and Local Infrastructure; Environmental Protection Authority Victoria; the City of Frankston and Southern Rural Water. Maintaining compliance to licences and regulations requires Hanson to constantly monitor its activities and provide regular reports to the relevant authorities. Non-compliance with these regulations can incur stringent penalties.

Dust management is directed by regulatory controls that require consistent monitoring and reporting to the relevant authority. The watering of internal roads and product stockpiles with an onsite water cart and the utilisation of dust suppression sprays within the crushing and screening plant maximise dust control. Further, Hanson is currently undertaking research and development trials at other Melbourne metropolitan quarries into dust suppression products that manage fine dust particles.

Noise impacts from quarrying operations are minimal due to the 20 metre buffer, earth mounds and tree planting which all assist to minimise the impact of operational activity. Truck movements are subject to strict noise reduction regulation and all drivers must adhere to a Driver's Code prepared specifically for the Langwarrin Quarry and the surrounding traffic routes.

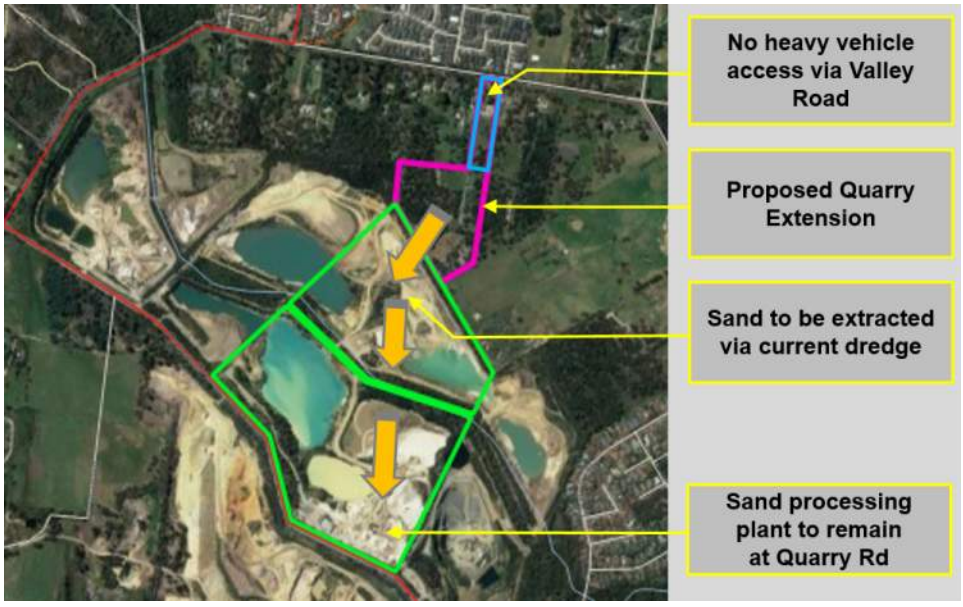
Earlier in 2018, the Hanson Langwarrin Quarry played an important role in controlling an outbreak of bushfires at Carrum Downs. As a result of the fires, residents in the areas of Skye and Langwarrin were advised to evacuate their properties. Water-bombing helicopters were used to protect properties as fire crews on the ground worked to put out fences, sheds and roofs that caught alight. The fire took more than 300 firefighters to put out and prompted the evacuation of around 30 residents in Carrum Downs. The Langwarrin Quarry was used as source of water for the helicopters assisting with the fire fighting.

Stormwater falling within the quarry is collected and conveyed to a storage. The stored water is used for product washing, dust suppression within the plant and keeping the quarry entrance and Quarry Road clear of mud carried by trucks from the site. This water is tested by a third-party licensed under the *Environment Protection Act 1970,* to ensure it is free from pollutants.

The operating hours of the quarry are from 6.00am to 4.45pm Monday to Friday and 6.00am to 11.45am Saturday, except for Christmas Day, Boxing Day and Good Friday.

THE FUTURE OF THE SITE

Hanson has purchased the property at 60 Valley Road, Langwarrin, and is applying to the State Government to increase the site's permitted extraction area. It is Hanson's intention to extract sand from the area located a further 250 metres beyond the currently approved boundary.



Proposed additional extraction area

While this application will extend the lifespan of the quarry by approximately 8 years, production and traffic will not increase.

Processing will remain on the southern side of the site and all quarry trucks and equipment will utilise the Quarry Road entrance. The Valley Road property will only allow access for light maintenance and emergency vehicles.

To obtain approval for this expansion, Hanson has committed to undertake a range of specialist studies including flora and fauna, bushfire assessment, surface water management, cultural heritage and geotechnical risk. These studies will be conducted in accordance with the *Mineral Resource (Sustainable Development) (Extractive Industries) Regulations 2013* and assessed by Earth Resources Regulation, a division of the Department of Economic Development, Jobs, Training and Resources.

Hanson is currently participating in the City of Frankston's development of the Frankston Green Wedge Management Plan, and has recommended to Council that the site be identified as a 'Potential Future Employment Precinct'. This is an active response to Council's concern regarding future employment opportunities for its growing community.

Hanson is committed to working closely with the community to be a good neighbour, protect the environment and continually improve standards. We thank you for your attendance today and encourage you to ask questions, seek information and meet the Hanson staff committed to performing their respective roles to the highest standard.

Hanson Construction Materials Pty Ltd
150 Quarry Road
LANGWARRIN VIC 3910

Project Manager: Mark Morse
Email: community.vic@hanson.com.au
Phone: 9764 4319 during business hours
Hours of Operation: Monday to Friday 6.00am to 4.45pm
Saturday 6.00am to 11.45am

19 November 2018

(Name)
000 Valley Road
LANGWARRIN VIC 3910

Dear (Name)

Langwarrin Quarry Community Information Site Tour

Thank you for taking the time to attend the Langwarrin Quarry Community Information Site Tour on Saturday 10 November 2018. We greatly appreciate your effort.

We also appreciate your questions and comments and trust that you received the information you sought. The comments you provided will assist us with the development of the variation to Works Approval 13 and to the future planning of the Langwarrin Quarry.

As promised, attached please find the PowerPoint presentation delivered to you at the information session. Should you have any further queries or require further information about the presentation, please do not hesitate to contact either Mark Morse or Robert Francis. Their contact information is contained within the presentation.

Further, some of the issues raised by community members are beyond Hanson's scope of authority, so we have included some external links that may provide the information being sought.

Earth Resources Regulation, Extractive Industry Guidelines and Codes of Practice:
http://earthresources.vic.gov.au/earth-resources-regulation/licensing-and-approvals/sand-stone-and-clay/guidelines-and-codes-of-practice

Frankston Planning Scheme: http://planningschemes.dpcd.vic.gov.au/schemes/frankston

Native Vegetation Offset information: https://www.environment.vic.gov.au/native-vegetation/native-vegetation/offsets-for-the-removal-of-native-vegetation

Native Vegetation Offset Brokers:
https://www.environment.vic.gov.au/__data/assets/pdf_file/0020/329501/List-of-NVCR-accredited-brokers-and-site-assessors_July2018.pdf

Meanwhile, should you have any queries or require further information, please do not hesitate to contact me.

Regards

Mark Morse
Project Manager

MacInnes, Kathy

From: Richard Hook <Richard.Hook@epa.vic.gov.au>
Sent: Tuesday, April 9, 2019 3:55 PM
To: Fyfe, Daniel (Doncaster) AUS; Kathy Macinnes
Cc: Megan Vallas; Stephen Adamthwaite; Quentin Cooke
Subject: EPA Approval Pathway form - Hanson Langwarrin Quarry

Dear Kathy

Following our conversation earlier this afternoon and our conversation at the start of February (where I stressed the need to include confirmation information on the effect of the proposed expansion would have on the licensed discharge from the quarry and confirmation of any drainage line diversion), please find below EPA's feedback on the pathway application.

On the assumption that there is no change to the volume of discharge and the indicators in the licence table (see extract below), no Works Approval would be required, just an Amendment to EPA Licence 3307 to reflect the change in the Site Boundary and Premise Plan – which would be dealt with our Licencing Team (led by Stephen Adamthwaite).

Discharge to Water Table - Discharge Limits

Discharge Point No	Description of Discharge Points	Indicator	Limit Type	Unit	Discharge Limit
1	Boggy Ck 300m E & 250m S of NW corner	Flow Rate	Mean Daily flow	ML/D	0.3
		Electrical conductivity	Annual Median	µS/cm	800
		Electrical conductivity	Maximum	µS/cm	1,000
		Turbidity	Annual Median	NTU	40
		Turbidity	Maximum	NTU	50
		pH	Maximum	pH	9
		pH	Minimum	pH	6

ML/D = Megalitre per day
NTU = Nephelometric Turbidity Units
pH = pH Units
µS/cm = Microsiemens per centimeter

LI_DW2.1.1 You must not discharge wastewater to surface waters at a rate of more than 4.32ML/da

Accordingly, going forward we would ask that you:

- confirm, in writing, the current frequency of off-site discharges to Boggy Creek
- confirm, in writing, that there would be no change in the discharge volume or indicators above with substantiating information to demonstrate this
- provide the hydrological study that clarifies how the drain line is to be diverted and any changes that may have to surface water management at the site
- formally write to the EPA'S Licencing Team requesting an amendment to Licence 3307, including a high resolution copies of the revised site boundary and premise plan

Kind regards

Richard

Richard Hook
Senior Project Manager - Approvals
Development Assessments

Environment Protection Authority Victoria
200 Victoria Street, Carlton VIC 3053 | GPO Box 4395, Melbourne VIC 3001 | DX 210082
☎ 0396952794 | **M** 0475974791 | **E** richard.hook@epa.vic.gov.au | www.epa.vic.gov.au

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Department of Environment,
Land, Water and Planning

PO Box 500, East Melbourne,
Victoria 8002 Australia
delwp.vic.gov.au

Kathy Mac Innes
Principal Environmental Consultant
PLC Consulting
PO Box 33298
MELBOURNE VIC 30043

Dear Kathy,

WA13 LANGWARRIN QUARRY

Thank you for your invitation to attend an onsite meeting regarding the above project. At this stage it is not necessary that a representative from this office attend an onsite meeting.

There are no known historical heritage sites within the works area.

It is important to note that there is blanket protection for all historical archaeological sites in Victoria. It is an offence to disturb these sites without consent from this office. If at any time any historical archaeological features, deposits and/or artefacts are uncovered during works please cease works in the immediate vicinity and contact this office.

If you have any questions or queries please contact Maddison Miller, Archaeologist at 03 9938 6879 or Maddison.miller@delwp.vic.gov.au.

Yours sincerely

for
Steven Avery
Executive Director
HERITAGE VICTORIA

12/09/18

VICTORIA State Government

Melbourne Water

30 November 2020

Julian Giannetti,
Engeny Water Management.

Dear Julian,

Proposal: Pre-development advice - Proposed extension to existing Quarry works
Site location: Lot No 1, 60 VALLEY ROAD LANGWARRIN 3910

Melbourne Water reference: MWA-1067240
Date referred: 24/07/2018 - Current info on 07/10/2020

Thank you for your submission of a preliminary Functional Design and a Stormwater Management Plan for the proposed extension of the Hansen Langwarrin Quarry. (Functional Design and SWMS Report by Engeny Consultants; Ref No.: V1259_001; Dated: October 2019)

As discussed with you over the telephone, Melbourne Water is not in a position to carry out a complete assessment or provide advice on the proposal until an interagency meeting is held which is part of the process of varying a works authority. Our preference is to wait until such a meeting is organized to provide specific requirements for the proposal.

However as part of an initial assessment we can provide the following advice:

- Understanding the existing conditions and operations of the quarry, we have been experiencing an on-going issue downstream with sand deposition into the PV managed Reserve, and therefore would require to see evidence that the quarry is NOT contributing to the sand deposition;

- We also haven't had any follow up on the items requested back in 2019 around existing conditions/operations of the quarry; (Refer attached email to Kathy Macinnes of PLC Consulting on behalf of Hanson Partnership).

Feedback on the submitted SWMP is as follows:

- How / where the RORB initial loss and continuing loss values came from needs to be specified. They appear a little high but may be justified with supporting information;

- Validation of the calculated RORB flows by comparing them to the ARR RFFE determined flows is not supported by Melbourne Water. In the relatively short period of time since the ARR RFFE model has been available for use, it has been seen that it estimates lower flows than many of the other methods used prior to the publication of ARR2019, particularly for smaller catchments. Comparing against at least two estimation methods needs to be included if ARR RFFE is one of them;

- The discharge of upstream catchment water/flows into the quarry hole is something

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990 La Trobe Street Docklands VIC 3008
PO Box 4342 Melbourne VIC 3001 Australia
T 131 722 F +61 3 9679 7099
melbournewater.com.au

that Melbourne Water and Southern Rural Water has rejected at other sand quarry operations over the last 10 years that we know of. Did this quarry obtain previous approval for water/flows to enter the pit hole or is this just something that has happened?;

- If the water/flow diversion into the quarry hole is allowed during the operation of the quarry, a concept design of how it will be reinstated to flow into Boggy Creek following rehabilitation of the site is required prior to our approval being given. The final arrangement must be sustainable using only minor / standard maintenance activity and located on undisturbed land or land certified by an approved geotechnical engineer as being 'as good as natural land'. The capacity of the diversion is to be the 1% AEP flow plus freeboard and include where higher flows will enter the former quarry hole during rarer event while maintaining overall stability / no erosion of the system;

- Following the suggested future interagency meeting, any other issues raised related to stormwater management are to be included in a review of the submitted SWMP. The revised SWMP will then need to be submitted for our acceptance prior to referral of the quarry's Work Plan Variation.

Advice

To find out more information in regards to development within flood prone areas please visit our website for more information.

For general development enquiries contact our Customer Service Centre on 131722.

Regards,

Indi Prathapasinghe
Development Planning Services

MacInnes, Kathy

From: Vince Lopardi <VinceL@SRW.com.au>
Sent: Friday, August 2, 2019 11:25 AM
To: Kathy Macinnes
Cc: Warren Santurini; Frank Crameri; Michael D Stevenson (DEDJTR)
Subject: FW: confirming Langwarrin site meeting tomorrow (Tues 28th)

Good Morning Kathy

Apologies for the delay in responding, this has been a tricky issue. As mentioned, Hanson hold a current Registration licence authorising the take and use of 400 megalitres. This licence was initially issued in 2003/04.

Looking at the original application it does appear that SRW issued the licence incorrectly. Registration licences were issued based on the historical use of water and not based on historical operations. Nevertheless it is acknowledged that there is a current licence and therefore I am of the opinion that SRW should accept the status quo.

Therefore current operations can continue with an understanding/commitment that as part of the rehabilitation of the site (or sooner) The waterway located within the variation site must be deviated around or through the quarry site and discharged directly into Boggy Creek.

Whilst this is the view of SRW, Melbourne Water may have another view.

Vince Lopardi
Manager Water Resources & Central Region | Southern Rural Water
Managing Water. Serving Communities

ph: 03 5139 3113 **m:** 0412 514 795 **w:** www.srw.com.au

From: Vince Lopardi
Sent: Wednesday, 29 August 2018 9:01 AM
To: Kathy Macinnes <Kathy.Macinnes@plcconsulting.com.au>
Cc: Ian.McLeod@ecodev.vic.gov.au; Michael D Stevenson (DEDJTR) <michael.stevenson@ecodev.vic.gov.au>
Subject: RE: confirming Langwarrin site meeting tomorrow (Tues 28th)

Good Morning Kathy

In brief, just to recap on SRW's concerns/issues:

Groundwater – From the information provided it would appear that groundwater will be intercepted and therefore the proponent will need to provide a hydrogeological assessment which address but not limited to:

1. Impacts on the water resource and nearby groundwater users;
2. Groundwater use for onsite operations – the use of groundwater for operational use is licensable in accordance with S51 of the Water Act 1989.
3. Please note that the site is located within the Frankston Groundwater Management Area.

Surfacewater – Direct rain water that falls within the void can be used for quarry operations without the need for a licence. However, overland water or natural catchment water must not enter the quarry void or quarry operational areas. Water must be direct around the site. In particular the drainage line located within the variation site must be deviated around the site and discharged directly into Boggy Creek. Please note that area is capped in regards to surfacewater resources.

Vince Lopardi
Manager Water Resources & Central Region Operations

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From: Kathy Macinnes [mailto:Kathy.Macinnes@plcconsulting.com.au]
Sent: Monday, 27 August 2018 3:53 PM
To: Martin.OShaughnessy@epa.vic.gov.au; michael.stevenson@ecodev.vic.gov.au; geoffrey.gilbert@ecodev.vic.gov.au; Vince Lopardi; heritageadvisor@bunuronglc.org.au; marc.yanuli@delwp.vic.gov.au; DevConnect@melbournewater.com.au; Aijaz.memon@melbournewater.com.au; jessica.halstead-smith@melbournewater.com.au; Patrick.McCluskey@melbournewater.com.au; indi.prathapasinghe@melbournewater.com.au; Megan.Vallas@epa.vic.gov.au; Lily.Surace@delwp.vic.gov.au; robert.lean@frankston.vic.gov.au; joanne.lee@delwp.vic.gov.au; Robert Ogden
Cc: jack.jaskolowski@hanson.com.au; Morse, Mark (Langwarrin) AUS; Tom Harrington; Mathieu Maugueret; Lyndel Hunter
Subject: confirming Langwarrin site meeting tomorrow (Tues 28th)

Hello everyone,

Confirming the site meeting tomorrow, please meet at Building 4, entry through the Admin Entrance (refer attached photo).

Meeting will commence at 1pm, please arrive a bit earlier to have time for sign in prior to the meeting starting.

Please bring steel cap boots, hi-vis vest and a hard hat.

If you have any questions please give me a call

kathy mac innes
principal environmental consultant | hydrogeologist

mobile +61 (0)437 401 554
phone (03) 9978 7823
po box 33298 melbourne vic 3004
level 4, 3 bowen crescent, melbourne vic 3004
plcconsulting.com.au

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3 May 2021

Michael Stevenson
Senior Assessment Officer
Earth Resources Regulation
Department of Jobs, Precincts and Regions
GPO Box 4509,
Melbourne,
Victoria 3001

Response emailed to: michael.stevenson@ecodev.vic.gov.au

Dear Michael,

Re: Proposed amendments to Work Plan WA13 for Hanson Sand Quarry at Langwarrin

SRW (Matt Hudson and Josh Hayward) attended a briefing on the above proposal with Robert Francis from Hanson and Kathy MacInnes from Ricardo Energy on 8th April 2021. Kathy also sent through a copy of the following report: 'Hydrogeological Review. WA13 Langwarrin (Issue 4 21 April 2021)'.

SRW has provided comments on the matters relating to our authority, namely:

Work Plan Variation Groundwater Management Plan
I understand that the formal process to refer the work plan variation has not yet taken place however this is an opportunity to comment on the proposal and in particular the proposed Groundwater Management Plan at an earlier stage. I am also aware that initial comments were provided by Vince Leopardi from SRW in early 2020.

In regards to the Groundwater Management Plan SRW recommends that the following improvements are considered:

- There is a clearer statement about the purpose of the Management Plan
- Baseline sampling of BH1, BH2 and BH3 is undertaken to include key metals (total and soluble Fe, Mn, Cu. PB, Zn, Al and As)
- In addition to bores BH1, BH2 and BH3, that consideration is given to the construction of 2 additional bores in the sand aquifer at the southern margin of the site along Quarry Road. If constructed, these bores should be sampled (including metals as above) and included in the ongoing monitoring plan for the site.
- That there is a clear statement regarding the reporting of the management plan (for example annually to ERR, copied to SRW and EPA)

- A clearer statement about the water requirements for the closure and rehabilitation phase, and any ongoing water use.

Groundwater Take and Use Licence
There is an existing groundwater licence for the property (BEE024907) for 102.4 ML , with an operating Licence WLE038553 associated with bore WRK039045.

The existing groundwater take and use licence on site will need to be amended to include the new parcel of land.

As part of the licence variation process SRW would expect to see a groundwater impact assessment of the proposed changes, including consideration of impacts on neighbouring groundwater and surface water beneficial uses, including the environment, and existing groundwater bores.

The hydrogeological impact assessment should include a detailed conceptual model including conceptual cross section(s), and include where practicable groundwater monitoring data from adjacent sites.

In regards to the potential consumptive water demand from the site SRW will expect to see a sensitivity analysis of the volumes required by varying the key parameters within reasonable limits.

Please note that any observation bores will require bore construction licences from SRW.

Surface water licence
The catchment area for the dredge pond (ie north of Boggy Creek) is approximately 117 ha, and this currently flows into the pit which is to the north of Boggy Creek (Fig 4.1 of Hydrogeological Review report). The harvesting of surface drainage is licenced through an annual Farm Dam Registration licence BEE026611 for 400ML. We understand that this pit void does not have a dam wall and is an excavated sand quarry.

The proposed site extension (Valley Road site) will remove some of this catchment, and our understanding is that water will be diverted to a perimeter drain which flows 20m into the existing site where it joins the onsite dams (email Kathy MacInnes 30/04/2021). Given that there are no changes to the operation of the registration licence, a licence amendment to this licence is not required.

If you have any questions relating to this matter then please do not hesitate to contact me on 1300 139 510.

Yours sincerely

Angus Ramsay
Acting Manager Groundwater and Rivers

MacInnes, Kathy

From: Matthew Hudson <MatthewH@SRW.com.au>
Sent: Wednesday, 16 June 2021 1:07 PM
To: MacInnes, Kathy
Cc: Francis, Robert (Doncaster) AUS; michael.stevenson@ecodev.vic.gov.au
Subject: SRW comments on groundwater aspects relating to WA13 Hanson Quarry Langwarrin

Hi Kathy

I can confirm that the comments raised by SRW have been addressed by the comments and proposed actions in the table below, which will be incorporated into the Groundwater Management Plan, or addressed as conditions in the Work Plan.

I have copied Michael Stevenson from Earth Resources into this response.

Matt

From: MacInnes, Kathy <Kathy.MacInnes@ricardo.com>
Sent: Wednesday, 16 June 2021 11:32 AM
To: Matthew Hudson <MatthewH@SRW.com.au>
Cc: Francis, Robert (Doncaster) AUS <robert.francis@hanson.com.au>
Subject: RE: SRW comments on groundwater aspects relating to WA13 Hanson Quarry Langwarrin

Hi Matt

ERR have requested further consultation with SRW (ERR comments in blue).

In response to their previous request for consultation I had responded as follows in their assessment spreadsheet:
A copy of the HA has been provided to SRW and their response is contained in Appendix 13 of the Summary Report. The Groundwater Management Plan in the Hydrogeological Assessment and Risk Assessment have been revised to include SRW's recommendations. It is expected that any outstanding recommendations will be included as conditions on the Endorsed Work Plan.

ERR's response:

Note:
Consult with SRW that the recommendations and comments in their letter dated 3/5/21 have been addressed or can be as part of Endorsed Work Plan conditions

The following table summarises our response to your recommendations:

SRW Comment	Ricardo Response
There is a clearer statement about the purpose of the Management Plan	A statement of purpose was added to the Groundwater Management Plan (Appendix C1)
Baseline sampling of BH1, BH2 and BH3 is undertaken to include key metals (total and soluble Fe, Mn, Cu. PB, Zn, Al and As)	The requested analytes were added to the Monitoring Program (Appendix C3.1 and 3.2)

In addition to bores BH1, BH2 and BH3, that consideration is given to the construction of 2 additional bores in the sand aquifer at the southern margin of the site along Quarry Road. If constructed, these bores should be sampled (including metals as above) and included in the ongoing monitoring plan for the site.	These bores will be installed if the quarry is approved as they would not be needed otherwise. It is expected this recommendation would be included as a condition during the formal referral process.
That there is a clear statement regarding the reporting of the management plan (for example annually to ERR, copied to SRW and EPA)	A new reporting section was added to the Groundwater Management Plan (Appendix C4)
A clearer statement about the water requirements for the closure and rehabilitation phase, and any ongoing water use.	Will need to make a decision on the long term future of the processing plant once quarrying of the Valley Road site s completed. The final land use for the part of the site where the processing plant sits is light industrial so it may be they wish to retain some/all processing capacity with sand from offsite. If so then retaining the existing groundwater licence would be needed. If not then then future water use would depend on the industries that set up there. For this reason the current water use requirements cannot be determined at this time.
Amendment of the existing groundwater licence to include the new parcel of land	It is expected that this would be a condition on the Work Plan endorsement. The requirements of the application as identified in your letter are acknowledged.

I have attached the Hydrogeological report which incorporates the amendments outlined above which formed part of the submitted application

Can you please provide a further written response to ERR's comment (in blue above)

Happy to discuss

regards

Kathy Mac Innes
Associate Director
Ricardo Energy, Environment & Planning

Email: kathy.macinnes@ricardo.com
Mobile: +61 (0)437 401 554

From: Matthew Hudson <MatthewH@SRW.com.au>
Sent: Thursday, 13 May 2021 9:18 AM
To: michael.stevenson@ecodev.vic.gov.au
Cc: MacInnes, Kathy <Kathy.MacInnes@ricardo.com>; Angus Ramsay <AngusR@SRW.com.au>; Joshua Hayward <JoshuaH@SRW.com.au>
Subject: SRW comments on groundwater aspects relating to WA13 Hanson Quarry Langwarrin

Hi Michael

Please find attached comments from SRW regarding the groundwater aspects of the proposed work plan variation at Langwarrin Quarry, noting that this is in advance of a formal Work Plan Referral.

Please let me know if you have any questions or wish to discuss further.

Regards

Matt

Matthew Hudson
Principal Hydrogeologist | Southern Rural Water
Managing Water. Serving Communities

ph: 03 9974 4704 **m:** 0407 103 838 **w:** www.srw.com.au

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Slimes Management Plan

30277 Langwarrin

Hanson Construction Materials have prepared this Slimes Management Plan for their sand quarry located in Langwarrin. Currently, slimes are held in containment dams. Hanson intend to blend the contained slimes with imported fill and use this product to fill former quarry excavations. This Slimes Management Plan outlines the processes, procedures and programs that will be applied in utilising the slimes on site.

1 Existing slimes infrastructure

Item	Information
History of site use	Quarrying operations at the site commenced in 1975. Hanson Construction Materials purchased the site from Rocla in 2016.
Slimes dam details	There are three former slimes dams located in the area adjacent to the Processing Plant. No slimes material has been placed in Silt Dam 1 and Silt Dam 2 since 2017 and the upper portions of the dams are now relatively dry.
Depth of existing slimes dam(s)	The depth of slimes in these dams is thought to be less than 8m thick.
Proximity to waterway and infrastructure	Boggy Creek mostly occupies part of a corridor of land through the centre of the site. A sewer main is also contained within the corridor.
Site drainage and depth to groundwater	Boggy Creek flows from east to west north of the slimes processing area. The creek is on an elevated berm of unquarried material between excavations on either side. The slimes processing area is below the creek elevation so there is no possibility of slimes material entering this creek. The drainage line through the Valley Road site is further to the north again. Groundwater was measured as between RL30 mAHD and RL25 mAHD, (i.e., around 10mbgl to 20mbgl)
Site security	The Work Authority area has a perimeter fence to the south along Quarry Road. There are no internal fences separating the neighbouring quarries to the east and west. The new extraction area is fully fenced around its entire perimeter up to Valley Road. The Valley Road entrance could be used as an emergency access point.
Rehabilitation	Slimes to be blended with imported fill and backfill and used in rehabilitation.
Design of slimes drying pans	The new slimes drying pans will be a turkey nest construction
Embankment height and freeboard	Embankment height will be as required to optimise drying capacity. The drying pans will have a freeboard of 1m.

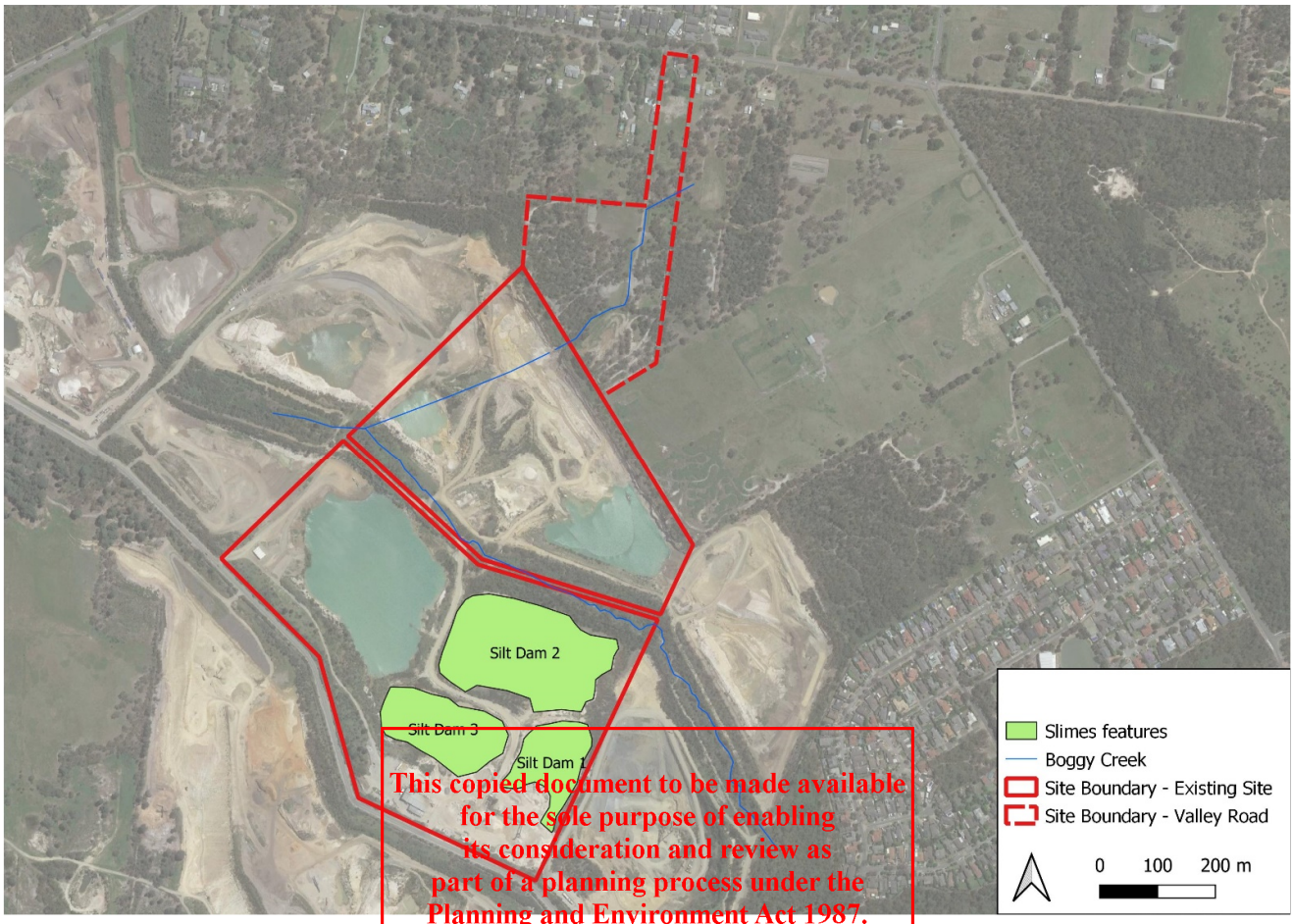

Figure 1 Existing Slimes Dams

2 Slimes Use

The backfill specification, prepared by CMW Geosciences, considers the requirements for intentional placement of slimes with backfill. This process is known as co-disposal and requires careful adherence to procedures to ensure the outcome is as intended. The specification states that slimes used could include those re-excavated from existing slimes dams or slimes separated from active quarry production. If the slimes are from active quarry activities it is a requirement that the slimes are deposited in a basin for the purpose of settlement and drying prior to co-disposal.

Existing slimes on site will be excavated and blended with backfill and imported fill and used in site remediation and rehabilitation. The blended slimes will be used in Stage 1 filling activities onsite. With the slimes removed, these areas can then be filled in accordance with the Fill Specification, and the final landform can be used for employment purposes with buildings.

There are two land uses proposed for the rehabilitated WA13: conservation and employment. It is envisaged that small buildings or factories would be constructed across the employment areas, with the conservation areas existing around the majority of the site perimeter and the Valley Rd site. Removal of the slimes is key to ensuring that development can occur in line with the rehabilitation plan.

The specification for the co-disposal of slimes and backfill includes the following conditions:

- Wet slimes in in the form of a slurry shall not be incorporated into backfill.
- The proportion of slimes in comparison to the other fill shall be 5% or less of the volume (or mass) of the fill layer. After placing a complete layer (lift) of fill a thin layer of slimes shall be spread over the surface. The slimes shall be evenly distributed across the fill placement area. The slimes shall be worked into the surface of the fill during compaction with heavy plant.

2.1 Timing

Slimes Dams 1 and 2 have not received slimes material since 2017, excavation and blending of this material will commence in Phase 2 and 3 of the Rehabilitation Plan. Slimes Dams 1 and 2 are referred to as 'Area D' in the Rehabilitation Plan. Slimes drying pans will be constructed to assist in the drying of the excavated slimes material prior to blending. The indicative location of the pans for Slimes Dams 1 and 2 are shown in **Figure 2** below.

Figure 2 Indicative Pan Locations

Slimes Dam 3 will be used to process the sand from the Valley Rd site. Removal, drying and blending of the slimes material from this dam will occur in Phase 7 of the Rehabilitation Plan.

3 Inspection Program

Hanson Construction Materials personnel will be responsible for completion of the weekly inspection program. Observations on the criteria will be documented during the weekly inspection program:

Table 3-1 Inspection Program

Inspection aspect		Detail
Slimes Infrastructure	Upstream and downstream slopes	Evidence of erosion Photographic evidence required Visually uniform slope (or are erosion channels visible) Evidence of repairs Evidence of seepage
	Crest	Breach / wash out Lateral movement Evidence of settlement or cracking Shoulder erosion Crest visually horizontal Evidence of repairs
	Observed features	Evidence of seepage Evidence of contamination Evidence of erosion or cracking Evidence of movement or settlement Other unusual conditions Evidence of repairs Evidence of vegetation kills in adjacent areas Evidence of sloughing Evidence of boils
Operational Inspections	Drain outlets	Flow efficiency Breakages Animal life observed
	Outer perimeter	Evidence of spillage or seepage Presence of wet areas Vegetation growth
	Decant facility & access	Adequacy of catwalk/access Structural integrity of decant Pond wall position/integrity Pond control
	Slimes delivery system	Operation & control condition of pipes & valves System effectiveness
	Return water storage facility	Storage level Degree of siltation

		Condition of wall
		Spillway condition
		Decant facility
		Pumps, valves and pipes
	Rehab work	Monitor against program
		Fertiliser applications
		Performance of vegetation
	Water quality	Clarity of decant water
		Water chemical testing
		General condition
	Other issues	Buffer zone conditions

4 Incident reporting

After becoming aware of any non-compliance with the conditions, Approved Work Plan, or an environmental incident that will, or is likely to cause material harm to the environment, the Site Manager will notify the relevant Authority of the non-compliance and/or environmental incident.

Events requiring notifications may include but are not limited to:

- Uncontrolled release of slimes (broken pipe, overtopping of dam)
- Seepage (discernible impact on vegetation, soil contamination, groundwater levels)
- Defects in the structure of the slimes dam (cracking, slumping or significant erosion of the wall, faults in the decant system)
- Exceeding the monitoring trigger levels related to surface water or groundwater quality
- Injury or death of fauna on or near the slimes dam.

EPA notification is also required where there is a potential or actual impact on the community or the environment.

All incidents must be reported. The reporting must include:

- The date and time of the event;
- Description of the event and setting;
- The cause, or likely cause;
- The impacts, or likely impacts of the event;
- The actions taken to prevent, minimise or otherwise manage the impacts, or likely impacts; and
- The actions to be taken to prevent such an incident from happening in the future.

5 Emergency response

The Emergency Response Procedures (ERP) should include responses to all potential emergency scenarios including, but not limited to, slimes dam failure, spill events and pipeline rupture. The ERPs should describing and prioritising actions such as protection of personnel, the public, the environment and infrastructure, advice to neighbours and immediate and longer term remedial actions.

An emergency response procedures should include, at a minimum:

- an assessment of persons, property, infrastructure and environmental features at risk
- actions to be taken appropriate to the scale of the emergency, including lines of responsibility (and names and contact details of nominated safety personnel), communications, and involvement of police and emergency services
- provision for training and refreshment programs of safety procedures for all personnel involved
- the types of equipment needed for initial response and later stages of clean up.

6 References

CMW Geosciences. (2021). *Langwarrin Quarry, Outline Backfill Specification.*

Earth Resources Regulation. (2017). *Technical Guideline Design and Management of Tailings Storage Facilities.* Department of Economic Development, Jobs, Transport and Resources.

Earth Resources Regulation. (2021, August). *Environmental guidelines for the management of small tailings storage facilities*. Retrieved from Earth Resources: https://earthresources.vic.gov.au/legislation-and-regulations/guidelines-and-codes-of-practice/environmental-guidelines-for-the-management-of-small-tailings-storage-facilities