26 July 2022

Your Ref:
Our Ref: H20098Av3

Aigle Royal Developments
Level 8, 225 St Georges Terrace
Perth WA 6000
ATTENTION: Kris Kennedy

Dear Kris,

LOT 4 KING RD OLDBURY, HYDROLOGICAL INVESTIGATION

Hyd2o was commissioned by Aigle Royal Developments in July 2020 to undertake groundwater mapping for Lot 4 King Rd, Oldbury to assist an assessment of the potential of the land for sand extraction.

This report outlines the collation of groundwater monitoring data to establish average annual maximum groundwater levels (AAMGL) and maximum groundwater levels (MGL) over the site. These groundwater levels together with other hydrological considerations were then used to inform a suitable sand excavation floor level and provide an estimation of the potential sand resource.

Recommendations are made with reference to the Department of Water and Environmental Regulation (DWER) Water Quality Protection Note 15: Basic Raw Materials Extraction (DWER, 2019) as well as direct DWER advice to aid agency discussions.

1. MONITORING DATA AND AAMGL/MGL CALCULATION

Three monitoring bores were installed local to the site via drill rig on 8 October 2021 by Edrill Environmental with installation overseen by Hyd2o. The bores were constructed and made suitable for water level and water quality monitoring. Bore locations were selected by Hyd2o prior to allow for maximum coverage with reference to available DWER groundwater data in the local area (DWER, 2021a). Bore locations are shown in Figure 1 with bore logs contained in Attachment A.

Given the sandy profile observed during installation, in which groundwater is relatively quick to stabilise, level readings were able to be taken the same day. These readings are shown in Table 1.

Three long term DWER monitoring bores (T200, T210 and T260) were identified within a 2.5km radius of the site to be used for reference in calculations. An additional short term monitored DWER bore (SSB22) was also identified approximately 1km northwest of the site to be used as an additional reference point in mapping. All four DWER bores were also monitored 8 October 2021.

The AAMGL's and MGL's for the long term DWER bores are shown in Table 2 and reflect the period since 2000, a period considered more representative of current and future climate conditions. Long term hydrographs for these bores are shown in Attachment B.

The difference between the DWER bore AAMGL's and MGL's to the readings taken 8 October 2021 are also shown in Table 2. These were averaged into applicable correction values and applied to the monitored site bore readings (and SSB22 reading) to calculate the AAMGL and MGL at each location (Table 3). Mapped groundwater contours over the site based on these AAMGL's and MGL's are shown in Figure 1.

At the three installed bores the estimated MGL ranged from 18.65 mAHD at KR1 to 19.72 at KR3, with AAMGL's 0.63m lower across the site.

Based on these levels, groundwater flows in a northeast direction across the site with an MGL of approximately 19.7 mAHD in the southwest corner of the site and an MGL of 18.8 in the northeast corner of the site. This provides a clearance from natural surface to MGL's of approximately 0.5m to 9.2m over the site.

Table 1: Groundwater Level Monitoring

Bore	Easting (m)	Northing (m)	Top of Casing mAHD	Natural Surface mAHD	Groundwater Level-mAHD 8-10-21
KR1	397359	6432203	23.30	22.70	18.16
KR2	397677	6431820	22.25	21.65	18.52
KR3	396995	6431817	20.80	20.20	19.23

Table 2: Nearby DWER Bore AAMGL and MGL

Long Term DWER Bore	Monitoring Period	AAMGL (mAHD)	MGL (mAHD)	Groundwater Level (mAHD) 8-10-21	AAMGL Correction Value 8-10-21	MGL Correction Value 8-10-21
T200	2000-2021	19.14	19.80	19.12	0.02	0.68
T210	2000-2021	17.62	18.26	17.80	-0.18	0.46
T260	2000-2021	14.77	15.36	15.03	-0.26	0.33
				Average	-0.14	0.49

Table 3: Estimated Bore AAMGLs and MGLs

Bore	Groundwater Level (mAHD) 8-10-21	AAMGL (mAHD)	MGL (mAHD)
KR1	18.16	18.02	18.65
KR2	18.52	18.38	19.01
KR3	19.23	19.09	19.72
SSB22	19.51	19.37	20.00

2. EXCAVATION LEVEL

Water Quality Protection Note 15: Basic Raw Materials Extraction (DWER, 2019) requires an adequate vertical separation to be provided between the base of extraction and the highest groundwater level to protect water quality and prevent evaporation loss, during and after extraction.

It is stated that this vertical separation distance will be determined in the planning and approval process, and as such can be supported by this report.

Setting of any mining excavation level also requires consideration of any future landuse following the completion mining works. As such considerations should be made based on the zoning of the site as 'rural' in the Shire of Serpentine-Jarrahdale's latest planning scheme (LSP3) (Shire of Serpentine-Jarrahdale Intramaps, 2022).

To aid in negotiations Hyd2o have conducted the remainder of the calculations in this report consistent with a mining floor level set 0.5m above site MGL's. However, based on the above Hyd2o considers a clearance of 0.3m above MGL's as a more suitable criteria for excavation. This is consistent with direct DWER advice to align with Water Quality Protection Note 15: Basic Raw Materials Extraction (DWER, 2019). For reference this still provides a clearance of greater than 0.9m to site AAMGL's.

In consideration of the 'rural' zoning a lesser clearance should also provide further opportunity in reestablishment of the land with shallow rooted vegetation following works. It should also be noted that the site has already been predominantly cleared historically, also for sand mining, and as such consideration to any groundwater rise due to the clearing of sparse shallow vegetation is considered to not be relevant.

It is recommended this criterion be discussed with the Shire of Serpentine - Jarrahdale.

3. RESOURCE AVAILABILTY

Based on DWER LiDAR 1m contours the site ranges from 20 mAHD in the southwest corner to a 28 mAHD mound near the northeast corner (Figure 1).

Based on setting mining floor level 0.5m above site MGL's, it is estimated approximately that 307,000 m^3 of sand is available for extraction. Note this estimated volume is inclusive of topsoil.

Figure 2 provides an indication of extractable sand over the site.

4. CONCLUSIONS/RECOMMENDATIONS

This report has been prepared by Hyd2o in support of proposed sand excavation works at Lot 4 King Rd, Oldbury. Groundwater mapping within the site has been undertaken following the installation and monitoring of bores on site.

Mapping of bore data indicates an MGL over the site ranging from 19.7 to 18.8 mAHD with groundwater flowing in a northeast direction. This provides a clearance from natural surface to MGL's of approximately 0.5m to 9.2m over the site.

Based on the adopted mine level for this report of a 0.5m clearance to site MGL's and available DWER LiDAR data it is estimated that 307,000 m^3 of raw sand is available for extraction (inclusive of topsoil).

It is recommended this criterion be discussed with the Shire of Serpentine – Jarrahdale with a clearance of 0.3m to MGL's considered more suitable in consideration of DWER advice aligning with Water Quality Protection Note 15: Basic Raw Materials Extraction (DWER, 2019) as well as future landuse.

It is important to note that this estimate has been based on DWER LiDAR 1m contours and the natural surface may have changed since the LiDAR survey was taken. Hyd2o therefore recommend a site survey be conducted to verify the site's existing levels and the resource quantity detailed in this report.

5. REFERENCES

Department of Water and Environmental Regulation (2021a), Water Information Reporting (online, viewed 15 October 2021)

Department of Water and Environmental Regulation (2021b), Floodplain Mapping Tool (online, viewed 18 October 2021)

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

Shire of Serpentine-Jarrahdale (2021), Intramaps System (online, viewed 10 July 2022)

Should you have any queries regarding this report, please do not hesitate to contact Sean O'Sullivan or Sasha Martens of this office.

Yours sincerely,

Sean O'Sullivan
Engineering Hydrologist

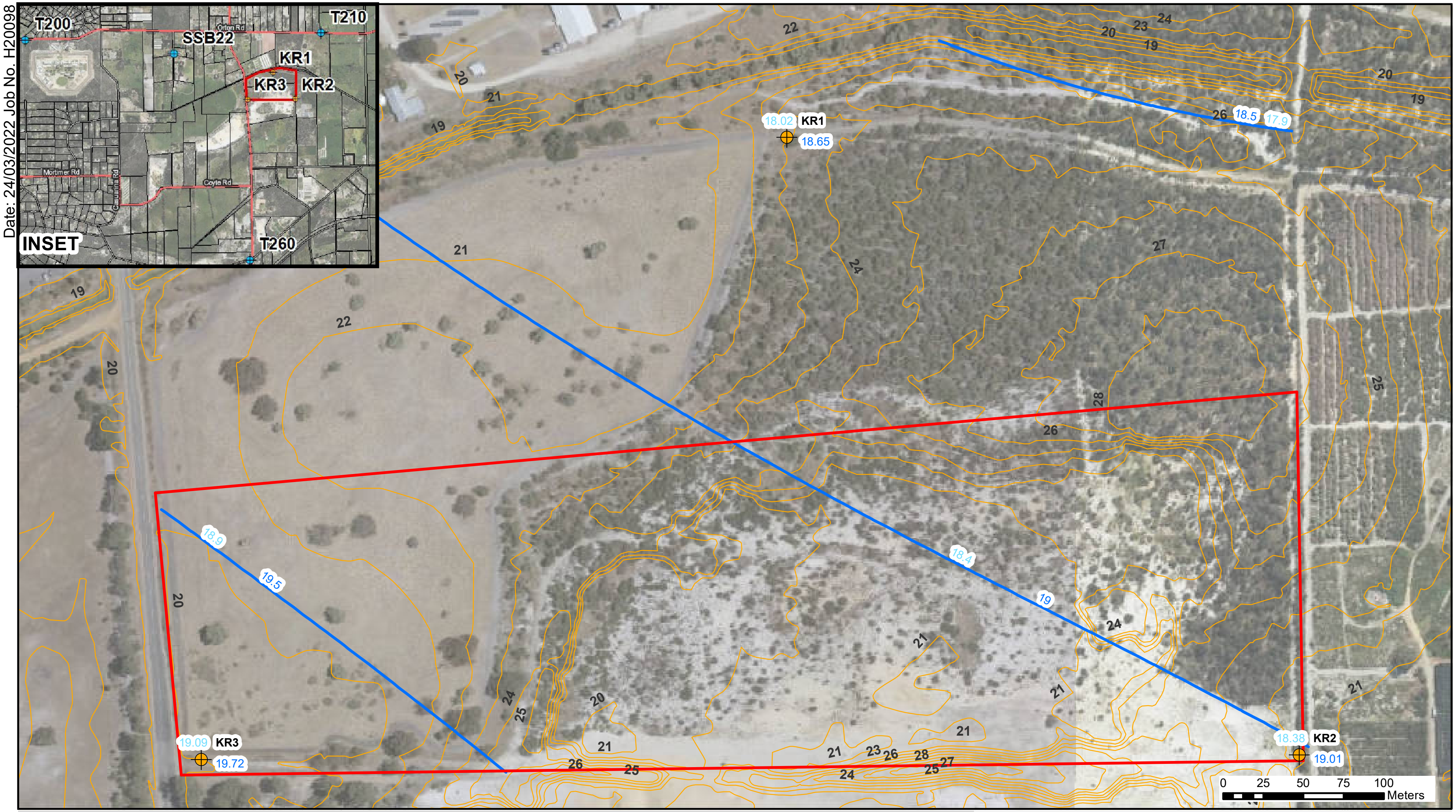
Figure 1: Groundwater Plan

Figure 2: Mining Plan

Attachment A: Lithological Logs

Attachment B: DWER Bore Long Term Hydrographs

FIGURES



Site

Site Bores

MGL (mAHD) AAMGL (mAHD)

DWER Bores

Groundwater Contours

MGL (mAHD) AAMGL (mAHD)

DWER 1m LiDAR Topography (mAHD)

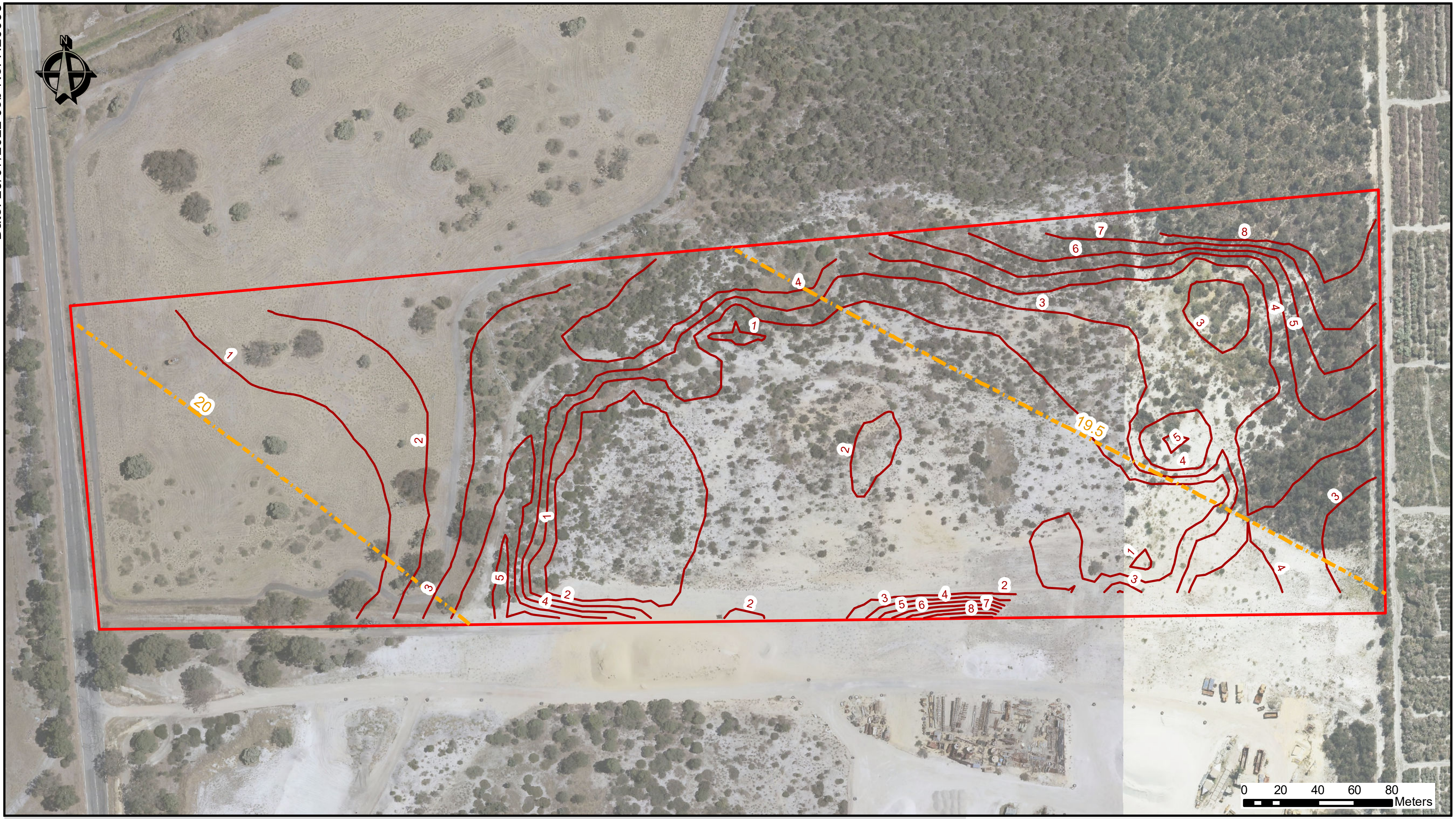
hyd2o

Lot 4 King Rd Olbury Hydrological Investigation

Groundwater Plan

Figure 1

Date: 26/07/2022 Job No. H20098



Site

Mine Level (mAHD)

Extractable Resource (m above mine floor level)

hyd2o

Lot 4 King Rd Olbury Hydrological Investigation

Mining Plan

Figure 2

Attachment A
Lithological Logs

Lithological Log

Hyd2o
Suite 6B 103 Rokeby Rd
Subiaco, WA 6008

PO Box 1055
Subiaco WA 6904

HYDROLOGY

Date :	**08-10-21**
Client :	**Aigle Royal**
Project:	**King Rd DD & Bores**
Easting	**397358.663**
Northing	**6432203.013**
Datum:	GDA94
Drill type:	Drill Rig Hollow Auger
Hole diameter:	75 mm

Job Number :	H21098
Start Hole :	**9:37AM**
End Hole :	**10:32 AM**
Logged by :	**GR**
Total Depth :	**7.5m**
RL Top of Casing :	**23.3**
RL Nat Surface :	**22.7**

Bore Name

KR1

support	backfill	water	Slot / Screen Depth	Depth (metres)	Soil Characteristics					
					Colour	Particle Size	Texture	Organic Content	Moisture	Comment
PVC (Class 9)		∇		1.0m 2.0m 3.0m 4.0m 5.0m 6.0m 7.0m 7.5m	Grey/ Light Brown Beige Light Brown Brown	Fine - Medium	Sand	None	Dry Slightly Moist Moist Saturated	

COLOUR : Black, White, Biege
Dark/Medium/Light : Brown, Red, Orange, Yellow, Grey, Blue
Composition : Solid , Blemish, Mottle
PARTICLE SIZE : Fine, Medium, Course
TEXTURE : Sand, Loamy Sand, Clayey Sand
Silt, Loam, Sandy Loam, Clayey Loam
Clay, Sandy Clay
ORGANICS : High, Medium, Low
MOISTURE : Dry, Slightly Moist, Moist, Saturated

Static Water Level

Date	08-10-21
Stickup above NS (m)	0.6
Water Level bTOC (m)	5.6
Water Level bNS (m)	5

hyd2o HYDROLOGY

Hyd2o
Suite 6B 103 Rokeby Rd
Subiaco, WA 6008

PO Box 1055
Subiaco WA 6904

Lithological Log

Date :	08-10-21				
Client :	Aigle Royal	Job Number :	H21098	Bore Name	
Project:	King Rd DD & Bores	Start Hole :	12:15 PM		
Easting	397676.658	End Hole :	12:43 PM		
Northing	6431819.645	Logged by :	GR	KR2	
Datum:	GDA94	Total Depth :	5m		
Drill type:	Drill Rig Hollow Auger	RL Top of Casing :	22.25		
Hole diameter:	75 mm	RL Nat Surface :	21.65		

support	backfill	water	Slot / Screen Depth	Depth (metres)	Soil Characteristics: Colour	Particle Size	Texture	Organic Content	Moisture	Comment
PVC (Class 9)				0–0.25m	Grey	Fine - Medium	Sand	Some	Dry	
				0.25–0.5m	Medium Brown			Some	Dry	
				0.5–1.0m	Medium Brown			None	Dry	
				1.0m–2.0m	Beige			None	Dry	
				2.0m–2.5m	Beige			None	Slightly Moist	
			2.4m–5.0m (screen)	2.5m–3.0m	Beige			None	Moist	
		▽ (3.0m)		3.0m–3.5m	Beige			None	Saturated	
				3.5m–5.0m	Brown			None	Saturated	

COLOUR : Black, White, Biege
Dark/Medium/Light : Brown, Red, Orange, Yellow, Grey, Blue
Composition : Solid , Blemish, Mottle
PARTICLE SIZE : Fine, Medium, Course
TEXTURE : Sand, Loamy Sand, Clayey Sand
Silt, Loam, Sandy Loam, Clayey Loam
Clay, Sandy Clay
ORGANICS : High, Medium, Low
MOISTURE : Dry, Slightly Moist, Moist, Saturated

Static Water Level

Date	08-10-21
Stickup above NS (m)	0.6
Water Level bTOC (m)	3.6
Water Level bNS (m)	3

hyd2o HYDROLOGY

Lithological Log

Hyd2o
Suite 6B 103 Rokeby Rd
Subiaco, WA 6008

PO Box 1055
Subiaco WA 6904

Date :	08-10-21			Bore Name
Client :	Aigle Royal	Job Number :	H21098	
Project:	King Rd DD & Bores	Start Hole :	11:00 AM	
Easting	396995.053	End Hole :	11:28 AM	**KR3**
Northing	6431816.795	Logged by :	GR	
Datum:	GDA94	Total Depth :	4.5m	
Drill type:	Drill Rig Hollow Auger	RL Top of Casing :	20.8	
Hole diameter:	75 mm	RL Nat Surface :	20.2	

support	backfill	water	Slot / Screen Depth	Depth (metres)	Colour	Particle Size	Texture	Organic Content	Moisture	Comment
					Soil Characteristics					
PVC (Class 9)					Black	Fine - Medium	Sand	None	Slightly Moist	
				1.0m	Grey				Moist	
					Black/Grey				Saturated	
				2.0m	Black					
					Black/Dark Brown					
				3.0m	Dark Brown					
		▽		4.0m	Grey					

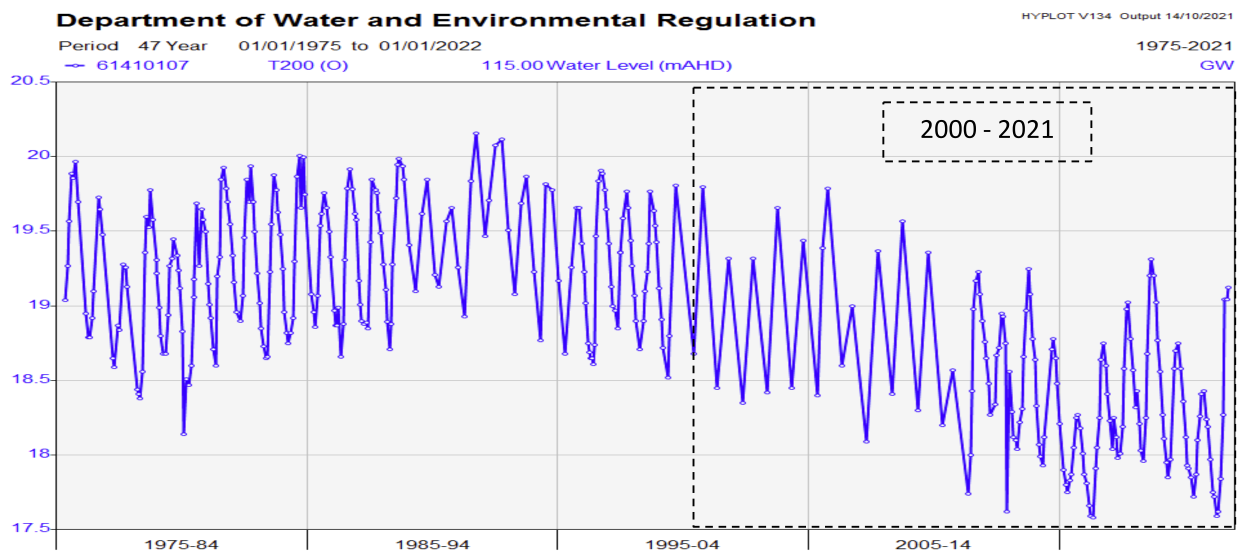
COLOUR : Black, White, Biege
Dark/Medium/Light : Brown, Red, Orange, Yellow, Grey, Blue
Composition : Solid , Blemish, Mottle
PARTICLE SIZE : Fine, Medium, Course
TEXTURE : Sand, Loamy Sand, Clayey Sand
Silt, Loam, Sandy Loam, Clayey Loam
Clay, Sandy Clay
ORGANICS : High, Medium, Low
MOISTURE : Dry, Slightly Moist, Moist, Saturated

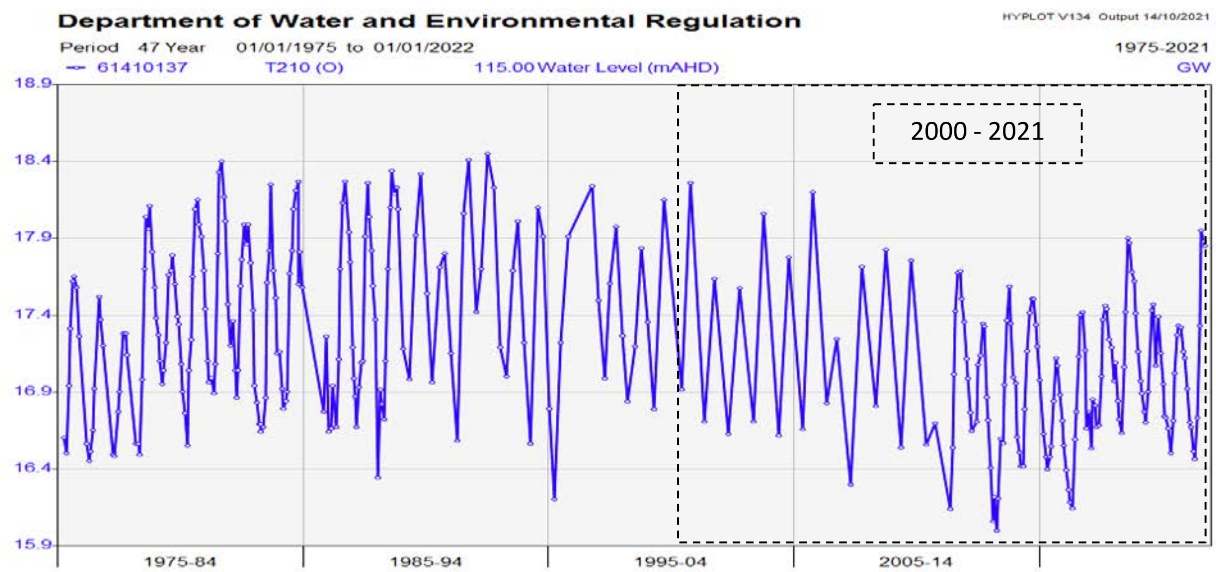
Static Water Level

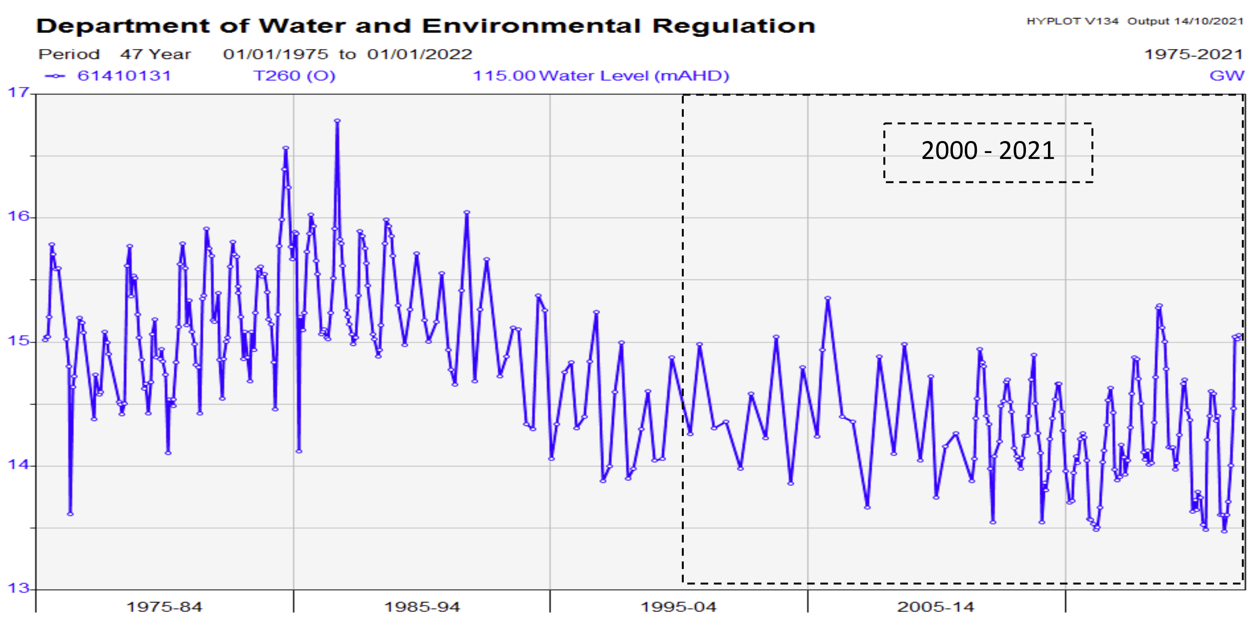
Date	08-10-21
Stickup above NS (m)	0.6
Water Level bTOC (m)	2.1
Water Level bNS (m)	1.5

Attachment B
DWER Bore Long Term Hydrographs

Date: 19/10/2021 Job No. H20098







hyd2o

Lot 4 & 5 King Rd Olbury Hydrolgical Investigation

DWER Bore Hydrographs

Attachment B