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Mike Mulhall
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By email: mike@smartstream.net.au

Dear Mike,

Response to Shire comment on Condition 22 – Groundwater Testing, Lot 41 Cardup Siding Road

1 Introduction

Talis Consultants (Talis) were engaged by Smartstream Technology (the Client) to provide a response to the following Shire comment on Condition 22 – Groundwater Testing for Lot 41 Cardup Siding Road, Cardup WA (the Site).

Condition 22 – Groundwater Testing: The submitted groundwater testing appears to demonstrate that the 'production of plastic at Lot 41 917 Cardup Siding Road has not impacted the underlying aquifer'. However, the assessment does not name the aquifer or provide the depth of the groundwater resource being tested. Therefore, Officers cannot determine which aquifer is being monitored (superficial or deeper aquifers). Furthermore, Officers are unaware of the location of the bore which was monitored, this posing a concern as the report clearly states that 'it is not possible to gain an understanding of groundwater flow direction and consequently the source of any impacts will be difficult to determine.' As such, clarification is required and more certainty that the development has not resulted in adverse groundwater impacts."

1.1 Scope of Work

The scope of work comprised a desktop review and preparation of this letter report. The following information sources were reviewed.

- Geology/hydrogeology 1:50,000 Environmental Maps series;
- Water Information Reporting (WIR) data on-line for registered bores;
- Aerial photography (site layout, location of bore, proximity to river, etc.); and
- Previous reports on groundwater quality monitoring completed at the Site.

2 Environmental Setting

2.1 Topography and Drainage

The Site is located approximately 40km south of Perth near the intersection of Cardup Siding Road and the South Western Highway. It is situated on the coastal plain, west of the Darling Scrap at approximately 58-61m AHD sloping gently to the west and north.

The nearest surface water body is Cardup Brook located approximately 80 m north of the site and flowing to the west. Water samples from the brook collected by Department of Water in 2000 and 2003 recorded salinity in the range 159 to 216 mg/L (249 to 338 µS/cm) where the brook passes under the highway (WIR ref 6142790).

2.2 Geology

The Geological Survey of WA (GSWA) 1:50 000 Environmental Geology Map Sheet 2033 I and 2133 IV identifies the surficial geology beneath the Site as late Pleistocene colluvium comprising:

- GREVELLY SANDY CLAY: variable, with lenses of silt and gravel, quartz sand, subangular with eolian rounded component; heavy minerals common; gravel rounded, of colluvial origin (Csg).

Granite, gneiss is exposed along Cardup Brook to the north and early to mid-Pleistocene sands of the Yoganup Formation (S12) and Bassendean Sands (S8) occur near the site to the east, and west of the highway respectively.

Investigations completed by GSWA in 1978 at the brickworks bore located just east of the railway reserve indicated the colluvium is thin and probably less than two meters in thickness and is variably lateritized and podsolised. The underlying Guildford Formation was described as an essentially clay sequence with intervening thin stringers of sand and occasional gravel. At the brickworks locality the Guildford Formation was interpreted to be less than 5m thick but may extend to a greater depth beneath the Site. Sediments of the Leederville Formation were reported to occur beneath the Guildford Formation.

2.3 Hydrogeology

The GSWA 1978 investigation indicated the most important aquifer in the succession intersected at Cardup is the Leederville Formation. Several minor aquifers occur through the sequence but the major water bearing zone occurs toward the base of the succession from a depth of approximately 25 to 29 m beneath the brickworks site in coarse to fine grained red and brown sand. Salinity recorded in the brickworks bore was approximately 860 mg/L.

Aquifer testing completed by GSWA indicated there was a degree of connectivity between the shallow and deeper sand units but the results of testing were incomplete. Recharge was assumed to be from leakage through overlying formations. It may be possible there is also leakage beneath Cardup Brook, although the GSWA report indicates the brook is a gaining stream.

Groundwater flow in the area is represented in the GSWA report as being generally to the west.

2.4 On-site Production Bore

Details for the on-site production bore, and an old shallow bore presumed to be lost, are presented in **Table 2-1**. It is located along the central western side of the Site, essentially between the site operations and residential property to the west of Soldiers Road.

The available information indicates water is being extracted from a confined or semi-confined 13 m thick layer of coarse sand between 24 to 37 m depth. Above this layer is an approximately 2 m thick shallow sand horizon (12 to 14 mbgl) separated by a 5 m thick clay layer. The bore construction log indicates the annulus was backfilled with drill cuttings.

The static water level of the on-site bore has not been recorded as the bore has been operational during monitoring events. Water testing since 2019 has indicated groundwater is fresh with salinity in the range 286 to 375 mg/L (447 to 587 µS/cm).

Table 2-1: Groundwater Licence Details

Licence No.	Allocation (kL/yr)	Expiry Date	Parties	Aquifer
181432	2625	28/05/2027	C.C. Wormall Pty Ltd	Perth – Superficial Swan

Bore ID (AWRC)	Type	Easting	Northing	MGA Zone	Date Completed	Depth (m)	Distance from Site
61470294	Production Bore	6432335	406020	50	03/02/2017	37	Onsite
61405725	Bore/Well	6432338	406238	50	30/06/1978	11.8	Onsite (lost)

Table 2-2: Lithology Profile of Onsite Production Bore

Lithology Log *(Site reference: 61470294)*

From (mbGL)	To (mbGL)	Interpreted By	Substance	Lithological Description
0.000	1.000	Driller		Road base top fill
1.000	7.000	Driller	Clay	Orange gravelly clay
7.000	10.000	Driller	Clay	Silty grey clay
10.000	12.000	Driller	Clay	White clay
12.000	14.000	Driller	Sand	Medium sand
14.000	19.000	Driller	Clay	Red - yellow clays
19.000	24.000	Driller	Sand	Medium sand with some clay traces
24.000	37.000	Driller	Sand	Medium and coarse sand
37.000	38.500	Driller	Clay	Yellow clay

From (mbGL)	To (mbGL)	Element	Material	Inlet Type	Inside Dia. (mm)	Outside Dia. (mm)	Aperture (mm)
0.000	19.000	Casing	PVC	Not applicable	155.000	169	
19.000	37.000	Inlet (screen)	PVC	Slotted			0.500

3 Registered Bores

A search of the DWER Water Information Reporting (WIR) databased identified eight registered bores within 400 m of the site including a production bore located approximately 30m south of the Site registered to Austral Bricks. Site Detail Reports are summarised in **Table 3-1**.

The registered bores in the area appear to be screened at between 9.8-15.5 m or 28.7-33 m except for one deeper bore at 160 m.

Table 3-1: Results of 400 m Registered Bore Search

Bore ID (AWRC)	Type	Easting	Northing	MGA Zone	Date Completed	Depth (m)	Distance from Site
61405729	Bore/Well	6432206	406212	50	23/02/1979	28.7	30 m South
61405730	Bore/Well	6432094	406067	50	15/02/1978	29.3	200 m South
61402537	Bore/Well	6432345	405881	50	~01/01/1973	9.8	280 m West
61402610	Bore/Well	6432319	405864	50	Unknown	Unknown	290 m West
61402541	Bore/Well	6432209	405836	50	~01/01/1973	11.6	340 m West
61470130	Bore/Well	6432527	405891	50	23/08/2005	160	350 m Northwest
61402682	Bore/Well	6432276	405805	50	07/09/1987	33	360 m West
61402542	Bore/Well	6432185	405816	50	~01/01/1973	15.5	360 m West

4 Discussion

The on-site bore is located along the central western side of the Site. It appears to target an approximately 18 m thick layer of coarse sand between 19 to 37 m depth. Above this is an approximately 2 m medium sand horizon separated by a 5 m thick clay layer with leakage likely to be occurring between theses horizons.

The analysis of water samples collected from the on-site bore since 2019 has not shown any sign of contamination (Talis, 2021). Given the bore is situated along the central western side of the Site, down hydraulic gradient from the site operations, and there is likely to be a degree of leakage between the aquifer and across the shallow clay horizon via the bore annulus the results provide confidence the operations are not impacting groundwater quality in the area and there is no unacceptable risk to the identified registered bores in the area or Cardup Brook.

5 Conclusion

Based on the results of the review the following conclusions are provided.

- The on-site production bore targets a semi-confined aquifer comprising medium to coarse sand between 19 to 37 m depth with the study completed by GSWA in 1979 indicating there is potentially leakage from overlying formations.
- Groundwater flow direction beneath the Site is inferred to be generally to the west based on the GSWA study.
- The static water level in the on-site production bore has not been measured as the bore has been operational during monitoring events.
- Groundwater is fresh with salinity in the range 286 to 375 mg/L (447 to 587 µS/cm).
- Water testing completed since 2019 has not detected any sign of contamination attributed to the operations and it is concluded the results provide confidence the operations are not impacting groundwater quality and there is no unacceptable risk to the identified registered bores in the area or Cardup Brook.

DOCUMENT CONTROL

Version	Description	Date	Author	Reviewer	Approver
1.0	First Release	5/10/2022	CA	GR	GR
2.0	Final	19/10/2022	CA	GR	GR

Approval for Release

Name	Position	File Reference
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