EPA Services Unit

8th March 2024

123 Mortimer Rd Casuarina

INLAND WATERS

Peter Keating BSc (Hon) PhD

Bioscience Pty Ltd

1. Introduction

Bioscience has been requested to specifically address inland waters as part of our response to comments on the Supplementary Environmental Review of the proposal to subdivide 123 Mortimer Rd into a Lot for subsequent urban development, and the maintenance of a conservation area.

2. Definition of Inland Water

The EPA guideline (29 June 2018) defines inland waters as:

Inland waters include groundwater, such as superficial and confined aquifers, and surface water, such as waterways, wetlands and estuaries. A 'waterway' is any river, creek, stream or brook, including its floodplain and estuary or inlet. This includes systems that flow permanently, for part of the year or occasionally, and parts of the waterway that have been artificially modified.

Since the initial work on 123 Mortimer Rd starting in 2005, and from available antecedent imagery, there has never been any surface water, waterways (river, stream or brook) nor estuaries on the site. This report is thus confined to groundwaters of the Perth Superficial aquifer below the site. The nearest surface waters have historically been on land 450 m to the west of the northern section of the property boundary and these have only held water in wet winters.

However, Bioscience was first called to the land by the owner's (then) town planner with the request to have the mapped Conservation Category Wetland reclassified. The immediate impression formed was what had once been a wetland, based on the low topology and remaining wetland vegetation was in decline. Thus, we suspected localised groundwater had dropped.

Investigation of aerial photography from 1953 onwards confirms no surface water, rivers, creeks, stream or brooks. The CCW appears wettest in the Landgate satellite image of 6 August 1974, but there is no surface water.

3. Site Drainage

With the construction of the Peel Main Drain (commencing in 1920), low lying and winter inundated properties to the west of 123 Mortimer Rd took the opportunity to connect to the new drainage system to alleviate lower pasture productivity due to surface water. (See 1953 and 1970 Landgate Images)

Figure 1. 1953 Landgate image show drainage of areas to the west of 123 Mortimer Rd (which is on the right of the image)

Figure 2. 1970 Landgate image. Note deeper drainage to the west and that much of 123 Mortimer Rd (RHS of photo) had been cleared of vegetation.

With the extension of Kwinana Freeway, commencing with land clearing in 2000, and construction in 2001, then completion and opening in 2002, a substantial culvert under the freeway was designed to prevent any prospect of the freeway flooding even in a very heavy rainfall years. The culvert is documented with inverts entering the drain at 11.90 m AHD, and exiting at 10.04 m AHD This culvert

forms part of the Peel Sub O drain which originates in the mapped CCW of 123 Mortimer at an invert level of 17.90 m AHD. The Photograph attached (Photo 1) shows 4 x 1 m diameter concrete pipes. From the staining of concrete, it is clear that the culvert occasionally runs at near full capacity.

The culvert is 665 m from the western boundary of 123 Mortimer Rd (Photo 3) with an outlet invert of 7.86 m below the mapped CCW, (i.e. a fall of 1:15)

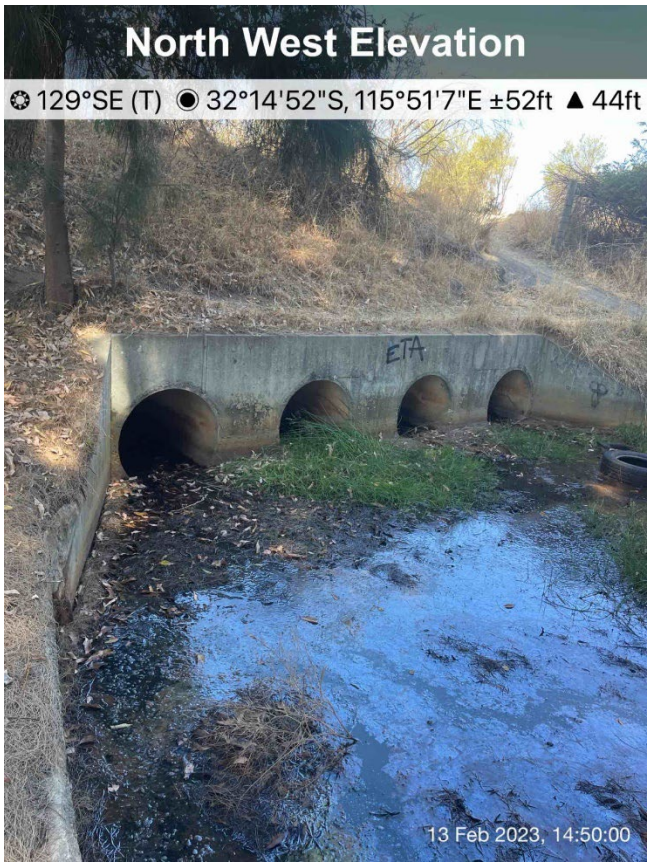


Photo 1. The exit of culvert of the Peel Sub O drain immediately west of the Freeway.

Photo 2. The inlet of the above culvert is obscured by vegetation immediately east of the Freeway.

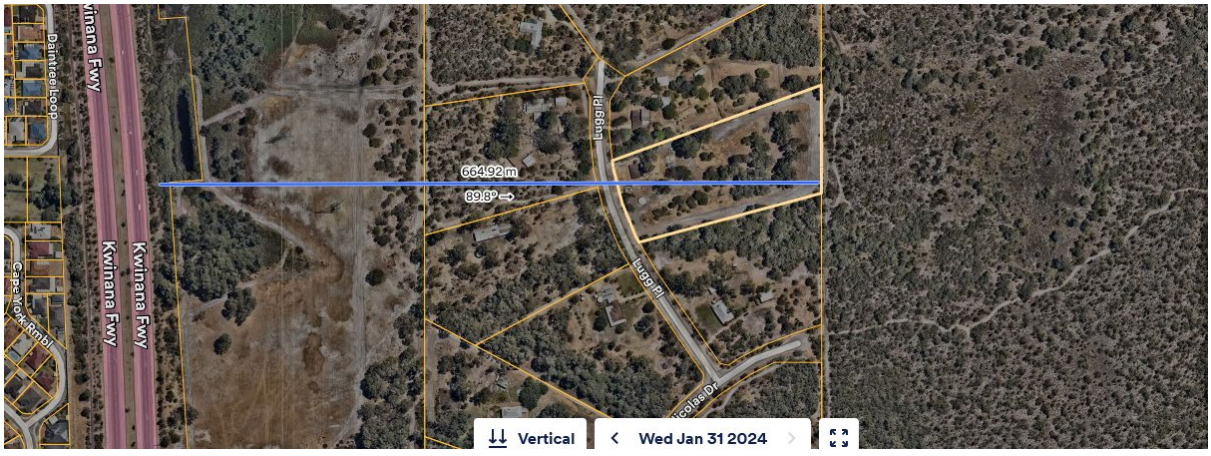


Photo 3. Distance from 123 Mortimer Rd to Freeway Peel Sub O culvert is 665 m from the boundary.

4. Drainage Impacts on 123 Mortimer Rd.

There is abundant and consistent evidence that both the maximum and minimum groundwater levels recorded has been reducing since the construction of the Freeway, based on initially 5 piezometers in 2006, to then 11 piezometers from 2011 (monthly) then twice in 2020. This is "independently" yet professionally reviewed and verified in the Geo and Hydro Environmental

Management Report at pp 130 -134, (Appendix 4 in the Bioscience CERD report of 13 June 2023.) In the latest level assessment undertaken (1st March, 2024) albeit after a record hot summer and record dry spring) the minimum groundwater levels appears to have stabilised at a level now 3 m below the surface in the mapped CCW, at a min-max height of 14.6 – 15.4 mAHD,

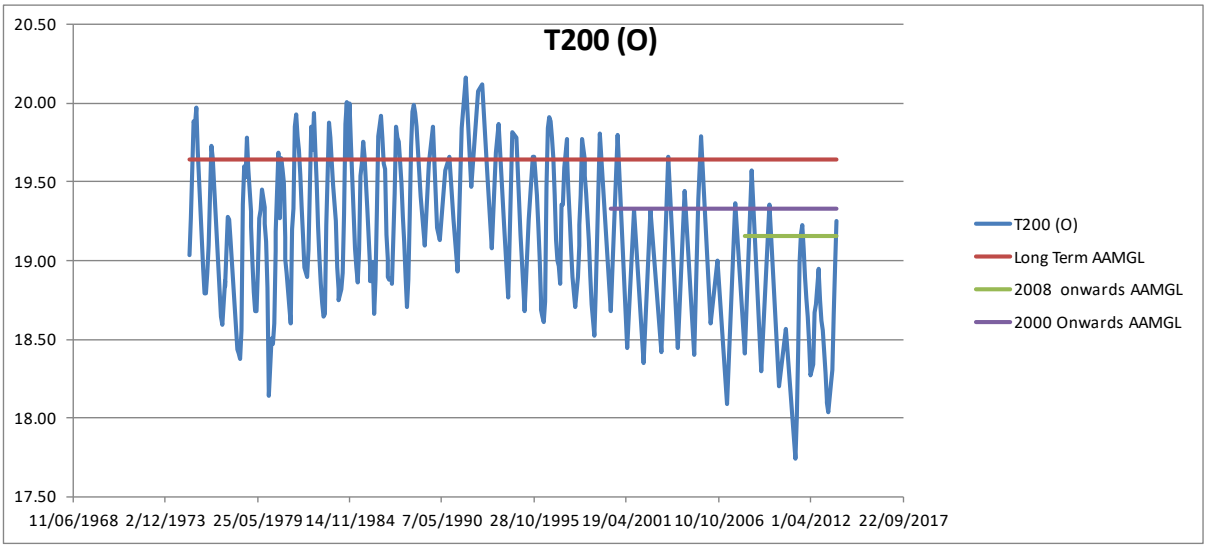
5. Pre-Drainage Groundwater Levels.

Although there are no pre-2006 water levels of the Mapped CCW available, they can reasonably be inferred from the soil logs of the 5 piezometers installed in 2006.

This interpretation is based on the fact that as groundwater rises and falls, it changes the redox potential of the temporarily inundated zone between minimum and maximum groundwater, thus iron is oxidised from the soluble Fe^{2+} form to insoluble and brown coloured Fe^{3+} form which forms the "ferruginous" brown layer in otherwise white to yellow Bassendean sands.

Whereas the Geological Survey of WA mapping undertaken in 1983 (map 2033 II maps the south of the property and map 2033 IV maps the north.) the area is mapped at S_{10} Bassendean sand for the majority of the site, with the wetland areas (north and west) mapped as Mps Peaty silt. The bore soil logs obtained by Bioscience during the installation of piezometers in 2006, (Appendix 1) found exclusively sand near the surface. Only one bore (bore 5) found evidence of black (peaty) sand at 100 – 200 mm below the surface. However, as the Bassendean sands were coloured brown in layers, we can reasonably infer from this ferruginous zone where the maximum and minimum groundwater levels were in the past. For example, for bore 1 the maximum groundwater level was 0.7 m below the surface and the minimum groundwater level was 2.7 m below the surface. The nearest the previous maximum groundwater level came to was 0.3 m below the surface in bore 2 and perhaps 0.2 m below the surface in Bore 5. (note bores 2 and 5 are near the middle of the mapped CCW and have the lowest topological level). The water collected from monitoring bores was fresh (around 600pp. TDS) and acidic but the soil core samples when tested did not display any acid sulfate properties.

This is consistent with long term DoW monitoring bore data as below.



Graph 1. DoW bore T200 shows a decline since the Freeway extension. The bore is 2.2 km ENE of the Freeway culvert

6. Site Hydrogeology

Surface geology and deeper geology hosting the aquifer is described in GSWA 2033 IV, (1983) and refined through surface soil investigation (to 4m) by Bioscience between 2005 - 2011.

GSWA report the nearest deep exploration bore (north, near Orton Rd) of 36 m deep. There is uniform Bassendean sand to 27 m, overlying a 3 m limestone layer, below which is becomes sand to 36 m.

This is broadly consistent with the subsequent description of the Jandakot mound of the Perth Superficial aquifer in Davidson (1995) GSWA Bulletin 142 *Hydrology and groundwater resources of the Perth Region.* At plate 52, the depth to the water table is 0 – 6 m below ground level. At Plate 53, the region of 123 Mortimer Rd is point 3 of his flownet and drops from 25 m AHD to 20 m within a few kilometres. The transmissivity is 800 m^2/d.(Plate 55)

The direction of flow of the aquifer is east to west, and the aquifer has low salinity and low turbidity.

7. Summary

Whereas before the Peel Sub O drain was installed under the Freeway, the mapped CCW (UFI 6679) had an interpreted groundwater level ranging from a minimum of 0.2 to a maximum of 1.2 m below the surface, due to the newly created freeway culvert and the high transmissivity of sandy soils, it now varies according to season and rainfall from 2 to 3 m below the ground surface. This compares to the REW's on the western boundary where REW wetlands (whose pre-drainage groundwater levels could not be ascertained) where REW (UFI 6690) has a maximum groundwater now at 2.66 m below the ground surface as measured in Monitoring Bore 6 and REW (UFI 13969) has a maximum groundwater at 1.897 m below the ground surface at Monitoring Bore 7.

8. EPA Environmental Factor Guideline

8.1 Environmental values supported by or dependent on Inland Waters and their significance.

As there has been no evidence of surface waters ever being on the site, it has never been able to support aquatic fauna and birdlife. However, before site drainage, groundwater was sufficiently high to have formerly supported wetland vegetation. The decline in groundwater levels documented in the preceding sections of this report explain the decline of wetland vegetation, in it's now over 20 year progression towards upland vegetation. With the site becoming developed as proposed, once and Outline Development Plan has been produced, there are prospects of using the principles embraced in Better Urban Water Management Planning and a corresponding LWMS to direct the anticipated increased available water (due to clearing causing less evapotranspiration and lesser infiltration by impervious roadway water capture) to be directed towards the wetland areas to thereby arrest their decline and restore former environmental values of wetlands.

8.2 information required for EIA

The preceding sections and the Geo and Hydro report appended to the SERD describe studies and surveys of the groundwater systems. The SERD describes proposed buffers to the conservation area and CCW.

The water to be used should the proposed subdivision go ahead will be determined by future development planning, but this will realistically include water required to irrigate public open space. According to the Water Register (as of 14 March 2024) the groundwater under the Mortimer Rd site is not fully allocated, with an unallocated reserve of 310,257 KL as at 19 Dec 2023 DWER allocation report, thus the developer can apply for a groundwater licence to irrigate public open space. The site is part of the Jandakot Mound, but not within the Public Drinking Water supply area.

There is unlikely to be excess water to dispose of. Given the very high transmissivity of the underlying soils, it seems likely that compensation/retention basins as required of a BUWMP would rapidly empty.

Finally, with the adoption of the proposal, and with the exception of the opportunity to provide a greater volume of water to the conservation area as stated above, any changes to groundwater elsewhere on the site are more likely to be driven by the Peel Drainage scheme than by urban development. Likewise, groundwater quality, currently fresh but somewhat acidic are likely to be managed in the planning process by BUWMP.

8.3 Issues

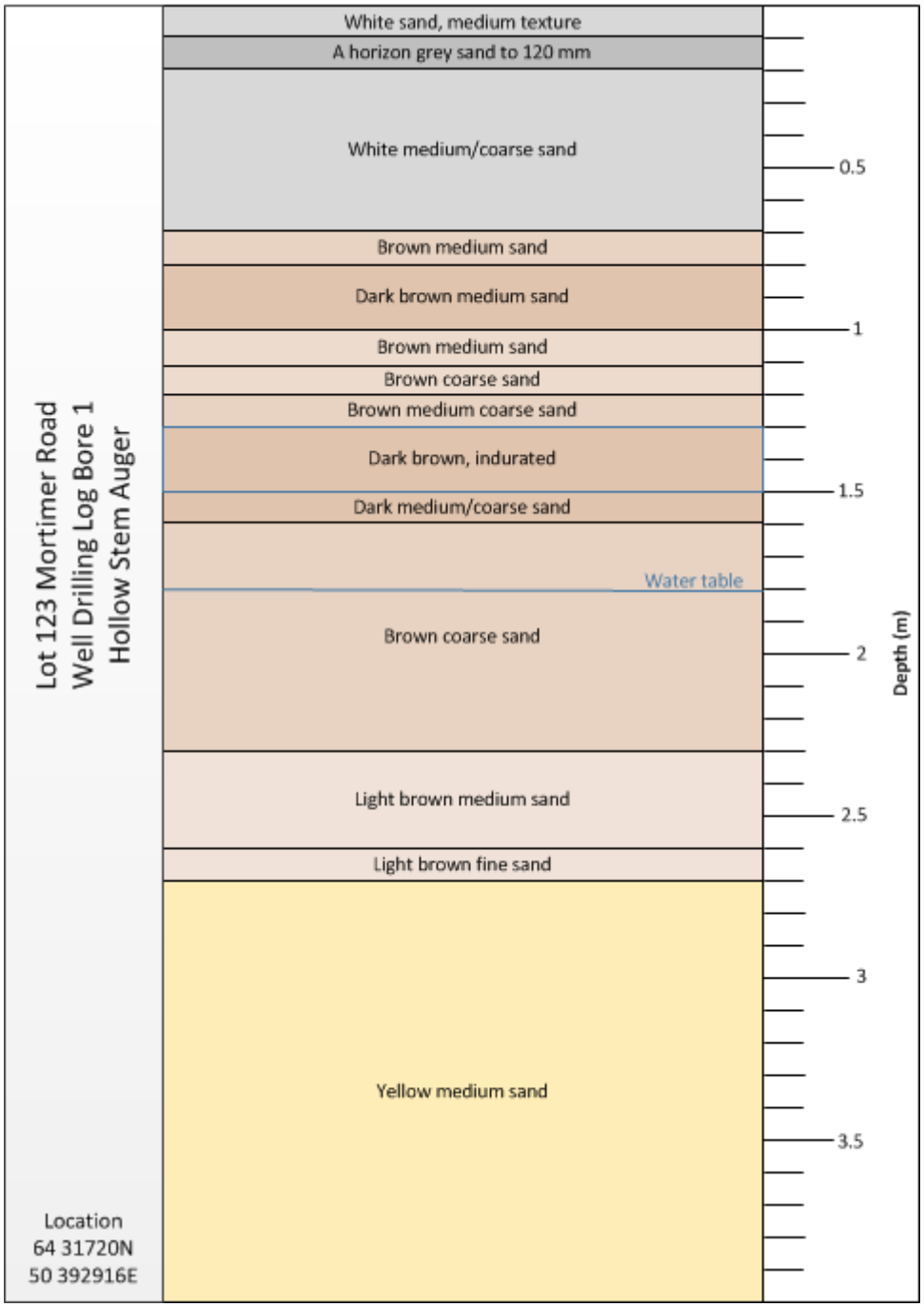
The identification and management of buffers to the wetlands are dealt with the in SERD (Section 5.3.6.2).

9 Reference

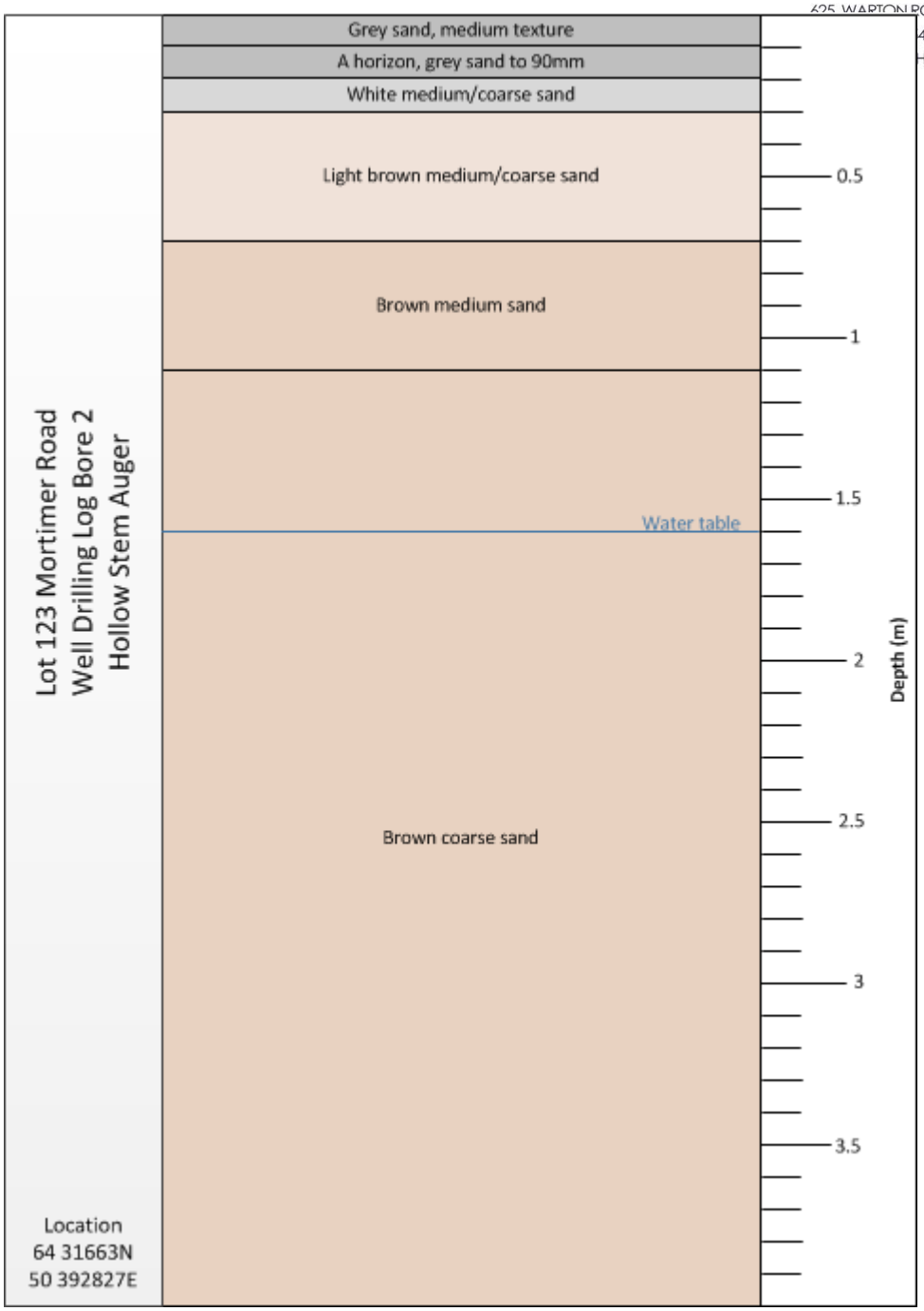
Geo & Hydro (2020). *Water Balance of Lot 123 Mortimer Rd, City of Kwinana*. Unpublished report.

BIOSCIENCE PTY LTD ACN 054 829 131
625 WARTON ROAD FORRESTDALE WESTERN AUSTRALIA 6112
PO BOX 5466 CANNINGVALE WESTERN AUSTRALIA 6155
TELEPHONE (08) 9397 2446 FACSIMILE (08) 9397 2447
EMAIL bioscience@biosciencewa.com
WEBSITE www.biosciencewa.com

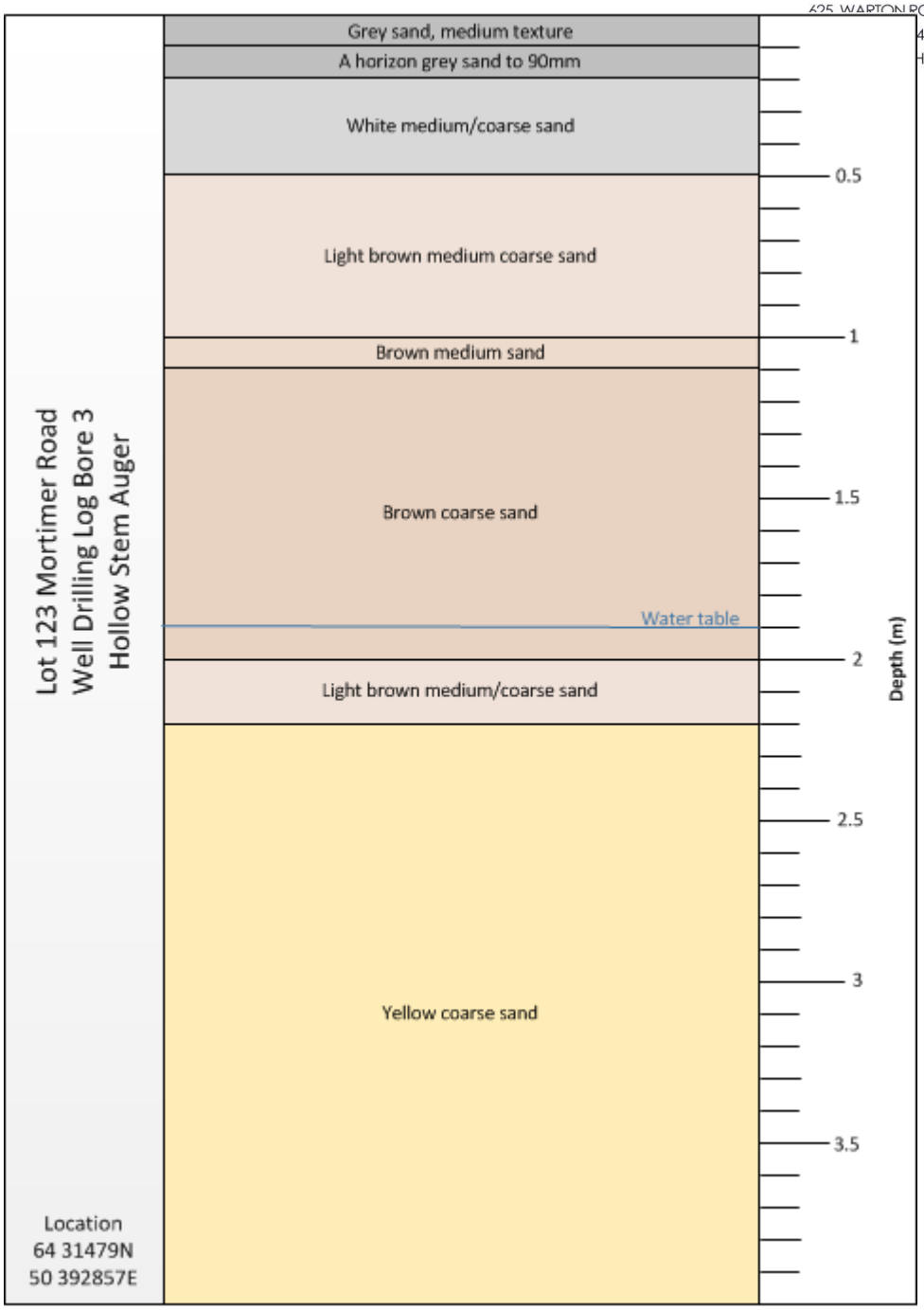
APPENDIX 1: Soil Profiles from the Request for modification of wetland report, Bioscience (2011)



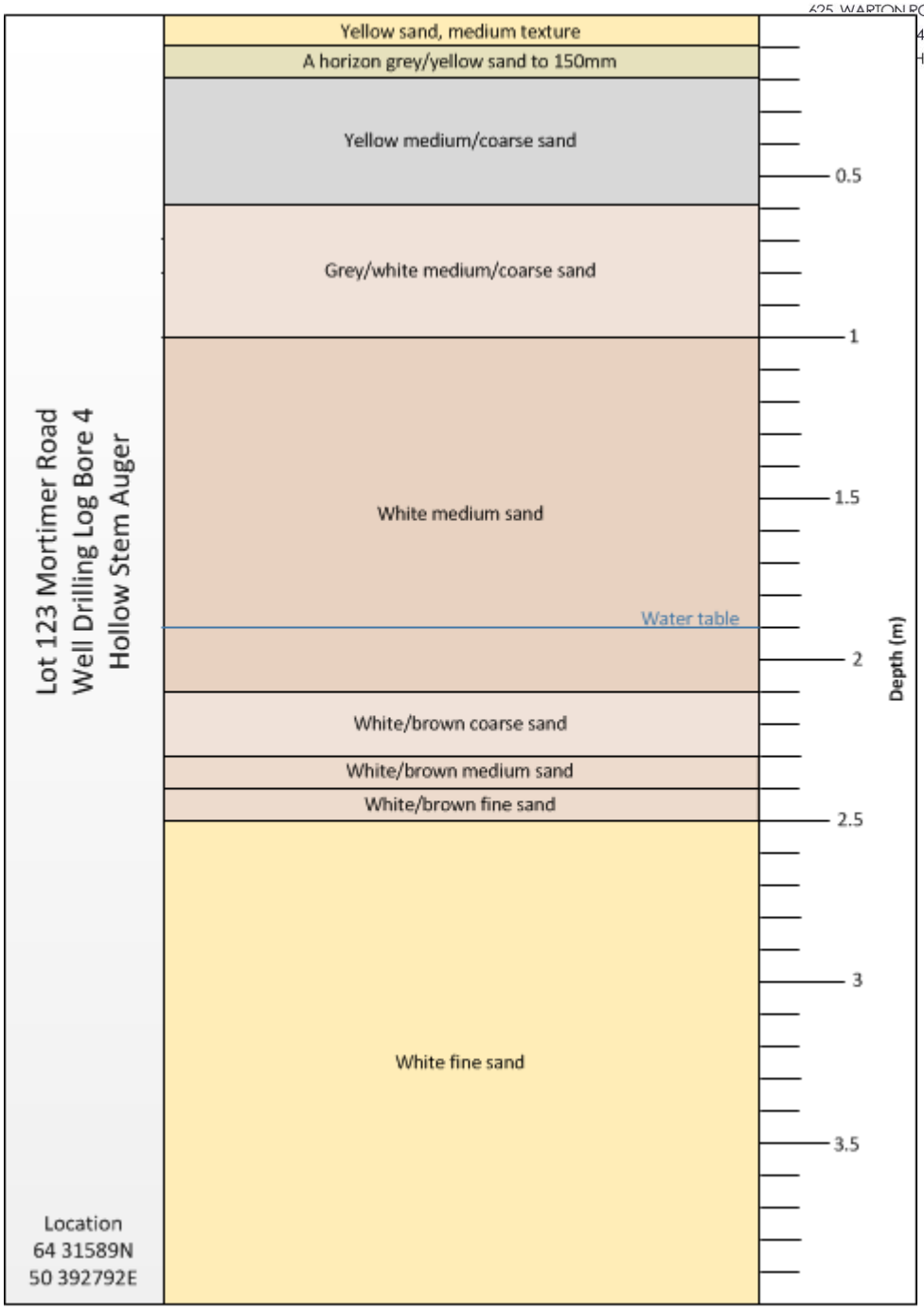
BIOSCIENCE PTY LTD ACN 054 829 131
625 WARTON ROAD FORRESTDALE WESTERN AUSTRALIA 6112
466 CANNINGVALE WESTERN AUSTRALIA 6155
HONE (08) 9397 2446 FACSIMILE (08) 9397 2447
EMAIL bioscience@biosciencewa.com
WEBSITE www.biosciencewa.com



BIOSCIENCE PTY LTD ACN 054 829 131
625 WARTON ROAD FORRESTDALE WESTERN AUSTRALIA 6112
466 CANNINGVALE WESTERN AUSTRALIA 6155
HONE (08) 9397 2446 FACSIMILE (08) 9397 2447
EMAIL bioscience@biosciencewa.com
WEBSITE www.biosciencewa.com



BIOSCIENCE PTY LTD ACN 054 829 131
625 WARTON ROAD FORRESTDALE WESTERN AUSTRALIA 6112
466 CANNINGVALE WESTERN AUSTRALIA 6155
HONE (08) 9397 2446 FACSIMILE (08) 9397 2447
EMAIL bioscience@biosciencewa.com
WEBSITE www.biosciencewa.com



BIOSCIENCE PTY LTD ACN 054 829 131
625 WARTON ROAD FORRESTDALE WESTERN AUSTRALIA 6112
466 CANNINGVALE WESTERN AUSTRALIA 6155
HONE (08) 9397 2446 FACSIMILE (08) 9397 2447
EMAIL bioscience@biosciencewa.com
WEBSITE www.biosciencewa.com