Landfill Capacity Estimates

Shire of Wyalkatchem

September 2022

Acknowledgements

ASK Waste Management acknowledges the Traditional Owners of the land in which we work and live, and pays respects to Elders past, present, and emerging.

ASK also gratefully acknowledge the cooperation of the Shire of Wyalkatchem staff that provided information and assistance in the development of this report.

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1 INTRODUCTION

The North Eastern Wheatbelt Regional Organisation of Councils (NEWROC) is a voluntary organisation that unites councils from the Shires of Koorda, Mount Marshall, Mukinbudin, Nungarin, Trayning, Dowerin and Wyalkatchem to work together for the economic prosperity of the region which covers close to 19,500 square kilometres and is home to around 2,500 people.

In 2019, NEWROC engaged ASK Waste Management (ASK) to assess their waste facilities and develop achievable concepts to improve waste management across the region. The findings were documented in a Regional Landfill Strategy Feasibility Study. The NEWROC decided in 2021 to further investigate Option 4 of the Regional Landfill Strategy which involves:

- Development of the Wyalkatchem site (the Facility) as a Regional Landfill to receive waste from all the NEWROC communities
- Converting the other landfills in the region to waste transfer stations that would be used to receive waste in front lift skip bins that would be collected on a weekly basis and transported to the Regional Landfill
- Securing all waste sites against unauthorised access using remote access technologies and the provision of swipe card access to ratepayers.

ASK was subsequently engaged by NEWROC in 2021 to undertake detailed financial modelling of Option 4 and to produce a series of recommendations that NEWROC can follow to progress implementation of the project.

As a key stakeholder, the Shire of Wyalkatchem (the Shire) sought to progress implementation of the recommendations by undertaking site investigations to more accurately determine the potential remaining capacity of the landfill, and its suitability as a regional facility. This involved having a contractor undertake a drilling program at the Site to document the soil profile and the presence of rock layers, previously buried waste and the presence of groundwater.

The Shire engaged ASK to undertake the following:

- Review borehole data and detail the findings
- Identify areas of the site that may be suitable for landfill expansion based on borehole data, vegetation, and topography
- Mark potentially suitable areas with GPS coordinates and calculate area in square metres
- Calculate the potential volume of soil that can be generated based on an average depth of excavation
- Calculate the potential volumetric capacity of airspace that can be created in the potentially suitable area/s based on average depth of excavation and average height of above ground cells
- Utilise waste quantity data from the NEWROC Landfill Consolidation report to calculate the potential operational life
- Make comment on potential limitations of the site in terms of clearing permit implications and community attitudes towards landfilling near the cemetery.

This report details the methodology, findings, and recommendations arising from the above actions.

1.1 WYALKATCHEM LANDFILL

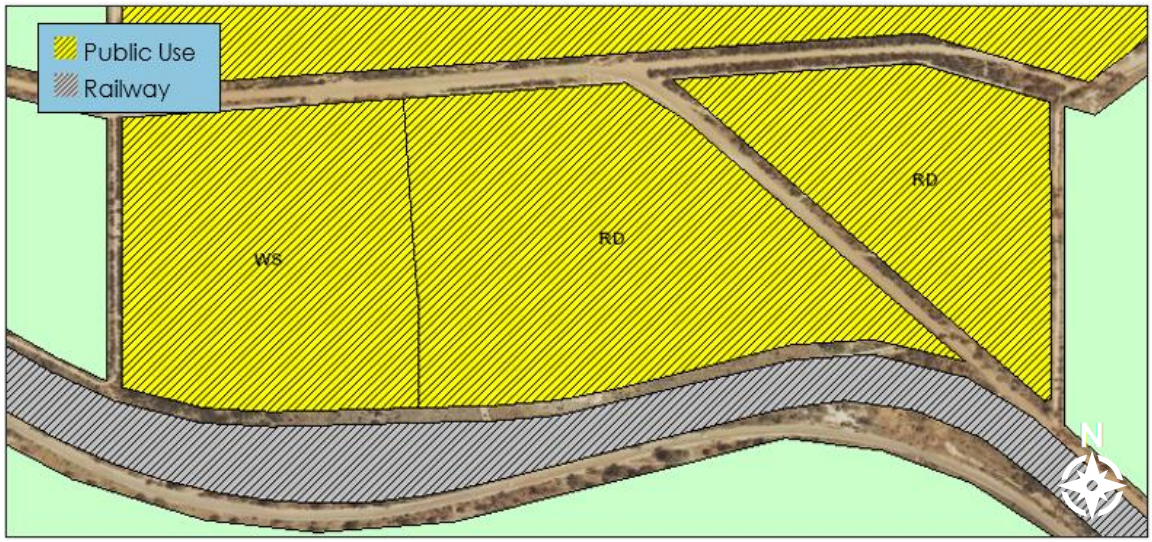
The Wyalkatchem landfill is one of the largest facilities in the NEWROC area. The current landfill facility occupies a 20.8 hectare area located adjacent to the town's cemetery, approximately two kilometres northwest of the Wyalkatchem townsite. It is unstaffed, has unrestricted 24-hour access and is fenced. The road leading from the main (sealed) road into the main cell is unsealed and 200m long with all-weather access.

Table 1.1 - Summary of the Wyalkatchem landfill site

Facility address:	Cemetery Road, Wyalkatchem, WA 6485
Ownership:	Shire of Wyalkatchem
Operator:	Shire of Wyalkatchem
Landfill class:	Category 89 – Registered landfill
Tonnage:	Estimated at 500 to 700 tonnes per annum
Size:	The current site is 20.8ha with another 11.6ha to the east of Cemetery Road that is unlikely to be used for waste disposal purposes due to high value native vegetation.
Population serviced:	The Facility services the Shire of Wyalkatchem which has a population a total population of 470, whilst the locality of Wyalkatchem has 358 (2021 Census QuickStats).

Figure 1.1 - Cadastral Boundaries of Wyalkatchem Landfill Site (SLIP Locate GIS)

Figure 1.2 - Local Planning Zones and Reserves (SLIP Locate GIS)



2 BOREHOLE INVESTIGATIONS

The Shire engaged a contractor to drill boreholes at fifteen locations in the eastern portion of the site as detailed in **Section 2.1**. The contractor was instructed to drill to depths of three to four metres where possible, and to document types and depths of the different soil profiles encountered. The drilling was undertaken in June 2022. The findings of the drilling program are provided in **Section 2.2** below.

2.1 BOREHOLE LOCATIONS

Table 2.1 – Borehole coordinates

Reference Point	Zone	Easting	Northing	Latitude	Longitude
BH1	50J	534215.53 m E	6551656.49 m S	-31.168607°	117.359037°
BH2	50J	534312.22 m E	6551662.88 m S	-31.168554°	117.360049°
BH3	50J	534429.61 m E	6551682.81 m S	-31.168370°	117.361276°
BH4	50J	534536.52 m E	6551704.06 m S	-31.168169°	117.362398°
BH5	50J	534196.94 m E	6551732.56 m S	-31.167926°	117.358830°
BH6	50J	534271.27 m E	6551724.08 m S	-31.167996°	117.359617°
BH7	50J	534351.70 m E	6551717.78 m S	-31.168057°	117.360457°
BH8	50J	534452.55 m E	6551755.90 m S	-31.167711°	117.361515°
BH9	50J	534252.15 m E	6551794.93 m S	-31.167365°	117.359415°
BH10	50J	534312.12 m E	6551835.07 m S	-31.166993°	117.360044°
BH11	50J	534428.21 m E	6551837.57 m S	-31.166972°	117.361261°
BH12	50J	534240.50 m E	6551888.86 m S	-31.166517°	117.359286°
BH13	50J	534307.32 m E	6551925.38 m S	-31.166181°	117.359988°
BH14	50J	534169.96 m E	6551929.65 m S	-31.166149°	117.358540°
BH15	50J	534221.14 m E	6551943.54 m S	-31.166021°	117.359085°

Figure 2.1 - Borehole Locations

2.2 BOREHOLE RESULTS

2.2.1 *Borehole 1*

The borehole showed that this location can be excavated to an approximate depth of 3m with no obvious impediments. **Figure 2.2** displays the layers of material removed.

Table 2.2 - Borehole 1 drilling results

Layer Description	Depth (m bgl)
Sand	0 – 0.6
Gravel	0.6 – 1.0
Gravel/Clay	1.0 – 2.0
Clay/Rock	2.0 – 2.5
Clay/White Rock	2.5 – 3.0

Figure 2.2 - Borehole 1 Samples

2.2.2 *Borehole 2*

The borehole displayed unimpeded drilling, culminating in a clay bed from 2.6-3.9m below ground level (BGL). This area can be excavated at least down to that depth. There were no images taken of the material removed from this hole.

Table 2.3 - Borehole 2 drilling results

Layer Description	Depth (m bgl)
Sand	0 - 0.6
Gravel	0.6 - 1
Gravel/Clay/Sand	1 - 2
Clay/Rock	2 - 2.6
Clay	2.6 - 3.9

2.2.3 *Borehole 3*

This borehole proved more difficult to drill after 1.8m but was logged as Clay and White Rock down to 3.6m BGL. Future excavation can be carried out comfortably to 2m BGL, with a potential to go deeper. **Figure 2.3** displays the layers of material removed.

Table 2.4 - Borehole 3 drilling results

Layer Description	Depth (m bgl)
Sand	0 – 0.6
Gravel	0.6 – 0.9
Sandy Clay	0.9 – 1.8
Clay/White Rock	1.8 – 3.6

Figure 2.3 - Borehole 3 Samples

2.2.4 *Borehole 4*

The borehole showed surface layers of yellow sand, transitioning through to clay, finishing at 2.8m BGL before proving too hard to drill any deeper. This gives a maximum depth of excavation of 2.8m. **Figure 2.4** displays the layers of material removed.

Table 2.5 - Borehole 4 drilling results

Layer Description	Depth (m bgl)
Sand	0 – 0.3
Gravel/Clay/Sand	0.3 – 1.3
Clay	1.3 – 2.8
Rock	Too hard to drill

Figure 2.4 - Borehole 4 Samples

2.2.5 *Borehole 5*

The borehole had a shallow layer of sand and then gravel, culminating with clay and small rocks at a depth of 3m BGL. Excavation should be achievable down to that level. **Figure 2.5** displays the layers of material removed.

Table 2.6 - Borehole 5 drilling results

Layer Description	Depth (m bgl)
Sand	0 - 0.15
Gravel	0.15 - 0.45
Gravel/Clay	0.45 - 2
Clay/White Rock/Sand	2 - 3

Figure 2.5 - Borehole 5 Samples

2.2.6 *Borehole 6*

The borehole showed a deeper level of sand before transitioning to gravel and ending up 3m BGL with a consistency of clay and white rocks. Once again, excavation down to 3m should be achievable. No images were taken of the material removed from the hole.

Table 2.7 - Borehole 6 drilling results

Layer Description	Depth (m bgl)
Sand	0 - 1
Sandy Gravel	1 - 1.4
Sandy/Gravel/Clay	1.4 - 2.4
Clay/White Rock/White Clay	2.4 - 3

2.2.7 *Borehole 7*

This borehole began with a shallow level of sand and led into 1.2m of gravel and clay. The hole was drilled to a depth of 3.2m BGL, which should be achievable for future excavation. **Figure 2.6** displays the layers of material removed.

Table 2.8 - Borehole 7 drilling results

Layer Description	Depth (m bgl)
Sand	0 - 0.1
Gravel/Clay	0.1 - 1.3
Clay/Rock	1.3 - 1.9
Clay	1.9 - 3.2

Figure 2.6 - Borehole 7 Samples

2.2.8 *Borehole 8*

The borehole showed shallow layers of yellow sand and gravel and quickly evolved into sandy clay, becoming no longer drillable at 1.8m BGL. This would be maximum depth for any excavation. **Figure 2.7** displays the layers of material removed.

Table 2.9 - Borehole 8 drilling results

Layer Description	Depth (m bgl)
Sand	0 - 0.2
Gravel	0.2 - 0.4
Sandy Clay	0.4 - 1.8
Rock	Too hard to drill

Figure 2.7 - Borehole 8 Samples

2.2.9 *Borehole 9*

This borehole started with a shallow layer of sand and gravel and culminated in clay and white rock at a depth of 3m BGL. This infers an excavatable depth of 3m or greater. **Figure 2.8** displays the layers of material removed.

Table 2.10 - Borehole 9 drilling results

Layer Description	Depth (m bgl)
Sand	0 - 0.15
Gravel	0.15 - 0.35
Sandy Clay	0.35 - 2
Clay/White Rock	2 - 3

Figure 2.8 - Borehole 9 Samples

2.2.10 *Borehole 10*

The borehole commenced with a layer of gravel and progressed into slow drilling to a depth of 3.3m BGL. It isn't clear what the achievable depth of excavation will be, but an estimate of 1.5-2m seems reasonable. **Figure 2.9** displays the layers of material removed.

Table 2.11 - Borehole 10 drilling results

Layer Description	Depth (m bgl)
Gravel	0 - 0.3
Sandy Clay	0.3 - 3.3

Figure 2.9 - Borehole 10 Samples

2.2.11 *Borehole 11*

The borehole showed shallow layers of sand before a primary layer of gravel, becoming no longer drillable at 1.9m BGL. This would likely be the maximum depth for any excavation. No images were taken of the material removed from the hole.

Table 2.12 - Borehole 11 drilling results

Layer Description	Depth (m bgl)
Sand	0 - 0.2
Gravel	0.2 - 1.5
Clay	1.5 - 1.9
Rock	Too hard to drill

2.2.12 *Borehole 12*

The borehole started with a layer of sandy gravel and progressed into slow drilling through heavy powder and sedimentary rock to a depth of 3.3m BGL. An estimated depth of 1.5-2.5m should be able to be excavated. No images were taken of the material removed from the hole.

Table 2.13 - Borehole 12 drilling results

Layer Description	Depth (m bgl)
Sand/Gravel	0 - 0.3
Sandy Clay	0.3 - 3.3

2.2.13 *Borehole 13*

The borehole commenced with sandy gravel before moving into a sizeable layer of sandy clay. The results aren't entirely clear but suggest that it was drilled down to 2.5m BGL. If this is correct, that same depth should be an achievable target for future excavation. **Figure 2.10** displays the layers of material removed.

Table 2.14 - Borehole 13 drilling results

Layer Description	Depth (m bgl)
Sand/Gravel	0 - 0.3
Sandy Clay	0.3 - 2.5
Rock	Too hard to drill

Figure 2.10 - Borehole 13 Samples

2.2.14 *Borehole 14*

This borehole began with 1.5m of sand but the description beyond this depth was also ambiguous. An estimated depth of 2-2.5m should be achievable for excavation by the look of the material in **Figure 2.11**.

Table 2.15 - Borehole 14 drilling results

Layer Description	Depth (m bgl)
Sand	0 - 1.5
Sandy Clay	1.5 - 2

Figure 2.11 - Borehole 14 Samples

2.2.15 *Borehole 15*

The final borehole was logged as showing yellow sand down to a depth of 3.5m BGL before hitting rock. That indicates a similar depth should be achievable for excavation. **Figure 2.12** displays the layers of material removed.

Table 2.16 - Borehole 15 drilling results

Layer Description	Depth (m bgl)
Yellow Sand	0 - 3.5
Rock	Too hard to drill

Figure 2.12 - Borehole 15 Samples

3 ENVIRONMENTAL CONDITIONS

3.1 TOPOGRAPHY

A topographic survey of the site has not been recently undertaken but 2 metre contour maps (**Figure 3.1**) provide an indication of the site's natural topography which slopes downwards to the southeast corner 314m AHD from a high point of approximately 334m AHD in the northwest corner.

Figure 3.1 - 2m Contour Map (SLIP Locate GIS)

3.2 GROUNDWATER

The Rural Landfill Regulations specify that a separation distance of three metres must be maintained between waste and the highest level of the water table aquifer at the site.

Groundwater was not encountered during the drilling program which indicates that it is at least four metres below ground level. A desktop review of groundwater levels found data provided by the Department of Agriculture (2022b) for monitoring bores located approximately 12km southeast of the site. The data suggests that groundwater in the Wyalkatchem area is between 260 - 290mAHD. Further evidence suggesting groundwater levels in the area to be 290mAHD, is the presence of salt lakes (Cowcowing Lakes) to the north of the site that have elevations between 280mAHD and 290mAHD.

If groundwater levels are close to 290mAHD at the site, groundwater would be expected to be more than 20 metres below ground level at the lowest portion of the site. Groundwater levels are therefore not anticipated to prevent any impediments to the depth of excavations for a new cell, and the maximum cell depth will be limited by the presence of rock that cannot be readily excavated.

3.3 FLORA AND FAUNA

There are a range of protected and threatened species occurring throughout the Wheatbelt region. A report for the Wyalkatchem landfill was generated using the Protected Matters search tool (DAWE 2022) and the results are detailed below.

The Eucalypt Woodlands of the WA Wheatbelt is listed as a threatened ecological community and is to be protected wherever possible. Along with this community there are also the Velvety Spiral Pod Wattle (*Acacia Cochlocarpa)* and the Native Foxglove (*Dasymalla Axillaris)* which are both likely to occur within the feature area. Both species are on the list as critically endangered and should be considered before any clearing takes place.

The Carnaby's Black Cockatoo is listed as an endangered species and is likely to breed within the area surrounding the Wyalkatchem landfill. The area is also considered possible habitat for both the Western Quoll and the Red-tailed Phascogale which are listed as vulnerable species.

Considering the high conservation values of remnant vegetation in the area, attempts should be made to limit further clearing as much as possible in the development of any new landfill cells. Aerial imagery shown in **Figure 3.2** suggests that area circled in green may represent a lower conservation value than the more densely vegetated area east of it.

Figure 3.2 - Aerial imagery showing area possibly representing lower conservation value

4 LANDFILL CAPACITY ESTIMATES

4.1 PROPOSED CELL

4.1.1 *Phase 1*

Results from the drilling program indicate that the most suitable area for excavation is in the proximity of Boreholes 1, 2, 3, 5, 6, 7 and 9, where excavations of up to three metres or more below ground level are expected to be achievable. This area is also considered favourable as it has less dense remnant vegetation.

Based on the above factors, it is proposed that the area delineated in **Figure 4.1** be considered for the development of the first phase of a new landfill cell. The proposed area covers approximately 10,000m^2 and accounts for a twenty metre offset from the southern road reserve boundary. The GPS coordinates for the four corners of the proposed Phase 1 area are detailed in **Table 4.1**.

Figure 4.1 - Proposed Phase 1 cell location

Table 4.1 – Coordinates of Phase 1 cell location

Point	Latitude	Longitude
Northeast	-31.167115°	117.359428°
Northwest	-31.167891°	117.358886°
Southwest	-31.168347°	117.359213°
Southeast	-31.168079°	117.360372°

4.1.2 *Phase 2*

The Phase 2 area delineated in **Figure 4.2** is proposed to provide additional disposal capacity once Phase 1 is filled. Drilling logs for bores near the east portion of Phase 2 (BH12, BH10, and BH8) suggest that there may be more difficulty excavating than in Phase 1 due to the presence of dense clay and rock layer at around 2 – 3 metres below ground level. This area also has denser stands of native vegetation that will require clearing when compared to Phase 1.

The proposed Phase 2 area Phase covers approximately 15,000m^2 and the GPS coordinates for the five corners are detailed in **Table 4.2**.

Figure 4.2 - Proposed Phase 2 cell location

Table 4.2 – Coordinates of Phase 2 cell location

Point	Latitude	Longitude
Northeast	-31.166336°	117.359578°
Northwest	-31.167115°	117.359428°
Southwest	-31.168079°	117.360372°
South	-31.167977°	117.360823°
Southeast	-31.167945°	117.361472°

4.2 ESTIMATED VOLUMETRIC CAPACITY AND SOIL BUDGET

4.2.1 *Phase 1*

If the proposed area is excavated to an average depth of three meters below ground level with 1v:3h side batters, approximately 26,250m^3 of soil would be removed.

Of the soil excavated, approximately 12,000m^3 should be stockpiled for capping the landfill cell with one metre of soil once landfilling ceases. The remaining 14,250m^3 can be utilised for the regular covering of waste. Assuming a 20% cover utilisation rate[1] (eg. 2m^3 of cover for 10 m^3 of waste), this should be sufficient for covering 71,250m^3 of waste over the life of Phase 1.

Of the 71,250m^3 of total disposal capacity, 26,250m^3 of disposal would occur below ground in the excavated area, with the remaining 45,000m^3 developed into an above ground landform with an average height of around 3.75 metres.

4.2.2 *Phase 2*

Based on the drilling logs it is assumed that the 15,000m2 Phase 2 area could be excavated to an average depth of 2.5m below ground level. With 1v:3h side batters it calculated that approximately 34,750m3 of soil would be removed.

Of the soil excavated, approximately 18,000m^3 should be stockpiled for capping the landfill cell with one metre of soil once landfilling ceases. The remaining 16,750m^3 can be utilised for the regular covering of waste. Assuming the 20% cover utilisation rate, this should be sufficient for covering 83,750m^3 of waste over the life of Phase 2.

Of the 83,750m^3 of total disposal capacity, 34,750m^3 of disposal would occur below ground in the excavated area, with the remaining 49,000m^3 developed into an above ground landform with an average height of around 2.7 metres.

4.3 WASTE CAPACITY AND PROJECTED LIFESPAN

With the use of a tracked loader to compact waste, a compaction rate of 600kg/m^3 should be readily achievable and enable an estimated 42,750 tonnes of waste to be disposed in Phase 1, and 50,250 tonnes in Phase 2 over their operational life, for a cumulative capacity of 93,000 tonnes.

Waste data estimates from the Regional Landfill Strategy Detailed Assessment (ASK, 2021) are presented in **Table 4.3** below that show the estimated total tonnes of waste requiring landfill disposal annually.

If the proposed landfill cell is used to service the whole NEWROC region, it is estimated that approximately 3,800 tonnes would be received annually which would result in an operational life of approximately 11 years for Phase 1, 13 years for Phase 2, and 24 years in total. These lifespan projections should be considered relatively conservative as they have not accounted for population decline that is likely to occur over the next two decades which would be expected to reduce waste quantities received at the Facility. Further, if efforts are made to reduce cover utilisation from 20% to 15%, the projected life of the new cell would increase to over 30 years.

[1] A 20% cover utilisation rate should be relatively easy to achieve if the Shire utilises a tracked loader to compact waste prior to cover application. Use of landfill lids could also significantly reduce cover utilisation below 20%.

Table 4.3 - Estimated waste quantities for NEWROC

Shire	Wyalkatchem	Koorda	Mukinbudin	Nungarin	Trayning	Dowerin	Mount Marshall	Total
Shire Population (2016)	498	408	531	247	348	676	518	3,226
Total waste generated (tonnes)	822	673	876	408	574	1,115	855	5,323
On Farm Disposal (tonnes)	90	125	157	91	4	186	103	755
Kerbside recycling recovery (tonnes)	0	34	42	0	30	62	35	203
Greenwaste burning (tonnes)	47	32	46	23	35	58	51	293
Scrap metal recovery (tonnes)	47	32	46	23	35	58	51	293
Landfill disposal (tonnes)	638	451	586	270	470	751	614	3,780

5 RECOMMENDATIONS

5.6 CLEARING PERMIT APPLICATION

It is recommended that as a next step the Shire should complete and submit a clearing permit referral application for the Phase 1 and 2 areas. This process can be completed inhouse and it will provide the Shire with specific requirements for any further works such as biodiversity surveys that may be required. This should help minimise costs associated with commissioning flora and fauna surveys prior to the application process.

A revegetation plan for the site should be developed for submission with the clearing permit application as this can be used as a clearing offset which would likely increase the chance of a favourable outcome. A revegetation plan should consider the potential use of the topsoil layer and cleared biomass from Phases 1 and 2 for use in revegetation activities at other areas of the site requiring rehabilitation.

Depending on the outcomes of the referral application process, it may be in the Shire's interest to initially seek a clearing permit only for Phase 1. A clearing permit for Phase 2 could then be sought once Phase 1 is in the second half of its operational life. This approach may help fast track implementation of the project as it would likely reduce the time and cost to obtain a clearing permit due to the lower value vegetation present in Phase 1.

5.1 TOPOGRAPHIC SITE SURVEY

Once a clearing permit is obtained (or expected to be obtained) the Shire should engage a surveyor to undertake a topographic contour survey of the site to facilitate a more detailed cell design and site master plan. The surveyor should also be requested to mark out the extent of the proposed cell (**Table 4.1**) and the southern road reserve. Additionally, if they have the capacity to do so it would be useful to have aerial imagery of the site captured with a drone.

5.2 CELL DESIGN AND SITE MASTER PLAN

Once the site has been surveyed, an engineer should be commissioned to produce a detailed landfill cell design and site master plan that considers the following:

- Site access and traffic flows

- Development of a transfer station (as proposed in the *Regional Landfill Strategy Detailed Assessment*)
- Stormwater management
- Cell staging and development
- Site aesthetics
- Windblown litter control.

These works will help verify the capacity estimates detailed in this report and will provide the Shire with a clear plan for development of the site.

It is recommended the Shire should budget between $4,000 and $6,000 for this work to be undertaken.

5.3 PRESERVE EXISITING AIRSPACE

Whilst the proposed cell would provide the Shire with significant additional airspace for waste disposal, preserving the life of the existing waste cell should remain a priority as the process for development of the new cell will likely be more than 12 months. Options that may be taken to preserve existing airspace could include:

- More frequent compaction of waste with existing plant
- Procurement of a tracked loader to increase compaction rates
- Procurement and utilisation of landfill lids to remove the need for soil cover (see **Figure 5.1**)
- Increasing the height of the existing cell and stripping back previously applied cover for reuse.

Figure 5.1 - Tracked loader and landfill lid

REFERENCES

ASK Waste Management (2021). ***Regional Landfill Strategy Detailed Assessment.*** Produced for North Eastern Wheatbelt Regional Organisation of Councils

Department of Agriculture, Water and Environment (2022a). ***Protected Matters Search Tool.*** Available at https://pmst.awe.gov.au/

Department of Agriculture, Water and Environment (2022b). ***Interactive groundwater and salinity map for the south-west agricultural region.*** Available at https://www.agric.wa.gov.au/resource-assessment/interactive-groundwater-and-salinity-map-south-west-agricultural-region#legendmap

APPENDIX – BOREHOLE LOGS

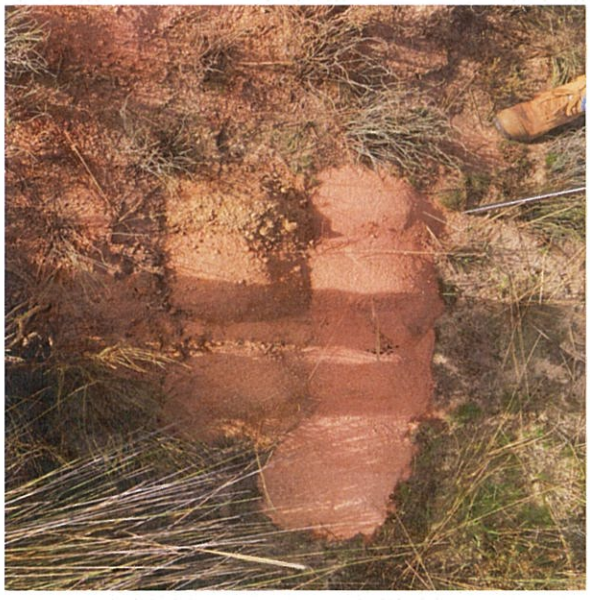
TP1
Sand 600mm
Gravel 400mm
Gravel/clay next metre
Clay /rock at 2 m
Clay white rock through to 3m

TP 2
Sand 600mm
Gravel 400mm
Gravel/clay/sand next metre
Clay/rock next 600mm
Clay 1.3metres

TP 3
Sand 600mm
Gravel 300mm
Sandy/ clay 900mm
Clay/rock white next 1.8m hard but drillable

TP 4
Sand 300mm
Gravel/ clay/ sand next 1000mm
Clay next 1500mm
Rock to hard to drill
Site close to watercourse fed from railway line access/fire breaks

TP 5
150mm sand
300mm gravel
Gravel clay to 2m
Sandy/clay/white rock to 3m



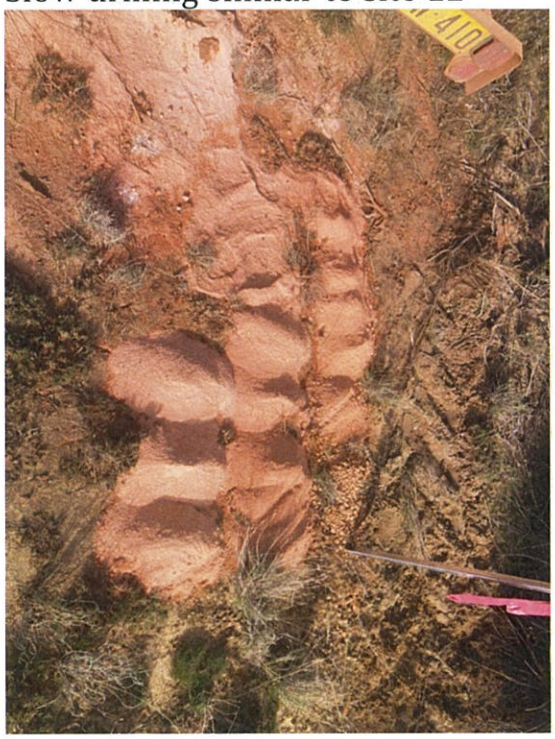
TP 6
Sand 1000mm
Sandy gravel 400mm
Sandy clay gravel next 1000mm
Clay /white rock to white clay up to 3m

TP7
Sand 100mm
Gravel / clay to 1200mm
Clay/rock next 600mm
Clay 1.3 m

TP 8
Sand 200mm
Gravel 200mm
Sand clay next 1.4m
Rock to hard to drill

TP9
Sand 150mm
Gravel 200mm
Sandy clay to 2m
Clay and white rock to 3m

TP10
Gravel 300mm
Sandy clay next 3m
Slow drilling similar to site 12



TP11
Sand 200mm
Gravel 1.5m
Clay 200mm
Rock to hard to drill

TP12
Sandy gravel 300mm
Sandy clay for the next 3m
Very heavy powdery and hard slow to drill like sediment rock

TP13
Sand / gravel 300mm
Sandy clay for the next 2200mm rock to hard to drill

TP14
Sand 1.5m
Sandy clay pink grit white rock

TP15
3.5m yellow sand onto rock