Shire of Dardanup

APPENDICES

PART 1 - Item 12.1

ORDINARY COUNCIL MEETING

To Be Held

Wednesday, 16 December 2020
Commencing at 5.00pm

At

Shire of Dardanup
ADMINISTRATION CENTRE EATON
1 Council Drive - EATON

This document is available in alternative formats such as:
~ Large Print
~ Electronic Format [disk or emailed]
Upon request.

RISK ASSESSMENT TOOL

OVERALL RISK EVENT: Local Development Plan – Banksia Road Landfill Site

RISK THEME PROFILE:

7 - Environment Management

RISK ASSESSMENT CONTEXT: Operational

CONSEQUENCE CATEGORY	RISK EVENT	PRIOR TO TREATMENT OR CONTROL			RISK ACTION PLAN (Treatment or controls proposed)	AFTER TREATEMENT OR CONTROL		
		CONSEQUENCE	LIKELIHOOD	INHERENT RISK RATING		CONSEQUENCE	LIKELIHOOD	RESIDUAL RISK RATING
HEALTH	No risk event identified for this category.	Not Required - No Risk Identified	N/A	N/A	Not required.	Not required.	Not required.	Not required.
FINANCIAL IMPACT	Non-compliance with an adopted LDP and subsequent Development Approvals for the site may lead to increased prosecution with increased financial cost to the Shire.	Moderate (3)	Possible (3)	Moderate (5 - 11)	Not required.	Minor (2)	Possible (3)	Moderate (5 - 11)
SERVICE INTERRUPTION	No risk event identified for this category.	Not Required - No Risk Identified	N/A	N/A	Not required.	Not required.	Not required.	Not required.
LEGAL AND COMPLIANCE	Lack of an adopted LDP for the site may lead to non-compliance with Development Approvals increasing the risk to the Shire's reputation and the environment.	Moderate (3)	Possible (3)	Moderate (5 - 11)	Not required.	Moderate (3)	Possible (3)	Moderate (5 - 11)
REPUTATIONAL	Lack of proper Development Controls for the site through an adopted LDP may lead to community outrage damaging the Shire's reputation.	Moderate (3)	Possible (3)	Moderate (5 - 11)	Not required.	Moderate (3)	Possible (3)	Moderate (5 - 11)
ENVIRONMENT	Lack of proper Development Controls	Moderate (3)	Possible (3)	Moderate (5 - 11)	Not required.	Moderate (3)	Possible (3)	Moderate (5 - 11)

CONSEQUENCE CATEGORY	RISK EVENT	PRIOR TO TREATMENT OR CONTROL			RISK ACTION PLAN (Treatment or controls proposed)	AFTER TREATEMENT OR CONTROL		
		CONSEQUENCE	LIKELIHOOD	INHERENT RISK RATING		CONSEQUENCE	LIKELIHOOD	RESIDUAL RISK RATING
	for the site through an adopted LDP may lead to environmental on and off site impacts.							

CLEANAWAY
Making a sustainable future possible

DARDANUP LANDFILL MASTERPLAN

Banksia Road Dardanup WA

Date: November 2020
Prepared by: Sally Carlton/ Francesco Abate
Version: 1

Executive Summary

Cleanaway has operated the Class III (mid-level) landfill site at the Banksia Road site in Dardanup since approval was granted in 2006. The site is 175km south of Perth and 6km southwest of the Dardanup townsite and services the surrounding Greater Bunbury Region, including industries throughout the wider South West.

There are currently nine landfill Waste Disposal Cells of which seven are being actively filled, in addition to the two liquid and tailings Waste Disposal Cells. The final project plan would see up to 22 Cells and two liquid and tailings Waste Disposal Cells on the site constructed and rehabilitated in sequence across the life of the project. This Masterplan outlines details of the existing operations and future plans in relation to the landfill cell construction and rehabilitation of the site overall.

Contents

1. Introduction

1.1 Cleanaway

Cleanaway currently operates the existing landfill site at Banksia Road, Dardanup (Lot 2 on Diagram 65861, being the subject site).

Cleanaway has been in operation for over 50 years and specialises in the collection, handling, processing, recycling and landfilling of a wide range of waste materials throughout Australia. Cleanaway as a company consists of over 6000 staff and has a fleet of over 4500 specialist vehicles across more than 260 locations around Australia.

Cleanaway is Australia's largest waste, recycling, industrial and liquids service provider with a network of facilities, transfer stations, engineered landfills, liquid treatment plants and refineries.

Part of the operation of the site is focussed on investment in the local Dardanup economy through local procurement (up to 30 organisations) and local employment (13 direct employees), and Cleanaway also partners with the Activ Foundation to provide working opportunities on site, specifically weekly litter picking.

1.2 Aims and Objectives of the Masterplan

This Masterplan relates to Cleanaway's existing landfill site at Banksia Road, Dardanup.

This Masterplan seeks to outline details of the existing landfill site operations and future plans in relation to the landfill cell construction and rehabilitation of the site overall.

It represents the current state of future planning for the site not withstanding future unforeseen circumstances that may require modification of these plans.

There are currently nine landfill waste disposal cells of which seven are yet to be completely filled, in addition to the two liquid and tailings waste disposal cells. The final project plan would see up to 22 landfill waste disposal cells and two liquid and tailings waste disposal cells on the site constructed and rehabilitated in sequence across the life of the project.

1.3 Relationship to existing documents

The Masterplan includes relevant information on existing infrastructure and future landfill cell development layout and sequence, rehabilitation plans, stages and associated final landform plans.

The Masterplan also collates the existing reports that have been prepared for various elements of the site operations, including dust management, fire control, landscaping, rehabilitation and stormwater management.

1.4 Relevant Legislation

Approval was granted in 2006 for a Class III (mid-level) landfill site to be developed at the Banksia Road site in Dardanup.

Cleanaway operates the site and, since 2006, has sought and obtained a number of Development Application approvals from the Shire of Dardanup for Class III landfill waste

disposal cells, liquid and tailings waste disposal cells, stormwater and leachate ponds and internal infrastructure to service the public and industry.

The landfill is licensed by the Department of Water and Environmental Regulation (DWER) under the Environmental Protection Act 1986 (EP Act). The DWER licence allows Cleanaway to accept 350,000 tonnes per annum of Class III waste and 353,000 tonnes per annum of liquid waste. The licence also allows Cleanaway to store tailings from titanium dioxide processing.

The licence requires Cleanaway to monitor and report on:

- Construction Compliance:
- Annual Audit Compliance Report:
    - Waste quantities received;
    - Details of non-compliance with the licence conditions (if any);
- Annual Environmental Report:
    - Information on active landfill areas, liquid and tailings areas;
    - Information on landfill gas collection and management systems;
    - Summary of failures or malfunctions (if any);
    - Waste inputs and outputs;
    - Waste handling processes
    - Groundwater monitoring;
    - Complaints management;

Cleanaway submits an Annual Audit Compliance Report and an Annual Environmental Report to DWER at the end of March each year. The reporting period for these reports is 1 January to 31 December each year.

In addition, the licence requires Cleanaway to notify the DWER of the timing of the progressive expansion of the landfill gas management system and any landfill fires that may occur.

1.5 Site History

The site has a history of varied uses and occupies, which includes the following:

- J&P Metals, a local Bunbury business, or related parties have owned the site prior to any development occurring and continue to retain ownership of the site;
- The landowner has either developed various activities on site or leased out portions of the site for other business opportunities;
- In the early 1990's, the landowner substantially cleared the site of native vegetation for the purposes of gravel and sand extraction;
- In the late 1990's the site owner developed the central portion of the site as a Class II landfill facility and at a similar time, leased the western portion of the site to a tree plantation company for the development of a blue gum plantation;
- In 2006, Cleanaway leased the site from the landowner and soon thereafter amended the licence to allow Class III waste to be received;
- Progressively, as Cleanaway activities expanded, the tree plantation area decreased and ceased completely in early 2017;

In addition to the above, there are/were extensive mining leases (mineral sands) over portions of the site, mainly the western portion.

Prior to any change of use or development, either the landowner or Cleanaway obtained the necessary Regulatory Approval(s) for the proposed activity.

Since the original approval for the landowner to develop a landfill facility, the Shire of Dardanup has approved a number of developments relating to the waste disposal facility including the following :

- December 2010 - Council approved the construction of a landfill Cell 5 and associated works (421/10);
- December 2011 - Council approved the construction of two leachate ponds and the construction of a residue disposal cell (371/11);
- May 2012 - The Shire approved the construction of a water resource recovery and storage shed under delegated authority;
- November 2014 - Council approved the construction of a leachate dam and associated works (383/14);
- March 2016 - Council approved an extractive industry for the landowner on the western portion of the property (38/16);
- April 2016 - The Shire approved the construction of stormwater infrastructure (stormwater pond and stormwater bund) under delegated authority;
- December 2016 - Council approved the construction of landfill Cells 6, 7 and 8 for the purpose of Waste Disposal; and
- May 2018 - Officers approved the construction and use of a liquid and tailings waste disposal cell and associated leachate pond under delegated authority.

1.6 Adoption as Local Development Plan

This Masterplan has been prepared with the intention of being adopted by the Shire of Dardanup as a Local Development Plan. Local Development Plans can be approved by local governments in accordance with clause 52 (1)(a) of the Planning and Development (Local Planning Schemes) Regulations 2015.

The Masterplan once formally adopted as a Local Development Plan would guide future decision making for the subject site, including future Development Applications.

2. Subject Site

2.1 Locality

The Dardanup landfill site is located on Lot 2 on Diagram 65861, Banksia Road, Crooked Brook, WA, in the Shire of Dardanup.

Figure 1 below shows the Dardanup Landfill Locality Plan

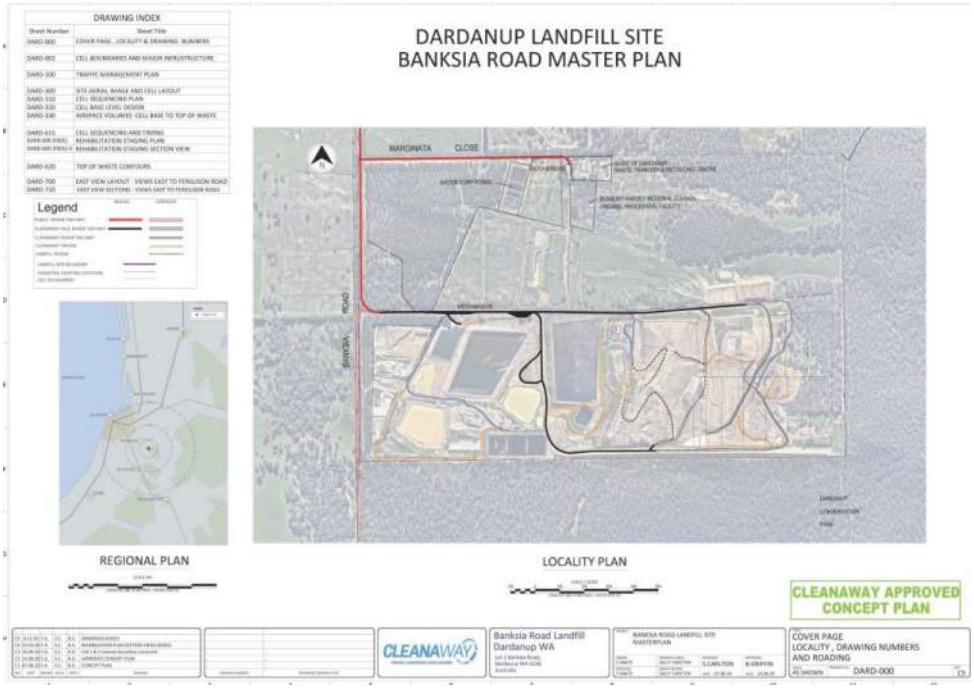


Figure 1: Locality Plan and Drawing Index

2.2 Opportunities and Constraints

The subject land and its existing operation has many opportunities, including:

- Sufficient area to dispose of and process various types of waste;
- A location which is well suited to service the greater Bunbury region;
- A location that is buffered by the adjacent Dardanup Conservation Park and surrounding rural land;
- Minimal close neighbours (nearest 450 m to the south west);
- An existing waste management facility;
- Good hydrogeological structure below ground to protect the regional groundwater;

Constraints relating to the subject land and its operations include:

- Raised topography making the site visible from the west;
- Native soil being silty clay provides a good environmental barrier, but generates substantial dust;

2.3 Site Operations

The existing waste disposal operations are permitted within the existing DWER licence as a Category 61 liquid waste facility and a Category 64 Class II or III putrescible landfill site under Schedule 1 of the *Environmental Protection Regulations 1987*.

The landfill waste disposal cells as well as the liquid and tailings waste disposal cells have been incrementally approved and developed over time.

The subject site currently has one main active landfill disposal area which is in Cell 7. The construction of this cell was completed in March 2020 with approval to use the Cell granted by DWER in May 2020. The waste is placed in horizontal layers until the final design waste profile is reached.

A secondary waste disposal area exists at the top of Cells 3, 4, 4b, 5, 6 and 12 which is typically used for asbestos and quarantine waste placement.

2.4 Cell Boundaries, Layout and Infrastructure

There are currently nine landfill waste disposal cells, of which seven are yet to be completely filled, in addition to the two liquid and tailings waste disposal cells. The final project plan would see up to 22 landfill cells and the two liquid and tailings waste disposal cells on the site constructed and rehabilitated in sequence across the life of the project.

Figure 2 shows the cell boundaries and major infrastructure.

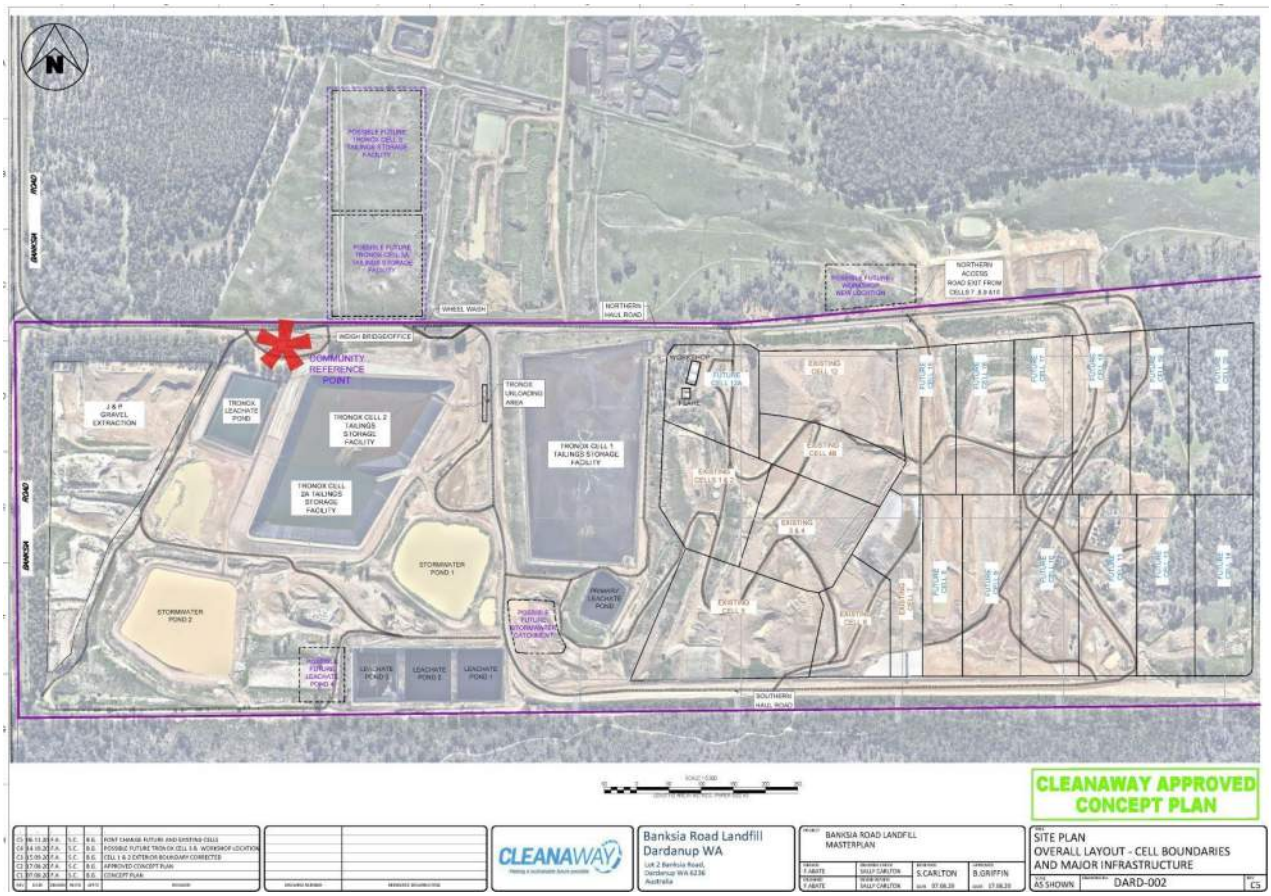


Figure 2: Cell Boundaries and Major Infrastructure

2.5 Traffic Plans

The adopted traffic management regime is detailed in Figure 3 below. The traffic management plan (Figure 3) includes the following details:

- Public (two-way) Roads;
- Cleanaway Haul Roads (two-way);
- Cleanaway Tracks;
- Landfill Roads;
- One way Haul Road – for landfill customers; and
- Location of 'stop' and 'give way' signs.

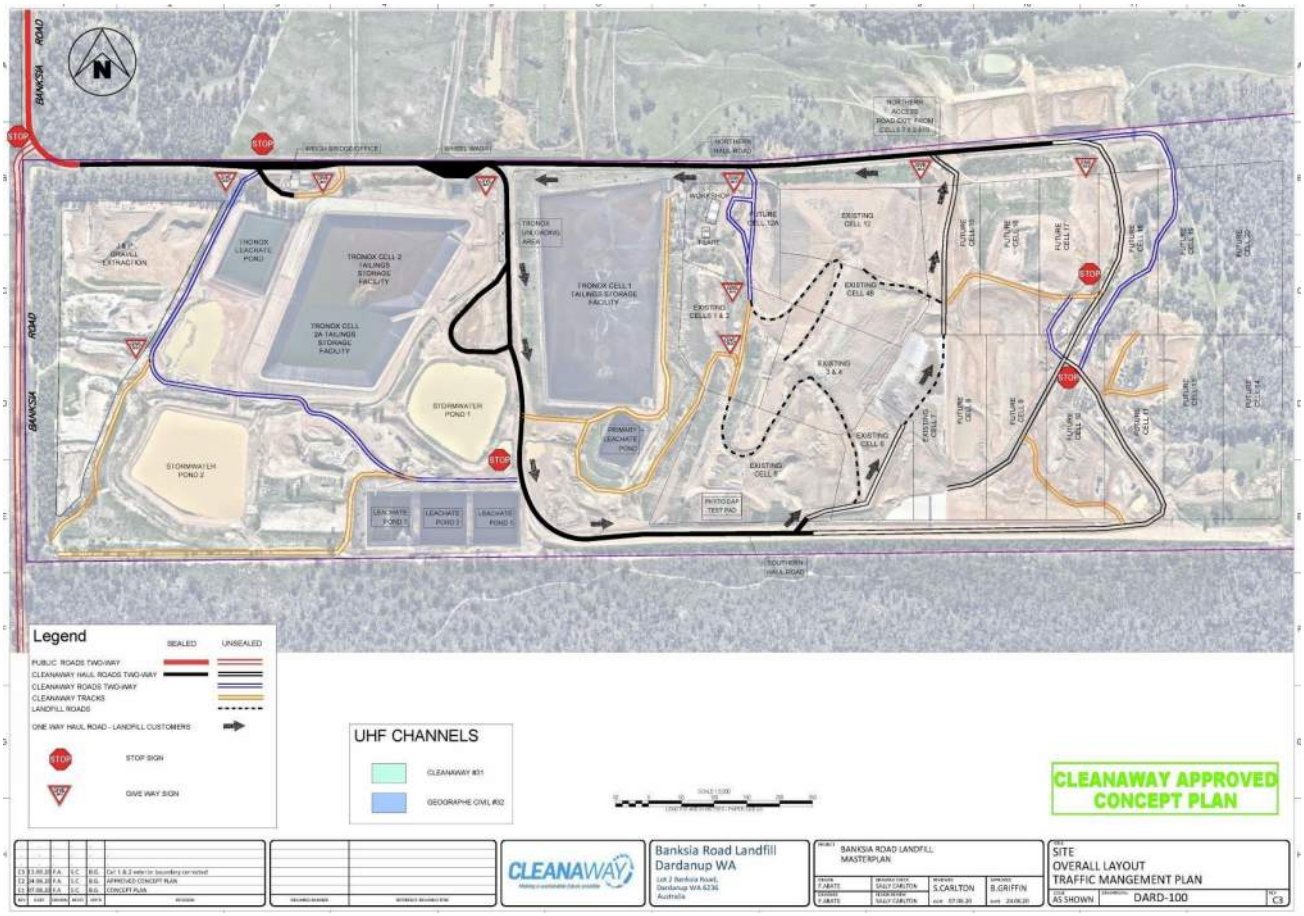


Figure 3: Traffic Management Plan

3. Cell Development

3.1 Overview

There are currently nine waste cells of which seven are yet to be completely filled, in addition to the two liquid and tailings waste disposal cells. The final project plan would see up to 22 landfill cells and the two tailings waste disposal cells on the site constructed and rehabilitated in sequence across the life of the project.

Future cells are progressively designed with ten solid waste cells designed to date. Nine of those cells have already been constructed and Cell 8 is currently under construction. The next three, Cells 12A, 9 and 10 are currently being designed.

Future liquid and tailings waste disposal cells, Cell 3/3A, may be required within a 4-5 year period assuming the current commercial agreements are extended. Due to limited space availability on the existing site, the option is being considered to locate these new tailings waste disposal cells on the site to the north of the existing landfill site. The possible future location for these new tailings waste disposal cells is shown on the Figure 4 below.

Figure 4: Cell Layout and Aerial Plan

The original Cell Layout Plan has been modified.

The key change is that while the overall future landfill area has not increased, the width of future landfill cells has increased to provide more airspace per cell construction and a better match with incoming waste tonnages. This change has resulted in fewer future landfill cells within the available future landfill area .Figure 5 below shows the expected future sequence for landfill cell construction.

Figure 5: Cell Sequencing Plan

3.2 Cell Design and Layout

The landfill cell design and layout have been conceptualised based on inputs provided by IW Projects, a Specialist Waste Management Consultancy.

The concept design of the cells is based on the following assumptions:

- Landfill cell sump base levels stepped up 500mm vertically between each cell towards the east;
- To ensure adequate leachate collection and extraction, cell floor slopes are set to a minimum of 3% towards a valley and 1% towards a leachate collection sump;
- Final top of waste batter slopes are designed at a slope of 1 m vertical in 3.5 m horizontal;
- The design surface on the 'Cell Base Level Design' is the 'top of base liner' surface which is shown on the 'DARD-330 CELL Base Level Design Drawing';
- The design 'Top of Waste' surface is as per Drawing 'F001 Landfill Final Top of Waste Contour C2'. The original 'Drawing F001 Landfill Final Top of Waste Contour', which formed part of the Cleanaway 2016 Rehabilitation and Closure Plan, was submitted to DWER as part of the Works Approval Application for Landfill Cells 6,7, & 8.

The 'Top of Waste' surface and the 'Cell Base Level Design' surfaces were used to estimate the quantity of waste that can be disposed of within the landfill cells (landfill airspace capacities).Figure 6 below

shows the current design for the Cell Base Level of the cells.

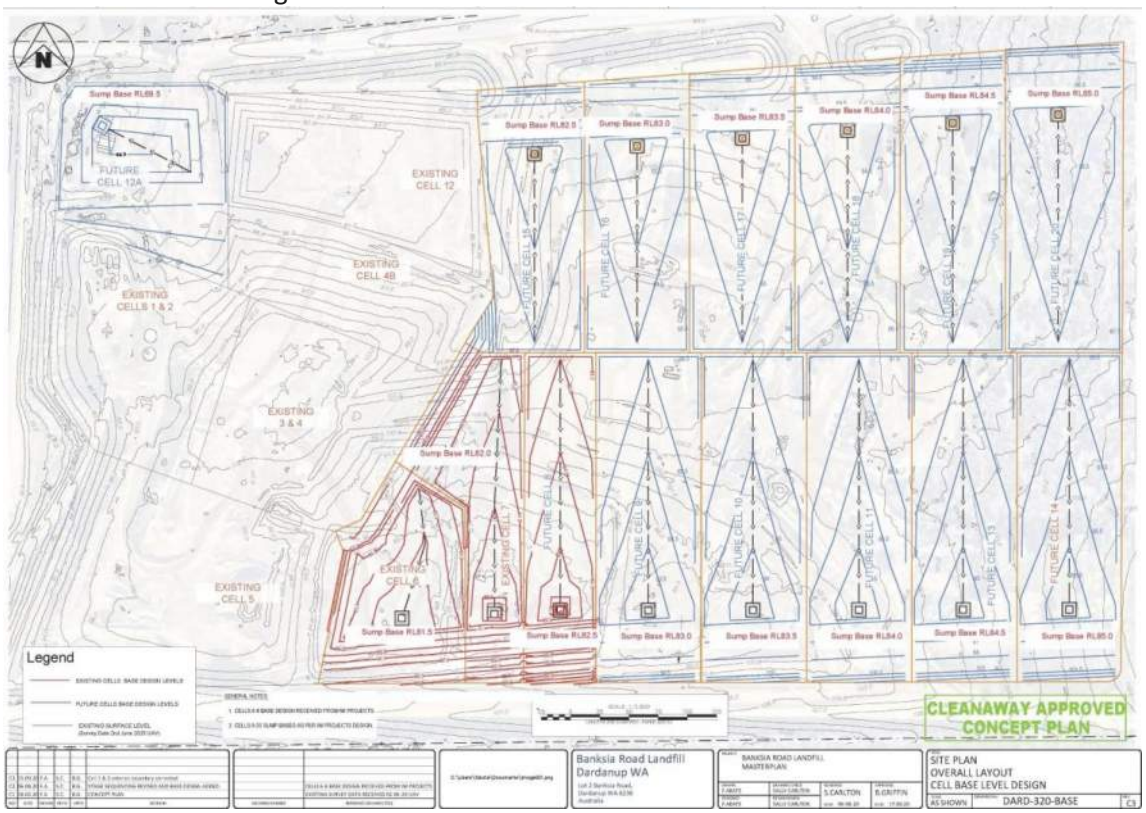


Figure 6: Cell Base Level Design Plan

3.3 Model Analysis and Airspace Calculations

It is intended to develop future cells progressively but in sufficient time to allow for an airspace capacity buffer between the development of the new cell and the requirement to use it for waste disposal.

Airspace is determined using a 3D Model to calculate the volume between a top and bottom design surface.

The bottom design surface used to determine the airspace volumes used in the Indicative Timing Assessment is the 'Cell Base Level Design'. The top design surface used to determine the airspace volumes presented in these drawings is the 'Final Top of Waste Contour' level.

The following figure is a visual representation of how the airspace volume is determined for the future cells.

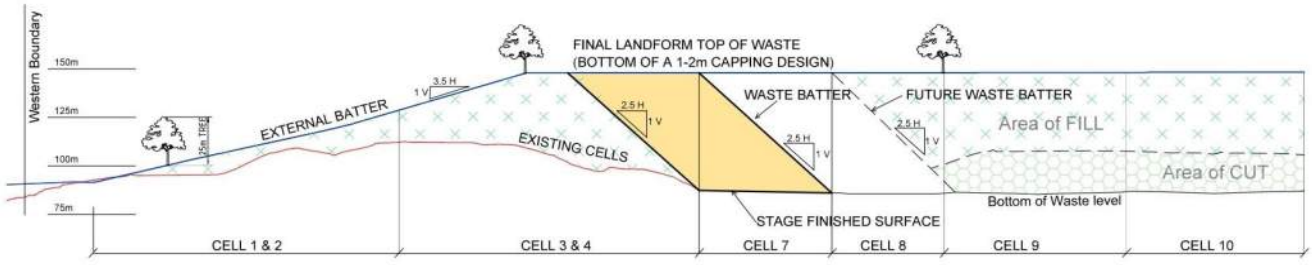


Figure 7: Typical waste section

3.4 Final Landform and Indicative Landfill Cell Development Timing

Cleanaway is proposing to slightly modify the slopes of the final landform, from the existing 1 m vertically and 4 m horizontal to 1 m vertically and 3.5 m horizontal. There is no proposal to increase the height of the landfill, simply to slightly change the side slope angle. This change increases the available airspace capacity within the landfill without increasing the height of the landfill above current approval levels.

Figure 8 below shows the 'DARD-615- CELL TIMING 'Drawing with the cell sequence and timing detailed and the proposed overall layout for the 'Top of Waste Contour' at the AHD 149m level shown.

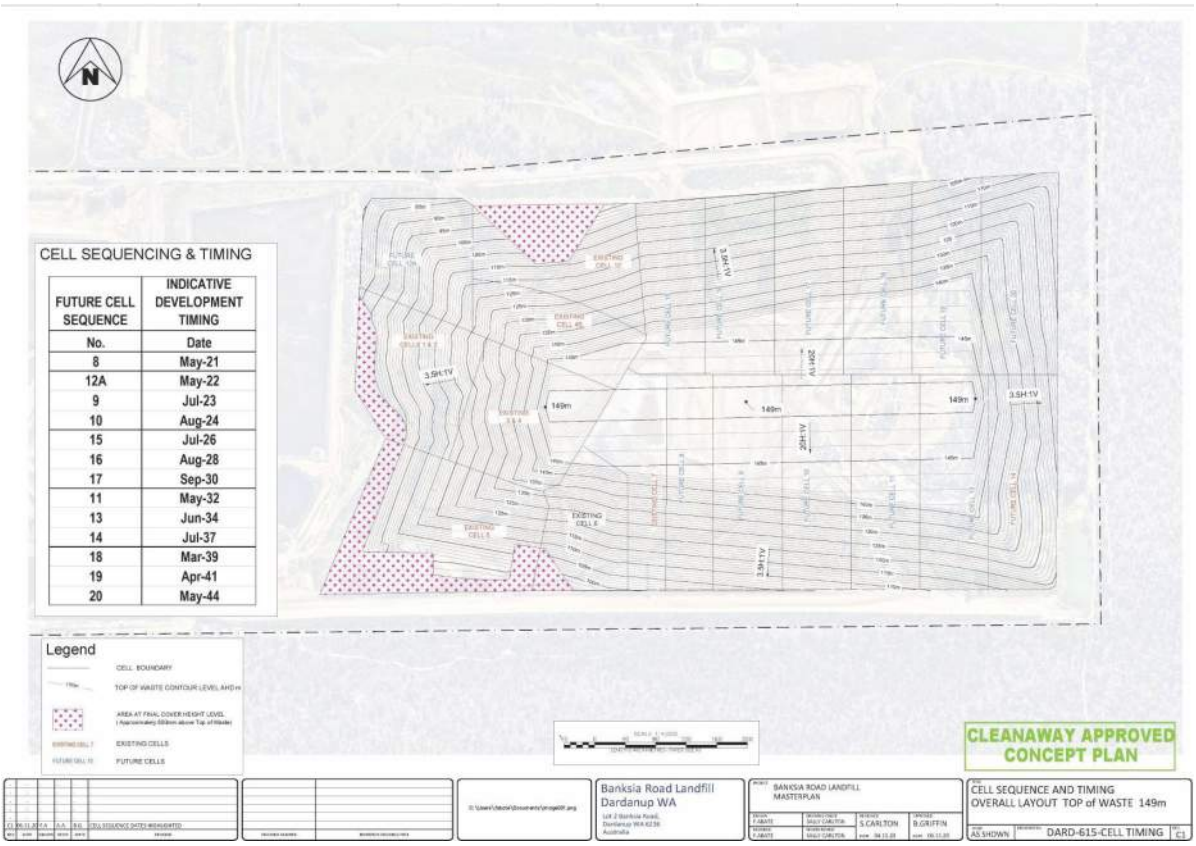


Figure 8: Cell Sequence and Timing Drawing with the 'Final Top of Waste Contour'

The following should be noted in relation to Cell Sequence and Cell Timing information in the Figure 8 drawing:

- The airspace volumes used are from the 3D modelling as described in Section 3.2 Model Analysis and Airspace Calculations;
- The 'Top of Waste' surface as per Drawing 'F001 Landfill Final Top of Waste Contour C2'and the 'Cell Base Level Design' surface as per Drawing 'DARD-330 CELL Base Level Design' were used in the 3D Model estimate the airspace capacities;
- Internal waste batter slopes between successive landfill cells are set at 1m vertical to 2.5m horizontal (allowable stable batter for temporary waste slopes);
- Any benching requirements on the waste batters for road access are not considered in the estimated airspace volume assessments for individual cells. Benches would potentially reduce the overall waste slope batter and hence impact on the estimated airspace capacity in an individual landfill cell, but when the adjacent landfill cell is subsequently filled, this 'lost' airspace capacity is then gained.

- The projected annual waste tonnage used to determine the 'Indicative Development Timing' information was 350,000T/annum; and
- A Waste Compaction Rate of 0.94 tonnes /m3 was used to estimate the 'Indicative Development Timing' information.

4. Management and Rehabilitation

4.1 Management

Cleanaway has developed a number of management plans for the ongoing development and operation of the site. These plans include the following:

- Dust Management Plan.
- Fire Control Plan
- Landfill Rehabilitation and Closure Plan
- Landfill Rehabilitation and Closure Plan - Appendix D - Landscaping Plan

all of which have been submitted as Appendices.

4.2 Final Landform

The Dardanup site is expected to receive waste until approximately 2048 with a projected landfill footprint of 47.9 Hectares.

The current approved height permitted within the existing DWER licence is AHD 128m.

The final landform is planned to reach a height of AHD 149m consistent with the final landform design submitted by to DWER in 2016 and publicly advertised as part of the Cells 6, 7 and 8 Works Approval .

Rehabilitation will occur progressively once cells have reached the final top of waste design profile. The Rehabilitation Stages start with the Western facing slopes to improve the visual amenity. These west facing slopes of the final landform will be covered with Hydromulch to assist with the visual impact and minimise dust.

Figure 9 below includes the 'Completed Rehabilitation Plan – Overall Layout'.

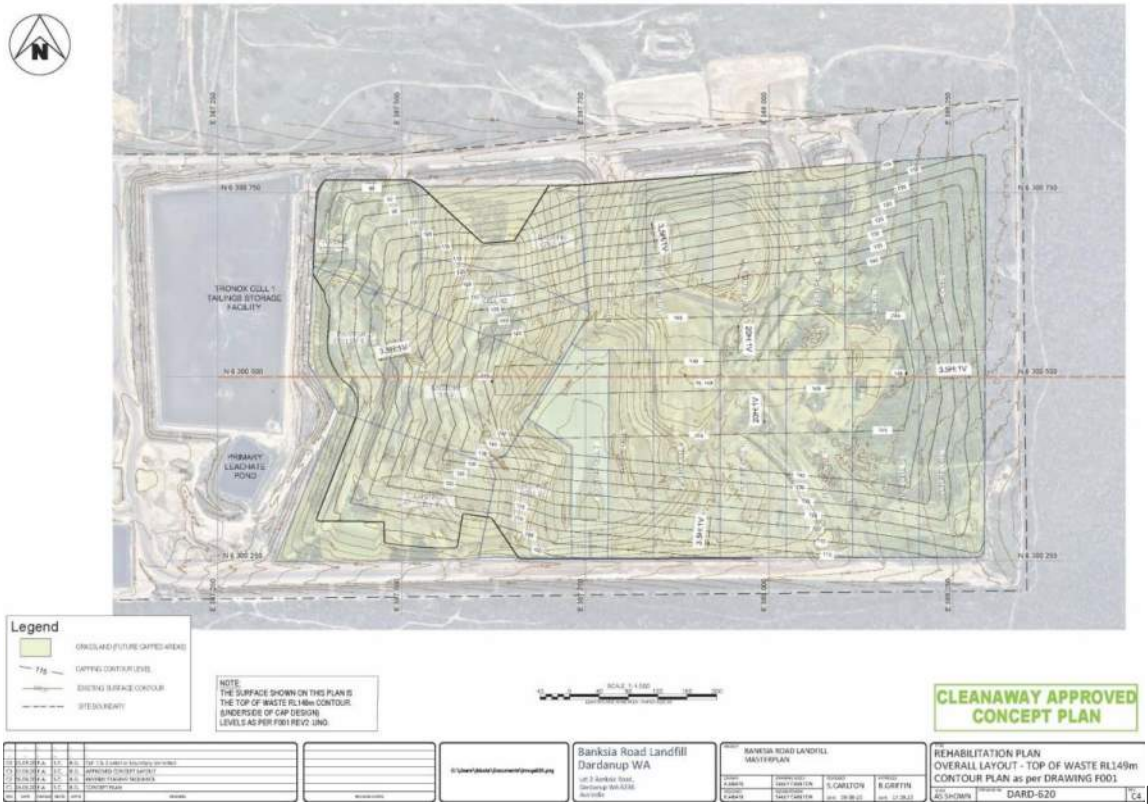


Figure 9: Completed Rehabilitation Plan – Overall Layout

4.3 Rehabilitation Stages

The 3D model that was used to determine the airspace of future cells was also used to determine both the Capping Area and the timing required to develop the Rehabilitation Stage Plan shown below in Figure 10.

The capping system will be constructed on top of the 'Top of Waste Contour' surface. The final design of the cap is yet to be determined but will typically consist of either a synthetically lined cap with a 1.5 m growing medium on top or a thicker soil capping system without a synthetic liner (phyto cap).

There is currently a phyto capping trial being carried out on site, which was approved as part of the landfill Cell 6, 7 & 8 approvals in 2016. A decision on the final capping system will be made following the completion of the capping trial, which is due to run through to approximately July 2022.

Rehabilitation Stage	Capping Area	COMPLETION DATE
No.	m^2	Date
1	20,760	2023
2	25,620	2024
3	21,205	2025
5	35,145	2026
6	37,125	2027
4	29,270	2028
7	68,070	2032
8	60,020	2038
9	62,800	2045
10	71,800	2051

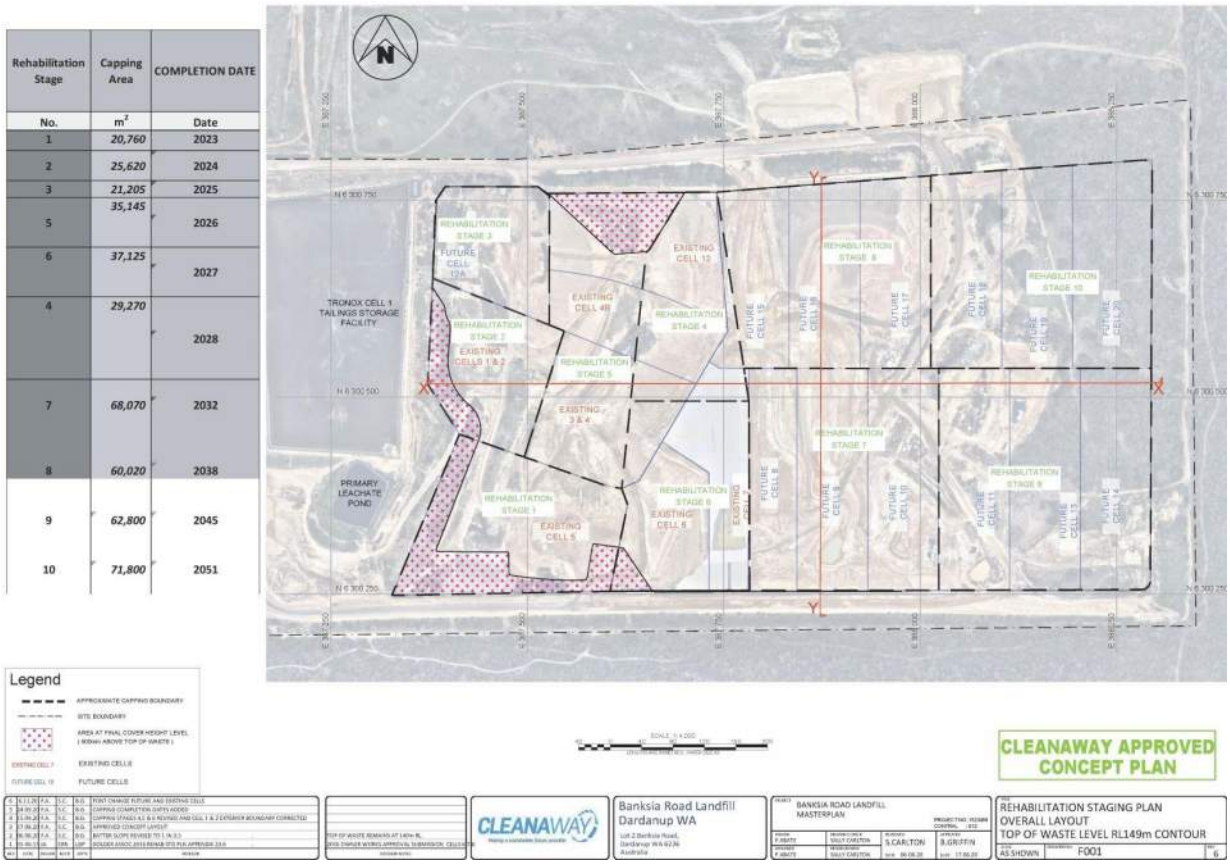


Figure 10: F001 Rehabilitation Staging Plan – Top of Waste Level -RL 149m Contour Drawing.

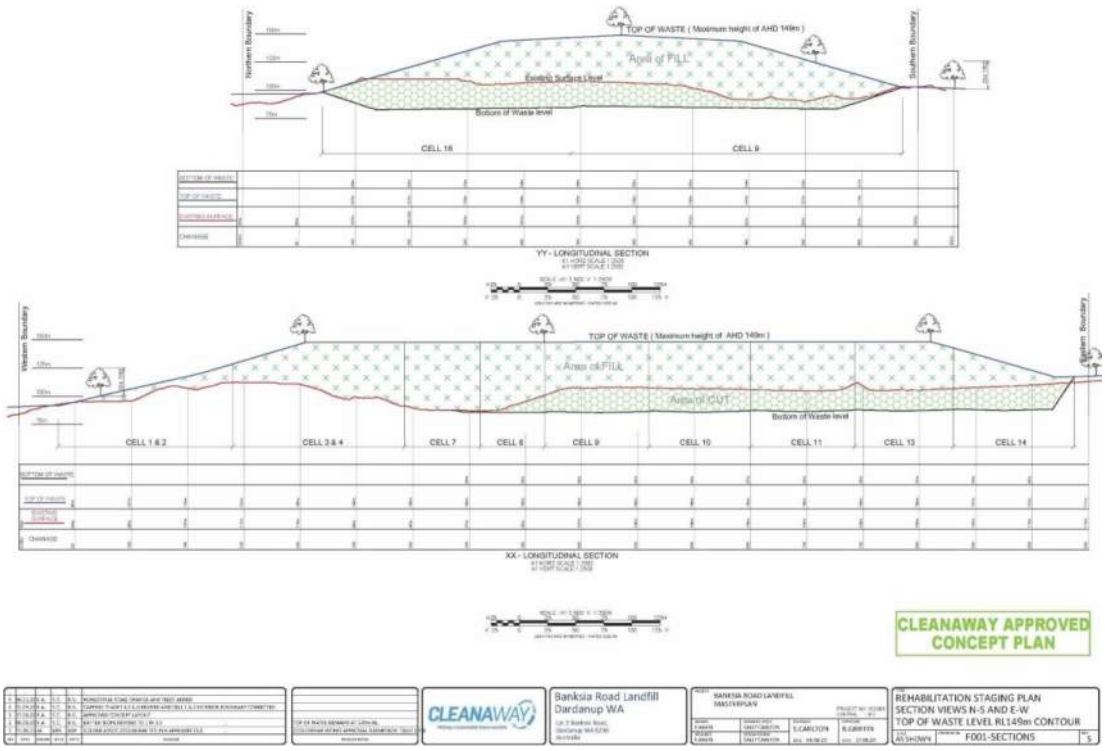


Figure 11: F001 Rehabilitation Staging Plan – Top of Waste Level -RL 149m Contour- Section Views Drawing.

4.4 Indicative Rehabilitation Timing Summary

The indicative timing of the rehabilitation stages is detailed in Table 1 below.

Table 1: Landfill Rehabilitation Indicative Capping Completion Dates

Rehabilitation Stage	Capping Area m2	Indicative Completion Date
1	20,760	February 2023
2	25,620	Dec 23-Mar 24
3	21,205	Jan-Mar 2025
5	35,345	Dec 25-Mar 26
6	37,125	Dec 26-Mar 27
4	29,270	Dec 27-Mar 28
7	68070	Dec 31-Mar-32
8	60,020	Dec 37-Mar 38
9	62,800	Dec 44-Mar 45
10	71,800	Dec 50-Mar 51

4.5 Rehabilitation Plan Eastern Views

A schematic sight line plan has been developed for the easter facing final top of waste design profile. This indicates extent to which the completed landfill will be visible when viewed from the east.

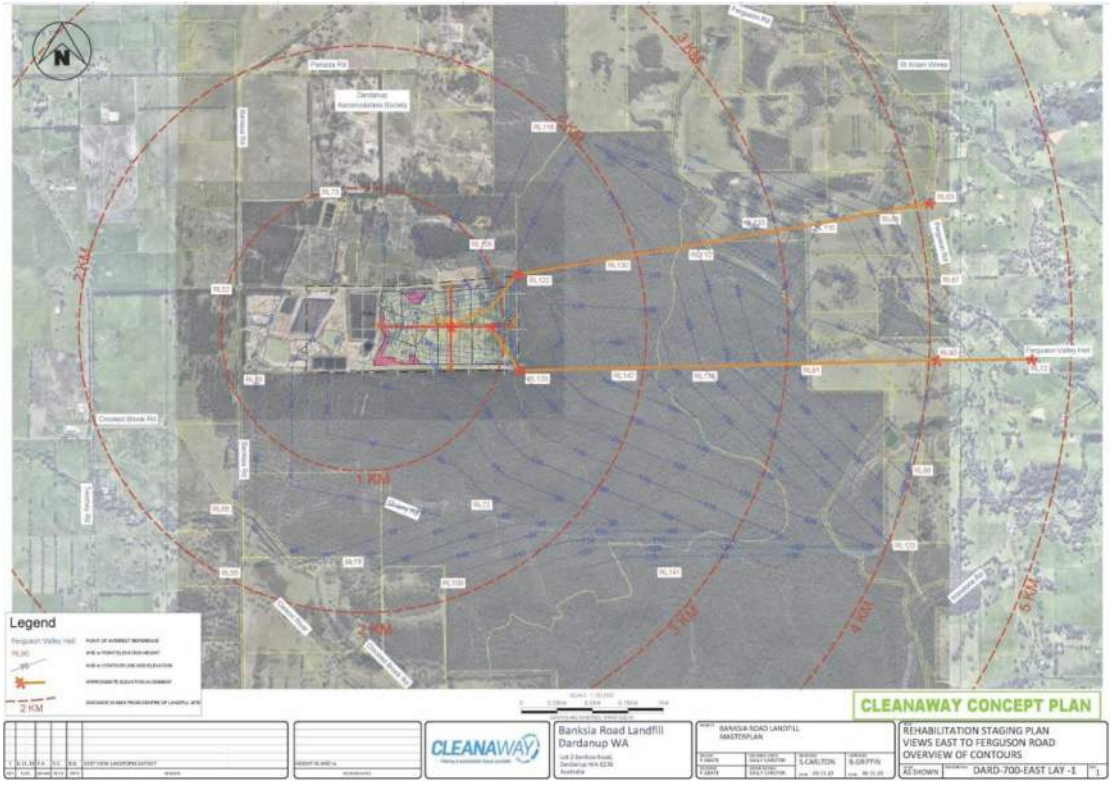


Figure 12: Rehabilitation Plan East Layout Views

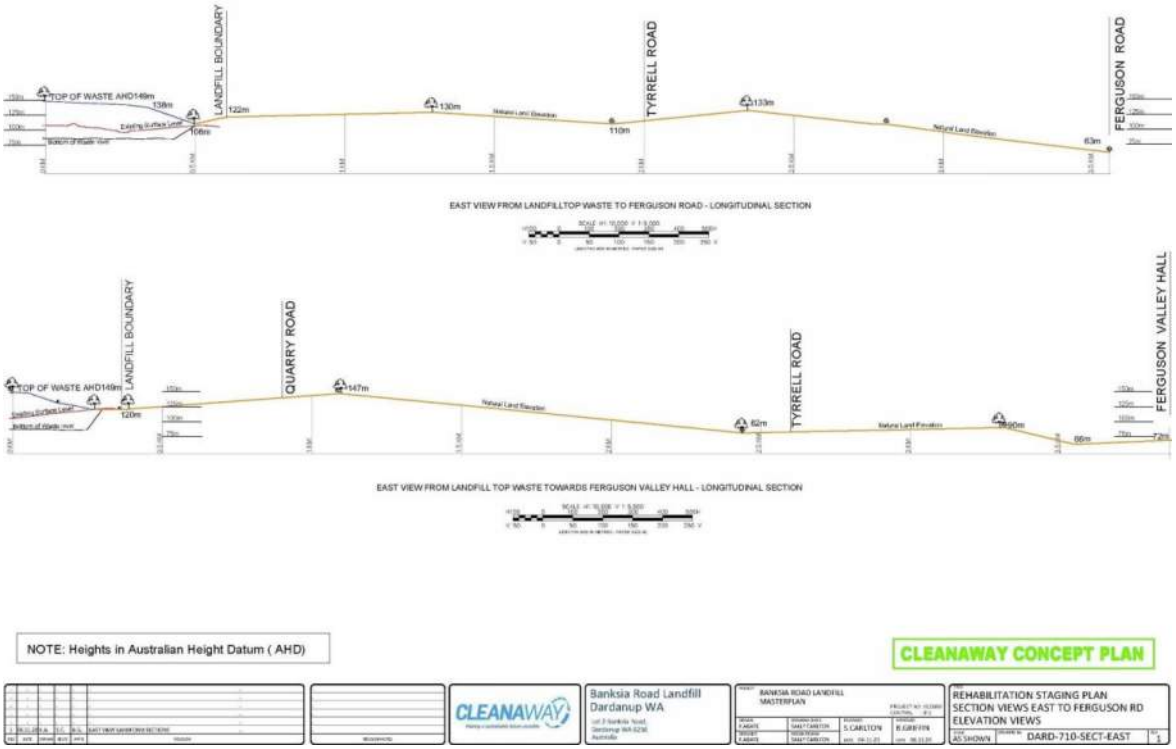


Figure 13: Rehabilitation Plan East Elevation Views

4.6 Rehabilitation Landscaping

A Landscaping Plan providing an overview of the how the Dardanup Site Rehabilitation Landscaping for the final landform will look has been provided to the Shire of Dardanup.

The Landscaping Plan identifies five distinct areas (infrastructure, grasslands, native woodland, buffer area and wetland) that require different vegetation approaches. Figure 14 shows the Landscaping Plan Zone Layout.

Figure 14 Landscaping Plan – Concept Zone Layout

Figure 15 below shows isometric and vantage point artistic impression views of the final landscape form.

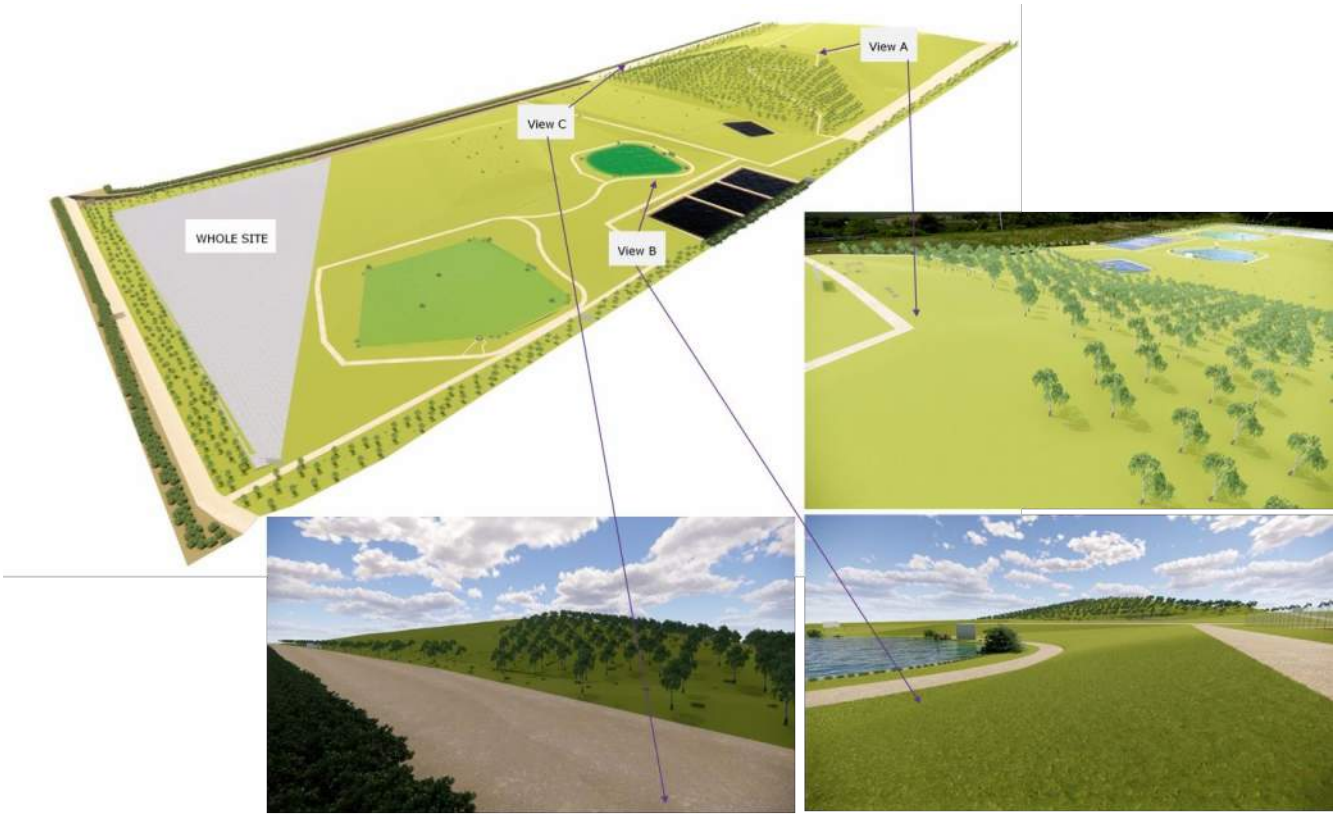


Figure 15 Isometric and Vantage Point Photos of the Final Landscape

5. Implementation

This masterplan sets out the future vision for the site and provides detail on the proposed individual developments. The implementation of this Masterplan will occur via subsequent Development Applications and Environmental Approvals as are necessary for the ongoing development of the site.

Due to the number of future landfill cells proposed to be developed and then subsequently closed, capped and then rehabilitated, future regulatory approval applications will aim to include a few activities in a single application, as opposed to there being a large number of application being processed over the life of the facility. Historically, landfill cell development has covered the construction of three landfill cells in a single application. This is typically the scale of works that will be included in future applications.

6. Review

This masterplan covers the proposed future development of the site over the next approximately 25 years. The aspects of the proposed development are based on today's understanding of Regulatory Approval requirements and the region's waste management needs and services. During the validity period of this masterplan, it is likely that there will be changes that needs to be accommodated within this masterplan. Consequently, there is a need for the regular review of this masterplan to ensure ongoing relevance thereof.

As a minimum this master plan will be reviewed every five years. In addition, the masterplan will be reviewed in the following circumstances:

- In the event that there is a significant change in either Regulatory Approval requirements or waste management needs or services; and
- If during the execution of this masterplan, aspects of the plan are deemed no longer relevant or insufficient.

7. Appendices

7.1 Dust Management Plan

Please find below the link to the Dust Management Plan

https://cleanaway2stor.blob.core.windows.net/cleanaway2-blob-container/2020/11/Banksia-Road-Landfill-Rehabilitation-and-Closure-Plan-Dust-Mgmnt.pdf

7.2 Fire Control Plan

Please find below the link to the Fire Control Plan

https://cleanaway2stor.blob.core.windows.net/cleanaway2-blob-container/2020/11/CWY-Dardanup-Landfill-Fire-Control-Process.pdf

7.3 Rehabilitation and Closure Plan

Please find below the link to the Rehabilitation and Closure Plan

https://cleanaway2stor.blob.core.windows.net/cleanaway2-blob-container/2020/11/Rehab-closure-plan-2020.pdf

7.4 Rehabilitation and Closure Plan- Appendix D -Landscaping Plan

Please find below the link to the Landscaping Plan which is Appendix D of the Rehabilitation and Closure Plan.

https://cleanaway2stor.blob.core.windows.net/cleanaway2-blob-container/2020/11/Banksia-Road-DMP-Landscaping-Plan.pdf

End of Document

CLEANAWAY
Making a sustainable future possible

2020

Banksia Road Landfill Rehabilitation and Closure Plan

PROPOSED REHABILITATION PLAN WITH PHYTOCAP

CLEANAWAY WASTE MANAGEMENT LIMITED

27 Halifax Drive, Bunbury WA 6230 Australia | PO Box 5037, Bunbury DC WA 6230

Updated Rehabilitation and Closure Plan (2020) edited in conjunction with Tonkin.

Document Control

Version (Date)	Author	Reviewed By	Approved By
V1 (07 September 2016)	Paul Antony	Graham Rose / Alaa Abou-Antoun	Louis Sparks
V2 (15 September 2020)	Adam Williams / Isaac Nicholls (Tonkin)	Melissa Salt (Tonkin) / Sally Carlton	Sally Carlton

Document Issue Register

Version (Date)	Issued To
V1 (07 September 2016)	IW Projects Submitted to Department of Environment Regulation, WA
V2 (15 September 2020)	Sally Carlton submitted to Shire of Dardanup for Information only

TABLE OF CONTENTS

TABLES

1 INTRODUCTION

The Banksia Road Landfill Facility located at Lot 2 Banksia Road, Crooked Brook, WA (Site) is licensed under Cleanaway Solid Waste Pty Ltd (CWY) by the Western Australian Department of Water and Environment Regulation (DWER) as per licence amendment number **L8904/2015/1** amendment dated 12 May 2020. The Class III (putrescible) landfill site currently accepts municipal, commercial and industrial waste under the following categories:

TABLE A: CATEGORY AND THROUGHPUT FOR CURRENT LICENCE

Waste Type	Category	Quantity Limit Tonnes per Annual Period	Specification
Clean Fill	Category 64	350,000	None specified
Inert Waste Type 1			
Inert Waste Type 2			Plastics Only
Special Waste Type 1			Cement bonded asbestos. No fibrous asbestos shall be accepted.
Special Waste Type 2			Biomedical/clinical
Putrescible Waste			Must meet the acceptance criteria for Class III landfills.
Contaminated Solid Waste			
Liquid Waste	Category 61	3,000	TWM Processed Septage
		350,000	Cristal Pigment Slurry
		3,000	Drill Muds

1.1 PURPOSE AND SCOPE

The progressive rehabilitation is expected to commence within 6 months from the completion of disposal in that cell or part of a cell once that has reached final waste heights. The document “Banksia Road Landfill Rehabilitation and Closure Plan” defines:

- Indicative design for the landfill cap,
- Final waste height contours to be achieved,
- Indicative staging of rehabilitation,
- Post Closure Period and Monitoring Regimes, and
- Potential Post Closure Use of the Site

2 CAPPING DESIGN

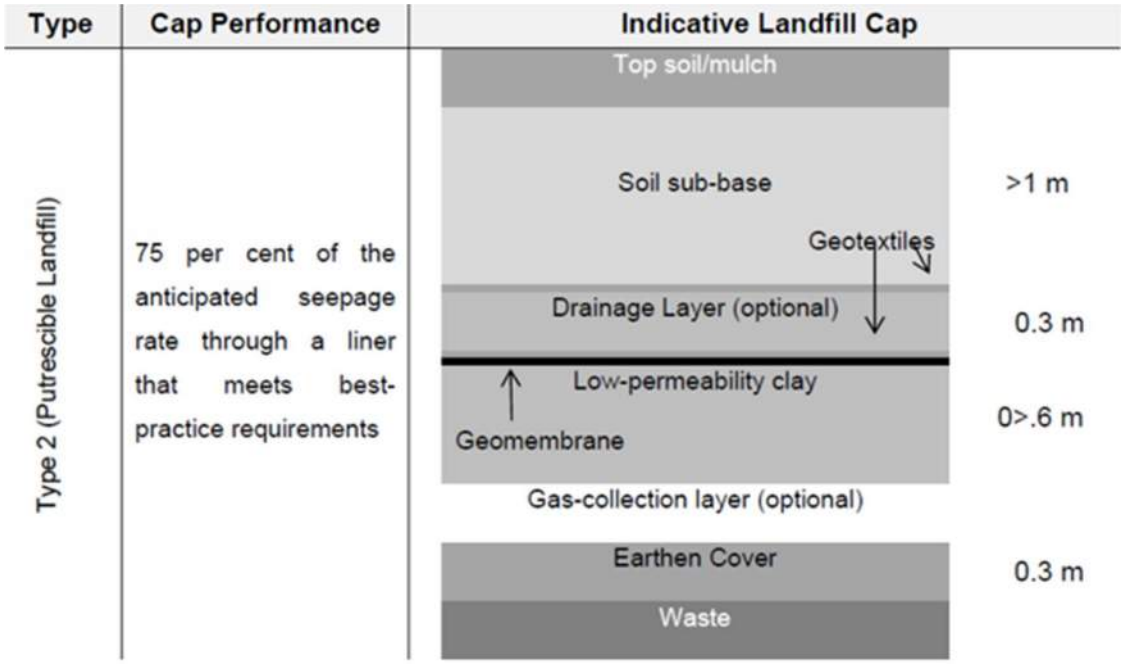
The aim of a landfill cap as stated in the Environment Protection Authority Victoria Publication Number 788.3 "Siting, design, operation and rehabilitation of landfills" (VIC Landfill BPEM) released in August 2015, is to:

- Achieve a design seepage rate of the cap that does not exceed 75 per cent of the design seepage rate of the landfill liner,
- Provide a long-term stable barrier between waste and the environment in order to protect human health and the environment,
- Prevent the uncontrolled escape of landfill gas, and
- Providing land suitable for its intended after use.

2.1 SYNTHETIC CAP DESIGN

The VIC Landfill BPEM refers to the below configuration for a synthetic cap.

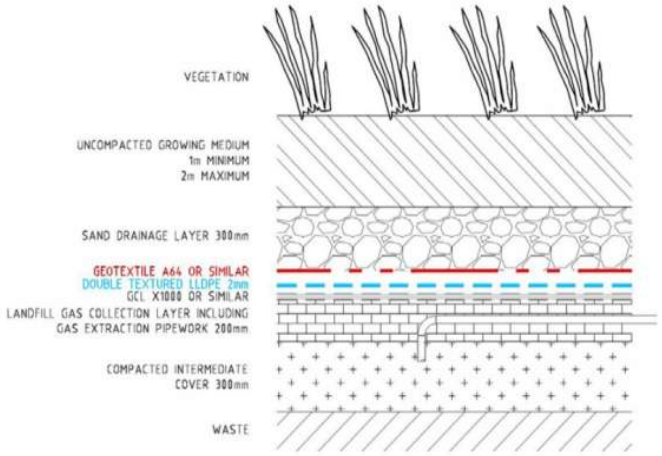
FIGURE A: INDICATIVE SYNTHETHIC CAP PROFILE



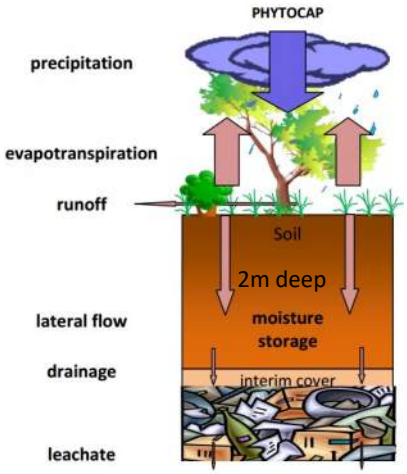
Cleanaway undertook extensive in-situ soil investigation to consider the potential to move away from a synthetic cap and to implement a phytocap at Site. Synthetic caps provide a physical barrier to reduce the movement of moisture through the cap and into the waste. For a phytocap, as with a natural system by using in-situ available soil, the control of moisture movement is provided by the hydraulic properties of the soil and the water use requirements of the plants matching the net moisture input from climate. A schematic representation is in **Figure B**.

FIGURE B: SYNTHETIC CAP PROFILE COMPARISON TO PHYTOCAP

Indicative Synthetic Landfill Cap Profile



Conceptual Phytocap Profile



Source : Opal Vale Landfill Report by IW Projects

: WMAA Guidelines for the Assessment, Design, Construction and Maintenance of Phytocaps

Tonkin Consulting was engaged by Cleanaway to undertake risk assessment on the nature of soil available onsite to suit a phytocap and thereafter provide feedback on establishing a phytocap at Banksia Road Landfill site. The risk assessment outcome was favourable to establishing a phytocap provided the identified risks were appropriately managed. Cleanaway wishes to undertake construction of phytocap and monitoring of the same to validate the performance against the capping design objectives. The initial phytocap construction and monitoring will be considered as a trial and more detail around the trial is in **Section 2.2**.

If for any unidentifiable reason the phytocap trial results in a failure, the phytocap profile will be abandoned and the synthetic cap design will be adopted for construction and performance monitoring. The trial area will also be replaced with the synthetic cap profile.

2.2 PHYTOCAP DESIGN AND TRIAL

An initial screening risk assessment was undertaken by Tonkin Consulting to ensure that a phytocap would be a suitable capping system for the Site. The screening risk assessment has identified few risks to utilising a phytocap at the Site and are listed below:

- In-situ soil assessment showed that the good establishment of vegetation (particularly grasses) requires supplementary watering to minimise drainage,
- There is also a moderate risk associated with the winter dominant rainfall. Other trials have been undertaken in higher rainfall environments but these trials have not been in a Mediterranean climate and hence have not required significant storage over winter. The addition of mulch to the topsoil and selection of plants will assist in mitigating this risk, and
- Care needs to be used in utilising organic supplements as these often increase weed competition and reduce native plant establishment. As natives are suited to low nutrient environments and the plant species selected includes leguminous species, i.e. those that fix nitrogen and make it available in the soil to other plants, the lack of topsoil is not considered to be a high risk.

Overall, there is great potential to implement phytocap by managing the above risks during design, construction and maintenance. Performance monitoring over a two year period will be undertaken to determine the performance of phytocap for the Site.

Tonkin Consulting has prepared a Capping Design Report (**Appendix A**) based on the risk assessment and recommended the below as key design features for the capping profile:

- Existing 2m deep Cell 5 overburden in-situ material over final waste height as this is likely to be representative of the mixed natural profile available in the future, and
- Mulch incorporated into the surface layer to assist plant establishment.

The Capping Design Report (**Appendix A**) details on all the below aspects:

- Concept Design
  - Goals and Performance Objectives
  - Capping Designs
  - Assumptions and Inputs
  - Scenarios Considered
  - Hydraulic Performance and Risks
- Trial Design
  - Trial Objectives
  - Capping Profile
  - Trial Layout
  - Monitoring

The trial phytocap is currently being undertaken on the southern portion of Cell 5 with construction completed in 2019. The southern portion of Cell 5 has reached full waste height and has 2m thick in-situ sourced soil layer placed using a front end loader. Soil testing to determine suitability of the in-situ material was undertaken on this area and results are available in Capping Design Report. A Phytocap Technical Specification has been prepared by Tonkin Consulting to suit site specific requirements for various phytocap construction elements, vegetation selection and is attached as **Appendix B**. The technical specification allows phytocap construction in two stages, namely Stage A and Stage B. Stage A (1.3 ha) refers to the southern portion of Cell 5 and Stage B (2.7 ha) refers to the western portion of Cell 5 and Cell 1. The drawings on the same is enclosed in **Appendix B**. Capping of further stages will be undertaken after a successful trial of Stage A.

A phytocap specific performance monitoring plan has been developed and is attached as **Appendix C**. The phytocap trial as defined by Tonkin Consulting will be considered to be completed when:

- Plant roots are removing moisture to at least 0.7 m depth. This can be shown by active removal of moisture from deeper layers,
- Fair to good establishment of plants within the lysimeter and vegetated pad, i.e. greater than 40% survival and greater than 70% groundcover has been achieved,
- Self-seeding and succession of native grasses is evident,
- The performance of the cap is known as defined by one or more of the following:
  - a year wetter than the climatic average has been received but resulted in drainage at or below the performance criteria, or;

- after plants have established (see points above), a year drier than the climatic average has been received but resulted in drainage an order of magnitude above the performance criteria; or
- a minimum of two years of data once plants have established (see points above) are used to calibrate a water balance model and then predict the water balance performance over a longer time period, and

- DWER has accepted the final monitoring report.

A final report on the performance of the phytocap will be provided within 6 months from completion of 2-year monitoring period to the DWER for review and feedback, which is expected to be following winter and spring of 2022.

3 FINAL CONTOUR PLAN

An updated Landfill Rehabilitation Contour Plan was developed in August 2020 for the entire potential landfill footprint including consumed footprint. The contour plan shown in **Drawing F001** refers to the top of waste and bottom of cap. The contour plan reflects waste pre-settlement contours, this is to minimise any risk of overfill with waste.

The final capped landform will be 2m above top of waste contour if the phytocap profile was adopted. The top of final waste contour was originally submitted in 2016 and has been updated in 2020 to achieve the same objectives as the previous landform. The top of waste contour has been changed to provide batter grades of 1:3.5 instead of 1:4. The objective of the finished phytocap profile on the updated top of final waste contour is to achieve finished slopes of:

- 5 % on the top platform,
- A maximum of 1:3.5 grade (approximately 30%) on the batter slopes.

The finished capped contour will be maintained by filling and shaping to prevent ponding of stormwater which may occur as the underlying waste settles. The maximum height of the final capped contour will be RL 151 (prior to settlement) and aligns with the topography of the adjacent state forest.

4 CAPPING STAGING PLAN

Cleanaway has developed a whole of life model to understand future landfill cell construction and landfill cap staging plan shown in **Drawing F001** based on the below assumptions:

- Receive up to 350,000 tonnes of landfill waste per annum,
- Achieve a landfill density of 0.94 tonne per m^3, and
- Progressive rehabilitation of landfill cells in part or in full after reaching final waste contour.

The objective of the landfill cap staging plan is to meet DWER's operating licence L8904/2015/1 condition 1.3.6(c) *rehabilitation of a cell or phase takes place within 6 months after disposal in that cell or phase has been completed.*

The area deemed as potential landfill footprint including consumed footprint is 47.9ha. The total footprint is estimated to generate approximately 19 million m^3 of airspace, of which approximately 16.5 million m^3 is remaining as of June 2020 based upon the July 2020 Aerial Budget Model figures. The landfill, based on the above stated assumptions, is expected to receive waste until approximately 2048.

The landfill is expected to be capped over 10 rehabilitation stages as shown in **Table B** below. Estimation of waste volumes beyond 5 years is uncertain due to increased recycling rates and initiatives in reducing waste disposed to landfill. For this plan, we have used a disposal rate of 350,000 tonnes/annum to estimate the period in which capping is likely to commence for Rehabilitation Stages 7-10. All capping campaigns are assumed to commence in summer to limit wet weather delays and allow for vegetation planting in autumn or winter. Performance monitoring report post completion of Stage A will be provided to the DWER upon completion of first 2 years of monitoring phytocap efficiency and it is assumed that the trial will have reached a satisfactory conclusion in this timeframe to enable capping of further stages.

TABLE B: LANDFILL CAPPING EVENTS

Rehabilitation Stage	Cells	Cell sequence	Hectares	Commence Capping
A	5	Constructed	1.30	Complete July 2020
B + 1			5.41	February 2023
2	1, 2	Constructed	2.56	Dec 23-Mar 24
3	12A	2	2.12	Jan-Mar 2025
5	Part 3/4, Part 4B, Part 12	Constructed	3.51	Dec 25-Mar 26
6	6, Part 7, Part 3/4	Constructed	3.71	Dec 26-Mar 27
4	Part 7, Part 3/4, Part 4B, Part 12, Part 15	Constructed	2.92	Dec 27-Mar 28
7	8, 9, 10, Part 7	1, 2	6.81	Dec 31-Mar-32
8	Part 15, 16, 17	3	6.00	Dec 37-Mar 38
9	11, 13, 14	4	6.28	Dec 44-Mar 45
10	18, 19, 20	5	7.18	Dec 50-Mar 51

5 POST CLOSURE PERIOD AND MONITORING REGIME

Post closure period refers to environmental performance monitoring duration after placing the final tonne of waste into the landfill cell, to consume total airspace. Post closure period is expected to be a minimum of 30 years from completion of final capping event and the below aspects will be monitored:

- Groundwater quality,
- Landfill gas migration,
- Landfill settlement due to waste subsidence,

- Landfill cap free drainage capability,
- Leachate generation and leachate evaporation rates,
- Vegetation health and coverage, and
- Buffer distance maintenance.

5.1 GROUNDWATER QUALITY

The parameters and frequency of groundwater monitoring will reflect current or future requirements in Table 2.4.1 of the DWER operating licence L8904/2015/1 Amendment issued 12 May 2020. **Table C** below shows the current monitoring requirements for the site. If the assessment of groundwater quality over a certain period during post closure reveal stable conditions, then a revised list of parameters and monitoring frequency will be proposed to the DWER for approval.

TABLE C: MONITORING REQUIREMENT OF GROUNDWATER QUALITY

Monitoring point reference and location	Parameter	Units	Sample Type	Frequency
Bore 1 Bore 3 Bore 4 Bore 5 Bore 6 Bore 7 Bore 8 Bore 9 Bore 10	Standing water level	m (AHD)	Spot Sample	Six Monthly
	pH	pH unit		
	Electrical conductivity1	µS/cm		
	Redox potential	Eh		
	Chemical oxygen demand	mg/L		
	Nitrate-nitrogen			
	Ammonia-nitrogen			
	Total nitrogen			
	Total phosphorus			
	Total dissolved solids			
	Total organic carbon			
	Dissolved oxygen1			

Monitoring point reference and location	Parameter	Units	Sample Type	Frequency
	Major cations and anions: calcium, magnesium, potassium, sodium, chloride, bicarbonate and sulphate			
	Heavy Metals: Aluminium, Arsenic, Cadmium, Chromium, Copper, Iron (total) Lead, Manganese, Mercury, Nickel, Selenium and Zinc			
	PFAS: Perfluorooctane sulfonate; Perfluorooctanoic acid; 6:2 Fluorotelomer sulfonate; 8:2 Fluorotelomer sulfonate, Perfluoroheptanoic acid; Perfluorobutane sulfonate; Perfluorobutanoic acid; Perfluorohexanoic acid; Perfluorohexane sulfonate; Perfluoropentanoic acid; Perfluorooctane sulfanomide; Perfluorodecane sulfonate; Perfluorononanoic acid; Perfluorodecanoic acid; Perfluoroundecanoic acid; Perfluorododecanoic acid; Perfluorotridecanoic acid; Perfluorotetradecanoic acid; N-Methyl-heptadecafluorooctane sulfanomide; N-Eethyl-heptadecafluorooctane sulfanomide; N-Methyl-heptadecafluorooctane sulfanomidoethanol; and, N-Ethyl-heptadecafluorooctane sulfanomidoethanol.	µg/L	Spot Sample	Annual

Monitoring point reference and location	Parameter	Units	Sample Type	Frequency
	Organics: Phenols, Polyaromatic hydrocarbons (PAH), Organochlorine pesticides, Organophosphate pesticides (Demeton-S-Methyl, Diazinon, Dimethoate, Fenamiphos, Fenthion, Malathion and Parathion), Polychlorinated biphenyls (PCB), Atrazine, BTEX (benzene, toluene, ethylbenzene, xylens), Total Petroleum Hydrocarbons and Trichloroethylene/ Perchloroethylene	mg/L	Spot Sample	Annual

5.2 LANDFILL GAS MIGRATION

In 2013, a LFG extraction system was installed under Works Approval W5301/2012/1. A submission for the expansion of the landfill gas collection system at the landfill has been lodged with the DWER in 2020. This submission is to install gas extraction wells across filled areas of the landfill to provide active landfill gas management. The landfill gas migration detection regime during post closure will reflect the monitoring program stated in Section 6 of the Landfill Gas Management Plan.

5.3 LANDFILL SETTLEMENT DUE TO WASTE SUBSIDENCE

Waste subsidence can create internal stress on cap due to differential settlement across the final capped landform. This will lead to zones of tension cracking, allowing escape of landfill gas through the cracks and percolation of stormwater into the landfill. The cracks can be detected by virtue of landfill gas surface monitoring regime and visual inspection. The widening of cracks will be minimised with identified vulnerable areas being reworked by the addition of soil and re-establishing revegetation. The greater rooting depth allows erosion control to be easier on phytocaps.

5.4 LANDFILL CAP FREE DRAINAGE CAPABILITY

Cleanaway will undertake annual aerial survey of the site during post closure period to determine the settlement areas. The survey will be used to identify the low spots and works required to maintain the cap as free draining.

5.5 LEACHATE GENERATION AND LEACHATE EVAPORATION RATES

Leachate is managed by pumping to leachate storage ponds. Leachate head within the landfill is measured by bubbler instrumentation. The volume generated is derived from pump data and/or flow meters. Sprinklers are installed in the leachate ponds to assist evaporation during appropriate weather conditions. The leachate water balance will be calculated on an annual to biennial basis during the post closure period.

5.6 VEGETATION HEALTH AND COVERAGE

A Landscaping Plan (**Appendix D**) has been prepared for the site which identifies several zones, being:

- Zone 1 – an infrastructure zone near the landfill perimeter and includes access roads and tracks and stormwater drains.

- Zone 2 – a grassed area on the upper crest of the landfill and the Tronox ponds area for use as passive recreation. Trees, shrubs and native gardens may be included in this space.
- Zone 3 – The western batter slopes of the landfill will be planted to native trees, shrubs and grasses to provide a visual screen and blend the visual amenity to the eastern & southern boundaries with the Dardanup Conservation Park vegetation and landfill topography.
- Zone 4 – Buffer zone around the landfill comprised of native vegetation, including trees, shrubs and groundcover species to link with adjacent areas.
- Zone 5 - a wetland zone around the stormwater basins and leachate ponds, consisting of native shrubs and groundcovers

The Landscaping Plan also nominates species for use within these zones and methods of sowing, establishment and maintenance. It is noted that weed suppression during vegetation establishment is of critical importance.

Vegetation health and coverage will be monitored as per the recommendation in Table 9.2 of the Waste Management Association of Australia's *Guidelines for the Assessment, Design, Construction and Maintenance of Phytocaps as Final Covers for Landfills.* A copy of Table 9.2 is enclosed as **Appendix E**.

Tree and shrub density should achieve a minimum of 1 plant/20 m2 and groundcover should have a minimum coverage of 75%. Where bare patches > 4m2 or vegetation stablishes poorly (refer to Appendix C), species shall be replanted with the same or similar species using tubestock for small area or broadscale seeding for larger areas, as advised by a vegetation contractor.

5.7 SEPARATION DISTANCE MAINTENANCE

DWER has prepared *Guidance for the Assessment of Environmental Factors, Separation Distances between Industrial and Sensitive Land Uses,* (WA EPA, 2005) which nominates a 500 m separation distance between a Class III Landfill and any sensitive land use. A draft update to this guideline published in September 2015 nominates a 1000 m buffer zone between a Class III Landfill and any sensitive land use. This guideline is to be used when assessing a proposed new development, and any encroachment to this buffer zone by a new development requires assessment to satisfy the planning authorities that any proposed new development or rezoning will not be adversely impacted by its proximity to the landfill site. The VIC Landfill BPEM stipulates a 500m buffer from buildings or structures to be maintained during the post closure period. This is in line with the WA EPA Separation Distance Guidance.

6 POTENTIAL POST CLOSURE USE OF THE SITE

The post closure use of the site is expected to be public open space utilisable as parks for recreational purposes. Other potential alternatives include:

- agricultural land;
- a waste precinct (non-landfill operations);
- a renewable energy precinct;
- active recreational space (e.g. sporting or other community facilities);

The Dardanup Conservation Park is located to the south of the site and the post closure use for the site may have recreational links with the Conservation Park. The post closure use of the site will be managed by the landowner to suit future requirements of the site and then existing planning regulations at the time of closure.

7 CLEANAWAY CONTACT DETAILS

Please contact the below person for any clarifications (in order of preference):

Sally Carlton
Engineering Manager - WA
27 Halifax Drive, Bunbury WA 6230 Australia | PO Box 5037, Bunbury DC WA 6230
M +61 401 222 508
E sally.carlton@cleanaway.com.au

Barry Griffin
Head of Engineering
Landfills & Remediation
Level 4, 441 St Kilda Road, Melbourne VIC 3004 Australia
M +61 456 067 670
E barry.griffin@cleanaway.com.au

8 DRAWINGS

8.1 DRAWING F001 REV 4: REHABILITATION STAGING PLAN - OVERALL LAYOUT - TOP OF WASTE LEVEL RL149M CONTOUR

8.2 DRAWING DNP – 620 REV C2: LANDFILL FACILITY - OVERALL LAYOUT - TOP OF WASTE CONTOUR PLAN

9 APPENDICES

9.1 APPENDIX A: CAPPING DESIGN REPORT

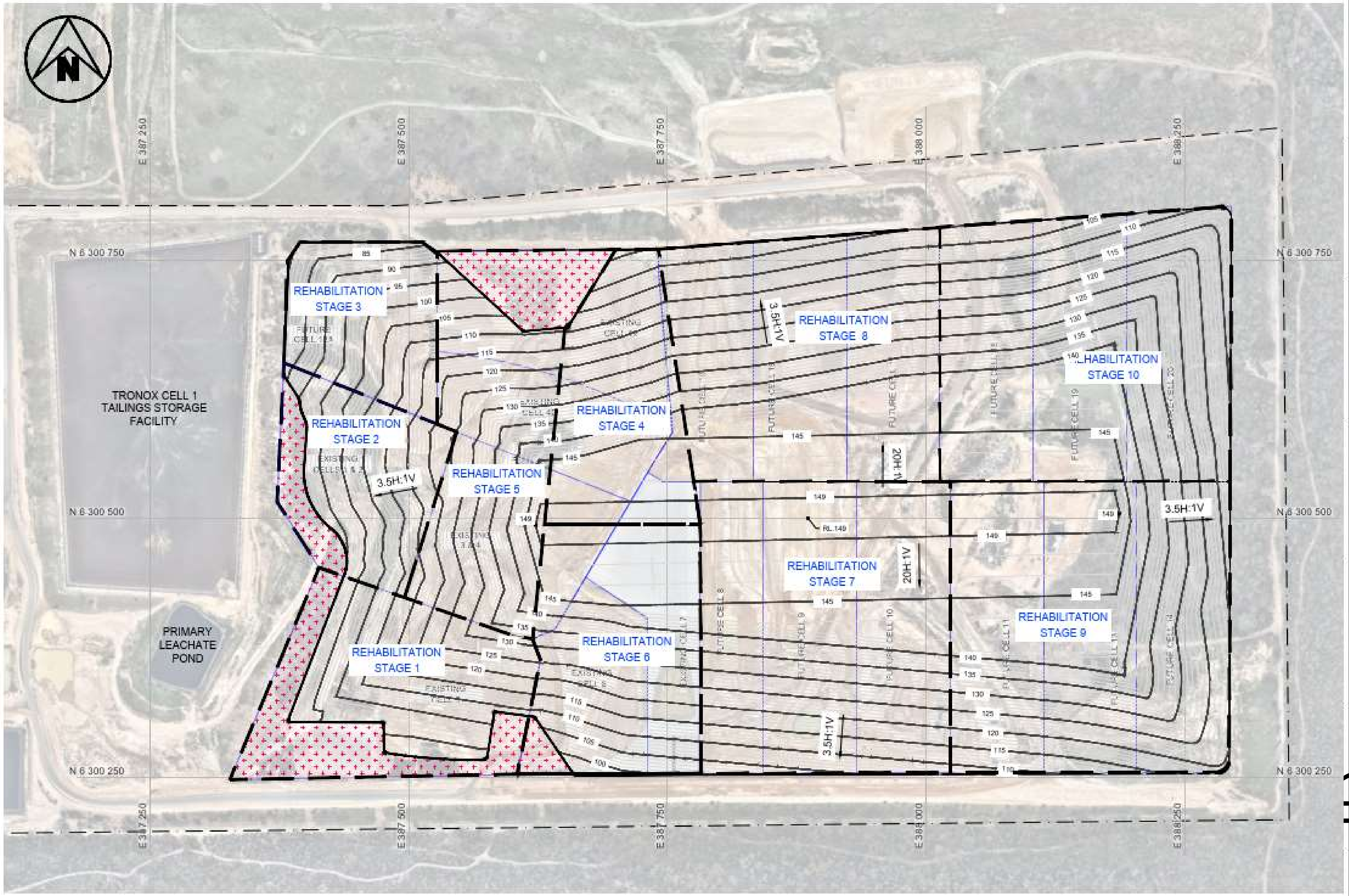
9.2 APPENDIX B: PHYTOCAP TECHNICAL SPECIFICATION

9.3 APPENDIX C: PHYTOCAP TRIAL MONITORING PLAN

9.4 APPENDIX D: LANDSCAPING PLAN

9.5 APPENDIX E: TABLE 9.2 OF WMAA GUIDELINE FOR PHYTOCAP

Rehabilitation Stage	Capping Area	CELL Number
No.	m²	No.
1	20,760	5
2	25,620	1 2
3	21,205	12A
5	35,145	PART 3-4 PART 4B PART 12
6	37,125	6 PART 7 PART 3-4
4	29,270	PART 12 PART 4B PART 3-4 PART 7 PART 15
7	68,070	8 9 10 PART 7
8	60,020	PART 15 16 17
9	62,800	11 13 14
10	71,800	18 19 20



Legend

- APPROXIMATE CAPPING BOUNDARY
- SITE BOUNDARY
- 115 CAPPING CONTOUR LEVEL
- AREA AT FINAL COVER HEIGHT LEVEL (500mm ABOVE TOP OF WASTE)

SCALE 1:4,000 — 40 0 40 80 120 160 200 — LENGTHS ARE IN METRES - PAPER SIZE A3

APPROVED CONCEPT PLAN

REV	DATE	DRAWN	REVD	APPD	REVISION
4	15.09.20	F.A.	S.C.	B.G.	CAPPING STAGES 4,5 & 6 REVISED AND CELL 1 & 2 EXTERIOR BOUNDARY CORRECTED
3	17.08.20	F.A.	S.C.	B.G.	APPROVED CONCEPT LAYOUT
2	06.08.20	F.A.	S.C.	B.G.	BATTER SLOPE REVISED TO 1 IN 3.5
1	25-06.15	JA	ERN	LDP	GOLDER ASSOC.2016 REHAB STG PLN APPENDIX 23.6

REVISION NOTES:
TOP OF WASTE REMAINS AT 149m RL
2016 OWNER WORKS APPROVAL SUBMISSION CELLS 6,7,8

CLEANAWAY

Banksia Road Landfill
Dardanup WA
Lot 2 Banksia Road,
Dardanup WA 6236
Australia

PROJECT: BANKSIA ROAD LANDFILL MASTERPLAN
PROJECT NO: 1520088 CONTRAL: 012
DRAWN: F.ABATE — DRAWING CHECK: SALLY CARLTON — REVIEWED: S.CARLTON — APPROVED: B.GRIFFIN
DESIGNED: F.ABATE — DESIGN REVIEW: SALLY CARLTON — DATE: 06-08-20 — DATE: 17.08.20

TITLE: REHABILITATION STAGING PLAN
OVERALL LAYOUT
TOP OF WASTE LEVEL RL149m CONTOUR
SCALE: AS SHOWN — DRAWING No: F001 — REV: 4

Legend

- GRASSLAND (FUTURE CAPPED AREAS)
- 115 — CAPPING CONTOUR LEVEL
- 105.0 — EXISTING SURFACE CONTOUR
- SITE BOUNDARY

NOTE:
THE SURFACE SHOWN ON THIS PLAN IS THE TOP OF WASTE RL149m CONTOUR. (UNDERSIDE OF CAP DESIGN) LEVELS AS PER F001 REV2 UNO.

SCALE 1:4,000
40 0 40 80 120 160 200
LENGTHS ARE IN METRES - PAPER SIZE A1

APPROVED CONCEPT PLAN

REV	DATE	DRAWN	REVD	APPD	REVISION
C4	15.09.20	F.A.	S.C.	B.G.	AMENDED STAGE BOUNDARIES
C3	17.08.20	F.A.	S.C.	B.G.	APPROVED CONCEPT LAYOUT
C2	06.08.20	F.A.	S.C.	B.G.	REVISED STAGING SEQUENCE
C1	18.06.20	F.A.	S.C.	B.G.	CONCEPT PLAN

REVISION NOTES

CLEANAWAY — Making a sustainable future possible

Banksia Road Landfill
Dardanup WA
Lot 2 Banksia Road,
Dardanup WA 6236
Australia

PROJECT: BANKSIA ROAD LANDFILL MASTERPLAN

DRAWN	DRAWING CHECK	REVIEWED	APPROVED
F.ABATE	SALLY CARLTON	S.CARLTON	B.GRIFFIN
DESIGNED	DESIGN REVIEW	DATE	DATE
F.ABATE	SALLY CARLTON	06-08-20	17.08.20

TITLE: REHABILITATION PLAN
OVERALL LAYOUT - TOP OF WASTE RL149m
CONTOUR PLAN as per DRAWING F001

SCALE	DRAWING No.	REV.
AS SHOWN	DARD-620	C4

DATE: 15/09/2020 9:43:38 AM
LOCATION: C:\Users\fabate\Documents\DARD-620-REV2.dwg

Banksia Road Landfill Rehabilitation and Closure Plan

Appendix D - Landscaping Plan

Cleanaway Waste Management

9 November 2020
Ref: 201515R003

Building exceptional outcomes together

Document History and Status

Rev	Description	Author	Reviewed	Approved	Date
A	For Client Comment	AW/MRS	IN	MRS	11/09/2020
B	For Client Comment	MRS	MRS	MRS	29/09/2020
0	For Issue	MRS	Sally Carlton, Cleanaway	MRS	01/10/2020
1	Updated for CWY Comments	MRS	MRS	MRS	09/11/2020

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Project: Banksia Road Landfill Rehabilitation and Closure Plan | Appendix D - Landscaping Plan
Client: Cleanaway Waste Management
Ref: 201515R003

Tables

Figures

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Figures

Appendix A – Species List

1 Introduction

Tonkin was engaged by Cleanaway Waste Management to prepare a Landscaping Plan (the Plan) for the Dardanup Landfill (Landfill). The site is located in the Shire of Dardanup local government area. Department of Water and Environmental Regulation (DWER) Licence 8904/2015/1 incorporates Lot 2 on Plan 65861, Banksia Road, Crooked Brook WA.

1.1 Aims and Objectives

The Plan aims to provide a clear, concise and practical framework for the landscaping of the final landform of the Landfill, in accordance with the requirements of the *DWER Revegetation Guideline* (DWER, 2018) and the *Rehabilitation and Closure Plan* (Cleanaway, 2020) for the site. The final landform and landscaping are intended to facilitate a final land use as passive open recreational space.

The objectives of the Landscaping Plan are to:

- determine local vegetation characteristics;
- describe the landscaping activities necessary to restore the native vegetation;
- describe the maintenance program to ensure establishment;
- utilise cost efficient restoration techniques;
- restore the Landfill in a manner which minimises management costs in perpetuity; and
- provide an indication of the costing for the landscaping work.

1.2 Relationship with Existing Reports

The Plan has taken into consideration the impacts of the following documentation:

- Rehabilitation and Closure Plan, Updated V2 (Cleanaway, 2020);
- Capping Staging Plan (Drawing DNP-600, Cleanaway, 2020);
- Capping Design Report (ref: 201515R001Rev2, Tonkin, 2020);
- Phytocap Technical Specification (ref: 20155261R002B, Tonkin, 2016);
- Southern Boundary Vegetation Buffer Plan (Cleanaway, 2016);
- Waste Management and Resource Recovery's Phytocap Guidelines (WMAA, 2011).

All work to be performed on site will be in accordance with the following guidelines, or updated versions thereafter:

- Florabank Guideline Series
- Regional forest Agreement for the South-West Forest Region of Western Australia 1999.
- Fire Management Strategy (DPaW, 2019)
- A Revegetation Guide for Eucalypt Woodlands (DWEWPC, Greening Australia and Landcare, undated)

1.3 Relevant Legislation

The Plan has been prepared in accordance with the provisions contained in relevant legislation and policy guidelines, including but not limited to the following:

- *Biodiversity Conservation Act 2016* (WA) provides protection for biodiversity, including threatened species and ecological communities and critical habitat;
- *Bush Fires Act 1954* (WA) provides for prevention control and extinguishment of bush fires and diminishing bush fire danger for the public.
- *Conservation and Land Management Act 1984* (WA) provides for the management of land for native vegetation conservation purposes;

- *Environment Protection Act 1986* (WA) provides for the establishment of environment protection policies, regulation of clearing for development and definition of prescribed premises, works, approvals and licences
- *Environment Protection and Biodiversity Conservation Act 1999* (Cth) provide protection of the environment on matters of national significance and identifies species and communities which are under threat;
- *Soil and Land Conservation Act 1945* (WA) provides for the conservation of soil and land resources to mitigate the effects of erosion, salinity and flooding and includes the management of native vegetation to conserve land;

2 Description of Proposed Development

This section provides a general description of the proposed development based on discussions with Cleanaway and in accordance with the *Rehabilitation and Closure Plan* (Cleanaway, 2020), the *Capping Design Report* (201515R001Rev2, Tonkin, 2020) and the *Phytocap Technical Specification* (20155261R002B, Tonkin, 2016).

2.1 General

The site operates in accordance with the Licence L8904/2015/1 issued by DWER. Cleanaway proposes to continue landfilling the Dardanup Landfill site to a top of waste height of 149 m AHD with capping design and settlement allowances in addition to this. Landfilling rates are not expected to differ substantially from current levels. Site operations require the ongoing use of site facilities including stormwater management infrastructure. Refer to Section 2 of the *Capping Design Report* (Tonkin, 2020) for additional site setting and background information.

The final landform for the site has been designed to account for the following considerations:

- Providing a long-term stable barrier between waste and the environment
- Providing land suitable for its intended after use.

2.2 Landfill Capping System

The landfill capping will be constructed in accordance with the *Rehabilitation and Closure Plan* (Cleanaway, 2020). The capping system profile is set out in Section 2 of the *Rehabilitation and Closure Plan* and is as either:

- Geomembrane cap including (from bottom to top): gas collection layer, geosynthetic clay layer (GCL), linear low-density polyethylene (LLDPE), cushion geotextile, drainage layer, 1-2 m growing medium, appropriate vegetation (grasses and/or small shrubs); OR
- Phytocap: constructed of 2 m of locally available mixed natural soil material (similar to Cell 5 material utilised for phytocap trial) with organic mulch incorporated into the surface layer or Hydromulch applied to assist plant establishment and appropriate vegetation including endemic trees, shrubs and grasses.

The Landscaping Plan assumes that the phytocap trial being undertaken currently at the site will be successful and a phytocap will be implemented as part of the final capping solution. Should the trial be unsuccessful, this plan will need to be updated accordingly.

2.3 Surface Water

An extensive infrastructure system has been installed / maintained to manage stormwater runoff from and across the site incorporating the following:

- Two stormwater ponds;
- A network of vegetated swales, stormwater drains, channels and bunds;
- Secondary underground drainage on the side of the Southern Haul Road via pit and pipe systems; and,
- Maintained surface grades to prevent ponding of surface water.

The system relies on the principle of preventing 'run-on' to active areas and runoff from active areas and the separation of clean and 'dirty' runoff throughout the site. The stormwater management plan (Golder Associates, 2020) for the site details the stormwater management practices at the site and the design of the above infrastructure.

3 Landscaping Plan

The following information provides an assessment of the opportunities and constraints at the site in relation to landscaping and a detailed description of all activities required to implement the PLAN. The opportunities have been developed using desk top research or existing reports relevant to the site, current vegetation maps and restoration guidelines, previous field investigations and liaison with Cleanaway.

3.1 Site Opportunities and Constraints

The restoration of such a large area provides numerous opportunities and constraints. To ensure the success of the project it is important to identify these prior to developing a design or undertaking any works.

3.1.1 Opportunities

The opportunities that this project provides include:

- Restoring a large area of native vegetation/habitat;
- Providing valuable bird habitat through the mass installation of native shrubs;
- Linking with local habitat corridors;
- Improving aesthetics of the area;
- Providing a passive recreation area for local residents;
- Utilising 'best practice' vegetation restoration techniques;
- Integrating ecological function and engineering design to achieve balanced landscape outcomes; and
- Improving water quality at the site;
- Providing future use areas for activities such as active recreation (e.g. courts, playing fields), shed-based commercial industries (e.g. farm supplies) or on-going waste related activities (e.g. energy from waste plant, material recovery and recycling facility).

3.1.2 Constraints

Constraints to be considered during project design include:

- Highly modified/artificial site conditions;
- Low summer rainfall;
- Erodible natural soil;
- Depleted natural seed source;
- Weed burden from green waste materials transported to site;
- Settling of landfill and production of landfill gas during early stages;
- Maintenance requirements of the landscaped area.

3.2 Restoration Zones

The Landfill site is divided into five distinct areas that require different vegetation management approaches. These areas are:

Zone 1 Infrastructure –an infrastructure zone near the landfill perimeter and includes access roads and tracks and stormwater drains and channels. No vegetation will be required in this area.

Zone 2 Grassland – a grassed area on the upper crest of the landfill and over the Tronox ponds for use as passive recreation. Capping may be geomembrane cap or phytocapping. Trees, shrubs and native gardens may be included in this space.

Zone 3 Native Woodland – The western batter slopes of the landfill will be planted to native trees, shrubs and grasses to provide a visual screen and reduce the visual impact of the landfill topography by blending into the surrounding Dardanup Conservation Park vegetation. The capping proposed is a phytocap.

Zone 4 Buffer – buffer zone around the landfill comprised of native vegetation, including trees, shrubs and groundcover species to link with adjacent Dardanup Conservation Park vegetation. This area is not over landfill and does not require capping

Zone 4a Established– this area has already been planted to trees and has a grass understorey
Zone 4b Groundcovers – this area is along the batter slope of the leachate ponds. The pond wall provides a visual screen between adjacent forest and the landfill. Native grasses and forbs will be planted along this section.
Zone 4c Establishing – some native shrubs and small trees are present in this area; however additional planting is required to further improve the visual screen.
Zone 4d Proposed – requires planting of a range native vegetation to provide a link to the adjacent Dardanup Conservation Park.

Zone 5 Wetland - a wetland zone around the stormwater basins and leachate ponds, consisting of native shrubs and groundcovers. This area is not over landfill and hence a cap is not required.

Figure 1 shows the location of the zones and Figure 2 is an impression of the final landscaped site. A species list for Zones with native vegetation is provided in Appendix A with selected photographs.

3.3 Seed Collection and Supply

Native seed and tube stock will be purchased from Revegetation Industry Association of WA (RIAWA) accredited seed collector and suppliers (riawa.com.au) and will be local provenance, where possible, for trees and shrubs. One potential supplier is Nindethana Seed Suppliers (part of Greening Australia (WA)) who are RIAWA accredited and located in Albany so able to supply local provenance seed and provided the seed for the phytocap trial (Table 1). To allow sufficient lead-in time for the propagation of provenance species, native plant orders must be placed prior to spring for sufficient stock to be available. The vegetation supplied should be consistent with those listed in Appendix A, noting species may be substituted as required and that native seed availability is highly variable.

Non-native grasses will be purchased from companies which meet the seed certification standards specified by the Australian Seed Federation. One potential supplier is PGG Wrightson Turf which supplies certified seed and is located in Perth and has previously provided ryegrass seed for stabilisation of embankments (Table 1). They also can supply sterile grass seed which can be used as a cover crop prior to establishment of native seed.

Table 1 Contact Details for Potential WA-Accredited Vegetation Suppliers

Vegetation type	Supplier
Native seed and tubestock	Nindethana Seed Supplies Phone: 08 9844 3533 Email: seed@nindethana.net.au www.nindethana.net.au
Native tubestock (including installation)	Matthew Blunt Tranen 20 Possum Place, Vasse, WA 6280 Phone: (08) 9754 2643

Vegetation type	Supplier
	Mobile: 0400 165 729 matt.blunt@tranen.com.au www.tranen.com.au
Non-native grasses	Glen Liebold Revegetation Territory Manager WA & NT. PGG Wrightson Turf Phone: 1800 3872 8879 Email: gliebold@pgwturf.com.au www.pggwrightsonturf.com.au

3.4 Plant Propagation

Plant propagation refers to the germination of collection seed and the 'growing on' of plants in enviro cells, hiko cells or forestry tubes. This will be undertaken by a suitably qualified and experienced native plant production nursery.

3.5 Site Preparation

3.5.1 Site Protection

Once the bulk earthworks are complete and to ensure the success of plant establishment, it will be necessary to control access into the area. Machine access should be limited inside the landscaping zones other than for landscaping purposes and re-shaping areas of erosion or maintaining a free draining surface.

3.5.2 Erosion Control

At the completion of earthworks, appropriate sediment control fencing will be installed as specified in the detailed design for capping. Consideration will be given to alternative control structures, particularly those shown in "Best Practice Erosion and Sediment Control" (IECA, 2008).

Areas of high erosion potential may require the installation of jute matting or hydromulching. The Hydromulch "mixture" will include jute fibre and a mixture of pre-treated native seed. Experience has shown that using a mixture of native peas and Acacia's in the hydro mulch is an inexpensive way to establish native vegetation at difficult sites.

3.5.3 Litter Removal

All litter from the site should be removed prior to the commencement of landscaping works.

3.5.4 Weed control

Being highly modified, the site is unlikely to contain significant weed seed loads at the completion of the bulk earthworks, other than those growing on existing batters. Inspection for and removal of any noxious weeds prior to any landscaping works should be undertaken. All weed control activities are to be completed by a suitably qualified contractor.

3.5.5 Installation of Irrigation System

Before revegetation activities commence an irrigation system, e.g. drippers or sprinklers, will be installed throughout Zones 2, 3, 4B, 4C and 5 (refer Figure 3) to assist in establishing vegetation. Once

established the irrigation may be retained or removed. As far as practical, the system should be buried to prevent damage and is anticipated to be required for at least 3 years. Installation of an irrigation system helps ensure establishment targets are achieved.

3.6 Sowing/Planting Techniques

A combination of landscaping techniques should be employed in each of the zones to maximise the potential for good establishment of plants. Due to the different characteristics of each zone and the different type of vegetation to be established (as described in Section 3.2 and Appendix A), the landscaping techniques recommended for each zone are also different. The landscaping techniques to be used for each zone are summarised in Table 2 and described in more detail below.

Table 2 Sowing/Planting Technique for Each Zone

Technique	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5
Hydromulch	NR	✓	✓		✓
Tube stock	NR		✓	✓	✓
Native seed	NR	✓	✓	✓	✓
Lawn seed	NR	✓			
NR – not required					

3.6.1 Hydromulch

Hydromulch is the means by which mulch in the form of plant fibre can be placed onto topsoil using water as a carrier. Pre-treated seed, including native seed can be added to the mulch; native seed must be added with minimal agitation to minimise seed damage. Hydromulch encourages vegetation cover and provides protection against erosion. Initially, it is recommended that blends of the appropriate pre-treated native seed mix be added to the mulch and spread across the Zones. It is recommended that 2-3 kg/ha of seed be added to the mulch.

3.6.2 Tube Stock

Native tube stock may also be used across the Zones by hand across smaller areas (up to 10 ha). Machinery is available but is not currently recommended for tube stock. The recommended planting density for trees and shrubs for each zone is 1 per 10 m^2 with 5 m interrow spacings with groundcovers planted in the interrow at 4 per m^2.

Most plants will be planted as hiko or enviro cells. Each plant will have a surface mulch ring placed around its base and then protected using a tree guard, stabilised by stakes. This is to prevent herbivory and weed competition and to encourage optimum growing conditions.

In general, autumn is the best season for planting to reduce stress on young plants from high temperatures or frost. Planting in early spring can be effective provided a suitable watering regime is implemented; however, has higher risk of lower survival rates.

3.6.3 Seeders

Non-native grass and native seed, particularly native grasses, may be mechanically sown on-site. Modified air seeders with trailing harrows have been successfully used across large areas to provide a light cover to native seed. Seeders may be used in the inter-row of tree and shrub tube stock. It is recommended that 3-5 kg/ha of seed be used.

3.6.4 Hand Broadcasting of Seed

To supplement the establishment of vegetation, grass seed may be hand broadcast throughout the maintenance period of the landscaping program.

3.6.5 Fertiliser

Fertiliser will only be applied to native vegetation areas if required due to low nutrient conditions. Fertiliser for the native vegetation will be a low or no phosphorus fertiliser suitable for native vegetation and applied at low rates to minimise weed competition.

Fertiliser will be applied to the non-native grass areas to improve establishment as recommended by the seed supplier.

3.7 Maintenance Program

At the completion of the planting a 36-month maintenance program will commence. The maintenance program will optimise plant establishment and weed control. Activities will include watering, herbicide spraying, replacement planting and general maintenance. The aim of the maintenance program is to ensure an establishment rate of >70% and no base patches > 4 m^2 is achieved at Final Completion.

3.7.1 General Maintenance

Six-monthly general maintenance visits will be scheduled throughout the three - year maintenance period. These activities will include repairing and removing tree guards, monitoring survival and growth rates (see Section 3.8.3), installing replacement plants as required, weeding and continued follow-up spot spraying.

3.7.2 Watering

All plants will be 'watered in' on installation, with each plant receiving a minimum five litres. All plantings will receive a further three applications of water during the first 6 weeks to assist establishment, depending on rain fall. Irrigation will be undertaken by drip or sprinkler irrigation or by hand watering, depending on the zone and resources available.

3.7.3 Weed Control

To ensure the success of the revegetation activities it is essential to control weeds. Weeds compete with the newly installed plants for nutrients and water thereby limiting their survival and growth rates. In Zones 2, weed control will include the removal of any emergent tree species to minimise the potential for roots to penetrate the landfill capping.

Weed spraying will be instigated as required from General Maintenance. All spraying will be carried out by suitably trained contractors.

3.8 Monitoring and Reporting

In order to accurately evaluate the success of the landscaping works, a monitoring and evaluation program will be put into place. The monitoring and reporting requirements are:

- An implementation report;
- Maintenance checklists;
- Vegetation assessment – Zone 3 only; and
- Landscape Report.

All reports should be prepared by suitably experienced and qualified consultants.

3.8.1 Implementation Report

When the landscape works are completed, an Implementation Report will be prepared as an addendum t the As Constructed Report prepared for final capping. This will provide written certification that:

- The individual or company that supplied seed/tube stock is suitably accredited;
- The landscape works have been implemented substantially in accordance with the approved plans. Minor variations to the approved plans, such as small changes in plant species and quantities, are acceptable subject to Cleanaway approval;
- The landscape works have been implemented in accordance with best practice industry standards; and
- A landscape maintenance program has been established.

3.8.2 Maintenance Checklists

As part of the General Maintenance program a checklist will be completed to record all measurements and observations.

3.8.3 Zone 3 Vegetation Assessment

In Zone 3 only, vegetation assessment for survival and establishment will be undertaken at 6 monthly intervals after planting for the first 3 years and then annually until vegetation is fully established, which is anticipated to be around 10 years following planting. The vegetation assessment involves:

- Locating one 10 m x 10 m plot every 2 ha (with a minimum of five plots). These plots will be permanently located, e.g. by flagging or pegs
- At each assessment:
  - For each tree and shrub in the plot, record the species, height and reproductive state;
  - For groundwater cover, randomly select four locations within each plot by throwing a 0.5 m x 0.5 m quadrat and record coverage, mortality and species (if possible) or at least if it is a native plant or weed.

It is important for this assessment to be undertaken initially on a six-monthly basis to inform the maintenance program including, weed and pest management, replanting requirements and irrigation requirements.

3.8.4 Three Year Landscape Report

After three years, a landscape report will be prepared which details:

- Summarizes the maintenance undertaken;
- Analyses the survival, establishment and ground cover of vegetation
- Determines if vegetation has matured or whether any additional actions are required.

4 Program of Works

In 2019, a phytocap was constructed on a portion of Cell 5 to trial the potential for 2 m of locally available soil planted to endemic trees, shrubs and grasses. Limited irrigation over summer resulted in poor establishment of vegetation so hydroseeding was reapplied in July 2020 to increase the native seed load on the site and improve establishment. These plants will be adequately irrigated over summer to ensure their survival. Technical specifications and a trial performance plan are included as Appendix B and C of the *Rehabilitation and Closure Plan* (Cleanaway, 2020).

Landfill capping will be undertaken in stages as described in Table B of the *Landfill Closure and Rehabilitation Plan* (Cleanaway, 2020).

5 Costings

Approximate costs to complete the landscape plan are provided in Table 3. These costs are indicative only (+/- 40% at present value) and are provided for budgeting purposes only and should not be utilised for any other purpose. If required, a detailed cost estimate will need to be requested prior to commencing construction works on site.

Table 3 Estimated Costs for Revegetation Works

Task	Area (ha)	Estimated Cost	Basis
Seed - grass	58	$67,000	$7/kg @ at 150kg/ha
Seed - native	27	$99,000	Phytocap trial
Hydromulching	85	$374,000	Phytocap trial
Tubestock	6.5	$178,000	Quote from Cleanaway
Planting	6.5	$64,000	Quote from Cleanaway
Tree guards	6.5	$64,000	Schirmer and Field (2000)
Fertiliser	93	$8,000	150 kg/ha of <4%P fertiliser @ $500/t
Irrigation	93	$120,000/yr	50kL/ha/week for 16 weeks at $1.45/kL
Weed Control	93	$15,000/yr	$70/ha/application, twice/yr
Replacement	93	$243,000	30% replacement
Project Management		$24,000/yr	Cleanaway Engineering 10 hours/ month
Monitoring and Reporting		$30,000/yr	Tonkin estimate
Total (ex. GST)		**$1,364,000**	

6 References

Casson, N, Downes, S and Harris, A. 2009, *Native vegetation condition assessment and monitoring manual for Western Australia*. Department of Environment and Conservation, Western Australia

Cleanaway. 2020. *Banksia Road Landfill Rehabilitation and Closure Plan*. V2 Dated 15 September 2020. Bunbury, WA.

Department of the Environment and Energy. undated., *Australia's bioregions – Maps*. Australian Government. www.environment.gov.au/land/nrs/science/ibra/australias-bioregions-maps

DWER. 2018. *A Guide to Preparing Revegetation Plans for Clearing Permits*. Dated March 2018, Department of Water and Environmental Regulation, Perth, WA.

DSEWPC, Greening Australia and Landcare Australia. undated. *A Revegetation Guide for Eucalypt Woodlands*. Department of Sustainability, Environment, Water, Population and Communities.

Environmental Protection Authority. 2006. *Guidance for the assessment of environmental factors: rehabilitation of terrestrial ecosystems*. Guidance no. 6, EPA, Western Australia.

Golder Associates. 2020. Dardanup Landfill Stormwater Management Plan Updates, Revision 2, 15 September 2020, Ref: 19124751-001-M-Rev2.

Ironbank Environmental & Eco Logical Australia. 2009. *Shire of Dardanup Local Biodiversity Strategy Discussion Paper*. Dated May 2009

Keighery, G., Keighery, B. Webb, A., Longman, V.M. and Griffin, E.A. 2008. *A Floristic Survey of the Whicher Scarp.* Department of Environment and Conservation and E.A. Griffin and Associates

Schirmer, J. and Field, J. 2000. *The Cost of Revegetation.* ANU Forestry an Greening Australia Dated January 2000

Tonkin. 2020. *Capping Design Report.* Ref 201515R001Rev2. Tonkin Consulting, Adelaide, SA

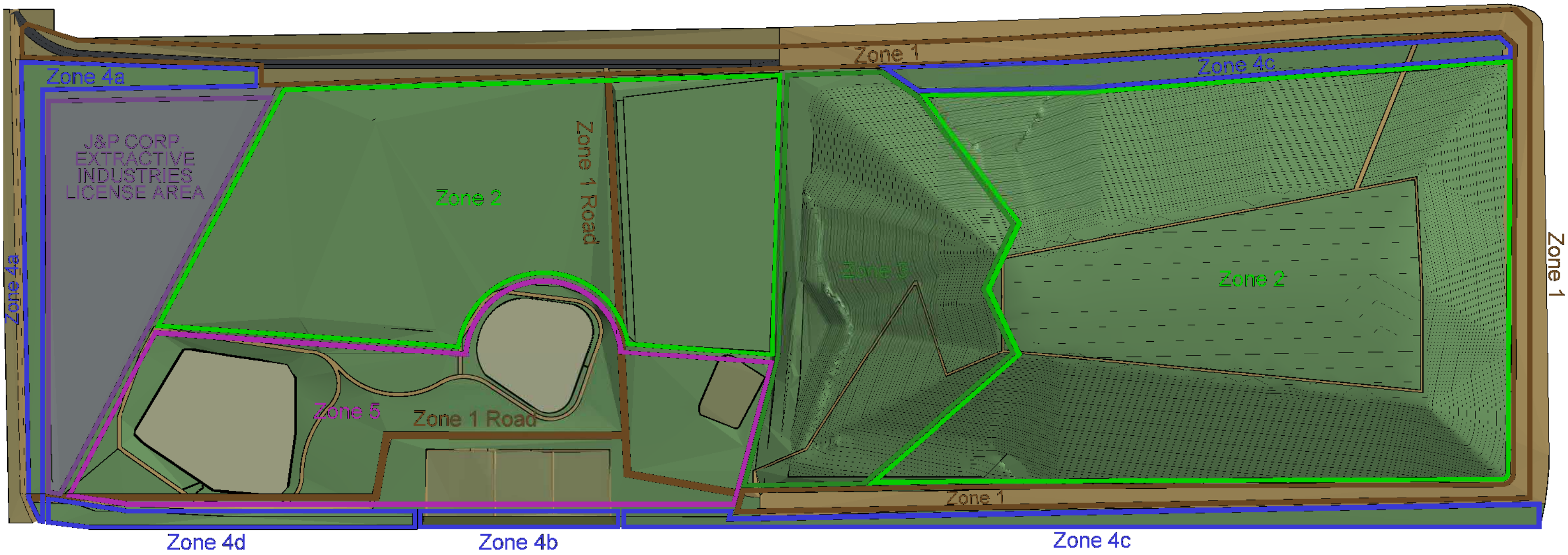
Tonkin. 2016. *Phytocap Technical Specification*. Ref 20155261R002B. Tonkin Consulting, Adelaide SA.

Western Australia Herbarium. 2020. Florabase – the Western Australia Flora. Department of Biodiversity, Conservation and Attractions. https://florabase.dpaw.wa.gov.au accessed 29/09/20

Western Australian Planning Commission and Department for Planning and Infrastructure. 2007. *Visual Landscape Planning in Western Australia. A Manual for Evaluation, Assessment Siting and Design*. Western Australian Planning Commission, Perth WA

WMAA (2011). Guidelines for the Assessment, Design, Construction and Maintenance of Phytocaps as Final Covers for Landfills, Waste Management Association of Australia

Figures



LEGEND

ZONE 1	INFRASTRUCTURE
ZONE 2	GRASSLAND
ZONE 3	NATIVE WOODLAND
ZONE 4	BUFFER ZONE COMPRISED OF: • ZONE 4a - ESTABLISHED WOODLAND • ZONE 4b - PROPOSED GROUNDCOVER • ZONE 4c - ESTABLISHING WOODLAND • ZONE 4d - PROPOSED WOODLAND
ZONE 5	WETLANDS

(Appendix ORD: 12.1D)

100mm ON ORIGINAL DRAWING - DO NOT SCALE DRAWING

Scale : 1 : 2500	Coordinates & Datum	Sheet Size
SURVEYED:AUAV SURVEY DATE:08.06.2020	Coords to MGA94 ZONE 50 All Levels to A.H.D.	A1

REV	AMENDMENT / REASON FOR ISSUE	DATE	DES.	DWN.

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PRELIMINARY

CLEANAWAY SOLID WASTE

AERIAL BUDGET MODEL CONCEPT
DARDANUP LANDFILL, WA
CONCEPT ZONE LAYOUT

JOB NUMBER	SHEET NUMBER	REVISION
201515	P101	

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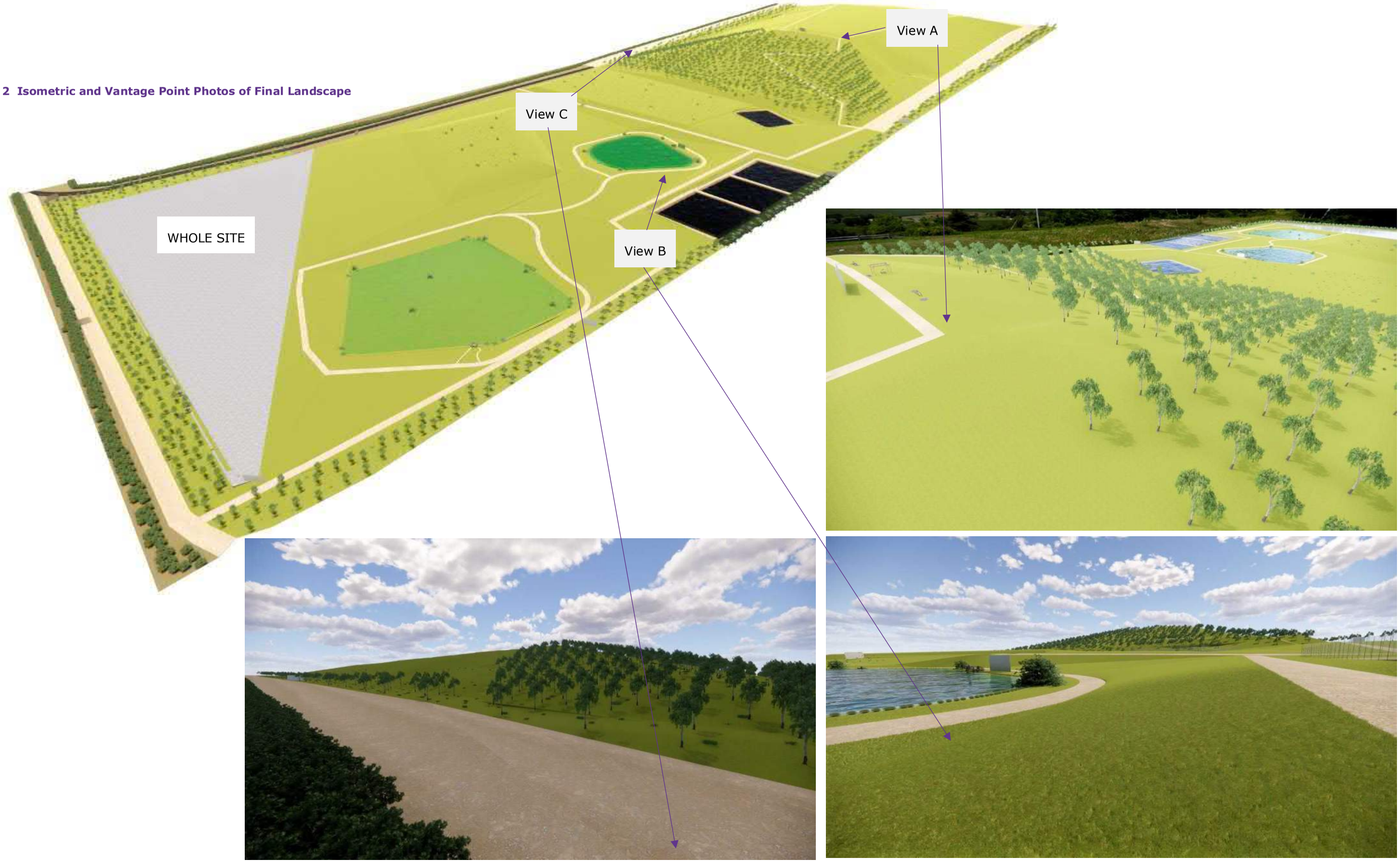
Figure 2 Isometric and Vantage Point Photos of Final Landscape



Appendix A – Species List

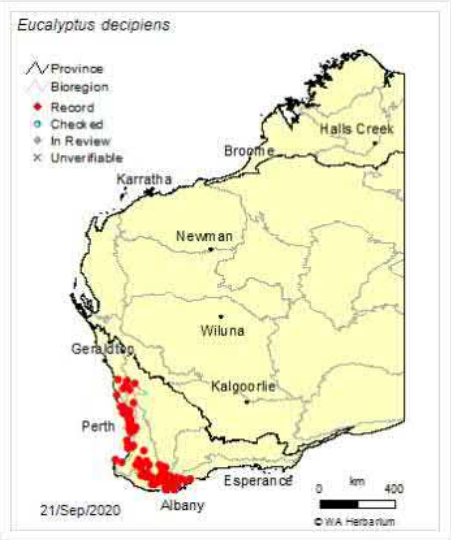
Native Trees and Shrubs		Native grasses and forbs	
Species	**Common Name**	**Species**	**Common Name**
Eucalyptus calophylla	Marri – Red Gum	*Austrodanthonia spp*	Wallaby Grass
Eucalyptus decipiens	Redheart moit	*Austrostipa compressa*	Compact needlegrass
Eucalytpus drummondii	Drummond's gum	*Austrostipa semibarbata*	Bearded spear-grass
Eucalyptus haematoxylon	Mountain Marri	*Ficinia nodosa*	Club rush
Eucalyptus marginata	Jarrah	*Lomandra sericea*	Silky mat rush
Eucalyptus megacarpa	Bullich	*Mesomelaena tetragona*	Semaphore sedge
Eucalyptus patens	Blackbutt	*Microalaena stipoides var stipoides*	Weeping grass
Acacia lasiocarpa var lasiocarpa	Wattle	*Patersonia occidentalis*	Purple flag
Acacia pulchella var glaberrima	Prickly moses	*Themeda triandra*	Kangaroo grass
Acacia saligna	Golden Wreath Wattle		
Allocasuarina fraseriana	Sheoak		
Banksia grandis	Bull Banksia		
Banksia littoralis	Swamp Banksia		
Hakea cyclocarpa	Ramshorn		
Hakea ruscifolia	Candle Hakea		
Hakea undulata	Way leaf Hakea		
Hibbertia hypericoides	Yellow buttercups		
Hibbertia subvaginata	-		
Kunzea glabrescens	Spearwood		
Kunzea micrantha	-		
Leucopogon glabellus	-		
Melaleuca preissiana	Stout Paperback		
Melaleuca viminea	Mohan		
Persoonia longifolia	Long-leaf Persoonia		
Pityrodia bartlingii	Woolly Dragon		
Podocarpus drouynianus	Wild Plum		
Pultenaea reticulata	Bush Pea		

Picture Source: Florabase.dpaw.wa.gov.au

Eucalyptus decipiens Endl. Redheart

Endl., Fenzl, Benth. & Schott, Enum.Pl. 49 (1837)

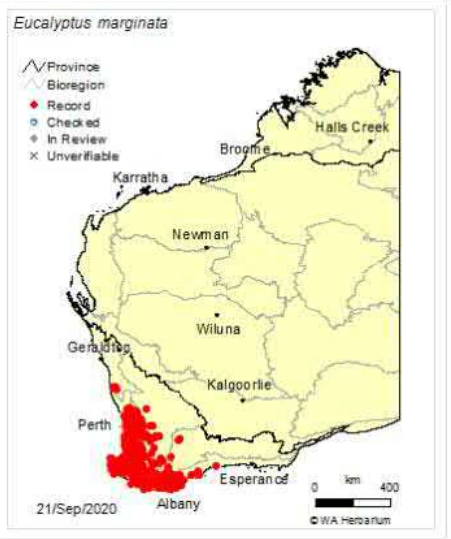
Conservation Code: Not threatened
Naturalised Status: Native to Western Australia
Name Status: Current



Eucalyptus marginata Sm. Jarrah

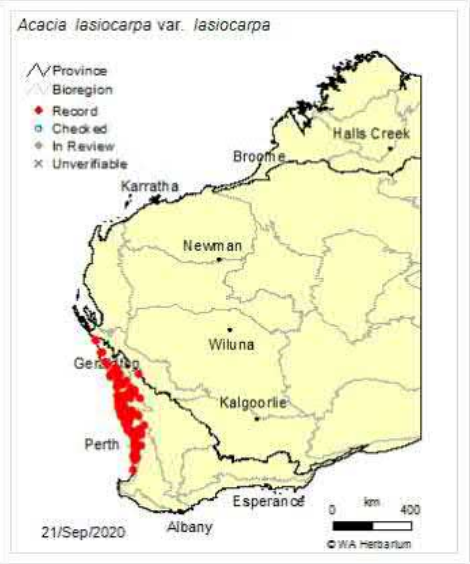
Trans.Linn.Soc.London 6:302 (1802)

Conservation Code: Not threatened
Naturalised Status: Native to Western Australia
Name Status: Current



Acacia lasiocarpa Benth. var. *lasiocarpa*

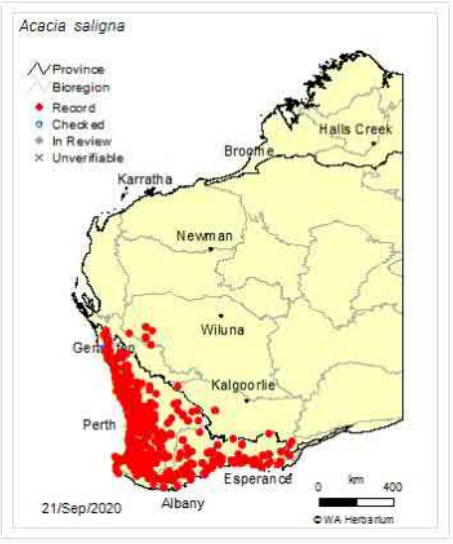
Conservation Code: Not threatened
Naturalised Status: Mixed (Native in Part of Range, Naturalised Elsewhere)
Name Status: Current



Acacia saligna (Labill.) H.L.Wendl. Orange Wattle

Comm.Acac.Aphyll. 26-27 (1820)

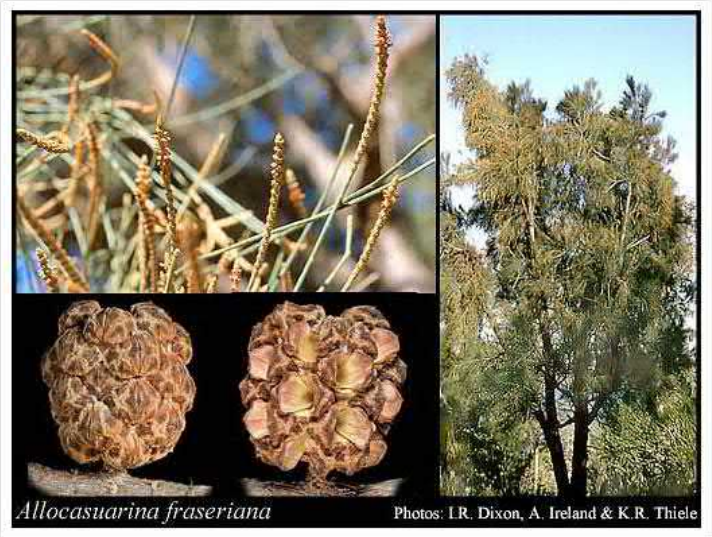
Conservation Code: Not threatened
Naturalised Status: Native to Western Australia
Name Status: Current



Allocasuarina fraseriana (Miq.) L.A.S.Johnson Sheoak

J.Adelaide Bot.Gard. 6:75 (1982)

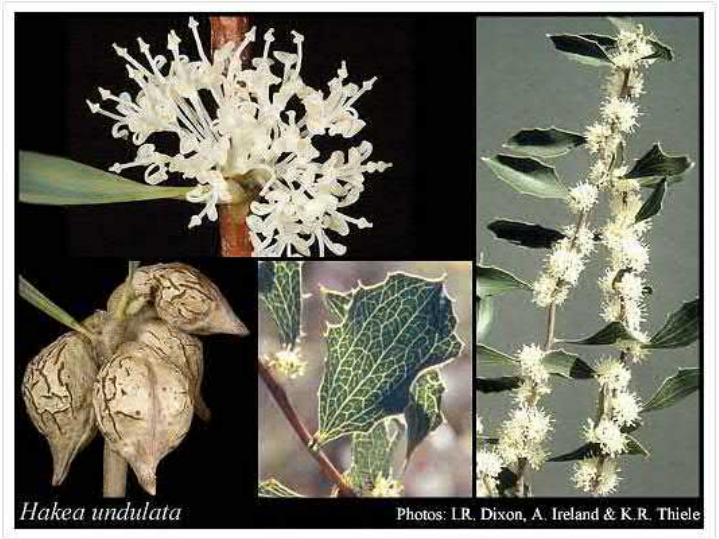
Conservation Code: Not threatened
Naturalised Status: Native to Western Australia
Name Status: Current

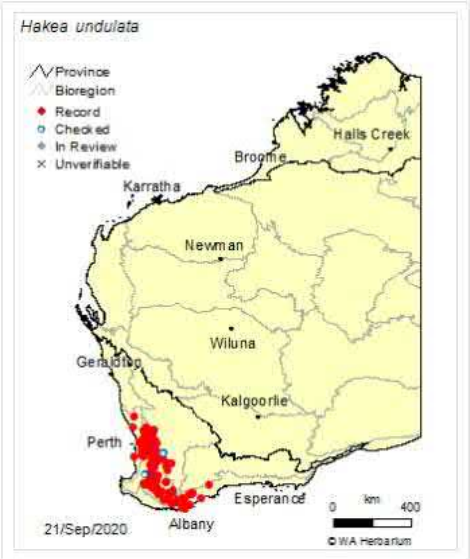


Hakea undulata R.Br. Wavy-leaved Hakea

Trans.Linn.Soc.London 10:185 (1810)

Conservation Code: Not threatened
Naturalised Status: Native to Western Australia
Name Status: Current

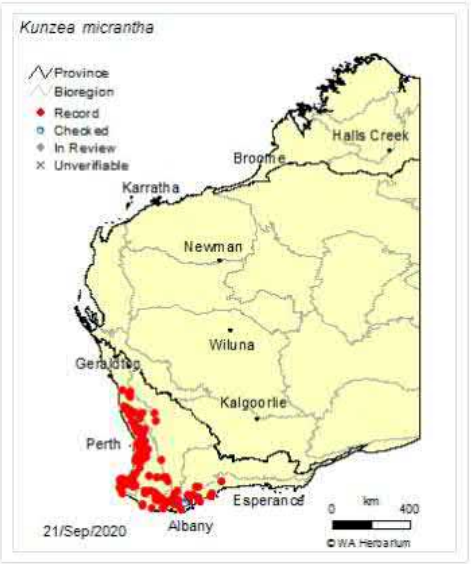




Kunzea micrantha Schauer

Lehm., Pl.Preiss. 1:125 (1844)

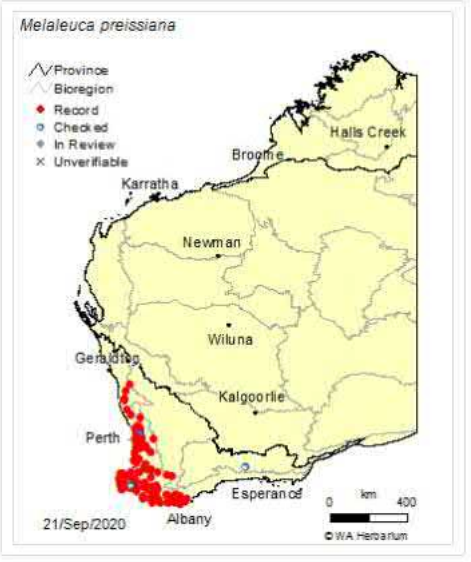
Conservation Code: Not threatened
Naturalised Status: Native to Western Australia
Name Status: Current



Melaleuca preissiana Schauer Moonah

Lehm., Pl.Preiss. 1:143 (1844)

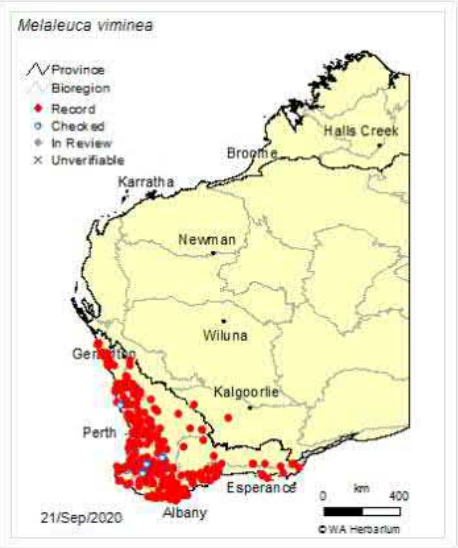
Conservation Code: Not threatened
Naturalised Status: Native to Western Australia
Name Status: Current



Melaleuca viminea Lindl. Mohan

Sketch Veg.Swan R. 8 (1839)

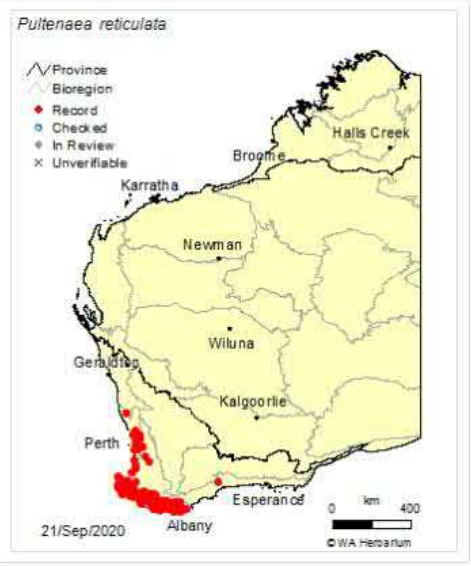
Conservation Code: Not threatened
Naturalised Status: Native to Western Australia
Name Status: Current



Pultenaea reticulata (Sm.) Benth.

Fl.Austral. 2:119-120 (1864)

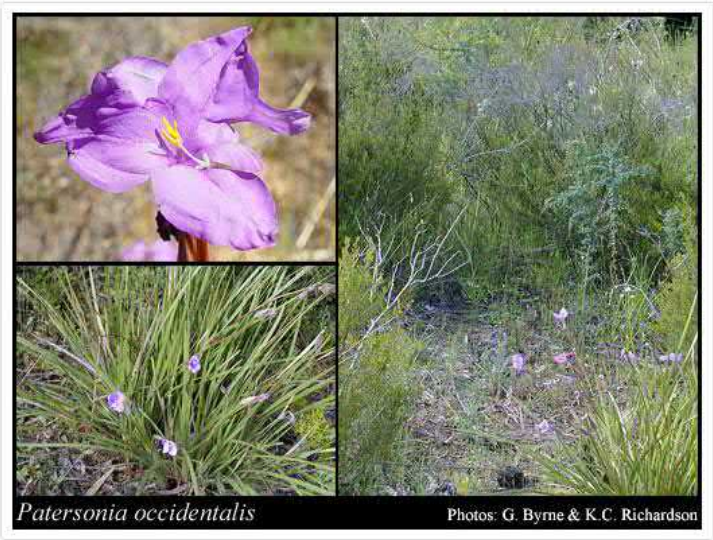
Conservation Code: Not threatened
Naturalised Status: Native to Western Australia
Name Status: Current

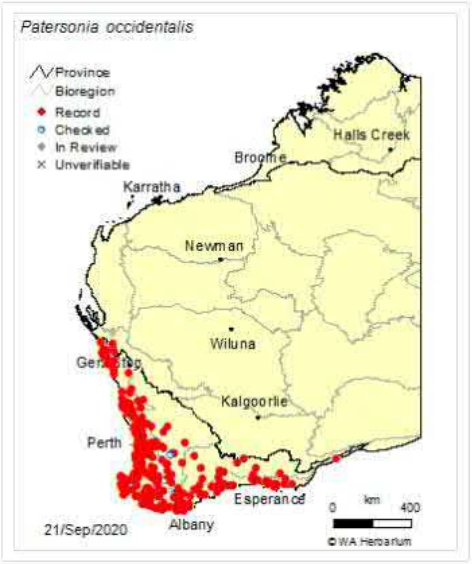


Patersonia occidentalis R.Br. Purple Flag

Prodr. 304 (1810)

Conservation Code: Not threatened
Naturalised Status: Native to Western Australia
Name Status: Current

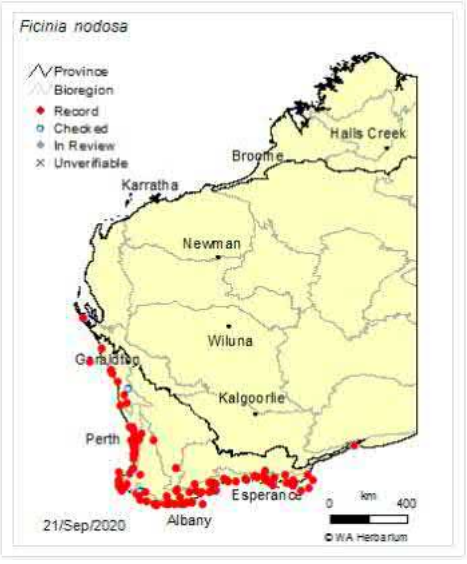




Ficinia nodosa (Rottb.) Goetgh., Muasya & D.A.Simpson Knotted Club Rush

Novon 10:133 (2000)

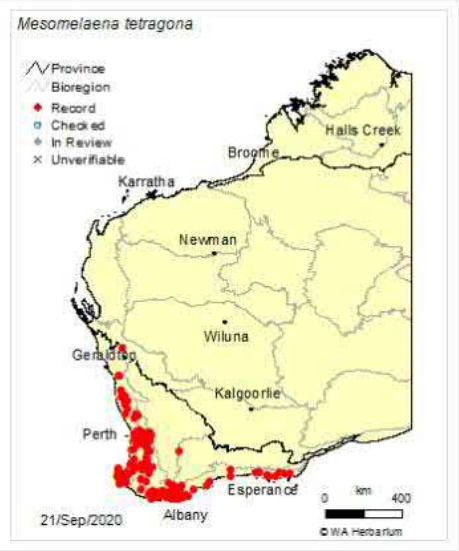
Conservation Code: Not threatened
Naturalised Status: Native to Western Australia
Name Status: Current



Mesomelaena tetragona (R.Br.) Benth. Semaphore Sedge

Fl.Austral. 7:379-380 (1878)

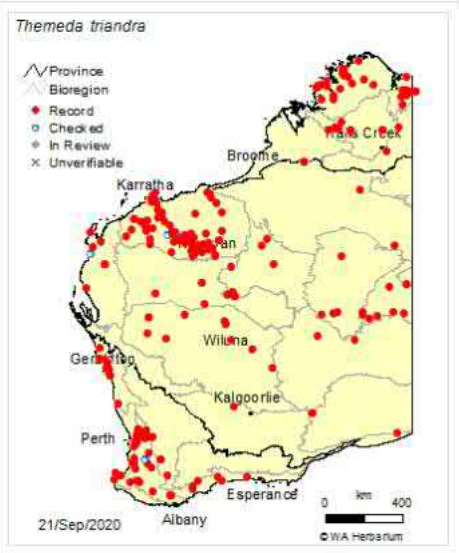
Conservation Code: Not threatened
Naturalised Status: Native to Western Australia
Name Status: Current



Themeda triandra Forssk.

Fl.Aegypt.-Arab. 178 (1775)

Conservation Code: Not threatened
Naturalised Status: Native to Western Australia
Name Status: Current



Cleanaway Solid Waste PTY LTD

Dardanup Landfill

EMERGENCY MANAGEMENT PLAN

ADDRESS: Lot 2 Banksia Road, Dardanup, WA 6236

TELEPHONE: +61 8 9725 6344 - Weighbridge

FAX: N/A

REGIONAL MANAGER: John Mulholland

TELEPHONE: 0466391105

SITE SUPERVISOR: TBA

TELEPHONE: 0428928516

EMERGENCY CONTROLLER: Leading Hand determined by date

TELEPHONE: 0423987123, or 0429107795

Prepared by: John Mulholland.

Date: 13/10/2020

Revision: 3

FIRE CONTROL PROCEDURE CWY BANKSIA ROAD

Landfill Fires

Landfill fires can be caused by, but not limited to;

1. Chemical reaction - those caused by an oxidizer or reactive agent;
2. Ignition - those caused by hot sparks, matches, cigarettes, and;
3. Spontaneous combustion- caused by compacted wet grass, waste, etc.

CWY Banksia Road Site Map

CWY Banksia Road Contacts

Weighbridge (0600-1800) 0401 235 654

Operations Manager (A/H) 0428 928 516

Leading Hand (A/H) 0423 987 123 or 0429 107 795

Site Communication UHF Channel 31

CWY Banksia Road Fire / Hotspot Response Protocol

1. Identification of Fire/Hot Spot in active Landfill Area, Waste Processing Area or Storage Area

1. CWY responder onsite to enact immediate internal incident notification protocol, notifying in order of preference until immediate verbal notification is achieved:

2. CWY responder onsite to inspect and estimate area of fire:

< 50m2. Where area is estimated to be less than 50m2, and at least two CWY machine qualified operators are available, CWY resources may be deployed to contain the fire. Fire department to be notified as soon as reasonably practical

> 50m2 or if there is less than two CWY machine operators. Where area is estimated to be greater than 50m2 or if there is less than two CWY machine qualified operators are available, emergency services 000/DFES must be engaged immediately.

2. Containing the Fire with CWY Resources

CWY responder onsite:

1. Call 'fire, fire, fire' over UHF channel 31;
2. Deploy watercart to affected area; Refer Appendix A for water cart specs
3. Divert waste trucks and non-essential machines away from fire affected area;
4. Deploy suitable machines to:
   - Push/isolate fire affected material and surrounding non-fire affected material out of the fire zone onto areas of inert or cover material; **AND/OR**
   - Push inert material such as sand or clay onto the fire zone, particularly where fire zone is on a slope or batter.

   Keynote: sufficient stockpiles of cover material, (enough to cover all open waste) must always be maintained within the vicinity of the tip face, and an excavator, traxcavator, or wheel loader available for Cleanaway operation.

5. Use water truck to saturate isolated fire affected material.
6. Push out saturated fire affected material in a layer of less than a metre in thickness.
7. Establish the below information and notify DFES, via 000, of the fire as soon as practicable:
   a) CWY control over fire, including contact details of CWY controller
   b) Approximate size fire,
   c) Exact location via supply of map on arrival,
   d) Wind direction and speed

Note: Machines are not to come into direct contact with flames. Use the blade to roll up unburned material in front of the machine as a protective barrier between the machine and the flames.

Machines must have cabs sealed closed.

Direct contact with DFES regional office should only occur if absolutely necessary

- **Office number within business hours 9780 1900**
- **After Hours Regional Duty Coordinator 1800 411 742**

3. Management of Fire Affected Material

Senior CWY responder onsite to arrange:

1. Fire affected material to be isolated and remain isolated.

2. Periodic saturation of affected material / area with water truck, at least once in two hours and every two hours thereafter where resources permit

3. Covering of affected material with 150mm inert type 1 material and keep covered for at least 24 hours. **Keynote:** sufficient stockpiles of cover material, (enough to cover all open waste) must always be maintained within the vicinity .

4. Monitoring of temperature in affected area with handheld heat gun or heat probes; in the case of probes, leave in place for minimum of 24 hours.

5. CWY Site Manager, in collaboration with CWY Health and Safety Business Partner to risk assess integrity of extinguished fire and requirement to enact the Fire Watch Plan where afterhours monitoring is required. If the fire is in the tip face, or batter and cannot be dug out a fire watch is required.

6. Uncovering and/or compaction into normal tip contour once temperature of the affected material reaches normal tip surface temperature as determined by handheld heat gun or heat probes, and after notification is made to DFES

Note: Where fire is estimated at greater than 50m2, third party testing is conducted to determine whether or not an underground fire is ongoing using criteria and methodology consistent with DWER licence. – the size will be where it is not operationally practical to dig it out.

4. Communication

1. Ensure DFES are notified of all fires which occur on site by calling 000 or local number depending on the severity of the fire

2. Ensure DWER (regulator) are notified immediately after the fire and followed up with formal report as per licence requirements.

3. Ensure Management, HSBP, Senior HSBP, Environmental BP and Senior Environmental BP are notified of the fire so it can be reported to regulator (Comcare).

5. Role of Weighbridge Attendant in Fire Situation (Working hours 0600-1800)

1. Advise incoming vehicles of fire

2. Divert oncoming vehicles away from weighbridge/do not accept loads.

3. Establish the below information and advise any DFES trucks on arrival and provide a site map detailing location of fire and route for Fire Trucks to access safely.

4. Name and contact details for the Senior CWY Responder

5. CWY control over fire,

6. Approximate size fire,

7. Exact location (marked on the map); and

8. Wind direction and speed

CWY Banksia Hot Load Response Protocol

If a hot load is discovered in a truck outside the landfill, the carrier may be instructed by the dispatcher or emergency services to eject the load in a safe area before reaching the landfill; the landfill will not accept known hot loads unless it is reasonably practicable and safe to do so.

Usually trucks are not aware that they have a hot load and will proceed to the weighbridge as normal, and that is where the hot load is identified by the weighbridge attendant. The following procedure refers to situations such as this.

1. Identification of Hot Load Entering Site or Within Active Landfill Area, Waste Processing Area or Storage Area

CWY responder onsite to:

1. Divert hot load to inert covered area or stockpiles if safe to do so;
2. Deploy watercart to area; Refer Appendix A for water cart specs
3. Divert waste trucks and non-essential machines away this area;
4. Truck to eject load if safe to do so – This is usually under the direction of emergency services;
5. Deploy suitable machines to;

    a) Isolate affected material; AND/OR
    b) Push inert material such as sand or clay onto the hot load material, particularly where hot load is on a slope.

6. Use water truck to saturate affected material.
7. Push out saturated affected material in a layer of less than a metre in thickness.
8. Fire affected material to be and remain isolated.
9. Periodic saturation of affected material / area with water truck, at least once in two hours and every two hours thereafter where resources permit
10. Covering of affected material with 150mm inert type 1 material and keep covered for at least 24 hours.
11. Monitoring of temperature in affected area with handheld heat gun or heat probes; in the case of probes, leave in place for minimum of 24 hours.
12. DFES to determine integrity of extinguished fire and requirement to enact the Fire Watch Plan where afterhours monitoring is required. If the fire is in the tip face, or batter and cannot be dug out a fire watch is required
13. Uncovering and/or compaction into normal tip contour once temperature of the affected material reaches normal tip surface temperature as determined by handheld heat gun or heat probes, and after notification is made to DFES South West Region (9780 1918 or 0427 026 964)

2. Machine and Vehicle Fire Protocol

As soon as a machine fire is detected, the following things are to occur:

WHAT TO DO

1. Quickly move the machine off the working face, if safe to do so.
2. Turn the machine OFF.
3. Quickly activate the fire suppression system by pulling the safety ring pin and pushing down the actuator plunger. Disconnect master switch, if safe to do so.
4. Move away from the machine. Take a hand portable fire extinguisher with you, if safe to do so.
5. Communicate with Supervisor.
6. Supervisor to contact emergency services 000 and notify them of a vehicle fire and enact fire control process at the direction of DFES.
7. Stand by with the portable extinguisher at a safe distance.

Note: If fire has been extinguished it is still required to be communicated through to emergency services

WHY DO IT

1. Moving the machine off the face will prevent the fire from spreading to the waste. If the fire grows too rapidly to move the machine, activate the fire suppression system and abandon the machine.
2. If the machine is left running, it may add fuel or flammable oils to the fire or restart the fire.
3. React quickly in activating the suppression system to reduce the threat of spreading fire.
4. By leaving the immediate area, you are protected from flames, explosions or other dangers created by the fire.
5. Heat from the fire will cause re-ignition after the Fire suppression System has discharged. Therefore, it is important that someone standby at a safe distance with a portable extinguisher.

WHAT TO DO AFTER THE FIRE IS OUT?

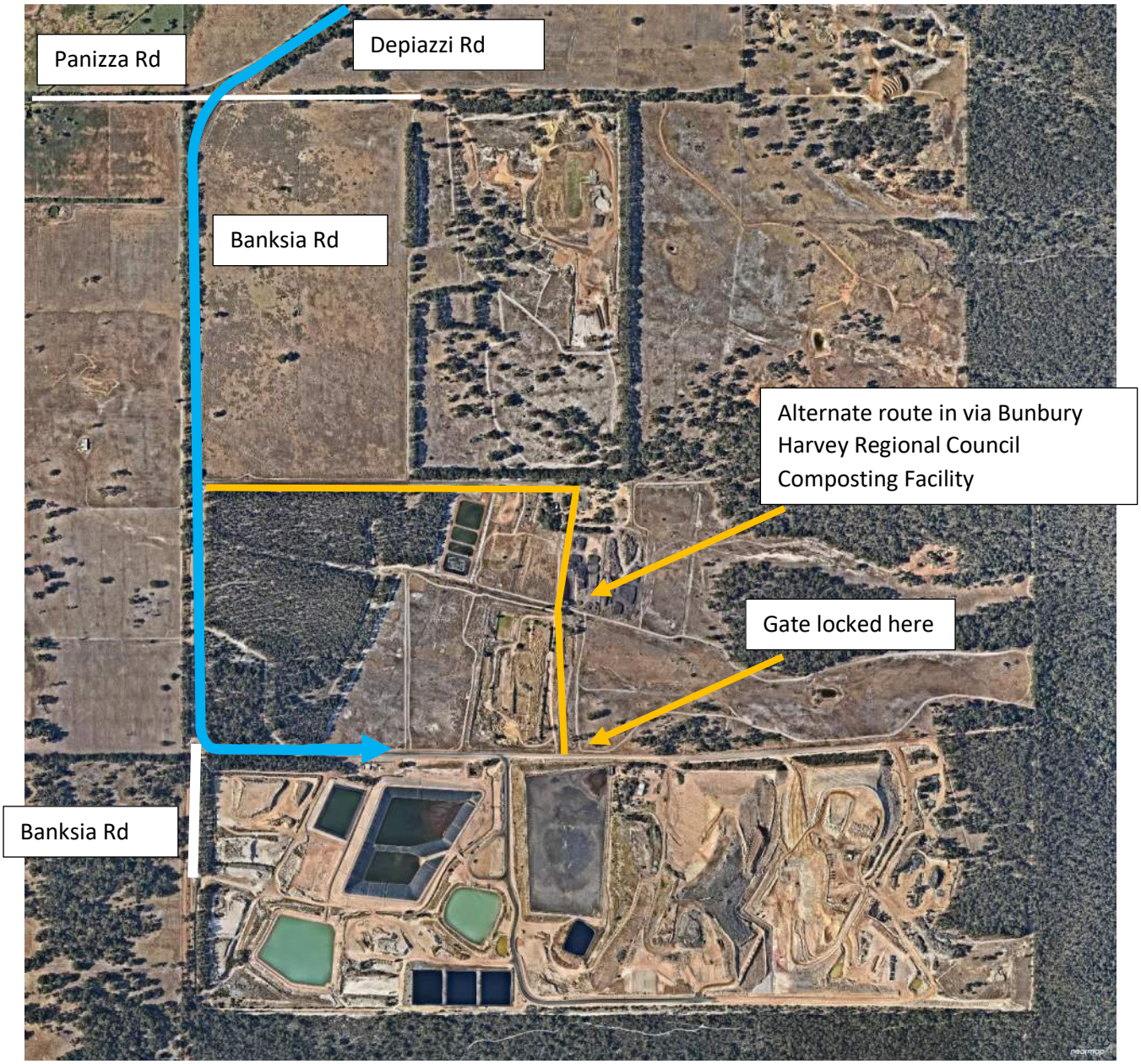
Take directions from emergency services ;

Machinery should not be re-started until it has been serviced, cleaned and repaired;

IMMEDIATELY recharge the fire suppression system!

Directions for Fire Services Attending Cleanaway Landfill Site Emergency

Banksia Road turn left into Landfill Site:



Entering site via Weighbridge – Weighbridge Attendant present during hours 0600 to 1800

Note: all roads throughout the facility are either hard seal bitumen or constructed all weather surfaces, allow for two-way access as necessary with adequate turnaround areas set aside.

Site Map

Route to Primary stormwater Dam 1 for filling fire trucks, with hydrant system – 65mm BIC camlock fitting

Route around entire landfill facility. **Note: CWY responder to provide directions on entry to landfill given nature of frequent change in access**

Route to Secondary stormwater Dam 2, and access through to landfill perimeter – not for fire truck fill; use Dam 1

Water Bore to ensure 50klt water supply is always available

Water source – overhead standpipe | Weighbridge and Muster | Main site entry | Alternate entry | Truck turn around area

(Appendix ORD: 12.1E)

Hardstand and Hydrant filling area at Stormwater Dam 1

- Compacted all weather surface
- Suitable for type 3.4fire appliances and able to support 30tonne vehicular mass
- 65mm BIC male coupling for fire truck refilling (separate to standpipe)
- Adjacent, sealed passing area and turnaround circle

Secondary Stormwater dam 2 for water truck feed only

- Standpipe only for filling water carts (no 65mm BIC coupling for filling fire trucks)
- Capable to support 30tonne vehicle
- No passing
- Full turnaround area

(Appendix ORD: 12.1E)

Potential DFES Control Point set up location; lighting, power, communications, truck parking with passing access, drinking water, toilets, lunchroom, offices, under cover area for briefing

Potential DFES Control Point set up location; lighting, power, truck parking with passing access, toilets, under cover area for briefing

North and south boundary sprinkler system; if required, manually operated via Cleanaway Leading hand

Appendix A; Watercart Specs

- Minimum 15 klt capacity
- 65mm BIC fire service fitting – ability for DFES fire trucks to draw water feed from the water truck
- Water cannon – in cab operated
- Front and rear spray bars
- Off road terrain capability - capability to access landfill terrain outside of sealed roads
- Inbuilt fire suppression system

Cleanaway Solid Waste Pty Ltd

Dust Management Plan

Banksia Road Landfill
Crooked Brook, WA 6236

11 September 2020

58071/126,854 (Rev 3)

JBS&G Australia Pty Ltd T/A Strategen-JBS&G

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Document control

Document Status

Rev No.	Author	Reviewer	Approved for Issue			Version
		Name	Name	Signature	Date	
A	C.Ingram	J.Bailes	J.Bailes		14/01/2020	Draft document issued for Cleanaway review.
0	C.Ingram	J.Bailes	J.Bailes		16/01/2020	Final draft document issued for Cleanaway and Shire of Dardanup review.
1	C.Ingram	J.Bailes	J.Bailes		21/02/2020	Document updated to consider Shire of Dardanup comments; final version issued for public advertisement, external peer review and Department of Water and Environmental Regulation (DWER) review.
2	C.Ingram	J.Bailes	J.Bailes		07/08/2020	Document updated to consider peer review and DWER review comments; revised version issued for Shire of Dardanup review.
3	J.Bailes	C.Ingram / P.Forster	J.Bailes		11/09/2020	Document updated to consider Shire of Dardanup review comments; revised version issued for public advertisement and Shire of Dardanup Council review.

Definitions and abbreviations

Term	Definition
Ambient air	The external air environment, it does not include the air environment inside buildings or structures.
DMP	Dust management plan.
Dust	The generic term used to describe solid airborne particles generated and dispersed into the air by processes such as handling, crushing and grinding of organic or inorganic materials such as rock, ore, metal, coal, wood or grain and stockpiling of materials and windblown dust.
Dust event	The occurrence of visible fugitive dust from a source or activity at the site that exits a boundary of the site for a duration of greater than one (1) minute.
Dust generating development	Means development referred to in clause 3.1 of the Shire of Dardanup's 2011 Dust Control Local Law.
Dust Risk Areas	The areas highlighted as having moderate to high risk of dust generating potential as shown on Figure 4
DWER	Department of Water and Environmental Regulation.
EPA	Environmental Protection Authority.
EP Act	*Environmental Protection Act 1986.*
Fugitive dust	Dust which could not reasonably pass through a stack, chimney, vent, or other functionally equivalent openings.
NEPM	National Environmental Protection (Ambient Air Quality) Measure 2015.
PM_{10}	Dust particles/particulate matter with an equivalent aerodynamic diameter of up to 10 micrometres.
$PM_{2.5}$	Dust particles/particulate matter with an equivalent aerodynamic diameter of up to 2.5 micrometres.
QA/QC	Quality assurance/quality control
Sensitive receptor	Individuals/communities/components of the environment which could be adversely affected by dust emissions, such as people in dwellings, schools, hospitals, nursing homes, childcare facilities, offices, public recreation areas that exist now and in the future and protected wetlands. Some individuals may be more susceptible to adverse air quality, such as, children, the elderly and people with pre-existing medical conditions such as asthma or heart disease.
Total suspended particles (TSP)	All particles entrained/suspended in the atmosphere and includes the fine, respirable particles (PM_{10} and $PM_{2.5}$) and larger size particles that may settle out of the air causing nuisance impacts, usually measured as those particles having an equivalent aerodynamic diameter of 50 micrometres or less.
Trigger level	The 'corrective action' trigger level is the ambient boundary air dust level which if exceeded will result in corrective action being taken to reduce dust emissions until the dust levels fall below the trigger level. The 'stop work' trigger level is the ambient boundary dust level which will result in site activities ceasing until the dust levels fall below the trigger level.

1. Introduction

Cleanaway Solid Waste Pty Ltd (Cleanaway) operates the Banksia Road Waste Landfill (the site) located at Lot 2 on Plan 65861, Banksia Road, Crooked Brook in the Shire of Dardanup approximately 10 km southeast of the City of Bunbury and 3.8 km southeast of the town of Dardanup (Figure 1).

The use of the land as a waste disposal facility has been determined by the Shire of Dardanup (the Shire) to constitute 'dust generating development'. Therefore, this dust management plan (DMP) has been prepared to meet obligations under the Shire's Dust Control Local Law 2011.

1.1 Objective

The objective of this DMP is to provide a framework for the management and mitigation of dust from the activities and operations conducted at the site to minimise the risk of dust emissions crossing the site boundary.

The DMP consists of the following:

- introduction outlining site background, context and purpose of the DMP
- a description of the existing environmental setting, regulatory obligations, site characteristics and significant environmental aspects to be managed
- details of the proposed dust management measures.

The purpose of this plan is to prevent dust-related impacts, including amenity impacts, on workers, surrounding residences and the environment from activities associated with the operation of the site.

1.2 Site background

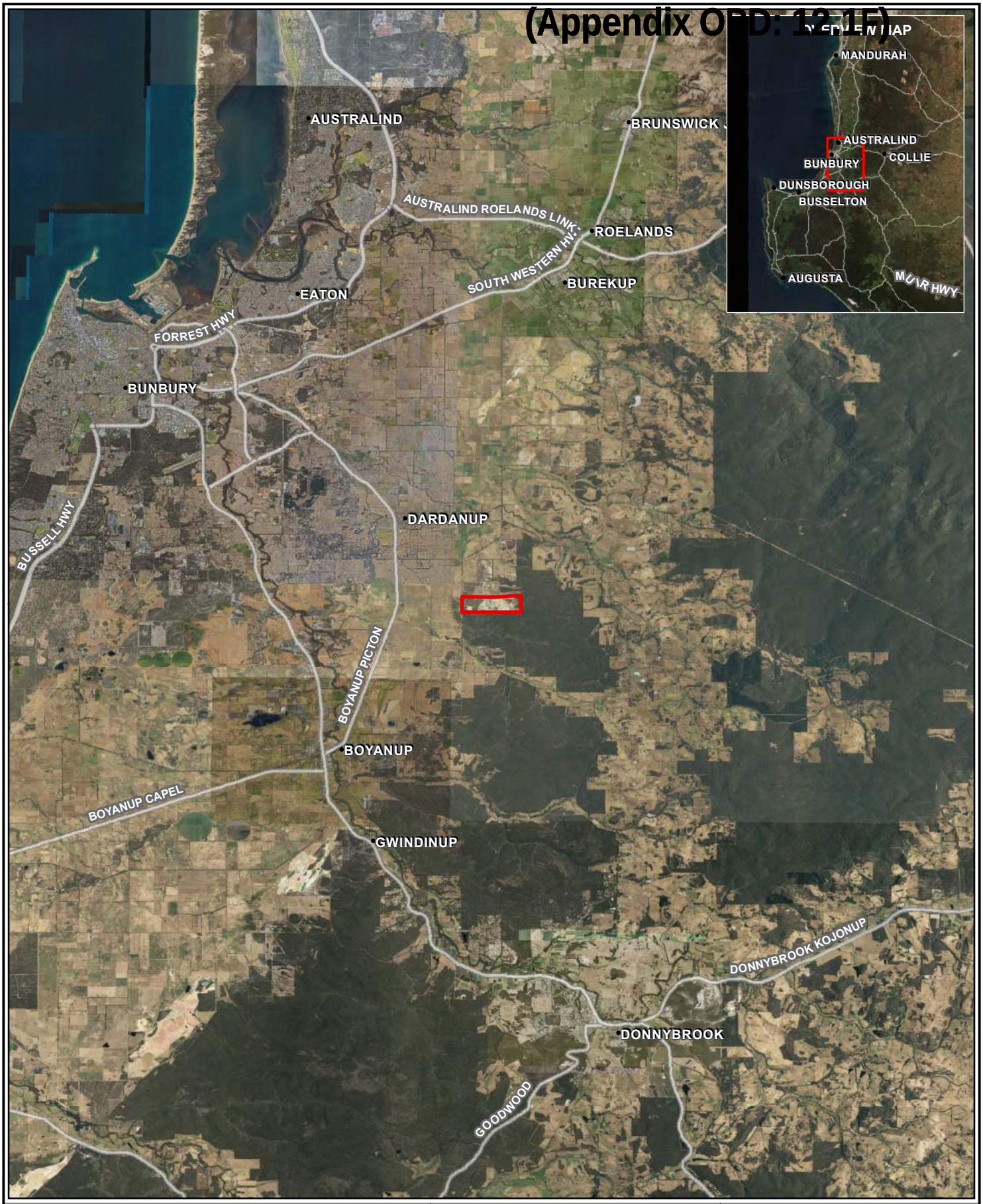
The site is a putrescible landfill and liquid waste facility operated under *Environmental Protection Act 1986* (EP Act) Licence L8904/2015/1 (the licence) granted by the Department of Water and Environmental Regulation (DWER). The site accepts general (household and commercial) waste and tailings[1].

1.3 Stakeholder consultation

This DMP has been developed in consultation with relevant stakeholders, including the Shire of Dardanup and DWER; and has also been advertised to the public and subject to third-party peer review (refer to Document Control page).

The DMP will continue to be updated in consultation with relevant stakeholders where appropriate in accordance with the document review schedule described in Section 10.

[1] Cleanaway is currently authorised to accept and store tailings from mineral sands processing within defined cells at the site.



Legend:

- Premises boundary
- Suburb boundary
- Roads (MRWA)

Scale 1:200,000 at A4	0 2.5 5 Kilometres	**Banksia Road Landfill** **Crooked Brook, WA 6236**
Coord. Sys. GCS GDA 1994		**SITE LOCATION**
Job No: 58071		
Client: Cleanaway		**FIGURE 1**
Version: A	Date: 31-Jul-2020	strategen JBS&G
Drawn By: hsullivan	Checked By: JB	

File Name: W:\Projects\1)Open\Cleanaway\58071 Banksia Road DMP\GIS\Maps\R01_Rev_A\58071_01_SiteLocn.mxd
Image Reference: SLIP Public Services Locate 2020.

2. Environmental setting

The environmental setting and proximity of surrounding environmental features and nearby sensitive receptors to the site are shown in Figure 2.

2.1 Existing land use

The 121 ha site is zoned 'General Farming' under Shire of Dardanup Town Planning Scheme No. 3. The site is privately owned and leased by Cleanaway. The site has been operated by Cleanaway since the landfill was first granted approval in 1999.

A portion of the western part of the site not under the control of Cleanaway is currently used by a third-party for sand extraction (see Figure 3). DWER has confirmed that this activity is not a prescribed premises category specified in Schedule 1 of the *Environmental Protection Regulations 1987* and is not regulated by the department under the works approvals and licensing provisions of the *Environmental Protection Act 1986* (EP Act).

2.2 Surrounding land use

Land uses surrounding the site include rural properties, other waste management facilities and conservation areas. Surrounding land uses include:

- North: Dardanup Landfill Site (closed)
- East: State Forest (Regional Open Space)
- South: State Forest (Regional Open Space)
- West: Banksia Road and rural properties.

Other waste management facilities are located approximately 400 m north of the site and include the Bunbury Harvey Regional Council Banksia Road Organics Processing Facility, the Shire of Dardanup Waste Transfer Station and a Water Corporation wastewater treatment plant.

Table 2.1 below provides a summary of the potential human and environmental receptors that may be impacted as a result of dust-generating activities at the site.

Table 2.1: Sensitive human an environmental receptors

Human receptors	Distance from site
Closest residential receptors	• 0.5 km south of the southwest corner of the site boundary, separated by the Dardanup Conservation Park and Boyanup State Forest • 0.9 km due west of the site boundary • 1 km west southwest of the southwest corner of the site boundary • 1.5 km due south of the site boundary, separated by the Dardanup Conservation Park and Boyanup State Forest • 1.5 km northwest of the northwest corner of the site boundary • 1.5 km northeast of the northeast corner of the site boundary separated by the Dardanup Conservation Park and Boyanup State Forest • 1.75 km east northeast from the eastern boundary of the site boundary separated by the Dardanup Conservation Park and Boyanup State Forest.
Environmental receptors	**Distance from site**
Dardanup Conservation Park and Boyanup State Forest	Immediately adjacent south and east of the site boundary.
Threatened Ecological Communities	Four priority Threatened Ecological Communities are present within the adjacent Dardanup Conservation Park.
Geomorphic wetland: Multiple use Palusplain and Dampland (flat, seasonally waterlogged)	Approximately 400 m southwest through northwest of the site boundary.
Crooked Brook (including Registered Aboriginal Heritage Places)	Approximately 1,100 m south/southwest of the site boundary flowing in a generally east to west direction. A minor watercourse located approximately 750 m south of the site boundary flows into Crooked Brook.

2.3 Physical environment

2.3.1 Climate and meteorology

The Southwest of WA experiences a Mediterranean type climate with cool, wet winters and hot, dry summers, with the majority of the rain falling in the winter. The nearest Bureau of Meteorology (BoM) climate station, which records wind speed and direction is Bunbury (Site number:9965), located approximately 14 km to the northwest of the site.

The average maximum temperatures (1995-2018) for Bunbury range from 17.3°C in July to 30.0°C in February. The average minimum temperatures range from 7.1°C in July to 15.9°C in February.

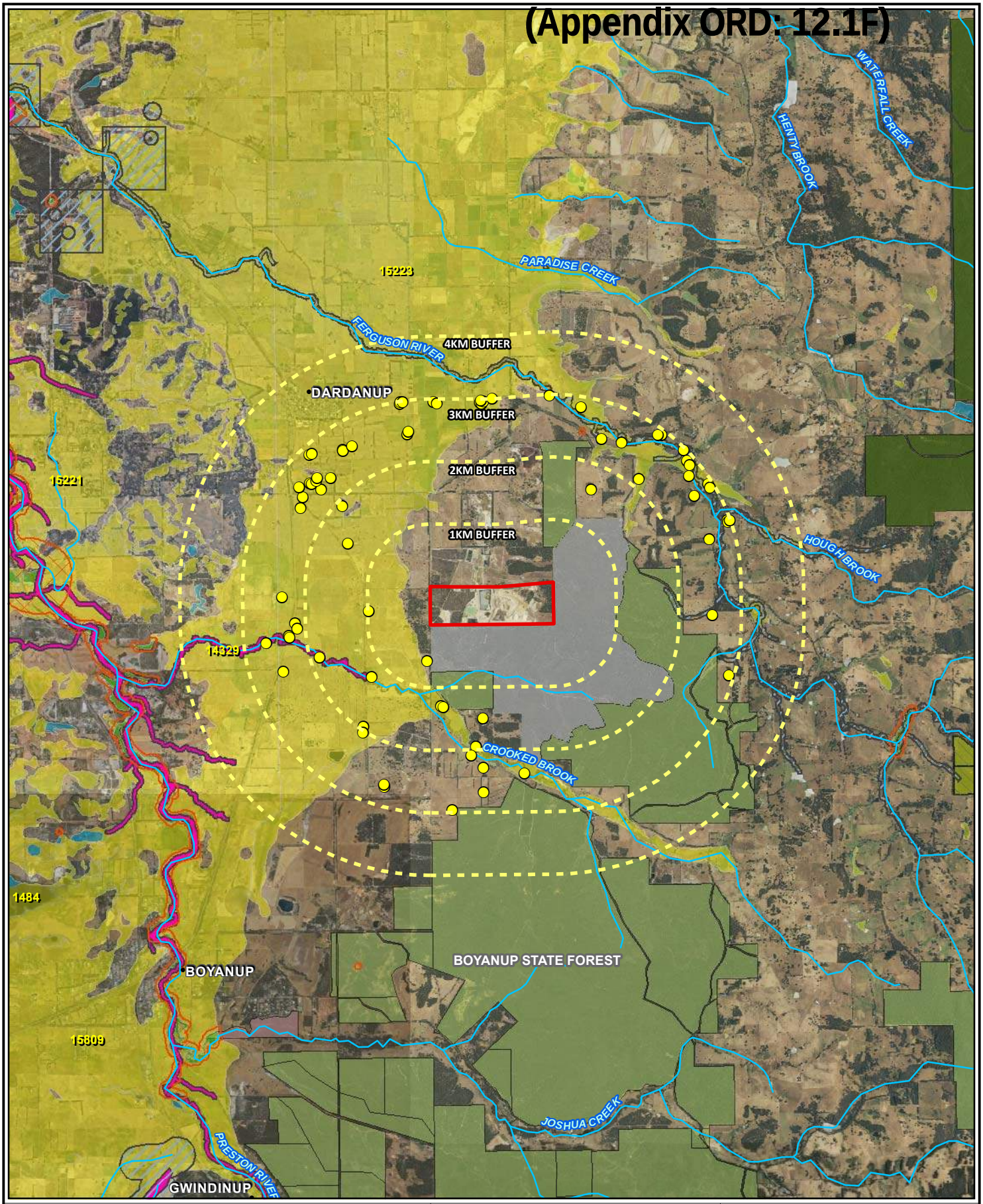
The majority of rainfall is received between April and October. Rainfall averages 726.1 mm/year and mean monthly rainfall varies from 7.2 mm in February to 142.5 mm in July.

At the Bunbury BOM station, the average morning (9 am) wind speed reported during summer is 4.3 m/s, prevailing predominately from the east and southeast. Wind speed typically increases in the afternoon (3 pm) with an average wind speed 5.6 m/s reported, which prevails from a westerly direction. During winter, winds abate to an average of 3.5 m/s during the morning prevailing from the east and northeast. Afternoon winds increase to an average of 5.1 m/s during winter and range in direction from the west, northwest and north.

In order to characterise the local wind influences at the site, monitoring of the meteorology on-site commenced at the end of June 2019. Monthly wind roses to date are contained in Appendix A.

2.3.2 Topography

The site is situated along the boundary between the Swan Coastal Plain and the western facing slope of the Whicher Scarp. Due to its location on the scarp, the ground surface falls from approximately 125 mAHD in the southeast of the site to 45 mAHD at the western boundary. The natural ground surface has been modified due to landfilling activities.



Premises boundary
1km interval buffers

Aboriginal Heritage Places (DAA-001)
Registered Site
Other Heritage Place

Geomorphic Wetlands (DBCA)
Conservation
Resource Enhancement
Multiple Use
Watercourses

Environmentally sensitive areas (DWER)

Legislated Lands and Waters (DBCA)
National Park
Section 34A Freehold
Section 5(1)(h) Reserve
Nature Reserve
State Forest
Other Reserves
Sensitive receptor - residence

Scale 1:80,000 at A4 (0, 1, 2 Kilometres)	**Banksia Road Landfill** **Crooked Brook, WA 6236**
Coord. Sys. GDA 1994 MGA Zone 50	**ENVIRONMENTAL SETTING AND SENSITIVE RECEPTORS**
Job No: 58071	
Client: Cleanaway	**FIGURE 2**
Version: A — Date: 23-Jul-2020	strategen JBS&G
Drawn By: cthatcher — Checked By: JB	

File Name: W:\Projects\1)Open\Cleanaway\58071 Banksia Road DMP\GIS\Maps\R01_Rev_A\58071_02_SensReceptors.mxd
Image Reference: SLIP Public Services Locate 2020.

3. Regulatory Framework

3.1 Environmental Protection Act 1986

The site is regulated by DWER under Part V of the EP Act. Cleanaway holds Licence L8904/2015/1 for prescribed premises categories 61 and 64, as shown in Table 3.1.

Table 3.1: Current prescribed premises categories

Category	Description	Category production or design capacity	Premises production or design capacity
Existing categories			
61	Liquid waste facility: premises on which liquid waste produced on other premises (other than sewerage waste) is stored, reprocessed, treated or irrigated.	100 tonnes or more per year	353,000 tonnes per year
64	Class II or III putrescible landfill site: premises on which waste (as determined by reference to the waste type set out in the document entitled "Landfill Waste Classification and Waste Definitions 1996" is accepted for burial.	20 tonnes or more per year	350,000 tonnes per year

The licence is prescriptive of the control of fugitive dust emissions (conditions 1.4.15 to 1.4.22) and includes a dust risk area map reproduced in Figure 4.

The Dust Risk Areas were identified by their potential for fugitive dust generation, considering orientation, exposed surfaces, topography and vehicle movements as detailed in the figure notes. The DMP includes management actions consistent with the licence conditions related to dust, as indicated in Section 7.

3.2 National Environmental Protection (Ambient Air Quality) Measure

The *National Environment Protection Council (NEPC) (Commonwealth) Act 1994* established the National Environmental Protection Council (NEPC) which determines and evaluates National Environment Protection Measures (NEPMs) for the nation. The *National Environment Protection Council (Western Australia) Act 1996* is mirror legislation of the commonwealth act and implements the NEPMs in Western Australia.

The National Environmental Protection (Ambient Air Quality) Measure 2015 (the ambient air quality NEPM; NEPC 2015) provides air quality standards applicable to urban airsheds. In the absence of guidance specifically for rural settings, the ambient air quality NEPM is adopted.

3.3 Shire Local Laws

The site is required to comply with the Shire of Dardanup Dust Control Local Law 2011 (the Local Law). The Local Law requires a dust management plan to be accepted by the local government and operations to be conducted within any terms and conditions to which the accepted dust management plan is subject.

3.4 Separation guidance

Environmental Protection Authority (EPA) Guidance Statement No. 3 (GS3) (EPA 2005) provides advice on the use of generic separation distances for a range of industrial land uses. In determining the separation distances emissions – including gaseous and particulate emissions, noise, dust and odour – that may affect the amenity of nearby sensitive land uses were considered. Separation distances are not intended to replace actions to mitigate emissions and offsite impacts.

Recommended separation distances for category 64 putrescible landfill sites (Class II & III) is 500 m for sensitive uses (subdivisions), 150 m for single residences with an internal buffer of 35 m from the site boundary. There are no single residences within 150 m of the site boundary (see Table 2.1).

3.5 Dust management guidelines

The 2011 Department of Environment and Conservation (DEC) document, *A guideline for managing the impacts of dust and associated contaminates from land development sites, contaminated sites remediation and other related activities*, is applicable to the dust management bulk handling, stockpiling and disposal of materials activities conducted at the site.

It is understood that DWER is preparing a new guideline on dust emissions. This DMP will be reviewed when the new guideline is published to ensure it meets the relevant requirements (see Section 10).

4. Site activities

Activities conducted at the site include vehicle movements on sealed and unsealed surfaces and transport, bulk handling, stockpiling and burial of waste. The layout of the site is shown in Figure 3.

4.1 Hours of operation

The hours of operation, for the disposal of solid waste at the site are as agreed with Council currently, including:

- weekdays and weekends: 6.00 am to 6.00 pm
- Public Holidays: open, unless otherwise posted.

4.2 Equipment

Equipment used on-site may include, but is not limited to:

- two landfill compactors (greater than 50 tonnes) to compact the waste
- bulldozer to spread and cover the waste and for general earthmoving activities
- two track loaders for cleaning the landfill floor, spreading, processing and covering waste
- front end loader and articulated dump truck for moving cover soils from stockpiles, supplying materials for access roadways and other earthmoving activities
- two excavators to assist in excavating landfill areas and to load aggregate materials and cover soils from stockpiles
- water truck and water cart for dust mitigation and for emergency fire response
- diesel generators for power supply and water pumps for managing stormwater
- street sweeper for use on bitumised haul roads for managing fugitive dust.

4.3 Solid waste handling procedures

The working face is the area where solid waste is unloaded from the incoming vehicles, levelled, compacted, and cover material is applied. The site limits the number of working faces in use at any one time – generally, there will only be one active disposal area in operation. However, some circumstances require additional disposal areas to be open-ended (e.g. in response to adverse weather conditions and for receipt of special waste materials).

The size of the working face depends on the number of vehicles that need to be managed and the landfill equipment that is available to place and cover the waste. The area of the working face is kept as small as practical, minimising potential environmental impacts and requirement for cover material.

Trucks can be unloaded from either the top or bottom of the working face. Where possible, trucks are unloaded at the bottom of the working face, which is shielded from wind, unless surface water and muddy conditions during wet weather hinder truck movement and cause mud-tracking issues. Drop/tip heights are also minimised as far as practicable.

The deposited waste is spread in layers no greater than 500 mm thick using a bulldozer, track loader or compactor and then compacted by a compactor, which makes several passes over each layer. The waste is compacted and covered with inert material or approved alternate materials at the end of each working day. The cover material is also placed in a progressive manner through the day on the side slopes and top deck areas, and an amount is retained for fire control.

Legend:

- Premises boundary
- Cadastral boundary
- Sand extraction area (excluded from DMP)
- Cristal - sealed road
- Waste - sealed road
- Waste alt - unsealed

strategen JBS&G

Job No: 58071

Client: Cleanaway

Version: A	Date 10/09/2020
Drawn By: cthatcher	Checked By: JB

Scale 1:8,750

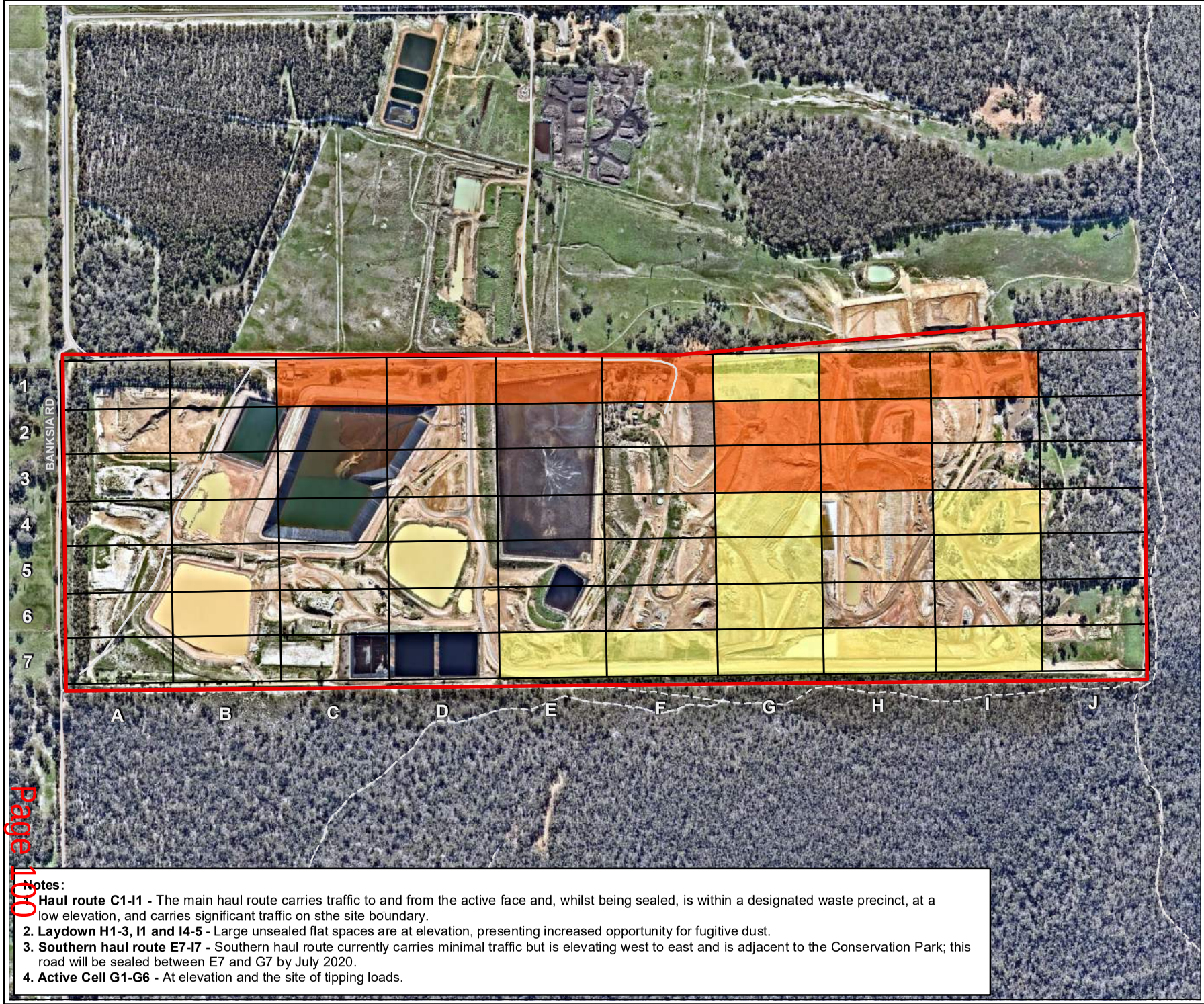
0 100 200
metres

Banksia Road Landfill
Crooked Brook, WA 6236

SITE LAYOUT

FIGURE 3

File Name: W:\Projects\1)Open\Cleanaway\58071 Banksia Road DMP\GIS\Maps\R01_Rev_A\58071_03_SiteLayout.mxd
Image Reference: www.nearmap.com© - Imagery Date: 10 July 2020



Legend:

- Premises boundary
- Grid
- Dust risk - high
- Dust risk - moderate
- Minor road
- Track

strategen JBS&G

Job No: 58071

Client: Cleanaway

Version: A | Date 31/07/2020

Drawn By: hsullivan | Checked By: JB

Scale 1:9,250

0 100 200
metres

Banksia Road Landfill
Crooked Brook, WA 6236

DUST RISK AREA MAP

FIGURE 4

(Appendix ORD: 12.1F)

Notes:

1. **Haul route C1-I1 -** The main haul route carries traffic to and from the active face and, whilst being sealed, is within a designated waste precinct, at a low elevation, and carries significant traffic on sthe site boundary.
2. **Laydown H1-3, I1 and I4-5 -** Large unsealed flat spaces are at elevation, presenting increased opportunity for fugitive dust.
3. **Southern haul route E7-I7 -** Southern haul route currently carries minimal traffic but is elevating west to east and is adjacent to the Conservation Park; this road will be sealed between E7 and G7 by July 2020.
4. **Active Cell G1-G6 -** At elevation and the site of tipping loads.

File Name: W:\Projects\1)Open\Cleanaway\58071 Banksia Road DMP\GIS\Maps\R01_Rev_A\58071_03_DustRisk.mxd
Image Reference: www.nearmap.com© - Imagery Date: 10 July 2020

5. Potential impacts

5.1 Parameters of interest

The operational activities conducted at the site have the potential to result in airborne dust (fugitive dust), including the Total Suspended Particulates (TSP) and PM_{10} fractions, which could impact upon human health and amenity. Impacts to amenity from dust include:

- regular dust events over several weeks leading to a gradual build-up of dust on surfaces
- short period dust events of very high concentrations which cause a rapid build-up of dust on surfaces, or soiling, if dust deposition rates are high.

Dust may impact upon the environment where surface deposition affects vegetation growth.

5.1.1 Particles

PM_{10} is particulate matter of 10 micrometres or less in diameter, which is the fine particle fraction of TSP. PM_{10} includes inhalable particles that are small enough to penetrate the thoracic region of the lungs, where they can have a direct physical (inflammatory) effect and/or be absorbed into the bloodstream. All people are continuously exposed to PM_{10} from naturally occurring and anthropogenic dust emissions in urban and industrial areas.

The TSP fraction comprises particles each having an equivalent aerodynamic diameter of up to nominal 50 micrometres. Upper respiratory tract health effects from TSP inhalation can arise in sensitive individuals; however, the primary issue with TSP emissions relates to impacts on amenity from a visible dust perspective and deposition onto surfaces.

$PM_{2.5}$ is particulate matter of 2.5 micrometres or less in diameter. $PM_{2.5}$ is not considered in this DMP as it is typically associated with combustion emissions. This particle size is expected to form a small fraction of the particulate matter emitted from the site and will be managed in accordance with the management actions defined for the control of PM_{10} emissions.

5.1.2 Contaminated waste

The site is a Class III landfill and is licensed to accept contaminated materials (solids) in accordance with the acceptance criteria for Class III landfills (DWER 2019).

Contaminated wastes are subject to specific management in accordance with conditions of the licence including contaminated waste must be accompanied by documentation (thus identifying hazard to operators) and must only be disposed of by burial to the active landfill area. Following the application of controls, it is expected that species arising from contaminated wastes are not expected to occur in fugitive dust in concentrations that will pose a human health risk.

5.1.3 Radiation

The tailings accepted at the site contain technically enhanced trace levels of naturally occurring radioactive materials thorium and uranium. The potential impacts from radiation are specifically managed under the site Radiation Management Plan including quarterly monitoring of radiation emissions undertaken by an independent specialist organisation. Radiation is therefore not considered further in this DMP.

5.1.4 Asbestos

Asbestos containing waste is handled as Special Waste Type 1 in order to mitigate the potential discharge of asbestos containing material or asbestos fibres. Asbestos containing materials are managed under the site Asbestos Management Plan and, therefore, are not considered further in this DMP.

5.2 Emissions sources

The dust-generating sources and activities identified the site are described in Table 5.1.

Table 5.1: Potential dust sources and dust-generating activities

Activity	Description	Dust generation and exposure potential
Wind erosion and dust lift-off from dry waste material, soil stockpiles or unsealed surfaces	As the active landfill cell is filled there may be areas of fine material on the surface. Natural residual soils are stockpiled on-site, and there are large areas of unsealed exposed surfaces.	Airborne dust generated by action of wind on exposed ground, stockpile surfaces, or dry waste material surfaces.
Vehicles movements	Heavy plant/earthwork vehicles, trucks and light vehicles will be traversing the site.	Vehicle movements on paved and unpaved roads could suspend fine particles in air. Vehicles exiting site can track material out onto the public road which could become airborne once dried out.
Vehicle unloading	Emptying of waste trucks at active landfill working face by tipping.	Dust generation during tipping of waste from trucks either from fine waste material from within truck or fine material disturbed from receiving surface.
Heavy plant activity spreading and compacting waste in the active landfill area	In the process of spreading, combining and compacting waste materials, heavy plant may traverse over dry soil or dry waste material.	Dust generated by soil or dry fine waste material disturbance during dozer movement. Dust generated by action of wind over exposed dry ground or dry fine waste material.

5.3 Relevant air quality criteria

5.3.1 TSP

As discussed previously, health effects associated with TSP mainly arise from the PM_{10} fraction. Given this, any particulate monitoring results would be compared to air quality standards for PM_{10} (see Section 5.3.2).

5.3.2 PM_{10}

The standards in the ambient air quality NEPM will be adopted as a basis against which to compare monitoring results for particulates. The air quality standards are applicable to urban airsheds, and include criteria for particles as PM_{10} at 50 µg/m^3 on a 24-hr averaging period, and an annual limit of 25 mg/m^3 derived from 24-hr measurements across a year.

6. Dust risk assessment

A site risk assessment/classification was conducted in accordance with the framework provided in the DEC (2011) guideline to determine the level of dust management and monitoring required for the site as follows.

Part A Nature of site

Item	Comment	Score
Nuisance potential of soil when disturbed	Dust is largely expected to be windblown uncontaminated crustal particles; therefore, the nuisance potential is considered primarily to amenity. Potential for contaminated dust is low due to specific procedures in place to manage hazardous substances, i.e., asbestos and radiation.	2
Topography and protection provided by undisturbed vegetation	Some parts of the site are less exposed (lower down or within pits); however, the elevated topography of the eastern end of the site means little protection is afforded to exposed surfaces and ground level.	18
Area of site disturbed by the works	More than 10 ha.	9
Type of work being done	Bulk earthworks – this is conservative as no ongoing construction involving bulk earthworks takes place, and handling of waste is largely below the level of the surface. The waste material being handled generally has lower dust-generating potential than soils.	9
Total part A score		**38**

Part B Proximity of site to other land uses

Item	Commentary	Score
Distance of other land uses from site	The nearest residence is approximately 500 m from the site boundary.	12
Effects of prevailing wind direction (at time of construction) on other land uses	The residential properties are isolated land uses affected by one wind direction.	6
Total Part B score		**18**

Site classification score

The site classification score is the product of the Part A and Part B scores. The total score is used to determine the site classification score as follows:

- Site classification 1 — under 199
- Site classification 2 — 200 to 399
- Site classification 3 — 400 to 799
- Site classification 4 — over 800.

Based on a site classification score of 38 x 18 = 684, the site is considered Classification 3 and medium risk for potential dust impacts. The dust management and monitoring requirements in this DMP have been determined in accordance with those recommended for Classification 3 sites in the DEC (2011) guideline.

7. Dust control measures

The following dust control measures (referenced to the relevant licence conditions where applicable) are implemented at the site as part of normal operations to mitigate dust generation. The control measures aim to achieve a residual level of risk of fugitive dust emission that is as low as reasonably practicable.

7.1 General management

General management measures pertaining to fugitive dust mitigation are:

- weather forecasts will be used to minimise dust generating activities during adverse meteorological conditions
- wind speed and direction will be checked throughout the day and used to plan and modulate active landfill operations. The outcome of the air monitoring campaign will inform specific controls measures for implementation on-site (see Section 8.2)
- where wind speed and direction indicate a likelihood of fugitive dust emission, site speed limits will be reduced for Dust Risk Areas (Figure 4)
- stormwater dams have capacity and are maintained in order to provide sufficient water for dust suppression
- leachate, where available, will be used for dust suppression in the wetting down of the active landfill areas only (Condition 1.4.17 (b))
- a 15 kL water cart will be available for application of water for dust suppression and priority will be given to high-risk Dust Risk Areas (Figure 4); the use and frequency of the water cart will be determined using wind speed and direction observations, use of trafficable areas and active tipping areas, observations of visible dust and effectiveness of water application.
- dust suppressant will be applied, as far as practicable, to the Dust Risk Areas identified to have potential for fugitive dust-generating including non-vegetated areas, landfill batters and within in the laydown area as identified in the dust risk area map (Figure 4), when such areas have the potential to generate fugitive dust (Condition 1.4.19); the frequency of dust suppressant application will be set based on the effectiveness of the applied suppressant and the current risk associated the relevant Dust Risk Area.

7.2 Management of trafficable areas

In accordance with licence conditions:

- the Main Haul Road and Southern Haul Road were bitumised before 31 July 2020 (Condition 1.4.15)
- prior to commencement of and during work activities:
    - a water cart will be used to apply water from primary and secondary stormwater dams to trafficable areas (condition 1.4.16 (a)); or
    - a street sweeper will be used on the bitumised Main Haul Road and Southern Haul Road (condition 1.4.16 (b))
- a wheel wash operates in the northwest of the site and will be used by all operational vehicles exiting the site (Condition 1.4.22); the area between the wheel wash and the public road is sealed

- the area between the wheel wash and the public road will be inspected daily to ensure that the wheel wash is operating effectively, and that mud is not being tracked on to the public roads.

7.3 Operation of vehicles

Vehicle movements across the site may disturb soils and generate dust. The following measures are adopted during all operational activities to prevent excessive dust generation:

- all loads will be contained in sealed or covered vessels prior to acceptance - uncovered vehicles or vessels for which cover is not effective must not proceed beyond the weighbridge; where effective cover cannot be achieved, loads will be rejected in accordance with the site rejected waste procedure
- speed restrictions exist within the site – the appropriate speed limit, up to a maximum of 25 km/h, will be determined by weighbridge staff and will be based on the activities being undertaken, location and site conditions at the time
- vehicles will keep to designated access roads as far as reasonably practicable; vehicles deviating from designated access routes will do so only as required for specific work activities and under appropriate permissions.

7.4 Landfill areas

- dust emissions from the active tipping area are managed by applying water using the water cart during working hours (Condition 1.4.17(a))
- material with potential to generate fugitive dust will be wet down during disposal and burial at the active tipping area (Condition 1.4.18)
- waste will be covered with a minimum of 150 mm of Type 1 inert waste or clean fill as soon as practicable after tipping and no later than the end of the working day
- as far as practicable, the active landfill area will be positioned away from the edge of the active cell
- as far as practicable, loads will not be tipped oblique to the wind, with dust being more likely to travel further where this is case
- material drop/tip heights will be minimised where possible
- where waste processing is approved, wastes processed by crushing, shredding or screening will be wet down during processing
- Exposed soil surfaces and stockpiles in non-active area will be stabilised (e.g. with chemical surfactants) or temporarily covered (e.g. with mulch) prior to permanent re-vegetation or restoration.

7.5 Administrative controls

- operational personnel will be trained with respect to dust mitigation; training will include mechanisms of the generation of dust emissions, the importance of and responsibility of individuals to implement mitigation measures and reporting of visible dust emissions
- personnel and contractors will be required to report observations of visible dust emissions that appear to cross the boundary of the site, including date, time, location and extent of the visible plume
- fugitive dust emission inspections will be conducted monthly in accordance with a documented site operational procedure; the results of all inspections will be documented and recorded

- an annual assessment of the potential for dust emissions from within the site will be carried out, and proposed controls for high-risk Dust Risk Areas will be detailed (Condition 1.4.20); the annual review will be submitted to DWER (Condition 1.4.21)
- adjoining landowners and the Shire will be notified in writing at least 48 hours in advance of any activities outside of normal or regular site operations that have the potential to generate dust; records of such notifications will be maintained.

7.6 Incident and complaints management

- fugitive dust events will be raised as an Environmental Incident and an event report entered into the site incident management system with corrective actions identified and allocated
- the following information will be recorded in the site incident management system in relation to complaints received by the site (whether received directly from a complainant or forwarded by the Shire or DWER) about any alleged emissions from the premises:
  - the name and contact details of the complainant (if provided)
  - the time and date of the complaint
  - the complete details of the complaint and any other concerns or other issues raised
  - the complete details and dates of any action taken to investigate or respond to any complaint
  - the effectiveness of any action taken in response to the complaint to reduce or eliminate the risk of future events.

8. Dust monitoring

8.1 Visual monitoring

Visual assessments of fugitive dust emissions will be conducted by operational personnel during working hours. A 'dust event' is defined as the occurrence of visible fugitive dust from a source or activity at the site that exits a boundary of the site for a duration of greater than one (1) minute. A windsock will be installed at the site to indicate wind direction and approximate wind strength to aid visual monitoring.

When a 'dust event' is observed and reported on-site, the following corrective actions will be implemented:

- the site operational personnel will review the working methodology of the dust-generating activity and ensure that the appropriate measures listed in the DMP have been implemented
- if the dust event continues following implementation of the above measures, the activity will be controlled, and water will be applied at the source of the dust generation to damp down soils; work will not recommence until the dust event is under control
- spraying of water will be carried out at a frequency sufficient to keep surface soils damp throughout the dust-generating activity without resulting in run-off.

8.2 Dust monitoring

In addition to existing management already in place, the implementation of the added measures in this DMP will result in a further reduction in the likelihood of any airborne dust exiting the site.

Air quality monitoring will be conducted to assist in further understanding of the effectiveness of the control of dust emissions from the site operations. The monitoring will be initially carried out for six months between November 2020 and April 2021 to encompass the dryer months of the year.

The PM_{10} fraction is selected for the monitoring program as this is relevant to human health and has criteria to assess against (NEPM). If required, the sampled particle fraction can be changed to TSP during the sampling campaign by changing the sampling head.

The purpose of the monitoring program will be to establish data regarding existing ambient air quality surrounding the site. This will allow an assessment of the effectiveness of the management of emissions during site operation activities and confirm that off-site impacts are being minimised.

8.2.1 Monitoring equipment

The air quality monitoring program will utilise three real-time nephelometer dust monitoring instruments, each equipped with sensors to monitor wind speed and direction at the sampling location. Each monitoring location will be fitted with telemetry to enable remote interrogation of the monitoring data and to allow alarms when trigger levels (See Section 8.2.3) are exceeded to be set with SMS text notification to a nominated phone number. The instruments will be powered by solar panels with battery storage.

8.2.2 Monitoring locations

The monitoring instruments will be located according to an analysis of the prevailing winds expected for the time of year the monitoring program will be conducted. This analysis will include current data from the on-site meteorology monitoring station and data from the BOM station in Bunbury.

The monitors will be located on boundary locations most likely to be impacted by dust, which will be informed by analysis of wind direction and available information on visual observation of dust emissions. If appropriate to the prevailing wind directions, one monitor will be set upwind and two downwind to allow comparison of dust concentrations between the three sites.

Siting of monitoring instruments will be subject to a site inspection and assessment of feasible locations. The stations will be sited, to the extent possible, in accordance with AS/NZS 3580.1.1:2007 *Methods for sampling and analysis of ambient air, Part 1.1: Guide to siting air monitoring equipment.*

The locations of the monitoring instruments are shown on Figure 5 in Appendix B, which will be updated when monitors are relocated in response to changing site operations or prevailing weather conditions.

8.2.3 Performance criteria (trigger levels)

Trigger levels will be set at the monitoring locations for the duration of the monitoring program as follows.

Corrective action trigger

The corrective action trigger level will be used to set alarm notifications that will be received by the responsible site employee (refer to Section 9). If the corrective action trigger level is exceeded, corrective actions will be implemented as required, including, but not limited to:

- the site operational personnel will review the working methodology of any dust-generating activities and ensure that the appropriate measures have been implemented
- if the dust event continues following implementation of the above measures, the activity will be controlled, and water will be applied at the source of the dust generation to damp down soils; work will not recommence until the dust event is under control and dust levels have reduced below the corrective action trigger level
- spraying of water will be carried out at a frequency sufficient to keep surface soils damp throughout the dust-generating activity without resulting in run-off.

The corrective action trigger level will be established after the first month of monitoring, considering measured concentrations of dust and will be designed to protect the air quality criteria at the site boundary. In the interim, an initial trigger level has been set (Appendix C). The level set is likely to be below the threshold of a visible dust event and provide an early warning.

Stop work trigger level

The stop work trigger level is the ambient dust level which will result in a stop work alarm being dispatched. Actions in response to stop work alarms include:

- all site activities generating visible dust will cease
- the site operational personnel will review the working methodology of any dust-generating activities and ensure that the appropriate measures can be implemented
- water will be applied at the source of the dust generation to damp down soils; work will not recommence until the dust event is under control and dust levels have reduced below the corrective action trigger level
- spraying of water will be carried out at a frequency sufficient to keep surface soils damp throughout the dust-generating activity without resulting in run-off.

The stop work trigger level will be established after the first month of monitoring informed by the measured data. In the interim, an initial trigger level has been set (Appendix C).

The current corrective action and stop work trigger levels are contained in Appendix C, which allows for the value to be easily updated outside of formal review of the DMP (refer to Section 10).

The trigger levels will be periodically reviewed as required to determine their adequacy in protecting sensitive receptors from dust and to ensure they are relevant to actual dust events and do not result in multiple false-alarms that can distract from and disturb site operations.

8.2.4 Data analysis, QA/QC and reporting

During the monitoring period, continuous data will be routinely downloaded weekly from each station, recorded and securely archived. The data will be used for assessment and comparison to the adopted trigger criteria and to confirm satisfactory implementation of dust management practices at the site.

Validated data, which has been subject to QA/QC checks, will be delivered to the Shire on a monthly basis (or as required/requested if a dust event requires investigation). A valid data capture rate of greater than 90% is expected. Instruments will be subject to maintenance in accordance with Australian Standards and manufacturers' guidelines.

Should a dust event be recorded by on-site monitoring; or community complaints are received; or exceedances of the NEPM recorded at the monitoring locations, the source of the dust will be investigated via analysis of the wind direction data. The data will be utilised to inform and improve the implementation of this plan.

Upon on completion of the six month monitoring program, a summary report will be provided to the Shire within 30 calendar days that will include, but not be limited to:

- the locations of the monitoring instruments
- the specifications of the monitoring equipment
- tabular and graphical representation of the monitoring data
- summary of any exceedances of and performance against the trigger levels (including number of SMS text alarms) and any corrective action taken
- summary of any exceedances of the NEPM criteria and identification of dust source(s)
- evaluation of the effectiveness of the applied dust controls and recommendations for any amended or additional controls as informed by the monitoring and assessment of dust emissions generated
- recommendation on the need for, or specification of, ongoing dust monitoring
- summary of complaints received
- summary of any notifications provided to adjacent landowners and the Shire regarding activities outside of normal or regular site operations that have the potential to generate dust.

The need for or specification of any ongoing instrumental monitoring of dust will be reviewed after the first six month monitoring program and will be informed by:

- monitoring data and trends
- performance against trigger levels
- verified complaints
- review of the site classification score and associated management and monitoring requirements (see dust risk assessment in Section 6)
- risk-based assessment carried out in accordance with DWER guidelines (DER 2017) to assess the consequence of emissions at the levels measured impacting sensitive receptors and the likelihood of those impacts occurring.

The outcomes of the above review and the use of ongoing instrumental monitoring will be determined in consultation with relevant stakeholders, including the Shire (see Section 1.3). Visual monitoring of dust-generating site activities will continue as a primary mechanism for ongoing dust monitoring (refer to Section 8.1).

9. Roles and responsibilities

Roles and responsibilities with respect to management of fugitive dust emissions are outlined in Table 9.1 below:

Table 9.1: Site roles and responsibilities

Role	Responsibilities
All personnel	Monitor and report instances of fugitive dust by raising an incident report as required.
Operations Manager	Develop and allocate resources to provide for a level of risk of fugitive dust that is as low as reasonably practicable and conduct and review fugitive dust inspections. Ensure compliance obligations are met, including annual reporting on the assessment of the potential for dust emissions and proposed controls within the required timeframe. Investigate and document complaints as required.
Leading Hand	Monitor wind speed, direction and incoming and nature of incoming loads throughout the day. Incorporate appropriate controls into planning and modulation of active landfill operations, including guidance and coaching of personnel and allocation of water cart routes and waste processing activities. Intervene in and modify/stop active landfill operations in response to notification of exceedances of trigger levels in order to prevent triggering and stop any dust event. Investigate complaints as required.
Customer Service Officer	Maintain site complaints register.
Weighbridge Operator	Monitor and control incoming loads and advise Leading Hand of any oncoming loads consisting of soil or fine particulate. Monitor dust concentrations at the monitoring locations throughout the day and respond to any alarms notifying an exceedance of trigger levels by advising UHF channel 31 and Leading Hand. Advise incoming drivers of any reduction in speed limits.
Landfill Operator	Monitor wind speed, direction and contents of tipped loads throughout the day and modulate active landfill operations accordingly. This is to include communication with tippers to ensure appropriate tipping direction. Modify/stop own machine operation and influence carrier activities in response to notification of exceedances of trigger levels in order to prevent triggering and stop any dust event.

10. Review

This DMP will be subject to, at a minimum, twelve-monthly review to ascertain its relevancy for ongoing site management and allow for continual improvement. Reviews may also be implemented:

- at the direction of the Shire of Dardanup
- after completion of the initial six month monitoring campaign
- as a corrective action resulting from an investigation into a dust impacts
- after completion of the annual review required by Condition 1.4.20 of the licence
- prior to any significant change to site activities and operations
- on publication of a new dust emission guideline by DWER.

11. Limitations

Scope of services

This report ("the report") has been prepared by Strategen-JBS&G in accordance with the scope of services set out in the contract, or as otherwise agreed, between the Client and Strategen-JBS&G. In some circumstances, a range of factors such as time, budget, access and/or site disturbance constraints may have limited the scope of services. This report is strictly limited to the matters stated in it and is not to be read as extending, by implication, to any other matter in connection with the matters addressed in it.

Reliance on data

In preparing the report, Strategen-JBS&G has relied upon data and other information provided by the Client and other individuals and organisations, most of which are referred to in the report ("the data"). Except as otherwise expressly stated in the report, Strategen-JBS&G has not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report ("conclusions") are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data. Strategen-JBS&G has also not attempted to determine whether any material matter has been omitted from the data. Strategen-JBS&G will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to Strategen-JBS&G. The making of any assumption does not imply that Strategen-JBS&G has made any enquiry to verify the correctness of that assumption.

The report is based on conditions encountered and information received at the time of preparation of this report or the time that site investigations were carried out. Strategen-JBS&G disclaims responsibility for any changes that may have occurred after this time. This report and any legal issues arising from it are governed by and construed in accordance with the law of Western Australia as at the date of this report.

Environmental conclusions

Within the limitations imposed by the scope of services, the preparation of this report has been undertaken and performed in a professional manner, in accordance with generally accepted environmental consulting practices. No other warranty, whether express or implied, is made.

The advice herein relates only to this project and all results conclusions and recommendations made should be reviewed by a competent person with experience in environmental investigations, before being used for any other purpose.

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12. References

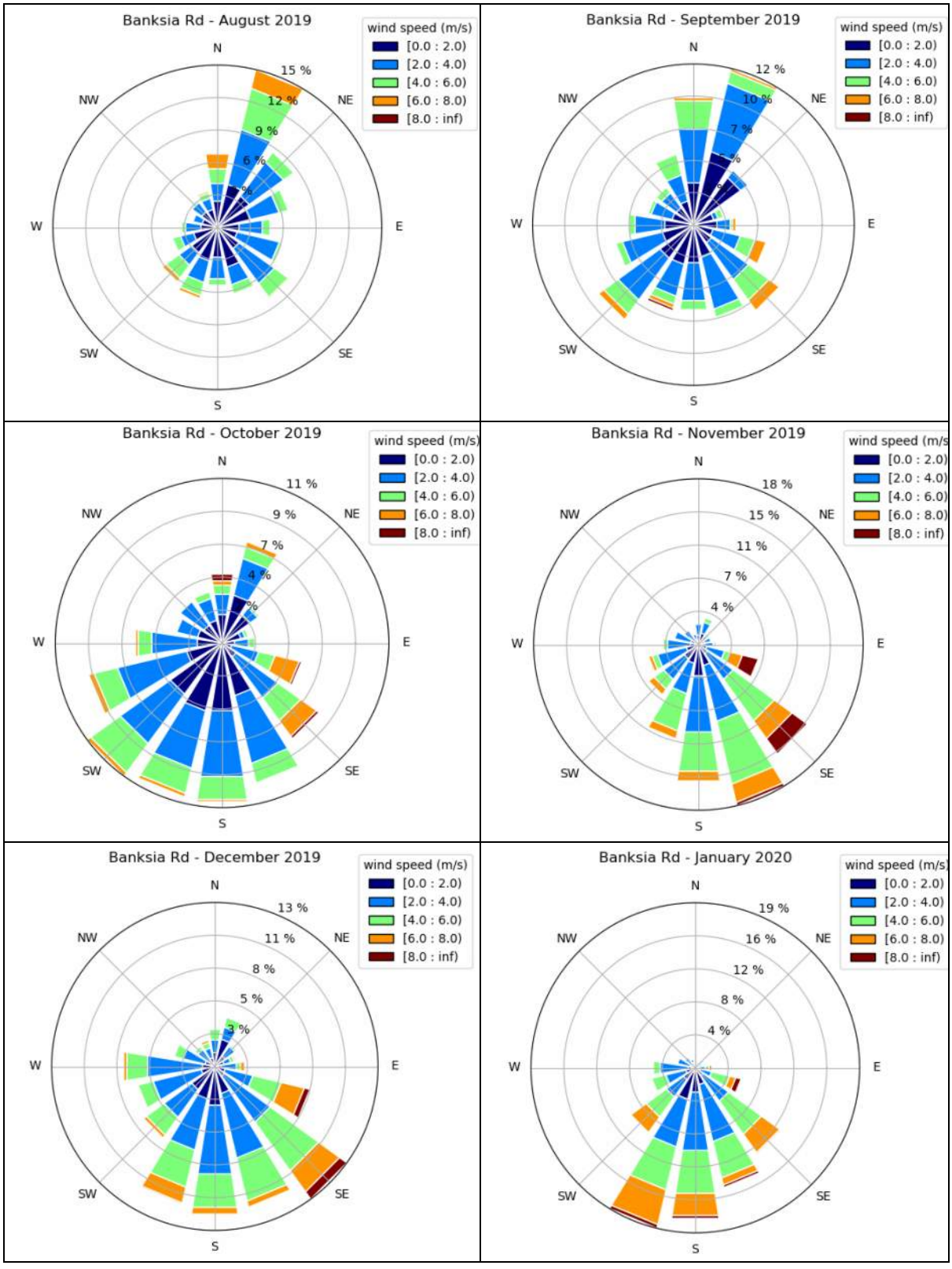
DER (2017). *Guidance Statement: Risk Assessments*. Department of Environment Regulation. Perth, Western Australia.

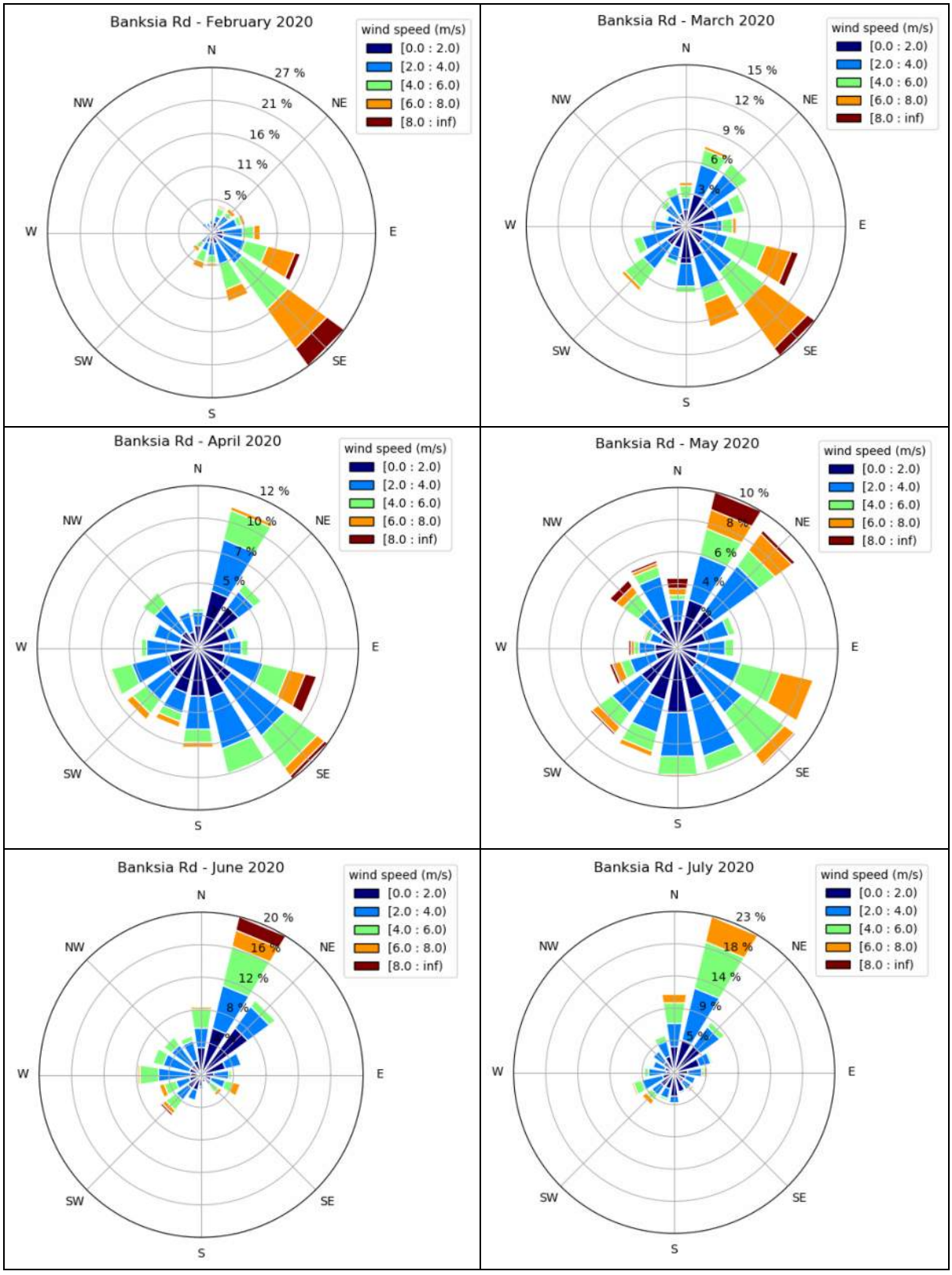
DWER (2019). *Landfill Waste Classification and Waste Definitions 1996 (as amended 2019)*. Retrieved from https://www.der.wa.gov.au/images/documents/our-work/licences-and-works-approvals/WasteDefinitions-revised.pdf.

EPA (2005). *Guidance for the Assessment of Environmental Factors (in accordance with the Environmental Protection Act 1986) Separation Distance between Industrial and Sensitive Land Uses No. 3.* Environmental Protection Authority. Perth, Western Australia.

National Environmental Protection Council (NEPC) (2015). National Environmental Protection (Ambient Air Quality) Measure. Accessed from https://www.legislation.gov.au/Details/F2016C00215.

Appendix A Wind roses (on-site station)




Banksia Rd - February 2020
wind speed (m/s)
[0.0 : 2.0)
[2.0 : 4.0)
[4.0 : 6.0)
[6.0 : 8.0)
[8.0 : inf)
N
NE
E
SE
S
SW
W
NW
27 %
21 %
16 %
11 %
5 %
Banksia Rd - March 2020
15 %
12 %
9 %
6 %
3 %
Banksia Rd - April 2020
12 %
10 %
7 %
5 %
Banksia Rd - May 2020
10 %
8 %
6 %
4 %
Banksia Rd - June 2020
20 %
16 %
12 %
8 %
Banksia Rd - July 2020
23 %
18 %
14 %
9 %
5 %

Appendix B Monitoring locations

Legend:

- Premises boundary
- Cadastral boundary
- Sand extraction area (excluded from DMP)
- Dust monitoring location

strategen JBS&G

Job No: 58071

Client: Cleanaway

Version: A	Date 10/09/2020
Drawn By: cthatcher	Checked By: JB

Scale 1:8,750

0 100 200
metres

Banksia Road Landfill
Crooked Brook, WA 6236

DUST MONITORING LOCATIONS

FIGURE 5

File Name: W:\Projects\1)Open\Cleanaway\58071 Banksia Road DMP\GIS\Maps\R01_Rev_A\58071_05_DustMon.mxd
Image Reference: www.nearmap.com© - Imagery Date: 10 July 2020

Appendix C Trigger levels

The current trigger levels described in Section 8.2.3 are shown in Table C.1 and Table C.2.

Table C.1: Trigger level

Date	Parameter	Corrective action trigger level	Units	Averaging period	Comment
11/09/2020	PM_{10}	600	$\mu g/m^3$	10-minute	Initial trigger level set prior to completion and review of one month of monitoring data

Table C.2: Stop work trigger level

Date	Parameter	Stop work trigger level	Units	Averaging period	Comment
11/09/2020	PM_{10}	1200	$\mu g/m^3$	10-minute	Initial trigger level set prior to completion and review of one month of monitoring data

ASK and DWER AQB recommendations to be included in DMP Ref: 58071/126,854 (Rev 2)

Key:

(clear)	Item that provides clarification or detail
	Suggested to be included. However, not essential
	Major item/Significant matter to be included

#	Section of DMP	Update requested	Source	Cleanaway response
1	Contents - 7	Include 'complaints management' in Contents	ASK peer review	Section 7.6 added to describe complaints management so heading can be added to TOC.
2	Contents – 8.2	Include 'QA/QC' in Contents	ASK peer review	Heading for section 8.2.4 amended to 'Data analysis, QA/QC and reporting' so QA/QC can be referenced in the TOC.
3	Contents - Appendices	Consider including appendix on Stakeholder Consultation	ASK peer review	Section 1.3 added to discuss stakeholder consultation and document version control table updated to reference external reviews.
4	Definition and Abbreviations – Trigger Level	Amend corrective action trigger level description to: 'ambient **boundary** air dust level…'	DWER AQB peer review	Amended
5	Definition and Abbreviations – Trigger Level	Amend stop work trigger level description to: 'ambient **boundary** air dust level…'	DWER AQB peer review	Amended
6	2.1 Existing land use	Include DWER's comment: "DWER Air Quality Branch agrees that dust from the sand mine should be managed, however advice from DWER Industry Regulation is the activity has been assessed, is not a Prescribed Activity under Schedule 1 of the Environmental Protection Regulations 1987 and is not under the control of Cleanaway. The activity and area in question is not subject to the licensing and works approval provisions of the Environmental Protection Act 1986 and was excluded from L8904 as part of the licence review undertaken in 2017."	DWER AQB peer review	Amended

7	Table 2.1: Sensitive human and environmental receptors – Closest residential receptors	Include comment on whether or not this meets the separation distances recommended in the EPA's 'Guidance Statement No. 3 Separation Distances between Industrial and Sensitive Land Uses (2005) (EPA GS3)'.	ASK peer review	No change made to the DMP. Section 3.4 describes GS3 and separation distance.
8	3.2 National Environmental Protection (Ambient Air Quality) Measure	Include reference to the 'National Environmental Protection Council (Western Australia) Act 1996'.	ASK peer review	Amended
9	3.5 Dust management guidelines	Include statement that this is the current guideline, and that a new dust guideline is in preparation by DWER ('Guideline: Dust Emissions').	ASK peer review	Amended
10	3.5 Dust management guidelines	Consider including: 'the DMP may be reviewed and updated (as appropriate/necessary) upon release of the new DWER dust guidelines'.	Environmental Health Services – Shire	Section 10 amended to include new DWER guideline as trigger for DMP review.
11	Figure 3	Insert North Point	ASK peer review	North point already included – error in document used by the Shire.
12	Figure 4 - Legend	Include in this map: – Entry and Exit points – Physical barriers – Fencing – Windbreaks – Trees – Buildings, etc.	ASK peer review	No change. These items are marked, labelled or clearly identifiable on Figure 3.
13	Figure 4	Insert North Point	ASK peer review	North point already included – error in document used by the Shire.
14	5.1 Parameters of interest	Include DWER AQB comment: 'PM2.5 is not included as it is typically associated with combustion emissions and therefore this particle size is likely to be a small fraction of particles emitted from the site activities, and would be able to be managed using the PM10 management approach'.	DWER AQB peer review	Section 5.1.1 amended.

-	5.2 Emissions sources	Should include Cleanaway development on adjacent property Lot 81 Marginata Close as source. Current development located next to high risk areas. Vic EPA BPEM Siting, design, operation and rehabilitation of landfills, p.36: Any large area where the land has been disturbed and is subject to vehicular traffic has the capacity to generate dust. Other potential dust sources are stockpiles of earth and the delivery of dusty loads of waste. The magnitude of the impact will depend on the: • type and size of the operation • prevailing wind speed and direction • adjacent land use • occurrence of natural and/or constructed wind breaks • wind-abatement measures or buffers.	Statutory Compliance Officer	Clarification required from Shire. The DMP is for the Banksia Rd landfill and not activities on Lot 81 whether operated by Cleanaway or not. The identification of other waste facilities in the precinct is described in section 2.2.
15	6 Dust risk assessment – Part B Proximity of site to other land uses	State that 684 equates to a 'Site classification 3' under the DEC Guidelines 2011. Include reference to recommended actions for Classification 3 sites on page 38 of the DEC Guidelines 2011 in the appendix.	Environmental Health Services – Shire	Amended
16	6 Dust risk assessment – Part B Proximity of site to other land uses	Recommend: Acknowledgement of compliance with these DEC Dust Guidelines 2011 recommendations for Site Classification 3, where applicable to the Cleanaway operation.	Environmental Health Services – Shire	Amended
17	7.1 General management – (dot point 5)	Provide clarity on the exact trigger/s and frequency of use of the water cart.	ASK peer review	Amended
18	7.1 General management – (dot point 5)	Include: • Wetting down of roads and working surfaces prior to the commencement of work activities. • Use of weather forecasts to minimise chance of dust generating activities during adverse meteorological conditions.	DWER AQB peer review	Amended

19	7.1 General management – (dot point 6)	Include: • 'Areas' mean: as identified in the DWER licence assessment process depicted in Figure 3. • Frequency of application of suppressant would be dictated by the existing suppressant becoming ineffective, and the risk from the areas identified to have the potential for fugitive dust generation.	ASK peer review	Amended and definitions updated
20	7.3 Operation of vehicles	Include details on management of wheel wash to prevent secondary dust sources from drying mud on outbound roads.	DWER AQB peer review	Amended
21	7.4 Landfill areas	Include reference to condition 1.14.17 of the DWER Licence in this section.	ASK peer review	Already included in bullet point one of section 7.4.
22	7.5 Administrative controls	Recommend: Include reference of abidance with Clause 2.1 c) of the Dust Local Laws: 'adjoining landowners will be notified in writing 48 hours prior to the commencement of any activity that has the potential to cause the release or escape of dust from the land giving details of— (i) the nature of the activity; (ii) the proposed time and location of the activity; and (iii) the name of the person responsible for carrying out the activity and how and where that person may be contacted.' For an operation like the Cleanaway Banksia Rd facility notification apply to activities outside of regular/normal site activities, that are likely to generate dust.	Environmental Health Services – Shire	Section to be reviewed and amended if necessary. Other means of notification other than writing may be more appropriate.
23	7.5 Administrative controls – (dot point 3, sub-point 2)	Include details of the parameters that are recorded for each complaint.	DWER AQB peer review	Amended

24	7.5 Administrative controls – (dot point 3, sub-point 3)	Include detail of how effectiveness will be quantified/ determined.	ASK peer review	Amended
25	7.5 Administrative controls – (dot point 4)	Include: • Detail on the inspection process. • How fugitive dust is monitored in between monthly inspections	ASK peer review	Amended
26	7.5 Administrative controls – (dot point 5)	• Mention that a complaints summary will be included in the Annual Environmental Report.	ASK peer review	Section 8.2.4 amended
27	7.5 Administrative controls – (dot point 5)	Mention that the annual report will include dust event statistics, including no. of SMS notifications.	DWER AQB peer review	Section 8.2.4 amended
-	7.5 Administrative controls	DEC 2011 Guidelines apply. Cleanaway response describes dust control not complaints management. DMP should refer to/outline complaints management system.	Statutory Compliance Officer	Additional section to be added detailing complaints management (ref point 1).
28	8.1 Visual monitoring	Both DWER and ASK indicate visual monitoring alone is not enough. Suitable justification will need to be provided for visual monitoring [only] as there is no way to determine particulate concentration levels, and no way to determine compliance with trigger levels. At the very least: **Consider visual monitoring coupled with some form of base-level dust monitoring instrument/s.** Note the DWER AQB's comment on this matter: 'AQB is supportive of the ongoing use of dust monitoring equipment, unless the proponent can demonstrate improved dust management and reduction in impacts'. ASK comments: The monitoring program should provide quantifiable data of any dust emissions. Such data will determine if current dust control measures are appropriate, and provide transparent information to the wider stakeholders.	ASK peer review DWER AQB peer review Environmental Health Services – Shire	Visual monitoring is coupled with instrumental dust monitoring (sections 8.1 and 8.2). Shire to clarify comments.

-	8.1 Visual monitoring	The wording of Dust Control Local Law, s.2(1) is mandatory. Cleanaway could include sentence in DMP Introduction after sentence 1 para.2 that its operations have the potential to cause the release or escape of dust from the land. Cleanaway could send copy/link of DMP to adjoining owners to satisfy notice requirement.	Statutory Compliance Officer	Section 1 amended. Ref point 22. The Council approved DMP will likely be made publicly available through Shire processes (e.g. Council minutes) and will not be provided to adjoining owners as an operational document.
29	8.2 Dust monitoring	Provide detail and rationale, or industry sources, for the values and methodology provided in the dust monitoring plan.	ASK peer review	Shire to clarify comment/requirement. No similar comment identified in ASK peer review.
30	8.2 Dust monitoring – Final paragraph	Reconsider the inclusion of visual monitoring [only]. Include some form of instrument verification of dust concentrations.	ASK peer review DWER AQB peer review Environmental Health Services – Shire	As above. Visual monitoring is coupled with instrumental dust monitoring (sections 8.1 and 8.2). Shire to clarify comments.
31	8.2.1 Monitoring equipment – (First paragraph)	• Give an example of the type of equipment (Even if the exact type of equipment cannot be specified) and clarify that this will be determined by a third party air quality professional. • Confirm that monitoring will also include measurement of particulate concentration, and what parameter exactly (PM10 / TSPs).	ASK peer review	• Amended • Measurement parameters specified in para 3 of section 8.2
32	8.2.1 Monitoring equipment	In addition to Dust Monitoring Instruments, consider inclusion of use of Dust Deposition Gauges to gain an indication of amenity impacts, using the NSW standard of 4g/m²/month.	DWER AQB peer review	No change made to the DMP. DDGs are appropriate to monitoring at receptor locations and are not relevant to operational monitoring at the boundary noting they collect data over long periods (days, weeks, months). The NSW standard of 4 g/m²/month referenced by the Shire is an annual average figure derived from studies of coal mines in the Hunter Valley. This has been adopted by regulatory authorities for assessment of dust deposition impacts from non-coal sources. No studies have been published linking deposition rates and impacts on amenity. The NSW standard is not directly applicable to inform impacts on amenity at locations surrounding the facility.

33	8.2.1 Monitoring equipment	Include/demonstrate that: • Monitoring equipment will be operated and maintained as per manufacturer's instructions. All monitoring data is recorded and securely archived.	DWER AQB peer review	Amended
34	8.2.1 Monitoring equipment	• State the particulate concentration threshold that would trigger an alarm. If based on corrective action and stop work trigger levels, state it here. • Consider including Shire phone in SMS alert.	ASK peer review	• Trigger levels are stated in sections 8.2.3 and specified in Appendix B. • Cleanaway will not include the Shire in SMS notifications as these are for operational control and do not require action from the Shire. A summary of SMS triggers will be reported (ref points 27 and 35)
35	8.2.1 Monitoring equipment	Recommend to include that annual report to DWER will include SMS alert stats (i.e. no. of dust events).	DWER AQB peer review	Section 8.2.4 amended.
36	8.2.2 Monitoring locations	Specify on a map (appendix) the likely location/s of monitors. DWER AQB: • 'The monitoring locations should be specified in the DMP, and reviewed as part of the DMP review'. • 'AQB generally recommends that boundary monitoring equipment is moved as required as work areas change so that the equipment is located between major dust sources and receptor areas with reference to predominant wind patterns'.	DWER AQB peer review	Location map appended (Appendix C).

37	8.2.2 Monitoring locations	Reconsider the use of only two dust monitors suggested in this DMP. Both ASK and DWER's AQB suggest two may be insufficient.
		
		ASK suggests **multiple 'background site' and 'peak site' monitors:**
		• **Multiple 'background sites' at locations along the site boundary in the direction of nearby sensitive receptors.**
		• **'Peak sites' should be set up adjacent to work area/site infrastructure where high exposure and highest concentrations are likely.**
			ASK peer review
			DWER AQB peer review
			Environmental Health Services – Shire
				Three boundary monitors are proposed. Initial position determined based on:
				• Summer wind directions (start November to end of March).
				• Location of sensitive receptors (and justification):
				  ○ The N1 boundary monitoring station is upwind of a cluster of receptors 2-3 km NW from the site and captures impacts from SE winds in summer months.
				  ○ The S boundary station provides background data for those months.
				  ○ The N2 boundary station captures SSW-SW winds for summer months upwind of receptors NE of the site (the S station is also background and N-1 station provides additional background for those conditions).
				• Soil moisture at other times of the year are expected to be higher and a lower dust risk should prevail.
				• Indicated stations will still capture any emissions for prevailing winds at those locations; for example, August and September have a strong prevalence of NNE winds, with any dust generated under those conditions likely to be detected by station S.

38	8.2.3 Performance criteria (trigger levels) – Stop work trigger level – (last paragraph)	Change to: **Trigger levels should be reviewed for the purpose of determining their adequacy in protecting sensitive receptors from dust.** Sentence seems to only be about protecting of the operation.	Environmental Health Services – Shire	Amended

-	8.2.3 Performance criteria	DWER approach is that trigger values are arbitrary. DWER neither supports nor disagrees with the value of 200µg/m3. DWER supports refining the value after the first month of monitoring. Therefore the Shire's position is that the lower value suggested by peer reviewer should be used (not the higher values of 1200µg/m3 and 600µg/m3). Vic EPA BPEM p. 36 states; An hourly trigger level of 80 µg/m³ should be used to assess the real-time data. If exceeded additional dust management practices, such as increased water sprays and dust suppressants should be applied.	Statutory Compliance Officer	No change made to the DMP. Refer to point 42 and noting DWER comments that trigger valued are arbitrary and that is does not support a lower value of 200 µg/m³. The VIC BPEM trigger level of 80 µg/m³ is for a one-hour average. The trigger values in the DMP are for 10-minute averages. These are intended to assess the extent of peak, short-duration spikes in PM_{10} concentrations that can occur from time to time, that may indicate a risk of exceedance of the 24-hour average NEPM. A 1-hour average trigger value may not capture those short-duration events in a timely manner and opportunity to implement immediate controls measures may be lost. The current trigger levels in the DMP are considered reasonable and will be refined after the first month of monitoring as informed by the measured data.
39	8.2.4 Data analysis and reporting – (dot point 4)	Include that the report will also include a summary of performance against the trigger criteria.	ASK peer review	Amended
40	8.2.4 Data analysis and reporting – (dot point 6)	Clarifying the wording that the summary report will recommend controls based on assessment of dust emissions generated (throughout the monitoring period).	ASK peer review	Amended

41	8.2.4 Data analysis and reporting – (dot point 7)	Provide detail on the criteria for determining ongoing monitoring. AQB recommends/supports >**2 monitors, and a staged approach:** • **"If impacts are demonstrated and continue to occur at receptor locations, [then] ambient air monitoring at receptors is recommended as per the 2011 Guideline."** • **"Given that the site is located in a rural area with isolated residences, the use of non-standard dust monitoring units for ambient monitoring as a first step is considered acceptable, but cannot be compared to health criteria, and should only be used for examining trends. If impacts continue then standard monitoring methods should be employed as per the 2011 Guideline to assess the health and amenity risks at sensitive receptors."** Consider AQB's recommendations above. If included in this DMP, suitable level of detail will need to be provided on the process of determining if additional/ongoing monitoring is or is not required.	DWER AQB peer review Environmental Health Services - Shire	Section to be reviewed and amended if necessary. Process of determining if additional/ongoing monitoring is or is not required will be determined using site monitoring data/trends, verified complaints, performance against triggers and ongoing consultation with the Shire and community. A risk-based approach will be taken to inform a need for additional or ongoing monitoring, that considers the consequences of emissions at the levels measured impacting at sensitive receptors and the likelihood of impacts occurring. The monitoring data will inform the risk assessment. The selection of monitoring methods for additional/ongoing monitoring (if deemed to be required) will be based on the level of uncertainty in the risk assessment, as informed by the monitoring carried out using "non-standard" monitoring instruments.
42	Appendix B Trigger levels	Consider revising this down both the 'Corrective action trigger level' and the 'stop work trigger level' in line with ASK's comment that: "A value of 600 Mg/m3 (10-min average) could be considered high. For comparison, Ministerial Statement 741 (Pilbara iron ore ship loading facility) states "a short-term TSP dust impact occurs when dust emissions exceed 200 µg /m3 averaged over a 10 minute interval".	ASK peer review	No change made to the DMP. The Port Hedland trigger level is relevant to an already highly impacted air shed with multiple significant sources and sensitive receptors close to the sources. The current trigger levels in the DMP are considered reasonable and will be refined after the first month of monitoring as informed by the measured data.

2 December 2020

Susan Oosthuizen
Director Sustainable Development
Shire of Dardanup
1 Council Drive
Eaton WA 6232

Dear Susan,

Review of Cleanaway documents to satisfy planning issues raised by the Shire

Urbaqua has undertaken a review a number of documents submitted to the Shire by Cleanaway for breaches of the development approval dated 1 November 1999. It is understood that the Shire sent a letter to Cleanaway outlining the outstanding planning issues and proposed resolution and in order to resolve the issues the Shire requested the following be submitted for consideration:

- Landscaping plan designed to lessen the visual impact of the site, especially cell 5 (later corrected to cell 4), on the surrounding area
- A comprehensive environmental management plan covering 'items such as but not limited to litter, dust, [odour] and vermin control'
- A fire management plan which details how 'suitable and sufficient firefighting facilities are to be jointly made available on site or in close vicinity'
- An explanation of the waste classifications of waste previously and currently disposed of at the facility and the steps Cleanaway is taking to ensure that the groundwater does not become contaminated.

It is noted that both the Fire Management and updated Dust Management Plan have been peer reviewed and therefore are not part of this review.

The documents that have been considered as part of this review are:

- Cleanaway, 2020a, Dardanup Landfill Masterplan, Banksia Road Dardanup WA, Cleanaway, November 2020
- Cleanaway, 2020b, Banksia Road Landfill Rehabilitation and Closure Plan V2, Cleanaway, 2020
- Cleanaway, 2020c, Banksia Road Landfill Rehabilitation and Closure Plan, Appendix D - Landscaping Plan, Cleanaway Waste Management, 9 November 2020
- Cleanaway, 2020d, Banksia Road Dardanup Landfill Stage A and B Phytocap Technical Specification, Cleanaway Pty Ltd, August 2016
- Cleanaway, 2020e, Banksia Road Dardanup Landfill Phytocap Trial Monitoring Plan, Cleanaway Pty Ltd, July 2016
- Cleanaway, 2020f, Banksia Road Dardanup Landfill Capping Design Report, Cleanaway Waste Management, 15 September 2020

ABN 95 614 256 834

Suite 4/226 Carr Place, Leederville WA 6007
P: 08 9328 4663 F: 08 6316 1431
Email: info@urbaqua.org.au www.urbaqua.org.au

Dardanup Landfill Masterplan

The Dardanup Landfill Masterplan (Cleanaway, 2020a) outlines details of the existing operations and future plans in relation to the landfill cell construction and rehabilitation of the site. This includes some discussion of site operations, cell development including timing and final top of waste contours and rehabilitation. A view analysis has been undertaken for eastern views. The Masterplan also refers to the Dust Management Plan, Fire Control Plan and Land Rehabilitation and Closure Plan.

Key excerpts from the Masterplan that are relevant to this review are:

- The Masterplan once formally adopted as a Local Development Plan would guide future decision making for the subject site, including future Development Applications.
- The current approved height permitted within the existing DWER licence is AHD 128m. The final landform is planned to reach a height of AHD 149m consistent with the final landform design submitted by to DWER in 2016 and publicly advertised as part of the Cells 6, 7 and 8 Works Approval.
- The final project plan would see up to 22 landfill cells and the two liquid and tailings waste disposal cells on the site constructed and rehabilitated in sequence across the life of the project... The key change is that while the overall future landfill area has not increased, the width of future landfill cells has increased to provide more airspace per cell construction and a better match with incoming waste tonnages.
- Currently (there are) nine landfill waste disposal cells, of which seven are yet to be completely filled, in addition to the two liquid and tailings waste disposal cells… The main active landfill disposal area is Cell 7... The waste is placed in horizontal layers until the final design waste profile is reached. A secondary waste disposal area exists at the top of Cells 3, 4, 4b, 5, 6 and 12 which is typically used for asbestos and quarantine waste placement.
- Rehabilitation will occur progressively once cells have reached the final top of waste design profile. The Rehabilitation Stages start with the Western facing slopes to improve the visual amenity.
- There is currently a phyto capping trial being carried out on site, which was approved as part of the landfill Cell 6, 7 & 8 approvals in 2016. A decision on the final capping system will be made following the completion of the capping trial, which is due to run through to approximately July 2022.
- Historically, landfill cell development has covered the construction of three landfill cells in a single application. This is typically the scale of works that will be included in future applications.
- As a minimum this master plan will be reviewed every five years.

The indicative timing of rehabilitation stages is provided in table and figure format (see Figure 1, Attachment 1). It is noted that the establishment of trees and shrubs on the upper slopes of the western batter (Stages 4 and 6) is unlikely to commence until 2027/2028, with an approximate establishment time of 10 years.

Rehabilitation and Closure Plan

The Banksia Road Landfill Rehabilitation and Closure Plan V2 (Cleanaway, 2020b) provides information regarding the design for the landfill cap, final waste height contours, staging of rehabilitation, post closure period monitoring and use. Some key excerpts not addressed by the Masterplan are as follows:

- The progressive rehabilitation is expected to commence within 6 months from the completion of disposal in that cell or part of a cell once that has reached final waste heights.
- Post closure period is expected to be a minimum of 30 years from completion of final capping event and the (following) aspects will be monitored: groundwater quality, landfill gas migration, landfill settlement due to waste subsidence, landfill cap free drainage capability, leachate generation and leachate evaporation rates, vegetation health and coverage, and buffer distance maintenance.
- the parameters and frequency of groundwater monitoring will reflect current or future requirements … of the DWER operating licence L8904/2015/1 Amendment issued 12 May 2020 ... If the assessment of groundwater quality over a certain period during post closure reveal stable conditions, then a revised list of parameters and monitoring frequency will be proposed to the DWER for approval.
- Vegetation health and coverage will be monitored as per the recommendation in Table 9.2 of the *Waste Management Association of Australia's Guidelines for the Assessment, Design, Construction and Maintenance of Phytocaps as Final Covers for Landfills*.
- Tree and shrub density should achieve a minimum of 1 plant/20 m2 and groundcover should have a minimum coverage of 75%. Where bare patches > 4m2 or vegetation stablishes poorly, species shall be replanted with the same or similar species using tubestock for small area or broadscale seeding for larger areas, as advised by a vegetation contractor.

Landscaping plan

Banksia Road Landfill Rehabilitation and Closure Plan, Appendix D - Landscaping Plan by Cleanaway Waste Management dated 9 November 2020 "aims to provide a clear, concise and practical framework for the landscaping of the final landform of the Landfill, in accordance with the requirements of the DWER Revegetation Guideline (DWER, 2018) and the Rehabilitation and Closure Plan (Cleanaway, 2020) for the site. The final landform and landscaping are intended to facilitate a final land use as passive open recreational space."

The plan outlines restoration zones and discusses sourcing of plant stock, site preparation, planting techniques, maintenance and monitoring and reporting. A species list is provided in Appendix A; however, limited information is provided on the program of works (the Rehabilitation Staging Plan is not included in this document).

Grassland vegetation is proposed for the majority of the site which includes the upper crest of the landfill and over the Tronox ponds (zone 2) for use as passive recreation. The western batter slopes of the landfill will be planted to native trees, shrubs and grasses (Zone 3) and some additional trees and vegetation are proposed for the buffer zone around the landfill (zone 4c & 4d) while low vegetation is proposed around the stormwater basins and leachate ponds (zone 4b and Zone 5). Zone 1 Infrastructure will not be revegetated (See Figure 2 of Attachment 1).

Key excerpts not previously referred to include:

- At the completion of earthworks, appropriate sediment control fencing will be installed as specified in the detailed design for capping. Consideration will be given to alternative control structures, particularly those shown in "Best Practice Erosion and Sediment Control" (IECA, 2008). Areas of high erosion potential may require the installation of jute matting or hydromulching.
- Native tube stock may also be used across the Zones by hand across smaller areas (up to 10 ha). The recommended planting density for trees and shrubs for each zone is 1

per 10 m_2 with 5 m interrow spacings with groundcovers planted in the interrow at 4 per m_2.
- Before revegetation activities commence an irrigation system, e.g. drippers or sprinklers, will be installed throughout Zones 2, 3, 4B, 4C and 5 to assist in establishing vegetation.
- At the completion of the planting a 36-month maintenance program will commence. The maintenance program will optimise plant establishment and weed control. Activities will include watering, herbicide spraying, replacement planting and general maintenance. The aim of the maintenance program is to ensure an establishment rate of >70% and no base patches > 4 m_2 is achieved at Final Completion.
- The monitoring and reporting requirements include an implementation report; maintenance checklists; vegetation assessment (Zone 3 only); and landscape report.
- After three years, a landscape report will be prepared which summarises the maintenance undertaken; analyses the survival, establishment and ground cover of vegetation; and determines if vegetation has matured or whether any additional actions are required.

Environmental management

Whilst it is understood that no comprehensive environmental management plan has been supplied to the Shire, some guidance on the operational management of litter, dust, [odour] and vermin control can be gathered from the Dardanup Landfill Masterplan (Cleanaway, 2020a) and its associated appendices (which are available on the Cleanaway website):

- Dust Management Plan;
- Fire Control Plan;
- Rehabilitation and Closure Plan; and
- Landscape Plan (Rehabilitation and Closure Plan Appendix D)

It is also recognised that the Department of Water and Environmental Regulation (DWER) licence requires Cleanaway to monitor and report on the following:

- Construction Compliance:
- Annual Audit Compliance Report:
    - Waste quantities received;
    - Details of non-compliance with the licence conditions (if any);
- Annual Environmental Report:
    - Information on active landfill areas, liquid and tailings areas;
    - Information on landfill gas collection and management systems;
    - Summary of failures or malfunctions (if any);
    - Waste inputs and outputs;
    - Waste handling processes
    - Groundwater monitoring;
    - Complaints management.

Although the full annual environmental report is not publicly available, Cleanaway publishes a summary of the results of the groundwater monitoring program on its website (https://www.cleanaway.com.au/dardanup-landfill/ under Reports and Documents).

Discussion

The key issues of concern to the Shire are understood to be final landform/ landscaping and overall environmental management including risk of contamination to groundwater. These are expanded on below.

Final landform

Cleanaway proposes to continue landfilling the Dardanup Landfill site to a top of waste height of 149 m AHD with capping design and settlement allowances in addition to this. The final landform height will therefore be in the order of 152m, which is 8m higher than the highest point in the landform for 4km and 46m above the natural land surface (see Figure 3, Attachment 1). The approved height by DWER of 128m is 22m above the natural land surface.

The view analysis has been undertaken only for eastern views, presumably because it is considered that the establishment of trees and shrubs on the western-facing slopes will mitigate any visual impact from other vantages. However, the significant height of the final landform above the surrounding land, the majority of which is proposed to only be rehabilitated to grassland, suggests that this is unlikely to be sufficient, particularly in the near to mid-term future.

Rehabilitation

There is no justification as to why the majority of the revegetation proposes to return the site to grassland rather than the previous vegetation type of native bushland. It is possible that this is to permit the intended final land use of "passive open recreational space"; however, there is no justification for this end land use in either the Masterplan or the Landscape Plan. The useability of the site for passive recreation in future is questionable.

The use of grasses rather than shrubs and trees over the bulk of the site also has the potential to increase the need for maintenance of the landscape after establishment, as grasses with no overstory are not as resilient during the hot summer months, increasing the likelihood of plant death and the opportunity for weed incursion. It is also considered that revegetating the batter slopes only with grassland species could lead to increased risk of erosion from rainfall.

The Landscaping Plan contains some conflicting statements in terms of certainty of delivery. Although the document refers to the species list in Appendix A, it is not clear which species are proposed to be used in each zone. Furthermore, in some instances, actions are only 'considered' or "may" be completed, while in other sections, there is more of a commitment to delivery. This includes references to the application of sediment control, use of tube stock and use of irrigation.

The width of the vegetated buffer around the site is unclear. Previous consultation has identified a preference for a 20m vegetated buffer as a minimum. There is also no buffer proposed for the eastern boundary of the site.

The completion criteria to be used are unclear. The Rehabilitation and Closure Plan refers to "minimum of 1 plant/20 m^2", while the Landscaping Plan refers to "recommended planting density for trees and shrubs for each zone is 1 per 10 m^2". It is also noted that trees and shrubs are lumped together. It is recommended that this be amended to a minimum of 1 tree per 10m^2. It is also recommended that the criteria include a minimum amount of weeds.

The timing for commencement of the rehabilitation is unclear. Although there is an indicative staging plan, there are no contingencies proposed if the secondary waste disposal area (as is currently identified for Cells 3, 4, 4b, 5, 6 and 12) remains unfilled for a number of years.

The monitoring and evaluation program in the Landscaping Plan is supported; however, the timing of such is not clear as it refers to "when landscape works are completed". The highly staged nature of the works suggests that this should be clarified, and the document state that an implementation report is required for each stage of the rehabilitation. It should also refer to reporting against the completion criteria. Furthermore, the vegetation assessment is only proposed for zone 3; however, this should be expanded to include zone 4 which is critical for

screening from adjacent land as a minimum. There should also be reference to where the reports are lodged and for whose approval.

Operational environmental management

As noted previously, dust and fire risk are not considered as part of this review.

The summary of groundwater monitoring information on the Cleanaway website contains some useful information; however, it is not immediately obvious which samples exceed which guidelines for which analytes. Community confidence in the sampling and reporting program would be increased if there was greater transparency of results. This could include a figure showing the bore locations and graphs showing trends in results.

There is also no publicly available information on the management of litter or vermin.

Summary

The key matters identified from this review for consideration by the Shire in relation to the proposed Masterplan are:

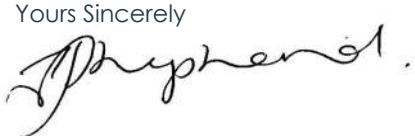
- insufficient discussion and mitigation of the visual impact on the surrounding locality;
- lack of justification of the future use of the area for passive recreation;
- lack of justification for rehabilitation of the majority of the site with grasses rather than the reinstatement of the former vegetation type;
- uncertainty around completion criteria, timing, monitoring and reporting of rehabilitation actions; and
- lack of a vegetated buffer along the eastern boundary.

Other matters that could be addressed in the Masterpan include:

- site context, character and environmental conditions;
- future use of the site post closure including timing and ongoing management;
- future traffic plans as staged development occurs;
- hours of operation;
- impacts on public amenity from litter and/or pests;
- locations and reporting of groundwater quality monitoring;
- reference to the assessment and decision-maker regarding the choice of capping; and
- commitments to the delivery of actions contained in the appended plans.

Thank you for the opportunity to assist the Shire with their review of the Cleanaway Masterplan and associated documents. Please do not hesitate to contact me on 0403 170 040 or at shelley@urbaqua.org.au should you have any questions.

Yours Sincerely



Shelley Shepherd
PARTNER/PRINCIPAL ENVIRONMENTAL PLANNER
URBAQUA

Attachment 1: Key figures

Figure 1: Indicative staging plan (Figure 10 from Masterplan)

Rehabilitation Stage	Capping Area	CELL Number	
No.	m^2	No.	
1	20,760	5	PART 3-4
2	25,620	1	PART 3-4
		2	PART 4B
3	21,205	12A	PART 12
5	35,145	PART 3-4	
		PART 4B	
		PART 12	
6	37,125	6	PART 7
		PART 3-4	
4	29,270	PART 12	
		PART 4B	
		PART 3-4	
		PART 7	
		PART 15	
7	68,070	8	PART 15
		9	PART 7
		10	PART 7
8	60,020	16	PART 15
		17	
9	62,800	11	
		13	
		14	
10	71,800	18	
		19	
		20	

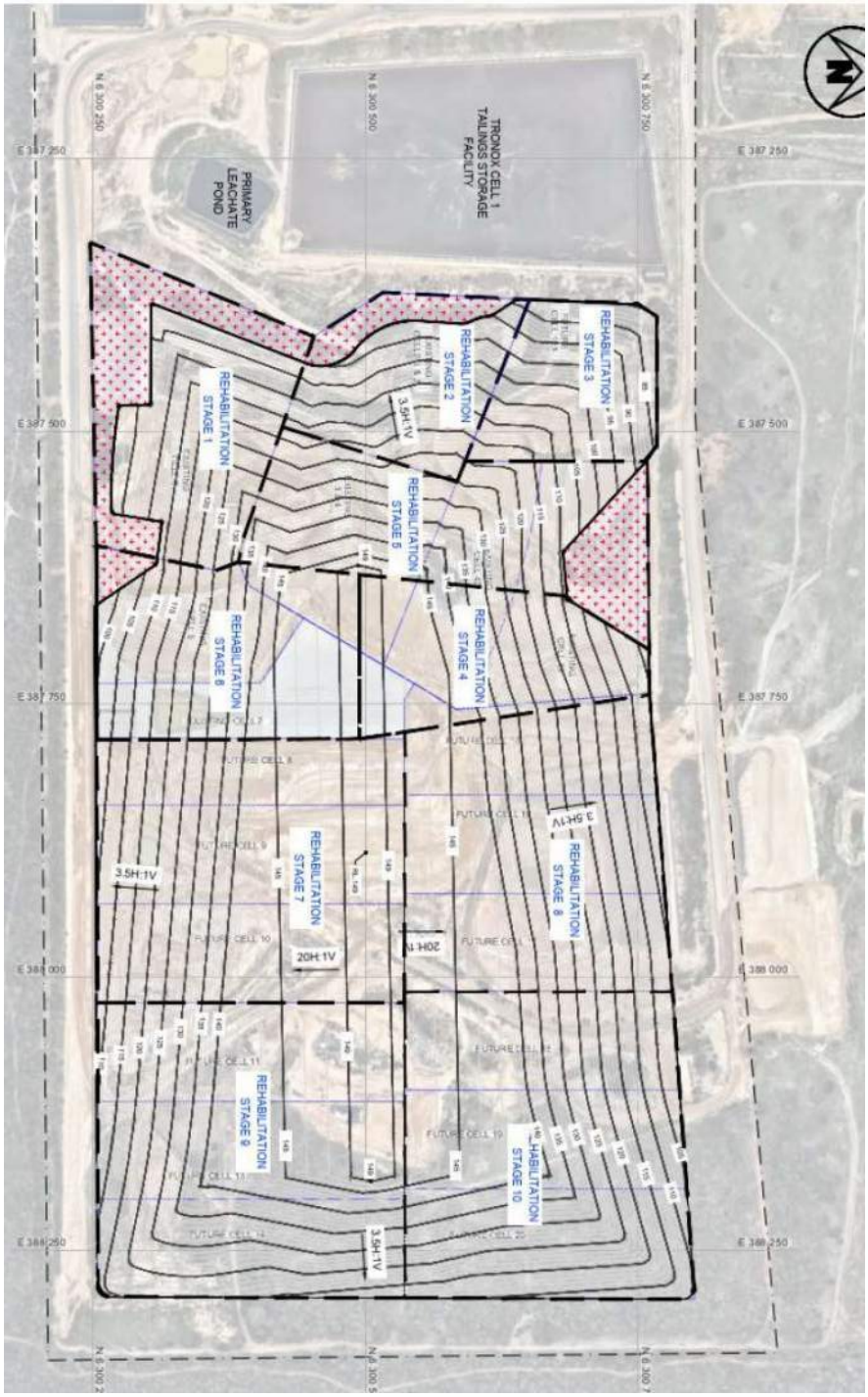


Figure 2: Landscape zones and proposed planting (Figure 14 from Masterplan)

Zone 4a – Established. No further planting

Zone 4d - some additional trees and vegetation in the buffer zone around the landfill

Zone 2: Grassland vegetation

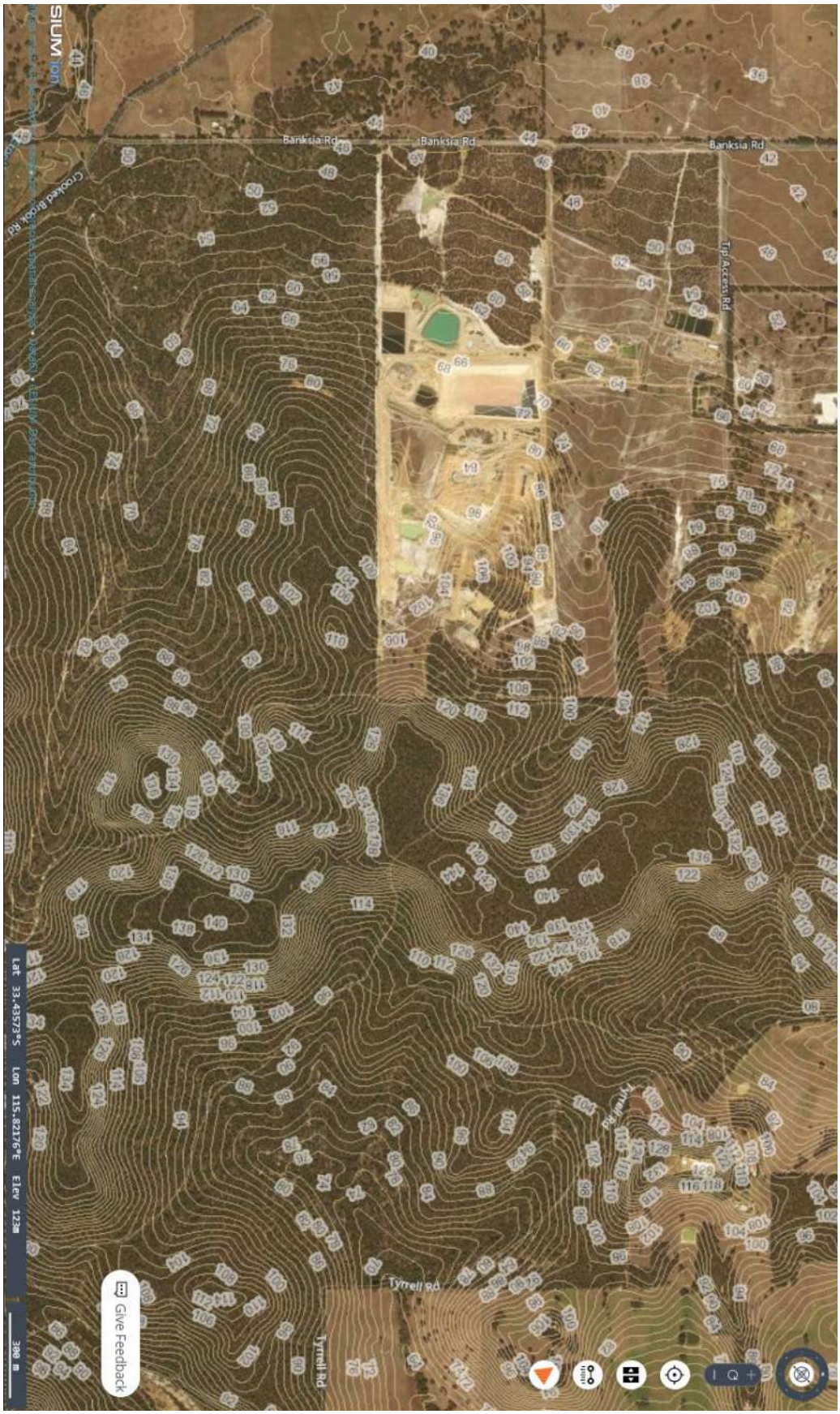
Low vegetation around stormwater basins and leachate ponds (Zone 4b and Zone 5).

Zone 3: Native trees, shrubs and grasses

Zone 2: Grassland vegetation

Zone 4c - some additional trees and vegetation in the buffer zone around the landfill

Figure 3: Existing topography from DPIRD mapping



Cleanaway

Dardanup Landfill Operations Update
November 2020
Cleanaway.com.au

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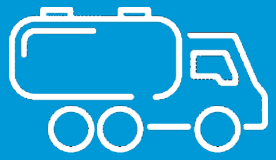
Who is Cleanaway?



Cleanaway is Australia's leading waste management, industrial and environmental services company.

Our services are essential to functional, safe and healthy communities.

There will always be a need to dispose of waste and the processes for doing this must be handled appropriately.

Cleanaway is committed to minimising the impact of our operations and reducing any risks to the environment and our communities.

With nearly 6,000 employees Australia wide, Cleanaway designs, operates and rehabilitates waste management facilities for communities and industries.

Our purpose is to create long-term sustainable value for our stakeholders and manage and mitigate potential negative impacts from our operations.

Some of the impacts we manage include noise and traffic congestion from our fleet, odour, dust and visual impacts.

Through proactive measures and regular engagement with our communities and key stakeholders – we believe we can operate safely and without incident for many years to come.

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Community Engagement

- We build and maintain relationships with local communities, businesses and other stakeholders to create value in the places we operate and manage some of the impacts brought about by our work.
- We are committed to continually improving our engagement practices, and building better and stronger relationships with communities.
- We are working with the Dardanup community reference group as the forum for two-way collaborative discussions.
- We are focussed on investment in the local Dardanup economy through local procurement (up to 30 organisations), local employment (13 direct employees) and we partner with the Activ Foundation to provide working opportunities on site, specifically weekly litter picking.

Environmental Standards

Dardanup landfill is managed to the highest environmental standards, observing relevant legislation and regulations, while respecting community expectations.

- We are committed to ensuring we maintain a robust environmental management system to minimise the impact of our operations on the physical environment and the communities where we operate.
- We strive to minimise the environmental impacts of waste management, including greenhouse gas emissions, toxic and hazardous waste containment, and water and air pollution.
- We are continually innovating and applying lessons learned to provide sustainable outcomes for all our stakeholders, including our employees, customers, investors and communities.
- Our Environmental Policy includes our aim of 'Zero Harm' to the environment and our commitment to upholding and continuing to improve our environmental standards.
- Our future strategy is to go beyond Zero Harm and create positive environmental impacts by shifting our focus towards environmental restoration and associated opportunities.
- However, before we realise these ambitions, we recognise there is more work to do to embed consistently high standards of environmental risk management across all of our operations and transparently report on our performance to our communities.

Our Environmental Policy includes our aim of 'Zero Harm' to the environment

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Class III Waste Facility, Banksia Road Dardanup

About the Dardanup site

Approval was granted by the State Administrative Tribunal in 2006 for a Class III (mid-level) landfill site to be developed at the Banksia Road site in Dardanup

The site is 175km south of Perth – and 6km south-west of the Dardanup townsite – services the surrounding Greater Bunbury Region, including industries throughout the wider South West

Cleanaway operates the site and, since 2006, has sought and obtained numerous Development Application approvals from the Shire of Dardanup for Class III waste cells (see **Map One**), stormwater and **leachate** ponds and internal infrastructure to service the public and industry

The landfill is licensed by the Department of Water and Environmental Regulation (DWER) under the Environmental Protection Act 1986 (EP Act) [L8904/2015/1 (L8904)]

About our operation

Licence terms

- The DWER licence allows Cleanaway to accept 350,000 tonnes per annum of Class III waste and 353,000 tonnes per annum of liquid waste.
- The licence also allows Cleanaway to store tailings from titanium dioxide processing.

Licence requirements

The licence requires Cleanaway to monitor and report on:

- Waste inputs and outputs
- Groundwater
- Landfill gas
- Complaints

Cleanaway submits an Annual Audit Report and an Annual Environmental Report to DWER at the end of March each year.

Activities onsite

- There are currently nine waste cells of which seven are being actively filled, in addition to the liquid and tailings waste disposal cells.
- The final project plan would see up to 22 cells on the site constructed and rehabilitated in sequence across the life of the project.

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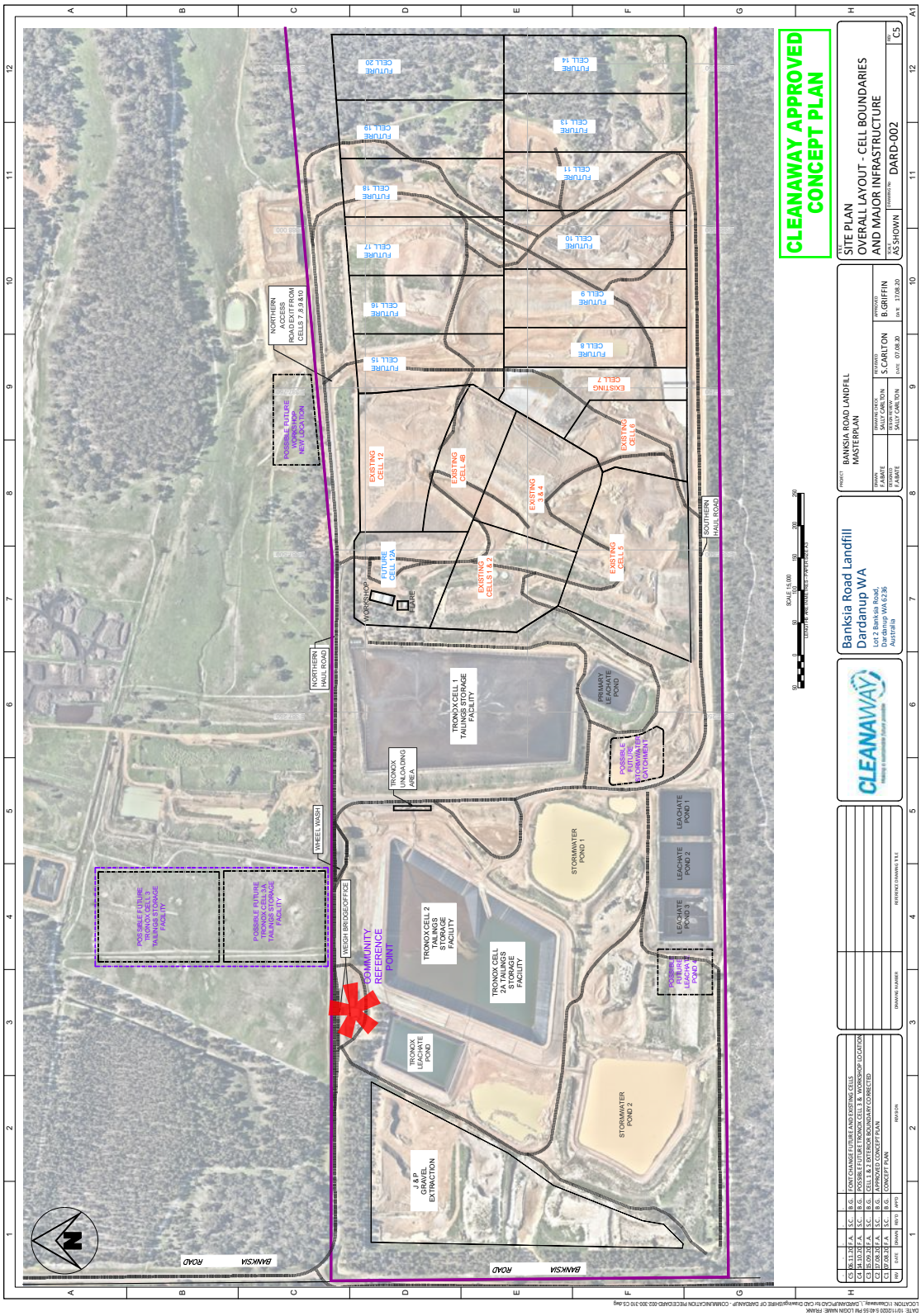
Map One Site Plan marking cell boundaries and major infrastructure



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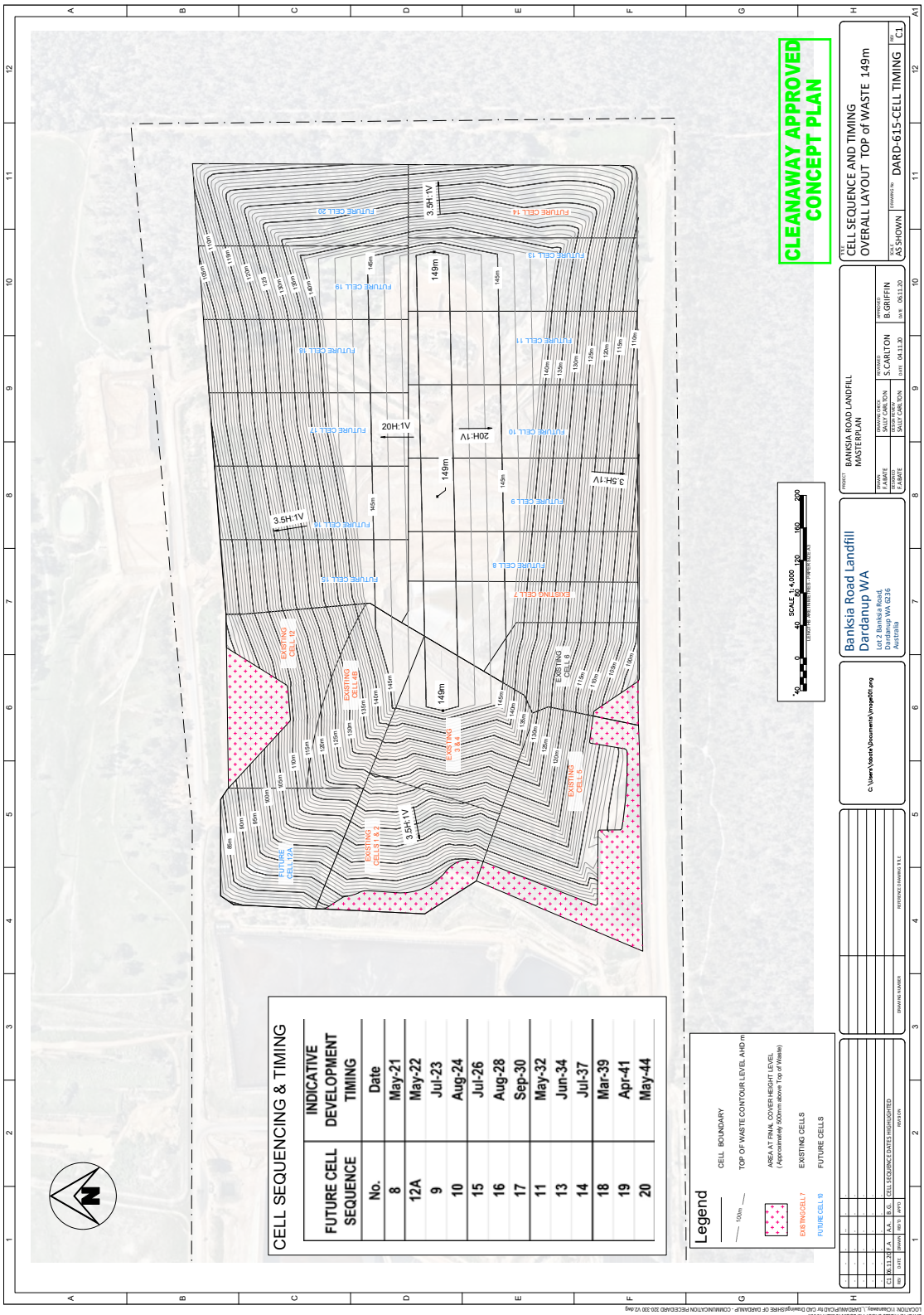
Map Two Cell Development Sequence and Timing



Masterplan and Development Sequence

Cell design

- Future cells have been progressively designed.
- Cell design is to environmental best practice in accordance with DWER guidelines .
- Cleanaway's Cells are purpose designed to protect against contamination to groundwater.
- The composite liner design which provides multiple layers of protection includes a geomembrane barrier which is composed of fully welded 2mm thick high-density polyethylene and a Geosynthetic Clay Liner (GCL) layer.
- Throughout the construction process the liner installation is quality verified by an independent third party.
- The increased width of future cells has been designed to provide more airspace per cell construction and is based on predicted waste tonnages.

Future cells

- Cleanaway's next priority will be construction of the already approved Cell 8.
- Pending approval Cells 12A, 9 & 10 would follow in sequence. A development application for these three cells is expected to be submitted to the Shire of Dardanup in December 2020.
- The future development of these cells will support the operation of the Dardanup facility for most of the next decade.

Final landform

- Public facing edges of the final landform will be covered with hydro mulch to assist with the visual impact and minimise dust.
- The landfill height will reach AHD 149m, which is consistent with the design submitted to DWER in 2016 and publicly advertised with Cell 6, 7 & 8 approvals.
- More information relating to rehabilitation and landscaping is included in this pack.

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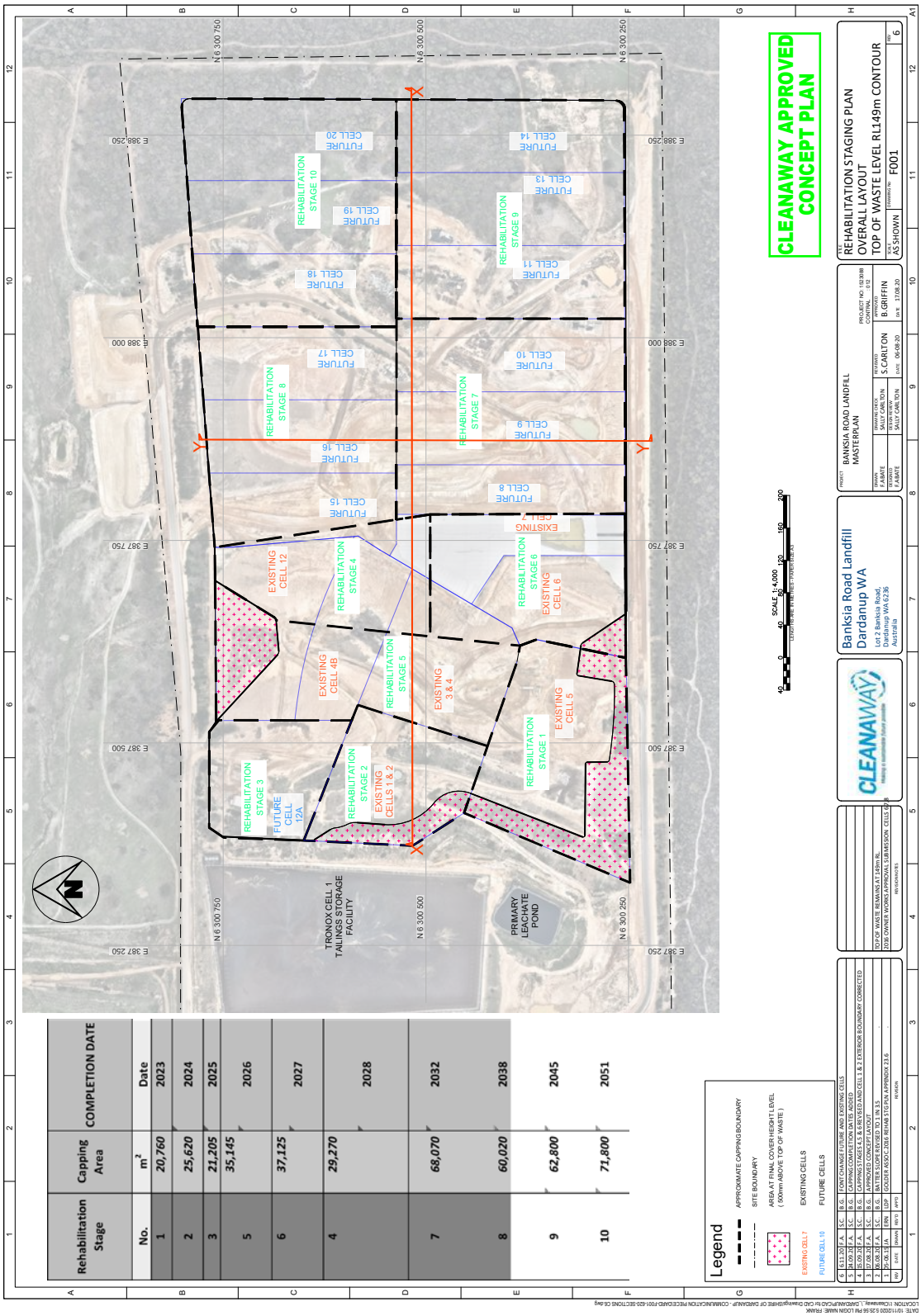
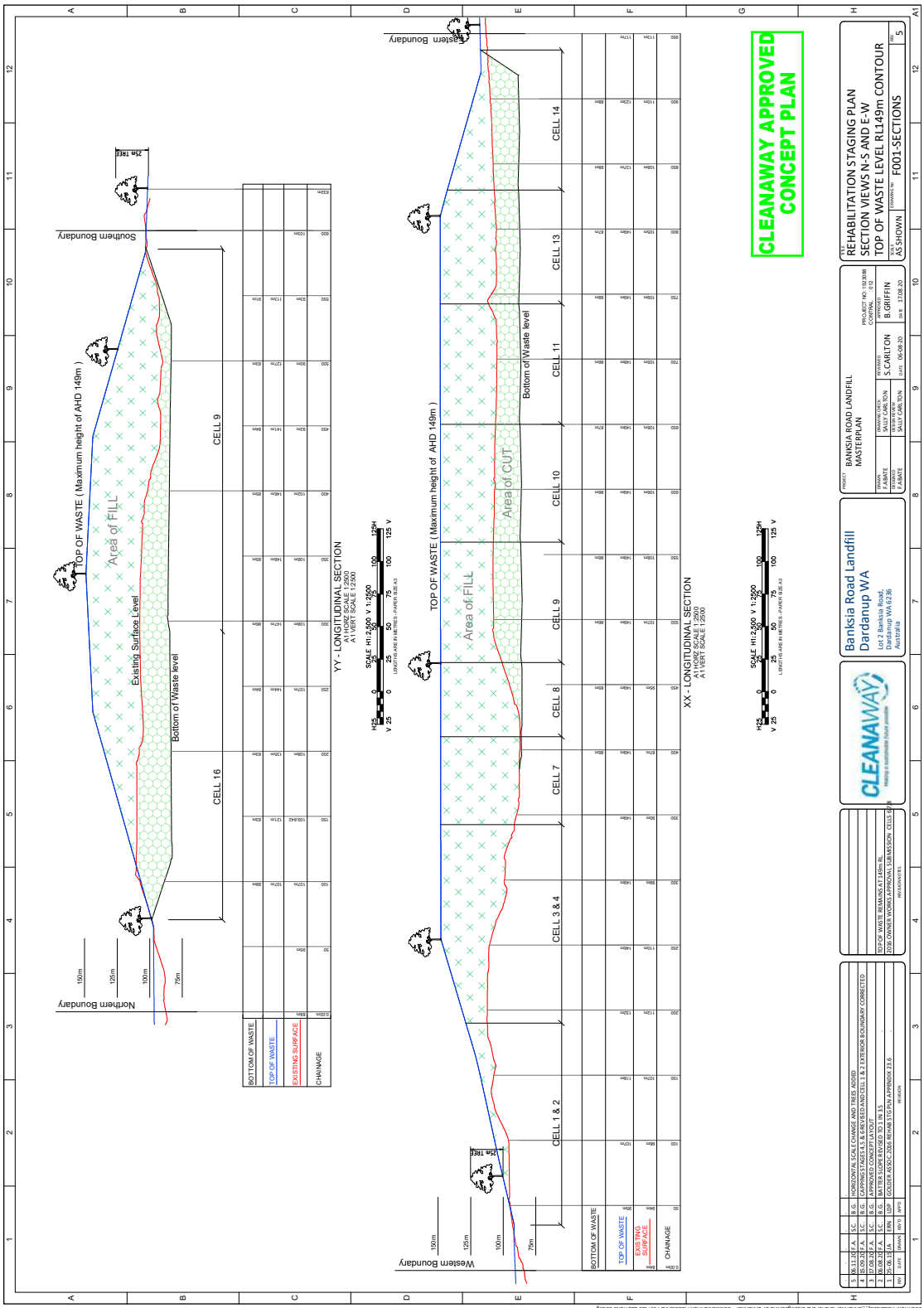
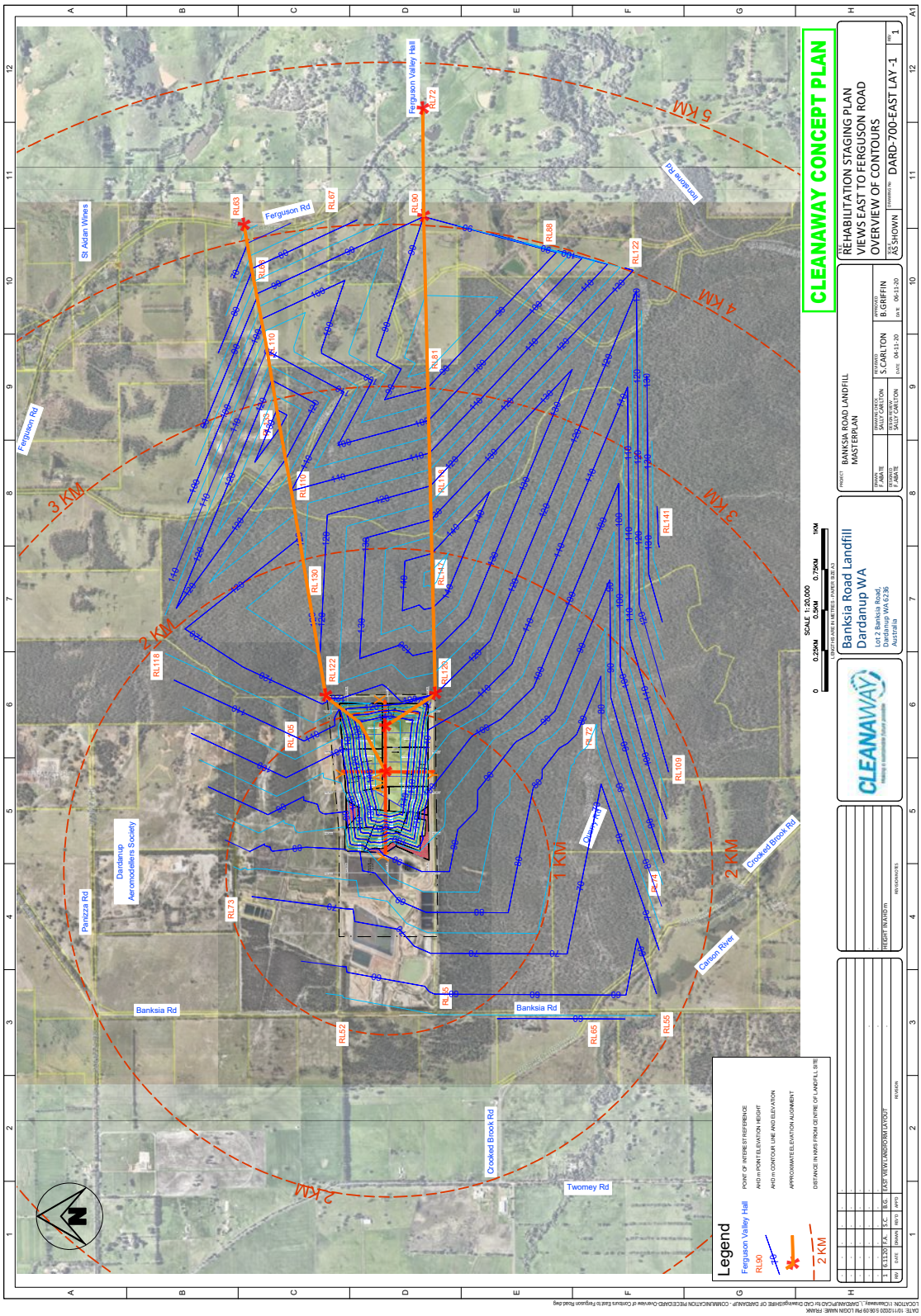
Map Three Rehabilitation staging plan overall site layout



Rehabilitation Stage	No.	Capping Area m²	COMPLETION DATE Date
	1	20,760	2023
	2	25,620	2024
	3	21,205	2025
	5	35,145	2026
	6	37,125	2027
	4	29,270	2028
	7	68,070	2032
	8	60,020	2038
	9	62,800	2045
	10	71,800	2051

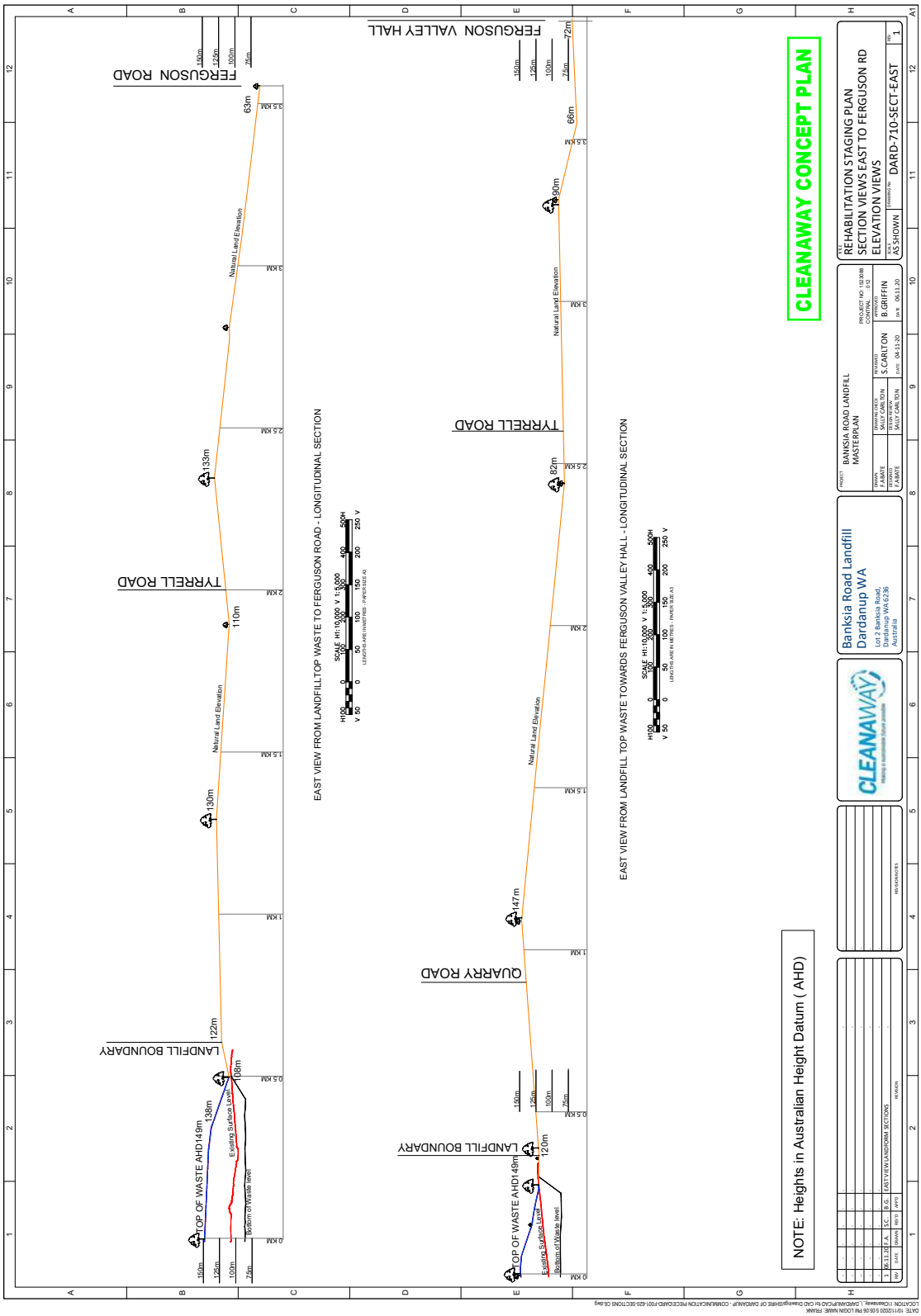
Map Four **Rehabilitation staging plan longitudinal section view**





Map Five Overview of rehabilitation contours relative to locality (east to Ferguson Road)

Map Six East view form landfill (top waste), relative to natural land elevation



Stormwater Management

Southern Stormwater Drain Upgrade Development Application

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Managing Water

Groundwater Management

Cleanaway undertakes numerous measures to ensure that we do not impact the local groundwater. To do this Cleanaway:

- Design landfill cells to ensure they have an adequate buffer distance between the base of the landfill and the top of the groundwater. At the Dardanup site, there is at least a 30 metre buffer between the outer lining of the cell and the Leederville Aquifer (water table). In addition, the ground is made up of very dense clay which is effectively impermeable. These are the primary reasons why this site was originally deemed as suitable for a landfill facility;
- Install a multiple-barrier lining system that ensures any leachate (water that comes into contact with the waste) is contained within the cell;
- Install a leachate collection system that removes the leachate from the cells and stores in a ponds for natural evaporation; and
- Regularly commissions third party specialists to undertake groundwater bore monitoring to ensure compliance and check that the lining system is performing as designed.

Stormwater management

- The primary objective of the stormwater system is to manage the runoff from site.
- The system is designed to separate “clean (Stormwater)” and “dirty” runoff water.

Stormwater runoff from the site is managed through a water management system consisting of:

- Two stormwater ponds
- A network of vegetated marshy ditches or swales, stormwater drains, channels and protective walls
- An underground stormwater drainage system

Southern Infrastructure Damage

In mid-2019 the southern drain failed in a number of locations, leading to an investigation.

The issue

- Damage to the system resulted in surface water flowing out of the drainage system.
- Water was then flowing into the adjacent Dardanup Conservation Park.
- Cleanaway has since commissioned specialists to develop design options that will repair/reinstate the southern drain.

The damage source

- A review of the drain and surrounding drain revealed the failure was a result of damage to the original drain liner.
- The source is a combination of erosion of the adjacent fire break on neighbours side, which then consequently caused erosion to the side wall of the drain, combined with liner deterioration and erosion from top section of drain.

How the leak occurred

- Initial damage resulted in water escaping through the liner and leading to greater erosion of the sidewall, ultimately leading to the stormwater flowing into the firebreak of the adjacent Dardanup Conservation Park.

Improved drainage solution

- During the investigation of possible solutions into the drain failures, Cleanaway discovered the southern boundary included more land space for us to develop an improved drainage solution.

Planned Infrastructure Upgrades

Cleanaway has been undertaking continuous review and upgrades of the stormwater management system since 2015. Urgent upgrades are currently going through the required approval process, with construction due to start in early 2021.

About the upgrades

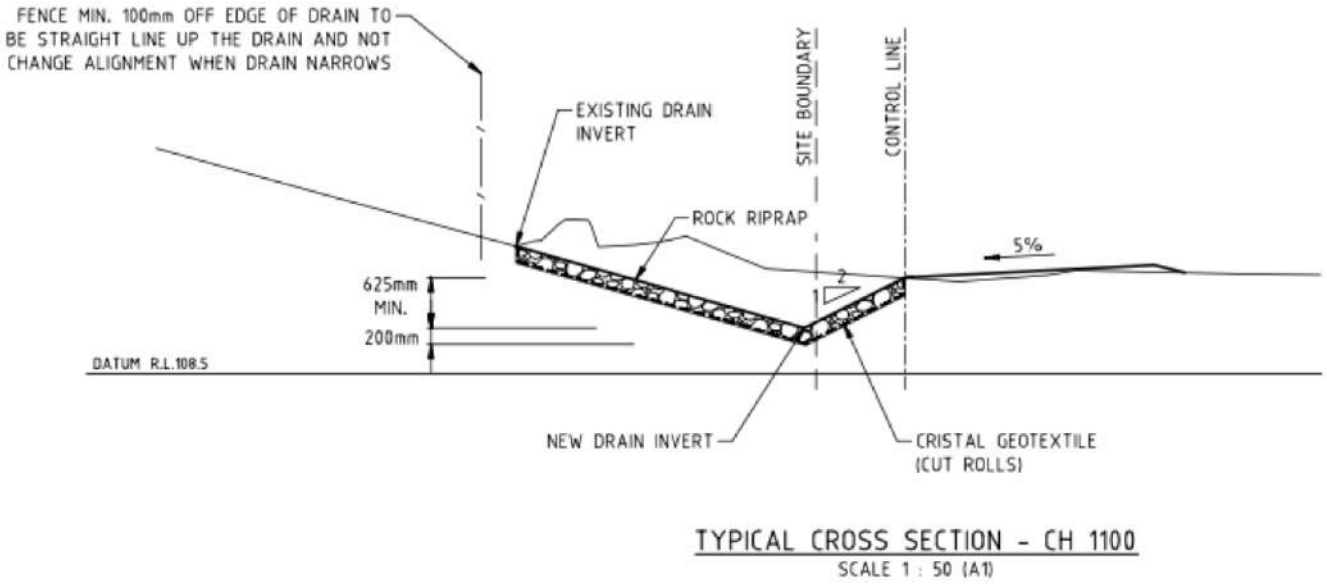
- Our solution will see an improved management of surface water along the southern boundary stormwater drain.
- The design considers the stormwater flow from our site and the adjacent Dardanup Conservation Park during an extreme storm event.
- Ongoing maintenance of the drain and fire track during winter and extreme storms will be a part of our program to maintain the effectiveness of the solution.

Upgrade design

- The upgrade design includes a V-shaped rock-lined drain and an adjacent fire track (which acts as an overflow guard).
- During peak storm events any overflow from the drain will flow down the fire track.
- The anticipated water flow will continue moving through the V-drain to remove accumulated silt downstream to a new silt trap and maintain the design capacity.
- The design incorporates efficient use of available space without impact on the adjacent Dardanup Conservation Park and provides a fire track that will be accessible in all but the most extreme rainfall events

Figure No. 5

IW Projects Drain Design – Various Sections



Dust Management Plan

Download here

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Control Methods and Dust Monitoring

General management

- Planning work around wind forecasts
- Using storm water dams and a water cart to suppress dust
- Applying further dust suppressant in high-risk areas.

Traffic management

- Street sweeping sealed roads
- Wheel washing operational vehicles exiting the site
- Sealing or covering loads – refusing to accept uncovered loads
- Applying speed restrictions to all site vehicles
- Using designated access roads wherever possible

Activity management

- Three water trucks, all fitted with front sprays, used during work hours.
- Covering new waste as soon as possible after tipping, and no later than the end of the working day
- Tipping at an appropriate height and with consideration to wind activity

Administrative controls

- Providing appropriate staff training
- Conducting monthly inspections
- Requiring staff and contractors to report observations of visible dust
- Issuing notifications of dust causing activities outside of normal/regular operations at least 48 hours in advance to the Shire and adjoining landowners.

Visual monitoring

- Our team assesses visible dust during working hours.
- If we see dust from a particular source or activity, we put in place measures to suppress it.

Air quality monitoring

- From November 2020 until April 2021, air quality monitoring will be in place to assess the effectiveness of the way we control dust emissions.
- The program will use three real-time nephelometer dust monitoring instruments to monitor windspeed and direction at sample sites (primarily boundary locations identified as being likely to be impacted by dust).
- The data collected will trigger a further set of procedures to either manage the dust, or if severe enough, stop work.
- Once complete a report of the data will be provided to the Shire.

Dust Impacts and Sources

Potential dust sources

- Wind erosion from dry waste material, or unsealed surfaces
- Vehicle movements – including on paved and unpaved roads
- Unloading vehicles, including tipping/emptying of waste.
- Use of heavy machinery including for spreading or compacting waste in the active landfill area

Potential impacts

- Dust is a recognised amenity issue – particularly for nearby residences
- Dust is not expected to occur at levels that pose a health risk

Fire Control Plan

Download here

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Fire Control Procedure

Cleanaway actively manages the risk of fire at the Dardanup site.

- Cleanaway regularly reviews the Fire Management Plan, including after any fire event, to minimise risks and ensure our response remains best practice.
- Potential fire sources
- Chemical reaction - those caused by an oxidizer or reactive agent;
- Ignition - those caused by hot sparks, matches, lighters, and;
- Spontaneous combustion- caused by batteries and aerosol cans or other waste items holding volatile combustion items

Fire management procedure

- Our fire control procedure outlines how we will respond to fire at our site.
- Cleanaway is responsible for the immediate response, containment and management of the fire.
- Relevant regulatory authorities will be notified in line with our license requirements.
- The primary stormwater dam is dedicated for fire fighting purposes, fitted with a hydrant system. A 50klt water bore is also available.
- Three water trucks are available for dust suppression and for responding to fire.

Landscaping and Rehabilitation Plan

Download here

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Rehabilitation Plan and Timeline

The Dardanup site will receive waste until approximately 2048, with a projected landfill footprint of 47.9ha

- Progressive rehabilitation will commence within 6 months from the completion of the cells or from when the cell has reached final capacity.
- Preparing the site for rehabilitation requires landfill capping and surface water management.
- We close, cap and transform the area so that it can be converted to a future use.

Surface water management

- A comprehensive stormwater plan [hyperlink to stormwater plan section] is already in place for managing surface water onsite.
- We will maintain the gradient of the land to prevent water forming in ponds.

Landfill reshape and capping

- The first step in rehabilitation involves reshaping onsite material to form the final profile of the site.
- Caps will then be installed to create a barrier from the waste, to ensure future vegetation can thrive and minimise moisture movement through to the underlying waste.

Site Preparation - Capping

Installation of cap lining

- There are two methods of application that have been assessed for the Dardanup.
- The preferred more sustainable option uses a two-metre thick layer of soil and mulch to cover the waste. The soil would then be planted with trees, shrubs and grasses. The combination of soil and vegetation will prevent water reaching the waste and reduce the amount of gas released to the atmosphere.
- We are currently trialing this option, which has had successful results at our **Fraser Road landfill rehabilitation**.
- The option is a composite synthetic cap which is a type of similar construction to the landfill base liner.

Landfill capping

- **Phytocap** engineering is proposed for the site. A phytocap is a soil and plant-based cap designed to minimise moisture movement through to the underlying waste while retaining sufficient moisture to support vegetation growth.
- Capping is expected to be done over 10 rehabilitation stages (see **Map Three**).
- This technology has been successfully used in our **Nuriootpa Landfill** rehabilitation plan.
- The Dardanup Phytocap trial is expected to run until spring in 2022.

The landfill lining and cap will ensure:

- A long-term stable barrier between waste and the environment, in order to protect human health and local environment.
- Prevention of the escape of uncontrolled landfill gas, ensuring the provided land is suitable for its intended post landfill use.

Future Vision - Site Landscaping Plan

Purpose

The Landscaping Plan provides an overview of how the Dardanup site will look.

Once complete, the site will offer a new recreational space – including native vegetation and grassy expanses.

The plan identifies five distinct areas (infrastructure, grassland, native woodland, buffer area, wetland) that require different vegetation management approaches.

Opportunities and constraints

- There are many opportunities for using best practice revegetation and restoration techniques to restore an area of habitat.
- However, significant constraints include the low summer rainfall and erodible natural soil composition.
- These factors are considered in our landscaping plan.
- A cost of more than $1 million is expected for executing this plan.
- Cleanaway will fund the cost of executing this plan.

Landscaping Plan - Vegetation

Seeds and planting

- Native seeds and nursery plants will be purchased from local, accredited collectors/suppliers.
- Non-native grasses will be purchased which meet seed certification standards.
- Seeds will be cultivated and planted onsite using either hand planting or planting machinery.

Fertilisers

- Fertilisers will only be used if nutrients are low and applied to non-native grasses as required.

Erosion

- To control erosion, special fences covered in woven material and fibre mats will protect soil from being dislodged.

Maintenance

- Once the initial landscaping works have been complete, our 36-month maintenance program will support the planting through to establishment and control weeds.
- Activities will include watering, herbicide spraying, replacement planting and general maintenance.
- Six-monthly general maintenance visits will be scheduled throughout the three - year maintenance period.

Monitoring and reporting

- To evaluate the success of the landscaping works we will implement a monitoring and reporting program.
- This will include reporting on a six-monthly vegetation assessment, and landscape report for Years 1-3 with a summary of works undertaken and analysis of established vegetation.

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Post-Closure Management Plans

- Cleanaway has management plans in place for ongoing monitoring of the site for 30 years post-closure to maintain an acceptable level of amenity and environmental management into the future

The post closure management plan addresses:

- **Ground water quality**, in accordance with DWER requirements ongoing testing requirements which currently will occur on a six-monthly basis (annual basis for PFAS and organics).
- **Landfill gas migration**, mitigated through the installation of gas extraction wells across filled areas of the landfill to ensure active landfill gas management
- **Landfill settlement** due to waste subsidence, mitigated through a continued monitoring regime and virtual inspection, as well as the addition of soil and re-established vegetation
- **Landfill cap free drainage capability**, with continuous annual aerial survey monitoring
- **Leachate generation and leachate evaporation rates**, with continuous monitoring on an annual to biennial basis
- **Vegetation health and coverage**, with a comprehensive landscaping management plan to be approved (link to plan)
- Continued **buffer distance maintenance**, ensuring a 500m separation distance between the Class III material and any sensitive land use

Contact Us

Should you wish to find out more about our company or our plans for the Dardanup site, please contact us.

You can visit our website, email us at

dardanup@cleanaway.com.au

or call our Community Hotline on

08 9719 9804

We look forward to hearing from you!

Glossary

Nephelometer - an instrument for measuring the concentration of suspended particulates by using a light beam and detector.

Leachate - water that has come into contact with waste

Phytocap - a soils-based cap designed to minimise the movement of moisture through to the underlying waste while retaining sufficient moisture to support vegetation growth.

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