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Environmental Management Plan

Milingimbi Waste Management Facility

East Arnhem Regional Council



Advice

Service

Knowledge

Acknowledgements

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

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CONTENTS

1	INTRODUCTION.....	1
1.1	Scope of the Plan	1
1.2	Revisions and Updates	1
2	LEGISLATIVE AND POLICY CONTEXT	3
2.1	Northern Territory Legislation	3
2.2	Commonwealth Legislation	3
2.3	Waste Management Guidelines for Small Communities	3
2.4	Guidelines for the Siting, Design and Management of Solid Waste Disposal Sites	3
2.5	Guideline for the Preparation of an Environmental Management Plan	4
3	ENVIRONMENTAL MANAGEMENT FRAMEWORK.....	5
3.1	Waste Management Strategy	5
3.2	Organisational Structure	5
4	BACKGROUND	6
4.1	Site History	6
4.2	Site Location	7
4.3	Current Operations	7
4.3.1	Waste disposal cells	8
4.3.2	Greenwaste disposal	12
4.3.3	Scrap Metal	12
4.3.4	ELV storage	13
4.3.5	Whitegoods storage	13
4.3.6	Listed waste collection	13
4.4	Infrastructure	14
4.5	Plant and Equipment.....	15
4.6	Proposed Operations	16
4.6.1	Relocation of the ELV storage area.....	16
4.6.2	Landfill staging and final landform.....	16
4.6.3	Borrow pits and stormwater sumps.....	18
4.6.4	Site security	18
5	EXISTING ENVIRONMENT	19
5.1	Receptors	19
5.2	Sites of Cultural Significance	20
5.3	Topography and Drainage	20
5.4	Geology and Lithology	20
5.5	Hydrogeology	20
5.6	Groundwater	21

5.7	Surface Water	21
5.8	Air Quality	21
5.9	Flora and Fauna	23
5.10	Fire Regimes	24
5.11	Climate	24
6	ENVIRONMENTAL RISK ASSESSMENT	27
6.1	Sources of Environmental Impact	27
6.2	Receptors of Potential Environmental Impacts	27
6.3	Pathways	27
6.4	Risk Matrix	27
6.4.1	Likelihood	27
6.4.2	Consequence	28
6.4.3	Risk rating	29
7	ENVIRONMENTAL MANAGEMENT STRATEGIES	36
7.1	Water	36
7.1.1	Stormwater	36
7.1.2	Groundwater	37
7.2	FIRE MANAGMENT	37
7.2.1	Waste separation and minimisation	38
7.2.2	Community education and awareness	39
7.2.3	Investigation of alternatives	39
7.3	Air	39
7.3.1	Landfill Gas	39
7.3.2	Odour	39
7.3.3	Dust	40
7.4	Windblown Litter	40
7.4.1	Load Control	40
7.4.2	Waste Handling	40
7.4.3	Portable Litter Screens	40
7.4.4	Perimeter fencing	40
7.4.5	Litter collection	40
7.5	Illegal Dumping	41
7.6	Disease Vectors and Introduced Fauna	41
7.7	Weed Control	41
7.8	Listed Waste Handling	42
8	CORRECTIVE ACTIONS AND CONTINGENCIES	43
8.1	Stormwater Emission	43
8.2	Leachate Contamination of Aquifer	43

8.3 Uncontrolled Fire 43

8.4 Chemical Fire 44

8.5 Disease Vectors and Introduced Fauna 44

8.6 Weed Control 44

8.7 Fuel and Chemical Spills 44

8.8 Serious Injury to User or Staff 45

8.9 Evacuation Plan 45

8.10 Asbestos Exposure 45

9 ENVIRONMENTAL MONITORING46

9.1 Facility Inspections 46

 9.1.1 Daily Inspections 46

 9.1.2 Weekly Inspections 46

 9.1.3 Monthly Inspections 46

9.2 Groundwater 47

 9.2.1 Sampling locations 47

 9.2.2 Sampling frequency 47

 9.2.3 Analysis 48

9.3 Complaints 48

9.4 Record keeping 48

10 LANDFILL CLOSURE, REHABILITATION, AND POST CLOSURE MANAGEMENT49

10.1 Final Capping Design 49

10.2 Progressive Rehabilitation 50

10.3 Post Closure Monitoring and Maintenance 50

 10.3.1 Landfill cap 50

 10.3.2 Stormwater System 52

 10.3.3 Groundwater Monitoring 52

 10.3.4 Recording 52

11 TRAINING, AWARENESS AND COMMUNICATION53

11.1 Staff Training 53

11.2 Community Awareness and Education 54

11.3 Communication 54

 11.3.1 Local Authority 54

 11.3.2 Direct communication 55

12 PERFORMANCE IMPROVEMENT PLAN56

13 AUDIT, REPORTING, AND REVIEW58

13.1 Annual Monitoring and Audit Report 58

13.2 Review 59

14 REFERENCES60

APPENDIX A - WIND ROSE DATA61

LIST OF FIGURES

Figure 3.1 - Organisational structure 5

Figure 4.1 - Facility location..... 7

Figure 4.2 - Aerial photo of Cell 1 (29/08/2019) 8

Figure 4.3 - Facility layout plan (26/08/2019) 9

Figure 4.4 - Aerial photo of Cell 2 (29/08/2019) 10

Figure 4.5 - Aerial photo of Cell 3 (29/08/2019) 10

Figure 4.6 - Aerial photo of Cell 4 (29/08/2019) 11

Figure 4.7 - Aerial photo of Cell 5 (29/08/2019) 11

Figure 4.8 - Photo of greenwaste storage area (29/08/2019) 12

Figure 4.9 - Photo of scrap metal storage area (29/08/2019) 12

Figure 4.10 - Photo of ELV storage area (29/08/2019) 13

Figure 4.11 - Photo of whitegoods storage area (29/08/2019) 13

Figure 4.12 - Photo of battery collection area (29/08/2019) 14

Figure 4.13 - Photo tyre collection area (29/08/2019) 14

Figure 4.14 - Facility entrance sign..... 15

Figure 4.15 - Proposed Facility layout 17

Figure 5.2 - Photo of lateritic soil profile typical at the site 20

Figure 5.2 - Construction and lithology log chart for Bore RN038234 20

Figure 5.3 - Hydrogeological cross section of Milingimbi Island, (a) south to north, and (b) west to east (Batelaan et al, 2015) 22

Figure 10.1- Proposed structure of the cap..... 49

LIST OF TABLES

Table 4.1 - Facility summary 6

Table 5.1 - Potential receptors of environmental impacts 19

Table 5.2 - Castlereagh Bay and associated islands flora and fauna (extracted from NRETAS, 2009) 23

Table 5.3 - Monthly climate statistics for Milingimbi 25

Table 5.4 - Predominant wind direction by month and season 26

Table 6.1 - Consequence categories and impact definitions..... 28

Table 6.2 - Risk calculator 29

Table 6.3 - Facility risk profile 30

Table 11.1 - Training requirements 53

Table 12.1 - Performance improvement actions..... 56

1 INTRODUCTION

ASK was commissioned by the East Arnhem Regional Council (the Council) to develop an Environmental Management Plan (EMP) for the Milingimbi Waste Management Facility (the Facility).

This EMP has been prepared considering the following documents:

- Waste Management Guidelines for Small Communities in the Northern Territory (LGANT, 2009);
- Guidelines for the Siting, Design and Management of Solid Waste Disposal Sites (NT EPA, 2013); and
- Guideline for the Preparation of an Environmental Management Plan (NT EPA, 2015).

The EMP commits the Council to undertaking various activities to ensure the landfill is operated in an environmentally responsible manner.

1.1 SCOPE OF THE PLAN

This EMP has been developed to facilitate the safe and efficient operation of the landfill and to ensure that the environment and the surrounding community is safeguarded from pollution and off-site effects. It describes the level of performance expected and practices for managing, operating, and monitoring the Facility.

The Council shall ensure that all staff and sub-contractors at the Facility are familiar with the relevant requirements described in this EMP.

A copy of this EMP shall be kept at the Milingimbi Council Office and Depot and be made available for inspection to the Department of Environment and Natural Resources (DENR) and the Northern Territory Environment Protection Authority (EPA) upon request. Further, the Council will ensure that the landfill and its associated facilities are operated in accordance with all regulatory requirements.

The EMP addresses the following:

- Legislative and policy context;
- Environmental management framework;
- Facility background and current operations;
- Description of existing environmental conditions;
- Environmental risk assessment;
- Environmental management strategies;
- Corrective actions and contingencies;
- Environmental monitoring;
- Landfill closure and rehabilitation;
- Training, awareness and communication;
- Performance Improvement Plan; and
- Audit, reporting, and review.

1.2 REVISIONS AND UPDATES

The EARC will review and update the EMP (as necessary) at least every three years. The purpose of the review is to:

- Evaluate the rate of landfilling and revise the Master Plan as required;
- Review site operations and identify areas where performance can be improved;
- Update the EMP to reflect any changes to Facility operations;
- Update the EMP to reflect regulatory changes;

- Update the EMP to reflect changes to Council, Territory and Federal strategic objectives; and
- Update the EMP to incorporate all changes arising from the review process.

2 LEGISLATIVE AND POLICY CONTEXT

2.1 NORTHERN TERRITORY LEGISLATION

Under the *NT Waste Management and Pollution Control Act 1998* an Environmental Protection Approval (EPA) is required to develop a landfill, regardless of the size of the community. Similarly, an Environmental Protection Licence (EPL) is required to operate a landfill for communities with more than 1000 people and landfills that accept Listed Waste. If the landfill accepts Listed Waste, the EPL only needs to cover the area where the Listed Waste is disposed, however if Listed Waste is mixed in and disposed with general waste an EPL is not required. If planning a new landfill or trench site, an assessment under the *Environment Assessment Act* may also be required.

As the Facility now services a population of over 1000 and accepts listed waste, Council will apply to the NT EPA for an EPL.

2.2 COMMONWEALTH LEGISLATION

In addition to Northern Territory requirements, Commonwealth legislation via the Australian Government may also have a role in environmental assessments and approval of a project, including under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) of matters relating to significant impacts of national environmental significance (NES). The Commonwealth Department of the Environment has its own Environmental Management Plan Guidelines for environmental impact assessments and approvals under the EPBC Act.

Commonwealth environmental legislation and guidelines are not considered relevant to this EMP as it does not have impacts of national environmental significance and does not require assessment under the EPBC Act.

2.3 WASTE MANAGEMENT GUIDELINES FOR SMALL COMMUNITIES

The Local Government Association of the Northern Territory (LGANT) *Waste Management Guidelines for Small Communities in the Northern Territory - Working Towards Best Practice* (the Guideline), provides a comprehensive guideline supporting communities with less than 1000 residents towards best practice in waste management.

The Guideline outlines applicable legislation and draws from the *Waste Management and Pollution Act* and provides information to councils on their responsibilities to prevent or minimise activities related to waste management that result in environmental harm. The four components identified by LGANT as striving towards best practice in waste management in small communities are: reduction of hazards associated with waste (Key Performance Area: Hazard Reduction); improving environmental management of waste (KPA: Environmental Protection); allowing communities to assess their current situation and provide initial steps for improved waste management; and providing guidance on the service delivery standards that should be aspired towards (KPA: Ongoing Site Management, and Service Delivery).

Whilst Milingimbi now has a population of over 1000, the LGANT Guidelines are still considered relevant and have been referred to in the development of this EMP.

2.4 GUIDELINES FOR THE SITING, DESIGN AND MANAGEMENT OF SOLID WASTE DISPOSAL SITES

The Northern Territory Environmental Protection Authority *Guidelines for the Siting, Design and Management of Solid Waste Disposal Sites In the Northern Territory* (Site Development Guideline) provides guidance to landfill operators, developers, planning authorities and regulatory bodies on landfill site development. This includes site selection, design, construction, operation, closure and post-closure management of municipal solid waste, and commercial and industrial (C&I) general waste landfill facilities, so that they can comply with the *Waste Management and Pollution Control Act*. The Site Development Guidelines purpose is to provide consistent and environmentally responsible approaches

to managing landfills in the Northern Territory and should be used for the planning of environmental approval and licensing for new landfills. The Site Development Guideline should be utilised for the planning of environmental approvals and licensing for new landfills sites, and expansion of existing sites, as well as application to existing landfill sites.

As the Milingimbi Facility is now servicing a population of more than 1000 and the Council intends to apply for an EPL, the Site Development Guidelines have been considered and referred to extensively in the development of this EMP.

2.5 GUIDELINE FOR THE PREPARATION OF AN ENVIRONMENTAL MANAGEMENT PLAN

The Northern Territory Environmental Protection Authority (NT EPA) *Guideline for the Preparation of an Environmental Management Plan* (EMP Guidelines) set clear guidelines for the development of EMPs for site/project specific plans. The objectives of the EMP Guidelines are to provide project proponents with advice on when and what is required in preparing an EMP for assessment by the NT EPA to ensure a minimum standards and consistent approach to EMP preparation.

There are four minimum EMP requirements which should document how:

- environmental risks associated with a project have been assessed, with good practice mitigation and management measures specified to ensure the risks will be properly managed throughout project life;
- the outcome from a project's environmental impact assessment will be implemented;
- compliance with environmental legislation and conditions of approval will be achieved; and
- environmental performance will be appropriately monitored and reported throughout the life of the project.

The Guidelines have been referred to extensively and the EMP developed to meet their requirements.

3 ENVIRONMENTAL MANAGEMENT FRAMEWORK

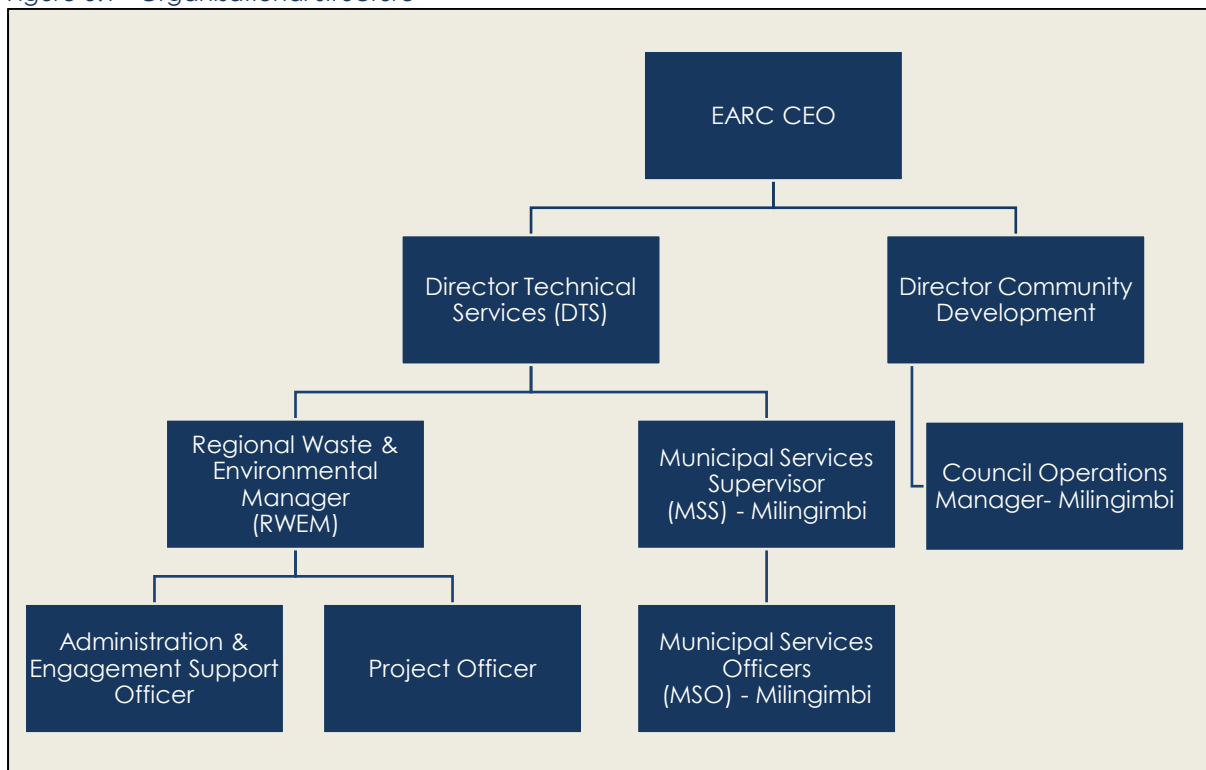
3.1 WASTE MANAGEMENT STRATEGY

Although the EARC does not currently have an overarching environmental management policy or system under which this EMP sits, it is currently developing a Waste Management Strategy that will be adopted by Council. The Strategy will include key actions and items identified in the Performance Improvement Plans included in this EMP (**Section 12**), and the EMPs for the other waste facilities operated by the EARC. It is intended that the Strategy be used to help source and allocate funding for actions that improve waste management services across the East Arnhem Land region and reduce environmental and human health risks. It shall include budget estimates for key actions and programs, implementation responsibilities, and delivery milestones that are prioritised on a risk basis.

3.2 ORGANISATIONAL STRUCTURE

The organisational structure of the EARC of relevance to implementation of this EMP is shown in **Figure 3.1** below.

Figure 3.1 - Organisational structure



4 BACKGROUND

Milingimbi Island is the largest island in the Crocodile Island Group in the Arafura Sea, NT, with a population of around 1097 people (2021 Census Data). Situated 200 kilometres West of Nhulunbuy and only accessible by plane or boat, the island is separated from the mainland by a narrow channel. After 40,000 years of Yolngu having occupied the area, a mission was established on Milingimbi island in 1923 by the Methodist Overseas Mission. Following the establishment of an air force base and bombings during World War 2, most of the Milingimbi population were forced to relocate to Elcho Island and the mainland. Milingimbi township was re-established by missionaries in the 1950s, and responsibility for administration of the community was transferred from the Church to Milingimbi Community Incorporated in 1974. Milingimbi was eventually incorporated into East Arnhem Shire in 2008, and the growing population and their housing, employment, health and waste management services are maintained by the East Arnhem Regional Council.

EARC operate the waste management facility to dispose of all waste generated on Milingimbi Island. This includes the landfilling of general waste in excavated unlined cells, the stockpiling of greenwaste, and the storing of scrap metal, end of life vehicles (ELVs), and white goods for recycling. Listed wastes received at the Facility (tyres and vehicle batteries) are regularly removed by Council staff for transport and disposal to appropriately licence facilities in Darwin.

A summary of the Facility site details is provided in **Table 4.1**.

Table 4.1 - Facility summary

Facility location:	The Facility is located approximately 1,100 metres northwest of the Milingimbi township on Rubbish Dump Access Road on NT Portion 1647, Milingimbi, Northern Territory 0822. Latitude: -12.096541° Longitude: 134.9047934°.
Land tenure:	Council has a Section 19 ALRA Lease for 12 years with a right for an additional 12 years from the Northern Land Council.
Operator:	East Arnhem Regional Council
Waste types received:	The Facility is operated by Council to receive all waste generated from the Milingimbi community, this includes Council collected domestic waste, self-hauled domestic waste and commercial waste. Waste types received at the Facility include putrescible, inert, and listed wastes (tyres, electronic, vehicle batteries).
Tonnage per annum:	Estimated to be approximately 1,200 tonnes per annum.
Size:	Approximately 4.3 hectares.
Population serviced:	1,097 residents based on 2021 Census data.
Method of construction:	Unlined below ground trenches and pits.
Opening date:	Evidence suggest the Facility began receiving waste sometime in the late 1980s to early 1990s.
Remaining operational life estimate:	As there are no alternative suitable sites on the island; it is likely that the Facility and the areas surrounding it will be used for waste disposal purposes as long as the community exists.

4.1 SITE HISTORY

It is believed waste disposal practices commenced in the vicinity of the current Facility in the late 1980s to early 1990's as no reference to a waste disposal facility on the island has been identified prior to this period. The earliest reference ASK could find to the existence of the Facility are NT parliamentary records (NT Government, 1995) that detail that Milingimbi received \$13,600 of funding in the 1994/95 financial year for the maintenance and operation of a landfill. A review of aerial imagery indicates that landfilling at Facility has been occurring at least since 2003.

A dedicated landfill may not have been necessary prior to the 1980s as waste generation would likely have been limited as there was less reliance on external goods that generate packaging waste, and plastic materials were significantly less common. Apart from small quantities of putrescible waste that

were likely burnt at a household scale, scrap metal would have been the largest waste stream and anecdotal evidence indicates that this was dumped in the sea surrounding Milingimbi island.

4.2 SITE LOCATION

The Facility is located on a large parcel of land identified as NT Portion 1647 that is owned by the Arnhem Land Aboriginal Land Trust. The site is located approximately 1,100 metres northwest of the Milingimbi township, and 300m north of the Milingimbi airstrip as is shown in **Figure 4.1** below. The whole site covers an area of approximately 4.3 hectares.

Figure 4.1 - Facility location



4.3 CURRENT OPERATIONS

The Facility is operated by Council to receive all waste generated from the Milingimbi community, this includes Council collected domestic waste, self-hauled domestic waste and commercial waste.

Council have adopted an estimate measure of waste based on the NT EPA Guidelines for the Siting, Design and Management of Solid Waste Disposal Sites in the Northern Territory for unmanned landfills (pp. 52). This involves conducting a survey over a seven day period each quarter and;

- a) count the number of vehicles entering and transporting waste into the facility;
- b) Record the vehicles according to their vehicle type, waste stream and material composition code;
- c) At the end of each week multiply the number of vehicles by the appropriate weight factor to determine the tonnage of waste received and transported that week; and

- d) Add all four weeks data together for each waste stream and multiply by 13 to estimate the annual amount of waste received and transported.

Based on this methodology Milngimbi Waste Management Facility currently receives approximately 300 -500 tonnes of general municipal waste each year.

Waste types accepted at the Facility include:

- General waste
- Greenwaste
- Scrap metal
- End of life vehicles (ELVs)
- White goods
- Listed wastes: Vehicle batteries, electronic waste and waste tyres.

The layout of the Facility and the locations of the various activities are presented in **Figure 4.3**.

4.3.1 Waste disposal cells

There are currently five distinct landfill cells at the Facility, four of which have been partially filled with waste. All cells have been excavated for below ground landfilling and are unlined.

Council has a Caterpillar 428F backhoe, Caterpillar 262D Skid Steer and Komatsu WA250 Loader that are utilised to compact and cover waste as required.

4.3.1.1 Cell 1

Cell 1 is the most western cell at the Facility and is approximately 40m long and 30m wide. It appears to have been constructed by excavating to a depth of approximately 1.5m below ground level (bgl) and storing the excavated soil in bunds on three sides of cell that are approximately one metre high.

As of October 2023, the Cell was being used for the disposal of commercial waste and was approximately 80% full. Waste was filled to a height of approximately 0.5 metres above the natural ground level.

Figure 4.2 - Aerial photo of Cell 1 (29/08/2019)



Figure 4.3 - Facility layout plan (26/08/2019)



4.3.1.2 Cell 2

Cell 2 is located immediately east of Cell 1 and is approximately 45m long and 40m wide. Like Cell 1 it has been excavated to a depth of 1.5m bgl with the excavated soil stored in bunds on three sides of the cell. At the time ASK visited the Facility, the Cell was being used for the disposal of domestic waste and was approximately 50% full. Waste was filled to a height of approximately 0.5 metres above the natural ground level.

Figure 4.4 - Aerial photo of Cell 2 (29/08/2019)



4.3.1.3 Cell 3

Cell 3 is located immediately east of Cell 2 and has the same approximate dimensions. When ASK visited the Facility, it was not actively being used for waste disposal, was filled to approximately 70% of its total capacity, and all waste had been covered with approximately 300mm of soil. Waste was filled to a height of approximately one metre above the natural ground level.

Figure 4.5 - Aerial photo of Cell 3 (29/08/2019)



4.3.1.4 Cell 4

Cell 4 is located immediately east of Cell 3 and is approximately 80m long and 45m wide. Waste has been filled to ground level in most areas and slightly above it in others. Although most waste has been covered with soil, some remains exposed as shown in **Figure 4.6**.

Figure 4.6 - Aerial photo of Cell 4 (29/08/2019)



4.3.1.5 Cell 5

Cell 5 is located to the south of Cell 4 and has not yet been used for the disposal of any waste. It is approximately 45m by 35m and has been excavated to a depth of 2m at its eastern edge. Soil removed during the excavation works has been stored in bunds surrounding the cell on three sides.

Figure 4.7 - Aerial photo of Cell 5 (29/08/2019)



4.3.2 Greenwaste disposal

Greenwaste is stockpiled in an area adjacent to the ELV Storage Area.

Figure 4.8 - Photo of greenwaste storage area (29/08/2019)



4.3.3 Scrap Metal

Scrap metal is stored in a designated area south of the Cells 3 and 4 for removal and recycling by a scrap metal business engaged by the Council to collect metals from all of the EARC communities. It is expected that the existing stockpile will be removed in 2020.

Figure 4.9 - Photo of scrap metal storage area (29/08/2019)



4.3.4 ELV storage

End of life vehicles (ELVs) are stored in a cleared area to the east of Cell 4.

Figure 4.10 - Photo of ELV storage area (29/08/2019)



4.3.5 Whitegoods storage

A whitegoods storage area is located between the battery and tyre collection areas. A contractor periodically visits the Facility to degas fridges and recover the refrigerants.

Figure 4.11 - Photo of whitegoods storage area (29/08/2019)



4.3.6 Listed waste collection

The Facility currently has designated areas for the collection of listed wastes including tyres and vehicle batteries.

Council personnel collect these items on a regular basis and transfer them to the Council Depot for packing and storage prior to them being transported to appropriately licenced disposal facilities in Darwin.

Figure 4.12 - Photo of battery collection area (29/08/2019)



Figure 4.13 - Photo tyre collection area (29/08/2019)



4.4 INFRASTRUCTURE

Infrastructure at the Facility is currently limited to the excavated waste disposal cells, unsealed site access roads, and limited entry and instructional signage.

Figure 4.14 - Facility entrance sign



4.5 PLANT AND EQUIPMENT

Whilst the Council does not currently store any plant or equipment onsite, the following equipment relevant to operation of the Facility is stored at the Council Depot:

- Hino 500 flatbed truck
- CAT 428F front loader and back hoe (pneumatic tyres)
- Komatsu WA250 front Loader
- Kubota M7040SU tractor with slasher for weed control and fire break maintenance
- Trailer with 1200 litre water tank and pump for fire control and dust suppression
- Chemical spill kits
- Chemical shower and eyewash kit
- Fire extinguishers
- Bunded storage pallets for waste oil and batteries

4.6 PROPOSED OPERATIONS

To improve the efficiency of operations at the Facility and minimise environmental impacts, the Council is developing a Master Plan for the Facility that aims to:

- Encourage waste separation and recycling.
- Increase the buffer distance between the Facility's eastern boundary and Restricted Works Area (RWA) 22.
- Minimise the perimeter of the Facility and disturbed areas.
- Enable a single CCTV camera to capture all activity at the Facility.
- Reduce windblown litter.
- Allocate areas to source cover and capping material and function as stormwater sumps.
- Allow for the establishment of an above ground landfill cell over existing waste cells to minimise leachate generation.

Figure 4.15 shows the proposed Facility layout and key components that will be incorporated in the Facility's Master Plan.

4.6.1 Relocation of the ELV storage area

Council intends to relocate the existing ELV storage area to the south of Cell 1. The existing ELV storage area will be closed and rehabilitated in order to provide a greater buffer distance between the Facility and RWA 22, consolidate waste activities, and reduce the total site perimeter.

4.6.2 Landfill staging and final landform

It is proposed that the landfill will be developed according to the following stages and estimated timeline:

- **Stage One (1-2 Years FY23 –FY24)**
 - 1) Temporarily close Cell 1 and cover the waste with 300mm of soil.
 - 2) Fill Cell 2 to ground level and cover the waste with 300mm of soil.
 - 3) Reopen Cell 1 and fill to ground level, cover the waste with 300mm of soil.
- **Stage 2 (2-4 Years FY24-FY27)**
 - 1) Fill Cell 3 to a height of approximately 1 metre above ground level (height of the bunds surrounding the Cell) and cover the waste with 300mm of soil.
 - 2) Fill Cell 2 to a height of approximately 1 metre above ground level (height of the bunds surrounding the Cell) and cover the waste with 300mm of soil.
 - 3) Fill Cell 1 to a height of approximately 1 metre above ground level (height of the bunds surrounding the Cell) and cover the waste with 300mm of soil.
- **Stage 3 (+5 Years – to be reviewed in FY25)**
 - 1) Working from east to west, progressively construct and fill an above ground cell that covers Cells 1, 2, 3 and 4. It is anticipated that this Stage 3 Cell would be approximately 70 metres wide and 300 metres long so that it totally covers Cells 1, 2, 3 and 4.
 - 2) The Stage 3 Cell will be constructed so that it peaks at a maximum height of 4 to 5 metres above ground level along its longitudinal axis, and have all gradients in the range of 11-14% which is within the 5-20% range specified by the NT EPA Guidelines (2013). This basic design would provide between 35,000 and 40,000 cubic metres of airspace and an estimated operational life of 20 to 30 years.
 - 3) Progressively cap and rehabilitate Stage 3 in accordance with **Section 10**.

The purpose of Stages 1, 2 and 3 is to ensure that all areas of the Facility containing buried waste are covered by above ground cells with capping that prevents water from entering the waste body and generating landfill leachate.

Figure 4.15 - Proposed Facility layout



4.6.3 *Borrow pits and stormwater sumps*

As additional soil will be required for the covering of waste and construction of the final landfill cap, it is proposed that soil be progressively extracted from borrow pits as shown in **Figure 4.14**. It is proposed that this be undertaken by:

- Clearing vegetation as required
- Scraping back the topsoil layer and stockpiling it separately.
- Extracting soil for waste cover and capping to a maximum depth of two metres.
- Levelling the borrow pit so that it has slopes no greater than 15%.
- Re-spreading the stockpiled topsoil across the borrow pit to facilitate revegetation.

In addition to providing the necessary soil for waste cover and final capping, the borrow pits will serve as stormwater sumps used to collect stormwater generated from capped sections of the landfill cell and disturbed areas of the Facility.

The area to the north of the landfill cells would be the largest source of soil for cover and capping purposes and would collect stormwater generated on the northern slope of the landfill cell.

A borrow pit will also be excavated to the south of Cell 1 to capture stormwater generated on the southwestern slopes of the landfill cell and the new ELV storage area.

It is proposed that Cell 5 not be used for waste disposal purposes and instead be converted into a stormwater sump servicing the recycling area and the south eastern slopes of the landfill cell. Conversion of Cell 5 is anticipated to involve the following actions:

- Removing the bunds of stockpiled soil and using it for waste cover, cell construction, or capping.
- Re-profiling the cell so that it has slopes less than 20%.
- Rehabilitation of the cell and disturbed areas surrounding it with native vegetation.

4.6.4 *Site security*

To improve management and security of the Facility, the Council has installed a pole mounted, motion sensing CCTV camera near the Facility entrance that records activity at the Facility and stream it to the Council's central office in Nhulunbuy. Such a system has already been employed at the Galiwin'ku and Ramingining waste facilities and has proved successful at improving the community's use of the Facilities whilst enabling Council to better collect tipping charges from commercial customers.

In 2023, 550m of 1800 high security fence with chainwire fabric in NTG Drawing CS3800 Amend 2 as well as a 7080mm RHS bar entry gate was installed along the Western and southern perimeter of the lease. This security fencing has blocked off previously used access tracks that residents utilised to cut through the facility to reduce unnecessary traffic through the site. The gate will also allow the facility to be closed temporarily when Council staff are operating earth moving machinery or conducting other landfill maintenance activity that requires increased safety precautions.

5 EXISTING ENVIRONMENT

Milingimbi and the surrounding Crocodile Islands are in the traditional homelands of the Maringa people. The Yolgnu Owners and Custodians of Milingimbi Lands group - including the Crocodile Island Rangers in conjunction with MOPRA (Milingimbi Outstations Progress Resource Aboriginal Corporation) - work with the Northern Land Council to care for the surrounding land and seas. The area is Aboriginal Freehold Land and is held by the Arnhem Land Aboriginal Land Trust. The surrounding region has a unique biodiverse backdrop with high conservation significance, hosting internationally significant migratory birds as well as marine turtles.

Tidal mudflats skirt Milingimbi Island and border the North of Milingimbi township which is met by a sandy beach to the East. Patches of mangroves exist to the North and North-East of Milingimbi township, with the South and West bordered by dry rainforest and lateritic plains which span inland Westward. Milingimbi Island is considered an isolated site with a current lack of expected development, which will help maintain the conservational values of the site. However, concerning degradation from sea-level rise due to climate change, and management of feral animal and weed species around Milingimbi and the wider region pose increasing threats.

The distribution of weed species is contained within travel to, from, and across Milingimbi Island, with some evidence of weed populations and feral animal activity around the Milingimbi waste facility. Burning and ongoing traditional fire regimes are common land management practices. Strong seasonal winds during the dry season, and monsoonal rain during the wet season create unique challenges for the overall management of the environment surrounding Milingimbi, and the wider Crocodile Islands and Arafura Swamp region on the mainland to the south.

5.1 RECEPTORS

Receptors of potential environmental impacts from the Facility are detailed in **Table 5.1** below. Distances between the Facility and receptors have been measured as the shortest distance between the perimeter of the Active Area (delineated yellow in **Figure 4.1**) and the perimeter of receptors.

Table 5.1 - Potential receptors of environmental impacts

Receptor Type	Description	Distance from perimeter of Active Area	Direction from Facility
Milingimbi Community	Residential and commercial buildings in the township	~1,020 m	East
Milingimbi Aerodrome	Tarmac airstrip used by regular turboprop charter flights in and out of Milingimbi Island.	~550 m	Southwest
Sacred sites	Restricted Works Area 22 encompassing sacred sites 5873-186, 5873-43A, 5873-43B, 5873-188	~50m	East
Surface water body	Seasonally inundated mudflats with fringing mangroves.	~400 m	North
Drinking water production bore	Water production bore RN38229 operated by the Power and Water Corporation to supply Milingimbi with drinking water.	~1,250 m	Southwest
Native vegetation	Vegetation containing native flora and fauna surrounds the Facility on all sides.	0 m	All directions

It should be noted that Australian aviation guidelines recommend that a buffer distance of 1,500 metres be maintained between aerodromes for piston engine propeller driven aircraft to minimise the risk of bird strike.

5.2 SITES OF CULTURAL SIGNIFICANCE

The Aboriginal Areas Protection Authority Certificate 201411929 identifies four sacred sites encompassed by a restricted works area (RWA 22) located approximately 50 metres east of the Facility's ELV storage area.

5.3 TOPOGRAPHY AND DRAINAGE

Although the topography of the site has been disturbed by landfilling activities there is a natural fall from south to north from the middle of the island towards the mudflats located north of the Facility. The natural gradients in the vicinity of the Facility are relatively flat as evidenced by a lack of natural drainage lines and erosion gullying. Highpoints at the Facility are the bunds surrounding landfill cells created from soil excavated from the cells. Landfill cells 1, 2 and 5 are the lowest points onsite and are likely to accumulate stormwater generated during the wet season until they are filled to ground level.

5.4 GEOLOGY AND LITHOLOGY

The regional geology involves an Upper Proterozoic unit referred to as the Wessel Group consisting of sedimentary sequences, specifically, Railwalla Shale overlain by the Marchinbar Sandstone and the Elcho Island formation (Power and Water Authority, 1991). Milingimbi Island is reported to largely consist of the Elcho Island formation overlain by Cretaceous sands with Cainozoic laterization (Power and Water Authority, 1991).

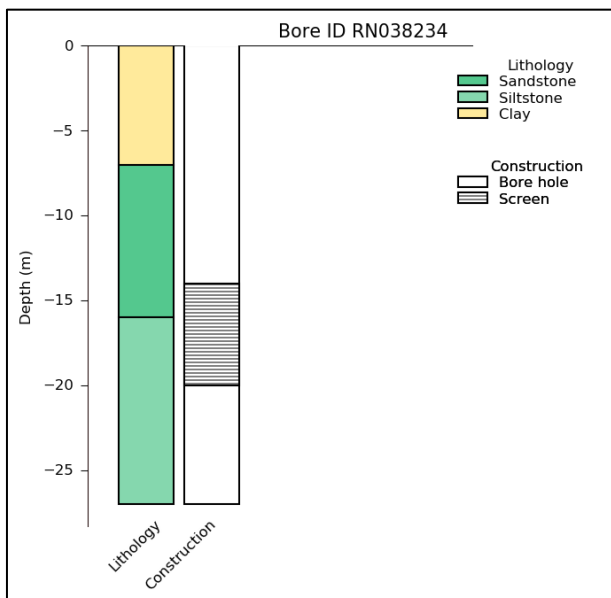
The lateritic profile is understood to extend to depths of 6 to 8 metres below ground level across the island (Yin Foo, 1982). It is this clay rich lateritic profile in which the Facility's waste cells have been excavated, **Figure 5.2** shows the lateritic soil profile present in the Cell 5 excavation.

Construction and lithology log charts for bore RN38234 which is located approximately 320 metres southwest from the Facility show the lateritic clay rich profile extending to depth of 7 metres, sitting atop a sandstone layer which extends to a depth of 16 metres, beneath which lies siltstone (**Figure 5.2**).

Figure 5.2 - Photo of lateritic soil profile typical at the site



Figure 5.2 - Construction and lithology log chart for Bore RN038234



5.5 HYDROGEOLOGY

The current conceptual hydrogeological model of Milingimbi Island (**Figure 5.3**) is largely based on the initial studies by Yin Foo (1982) and refined by Maria Woodgate (2014) following the provision of additional

geological information from a drilling program in 2013. Batelaan et al (2015) describe hydrogeological model as consisting of three main aquifers separated by two aquitards, specifically:

- "an upper near-surface aquifer (sandy clay, clay, claystone and laterite, average thickness 10 m; too small and shallow to exploit)";
- "a first aquitard consisting of fine sand, sandstone, and clay (average thickness 10 m)";
- "a central aquifer consisting of sand, gravel and sandstone (current community water supply, average thickness 8 m)";
- "a second aquitard of clay and siltstone (average thickness 6 m)"; and
- "a deep aquifer of fractured siltstone, chert, and siltstone (average thickness 13 m)".

Batelann et al (2015) report that the areal extent of the central and deep aquifers is currently understood to be limited to the central portion of the island, and that the two underlying aquifers are recharged by infiltration of seasonal rainfall through the overlying shallow aquifer.

Whilst the island's conceptual hydrogeological model is generally well understood, there remains significant uncertainties as to how the Facility fits within this model, for example:

- It is not certain as to whether the Facility sits atop of the central aquifer used for the community's water supply, or just outside of its areal extent.
- It is unknown whether there is connectivity between the shallow aquifer and the central aquifer in the vicinity of the Facility that could enable a leachate plume in the upper aquifer to impact the central aquifer.
- The direction of groundwater flow in the shallow aquifer is assumed to be towards the mudflats to the North but this cannot yet be confirmed.
- The depth to groundwater at the Facility is unknown. Standing water level (SWL) data collected at monitoring bore RN038234 (closest bore to the Facility) between October 2014 and December 2015 recorded SWL's ranging between 1.6 and 8.2 metres below ground level. If this data were applicable to the Facility, it would be expected that the base of the excavated landfill cells would be seasonally inundated by the shallow aquifer.

5.6 GROUNDWATER

Groundwater is extracted from the central aquifer to provide Milingimbi's water supply. Based on a review of groundwater bores on the Natural Resources Map NT, ASK understands that bore RN38229 serves as the island's main production bore operated by the Power and Water Corporation. Bore RN38229 is located approximately 1,250 metres southwest of the Facility.

5.7 SURFACE WATER

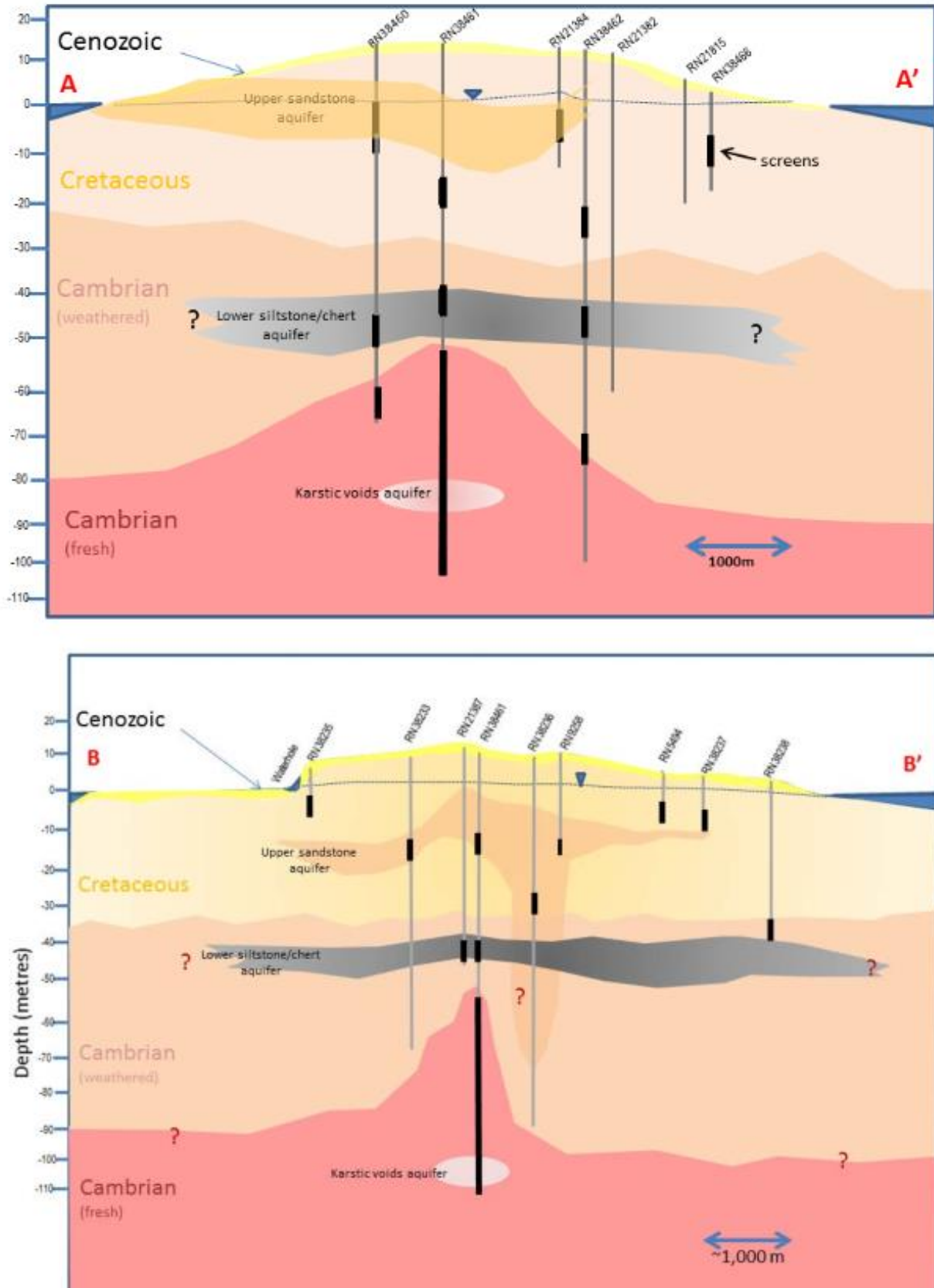
Extensive mudflats with fringing mangroves are located approximately 400 metres north of the Facility. These mudflats are seasonally inundated with surface water during the Northern Wet Season. There are no other permanent or seasonal watercourses and surface water bodies in proximity to the Facility.

5.8 AIR QUALITY

Although data on air quality is not available for the Milingimbi locality, the following observations on air quality were made when ASK visited Milingimbi and the Facility in late August 2019:

- Dust is generated by vehicle movements on unsealed roads surrounding the Milingimbi community
- Smoke is regularly generated from the traditional fire regimes maintained in East Arnhem Land

Figure 5.3 - Hydrogeological cross section of Milingimbi Island, (a) south to north, and (b) west to east (Batelaan et al, 2015)



5.9 FLORA AND FAUNA

The Castlereagh Bay region, encompassing the Crocodile Islands group and parts of the mainland directly south-southwest of Milingimbi Island, are internationally and nationally significant conservation sites. The region is recognised for its rock and sand islands, coastline, and extensive floodplains and tidal flats which host large quantities of migratory shorebirds in internationally significant numbers. The Islands support high numbers of colonial seabirds and marine turtles, and eight threatened species have been reported in the region. Details of the flora and fauna present in the Castlereagh Bay region are summarised in **Table 5.2** below.

Table 5.2 - Castlereagh Bay and associated islands flora and fauna (extracted from NRETAS, 2009)

	Significance Rating	National Significance
THREATENED SPECIES	Threatened plants and animals (Listings at National/NT level CR - Critically Endangered, EN - Endangered, VU - Vulnerable, NT - Near Threatened, LC - Least Concern, DD - Data Deficient)	Eight threatened species are reported from this site. Plants <ul style="list-style-type: none"> Australian Arenga palm <i>Arenga australasica</i> (VU/DD) Vertebrates <ul style="list-style-type: none"> Emu <i>Dromaius novaehollandiae</i> (-/VU) Partridge Pigeon <i>Geophaps smithii</i> (VU/VU) False Water-rat <i>Xeromys myoides</i> (VU/DD) Yellow-spotted Monitor <i>Varanus panoptes</i> (-/VU) Flatback Turtle <i>Natator depressus</i> (VU/DD) Green Turtle <i>Chelonia mydas</i> (VU/LC) (Chatto and Baker 2008) Olive Ridley Turtle <i>Lepidochelys olivacea</i> (EN/DD) <p>In the NT, the False Water-rat is only known from 10 records at six sites, and some of the most recent records are from the Glyde River floodplain in 1998 and 1999 (Woinarski <i>et al.</i> 2000).</p>
	Significance Rating	Not Significant
EDEMIC SPECIES	Notes	Endemic to the NT: 27 plant and three vertebrate species recorded in this site are endemic to the NT. Other: One plant species is only known from the site within the NT and one is only known from the Arnhem Coast bioregion within the NT, but both species also occur in other states.
	Significance Rating	International Significance
WILDLIFE AGGREGATIONS	Marine turtles	Sandy beaches on the islands of Mooroongga, Little Mooroongga, and North West Crocodile are significant for Flatback, Green, and Olive Ridley Turtles (Chatto and Baker 2008), although Flatback and Olive Ridley Turtles are the dominant nesting species. Here we consider the site of National significance to marine turtles.
	Seabirds	The small off-shore rock and sand islands north-east of Milingimbi are significant nesting sites for colonial breeding seabirds. Colonies on North West and North East Crocodile Islands (S013, S014) support large numbers of Crested Terns (10,000+) and Bridled Terns and are considered to be nationally significant (Chatto 2001).
	Waterbirds	This site is dominated by tidal flats but is frequented by some waterbirds. Chatto (2006) notes eight important waterbird records for this site, including counts of low thousands of ducks that are regionally important. One waterbird breeding colony dominated by 2000 egrets is reported from mangroves in this site (Chatto 2000a).
	Shorebirds	The extensive areas of intertidal mudflats in Castlereagh Bay support some of the largest flocks of shorebirds in the Top End. The area regularly supports >20 000 shorebirds, with highest counts of 30 500+ (1998) and 28 500 (1992) (Chatto 2003). Great Knots and Bar-tailed Godwits dominated these counts. Maximum counts of species that are internationally significant (> 1% East Asian-Australasian Flyway population; Bamford <i>et al.</i> 2008) include: 7000 Bar-tailed Godwit; 800 Terek Sandpiper; 4400 Great Knot (Chatto 2003); 700 Far Eastern Curlew; 456 Ruddy Turnstone; 800 Grey-tailed Tattler (Chatto 2000b). Maximum counts of Pied Oystercatcher (320) (non-migratory shorebird) (Chatto 2003) is also internationally significant (>1% global population; G. Dutton in prep.). There are 42 important shorebird records for this site (R. Chatto, NRETAS <i>unpubl</i>), including the significant counts identified above and other counts of regional importance.
	Other aggregations	None known
WETLANDS	Significance Rating	National Significance (possible International)
	Ramsar criteria met	This site has not been formally assessed against Ramsar criteria but is likely to satisfy at least waterbird based criteria (criterion 5: important waterbird aggregation site with >20 000 waterbirds; criterion 6: regularly supports >1% of the individuals in a population) for listing as a wetland of international importance under the Ramsar Convention.
	DIWA criteria met	This site has not been assessed against the criteria for listing as a wetland of national significance.

	Notes	<p>This site has been nominated as a national High Conservation Value Aquatic Ecosystem (the finalised list of HCVAE will replace the DIWA list), and is a priority HCVAE in the Caring for our Country Business Plan 2009-2010 (Commonwealth of Australia 2008).</p> <p>The floodplain area of this site is small in comparison to the adjacent Arafura Swamp and Bylth-Caddell River floodplains, but may still carry important wetland values. The site is a priority High Conservation Value Aquatic Ecosystem (Commonwealth of Australia 2008) and a target for investment in the Caring for our Country Business Plan 2009-2010.</p>
	Rivers	<p>The site encompasses the Glyde River between the Arafura Swamp and its outlet into Castlereagh Bay. Excess freshwater from the swamp drains across levee banks, or through an array of collection gutters, into the tidal channel of the river, which meanders for about 44 km across the 15 km-wide coastal plain (Brennan <i>et al.</i> 2003). This is an unusual river system in the Top End.</p>
FLORA	Significance Rating	Regional Significance
	Notes	<p>Rainforest: About 1 440 ha of rainforest (or 1% of the NT rainforest estate) occur in this site. Most is dry rainforest and occurs as small patches <100 ha, but larger patches are found on Milingimbi and adjacent islands and two patches are >100 ha (Russell-Smith 1991).</p>
OTHER ENVIRONMENTAL VALUES		<p>The Glyde River supports high densities of Saltwater Crocodiles which are amongst the highest of all rivers surveyed in the Top End (Fukuda <i>et al.</i> 2007).</p> <p>The Chestnut Rail is a range-restricted species that is reported from mangrove areas in this site (Chatto 2006).</p> <p>Forty two species recorded from this site are listed under international conventions or bilateral agreements protecting migratory animals.</p> <p>Castlereagh Bay is identified as an internationally important site for migratory shorebirds in the East Asian-Australasian Flyway (Bamford <i>et al.</i> 2008).</p> <p>The coastal fringe of Milingimbi Island and the small inshore islands of Darbada, Crocodile, Yabooma, Gananggargur and Moorongga, are proposed to be nominated by Birds Australia as an internationally-recognised <i>Important Bird Area</i> (G. Dutton in prep.) due to records of Chestnut Rail and significant counts of Pied Oystercatchers and migratory shorebirds.</p> <p>The Arafura Swamp is listed on the Register of the National Estate for its natural values (Australian Heritage Council) and part of it lies within this site.</p> <p>The isolation of the site and current lack of proposed development will help to maintain the conservation values of the site in the medium term (Chatto 2000b).</p> <p>The marine areas within this site are likely to encompass significant biodiversity values and these are currently being explored and collated in a project by the Marine Biodiversity Group of NRETAS (K. Edyvane, NRETAS, pers. comm.).</p>

5.10 FIRE REGIMES

Burning practices are similar across East Arnhem Land, with fire regimes like frequent controlled burning of patches of bushland during the dry season in place for a number of ecological and cultural reasons. Frequent controlled burning is done for sustainable management of habitats, hunting and food gathering practices, encouraging biodiverse growth, pest and weed control, and to lower the risks of large uncontrollable bushfires later in the dry season.

In Milingimbi, land management practices, including burning, is a focus area of the Crocodile Islands Ranger group. Some burning practices across East Arnhem Land extend to current land management practices to reduce the possibility of wind-blown litter, control weeds, deter animal scavenging, and prevent people from accessing culturally significant areas.

5.11 CLIMATE

The Bureau of Meteorology has collected climate data from the Milingimbi (Site 014402) and Milingimbi Airport (Site 014404) weather stations between 1939 and 2019. The average monthly climate data has been summarised in **Table 5.3**. The area receives an average annual rainfall of 1156.6mm with the vast majority of it falling between December and April. Temperature variations are moderated by the coastal location with an annual mean maximum of 32.3°C and an annual mean minimum of 23.1°C.

Table 5.3 - Monthly climate statistics for Milingimbi

Climate Statistic	January	February	March	April	May	June	July	August	September	October	November	December	Annual
TEMPERATURE¹													
Mean maximum temperature (°C)	32.9	32.8	32.4	32.3	32	30.7	30.5	30.9	31.9	33	33.8	33.9	32.3
Mean minimum temperature (°C)	25.5	25.3	24.9	24	22.5	20	19.3	19.2	21.3	23.7	25.5	26	23.1
RAINFALL²													
Mean monthly rainfall (mm)	283.9	229.9	266.2	129	26.9	6.2	3.1	2.2	3.9	7.9	62.6	148.6	1156.6
Decile 5 (median) monthly rainfall (mm)	216.7	223	257.8	60.9	15.7	0	1.5	0	0	0.9	30.2	145.5	1193.8
Mean number of days of rain >= 1 (mm)	12.6	11.4	14.1	9.1	3.7	0.6	0.5	0.1	0.5	1	3.7	7.8	65.1
Mean number of days of rain >= 10 (mm)	6.8	6.1	6.8	3.4	0.6	0.1	0.2	0.1	0.1	0.3	1.7	4	30.2
Mean number of days of rain >= 25 (mm)	3.7	3.4	2.9	1.6	0.3	0.1	0	0.1	0.1	0.1	0.8	1.8	14.9
9AM CONDITIONS³													
Mean 9am temperature (°C)	28.1	27.6	27.5	27	25.4	23	22	22.8	25	27.7	29.4	29.1	26.2
Mean 9am relative humidity (%)	83	85	85	81	80	79	79	80	78	75	73	76	79
Mean 9am wind speed (km/h)	8.6	9	8.1	9.7	11.3	11.9	10.7	9.9	9.3	8.5	7.7	8.2	9.4
3PM CONDITIONS⁴													
Mean 3pm temperature (°C)	30.8	30.2	30.4	30.5	30	28.3	28	28.9	30.3	31.7	32.4	31.9	30.3
Mean 3pm relative humidity (%)	73	75	72	66	62	61	59	57	57	58	60	65	64
Mean 3pm wind speed (km/h)	12.8	13.7	11.4	9.8	10.9	11.2	11.3	10.7	11.5	12.4	12.9	13.4	11.8

Annual and monthly average wind Rose data for Milingimbi (Site 014402) is presented in Appendix A for 9am and 3pm conditions. The annual averages show that south easterly winds are predominant in the mornings with the wind swinging to the northeast in the afternoons.

¹ Milingimbi Airport (Site 014404) 2003-2019

² Milingimbi Airport (Site 014404) 2003-2019

³ Milingimbi weather station (Site 014402) 1939-2003

⁴ Milingimbi weather station (Site 014402) 1939-2003

The monthly average wind roses were reviewed by ASK and summarised in **Table 5.4** that shows the predominant wind direction for each month at 9am and 3pm. It can be seen that the Northern Dry season is dominated by easterly biased wind direction whereas the Northern Wet Season has a higher predominance of northerly and westerly wind conditions.

Table 5.4 - Predominant wind direction by month and season

Season	Month	Predominant Wind Direction	
		9am	3pm
Northern Wet Season	November	East	North East
	December	All directions	North
	January	West	North West
	February	West	North West
	March	South East	North
	April	South East	East
Northern Dry Season	May	South East	East
	June	South East	East
	July	South East	East
	August	South East	North East
	September	South East	North East
	October	East	North East

6 ENVIRONMENTAL RISK ASSESSMENT

For the purposes of the risk assessment, the key definitions are as follows:

- Source – The prime mover to cause significant contamination or harm to the environment.
- Pathway – The route by which potential contamination or harm can migrate.
- Receptor – The on-site and off-site location where the impact or harm is registered.

6.1 SOURCES OF ENVIRONMENTAL IMPACT

The sources of environmental impact during the operation of the Facility include:

- Fire
- Vermin
- Landfill gas (LFG) / odour
- Leachate
- Dust
- Litter
- Invasive flora species

6.2 RECEPTORS OF POTENTIAL ENVIRONMENTAL IMPACTS

The possible receptors of the impacts include:

- Surrounding land users – businesses and communities surrounding the Facility.
- Surrounding infrastructure – buildings, road corridors, powerlines, etc in close proximity to the Facility.
- Surface water – permanent or semi-permanent surface water which provides a habitat for flora and fauna.
- Groundwater – groundwater at the site that recharges the onsite wetland or from which a water supply may be extracted for industrial or potable purposes.
- Vegetation and flora – onsite and offsite vegetation and flora species (e.g. grass or shrubs).
- Fauna – species whose habitat is within the landfill site or the surrounding area.

6.3 PATHWAYS

The key pathways include:

- Airborne - through which lightweight materials such as dust, odour and landfill gas travel;
- Surface transport - along which the sources of impact can travel (e.g. surface water runoff);
- Sub-surface flow - whereby the underlying soils, bedrock, aquifers and infrastructure permit contaminants to pass to the soil and groundwater receptors below.

6.4 RISK MATRIX

Risk is defined as a coupled function of likelihood and consequence, based on the levels shown in the following sub-sections.

6.4.1 Likelihood

Likelihood is measured in terms of probability, defined on a scale of 1 to 5, based on the following classification:

1. Rare - The risk event may only occur in exceptional circumstances
2. Unlikely - The risk event will probably not occur in most circumstances

3. Possible - The risk event could occur at some time
4. Likely - The risk event will probably occur in most circumstances
5. Almost Certain - The risk event is expected to occur in most circumstances

6.4.2 Consequence

Consequence is categorised as shown in **Table 6.1**. ASK has applied a scale of A – E for ease of reporting.

Table 6.1 - Consequence categories and impact definitions

	Environment	Public health and amenity
Slight (A)	<ul style="list-style-type: none"> • On-site impact: minimal • Specific Consequence Criteria (for environment) met 	<ul style="list-style-type: none"> • Local scale: minimal impacts to amenity • Specific Consequence Criteria (for public health) criteria met
Minor (B)	<ul style="list-style-type: none"> • On-site impacts: low level • Off-site impacts local scale: minimal • Off-site impacts wider scale: not detectable • Specific Consequence Criteria (for environment) likely to be met 	<ul style="list-style-type: none"> • Specific Consequence Criteria (for public health) are likely to be met • Local scale impacts: low level impact to amenity
Moderate (C)	<ul style="list-style-type: none"> • On-site impacts: mid-level • Off-site impacts local scale: low level • Off-site impacts wider scale: minimal • Specific Consequence Criteria (for environment) are at risk of not being met 	<ul style="list-style-type: none"> • Adverse health effects: low level or occasional medical treatment • Specific Consequence Criteria (for public health) are at risk of not being met • Local scale impacts: mid-level impact to amenity
Major (D)	<ul style="list-style-type: none"> • On-site impacts: high level • Off-site impacts local scale: mid-level • Off-site impacts wider scale: low level • Short term impact to an area of high conservation value or special significance • Specific Consequence Criteria (for environment) are exceeded 	<ul style="list-style-type: none"> • Adverse health effects: mid-level or frequent medical treatment • Specific Consequence Criteria (for public health) are exceeded • Local scale impacts: high level impact to amenity
Severe (E)	<ul style="list-style-type: none"> • On-site impacts: catastrophic • Off-site impacts local scale: high level or above • Off-site impacts wider scale: mid-level or above • Mid to long term or permanent impact to an area of high conservation value or special significance • Specific Consequence Criteria (for environment) are significantly exceeded 	<ul style="list-style-type: none"> • Loss of life • Adverse health effects: high level or ongoing medical treatment • Specific Consequence Criteria (for public health) are significantly exceeded • Local scale impacts: permanent loss of amenity

6.4.3 Risk rating

Risk is assessed on the combination of likelihood and consequence levels by a qualitative risk calculator, with the classification system shown in **Table 6.2**.

Table 6.2 - Risk calculator

Likelihood	Consequence				
	Slight	Minor	Moderate	Major	Severe
	A	B	C	D	E
Almost certainly (5)	5A	5B	5C	5D	5E
Likely (4)	4A	4B	4C	4D	4E
Possible (3)	3A	3B	3C	3D	3E
Unlikely (2)	2A	2B	2C	2D	2E
Rare (1)	1A	1B	1C	1D	1E

The risk rating is given a rating out of four possible levels, with appropriate actions associated with each as follows:

	Low risk	Rectify hazard as appropriate
	Medium risk	Plan and schedule appropriate controls
	High risk	Implement high level controls
	Extreme risk	Conduct full analysis

Table 6.3 shows the risk profile for the operational phase of the Facility, including the identified source, pathway, receptor (S-P-R) linkage.

Table 6.3 - Facility risk profile

Source	Receptor	Pathway	Pathway description	Risk description	Risk	Justification	Mitigation measures
Landfill leachate	Site users and workers	Air	Ponded landfill leachate is volatilised and becomes airborne.	Nuisance caused by the odour.	Low (3A)	It is possible for leachate to pond in the below ground landfill cells during the wet season which may result in odour nuisance.	Section 7.1.1
	Milingimbi community - residents	Subsurface	Leachate migration via groundwater & extraction via production bores	Leachate contaminates the freshwater aquifer and is extracted to supply potable water to the community.	Extreme (3E)	Although leachate generation is thought to be low considering the small quantities of putrescible waste received there remains a risk that leachate will impact the central aquifer used for water production. Whilst unlikely, significant contamination of the aquifer would affect the viability of the community due to the island's limited water resources. Considering the severity of the potential impact to the community, a detailed hydrogeological investigation will be undertaken to assess the risk more accurately.	Section 7.1.2
	Offsite Ecological Receptors – Surface water bodies	Surface	Leachate migration via surface water runoff.	Contaminated surface water run-off impacting the ecological receptors.	Low (1A)	The absence of drainage channels and erosion in the vicinity of the Facility indicate that surface water runoff is limited.	Section 7.1.1
		Subsurface	Vertical and lateral migration of leachate within the groundwater	Contaminated groundwater reaching the surface. Direct or indirect consumption of the leachate. Contaminants causing adverse impacts to these receptors & associated ecosystems	Low (2A)	Groundwater flow within the shallow aquifer is assumed to be towards the north in the direction of the mudflats. Although it is possible that leachate contaminated groundwater may express itself at the interface of the laterite and the mud flats, the total concentration of contaminants is likely to be below the limits of detection due to the attenuation processes it will be exposed to whilst passing through more than 300 metres of clay rich laterite.	Section 7.1.2

Source	Receptor	Pathway	Pathway description	Risk description	Risk	Justification	Mitigation measures
	Offsite Ecological Receptors - Bushland flora/fauna	Surface	Leachate migration via surface water runoff.	Contaminated surface water run-off impacting the ecological receptors.	Low (2A)	The site is surrounded by the bushland. It is possible that surface water run-off from waste storage areas and cells may cause minor impacts to these receptors & associated ecosystems.	Section 7.1.1
		Subsurface	Vertical migration of leachate within the groundwater.	Contaminated groundwater may impact deep rooted flora.	Low (1B)	Leachate generation is thought to be low considering the small quantities of putrescible waste received.	Section 7.1.2
Landfill gas – explosive & asphyxiant gases	Site users and workers	Air	Landfill gas migration via direct venting into the atmosphere.	Asphyxiation & explosion caused by the landfill gas.	Low (1B)	The likelihood for risk occurring is rare as landfill gas generation at the Facility is minimal due to extremely low quantities of waste. Any landfill gas generated will be rapidly dispersed & oxidised and there are no structures in which gas can accumulate.	Section 7.3.1
Landfill gas - odour	Site users and workers	Air	Landfill gas migration via direct venting into the atmosphere.	Nuisance caused by the odour. Odour can be detected near the landfill surface.	Medium (4A)	It is likely that odour will be detected near the landfill surface and in close proximity to exposed waste.	Section 7.3.2
Dust	Milingimbi community - residents	Air	Dust from site access roads and earthworks becoming airborne.	Nuisance caused by the dust and health impacts from particulate matter.	Low (3A)	Dust generated at the Facility is largely limited to vehicle movements on the unsealed access roads as heavy machinery is rarely used to cover waste and construct cells. Dust generation is considered to be insignificant compared to that generated by normal vehicle movements on unsealed roads surrounding the community.	Section 7.3.3
	Milingimbi Aerodrome						
Fire	Site users and workers	Air	Uncontrolled fires emitting smoke	Members of the public could potentially burn waste to reduce odour, vermin, and	Extreme (5E)	Site users and workers present at the landfill whilst waste is burning are likely to be exposed to concentrated toxic emissions.	Section 7.1.2

Source	Receptor	Pathway	Pathway description	Risk description	Risk	Justification	Mitigation measures
	Milingimbi community - residents		containing toxic compounds.	windblown litter as well as light fires in proximity to landfill. The combustion of waste materials can result in dangerous toxic emissions that includes dioxins, sulphur dioxide, lead and mercury. These emissions can cause immediate and long-term harm to the nervous system, lungs, liver and kidneys and result in reproductive and developmental disorders.	High (5C)	Smoke from burning waste can impact the community during certain meteorological conditions such as when the wind blows from the north and west. The closest building to the Facility is located 1,000m east. This buffer distance will reduce the concentration of toxins compared to that experienced at the Facility, but significant risk still remains.	Section 7.1.2
	Restricted Works Area 22				Extreme (5D)	People accessing RWA 22 are at risk of being exposed to high concentrations of smoke containing toxins from burning waste during westerly wind conditions.	Section 7.2
	Milingimbi Aerodrome				High (5C)	People accessing the aerodrome and driving along Airfield Access Road and Bodia Road are at risk of being exposed to smoke containing toxins from burning waste under certain meteorological conditions, especially when wind is blowing from the north and east.	Section 7.1.2
	Site users and workers	Direct contact	Direct contact, ingestion, or inhalation of ash from burnt waste.	Members of the public could potentially burn waste to reduce odour, vermin, and windblown litter as well as light fires in proximity to landfill. Ash from burnt waste present in the landfill cells can contain a range of carcinogens, heavy metals, and other toxic compounds harmful to human and animal health.	High (3D)	People accessing the facility may be inadvertently exposed to ash from burnt waste that can have short and long-term health implications.	Section 7.2
	Fauna				Medium (3B)	Fauna such as reptiles and birds may be exposed to ash whilst scavenging in landfill cells and suffer health implications as result.	Section 7.2

Source	Receptor	Pathway	Pathway description	Risk description	Risk	Justification	Mitigation measures
Exposed waste and ponded water	Offsite Ecological Receptors – Bushland flora & fauna	Vermin and invasive fauna species	Exposed waste may be used as a food source by vermin and introduced fauna species such as rodents, dogs, and cats and could result in elevated population levels.	Milingimbi Island is a Site of International Conservation Significance. Preventing the establishment and spread of introduced fauna species is important for maintaining the value of the area as a refuge and minimising the impact on local ecosystems.	Medium (2D)	The putrescible content of waste received at the Facility which would attract pest species is low. It is possible that changes to waste composition and Facility operations could result in more putrescible waste being available as a food source for pests.	Section 7.6
	Milingimbi community - residents	Airborne disease vectors (flies and mosquitoes)	Exposed waste and ponded water can facilitate the breeding of disease vectors that are capable of impacting the community.	Flies and mosquitoes can spread disease to humans and negatively impact the community amenity.	Medium (2D)	Water does not readily pond onsite and is an insignificant breeding habitat compared to the freshwater bodies in proximity to the community.	Section 7.6
	Milingimbi Aerodrome	Birds attracted to the landfill for food.	Birds attracted to the Facility increase the risk of bird strike with planes.	Bird strike can cause significant and catastrophic damage to aircraft landing at the aerodrome.	High (3D)	Guidelines recommend that a buffer distance of 1,500 metres be maintained between aerodromes for piston engine propeller driven aircraft to minimise the risk of bird strike. The Facility only has a buffer distance of 550m from the aerodrome. Risk is somewhat minimised by the fact that the Facility is located to the side of the aerodrome and not on a direct flight path for planes landing and taking off.	Section 7.6

Source	Receptor	Pathway	Pathway description	Risk description	Risk	Justification	Mitigation measures
Invasive flora species	Offsite Ecological Receptors – Bushland flora & fauna	Air, surface water runoff, and animal movements.	Landfills often have populations of invasive weed species due to the presence of seeds in waste received. These populations can spread to the surrounding environment when seed is transported by wind, surface water, and animal movements.	Milingimbi Island is a Site of International Conservation Significance. Preventing the establishment and spread of introduced flora species is important for maintaining the value of the area as a refuge and minimising the impact on local ecosystems.	High (4D)	It is likely that weed species will be present at the Facility due to waste being received that contains seeds. If left to become well established, weeds are likely to spread to the surrounding ecosystems where controlling them becomes more difficult and costly.	Section 7.7
Litter	Milingimbi community - residents	Air	Litter blown in the wind.	Mainly visual impact.	Low (1A)	Due to the long distance, vegetative buffer, and prevailing wind direction, the windblown litter is unlikely to reach the township & the impacts are mainly visual (i.e. minor).	Section 7.4
	Milingimbi Aerodrome				Low (2A)	Due to the vegetative buffer, and prevailing wind direction, windblown litter is unlikely to reach the aerodrome & the impacts are mainly visual (i.e. minor).	Section 7.4
	Offsite Ecological Receptors – Bushland flora & fauna				Low (4A)	It is likely that some windblown litter will enter the surrounding bushland, but the impacts are mainly visual (i.e. minor).	Section 7.4
	Offsite Ecological Receptors – Surface water bodies				Medium (3B)	It is possible that some windblown litter will be carried with a strong southerly wind into the mudflats where birds could ingest it.	Section 7.4

Source	Receptor	Pathway	Pathway description	Risk description	Risk	Justification	Mitigation measures
Illegal Dumping	Offsite Ecological Receptors – Bushland flora & fauna	Residents and contractors	Residents and contractors illegally dumping waste in bushland surrounding the community and Facility.	Illegally dumped waste presents a range of potential environmental and human health risks including aquifer contamination, physical injury and exposure to toxic substances.	High (4C)	Waste is illegally dumped due to a variety of reasons. Although waste dumped outside the Facility is not technically the responsibility of Council, strategies can be implemented at the Facility and within the community to reduce the occurrence of illegal dumping in the area.	Section 7.5
	Milingimbi community - residents						

7 ENVIRONMENTAL MANAGEMENT STRATEGIES

Landfills have served a key role in the management of solid wastes and are likely to continue to be an important component of the waste management system, despite being the least preferred management option based on the waste hierarchy. Landfills must therefore be managed so that they do not leave an unacceptable environmental legacy for future generations to address. As long as landfilling remains part of our waste management strategy, best-practice measures must be adopted to ensure that landfills are acceptable to the public.

The following section provides key best practice environmental management guidelines that will be employed to minimise environmental impacts at the Facility.

7.1 WATER

The Council will undertake all practical measures to prevent the emission of contaminated water from the Facility. Facility operations will generate different quality waters, including:

- Run-off from undisturbed areas within and upstream of the landfill site (clean stormwater run-off);
- Run-off from rehabilitated (revegetated) areas of the landfill site (clean stormwater run-off);
- Run-off from disturbed areas of the landfill site (potentially turbid stormwater runoff);
- Run-off from within the active landfilling area (potentially leachate); and
- Leachate from within the landfill.

Management of water at the Facility is aimed at minimising the generation of contaminated water and preventing deterioration of water quality standards in local surface waterways and groundwater in the vicinity of the site.

7.1.1 Stormwater

Stormwater on a landfill site is water which falls on undisturbed areas of the site, and water which falls outside waste filled areas but over disturbed areas (i.e. cleared or construction, intermediate cover and final landfill cap) and is potentially contaminated with sediments.

Poor control of stormwater can have impacts not only on receiving waters downstream of the site (e.g. due to entrained litter, sediment and chemical contaminants), but also on the practicality and cost of site operations. Providing adequate surface water drainage is therefore a critical component of any landfill facility design.

There are three main types of stormwater generated on the site:

1. Clean stormwater run-off from undisturbed and rehabilitated / revegetated areas of the Site;
2. Potentially sediment laden stormwater run-off from disturbed areas of the Site; and
3. Potentially leachate contaminated stormwater run-off from the active landfilling area.

The fundamental approaches the EARC shall apply to stormwater management is as follows:

- Maintain undisturbed and rehabilitated / revegetated areas as filters for sediment from disturbed sub-catchments;
- Minimise disturbed areas on the site;
- Maintain all stormwater run-off from disturbed areas as diffuse as possible to minimise sediment loads and maximise the opportunities for the vegetation to strip sediment from the run-off. Any concentration of flow over bare and disturbed areas should be avoided;
- Establish and maintain erosion controls (re-vegetation, silt fencing etc.) on disturbed areas as required; and
- Ensure that water that has contact with waste in the active landfilling area does not leave the site.

7.1.2 Groundwater

Landfill leachate has the potential to negatively impact groundwater aquifers in the vicinity of landfill facilities. Although the small quantities of waste received (~1,200 tonnes per year) means that the quantities of leachate generated are likely to be limited, especially during the dry season, there remains a risk that leachate may reach the central aquifer, and that leachate may contain elevated levels of soluble heavy metals.

Whilst ASK considers that significant leachate contamination of the central aquifer is unlikely, the current understanding of the site's hydrogeology is insufficient to rule this out completely, and the impact on the Milingimbi community would be severe as there are not alternative water resources available.

In order to more accurately determine the risk posed by landfill leachate, the EARC shall engage a hydrogeologist to undertake a detailed Hydrogeological Investigation for the site that involves:

- A desktop review of previous groundwater investigations and hydrogeological studies of Milingimibi.
- Development of a groundwater monitoring program with recommended locations for monitoring bores capable of detecting a leachate plume (if identified during hydrological study).
- A one-year period of monitoring standing water levels and analysis of groundwater samples for indicators of landfill leachate (if identified during hydrological study).
- Investigations necessary for the development of a conceptual site model that details the pathways likely to be taken by a leachate plume.
- Production of a final report detailing the findings of the investigation and the conceptual site model.

To minimise the risks of groundwater contamination by leachate the EARC will undertake the following measures:

- Cessation of below ground landfilling once Cells 1 and 2 have been filled to ground level (refer to **Section 4.6.1**).
- Maintaining stormwater control infrastructure to divert stormwater away from landfill cells to reduce the amount of water available to produce leachate.
- Covering waste with 0.3 to 0.5 metres of soil prior to onset of the wet season to minimise infiltration of water into the waste body.
- Establishing an above ground landfill cell to cover previously filled areas (refer to **Section 4.6.1**). This cell should be constructed with gradients between 5 and 20% capable of shedding stormwater without cover/capping material being eroded.
- Progressively capping and rehabilitating completed landfill cells in accordance with **Section 10** to minimise infiltration of water into the waste body.

7.2 FIRE MANAGEMENT

The burning of waste presents an extreme risk to human health as the combustion of waste materials can result in dangerous toxic emissions and ash that includes dioxins, sulphur dioxide, lead and mercury.

Rapid vegetation growth and the traditional fire regime implemented in the East Arnhem Land region make it inherently difficult to prevent waste being burnt as the landfill will be subject to regular bushfires. This is problematic because if waste is not burnt in a controlled manner, it is likely that subsurface landfill fires will occur on a semi regular basis. These subsurface landfill fires are difficult to extinguish and can slowly burn for weeks or months at low temperatures which result in higher concentrations of toxins being emitted.

The following strategies are to be undertaken by Council at the Facility to reduce subsurface landfill fires:

- Construction of a perimeter fence and gate to prevent unauthorised access;
- Construction and maintenance of fire breaks around the perimeter of the landfill as well as the listed waste separation bays;
- Regular slashing / mowing of vegetated areas will be undertaken by site staff, particularly surrounding higher risk areas;
- Routine removal of hazardous waste streams such as tyres, oils and batteries.
- Clear separation of storage areas for incompatible waste streams;
- No smoking in or near waste equipment, disposal areas, stockpiles or surrounding vegetated areas;
- No overnight storage of waste within trucks / attached trailers;
- Routine monitoring and removal of ignition sources;
- Do not utilise the plant that carries a fire risk during periods of warm weather or high winds; and
- No fuel storage on site.

As it is not currently economically viable or sustainable for the Council to fund having a fully supervised landfill, a range of measures detailed below shall be implemented to reduce human health risks associated with fire.

7.2.1 Waste separation and minimisation

The risks associated with fire can be reduced if care is taken to avoid the combustion of toxin generating materials such as plastics, batteries, tyres, and CCA treated timber. To improve waste separation the Council will install and maintain the following infrastructure:

- Signs at the Facility prohibiting the unauthorised burning of waste and communicating the risks posed.
- Delineated areas and cells with signage to encourage the separation of waste streams into the following categories:
 - scrap metal;
 - listed waste (refer to **Section 7.8**);
 - white goods;
 - End of Life Vehicles;
 - Solar Panels;
 - Green Waste;
 - Construction and Demolition materials; and
 - Reusable (pallets, bikes etc).

It is recommended that signage be culturally and linguistically appropriate considering the lower literacy rates of Indigenous communities in remote areas, this may include alternatives to text-based signage such as images and symbols.

To further reduce the quantities of plastics being burnt the Council shall consider implementation of the following programs:

- An increased frequency for the container deposit scheme (CDS) events held at Milingimbi, or establishment of a permanent Collection Depot on the island. The CDS events previously held at Milingimbi have been well received by the community and have resulted in significant quantities of plastic drink containers being removed from the island for recycling.
- A soft plastics recycling program such as that offered by RedCycle.

7.2.2 Community education and awareness

As the Facility is not supervised, all individuals accessing the Facility must be aware of the risks faced and how the Facility should be safely utilised. Waste burning is considered the highest risk faced by site users and should therefore be a priority focus of waste related community education and awareness programs. Refer to **Section 10** for more information on the community education and awareness actions the EARC will take.

7.2.3 Investigation of alternatives

Whilst the measures detailed in **Sections 7.2.1** and **Sections 7.2.2** above are expected to significantly reduce the risk of human health impacts on the community, the risks will continue to be present as long as waste has the potential to be burnt. It is therefore recommended that Council investigate medium term options; such as the purchase of a tracked or solid wheeled loader capable of compacting and covering waste on a regular basis without risk of puncture.

7.3 AIR

7.3.1 Landfill Gas

Landfill gas (LFG) is a natural by-product of the anaerobic biological decomposition of the organic fraction of solid waste disposed of in putrescible landfills. LFG consists primarily of Methane (CH₄) and Carbon Dioxide (CO₂), but may contain many other constituents in small quantities. Once the LFG has been generated it often moves through and out of the landfill via the path of least resistance.

LFG is a potential health and safety risk as:

- It can cause explosions when the concentration of Methane (CH₄) is between 5% and 15% by volume in air and the gases are contained in an enclosed space;
- It can cause fire when the concentration of Methane (CH₄) is above 15% by volume in air;
- Both of the major components of LFG, CH₄ and CO₂, are asphyxiates; in closed structures or areas where LFG could potentially accumulate, LFG may present an asphyxiation hazard;
- It may contain toxic or carcinogenic compounds that can pose a threat to human health if released into the atmosphere or groundwater. LFG may therefore present both acute and chronic toxic hazards.

LFG is not considered to pose any real risk at the Facility as the small quantities of waste received, the low putrescible content, ensures that LFG generation is minimal. There are also no buildings, structures, or enclosed spaces where LFG can accumulate to form an asphyxiation or explosion risk. A risk evaluation for LFG accumulation should be undertaken for any new structures the EARC intend to construct at the Facility, or they should be located in areas where waste has not been previously buried.

7.3.2 Odour

The biodegradation of wastes in landfill can result in the formation of offensive odours that have the potential to impact the amenity of surrounding land users. Odour may also be associated with load transport, the tipping face, leachate and LFG. The Council shall ensure that odour emitted from the premises does not unreasonably interfere with the health, welfare, convenience, comfort or amenity of any person who is not on the premises.

The location of the Facility is favourable in regard to odour control as it provides a significant buffer from sensitive surrounding land uses. The following management practices and mitigation measures should be implemented to further minimise odour emissions during the operation of the facility:

- All odour generating wastes delivered to the site must be contained in a covered vehicle to minimise potential odour emissions;
- The size of the working face must be kept as small as possible;
- Not depositing waste in standing water;

- Undertaking covering waste with soil if odour complaints are received or it is recognised as a problem by EARC staff;
- Minimising disturbance of previously filled areas.

7.3.3 Dust

Although dust emission from the Facility has a low risk rating and is not considered significant, all practicable measures will be taken by the EARC to minimise dust emissions arising from the operations of the Facility.

These shall include:

- Entrance and site access roads to be well maintained;
- Where practical, earthworks to be undertaken on days with little or no wind;
- Areas of existing vegetation must be maintained and cleared areas that are no longer of operational use must be progressively rehabilitated;
- Dust emissions should be monitored on a regular basis through visual inspections of disturbed and open areas.

7.4 WINDBLOWN LITTER

A hierarchy of litter control measures is available, based firstly on load containment, load handling and tipping, and moving through to secondary measures such as mobile litter screens, nets and litter picking at site boundaries (ISWA, 2010). Based on the litter control hierarchy, the following measures must be undertaken to prevent the accumulation of windblown litter along and outside the Facility's boundaries:

7.4.1 Load Control

- Require site users to secure loads with nets and tarpaulins to prevent the accumulation of litter along principal site access routes.
- Regular inspections of primary access routes with active litter clean up as required.

7.4.2 Waste Handling

Most of the litter arising from landfill sites results from wind acting on the waste at the point of tipping. Litter loss at the point of tipping will be minimised where practicable by:

- If possible, set up waste cells so that they are filled from east to west to provide protection from the predominant easterly wind.
- Periodically placing heavier waste on loose waste.
- Keeping the working area as tight as practicable.

7.4.3 Portable Litter Screens

- Portable litter screens to be utilised down-wind and as close to the tipping face as possible.
- Screens to be cleared frequently to prevent them from becoming overloaded and potentially being blown over.
- Screens to be relocated with changes in the wind direction and tipping face.

7.4.4 Perimeter fencing

If the litter control measures detailed above are insufficient the Council could consider installing a ring lock fence around the perimeter of the Facility to prevent it being blown offsite.

7.4.5 Litter collection

- As it is practically impossible to totally prevent litter escaping from the site, litter collections are to be regularly undertaken along access roads and buffer zones surrounding the site.

- The volumes of litter collected, and the staff hours spent collecting litter around the site should be recorded to assess the effectiveness of prevention measures outlined above.

7.5 ILLEGAL DUMPING

Waste is illegally dumped by contractors and members of the community in areas surrounding the Facility and township. Although waste dumped outside the Facility is not technically the responsibility of Council, the following strategies can be implemented to reduce the occurrence of illegal dumping and minimise potential environmental and human health risks including aquifer contamination, physical injury and exposure to toxic substances.

- Clearly signposting directions to the Facility.
- Installation of signage warning against illegal dumping in problem areas.
- Ensuring that the Facility is attractive for the community to use in terms of amenity and efficiency.
- Community consultation, engagement and education on the issue of illegal dumping (**Sections 11.2 and 11.3**)
- Reporting instances of illegal dumping by commercial entities to the NT Pollution Hotline by calling 1800 064 567.

7.6 DISEASE VECTORS AND INTRODUCED FAUNA

Potential disease vectors at a landfill can include rats and other rodents, foxes, feral cats and dogs, insects, birds and other animals, each of which can carry disease and be a threat to public health. Each type of vector can live and multiply at a landfill, and is potentially of concern to site operators, regulators, public health professionals, and the general public.

Effective vector control is based on preventing vectors from becoming established on the landfill by excluding access to sources of food, water and shelter. The only vectors that should be observed in any significant numbers at a landfill should be those that happen onto the landfill, rather than vectors that are 'resident' at the Facility.

Vectors and pests are controlled by methods that are aimed at eliminating vectors to the greatest practical extent, including operational practices, monitoring, and eradication.

Vermin control on site is achieved via the following mechanisms:

- Regular covering of waste.
- Regular pushing up and compaction of the waste.
- Regular collection of uncontrolled tipping and placing the material into the active tipping face.
- Elimination of ponding water on the property, except as designed for runoff storage or treatment or natural water bodies.
- Vermin control such as baiting and trapping by a pest control contractor if required.

EARC staff are expected to monitor the levels of key vectors and pest species as part of daily management. Their presence is to be formally reported as part of the monthly inspection program. Should either process identify the presence of any key vectors or pest at higher than baseline levels the staff will:

- Inform the RWEM of the issue;
- Increase monitoring intensity (either internally or via the contracting of pest control experts);
- Refine operational practices to reduce populations where possible.

7.7 WEED CONTROL

A review of the Natural Resource Maps NT indicates that there are a range of weeds recorded on Milingimbi with their distribution focused the Milingimbi township, Bodia outstation and the Facility.

Landfills often have populations of invasive weed species due to the presence of seeds in waste received and disturbed conditions favourable to the establishment of such species. These populations can spread to the surrounding environment when seed is transported by wind, surface water, and animal movements.

The EARC will implement the following measures to prevent weed species becoming established and spreading to the surrounding ecosystems:

- Staff to be trained on the identification of problematic environmental weeds and invasive species.
- Staff to inspect the Facility for weed species on a monthly basis and record the species of weeds and their locations.
- If weeds are identified during the inspection the EARC shall either:
 - Direct appropriately trained EARC staff to control the weeds with herbicide, or
 - Engage a contractor to undertake weed control actions appropriate for the species present.
- Manage stormwater in accordance with **Section 7.1.1** to minimise its emission from the site and limit the dispersal of weed seeds.
- All weed control actions undertaken should be recorded and included in the Annual Report (**Section 13.1**).

7.8 LISTED WASTE HANDLING

The Council intend to continue receiving listed wastes that include tyres and vehicle batteries at the Facility. Council personnel shall collect these items on a regular basis and transfer them to the Council Depot for packing and storage prior to them being transported to appropriately licenced disposal facilities in Darwin. To minimise environmental risk, these wastes will be safely stored in a designated listed waste area in containment structures that prevent the ingress of rainfall and are well ventilated. Batteries will also be stored on bunded pallets capable of containing chemical spills. A 10-metre-wide firebreak will be maintained around the designated listed waste area to minimise the risk of fire. The designated listed waste area will be inspected and maintained by EARC staff on a daily basis to ensure that listed wastes are stored safely and regularly removed to the Council Depot

Please refer to the *East Arnhem Land Listed Waste Management Plan* (ASK, 2019) for additional information on listed waste storage and handling procedures, and emergency response procedures.

8 CORRECTIVE ACTIONS AND CONTINGENCIES

The following subsections detail corrective actions, contingencies, and basic emergency response procedures that shall be taken in the event of emergencies or failure of the environmental management strategies detailed in **Section 7**.

8.1 STORMWATER EMISSION

If significant quantities of stormwater are observed to be emitted from the site, or are found to be flowing into below ground waste cells the following actions shall be taken:

- EARC staff shall document the situation with photographic evidence and contact the Regional Waste and Environmental Manager (RWEM) to inform them of the situation.
- The EARC shall promptly engage a contractor, or deploy internal resources, to undertake site works required to mitigate the issue in the short term.
- If the situation is considered likely to reoccur, the EARC shall survey the site and develop a Stormwater Management Plan (SMP) that outlines site works and infrastructure required to improve stormwater management.
- The EARC shall engage a contractor, or deploy internal resources, to construct stormwater infrastructure in accordance with the SMP.
- Maintenance and monitoring of stormwater infrastructure shall be undertaken in accordance with the SMP.

8.2 LEACHATE CONTAMINATION OF AQUIFER

If groundwater monitoring activities (**Section 9.2**) indicate that the Facility is resulting in significant contamination of the aquifer and poses a risk to drinking water quality the EARC shall:

- Inform and consult with the Power Water Corporation and the NT EPA on the issue.
- Engage a hydrogeologist to investigate the contamination and the risk it poses to drinking water supplies.
- Investigate alternative waste disposal practices that would minimise contamination.
- Once a viable alternative has been identified and implemented, the existing unlined landfill cells shall be capped and rehabilitated in accordance with **Section 10**.

8.3 UNCONTROLLED FIRE

If an uncontrolled bushfire threatens to impact the Facility, or a fire has ignited in an area of the Facility not designated for the burning of waste, EARC staff shall:

- Alert firefighting crews;
- Contact the Municipal Services Supervisors (MSS);
- Evacuate all public, customers and non-essential staff away from the area;
- Try to prevent the spread of fire to the other areas of the site; and
- Attempt to extinguish the fire or contain the fire until further assistance arrives.

EARC staff shall complete an Incident Report and submit to the RWEM and EARC's Work Health and Safety Representative.

The EARC shall keep a record of any incident of any uncontrolled fire experienced at the Facility and provide a summary of each incident in the annual report.

8.4 CHEMICAL FIRE

Although chemicals and hydrocarbons are not stored at the Facility as any listed wastes received are removed on a daily basis in accordance with **Section 7.8**, there remains a small risk that recently received chemicals or hydrocarbons could catch fire.

In the event that the chemicals or hydrocarbons catch fire, EARC staff are to:

- Alert firefighting crews;
- Contact the MSS;
- Evacuate all public, customers and non-essential staff away from the area;
- Try to prevent the spread of fire to the landfill site or bush; and
- Attempt to extinguish the fire or contain the fire until further assistance arrives.

EARC staff shall complete an Incident Report and submit to the RWEM and EARC's Work Health and Safety Representative.

The EARC shall keep a record of any incident that includes the combustion of chemicals including fuel, oil or other hydrocarbons and provide a summary of each incident in the annual report.

8.5 DISEASE VECTORS AND INTRODUCED FAUNA

If monitoring of the Facility indicates that populations of disease vectors, vermin, or introduced fauna species are increasing and current control activities detailed in **Section 7.6** are insufficient, the EARC will:

- Consider installing a perimeter fence and gate to limit fauna's access to the Facility
- Develop and implement a management plan targeting the species of concern.

8.6 WEED CONTROL

If monitoring of the Facility indicates that weed and invasive species populations are increasing and current control activities detailed in **Section 7.7** are insufficient, the EARC will develop and implement a Weed Control Management Plan targeting the species of concern.

8.7 FUEL AND CHEMICAL SPILLS

Spills of chemicals including fuel, oil or other hydrocarbons have the potential to contaminate ground and surface waters.

The Council shall immediately remove and dispose of any liquid resulting from spills or leaks of chemicals including fuel, oil or other hydrocarbons. Oil spills will be treated as an emergency in accordance with procedures outlined below:

- Contact the MSS;
- Evacuate all public, customers and non-essential staff away from the area;
- Contain the spill with soil or other appropriate absorption materials;
- Prevent entry to the area until further assistance arrives; and
- Engage a licenced listed waste transporter to dispose of contaminated soils and materials to an appropriately licenced facility (refer to Listed Waste Company Summary available at <https://ntepa.nt.gov.au/waste-pollution/approvals-licences/listed-waste>)

EARC staff shall complete an Incident Report and submit to the RWEM and EARC's Work Health and Safety Representative.

The EARC shall keep a record of any incident that includes the loss of chemicals including fuel, oil or other hydrocarbons and provide a summary of each incident in the annual report.

8.8 SERIOUS INJURY TO USER OR STAFF

Landfills have many hazards that can cause a serious injury to a person. In the event of a serious injury to a person, EARC staff are to:

- Contact the MSS;
- Request ambulance and/or medical assistance;
- Make the area safe or move the injured person to a safe area if safe to do so; and
- Administer first aid until further assistance arrives.

EARC staff shall complete an Incident Report and submit to the RWEM and EARC's Work Health and Safety Representative.

The EARC shall keep a record of any incident that results in a serious injury to a person and provide a summary of each incident in the annual report.

8.9 EVACUATION PLAN

The Facility may need to be evacuated for a number of reasons including a fire or toxic chemical spill. The order to evacuate will be given by the MSS. Though, if a staff member believes themselves to be in danger, they have the right to evacuate the premise at any time.

Upon receiving the evacuation order, staff should:

- Turn off any plant equipment they are using;
- Ensure all members of the public and customers in the area have been evacuated;
- Proceed to a location previously designated or a default location outside of the Facility; and
- Perform a count of staff in the evacuation area to determine whether all staff have been safely evacuated.

8.10 ASBESTOS EXPOSURE

Asbestos is a potentially hazardous material to human health. Although the EARC maintains a policy of not accepting asbestos at the Facility to minimise risk to human health, it is possible that asbestos may be illegally dumped at the Facility.

It is a significant occupational health and safety hazard if any event occurs that results in exposed asbestos material on the site. Such events require immediate action and are treated as an emergency.

In the event of open-air exposure of asbestos, EARC staff are to:

- Contact the Municipal Services Supervisor (MSS) or the Director of Technical Services (DTS);
- Evacuate all public, customers and non-essential staff away from the area and close the Facility;
- Issue responding staff with appropriate masks and protective disposable clothing;
- Manoeuvre vehicles and staff responding to the incident upwind of the exposed asbestos;
- Wet down the asbestos to prevent wind borne emissions;
- Contact the person that deposited the asbestos and / or a licenced asbestos contractor to contain and remove the exposed asbestos; and
- Prevent entry to the area until further assistance arrives, and site evaluation and clearance is complete.

9 ENVIRONMENTAL MONITORING

To ensure operation of the Facility is not causing detrimental environmental impacts, the EARC will undertake regular facility inspections and monitoring of groundwater.

The monitoring and inspection program will be reviewed on an annual basis to assess trends in the monitoring data and the suitability of the parameters tested for, and to make recommendations for improvement of the program.

9.1 FACILITY INSPECTIONS

To ensure compliance with the EMP, inspections shall be undertaken on a daily, weekly, and monthly basis by the EARC.

9.1.1 *Daily Inspections*

The Council shall require an EARC staff member to visit the Facility at least once per day during normal workdays and undertake a visual inspection. The staff member should record details of any critical issues identified during these daily inspections and immediately inform the RWEM and MSS. Critical issues include the following:

- Oil or chemical spill incidents;
- Uncontrolled fire incidents;
- Illegally dumped listed wastes; and
- Hazards to human health.

9.1.2 *Weekly Inspections*

The Council shall require an EARC staff member to visit the Facility once per week to complete a 'Weekly Inspection Sheet' that includes, but is not limited to, the following information:

- Name of staff member;
- Time and date the Facility was inspected;
- Condition of the listed waste storage area/s;
- Quantities of listed waste items being stored;
- Presence of illegal dumping at the Facility or in areas surrounding it;
- Presence of litter on the Facility access roads;
- Visible of windblown litter from the premises;
- Presence of disease vectors and pests;
- Uncontrolled fire incidents;
- Emission of dirty stormwater from the premises; and
- Oil or chemical spill incidents.

The staff member who completed the 'Weekly Inspection Sheet' should forward the completed checklist to the RWEM by the next working day.

It is recommended that the EARC investigate implementing a digital solution for completing, submitting and storing facility inspection sheets to make the process more efficient and to improve the accessibility and organisation of the captured data.

9.1.3 *Monthly Inspections*

The Municipal Services Supervisor (MSS) should undertake a monthly assessment of the Facility to ensure that this EMP is being complied with and that the Facility is being operated in a safe and efficient manner. The assessment should be recorded on a standardised assessment form/checklist. The name of the individual undertaking the inspection and the date of the inspection shall be recorded.

The monthly assessments should include, but not be limited to, the following:

- Inspection of signage condition;
- Inspection of stormwater infrastructure for damage or impediments to flow;
- Inspection of firefighting equipment and facilities for damage;
- Inspection of firebreaks;
- Inspection of the volumes of recyclable materials stored onsite, and whether actions need to be taken to have them processed or removed from the premises;
- Inspection of the listed waste storage area;
- Checking that any waste that has been washed or blown away from the tipping area has been collected and returned to the tipping area;
- Inspection of the site access road and areas surrounding the Facility for the presence of any windblown litter and illegal dumping;
- Checking that waste placement and burial has been occurring in accordance with the filling plan; and
- Checking for the presence of odour, dust, litter, disease vectors and noxious weeds.

The staff member who completed the inspection should forward the completed checklist to the RWEM by the next working day.

As mentioned above, it is recommended that the EARC investigate implementing a digital solution for completing, submitting and storing facility inspection sheets to make the process more efficient and to improve the accessibility and organisation of the captured data.

9.2 GROUNDWATER

Findings from the Hydrogeological Investigation detailed in **Section 7.1.2** will be used to develop an ongoing groundwater monitoring program capable of assessing landfill leachate impacts on the aquifer.

The following subsections outline the basic requirements that the final monitoring program is expected to include.

9.2.1 *Sampling locations*

It is recommended that at a minimum, groundwater sampling be undertaken at two bores likely to be impacted by a leachate plume (down gradient from the Facility). One of these bores should be further down gradient than the other to assess the impact of dispersion and attenuation on contaminant concentrations.

Sampling should also be undertaken at a third bore installed upstream of the Facility, or at an existing bore located in an area not likely to be impacted by landfill leachate. This bore would be used to provide baseline data to compare groundwater quality data.

9.2.2 *Sampling frequency*

It is anticipated that sampling of the bores be undertaken at least twice per year. Samples should be collected towards the end of the wet season when groundwater levels are likely to be at their highest, and towards the end of the dry season when groundwater levels are likely to be at their lowest.

9.2.3 Analysis

The representative samples taken from the bores shall be analysed for the following parameters:

- Arsenic
- Cadmium
- Chromium
- Copper
- Lead
- Manganese
- Nickel
- Zinc
- Total Dissolved Solids
- Ammonia-nitrogen
- Nitrate-nitrogen
- Total Nitrogen
- Potassium
- Chloride
- Conductivity
- pH

When the groundwater samples are being taken, the EARC should also ensure that the Standing Water Level (in metres AHD (Australian Height Datum)) is measured for each bore.

In addition to the requirements detailed above, the EARC must ensure that:

- All water samples are collected and preserved in accordance with AS/NZS 5667.1;
- All laboratory samples are submitted to and tested by a laboratory with Current NATA accreditation for the parameters being measured; and
- All monitoring equipment is calibrated in accordance with the manufacturer's specifications.

9.3 COMPLAINTS

The Council shall implement and maintain a complaints management system to record the number and details of complaints received concerning the environmental impact of the activities at the Facility and any action taken in response. The Council shall record the following information regarding complaints received:

- Date and time of the complaint;
- Complaint method;
- Any personal details of the complainant, if provided;
- Nature of the complaint;
- Subsequent action taken; and
- If no action was taken, an explanation why no action was taken.

9.4 RECORD KEEPING

The details of the monitoring activities outlined above will be recorded with the following information:

- Sampling date(s);
- Sampling time(s);
- Sampling point(s);
- Sampling results; and
- The name of the person who collected the sample.

The monitoring records will be kept for at least four years after the monitoring event and will be produced to any authorised officer on request. Suitably qualified personnel will perform all environmental monitoring.

10 LANDFILL CLOSURE, REHABILITATION, AND POST CLOSURE MANAGEMENT

As many environmental impacts of landfilling continue to occur long after a landfill has closed, best practice rehabilitation and long-term aftercare of a site is necessary to minimise the potential of any detrimental impacts on the local environment and community.

This section of the EMP focuses on the activities required during the rehabilitation and post-closure management of the Facility.

10.1 FINAL CAPPING DESIGN

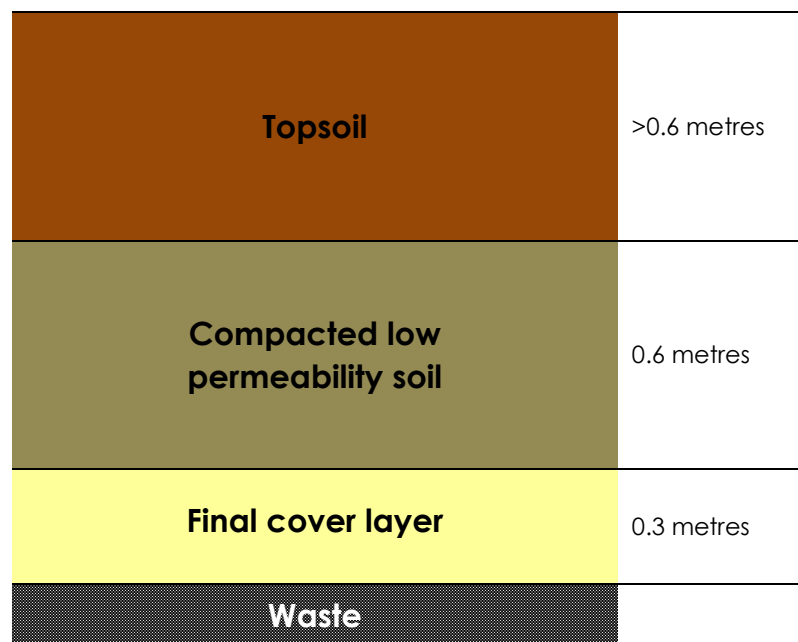
The landfill cap forms a major component of the closure and rehabilitation of landfill cells at the Facility as it will:

- Improve the visual amenity of the site;
- Provide a physical barrier to the waste body;
- Manage surface water flows and infiltration to minimise the potential for leachate generation and surface ponding; and
- Provide a suitable substrate for vegetation growth.

The gradient of the final cap should be sufficient to ensure that most of the precipitation landing on the capped waste runs off to minimise infiltration, whilst not running off fast enough to result in significant erosion. The NT EPA Guidelines (2013) recommend gradients between 1v (vertical):20h (horizontal) (5%) and 1v:5h (20%) are optimum for adequately shedding water whilst minimising erosion.

The final landform is proposed to be developed in accordance with **Section 4.6.1** with gradients in the range of 11 to 14%. The capping design detailed in **Figure 10.1** would then be constructed over the waste.

Figure 10.1- Proposed structure of the cap



The cap would comprise of the following layers:

- Topsoil layer. The surface layer should replicate the type and depth of topsoils found in the vicinity of the Facility and be capable of sustaining vegetation. It is recommended that this layer be at least 600mm thick.

- Low permeability layer. A locally available clay rich soil should be sourced to construct a low permeability layer that is 600mm thick. The soil should be placed in layers approximately 150mm thick and compacted thoroughly to minimise the infiltration of rainwater into the waste body.
- Final cover layer. A final cover layer of 300mm should be spread over the last layer of waste and appropriately compacted to provide a stable, uniform layer with no exposed waste for the capping to be constructed over.

This layer may require the addition of more than the volume of soils required to provide the 300mm layer, as a proportion of soil will 'settle' into the voids between the waste at the surface. Once these voids are filled, the 300mm layer of cover can be built up.

The portion of the landfill that has been used for waste disposal will be rehabilitated to natural vegetation after its closure. Advice should be sought regarding suitable species that are indigenous to the area and local provenance, to avoid inappropriate planting, ensure the species are adapted to the local climate, and enhance the local habitat. Shallower rooting species should be used where possible as any roots penetrating the low permeability layer into the waste body may provide a conduit for water to flow through the cap.

10.2 PROGRESSIVE REHABILITATION

Where possible, the EARC will endeavour to undertake progressive rehabilitation of the Facility in accordance with the NT EPA Guidelines (2013) by rehabilitating a completed cell whilst a new one is being filled. The benefits of progressive rehabilitation include:

- Minimising future financial liabilities associated with landfill closure and rehabilitation;
- Minimising leachate generation and odour formation;
- Reducing human health risks and hazards; and
- Improving the amenity of the site to the community.

10.3 POST CLOSURE MONITORING AND MAINTENANCE

Following the closure of the Facility and the completion of initial post-closure works and revegetation, the site will still require regular monitoring for a period of at least 20 years. The Facility is a remote landfill with limited systems that would need post-closure monitoring and management. However, it is important that a competent person completes the required post-closure monitoring to ensure minimal risk of impact to the environment and surrounding receptors.

10.3.1 Landfill cap

The integrity of the final cover layer strongly influences the environmental performance and safety of the landfill during closing and maturation periods. Signs of erosion, cracks, differential settlement, vegetation death, seepage of leachate and incursion of burrowing animals should be investigated to identify potentially adverse influences on the performance of the final cover layer.

After the Facility is closed, initial monitoring inspections should be completed every six months and after significant rainfall events. The inspections can be completed at the same time that groundwater samples are being collected. Any problems found during the Site Inspections should be rectified as soon as practically possible. The frequency of monitoring can be decreased as the cap stabilises and vegetation becomes established during the aftercare period.

10.3.1.1 Erosion

Rainfall runoff may cause degradation of the final landfill surface, resulting in damage to the capping layers. The purpose of inspecting the final surface is to identify possible breaches in the cap caused by erosion.

Visual indicators that erosion may be occurring include:

- Exposure of underlying landfill capping layers
- Absence of vegetation, or
- Formation of rifts or soil sediments.

Replacement of the capping layers along with re-establishing vegetation are means of repairing breaches in the final surface.

10.3.1.2 *Differential settlement*

The contour of the final surface is important to ensure rainfall quickly drains from the landfill surface, thus minimising infiltration of rainwater into the waste body. Differential settlement of the landfill waste body may occur resulting in depressions that may cause ponding of rainwater and result in increased infiltration.

In areas where differential settlement has formed depressions in the surface, re-profiling should match the final design profile. Re-profiling should involve reinstating the capping layers up to the required profile and re-establish vegetation cover.

Surface depression will require corrective actions when rainfall ponding is observed.

10.3.1.3 *Vegetation*

The aim of the vegetation inspections is to identify any changes in vegetation growth, death of vegetation or where vegetation has been removed due to erosion. Inspections should also determine whether there is a need for irrigation, fertilisers, trimming, disease treatment, and weed control. Apparent indicators include wilting, pest damage and vegetation death.

To ensure the health of the vegetation, recommended maintenance practices are as follows:

- Irrigation – Regular irrigation to maintain soil moisture levels through the first 3 – 6 months of vegetation establishment is required if rainfall is insufficient. The objective of irrigation is to balance soil moisture with the needs for vegetation growth without exceeding the water holding capacity and increasing infiltration through the cap.
- Fertiliser – Maintenance is undertaken by ensuring the soil has the correct levels of key parameters for plant growth (organic matter, N, P, K, pH, etc.) for the vegetation to be established. Further additions may be required to ensure continued growth and health.
- Weed control – Maintenance can be performed through both manual removal of weed specifics and through the application of appropriate herbicides.
- Slashing – If excessive vegetation growth becomes an issue, regular pruning or slashing should be performed.

10.3.1.4 *Leachate seeps*

Containment of leachate within the waste body is important to avoid adverse environmental and human health impacts. Breach of the landfill cap may occur in the form of leachate seeps. Inspection of the final landfill surface to identify the presence of leachate seepage should be undertaken, with focus on landfill batter slopes that are particularly susceptible to leachate seepage.

Depending on the cause and magnitude of the leachate seep, maintenance options are as follows:

- If the seep is large and active, a collection and treatment system should be installed
- If the seep is causing erosion to the landfill cap, the capping should be re-established to prevent further erosion
- If the seep is small and localised, in-situ leachate treatment may be used (e.g. biological treatment at the point of seepage)

10.3.1.5 *Burrowing animals*

Burrowing animals such as rabbits and rats can cause breaches in the final capping layer and promote the formation of depressions, potentially causing increased infiltration and pooling on the surface. Inspection of the final landfill surface aims to identify the presence of burrowing animals and the need for restoration. Typically, restoration requirements may include removal of animals, replacement of capping materials displaced by burrows and replacing any fencing areas that may have been compromised as animals accessed the site.

10.3.2 *Stormwater System*

Initially any stormwater channels, bunds and sumps must be monitored for signs of erosion or damage, excessive vegetation growth, etc. However, once the Facility is closed and the cap vegetated and stable, there is no requirement to continue to control run-off from the site as it shall not have been in contact with any waste. The condition of the stormwater system can have a direct influence on the accumulation of sediment and vegetation debris that could reduce the effectiveness of the stormwater system. Poor stormwater drainage may cause increased infiltration of rainfall, increased generation of leachate and localised ponding of rainfall.

Inspection of the stormwater system is required to identify any damage to, or blockages of the drainage paths. If the drainage system becomes blocked due to sediment building up or other debris, these areas should be cleared immediately to prevent alternative drainage pathways from becoming established, causing localised erosion.

10.3.3 *Groundwater Monitoring*

It is recommended that groundwater continue to be sampled and analysed in accordance with **Section 9.2** for a period of 20 years after the Facility has ceased landfilling operations. If it is found that the impacts of landfill leachate on groundwater quality have stabilised, or are not above baseline levels, the Council will consult with the EPA to reduce the monitoring frequency or cease monitoring all together.

10.3.4 *Recording*

As the monitoring period is likely to exceed twenty (20) years, the post-closure assessment will most probably be completed by a number of different Council officers. To ensure consistency and good record keeping, the Council should use a standard form for each landfill site inspection. This will detail the area requiring assessment, the person that completed the assessment and the date. Any findings, observations and corrective actions should be recorded. If corrective actions are required, a record should also be made of any changes that were made to avoid a reoccurrence.

11 TRAINING, AWARENESS AND COMMUNICATION

11.1 STAFF TRAINING

The EARC will ensure that the various staff and contractors responsible for implementation of this EMP are adequately trained to fulfil their responsibilities under the EMP and understand their obligation to exercise due diligence for environmental matters. The training requirements for each role and responsibility detailed in the EMP are provided in **Table 11.1** below.

Records of all training should be maintained and reported in the Annual Monitoring and Audit Report.

Training should be implemented in a way that is capable of overcoming English literacy and language barriers; audio-visual staff training guides may be an effective tool for the EARC to utilise.

Table 11.1 - Training requirements

Role / Responsibility	Training Type	Description
All staff and contractors undertaking work on the Facility	Site Induction Training	Municipal Services Supervisor to provide onsite site induction training to any new staff or contractors that will be undertaking works at the Facility. The training should detail key hazards and risks likely to be encountered, safety precautions to be followed and emergency response procedures. Elements of this EMP relevant to the work being undertaken should also be communicated.
All staff responsible for the operation and management of the Facility.	EMP Familiarisation	Staff that are responsible for the management, supervision, and day to day operations of the Facility shall be required to familiarise themselves with the EMP. Their level of familiarisation with the EMP will be assessed via a written or oral comprehension test undertaken by the Regional Waste & Environmental Manager.
All staff responsible for the operation and management of the Facility.	Emergency Response Training	Staff that are responsible for the management, supervision, and day to day operations of the Facility shall be required to familiarise themselves with Emergency Response Procedures (ERPs). Their level of familiarisation with the ERPs will be assessed via an oral or written comprehension test undertaken by the Regional Waste & Environmental Manager. A discussion of ERPs should be undertaken between the Regional Waste & Environmental Manager, Director of Technical Services, Municipal Services Supervisor, and Municipal Services Officers on an annual basis and following any emergency response incident.
Staff responsible for the handling and storage of listed waste.	Listed Waste Handling	Regional Waste & Environmental Manager to provide familiarisation and training on the following topics: <ul style="list-style-type: none"> Listed waste handling and storage requirements and procedures Listed waste emergency response procedures OHS requirements and procedures. This training should be undertaken for all new staff responsible for the handling and storage of listed waste on commencement of their employment, and refresher training should be provided on annual basis. Staff competencies in these topics to be assessed with oral or written comprehension tests undertaken by the Regional Waste & Environmental Manager

11.2 COMMUNITY AWARENESS AND EDUCATION

As the Facility is not staffed, members of the community accessing the Facility act as informal facility personnel. If the EMP is to be effectively implemented and complied with, it is therefore essential for the EARC to take actions that educate the community and raise awareness on how the Facility should be utilised, and risks to human health and the environment minimised.

The EARC will go about this by developing and implementing a Community Awareness and Waste Education Strategy (CAWES) that focusses on the following issues:

- Waste hazards to human health
- Waste hazards to the environment
- Environmental, health and economic impacts of illegal dumping and littering
- Health impacts from burning waste
- The benefits of recycling
- How to safely use the Milingimbi Waste Management Facility.

In addition to implementing improved waste management practices that are sustainable, successful, and contextual to Milingimbi, other contributing factors to ongoing community waste management issues need to be thoroughly considered in the development and implementation of the EMP and subsequently the CAWES.

Education through public awareness campaigns, and collaborative programs between the EARC and local schools, stores, health organisations and community authorities will increase public participation in waste management practices, including increased involvement of existing programs.

Waste-monitoring programs that assess the performance of public participation in waste management practices is also recommended and increases the overall success of community waste management. This may be added as a Key Performance Indicator, or in the form of data collection, community feedback, or a creative monitoring program controlled by the community.

Appropriate education should consider local cultural understandings of the links between environment and human health and wellbeing, be culturally and linguistically appropriate to Milingimbi, therefore using Yolngu language in both written and audio/visual resources.

The CAWES should be produced in close consultation across all decision-making processes with key stakeholder groups in the community to ensure that effective measures are developed for communicating and engaging with all members of the community.

It is recommended that the document "A gap to close: A literature review of waste management, health and wellbeing in rural and remote Aboriginal and Torres Strait Islander communities"⁵, in particular Section 8, 9 & 10, is taken into high consideration upon the development of a CAWES.

11.3 COMMUNICATION

11.3.1 Local Authority

Following the *Local Government Act (NT) 2008*, there is a requirement that all Regional Councils establish and maintain a Local Authority (LA) in the towns and communities within the Regional Council area. Between six to fourteen local representatives acting as ordinary members make up the Local Authority and act as the voice of the community. The ordinary members inform Elected Members and Stakeholders while upholding and promoting cultural structures and the complexity of traditional society. All organisations and stakeholders requesting to present to an LA must do so 10 days prior to a meeting.

⁵ Seemann, McLean & Fiocco (2017)

Structured meetings are required at a minimum of six times a year and provide opportunities for community to advise and make recommendations to Council and collaborate on practical solutions and best outcomes for the community. Local Authorities act as essential forums for community engagement and play a pivotal role in sustaining an informed administrative environment within the communities, and the wider region⁶.

The Regional Waste and Environmental Manager regularly attends LA meetings to inform and consult members on waste management activities, policies and strategies being undertaken.

11.3.2 *Direct communication*

It is anticipated that development and implementation of the CAWES will result in a range of direct communication and engagement channels between community stakeholder groups and the EARC being established. These channels may include community radio, information sessions with community groups, school programs, social media, signs, artwork, print media, special events and a waste ambassador program.

⁶ East Arnhem Regional Council (2015). Local Authorities. Retrieved from <http://www.eastarnhem.nt.gov.au/local-authorities/>

12 PERFORMANCE IMPROVEMENT PLAN

Performance improvement actions that need to be implemented to ensure compliance with this EMP and minimise the risk of environmental impacts are detailed in **Table 12.1** below. Estimates of staff or financial resources required should only be considered accurate to $\pm 30\%$. The implementation priorities referred to in the table are defined as: 'Immediate' - Before December 2020; 'High' - Before July 2021; 'Medium' - Before December 2021; and 'Low' - Before December 2022.

Table 12.1 - Performance improvement actions

Relevant sections of EMP	Relevant sections of 10 Year Waste Strategy	Description of issue	Performance improvement actions	Resources required	Implementation priority	Completed
4.6.4		Site security	Installation of a pole mounted motion activated CCTV camera near the Facility entrance	\$10k for installation	Medium	
4.6.4		Site security	Installation of a ringlocked perimeter fence and gate.	Capital cost: \$225,000 (Assuming 900m of fencing at \$250/m)	Low	
7.1.1 and 7.1.2		Stormwater management	Undertake site works to direct stormwater away from landfill cells prior to wet season.	Contractor: <\$5,000, or EARC plant and staff: 1 day	Immediate	
7.1.2		Hydrogeological Investigation	Engage a hydrogeologist to undertake a detailed Hydrogeological Investigation to assess the risk of leachate contamination of the central aquifer.	\$75,000 - \$150,000	Medium	
7.2.3		Waste Compaction	Investigate and assess the economic feasibility of the purchase of a tracked or solid wheeled loader capable of compacting and covering waste on a regular basis.	RWEM: 14 days, or Consultant: \$6k - \$10k	Medium	
7.4.3		Windblown Litter	Install portable litter screens downwind of landfill cell.	<\$5k if low cost material such as ringlock wire or old mattress springs are installed with star pickets	Medium	
7.5		Illegal dumping	Install signs warning against illegal dumping and prevent access to illegal dumping and legacy waste sites where possible.	~\$5k if signs are installed by EARC staff.	High	
7.8		Listed Waste	Construct a Listed Waste Compound at the Facility with suitable containment structures storing listed wastes.	\$10k - \$70k depending on infrastructure required.	Medium	

Relevant sections of EMP	Relevant sections of 10 Year Waste Strategy	Description of issue	Performance improvement actions	Resources required	Implementation priority	Completed
9.1		Facility Inspections	Develop and implement daily and monthly facility inspections.	No cost if completed internally using traditional hard copy inspection forms. \$2k to \$20k pa if a digital system using mobile device applications is implemented at all EARC facilities. Final cost is dependent on EARC deployment and support requirements.	High	
9.2		Groundwater Monitoring	Commence groundwater sampling program.	Sample analysis: ~\$4k pa Sample collection by contractor: ~\$10k pa, or Sample collection by EARC staff: 2 days pa + \$2k pa for training and equipment.	Medium	
10		Landfill Closure and Rehabilitation	Establish a reserve fund for the progressive closure and rehabilitation of landfill cells at the Facility.	Assuming an area of 15,000 square metres will require capping in accordance with Section 10.1 , approximately 23,000 cubic metres (m ³) of soil would have to excavated and placed over the waste. If it is assumed that this would cost \$25-40/m ³ , the EARC would need a reserve of approximately \$560,000 to \$900,000.	Low	
11.1		Staff Training	Commence staff training as detailed in the EMP.	1 day pa per MSO 2 days pa for MSS 2 days pa for RWEM	High	
11.2		Community Awareness and Education	Consult with the community and develop a Community Awareness and Waste Education Strategy	RWEM: ~15 days Consultant: \$20k to \$35k	Medium	
11.2		Community Awareness and Education	Implement the Community Awareness and Waste Education Strategy (CAWES)	Dependent on actions and strategies contained within the CAWES.	Medium	

13 AUDIT, REPORTING, AND REVIEW

Internal auditing of EMP implementation is required to evaluate and record whether the EMP is being complied with and how improvements to the implementation process can be improved, or the EMP updated. Audits are useful for demonstrating the extent of compliance with EMP commitments and legal conditions to Council and its staff, and external stakeholders such as the community and the NT EPA.

13.1 ANNUAL MONITORING AND AUDIT REPORT

The EARC will prepare an Annual Monitoring and Audit Report (Annual Report) that documents environmental performance at the Facility and whether the EMP is being complied with and implemented successfully. The Annual Report will be prepared for the period commencing 1st July and ending 30th June. The report will be completed and made available to the public and the NT EPA by the 30th of September each year.

The Annual Report will include but not be limited to the following information:

- Types and quantities of listed wastes received.
- Types and quantities of waste recycled.
- The monitoring methods used to collect and analyse data required by the EMP.
- Tabulated results of groundwater monitoring data collected.
- Graphical presentation of any groundwater data from at least the last three years to demonstrate variability and/or trends. Any statistically significant variations or anomalies in the data will be highlighted and explained.
- Analysis, interpretation and explanation of all monitoring data with respect to the environmental impacts.
- The details of uncontrolled fires at the Facility.
- Details of any environmental pollution or human health incidents.
- Actions taken to control weeds, vermin and feral animals.
- The quantity of litter and illegally dumped waste collected.
- The amount of staff time dedicated to the collection of litter and illegally dumped waste.
- The number and type of complaints received including complainants name, address, nature of complaint (where appropriate cross reference with prevailing wind directions) and action taken.
- Identification of any deficiencies in environmental performance identified by the monitoring data, trends or incidents; and of remedial action taken or proposed to be taken to address these deficiencies.
- Any issues raised from inspections or incident responses during the reporting period together with details as to how these have been addressed/rectified or, if the required work has yet to be completed, how and when they will be rectified/completed.
- Any changes to site boundaries, internal buffer zones, waste disposal areas, location of groundwater monitoring bores, surface drainage channels and on-site or off-site impacts or pollution.
- Details of any progressive rehabilitation actions undertaken.
- Details of staff training actions undertaken.
- Details of community education, awareness, and consultation actions undertaken.
- Recommendations on improving the environmental performance of the Facility.

13.2 REVIEW

As detailed in **Section 1.2**, the EARC will review and update the EMP (as necessary) at least every three years. The purpose of the review is to:

- Evaluate the rate of landfilling and revise the Master Plan as required;
- Review site operations and identify areas where performance can be improved;
- Update the EMP to reflect any changes to Facility operations;
- Update the EMP to reflect regulatory changes;
- Update the EMP to reflect changes to Council, Territory and Federal strategic objectives; and
- Update the EMP to incorporate all changes arising from the review and audit process.

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APPENDIX A - WIND ROSE DATA

Rose of Wind direction versus Wind speed in km/h (01 Jan 1962 to 28 Feb 2003)

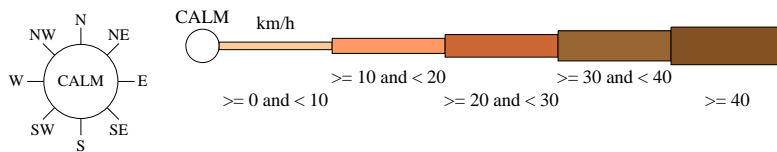
Custom times selected, refer to attached note for details

MILINGIMBI

Site No: 014402 • Opened Jan 1923 • Closed Mar 2003 • Latitude: -12.1239° • Longitude: 134.9078° • Elevation 4m

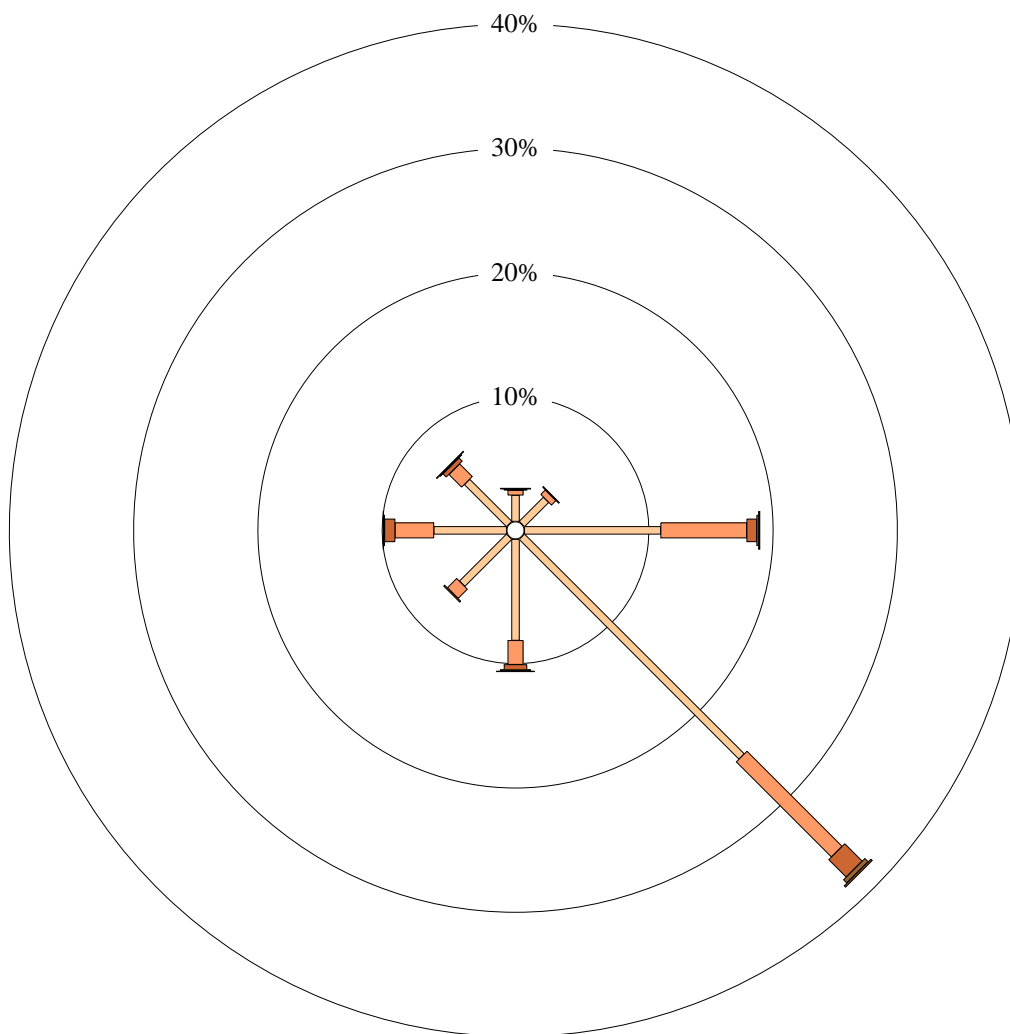
An asterisk (*) indicates that calm is less than 0.5%.

Other important info about this analysis is available in the accompanying notes.



9 am
11829 Total Observations

Calm 3%



Rose of Wind direction versus Wind speed in km/h (01 Jan 1962 to 28 Feb 2003)

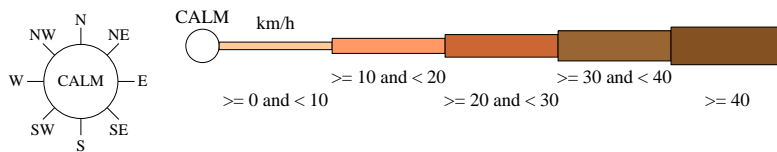
Custom times selected, refer to attached note for details

MILINGIMBI

Site No: 014402 • Opened Jan 1923 • Closed Mar 2003 • Latitude: -12.1239° • Longitude: 134.9078° • Elevation 4m

An asterisk (*) indicates that calm is less than 0.5%.

Other important info about this analysis is available in the accompanying notes.



3 pm
8996 Total Observations

Calm 2%

