Bravo Resource Solutions

Module 3.0, Endeavour House, 11-15 Fourth Avenue Mawson Lakes, SA 5095

CRESCENT HEAD ILMENITE STOCKPILE REHABILITATION

Water and Sediment Management Plan

For Greencoast Environmental Rehabilitation

Contents

Crescent Head Water & Sediment Management Plan

1. Introduction

Greencoast Environmental Rehabilitation (GER) is seeking approval under the section 11A of the NSW Mining Act 1992 to remove an existing low-grade ilmenite stockpile to natural ground level and revegetate the stockpile footprint. The stockpile covers an area of approximately two hectares and is located at the site of a former mineral separation plant or 'dry mill', approximately one kilometre south of the township of Crescent Head, New South Wales. The stockpile is located within GER's Exploration Licence 8085 on Crown Land on the eastern side of Point Plomer Road, on Lot 2281 Deposited Plan 1153793 (Appendix A, Figures 5-7).

GER has engaged the services of Bravo Resource Solutions (BRS) to prepare this Water & Sediment Management Plan (WSMP), which forms part of GER's overall Rehabilitation Management Plan for the stockpile removal and revegetation and it addresses the specific requirements of the Secretary's Environmental Assessment Requirements (SEARS) under Section 78A (8) of the *Environmental Planning and Assessment Act 1979* and Schedule 2 of the *Environmental Planning and Assessment Regulation 2000*.

2. Scope

The WSMP forms part of GER's overall Rehabilitation Management Plan to remove the ilmenite stockpile and revegetate the site. In this WSMP the proposed stockpile removal and subsequent site revegetation are together referred to as the Project Site, which covers approximately two hectares.
The Scope of Works (SOW) covered by the WSMP includes the following proposed works on the Project Site by GER, summarised as follows:

1. Prepare the ilmenite stockpile for removal by grubbing and stripping to remove weeds and surficial organic matter;
2. Remove the ilmenite stockpile to as close to natural ground level as practicable; and
3. Reinstate native vegetation and habitat over the former stockpile footprint.

3. Objectives

The objectives of this WSMP are to:

1. Describe how potential risks to surface water and ground water associated with the rehabilitation works will be minimised and managed;
2. Comply with all regulatory requirements; and
3. Address the requirements of the Secretary's Environmental Assessment Requirements (SEARS) under Section 78A (8) of the Environmental Planning and Assessment Act 1979 and Schedule 2 of the Environmental Planning and Assessment Regulation 2000, including the following specific water issues:
    - "…an assessment of the likely impacts of the development (including flooding) on surface water and groundwater resources (including watercourses), wetlands, riparian land, groundwater dependent ecosystems, related infrastructure, surrounding Crown land, adjacent licensed water users and basic landholder rights",
    - "…measures proposed to monitor, reduce and mitigate these impacts",
    - "…details of water supply arrangements", and
    - "…a description of the erosion and sediment control measures that would be implemented to mitigate any impacts in accordance with Managing Urban Stormwater: Soils & Construction".

4. Site Conditions

1. Rainfall

Crescent Head has a humid subtropical climate with warm, humid summers and mild winters. Continuous rainfall records from the Crescent Head Weather Station (Station Number 59047) are available from 1st September 1961. The average Crescent Head annual rainfall is 1,426 mm, with rainfall occurring in all months of the year. The wettest months are typically January to April as shown in Figure 1. A histogram of daily rainfall is shown in Figure 2.

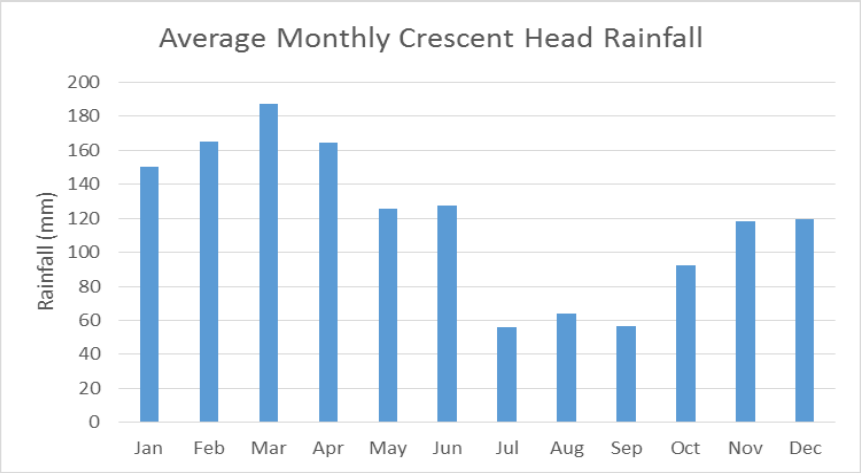

Figure 1. Average Monthly Crescent Head Rainfall

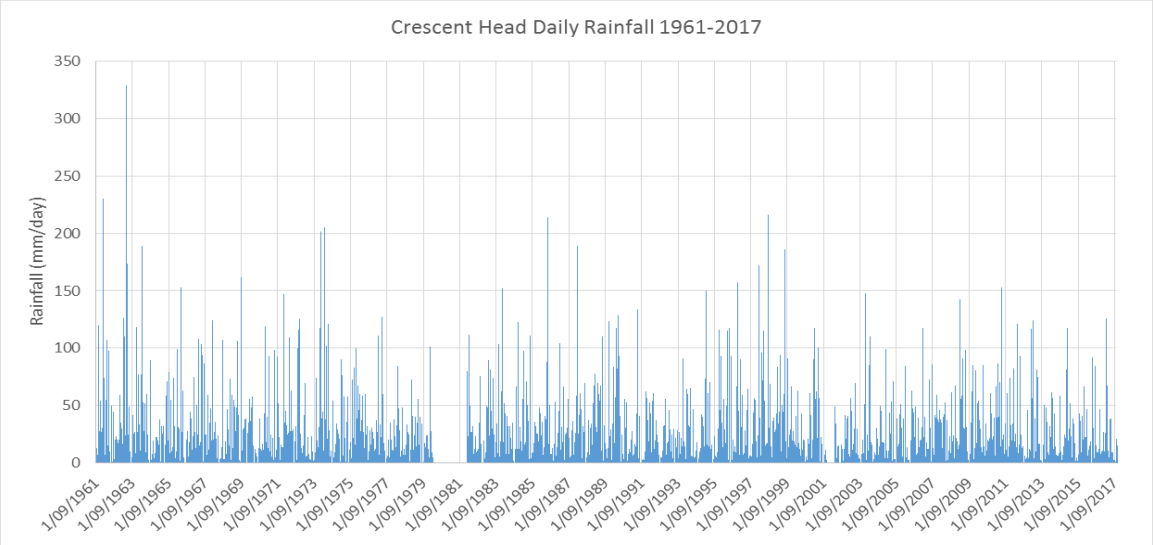

Figure 2. Crescent Head Daily Rainfall 1961-2017

The Bureau of Meteorology's 2016 Computerised Design IFD rainfall system (CDIRS) has been used to construct a full set of Intensity-Frequency-Duration (IFD) curves for Crescent Head, which allow estimation of the probability of rainfall events of different intensity and duration at the Project Site. In accordance with s 2.3.1 of *Managing Urban Stormwater: Soils and Construction Manual* (Landcom, 2004) the design storm event for

the Project Site is taken as the 15-minute time of concentration[1] for a 1:10 year Average Recurrence Interval (ARI), which is equivalent to a 10% Average Exceedance Probability (AEP).

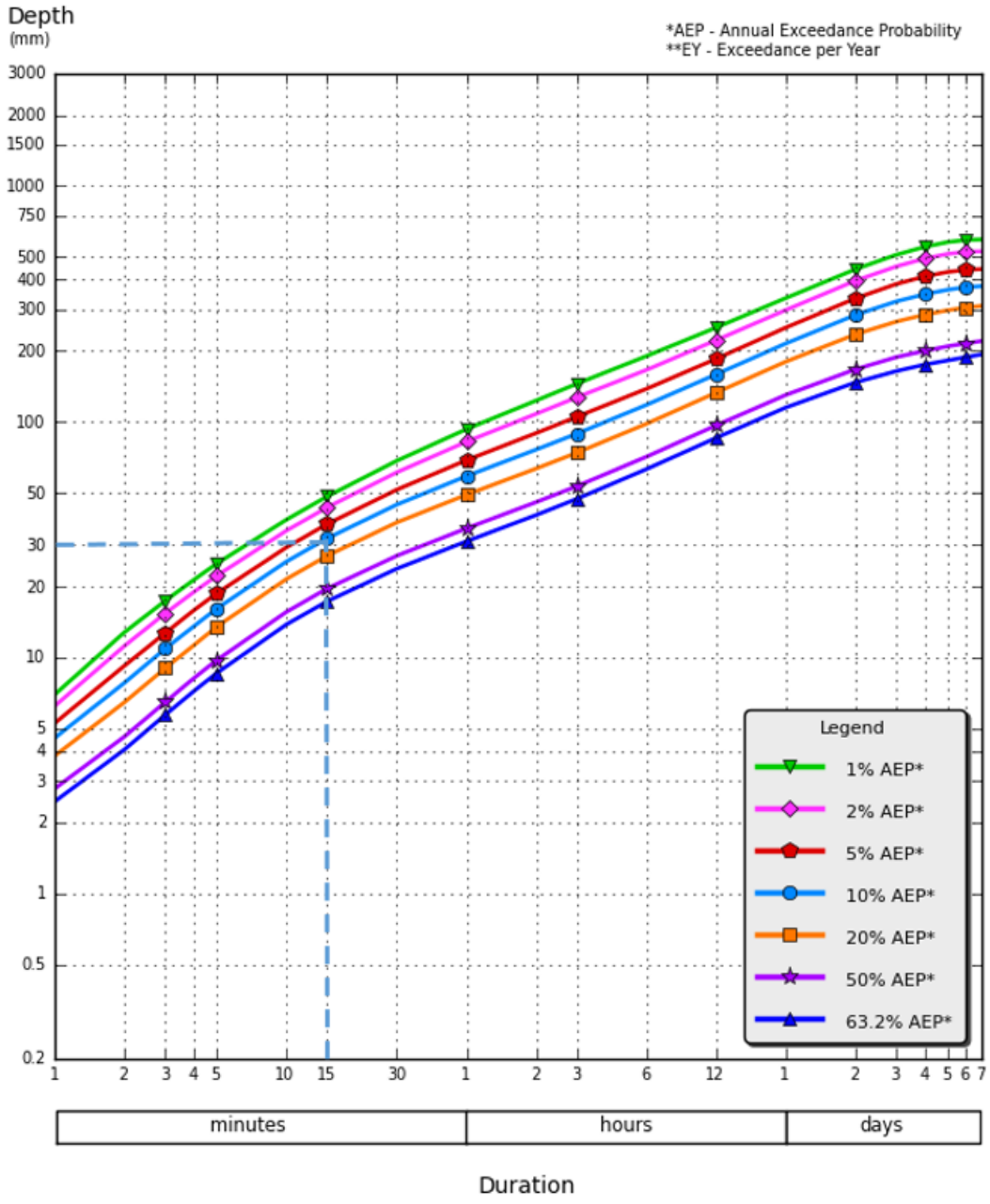

Figure 3. Crescent Head Depth-Frequency-Duration curves created from the BoM Rainfall IFD Data System. A 15-minute time of concentration for 10% AEP equates to 30mm depth, as shown.

[1] Time of Concentration (TOC) is the estimated time required for rain falling in the Project Area to flow from the most remote point to the water shed outlet. A 15-minute TOC is considered a conservative estimate based on the topography and soil type of the Project Area.

2. Surface Water Runoff & Infiltration

The ilmenite stockpile and the underlying quartz sand at the Project Site are both Group-A Soils. Group-A Soils have very low runoff potential and water is expected to move through the soil profile relatively quickly (F.2, Managing Urban Stormwater: Soils and Construction Manual Landcom, 2004). High infiltration capacity at the Project Site is confirmed by the absence of drainage lines or areas of surface water ponding, even in low lying areas of the ilmenite stockpile.

Infiltration capacity is highest when the sand is dry and declines once it is saturated. Group-A Soils have both very high initial infiltration capacities, typically around 60mm/hour, and long-term infiltration capacities, typically ranging between 180 - 275mm/day[2].

For a 15-minute TOC and 10% AEP storm a depth of 30mm depth is predicted at the Project Site (Figure 3). This indicates that for the design storm event no runoff is expected at the Project Site, as the estimated initial infiltration capacity (60mm) is double the expected water depth (30mm).
For longer duration rain events the data in Figure 2 shows only nine days since 1961 where daily rainfall has exceeded the estimated minimum long-term infiltration capacity of 180mm, and only one day in excess of the estimated maximum long-term capacity 275mm. This indicates that the Project Site will not shed runoff except during extreme long-duration rain events.

Hand auger drilling completed by GER (14 holes) suggests that once the stockpile has been removed the resulting gently undulating natural ground profile will be similar to surrounding natural topography (Appendix A, Figure 7). Surface water is likely to infiltrate into the sand after rain, with little or no ponding or runoff. Erosion is unlikely to occur in the short term, due to the relatively flat natural topography and lack of runoff, and once the stockpile footprint has been revegetated raindrop impact on the soil will be minimal.

3. Groundwater

Standing water in an existing shallow drainage trench east of the stockpile has an elevation of approximately 1.9 mAHD (Appendix A, Figures 6 & 7). It is likely the standing water level in the trench is similar to the local water table elevation. Based on this assumption the base of the stockpile (natural ground level) is between 2.2m and 5.1m higher than the local water table, and removal of the stockpile to natural ground level will have no direct impact on groundwater.
Hand auger drilling indicates the ilmenite stockpile has a maximum thickness of approximately 4.15m. The stockpile sits directly on natural ground comprised of quartz (silica) sand. Groundwater was not encountered in any of the auger holes, which confirms the base of the stockpile is above the local water table.

Due to the high infiltration capacity of the ilmenite and the underlying quartz sand, GER should pay particular attention to protecting groundwater by minimising the potential for any spills to occur at the Project Site (eg hydrocarbons or chemicals) and ensuring that adequate spill response procedures are in place including clean up, testing, monitoring and reporting, in the event a spill was to occur (Appendix C).

It is understood that groundwater will not be abstracted during GER's site activities, including rehabilitation. Any water that is required at the Project Site eg for local dust suppression or plant watering during revegetation will be sourced by GER off-site from a local water cartage contractor (Table B7).

[2] Mays, LW (2001). Stormwater Collection Systems Design Handbook. Tables 4.12 & 9.1.

4. Drainage

GER do not expect drainage works will be required as the project aims to return the site to natural ground level, and little or no runoff is expected due to the high infiltration capacity of ilmenite and quartz sand. However, Appendix B lists mitigation and management measures including temporary drainage works that shall be undertaken by GER, if they are required.

2. Relevant Legislative Requirements & Guidelines

2.1.Legislation

Water management activities carried out at the Project Site by GER must comply with relevant policy, legislation and regulations identified in Table 1.

Legislation / Policy	Relevance
NSW Environmental Planning and Assessment Act 1979 (EP&A Act)	The EP&A Act and Regulation include provisions to ensure that proposals that have the potential to impact the environment are subject to detailed assessment.
Protection of the Environment Operations Act 1997 (POEO Act)	The POEO Act controls pollution and regulates waste including excavated soil.
The State Environmental Planning Policy No. 14 Coastal Wetlands (SEPP 14)	SEPP aims to protect and preserve coastal wetlands across NSW.
NSW Groundwater Quality Protection Policy	The policy aims to manage and protect the State's groundwater resources so that they can sustain environmental, social and economic uses for the people of NSW. Surface activities can impact on shallow unconfined aquifers.

Table 1. Relevant Legislation & Policy.

2.2.Guidelines

Other guidelines, specifications and documents potentially relevant to this Project include:

- Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand (2000) National Water Quality Management Strategy – Australian and New Zealand Guidelines for Fresh and Marine Water Quality
- DECCW (2010) NSW Wetlands Policy, March 2010
- DLWC (1998) The NSW Groundwater Quality Protection Policy, December 1998
- Landcom (200) Urban Stormwater: Soils and Construction (Blue Book)
- NSW Department of Housing (1998) Managing Urban Stormwater: Soils and Construction.

6. Identification and Assessment

6.1.Existing Environment

The Project Site consists of a stockpile of ilmenite sand which sits on generally flat or gently undulating quartz sand. The Project Site is on Crown Land, lying entirely within the property boundaries of Lot 2281/DP 115793. The Project Site is bounded by Goolwah National Park to the east (Lot 7302 / DP 1130597), Crown Land to the north (Lot 2281/DP 115793), freehold land to the south (Lot 291/DP 754441) and Point Plomer Road to the west (Appendix A, Figures 5-7).
There are no surface water features on the ilmenite stockpile. The main surface water feature in the vicinity of the Project Site is an existing shallow drainage trench, which is believed to have been cut when MDL operated the site. The drainage trench runs for about 230m on the eastern boundary of the stockpile. The southern end of the trench contains standing water, which is likely at a similar elevation as the local water table, while the remainder of the trench is normally dry. It is understood that GER's activities are restricted to removing and rehabilitating the stockpile and will not affect the drainage trench.

6.2. Site Activities and Potential Surface Water and Groundwater Impacts

Site activities that could potentially impact on surface water and groundwater include:

- Disturbance resulting in soil erosion and sedimentation; and
- Spills of fuel, oil or chemicals resulting in contamination of surface waters and/or groundwater

Based on the soil type and meteorological data it is expected that for rainfall events up to a 1:10 year ARI rainfall will infiltrate directly through the ground, rather than leave the Project Site as runoff. Surface water runoff is therefore unlikely to leave the Project Site. However, sediment erosion control measures should be installed by GER if required and checked and maintained for duration of the site works and subsequent revegetation (refer Appendix B).

Surface water related erosion, sediment runoff or off-site water impacts are also considered unlikely to occur, due both to the nature of the project (ie. site rehabilitation to near-natural conditions) and the high soil infiltration capacity.

The primary potential water issue identified at the Project Site relates to potential spills impacting groundwater, due to the high infiltration capacity of the ilmenite and underlying quartz sand. This WSMP includes a number of recommended control measures to protect groundwater, including measures to minimise the volumes of fuel, oil or chemicals used or stored at the Project Site, refuelling most vehicles off-site, and, when necessary, parking and refuelling on an existing impermeable concrete hardstand[3] (Appendix B, Tables B2 and B7). Control measures in the event of a spill taking place are listed in Appendix C.

7. Consultation and Communication

7.1. Stakeholder Consultation

It is understood that a Community Consultation Plan has been prepared by GER. Prior to- and after-commencement of on-site works GER will invite stakeholders to the Project Site for regular meetings, in accordance with GER's Community Consultation Plan. Any water- or sediment-related issues that stakeholders may have can be addressed during these meetings.

7.2. Training and Awareness

[3] Concrete slab foundations from the former MDL mineral separation plant site are located approximately 100m NE of the ilmenite stockpile (shown in Figures 6 and 7). GER propose using the existing 25 x 50m slab as a hardstand for vehicles to minimise risk of fuel spills or leaks.

It is recommended that all of GER's project personnel, subcontractors and consultants be given training on their personal and company environmental obligations during their site inductions and toolbox talks. This should include training on the measures that will be implemented to protect surface water and groundwater during site activities. Examples of topics that may be covered during project induction and tool box meetings include:

- Erosion and sediment controls;
- Minimising fuel and chemical use and/or storage on site;
- Vehicle parking in designated area (existing concrete hardstand);
- Rapid spill response; and
- Planning for heavy rain events.

8. Implementation of Controls

8.1.Surface Water and Groundwater Mitigation and Management Measures

Project mitigation measures and responsibilities associated with water and sediment management are outlined in Appendix B. These mitigation measures have been developed to ensure GER's compliance with the relevant legislation and best industry practice.

9. Monitoring and Review

9.1.Monitoring, Inspection and Reporting

It is recommended that runoff and sediment control measures be inspected by GER weekly, and after each rainfall event that causes runoff to occur from the Project Site, to ensure the controls are working efficiently and effectively.

Inspection of environmental management measures by GER should occur for the duration of site activities including revegetation. Daily visual inspections of the site should be undertaken by GER site personnel to identify actual or potential water and sediment related issues during stockpile removal.
Inspections of erosion and sediment control devices should be undertaken by GER as follows:

- Weekly; or
- Following a rainfall event of 10mm or greater; and
- Within 24 hours of cessation of a rainfall event causing runoff to occur from the Project Site.

The soil and water monitoring, inspection and reporting program is summarised in Table 2.

9.2.Records

It is recommended that the following records relating to surface water and groundwater management and monitoring be maintained by GER's Load and Haul and Revegetation contractors:

- Spill or incident reports
- Records of daily/weekly inspections
- Data relating to water cart usage
- Data relating to the portable chemical toilet

The following record(s) should also be maintained by GER:

- Records of all periodic site inspections where surface and/or groundwater is considered.

9.3. Auditing

It is recommended that quarterly audits for compliance against the WPM and relevant regulations and approvals be undertaken as shown in Table 2 including an audit of the worksite and subcontractors to assess compliance, and all environmental management aspects related to surface water and groundwater.

Activity	Area	Resources	Responsibility	Frequency	Reported To
ROUTINE INSPECTIONS					
Daily Environmental Inspection	All	Site Diary	Site Supervisor	Daily	Site Manager
Weekly Environmental Inspection	All	Erosion control and water management checklist	Site Supervisor	Weekly or following +10mm rainfall	Site Manager,
Quarterly Audit	All	WSMP	Environmental Advisor	Quarterly	Site Manager, GER Management
REPORTING					
Monthly Environmental Reports	All	Monthly Compliance Tracking Report, Weekly Checklist	Site Manager	Monthly	GER Management

Table 2. Inspection, Monitoring & Auditing

9.4. Incident Management

It is recommended that environmental incidents occurring within the Project Site be managed by GER's Load and Haul and Revegetation Contractors, in consultation with GER, including notification, recording, reporting and response processes.

Appendix A: Figures

Figure 5. Existing ilmenite stockpile & topographic contours (mAHD) with deposited plan property boundaries.

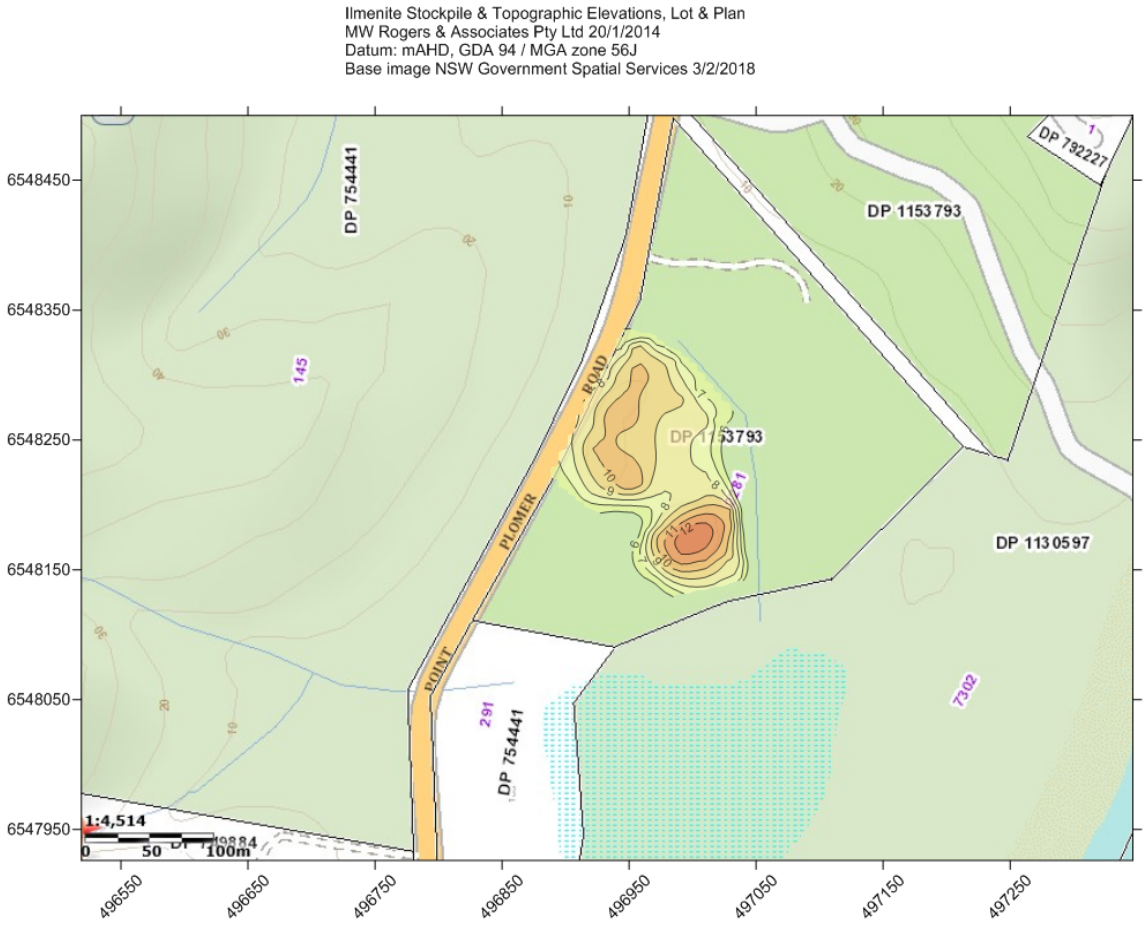

Figure 6. Existing ilmenite stockpile contours (mAHD), stockpile surface area approximately 2 Ha. Former MDL foundations n

Figure 7. Approximate natural ground elevation below ilmenite stockpile (mAHD)

Appendix B: Mitigation and Management Measures

Table B-1 General

General			
ID	**Management & Mitigation Measure**	**Responsibility**	**Inspection/ Timing**
1	Site employees including contractors and sub contracts are required to attend an induction prior to commencing work to ensure all personnel are aware of their HSE responsibilities and have the necessary skills and knowledge to fulfil them.	Project Manager	Before site works & revegetation
2	Restrict vehicle traffic to defined areas within the Project Site.	Site Manager	During site works & revegetation
3	Prevent the movement of sediment away from the stockpile by installing temporary erosion and sediment control structures, as required, consistent with ***Managing Urban Stormwater: Soils and Construction Manual*** (Landcom, 2004, or latest version).	Site Supervisor	Before and during site works & revegetation
4	Minimise on-site vehicle activity on disturbed areas during and after heavy rain events.	Site Supervisor	During site works & revegetation
5	Construct temporary diversion drains and sediment control structures to manage surface water and sediment around working areas, if required, consistent with ***Managing Urban Stormwater: Soils and Construction Manual*** (Landcom, 2004, or latest version).	Site Supervisor	During site works & revegetation
6	Maintain any runoff, erosion or sediment control structures that may be required to appropriate standards.	Site Supervisor	During site works & revegetation
7	Regularly inspect and monitor Project Site for signs of erosion and determine if temporary erosion control structures and/or diversion drains are required.	Site Supervisor	During site works & revegetation
8	Ensure that any water used on the Project Site eg for local dust suppression or watering of seedlings is minimised.	Site Supervisor	During site works & revegetation
9	Check weather forecasts each day for potential heavy rain and flood events.	Site Supervisor	During site works
10	Clearing and grubbing of stockpile to be undertaken in a staged manner to minimise potential for erosion and sediment runoff.	Site Supervisor	During clearing & site works
11	Ensure any civil works that may be required are consistent with runoff expected from a 1:10 year ARI event consistent with ***Managing Urban Stormwater: Soils and Construction Manual*** (Landcom, 2004, or latest version).	Site Manager	Before and during site works

12	Site activities will be managed so as not to disturb the existing shallow drainage trench on the east side of the stockpile.	Site Supervisor	During site works & revegetation

Table B-2 Illegal Dumping

Illegal Dumping			
ID	**Management & Mitigation Measure**	**Responsibility**	**Inspection/ Timing**
1	Reasonable measures will be taken to maintain security of the Project Site for duration of site works and revegetation to prevent third parties from gaining access.	Site Supervisor	During site works & revegetation
2	If dumped waste is observed on the Project Site it will be removed to an appropriate waste facility and treated as an environmental incident.	Site Supervisor	During site works & revegetation
3	If any evidence of illegal dumping of waste on the Project Site is observed it will be recorded and treated as an environmental incident. The relevant authorities will be informed within 24 hours including the land owner (Crown Lands) and NSW Police Service.	Site Supervisor	During site works & revegetation

Table B-3 Access Tracks

Access Tracks			
ID	**Management & Mitigation Measure**	**Responsibility**	**Inspection/ Timing**
1	Access shall be restricted to designated tracks in the Project Site to minimise ground disturbance.	Site Supervisor	During site works

Table B-4 Stockpile Slope Batters & Final Landform

Stockpile Slope Batters & Final Landform			
ID	**Management & Mitigation Measure**	**Responsibility**	**Inspection/ Timing**
1	During site works the batter angle of the stockpile shall be maintained at less than 3(H):1(V), or at the natural angle of repose, whichever is lower.	Site Supervisor	During site works
2	The ilmenite stockpile will be removed as close as practical down to natural ground level, resulting in a final landform that is consistent with natural gently sloping surface morphology.	Site Manager	During site works

3	Exposed soils will be revegetated as soon as possible to reduce potential for sediment-laden runoff.	Site Supervisor	During revegetation
4	Temporary wind breaks or equivalent control measures will be placed around exposed areas if required to prevent wind erosion.	Site Supervisor	During revegetation

Table B-5 Silt Fences & Straw Bales

Silt Fences & Straw Bales			
ID	**Management & Mitigation Measure**	**Responsibility**	**Inspection/ Timing**
1	Silt fences and/or straw bale filters shall be installed as required to minimise sediment movement. They shall be installed between site works and the existing shallow drainage trench to the east of the stockpile, as well as disturbed areas if required in accordance with Chapter 6.3.7 of ***Managing Urban Stormwater: Soils and Construction Manual*** (Landcom, 2004, or latest version). Silt fences shall: • Be for low energy flows when filtering is the main aim, or straw bale filters used where a degree of ponding or energy loss is required; • Be a geo-fabric such as silt fence or equivalent; • Be no more than 0.6m high; • Be securely attached (eg staples or ties) to support stakes no more than 3m apart, driven into the ground; • Extend 0.15m below ground surface via excavation of small trench that is backfilled after placement of filter fabric; • Comprise a continuous roll where practical. Where joins are necessary the filter fabric shall be connected with wire ties or clips, with a minimum overlap of 0.15m; • Be maintained and regularly cleaned of sediment during use; • Be removed when no longer required.	Site Supervisor	During site works & revegetation

Table B-6 Diversion Drains

Diversion Drains			
ID	**Management & Mitigation Measure**	**Responsibility**	**Inspection/ Timing**
1	Diversion drains will only be constructed if required, if it is determined that runoff is occurring or is likely to occur, to divert surface water away from stockpiles, excavations or other disturbed areas.	Site Supervisor	During site works & revegetation

2	Diversion drains shall be constructed according to guidelines provided in ***Managing Urban Stormwater: Soils and Construction Manual*** (Landcom, 2004, or latest version).	Site Supervisor	During site works & revegetation

Table B-7 Water, Wastewater, Chemicals, Fuel & Spills

Water, Wastewater, Chemicals, Fuel & Spills			
ID	**Management & Mitigation Measure**	**Responsibility**	**Inspection/ Timing**
1	Store and handle any dangerous goods (as defined by the Australian Dangerous Goods Code) in a designated area in accordance with: a. All relevant Australian standards; b. For liquids a minimum bund volume requirement of 110% of the volume of the largest single stored volume within the bund; and c. The DECC's Environment Protection Manual Technical Bulletin Bunding and Spill Management.	Site Supervisor	During site works & revegetation
2	Spill kits will be supplied and maintained on the Project Site and any spills will be contained immediately. Refer to Spill Response Procedure in Appendix C.	Site Supervisor	During site works & revegetation
3	Refuelling of vehicles and equipment is to be conducted off-site as much as possible, including all road-registered vehicles such as dump trucks and light vehicles.	Site Supervisor	During site works & revegetation
4	Storage of any chemicals or fuels will be located will be in separately bunded containers on the former MDL plant site concrete foundations (hardstand).	Site Supervisor	During site works & revegetation
5	The volumes of any chemicals or fuel on the Project Site will be minimised.	Site Supervisor	During site works & revegetation
6	All materials will be stored and transported according to their material safety data sheet (MSDS).	Site Supervisor	During site works & revegetation
7	All vehicles and machinery will be appropriately maintained, and inspected daily for leaks.	Site Supervisor	During site works & revegetation
8	Parking and refuelling of vehicles and equipment shall be on the former MDL plant site concrete foundations (hardstand).	Site Supervisor	During site works & revegetation
9	Vehicles and equipment are not to be washed within the Project Site.	Site Supervisor	During site works & revegetation

10	Water required for site use eg localised dust suppression or plant watering will be sourced from existing supply infrastructure outside the Project Site, eg water carting contractor may supply water tanker filled from a standpipe in Kempsey.	Site Supervisor	During site works & revegetation
11	Transport amenities offsite by a licenced operator to a licenced disposal facility waste (ie portable chemical toilet).	Site Supervisor	During site works & revegetation

Appendix C: Spill Response Procedure

Appendix C: Spill Response Procedure

This spill response strategy has been developed by GER as a contingency plan flow chart in Figure 8. If a significant spill or leakage occurs on the Project Site, including potential impacts from illegal dumping, the response will include measures a-f as follows:

a. Confirm the source and location of contamination
b. Control or remove the contamination source
c. Clean up the contamination source
d. Assess groundwater quality against relevant guidelines and background concentrations
e. Investigate the most appropriate remedial response
f. Implement remedial response

A significant spill volume involving diesel, hydraulic oil or other chemicals with potential to cause Environmental Harm is defined as one that exceeds a threshold of 20 litres. In the event of a significant spill on the Project Site, including illegal dumping, this Spill Response Plan would be immediately adopted.

For spills of less than 20 litres, or spills contained on the concrete hardstand, only measures a-c above would be adopted.

Figure 8. Contingency Significant Spill Response Plan Flow Chart