**This is a sub-plan to be used in conjunction with the Environmental Management Plan**

# ElectraNet Project EnergyConnect SA to NSW Interconnector 330kV and 275kV Transmission Lines

Customer: ElectraNet

Contract Number: EC 14171

| Document Preparation and Control | Document Review |
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# TABLE OF CONTENTS

# 1 PURPOSE

The purpose of this sub-plan is to describe how potential impacts on land and soil will be managed throughout the duration of the project. All works will be implemented in accordance with the management measures and strategies contained in this sub-plan.

# 2 DOCUMENT SCOPE

The scope of this plan applies to all Downer workers for ElectraNet's Project EnergyConnect (PEC). This plan incorporates the requirements in ElectraNet's project relevant documents including Scope for Environmental Management Plan EC.14171 – Project EnergyConnect Major Works Contract – Design and Construct (March 2021); Safety and Sustainability Standards; and Engineering Contract Specifications .

This plan applies to all aspects of environmental management for the project.

Where additional management requirements are identified outside the scope of the Environmental Management Plan (EMP) and this sub-plan specific environmental controls will be identified and documentation/procedures updated..

# 3 ENVIRONMENTAL MANAGEMENT PLAN STRUCTURE

A series of environmental sub-plans, as referenced in the project's Environmental Management Plan, aim to identify environmental risks and opportunities, and provide mitigation controls to manage those risks with an emphasis on the critical risks and controls.

As with the environmental management plan, sub-plans reference any IMS documents (including but not limited to, procedures, work instructions, and forms), customer specific requirements, and project specific documents required to execute the project.

Updates to sub-plans are subject to the document review and approval process detailed in the project's document control plan.

# 4 REFERENCED & ASSOCIATED DOCUMENTS

## 4.1 Legislation

The *Landscape South Australia Act 2019* administrated by the Department for Environment and Water replaced the *Natural Resources Management Act 2004* on July 1 202. Under this new legislation, natural resource management regions have been replaced by landscape regions. Murraylands and Riverland Landscape Region covers the project boundary.

## 4.2 Standards and Guidelines

The standards and guidelines applicable to soil and water management are listed in the following table.

| **Australian Standards and Guidance Material** |
|---|
| AS 1940 (2017) The storage and handling of flammable and combustible liquids |
| *Environment Protection (Water Quality) Policy 2015* |
| *Environmental Protection (Air Quality) Policy 2016* |
| *Environmental Protection Act 1993* |
| *Guidelines for the assessment and remediation of site contamination* (SA EPA, 2019) |

| |
|---|
| *Guidelines for regulatory monitoring and testing - Groundwater sampling* (SA EPA, 2019) |
| *Waste Disposal Information Sheet: Current criteria for the classification of waste including Industrial and Commercial Waste (Listed) and Waste Soil* (EPA South Australia, 2010) |
| Water Quality Guideline: Environmental management of dewatering during construction activities (SA EPA, 2018) |
| *Erosion & Sediment Control Field Guide for Road Construction* (Witheridge, 2017) |

## 4.3 Downer Documents

| **DOWNER DOCUMENTS** | |
|---|---|
| **POLICIES** | |
| ***DG-ZHAN-PO200*** | Environmental Sustainability Policy |
| **PRINCIPLES** | |
| ***DG-ZH-PN002*** | 10 Environmental Principles |
| **PROCEDURES** | |
| ***DG-DM-PR003*** | Operational Change Management Procedure |
| ***DG-QA-PR003*** | Internal Audits Procedure |
| ***DG-RM-PR003*** | Project Risk and Opportunity Management |
| ***DG-ZH-PR006*** | Incident Management Procedure |
| ***DG-ZH-PR007*** | Zero Harm Performance Monitoring and Reporting Procedure |
| ***DG-ZH-PR015*** | Emergency Management Procedure |
| ***DG-ZH-PR116.1*** | Inspections Procedure |
| **STANDARDS** | |
| ***DG-HR-ST013*** | Training & Competency Management Standard |
| ***DG-ZH-ST002*** | Legislative and Other Requirements Standard |
| ***DG-ZH-ST013*** | Zero Harm Worker Consultation Standard |
| ***DA-ZH-ST054*** | Hazardous Chemicals and Dangerous Goods Storage Principles and Transportation |
| ***DA-ZH-ST064*** | Soil and Water Management Standard |
| **REGISTERS** | |
| ***Downer Group Definitions Register*** | |
| **PROJECT SPECIFIC DOCUMENTS** | |
| **PLANS** | |
| 14171-DOW-PRM-PLM-0362 | Quality Management Plan |
| 14171-DOW-PRM-PLM-0388 | Emergency Preparedness Management Plan |
| 14171-DOW-PRM-PLM-0379 | Environmental Management Plan |
| 14171-DOW-PRM-PLM-0380 | Waste Management Plan Sub-plan |
| 14171-DOW-PRM-PLM-0381 | Weed, Pest and Disease Management Sub-plan |
| 14171-DOW-PRM-PLM-0552 | Biodiversity and Rehabilitation Management Sub-plan |
| 14171-DOW-PRM-PLM-0383 | Landholder Liaison Sub-plan |
| 14171-DOW-PRM-PLM-0385 | Waterway Management Sub-plan |
| 14171-DOW-PRM-PLM-0526 | Cultural Heritage Management Sub-plan |
| 14171-DOW-PRM-PLM-0387 | Bush Fire Management Plan |

## 4.4 Approvals and Client Documents

| PROJECT APPROVALS AND CLIENT DOCUMENTS | |
|---|---|
| DA | TBC |
| ECS | ElectraNet Section 3 - Engineering Contract Specification (December 2020)<br>Section 3.2a: Transmission Lines - Detailed Design<br>Section 3.2b: Transmission Lines - Construction |
| SEMP | Scope for Environmental Management Plan EC.14171 – Project EnergyConnect Major Works Contract – Design and Construct (July 2021); |
| S&S | ElectraNet Safety and Sustainability Standards (October 2020) |

# 5 DEFINITIONS

The following terms are used in this document.

| | |
|---|---|
| CAZ Plans | Construction Activity Zones (CAZ) include all ground disturbing activities, access routes and work areas associated with the project including:<br>▪ new tracks, pads and facilities<br>▪ maintenance of existing access tracks including grading, widening or stabilisation<br>▪ areas of disturbance associated with demolition works.<br>These designated CAZ will be available as spatial data and/or PDF maps for all workers. |
| Downer Worker | All individuals working for Downer as: employees, contingent labour hire, contractors, subcontractors, apprentices, trainees, and work experience students. |
| EMP | Environmental Management Plan for the Project |
| INX | The Zero Harm database used to record, investigate and follow-up events, including audits, hazards, incidents, inspections, meetings, observations, risk assessments, reviews, and suggestions. |

# 6 EXISTING PROJECT ENVIRONMENT

The Project area is located between Robertstown to SA/NSW border, South Australia. The Western extent of the transmission line corridor, is located on the eastern margin of the Mount Lofty Ranges, it is dominated by a gentle easterly sloping landscape which mainly consists of outwash fans, with some defined creeks and other poorly defined drainage lines. Further to the east, the landform is characterised by an expansive flat to gently undulating plain formed by Tertiary sediments of the central-southern Murray Basin and incised by the modern River Murray valley.

## 6.1 Landforms

The elevation along the transmission corridor varies from approximately 360m in the western most portion of the transmission corridor to 20-80m above sea level across the central and western portions of the proposed route. The corridor intersects 3 separate bioregions: The Flinders Lofty Block, Murray Darling Depression and Riverina. These bioregions are further separated in to 5 subregions. The table below highlights the landform, soils and vegetation associated with each sub region.

| IBRA Region | IBRA Subregion | Description |
|---|---|---|
| Flinders Lofty Block (FLB) | Broughton (FLB02) | **Landform:** Hills and valleys; alternating subparallel hilly ridges and valleys with a general N-S trend in north. In south, hilly dissected tableland.<br>**Soils** are hard setting loams with red clayey subsoils, highly calcareous loamy earths, hard setting loams with mottled yellow clayey subsoil, coherent sandy soils, cracking clays.<br>**Vegetation:** Native vegetation cover has been subject to widespread clearance for agriculture. |
| Murray-Darling Depression (MDD) | Murray Mallee (MDD02) | **Landform:** Very gently undulating, to flat aeolian sand covered depositional plain of the central-southern Murray Basin.<br>**Soils** are brown calcareous earths, highly calcareous loamy earths, cracking clays, hard setting loamy soils with red clayey subsoils.<br>**Vegetation** in the subregion consists of mallee heath and shrublands. |
| | Braemer (MDD07) | **Landform:** Plains with variable dune cover, from dune formations with relatively small plains between to plains with isolated tracts of dunes. Claypans, saline soils, swamps, and intermittent lakes in low-lying areas.<br>**Soils** are brown calcareous earths, highly calcareous loamy earths, cracking clays, hard setting loamy soils with red clayey subsoils.<br>**Vegetation** in the subregion consists of chenopod shrublands. |
| | South Olary Plain (MDD01) | **Landform:** Plains with variable dune cover, from dune formations with relatively small plains between to plains with isolated tracts of dunes. Claypans, saline soils, swamps, and intermittent lakes in low-lying areas.<br>**Soils** are brown calcareous earths, highly calcareous loamy earths, cracking clays, hard setting loamy soils with red clayey subsoils.<br>**Vegetation** in the subregion consists of mallee with and open shrubby understorey. |
| Riverina (RIV) | Murray Scroll Belt (RIV06) | **Landform:** An ancient riverine plain and alluvial fans composed of unconsolidated sediments with evidence of former stream channels. The Murray and Murrumbidgee Rivers and their major tributaries, the Lachlan and Goulburn Rivers flow westwards across this plain.<br>**Soils** are cracking clays, brown sands.<br>**Vegetation** in the subregion consist of eucalyptus woodlands with a shrubby understorey. |

### 6.1.1 Acid Sulfate Soils

Acid Sulfate soils mapping (DEW 2009, CSIRO 2011) indicates that Acid Sulfate soil potential in the transmission line corridor is predominantly negligible. Calcareous soils and limestone are common along the transmission line corridor and the alkalinity of soils present is reported as being alkaline to strongly alkaline.

The ephemeral lakes in the Riverland Ramsar site (which are adjacent to the proposed alignment at its eastern end but are not intersected by it) are mapped as having a high probability of occurrence of acid sulphate soils. Lake Woolpolool and Lake Merreti are characterised as having more than 60% of land susceptible to the development of acid sulfate soil. The Riverland Ramsar site was assessed as medium acidification hazard. The transmission line corridor has been designed to remain in areas deemed extremely low probability of acid sulfate soils.

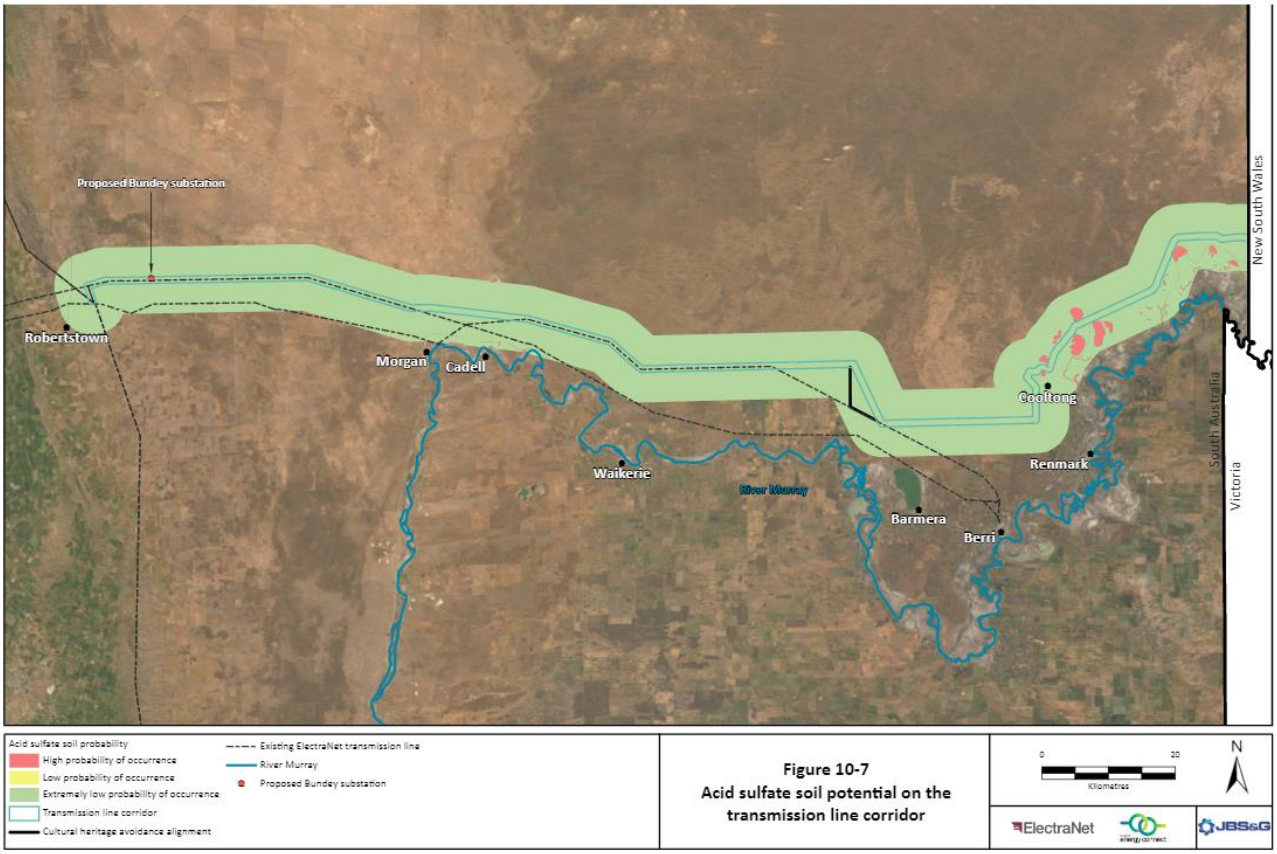



**Figure 1: Occurrence of potential acid sulphate soils across the project area.**

Green is extremely low probability of acid sulphate soils occurrence

### 6.1.2 Saline Soils

Saline soils are commonly occurring across a range of soil profiles. The common characteristic is high sodium chloride (salt) content. Saline soils generally occur where saline ground water comes close to the land surface, within approximately 1 m. Low-lying areas of poor to very poor drainage are predominantly affected. For example back swamps, old lagoon and lake floors, closed depressions, valley floors and drainage depressions.

Saline soils are predominantly devoid of vegetation, with the exception of some salt-tolerant plant species. Saline soils are generally more susceptible to water erosion due to the inability to produce and support vegetation.

Soils within the transmission corridor are characterised as low to moderate salinity and negligible acidity. However, the Yamba Formation slat lakes and Blanchetown Clay can be hypersaline and saline respectively

# 7 CONSTRUCTION IMPACTS

There will be potential physical impacts on land and soil from vehicles, machinery and equipment use. The types of impacts may include:

- change in landforms through the construction of access tracks, benches and substation upgrades
- alteration of topsoil such as structure, stability and permeability, due to soil stripping and stockpiling
- alteration of subsoil structure and compaction on structure locations and within substations from parking and use of vehicles, machinery and equipment

- compaction of soil on tracks from construction traffic

Other potential impacts include contamination, dewatering, generation of dust, and erosion and sedimentation as discussed in the following Sections.

# 7.1 Contamination

During construction, accidental spills or leaks of hydrocarbons and chemicals have the potential to contaminate soil. Further information on the storage, handling and use of hydrocarbons and chemicals is provided in the following Section.

## 7.1.1 Hydrocarbons and Chemicals

Typical types of hydrocarbons and chemicals that will be stored and used during construction of the transmission line and substation upgrades are listed in the Table below.

**Table 1: Typical hydrocarbons and chemicals stored and used**

| | Approx. Volume | Storage Areas | Use |
|---|---|---|---|
| Diesel | 80-100 L | Flammables cupboard<br>Bunded container | Mobile plant fuel |
| | 1,500 L | Fuel trailer | Refuelling plant in field |
| | 5,000 L | Refuelling truck | Refuelling plant and heavy vehicles in field |
| Unleaded | 20 L | Flammables cupboard<br>Bunded container | Small petrol tools |
| Oils | 20 L Hydraulic oil | Flammables cupboard<br>Bunded container | Maintenance, equipment and tools use |
| | 240 L Hydraulic oil | | |
| | WD40 spray cans | Flammables cupboard | Drilling, lubrication, rust |
| Paints | Spray cans | Flammables cupboard<br>Bunded container | Painting conduits, cold galvanising steel |
| | 40 L Amerlock | | Painting bases of steel work |
| | 20 L Thinners | | Mixing paints, clean up |
| Silicon | Tubes | Flammables cupboard | Labels and sealing |
| Alminox | Tubes | Flammables cupboard | Conductor grease |
| Herbicides | 20 L drums | Bunded container | Weed management |

All hydrocarbons and chemicals will be stored in designated storage areas in accordance with *AS 1940 The storage and handling of flammable and combustible liquids* as summarised in the Table below. The minimum storage requirements for hydrocarbons and chemicals will be:

- storage areas located at least 50 m of sensitive areas such as waterways
- stored in fit-for-purpose, labelled containers
- stored within bunded areas within 120% capacity of the largest container or within self-bunded tanks
- bunding for flammable liquids should be 133% of the capacity of the stored liquid
- fit-for-purpose spill kit available at storage locations
- current hardcopy SDS register available at storage locations

The storage of hydrocarbons and chemicals will be inspected through fortnightly environmental inspections using the DA-ZH-FM116.9 Environmental Inspection Checklist.

### 7.1.2 Refuelling

Where possible, vehicles, machinery and equipment will be refuelled offsite (i.e. at a service station) or at designated locations at the camp site or laydown area.

Mobile refuelling will be undertaken at locations at least 50m from waterways or sensitive receptors. A drip tray must be used during mobile refuelling.

### 7.1.3 Maintenance

All maintenance tasks will be undertaken offsite or at designated locations at the camp site or laydown area. For repairs required onsite, machinery and equipment will be moved away from sensitive sites such as drainage corridors and No Go areas where possible. If the machinery and equipment cannot be moved then control measures will be implemented such as the availability of spill kits at the repair location.

### 7.1.4 Spill Kits

Appropriate spill kits kept onsite at all times, including work areas and refuelling locations, and used in the event of a spill. A DA-ZH-FM015.2 Spill Response Equipment Needs Assessment form will be completed prior to commencing the works to determine appropriate spill response equipment needs.

Any spill would be contained and cleaned up immediately (if safe to do so) in accordance with Emergency Preparedness Management Plan. Any contaminated materials from the clean-up of the spill would be segregated for disposal at a licensed waste disposal facility. For storage and disposal of hazardous waste management refer to the Waste Management Sub-plan.

## 7.2 Dewatering

Dewatering of foundations and other excavations may be required including if the groundwater table is intersected or rain which is captured in an open excavation. Prior to dewatering, the water will be tested for pH and turbidity. The pH and turbidity levels will determine if the water is suitable for pumping onto vegetated areas and if further controls for sediment are required during dewatering.

Dewatering will be undertaken in accordance with the ***DA-ZH-ST064 Soil and Water Management Standard*** and in accordance with the SA EPA guideline 'Environmental management of dewatering during construction activities'. The discharge limits for south central Australia is 6.5-9.0 pH units and 50 mg/L for and turbidity.

Noted that the project is not located within a Groundwater Prohibition Area and no known areas of contamination are located adjacent to the project site.

A ***DA-ZH-FM064.1 Dewatering Permit*** will be developed and authorised by the Environmental Advisor and Supervisor prior to commencing dewatering. Depending on the suitability of the water, it will be discharged onto vegetated areas away from waterways or drainage lines, and within the transmission line easement, to allow for natural filtration. If the discharge water is highly turbid, dewatering through a filter sock (or similar) shall be considered, where appropriate to minimise sedimentation. Filter socks will be removed immediately after conclusion of the dewatering activity. All reasonable and practicable measures will be undertaken to avoid discharging to inland or marine waters or stormwater system.

It is not anticipated that works will require a Licence under the EPA for Earthworks Drainage, as the volume of water dewatered is not anticipated to exceed 100kilolitres of wastewater containing suspended solids at a rate of 25mg/l. A licence will be obtained if this is triggered by the construction works.

Groundwater wells are not proposed to be constructed with the project.

## 7.3 Dust

Dust is likely to be generated from vehicles and machinery driving and working on unsealed structure pads, access tracks and roads. Where required, dust suppression techniques will be implemented to minimise dust generation. Dust suppression techniques may include:

- minimising traffic movement
- slowing down traffic in particular in problematic locations or times

- wetting access tracks and pads with a water cart
- addition of wetting agents and polymer binders during wetting of access tracks and pads
- covering or wetting of stockpiles
- progressively rehabilitating and stabilising disturbed areas

Air Quality Management is covered in more detail in the Environmental Management Plan (Construction). Water used for dust suppression will be sourced from potable town water and dewatered groundwater will not be used for dust suppression.

# 8 EROSION AND SEDIMENTATION

Rain, water runoff and wind can cause erosion and sediment deposition. During construction, there is an increased risk of erosion and sediment movement due to disturbance of vegetation and topsoil resulting in exposure of soils. Soil erosion and sedimentation can result in adverse effects to soils, landforms and receiving waters such as:

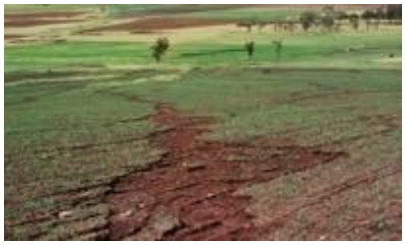
- loss of topsoil
- decreased soil stability
- decrease in receiving water quality in particular increased turbidity
- salinity from the accumulation of soluble soils
- changes to natural drainage pathways.

Erosion and sedimentation can also strain relationships with landowners and stakeholders due to land degradation and changing landforms. The types of erosion relevant to the project are detailed in the following Sections.

## 8.1 Types of Erosion

The different types of erosion are listed in the Table below.

**Table 2: Typical types of erosion (Adapted from Wetheridge, 2017)**

| Type | Description | Example |
|---|---|---|
| Rainwater impact | ▪ this erosion occurs as a result of direct impact of raindrops on the ground<br>▪ raindrops can impact the ground with significant force leading to topsoil loss and sediment runoff<br>▪ particularly detrimental in disturbed areas of bare unprotected earth where soils are exposed<br>▪ this erosion can be managed by providing ground cover such as vegetation to protect and stabilise the soil |  |
| Sheet | ▪ this erosion occurs due to the loss of a relatively shallow layer of topsoil from the surface caused by water runoff or 'sheet-flow'<br>▪ rainfall impact often loosens and destabilises exposed soil particles that are then moved by water<br>▪ sheet erosion may often go unnoticed because visually the impacts seem minor. However, a one centimetre layer represents the loss of 100 $m^3$ per hectare |  |

| | | |
|---|---|---|
| Rill | ▪ this erosion occurs where concentrated water flows at higher velocities result in shallow eroded channels<br>▪ rills are particularly frequent on steep slopes<br>▪ soil chemistry also influences the susceptibility of an area to rill erosion. If the soil type is dispersive, the risk of rill erosion increases. |  |
| Tunnel | ▪ this erosion occurs when excess water flows through dispersive subsoil<br>▪ it is most commonly formed when water flows along a relatively stable ground surface into cracks or openings such old root holes. Once the water has penetrated the surface, the subsoil is washed away creating tunnels.<br>▪ tunnels can be particularly dangerous to construction activities as the ground can become increasingly unstable with minor visual indication on the surface |  |
| Wind | ▪ this erosion occurs when soil particles are loosened at the surface by wind energy. Wind then transports the soil particles in one of three ways:<br>  ▪ surface creep: larger particles rolling along the ground<br>  ▪ saltation: larger particles skimming or skipping along the ground<br>  ▪ suspension: smaller particles become airborne.<br>▪ sandy soils are particularly susceptible. |  |

## 8.2 Soil Characteristics and Erosion Susceptibility

Water erosion potential mapping along the transmission corridor indicates that water erosion potential is predominately low. This classification is based on the inherent slope and soil erodibility characteristics and excludes the influence of vegetation and other protective cover.

At the western end of the transmission line corridor, some areas of higher water erosion potential are present. They include:

- the most western 6km of the transmission line corridor (in the slopes of the Mt Lofty Ranges), water erosion potential is classified in DEW mapping as moderate, with short sections of high erosion potential on slopes south of Powerline road
- the next 6km to the east water erosion potential is classified as moderately low as the slopes transition to the plains
- between the eastern slopes of Mount Lofty Ranges and in the vicinity of Morgan near larger drainage lines (e.g Burra creek and Emu Gully) water erosion potential is classified as moderately low.

Wind erosion potential has been classified as low to moderately low along the transmission corridor to the west end of Morgan.

The central portion of the transmission line corridor has been classified as mostly moderately high wind erosion potential, with some sections moderately low. The higher wind erosion potential is typically associated with dune field and sand plains of the Woorinen Foundation which are inherently sensitive to wind erosion.

## 8.3 Site Specific Assessment

An assessment of each area of disturbance for sediment and erosion loss will be undertaken prior to the commencement of soil disturbance activities. This will consider:

- slope/gradient
- soil type
- area of disturbance
- proximity to watercourses and other sensitive features

Timing of works and projected forecast will also be considered when determining risk of erosion and sedimentation.

If a higher risk of erosion and sedimentation is identified from the site specific assessments, erosion and sediment control structures can be installed (where required) prior to commencement of site disturbance.

### 8.3.1 Erosion and Sediment Control Plan

The size of the disturbance area and risk rating will determine the need for a site specific Erosion and Sediment Control Plan (ESCP). If the disturbance area is greater than 250 $m^2$, an ESCP will be prepared prior to commencing works. If the disturbance area is less than 250 $m^2$, general erosion and sediment control measures will be implemented in accordance with the Sections below.

In addition, an ESCP will be developed for medium or higher risk sites including sites less than 250 $m^2$. The ESCP will include:

- site Layout Plan showing the area of disturbance and infrastructure (topsoil stockpiles, excavations etc.) overlaid with environmental features (watercourses, drainage lines, gradients etc.)
- location and type of erosion and sediment controls
- maintenance and inspection schedule

## 8.4 General Erosion and Sediment Control Measures

General erosion and sediment controls will be installed for all soil disturbance works. This may include:

- divert clean water from disturbed areas through installation of upslope diversion or catch drains
- prevent water flow over fill banks by sloping pads and tracks towards the cut banks
- install diversion banks/whoa boys/erosion control banks (low profile, trafficable earth banks) to intercept runoff flowing down a track
- install table drains and turn-out drains alongside tracks to carry runoff water
- construct batters with least steep slope as possible (>2:1)
- use coir logs, rock or sediment fences to trap sediment on flow points from disturbed areas
- stabilise batters as soon as practicable using topsoil and adding seed, straw or mulch as required.

The general further control measures are described in the following Sections.

### 8.4.1 Access Track Design

Tracks will be located on ridge lines wherever possible whilst trying to avoid steep slopes and minimising the amount of disturbance required. Disturbance of vegetation should be minimised as this can affect soil stability. Locate tracks within areas of previous disturbance, where practicable.

No windrows of soil or debris shall be left on the lower side of the track or across drainage lines.

Other erosion and sediment control measures can be incorporated into the access track design as detailed below in section 8.4.4.

Standard drawings for track formations and access track upgrades is illustrated in Figure 2.

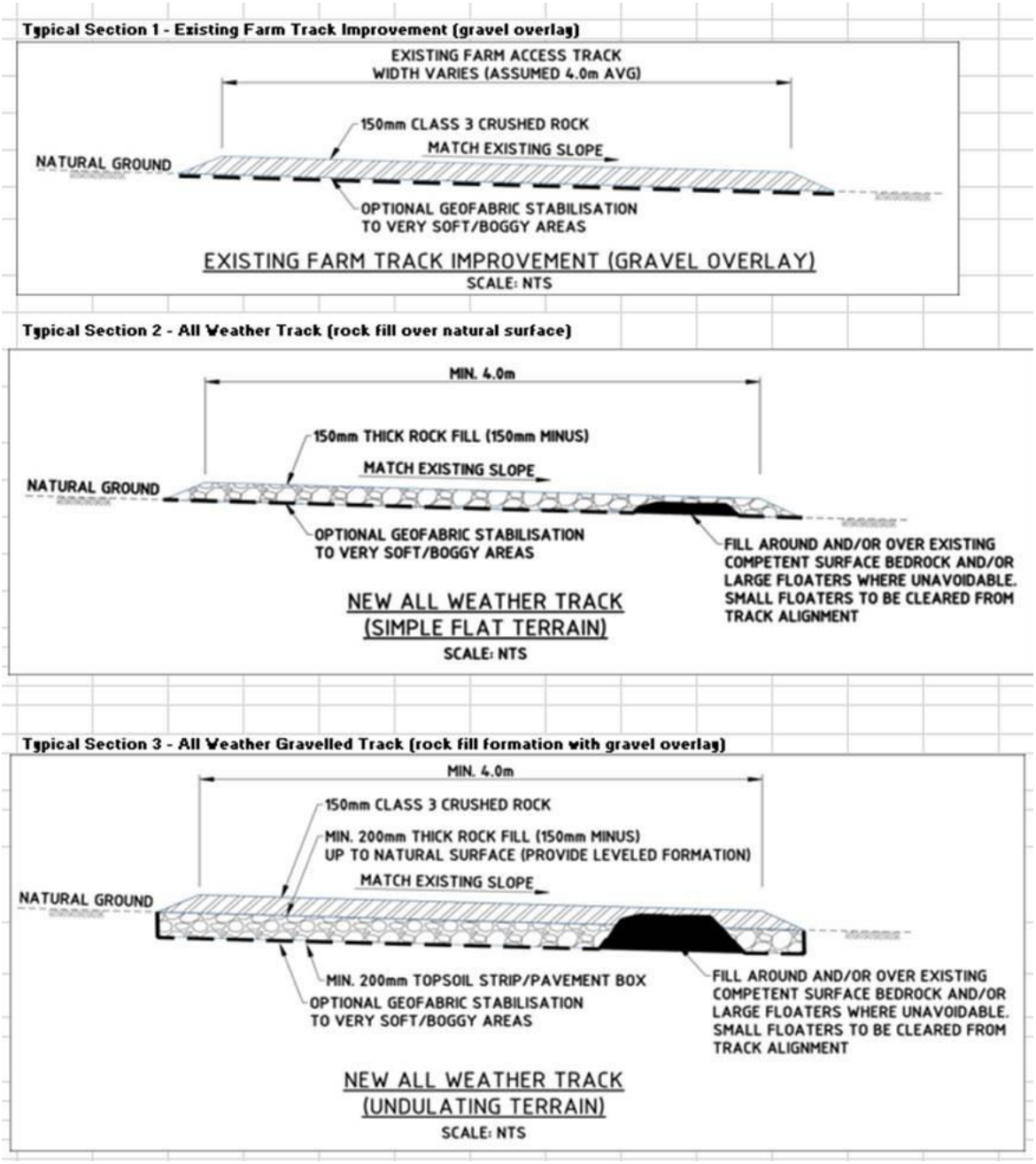



***Figure 2 Track Formation Standard Drawings***

## 8.4.2 Catch Drains and Diversion Bunds

Catch drains and diversion bunds can be installed around the high side of structure pads or access tracks to catch and divert clean water away from disturbed areas in areas of high rainfall (limited requirement on project). Catch drains and diversion bunds can also be installed around the lower side of tower pads to catch dirty water runoff from disturbed areas. Where the drain or bund is installed to catch dirty water, a rock chute drain or coir logs/sediment fence may be installed at the lowest (overflow) point.

Catch drains should only be used for non-dispersive soils. A drain should not be cut into dispersive soil as it can initiate severe rill erosion along the invert of the drain (Witheridge, 2017).

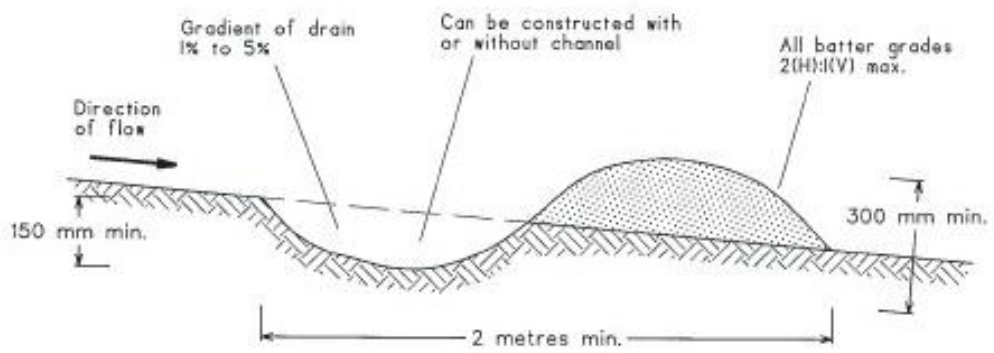



**Figure 3: Catch drain and diversion bund (Landcom, 2004)**

## 8.4.3 Table and Spur Drains

Table drains are used to carry runoff along the sides of tracks. They are installed in conjunction with whoa boys. Table drains should have a broad base in a “U” shaped. The flow velocity within the table drain can be controlled with the installation of check dams. Check dams are most effective when used in channels with a gradient less than 10% and not on batter chutes.

There are basically three types of check dams as shown in the Figure below:

- sandbags which are generally used in shallow drains less than 500 mm deep
- rock check dams used only be used in deep drains greater than 500 mm deep
- coir logs used in drains where flows will overtop (not pass around) the logs

Check dams should not be used in dispersive soils; on very steep slopes; and in a manner that allows flow by-passing within the drain (Witheridge, 2017).

Sandbag Rock Coir logs

**Figure 4: Examples of table drains with check dams (Sourced from Witheridge, 2017)**

Spur drains or turnouts are used to direct runoff from table drains to the adjacent land. Spur drains have a broad base in a “U” shaped and discharge onto stable, vegetated areas. They should extend far enough to prevent discharged water flowing back onto the access track.

## 8.4.4 Whoa-boys

Whoa-boys are used to divert water off the track into a table drain or protected outlet, such as a rock chute drain, through the use of an angled ‘speed bump’ on the track. Whoa-boys must be easily trafficable and drain water across the road without scouring, ponding or overtopping.

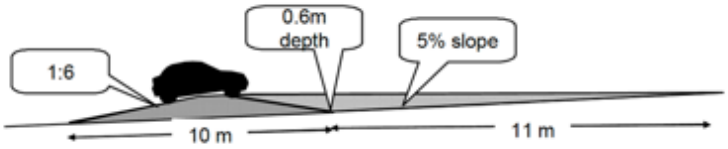
Increasing the number of whoa-boys on a sloped track section ensures that runoff velocity is reduced however there are no strict rules to determine their spacing. Important considerations are:

- soil type with some soils more susceptible to erosion than others
- significant changes in slope or approach to a drainage line or creek

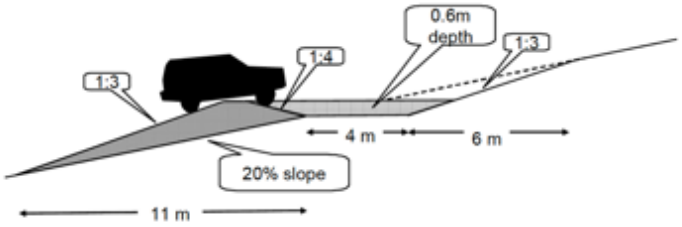
- located just above any existing rills on the track. If the erosion appears to be active, it may be necessary to start even further up the slope.
- suitable discharge locations with a stable outlet such as a vegetated or rocky area

The specifications and construction techniques for whoa-boys depends on the track slope and amount of potential runoff. Whoa-boys with a height of 45 cm may be acceptable on slopes of 1-2 % and in areas with minimal overland flow. Whoa-boys with a height of 60 cm provides more capacity on slopes above 2%.

As the track slope increases, it becomes more difficult to provide sufficient cross sectional capacity and trafficable batters for whoa-boys. Even high clearance vehicles have difficulty negotiating whoa-boys on slopes steeper than 20%. Whoa-boys on steep slopes can either be built using a cut and fill technique or by importing fill material although batter may be very susceptible to erosion.




Cross-section of a whoa-boy on a 5% slope with no cut and fill




Cross section of whoa-boy on a 20% slope constructed with cut and fill

**Figure 5: Examples of 60 cm whoa-boys on different slopes (Sourced from Queensland Government, 2013).**

## 8.4.5 Batter Chute Drains

Batter chute drains can be installed to convey concentrated water runoff down an embankment or change in grade without causing erosion. Batter chute drains can be constructed temporarily with geofabric or permanently with geofabric and rock; or rock and vegetation.

Geotextile cloth can be used to provide temporary scour protection in temporary, low to medium velocity diversion drains. Heavy-duty filter cloth can also be used to form temporary batter chutes. Filter cloth should not be used as a channel lining if the surface soils are dispersive as this can cause severe rilling or tunnel erosion under the fabric.

Rock chutes should be at least 30 cm deep with a minimum width of 150 cm at the inlet and outlet points. Rock chutes should be lined with geofabric and rock of a sufficient size installed to slow water without the rock being washed away. Rounded rock can be significantly less stable (reduced by 30%) than angular, fractured rock especially when placed on steep slopes. Vegetating rock-lined drains and chutes can significantly increase the stability of the rocks however, it can also reduce the drains hydraulic capacity (Witheridge, 2017).

Geotextile

Rock and geotextile

Rock and vegetation

**Figure 6: Examples of chute drains**

## 8.4.6 Coir Logs and Sediment Fences

Coir logs can be installed in drainage lines and contours to slow down water flow and prevent erosion. Coir logs can also be arranged at outlet points for filtering of dirty water from disturbed areas to create a catchment area to trap sediment.

Sediment fences can also be used as sediment trap in drainage lines by slowing the water and trapping courser grained particles. However they are typically not preferred as a sediment control measure as they generally require additional ongoing maintenance to remain functional.

Coir logs

Sediment fence

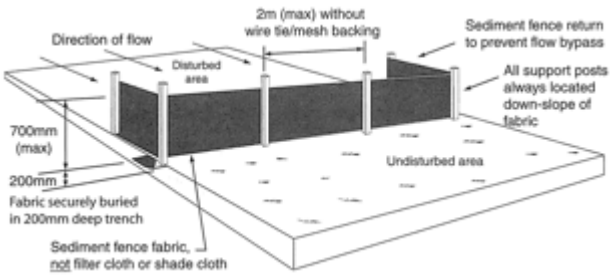



**Figure 7: Examples of coir logs and sediment fence**

## 8.4.7 Stockpile Management

Stockpiles should be constructed as low flat mounds. Stockpiles should be located away from drainage lines and other sensitive locations.

If stockpiles are required on a slope, clean water should be diverted around the stockpile through a catch drain and/or diversion bund. A sediment fence or coir logs may be required downslope of the stockpile to trap sediment runoff. It should be noted that sediment controls are not typically required on flat or gently

sloping ground or where there is a sufficient vegetated buffer separating the stockpile from a waterway or other sensitive area.

## 8.5 Control Measures for Specific Soil Types

The general management requirements for the different soil types to minimise impacts, such as production of acidic soils, and prevent erosion and sedimentation are detailed in the Table below.

| Soil Type | Control Measures |
|---|---|
| Acid sulphate soils | ▪ minimise soil disturbance. Where disturbance is necessary, minimise the duration of exposure, especially for sandy soils.<br>▪ treat exposed soils as required.<br>▪ backfill open excavations within 24 hours. |
| Dispersive soils | ▪ avoid 'cutting' drainage channels into dispersive soils. Divert and channel water using flow diversion banks or topsoil windrows.<br>▪ avoid the use of check dams in drains containing exposed dispersive soils.<br>▪ key to managing dispersive soils is to over-excavate all surfaces by at least 500 mm and then to cap the exposed dispersive soil with non-dispersive soil. Exposed dispersive soils typically only need to be capped with a 200 to 300 mm layer of non-dispersive soil. However, when working in a waterway crossing, an allowance must be made for additional soil disturbance by animals and natural stream erosion. |
| Saline soils | ▪ minimise soil disturbance. Where disturbance is necessary, prevent mixing of saline and non-saline soils.<br>▪ prevent changes to stream flows and water ponding.<br>▪ cover saline soils with non-saline soils before protecting the soil and reducing evaporation with mulch, cleared vegetation, reseeding etc. |
| Sandy soils | ▪ control water movement and velocity flow by constructing adequate drainage and erosion and sediment controls.<br>▪ stabilise soil particles with the use of soil binders where necessary.<br>▪ long-term erosion control is best achieved with groundcover vegetation such as grass. |

# 9 MITIGATION AND CONTROL

The following management measures and mitigation strategies to be undertaken as far as practicable to mitigate the potential impacts on land and soil.

## 9.1 Inspection and Maintenance

Erosion and sediment control measures will be inspected at least fortnightly on active construction sites. Following heavy rainfall (greater than 10 mm rain within a 24 hour period), and prior to forecasted rainfall where practical the following will be implemented:

- inspect sediment and erosion controls for any damage and suitability of design capacity
- implement maintenance and further controls if required

The Environmental Inspection Checklist will be used to complete the inspections.

## 9.2 Mitigation and Management Measures

The following table outlines the mitigation and management measures that will be implemented as far as practicable throughout the project to prevent potential impacts on soil and water.

| Ref | Mitigation Strategy | Location / Activity | Downer Procedure | Responsibility | Management Measure & Monitoring of Controls |
|---|---|---|---|---|---|
| **Pre-execution Phase** | | | | | |
| SEMP | Proposed source/s of borrow material or fill for the project to be determined. | Planning Phase | This sub-plan | Construction Manager | Prior to the commencement of construction, borrow sources will be identified and all necessary approvals/permits/licenses will be obtained. |
| SEMP | If required, a licence in accordance with s.36 and Schedule 1 of the *Environmental Protection Act 1993* where the volume of dewatering for the project will exceed 100kL and 25mg/l of total suspended solids | Planning Phase | This sub-plan | Environmental Advisor | A licence will be obtained if dewatering for the project is expected to exceed 100kL and 25mg/l of total suspended solids |
| S&S | Develop, implement, monitor and review a documented process or management plan that controls all aspects of the management of soil in accordance with applicable legislation and good practice. | Prior to commencing onsite | This sub-plan | Environmental Advisor | This sub-plan has been developed to include:<br>▪ a risk assessment process<br>▪ provisions for soil erosion and sediment control<br>▪ identification of affected soil volumes, detailing soil reuse and stockpile management |
| ECS | Undertake a risk assessment of the site's susceptibility to erosion and sediment loss that considers as a minimum:<br>▪ slope/gradient<br>▪ soil type<br>▪ areas devoid of vegetation/cover<br>▪ proximity to watercourses and other sensitive features | Planning | DA-ZH-ST064 Soil and Water Management | Environmental Advisor | An assessment of each area of disturbance for sediment and erosion loss will be undertaken prior to the commencement of activities.<br>An ESCP will be developed as required. |
| S&S | All personnel must be fully informed of their specific environmental obligations and are suitably trained and competent to undertake works in accordance with ElectraNet and Downer requirements. | Prior to commencing works onsite | Project Induction | Construction Manager<br>Environmental Advisor | Personnel undertaking the works will be competent for their role and tasks.<br>All personnel are required to undertake the Project Induction which includes soil and water management, prior to commencement onsite. |
| **Execution Phase** | | | | | |

| Ref | Mitigation Strategy | Location / Activity | Downer Procedure | Responsibility | Management Measure & Monitoring of Controls |
|---|---|---|---|---|---|
| **Sediment and Erosion Control** | | | | | |
| ECS | Implementation of sedimentation and erosion controls. | Ongoing throughout works | DA-ZH-ST064 Soil and Water Management | Environmental Advisor<br>Construction Manager | The following controls will be implemented to minimise impacts on soil disturbance and prevent erosion during construction:<br>▪ minimise vegetation and soil disturbance to the smallest area operationally practicable<br>▪ limit vehicle, machinery and equipment to designated access tracks and work areas<br>▪ implement control measures in accordance with ESCP<br>▪ stabilisation and remediation of disturbed areas as soon as practicable following the completion of works |
| SEMP | Stockpiles will be managed to prevent movement of materials. | Ongoing throughout works | DA-ZH-ST064 Soil and Water Management | Construction Manager | The following controls will be implemented during construction to minimise impacts from stockpiles:<br>▪ stockpile topsoil and cleared vegetation separately to subsoil<br>▪ soil will be stockpiled at least 50 m away from drainage pathways<br>▪ stockpiles should be < 2 m high<br>▪ establishment of a diversion drain upslope or catchment drain downslope of stockpile/s as required<br>▪ stockpiles covered as required to prevent wind and water erosion |
| SEMP | Soil or other material deposited onto roadways having originated from plant/vehicles to be removed. | Ongoing throughout works | DA-ZH-ST064 Soil and Water Management | Construction Manager | Removal of soil or other material deposited onto bituminised roadways as required. |
| EOR | Implementation maintenance and inspection schedule for ESCP as required. | Ongoing throughout works | DA-ZH-ST064 Soil and Water Management | Environmental Advisor | Erosion and sediment control measures will be inspected at least fortnightly on active construction sites.<br>Following heavy rainfall (greater than 10 mm rain within a 24 hour period), the following will be implemented:<br>▪ inspect sediment and erosion controls for any damage and suitability of design capacity<br>▪ implement maintenance and further controls if required |
| **Contamination** | | | | | |

| Ref | Mitigation Strategy | Location / Activity | Downer Procedure | Responsibility | Management Measure & Monitoring of Controls |
|---|---|---|---|---|---|
| SEMP | Undertake risk review of potential contaminants that could be encountered during construction. | Ongoing throughout works | DA-ZH-ST064 Soil and Water Management | Environmental Advisor | The typical types of hydrocarbons and chemicals to be used during construction are listed in Section 7.1.1.<br>An up-to-date list of all hydrocarbons and chemicals used and stored onsite will be available throughout the works. |
| SEMP | Any fill brought onto site must meet the SA EPA 'Waste Fill' criteria. | Ongoing throughout works | DA-ZH-ST064 Soil and Water Management | Environmental Advisor | All fill bought onto site must comply with the *Waste Disposal Information Sheet: Current criteria for the classification of waste including Industrial and Commercial Waste (Listed) and Waste Soil* (EPA South Australia, 2010). See Waste Management Sub-plan for further details. |
| SEMP<br>EOR | Hydrocarbon and chemical storage, handling and disposal meets the standards in accordance with AS:1940. | Ongoing throughout works | DA-ZH-ST064 Soil and Water Management | Construction Manager | Hydrocarbons and hazardous chemicals will be stored in accordance with the following requirements:<br>▪ storage areas located at least 50 m of sensitive areas such as waterways<br>▪ stored in fit-for-purpose, labelled containers<br>▪ stored within bunded areas or within self-bunded tanks<br>▪ fit-for-purpose spill kit available at storage locations<br>▪ current hardcopy SDS register at storage locations |
| SEMP | Storage of hazardous construction materials and waste at least 50m from drainage lines or watercourses. | Ongoing throughout works | DA-ZH-ST064 Soil and Water Management | Construction Manager | Storage of hazardous construction materials at least 50m from drainage lines or watercourses.<br>For storage of hazardous wastes refer to the Waste Management sub-plan. |
| SEMP | Develop and maintain an up to date, hard-copy Safety Data Sheet (SDS) register with a hard-copy SDS for all chemicals used or stored on site. | Ongoing throughout works | Safety Data Sheet register | Zero Harm Advisor | An up to date, hard-copy of the SDS register and SDSs for all chemicals and fuels to be used or stored onsite will be developed and kept in onsite offices and within vehicles. |
| SEMP | Spill kits to be available on site. | Ongoing throughout works | DA-ZH-FM015.2 Spill Response Equipment Needs Assessment | Environmental Advisor | Quantity, size and suitable materials in spill kits will be determined using Spill Response Equipment Needs Assessment Form. Then:<br>▪ appropriate spill kits kept onsite at all times and used in the event of a spill.<br>▪ training provided to workers in the use of spill kits.<br>Inspection of spill kits through Environmental Inspection Checklist. |

| Ref | Mitigation Strategy | Location / Activity | Downer Procedure | Responsibility | Management Measure & Monitoring of Controls |
|---|---|---|---|---|---|
| SEMP | Refuelling activities occur >50m from any watercourse or sensitive area. | Ongoing throughout works | DA-ZH-ST054 Hazardous Chemicals and Dangerous Goods Storage Principles and Transportation | Environmental Advisor<br>Construction Manager | Where possible, vehicles, machinery and equipment will be refuelled offsite (i.e.. at a service station) or at designated locations at the camp site or laydown area.<br>Designated refuelling areas will comprise of the following:<br>▪ fuel storage in bunded areas or within self-bunded tanks within 120% capacity of the largest container<br>▪ fit-for-purpose spill kit available<br>▪ current hardcopy SDS register<br>For machinery and equipment that cannot be transported offsite or to a designated refuelling area, drip trays will be used and spill kit available. |
| SEMP | Where fuel or chemical spills occur onsite, implement spill response procedures, and segregate recovered product and soil etc. for appropriate disposal. | Ongoing throughout works | Emergency Preparedness Management Plan (EPMP) | Environmental Advisor | Appropriate spill kits kept onsite at all times, including work areas and refuelling locations, and used in the event of a spill.<br>Any spill would be contained and cleaned up immediately (if safe to do so) in accordance with EPMP.<br>Any contaminated materials from the clean-up of the spill would be segregated for disposal at a licensed waste disposal facility. For storage of hazardous waste management refer to the Waste Management sub-plan. |
| SEMP | Stop work in the event of encountering potentially contaminated soil and reassess site drainage to ensure sediments from potentially contaminated soils are contained. | Ongoing throughout works | DA-ZH-ST064 Soil and Water Management | Construction Manager | If potentially contaminated soil is identified then works will stop immediately in the area and the Site Supervisor notified.<br>The site will be made safe and secure including preventing personnel access as well as potentially contaminated materials moving offsite through the installation of a soil bund around the area.<br>The soil will be tested and disposed of in accordance with the Waste Management Sub-plan. |
| SEMP | All environmental incidents and hazards identified during the project must be recorded, reported and managed effectively. | Ongoing throughout project | INX | Environmental Advisor | All environmental incidents and hazards will be verbally reported to ElectraNet within 1 hour of identification outlining factual information.<br>An investigation report from INX will be provided to ElectraNet within 24 hours.<br>Environmental incidents and hazards will be reported through ElectraNet's online Incident Management System (IMS). |

| Ref | Mitigation Strategy | Location / Activity | Downer Procedure | Responsibility | Management Measure & Monitoring of Controls |
|---|---|---|---|---|---|
| **Dust Management** | | | | | |
| SEMP | Ensure active dust suppression is implemented for all dust generating activities. | Ongoing throughout works | DA-ZH-ST064 Soil and Water Management | Construction Manager | Dust generation will be minimised by implementing:<br>▪ minimise vegetation and soil disturbance to the smallest area operationally practicable<br>▪ limit vehicle, machinery and equipment to designated access tracks<br>▪ utilise water carts for dust suppression, as required.<br>▪ Limit dust generating activities on days with high temperatures and strong winds |
| SEMP | Assess stockpiled materials and implement stabilisation measures where left for extended durations. | Ongoing throughout works | DA-ZH-ST064 Soil and Water Management | Environmental Advisor | Stockpiles will be stabilised if required including:<br>▪ divert clean water around stockpiles and install catch drains or sediment fences downslope of stockpiles<br>▪ limiting the height of stockpiles to less than 2m and batter the sides to 2:1 or flatter<br>▪ where required, cover stockpiles to minimise dust. |
| SEMP | Manage vehicle and plant usage/speeds to minimise dust generation. | Ongoing throughout works | DA-ZH-ST070 Air Quality Management | Construction Manager | Vehicles and plant to drive to conditions. This includes limiting speed to mitigate dust to 40km/hr on tracks |
| SEMP | Ensure plant is maintained according to manufacturer's specifications to minimise exhaust emissions. | Ongoing throughout works | Safety Management Plan | Construction Manager | Vehicles and equipment shall be maintained in accordance with the manufacturer's specifications.<br>Daily pre-start inspection of vehicles and plant, and regular servicing. |
| **Dewatering** | | | | | |
| SEMP | All dewatering to be undertaken in accordance with the SA EPA guideline 'Environmental management of dewatering during construction activities'. | Ongoing throughout works | DA-ZH-FM064.1 Dewatering Permit | Environmental Advisor<br>Construction Manager | The following will be implemented for dewatering:<br>▪ water tested for turbidity (NTU) and pH prior to dewatering<br>▪ dewatering Permit to be issued prior to any dewatering<br>▪ licence obtained if dewatering for the project will exceed 100kL and 25mg/l of Total Suspended Solids |
| SEMP | Maintain records of produced water and make them available to the ElectraNet upon request. | Ongoing throughout works | DA-ZH-FM064.1 Dewatering Permit | Environmental Advisor | Records of produced water to be kept and made available to ElectraNet on request. |

# 10 MONITORING & REPORTING

In addition to the requirements outlined in the Environmental Management Plan, the following table outlines the monitoring and reporting to be undertaken during the pre-execution, execution, and post-execution phases of the project relating to land and soil management.

| Monitoring & Reporting Requirements | Responsibility | Reference |
|---|---|---|
| **Pre-execution Phase** | | |
| Undertake pre-construction survey to identify sediment and erosion control requirements. | ElectraNet Construction Manager | SEMP |
| **Execution Phase** | | |
| Fortnightly environmental inspections through Environmental Inspection Checklist | Environmental Advisor | SEMP |
| **Post-execution Phase** | | |
| Post-construction inspections will be undertaken within four weeks of construction completion | ElectraNet Construction Manager | SEMP |