Construction Environmental Management Plan

Muirhead North Subdivision

DC1603

Prepared for

Defence Housing Australia

27 October 2021

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1 Introduction

In May 2019, Cardno (NT) Pty Ltd (Cardno) was engaged by Defence Housing Australia (DHA) to carry out the detailed engineering design and documentation of Muirhead North subdivision and associated external works at Lee Point in Darwin, Northern Territory.

This document serves as the Construction Environmental Management Plan (CEMP) for the development of the subdivision.

The CEMP will be updated during the course of the project to reflect any changes in scope, legislative requirements and site contact details.

1.1 Background

The Muirhead North project is situated on a 51 hectare parcel of land located approximately 17km by road north-east of the Darwin CBD. The site is bordered to the west by Lee Point Road, to the north by Lee Point Village Resort, to the south by Aldenham Road and to the east by Crown Land.

The majority of the site is currented vegetated, with the exception of several unformed tracks and small pockets of historical clearing. An 8.3 hectare conservation parcel will be preserved on the eastern side of the development. This incorporates an area of monsoon rainforest with conservation value, to be protected by a 25m conservation buffer.

A site of historical significance, the 'Konfrontasi Cruciform', is located adjacent Lee Point Road near the north-western corner of the site.

The development consists of 3 stages with an expected yield of 273 lots, comprising of 240 standard urban lots, 30 low density rural lots and 3 commercial lots.

The site location and proposed staging plan are depicted in Figures 1-1 and 1-2 below.

Figure 1-1 Location plan

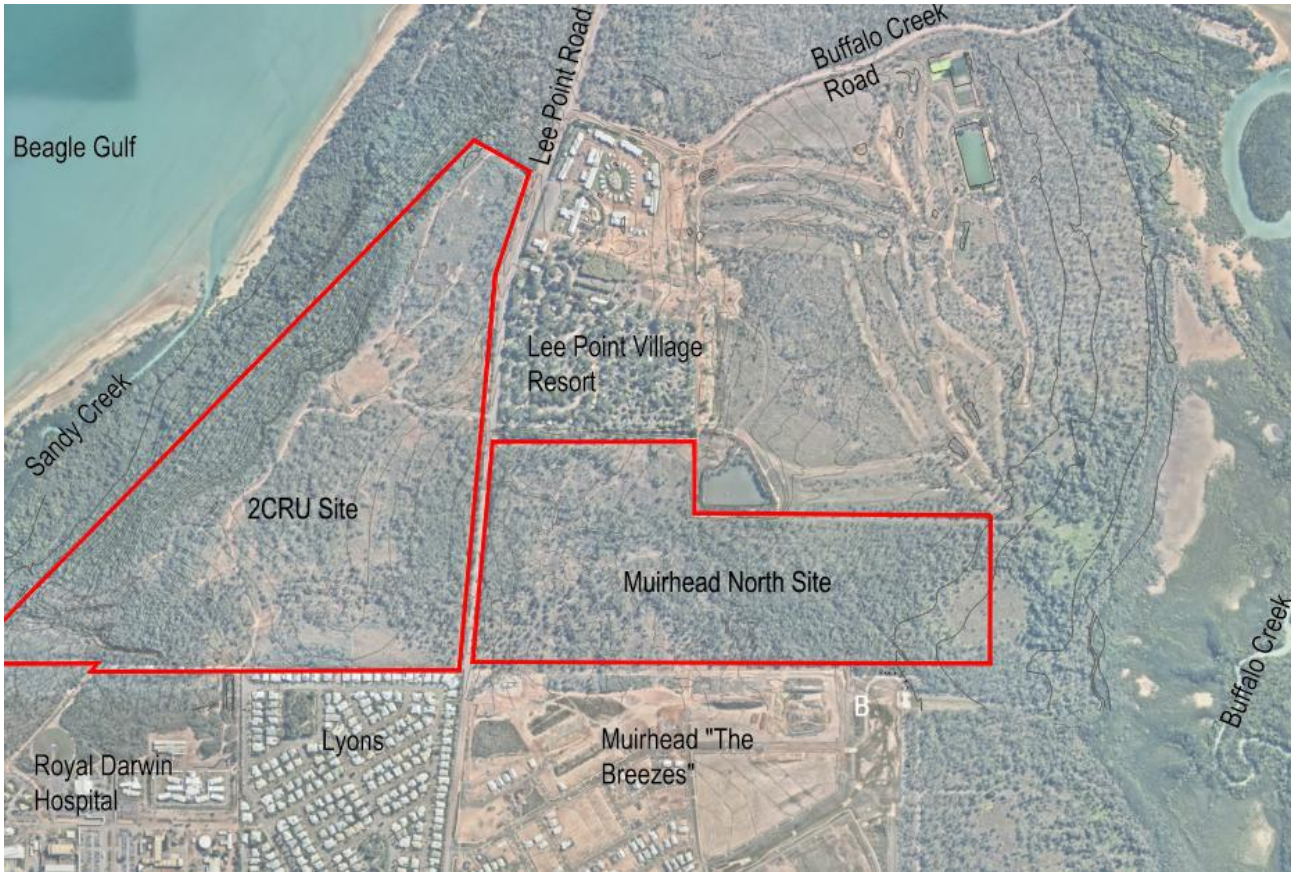
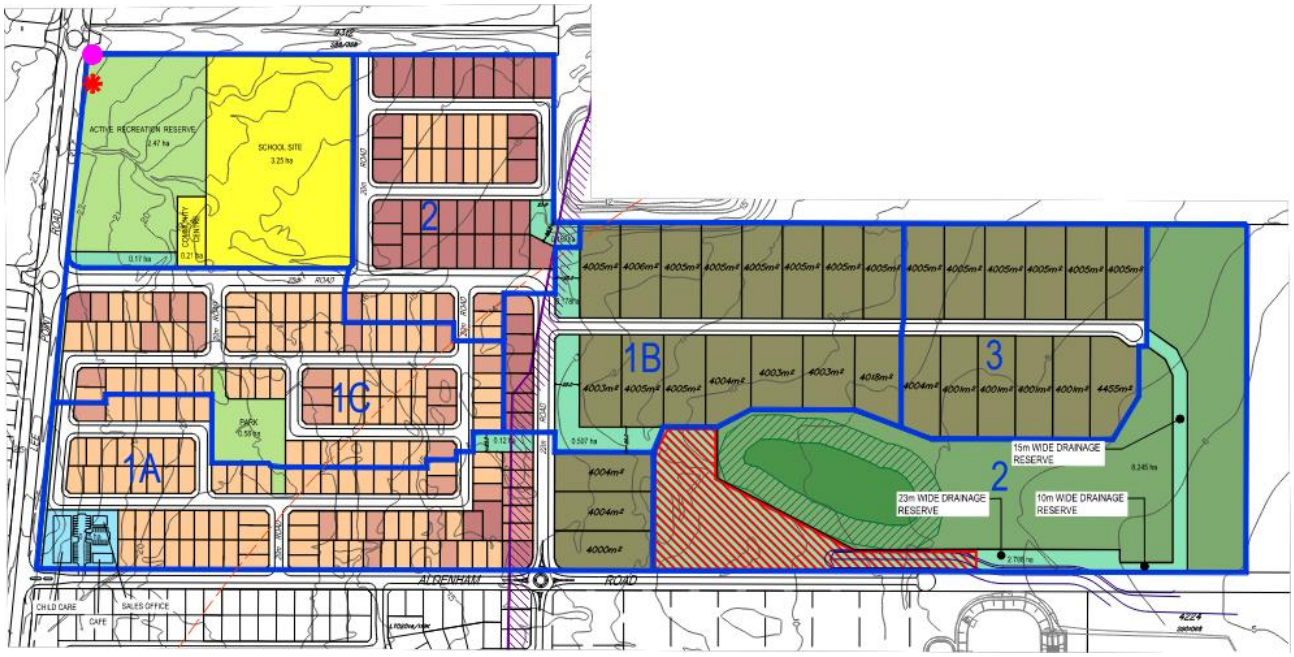


Figure 1-2 Proposed staging



1.2 Contractual Obligations

This CEMP addresses the requirements for the environmental management of construction activities from the commencement of works on site until final completion. During this phase, the Contractor is responsible for ensuring that the provisions and requirements of this CEMP are met.

Condition Precedent 2 of the Development Permit DP19/0050 requires the preparation of this CEMP to include provision for environmental controls for the works. This CEMP is to be adopted and its recommendations are to be implemented prior to and during the construction works to the satisfaction of the Development Consent Authority.

The CEMP includes details of requirements for waste management, traffic management, haulage routes, stormwater drainage, erosion and sediment control, management of dust, noise and vibration impacts, communication and complaints protocols. This is in line with and to meet the requirements of the Development Permit condition.

2 Legislative Requirements, Standards and Guidelines

2.1 Standards, Guidelines and Policies

Standards, guidelines and policies relevant to the project include:

- Noise Guidelines for Development Sites in the Northern Territory, NTEPA (2014);
- Noise Management Framework Guideline, NTEPA (2018);
- National Standard for Occupation Noise [NOHSC: 1007(2000)];
- Erosion and Sediment Control Guidelines, DEPWS;
- Best Practice Erosion and Sediment Control, IECA;
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality, WQPSC & NWRC (2018);
- Workplace Exposure Standards for Airborne Contaminants, Safe Work Australia;
- Subdivision and Development Guidelines, Darwin City Council;
- Waste Management and Pollution Control Act (1998);
- Heritage Act (2012);
- Bushfires Management Act (2016);
- Weeds Management Act (2001), and the Northern Territory Weed Management Handbook (2018);
- Workplace Health and Safety Regulations; and
- Northern Territory Planning Scheme.

2.2 Legislative Requirements

Table 2-1 Environmental Legislation Relevant to the Project

Legislation	Legislation Requirement	Project Relevance
Commonwealth Act: Aboriginal and Torres Strait Islander Heritage Protection Act 1984	The purpose of this Act is the preservation and protection from injury or desecration of areas and objects in Australia and in Australian waters, being areas and objects that are of particular significance to Aboriginals in accordance with Aboriginal tradition.	A Person who discover anything that he or she has reasonable grounds to suspect to be Aboriginal remains shall report his or her discovery to the Minister, giving particular of the remains and of their location (Section 20) Any discovery of Aboriginal and Torres Strait Islander remains must be reported immediately to AAPA.
Commonwealth: Environmental Protection and Biodiversity Act 1999 (EPBC)	The EPBC Act requires that proposed actions to be taken which are likely to have significant impact on matters of national environmental significance (NES) shall be referred to the Minister for a decision if it will be subject to a rigorous assessment and approval process. The EPBC Act also applies to actions that are likely to have a significant impact on the environment of Commonwealth Land and to actions taken by the Commonwealth that will have a significant impact on the environment anywhere.	Environmental Impact Statement (EIS) submitted in response to terms of reference provided by NTEPA, including mitigation of impacts to water quality, air quality, noise, biodiversity and heritage
NT Act: Soil Conservation and Land Utilization Act 1969	Makes provisions for the prevention of soil erosion and for the conservation and reclamation of soil.	Erosion and sedimentation measures will be required during construction of the development.

NT Act: Dangerous Goods Act 1998	This act provides definition and regulatory requirement for handling, transporting and storage of dangerous goods as defined by the Act.	A license may be required for the storage, transport and handling of fuels, chemicals or other dangerous goods during construction.
NT Act: Water Act 1992	An Act to provide for the investigation, allocation, use, control protection, management and administration of water resources, and for related purposes.	Erosion and sediment control and water quality treatment infrastructure will be required to treat the stormwater discharge prior to release to the waterways
NT Act: Planning Act 1999	The objects of this Act are to plan for, and provide a framework of controls for, the orderly use and development of land in the NT.	Development Permit DP19/0050 issued by Development Consent Authority on 27 February 2019 to use and develop the land for the purpose of a subdivision to create 282 lots
NT Act: Waste Management and Pollution Control Act 1998	The objectives of this Act are to protect the environment by preventing, reducing or avoiding pollution; effective waste management and encouraging sustainable development	Construction works must ensure that waste is safely and effectively managed without detrimental impact to the environment. Pollution level arising from the development must be monitored and managed to prevent nuisance or harm to the surrounding community or environment.
NT Act: Territory Parks and Wildlife Conservation Act 1976	The act makes provision for conservation, management and relocation of wildlife in the NT. A permit is required to take or interfere with Wildlife.	A permit is required to take or interfere with Wildlife
NT: Northern Territory Aboriginal Sacred Sites Act 1989	Aims to build enhanced relations between Aboriginal and other citizens with regard to effective land use within a regime of sacred site protection, for the benefit of all Territorians. All Aboriginal sacred sites are protected under the Act.	Aboriginal Areas Protection Authority (AAPA) certificates confirm that there are no known sacred sites within Lot 9370. Immediately stop work in the event that items of possible significance are identified

Any changes to the legislation, standards, policies and guidelines during the staged development will need to be reviewed and its impact on the development shall be distributed to the project team.

3 Project Scope and Risk Assessment

3.1 Construction Activities

The proposed development of Muirhead North will include the following construction activities:

- Land clearing progressively for staged construction. No land clearing shall extend beyond designated boundaries;
- Cut and fill earthworks;
- Road pavement construction;
- Road surfacing;
- Concrete works including driveways, footpaths and kerb and gutters;
- Construction of open drains;
- Construction of detention basins and outfall drain;
- Construction of protection works including gabions, grouted stone pitching and rock weirs;
- Services trenching;
- Construction of water reticulation and service connections;
- Construction of sewer reticulation and service connections;
- Construction of electrical reticulation, service connections and street lighting;
- Construction of telecommunication (NBN) reticulation and service connections;
- Landscaping works including topsoiling and grassing; and
- Implementation of Erosion and Sediment Control measures pre, during and post-construction.

3.2 Risk Assessment

A risk assessment was undertaken to assess potential health, safety and environmental risks that may arise during the construction process. Refer to Tables 3-1 to 3-5 below.

Table 3-1 Risk Matrix

CONSEQUENCE SEVERITY					
LIKELIHOOD OR FREQUENCY	1 INSIGNIFICANT	2 MINOR	3 MODERATE	4 MAJOR	5 CATASTROPHIC
A – ALMOST CERTAIN	MODERATE 11	HIGH 16	EXTREME 20	EXTREME 23	EXTREME 25
B – LIKELY	MODERATE 7	HIGH 13	HIGH 17	EXTREME 21	EXTREME 24
C – POSSIBLE	MODERATE 5	MODERATE 8	HIGH 14	HIGH 18	EXTREME 22
D – UNLIKELY	LOW 2	LOW 4	MODERATE 9	HIGH 15	HIGH 19
E - RARE	LOW 1	LOW 3	MODERATE 6	MODERATE 10	MODERATE 12

Table 3-2 Risk Category Table

Risk Category	
E = EXTREME RISK	Immediate action required to implement better controls. Activity must not start. If started, activity must immediately be stopped. Superintendent's approval is required for work to commence or recommence.
H = HIGH RISK	Seek manager approval for work to commence or continue. More suitable controls to be investigated.
M = MODERATE RISK	Work to proceed once risk is reduced as low as reasonably practicable and controls are implemented
L = LOW RISK	Work to proceed while monitoring and managing risk

Table 3-3 Qualitative Measures of Impact – Consequence

Level	Impact	Example of Consequence
1	INSIGNIFICANT	No injuries; No environmental impact
2	MINOR	First aid; Environmental release immediately contained
3	MODERATE	Medical treatment; Environmental release not immediately contained with no detrimental effects
4	MAJOR	Lost time injury/illness; Environmental release not immediately contained with toxic effects
5	CATASTROPHIC	Fatality; Release to the environment with long term/permanent toxic effects

Table 3-4 Qualitative Measures of Likelihood

Level	Measure	Description	Guide
A	ALMOST CERTAIN	The event is expected to occur in most circumstances	Once or several times a day
B	LIKELY	Will probably occur in most circumstances	Once per week
C	POSSIBLE	Might occur at some time	Once per month
D	UNLIKELY	Could occur at some time	Once per year
E	RARE	May occur only in exceptional circumstances	May occur once per ten years

Table 3-5 Health Safety & Environment Risk Assessment Summary

Item	Job Step	Hazard	Consequences	Risk Rating	Control Method	Residual Risk Rating
1	Construction	Other Vehicles, Speed, Animals	Vehicle Crash	High 14	> Follow site traffic rules at all times > Only drive roadworthy and registered vehicles > Only licensed drivers to drive vehicles for which they are approved > Drive to conditions > Wear a seatbelt > Do not drive while fatigued > Be aware that wildlife may be on the road especially at dusk and dawn	Low 4
2	Construction	Workers/ Pedestrian	Persons hit by vehicle	High 19	> Drive at the recommended site speed and slow down around workers > Continuously scan the road/surroundings for pedestrian movements > Use appropriate communications	Moderate 12
3	Construction	Endangered Flora and Fauna	Loss of endangered Flora and Fauna	High 17	> Consult with Superintendent and DEPWS where applicable	Moderate 12
4	Construction	Noise	Hearing Loss, impact on community amenity	Extreme 21	> Ensure noise level generated during construction is within safe acceptable level > Adhere to 'Noise Guidelines for Construction Site in The Northern Territory'	High 17
5	Construction	Uneven / Unstable / Loose Surfaces	Vehicle rollover, vehicle bogged, vehicle crash	Moderate 10	> Do not drive in unfamiliar terrain, unless site condition is known > Maintain appropriate safe distance from batter edges and water > Use spotter when reversing in inspection site or if near mobile/fixed plants > If undertaking inspection in water, ensure depth is checked and monitored	Low 3
6	Construction	Weather conditions (limited visibility)	Vehicle Crash Hitting a person or object.	High 15	> Delay inspection if weather conditions does not allow for safe driving (fog, rainy) > Drive to conditions and slow down if visibility is poor.	Moderate 10
7	Construction	Drugs and Alcohol	Vehicle Crash Hitting a person or object.	Extreme 23	> Do not drive or attend site under the influence of Drugs or Alcohol.	Moderate 10
8	Construction	Reversing	Hitting a person or object.	High 18	> Keep reversing to a minimum. > Use mirrors and perform head checks > If you cannot see, get out and look.	Moderate 10
9	Construction	Parking	Hitting a person or object	High 18	> Vehicle must be parked in designated areas. > Do not stop or park in an area that will obstruct clearways, walkways, pedestrian crossings, etc.	Moderate 10

Item	Job Step	Hazard	Consequences	Risk Rating	Control Method	Residual Risk Rating
10	Construction	Using handheld devices (Mobile Phones, GPS)	Hit by mobile plant Hit by falling object	High 19	> Driver is not to use any handheld devices (mobile phone, cameras), while driving.	Moderate 10
11	Construction	Waterways	Pollution to waterways	Extreme 24	> Implement erosion and sediment control measures > Test water quality periodically > Ensure stormwater treatment train functioning efficiently > Inspect and maintain sediment basin regularly	Moderate 10
12	Construction	Uneven, unstable and slippery surfaces:	Slips, trips and falls causing abrasions, strains and lacerations.	High 18	> Visually inspect surroundings and identify hazards, report and ensure these are removed or controlled. > Extreme care should be taken when walking along embankments adjacent to water, steep batters and other slippery/unstable surfaces. > Maintain a 2m distance from steep drops, rock walls or pit walls.	Moderate 10
13	Construction	New electrical installations	Electrocution	Extreme 22	> Be aware of any new electrical installations and always treat electrical wiring as live if you aren't sure and do not touch. > Report any exposed wiring that is not capped or taped.	Moderate 12
14	Construction	Confined Spaces	Lack of oxygen / atmospheric contaminants Flammable atmosphere Engulfment Entrapment	High 19	> Undertake Confined Spaces Awareness training. > Do not enter a confined space without consultation with your supervisor or without qualified training and accreditation.	Low 1 (no entry) Moderate 12 (entry)
15	Construction	Mobile Plant (Excavating machinery, light vehicles, cranes, drill rigs)	Person being hit by mobile plant	High 19	> Wear high visibility vests or shirts > Do not walk along carriage way unless it is safe to do so > Where appropriate, use someone as spotter to scan surroundings for any moving vehicles > Where available use pedestrian crossing > Obtain permission with the operator to enter a plant designated area > Always approach plant from the front, always gain eye contact with the driver before moving into the hazard zone > Inspection must not be carried out within 3 meters of mobile plant/plants, or within 5m of suspended loads. Be aware of reversing mobile plants, listen for reversing alarm > Walk in designated "safe zones"	Moderate 12

Item	Job Step	Hazard	Consequences	Risk Rating	Control Method	Residual Risk Rating
					> Persons working on public roads are to be trained in accordance with AS1742. > Persons working on public railways are to be trained in accordance with local Railway legislative requirements and have obtained correct certification. > Maintain appropriate communications and use spotters where required.	
16	Construction	Situational awareness	Getting lost and not maintaining concentration leading to an incident and personal injury.	Extreme 22	> Do not proceed onto a site unless you are either inducted onto that site by a suitably trained person, OR, you are escorted at all times by an authorised person.	Moderate 12
17	Construction	Overhead / Under-ground Power Lines	Electrocution	High 19	> Check for any low overhead power lines at site and check with site foreman. > Do not work near overhead power lines if they are sagging and it is windy and/or rainy. > Ensure appropriate clearance from overhead power lines (suggested 8 meter distance from high voltage) > Do not excavate until area has been cleared of existing services.	Moderate 12
18	Construction	Falling objects	Person being hit by falling objects	High 19	> Be aware of surroundings and always scan above and around for hazards. > PPE – Hardhat. > Maintain safe distance from suspended loads.	Moderate 12
19	Construction	Dust/fumes	Inhalation, respiratory affects, eye affects, loss of community amenity	Moderate 9	> Avoid prolonged exposure to dust/fumes by keeping reasonable distance from sources of fumes if possible > Wear protective respiratory mask and safety glasses where appropriate > Ensure appropriate dust control measures are implemented.	Moderate 6
20	Construction	Uncapped or exposed reinforce-ment bars or untidy workplace	Cuts, Abrasions, Impaling	High 18	> All exposed reinforcement bars to be capped > Workplace to be kept clear of debris and trip hazards.	Moderate 5
21	Construction	Using handheld devices	Person being hit by mobile plant	High 19	> Do not use mobile phone or camera in the vicinity of moving vehicles. > Make phone calls in your vehicle if it is nearby, behind a barrier or in a designated safe zone.	Moderate 12

4 Implementation and Communications

4.1 Project Team Resources

The following personnel will be required to implement the CEMP:

- Construction Project Manager
- Construction HSE Manager
- Construction Site Foreman
- Construction Labourers; and
- Subcontractors.

4.2 Communication Processes

Communication processes for the project will be organised in accordance with Table 4-1 below.

Table 4-1 Communication Process

Subject	Responsibility	Action	Frequency
CEMP approval	Project Manager	Submit to approval agency	Minimum two weeks prior to works commencing
CEMP distribution	Project Manager	Distribute for implementation	Prior to commencement of site inductions
Liaison with City of Darwin, DEPWS	Project Manager	Notify CoD and DEPWS of project start date, contact details	Prior to start of work
Notify local residences of project start, contact details and any anticipated possible nuisance or service disturbances	HSE/Project Manager	Deliver information pamphlet	Prior to start and as required during the construction. At least 10 working days prior to commencement of work.
Community Complaints	Project Manager	Record complaints and actions taken to resolve. Notify DHA, CoD and DEPWS within 24 hours where applicable	As required
Injured Wildlife	HSE Officer	Record in incident register and inform Wildcare NT immediately	As required
Discovery of protected or threatened flora and fauna	HSE Officer	Inform and liaise with DEPWS	As required
Environmental Monitoring	HSE Officer	Record in environmental register	Weekly and after major storm event
Pollution	HSE Officer / Project Manager	Record in environmental register and report incident to the relevant agency	As soon as practicable after incident
After hours works	Project Manager	Deliver information pamphlet	After approval given by CoD and at least 5 days prior to work commencing
Archaeological, heritage and Aboriginal remains	Project Manager	Inform AAPA or DTSC as appropriate	Same day
Audit	Environmental Auditor	Provide report	Every 6 months
Management Review	Project Manager and Environmental Officer	Provide minute of meetings	Every 6 months

4.3 Complaints Management

The following steps will be taken during construction to address complaints:

- List the project contact details for community engagement and complaints on DHA's project website and the Contractor's website (BMD);
- Install sign boards at the site access point or on the fence bordering the community, containing contact person position, phone number and email address; and
- Contractor to maintain a register of any complaints made. Actions taken to resolve the complaint should be made available to DHA, City of Darwin and DEPWS (as appropriate) as soon as practicable after a complaint has been made.

4.4 Contractor's Site Management Plan

An Integrated Project Management Plan (IPMP) shall be developed by the Contractor to incorporate the requirements of this CEMP with the Contractor's proposed construction methodology. The IPMP shall also address any additional requirements contained within the approvals to undertake the works, obtained by the Principal. Staging plans, developed by the Contractor to minimise the extent of areas disturbed at any time, shall be included in the IPMP.

Traffic management for the site access and construction activities will be required to be addressed within a Traffic Management Plan (TMP) and submitted to the Superintendent for approval.

The Contractor should address the following details in their IPMP:

- Work Hours
- Plant and Equipment
- Timing and Scheduling
- Site Facilities
- Storage, handling and transporting dangerous goods
- Environmental training
- Waste Management
- Incident Management
- Site Induction
- Staff training
- Pre-start toolbox session
- Training Records; and
- Environmental Monitoring.

4.5 Work Hours

Construction activities including delivery of materials and supplies are restricted to the times set out in Table 3-1 below or as set out in the Contract.

Table 4-2 Work Hours

Day	Time	Restriction
Monday to Saturday	7AM to 7PM	Allowed
Sunday and Public Holidays	9AM to 6PM	Permit required
After Hours		Permit required

4.6 Project Contacts

The following personnel and organisations can be contacted regarding the management of the site during construction:

Table 4-3 Project Contacts

Organisation	Position	Name	Number
DHA	Senior Development Manager	Chris Grimm	(03) 9947 8111
Cardno NT	Civil Engineer	David Bramley	(08) 8942 8231
City of Darwin	Customer Service	Customer Service	(08) 8930 0300
City of Darwin	Customer Service	Emergency After Hours	1800 099 557
Cardno NT	Superintendent	David Bramley	(08) 8942 8231
Cardno NT	Superintendent Representative	Chris Kessaris	(08) 8942 8237
BMD	Project Manager	Brendan Lam	0457 566 635
BMD	Environmental Officer	Brendan Lam	0457 566 635
BMD	Site Foreman	Leroy Balnaves	0438 720 671
Ambulance/Fire/ Police	Emergency		000
Police	NT Police (Darwin)		131 444
Hospital	Royal Darwin Hospital		(08) 8922 8888
Poison	Poisons Information		131 126
Cyclone	Tropical Cyclone Information		1300 659 211
Wildcare NT	Injured Animal Organisation		(08) 886 121 0408 885 341
Aboriginal Areas Protection Authority	AAPA	General Enquiries	(08) 8999 5511
Department of Environment, Parks and Water Security	Bushfires, Environment, Flora & Fauna, Weed Management, Water Resources, Rangelands	General Enquiries	(08) 8999 5511

5 Site Control and Waste Management

5.1 Policy

To maintain construction compounds and the site in a neat and tidy state without build-up of litter and waste, and to provide a safe facility for the storage of construction equipment and materials.

5.2 Performance Objectives

To maintain construction compounds in a neat and tidy state without build-up of litter and waste, and to provide a safe facility for the storage of construction equipment and materials. The site shall be maintained in a safe and tidy condition. Waste materials generated on site shall be stored in safe temporary storage prior to final disposal. All relevant NTEPA guidelines and Council by-laws shall be complied with.

5.3 Control Measures

As part of the IPMP, the Contractor shall establish a Litter and Waste Control Plan to manage the collection, storage and removal of all litter and waste on the site.

Litter and waste, including pre-existing materials, construction waste, human waste, used oils and any other surplus materials, shall not be disposed of on site. Material shall not be burnt or buried on site. All such materials shall be collected as they are accumulated, using appropriate methods to enable their future removal from the site. All such materials shall be stored on site in approved secure, confined area(s).

Specific areas shall be set aside for the storage of construction materials. In particular, a safe storage location for fuels and oils shall be provided in accordance with AS 1940 “The Storage and Handling of Combustible Liquids”. This area shall be bunded in compliance with the standard.

5.4 Monitoring

The Contractor shall construct, monitor and record details of work areas, fencing, storage locations and access roads. Weekly inspections of the site, by the Contractor, are required to verify locations and storage of litter and waste on the site.

5.5 Reporting

Records of removal of oils, litter and waste shall be maintained by the Contractor.

5.6 Corrective Action

Non-conformance with the Litter and Waste Control Plan shall be recorded by the Contractor and a corrective action request (CAR) issued. All CAR’s shall be included in the Non-Conformance Register maintained by the contractor.

The Contractor shall implement the corrective action, as required, within the agreed time frame noted in the CAR.

The Contractor shall advise the Superintendent upon completion of the corrective action.

6 Community Amenity

6.1 Policy

Appropriate measures are to be taken to minimise the impact of construction activities on the local community.

6.2 Performance Objectives

Unreasonable disruption to the residential amenity of the local area shall not occur. If a complaint is received, the cause of the complaint shall be investigated and, so far as it is the responsibility of the contractor to do so, the cause of the complaint shall be remedied.

6.3 Control Measures

As part of the IPMP, the Contractor shall establish an induction program, to the satisfaction of the Superintendent, to inform all site workers prior to their commencement on the site of the environmental protection requirements and practices to be adhered to while working on site.

6.4 Monitoring

The Contractor shall maintain records of induction training, and all communications with residents.

6.5 Reporting

The Contractor shall submit monthly reports to the Superintendent. These reports shall include records of communications with local residents and full details of any contentious issues and actions taken.

6.6 Community Complaints

Complaints shall be managed in accordance with the procedures outlined in Section 4.3 of this document.

6.7 Corrective Action

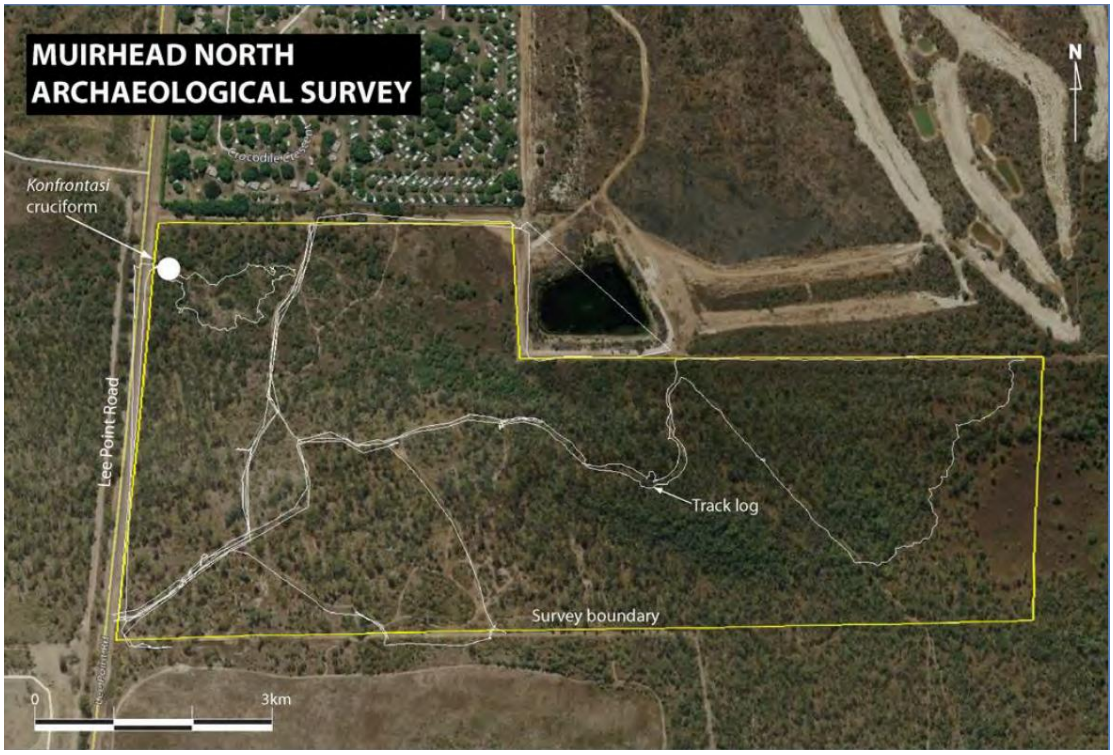
Non-conformance shall be documented, by the Contractor, and a corrective action request (CAR) issued. All CAR's shall be included in the Non-Conformance Register maintained by the Contractor. The Contractor shall implement the corrective action, as required within the agreed time frame noted in the CAR. The Contractor shall advise the Superintendent upon completion of the corrective action.

7 Heritage

Lot 9370 contains a site of historical significance, the 'Konfrontasi Cruciform', which is a ring of earth-filled 44-gallon drums erected as a defensive gun emplacement in the 1960's during the Konfrontasi period. The site is located adjacent Lee Point Road as indicated below. An interpretive sign is situated to the front of the structure providing information on the site and the Konfrontasi period.

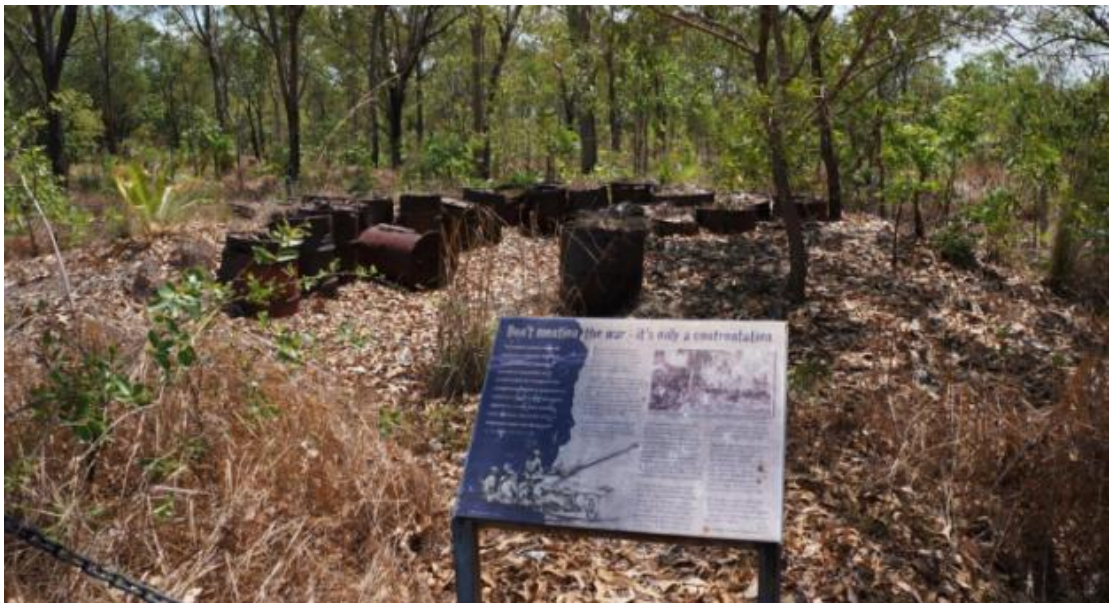
The Konfrontasi Cruciform shall be retained and protected during construction and incorporated into public open space in accordance with the Landscaping Master Plan. The Contractor shall erect temporary fencing to ensure protection of the site.

Figure 7-1 Konfrontasi Cruciform location plan



Source: Jung, S. 2015. Muirhead North - Archaeological Survey Report

Figure 7-2 Konfrontasi Cruciform



8 Traffic Management and Haulage Routes

8.1 Traffic Management Plan

The Contractor shall prepare a project-specific Traffic Management Plan (TMP), and site-specific Traffic Guidance Schemes (TGSs) of a complex and noncomplex nature per activity as required for the scheduled works.

The TMP shall be designed by a Northern Territory accredited Traffic Management Plan Designer.

The Contractor shall submit the Traffic Management Plan (TMP), with the Traffic Guidance Schemes to the road authority for acceptance.

The Contractor shall implement the TMP using personnel with the required accreditations and in accordance with the specification.

The Traffic Management for this contract may be subject to audit.

8.2 Haulage Routes

Fill materials won from within the site will be transported via site temporary access roads. These will be subject to internal controls by the Contractor and in locations approved by the Superintendent prior to use.

Materials brought to site will be subject to NT Government road rules with regards to load limits and speed controls. Routes for the transportation of materials shall be confined to permitted arterial routes and shall only access the site via nominated site access roads for transportation, namely Stuart Highway, Vanderlin Drive, McMillans Road, Bagot Road and Lee Point Road.

Comply with all road authority requirements for the transportation and securing of plant and materials.

9 Air Quality and Dust Control

9.1 Policy

The Contractor shall implement management measures to minimise the impact of construction activity on air quality.

9.2 Performance Objectives

Implementation of management measures to minimise the impact of construction activity on air quality. If an air quality complaint is received, the Contractor shall investigate the complaint and implement air quality monitoring. Where required, action shall be taken to mitigate any decline in air quality, including but not limited to ongoing action that will be required to reduce dust emissions from the site.

Table 9-1 Management Actions

Objective	Management Actions	Monitoring	Performance Indicators
Maintain the respiratory health of workers and adjoining residents, and no adverse impacts on vegetation	• Notify adjoining residents prior to works commencing • Vegetation cleared in a staged manner • Watering of haul roads, and exposed areas • Vehicles obey speed limits and stick to formed road • Trafficable areas clearly marked • Stabilise exposed areas • Rehabilitate as soon as possible	Complaints by adjoining residents	No decline in respiratory health of staff/adjoining residents, or decline in vegetation health, that can be attributed to the project

9.3 Control Measures

9.3.1 General

To manage air quality control on the site, the Contractor shall establish as part of the IPMP an Air Quality Management Plan to the satisfaction of the Superintendent and prior to commencing work. The following specific issues shall be addressed.

9.3.2 Fumes

All equipment shall be efficient, operated in accordance with established operating procedures and maintained to minimise exhaust emissions. Engines shall not be left idling needlessly.

All vehicles and plant shall be properly maintained, to ensure that emission levels are less than the limits defined by relevant guidelines produced by the Department of Infrastructure, Transport, Regional Development and Communications, Office of Road Safety, and the Australian Design Rules:

- ADR30 Diesel Engine Exhaust Smoke Emissions
- ADR36 Exhaust Emission Control for Heavy Duty Vehicles
- ADR37 Emission Control for Light Vehicles
- ADR70 Exhaust Emission Control for Diesel Engine Vehicles.

9.3.3 Odours

All materials (e.g. paints) which generate fumes or odours shall be properly stored and used with efficient equipment and in accordance with established procedures.

9.3.4 Earthworks

Earthworks shall be managed to control dust generation. Specific control measures include:

- Completion of vegetation clearing in stages, to minimise the area of ground disturbed at any one time;
- Early stabilisation and revegetation of cut or filled areas and slope works;
- Watering of all exposed areas, including haul routes; and
- Provision of windbreaks and silt fences, as required.

9.3.5 Dust

Dust control measures shall be implemented for all processes that generate dust. Where considered necessary, windbreak screens shall be employed between work areas and abutting residential areas. Oil must not be used for the suppression of dust.

Haul roads and exposed earthworks shall be watered regularly to mitigate dust generation and monitored throughout the works.

9.3.6 Deliveries

Deliveries shall be managed to control dust. Specific control measures include:

- Covering of loads entering and leaving the site;
- Cleaning of vehicles and plant; and
- Removal of soil from wheels of vehicles leaving the site. This includes the requirement for installation of a vibration grid.

9.3.7 Stockpiles

Stockpiles shall be managed to control dust. Specific control measures include:

- Minimisation and stabilisation of stockpile areas. Stabilisation shall be undertaken by ensuring that angles of repose are not exceeded and, if necessary, by the placement of supporting structures to retain the stockpile within a designated area. If required, the surface of the stockpile shall be covered with either mulched vegetative matter, or an artificial cover, suitably weighted to prevent movement;
- Maintenance of stockpiles within designated areas and prevention of spread of stockpile material into adjacent areas;
- Creation of the minimum necessary stockpiles and removal of all stockpiles upon completion of works on site; and
- Provision of windbreaks and silt fences as required.

9.4 Monitoring

Daily inspection of the types, locations and details of control measures in place within the site is to be undertaken by the Contractor. Weekly recording by the Contractor of the effectiveness of the control measures is required.

The Contractor shall maintain daily records of meteorological conditions including rainfall, wind speed and direction. The Contractor shall record all air quality complaints received and details of all control measures undertaken. In the event of a dispute, an independent party, such as the Superintendent, shall implement air quality monitoring.

The Contractor shall take necessary action should the accepted limits be exceeded.

9.5 Reporting

The Contractor shall submit monthly reports to the Superintendent on the monitoring activities, control measures and corrective actions undertaken.

9.6 Corrective Action

Non-conformance shall be documented, by the Contractor, and a corrective action request (CAR) issued. All CAR's shall be included in the Non-Conformance Register maintained by the Contractor. The Contractor shall implement the corrective action, as required within the agreed time frame noted in the CAR. The Contractor shall advise the Superintendent upon completion of the corrective action.

10 Noise and Vibration Impacts

10.1 Policy

To control noise generated by construction activities and to minimise the impact of construction noise on the amenity of the local community; and to protect workers from occupational noise-induced hearing loss.

10.2 Performance Objectives

To comply with the Northern Territory Waste Management and Pollution Control Act, Council By-Laws and Northern Territory Environmental Protection Authority documents “Noise Guidelines for Development Sites in the Northern Territory” and “Noise Management Framework Guideline.”

10.3 Noise Management Framework Guideline

https://ntepa.nt.gov.au/__data/assets/pdf_file/0004/566356/noise_management_framework_guideline.pdf

The Noise Management Framework Guideline (NMFG) provides the recommended assigned construction noise levels at residences and for other effected land uses at normal working times and outside normal working times (for working times refer to Section 4.5 of this CEMP).

The recommended level $L_{Aeq\ (15\ min)}$ for residences is:

- +10 dB during normal working times; and
- +5 dB outside normal working times.

The Contractor shall apply all feasible and reasonable work practices to meet the noise affected level.

The Contractor shall inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details in accordance with the NMFG.

10.4 Control Measures

As part of the IPMP, the Contractor shall develop and submit to NTEPA a Noise Management Plan (NMP) for minimising noise levels within adjacent residential areas. All noise generating mobile and stationary plant, equipment and processes shall be controlled to minimise noise emissions in accordance with AS 2436 and the NMFG.

The NMFG provides guidance on operational practices to minimise noise impacts.

Control measures may include:

- The fitting of effective exhaust silencers to all mobile plant;
- The fitting of engine acoustic shielding;
- Using exhaust silencers on compressed air exhausts;
- The use of physical noise barriers such as earth mounds or mobile screens; and
- Review of times of operation of plant.

Lighting devices shall be used instead of whistles, bells and buzzers to control site operations. Audible alarms shall only be used for safety warnings.

All vehicles entering, leaving or used within the site shall be operated and maintained in a manner which ensures that the resulting noise levels are within the prescribed limits.

In the event that the adjusted noise level for a single source or activity exceeds the maximum permitted noise level by more than 10 db(A), consideration shall be given to restricting the times during which the activity can occur to a number of separate periods each day. Persons affected by the noise shall be consulted with regard to suitable hours and advised of the agreed operations schedule.

The Contractor shall also comply with:

- National Standard for Occupational Noise [NOHSC: 1007(2000)] to prevent occupational noise induced hearing loss.

- ANZECC guidelines – Technical basis for Building to Minimize Annoyance due to Blasting, Over Pressure and Ground Vibration (1990).

10.5 Monitoring

The Contractor shall perform weekly inspections of all noise producing sources (including inspection of new items of plant before they commence work on the site).

If complaints about noise are received, the Contractor shall investigate the complaint and implement appropriate mitigation measures if required. In the event of a dispute, an independent party such as the Superintendent shall undertake noise monitoring.

The Contractor shall keep a written record of all complaints and subsequent noise monitoring and remediation measures.

10.6 Reporting

The Contractor shall provide monthly reports to the Superintendent on noise monitoring, control measures and corrective actions taken.

10.7 Corrective Action

Non-conformance shall be documented by the Contractor and a corrective action request (CAR) issued. All CAR's shall be included in the Non-Conformance Register maintained by the Contractor. The Contractor shall implement the corrective action as required within the agreed time frame noted in the CAR. The Contractor shall advise the Superintendent upon completion of the corrective action.

11 Vegetation and Weed Management

11.1 Policy

To ensure that completed work areas are stabilised in a manner which minimises future adverse environmental impacts and to manage weed species within the project area.

11.2 Performance Objectives

To create conditions and implement measures which ensure the prompt establishment of vegetation within all areas disturbed during the works. Manage discovery of weed species within the project area in accordance with NT 'Weed Management Handbook'.

11.3 Control Measures

All vegetation to be cleared shall be clearly flagged prior to removal.

No clearing shall be undertaken without the written approval of the Superintendent.

No clearing shall be undertaken within the identified rainforest patch including the buffer area.

All cleared vegetation shall be disposed of by mulching on site.

Establish controls as shown in the Erosion and Sediment Control Plan (ESCP).

Establish the biting insect buffer as shown in the ESCP. Remove all trees and shrubs where indicated and maintain short grass cover within this buffer area. Maintenance mowing should be undertaken during the construction to maintain short grass height. It is important that grass cover should not be removed but its height merely maintained.

As part of the IPMP, the Contractor shall prepare a program for the rehabilitation of the site. Restoration, planting and grassing shall be carried out as specified, to the satisfaction of the Superintendent. A staged weed control program shall be implemented within rehabilitated areas as per the NT "Weed Management Handbook".

Stockpiled, weed infested vegetation shall not be mulched for re-use on site, nor disposed of at a green waste recycling facility, as these practices facilitate the re-establishment and spread of weed species.

Fertiliser application rates shall be closely monitored to ensure that excess fertiliser is not washed off by stormwater runoff and discharged to downstream water bodies. Controlled-release fertilisers shall be used wherever possible.

11.4 Monitoring

Monitoring of rehabilitation and landscaping works shall be undertaken by the Contractor at monthly intervals to assess the health and vigour of plantings. Any unhealthy plantings shall be treated or replaced. This monitoring shall also note the establishment of any weed species.

The frequency of monitoring may be progressively reduced as the plantings become established.

11.5 Reporting

Monthly reporting is to be provided by the Contractor to the Superintendent covering all control measures implemented and monitoring activities.

11.6 Corrective Action

Non-conformance shall be documented by the Contractor and a corrective action request (CAR) issued. All CAR"s shall be included in the Non-Conformance Register maintained by the Contractor. Copies of CARs shall be provided to the Superintendent upon request. The Contractor shall implement the corrective action as required within the agreed time frame noted on the CAR. The Contractor shall advise the Superintendent upon completion of the corrective action.

12 Stormwater Management and Water Quality

12.1 Policy

To minimise the impact of construction activity on water quality in water bodies external to the site.

12.2 Performance Objectives

To avoid detrimental impact on the water quality and the aquatic environment of downstream water bodies as a result of the discharge of contaminated stormwater runoff from the site.

12.3 Control Measures

12.3.1 Stormwater Quality Management Plan

As part of the IPMP and prior to the commencement of works on site, the Contractor shall submit a Stormwater Quality Management Plan to the Superintendent for approval. Work shall not commence until approval is granted.

12.3.2 Storage of Construction Materials

Construction materials stored on site shall be placed in suitably prepared locations to limit the potential for suspended solids to be transported from the site. Existing runoff paths shall be diverted around these storage locations and bunds shall be provided to retain material.

A safe storage location for fuels and oils shall be provided in accordance with AS 1940 “The Storage and Handling of Combustible Liquids”. This area shall be bunded in compliance with the standard. Any fuel and oil spills shall be attended to immediately to limit the potential for off-site impacts.

12.3.3 Temporary Control Measures

The Contractor shall provide temporary control measures, as required, during the course of the work to prevent soil erosion, scour, sediment transport and deposition.

During the construction period, all reasonable and practicable measures must be implemented to control flow velocities in such a manner that prevents soil erosion along drainage paths and at the entrance and exit of all drains and drainage pipes during all storms up to the relevant design storm discharge.

To the maximum degree reasonable and practicable, all waters discharged during the construction phase must discharge onto stable land, in a non-erosive manner, and at a legal point of discharge.

The measures detailed in the Erosion and Sediment Control Plan (ESCP) shall be implemented and maintained. Refer to Section 13 of this CEMP and the ESCP drawings.

12.3.4 Permanent Control Measures

Permanent control measures shall be provided as soon as possible after completion of work in each construction area. Permanent measures to be adopted for this project include the adoption of Water Sensitive Urban Design (WSUD) principles where feasible and accepted by City of Darwin, re-vegetation and stabilisation of disturbed areas.

Permanent stormwater treatment features include

- Stormwater Quality Improvement Devices, such as Gross Pollutant Traps (GPTs); and
- Grassed lined grains, which facilitate velocity reduction and encourage pollutant settlement and retention.

12.3.5 Outlet Structures

Outlet structures are provided at the end of stormwater outlets to dissipate energy from discharged run off and to limit scour potential of flows. Construct as detailed on the drawings. Where detailed, rock shall be hard angular rock placed over geofabric. For temporary rock protection works, proposed depth and diameter of rock is to be advised and based on the velocity of the drainage outlet discharge.

12.4 Monitoring

The Contractor shall monitor the aforementioned measures to ensure that the construction activities are not resulting in any worsening of the pre-development quality of stormwater being discharged from the site.

In addition, a Water Quality Monitoring Plan will be implemented in accordance with the Development Permit conditions.

12.5 Reporting

Monthly reports shall be provided by Contractor to the Superintendent on the monitoring undertaken during construction, including details of any changes from the approved Stormwater Quality Management Plan and of all corrective action taken to maintain the performance requirement. All relevant reports and records shall be retained by the Contractor.

12.6 Corrective Action

Non-conformance shall be documented by the Contractor and a corrective action request (CAR) issued. All CAR's shall be included in the Non-Conformance Register maintained by the Contractor. The Contractor shall implement the corrective action as required within the agreed time frame noted in the CAR. The Contractor shall advise the Superintendent upon completion of the corrective action.

13 Erosion and Sediment Control

13.1 Policy

The Contractor is to implement controls to minimise the impact of soil erosion and transport of sediment within or from the construction site.

13.2 Performance Objectives

Soil erosion and the transport of sediment within or from the construction site shall be mitigated by the implementation, monitoring and maintenance of controls in accordance with the Erosion and Sediment Control Plan.

13.3 General

13.3.1 Control Measures

Erosion and Sediment Control Plans (ESCP) have been prepared as part of the design and construction drawings by a Certified Professional in Erosion and Sediment Control. The Contractor is expected to include in its IPMP an ESCP program that includes the implementation and monitoring of the appropriate ESCP measures and the process for amending controls to suit actual or changed conditions. Any proposed amendments to the approved ESCP shall be submitted by the Contractor to the Superintendent for approval prior to implementation.

The ESCP details the methods that shall be used to control erosion on the site, and to prevent discharge of sediment contaminated runoff to receiving waters, including but not limited to:

- Where possible, earthworks shall be completed in stages, such that the minimum area is disturbed at any one time;
- Where possible, perimeter bunds or catch drains shall be constructed around disturbed areas to divert external catchment flows around these areas;
- Mulch filter berms shall be used to prevent sediment transport from disturbed areas;
- Open drains shall be protected from scour using regular rock check dams. Temporary drains shall be lined with rock;
- Sediment traps are to be used in drainage lines to collect silt contained in the runoff;
- Soil stockpile areas are to be stabilised to prevent erosion;
- Following construction, embankment slopes shall be stabilised to retain vegetation and topsoiled to promote successful planting. Disturbed areas shall be vegetated as soon as possible after earthworks are complete; and
- Where areas are required to remain open for any significant period of time prior to re-vegetation and/or stabilisation, the soil surface shall be covered with straw or other suitable material to prevent rain spatter.

The ESCP details the controls to be implemented during:

- Phase 1 – Pre-Construction
- Phase 2 – During Construction
- Phase 3 – Post-Construction.

13.3.2 Monitoring

An inspection and maintenance schedule for erosion and sediment control measures is presented in **Table 13-1.** The Contractor shall monitor the works at the stipulated intervals for evidence of:

- Non-functioning control measures or controls requiring maintenance;
- Erosion; and
- Accumulation of sediment at discharge points.

While work is occurring on site or during wet weather, the Contractor shall inspect the erosion and sediment controls daily for damage such as scour, soil erosion, sediment deposition, by-passing of treatment devices, silt plumes, etc.

Table 13-1 Erosion and Sediment Controls Inspection and Maintenance Schedule

Period	Frequency	Location	Type	Parameters to be Monitored
Whilst temporary sediment control measures are in place	Daily during construction, weekly thereafter	All erosion control measures	Visual	Check to ensure that erosion control measures are in place and are functioning satisfactorily
	Daily during construction, weekly thereafter	Sediment ponds and treatment areas	Visual	> Degradation of water quality > Signs of erosion, such as gully erosion > Accumulation of sediment at discharge points
	Daily during wet weather	All erosion control measures including sediment traps silt fences etc.	Visual	Check for damage, bypassing deposition of excessive silt, scour etc

13.3.3 International Erosion Control Association

Refer to the International Erosion Control Association – Best Practice Erosion and Sediment Control guideline for additional technical support, standard drawings, specification information and management methods.

13.4 Methodology

The proposed erosion and sediment control methodology is to be implemented in three distinct phases in accordance with construction activities being undertaken and as detailed on ESCP drawings:

- Phase 1 – Pre-Construction
- Phase 2 – During Construction
- Phase 3 – Post-Construction

Sediment basins are to be established as indicated on the ESCP prior to works commencing in the basin's catchment area.

The site is to be filled in a cellular fashion, in that the external fill batters are to be filled and stabilised first prior to the infilling of the fill areas. The entire earthworks area will be managed by the Contractor in a logical and reasonable sequence.

Topsoil management is critical in the overall strategy for carrying out earthworks over the site. It is proposed only to strip those areas immediately required to be cut or filled and to place stripped topsoil into long low flat mounds to retain the seed and organism life. Topsoil is only ever to be transported in a damp condition and is to be re-placed on a roughened surface. Topsoil is to be placed back on the site at the depth indicated on the drawings, left in a roughened condition and immediately seeded / hydro-mulched / mulched / turfed as detailed.

Dust control of the site is to be maintained at a level to ensure there are no visible dust emissions from the site during earthworks and construction activities.

13.5 Phasing

13.5.1 Phase 1 – Pre-Construction

Prior to the commencement of earthworks, the Contractor shall establish the site entry/exit including a vibration grid access point off Lee Point Road.

All “No Go” areas shall be clearly delineated and fenced.

Diversion drains and catch drains (with rock lining and rock check dams where detailed) shall be constructed to divert external catchment flows around areas to be disturbed, where possible.

Internal mulch filter berms shall be constructed where detailed to limit and contain the transportation of sediment from individually work areas as clearing progresses.

Catch drains shall direct flows to sediment basins to be constructed at the locations shown on the drawings.

13.5.2 Phase 2 – Construction

The Contractor shall establish mulch filter berms with rock weirs at the locations detailed, including the perimeter of the site, perimeter of lot areas and internally along contour lines.

Rock check dams shall be installed along drainage paths where shown on the drawings.

The extremities of fill platforms should initially be bunded to contain any flows potentially transporting sediment, and to direct these flows to mulch filter berms, catch drains and the sediment pond.

As clearing and bulk earthworks progresses, further mulch filter berms and catch drains are to be established to cater for the specific earthworks area and direct any flows potentially transporting sediment to the settling pond.

Each area of earthworks shall be fenced off as works are completed to prevent vehicle access. Verges are to be topsoiled and grassed. A turf filter strip shall be established behind road kerbs.

Open space areas and batters shall be topsoiled, mulched and vegetated as detailed as soon as practical following completion.

The open wind buffer, required for biting insect control, shall be cleared as indicated on the drawings. Pockets of existing tall trees are to be retained at locations advantageous to mitigating sediment transport. Existing ground shall be graded where required to avoid ponding, and topsoiled with natural material containing grasses. Other disturbed areas with exposed soils shall be covered with mulch to a minimum depth of 100mm. Undisturbed grassed areas are to be slashed.

13.5.3 Phase 3 – Post-Construction

On completion of lot earthworks, boundary controls including mulch filter berms with integral rock weirs shall be established.

As the roadways, hardstand areas and stormwater systems are installed, appropriate inlet sediment traps are to be provided.

Site perimeter areas and batters shall be topsoiled with non-dispersive soil, seeded, mulched or stabilised as instructed by the Superintendent.

As areas are revegetated and established, the temporary ESC devices and sediment basins may be decommissioned and removed. The area of disturbance from decommissioned sediment basins is to be topsoiled, left in a roughened condition, and seeded; or converted to a permanent detention basin where documented.

Following decommissioning of the construction compound, the area to be topsoiled with non-dispersive soil and seeded or stabilised in accordance with the Superintendent’s instructions.

13.5.4 Installation Sequence

The general installation sequence as shown on the ESCP drawings is as follows:

Table 13-2 ESCP Installation Sequence

GENERIC INSTALLATION SEQUENCE:

THIS INSTALLATION SEQUENCE ONLY SERVES AS A GENERIC GUIDE FOR THE MINIMUM EROSION AND SEDIMENT CONTROL (ESC) MEASURES FOR EVERY STAGE OF WORK, SITE CONDITION SUCH AS DISPERSIVE SOIL MAY WARRANT HIGHER ESC STANDARD (CONTACT SUPERINTENDENT OR THE ENGINEER PRIOR TO WORK).

CODE	ITEM	PLAN	INSTALLED	REMOVED
MARK OUT INITIAL LIMITS OF DISTURBANCE. IDENTIFY LOCATION OF DISPERSIVE SOIL IF ANY. IF DISPERSIVE SOIL IS ENCOUNTERED CONTACT THE SUPERINTENDENT PRIOR TO COMMENCING WORK.				
Entry/Exit	Construction entry/exit – vibration grid	DWG. DC1603-MHN-1A-ES04 & DC1603-MHN-1A-ES10	Day One	When Entry/Exit is no longer required
SF	Sediment Fence with Woven Fabric	DWG. DC1603-MHN-1A-ES04 TO DC1603-MHN-1A-ES08	Prior to clearing of upslope areas	When site office and Stockpile is removed and when upslope site is suitably stabilised
Site Office	Site Office		Day One	End of Work
Stockpile	Stockpile/Waste/Parts Washdown Area		Day One	End of Work
CD	Parabolic Catch Drain without bank – Type A	DWG. DC1603-MHN-1A-ES04 TO DC1603-MHN-1A-ES08	Day One	After site stabilisation
MB	Mulch Filter Berms	DWG. DC1603-MHN-1A-ES04 TO DC1603-MHN-1A-ES08	As soon as construction activities allows. Install as required	After site stabilisation or house construction on each individual lots commenced
OG, SA, FD	On Grade, Sag, and Fabric Drop Inlet Protection	DWG. DC1603-MHN-1A-ES07 & DC1603-MHN-1A-ES08	As soon as inlets and pipes are constructed	After site stabilisation
GFS	1.2m Grass Filter Strip	DWG. DC1603-MHN-1A-ES07 & DC1603-MHN-1A-ES08	As soon as construction activities allows	NA
LS	Level Spreader	DWG. DC1603-MHN-1A-ES04 & DC1603-MHN-1A-ES06	As soon as construction activities allows. Downslope land condition to be determined on site	When next stage begins and LS is no longer required
FR	Fibre Roll	DWG. DC1603-MHN-1A-ES04 TO DC1603-MHN-1A-ES08	As soon as open drains are constructed	After site stabilisation
RCD	Rock Check Dam	DWG. DC1603-MHN-1A-ES04 TO DC1603-MHN-1A-ES08	As soon as construction activities allows. Provide geotextile splash pad and ensure 150mm is provided between centre and outer check dam wing.	After drain stabilisation
RFD	Rock Filter Dam	DWG. DC1603-MHN-1A-ES04, DC1603-MHN-1A-ES05 & DC1603-MHN-1A-ES06	Following installation of boundary sediment controls and prior to land clearing	After adequate stabilisation of contributing upslope catchment
Dust	Dust Suppression		At sufficient interval to suppress dust generation	N/A
Revegetation	Revegetation by native species grassing in any disturbed areas		As soon as practicable	N/A

13.6 Site Access

Prior to the commencement of site works, the location of the site access point must be established. Site access will be limited to a constructed stabilised access off Lee Point Road. A vibration grid shall be installed as detailed in the ESCP.

The site exit point is to be monitored and maintained to prevent sediment being tracked onto sealed, public roadways. Stormwater runoff from access roads and stabilised entry/exit points are to be directed to onsite sediment control devices.

13.7 Land Clearing

No land clearing shall be undertaken unless preceded by the installation of adequate drainage and sediment control measures, unless such clearing is required for the purpose of installing such measures, in which case only the minimum clearing required to install such measures shall occur.

Prior to land clearing, areas of protected vegetation and areas of other retained vegetation must be clearly identified (e.g. with high-visibility tape, or light fencing) to eliminate the risk of unnecessary land clearing.

All reasonable and practicable measures shall be taken to minimise the removal of, or disturbance to, those vegetated areas that are not required to be cleared for the works proposed.

All land clearing must be in accordance with the Federal, Territory and local government vegetation protection/preservation requirements and/or policies.

13.8 Soil and Stockpile Management

All reasonable and practicable measures must be taken to obtain the maximum benefit from existing topsoil. Viable topsoil is to be stockpiled in long low flat mounds to facilitate the survival of seed and micro-organisms vital for the topsoil.

Stockpiles of erodible material that has the potential to cause environmental harm, if displaced, must be:

- Appropriately protected from wind, rain, concentrated surface flow and excessive up-slope stormwater surface flows;
- Located at least 2m from any hazardous area, retained vegetation, or concentrated drainage line;
- Located up-slope of an appropriate sediment control system; and
- Provided with an appropriate protective cover (synthetic, mulch or vegetative), if the materials are likely to be stockpiled for more than 28 days.

A suitable flow diversion system must be established immediately up-slope of a stockpile of erodible material if the up-slope catchment area will generate flows sufficient to create stockpile erosion and sediment transfer.

13.9 ESC Devices

All erosion and sediment control measures must be applied and maintained.

Optimum benefit must be made of every opportunity to trap sediment within the work site, and as close as practicable to its source. Sediment traps must be installed and operated to both collect and retain sediment.

The potential safety risk of a proposed sediment trap to site workers and the public must be given appropriate consideration. Suitable all-weather maintenance access must be provided to all sediment control devices.

Materials, whether liquid or solid, removed from sediment control devices during maintenance or decommissioning, must be disposed of in a manner that does not cause ongoing soil erosion or environmental harm.

Constructed sediment basins must be maintained and fully operational throughout the construction period and until the basin's catchment area achieves 75% ground cover on all soil surfaces. Settled sediment must be removed from the sediment basin when the volume of the sediment exceeds the designated sediment storage volume, or the design maximum sediment storage elevation.

The following devices are proposed to be used during the construction of the proposed works and are from IECA Best Practice Erosion and Sediment Control (November 2008).

13.9.1 Site Access

Site access treatment shall be in the form of a vibration grid. The site access shall have the topsoil removed and area levelled and compacted. Install RCBC as storage chamber and vibration grid. The access shall be constructed of crushed rock over geotextile as detailed in the ESCP drawings.

13.9.2 Stockpile

Stockpiles of material are best located at a high point to prevent surface runoff entering the stockpile area. If located on the downslope side, ensure that a catch drain or diversion bank is used to divert upslope runoff.

Downstream of stockpile should be protected with a mulch filter berm or sediment fence to trap sediment from leaving the stockpile area. Ensure a minimum distance of 2m between toe of the stockpile and the sediment fence.

13.9.3 Rock Check Dams

Rock check dams will generally consist of large rock rubble weirs, with a trough in the centre to maintain flows in the drain. The check dams will allow trickle flows through the structure, with the intention that sediment and suspended particles will drop out before exiting the drain.

13.9.4 Catch Drains

Catch drains and perimeter banks will be used where required to divert flows across slopes and around disturbed or unstable areas and stockpiles. The drains may also be used to limit the flow path length down steep grades or unstable or newly grassed areas.

Rock lining of the catch drains is required where detailed on the Erosion and Sediment Control Plans.

13.9.5 Level Spreader

Required at the end of flow diversion drains to discharge flows evenly across vegetated stable slopes.

13.9.6 Mulch Filter Berms

Mulch generated as a by-product during clearing is to be used to form mulch filter berms as detailed. The mulch is to comply with the requirements of AS4454.

The key principle of mulch filter berms is sediment trapping achieved through gravity-induced settlement resulting from ponding up-slope of the berm, however significant filtration is achieved on water passing through the berm. Where detailed on the ESCP drawings, mulch filter berms shall be placed along contour lines.

13.9.7 Sediment Fences

The use of mulch filter berms is preferred to sediment fences, which shall only be used where insufficient mulch is available on site. Sediment fences shall generally be installed along contour lines where practical.

13.9.8 Outlet Structures

Outlet structures are provided at the end of drains to dissipate energy from discharged run off and to limit scour potential of flows. Outlet structures shall be constructed out of hard angular rock placed over a geo-fabric layer, or where detailed for permanent installations, reinforced concrete. For temporary structures, depth and diameter of rock is to be based on the velocity of the drainage outlet discharge. For permanent structures, refer to design drawings.

13.9.9 Mulching / Revegetation

All batters and significant slopes not being turfed are to be mulched and planted or other alternative covering treatment applied as approved by the Superintendent, immediately after final formation.

13.9.10 Grass Filter Strips

Grass filter strips comprising of turf strips are to be installed along the up-slope edge of kerbs as shown on the drawings.

13.9.11 Sediment Basins

Sediment basins are proposed to be constructed prior the commencement of earthworks on the site. The sediment basins are to be wet type basins. The basin is to have a specifically sized outlet weir to be constructed and armoured with rock rubble overlaying a geotextile layer. Sediment basin flocculation will be undertaken and carried out in accordance with the manufacturer's specifications, as and when required. Any retained water may be reused on site for construction purposes. Sediment material deposited in the sediment basin is to be dried out and disposed of in a manner that does not cause erosion, sediment transfer or environmental harm.

13.9.11.1 Materials

Earth fill: clean soil with Emerson Class 2(1), 3, 4, or 5, and free of roots, woody vegetation, rocks and other unsuitable material. Soil with Emerson Class 4 and 5 may not be suitable depending on particle size

distribution and degree of dispersion. Class 2(1) should only be used upon recommendation from geotechnical specialist.

Spillway rock: hard, angular, durable, weather resistant and evenly graded rock of size specified on the drawings. Large rock should dominate, with sufficient small rock to fill the voids between the larger rocks. The diameter of the largest rock size should be no larger than 1.5 times the nominal rock size. The specific gravity should be at least 2.5.

Geotextile fabric: heavy-duty, needle-punched, non-woven filter cloth, minimum Bidim A24 or equivalent.

13.9.11.2 Construction

Notwithstanding any description contained within the approved plans or specifications, the Contractor shall be responsible for satisfying themselves as to the nature and extent of the specified works and the physical and legal conditions under which the works will be carried out. This shall include means of access, extent of clearing, nature of material to be excavated, type and size of mechanical plant required, location and suitability of water supply for construction and testing purposes, and any other like matters affecting the construction of the works.

Refer to approved plans for location, dimensions, and construction details.

13.9.11.3 Embankments

Scarify areas on which fill is to be placed before placing the fill. Unless otherwise specified on the approved plans, compact the soil at about 1% to 2% wet of optimum and to 95% modified or 100% standard compaction.

Where both dispersive and non-dispersive classified earth-fill materials are available, non-dispersive earth-fill must be used in the core zone.

After completion of the embankment all loose uncompacted earth-fill material on the upstream and downstream batter must be removed prior to spreading of topsoil.

Topsoil and revegetate/stabilise all exposed earth as directed within the approved plans.

13.9.11.4 Outlet Weir Construction

Ensure excavated dimensions allow adequate boxing-out such that the specified elevations, grades, weir width, and entrance and exit slopes for the weir will be achieved after placement of the rock or other scour protection measures as specified in the plans.

Place specified scour protection measures on the spillway. Ensure the finished grade blends with the surrounding area to allow a smooth flow transition from spillway to downstream channel.

Where a synthetic filter fabric underlay is specified, place the filter fabric directly on the prepared foundation. If more than 1 sheet of filter fabric is required, overlap the edges by at least 300mm and place anchor pins at minimum 1m spacing along the overlap. Bury the upstream end of the fabric a minimum 300mm below ground and where necessary, bury the lower end of the fabric or overlap a minimum 300mm over the next downstream section as required. Ensure the filter fabric extends at least 1000mm upstream of the spillway crest.

Take care not to damage the fabric during or after placement. If damage occurs, remove the rock and repair the sheet by adding another layer of fabric with a minimum overlap of 300mm around the damaged area. If extensive damage is suspected, remove and replace the entire sheet.

Where large rock is used, or machine placement is difficult, a minimum 100mm layer of fine gravel, aggregate, or sand may be needed to protect the fabric.

Placement of rock should follow immediately after placement of the filter fabric. Place rock so that it forms a dense, well-graded mass of rock with a minimum of voids. The desired distribution of rock throughout the mass may be obtained by selective loading at the quarry and controlled dumping during final placement.

The finished slope should be free of pockets of small rock or clusters of large rocks. Hand placing may be necessary to achieve the proper distribution of rock sizes to produce a relatively smooth, uniform surface. The finished grade of the rock should blend with the surrounding area. No overfall or protrusion of rock should be apparent.

Ensure that the final arrangement of the weir crest will not promote excessive flow through the rock such that the water can be retained within the settling basin at an elevation no less than 50mm above or below the nominated spillway crest elevation.

13.9.11.5 Maintenance

Inspect the sediment basin during the following periods:

- During construction to determine whether machinery, fallen trees, or construction activity has damaged any components of the sediment basin. If damage has occurred, repair it;
- After each runoff event, inspect the erosion damage at flow entry and exit points. If damage has occurred, make necessary repairs;
- At least daily during construction and weekly when work is not occurring on site;
- Daily during the wet season, where applicable; and
- Prior to and immediately after periods of 'Stop Work' or site 'Site Shutdown.'

Clean out accumulated sediment when it reaches the marker board/post, and restore the original storage volume. Place sediment in a disposal area or, if appropriate and suitable, mix with dry soil on the site. Do not dispose of sediment in a manner that will create an erosion, sediment transfer or pollution hazard.

Check fill material in the dam for excessive settlement, slumping of the slopes or piping between the conduit and the embankment. Make all necessary repairs.

Remove all trash and other debris from the basin.

13.9.11.6 Removal and Rehabilitation of Temporary Sediment Basins

When grading and construction in the drainage area above a temporary sediment basin is completed and the disturbed areas are adequately vegetated or stabilised, the basin must be removed or otherwise incorporated into the permanent stormwater drainage system. In either case, sediment should be cleared and properly disposed of and the basin area stabilised.

All water and sediment must be removed from the basin prior to the basin's removal. Dispose of sediment and water in a manner that will not create an erosion or pollution hazard.

Bring the disturbed area to a proper grade, then smooth, compact, and stabilise and/or revegetate as required to establish a stable land surface.

Required drainage, erosion and sediment control measures during the decommissioning and rehabilitation or a sediment basin must comply with the same standards specified for the normal construction works.

A temporary sediment basin must not be decommissioned until all up-slope site stabilisation measures have been implemented and are appropriately working to control soil erosion and sediment runoff in accordance with the specified ESC standard.

13.10 Maintenance and Management

13.10.1 Maintenance Considerations

Maintenance inspections of all erosion and sediment control devices must be carried out in accordance with the schedule included in the ESCP drawings and prior to and after rainfall events. The Contractor is responsible for the maintenance of all erosion and sediment control devices. Any issues with devices are to be noted and repaired or altered as necessary. The sediment basins are to be flocked and emptied as required. It is the responsibility of the Contractor to ensure that verification testing of the water prior to discharge is undertaken and the water quality complies with all statutory requirements.

13.10.2 Site Management

All operational activities must be located such that any liquid effluent (e.g. process water, wash-down water, effluent from equipment cleaning, or plant watering), can be totally contained and treated within the site.

The construction schedule must aim to minimise the duration that any areas of disturbed ground are exposed to the erosive effects of wind, rain and surface water.

Land-disturbing activities must be undertaken in accordance with the CEMP, the Contractor's approved site management plans and associated development conditions.

Land-disturbing activities must be undertaken in such a manner that allows all reasonable and practicable measures to be undertaken to:

- Allow stormwater to pass through the site in a controlled manner and at non-erosive flow velocities up to the specified design storm discharge;
- Minimise soil erosion resulting from rain, water flow and/or wind;
- Minimise adverse effects of sediment runoff, including safety issues;
- Prevent, or at least minimise, environmental harm resulting from work-related soil erosion and sediment runoff; and
- Ensure that the value and use of land/properties adjacent to the development (including roads) are not diminished as a result of the adopted ESC measures.

All erosion and sediment control measures must conform to the standards and specifications contained in:

- The Development Permit;
- The ESCP drawings
- This CEMP and supporting documentation; and
- The latest version of IECA Best Practice Erosion and Sediment Control guidelines, if the standards and specification are not detailed in the drawings.

Additional and/or alternative ESC measures must be implemented in the event that site inspections, the site monitoring and maintenance program, or the regulatory authority, identifies that unacceptable off-site sedimentation is occurring as a result of the work activities.

Sediment (including clay, silt, sand, gravel, soil, mud, cement and ceramic waste) deposited off the site as a direct result of an on-site activity, must be collected and the area appropriately cleaned and rehabilitated as soon as reasonable and practicable, and in a manner that considers the safety and environmental risks associated with the sediment deposition.

Site spoil must be lawfully disposed of in a manner that does not result in ongoing soil erosion, sediment transport or environmental harm.

Management of the site is the responsibility of the Contractor, who is responsible for the construction and sequence of installation of all devices and measures contained in this document and as indicated in the Erosion and Sediment Control Plan. The Contractor is directed to the IECA guideline for compliance with managing the site.

The Superintendent may, at his discretion, direct the Contractor to carry out additional controls, as and when required. The Contractor may also at their discretion opt to include additional devices as may be required to ensure compliance with the approvals as they see fit.

It is important to note that the details contained herein and in the ESCP drawings are not necessarily all the measures that may be necessary to fulfil the requirements and are to be used as a guide for the Contractor.

13.10.3 Site Maintenance

All temporary erosion and sediment control measures, including drainage control measures, must be fully operational and maintained in proper working order at all times during the construction period.

All drainage, erosion and sediment control measures must be inspected:

- At least daily (when work is occurring on-site);
- At least weekly (when work is not occurring on-site);
- Within 24 hours of expected rainfall; and
- Within 18 hours of a rainfall event of sufficient intensity and duration to cause runoff on-site.

Specific inspections of all devices are required prior to any significant rainfall event and afterwards to ensure that devices are operational at all times.

Cleaning of sealed roadways must only occur where sweeping has failed to remove sufficient sediment and there is a compelling need to remove the remaining sediment (e.g. for safety reasons). In such circumstances, all reasonable and practicable sediment control measures must be used to prevent, or at least minimise, the release of sediment into receiving waters. Only those measures that will not cause safety and property flooding issues shall be employed. Sediment removed from roadways must be disposed of in a lawful manner that does not cause ongoing soil erosion or environmental harm.

Sediment removed from sediment traps and places of sediment deposition must be disposed of in a lawful manner that does not cause ongoing soil erosion, sediment transport or environmental harm.

13.10.4 Post Construction

When works are complete and final inspections have been carried out, the monitoring program will reduce to monthly inspections, plus additional inspections before and after significant rainfall events.

13.10.5 ESCP Review and Amendment

The plans and reports comprising the Erosion and Sediment Control Plan are to be reviewed and updated by the Contractor following consultation with the Superintendent, DEPWS and Council's representative as and when required. This may be due to changes in construction sequencing and any unforeseen issues that may occur during the construction of the works. No change to the proposed erosion and sediment control measures is to increase the risk of potential environmental harm.

Additional erosion and sediment control measures shall be implemented and a revised Erosion and Sediment Control Plan put in place in the event that site conditions change significantly from those considered within the ESCP. The ESCP prepared by the Contractor shall be a living document and will need to be amended regularly to reflect construction works underway and the specific nature of the proposed management methods employed to manage erosion and sediment on the site.

Where there is a risk of environmental harm occurring as a result of sediment leaving the site, appropriate additional erosion and sediment control measures must be implemented such that all reasonable and practicable measures are being taken to prevent or minimise such harm.

The Contractor is ultimately responsible for the construction site and compliance with all relevant approvals and management plans for addressing erosion and sediment control requirements.

13.11 Reporting

Monthly reporting is to be submitted by the Contractor to the Superintendent outlining all maintenance activities and corrective actions.

All environmentally relevant incidents must be reported as soon as practicable and recorded in a register that is accessible to all relevant regulatory authorities.

13.12 Corrective Action

Non-conformance shall be documented by the Contractor and a corrective action request (CAR) issued. All CAR's shall be included in the Non-Conformance Register maintained by the Contractor. The Contractor shall implement the corrective action as required within the agreed time frame noted in the CAR. The Contractor shall advise the Superintendent upon completion of the corrective action.

About Cardno

Cardno is a professional infrastructure and environmental services company, with expertise in the development and improvement of physical and social infrastructure for communities around the world. Cardno's team includes leading professionals who plan, design, manage and deliver sustainable projects and community programs. Cardno is an international company listed on the Australian Securities Exchange [ASX:CDD].

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