



UPDATED ENVIRONMENTAL MANAGEMENT PLAN

FOR THE

**FOR THE REPLACEMENT AND UPGRADING OF ADDITIONAL 39 KM EXISTING
WATER PIPELINE FROM DEVILS FORK SOUTHWARDS TO THE COLLECTOR 2
RESERVOIR, SWAKOPMUND – MILE 7, ERONGO REGION**

MARCH 2020

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ABBREVIATIONS

CEMP	Construction Environmental Management Programme
EC	Environmental Clearance
ECO	Environmental Control Officer
EAP	Environmental Assessment Practitioner
EMA	Environmental Management Act (No. 7 of 2007)
EIA	Environmental Impact Assessment
EO	Environmental Officer
GIS	Geographic information system
I&APs	Interested and Affected Parties
LEMP	Life-Cycle Environmental Management Programme
MET: DEA	Ministry of Environment and Tourism: Department of Environmental Affairs
MSDS	Material Safety Data Sheets
OEMP	Operational Environmental Management Programme
O&M	Operation and Maintenance
PPE	Personal Protective Equipment
TB	Tuberculosis
SACNSP	Professional Natural Scientist with the South African Council for Natural Scientific Professions
SS	Schwarzekuppe-Swakopmund pipeline
STD	Sexually Transmitted Diseases
IFC	International Finance Corporation

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1 INTRODUCTION

This document represents the Life-Cycle Environmental Management Programme (LEMP) for the proposed Swakopmund – Mile 7 water supply pipeline, Namibia.

1.1 PURPOSE OF THE LEMP

This Life-Cycle Environmental Management Plan (LEMP) is compiled for the management of potential environmental impacts during the construction, operation, and decommissioning phases of the proposed Swakopmund – Mile 7 water supply pipeline project. Best practice is proposed for the generic issues of construction management and supervision as well as the on-going management and operation of the pipeline.

NamWater intends to replace Priority 2 water supply pipeline from Swakop base (NamWater offices) southwards to the Collector 2 Reservoir via Schwarzekuppe and the Collector 1 Reservoirs. This is mainly due to frequent breakages and high maintenance costs currently experienced by NamWater. The replacement activities will be done in different priorities, by replacing the most critical sections first.

The Kuiseb Collector 2 – Schwarzekuppe – Swakopmund pipeline is 45 years old and for the past decade, it has experienced frequent breaks mainly due to corrosion of the pre-stressed concrete pipes. This approximately 76 km long pipeline has reached the end of its economic life span. Since this pipeline is the primary water transfer system from the Kuiseb to Walvis Bay and Swakopmund, there is a need to replace the pipeline to improve the current level of security of water supply to the various customers. Please note that 0 km is starting at the Collector 2 reservoir ending at 76 km Swakop base (Collector 2 – Swakop base = 76 km), refer to **Figure 1** below for the area plan.

In terms of the Environmental Assessment Policy of 1994 and the Environmental Management (Act No 7 of 2007) (EMA), the activities required for the construction of the proposed project requires authorization from the Directorate of Environmental Affairs at the Ministry of Environmental and Tourism (MET:DEA). An EIA was completed and a clearance certificate was awarded to NamWater in 2017, and this EMP serves as an application for the renewal of the 2017 ECC.

1.2 PROGRESS SCHEDULE

Construction is taking place according to three different priorities (phases). Priorities are divided up into different sections, and sections are divided up into subsections of important water pipelines due for replacement, **Table 1** shows completed and future construction works.

Table 1 pipeline Chainage complete and in progress

Priority 1 (Phase1)	Chainage	Replacement	Length (km)
Section 1a: Collector 1–Schwarzekuppe (complete)	10 – 10.2 km	700 NB DCI x 3000	0.6

Section 1b: Collector 1–Schwarzekuppe (complete)	10.6 – 14.8 km	600 NB DCI x 3000	4.4
Section 2: Schwarzekuppe – Quarry (complete)	22.5-30.7 km	700 DCI x 7820 m	7.6
Section 3_A: Schwarzekuppe – Dune 7 (March 2020)	40.3 – 42.8 km	630 OD HDPE x 2500 m	2.5
Section 3_B:Schwarzekuppe – Swakopmund (March 2020)	42.8-44.8 km	600 NB DCI x 2000 m	1.9
Priority 2 (Phase 2)	Chainage	Replacement	Length (km)
Section 4: collector 1 to Schwarzekuppe (June 2020)	14.8 to 22.5 km	600 NB DCI x 1500 m	7.5
Section 5: Schwarzekuppe – Swakopmund (TBA)	30.7 - 35.6 km	600NB DCI x 4830 m	5.5
Section 6 A: Schwarzekuppe – Swakopmund (TBA)	44.7 to 67.1 km	600NB DCI x 30100 m	22.4
Section 6 B: Schwarzekuppe – Swakopmund (TBA)	67.1 to 72.1 Km	600 NB GRP	5.0
Section 6 C: Schwarzekuppe – Swakopmund (TBA)	72.1 to 74.6 Km	710 OD HDPE	2.5
Priority 3 (Phase 3)	Chainage	Replacement	Length (km)
Section 7: Collector 2 to Collector 1 (TBA)	0 to 10.0 km	600 NB DCI	10.0



Figure 1: Locality Plan of the project

1.3 ENVIRONMENTAL CONTROL OFFICER

a) Roles and responsibilities

The role of the ECO is to oversee and monitor compliance with and implementation of the construction phase EMP (CEMP) (i.e. Chapter 2 of this LEMP). The ECO is therefore responsible for the following responsibilities:

- i) Liaison with the community, Engineer and Environmental Authorities regarding environmental matters related to the project;
- ii) Monitoring of all the NamWater construction team 's activities for compliance with the various environmental requirements contained in this CEMP;
- iii) Reviewing of the NamWater construction team 's Environmental Method Statements as well as ensuring NamWater's approval thereof;
- iv) Ensuring that the requisite remedial action is implemented in the event of non-compliance;
- v) Ensuring the proactive and effective implementation and management of environmental protection measures;
- vi) Ensuring that a register of public complaints is maintained by the Resident engineer and that any and all public comments or issues are appropriately reported and addressed;
- vii) Routine recording and reporting of environmental activities on a monthly basis;
- viii) Recording and reporting of environmental incidents;
- ix) Notifying the Environmental Authorities immediately of any events or incidents that may cause significant environmental damage or breach the requirements of the CEMP; and
- x) Environmental Awareness Training courses to be conducted for the Contract workforce.

b) Site visits and reporting:

The ECO shall visit the site once a month during the construction phase. Based on the ECO's professional discretion, site visits can then be reduced to a minimum of once every month.

Bi annual compliance reports shall be submitted to the Resident Engineer and NamWater Manager and distributed as desired. The compliance report shall speak to the requirements of the CEMP and the project specifications.

1.4 RESPONSIBLE PARTIES

The following parties are responsible for the implementation of the LEMP during the various life-cycle phases:

PHASE	RESPONSIBLE PARTY	REPRESENTATIVES
Construction phase	NamWater	Environmental Manager
Operational phase	NamWater	Environmental Manager
Decommissioning phase	NamWater	Environmental Manager

2 CONSTRUCTION PHASE

2.1 SCOPE

The general principles contained within this CEMP shall apply to all construction activities. All construction activities shall observe any relevant environmental legislation and in so doing shall be undertaken in such a manner as to minimise impacts on the natural and social environment. Best practice shall apply where this CEMP does not describe the management measures for a construction activity. The ECO must be consulted should there be no management measures in this CEMP for a specific construction activity or where there is uncertainty as to how the measures in this CEMP should be implemented. In such an instance the ECO must determine the Best Available Technique(s) to avoid and/ or minimise potential impacts that an activity might have as per available best practice guidelines.

2.2 GENERAL

NamWater is responsible for:

- Appointing a qualified independent ECO;
- Ensuring that the objectives of the CEMP are given effect by including it in all contract documentation;
- Ensuring that all environmental impacts are managed in accordance with the CEMP;
- Ensuring that all monitoring and compliance auditing occurs in line with the CEMP;
- Ensuring that the environment is rehabilitated as far as practical to its natural state or existing land use practices; and
- Any environmental damage, pollution, pumping and treatment of extraneous water or ecological degradation as a result of activities both in and outside the site boundaries.

With regard to the above, the NamWater construction team shall conduct their activities so as to cause the least possible disturbance to the existing amenities, whether natural or man-made, in accordance with all the current statutory requirements. Special care shall be taken by the NamWater construction team to prevent irreversible damage to the environment. The NamWater construction team shall take adequate steps to educate all members of his workforce as well as his supervisory staff on the relevant environmental laws and protection requirements. The NamWater construction team shall supplement these steps with prominently displayed notices and signs in strategic locations to remind personnel of environmental obligations.

A suitably qualified independent ECO shall be appointed by NamWater to undertake the following tasks:

- Liaison with NamWater, Interested and Affected Parties (I&APs); and Engineer regarding environmental matters;

- Monitoring of all of the NamWater construction team 's activities for compliance with the various environmental requirements at regular intervals;
- Routine environmental auditing and reporting of the NamWater construction team 's performance against the CEMP;
- Reporting of environmental incidents and routine reporting of environmental issues associated with construction activities to NamWater, and any relevant environmental authority; and
- Identifying environmental non-conformances and initiating measures to remedy such issues.

The NamWater construction team shall construct and/ or implement all the necessary environmental protection measures in each area before any construction work may proceed. The Engineer/ ECO may suspend the Works at any time should the NamWater construction team , in the Engineer/ ECO's opinion, fail to implement, operate or maintain any of the environmental protection measures adequately.

a) **Schwarzekuppe-Swakopmund Pipeline:**

Table 2 below indicates the sections suggested to be laid belowground so as not to affect wildlife movement for the proposed alternative replacement route (i.e. eastern route).

Two "bottleneck" areas (refer to **Table 2**, items 1 and 10) could potentially occur along the Eastern Route. This is where existing aboveground pipelines, roads, a railway line, pylons (and/ or combinations thereof) occur in an area. Should another aboveground pipeline structure be erected in these areas it potentially could cause a "bottleneck" where wildlife movement would be concentrated, thereby increasing the potential of conflict between animals and vehicles. Although wildlife, especially ungulates and ostrich, are generally sparse in the general area it nevertheless could be problematic and should be recognised and avoided if possible.

It is recognised that the abovementioned recommendations would depend on the geology of the area. However, where geology is suitable, these recommendations should be incorporated as far as possible.

b) Turning Circles

As mentioned earlier, the need for turning circles are not expected. However, should they be required, they should be sized as per figure 2 and limited to disturbed sections as per table 2.

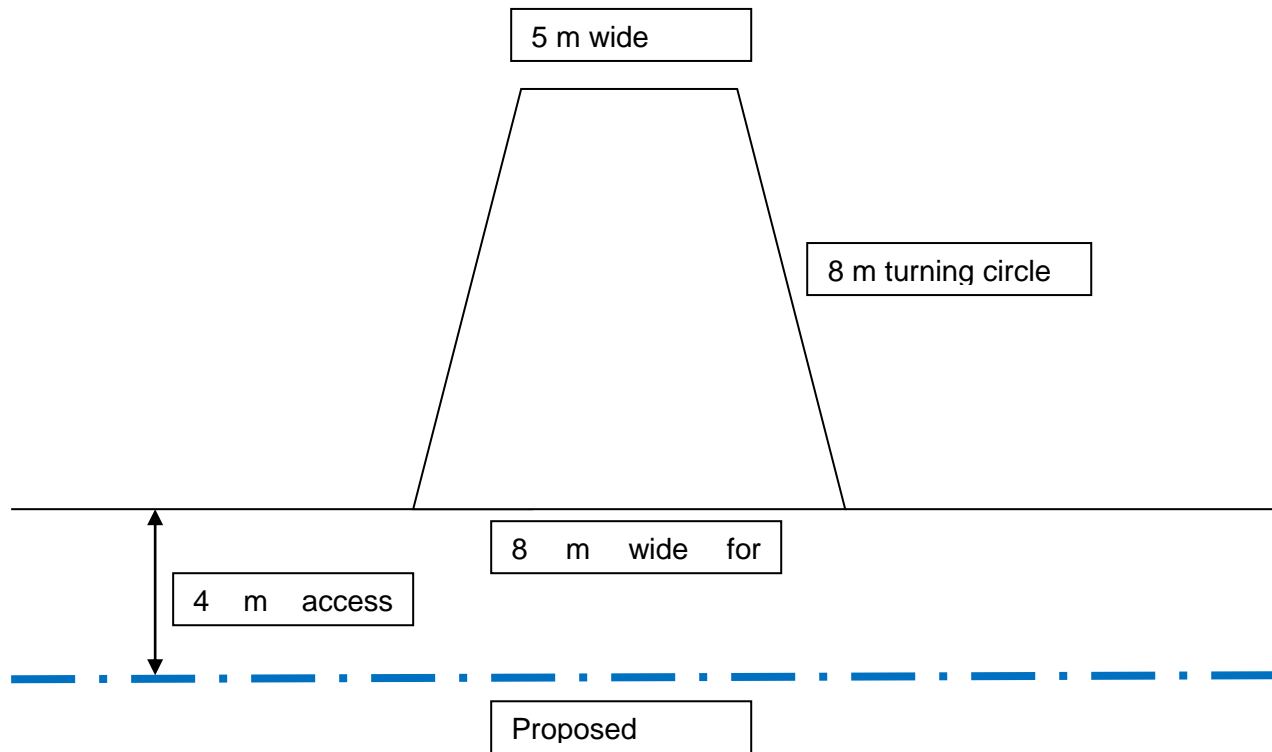


Figure 2: Turning Circles

Table 2: Areas of importance – i.e. sections suggested being laid belowground, Schwarzekuppe – Swakopmund Base station

Important areas	Distance (km)	Coordinates	Pipeline: Above- or Belowground	Importance	Dominant Vegetation	Importance Ranking
1	0.0 to 2.0	S22°59'10.4"; E14°36'29.9" to S22°57' 51.7"; E14°36'06.6"	Below	Saline areas; Open surface water; Well vegetated area; Bottleneck area	<i>Salsola nollothensis</i>	Medium
	2.0 to 2.6					
	2.6 to 8.4		Above			Low
2	8.4 to 8.8	S22° 54' 47.7"; E14° 35' 54.8" to S22° 54' 35.1"; E14° 35' 54.0"	Below	Drainage line	<i>Salsola nollothensis</i>	High
	8.8 to 10.3		Above			Low
3	10.3 to 10.7	S22° 53' 48.1"; E14° 35' 52.8" to S22° 53' 35.4"; E14° 35' 49.7"	Below	Drainage line	<i>Salsola nollothensis</i>	High
	10.7 to 12.0		Above			Low
4	12.0 to 12.3	S22° 52' 52.1"; E14° 35' 47.0" to S22° 52' 44.2"; E14° 35' 46.5"	Below	Drainage line	<i>Salsola nollothensis</i>	High
	12.3 to 20.6		Above			Low
5	20.6 to 21.0	S22° 48' 20.7"; E14° 35' 29.1" to S22° 48' 07.1"; E14° 35' 28.2"	Below	Drainage line [Large depression, but not well vegetated]	<i>Arthroa leubnitziae</i>	High
	21.0 to 22.7		Above			Low
6	22.7 to 23.0	S22° 47' 14.1"; E14° 35' 24.6" to S22° 47' 03.2"; E14° 35' 23.8"	Below	Drainage line [Big DL]	<i>Arthroa leubnitziae</i>	High
	23.0 to 23.6		Above			Low
7	23.6 to 24.0	S22° 46' 42.9"; E14° 35' 22.5" to S22° 46' 33.0"; E14° 35' 21.8"	Below	Drainage line [Big DL]	<i>Arthroa leubnitziae</i>	High
	24.0 to 27.7		Above			Low
8	27.7 to 28.3	S22° 44' 34.7"; E14° 35' 13.8" to S22° 44' 13.9"; E14° 35' 12.4"	Below	Drainage line [Wide area]	<i>Arthroa leubnitziae</i>	High
	28.3 to 30.7		Above			Low
9	30.7 to 30.9	S22° 42' 58.3"; E14° 35' 07.0" to S22° 42' 51.9"; E14° 35' 06.7"	Below	Wide well vegetated plain; Open culvert; Lichens on gravel plain	<i>Arthroa leubnitziae</i>	High
	30.9 to 33.3		Above			Low
10	33.3 to 35.1	S22° 41' 37.7"; E14° 35' 05.4" to S22° 40' 51.8"; E14° 34' 52.6"	Below	Turnoff to filming area; Pylons; Drainage lines; Bottleneck area		Medium
	35.1 to Swakop River		Above			Low
11	Swakop River		Above	Swakop River; Well vegetated area	<i>Tamarix usneoides</i>	High
	Swakop River to Base Station		Above			Low

It is important that the NamWater construction team is made aware of the archaeological sensitivity of the historical Ururas border post site. It is recommended that mitigation work at this site should include detailed surface mapping of all features and a systematic surface collection of material to be deposited at the National Museum of Namibia. Mitigation work on the site will require a permit issued by the National Heritage Council.

NamWater makes sure that all personnel and are aware of the protected nature of archaeological sites as well as the legal obligation to report any finds to the National Heritage Council as soon as possible. It is further recommended that the client adopt the archaeological “chance finds” procedure attached to this EMP in **Annexure A**. In the event that burials or other remains are located in the course of construction NamWater’s construction team should adhere to the procedure as set out.

Ecologically there are also high sensitive areas that need to be looked at with special care. The areas of most concern along the Devils Fork to Collector 2 Reservoir (ranked in importance) are expected to be:

Kuiseb River and tributaries

The Kuiseb River is one of the most important ephemeral drainage lines passing through the central Namib area and is a site of special ecological importance in Namibia with distinctive values such as biotic richness, large desert-dwelling mammals, **high value** for human subsistence and tourism (Curtis and Barnard 1998).

The pipeline should be laid underground between the Rooibank turnoff and the Collector 2 Reservoir – to facilitate wildlife movement to and from the Kuiseb River and inland areas. The pipeline activities should also attempt to affect this river system and associated drainage lines as little as possible.

Wetland area

A wetland area, albeit artificial, is located just north of the Schwarzekuppe Reservoir and is well vegetated and probably one of the Tumas River delta tributaries. The vegetation is dominated by *Arthroa leubnitziae* and *Phragmites australis*. This wetland and drainage line serve as habitat to a variety of vertebrate fauna and foraging routes for ungulates and is seen as a **high sensitive** area.

The pipeline should be laid underground at the wetland area, albeit artificial, in a Tumas River drainage line to facilitate wildlife movement along this area – i.e. potential foraging route. The pipeline activities should also attempt to affect this drainage line as little as possible.

Vegetated ridge

A vegetated ridge south of the Devils Fork area is a potential wildlife corridor of **high value** although sparsely vegetated compared to the Kuiseb and Tumas Rivers.

The pipeline should be laid underground at this site to facilitate wildlife movement along this area – i.e. potential foraging route. The pipeline activities should also attempt to affect this vegetated ridge as little as possible.

Important areas – i.e. areas where the pipeline should be laid belowground so as not to hinder wildlife movement, especially ungulates and ostrich – are indicated as measured in km's and GPS coordinates from Devils Fork in the north towards the Collector 2 Reservoir in the south (Table 3 & Table 4 – with coordinates).

Table 3: Areas of importance – i.e. sections suggested being laid belowground so as not to affect wildlife movement – along the proposed Devils Fork to the Collector 2 Reservoir.

Direction: Devils Fork to the Collector 2 Reservoir – Figures referred to below are presented in the Ecological Report

Important areas	Distance (km)	Area	Pipeline: Above- or Belowground	Importance	Dominant Vegetation	Importance Ranking
	0.0 to 7.1		Above	First 3.1 km is completed & aboveground		Low
1	7.0 to 7.4	See Fig 2	Below	Vegetated ridge	<i>Arthraerua leubnitziae</i>	High
	7.4 to 14.1		Above			Low
2	14.1 to 14.5	See Fig 3 & 11	Below	Artificial wetland area	<i>Salsola nollothensis</i>	High
	14.5 to 19.9	Rooibank Turnoff	Above			Low
	19.9 to 24.3		Below			
3	24.3 to 24.5	See Fig 4	Below	Drainage line	<i>Salsola nollothensis</i>	High
	24.5 to 24.6		Below			Low
4	24.6 to 25.2	See Fig 4	Below	Drainage line	<i>Salsola nollothensis</i>	High
	25.2 to 27.0		Below			Low
5	27.0 to 27.2	See Fig 7	Below	Drainage line	<i>Salsola nollothensis</i>	High
	27.2 to 35.1		Below			Low
6	35.1 to 35.5	See Fig 10 & 12	Below	Drainage line	<i>Salsola nollothensis</i>	High
	35.5 to 37.4		Below			Low

Importance rankings: Blue = low & red = high – based on uniqueness of the area.

Table 4: Important “hotspot” areas along the proposed Devils Fork to the Collector 2 Reservoir.

[Direction: Devils Fork to the Collector 2 Reservoir]

Important “Hotspot” areas	Distance (km)	Coordinates	Pipeline: Above- or Belowground	Importance Ranking
1	7.0 to 7.4	23°03’55.3” 14°38’29.6”	Below	High
2	14.1 to 14.5	23°07’38.4” 14°39’49.7”	Below	High
3	24.3 to 24.5	23°12’06.6” 14°42’18.8”	Below	High
4	24.6 to 25.2	23°12’14.8” 14°42’28.4”	Below	High
5	27.0 to 27.2	23°13’12.2” 14°43’22.8”	Below	High
6	35.1 to 35.5	23°16’51.2” 14°46’11.7”	Below	High

Up to the Rooibank Turnoff – i.e. where the pipeline route turns east following the Gobabeb-Rooibank road – it is recommended that the pipeline could be aboveground except for the 2 “hotspot” areas where it should be belowground acting as a crossing point for wildlife in association with unique habitats – e.g. vegetated ridge and artificial wetland area (See Table 3 & Table 4).

2.3 ENVIRONMENTAL AWARENESS

2.3.1 Environmental, health and safety induction course

The NamWater construction senior personnel is responsible for informing employees of their environmental obligations in terms of the CEMP and for ensuring that employees are adequately experienced and properly trained in order to execute the works in a manner that will minimise environmental impacts.

The NamWater construction senior personnel shall ensure that all employees, attend an Environmental, Health and Safety Induction Course. This course shall be structured to ensure that attendees:

- Acquire a basic understanding of the key environmental features on the site and its immediate environs;
- Become familiar with the environmental controls contained in the CEMP;
- Are made aware of all protected areas and that the trapping, poisoning, and/ or shooting of animals is strictly forbidden. No domestic pets are allowed on site;
- Are informed that natural features (e.g. rock formations) are not defaced or marked for survey or other purposes unless agreed beforehand with the engineer. Furthermore, natural water sources (e.g. streams) are not allowed to be used for the purposes of swimming, personal washing, and the washing of machinery or clothes;
- Are made aware of the need to conserve water and minimise waste;
- Receive pertinent, written instructions regarding compliance with the relevant environmental management requirements (viz. typical environmental “do’s” and “don’ts”);

- Are made aware of any other environmental matters as deemed necessary by the Engineer/ ECO;
- Are made aware of the importance of preserving archaeological sites;
- Receive detailed training in site health and safety requirements, emergency responses and site evacuation procedures in terms of the NamWater construction team 's health and safety plan;
- Are made aware of NamWater's Code of Conduct;
- Are aware that a copy of the CEMP is readily available on site and that all site staff are aware of the location and have access to the document;
- Are aware of the requirements of any approved Method Statements that have bearing on their activities, and where necessary, any specialised training required to ensure compliance with the approved Method Statements has been provided; and
- Are informed that employee information posters, outlining the environmental "do's" and "don'ts" (as per the environmental awareness training course) will be placed at prominent locations throughout the site.

The Environmental, Health, and Safety Induction Course should be conducted by the ECO and NamWater construction team's Health and Safety officer, who shall provide the site staff with an appreciation of the project's environmental requirements, and how they are to be implemented. All new staff coming onto site after the commencement of construction activities must also attend the Environmental, Health and Safety Induction Course, and refresher courses should be undertaken on a quarterly basis.

The initial Environmental, Health, and Safety Induction Course shall be held within 14 days from the site mobilisation date, and subsequent courses shall be arranged for all new employees arriving after the initial training course, also within 14 days of their arrival.

NamWater shall provide a suitable venue with necessary facilities and ensure that all employees attend the environmental, health and safety induction course. The course shall be held in the morning during normal working hours. No more than 30 people shall attend each course and NamWater shall allow for sufficient sessions to train all personnel. NamWater shall provide proof of attendance by all of his employees in the form of a signed attendance register.

2.3.2 Toolbox talks

Environmental, health and safety issues specific to each area of the works, shall form part of the daily toolbox talks in each area. These can be short 10 – 15 minute discussions on the environmental sensitivities of the general area and/ or the specific sections that would be worked on, on that day. The foreman responsible will provide feedback to his staff on their day-to-day environmental performance and address issues requiring attention and specific actions required. A synopsis of the topics discussed at each area shall be recorded on a register and submitted to the ECO on regular (typically weekly) basis. Environmental matters shall be dealt with in toolbox talks on a regular basis (typically at least once a week).

2.3.3 Safety of the public

NamWater shall take all reasonable measures to ensure the safety of people in the surrounding area. Where the public could be exposed to danger by any of the Works or site activities, NamWater shall provide flagmen, barriers, and/ or warning signs in English, all to the approval of the Engineer/ ECO.

All unattended open excavations shall be adequately demarcated (fencing shall consist of orange mesh). Adequate protective measures must be implemented to prevent unauthorised access to the Working Area. No firearms shall be permitted on site.

NamWater shall implement appropriate measures to limit any adverse social impacts associated with the accommodation of a construction workforce on the local communities. The following mitigation and management measures are prescribed in this regard:

- Measures to combat HIV/ AIDS and other social ills:
 - NamWater should ensure the health of its employees and their dependants by adopting rigorous health programmes, which should, at a minimum, include programmes to combat HIV/ AIDS and tuberculosis (TB);
 - The NamWater should provide an adequate supply of free condoms to all workers;
 - Access at the construction site and camp should be controlled to prevent sex workers from either visiting and/ or loitering at or near these locations.

- Measures to prevent crime:
 - Construction workers shall be clearly identifiable by wearing proper construction uniforms displaying the logo of the construction company. Construction workers could also be issued with identification tags in order to gain access to the construction site;
 - All construction workers shall at all times wear the required Personal Protective Equipment (PPE); and
 - NamWater should establish clear rules and regulations for access to the construction site and offices to control loitering. Consultation should occur with the local Namibian police branch to establish standard operating procedures for the control and/ or removal of loiterers.

- Measures to reduce traffic related incidents:
 - Ensure that road junctions have good sightlines;
 - Transport the materials in the least amount of trips as possible, whilst being careful of overloading vehicles;
 - Limit speed both on and off the site;
 - Adhere to the speed limit; and
 - Implement traffic control measures where necessary.

2.3.4 Human resource and opportunities management

Job creation, inward migration of workers and accommodation of a workforce within a small community have the potential to result in significant social impacts. NamWater must approach human resource management in a careful, cooperative and considered fashion so as to enhance the positive impacts, whilst minimising negative impacts associated with construction projects.

Given the proximity of the proposed project to Swakopmund, Walvis Bay and the nearby Topnaar community, these communities should be given special consideration in terms of the benefits arising from the project. In order to enhance the benefits of employment creation for these communities, it is recommended that the following measures be implemented:

- NamWater shall establish a formal and organised recruitment process;
- NamWater shall be encouraged to employ local labour (i.e. from Walvis Bay, Swakopmund and the nearby Topnaar communities) where possible;
- NamWater shall be encouraged to recruit Namibian labourers;
- Recruiting by NamWater must be conducted through a central office and no on-site hiring should be allowed;
- NamWater shall inform job seekers that they are hired for a contract period only;
- NamWater shall be encouraged to source construction materials locally as far as possible; and
- NamWater shall be encouraged to make use of local sub-NamWater construction teams.

2.3.5 Working times

NamWater shall restrict construction activities to the hours of 06h30 - 18h00 during summer and 07h00 - 17h30 during winter on Mondays to Saturdays and no work will be permitted on Sundays or public holidays.

2.4 METHOD STATEMENTS

Any Method Statements required by the Engineer/ ECO or called for by the Project Specification shall be produced within such reasonable time as specified by the Engineer/ ECO or as stipulated in the Project Specification. Please refer to **Appendix C** for a generic example of a method statement. The NamWater construction team shall not commence the activity until the Method Statement has been approved, except in the case of emergency activities. NamWater shall allow the Engineer/ ECO a one week period for the review and approval of the Method Statement. Such approval shall not be unreasonably withheld.

The Engineer/ ECO may require changes to a Method Statement if the proposal does not comply with the Specification or if, in the reasonable opinion of the Engineer/ ECO, the proposal may result in, or carries a greater risk of, damage to the environment in excess of that which can be tolerated.

Approved Method Statements shall be readily available on the site and shall be communicated to all relevant personnel. The NamWater construction team shall carry out the works in accordance with the approved Method Statement. Approval of the Method Statement shall not absolve the NamWater construction team from any of their obligations or responsibilities in any other law except where this is specifically stated in the method statement.

Method Statements that shall be provided by the NamWater 14 days prior to the mobilisation on site include:

1. Mobilisation plan, covering:
 - a. The location and layout of all offices, storage containers, gates and fences, fuel storage areas and protection bunds, material lay-down areas, ablution facilities, carpentry areas, hazardous chemical storage facilities, wash bays, workshops and works service and maintenance areas, oil separators and grease traps, storm-water layout, first aid facilities, recess, training, eating and meeting areas, central waste storage areas, access/ haul roads and any other facilities associated with the NamWater construction team 's yard;
 - b. Security and access control to the site;
 - c. The design and location of all waste storage facilities, in particular the central waste storage area;
 - d. The central waste storage area shall include separate, weather proof, water-tight vessels/ skips for the disposal of hazardous waste and contaminated soil recovered during spills and for general waste respectively;
 - e. The system of collection and disposal of wastes, including the name and location of the point of final disposal, to an appropriate landfill site;
 - f. Initiatives for the control and recovery of litter on and around the Site and NamWater construction team 's yard;
 - g. Fuels and fuel spills: Methods of refuelling vehicles and details of methods for fuel spills and clean-up operations;
 - h. Sedimentation and Erosion Control: Sedimentation and erosion control of bulk earthworks and the management of sediment into rivers;
 - i. Stormwater management: Provisions to manage stormwater during the construction phase;
 - j. Method of undertaking blasting;
2. Operational and rehabilitation plan, covering:
 - a. Procedure for grubbing of the works and handling, stockpiling and disposal of the debris arising from the excavation operations;
 - b. Measures to be used to protect the topsoil stockpiles against contamination or erosion;
 - c. Measures used to protect cleared areas from erosion, windblown dust and suspended solid contaminated runoff;
 - d. Method to be used for backfilling, shaping, spacing and shape of erosion protection berms and the redistribution of stockpiled topsoil (care to be taken that topsoil is not over diluted with sub-soil); and
 - e. Control of alien invasive species. It is encouraged that concurrent rehabilitation practices are used where possible.

2.5 ENVIRONMENTAL CONSIDERATIONS PERTAINING TO SITE LAYOUT

2.5.1 Employee eating and recess areas

NamWater shall identify a suitable area, which is shaded and away from construction noise and dust, where employees can eat and take work recesses in relative comfort. The eating areas shall be provided with scavenger proof rubbish bins which are to be emptied into the central waste storage vessel/ skip daily. Potable water and other sanitary conveniences shall also be located within reasonable range of the designated eating area. NamWater shall prevent its employees from eating or recessing anywhere else but in the designated eating area.

2.5.2 Security Guards

Security guards that would look after construction equipment, materials and plant at night time shall not be allowed to leave the construction yard. They must be provided with an office to shield them from the weather. They shall be bound by the conditions contained in this EMP. Security guards must therefore be made aware of the conditions of the CEMP, especially with relation to no-go areas, fires on site (refer to chapter 2.5.16), health and safety and protection of fauna and flora (refer to section 2.6).

2.5.3 Ablution facilities

Temporary/ portable toilets shall be supplied by NamWater for the workers at a minimum ratio of 1 toilet per 15 workers and be within walking distance of the work area. The toilets shall be placed at appropriate locations to the approval of the Engineer/ ECO. The toilets shall be located along the pipeline route as construction takes place, but not closer than 50m to water resources (e.g. vegetated drainage lines). Toilets shall not be located in depressed areas where they may be subject to flooding. Toilets shall be kept in a good state of repair and shall be serviced at intervals sufficient to ensure that they are kept in clean and sanitary condition. NamWater shall ensure that no spillage occurs when the toilets are cleaned or emptied and that the contents are removed from site. Discharge of waste from toilets into the environment is prohibited. Each toilet shall be stocked with toilet paper at all times. All toilets shall be secured to the ground to ensure that they do not overturn during high winds or for any other reason.

Washing, whether of the person or of personal effects, and acts of excretion and urination are strictly prohibited, other than at the facilities provided.

2.5.4 Site division and site demarcation

The NamWater construction team shall restrict all their activities, materials, equipment and personnel to the designated Site (as must be indicated on the mobilisation plan – refer to section 2.4). “No-go” areas shall be demarcated using either danger tape or orange mesh. All areas outside of the demarcated site shall be deemed as “no-go” areas for all construction personnel and equipment.

The NamWater construction team shall ensure that the clearance of vegetation (if required) is restricted only to that required to facilitate the execution of the works. Non-conformances

related to over-clearance of vegetation shall be regarded as a serious offence and dealt with to the full extent of these specifications. A preventative approach to rehabilitation is emphasised, site clearance shall occur in a planned manner, over- or accidental clearance will be prevented.

The NamWater construction team shall peg the route for the proposed pipeline before commencing with any clearing operations. These demarcations shall be used by the clearing teams as a guide to control and prevent accidental over clearance of vegetation. No clearing of vegetation will commence until the alignment is finalised and commencement authorised by the ECO/ Engineer.

The Topnaar cemetery site at 23° 2'1.93"S; 14°34'12.72"E at Mile 7 (refer to **Error! Reference source not found.**) must be demarcated using high visibility barrier netting during the construction phase. Access to this site shall be prohibited.

2.5.5 Access, traffic and haul roads

The NamWater construction team shall be held responsible for the control of all project related traffic, including that of their suppliers, in ensuring that vehicles associated with the project remain on designated routes and within the designated working times. Construction traffic shall be controlled to ensure minimal disruption to normal road users. All existing access roads that may be affected during construction shall be kept open and in a good state of repair, where this is not possible, unobstructed and safe alternative access routes through the Works must be provided under the guidance of the ECO.

The following mitigation measures are further proposed to limit the impact of traffic in the area:

- Access roads shall be widened to the minimum width required and should not exceed 5m;
- New roads shall not be constructed if the quality of existing roads deteriorates. Existing roads shall be repaired and maintained for the duration of the construction phase and beyond;
- Road construction methods should ensure good road surfaces to prevent vehicles driving off road to find smoother surfaces with less corrugations or potholes;
- The area to be cleared for road construction shall be as small as possible;
- Road surface shall be regularly assessed and upgraded where appropriate;
- No off-road driving shall be allowed except within the pipeline construction corridor (i.e. 15m) as to not degrade adjacent areas;
- No operator will operate any equipment when he is under the influence of alcohol;
- Make sure all vehicles are roadworthy. Repair faulty brakes, exhausts etc. immediately (preferably offsite, if not offsite the ground surface must be protected by impermeable material and/ or drip trays);
- Ensure that road junctions have good sightlines;
- Transport the materials in the least amount of trips as possible;
- Limit speed both on and off the site;
- Adhere to the speed limit;
- Implement traffic control measures where necessary.
- Good driving and adherence to safety rules shall be adhered to at all times;

- Drivers must keep their headlights on when driving on gravel roads;
- Drivers must have the correct licence and training for the vehicles they are driving; and
- The following minimum standards for access roads should be followed:
 - Enter and exit roadways and construction areas should be demarcated at the entrances;
 - Erect signage to warn motorists about construction activities and heavy vehicle movement where appropriate;
 - Use 3-point turns and not U-turns and confine turning to the road; and
 - Prevent shortcuts between roads.

No new parking bay, haul or access road or passage of any sort shall be opened or be caused to be opened without the prior consent of the Engineer/ ECO. Establishing new borrow pits are strictly prohibited. Any contraventions of this clause shall result in penalisation.

2.5.6 Solid waste management

NamWater shall provide sufficient number of scavenger proof rubbish bins with secured lids. Rubbish bins shall always be placed in pairs, to ensure that one is always present while the other is being emptied. As a minimum, rubbish bins shall be located at every point of entry/ exit to the site, any building, work area, ablutions facility or recess area. Areas where rubbish is likely to be generated in higher quantities shall be equipped with additional rubbish bins according to the activities occurring there and the volume of waste being generated. Areas requiring additional rubbish bin will include for example:

- Training and meeting facilities;
- Workshops;
- Stores;
- Canteens and eating areas;
- Materials laydown areas;
- Any work areas where outfitting (electrical, plumbing, mechanical) of structures is occurring (as required);
- Any mobile teams carrying out work away from the main site infrastructure, for example pipe or electrical installation teams, road building and maintenance teams, etc., shall carry a rubbish bin with them at all time and return all waste collected to the central storage area at the end of a day's work; and
- Any other area where an accumulation of litter and rubbish is noted or as instructed by the ECO.

No waste materials, including domestic, organic or construction wastes shall be burnt, dumped or buried on the Site. Bins shall be emptied daily or as required. The waste may be stored temporarily on site in a central waste area that is weather and scavenger proof, as approved by the Engineer/ ECO. NamWater shall, at their own cost, make available the time and resources required in recovering any litter or other wastes that have accumulated or have been dispersed as a result of his activities on the Site. The ECO shall monitor this strictly and institute strict penalties in the event of non-compliances.

The central waste storage vessel/ skip shall be emptied weekly or as necessary. All solid waste shall be disposed of at the closest registered waste disposal site. A copy of the waste disposal certificates shall be submitted to the Engineer/ ECO for record purposes.

2.5.7 Fuel and oil

The NamWater construction team shall ensure that all liquid fuels are stored in tanks or mobile bowzers with lids that are kept firmly shut. The tanks or mobile bowzers must be in good working order (i.e. not leaking). NamWater shall ensure that there is adequate fire-fighting equipment at the fuel storage areas. The tanks or bowzers shall be situated on a smooth impermeable surface (concrete slab or 250 micron plastic sheeting covered with at least 50mm of sand) with an earth bund. The impermeable lining shall extend to the crest of the bund. The volume of the bunded area shall be 130% the volume of the combined tank volumes stored therein. Provision shall be made for refuelling at the fuel storage area, by protecting the soil with an impermeable surface (similar to that used for the storage area itself). The tanks and/ or bowzers shall be inspected daily for any leaks. If they are leaking, either the leaks must be fixed immediately or the bowser/ tanks must be replaced.

The NamWater construction team shall prevent unauthorised access to the fuel storage area. No smoking shall be permitted in the vicinity of the fuel storage area. NamWater shall ensure that there are adequate fire-fighting provisions located at the fuel storage area.

Should a mobile fuel bowser be used, all refuelling shall occur with appropriate measures in place to prevent spillages; these may include the use of drip trays, funnels, non-drip dispensing nozzles, and any other similar device. Regardless of the preventative measures in place, all mobile fuel bowzers shall carry a spill-kit that is adequately sized to contain at least a 200 litre spill, at all times.

2.5.8 Equipment maintenance and storage

All vehicles and equipment shall be kept in good working order and shall be operated by designated and competent operators. Leaking or damaged equipment shall be repaired immediately or removed from the Site. Where emergency, *in situ*, maintenance operations are required the NamWater construction team shall ensure that the soil or vegetation does not become contaminated. Drip trays shall be provided in construction areas for stationary and parked plant as well as for the emergency servicing of vehicles. Drip trays shall be inspected and emptied daily, or as required. The contents of the drip trays shall be disposed of at an appropriately authorised facility and proof thereof shall be submitted to the Engineer/ ECO.

The washing of equipment shall be restricted to urgent or preventative maintenance requirements only during which the use of detergents for washing shall be restricted to low phosphate and nitrate containing, low foaming type detergents. Washing of equipment will only be allowed in a wash bay, at the site camp, approved by the Engineer/ ECO.

The NamWater construction team shall ensure that oil and lubricant containers are stored in an area where the ground has been protected. The containers shall be inspected regularly to ensure that no leakage occurs. When oil/ lubricants are dispensed, the proper dispensing

equipment shall be used, and the storage container shall not be tipped in order to dispense the oil/ lubricant. The dispensing mechanism of the oil/ lubricant storage container shall be stored in a waterproof container when not in use. The construction team shall take all reasonable precautions to prevent accidental and incidental spillage during the use of oils.

In the event of oil/ lubricant or other hazardous spill, the source of the spillage shall be isolated, and the spillage contained. The NamWater construction team shall clean up the spill by removing the contaminated soil to the hazardous waste vessel/ skip and the application of absorbent material to the affected area. Treatment and remediation of the spill area shall be undertaken to the reasonable satisfaction of the Engineer/ ECO.

2.5.9 Stockpiling and stockpile areas

Plant (i.e. machinery) and materials shall be stored within the demarcated construction camp or batching areas. Where this is not feasible, the Engineer/ ECO will identify additional sites for stockpiling within the Working Area. Where possible, stockpiled materials shall be stored off the ground on scaffolding and care shall be taken to minimise disturbance to the vegetation and topsoil.

Soil, sand, and gravel stockpiles shall be convex in shape and shall be located so as to cause minimal disturbance. Stockpiles shall be so placed as to occupy the minimum width compatible with the natural angle of repose of the material, and measures shall be taken to prevent the material from being spread over too wide a surface. The NamWater construction team shall ensure that all stockpiles do not result in the damming of water or run off, or are themselves washed away. Stockpiles shall be placed to not obstruct or pollute any storm water or drainage paths.

2.5.10 Materials

a) Materials handling, use and storage

The NamWater construction team shall ensure that any delivery drivers are informed of all procedures and restrictions, including “no-go” areas and designated haul routes.

All material shall be stored within the designated Site boundaries and all material stockpiles shall be located no less than 20m from any water resource. The NamWater construction team shall ensure that all material lay-down areas, workshops and stores, including temporary lay-down areas within the Works, are kept in a neat and orderly fashion on a daily interval, and to the satisfaction of the Engineer/ ECO.

Materials shall be appropriately secured and covered to ensure safe passage between destinations. The NamWater construction team shall be responsible for any clean-up resulting from the failure by employees or suppliers to properly secure transported materials.

b) Hazardous substances

Hazardous chemical substances used during construction shall be stored in secondary containers. The relevant Material Safety Data Sheets (MSDS) shall be available on site.

Procedures detailed in the MSDSs shall be followed in the event of an emergency situation. Potentially hazardous substances shall be stored, handled and disposed of as prescribed by the Engineer/ ECO.

The NamWater construction team shall provide a separate weather-proof, impervious vessel/ skip at the central waste storage area for the temporary storage of hazardous, potentially hazardous and contaminated materials. Waste from this vessel/ skip shall be disposed of at a landfill site that is registered to receive such waste. A copy of the Certificate of Disposal issued by the landfill shall be submitted to the Engineer/ ECO after every deposit.

2.5.11 Cement and concrete batching

The batching of concrete shall take place on a smooth, impermeable surface (plastic) and shall be enclosed with a bund and sloped toward a sump to contain any spillages. Concrete batching shall take place at least 20m away from any water resource, e.g. vegetated drainage lines, to avoid contaminated water and/ or sediment entering the resource. All waste water resulting from batching of concrete shall be contained and disposed of appropriately and shall not be discharged into the environment unless treated to acceptable standard, as determined by the Engineer/ ECO. Where concrete trucks are used, the NamWater construction team shall ensure that dumping of the drum-wash does not occur directly onto the ground. If needed, facilities for the handling of the concrete contaminated wash-water shall be established to the satisfaction of the Engineer/ ECO. Any spillages of concrete or concrete-truck-drum-wash-water shall be cleaned-up immediately and disposed of through the solid waste disposal system.

The construction team shall take all reasonable measures to prevent the spillage of cement/ concrete during batching and construction operations. During pouring, the soil surface shall be protected using plastic and all visible remains of concrete shall be physically removed on completion of the pour and disposed of as part of the solid waste disposal system. Empty cement bags shall be collected continuously and stored in temporary weatherproof containers, where they are protected from dispersion by wind and shall be disposed of regularly via the solid waste disposal system.

2.5.12 Blasting

Blasting is to be executed by a suitably qualified person with all the relevant blasting certificates/ registrations. All relevant Namibian blasting regulations shall be strictly adhered to. Controlled blasting techniques shall be employed to minimise dust and fly rock (i.e. loose pieces of rock that could be propelled into the air) during blasting.

Prior to blasting the NamWater construction team shall notify officials of the Dorob National Park (DNP) and discuss the method, date, time and place where blasting would take place.

Blasting or drilling shall take place during normal working hours. The construction team shall notify emergency services, in writing, a minimum of 24 hours prior to any blasting activities commencing on Site. Adequate warning must be issued to all personnel on site prior to blasting activities taking place. All legally required signals are to be clearly indicated. The Engineer shall be issued daily updates of the days intended blasting activities.

The construction team shall prevent damage to Topnaar cemetery site (23° 2'1.93"S; 14°34'12.72"E) (refer to **Error! Reference source not found.**) at Mile 7. Fly rock shall be removed in the general area where blasting will take place.

2.5.13 Dust

The construction team shall take all reasonable measures to minimise the generation of dust as a result of construction activity, to the satisfaction of the Engineer/ ECO. Dust suppression measures shall be agreed upon in consultation with the Engineer/ ECO. Appropriate dust control measures include the following:

- Construction vehicles shall only use designated roads;
- Dust carrying materials shall be secured and properly covered on transportation vehicles before they leave the site; and
- During high wind conditions the construction team must make the decision to cease works until the wind has calmed down.

2.5.14 Noise

The NamWater construction team shall limit noise levels by implementing the following:

- Install and maintain silencers on machinery;
- Appropriate directional and intensity settings are to be maintained on all hooters and sirens;
- No amplified sound shall be allowed on Site other than in Emergency situations; and
- Drivers and operators are to be instructed to not use their hooters unless absolutely required (i.e. operators of machinery should not use hooters for the purposes of general communication, which is typically seen on construction sites).

2.5.15 Trenching (only where applicable)

Trenches where envisaged shall be demarcated appropriately, using orange mesh, and securely and regularly monitored during operations to ensure that pedestrian (and vehicular) access to these areas is strictly prohibited. Where appropriate, sign boards, alerting pedestrians and road users to the potential dangers presented by the construction activities, shall be erected. The construction team shall ensure that the time a trench is left exposed is kept to a minimum, and that open trenches are inspected on a daily basis for animals which may have fallen or become trapped. Animals found trapped shall be rescued and released into the wild. If poisonous animals/ reptiles such as snakes are found, the DNP and/ or a snake handler must be contacted to rescue the snake/ animal. A local snake handler must be identified before works start and his contact details shall be readily available.

2.5.16 Fire control

Fires are only permitted in designated areas and shall not be left unattended. These areas must first be discussed and approved by the DNP officials. If such areas are approved by the DNP officials, cooking places shall be located at a safe distance from fuel/ hazardous materials storage area and vehicle parking areas. All grass and bushes shall be removed around

fireplaces. Fire extinguishers shall be readily available in the construction camp. Any fires that occur outside of designated areas shall be reported to the Engineer/ ECO immediately. Employees shall be made aware that the collection and removal of firewood is prohibited, except where indicated by the Resident Engineer as clearing takes place. NamWater shall either provide firewood or to limit the use thereof; provide gas or fuel efficient stoves. Smoking shall not be permitted in those areas where there is a fire hazard. Burning of waste for disposal purposes is not permitted.

The NamWater construction team shall be responsible for ensuring that immediate and appropriate actions are taken in the event of a fire and shall ensure that employees are aware of the procedures to be followed. NamWater shall ensure that there is at least one fire extinguisher at the entrance to the site and at the recess area. A fire extinguisher shall be present whenever undertaking any form of hot work, i.e. welding, gas cutting, angle grinding, etc. All transport, earth moving equipment, and materials handling equipment on the Site shall be fitted with fire extinguishers. All fire extinguishers shall be serviced at the specified intervals and all other fire-fighting equipment shall be maintained in a good state of repair.

2.5.17 Emergency procedures

The NamWater construction team shall ensure that his employees are aware of the procedure to be followed for dealing with leaks and spills, which shall include notifying the Engineer/ ECO. The construction team shall ensure that the necessary materials and equipment for dealing with leaks and spills are available on site at all times. Treatment and remediation of spills shall be done to the satisfaction of the Engineer/ ECO.

In the event of a hydrocarbon spill, the source of the spillage shall be isolated, and the spillage contained. The affected areas shall be cordoned off and secured. The construction team shall ensure that there is always sufficient supply of absorbent material on Site to absorb/ breakdown or encapsulate at least a 200ℓ liquid hydrocarbon spill. Any soil contaminated by such a spill must be removed and disposed of at an appropriately registered waste site.

Emergency equipment including spill kits and fire extinguishers shall be positioned at accessible locations near to areas or facilities where such emergencies may arise.

2.5.18 Erosion, water quality, and storm water control

The NamWater construction team shall take all reasonable steps to prevent or remediate damage to the environment resulting from the Works in the form of erosion and sedimentation. The NamWater construction team shall immediately remedy any situation that is or has the potential to result in soil erosion, water pollution and sedimentation from the works as a result of storm water flows. A preventative approach must be adopted whereby the extent of clearance and disturbance is limited to those areas required to complete the Works (i.e. a working corridor of 15 m). If required, the NamWater construction team shall establish necessary storm water control mechanisms in agreement with the engineer, to effectively control the movement of water onto, through and off the construction site.

The NamWater construction team shall establish, in agreement with the Engineer/ ECO, a suitable mechanism, where necessary, for containment and treatment of contaminated water emanating from the Works or associated activities, i.e. settlement or sedimentation ponds/ oil separators. Should dewatering of the pipe trench be required, then a method statement detailing how this will be done shall be compiled and submitted for the Engineer/ ECO's approval, before commencement. Consideration for erosion at discharge points is to be effectively dealt with. A plan must be submitted and approved by the ECO/ Engineer. The Plan for the control of large volumes of water associated with pipe pressure testing must be undertaken in a manner that does not pose a risk of soil erosion on slopes.

2.5.19 Topsoil Management

Topsoil stockpiles shall be convex and should not exceed 2 m in height. The mounds shall be formed such that no ponding of water occurs on the surface of the stockpile. Topsoil stockpiles along the pipeline trench will always occur on the upslope side of the trench, all subsoil will be stockpiled on the down-slope side of the trench.

Topsoil must not in any way be rendered unsuitable for further use and precautions shall be taken to prevent unnecessary handling and compaction. In particular, topsoil shall not be subject to a compaction force greater than 1 500 kg/m² and shall not be pushed by a bulldozer for more than 50 m. Trucks and other heavy equipment may not be driven over the stockpiles.

Unless otherwise specified, topsoil shall be taken from not deeper than 300 mm from the surface.

In the event that only a Biological Soil Crust is found and no re-usable topsoil, the soil shall be stabilised by following the trimming and reshaping of the area by soaking it with water. This causes the mineral salts to rise to the surface and to solidify with the evaporation of the water, and so stabilising the soil surface against aeolian erosion and setting the scene for the reformation of a biological soil crust.

2.6 PROTECTION OF NATURAL FEATURES AND HERITAGE RESOURCES

2.6.1 Protection of freshwater ecosystems

The NamWater construction team shall ensure that the impact on the riparian zone of any river systems is kept to a minimum. Heavy construction vehicles shall be kept out of the seasonal and ephemeral stream channels and the movement of construction vehicles shall be limited where possible to the existing roads. Contaminated runoff from the construction site shall be prevented from entering the river as far as possible. Where pipelines cross streams, they shall do so in a manner that does not impede or divert the flow in the channels. Riparian areas disturbed shall be rehabilitated, by the removal of alien vegetation where found and the re-vegetation of these disturbed zones with suitable indigenous vegetation. Also refer to chapter 2.7 below for the removal of alien vegetation associated with pipe leakages.

The following mitigation measures are proposed for the protection of riparian areas:

- Heavy construction vehicles should be kept out of the seasonal and ephemeral stream channels and the movement of construction vehicles shall be limited where possible to the existing roads;
- Where pipelines cross streams, they shall do so in a manner that does not impede or divert the flow in the channels;
- Contaminated runoff from the construction site shall be prevented from entering the river as far as possible;
- Avoid development in and destruction of the drainage lines throughout the area;
- All materials on the construction site shall be properly stored;
- Disposal of waste from the sites should be properly managed as per the waste management system (refer to chapter 2.5.6); and
- Construction workers should be given ablution facilities at the construction sites that are located at least 50 m away from the river system, fastened to the ground and regularly serviced (refer to chapter 2.5.2).

2.6.2 Protection of natural systems

The NamWater construction team shall ensure that the disturbance of vegetation and faunal communities and their habitats is kept to a minimum. The following mitigation and management measures are prescribed in this regard:

- Limit development activities in the sensitive areas – i.e. vegetated ridge; artificial wetland area; a few well vegetated ephemeral drainage lines and the Kuiseb River;
- A track discipline limited to existing tracks with maximum speed limits (e.g. 30km/h) shall be implemented;
- Off road driving shall not be allowed in areas prone to scarring (e.g. gypsum/ gravel plains) and especially the lichen fields (refer to **Error! Reference source not found.**). Nocturnal driving should also be avoided as this result in the killing of slow moving fauna, e.g. various reptiles and other nocturnal species;
- Avoid nocturnal construction – i.e. excessive use of lights – and/or use focused lighting;
- Overnight activities shall be prevented as far as possible and must be discussed with the DNP officials;
- Implement a “no kill” policy of fauna (e.g. poaching for meat (snares); killing of snakes, etc.) throughout the area, especially during the construction phase;
- Implement a policy of no collecting of “veld foods”, pets (for illegal pet trade) and fire wood (as little as there is) on site as this often results in over exploitation of natural resources;
- A suitable and appropriate refuse removal policy during the construction phase shall be implemented as littering could result in certain animals becoming accustomed to humans and associated activity and result in typical problem animal scenarios, e.g. Black-backed Jackal and Pied Crows;
- Limit development to the actual pipeline route only and protect as much of the endemic (e.g. *Arthraerua leubnitziae*) and protected species (i.e. *Acacia erioloba*, *Acanthosicyos horridus*, *Faidherbia albida* and *Tamarix usneoides*) as well as any other important vegetation – e.g. *Salsola nollothensis*, hummocks serve as habitat to a variety of smaller species (reptiles, small mammals, arthropods, etc.) as well as food for ungulates and domestic stock (Topnaar livelihood);

- No domestic animals shall be allowed on site;
- Remove and relocate slow moving vertebrate fauna (e.g. chameleon, snakes, etc.) to suitable habitat elsewhere in the general area;
- Avoid introducing ornamental plants, especially potential invasive alien species, as part of the landscaping of the various pump stations, etc., but rather use localised indigenous species, should landscaping be attempted, which would also require less maintenance (e.g. water);
- Remove all invasive alien species along the route alignment – i.e. *Nicotiana glauca* and *Solanum nigra* – as it is already an ecological problem along various water courses throughout western Namibia. This would not only indicate environmental commitment, but actively contribute to a better landscape;
- Rehabilitate all disturbed areas – e.g. access route(s), borrow pit(s), construction site(s), accommodation site(s), etc. Store top soil and cover and rip lightly once construction is complete;
- Avoid introducing pets – i.e. cats & dogs – during the construction phase as these species often become feral (e.g. cats); breed with indigenous species (e.g. cats breeding with African wild cat – causing genetic pollution); kill innumerable indigenous fauna (e.g. cats & dogs); transmit diseases (e.g. cats & dogs – rabies/distemper, etc.), etc.;
- All sumps are to be inspected daily for any trapped animals. Sumps shall be covered every night;
- Educate/ inform the construction team on dangerous and protected species to avoid and the consequences of illegal collection of such species. Liaise with MET to provide this service as the area falls within the DNP;
- A botanist/ ecologist shall identify protected and unique species (high concentrations of lichens; endemic species e.g. *Arthraerua leubnitziae* and protected species e.g. *Tamarix usneoides* (Forestry Ordinance No. 37 of 1952) before the commencement of development activities in areas where these occur. These areas must be avoided;
- Planting of potentially alien invasive plant species (e.g. *Pennisetum setaceum*) for ornamental purposes as part of the landscaping at the various developments – e.g. pump station shall not be allowed. Alien species often “escape” and become invasive causing further ecological damage; and
- Implement a policy of “no tolerance” towards the existing invasive alien plant species (i.e. *Nicotiana glauca* and *Solanum nigrum*) in the area. This should include the removal and destruction of these species throughout the proposed development areas, especially associated with current leakages. Such activity would be beneficial to the overall ecology of the area (Cunningham, 2014).

Additional Ecological Southern 39 km Pipeline Recommendations:

- Bury the pipeline at recommended “hotspot” sections along the route as indicated in the above tables;
- Bury the pipeline between the Rooibank turnoff and Collector 2 Reservoir as an aboveground structure will act as a barrier for wildlife (and Topnaar domestic stock) between the Kuiseb River and inland areas.
- These buried sections could then also serve as wildlife crossing points. Buried sections are better as crossing points than covered (i.e. raised) crossing points (See Cunningham 2011c, 2014 and Cunningham *et al.* 2015);

- Aboveground sections of the pipeline should not exceed 60cm in height. This is the height that most ungulates can still cross – i.e. not an effective barrier (See Cunningham 2011c, 2014 and Cunningham *et al.* 2015).

2.6.3 Protection of archaeological sites

The NamWater construction team shall ensure that the Topnaar cemetery site is declared a no-go area. The following shall be implemented to ensure the site is adequately protected:

- Demarcation of the Topnaar cemetery site (23° 2'1.93"S; 14°34'12.72"E) (refer to **Error! Reference source not found.**) at Mile 7 using high visibility barrier netting during the construction phase (this must be done to the satisfaction of the ECO) (also refer to chapter 2.5.4);
- The possibility of erecting a permanent boundary fence around the cemetery should be discussed with the Topnaar community; and
- A “chance finds” procedure shall be adopted (included as Appendix A).

All earthworks equipment operators shall be informed to cease operating immediately if any artefact is unearthed and to report the finding immediately to the Engineer/ ECO and NamWater, who in turn shall notify the National Heritage Council. The NamWater construction team shall take reasonable measures to protect any such find against further damage until its value can be properly assessed. In the event of such finds, the project management or NamWater construction team s should adopt the “chance finds” procedure set out in **Appendix A**. Work in the immediate vicinity of such a find shall also be discontinued until the Engineer/ ECO, and the National Heritage Council issues a clearance to recommence.

In addition the following Archaeological recommendations must be added for the Southern 39 km Section:

It is important that the client is made aware of the archaeological sensitivity of the historical Ururas border post site as well. It is recommended that mitigation work at this site should include detailed surface mapping of all features and a systematic surface collection of material to be deposited at the National Museum of Namibia. Mitigation work on the site will require a permit issued by the National Heritage Council.

NamWater should make sure that all personnel are aware of the protected nature of archaeological sites as well as the legal obligation to report any finds to the National Heritage Council as soon as possible. It is further recommended that the client adopt the archaeological “chance finds” procedure attached to this report as Appendix 2 of the Archaeological Report found in **Annexure B1**.

In the event that burials or other remains are located in the course of construction NamWater construction team should adhere to the procedure as set out.

2.7 REHABILITATION

The construction team shall, on completion of the project, ensure that all materials, temporary structures, temporary fences, plant, equipment and waste are completely removed from the Site. The area shall be inspected by the ECO for any form of damage, e.g. oil spills. If such

areas are identified the construction team shall be instructed to clean the area and rehabilitate to the satisfaction of the ECO.

Rehabilitation operations and re-vegetation of all disturbed areas shall commence as soon as possible and even run concurrently with construction activities where appropriate and practical.

For the purposes of this CEMP, the landscaping and rehabilitation of disturbed areas shall entail the clearing, shaping, trimming, and scarification of the area, replacement of stockpiled topsoil where relevant, topped by randomly distributed stone and gravel surface.

a) **Timing of landscaping and rehabilitation**

NamWater shall set a programme for the landscaping and rehabilitation of disturbed areas to occur as soon as practically possible following the cessation of the work in a specific area. In this regard, the programme shall clearly indicate how rehabilitation will be executed per phase, upon the completion of the works within a specific area. Once an area has undergone rehabilitation it shall be deemed a “no-go” area and protected accordingly against further or repetitive disturbance. The aforementioned needs to be accounted for in the work programme.

b) **Shaping and trimming**

All slopes which do not form part of the Permanent Works shall be graded so that no slope exceeds a maximum gradient of 1:3 or as otherwise directed by the Engineer. Contour drains may be provided to control erosion where required by the Engineer. Excavation and fills shall be formed in such a manner that the final profile shall appear as a natural extension to the adjacent, undisturbed ground profiles. Trimming shall consist of bringing the existing or previously shaped ground to a smoothly flowing surface with the final levels generally following the original surface and tying in with adjacent undisturbed areas as directed by the Engineer/ ECO.

c) **Replacement of soil, stone and gravel**

Replacement of soil, stone and gravel removed during site clearance shall be replaced in a random pattern or similar to that seen in adjacent, undisturbed areas, subject to the approval of the Engineer/ ECO. All excess overburden stones/ rocks shall be removed offsite. These rocks shall not be allowed to be stockpiled along the alignment. NamWater shall discuss the possibility of depositing these excess overburden rocks at one of the nearby quarries with the owners, if not possible the waste will be dumped at an appropriate waste dump site.

d) **Alien vegetation**

Alien vegetation on site, especially associated with leakages, shall be removed and destroyed. This must be done in consultation with an Ecologist to ensure that only alien vegetation are removed and destroyed in the correct manner. *Nicotiana glauca* (refer to Figure 3) and *Solanum nigrum* (refer to Figure 4), the first mentioned which is already becoming an ecological problem along various watercourses throughout western Namibia, are two alien species that should be removed.



Figure 3: *Nicotiana glauca* associated with leakage along the aboveground section of the pipeline between the C14 gravel road and the Devils Fork junction¹.



Figure 4: *Solanum nigrum* associated with leakage at the Devils Fork junction².

2.8 COMPLIANCE AND PENALTIES

2.8.1 Compliance

Environmental management is concerned not only with the final results of the NamWater construction team’s operations to carry out the Works but also with the control of how those operations are carried out. Tolerance with respect to environmental matters applies not only to the finished product but also to the standard of the day-to-day operations required to complete the works.

It is thus required that the NamWater construction team shall comply with the environmental requirements on an on-going basis and any failure on his part to do so will entitle the Engineer/ ECO to certify the imposition of a penalty, as detailed below, if such non-compliance is not corrected within a period of one week of notification thereof.

2.8.2 Penalties

Penalties will be issued for certain transgressions. Penalties may be issued per incident at the discretion of the Engineer/ ECO. Such penalties will be issued in addition to any remedial cost incurred as a result of the non-compliance with this Specification.

Penalties for the activities detailed below, will be imposed by the Engineer/ ECO on the NamWater construction team and/ or his Sub-contractors construction team s.

- | | |
|--|-----------|
| a) Any employees, vehicles, or things related to the NamWater construction team’s or Sub-contractors operations operating outside the designated boundaries or a “no-go” area. | N\$ 5,000 |
| b) Persistent and un-repaired oil leaks from machinery. | N\$ 2,000 |
| c) Persistent failure to monitor and empty drip trays timeously. | N\$ 2,000 |
| d) The use of inappropriate methods for refuelling, resulting in spillages. | N\$ 2,000 |

¹ Source: Cunningham (2014)

² Source: Cunningham (2014)

e)	Litter on site associated with construction activities.	N\$ 2,000
f)	Deliberate lighting of illegal fires on site.	N\$ 2,000
g)	Any employee eating meals on site, outside of the defined eating area.	N\$ 2,000
h)	Employees not making use of the site ablution facilities.	N\$ 2,000
j)	Failure to empty waste bins on a regular basis.	N\$ 200
k)	Unauthorised removal of vegetation.	N\$ 500
l)	Hunting, trapping and collection of animals (per unit taken).	N\$ 15,000
m)	Failure to implement specified noise controls.	N\$ 2,000
n)	A spillage, pollution, fire or any damage to the environment resulting from negligence on the part of the NamWater construction team.	N\$ 5,000
o)	Damage to vegetation or ground arising from equipment leaving designated haul or access routes.	N\$ 5,000
p)	Failure to submit and, or proceeding with work without having or deviating from an approved method statement, for those task requiring a method statements in terms of the EMP.	N\$ 5,000

For each subsequent similar offence the penalty shall be doubled in value to a maximum value of N\$ 20,000. The Engineer/ ECO shall be the judge as to what constitutes a transgression in terms of this clause.

2.9 MEASUREMENT AND PAYMENT (PERTAINS TO CONTRACTORS)

2.9.1 Scheduled items

All requirements of the environmental management specification

All work not measured elsewhere, associated with complying with any requirement of the environmental management Specification shall be as a measured sum. The tendered rate shall cover any cost associated with complying with the environmental management specification and shall include for all materials, labour and plant required to execute and complete the work as specified, described in the Schedule of Quantities or shown on the drawing(s).

Method statements: Additional work

No separate measurement or payment will be made for the provision of Method Statements but, where the Engineer/ ECO requires a change on the basis of his opinion that the proposal may result in, or carries a greater than warranted risk of damage to the work required, provided it could not reasonably have been foreseen by an experienced contractor .

Work “required by the project specification”

Where a clause in this Specification includes a requirement as “required by the Project Specification”, measurement and payment for compliance with that requirement shall be in accordance with the relevant measurement and payment clause of the Project Specification

2.10 SUMMARY OF CONSTRUCTION PHASE MANAGEMENT ACTIONS

Table 5: Construction Phase Management

Aspect	Management Objective	Management actions	Responsibility
Responsible management	To ensure that construction activities are carried out so as to cause the least possible disturbance to the existing amenities, whether natural or man-made.	<ul style="list-style-type: none"> NamWater shall take adequate steps to educate all members of its workforce as well as his supervisory staff on the relevant environmental laws and protection requirements. A suitably qualified independent ECO shall be appointed by the NamWater construction team. The NamWater construction team shall construct and/or implement all the necessary environmental protection measures in each area before any construction work may proceed. 	NamWater Construction Manager
Sensitivity areas	Implement special care as indicated in the sensitivity maps provided by the Ecologist.	Special care should be taken in the medium to high sensitivity areas as indicated in Figure 5 and Table 1.	NamWater Construction Manager
Environmental awareness	To ensure that all employees and Sub-NamWater construction team s are informed of their environmental obligations.	The Environmental, Health, and Safety Induction Course should be conducted by the ECO and NamWater construction team's Health and Safety officer.	ECO
		The foreman responsible will provide feedback to his staff on their day-to-day environmental performance and address issues requiring attention and specific actions required.	NamWater Construction Manager
Safety to the public	To reduce the risks posed by the project to the public.	<ul style="list-style-type: none"> Where the public could be exposed to danger by any of the Works or site activities, the construction team shall provide flagmen, barriers, and/or warning signs in English. No firearms shall be permitted on site without the prior approval of the Project Manager. <p>NamWater shall implement appropriate measures to limit any adverse social impacts associated with the establishment of a construction camp and/or the accommodation of a construction workforce on the local communities.</p>	NamWater Construction Manager
Human resource and opportunities management	To ensure that job creation, inward migration of workers and accommodation of a workforce within a small community does not result in significant social impacts.	In order to enhance the benefits of employment creation for these communities, it is recommended that the NamWater construction team shall establish a formal and organised recruitment process in line with this EMP.	NamWater Construction Manager
	Construction activities shall be restricted to specified hours in order to limit disturbance to the public.	NamWater shall restrict construction activities to the hours of 6h30 - 17h00 during summer and 07h00 - 17h00 during winter on Mondays to Saturdays and no work will be permitted on Sundays or public holidays.	NamWater Construction Manager
Dust	To limit dust levels.	Appropriate dust control measures must be implemented.	NamWater Construction Manager

Aspect	Management Objective	Management actions	Responsibility
Noise	To limit noise levels.	Appropriate measures shall be implemented to limit noise levels.	NamWater Construction Manager
Method statements	To ensure effective and formal communication between the Project Management Team and the NamWater construction team on construction issues throughout all stages of the project	System regarding method statement compilation, submission, review and approval to be rigorously implemented.	NamWater Construction Manager/ ECO
		Method Statements that shall be provided by the NamWater construction team 14 days prior to the mobilisation on site include: <ul style="list-style-type: none"> • Mobilisation plan; and • Operational and rehabilitation plan. 	NamWater Construction Manager/ ECO
Environmental considerations pertaining to site layout	Suitable area identified where employees can eat and take work recess.	<ul style="list-style-type: none"> • The NamWater construction team shall identify a suitable area, which is shaded and away from construction noise and dust, where employees can eat and take work recesses in relative comfort. • The eating areas shall be provided with scavenger proof rubbish bins, potable water and other sanitary conveniences. 	NamWater Construction Manager
Ablution facilities	Temporary toilets shall be provided by the NamWater.	<ul style="list-style-type: none"> • Temporary / portable toilets shall be supplied by the NamWater construction team for the workers at a maximum ratio of 1 toilet per 15 workers and be within walking distance of the work area. • The toilets shall be placed at appropriate locations to the approval of the Engineer / ECO. • Toilets shall be kept in a good state of repair and shall be serviced at intervals sufficient to ensure that they are kept in clean and sanitary condition. 	NamWater Construction Manager
Site demarcation	The NamWater construction team shall restrict all their activities, materials, equipment and personnel to the designated Site.	<ul style="list-style-type: none"> • The construction team shall ensure that the clearance of vegetation is restricted only to that required to facilitate the execution of the works. • The NamWater construction team shall peg the route for the proposed pipeline before commencing with any clearing operations. 	NamWater Construction Manager
Access, traffic and haul roads	Construction traffic shall be controlled to ensure minimal disruption to normal road users.	The construction team shall be held responsible for the control of all project related traffic, including that of his suppliers, in ensuring that vehicles associated with the project remain on designated routes and within the designated working times.	NamWater Construction Manager
Solid waste management	To ensure that there is no illegal disposal of waste.	<ul style="list-style-type: none"> • The NamWater construction team shall provide sufficient number of rubbish bins with secured lids. • No waste materials, including domestic, organic or construction wastes shall be burnt, dumped or buried on the Site. 	NamWater Construction Manager
Fuel and oil	To ensure that all liquid fuels are stored appropriately and adequate fire-fighting equipment is stored on site.	<ul style="list-style-type: none"> • The NamWater construction team shall ensure that all liquid fuels are stored in tanks or mobile bowsers with lids that are kept firmly shut. • All tanks and/or mobile bowsers shall be situated in a bunded area. 	NamWater Construction Manager

Aspect	Management Objective	Management actions	Responsibility
		<ul style="list-style-type: none"> NamWater shall ensure that there is adequate fire-fighting equipment at the fuel storage areas. 	
Equipment maintenance and storage	All vehicles and equipment are kept in good working order.	<ul style="list-style-type: none"> Leaking or damaged equipment shall be repaired immediately or removed from the Site. Drip trays shall be provided in construction areas for stationary and parked plant as well as for the emergency servicing of vehicles. 	NamWater Construction Manager
Stockpiling and stockpile areas	All plant and materials shall be stored in designated areas to minimise the disturbance to vegetation and topsoil.	Plant and materials shall be stored within the demarcated construction camp or batching areas.	NamWater Construction Manager
Materials handling, use and storage	All delivery drivers are informed of the on-site procedures and restrictions.	<ul style="list-style-type: none"> NamWater shall ensure that any delivery drivers are informed of all procedures and restrictions, including “no-go” areas and designated haul routes. All material shall be stored within the designated Site boundaries. 	NamWater Construction Manager
Hazardous substances	Any hazardous substances are stored appropriately.	<ul style="list-style-type: none"> Hazardous chemical substances used during construction shall be stored in secondary containers. The relevant Material Safety Data Sheets (MSDS) shall be available on site. 	NamWater Construction Manager
Cement and concrete batching	Cement and concrete batching takes place in designated areas.	<ul style="list-style-type: none"> The batching of concrete shall take place on a smooth, impermeable surface (plastic) and shall be enclosed with a bund and sloped toward a sump to contain any spillages. The NamWater construction team shall take all reasonable measures to prevent the spillage of cement / concrete during batching and construction operations. 	NamWater Construction Manager
Blasting	Blasting is to be executed by a suitably qualified person with all the relevant blasting certificates/registrations and all relevant Namibian blasting regulations shall be strictly adhered to.	<ul style="list-style-type: none"> Controlled blasting techniques shall be employed to minimise dust and fly rock (i.e. loose pieces of rock that could be propelled into the air) during blasting. Prior to blasting NamWater shall notify officials of the Dorob National Park (DNP) and emergency services, in writing, a minimum of 24 hours prior to any blasting activities to discuss the method, date, time and place where blasting would take place. The construction team shall prevent damage to Topnaar cemetery site (23° 2'1.93"S; 14°34'12.72"E) (refer to Error! Reference source not found.) at Mile 7. Fly rock shall be removed in the general area where blasting will take place. 	NamWater Construction Manager
Trenching	Trenches are appropriately demarcated and secured.	Trenches shall be demarcated appropriately and securely and regularly monitored to ensure that pedestrian (and vehicular) access to these areas is strictly prohibited.	NamWater Construction Manager
Fire control	To reduce the risk of fires	<ul style="list-style-type: none"> Fires are only permitted in designated area and shall not be left unattended. Fire extinguishers shall be readily available. 	NamWater Construction Manager
Emergency	All employees are aware of emergency	<ul style="list-style-type: none"> NamWater shall ensure that employees are aware of the procedure to be followed for dealing with leaks and 	NamWater

Aspect	Management Objective	Management actions	Responsibility
procedures	procedures.	<p>spills.</p> <ul style="list-style-type: none"> NamWater construction team shall ensure that the necessary materials and equipment for dealing with leaks and spills are available on Site at all times. 	Construction Manager
Erosion, water quality, and stormwater management	To prevent or remediate damage to the environment resulting from the Works in the form of erosion and sedimentation shall be taken.	<ul style="list-style-type: none"> The construction team shall take all reasonable steps to prevent or remediate damage to the environment resulting from the Works in the form of erosion and sedimentation. The construction team shall immediately remedy any situation that is or has the potential to result in soil erosion, water pollution and sedimentation from the works as a result of storm water flows. Storm water should be managed appropriately at the culvert crossing where the pipeline are planned to go through underneath the road, so that blockage does not occur. 	NamWater Construction Manager
Protection of natural systems and archaeological sites.	The Topnaar cemetery site (23° 2'1.93"S; 14°34'12.72"E) is declared a 'no-go area' and all impacts to natural systems are kept to a minimum.	<ul style="list-style-type: none"> Demarcation of the Topnaar cemetery site (23° 2'1.93"S; 14°34'12.72"E) (refer to Error! Reference source not found.) at Mile 7 using high visibility barrier netting during the construction phase (this must be done to the satisfaction of the ECO) Disturbance of vegetation and faunal communities and their habitats is kept to a minimum. Heavy construction vehicles should be kept out of the seasonal and ephemeral stream channels and the movement of construction vehicles should be limited where possible to the existing roads. All earthworks equipment operators shall be informed to cease operating immediately if any artefact is unearthed and to report the finding immediately to the Engineer / ECO and NamWater, who in turn shall notify the National Heritage Council. 	NamWater Construction Manager
	The Ururas boundary post National Monument	<ul style="list-style-type: none"> It is recommended that mitigation work at this site should include detailed surface mapping of all features and a systematic surface collection of material to be deposited at the National Museum of Namibia. Mitigation work on the site will require a permit issued by the National Heritage Council. 	NamWater Construction Manager
Rehabilitation	On completion of the Contract all materials, temporary structures, temporary fences, plant, equipment and waste are completely removed from the Site.	<ul style="list-style-type: none"> Rehabilitation operations and re-vegetation of all disturbed areas shall commence as soon as possible and even run concurrently where appropriate. 	NamWater Construction Manager
Penalties	To ensure that environmental requirements are strictly adhered to.	Penalties will be issues for certain specified transgressions.	NamWater Construction Manager

3 OPERATIONAL PHASE

3.1 INTRODUCTION

The Operational Phase Section of the Environmental Management Programme relates to the management and mitigation measures required to ensure that the proposed bulk water supply network is operated in a manner that demonstrates responsible, precautionary environmental management.

The Operational EMP (OEMP) will address specific areas of concern in terms of the long-term environmental management of the affected environment and is intended to serve as a guide to the on-going management of the water supply scheme site as well as the affected environment. The OEMP will therefore aim to provide NamWater with the necessary tools to ensure that the potential impacts on the natural environment of the site during the operation of the water supply scheme are minimised. Moreover, it will aim to ensure that the infrastructure is operated and maintained in an environmentally sensitive and sustainable manner, and that the operation of the infrastructure does not result in reasonably avoidable environmental impacts.

The information is summarised in tabular format illustrating the activity, aspect, impact, mitigation measure, performance indicators, resources, schedule and verification. These criteria are listed and explained below:

The following components are identified/ described:

- **Activity:** component/ activity of the project for which the impact has been identified;
- **Aspect:** the aspect of the above activity which will be impacted;
- **Impact:** the environmental impact identified and to be mitigated;
- **Mitigation measure:** measures identified for implementation in terms of environmental management to reduce, rectify or contain the identified environmental impact – mitigation is divided into the following:
 - **Objective:** desired outcome of mitigation measure,
 - **Mechanism:** method of achieving the objective;
- **Performance indicators:** outcomes that will indicate achievement of objective/s;
- **Responsibility:** party or parties identified for implementation of mitigation measure/s;
- **Resources:** available resources to aid implementation of mitigation;
- **Schedule:** timeframe in which identified impact and mitigation measure is anticipated to occur; and
- **Verification:** party or parties identified as responsible for review and assessment of final outcome.

Issue	Objective	Strategy	Actions	Time frame
Maintenance and emergency procedures	To ensure correct procedures are in place to avoid environmental impacts associated with maintenance activities as well as proactive intervention to avoid, and if required, to respond to emergencies	<ul style="list-style-type: none"> Establish environmentally sensitive and technically sound maintenance procedures as well as reporting structures. Compile a staff competency assessment and training programme. Establish emergency procedures to ensure appropriate response and minimise potential risk to the biophysical and social environment. 	<ol style="list-style-type: none"> Develop an Operation and Maintenance (O&M) manual of procedures with technical guidelines (chapter 3.2). Establish regular reporting procedures on maintenance (chapter 3.2). Undertake regular inspection and maintenance of all infrastructure to ensure they are in working order and to assess damaged/ deficient equipment, as per the O&M Manual. Review, and if necessary, revise maintenance manual. Establish emergency procedures guidelines for pipe and pump station blockage/ failure, flooding, contaminant removal and disinfection, power failure and fire. Implement the response procedures when emergency incident occurs. Complete the incident report checklist in the case of emergency and keep with monitoring records for submission. Undertake annual education course for all operational staff. Review, and if necessary revise emergency manual. 	<p>Within the first year of operation. Within the first year of operation. Once a month for lifespan of infrastructure as per the O&M manual. Bi-annually for lifespan of works. When emergency incident occurs.</p> <p>Emergency incident</p> <p>Annually for lifespan of operation. Annually for lifespan of operation Annually for lifespan of operation</p>
Road mortalities of fauna	To implement measures to avoid high occurrences of fauna road mortalities due to maintenance activities.	<ul style="list-style-type: none"> Establish access/ maintenance road rules for operational staff. 	<ol style="list-style-type: none"> The use of lights shall be limited during nocturnal activities such as emergency repairs. No off-road driving during inspections and/ or maintenance activities shall be allowed. Maintenance and/ or repair work shall be limited to the development corridor. 	<p>For the lifespan of the project.</p> <p>For the lifespan of the project.</p> <p>For the lifespan of the project.</p>
Alien vegetation associated with leakages	To implement measures to manage alien vegetation at leakages along the existing Schwarzekuppe-Swakopmund pipeline and new Mile 7 pipeline.	<ul style="list-style-type: none"> Establish an Alien vegetation management plan. 	<ol style="list-style-type: none"> Implement an alien vegetation management plan. Inspect the pipeline alignment for leakages and alien vegetation. Alien vegetation to be dealt with according to the alien vegetation management plan. 	<p>For the lifespan of the project. For the lifespan of the project.</p> <p>For the lifespan of the project.</p>

3.2 MAINTENANCE PROCEDURES

The optimal operation and effective maintenance of the pipeline and pump station are important in protecting the environment and ensuring that resources are not wasted and environmental incidents arising out of equipment or infrastructure failures, are avoided. A detailed O&M Manual will be compiled for the new Mile 7 pipeline and for the Schwarzekuppe-Swakopmund pipeline by a qualified person. The O&M Manual will be implemented once the operational phase of the new pipeline(s) commences. The manual will provide detailed guidance on the operation of all machinery and associated systems as well as related maintenance procedures, including maintenance schedules. Implementation of this manual by NamWater will facilitate the proactive management of potential risks and thus result in impacts on the receiving environment being averted. Accordingly, the O&M Manual shall be regarded as an integral component of the OEMP.

The O&M Manual will include, but not be limited to, the following sections:

- Works Safety including personnel safety and equipment safety;
- Equipment summary;
- Works description;
- Disposal of waste (e.g. sections of replaced pipe);
- Works operation, including:
 - Commissioning start up (Pre-startup checks), and
 - Normal operation (Operation and daily operation checks).
- Maintenance schedules, including
 - General care and maintenance,
 - Maintenance log,
 - Daily operating checks,
 - Monthly Maintenance Procedures, and
 - Annual Maintenance Procedures.

The maintenance procedures set out in the O&M Manual, will provide specific guidance in terms of the monitoring and maintenance of the key mechanical and electrical equipment. These procedures will specify the equipment item and specific component of each piece of equipment requiring checking, the scope and nature of the check that is to be carried out including detailed instructions related to the specific check, and the programme for conducting each check. Completed schedules will be kept on site to provide a complete compliance record.

3.3 FACILITY MANAGEMENT AND OPERATIONS

NamWater shall ensure that sufficient budget allocations and provisions are made available to ensure that the infrastructure can be adequately operated and maintained. NamWater must also attend to pipe damage resulting in water loss, and the subsequent creation of habitats for alien vegetation, as a matter of high priority.

3.4 ROUTINE MAINTENANCE AND REPAIRS

The condition of the infrastructure shall be inspected routinely and a maintenance list compiled. Identified, preventative maintenance issues shall be undertaken as soon as possible. Any wastes arising from the repair and maintenance work must be removed from site as part of the operation and disposed of at a registered waste site certified to take the particular waste.

3.5 ENVIRONMENTAL AWARENESS

Instilling a sense of environmental awareness and consideration in all employees, but especially those involved with the project is vital to the overall success of any environmental management plan. It is therefore recommended that a general environmental awareness course for all new operational staff and employees of maintenance NamWater construction teams, who may be required to carry out duties on the project, be undertaken on their appointment. It is recommended that the regional council create a “green rules” pamphlet for dissemination to all workers and NamWater construction teams working on all council projects and sites.

3.6 WASTE AND POLLUTION MANAGEMENT

3.6.1 Hazardous materials

Where hazardous materials are required for repair and maintenance work (including fuels and oils), care shall be taken to ensure that a competent individual is appointed to enforce the responsible use of such materials. The operational staff or maintenance teams shall carry a copy of the relevant MSDS whenever using such materials. NamWater shall ensure that persons working with hazardous materials have been trained in the handling of such substances, as well as in emergency procedures to be followed in the event of an accidental spillage or medical emergency. Maintenance teams shall also carry a spill kit containing the appropriate neutralizing chemicals, absorbent materials and other relevant equipment required to undertake a clean-up of any spill that may occur.

3.6.2 Noise management

During maintenance operations, all silencing mechanisms on all equipment must be in a good state of repair. Except for in emergency situations, no amplified sound may be broadcast. All routine maintenance shall be restricted to daylight hours.

4 DECOMMISSIONING PHASE

Given the nature and purpose of the infrastructure, it is unlikely that this infrastructure will be decommissioned in the foreseeable future. In the unlikely event that use of the infrastructure is discontinued by NamWater, the infrastructure would be auctioned. Removal of the infrastructure is likely to cause more environmental harm than its abandonment. It is strongly advised that adequate alternative water supplies are in place before the decommissioning of the pipeline is considered. If, for whatever reason, the pipelines need to be removed, the materials would either be disposed of at a registered landfill site or it would be recycled depending on the type of material. The best option at the time would be investigated.

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5 CONCLUSION

In conclusion, it should be noted that this LEMP should be regarded as a living document and changes should be made to the LEMP as required by project evolution while retaining the underlying principles and objectives on which the document is based.

The compilation of the LEMP has incorporated impacts and mitigation measures from the Scoping Report, as well as incorporating principles of best practice in terms of environmental management.

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**APPENDIX A:
Archaeological Procedures**

Archaeological “no go” area procedure

A “no go” area is closed to walking, driving, cutting access tracks or ground disturbance of any kind. Project managers should also ensure that an identified “no go” area is not accessed by team members during off-duty hours. A “no go” area may be accessed for purposes of heritage audit, inspection by the National Heritage Council, or legitimate research.

Scope:

In the sense employed here, a “no go” denotes a specific management status, with specific management consequences, of a heritage site that has been identified and sufficiently investigated to establish its particular importance. The process of identification and evaluation is carried out by a trained archaeologist or other appropriately qualified person.

Intent:

The “no go” site management procedure is intended to ensure compliance with the relevant provisions of the National Heritage Act (27 of 2004), especially Section 58 (1)(b) site management plans; (2)(c) and (3) “...enclosure of the site,...as need to be kept secure” (h) “...considers necessary or expedient for the conservation and management of the site”.

Responsibilities:

Foreman	To adequately supervise movement of personnel and/or NamWater construction teams
Superintendent	To adequately supervise movement of personnel and/or NamWater construction teams
Management	To endorse special status of “no go” areas within the study area
Archaeologist	To identify, evaluate and document potential “no go” sites; to advise management, to formulate a site management plan prior to the commencement of construction, and to perform site inspections or audits of designated “no go” sites.

Procedure:

A management plan for the “no go” site will be based on this documentation, which serves as a site “condition assessment” baseline. Site management plans are to include detailed assessment of the site sensitivity to both natural (i.e. weathering and erosion) and man-made threats (i.e. uncontrolled access). The site management plan must comply with National Heritage Act, Section 58 (1)(b).

The site management plan will indicate the specific protection measures to be applied, from access controls, to soil erosion control measures, to signage, to permissions procedures, to site inspection and audit procedures, all specific to the site concerned.

The management plan will indicate the procedure for gaining access to the site and identify the responsible level of management to grant access.

The boundary of a “no go” site will be identified by GPS position by the archaeologist and a plan will be generated. The boundaries of a “no go” site will include buffer zone appropriate to the circumstances, but sufficient to preserve the local setting of the site.

The boundary of a “no go” site will be marked by painted fence-posts placed at inter-visible points, set in concrete footings, and protruding 1.2m from the ground. “No go” sites are then to be danger taped in order to provide adequate visual awareness of the areas.

Appropriate signage (see below) will be placed at obvious points of access. Signage will be visible regardless of direction of approach to the site.

A site specific audit of the “no go” site will be carried out annually, or at shorter intervals if specified by the site management plan.

Site audit records are to be maintained with minimum entries of: Date of audit; names of participants; site integrity including details of any changes and causes; recommendations for changes to the site management plan; incident reports; actions to be taken resulting from incidents

Archaeological “Chance Finds” Procedure

Areas of the proposed project are subject to archaeological survey and assessment at the planning stage. These surveys are based on surface indications alone, and it is therefore possible that sites or items of significance will be found by chance in the course of development work. The procedure set out here covers the reporting and management of such finds.

Scope:

The “chance finds” procedure covers the actions to be taken from the discovery of an archaeological site or item, to its investigation and assessment by a trained archaeologist or other appropriately qualified person. This procedure is intended to ensure compliance with the relevant provisions of the National Heritage Act (27 of 2004), especially Section 55 (4): “ a person who discovers any archaeological objectmust as soon as practicable report the discovery to the Council”. The procedure of reporting set out below must be observed so that archaeological remains reported to the NHC are correctly identified in the field.

Responsibilities:

Operator	To exercise due caution if archaeological remains are found
Foreman	To secure site and advise management timeously
Superintendent	To determine safe working boundary and request inspection
Archaeologist	To inspect, identify, advise management, and recover remains

Procedure:

Action by person identifying archaeological or heritage material

- a) If operating machinery or equipment stop work
- b) Identify the site with flag tape
- c) Determine GPS position if possible
- d) Report findings to foreman

Action by foreman:

- a) Report findings, site location and actions taken to superintendent
- b) Cease any works in immediate vicinity

Action by superintendent:

- a) Visit site and determine whether work can proceed without damage to findings
- b) Determine and mark exclusion boundary
- c) Site location and details to be added to project GIS for field confirmation by archaeologist

Action by archaeologist:

- a) Inspect site and confirm addition to project GIS
- b) Advise NHC and request written permission to remove findings from work area

c) Recovery, packaging and labelling of findings for transfer to National Museum

In the event of discovering human remains:

- a) Actions as above
- b) Field inspection by archaeologist to confirm that remains are human
- c) Advise and liaise with NHC and Police
- d) Recovery of remains and removal to National Museum or National Forensic Laboratory, as directed.

**APPENDIX B:
NamWater’s Code of Conduct**

What is an Environmental Code of Conduct?

It is a set of rules that everybody has to follow in order to minimise damage to the environment.

What is the ENVIRONMENT?

The ENVIRONMENT means the surroundings within which people live. The ENVIRONMENT is made up of the **soil, water, plants, and animals** and those characteristics of the soil, water, air, and plant and animal life that influence **human health and well-being**. **People and all human activities** are also part of the environment and have to be considered during the operation of the Scheme.

Do these ENVIRONMENTAL RULES apply to me?

YES, The Environmental Rules apply to EVERYBODY. This includes all permanent, contract, or temporary workers as well as any other person who visits the Scheme. Every person will be required to adhere to the Environmental Code of Conduct.

**ALL PERSONNEL must study and keep to the
Environmental Code of Conduct**

The SCHEME SUPERVISOR will issue warnings and will discipline ANY PERSON who breaks any of the Environmental Rules. Repeated and continued breaking of the Rules will result in a disciplinary inquiry and which may result in that person being asked to leave the Scheme permanently.

What if I do not understand the ENVIRONMENTAL RULES?

ASK FOR ADVICE, if any member of the WORKFORCE does not understand, or does not know how to keep any of the Environmental Rules, that person must seek advice from the SCHEME SUPERVISOR. The PERSON that does not understand must keep asking until he/she is able to keep to all the Environmental Rules.

Safety and Security

1. Only enter and exit roadways and construction areas at demarcated entrances.
2. Wear protective clothing and equipment as per signboards at the Scheme and according to instructions from your SCHEME SUPERVISOR.
3. Report to your SCHEME SUPERVISOR if you see a stranger or unauthorised person in the construction area.
4. Never enter any area that is out of bounds or that is demarcated as dangerous without permission of your SCHEME SUPERVISOR.
5. Never climb over any fence or enter private property without permission of the landowner or your SCHEME SUPERVISOR.

6. Do not remove any vehicle, machinery, equipment, or any other object from the construction site without the permission of your SCHEME SUPERVISOR.
7. Keep clear of blasting sites. Follow the instructions of your SCHEME SUPERVISOR.
8. Never enter or work in the Scheme while under the influence of alcohol or other intoxicating substances.
9. All staff should know the emergency procedures in case of accidents.

Waste Disposal

10. Learn the difference between different types of waste, namely:
 - general waste, and
 - hazardous waste.

Containers will be provided for different types of wastes.

General Waste includes waste paper, plastic, cardboard, harmless organic (e.g. Vegetables) and domestic waste

Hazardous Waste includes objects, liquids or gases that are potentially dangerous or harmful to any person or the environment. Sewage, fuel, tyres, diesel, oils, hydraulic and brake fluid, paints, solvents, acids, soaps and detergents, resins, old batteries, etc. are all potentially hazardous.

11. Learn how to identify the containers for the different types of wastes. Only throw general waste into containers, bins or drums provided for general waste.
12. Recycle drums, pallets and other containers.
13. Never bury or burn any waste on-site, all waste is to be disposed of in allocated refuse disposal containers, bins or bags.
14. Never overfill any waste container. Inform your SCHEME SUPERVISOR if you notice a container that is nearly full.
15. Do not litter.
16. Do not bury litter or rubbish in the backfilled trench.

Plants and Animals

17. **Do not ever pick any plants, or catch any animal.** People caught with plants or animals in their possession will be handed to the authorities for prosecution.
18. Never feed, tease, play with, or set devices to trap any animal or livestock. Wild animals are not to be domesticated.
19. Keep off the rock outcrops unless given specific permission by the SCHEME SUPERVISOR to be there.
20. Never cut down any tree or branches for firewood.
21. Never leave rubbish or food scraps or bones where it will attract animals, birds, or insects.
22. Rubbish must be thrown into allocated waste disposal bins/bags.
23. Always close the gates behind you.

Preventing Pollution

24. Only work with hazardous materials in bunded areas.
25. Never discard any hazardous substances such as fuel, oil, paint, solvent, etc. into stream channels or onto the ground. Never allow any hazardous substances to soak into the soil.
26. Clean up spills immediately.
27. Immediately report to your SCHEME SUPERVISOR when you spill, or notice any hazardous substance overflow, leak or drip or spill on-site, into the streambeds or along the road.
28. Immediately report to your SCHEME SUPERVISOR when you notice any container, which holds hazardous substances overflow, leak or drip. Spillage must be prevented.
29. Only wash vehicles, equipment and machinery, containers and other surfaces at work site areas designated by your SCHEME SUPERVISOR.
30. Do not change the oil on uncovered surfaces.
31. If you are not sure how to transport, store, use, or get rid of any hazardous substances ask your SCHEME SUPERVISOR for advice.

Health

32. Drink lots of clean water every day.
33. Use toilets that have been provided.
34. Take the necessary precautions to avoid contracting HIV / AIDS. Condoms are available at most Clinics.
35. Inform your SCHEME SUPERVISOR when you are sick.
36. Do not work with any machinery when you are sick.
37. If you are working in malaria areas, you must take the necessary precautions.

Dust Control

38. Do not make any new roads or clear any vegetation unless instructed to do so by your SCHEME SUPERVISOR.
39. Keep to established tracks and pathways.
40. Keep within demarcated work areas.

Saving Water

41. Always use as little water as possible. Reduce, re-use and recycle water.
42. Never leave taps or hose pipes running. Close all taps after use.
43. Report any dripping or leaking taps and pipes to your SCHEME SUPERVISOR.

Working Hours

44. You may only work on weekends and after hours with the consent of the SCHEME SUPERVISOR.

Archaeological and Cultural Objects

45. If you find any archaeological, cultural, historical or pre-historical object on the construction site you must immediately notify your contractor.
46. Never remove, destroy, or disturb any cultural, historical, or prehistorical object on site.

Cultural and Historical Objects include old buildings, graves or burial sites, milestones, old coins, beads, pottery, and military objects.

Pre-Historical objects include fossils and old bones, old human skeletal remains, pieces of pottery and old tools and implements.

Sensible Driving

47. Tracks and roads should be kept to a minimum. Where possible follow existing roads.
48. No off-road driving is allowed.
49. Never drive any vehicle without a valid licence for that vehicle class and do not drive any vehicle that is not road-worthy.
50. Never drive any vehicle when under the influence of alcohol.
51. **Always** keep your headlights on when driving on dusty roads.
52. Keep to the roads as specified by your SCHEME SUPERVISOR. Vehicles may only be driven on demarcated roads. Drivers should always use three-point turns, “U-turns” are not allowed. Do not cut corners.
53. Do not drive on rocky outcrops.

Noise

54. Keep noise levels as low as possible.
55. Do not operate noisy equipment outside normal working hours.

Fire Control

56. Do not make open fires, use a drum or tin and do not collect any vegetation to burn.
57. Do not smoke or make fires near refuelling depots or any other area where fuel, oil, solvents, or paints are used or stored. Fireplaces should be at a safe distance from fuel and explosive storage sites as well as vehicle parking sites.
58. Cigarette butts should always be thrown in allocated refuse bins. Make sure that the cigarette butt is out before throwing it into the bin.
59. Immediately notify your SCHEME SUPERVISOR if you see an unsupervised fire at the campsite or construction site.

Dealing with Environmental Complaints

60. If you have any complaints about dangerous working conditions or potential pollution to the environment, talk to your SCHEME SUPERVISOR.
61. If any person complains to you about noise, lights, littering, pollution, or any harmful or dangerous condition, immediately report this to your SCHEME SUPERVISOR.

For any enquiries, please call

NP du Plessis

Tell: 061-71 2093

Cell: 081 127 9040

OR

Jolanda Murangi

Tell: 061-71 2105

Cell: 081 217 8116

APPENDIX C: Generic Method Statement Example

INFORMATION ON METHOD STATEMENTS

Method Statements are to be completed by the person undertaking the work (i.e. the Contractor). The Method Statement will enable the potential negative environmental impacts associated with the proposed activity to be assessed and potentially significant environmental aspects mitigated at the planning stage.

The Method Statement can only be implemented once approved by the ECO.

The Contractor (and, where relevant, any Sub-NamWater construction team s) must also sign the Method Statement, thereby indicating that the works will be carried out according to the methodology contained in the approved Method Statement.

The ECO will use the Method Statement to audit compliance by the Contractor with the requirements of the approved Method Statement.

Changes to the way the works are to be carried out must be reflected by amendments to the original approved Method Statement; amendments require the signature of the ECO, denoting that the changed methodology or works are necessary for the successful completion of the works, and are environmentally acceptable. The Contractor will also be required to sign the amended Method Statement thereby committing him/herself to the amended Method Statement.

This Method Statement MUST contain sufficient information and detail to enable the ECO to apply their minds to the potential impacts of the works on the environment. The Contractor will also need to thoroughly understand what is required of him/her in order to undertake the works. A method statement should clearly answer to following:

- What does the activity entail;
- Why is the activity required;
- When will it commence and how long;
- Where will the activity be undertaken;
- How will the activity be undertaken
 - What equipment and machinery will be required;
 - What materials (Chemicals) will be used in the process;
- What are the potential environmental, health and safety concerns associated with this activity and what mitigation measures will be employed to manage these risks?

The time taken to provide a thorough, detailed method statement is time well spent. Insufficient detail will result in delays to the works while the method statement is rewritten to ECO's satisfaction. The page overleaf provides a pro forma method statement sheet, which needs to be completed for each activity requiring a method statement in terms of the LEMP.

EXAMPLE OF METHOD STATEMENT

CONTRACT: DATE:

PROPOSED ACTIVITY (give title of Method Statement and reference number):

WHAT WORK IS TO BE UNDERTAKEN (give a brief description of the works):

WHERE ARE THE WORKS TO BE UNDERTAKEN (where possible, provide an annotated plan and a full description of the extent of the works):

START AND END DATE OF THE WORKS FOR WHICH THE METHOD STATEMENT IS REQUIRED:

Start Date:

End Date:

HOW ARE THE WORKS TO BE UNDERTAKEN (provide as much detail as possible, including annotated maps and plans where possible): Note: please attach extra pages if more space is required

DECLARATIONS

1) ENVIRONMENTAL CONTROL OFFICER

The work described in this Method Statement, if carried out according to the methodology described, is satisfactorily mitigated to prevent avoidable environmental harm:

(Signed)

(Print name)

(Signed)

(Print name)

Date: _____

2) PERSON UNDERTAKING THE WORKS

I understand the contents of this Method Statement and the scope of the works required of me. I further understand that this Method Statement may be amended on application to other signatories and that the ECO will audit my compliance with the contents of this Method Statement:

(Signed)

(Print name)

Date: _____

3) ENGINEER

The works described in this Method Statement are approved:

(Signed)

(Print name)

Date: _____

4) APPROVING AUTHORITY

The works described in this Method Statement are approved:

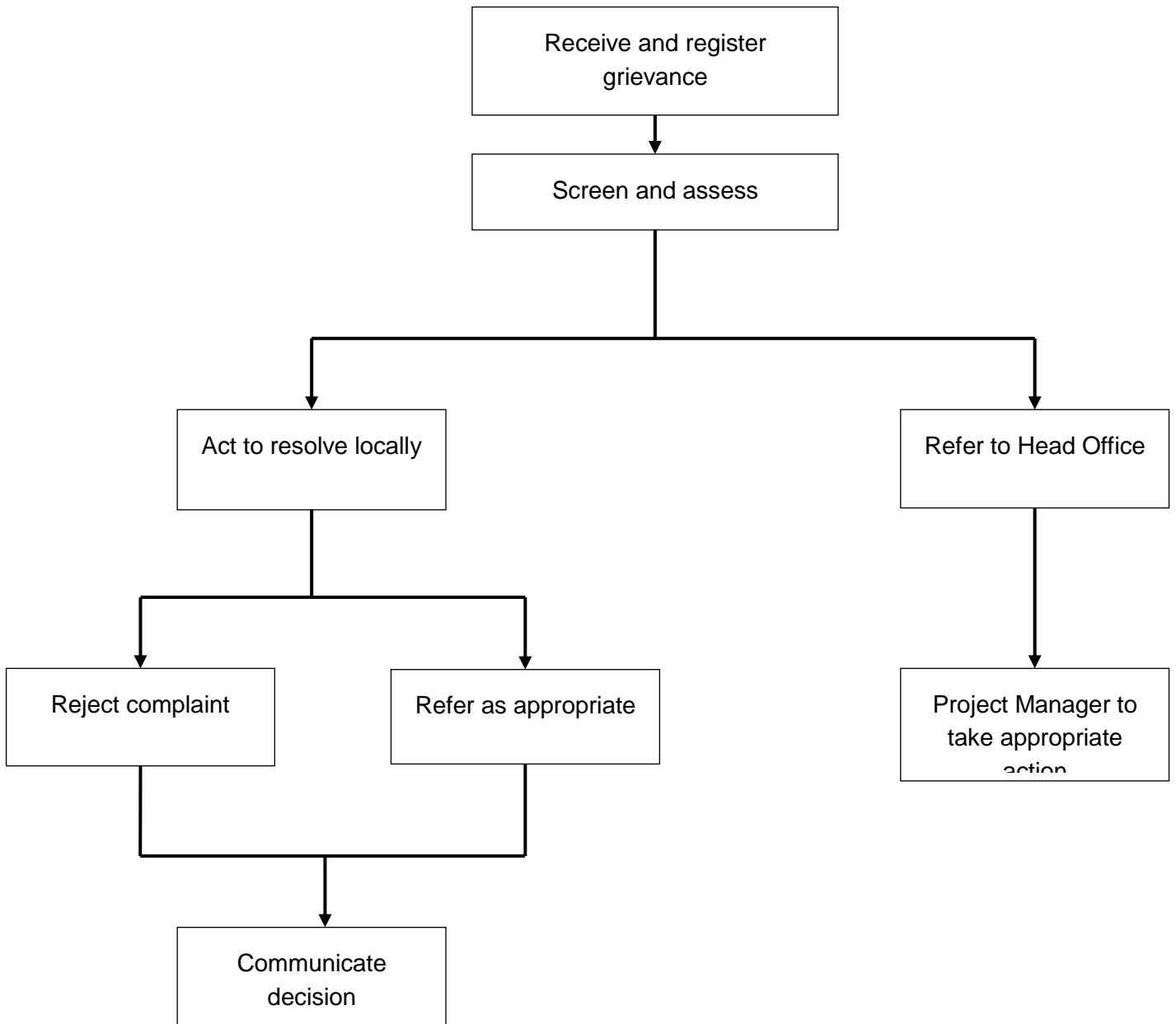
(Signed)

(Print name)

Date: _____

**APPENDIX D:
Grievance Procedure and Grievance Registration Form**

Grievance Procedure and Grievance Registration Form



Grievance Registration

Grievance Registration	
Case No:	Date:
Name of complainant:	Cell no:
	Email address:
Details of grievance: (Date, location, persons involved, frequency of occurrence, effects of ensuing situation, etc)	
Name of person recording grievance:	Cell number:
Proposed date of response:	
Signature of recording person:	Signature of complainant:
Date of redress:	
Decision and action:	