

RioTinto

Rössing Uranium Limited



**SOCIAL AND ENVIRONMENTAL IMPACT
ASSESSMENT FOR THE PROPOSED RÖSSING
URANIUM DESALINATION PLANT NEAR
SWAKOPMUND, NAMIBIA**

**FINAL SOCIAL AND ENVIRONMENTAL
MANAGEMENT PLAN**

PROJECT REFERENCE NO: 110914

DATE: JANUARY 2015

PREPARED BY



ON BEHALF OF

RioTinto

PROJECT DETAILS

PROJECT:	Social and Environmental Impact Assessment for the Proposed Rössing Uranium Desalination Plant, near Swakopmund, Namibia
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Note: All significant changes to the SEIA affected between the draft and final versions of the report are denoted by the underlining of text, as used here.

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LIST OF ACRONYMS AND UNITS OF MEASURE

%	Percentage
°C	Degrees centigrade
AIDS	Acquired Immune Deficiency Syndrome
Aurecon	Aurecon Namibia (Pty) Ltd
BID	Background Information Document
cm/s	Centimetres per second
CSIR	Council for Scientific and Industrial Research
dB	Decibels
Gecko	Gecko Namibia (Pty) Ltd
GIS	Geographic Information System
GPS	Global Positioning System
GRP	Glass reinforced plastic
GTZ	German Federal Enterprise for International Cooperation
Ha	Hectare
HDPE	High density poly ethylene
HIV	Human Immunodeficiency Virus
Hz	Hertz
I&APs	Interested and Affected Parties
IFC	International Finance Corporation
kg	Kilogram
km	Kilometres
km ²	Square kilometres
KOP	Key Observation Point: KOPs refer to receptors (people affected by the visual influence of a project) located in the most critical locations surrounding the landscape modification, who make consistent use of the views associated with the site where the landscape modifications are proposed. KOPs can either be a single point of view that an observer/evaluator uses to rate an area or panorama, or a linear view along a roadway, trail or river corridor.
Kpa	Kilopascals
kV	Kilovolt
m	Metres
m/s	Metres per second
m ²	Square metres
m ³ /day	Cubic metres per day
MAWF	Ministry of Agriculture Water and Forestry
MET	Ministry of Environment and Tourism
MET: DEA	Ministry of Environment and Tourism: Department of Environmental Affairs and Development
MFMR	Ministry of Fisheries and Marine Resources
mg/ℓ	Milligrams per litre
min	Minutes
Mℓ	Megalitre (1 Megalitre = 1,000 cubic metres)
M3/d	Megalitres per day
Mℓb/a	Million pounds per annum
mm	Millimetres
Mm ³	Million cubic metres
Mm ³ /a	Million cubic metres per annum
NamWater	Namibia Water Corporation
Omdel	Omaruru Delta (Aquifer)
pH	Potenx Hydrogen. A figure expressing the acidity or alkalinity of a solution on a logarithmic scale on which 7 is neutral, lower values are more acid and higher values more alkaline. The pH is equal to $-\log_{10} c$, where c is the hydrogen ion concentration in moles per litre.
RDP	Rössing Uranium desalination plant
RO	Reverse osmosis
RUL	Rössing Uranium Limited
SADC	Southern African Development Community
SEIA	Social and Environmental Impact Assessment
SEMP	Social and Environmental Management Plan
SLR	SLR Environmental Consulting (Namibia) (Pty) Ltd
spp.	Species
t/km ²	Tons per square kilometre
UNEP	United Nations Environment Programme
USAID	United States Agency for International Development

1 INTRODUCTION

Rio Tinto Rössing Uranium Limited (Rössing Uranium) has operated an open pit uranium mine in the Erongo Region of Namibia since 1976. As a result of reduced uranium prices, Rössing Uranium is urgently considering ways to enhance efficiency and overall economic viability of their mining operations near Arandis. Rössing Uranium currently purchases water through NamWater, which constitutes a significant overhead cost for the mine. The Erongo Region is a water scarce environment, relying predominantly on the Omaruru Delta (Omdel) aquifer for its supply. The Erongo region is also a centre for growth in Namibia and central to the country's economic vitality. As the demand for water increases, so does the value of water supplied. Rössing Uranium has determined that securing its own water supply, by way of a seawater desalination plant, may save costs and lead to a more efficient and resilient mining operation.

Rössing Uranium has investigated the design, construction, and operation of a new desalination plant, approximately 10km north of Swakopmund, to supply the mine's water needs. SLR Environmental Consulting (Namibia) (Pty) Limited (SLR), in association with Aurecon Namibia (Pty) Ltd (Aurecon), were appointed to undertake the SEIA process for the proposed desalination plant.

The aim of the SEIA process was to identify and investigate potentially significant socio-economic and bio-physical impacts associated with the proposed project and provide an opportunity for the public and key stakeholders to provide input and participate in the process. Recommendations arising from these studies have been incorporated together with generic environmental management procedures and best practices into this Social and Environmental Management Plan (SEMP), which aims to ensure the potential impact associated construction, operation and decommissioning of the facility is minimised. Should this SEMP be accepted by the Government of Namibia, its provisions will become binding on the applicant and by association, any consultants or contractors appointed during the project lifecycle.

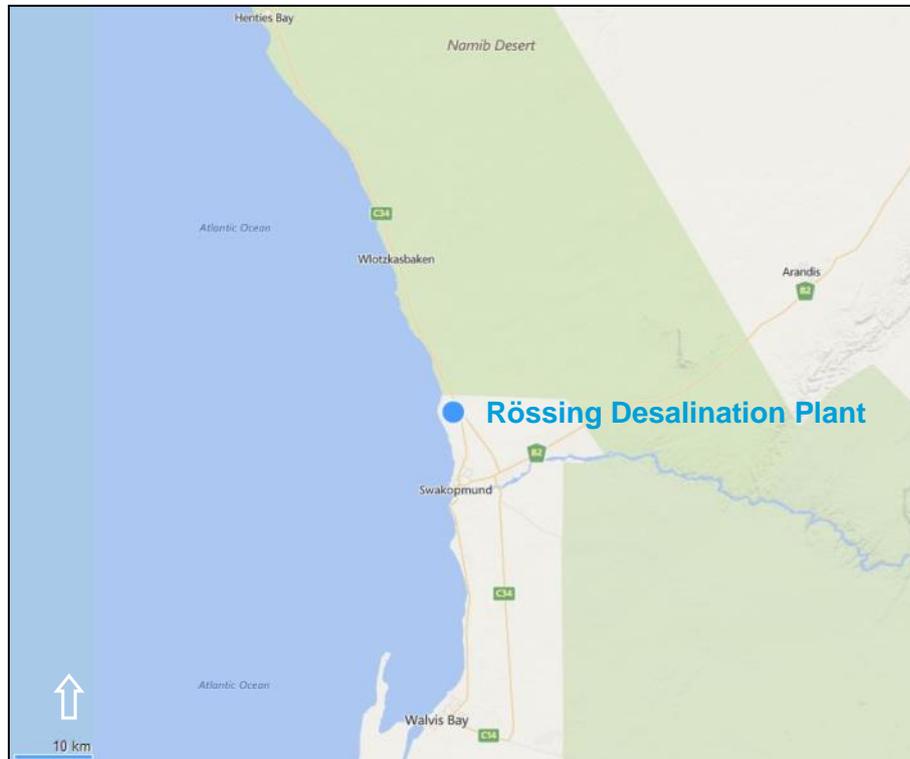
The purpose of this SEMP is to ensure that key Occupational Health, Safety, Environment and Community (OHSEC) aspects and mitigation measures are identified and implemented during the life cycle of the proposed project. Where required, these considerations are to be integrated with Rössing Uranium's existing HSE Management System, which apply to all Rössing Uranium operations. The SEMP is intended to serve as management guideline to ensure responsible OHSEC management of project on a day-to-day basis from conception and construction to operation and closure.

A number of project alternatives were considered in the SEIA process however it has been recommended that the SEIA optimised layout should be pursued into project implementation. This SEIA optimized project layout is described section 3 to follow and it is important to note that it differs slightly from the project description contained in the SEIA (The SEIA project description refers to the base case alternative). The following section is the non-technical summary from the SEIA report and provides the key findings emerging from the SEIA process and serves to contextualise the provisions made in this SEMP.

SEIA NON-TECHNICAL SUMMARY

Rio Tinto Rössing Uranium Limited (Rössing Uranium) proposes to develop a new desalination plant, approximately 6km north of Swakopmund at the existing Swakopmund Salt Works, to supply the mine's water needs. SLR Environmental Consulting (Namibia) (Pty) Limited (SLR), in association with Aurecon Namibia (Pty) Ltd (Aurecon), have been appointed to undertake the SEIA process.

Figure 1: Location of the proposed Rössing Uranium desalination plant in the regional context



Rössing Uranium is considering ways to improve the efficiency and overall economic viability of their mining operations near Arandis. The mine currently purchases water through NamWater, via the Areva Desalination Plant, which constitutes a significant overhead cost for the mine. Rössing Uranium have determined that having their own seawater desalination plant, may save costs and lead to a more efficient and resilient mining operation, especially during the current low uranium market prices. It is estimated that the cost of water from the new plant would decrease from the current average of US\$4.00/m³ to less than US\$2.00/m³ at point of supply, thus saving Rössing Uranium upwards of US\$6 Million per annum (approximately N\$60 million per annum).

The cost of US\$2.00/m³ to US\$2.50 is widely accepted as a benchmark cost for desalinated water supply. Several years of negotiation attempts have however remained unsuccessful in bringing the current desalination supply cost down to such a level. Progress on the NamWater Mile 6 plant has also been slow and the October 2014 date for completion of that plant has not been met. This leaves the mining community exposed to the current very high desalination water costs, which is the only alternative supply of water (other than the supply from the Omdel aquifer), for at least the next five years.

The proposed plant will be designed to have a 10 year operational life, which ties in with the current Rössing Uranium Life of Mine plan. The plant will be designed to produce up to 10,000m³ (10 Mℓ) of potable water in every 24 hour cycle. The plant would produce approximately 3Mm³ per annum (or average of 8,200m³/d), which is consistent with Rössing Uranium's water demand. At full production, the plant will abstract 25,000m³/d of seawater; produce 10,000m³/d of drinking water and discharge 15,000m³/d back to the ocean as concentrated seawater or brine (containing left-over water treatment chemicals).

The project can be divided into the following main components:

- Seawater intake system;
- Seawater pre-treatment system;
- desalination plant;
- Ancillary structures and infrastructure;
- Electrical supply system;
- Product water system and pipeline; and
- Effluent treatment and disposal system.

The plant will be designed for electrical efficiency since reverse osmosis requires significant electrical power. During the operational phase, the plant will be staffed with an estimated 12 to 18 contract staff and will be operated by Gecko Namibia (Pty) Ltd on Rössing Uranium's behalf. It should take about 18 months to build the plant, following environmental approval from the Ministry of Environment and Tourism (MET). At the end of its life, the plant may be refurbished for ongoing use, or closed, broken down and the site rehabilitated, or possibly sold to another mining operation or NamWater, depending on the needs at that time.

The aim of the SEIA process is to review the relevant legal requirements, undertake the processes as prescribed, identify and investigate potentially significant socio-economic and bio-physical impacts and provide an opportunity for the public and key stakeholders to provide input and participate in the process.

The impact assessment has considered impacts associated with:

- Project design and pre-construction impacts and considerations;
- Construction phase impacts;
- Operational phase impacts;
- Decommissioning phase impacts; and
- Cumulative impacts, taking into consideration existing pressures or impacts on the local socio-economic and biophysical environments.

for

- A Base Case (before and after proposed mitigations);
- Three project alternatives (after proposed mitigations); and
- The No-Go alternative.

Through the investigations, suitable mitigation and management measures have been proposed and carried forward into the Social and Environmental Management Plan (SEMP) which aims to guide responsible environmental management throughout the project lifecycle.

1.1 PROJECT ALTERNATIVES

During the scoping/pre-feasibility phase, many design options were considered, but these were reduced down and combined to form a Base Case project and feasible alternatives. The Base Case project and other feasible alternatives, together with the No-Go alternative, have been assessed in this SEIA phase. However, the Base Case project is described in detail in the SEIA Report as it was deemed the best way forward at the commencement of the impact assessment phase and assessed by all the specialists.

A number of feasible alternatives were also considered through the impact assessment. A summarised description of the various alternatives (compared to the Base Case project) with respect

to each of the above mentioned project components is provided in the table below and illustrated in Figure 2.

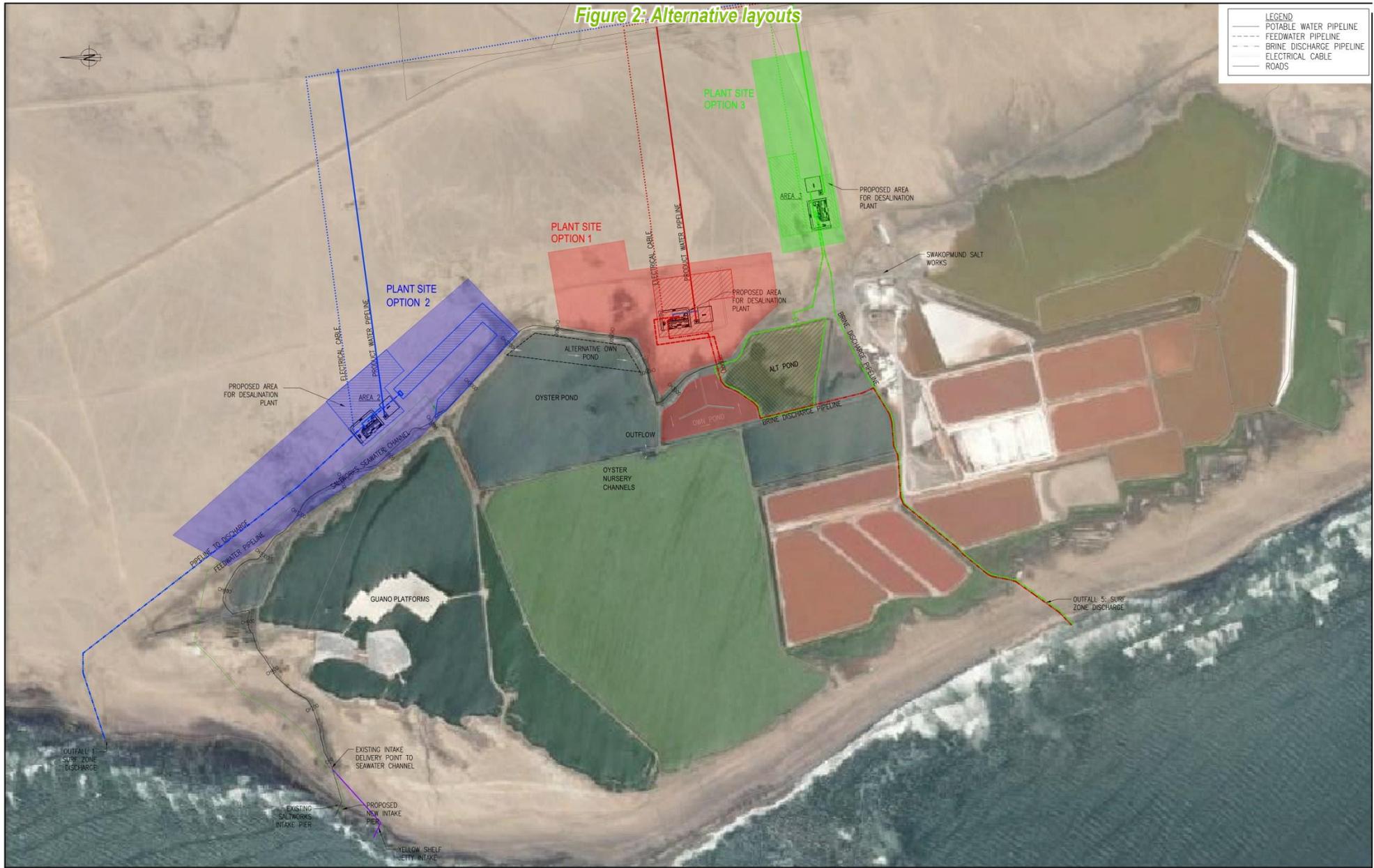
The optimised layout (i.e. SEIA recommended project layout), is described in Section 5 below and a detailed project description of this (SEIA optimised) layout is provided in Figure 3 on pg. 29.

Table 2: Summary of project alternatives assessed in the SEIA process

Base Case (pre-mitigation) (site 1)	Base Case (post-mitigation) (site 1)	Alternative 1 – Site 2	Alternative 2 – Site 3	Alternative 3 –with overhead power	Alternative 4 -No Go Alternative
desalination plant ~ 10,000m ³ /d seawater reverse osmosis (RO) plant and associated facilities situated in the centre of site locality 1. The desalination plant will house the pre-treatment systems and the various pumps for the product water system. The plant will also house various ancillary facilities (chemical stores, offices, ablutions, roads, parking bays, maintenance areas, spares stores, etc.). The desalination plant and associated facilities will be mostly housed within a single warehouse type structure, to protect them from the corrosive coastal air.	Same as base case alternative except that the Plant would be situated in the north / north-eastern area of location 1.	Same as base case alternative except that the Plant would be situated on site locality 2.	Same as base case alternative except that the plant would be situated in site locality 3.	Same as base case	No implementation means no direct environmental impacts. There will however be potentially significant socio-economic opportunity impacts.
Seawater intake system ~ A new seawater intake jetty and associated pumps and pipes will be erected just south of the existing Salt Works intake jetty. Seawater will enter the existing (possibly upgraded) Salt Works seawater intake channel and gravitate around the Salt Works and enter into a new seawater buffer pond located near the desalination plant. A new electrical cable will be run from the desalination plant around the eastern and northern shores of the salt pans, and provide power to the intake pumps on the new jetty.	Same as base case except that the new seawater intake pond would be situated closer to the desalination plant on Site locality 2.	Same as base case except that the new seawater intake pond would be situated closer to the desalination plant on Site locality 2.	Same as base case	Same as base case	
Pre-treatment system ~ Sea water abstracted from the buffer pond will be filtered and conditioned ahead of the desalination process. This may involve the use of pre-treatment chemicals or biological processes in combination with physical screens and filters to ensure that the water is free of particulates that could foul the RO membranes, and that the pH is optimum to allow for efficient RO process.	Same as base case	Same as base case	Same as base case	Same as base case	
Product water system ~ clear water from the RO process will then be remineralised to meet potable water standards and pumped via an 850m long pipeline, running due east from the plant, into the existing NamWater pipeline running along the eastern side of the Henties Bay Road (C34).	Same as base case	Same as base case	Same as base case	Same as base case	
Brine disposal system ~ Brine (together with filter backwash from the pre-treatment system and chemical cleaning processes) will be pumped from the plant via a new pipeline to ocean discharge (surf discharge) location situated south of the Salt Works bitterns outlet (southern discharge site).	Same as base case alternative except that due to desalination plant site on site 2, the northern discharge (Outfall 1) site becomes preferred due to the shorter pipe length.	Same as base case alternative except that due to desalination plant site on site 2, the northern discharge (Outfall 1) site becomes preferred due to the shorter pipe length.	Same as base case	Same as base case	
Electrical supply system ~ A buried cable would run from the existing Tamarisk substation in the northern parts of Swakopmund, along the C34 toward Henties Bay and then turn due west on a vector to connect with the new mini-substation to be constructed adjacent the desalination plant. The cable between the C34 and the plant should follow the same route as the product water pipeline connecting with the NamWater pipeline. Note	Same as base case. However the exact location where the buried cable would turn west from the Henties Bay Road is located further north.	Same as base case. However the exact location where the buried cable would turn west from the Henties Bay Road is located further north.	Same as base case. However the exact location where the buried cable would turn west from the	Same as base case alternative except that the distribution line from the Tamarisk substation along the C34 to Henties Bay	

Base Case (pre-mitigation) (site 1)	Base Case (post-mitigation) (site 1)	Alternative 1 – Site 2	Alternative 2 – Site 3	Alternative 3 –with overhead power	Alternative 4 -No Go Alternative
also that a buried cable will run from the desalination plant to the new seawater intake jetty.			Henties Bay Road is located further south.	will be above ground as opposed to a buried cable. From the C34 to the plant will remain a buried cable.	

Figure 2: Alternative layouts



DRG. No.	DRAWING TITLE	REV	DESCRIPTION	DATE	REV BY/CHKD
	REFERENCE DRAWINGS		REVISIONS		APPROVED :

I	AMENDMENTS TO PLANT POSITION	27.10.2014		DESIGNED	K.T	14.07.2014
H	CHANGES MADE, INTAKE & DISCHARGE PIPES	21.10.2014		DRAWN	N.U	14.07.2014
D	SITE POSITION MOVED	17.10.2014		CHECKED	K.T	14.07.2014
F	SITE ADDED, OPTION 2	09.10.2014	G.M.K.T.	PROJ. MANAGER	J.G.T	14.07.2014
E	CHANGES MADE, INTAKE & DISCHARGE PIPES	08.10.2014	G.M.K.T.	PROJ. PRINCIPAL	J.v.E	14.07.2014
D	CHANGES MADE, PIPELINE AND PONDS	30.09.2014				
C	CHANGES MADE, CHANNEL AND PONDS	26.09.2014				



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 Knysna, 6570
 Western Cape

PROJECT/DRAWING TITLE
RÖSSING DESALINATION PLANT

ALTERNATIVE LAYOUTS

SCALE	1:5000	SHEET	SHEET 1 OF 1
CONTRACT No.		PROJECT No.	CPT.000188
DRAWING No.	CPT_0188_1_002_(E3)	REV	

1.2 SEIA PROCESS

Prior to the commencement of the proposed desalination project, authorisation is required on the basis of an SEIA report and SEMP. In accordance with this legal framework the SEIA approach included the following:

- The scoping process was conducted to identify the environmental issues associated with the proposed project and to define the terms of reference for the required specialist studies and the SEIA.
- Specialist studies were commissioned in accordance with the relevant terms of reference. The specialists were selected on the basis of their expertise and knowledge of the project area. (Refer to Table 3 below).
- The SEIA report and SEMP was prepared on the basis of the findings of the specialist studies.
- A project specific public participation process was conducted. As part of this process the regulatory authorities and interested and affected parties (I&APs) were given the opportunity to attend information sharing meetings, submit questions and comments to the environmental team, and review the background information document, scoping report and now the SEIA report and SEMP. All questions and comments that were raised by the authorities and I&APs have been included and answered in the Comments and Responses Report, attached to the SEIA Report.

The following specialist studies were identified in the scoping phase and undertaken during the SEIA phase. These studies have assisted with the investigation and assessment of the key impacts, as well as providing recommendations to reduce and manage those impacts as best as possible:

Table 3: Specialist studies conducted as part of the assessment phase of the SEIA

SPECIALIST FIELD	SPECIALIST	DESCRIPTION
Socio-economic	Ms. Auriol Ashby (Social) (Ashby Associates CC) and Dr Jonathan Barnes (Economic) (Design and Development Services cc)	Identify and assess the potential Socio-economic impacts associated with the construction and operation of the proposed Rössing Uranium desalination plant.
Heritage and Archaeology	Dr John Kinahan (Quaternary Research Services)	This study will focus on the probable impacts of the proposed project on heritage and archaeological impacts within the footprint of the proposed project.
Visual	Stephen Stead (Visual Resource Management Africa)	Assess the potential visual impact caused by the proposed Rössing Uranium desalination plant.
Noise	Nicolette von Reiche (Airshed Planning Professionals)	Identify and assess the potential noise impacts associated with the construction and operation of the proposed Rössing Uranium desalination plant.
Avifauna	Mike and Ann Scott (African Conservation Services CC)	Identify and assess the potential impacts on local birdlife associated with the construction and operations of the proposed Rössing Uranium desalination plant and associated infrastructure (most notably a possible overhead powerline).
Marine ecology	Dr Andrea Pulfrich (Pisces Environmental Services (Pty) Ltd)	Identify and assess the potential impacts to marine and coastal ecology associated with the construction and operation of the proposed Rössing Uranium desalination plant. The study will rely on the marine discharge and modelling study to be undertaken by WSP.
Brine diffusion modelling	Christoph Soltau (WSP Group)	Assess the marine discharge options and undertake a hydrodynamic modelling exercise to determine the likely movement and dissipation of the discharge plume. Note that this is not an impact assessment but informs the marine ecology impact assessment.

SPECIALIST FIELD	SPECIALIST	DESCRIPTION
Shoreline dynamics	Christoph Soltau (WSP Group)	Identify and assess the potential impacts that may arise as a result of the construction and operation of the desalination plant's seawater intake, brine outfall and associated structures located on the beach or in the surf on natural coastal processes.

1.3 SOCIAL AND ENVIRONMENTAL IMPACT ASSESSMENT FINDINGS

Through the cause of the SEIA process it came to light that the Base Case project layout was situated in a Damara Tern (breeding endemic seabird, globally Near Threatened and also Near Threatened in Namibia) core breeding area and that the desalination plant would need to move.

With input from the bird specialist, the other specialists identified above, the technical team and Rössing Uranium, various other project layouts (as described in section 2 above) were developed and assessed as part of the SEIA process to come up with an SEIA optimised layout.

The following table provides a summary of the impact assessment results. This table only shows the post mitigation impact significance ratings.

The following (colour) legend is applicable to the significant ratings in the tables:

Legend	High (-)	Medium (-)	Low (-)	Very low (-)	Neutral	Very low (+)	Low (+)	Medium (+)	High (+)
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Table 4: Post-mitigation impact significance ratings summary

Aspect	Phase	Impact Description	Base Case - Post-mitigation	Alternative 1 - Plant site 2	Alternative 2 - Plant site 3	Alternative 3 - Overhead powerline	Alternative 4 - No go
Socio-economic	Construction	Increased traffic and road safety risks.	Very low (-)	Very low (-)	Very low (-)	Very low (-)	Neutral
		Reduction in Guano production as a result of disturbance of birds.	Very low (-)	Low (-)	Very low (-)	Very low (-)	Neutral
	Operations	Economic viability of Rössing Uranium Mine.	High (+)	High (+)	High (+)	High (+)	High (-)
		Financial implications for other water users and NamWater.	Medium (-)	Medium (-)	Medium (-)	Medium (-)	Medium (-)
		Financial implications On Langer Heindrich Uranium / Husab.	Low (-)	Low (-)	Low (-)	Low (-)	Low (-)
		Water availability in the region.	High (+)	High (+)	High (+)	High (+)	Low (+)
		Disruptions may result in a lower Guano production rates.	Very low (-)	Low (-)	Very low (-)	Very low (-)	Neutral
Decommissioning	Bulk water supply options associated with decommissioning.	High (+)	High (+)	High (+)	High (+)	Neutral	
Archaeology and heritage	Construction	Loss or damage of archaeological and heritage resources.	Very low (-)	Very low (-)	Very low (-)	Very low (-)	Neutral
	Operations	No operational phase impacts.	Neutral	Neutral	Neutral	Neutral	Neutral
	Decommissioning	No decommissioning phase impacts.	Neutral	Neutral	Neutral	Neutral	Neutral
Visual impacts	Construction	Intake jetty during construction.	Medium (-)	Medium (-)	Medium (-)	Medium (-)	Neutral
	Operations	desalination plant during construction.	Low (-)	Low (-)	Medium (-)	Medium (-)	Neutral
		Impact of the desalination plant and all associated infrastructure.	Low (-)	Medium (-)	Medium (-)	Medium (-)	Neutral
Decommissioning	Visual impact associated with the decommissioning phase of the project.	Very low (-)	Very low (-)	Very low (-)	Very low (-)	Neutral	
Noise impacts	Construction	Construction noise impact on birds.	Very low (-)	Very low (-)	Very low (-)	Very low (-)	Neutral
		Construction noise impact on humans.	Very low (-)	Very low (-)	Very low (-)	Very low (-)	Neutral
	Operations	Operations phase noise impact on birds.	Very low (-)	Very low (-)	Very low (-)	Very low (-)	Neutral
		Operations phase noise impact on humans.	Very low (-)	Very low (-)	Very low (-)	Very low (-)	Neutral
	Decommissioning	Decommissioning phase noise impact on birds.	Very low (-)	Very low (-)	Very low (-)	Very low (-)	Neutral
		Decommissioning phase noise impact on humans.	Very low (-)	Very low (-)	Very low (-)	Very low (-)	Neutral
Avifauna impacts	Construction	Destruction/modification of Damara Tern breeding habitat.	Low (-)	Very low (-)	Low (-)	Low (-)	Neutral
		Destruction/modification of habitat of other birds.	Low (-)	Low (-)	Low (-)	Low (-)	Neutral
		Physical disturbance to breeding birds, especially Damara Terns.	Low (-)	Very low (-)	Low (-)	Low (-)	Neutral
	Operations	Physical disturbance to breeding birds, especially Damara Terns.	Low (-)	Very low (-)	Low (-)	Low (-)	Neutral
		Physical disturbance to roosting/breeding cormorants.	Very low (-)	Low (-)	Very low (-)	Very low (-)	Neutral
		Collision of birds with power line structures.	Neutral	Neutral	Neutral	Medium (-)	Neutral
		Bird electrocutions on power supply structures.	Neutral	Neutral	Neutral	Medium (-)	Neutral

Aspect	Phase	Impact Description	Base Case - Post-mitigation	Alternative 1 - Plant site 2	Alternative 2 - Plant site 3	Alternative 3 - Overhead powerline	Alternative 4 - No go
	Decommissioning	Physical disturbance to breeding birds, especially Damara Terns.	Low (-)	Very low (-)	Low (-)	Low (-)	Neutral
Marine ecology impacts	Construction	Disturbance and destruction of marine biota through alteration and disruption of the coastal zone during construction.	Low(-)	Low(-)	Low(-)	Low(-)	Neutral
		Detrimental effects on marine biota through accidental hydrocarbon spills, concrete works and litter in the coastal zone during construction.	Low(-)	Low(-)	Low(-)	Low(-)	Neutral
		Reduced physiological functioning of marine organisms due to increased turbidity of nearshore waters during excavations.	Very low (-)	Very low (-)	Very low (-)	Very low (-)	Neutral
		Smothering of benthos through re-deposition of suspended sediments.	Very low (-)	Very low (-)	Very low (-)	Very low (-)	Neutral
		Disturbance of shore birds and marine biota through construction noise.	Very low (-)	Very low (-)	Very low (-)	Very low (-)	Neutral
		Disturbance and injury of shore birds and marine biota through blasting.	Low (-)	Low (-)	Low (-)	Low (-)	Neutral
		Elimination of benthic communities through loss of substratum in structural footprint.	Very low (-)	Very low (-)	Very low (-)	Very low (-)	Neutral
	Operations	Loss of marine species through impingement and entrainment.	Very low (-)	Very low (-)	Very low (-)	Very low (-)	Neutral
		Potential flow distortion around the discharge outlet.	Very low (-)	Very low (-)	Very low (-)	Very low (-)	Neutral
		Reduced physiological functioning of marine organisms due to elevated salinity.	Low (-)	Low (-)	Low (-)	Low (-)	Neutral
		Avoidance behaviour by invertebrates, fish and marine mammals of the discharge area.	Low (-)	Low (-)	Low (-)	Low (-)	Neutral
		Reduced physiological functioning of marine organisms due to elevated temperature.	Very low (-)	Very low (-)	Very low (-)	Very low (-)	Neutral
		Reduced physiological functioning of marine organisms due to reduced dissolved oxygen concentrations.	Very low (-)	Very low (-)	Very low (-)	Very low (-)	Neutral
		Detrimental effects on marine organisms due to residual chlorine levels in the mixing zone.	Very low (-)	Very low (-)	Very low (-)	Very low (-)	Neutral
		Chronic effects on marine organisms due to formation of halogenated by-products.	Low (-)	Low (-)	Low (-)	Low (-)	Neutral
		Reduction in dissolved oxygen concentrations as a result of dechlorination.	Very low (-)	Very low (-)	Very low (-)	Very low (-)	Neutral
		Excessive bacterial re-growth in the brine after chlorination.	Very low (-)	Very low (-)	Very low (-)	Very low (-)	Neutral
		Detrimental effects on marine organisms through discharge of co-pollutants in backwash waters.	Low (-)	Low (-)	Low (-)	Low (-)	Neutral
		Detrimental effects on marine organisms through discharge of antiscalants in backwash waters.	Very low (-)	Very low (-)	Very low (-)	Very low (-)	Neutral
		Detrimental effects on marine organisms or ambient seawater pH through discharge of residual cleaning solutions used periodically for cleaning in place.	Very low (-)	Very low (-)	Very low (-)	Very low (-)	Neutral
Detrimental effects on marine organisms of heavy metals from corrosion processes.	Very low (-)	Very low (-)	Very low (-)	Very low (-)	Neutral		
Decommissioning	Impacts to marine ecology associated with decommissioning activities.	Very low (-)	Very low (-)	Very low (-)	Very low (-)	Neutral	
Shoreline dynamics impacts	Construction	Intake Jetty: Disruption of coastal processes by marine works.	Very low (-)	Very low (-)	Very low (-)	Very low (-)	Neutral
		Intake Jetty: Alteration of beach composition with rock spoil.	Very low (-)	Very low (-)	Very low (-)	Very low (-)	Neutral
		Brine outfall: Disruption of coastal processes by marine works.	Very low (-)	Very low (-)	Very low (-)	Very low (-)	Neutral
		Brine outfall: Alteration of beach composition with rock spoil.	Very low (-)	Very low (-)	Very low (-)	Very low (-)	Neutral
		Brine outfall: Earthworks related flooding or beach erosion.	Very low (-)	Very low (-)	Very low (-)	Very low (-)	Neutral
	Operations	Intake Jetty: The coastal processes (waves, currents, sediment transport) are affected by the jetty structure.	Low (-)	Low (-)	Low (-)	Low (-)	Neutral
		Intake Jetty: Natural sand movement is impacted by the jetty abutment to shore.	Neutral	Neutral	Neutral	Neutral	Neutral
		Intake Jetty: Wind-blown sand pathways are impacted by the intake structure and pipelines.	Very low (-)	Very low (-)	Very low (-)	Very low (-)	Neutral
		Brine outfall: The outfall pipeline causing updrift accretion and downdrift erosion of the beach.	Low (-)	Low (-)	Low (-)	Low (-)	Neutral
		Brine outfall: wind-blown sand pathways on the upper beach are impacted by the brine outfall pipeline.	Neutral	Neutral	Neutral	Neutral	Neutral
		Brine outfall: The high velocity flow from the outfall causes scouring of the sandy seabed.	Low (-)	Low (-)	Low (-)	Low (-)	Neutral
	Decommissioning	Impacts to shoreline dynamics during decommissioning would be comparable with those experienced during the construction phase.	Very low (-)	Very low (-)	Very low (-)	Very low (-)	Neutral

1.4 OPINIONS AND RECOMMENDATIONS

In the interest of economic feasibility, Rössing Uranium decided to pursuing its own source of desalinated water. Given the current poor uranium market, it is essential that Rössing Uranium implement measures to remain viable and in so doing, avoid the potentially significant regional socio-economic impacts that could arise as a result of its premature closure.

In the Environmental Assessment Practitioner's (EAP's) opinion, three key aspects were identified during the impact assessment process that would be key informants in reaching a decision. The first relates to the projects potential impacts on bird life in the area, given that the Mile 4 Salt Works is a recognised Important Bird Area (IBA) and an important breeding area for the Damara Terns (breeding endemic seabird, globally Near Threatened and also Near Threatened in Namibia). The second relates to the potential impacts on marine ecology as a result of the desalination process. The third relates to the potentially significant negative socio-economic impacts if the project does not go ahead and the Rössing mine is forced to close prematurely. Although visual impacts were rated as a medium negative impact because of the nature of the area being unobstructed, we don't consider this to form one of the key aspects to be considered in making a decision.

Regarding the bird aspect, special attention has been given to the issue and was pivotal in the project team having to investigate various site locations for the desalination plant and finally informing the development of the SEIA optimised layout, which is dealt with in the key recommendations to follow, and which seeks to mitigate the impact significance to birdlife. It is believed that the operation of the desalination plant will have an acceptable level of impact to resident birdlife (given the recommended mitigations) however special care will need to be taken through the construction phase of the project to limit the disruption of the local bird assemblages and avoid disturbances to the Damara Terns during their annual breeding period.

Regarding marine ecology, and from a broader viewpoint, the marine ecology impacts associated with the operational phase were found to be within acceptable tolerances. As a result of this, the operational phase marine impacts associated with brine disposal need not factor significantly into the taking of the decision.

The socio-economic impacts associated with the No-Go alternative and assuming Rössing closes prematurely as a result translates into a significant socio-economic impact for the region that should be avoided, especially now, during a period of depressed uranium market prices.

Other impacts, including noise, visual, and heritage are all within acceptable tolerances.

The EAP is of the opinion (subject to the implementation of the recommendations and mitigations measures identified, most notably the key recommendations that follow) that not only could the project go ahead on the basis of the potential environmental impacts, but should go ahead on the basis of the potentially significant socio-economic impacts associated with not going ahead (if an alternative agreement between relevant parties cannot be reached timeously).

- **Key Recommendation 1: SEIA Optimised Layout:** The SEIA assessed three potential site locations (areas) for the desalination plant, i.e. site areas (options) 1, 2 and 3 Base Case. Through the assessment, supported by the relevant specialist and technical studies, an optimised project layout has taken shape which is believed to be a healthy comprise between the technical, financial, and environmental aspects. This layout sees the desalination plant shift to the far north or north-eastern corner of site area 1 (away from the core Damara Tern breeding area) but not as far as site option 2, where the desalination plant could impact more significantly on the residents of the correctional services accommodation (noise and visual impacts) and tourists (visual impacts) or the birds on the guano platform. Additionally, to use the northern brine discharge point, associated with the above mentioned plant location, as this would take the pipeline away from the

Salt Works inter-pond service road network (resulting in less disruption to the Salt Works during construction) and the Damara Tern breeding area but would also see the discharge making use of the derelict concrete Salt Works intake structure, which could reduce the construction phase impact for the brine discharge. The optimised project layout is shown at the end of this subsection. All the alternatives except the base case (unmitigated) could be approved by MET, subject to the implementation of all the commitments in the SEMP.

- **Key Recommendation 2: Earthen Berm Enclosure:** This key recommendation is closely linked to the foregoing SEIA optimised layout recommendation. It emerged during the course of the various specialist studies that enclosing the desalination plant with a 1.8m to 2m high earthen berm serve a number of impact mitigation functions, as follows:
 - Visual impacts: an earthen berm would act as a visual screen and reduce the visual impacts associated with ground level activities and movements around the plant. The earth berm would also lessen the vertical prominence of the plant when viewed from a distance (provided that the earthen berm ties in with the surrounds). At night the berm would reduce the spillage of light into the adjoining areas, mitigating light pollution related impacts.
 - Noise impacts: an earthen berm would serve as an acoustic barrier and mitigate noise pollution generated at or near ground level and delinking noises from specific movements or activities (i.e. if you can see the bulldozer, the noise seems more intrusive to the receptor.)
 - Avifauna impacts: by reducing the noise and visual disturbances associated with the movement of people, plant and vehicles and associated activities around the desalination plant, the potential impact to resident birdlife, most notably the Damara Terns (with their core breeding area located in the area adjacent the SEIA optimised layout) can be maintained within acceptable levels and is expected to have the following benefits:
 - ~ Delinking noises from sudden visible movements, which could otherwise spook birds;
 - ~ Reducing the overall noise level from the plant that could disturb nesting/roosting birds; and
 - ~ Preventing low level light spillage from the desalination plant or vehicle headlights around the plant, which would otherwise cause birds to cast a long shadow, increasing their visibility and susceptibility to would be predators.
- **Key Recommendation 3: ProGreen™ Technology:** The ProGreen™ technology is a new approach to desalination in southern Africa. As such the project is approaching the use of technology with precaution and has opted to retain a tried and tested pre-treatment process (i.e. dissolved air floatation (DAF)) and upon which the impact significance rating in the SEIA are based. In the event however that ProGreen™ does perform to full specification and full implementation is realised (i.e. all feedwater is treated to 100% by the ProGreen™ bio-flocculation technology), then this could reduce the potential impacts to marine ecology associated with the co-discharge of various water treatment, conditioning and cleaning chemicals, normally associated with a dissolved air floatation system. In the best case scenario, these impacts would reduce to zero or “Neutral”. Note that the ProGreen™ would still produce a sludge that would be co-discharged with the brine effluent arising from the Reverse Osmosis process. The use of this technology is encouraging for the desalination industry and, if proven effective, could have far reaching cumulative environmental benefits for future desalination plants across the subcontinent. Rössing Uranium may even be in a position to investigate the option to discharge the brine into the Salt Works evaporation ponds, which could further reduce the operation phase impacts associated with brine discharge on the marine environment.

Figure 2: SEIA optimised Layout



DRG. No.		DRAWING TITLE		DESIGNED		CLIENT		PROJECT/DRAWING TITLE		SCALE		SHEET	
REFERENCE DRAWINGS		REVISIONS		APPROVED :		 11 Nelson Street Knysna Tel: (044) 302 4900 Email: knysna@rhdhv.com Web: www.rhdhv.com		 GECKO WATER (PTY) LTD		Rössing Desalination Plant SEIA OPTIMIZED LAYOUT		1:5000 SHEET 1 OF 1	
								CONTRACT No.		PROJECT No.		REV	
								CPT.000188		CPT_0188_1_002_(E2)			

2 LEGAL FRAMEWORK

2.1 THE CONSTITUTION OF THE REPUBLIC OF NAMIBIA (ACT 1 OF 1990)

There are two clauses contained in the Namibian Constitution that are of particular relevance to sound environmental management practice, viz. Articles 91(c) and 95(l). In summary, these refer to:

- Guarding against over-utilisation of biological natural resources;
- Limiting over-exploitation of non-renewable resources;
- Ensuring ecosystem functionality;
- Protecting Namibia's sense of place and character;
- Maintaining biological diversity; and
- Pursuing sustainable natural resource use.

The above therefore commits the State to actively promote and sustain environmental welfare of the nation by formulating and institutionalising policies to accomplish the abovementioned sustainable development objectives.

2.2 ENVIRONMENTAL MANAGEMENT ACT (ACT 7 OF 2007)

In giving effect to Articles 91(c) and 95(l) of the Constitution of Namibia, general principles for sound management of the environment and natural resources in an integrated manner have been formulated. This resulted in the Environmental Assessment Policy of 1995. To give statutory effect to this Policy, the Environmental Management Act (Act 7 of 2007) was gazetted on 27 December 2007 in, Government Gazette No. 3966. Part 1 of the Environmental Management Act describes the various rights and obligations that pertain to citizens and the Government alike, including an environment that does not pose threats to human health, proper protection of the environment, broadened *locus standi*¹ on the part of individuals and communities, and reasonable access to information regarding the state of the environment.

Part 2 of the Act sets out a number of principles of environmental management, as follows:

- Renewable resources shall be utilized on a sustainable basis for the benefit of current and future generations.
- Community involvement in natural resource management and sharing in the resulting benefits shall be promoted and facilitated.
- Public participation in decisions affecting the environment shall be promoted.
- Fair and equitable access to natural resources shall be promoted.
- Equitable access to sufficient water of acceptable quality and adequate sanitation shall be promoted and the water needs of ecological systems shall be fulfilled to ensure the sustainability of such systems.
- The precautionary principle and the strategy of preventative action shall be applied.

¹ The right or capacity to bring an action or to appear in a court, from Latin: a place for standing.

- There shall be prior environmental assessment of projects and proposals which may significantly affect the environment or use of natural resources.
- Sustainable development shall be promoted in land-use planning.
- Movable and immovable cultural and natural heritage, including biodiversity, shall be protected and respected for the benefit of current and future generations.
- Generators of waste and polluting substances shall adopt the best practicable environmental option to reduce such generation at source.
- The polluter pays principle shall be applied.
- Reduction, reuse and recycling of waste shall be promoted.
- There shall be no importation of waste into Namibia.
- Promotion of the coordinated and integrated management of the environment.
- The Minister of Environment and Tourism was enabled to give effect to Namibia's obligations under international environmental conventions.
- Sustainable Development Commission and Environmental Commissioner have been provided for.

As the organ of state responsible for the management and protection of its natural resources, the MET:DEA is committed to pursuing these principles of environmental management.

The recently gazetted regulations promulgated in terms of the Environmental Management Act, identify certain activities which could have a substantially detrimental effect on the environment. These listed activities require Environmental Clearance from the competent environmental authority, i.e. MET:DEA, prior to commencing.

2.3 WATER RESOURCES MANAGEMENT ACT (ACT 24 OF 2004)

This Act provides a framework for managing water resources based on the principles of integrated water resources management. It provides for the management, development, protection, conservation, and use of water resources. Relevant principles of the Act include, *inter alia*:

- Equitable access for all people to safe drinking water is an essential basic human right to support a healthy productive life;
- Harmonisation of human water needs with the requirements of environmental ecosystems and the species that depend on them, while recognising that the water resource quality for those Ecosystems must be maintained;
- Promotion of the sustainable development of water resources based on an integrated water resources management plan which incorporates social, technical, economic, and environmental issues;
- Development of the most cost effective solutions, including conservation measures, to infrastructure for the provision of water; and
- Promotion of water awareness and the participation of persons having interest in the decision-making process should form an integral part of any water resource development initiative.

This Act is relevant since the project will abstract seawater and discharge effluent back to the ocean, with product water being entered into the NamWater system. In terms of the Act "water source" is defined as "water from a watercourse, an aquifer or the sea, and includes meteoric water" while "water resource" includes a "watercourse, an aquifer and the sea and meteoric water" and thus the provision of the Act apply to seawater abstraction.

The consequence is that Rössing Uranium will have to obtain a licence to abstract and use seawater and will have to comply with the various provisions of the Act set out in Part VIII of the Act (Sections 32 to 45). Section 32 prohibits the abstraction or use of water without a licence and significantly specifically states that the term "abstract water" includes the abstraction of marine water for any

purpose (Section 32(1)). The required Water Use License will be applied for by Rössing Uranium independently and as a separate process to the SEIA.

There are a number of requirements which must accompany the application to abstract water. Of particular importance is Section 33(3)(c) which stipulates that an application for a licence to abstract and use water must be accompanied by a number of requirements including “an environmental impact analysis of the proposed abstraction of water upon the environment and existing water users and water resources” .

Part XI of the Act (Sections 56 to 71) which deals with Water Pollution Control is relevant to the proposed desalination plant in light of the brine discharges back to the ocean. The opening section stipulates that a person may not discharge effluent directly or indirectly to any ‘water resource’ (defined to include the sea as seen above) unless such person is in compliance with a permit issued in terms of Section 60. The term “effluent” is defined to mean “...any liquid discharged as a result of domestic, commercial, industrial or agricultural activities”. Section 59 gives details on the information required for an effluent discharge permit.

It should be noted that this may be repealed by the new Water Resources Management Act (Act 11 of 2013), which has been accepted by parliament but not yet promulgated. Under the new act, Rössing Uranium may be required to register as a water services provider in terms of Section 41, which reads:

41 (1) A person may not operate as a water services provider without holding a licence as a water services provider issued by the Minister under this Act that authorises the person -
(a) to distribute water to end-consumers; and
(b) to operate a water treatment facility.

Under the new Act, a combined abstraction and discharge licence may also be applied for in terms of Section 47, as follows:

47. The Minister may, with the consent of the applicant concerned, grant a combined licence to abstract and use water and to discharge effluent if the requirements prescribed by this Act for a separate licence for each type of work or activity are complied with.

Rössing Uranium acknowledges the requirements in terms of the new Act and will adhere to these as required after promulgation.

2.4 THE NATIONAL HERITAGE ACT (ACT 27 OF 2004)

The Act makes provision for the protection and conservation of places and objects of heritage significance and the registration of such places and objects. The National Heritage Council has been established to identify, conserve, manage, and protect places and objects of heritage significance.

2.5 THE SOIL CONSERVATION ACT (ACT 76 OF 1969)

The Act makes provision for the prevention and control of soil erosion and the protection, improvement and conservation of soil, vegetation and water supply sources and resources, through directives declared by the Minister.

Care is to be taken in identifying any potential impacts on soil, vegetation, water supply sources, and resources by firstly trying to avoid these impacts. Where they can't be avoided, management measures should be implemented to reduce the significance of the impact(s).

2.6 THE NATIONAL POLICY ON COASTAL MANAGEMENT FOR NAMIBIA (2013)

The policy aims to “provide a framework to strengthen governance in Namibia’s coastal areas to realise long-term national goals defined in Vision 2030 and the more specific targets of National Development Plans, namely sustainable economic growth, employment creation and reduced inequalities in income”. One of the objectives of the policy is to provide a foundation for improving the quality of life of coastal communities while doing so responsibly. The proposed project is therefore in line with this policy as it aims to increase water security.

2.7 THE INTEGRATED COASTAL MANAGEMENT BILL (2014)

Once enacted the bill aims to establish a system of integrated coastal management in Namibia in order to promote the conservation of the coastal environment, maintaining the natural attributes of the coastal landscapes and seascapes, and ensuring the sustainable development and use of the natural resources within the coastal zone that is also socially, economically and ecologically justifiable. Furthermore it aims to define the rights and duties in relation to coastal areas; to determine the responsibility of the organs of state in relation to the coastal areas; to control pollution in the coastal zone, development of the coastal environment and other adverse effects on the coastal environment; to give effect to Namibia’s international obligations in relation to coastal matters; and to provide for related matters connected therewith.

2.8 THE NATIONAL POLICY ON HUMAN-WILDLIFE CONFLICT MANAGEMENT (2009)

The aim of the policy is to manage human-wildlife conflict efficiently and effectively, for example the destruction of water supply infrastructure.

The location of the project near the Dorob National Park and Important Bird Area of the salt pans necessitates the need to address potential conflicts between humans and wildlife during the construction phase as well as the operational phase.

2.9 PROPOSED CLIMATE CHANGE STRATEGY AND ACTION PLAN (2009)

The purpose of this document is to put Namibia’s commitment to achieving its Millennium Development Goals into action. The plan lists, *inter alia*, the following guiding principles:

- Sustainable development and ensuring environmental sustainability;
- Sustainable and equitable use of natural resources; and
- Human rights-based development.

The project therefore addresses some of the above as it will increase water security, as well as provide a medium-term integrated water supply system that would ensure sustainable utilisation of the available resources.

2.10 THE NAMIBIA VISION 2030

The principles that underpin Vision 2030², a policy framework for Namibia's long-term national development, comprise the following:

- Good governance;
- Partnership;
- Capacity enhancement;
- Comparative advantage;
- Sustainable development;
- economic growth;
- National sovereignty and human integrity;
- Environment; and
- Peace and security.

Vision 2030 states that natural environments are disappearing quickly. Consequently the solitude, silence and natural beauty that many areas in Namibia provide are becoming sought after commodities and must be regarded as valuable natural assets. Vision 2030 emphasises the importance of promoting healthy living which includes that the majority of Namibians are provided with safe drinking water. The importance of developing wealth, livelihood, and the economy is also emphasised by Vision 2030. This includes infrastructure provision like transport, communication, water, and electricity. This development will improve the viability of the Rössing Uranium mine, a significant employer and contributor to the local economy. Rössing Uranium's desalination plant will also inadvertently free up much needed water in the Erongo region which can be applied to alternative social and developmental objectives in the region.

2.11 SOCIAL POLICIES

2.11.1 The MET Policy on HIV and AIDS

The relevance of this policy for the proposed project stems from the fact that construction activities may involve the establishment temporary construction workforce. Experience with other construction projects in a developing-world context has shown that, where construction workers have the opportunity to interact with local community, a significant risk is created for the development of social conditions and behaviors that contribute to the spread of Human Immune-deficiency Virus (HIV) and Acquired Immune Deficiency Syndrome (AIDS).

In response to the threat the pandemic poses, MET has developed a policy on HIV and AIDS. This policy, which was developed with support from United States Agency for International Development (USAID) and German Federal Enterprise for International Cooperation (GTZ) (a German Development Fund), provides for a non-discriminatory work environment and for workplace programs managed by a Ministry-wide committee.

² Derived from Namibia's Green Plan drafted by MET in 1992 and followed by the sequence of National Development Plans.

2.12 BIODIVERSITY LEGISLATION AND POLICIES

The following legislation and policies, aimed at biodiversity conservation and management, may also be relevant for the proposed project:

- Convention on Biological Diversity (2000);
- Convention to Combat Desertification (1997);
- RAMSAR Convention (1975);
- Soil Conservation Act (Act 76 of 1969);
- United Nations Framework Convention on Climate Change (1992); and
- Climate Change Policy (draft).

The applicability of the aforementioned policies and legislation will be explored in further detail during the SEIA phase, based on the findings of the impact assessment and specialist investigations. The applicability and relevance of the legal framework will unfold during the SEIA phase.

2.13 RIO TINTO ENVIRONMENTAL AND SUSTAINABILITY POLICIES³

The following policy statement is provided on the Rio Tinto web page and provides a brief overview of their sustainability policies.

Sustainable development is commonly defined as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs”. While it cannot be achieved by one organisation on its own, Rio Tinto believe that our business can make an important contribution to the ongoing, global transition to sustainable development.

Because Rio Tinto recognises a responsibility to all their stakeholders and to the wider world, our commitment to sustainable development is integrated into everything we do. Rio Tinto operations give us the opportunity to bring long-lasting positive change to the communities, regions, and countries where we work, and the metals and minerals are transformed into end products that contribute to higher living standards.

To build and protect Rio Tinto’s reputation, there is a relentless focus on embedding and living these values – accountability, respect, teamwork, and integrity – and on deepening sustainable development capabilities.

Rio Tinto must maintain safety as our absolute priority – eliminating workplace fatalities, and continuing to reduce incident, injury, and illness rates towards our goal of zero harm. Recognising that strong leadership is essential for achieving our safety goals, we will continue to improve our leaders’ engagement around safety risks.

Rio Tinto’s approach to sustainable development and business integrity are, we believe, competitive advantages for us. They help us gain access to high quality resources and business development opportunities. In addition they allow us to attract talented people, engage with communities, reduce

³ Source: http://www.riotinto.com/sustainabledevelopment2012/strategy/our_sustainable_development_strategy.html

environmental impacts, manage risks effectively, and decrease operating costs. This enables us to give more confidence, and deliver higher returns, to our stakeholders.

Key policy aims are to:

- Wherever possible we prevent, or otherwise minimise, mitigate and remediate, harmful effects of the Group's operations on the environment.
- Excellence in environmental performance is essential to our business success. Compliance with all environmental laws and regulations is the foundation on which we build our environmental performance.
- Rio Tinto develops Group wide standards and builds systems to identify, assess and manage environmental risk to achieve continuous improvement in environmental performance.
- Rio Tinto businesses, projects, operations and products should contribute constructively to the global transition to sustainable development.
- Rio Tinto contributes to sustainable development by helping to satisfy global and community needs and aspirations, whether economic, social or environmental. This means making sustainable development considerations an integral part of our business plans and decision making processes.

2.13.1 Rössing Uranium Limited Policies

In order to accomplish Rössing Uranium's vision and commitment to social responsibility and sustainability, Rössing Uranium will:

- Commit to operate Rössing Uranium's business with respect and care for both the local and global environment in order to prevent and mitigate residual pollution;
- Be in full compliance with all applicable legislation, standards and requirements;
- Provide adequate training and resources to employees, contractors and visitors; and
- Enhance biodiversity protection by assessing and considering Ecological values and land-use aspects in investment, operational and closure activities.

2.13.2 Rössing Uranium's HSE system

Rössing Uranium has an HSE management system in place, which is consistent with the ISO:14001 Environmental Management System (EMS) amongst others. It is recommended that the management strategies identified hereunder be integrated into the existing EMS component of the HSE management system. In terms of the HSE structure, this SEMP would assist in the identification of the key environmental aspects and will serve to guide Rössing Uranium in the continued formulation of suitable Standard Operating Procedures and in attaining the continual improvement objective.

Due to the scale and complexity of Rössing Uranium's operations, the use of a formalised HSE is essential in allowing the company to optimise, coordinate, and manage the various operations, personnel, plant and equipment, and their interactions, in a manner that demonstrates consistent application of environmental best practice. Through the application of the HSE system, Rössing Uranium can identify and minimise potential impact of its activities on the environment. A brief overview of the elements of an ISO: 14 001 EMS, as entrenched in the HSE, is now provided.

An ISO:14 001 EMS aims to develop a systematic management approach to the management of environmental controls of the organisation. One of the key principles of this approach is the idea that continual improvement in the organisation's environmental management can be achieved and demonstrated.

Planning is accomplished with the formulation of an environmental policy followed by the identification the environmental concerns (Aspects) and then by defining what measures can be implemented to

control or mitigate these aspects (Objectives and Targets). An organisational structure, and system of personnel responsibilities, competency and training, are then developed and implementation begins. Communication lines, documentation control and procedural documents, operational control and emergency preparedness define the operational portion of the program. These items are usually included in an EMS Manual, which documents a program to accomplish the Objectives and Targets established at the outset. The organisation's methods for measuring and monitoring its environmental impacts are also included in the manual, along with practices for identifying non-conformances and for implementing corrective and, or preventive actions. The environmental monitoring, along with routine systems audits and record keeping, constitute the EMS checking and corrective action program. The final stage in the program involves a routine management review of its activities and the associated procedures, any improvements to the system based on the lessons learnt and performance observed during the previous cycle are brought into effect.

RÖSSING URANIUM'S HSE POLICY

The Rössing Uranium HSE Policy is the overarching and guiding document that informs the manner in which the company conducts its business activities and manages impacts on the environment, the health, and safety of its employees and on the public at large. Rössing's Health, Safety and Environmental (HSE) Policy is as follows:⁴

Excellence in HSE management is one of the foundations of Rössing's vision to be the safest and most efficient producer of uranium in the world. This is in line with our commitment to zero harm, corporate citizenship, social responsibility, and sustainability.

To accomplish this, Rössing Uranium Limited is committed to -

- the protection of the health and safety of our employees, contractors, stakeholders, and neighboring communities;*
- operating our business with respect and care for both the local and global environment to prevent and mitigate residual pollution;*
- understand and manage the effects of our product through its entire life cycle;*
- work with integrity and be in full compliance with applicable legislation and apply industry standards and best practice;*
- seek continual and sustained improvement in HSE performance to create a zero harm work environment;*
- identify and assess hazards arising from our activities and manage associated risks to the lowest practical level;*
- enhance biodiversity protection by assessing and considering ecological values and land-use aspects in investment, operational and closure activities;*
- continue in our efforts to raise the awareness of HSE issues in our neighbouring communities;*
- regularly review our performance and publicly report our progress; and*
- communicate our commitment to this HSE policy to all interested and affected parties.*
- In implementing this policy, we will engage in constructive dialogue with our employees, contractors, neighbouring communities and all other stakeholders in sharing relevant information and responsibility for meeting our requirements.*

⁴ Source: http://www.rossing.com/health_policy.htm

- *The HSE policy document is complemented by our HSE strategy document which is readily available to all our stakeholders.*

RÖSSING URANIUM'S HSE HAZARDS / ASPECTS REGISTER

Each area or activity is inspected to identify potential risks to the social or natural environment. The hazards or aspects are then listed in a register and ranked or prioritised according to the potential significance of the resulting impact. Where a hazard / aspect is rated as being of high or critical priority, a HSE Management Improvement Plan is set, which sets out an action plan for the management of certain hazards / aspects and clearly defines the roles and responsibilities, task deadlines and monitoring and reporting requirements. Medium and serious priority hazards / aspects are subject to ongoing monitoring programmes to ensure continued effective management.

KEY STAGES IN THE HSE MANAGEMENT SYSTEM

The information contained in the Risk Register and that contained in the SEMP, will assist in the operational review process, as they forego the need to undertake the initial stages of the HSE management system, namely, the identification of HSE aspects. The mitigation measures and recommendations proposed in the SEMP will be carried through into the Risk Register, which can be used to inform the development of objectives and targets as well as offer direction in the formulation of the Environmental Management Programmes and Operational Controls for the desalination plant and in general.

A HSE Improvement Plan is the all-important product of the HSE management system and is vital in ensuring that the management strategies are implemented and the effectiveness monitored. For each priority environmental aspect, a series of mitigation actions and an implementation programme are identified by the Environmental Coordinator, in certain cases with the assistance of the line manager, HSE Management specialists or specialist consultants. Progress and shortcomings in the implementation of the various Improvement Plans are reported on by the Environmental Coordinator during routine HSE meetings.

COMPETENCE, TRAINING AND AWARENESS

All employees and contract workers under Rössing Uranium's employment should possess the necessary knowledge and competence to carry out their delegated tasks in compliance with Rössing Uranium's HSE management system, especially those appointed to tasks that have the potential to cause significant environmental damage. Both Environmental Coordinators and the Health and Environment (H&E) officers will identify training requirements for the various departments and work areas and undertake training of employees and contract workers in the respective areas. A generic Induction Training Course is delivered to all new employees, which deals with overarching health, safety, and environmental issues on the Rössing Uranium premises. Task-specific training can take place in the various departments and sections on an *ad hoc* basis. Records of all training courses are to be kept on the HSE management system register.

COMMUNICATION AND REPORTING

To ensure that all levels of management are kept abreast of the performance in terms of the HSE management system, it is recommended that reporting occurs in a frequent and formalised fashion. The existing HSE management system reporting structure is adequate and will be expanded to incorporate the proposed desalination plant operations, as may be applicable. Rössing Uranium will ensure that sufficient capacity exists within the HSE sections to ensure that the various roles and responsibilities of the respective sections can be fulfilled.

The HSE Advisor is responsible for the collection and recording of data, which is collated into a weekly report and submitted to the relevant Environmental Coordinator. The collected data in the weekly reports is then collated by the Environmental Coordinators into a monthly HSE report which is interrogated and interpreted by the Environmental Management and Health Management sections and collated into a single HSE month-end report. This report is distributed to the Superintendent: Environmental Management, who is required to review and verify the content and quality of the environmental reporting. The Superintendent: Environmental Management, when satisfied, then approves the report and distributes it to all the Departmental Managers. The HSE Manager is responsible for generating an annual environmental report which is a key informant in the annual review of environmental policies and strategies.

The HSE Manager is responsible for compiling data on the environmental performance of Rössing Uranium for the monthly report, which is reviewed by the Managing Director before being forwarded to Rio Tinto. The HSE Manager is also responsible for facilitating communication between the various levels and functions of the Rössing Uranium organisation in response to customer, investor, stakeholder, and authority requirements. The Environmental Management section is responsible for ongoing formal and internal communications with the various regulatory agencies regarding environmental matters and Rössing Uranium operations.

Effective communication and reporting on environmental monitoring data and performance is key to the effective management of environmental aspects of concern and central to the HSE management system objective of continual improvement.

All reporting resulting from the upgraded desalination plant shall be subject to the document control procedures in effect at Rössing Uranium. All new HSE management system operational procedures, environmental data, audit reports, and Standard Operating Procedures resulting from the desalination plant must be effectively captured, distributed, and controlled in terms of the HSE management system by the Environmental Management Section.

OPERATIONAL CONTROLS

Operational controls are essential for the management of specific activities that may impact on the environment. The Environmental Management section is responsible for the generation of procedural documents for specific operations and activities where environmental management and mitigation measures are a priority. The Environmental Management section is responsible for monitoring performance against the operational procedures and reporting on non-conformances during the monthly HSE meetings. Departmental Managers are responsible for the rectification of any such non-conformances and the implementation of any corrective actions defined by the Environmental Coordinator. Contractors are required to abide by Rössing Uranium's HSE operational controls and procedures as well as the rectification of any non-conformances and implementation of any corrective actions deemed necessary by the Environmental Management Section.

ORGANISATIONAL FRAMEWORK

The various appointments and their associated roles and responsibilities identified as being central to the adoption and implementation of this SEMP are discussed under the respective headings to follow and are derived from Rössing Uranium's existing HSE management system.

Managing Director

The Managing Director is accountable to the Board for all HSE matters and is the custodian of the HSE Policy.

General Managers

General Managers are responsible for ensuring that the HSE Policy is implemented and are responsible to the Managing Director for ensuring that the necessary reporting procedures and structures are in place and that the annual environmental targets are met.

HSE Manager

The HSE Manager is the custodian of the HSE management system and is responsible for the implementation of the strategic aspects of the HSE management system. The strategic portion of the HSE management system determines the overall direction, priority, time frame, and resources allocated to Environmental Management at Rössing Uranium. The HSE Manager reports directly to the General Manager: Operations.

The HSE Manager is responsible for establishing procedures for internal communication on environmental issues between the various levels and functions within the organisation. The HSE Manager is also responsible for the procedures for external communications on environmental issues whereby customer/investor/stakeholder requirements, changes in legislation, changes in business objectives etc. are recognised, internalised, and transformed into changes in the operations. The HSE Manager is thus responsible for ensuring that the current interface between Rössing Uranium, its stakeholders, shareholders, Interested and Affected Parties (I&APs) and the authorities incorporates HSE issues and that relevant issues are communicated to the organisation.

The implementation of the operational HSE management system in each department is the responsibility of the individual departmental managers. They do, however, work according to the guidelines (or HSE programme) maintained by the HSE Manager.

Departmental Manager

The Departmental Manager of each department is responsible for the implementation of the HSE management system within the department, including the allocation of resources in the form of training and awareness, finance and operational control e.g. corrective actions and continual improvement.

Environmental Superintendent

The HSE Superintendent is the appointed management representative of the HSE management system at Rössing Uranium.

The Environmental Superintendent is responsible for the overall implementation of the HSE management system at Rössing Uranium and it is this person's responsibility to coordinate implementation efforts throughout all departments. The Environmental Superintendent liaises closely with the departmental managers, superintendents and the Environmental Coordinators in order to ensure that the programme is correctly managed and maintained. The Superintendent: Health Management facilitates and co-ordinates specialist environmental projects, should such be required.

The Environmental Superintendent is also responsible for reporting on the performance of the HSE management system to top management for review.

Line Superintendent

The Line Superintendent is responsible for all environmental aspects as a line function and is tasked with ensuring that the objectives and targets as stipulated for each environmental aspect in his/her

area are met. The Line Superintendent will therefore ensure that all target dates stipulated in a HSE system are met.

Environmental Coordinator

The Environmental Coordinator assists the Departmental Manager and Superintendents with the implementation of the HSE management system in their respective work areas. The Environmental Coordinator facilitates:

- Internal communication on environmental issues on a departmental level between the various levels and functions within the department;
- Collation and interpretation of monitoring results based on the objectives and targets identified for each environmental aspect;
- Setting up and the updating of Environmental Management Programs, through the annual HSE management system reviews; and
- Identification of training requirements.

The Environmental Coordinator ensures that the operational HSE management system is aligned with the Environmental Management Programme for Rössing Uranium and fulfils a facilitation, communication, and monitoring function.

HSE Officer

A HSE Officer is responsible for the monitoring of those aspects within the department that are stipulated in the monitoring programme.

3 PROJECT DESCRIPTION

The project description that follows relates to the SEIA optimised layout, which has been recommended as the go forward option for the project. It is important to note that this project description differs slightly from the project description provided in the SEIA. The SEIA described the Base Case alternative, which was the conceptual project that emerged from the prefeasibility study completed at the conclusion of the SEIA scoping phase. The Base Case and identified alternatives were then subjected to environmental assessment. The SEIA optimised layout is a combination of the Base Case and Project Alternative 1 (where the desalination plant was located on site alternative 2), and the key differences are that the desalination plant has been shift north east so as to avoid the core nesting area for the Damara terns, but is kept further south than site locality 2, and in so doing avoid potential increases in noise impacts to the “green houses” and the guano platforms. Secondly, the brine discharge pipeline runs to the northern discharge point as opposed to the southern discharge site, this also has the benefit of avoiding potential disturbances to the Damara tern nesting site (amongst other lesser benefits, i.e. minimising disturbances to the salt Works’ service road network and salt pan berms)).

3.1 PROJECT OVERVIEW

This subsection provides the reader with a description of what is likely to occur if the project receives clearance from MET:DEA and Rössing Uranium moves forward with the project (i.e. the SEIA optimised layout). The key activities occurring in each phase of the project are briefly described as follows. It should be noted that the project may undergo minor adjustments during the detailed design process, but these are unlikely to significantly impact on the assessed impacts (provided that there are not substantial relocations of infrastructure or expansions in project footprint).

3.1.1 Pre-construction phase

Following receipt of environmental clearance from MET:DEA, Rössing Uranium and their consultants would complete the detailed planning and design phase. The findings in the SEIA and any conditions contained in the MET:DEA clearance would be considered and catered for in the detailed design and associated planning. During this period, tenders called, adjudicated and an eligible contractor/s appointed to undertake the various construction activities.

During this time Rössing Uranium would also resolve any outstanding legal requirements and permits (i.e. a licence to abstract and use seawater, an effluent discharge permit and a licence to operate as a water services provider) which are required to operate the plant. During the period Rössing would also negotiate and secure agreements for use of the property and any services agreements i.e. use of the NamWater pipeline for transference of product water, NamPower for the supply and maintenance of electricity, and the Swakopmund Municipality for the disposal and treatment of sewage and solid waste, etc.

3.1.2 Construction phase

The construction phase of the project is expected to last approximately 18 months in duration. However, due to the strategic and financial significance of the project to the Rössing mine it is possible that the project could be accelerated, bringing the total build time down to around 12 months. At the peak of construction the project is expected to employ approximately 50 persons. Where construction personnel are not from the area it is likely that they will take up residence in Swakopmund for the duration of the project (through property lease holds). The various project components are described in greater detail in subsection 3.2 to follow.

The contractor would commence by establishing the various works areas and temporary construction areas, including a construction yard. The main construction yard would be located adjacent to the main desalination plant and smaller construction yards or laydown areas would be established at the Seawater intake Jetty and the Brine outfall. The existing salt works road will also be upgraded to cater for the construction and operations phase of the facility. The construction yards would be temporarily fenced for safety and security purposes. Housed within these areas would be container offices, ablution facilities, workshop containers, employee recess areas, general materials stockpiling, fuel and oil stores, and laydown areas and parking for vehicles, plant and equipment. In the case of the brine outfall and seawater intake, enough area will need to be set aside for storage and construction of the steel lattice jetty framework and for the connection of pipeline strings which need to be constructed as a single length, and pulled into their final positions, either on the jetty, or into an excavated trench through the beach and intertidal zone. The marine works component is the most challenging aspect of the build as it requires construction in the intertidal zone placing people and equipment in a precarious and unpredictable environment. To enable this work the contractor may need to extend a working platform (using beach sand and rock) out into the surf and drive steel piles to protect the work area from waves, enabling plant, equipment and people access to these areas for the construction of these structures.

Construction of the desalination plant would involve routine construction processes, commencing with site clearance, placement of concrete foundations and plinths onto which the building walls and various items of plant, equipment and pipelines would attach. The desalination plant building would then be erected and at the same time the various components making up the desalination plant (including the modular RO trains, pumps, compressors and chemical storage tanks) would be imported onto site and affixed to the concrete plinths or the building structure, where after the contractor would commence with the tying in of the components through an involved network of pipes and electrical connections. One of the larger tasks associated with the construction of the desalination plant will be construction of the various concrete holding tanks and the ancillary structures, including the various chemical storage and dosing areas, which must all be equipped within suitable bunded storage facilities. The chlorine storage facility for example is a specialized and sealed storage area, containing a number of safety features including chlorine gas detection systems and alarms. The construction of the desalination plant building will also involve the construction of a Motor Control Centre (MCC), office space, ablution facility and conservancy tanks, kitchen area, first aid station, workshop and spares storage areas and any other facilities that may be required for the operation of the plant.

The remainder of the construction work involves the trenching and laying of various pipelines and electrical cables between the key components.

Most construction processes (with the exception of marine works) are common and well understood and good repository of environmental best practices have been developed to manage these processes to reduce excessive environmental damage. The SEMP developed for this project and incorporates these generic mitigation and management measures, and if implemented affectively, can significantly reduce the environmental impact of construction activities to minimal levels.

3.1.3 Operations phase

The proposed desalination plant can produce up to 10M³/d of potable water in every 24 hour cycle. Water production times and rates will vary depending on demand at the mine, peak and off-peak electrical demand periods (and associated electrical rates), routine maintenance shutdowns, breakdowns and upset conditions (i.e. ocean storms or red tide conditions). The production rate for the plant should however average at 8.2M³/d or approximately 3Mm³ per annum. At peak production the plant will abstract up to 25M³/d of seawater, produce 10M³/d of potable water and discharge 15M³/d back to the ocean as brine. The plant will be designed to optimise electrical efficiency and

will be equipped with energy recovery systems to further improve the electrical efficiency and performance of the plant. The approximate footprint of the desalination plant is 200 x 100m, however larger areas have been considered initially to allow for flexibility (Trade-Off Study Report 5: Optimum Plant Location, 2014). The various project components are described in greater detail in subsection 3.2 to follow.

During the operational phase, the plant will be staffed with an estimated 12 to 18 contract staff working on a shift basis or as required to satisfy water production objectives at any given time. It is likely that the plant will be operated by Gecko under an Operation and Maintenance Contract with Rössing Uranium.

3.1.4 Decommissioning phase

The plant will be designed to have a 10 year operational life, which coincides in with the current Rössing Uranium Life of Mine plan. At the end of the design life period, the plant may be refurbished for continued operation, upgrade, or may be decommissioned, broken down and the site rehabilitated, or sold as a going concern to another mining house or NamWater, depending on the situation and needs at that time. Given that the plant will be producing water to potable water standards and will already be tied in with the existing NamWater system, decommissioning of the plant would seem to be a wasted opportunity.

3.2 PROJECT COMPONENTS

The project can be divided into the following main components, which are described in greater detail under respective headings to follow and conceptually shown in Figure 3 to follow:

- Seawater intake system;
- Seawater pre-treatment system;
- desalination plant;
- Ancillary structures and infrastructure;
- Electrical supply system;
- Product water system and pipeline; and
- Effluent treatment and disposal system.

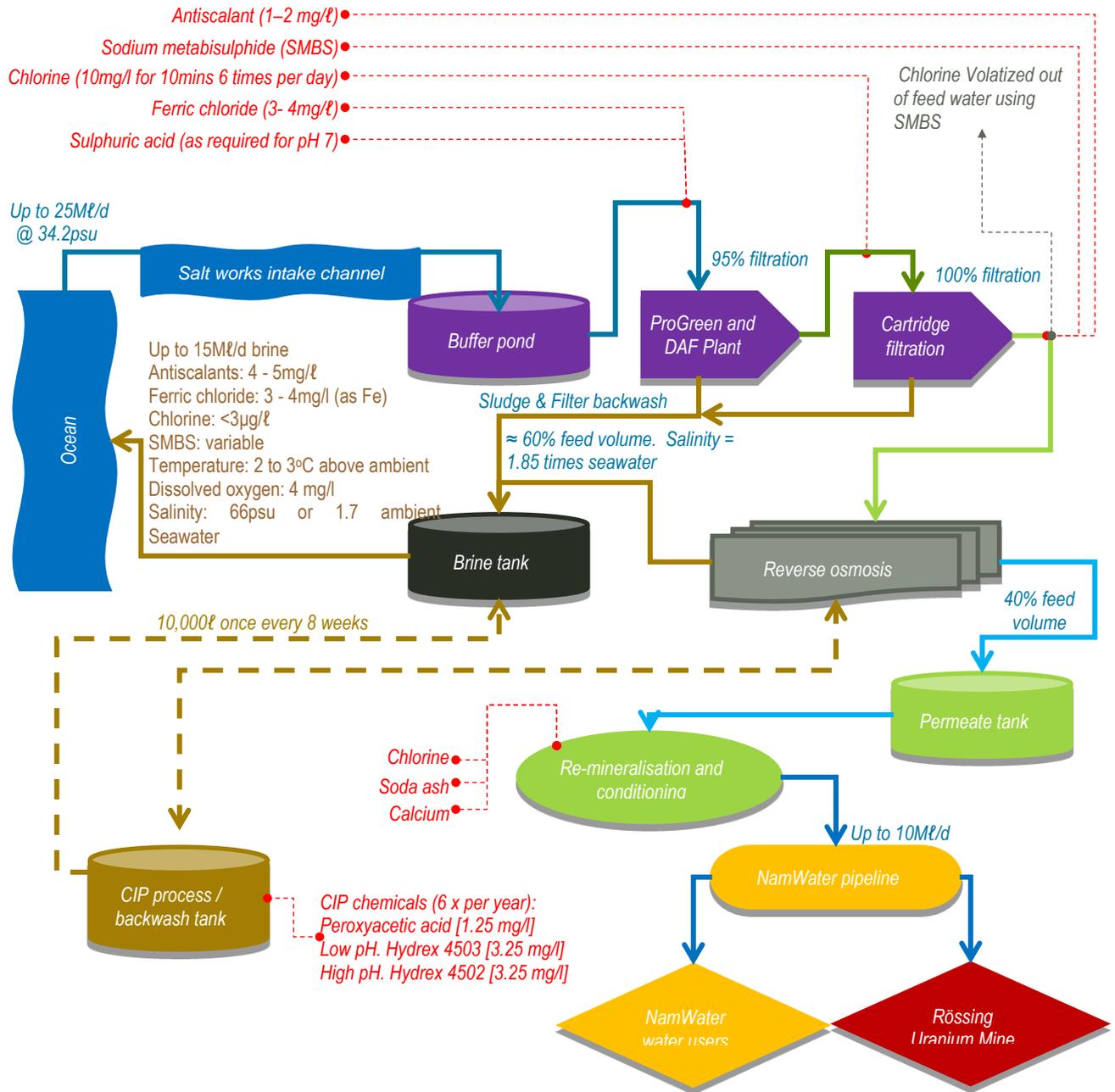
These components are described in further detail below, in terms of design, capacity and footprint, etc. The description provided here is referred to as the “SEIA optimised layout” in the assessment and was deemed the best way forward on completion of the impact assessment phase and what has been put to the MET:DEA for clearance. The environmental policies and procedures contained in this SEMP are therefore based on this SEIA optimised layout. Figure 3 to follow shows the SEIA optimised layout, at the time of submission and Figure 4 following that, provides an overview of the RO process, treatment chemicals, and waste stream associated with the plant, these may vary slightly as the detailed design process unfolds.



Figure 3: SEIA optimised layout

DRG. No. _____ DRAWING TITLE _____ REFERENCE DRAWINGS _____		AMENDMENTS TO PLANT POSITION 27.10.2014 H CHANGES MADE, INTAKE & DISCHARGE PIPES 21.10.2014 G SITE POSITION MOVED 17.10.2014 F SITE ADDED, OPTION 2 09.10.2014 G.M., K.T. E CHANGES MADE, INTAKE & DISCHARGE PIPES 08.10.2014 G.M., K.T. D CHANGES MADE, PIPELINE AND PONDS 30.09.2014 C CHANGES MADE, CHANNEL AND PONDS 26.09.2014		DESIGNED K.T. 14.07.2014 DRAWN N.U. 14.07.2014 CHECKED K.T. 14.07.2014 PROJ. MANAGER J.G.T. 14.07.2014 PROJ. PRINCIPAL J.v.E. 14.07.2014		CLIENT  GECKO WATER (PTY) LTD		PROJECT/DRAWING TITLE RÖSSING DESALINATION PLANT SEIA OPTIMIZED LAYOUT		SCALE 1:5000		SHEET SHEET 1 OF 1	
REV. _____ DESCRIPTION _____ DATE _____ REV BY/CHKD _____		APPROVED : _____		11 Nelson Street Knysna Tel: (044) 302 4800 Email: kogn@rhnhv.com Web: www.rhnhv.com		P.O.Box 1480 Knysna, 6570 Western Cape		CONTRACT No. _____ PROJECT No. CPT.000188		DRAWING No. CPT_0188_1_002_(E2)			

Figure 4: RO Project Process Flow Diagram



3.2.1 Seawater intake system

The seawater abstraction system would involve a shallow water direct abstraction system, with relatively simple screens around the pump intakes to prevent the abstraction of marine creatures and flotsam. An abstraction location 160m south of the existing Salt Works jetty has been identified and meets the various technical, financial and environmental requirements. This site is located at a natural shore perpendicular shelf (which provides a good foundation for the intake jetty) that extends some 40m from the 0m mean sea level contour line. The intake screens would be located on the seaward side of the shelf within a depression area. The fixed screen opening has been specified to be 100mm with a maximum intake velocity of 0.15m/sec to minimize impingement/entrainment of marine biota. This area is protected from large waves by submerged shelves on its seaward side. The shelf's level is just above mean sea level, which allows construction of a large portion of the jetty to be less tide dependent, potentially reducing construction downtime (Trade Off Study Report 1: Intake Site Selection, 2014).

A set of pumps and pipes placed on a new jetty would abstract water from the shallow surf zone. The jetty would be similar in concept, to that already used by the Swakopmund Salt Works only upgrade to meet current Rössing HSE and engineering standards, and shown here in Figure 5.

Figure 5: Existing seawater abstraction jetty for the Salt Works



Two low-lift, high-volume pumps and parallel 650mm diameter pipelines (one duty and one standby) would abstract up to ~26M³/d of seawater from the ocean and drain into the existing Swakopmund Salt Works seawater canal system and gravitate to the new seawater buffer pond near the desalination plant. The canal extends around the northern and eastern most side of the Swakopmund Salt Works pond complex. From here the seawater would enter into a new, purpose built seawater buffer pond and would then be abstracted directly and piped a short distance to the desalination plant's pre-treatment facilities.

Using the canal and a new pond system as part of the seawater intake system is expected to have the added benefit of reducing the suspended solids load in the seawater and provide a higher quality and more homogenous (biological, physical and chemical) feed water quality than a direct abstraction from the sea. To achieve a target reduction of approximately 50% in suspended solids concentration, it is estimated that 24 hours of retention time at the peak design flow rate should be provided. Further reductions in suspended solids can be achieved with longer retention times, and the proposed modification of the existing pond layout can achieve an estimated 42 hours feedwater retention (Trade-Off Study Report 4,7 & 9: Seawater Pipeline vs Seawater Channel, 2014).

The system will also provide operational storage and a buffer against sudden changes in ocean conditions, such as red tide, sulphur eruptions and ocean storms. The limitation of a shallow seawater intake is that it results in potential downtime for the seawater pumps when water levels drop below accessible levels during low tide events. The recommended intake option is therefore based on flows up to 339l/s and downtime of up to 3.5 hours per day. Therefore allowing at least 4 hours of storage, to achieve continuous transfer of seawater to the plant, is considered prudent (Trade-Off Study Report 4,7 & 9: Seawater Pipeline vs Seawater Channel, 2014).

It should be noted that prior to using the canal and pond it will need to be dredged and modified to ensure it is capable of accommodating the maximum daily volumes, whilst continuing to service the needs of the existing Swakopmund Salt Works operations. The upgrading of the channel would involve cleaning out deposited sand and sediments in a 3-5 metre wide, 300mm deep central slot, and trimming and stabilising side slopes where necessary (Trade-Off Study Report 4,7 & 9: Seawater Pipeline vs Seawater Channel, 2014). A final benefit of the canal and pond system is that it may

slightly increase the temperature of the feed water which improves the efficiency of the desalination process.

3.2.2 Seawater pre-treatment system

Pre-treatment of the feed water aims to limit RO membrane fouling. An accumulation of one or more foreign substances on the surface of a membrane will result in a loss of rate of flow through the membrane. This results in the need for higher operating pressures to achieve the specified water production which in turn results in an increased energy consumption and associated cost. Membrane fouling generally occurs through one of the following:

- Precipitation of inorganic salts (scaling) due to super-saturation;
- Deposition of silt or other suspended solids;
- Interaction of organics with the membrane; and
- Biological fouling caused by excessive microbial growth.

Seawater abstracted from the buffer pond will pass through a series of fine sieve screens to remove larger particulates and debris still present in the buffer pond. The feed water is then subjected to a bio-flocculation and Dissolved Air Filtration (Dissolved Air Flotation) process to remove finer particulate matter and colloids. In this process, chemical flocculants (ferric chloride at a rate of 3-6mg/l, resulting in a waste discharge concentration of 3-4mg/l (as Fe) in the brine discharge) are added to the feed water and then it is aerated, and air bubbles cause the flocs (a loosely clumped mass of fine particles) to float to the surface where they can be skimmed from the surface. The sludge is then pumped to the brine tank where it mixes with brine before being discharged back to the ocean.

A bio-flocculation pre-treatment technology, ProGreen™, will form part of the pre-treatment process. This system is a proprietary bio-flocculation pre-treatment step similar to a membrane bio-reactor (MBR) and employs a biological process, similar to those widely employed in existing wastewater treatment plants, to pre-treat the feed water and has the potential to significantly reduce or eliminate the need for standard pre-treatment and Clean-In-Place chemicals.

The feed water may also be conditioned using sulphuric acid which is used to correct the pH and ensures flocculation occurs at an optimised rate. Ferric chloride coagulates optimally at around pH 7.0 and by correcting the pH the optimal dosing rates can be achieved which reduces the overall chemical demand and chemical residue in the discharges.

Chlorine gas may be used to eliminate biological contaminants in the feed water and reduce biological growth in the pipes and pumps of the desalination plant and various holding tanks. The preferred process will not use continuous application of chlorine because of the bio-flocculation process (part of the ProGreen™ system) relies on biological action and would be destroyed by a biocide. However, shock doses of chlorine, i.e. 10mg/l for 10mins may be introduced infrequently at certain points for controlling bio-growth (e.g. at media filters, and at a maximum frequency of about 6 times a day or every 4 hours of operation). Prior to entering the RO trains (or module), the water is treated with sodium metabisulphite (SMBS) and, potentially, antiscalants. Chlorine is detrimental to the RO membranes and so the SMBS is used to neutralise any free chlorine before coming into contact with the RO membranes. An antiscalant may also be added to reduce the build-up of deposits inside the RO units or on the membrane itself which could lead to fouling of the membrane and reducing operational efficiencies.

The concentration of chlorine in the brine water discharges is expected to be low and within relevant standards due to the application of SMBS. Chlorine gas would be stored in 1-ton drums within a purpose built storage facility meeting the requirements for hazardous installations (i.e. leak detection

systems and alarms, shut-off valves, specialist safety equipment and secondary containment, amongst other requirements).

The RO trains are also fitted with disposable cartridge filters upstream of the RO membranes which will filter the feed water to the micro scale just prior to desalting.

3.2.3 desalination plant

The desalination plant will be situated on the eastern side of the Swakopmund Salt Works ponds as shown in Figure 3 on pg. 29. The desalination plant complex itself (including the pre-treatment and post-treatment systems and all associated infrastructure) is likely to have a permanent footprint of less than 5ha, all inclusive. This excludes any additional footprint area associated with the upgrading and modification of the canal and new buffer pond. The desalination plant enclosure will be approximately 60m by 20m (1,200m²) by 6m high, while the post treatment and pre-treatment plants, and storage tanks would be located adjacent to the plant building. The equipment room, offices, and chemical storage room would also be housed in a 13m by 20m (260m²) by 6m high building that is connected, or is immediately adjacent, to the main plant building.

The desalination plant will represent the most significant of the structures associated with the project. The plant will take the form of a large enclosed structure (to protect the various equipment and processes against the corrosive sea breezes). The plant will house the following, within an enclosed security fenced area with a gate to control access:

- Pre-treatment systems;
- Post-treatment systems;
- A series of RO trains with associated filters, piping, pumps and valves, access ladders gangways, cleaning and maintenance facilities, energy recovery systems, etc.;
- Feedwater, product water, and brine/waste buffer tanks;
- Clean In Place systems, tanks, and associated facilities;
- Water treatment chemical storage areas and dosing equipment;
- Electrical and mechanical control centre;
- Spares and maintenance stores and workshop area
- Offices, ablutions, kitchen, parking, sewerage, communications (possibly overhead telephone lines) and solid waste storage facilities and other amenities; and
- The 6m wide, and approximately 800m long, existing salt and gravel access road intersecting with the C34 is proposed to be upgraded to provide safe access to the proposed plant.

3.2.3.1 Sewage and solid wastes

Permanent ablutions will be established as part of the desalination plant complex. Sewage and grey water collected from kitchen sinks and elsewhere in the facility will be collected in conservancy tanks. The conservancy tanks will be pumped out on an as needed basis and the sewage delivered to the existing Swakopmund waste water treatment plant for processing.

The operations phase is not expected to generate significant volumes of waste and will be restricted to mostly domestic waste and chemical containers and packaging. Where possible the chemical storage containers will be returned to the supplier for reuse or disposal. Any residual waste will be collected from rubbish bins around the facility and moved to a central waste storage area and, when required, delivered to an approved landfill site for final disposal.

3.2.3.2 Clean In Place System

Even with good quality feed water, good pre-treatment practices, and the proposed cleaning systems (including the ProGreen™ technology); the RO membranes may experience fouling and may lose efficiency over time. The ProGreen™ technology claims to not require a CIP process and uses a patented in-line direct osmosis (DOC) cleaning flushing system using permeate water only, however, since this is the first time this technology is being used in the southern African context, the applicant wishes to keep the option for CIP process in the SEIA application.

To overcome membrane fouling, each RO membrane may be cleaned about once every six to eight weeks (in conventional plants) to ensure operational efficiency is maintained. The cleaning chemicals used for the RO membranes constitute mainly high and low pH solutions prepared by adding caustic soda or acid to product water. Small amounts of surfactant or chelating agent (e.g. citric acid) may also be added to the CIP mix. These solutions are then passed through the RO membranes a number of times, alternating between the high and low pH solutions. Once complete spent CIP solutions released into the brine over a period of 12 hours where they mix with one another (which has a pH neutralising affect), the brine, the sludge, and multimedia filter filtrate, and are discharged into the ocean. The waste from this intermittent process would be fed back into the brine discharge system over a time period, for example up to 12 hours, to achieve suitable dilutions.

The following CIP chemicals will be found in the following estimated concentration ion the brine discharge during release:

- Peroxyacetic acid (e.g. Hydrex 4203) – approximately 6 x per year [1.25 mg/ℓ]
- Low pH CIP solution (e.g. Hydrex 4503) – approximately 6 x per year [3.25 mg/ℓ]
- High pH CIP solution (e.g. Hydrex 4502) – approximately 6 x per year [3.25 mg/ℓ]
- Preservative (e.g. Hydrex 4301) – approximately 2 x per year [6 mg/ℓ]

Note that the concentrations of the spent CIP chemicals in the brine can be decreased by increasing the time period of release of each batch from the suggested 12 hours to meet any dilution requirements and avoid toxicological effects on marine biota (if required).

3.2.4 Electrical supply system

The desalination plant and associated facilities will be powered via a new 11kV cable running from the existing Tamarisk substation, located 6km away along the C34 on the outskirts of Swakopmund. The cable will run alongside the C34 towards Henties Bay in an existing electrical servitude. The cable will cross the C34 and follow the new product water pipeline route in a westerly direction to the new transformer and substation building adjacent the desalination plant complex.

The Tamarisk substation is currently able to provide more than 3MW of electricity, which is adequate for the purposes of the desalination plant. The desalination plant is expected to consume approximately of 1.5MW at full production.

The new seawater intake system will be fitted with two low-lift high-volume pumps that will pump the seawater to the buffer ponds. The proposed pumps are two 45kW that typically operate in a duty/standby configuration. The electrical equipment will however be designed to allow for simultaneous operation of the two pumps (Trade-Off Study Report 11: Electrical Supply To The Seawater Intake, 2014). A new ~3km long 11kV underground cable (a 25mm², 3 core, 6.35/11kV PILC cable) would run from the plant, alongside the existing Salt Works' canal to provide electrical supply to the seawater intake (this cable is shown in Figure 3 on pg. 29). The cable would be placed within a dedicated trench of 600mm (w) x 1000mm (d). Cable markers to indicate the position of the new MV cable will be installed at each turning point along the route. The cable will terminate in a new small

building close to the new intake jetty, similar to the existing Swakopmund Salt Works intake mini-substation building located near their intake jetty.

During plant operation, the plant will mainly only be run during standard and off-peak times, as a means to improve the cost efficiency and avoid overloading of the regional electrical supply at these critical times.

3.2.5 Product water system and pipeline

Product water produced by the desalination process will be pumped via a new 400mm diameter pipeline (steel, ductile iron and GRP piping are being considered) to intersect with the existing 700mm diameter NamWater pipeline that runs alongside the C34, approximately 850m to the east of the site.

Water will need to be inserted into the NamWater pipeline at a pressure that is compatible with the system. Prior to insertion, the product water will be pH corrected, re-mineralised (using soda ash and calcium) and chlorinated to the relevant potable water standards and will form part of the NamWater supply. Rössing Uranium will then be supplied with the equivalent volume of treated water by NamWater from the Swakopmund Base Reservoirs.

3.2.6 Effluent treatment and disposal system

Brine is the saltwater concentrate remaining on the upstream side of the RO membrane, after the separation process. The brine stream contains higher concentrations of salts and other impurities than are found in the intake water (since a portion of pure water has been removed), and which must be disposed of in an acceptable way. Due to the chemical makeup of the brine water, essentially a concentrate of the source water, the brine is commonly returned to the ocean where it is rapidly diluted, returning to ambient concentration over time. The brine will also contain traces of the water treatment chemicals that were introduced during the pre-treatment phase. This is typically regarded as one of the more significant environmental issues associated with desalination plants.

The desalination plant's peak product water capacity will be 10M³/d. This will require a seawater feed of approximately 25m³/d, with 15m³/d of brine to be discharged back to the sea. This brine flow translates to 174ℓ/s. The brine (which is approximately 1.85 times the saline concentration of seawater) would be mixed with the filter backwash, CIP backwash and sludge from the Dissolved Air Flotation and ProGreen™ pre-treatments processes before being returned to the ocean, resulting in a final estimated brine concentration of about 1.70 times that of ambient seawater salinity.

The brine will be piped from the desalination plant via a buried 400mm diameter HDPE pipe around the eastern side of the salt pans to the northern discharge site (Figure 3 on pg. 29). The final, approximately, 40m of pipeline on the seaward side of the high-water mark will be encased in concrete and is located adjacent the derelict salt works intake structure. The pipeline with a single diffuser will terminate in the surf zone. The diffuser will be located approximately 1.6m below the mean sea level or 0.6m below the lowest astronomical tide waterline (Trade-Off Study Report 3: Brine Discharge Methods, 2014). The purpose of the diffuser port is to concentrate the flow into a high velocity jet in order to attain good initial mixing of the effluent with the ambient receiving waters and preventing it from sinking and accumulating in seabed depressions. Brine is denser than the ambient receiving waters and will sink to the seabed under gravitational forces, not taking into account any external turbulent mixing mechanisms (e.g. waves and currents). Subsequently, the heavy brine will typically be transported away from the source by bottom gravity currents due to a sloping bathymetry.

Discharging the brine into the surf zone relies on the turbulence and mixing caused by energetic wave conditions, the long shore and cross shore currents and tidal exchanges which will aid with the expected rapid mixing, dilution and distribution of the brine discharges. This has been confirmed through the near-field dilution modelling undertaken as part of the SEIA process. The dilution

modelling found that the results of the intermediate mixing indicate a general influence area of approximately 30m to 40m (mixing zone) from the effluent discharge point under varying water levels and coastal processes. The surf zone discharge is considered to be a viable option for brine effluent disposal within the parameters detailed in the dilution modelling study.

Table 1 lists the expected composition of the brine effluent and the typical cleaning reagents and pre-treatment chemicals to be used should standard conventional RO technology be implemented. The brine effluent at the maximum plant capacity is anticipated to have a temperature of between 2–4° Celsius above the ambient average seawater temperature, a salinity of 66g/l or psu (based on the maximum feed-water salinity of 34.2g/l or psu), a density of 1,049kg/m³, and with a maximum effluent flow of ~10m³/d.

Table 1: Estimated brine physiochemical profile

Description	Units	Quantity
Feed-water Intake (average)	m ³ /d	23,600
Feed-water Intake (instantaneous)	m ³ /d	26,100
Average brine discharge (average)	m ³ /d	13,550
Average brine discharge (instantaneous)	m ³ /d	15,000
Average Co-discharge (Pre-treatment and Media Filtration Backwash – intermittent and discharged over 24 h)	m ³ /d	1,338 (in 24 h)
Instantaneous Co-discharge (Pre-treatment and Media Filtration Backwash – intermittent and discharged over 24 h)	m ³ /d	1,483 (in 24 h)
Co-discharge (CIP rinse water for conventional RO system – 6 x per year only and assumed to be discharged over 12 h)	m ³ /d	202 (in 12 h)
Discharge velocity	m/s	~6
Salinity	mg/l psu	66,000 66
Change in temperature	°C	2 - 4
pH		7.3 – 8.2
Suspended Solids (average)	mg/l	8 - 12
Phosphonate antiscalant for conventional RO system	mg/l	4 - 5
Chlorine – for conventional RO system	mg/l	0.002
Sodium bisulphate (SMBS)	mg/l	3 – 3.5
Spent CIP solution in waste flow (6 x per year and blended in over 12 hours) ⁵ <ul style="list-style-type: none"> • Peroxyacetic acid • Low pH cleaner • High pH cleaner 	mg/l	0.003 0.01 0.01
Preservative (sodium metabisulfite) in waste flow (twice a year)	mg/l	6.0
Coagulant: Ferric Chloride (FeCl ₃) will precipitate into Ferric Hydroxide, which will be removed as a solid.	mg/l	3-4
Discharges from preferred option (IDE Progreen™ system) <ul style="list-style-type: none"> • CIP rinse water Co-discharge • Phosphonate antiscalant • Chlorine • Sodium bisulphate (SMBS) 	n/a	n/a

⁵ Note: in the event that the ProGreen™ technology does not fulfill the operational requirements and a CIP process is required, the CIP chemicals will be co-discharged in the concentrate for a period of 12 hours every 6 to 8 weeks (Note that these concentrations can be reduced by slowing the bleed rate of the CIP chemicals into the brine, which should be determined following a whole effluent toxicity test).

4 PRE-CONSTRUCTION PHASE

Following the issuing of environmental clearance, Rössing Uranium and their technical team will enter into the pre-construction phase during which time the design for the desalination plant and associated infrastructure will undergo finalisation. Emerging from the SEIA were the following aspects for consideration during this period:

4.1 TENDERING

Rössing Uranium / Engineer must ensure that this SEMP is included in the briefing / tender documentation to all perspective Contractors. The Engineer must advise the Contractor to familiarise himself with the SEMP and ensure that adequate resource provision is made available to implement the requirements contained herein.

4.2 PERMITS AND AGREEMENTS

The following permits and agreements will be required:

- Lease agreement with Salt Works;
- Agreement with NamWater to permit Rössing to insert water into their pipeline to the east of the site;
- Revised agreement with NamWater regarding water conveyance;
- Agreements with NamPower, regard the provision of power and the maintenance and operation of the power cable supplying the desalination plant;
- Agreements with the Swakopmund Municipality to render waste disposal and treatment services (sewage and solid waste)
- Permits and license required in terms of the Water Resources Management Act (Act 24 of 2004) including:
 - Abstraction license (Section 33(3)(c));
 - Discharge permit (Section 60);
 - register as a water services provider in terms of (Section 41 of the new Water Resources Act (Act 11 of 2013, if promulgated))

4.3 ENVIRONMENTAL CONSIDERATIONS IN DESIGN

- General:
 - Designers should aim to reduce the project footprint to the efficient minimum by optimizing the footprint and clever use (double use) of the areas (this statement may be redundant, as this is what good engineering aims to achieve).
 - All liquid chemical storage areas and tanks should be bunded to (110% of the total maximum volume of chemical storage capacity) to contain accidental spills and leaks.
 - All dry chemical storage areas shall be restrict unauthorized access (i.e. lockable) and have impervious floors and adequate weather protection (rain and wind) to prevent the accidental spillage, dispersal, or spoilage of chemicals stored. All chemical storage area must be equipped with relevant the emergency provisions required to deal with a potential emergency in that environment.
 - The chlorine storage area must be equipment with the various safety and emergency equipment, including leak detection, isolation chambers (secondary containment), isolation valves, personal protective equipment (including breathing equipment), wind vein, emergency

alarms, emergency escape routes, fire extinguishers, emergency showers/ eye washing facilities, etc.

- Provision should be made in the facility design for the collection and storage of solid waste. Such storage area should be weather resistant and should make provision for the separation and storage of recyclables and returnable packaging (especially chemical containers) in an effort to reduce the volume of waste (and the hazard level) entering the landfill site. Where potentially hazardous wastes are produced, these should be put to one side and transported to the Rössing Mine for final disposal.
- Socioeconomic considerations:
 - During the design phase, consideration should be given to providing a widening of the C34 road at the turn-off point to the desalination plant to reduce traffic collision risks. This should be augmented through the appropriate road hazard / information signage to warn road users of the turning of heavy vehicles.
 - Rössing should develop local employment and procurement targets for the contractor for inclusion into the tender documents.
 - All Contractors should compile a draft Social and Environmental Policy (S&EP) in line with Rössing Uranium's Health, Safety and Environment (HSE) policy, statutory requirements and the provision forthwith. The draft S&EP should be compiled and submitted as part of the tender submission and considered during the tender adjudication process. The S&EP of the successful bidder will, upon award of the contract, be finalised for approval and will form part of the SEMP for the Contract and the Contractor's performance in relation to it shall be evaluated as part of the REA's quarterly environmental audit.
 - The Contractor should submit a site-specific health and safety plan, which includes a task-specific risk assessment. The risk assessment covers environmental, health and safety aspects, work methods and construction risks associated with each task that the Contractor team will or is likely to perform in the execution of the works. A Contractor should not commence any activity without having undertaken a task-specific risk assessment. Risk assessments are to be used to inform safe work procedures presented in relevant method statements.
- Visual:
 - During the design phase, provision should be made for the inclusion of an earthen berm encircling the desalination plant, to be erected at the commencement of the construction phase and remain in place throughout the project life cycle. This will have implications for the planning, programming and routing of access roads, pipelines and electrical supply cables. To reduce the project footprint it is recommended that this be accomplished by building a retaining wall, and the "topsoil", stripped from the desalination plant site, can be pushed up onto the wall on the outward facing side. The slope should be calculated to reduce the risk of soil erosion to within acceptable engineering tolerances.
 - The desalination plant lighting should be planned and designed to avoid the spillage of light into the surrounding areas, especially in the direction of the Damara Tern nesting site. The earthen berm mentioned above is one mechanism aimed at mitigating this potential impact, and should be levered to further mitigate light pollution from the plant. Care should be given to the type of lighting, height, position, direction and number of outside lights employed to minimise the magnitude of light spilt into the environment.
 - The desalination plant building should be planned to minimise the potential visual impact in the landscape. This can be achieved through the considered use of cladding materials and mostly the colour of the facades. As a guideline, the building style and colour should aim to replicate colour and style of the new Salt Works building, located nearby. Pastel colours simulating the natural sand colour of the area would also work and could be used in unison with the proposed earthen berm to reduce the prominence of the desalination plant building in the landscape.

- The Intake jetty should be designed to simulate the existing salt works jetty so that the two structures read as a single entity when viewed from a distance by the casual observer. The structure should also be painted a grey colour to reduce its visual prominence in this coastal landscape.
- Noise:
 - Acoustic attenuation devices should be installed on all ventilation outlets and high pressure gas or liquid should not be ventilated directly to the atmosphere, but through an attenuation chamber or device.
 - Vibrating equipment must be equipped with vibration isolation mountings on their mounting plinths.
 - Acoustic attenuation devices should be installed on all ventilation outlet and high pressure gas or liquid should not be ventilated directly to the atmosphere, but through an attenuation chamber or device.
 - Acoustic barriers are proven to be effective in reducing environmental noise impacts. Acoustic barriers should be without gaps and have a continuous minimum surface density of 10 kg/m² in order to minimize the transmission of sound through the barrier. Barriers should be located as close to the source or to the receptor location to be effective. In addition to shielding provided by the building for sources located indoors, an acoustic barrier should be considered on the perimeter of the Rössing Uranium desalination plant. This will provide additional shielding to residents at the Green Houses and the Damara Tern area from operational activities.
 - Rössing or the Contractor shall establish a noise baseline at the various potentially sensitive receptors (the green houses, the adjacent the Guano platforms, within the Damara Tern nesting site, at the salt works) prior to commencing with any construction activity. Refer to section 5.2.13 for details.
- Birds:
 - Roads, pipelines, cables should share servitudes as far as possible to reduce the disturbance footprint, and be routed to avoid the core bird breeding areas where possibly (this has been resolved through SEIA optimized layout).
 - Any construction activity located in (core breeding area) or close (within the buffer area) to the Damara Tern breeding site should be scheduled so as to avoid the breeding months of October to April.
 - The construction of an earth berm/wall of 1.8 - 2.0m high around the facility would contribute to the reduction of physical disturbance associated with movement, light, noise, and construction activity. This should be factored into the plant design
 - Outside lighting of the facility (including security lighting) must be kept to the minimum. Where required, all overhead lighting should be shield and pointed downwards onto the area where illumination is needed, rather than directed upwards or outwards, in order to avoid light pollution. The guidelines by the International Dark-Sky Association for the quality of outdoor lighting (including light design, wattage and light colour [preferably amber]) should be followed for preserving and protecting the night-time environment, including its wildlife (www.darksky.org).
 - An upper wire strand of any fencing should be demarcated to ensure that it is visible to low flying birds in low light conditions.
- Marine ecology
 - Adjust designs to ensure that peak intake velocities achieve a <0.15m/s velocity at the screens, to reduce the impingement and entrainment of marine biota.
 - Ensure the installation of screens on the end of the intake pipes, or the use of a screen box or shroud to limit the impingement and entrainment of marine biota.

- Design outlet velocities to minimise the potential for flow distortion but still achieve diffusion objectives.
- To mitigate the potential reduced physiological functioning of marine organisms due to elevated salinity, the seaward end of the discharge pipe should achieve the highest required dilution of brine (i.e. 18 times), thereby limiting increased salinities to the minimum achievable mixing zone only.
- Actively promote the integration and full realization of the ProGreen™ technology.
- Make provision for the aeration of brine in the brine release tank in the event that dissolved oxygen levels fall below specified standards and necessitate aeration.
- Design the plant to reduce corrosion of the RO components to a minimum by ensuring that dead spots and threaded connections are eliminated. Corrosion resistance is considered good when the corrosion rate is <0.1 mm/a (UNEP 2008).
- International guidelines (WHO 2007; UNEP 2008) recommend that, prior to the design and construction of the desalination plant, a study be conducted on the chemical and physical properties of the raw water. A thorough raw water characterisation at the proposed intake site should include an evaluation of physical, microbial and chemical characteristics, meteorological and oceanographic data, and aquatic biology. Seasonal variations should also be taken into account. The study should consider all constituents that may impact plant operation and process performance including water temperature, total dissolved solids (TDS), total suspended solids (TSS), membrane scaling compounds (calcium, silica, magnesium, barium, etc.) and total organic carbon (TOC).

5 CONSTRUCTION PHASE

The Social Environmental Management Plan (SEMP) has been compiled for the management of potential construction phase social and environmental impacts of the Rössing Uranium desalination plant according to the SEIA optimised layout. Whilst a SEMP is comprised of mitigation measures identified through the Social and environmental impact assessment process, the construction phase environmental impacts are mostly generic in nature, are well generally understood, and have an established set of standard mitigation measures and best practices pertaining to construction management and supervision, which are presented here as well.

5.1 SCOPE

The general principles contained within the SEMP shall apply to all construction activities (and all maintenance activities involving construction-type activities and decommissioning activities). All construction activities shall observe all relevant environmental legislation and in so doing shall be undertaken in such a manner as to minimise impacts on the natural and social environment.

5.2 GENERAL

The SEMP is to be included into all Tender and Contract documentation to ensure that the Contractor is aware of his obligations and given opportunity to cost for the implementation of the SEMP requirements. Failure to comply with the requirements contained herein could result in penalties or otherwise serve to hold the Contractor liable for damages arising from irresponsible behavior or non-compliance with the requirements. This ensures that the identified environmental issues receive adequate attention during the construction phase.

Rössing Uranium will carry the following responsibilities:

- Ensuring that all environmental impacts are managed in accordance with this SEMP;
- Ensuring that all monitoring and compliance auditing occurs in line with the SEMP;
- Ensuring that the environment is rehabilitated as far as practicable to its natural state or existing land use practices;
- 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.
- Any conditions contained in the environmental clearance are upheld.

The Contractor shall conduct his 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 Contractor to prevent irreversible damage to the environment. The Contractor shall take adequate steps to educate all members of his workforce as well as his supervisory staff on the relevant environmental laws, sensitive areas, and protection requirements. The Contractor shall supplement these steps with prominently displayed notices and signs in strategic locations to remind personnel of their environmental obligations (Refer to Annexure A for materials pertaining to environmental awareness).

5.2.1 Pre-commencement Requirements

5.2.1.1 Environmental Control and Supervision

A suitably qualified Rössing Environmental Advisor (REA) shall be appointed by Rössing Uranium to undertake the following tasks:

The REA's responsibilities include the following:

- Compile formal monthly reports for the Contract, based on~
 - Physical observations during a monthly site inspection,
 - REA's and CEO's daily and weekly internal reports (site diaries);
- Liaise with the Project Management Team (PMT), stakeholders, the general public (if required) and the CEO on *ad hoc* OHSEC matters;
- Undertake quarterly OHSEC compliance audits in terms of the SEMP on the Contractor's activities and present a report to the PMT;
- Present technical matters and issues requiring resolution at the monthly project meetings.
- Advise the CEO on Contractor's staff in general on Rössing Uranium's HSE management system, policies and procedures on OHSEC management to ensure continuity;
- Assist in the facilitation and accommodation of the Contractor's needs on matters relating to compliance with the OHSEC Mitigation Table;
- The establishment and implementation of an OHSEC monitoring program for the monitoring and recording of construction related impacts;
- Record and report on OHSEC performance of the Contractor against the OHSEC Mitigation Table;
- Undertake a weekly site inspection of each of the Contract area and compile an all-encompassing internal weekly compliance report on noncompliance issues for submission to the PM and the CEO;
- Photograph and investigate any OHSEC incidents and compile reports to form part of the weekly report;
- Liaise with the PM and the CEO on *ad hoc* OHSEC matters and advising the CEOs on day-to-day OHSEC management issues; and
- Liaise with the PM regarding the quantification and issuing of penalties for non-compliance.

Where non-conformances are identified by the REA during the quarterly audits and corrective action is requested, the REA shall sign-off that the necessary corrective actions have been affected, by way of formal letter. Copies of the signed-off corrective actions shall be included in the subsequent audit report.

The Contractor shall appoint, in writing, a suitably qualified senior member of his site staff as the Contractor's Environmental Officer (CEO). The CEO's duties shall entail:

A suitably senior member of each Contractor's staff should be delegated the responsibilities of the Environmental Officer. The role of the CEO is to ensure the physical implementation of the OHSEC Mitigation Table. The duties of the CEO include:

- Keeping a daily site diary detailing the key events and observations for the day, copies of which shall be submitted to the REA as part of the weekly submissions;
- Establishing and maintaining appropriate management systems for routine OHSEC management tasks, which may include but will not be limited to the following~
 - Waste collection, handling, storage, transport and disposal, including sewerage, domestic, construction and hazardous wastes,
 - Dust control within the area of activity,

- Noise control within the area of activity,
 - Handling, storage, distribution and storage of hazardous materials, including fuels and lubricants,
 - Establishing and maintaining a program for the maintenance of housekeeping at the works areas,
 - Establishing and maintaining a system for the handling and treatment of contaminated water from construction activities, and
 - Acquiring and maintaining the necessary fire, spillage and other accident and emergency response materials that may be required to deal with and contain the damage caused by such accidents;
- Notifying the REA of OHSEC incidents as well as initiating appropriate response actions to such incidents;
 - Initiating and supervising any remedial OHSEC actions;
 - Establishing a program and undertaking or ensuring that staff receive regular OHSEC awareness training as part of toolbox talks;
 - Liaising with the REA on technical aspects related to OHSEC matters; and
 - Furnishing the REA weekly with the necessary information required for compliance monitoring, which may include certificates of waste disposal, records of complaints, incidents and accidents, daily site diary entries, labour statistics, etc.

The Contractor shall construct and/or implement all the necessary environmental protection measures in each area before any construction work may proceed under the direction of the REA and Engineer. The Engineer / REA may suspend the Works at any time should the Contractor, in the Engineer / REA's opinion, fail to implement, operate or maintain any of the environmental protection measures adequately. The costs of such suspension shall be to the Contractor's account.

5.2.1.2 Labor policies and training

A local employment policy shall be developed in connection with Rössing Uranium. This plan shall be audited. Furthermore, recruitment shall be based on sound labour practices and with gender equality in mind.

A local procurement policy shall be developed and adopted to maximise the benefit to the local economy. The Contractor shall be responsible for making available the contact details for all the local businesses offering related goods and services to the sub-contractors. Appropriate training shall be provided to enable individuals to apply their skills to other construction and development projects in the region once the construction phase is completed.

Rössing Uranium may consider extending its skills and safety training programs to the construction personnel at the desalination plant.

5.2.2 Site establishment

A suitable area adjacent to desalination plant construction site shall be identified and agreed with the Engineer and REA (Avoiding the Damara Tern nesting site). Once a suitable agreed area has been identified the Contractor shall erect temporary perimeter fences or demarcations so as to isolate all construction materials, plant and equipment, facilities and activities from the ongoing operations on the remainder of the site. The demarcated site establishment area shall be of adequate size to house the following:

- Parking of all construction vehicles and plant;
- Site offices and storage containers for small plant and hand tools;

- Fuel and oil storage area and refueling area;
- All construction materials including piping, cladding, bricks, sand, aggregates, rebar, cement, bedding material, overburden, etc.; and
- Staff facilities including ablution facilities and a recess area.

A similar, but smaller, site establishment area shall be established adjacent to seawater intake and brine discharge sites (Please note that an upper wire strand of all temporary and permanent fencing must be marked so as to avoid bird collisions during low light conditions).

No staging (stockpiling/stacking) of materials shall occur outside of the demarcated area unless otherwise agreed with the Engineer and REA. All areas outside of the demarcated site shall be deemed as “no-go” areas for all construction personnel and equipment.

Prior to the erection of the site establishment areas, a photo of the site shall be taken. The Contractor shall return the area to same condition on project completion.

Prior to commencement the Contractor shall identify and agree with the engineer which roads will be used for the purposes of construction. Once the designated routes have been agreed, all other roads shall be deemed “no go” routes for construction plant and vehicles, unless otherwise agreed to with the engineer and, if required, the REA. The Contractor shall take pre-cautions to prevent his vehicles and plant from leaving the designated construction roads (this may, if required, involve flagging the road edges and turning points).

5.2.3 Environmental Awareness Training

All the Contractor’s and any Sub-Contractor’s employees and any suppliers that spend more than one day a week or four days in a month on site, must attend an Environmental Awareness Training course presented by the Contractor, the first of which shall be held within one week of the Commencement Date. Subsequent courses shall be held as and when required. A register shall be kept for all environmental awareness training. No more than 20 people shall attend each course and the cost, venue and logistics for this/ these course/s shall be for the Contractor’s responsibility.

The CEO shall conduct the environmental awareness training course with all construction personnel before commencement of any construction activities. Environmental awareness posters will also be erected at a prominent location on the site to remind construction staff of their obligations in terms of the SEMP. Refer to Annexure A1 for an Environmental do’s and don’ts poster.

The Contractor shall compile and issue all construction staff with an information booklet, based on the CEO’s environmental awareness training course, at the commencement of the project, containing key information regarding the project, safety regulations and environmental do’s and don’ts. All employees will be required to sign a register indicating receipt and understanding of the information booklet. The Contractor will ensure that environmental issues and risks are dealt with as part of daily / weekly “toolbox talks” and that specific environmental duties or tasks are assigned to individuals.

In addition, a comprehensive employee induction programme shall be presented within one week of the Commencement Date to address issues such as HIV/ AIDS and Tuberculosis as well as alcohol and substance abuse. The induction shall also address a code of behaviour for employees that would align with community values.

5.2.4 Employee eating and recess areas

The Contractor shall provide a suitable, ergonomically designed area with seating and a table, 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 daily. An adequate supply of potable water and other sanitary conveniences shall also be located within reasonable range of the designated eating area. The Contractor shall prevent his employees from eating or recessing anywhere else but in the designated eating area.

The recess areas shall be cleaned at regular intervals to ensure that there is not an accumulation of litter and waste food / food scraps that may attract wildlife or otherwise be distributed by the wind.

5.2.5 **Materials handling, use and storage**

The Contractor shall ensure that all delivery drivers are informed of all procedures and restrictions, including “no-go” areas and designated haul routes. In this regard specific reference is drawn to the potential disruption that such traffic may cause to the neighbouring industrial activities. The Contractor shall ensure that these delivery drivers are supervised during offloading, by someone with an adequate understanding of the SEMP and that disturbance to the surrounding activities are minimised.

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

All manufactured and/or imported material shall be stored within the designated Site boundaries. All lay down areas outside of the Site shall be subject to the Engineer and REA’s approval.

The Contractor 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 at a daily interval, and to the satisfaction of the Engineer / REA. The Contractor shall set aside the time and resources required to remedy any contraventions of this requirement at his own expense.

5.2.5.1 **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 / REA.

The Contractor shall provide a separate weather-proof, impervious vessel at the central waste storage area for the temporary storage of hazardous, potentially hazardous, and contaminated materials. Waste from this vessel shall be disposed of at a registered landfill site.

5.2.6 **Ablution facilities**

A sufficient number of portable chemical toilets shall be provided by the Contractor at appropriate locations around the Works to the approval of the Engineer / REA. The ratio of ablution facilities to workers should not be less than 1 per 15 staff and / or such facilities shall be located within 100m from any work area, but not closer than 50m from the high water mark of the sea or 25m from the edge of any of the salt pans.

Toilets shall, as far as possible, be placed out of view of the public and neighbouring residences / businesses. Where this is not possible a screen should be placed around the portable toilet to conceal it. 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 and do not cause an odour problem. 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.

5.2.7 Solid waste management

The Contractor 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. Bins shall be emptied weekly or as otherwise 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 / REA. The Contractor shall, at his 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 central waste storage vessel shall be emptied weekly or as necessary. All solid waste shall be disposed of at a landfill site. Where possible the Contractor shall implement measures to recycle and reduce the volume of waste going to landfill (this may include, where possible, returning packing and surplus materials to the supplier).

5.2.8 Fuel and oil

The Contractor shall ensure that all liquid fuels are stored in tanks or mobile bowsers with lids that are kept firmly shut. The tanks or bowsers shall be situated on a smooth impermeable surface (Concrete slab or 250 micron plastic sheeting covered with at least 50mm of sand overburden) 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 volume 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 Contractor shall prevent unauthorised access to the fuel storage area. No smoking shall be permitted in the vicinity of the fuel storage area. The Contractor 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 fuel bowsers shall carry a spill-kit that is adequately sized to contain at least a 200 litre spill, at all times.

5.2.9 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 practical, maintenance of plant shall not occur on the Site. Where emergency, *in situ* maintenance operations are required, the Contractor 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 in the appropriate vessel in the central storage area or workshop.

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. Vehicle washing may not occur on the beach.

The Contractor 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 appropriate 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 Contractor shall take all reasonable precautions to prevent accidental and incidental spillage during the use of oils. Fuel and oil shall not be stored in any of the beach works areas.

In the event of an oil / lubricant spill, the source of the spillage shall be isolated, and the spillage contained. The Contractor shall clean up the spill by removing the contaminated soil to the hazardous waste vessel 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 / REA.

All site plant, vehicles, and equipment shall be parked in the site establishment area overnight and weekends to reduce visual intrusions in the landscape. Unless required (i.e. dewatering pumps) and agreed to with the engineer and REA, no plant or equipment shall remain in any of the beach works sites and must be withdrawn to a safe area within the demarcated site establishment areas.

5.2.10 Site clearance

The Contractor shall ensure that site clearance activities (including grubbing of the works) are restricted only to that required to facilitate the execution of the works. Non-conformances related to over-clearance or inadvertent disturbances to surrounding areas shall be regarded as a serious offence and dealt with to the full extent of this SEMP. A preventative approach to rehabilitation is emphasised, site clearance shall occur in a planned manner, over or accidental clearance will be prevented. The Contractor shall not proceed with clearing until the area has been demarcated and agreed to by the engineer and REA.

The Contractor shall peg the route for the pipeline, access road, and electrical cable and footprint of the desalination plant prior to any clearing operations. These demarcations shall be used by the clearing teams as a guide to control and prevent accidental over clearance.

Prior to the commencement of clearing activities, the contractor shall walk the area and collect any stones that are covered with lichens. These shall be moved into the adjacent areas and distributed randomly, but face up.

In the case of the desalination plant, it is recommended that a 1.8 m high screening berm should be created to encircle the desalination plant during construction and operation phase of the plant (this will provide mitigation for noise, light, visual and disturbance of birdlife impacts). The Contractor shall strip the top 200mm of topsoil and place this in stockpiles around the site perimeter. An adequate volume of subsoil (to be determined by the Engineer) will then be pushed from the desalination plant footprint into stockpiles around the perimeter, but not covering or disturbing the topsoil stockpiles. Once the earth screen has been formed, the topsoil material will be distributed evenly across the face of the berm and lightly wetted every day for a period of one week. Care must be taken that the final slope of the earth berm is not sensitive to erosion forces prevalent at the site (at the discretion of the Engineer). Where possible, this berm should aim to have organic lines and irregularities to a better assimilate into the surroundings.

5.2.11 Access and haul roads

The Contractor shall be held responsible for the control of all traffic, including that of his 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 and specifically the adjoining Salt Works and the Gauno Company. 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 and around the Works must be provided. Construction vehicles shall not exceed a 20kph speed limit on the gravel and sand roads. Mud and sand deposits on public roads arising from construction traffic shall

be cleared on a daily basis or as required. Any damage to the public or private roads arising from the heavy construction vehicles shall be repaired to the Engineer's approval.

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 / REA. Any contraventions of this clause shall result in penalisation.

The Contractor shall ensure that all plant, equipment, and vehicles under his control remain on the designated routes and failure to do so shall result in penalties, as provided for in this SEMP. The Contractor may elect to flag the designated routes and turning points to avoid accidental off road driving. Note that lichens have been identified in the area and the main access road traverses the Damara Tern nesting area.

5.2.12 Construction activities on the beach

The Contractor shall keep informed of weather and ocean forecast and adjust his working program accordingly, i.e. if a significant ocean storm and high sea conditions are expected, then the contractor should withdraw from the equipment and materials from the intertidal area until conditions normalise.

The Contractor shall ensure that the buddy system is used for all operators and personal working in or near the ocean.

Beach work or driving across the beach shall be restricted to daylight hours on weekdays between and is not permitted on Saturdays, Sundays or public holidays, unless otherwise agreed to by the Engineer, REA and Safety Agent. The Contractor, Engineer, and REA shall determine the most suitable point of access to the beach. Once an access route has been determined no other access route may be opened or used by any construction vehicle. The Contractor shall make every effort to limit the volume of traffic onto and around the beach working areas i.e. vehicles not required for construction should park at the site establishment area and the occupants should walk onto the beach. Any member of the Contractor or project team found driving on the beach outside of the designated works areas and without consent for the Engineer / REA shall face disciplinary action and the incident shall be reported to the REA.

No foreign road surfacing or fill material of any sort may be imported on to the beach for the purposes of gaining access without the permission of the Engineer and REA. The Contractor shall limit the number of vehicles and plant accessing the beach to absolute minimum required to undertake the work on the beach. Only four wheel drive vehicles with optimally deflated tyres and construction plant of adequate off road capability are permitted on the beach, this is to limit the chance of getting stuck, requiring rescue, which can result in unnecessary disturbance to the beach. The number of daily trips across the beach will also be restricted as far as possible. Vehicles and plant may only travel along the beach outside of the high tide times, travelling below the high water mark and along the route already used, as far as possible. Plant and vehicles are forbidden from driving on sand dunes, except where required to access the beach. All drivers and operators are to be advised to avoid any nesting birds.

All ruts formed on the open beach during the operation shall be raked closed and smoothed over on completion to the satisfaction of the Engineer and REA.

The Contractor shall take photographs of all area to be impacted during the construction phase, prior to the commencement of such activities. The beach topography should also be surveyed, both up and down drift on the construction sites and on completion the profiles should be re-established to these levels so as to avoid impacts on shoreline dynamics. The area should also be surveyed 1 year

after the completion of construction to ensure that there has been no permanent impact on local shoreline dynamics.

After construction, any large pieces of rock or concrete or any other materials left in the intertidal zone must be recovered and moved off the beach.

5.2.13 Noise

The Contractor shall limit noise levels (e.g. install and maintain silencers on machinery). Appropriate directional and intensity settings are to be maintained on all hooters and sirens and no amplified sound shall be allowed on Site other than in Emergency situations. 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 frequently seen on construction sites).

All diesel powered equipment and vehicles must be regularly maintained and kept at a high level of maintenance. This must particularly include the regular inspection and, if necessary, replacement of intake and exhaust silencers. Any change in the noise emission characteristics of equipment must serve as trigger for withdrawing it for maintenance.

The contractor should maintain the main access road to prevent the formation of corrugations and potholes that could increase noise associated with traffic to and from the construction sites. The Contractor shall instruct plant operators to avoid reversing (reverse siren) and unnecessary idling times where possible.

The Contractor shall restrict any operations that may result in undue noise disturbance to nearby residences or bird Rössing site (i.e. the Correctional Services accommodations (green houses) or Guano platforms) to the hours of 07h00 to 22h00 on weekdays and Saturdays, unless otherwise agreed to by the Engineer / REA. Work occurring outside this time and with the Engineer / REA's approval may not generate noise levels that could be of nuisance to the nearest neighbours.

Rössing Uranium shall undertake routine noise monitoring during the construction and operational phase. This will involve establishing a baseline (24 hour to 1 week sampling at each site) prior to the commencement of construction at the following sites:

- The green houses
- Adjacent the Guano platform; and
- Centre of the Damara Tern nesting site.

Noise levels should be measured at these sites on a monthly interval. Monitoring should be conducted in accordance with the procedures specified by the International Finance Corporation (2007) and SANS 10103 (2008). Samples, at least 24-hours in duration should include the following parameters: L_{Aeq} , L_{A90} , and the un-weighted octave band sound pressure levels (L_{Zeq}). In the interpretation and reporting of sampled environmental noise levels, use should be made of a trained specialist. The Results of the noise monitoring should form part of the REA's monthly reporting. Where noise levels are found to exceed the recommended standards, interventions should be initiated to identify the causes and redress these.

5.2.14 Cement and concrete batching

The batching of concrete shall take place on a smooth, impermeable surface (plastic or similar) and shall be enclosed with a bund and sloped toward a sump to contain any spillages. All wastewater resulting from batching of concrete shall be contained and disposed of appropriately and shall not be discharged into the environment unless treated to acceptable standards, as determined by the

Engineer / REA. Where concrete trucks are used, the Contractor shall ensure that dumping of the drum-wash does not occur directly onto the ground, especially on the coastal dunes or beach. If needed, facilities for the handling of the concrete contaminated wash-water shall be established to the satisfaction of the Engineer / REA. 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 Contractor 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.

5.2.15 Fire control

The Contractor shall provide fire extinguishers wherever hot works is occurring. Any accidental fires shall be reported to the Engineer / REA immediately. Smoking shall not be permitted in those areas where there is a fire hazard, such as the fuel and oil stores. Burning of waste for disposal purposes is not permitted. Warming or cooking fires may be established at the recess areas, provided that these are contained in suitable vessels and do not pose a risk of spreading to other structures or material stockpiles.

5.2.16 Emergency procedures

The Contractor 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 / REA. The Contractor 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 / REA.

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 Contractor 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 appropriately.

Emergency equipment, including spill kits and fire extinguishers, shall be positioned at accessible locations near to areas or facilities where such emergencies may arise. The Contractor must advise all employees of the evacuation procedure to be followed in the event of an emergency.

5.2.17 Public safety and Community relations

The Contractor shall record any complaints or queries from the public as well as the action taken in response thereto, in a Site Request Book. Complaints and associated responses shall be communicated to the Engineer / REA immediately. The Contractor's contact details shall be posted on the Project Site board to enable the public to telephone should they have any complaints or comments.

The Contractor shall take all reasonable precautions to prevent incidents of disturbance or nuisance to the surrounding community or industrial operations that may arise from the works or from his employee's, vehicles, plant, and equipment *enroute* to or from the Site. All materials arriving or departing from the site must be effectively secured.

The Contractor shall not conduct any work on the beach on Saturdays, Sundays and public holidays or outside of daylight hours on weekdays, unless otherwise agreed to by the Engineer, REA and

Safety Agent. The Contractor will minimise the extent of open excavations outside of the stipulated work times and will clearly demarcate any remaining open excavation with danger tape or similar demarcations (Note that vehicles frequently drive cross country and could easily drive into an open trench).

Where private property is affected by the insertion of new pipeline or other service, the Contractor shall ensure that such disturbance is kept to the shortest possible time and that it is returned to its original condition as soon as possible. The Contractor shall ensure that access to each property is maintained at all times through temporary crossings.

5.2.18 Temporary site closure

If the site is closed for a period exceeding one week, the contractor, in consultation with the Engineer shall carry out the following checklist procedure.

Hazardous materials stores

- Fuels, oil and chemicals stores are locked and secure.
- Outlets secure/ locked.
- Bund empty (where applicable).
- Fire extinguishers serviced and accessible.
- Emergency and contact details displayed.
- Adequate ventilation.

Safety

- All trenches and manholes secured barricaded.
- Fencing and barriers in place as per the Occupational Health and Safety requirements.
- Emergency and Management contact details displayed.
- Stockpiles secured.

Erosion

- Wind and dust mitigation in place.
- Slopes and stockpiles at stable angle.

Water contamination and pollution

- Cement/bitumen and materials stores secured.
- Toilets empty and secured.
- Refuse bins empty and secured.
- Structures vulnerable to high winds secure.
- All plant and equipment withdrawn from beach area.

5.2.19 Protection of natural features

The Contractor shall not deface, paint, damage or mark any natural features (e.g. rock formations, trees) situated in or around the Site for survey or other purposes unless agreed to beforehand with the Engineer / REA. Any natural features affected by the Contractor in contravention of this clause shall be restored / rehabilitated to satisfaction of the Engineer / REA. The Contractor's staff shall be restricted to the confines of the demarcated site at all times.

5.2.20 Protection of flora and fauna

The Contractor shall protect fauna living within or near to the Site and shall ensure that hunting, snaring, poisoning, shooting, nest raiding or egg-collecting and disturbance does not occur and any transgression is dealt with severely and expediently. No domestic livestock or pets shall be permitted on the Site. The Contractor is to ensure that his employees are instructed not to feed or approach or in any other way interfere with any animal life encountered on the site. The use of pesticides or any poisonous substances is prohibited unless approved by the Engineer / REA.

All plant, equipment, and vehicles shall be restricted to designated routes and works areas. Any unwarranted off road driving shall be dealt with severely. The length of open trench across the beach and any other area, at any one time, shall be kept to the minimum. Any animal becoming trapped in the trench must be rescued and released.

Construction staff should be able to identify the Damara Tern and shall be made aware of the Damara Tern nesting area during awareness training and this area must be treated as a No-Go area during construction. Strict supervision and control must be exercised to keep people and plant out of this area, especially during the tern breeding months (October to April). This awareness campaign should be repeated several times during the construction phase and especially in lead up to the nesting season in the form of toolbox talks.

Construction activity should be restricted to daylight hours and where night-time construction activity (i.e. a late concrete pour) is required, careful attention shall be given to ensuring that lighting is task specific and does not result in the excessive light spill or flood lighting of vast areas. Construction plant and equipment should avoid using the bright headlight setting on their vehicles whilst driving through the Damara Tern breeding area. Similarly, construction vehicles should avoid the use of bright roof-mounted flashing lights (as is typical for construction sites); this becomes more critical during the nesting season, although construction activities should be scheduled outside this period if possible.

5.2.21 Protection of archaeological and paleontological remains

The Contractor shall take reasonable precautions to prevent any person from removing or damaging any fossils, coins, articles of value or antiquity and structures or other remains of archaeological interest discovered on the Site. All earthworks equipment operators shall be informed to cease operations immediately if any such artefact is unearthed and to report the finding immediately to the Engineer / REA. In the unlikely event that an archaeological artefact is discovered on the site the following “chance find” procedure shall be implemented:

The “chance finds” procedure covers the actions to be taken from the discovery of a heritage site or item, to its investigation and assessment by a trained archaeologist or other appropriately qualified person. The “chance finds” 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...object...must as soon as practicable report the discovery to the Council”*. The procedure of reporting set out below must be observed so that heritage 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 (operator) identifying archaeological or heritage material:
 - ~ If operating machinery or equipment: stop work;
 - ~ Identify the site with flag tape;
 - ~ Determine GPS position if possible; and
 - ~ Report findings to CEO.
- Action by CEO:
 - ~ Report findings, site location and actions taken to REA; and
 - ~ Cease any works in immediate vicinity.
- Action by REA:
 - ~ Visit site and determine whether work can proceed without damage to findings;
 - ~ Determine and mark exclusion boundary; and
 - ~ Site location and details to be added to Archaeological Heritage Geographical Information System AH GIS for field confirmation by archaeologist.
- Action by archaeologist:
 - ~ Inspect site and confirm addition to AH GIS;
 - ~ Advise National Heritage Council (NHC) and request written permission to remove findings from work area; and
 - ~ Recovery, packaging and labelling of findings for transfer to National Museum.
- In the event of discovering human remains:
 - Actions as above;
 - Field inspection by archaeologist to confirm that remains are human;
 - Advise and liaise with NHC and Police; and
 - Recovery of remains and removal to National Museum or National Forensic Laboratory, as directed.

5.2.22 Dust

The Contractor shall take all reasonable measures to minimise the generation of dust as a result of construction activity, to the satisfaction of the Engineer / REA. This will include restricting the disturbance footprint. Appropriate dust suppression measures, e.g. wetting gravel surfaces, shall be used when dust generation is unavoidable and particularly during prolonged hot and dry periods. Dust suppression measures shall be agreed upon in consultation with the Engineer / REA.

Where construction has been completed in an area and the site shall be reshaped, the Contractor shall wet the affected area daily for a period of at least one week, to encourage the formation of biological (and or mineral salt) soil crust (depending on the conditions at the time, it is possible that wetting may not be required as the coastal fog would be adequate to fulfil this role, with the acceptance of the Engineer / REA).

5.2.23 Erosion, water quality and storm water control

The Contractor 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 Contractor 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 or effluent flows.

The Contractor shall establish, in agreement with the Engineer / REA, a suitable mechanism, where necessary, for containment and treatment of any potentially contaminated water emanating from the Works or associated activities, i.e. settlement or sedimentation ponds / oil separators / evaporation ponds.

5.2.24 Exiting and rehabilitation

The Contractor shall, on completion of the Contract, ensure that all materials, temporary structures, temporary fences, plant, equipment, and waste are completely removed from the Site. All areas affected during construction shall be shaped and trimmed to resemble the surrounding environment and in agreement with the Engineer / REA. Stockpiled topsoil shall be replaced on all affected areas and lightly compacted and then wetted daily for a period of at least one week (unless coastal fog conditions fulfil this role). Where heavy equipment has traversed the beach, the ruts shall be ripped to a depth of 500mm to loosen any compaction, if deemed necessary by the REA and Engineer. After ripping, the sand will be raked smooth to achieve a profile that is consistent with the surrounding beach.

5.3 OCEAN-BASED CONSTRUCTION MATTERS

HDPE pipe sections will be welded together on shore and the full length might then be pulled out into the surf with a tug boat or similar vessel to its final alignment and then sunk and encased in concrete. It is however likely that, due to the small diameter of the pipeline, that this can be done from the landside using earthmoving equipment.

Prior to commencing with any ocean based pipe laying activities involving water craft, the Contractor should make contact with the following organisations to inform them of the construction activity, provide details of the operations and details around the specific locations and the expected duration of such activities.

- NamPort and Walvis Bay Harbor;
- Swakopmund Sea Rescue Institute; and
- Any local Yacht and Recreation boat or fishing clubs.

Where pipes are connected on shore, beach or harbour, the Contractor must make necessary arrangements and the required authorisations must be made with the above entities and the Municipality.

5.3.1 Seaworthiness and construction staff competence

The Contractor shall ensure that any vessel used to lay the ocean pipes is seaworthy and is equipped with all necessary safety and emergency equipment including flares, buoyancy devices, spill kits, first aid kits, air, or fog-horns and fire extinguishers. All construction staff working at sea or within the active surf zone should first demonstrate a proficiency in swimming and should receive safety training. The vessel shall be equipped with a functioning two way radio that can connect to the harbour or other emergency services.

The Contractor shall also observe weather forecast and only conduct construction operations during suitable weather conditions. The planning of commencement of operations must also take weather forecasts into consideration.

5.3.2 Working times

Unless otherwise agreed to by the Engineer, REA and Safety Agent, the Contractor shall limit construction at sea to day light hours, Monday to Friday and no construction on Saturdays, Sundays and public holidays due to the increase in recreational boating over these times and in the target area and increased risks associated with this.

5.3.3 Biodiversity

No construction staff member is permitted to engage in any fishing activities whilst undertaking the construction. Feeding or otherwise disturbing any sea or bird life is prohibited.

The pipeline should follow a route that reduces or avoids the need for blasting or breaking of rock formations. In the event that blasting of rock is required, a visual inspection of the ocean area, approximately 2km radius, should be conducted by boat to ensure that there are not any sea mammals (i.e. turtles or whales) in the area before such blast. Where multiple blast area required there should not be more than one blast per day. Blasting methods that reduce the magnitude of shock waves should be employed (i.e. sequential blasting).

Care should be taken to avoid the loss of litter and construction debris to the ocean where it may be consumed by or ensnare marine biota. No dumping may occur at sea, including excess concrete or any other inert materials.

The Contractor shall restrict noise and vibration causing activities to the minimum required to complete the task and develop a programme that limits the length of beach works and wet works.

5.3.4 Pollution

The Contractor must ensure that all debris arising from construction activity is returned to shore and disposed of appropriately. The Contractor shall ensure that a spill kit is kept on board and that staff or trained in it used to attend to any spillage of hydrocarbons into the ocean. Refuelling of equipment and plant shall not occur in the intertidal or subtidal zones. All plant that is required to work in the intertidal and subtidal zones shall be inspected daily for oil and fuel leaks, and cleaned or repaired as required, prior to commencing with wet works.

5.4 COMPLIANCE AND PENALTIES

5.4.1 Compliance

Environmental management is concerned not only with the final results of the Contractor'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 Contractor shall comply with the environmental requirements on an ongoing basis and any failure on his part to do so will entitle the Engineer / REA to certify the imposition of a penalty, as provided for below, if such non-compliance is not corrected within a period of one week of notification thereof or if there are multiple transgressions.

5.4.2 Penalties

Penalties will be issued for certain transgressions. Penalties may be issued per incident at the discretion of the Engineer / REA. Such penalties will be issued in addition to any remedial cost incurred as a result of the non-compliance with this Specification. The Engineer / REA will inform the Contractor of the contravention and the amount of the penalty, and shall be entitled to deduct the amount from the monies due under the Contract.

Penalties for the activities detailed below, will be imposed by the Engineer / REA on the Contractor and / or his Sub-contractors.

a) Any employees, vehicles, plant related to the Contractor's operations operating outside the designated boundaries or a "no-go" area.	N\$ 2,000
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
e) Litter on site associated with construction activities, inadequately addressed.	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\$ 2,000
l) Hunting, fishing, trapping and collection of animals (per unit taken)	N\$ 15,000
m) A spillage, pollution, or any damage to the environment resulting from negligence on the part of the Contractor.	N\$ 5,000
n) Damage to vegetation or ground arising from plant or equipment leaving designated haul or access routes, especially sand dune systems.	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 / REA shall be the judge as to what constitutes a transgression in terms of this clause. Money received from penalties should be donated to a relevant and worthy conservation cause, i.e. a Damara Tern research and conservation initiative

5.5 MEASUREMENT AND PAYMENT

5.5.1 Basic principles

Except as specified SEMP or as Scheduled, no separate measurement and payment will be made to cover the cost of complying with the provisions of this SEMP and such costs shall be deemed to be covered by the rates tendered for the items in the Schedule of Quantities completed by the Contractor when submitting his tender.

5.5.2 SCHEDULED ITEMS

5.5.2.1 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).

5.5.2.2 Method statements: Additional work

No separate measurement or payment will be made for the provision of Method Statements but, where the Engineer / REA 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, shall be valued in accordance with GCC 90 Clause 40.

6 OPERATIONS PHASE

6.1 INTRODUCTION

Following the construction phase, the project will enter into the commissioning and operations phase of the project lifecycle. It is likely that Rössing Uranium will appoint an operations and maintenance (O&M) contractor to oversee the operations phase of the project, however, Rössing Uranium as the applicant will retain ultimate responsibility for the management and compliance of the facility in line with this SEMP, all statutory requirements and any conditions associated with the environmental clearance. It is also possible that Rössing would extend its HSE system and associated policies and procedure to include the operation of this facility. The O&M Contractor will therefore need to work closely with Rössing to ensure the facility meets all the requirements of Rössing HSE system and demonstrate commitment to the continual improvement philosophy that underpins an Environmental Management System.

This section of the SEMP contains specific OHSEC measures associated with the operation of the desalination plant and the mitigation of potential social and environmental impacts. Any O&M operations that involve construction type activity or repair work to any of the structures or infrastructure shall be conducted in accordance with the provisions set out under the construction phase (Refer to section 5) of this SEMP.

6.2 ORGANISATIONAL FRAMEWORK AND ENVIRONMENTAL AWARENESS

It is understood that Rössing Uranium intends to outsource the operations, maintenance, and management of the desalination plant. This SEMP should form part of any contractual arrangement between Rössing Uranium and the O&M Contractor. This will allow the O&M Contractor to make requisite financial and resource provisions to meet these obligations.

Whilst the contractor may be responsible for the day-to-day implementation of the requirements of this SEMP, the obligation for compliance remains with Rössing Uranium. Rössing Uranium must ensure therefore that environmental requirements are being adequately addressed by the contractor and reported on at regular intervals. To this end, the O&M Contractor shall delegate, in writing, the environmental management responsibilities to a senior member of the operational staff, henceforth referred to as the O&M Contractor's Environmental Officer (O&MCEO), who shall sign acceptance of the written appointment and the associated duties detailed hereunder. The duties of the O&MCEO include the following:

- Monitor day-to-day compliance of the operations associated with the desalination plant in terms of this SEMP and take corrective actions where required;
- Monitor local employment and procurement figures;
- Ensure that environmental awareness amongst the contractor's staff is addressed through routine toolbox talks, signboards and posters, or any other measures deemed appropriate;
- Report to Rössing Uranium any issues where operations are failing to meet the objectives set out in the SEMP;
- Respond to and address any environmental risks arising from any incidents on site and report such incidents to Rössing Uranium verbally within 4 hours. Further, this must be followed up with a written report within 24 hours on the incident, containing detailed information of corrective actions,

implemented response measures, rehabilitation and restorative measures, and any potential residual risks associated with such incident to the social and biophysical environment;

- Maintain a public complaints register. Any complaints received shall be investigated and immediately communicated to Rössing Uranium, and followed up in the monthly environmental performance report;
- Administer the environmental monitoring requirements as provided for in this SEMP, and distribute the data to Rössing Uranium at monthly intervals;
- Implement routine marine monitoring and reporting requirements;
- Liaise with Rössing Uranium, the O&M Contractor's staff, and authorities on all environmental matters associated with plant operations; and
- Compile a monthly environmental performance report covering all of the above.

The O&MCEO shall train all new staff on environmental “dos and don'ts” during their orientation. Current environmental matters associated with plant operations shall also be discussed during routine toolbox talks, which shall occur at a least once a month. The topics discussed and the reasons for topic selection shall be included in the O&MCEO's monthly environmental performance report.

6.3 EMERGENCY PREVENTION, PLANNING, AND RESPONSE

The O&M Contractor shall compile an emergency plan for approval by Rössing Uranium. The plan shall provide procedures for the following potential emergency scenarios and response requirements:

- A major chemical spill on site;
- A major chemical spill *enroute* (i.e. traffic accident);
- The rupture of the chlorine storage tanks;
- A site evacuation procedure (in the event of bomb threat or fire);
- Medical emergency (including the need to airlift a patient);
- A medical emergency at sea;
- Fire inside the facility;
- Major pipe burst; and
- An explosion (i.e. transformers).

For all emergency scenarios described above, the O&M Contractor shall identify suitable measures to reduce the risks of such emergencies occurring and provisions required to respond to such emergencies effectively, or until emergency services can intervene.

A copy of the emergency plan shall be provided to Rössing Uranium, the relevant emergency services, one onsite and one off-site copy. The emergency plan shall contain layout drawings of the plant which shows general access information and layout, such as roads, access ladders, doors, manholes, alternative escape routes, fire extinguishers, first aid provisions, water access points, etc. The plan will also show the location of potential hazards, such as LPG or Chlorine gas bottles, chemicals stores (including the type, max volume and nature of chemical stored there), fuel and oil stores.

All staff shall be made aware of the emergency procedures during their induction training. Emergency drills should be carried out on an annual basis to ensure proficiency of staff and adequacy of procedures. Procedures should be amended and updated based on new information or drill experience, where required.

All permanent staff should undergo basic first aid training. At least one fully trained first aider should be on site during every shift. The first aiders will be responsible for maintaining all emergency

equipment, ensuring that all emergency equipment and first aid provisions are routinely inspected and replaced or serviced as required.

A project signboard shall be provided at the entrance to the site which will provide the relevant contact details for key staff of the O&M Contractor and Rössing Uranium. A list of key emergency telephone numbers shall be posted near the telephone.

Rössing Uranium shall ensure that the O&M Contractor does not utilise the premises for any activity not directly associated with the operation or maintenance of the plant.

6.4 EMPLOYMENT CREATION AND SKILLS DEVELOPMENT

Whilst the operation of the plant will be outsourced to an O&M Contractor, Rössing Uranium should stipulate in the contract that the O&M Contractor is required to employ local labour for all unskilled and semi-skilled positions and or train local staff to fulfil semi-skilled positions. The O&M Contractor should also be required to undertake a skills development programme, where unskilled and semi-skilled workers are trained to undertake basic plant operations, which could make staff employable in other water and waste treatment facilities at the project end of life. Rössing Uranium in association with the O&M Contractor should identify required skills sets and develop a skills development programme. In the event of a succession in the O&M Contractor, Rössing Uranium, through its tendering and contracts process, should institute measures to protect the employment opportunities of local staff associated with such succession.

In addition, the O&M contract should also include targets pertaining to local procurement in accordance with Rössing Uranium's procurement policies, which should give preference to local service providers.

6.5 SITE ACCESS AND SECURITY

The desalination plant possesses a health and safety risk to the uninitiated, since much of the equipment is automated, turning on and off without warning and the various potentially harmful chemicals stored on the site. The plant also represents a significant financial investment and an important asset to Rössing Uranium. The plant's proximity to beach and salt pans is also such that the public may be enticed to enter the site out of interest. For these reasons it is essential that security and access control measures are implemented throughout the project lifespan.

An access control system shall be developed to ensure that no unauthorised personnel can gain access to desalination plant. A windscreen sticker should be provided to all permanent staff, authorised service providers, and officials needing access from time to time. All other visitors are required to report to the site offices on entering the plant and must be escorted around the facility.

All buildings, when not actively occupied, should be closed and locked. All vehicular and pedestrian gates should also be kept locked at all times. "No Unauthorised Entry" warning signage should be posted at entrances, warning of the potential danger and providing relevant contact numbers of key operational staff in the event that outsiders need entry for whatever reason.

A security presence shall be maintained on the site permanently, including during shutdown or mothballing periods. All security incidents shall be immediately reported to Rössing Uranium within 24 hours of occurring. Security personnel should be sourced from a reputable company and random checks should be conducted to ensure that personnel are at their stations and alert.

The O&M Contractor shall ensure that the premises are not used for any activity not directly associated with the operation or maintenance of the plant.

6.6 GENERAL PLANT OPERATION AND MAINTENANCE

The desalination plant should undergo routine maintenance and repairs to ensure that it continues to operate in accordance with pre-construction section. The use of chemicals on site and the discharge of concentrate containing potentially deleterious chemicals could change with wear and tear of the plant, becoming more detrimental to the marine environment. The O&M Contractor shall conduct regular tests on the water quality to confirm that the plant continues to operate at its design specification.

A detailed Operation and Maintenance (O&M) Manual shall be developed by the plant manufacturer / Engineer. The manual will provide detailed guidance on the safe operation of all equipment and associated systems as well as maintenance inspections, procedures and schedules. The implementation of this manual is seen as proactive management in addressing potential risks to the biophysical environment through breakdowns or equipment failures.

The appearance of all buildings, fences, roadways and all other structures shall be maintained to ensure the plant doesn't detract from the scenic value of the area as viewed by the general public. Rössing Uranium should conduct inspections to confirm that the maintenance programme is being implemented in accordance with the manual.

All materials should be stockpiled in a neat and orderly fashion in designated areas. The O&M Contractor shall make provision to undertake routine inspections and address areas where housekeeping practices are lacking. Where maintenance work requires construction activity, such activities should be carried out in conformance with the principles contained the Construction phase of this SEMP.

6.6.1 Seawater intake system

Care should be taken through design and operation to ensure that the peak velocity at the intake does not exceed ~0.15m/s, so as to ensure that fish and other organisms can escape the intake current.

Should chlorination of the intake water be necessary, this should be undertaken intermittently to ensure that the intake pipeline and feed-water pumping systems remain free of biofouling organisms, and to prevent bacterial re-growth in the brine. However, as the RO membranes are sensitive to oxidizing chemicals, neutralisation of residual chlorine, with sodium metabisulfite (SMBS), is necessary if membrane damage is to be avoided.

Scaling of the plant pipelines and RO membranes is controlled by the addition either of acid or specific antiscalant chemicals. Acids and polyphosphates cause eutrophication through formation of algal blooms and macroalgae, and should therefore be avoided. The preferred method would be to use phosphonate and organic polymer antiscalants, which have a low toxicity to aquatic invertebrate and fish species. Depending on the membrane type, the antiscalant product should preferably be one for which relevant eco-toxicological testing has already been undertaken.

6.6.2 Brine discharges

The discharge pipe should be fitted with a suitable diffuser system at its seaward end to ensure rapid and efficient dilution of the effluent with the receiving water, thereby reducing plume footprints near the seabed and minimising impacts on marine ecology. The design of the diffuser and discharge rates would meet the requirements of the South African Marine Water Quality Guidelines and the

Operational Policy for the Disposal of Land-derived Water containing Waste to the Marine Environment insofar as they are applicable to this type of installation.

During commissioning of the desalination plant, it may be necessary to discard the membrane storage solution and rinse the membranes before plant start-up. If the membrane storage solution contains a biocide or other chemicals these must either be neutralised before being discharged to sea, or the storage solution disposed of at an appropriate waste disposal facility.

Traces of residual chlorine in the brine discharge must be kept below $3\mu\text{g}/\ell$ (ANZECC (2000) guideline levels) by neutralising with sodium metabisulfite (SMBS). As marine organisms are extremely sensitive to residual chlorine, it is vital to ensure that the residual chlorine concentration in the discharged brine is at all times reduced to a level below that which may have lethal or sublethal effects on the biota, particularly the larval stages. Should the exceedance of the recommended guideline ($<3\mu\text{g}/\ell$) be a more persistent or recurrent event, there could be serious implications for marine biota in the discharge gully and the plant would need to be closed down until the problem has been rectified.

Although it is predicted that residual chlorine levels in the discharge will be below guideline levels, continuous monitoring of the effluent for residual chlorine and dissolved oxygen levels is essential. Should residual chlorine be detected in the brine, SMBS dosing should immediately be increased. The use of SMBS during dechlorination is, however, associated with oxygen depletion in the effluent if overdosing occurs, as this substance is an oxygen scavenger. Shock dosing with SMBS is also an effective way of eliminating re-growth of aerobic bacteria in the discharge pipelines. Aeration of the effluent prior to discharge is therefore recommended, preferably with a permanent aeration system. Alternatively, if a permanent *in situ* effluent monitoring system is in place, aeration can be undertaken intermittently when monitoring results detect unacceptably low dissolved oxygen levels in the effluent.

If DBNPA (biocide) were to be used as alternative to chlorine, mitigation measures to ensure low residuals of DBNPA in any discharge to the marine environment include appropriate design of the brine basin so as to ensure greater and sufficient dilution of the DBNPA residuals in the effluent stream and higher degradation rate before discharge. A better option would be carefully monitored dosing to ensure minimal DBNPA concentrations in the discharge.

The solids generated by the filtration, backwash, and CIP processes will be mixed with the DAF sludge and co-discharged with the brine. Care should be taken to control the release of co-discharges to avoid sudden spikes in concentration.

6.6.2.1 Brine discharge impact verification monitoring program

Rössing Uranium should consider implementing a structured before-after/control-impact monitoring program (Underwood 1992, 1993, 1994), which would commence prior to the start of construction and continue for at least **4 years** following the commencement of operation. The results of such a monitoring program will not only inform/ verify the extent and magnitude of the construction impacts for the desalination plant, but also the cumulative effects of the brine discharge.

The waste brine often contains low amounts of heavy metals from corrosive processes, which tend to enrich in suspended material and ultimately marine sediments. It is recommended that the effluent be monitored regularly (every 6 months) for heavy metals until a profile of the discharge in terms of heavy metal concentrations is determined. These heavy metal concentrations in the brine effluent would then need to be assessed based on existing guidelines (DWAF 2005; ANZECC 2000). An inspection program at similar intervals (every 6 months) to check corrosion levels of plant constituent parts and the physical integrity of the intake and outlet pipes and diffuser should be implemented and

components replaced or modified if excessive corrosion is identified or specific maintenance is required.

Rössing Uranium may need to undertake routine environmental monitoring over the long term to satisfy authorities and any conditions of authorisation, permits, and or licensing conditions. The Long-term Marine Monitoring Programme (LMMP) shall be developed by the marine specialist in association with the authorities on the basis of the findings of the marine impact verification monitoring. The responsibility for the environmental monitoring will fall to the O&MCEO. The LMMP monitoring will be focused on chemical monitoring criteria and should be less onerous than that detailed in the impact verification program.

This document should be updated with any the conditions of authorisation and any compliance reporting requirements associated with the environmental clearance or any other water abstraction, effluent discharge or water service provider license/s or permits issued for the operation of the desalination plant.

BIOLOGICAL MONITORING

Rössing Uranium should appoint a marine ecologist to assist with the biological marine monitoring, diffusion and whole effluent toxicity (WET) test and validation requirements, as explained here.

Monitoring plays a key role in ensuring that plant operations function as intended and achieve the provision of water with minimal environmental impacts. It includes validation, operational monitoring, verification, and surveillance. Validation is the process of obtaining evidence that control measures are capable of operating as required, in other words it should confirm that specific pieces of equipment achieve accepted performance standards. Operational monitoring is the planned series of observations or measurements undertaken to assess the ongoing performance of individual control measures in preventing, eliminating, or reducing hazards. Operational monitoring will normally be based on simple and rapid procedures such as measurement of turbidity and chlorine residuals or inspection of the distribution system integrity. Verification provides assurance that a system as a whole is providing safe water while surveillance reviews compliance with identified guidelines standards and regulations.

A monitoring program should be developed to study the effects of the discharged brine on the receiving water body, and/or intertidal biological communities surrounding the discharge location, particularly as monitoring of the affected subtidal benthic communities is in this case not feasible. This recommendation is reinforced by the *Guidelines for Environmental Evaluation for Seawater Desalination* published by the South African *Department of Water Affairs and Forestry* (DWA 2007), in which it is stated that it is essential that the effects of the discharge of brine into any water body be monitored according to a monitoring program performed at 6-monthly intervals over a period of approximately 4 years. This monitoring program would validate numerical modelling results and/or ecological assessments based on these. Depending on initial results, reduced monitoring (*i.e.* annually) may be acceptable. This monitoring will include measurement of the main water quality parameters such as temperature, salinity and dissolved oxygen as a minimum. It is further recommended that every effort be made to publish the results in a peer-reviewed journal.

Once the desalination plant is in full operation, a monitoring program should be implemented to ensure that the required level of dilution (as predicted by the numerical modelling) is achieved. Typical brine and thermal footprints need to be confirmed by sampling with a conductivity-temperature-depth (CTD) probe after an initial period of operation of the discharge both to confirm the performance of the discharge system and the numerical model predictions. This should be done for a suitably representative range of “conservative” environmental conditions, *i.e.* conditions for which dispersion of the effluent is likely to be the most limited. It is envisaged that two to three field surveys

of one to two days duration would be adequate to confirm the performance of the discharge system and the accuracy of model predictions. If field observations and monitoring fail to mirror predicted results, the forecasted impacts will need to be re-assessed.

To ensure complete confidence in the potential effects of the antiscalant to be used in the desalination plant and that the co-discharged waste-water constituents are being managed to concentrations that will not have significant environmental impacts, it will be necessary to undertake toxicity testing of the discharge for a full range of operational scenarios (*i.e.* shock-dosing, etc.). Once samples of the different operational scenario effluents have been collected, these should be tested according to the criteria set out in Table 3 and the results (or brine's physiochemical profile) should be communicated to the Ministry of Fisheries and Marine Resources. Such sampling and Whole Effluent Toxicity (WET) testing need only be undertaken for the duration and extent necessary to determine an effluent profile under all operational scenarios. Given that there are uncertainties regarding the effects and combined effects of chlorinated or de-chlorinated water, backwash sludge and CIP chemicals on the marine environment, whole effluent toxicity (WET) tests be conducted at the plant as soon as possible after it comes on line. In this WET test a range of species from different phyla are exposed to increasing dilutions of effluent from the plant for use in determining Lowest Observed Effective concentration (LOEC) and Predicted No Effect Concentration (PNEC) values for the effluent. This data can be used in conjunction with data from the dilution modelling and biological monitoring studies, to confirm if dilutions achieved in the near field are adequate to minimise impacts on the environment. Alternative mitigations relating to the discharging the backwash sludge and CIP chemicals may need to be sought if the required dilutions cannot be achieved within the near field (22m from point discharge).

Entrainment and impingement of marine organisms on the intake screens of the intake pipe should also be assessed and recorded once a month for the first three months of operation to assess the actual magnitude of these impacts. Results should be assessed by a qualified marine biologist.

PHYSIOCHEMICAL MONITORING OF BRINE

In line, real time monitoring instruments / probes should be positioned on the seawater intake pipeline and the brine discharge pipeline. These instruments should provide data on volumes, electrical conductivity, dissolved oxygen; and temperature. Where anomalous readings are detected in these indicator readings, an investigation should be initiated, and additional water samples taken (for laboratory testing) to determine the underlying cause and identify corrective actions. This system should persist for the operational life of the desalination plant.

Applicable Water Quality Guidelines

The Water Resources Management Act does not contain target values for water quality associated with brine effluent. These will form part of the regulations associated with the new Water Act and will be implemented at a future date (these are provided further on in this SEMP). As far as can be established, South Africa is the only southern African country that currently has an official set of water quality guidelines for coastal marine waters. In terms of policy, legislation and practice South Africa's operational policy for the disposal of land-derived wastewater to the marine environment (DWAF 2004 a-c) is thus of relevance. Specifically, environmental quality objectives need to be set for the marine environment, based on the requirements of the site-specific marine ecosystems, as well as other designated beneficial uses (both existing and future) of the receiving environment. The identification and mapping of marine ecosystems and the beneficial uses of the receiving marine environment provide a sound basis from which to derive site-specific environmental quality objectives (Taljaard *et al.* 2006). To ensure that environmental quality objectives are practical and effective management tools, they need to be set in terms of measurable target values, or ranges for specific water column and sediment parameters, or in terms of the abundance and diversity of biotic components. The

South African Water Quality Guidelines for Coastal Marine Waters (DWA 2005) provide recommended target values (as opposed to standards) for a range of substances, but these are not exhaustive. Therefore, in setting site-specific environmental quality objectives, the information contained in the DWA guideline document is supported by additional information obtained from published literature and best available international guidelines (e.g. BCLME 2006; ANZECC 2000; World Bank 1998; EPA 2006). Recommended target values are also reviewed and summarized in the Benguela Current Large Marine Ecosystem (BCLME) document on water quality guidelines for the BCLME region (CSIR 2006). Recommended target values extracted from these guidelines are provided in Table 2.

A mixing zone is the area around an effluent discharge point where the effluent is actively undergoing dilution with the water of the receiving environment. This zone usually encompasses the near-field and mid-field regions of dilution to allow for the plume to mix throughout the water column. No water quality criteria for physical and chemical stressors are defined within the mixing zone. Instead, these water quality criteria ('trigger values') are **defined at the boundary of the mixing zone** to ensure the quality of nearby waters does not deteriorate as a result of the effluent discharge. The boundaries of a proposed mixing zone are typically defined according to an estimated distance from the discharge point at which point defined water quality guidelines will be met, as predicted by numerical modelling of the discharge.

According to the WSP diffusion modelling report the results of the intermediate mixing model indicate a general influence area of approximately 30m to 40m from the effluent discharge point under varying water levels and coastal processes. The required brine dilutions are achieved all of the time at a distance of 22m from the discharge point under normal ocean conditions. Water quality standards and guidelines should therefore be applied at the edge of the mixing zone, which for practical purposes will be set at 30m, updrift from the discharge point in the mid surf zone (this is where readings are likely to be the highest under normal conditions). The actual mixing zone should be confirmed by a marine ecologist.

Figure 6 : Sampling point at the edge of the predicted mixing for brine



Table 2: Water quality guidelines for the discharge of brine into the marine environment.

VARIABLE	SOUTH AFRICA (DWA 2005)	Benguela Current Large Marine Ecosystem (BCLME 2006)	AUSTRALIA/NEW ZEALAND (ANZECC 2000)	WORLD BANK ^a (World Bank 1998)	US ENVIRONMENTAL PROTECTION AGENCY (EPA 2006)
Zone of impact / mixing zone	To be kept to a minimum, the acceptable dimensions of this zone informed by the EIA and requirements of licensing authorities, based on scientific evidence.	-	-	100 m radius from point of discharge for temperature	
Temperature	The maximum acceptable variation in ambient temperature is $\pm 1^{\circ}\text{C}$	<u>Where an appropriate reference system(s) is available, and there are sufficient data for the reference system, the guideline value should be determined as the range defined by the 20%ile and 80%ile of the seasonal distribution for the reference system. Test data: Median concentration for the period</u>	Where an appropriate reference system is available, and there are sufficient resources to collect the necessary information for the reference system, the median, (or mean) temperature should lie within the range defined by the 20%ile and 80%ile of the seasonal distribution of the ambient temperature for the reference system.	$< 3^{\circ}\text{C}$ above ambient at the edge of the zone where initial mixing and dilution take place. Where the zone is not defined, use 100 meters from the point of discharge when there are no sensitive aquatic ecosystems within this distance.	-
pH		<u>Where an appropriate reference system(s) is available, and there are sufficient data for the reference system, the guideline value range should be determined as the range defined by the 20%ile and 80%ile of the seasonal distribution for the reference system. pH changes of more than 0.5 pH unit from the seasonal maximum or minimum defined by the reference systems should be fully investigated.</u>	-	-	-
Salinity	33 – 36 psu	<u>Where an appropriate reference system(s) is available, and there are sufficient data for the reference system, the guideline value should be determined as the 20%ile or 80%ile of the reference system(s) distribution, depending upon whether low salinity or high salinity effects are being considered. Test data: Median concentration for the period</u>	Low-risk trigger concentrations for salinity are that the median (or mean) salinity should lie within the 20%ile and 80%ile of the ambient salinity distribution in the reference system(s). The old salinity guideline (ANZECC 1992) was that the salinity change should be $<5\%$ of the ambient salinity.	-	-
Total residual Chlorine	No guideline, however, deleterious effects recorded for concentrations as low as 2 – 20 $\mu\text{g}/\ell$. A conservative trigger value is $<2 \mu\text{g}/\ell$.	<u>3 $\mu\text{g Cl}/\ell$ measured as total residual chlorine</u>	3 $\mu\text{g Cl}/\ell$ measured as total residual chlorine (low reliability trigger value at 95% protection level, to be used only as an indicative interim working level) (ANZECC 2000) ^c	0.2 mg/ℓ at the point of discharge prior to dilution	Long-term and short-term water quality criteria for chlorine in seawater are 7.5 $\mu\text{g}/\ell$ and 13 $\mu\text{g}/\ell$, respectively
Dissolved oxygen	For the west coast, the dissolved oxygen should not fall below 10 % of the established natural variation. For the south and east coasts	<u>Where an appropriate reference system(s) is available, and there are sufficient data for the reference system, the guideline value should be determined as the 20%ile of the reference system(s) distribution. Where possible, the guideline value</u>	Where an appropriate reference system is available, and there are sufficient resources to collect the necessary information for the reference system, the median lowest diurnal DO concentration	-	-

VARIABLE	SOUTH AFRICA (DWAF 2005)	Benguela Current Large Marine Ecosystem (BCLME 2006)	AUSTRALIA/NEW ZEALAND (ANZECC 2000)	WORLD BANK ^a (World Bank 1998)	US ENVIRONMENTAL PROTECTION AGENCY (EPA 2006)
	the dissolved oxygen should not fall below 5 mg/l (99 % of the time) and below 6 mg/l (95 % of the time)	<u>should be obtained during low flow and high temperature periods when DO concentrations are likely to be at their lowest.</u>	for the period for DO should be >20%ile of the ambient dissolved oxygen concentration in the reference system(s) distribution. The trigger value should be obtained during low flow and high temperature periods when DO concentrations are likely to be at their lowest.		
Nutrients	Waters should not contain concentrations of dissolved nutrients that are capable of causing excessive or nuisance growth of algae or other aquatic plants or reducing dissolved oxygen concentrations below the target range indicated for dissolved oxygen (see above)	<u>Nutrient concentrations in the water column should not result in chlorophyll a, turbidity and/or dissolved oxygen levels that are outside the recommended water quality guideline range (see above). This range should be established by using either suitable statistical or mathematical modelling techniques.</u> <u>Alternatively, where a modelling approach may be difficult to implement, nutrient concentrations can be derived using the Reference system data approach: Where an appropriate reference system(s) is available and there are sufficient data for the reference system, the guideline value should be determined as the 80%ile of the reference system(s) distribution.</u>	Default trigger values of PO ₄ -P: 100 µg/l NO _x -N: 50 µg/l NH ₄ ⁺ -N: 50 µg/l for the low rainfall southern Australian region (Table 3.3.8 in ANZECC 2000)	-	-
Chromium	8 µg/l (as total Cr)	<u>Marine moderate reliability trigger value for chromium (III) of 10 µg./l with 95% protection</u> <u>Marine high reliability trigger value for chromium (VI) of 4.4 µg/l at 95% protection.</u>	Marine moderate reliability trigger value for chromium (III) of 10 µg./l with 95% protection Marine high reliability trigger value for chromium (VI) of 4.4 µg/l at 95% protection.	0.5 mg/l (total Cr) for effluents from thermal power plants	1 100 µg/l for highest concentration at brief exposure without unacceptable effect 50 µg/l highest concentration at continuous exposure without unacceptable effect
Iron	-	=	Insufficient data to derive a reliable trigger value. The current Canadian guideline level is 300 µg/l	1.0 mg/l for effluents from thermal power plants	
Molybdenum	-	=	Insufficient data to derive a marine trigger value for molybdenum. A low reliability trigger value of 23 µg/l was adopted to be used as indicative interim working levels.		
Nickel	25 µg/l (as total Ni)	<u><70 µg/l</u>	7 µg/l at a 99% protection level is recommended for slightly-moderately disturbed marine systems.		74 µg/l for highest concentration at brief exposure without unacceptable effect 8.2 µg/l highest concentration at continuous exposure without unacceptable effect

- a The World Bank guidelines are based on maximum permissible concentrations at the point of discharge and do not explicitly take into account the receiving environment, *i.e.* no cognisance is taken of the fact of the differences in transport and fate of pollutants between, for example, a surf zone, estuary or coastal embayment with poor flushing characteristics and an open and exposed coastline. It is for this reason that we include in this study other generally accepted Water Quality guidelines that take the nature of the receiving environment into account.
- b The ANZECC (2000) Water Quality guideline for salinity is less stringent than, but roughly approximates, the South African Water Quality guideline that requires that salinity should remain within the range of 33 psu to 36 psu (=ΔS of approximately 1 psu). Scientific studies have shown that effects on marine biota are primarily observed for increases of >4 psu above ambient level. ΔS 1 psu and 4 psu have been chosen for assessment purposes.
- c In case of chlorine “shocking”, which involves using high chlorine levels for a short period of time rather than a continuous low-level release, the target value is a maximum value of 2 mg/l for up to 2 hours, not to be repeated more frequently than once in 24 hours, with a 24-hour average of 0.2 mg/l (The same limits would apply to bromine and fluorine.).

Every six months, laboratory samples should be taken from the intake pipeline, the brine discharge pipeline and the brine sampling point at the edge of the predicted mixing zone and sent for testing and analysis to confirm that the plant is operating within its expected design parameters and to confirm that the chemical profile of the discharge roughly match the expected values and that the rate of dilution is occurring as predicted. These results should be communicated to the Ministry of Fisheries and Marine Resource. The following provisional water quality standards for Namibia have been provided. The laboratory should test for all criteria contained in the guidelines in Table 2 and Table 3 to follow.

The water quality at the edge of the mixing zone should comply with the guidelines provided in Table 2 and the provisional standards provided in Table 3 to follow.

Table 3: Special Water Quality Standards for Effluents

Criteria	Proposed Special Water Quality Standards for Effluents
Turbidity	<5 NTU
Colour	<10%
Suspended solids	<25 mg/l
TDS	<500 mg/l above the intake potable water quality
pH	6.5- 9.5
Temp	± 1°C of ambient
Nitrate as N	< 15 mg/l (as N)
Nitrite as N	<2 mg/l
Fluoride (F)	< 1 mg/l
Na	<50mg/l above the intake potable water quality
Ca	-
Mg	-
K	-
Chloride as Cl	<40mg/l above the intake potable water quality
Alkalinity as CaCO ₃	Not specified
Hardness as CaCO ₃	Not specified
Sulphate as SO ₄	<20mg/l above the intake potable water quality
Iron as Fe	<200 µg/l

6.6.3 Product water

Rössing Uranium shall undertake routine monitoring (in line probes are recommended) to ensure that water exiting the plant is fit for human consumption in accordance with the NamWater relevant drinking water standards. The O&M Contractor shall notify Rössing Uranium immediately of any transgressions in terms of the water quality standards, discontinue distribution, and institute measures to correct the problem. Only once the problem has been resolved to the satisfaction of NamWater shall water from the plant be permitted into the NamWater reticulation system.

6.7 WASTE MANAGEMENT, POLLUTION, AND MANAGEMENT OF CHEMICALS

The facility shall be provided with an adequate number of rubbish bins. Rubbish shall be collected at a weekly interval or as required and disposed of via the municipal waste disposal system. Care will be taken to prevent potentially hazardous materials from entering the waste stream through staff training exercises. The O&M Contractor shall make provision to undertake routine clean-ups of the site to ensure that litter and other wastes items do not accumulate on the site or are windblown into adjacent areas. Rössing Uranium shall ensure that the O&M Contractor does not utilise the premises for any use not directly associated with the operation or maintenance of the plant.

All staff having access to the various chemicals used on the site shall receive training and be proved competent in the handling and use of such chemicals. Unauthorised access to chemicals storage areas shall be prevented through appropriate enclosures and lockable access points. Staff shall use the correct personal protective clothing when handling chemicals. The buddy system must be used by all staff accessing and handling chemicals to ensure that the alarm may be raised in the event of an incident.

As part of the O&M manual and staff induction process, an “end-of-shift” (EOS) checklist should be drawn up for each staff member to ensure that no valves, stores/ or equipment is left in a state that may result in the accidental release of chemicals, or otherwise result in damage to the plant or harm to employees. Staff should be required to complete their EOS checklists and hand these to the supervisor on site. The supervisor shall review the checklist and, where EOS actions have not been completed, query as to the reason and reassign the duty to a person in the shift taking over. The ultimate responsibility remains with the site supervisor who must ensure that the risk of accidents arising due to negligence is minimised and where occurring, are decisively addressed, and the offending staff member disciplined.

Where chemicals are stored, handled and used, care will be taken that no residues are left behind that may enter into the stormwater system or be windblown from the site, including hydrocarbon leaks and spills from vehicles and plant. A hazardous waste disposal bin will be kept on site for the collection of contaminated materials, spent or spilt chemicals.

The O&M Contractor shall attend to any chemical spillages immediately. The O&M Contractor shall keep the necessary spill kit provisions on site to deal with the various chemicals in storage. The spill kit should include the following:

- Fire extinguisher;
- Plastic spade and brooms;
- Plastic bags and or drums for the collection of spilt and contaminated materials;
- Loose absorbent material;
- Floating booms required for containing buoyant chemicals in water;
- All neutralising chemicals, i.e. for neutralising strong acids;
- Material Safety Data Sheets for all potentially hazardous chemicals kept on site;
- At least four sets of Personal Protective Equipment, including:
 - Breathing apparatus;
 - Goggles;
 - Gum boots;
 - Plastic gloves; and
 - And any other requirements needed to deal with chemical leaks or spill that may occur on the site; with special reference made to chlorine gas.

In the event of a major chemical leak or spill, the O&M Contractor shall notify Rössing Uranium immediately and submit a written incident report within 24 hours of the incident, indicating the causative agents, the measures taken to contain and clean up the spill, measures taken to remediate the environment and any potential residual risk to either the environment or public as a result of such spill or leak.

The O&M Contractor shall conduct daily inspections of all chemical storage areas, bunds, dosing pumps and pipes, and any other protection measures to confirm that they are in working order. All storage bunds shall be kept free of stormwater. Potentially contaminated stormwater collected in the bund areas shall under no circumstance be discharged into the environment. Where there is concern that water has been contaminated by any chemical contaminant, such shall be recovered by truck and sent to a landfill site or waste water treatment facility. Depending on the type and level of

contamination, this may need to be diluted or added slowly into the waste water treatment works to ensure the functioning of the works is not disrupted. In the event of such a disposal being required, this must be agreed to by Rössing Uranium (and the owner of any disposal facility) and any conditions abided by.

The O&M Contractor shall employ sound inventory management practices so as to ensure that the volume of various chemicals stored on the site at any one time is kept to the efficient minimum. During periods of planned, prolonged shutdown, the O&M Contractor shall ensure that very little chemicals remain on the site over such period.

6.8 PROTECTION OF WILDLIFE (AND BIRDS)

The Mile 4 Salt pans are a recognised Important Bird Area. The SEIA optimised layout for the project has been established as a means to reduce the potential impact on resident birdlife, including the wading species frequenting the pans, the roosting species using the guano platforms and most important, the Damara Tern, with a nesting site located adjacent to the plant. Whilst the level of impact to these assemblages is considered within acceptable range, the O&M Contractor needs to remain vigilant and take measure to ensure that the operation and maintenance activities do not result in excessive disturbance to these bird assemblages. This message must be conveyed to all O&M staff during their induction training and should be reiterated during toolbox talks throughout the year and especially in lead up to the start of the Damara Tern breeding / nesting season which runs from October to April of every year. Where Damara Terns nesting sites are identified by any operational staff, the location of the site should be communicated to the O&MCEO, who should in turn communicate this to the rest of the staff and ask that they minimise any potential disturbance in the area.

The O&M contractor shall ensure that staff does not approach any of the sensitive bird assemblages either on foot or by vehicle, unnecessarily. Care should be taken to ensure that no staff attempt to collect eggs, hunt, snare or otherwise disturb the birds or any wildlife species found on or near the site. Care will also be taken to ensure that all vehicles and plant used in the operational phase remain on the designated roads and keep speeds to below 40kmph. Contraventions of these stipulations shall be dealt with to the full extent of the disciplinary policy.

The O&M contractor shall take all reasonable measures to control noise (i.e. close open service doors and hatches when possible, service exhaust silencers where required, maintain any acoustic barriers and machinery in general) and light pollution (i.e. switch off outside lights when not required, avoid using high beam settings when driving the access road at night) emanating from the plant and associated activities and these efforts should increase over the October to April period.

6.9 VISUAL IMPACT MANAGEMENT

Management measures provided in the pre-construction and construction phase of this SEMP are aimed at minimising the visual intrusion or impact associated with the plant and its operations. The O&M Contractor need only maintain the appearance of the facilities, undertake routine housekeeping and the visual screen around the desalination plant is maintained for the operational period.

The key operational phase visual impact relates to the lighting of the facility by night. Lighting must be kept to the efficient minimum. All lighting should be downward facing, task-specific lighting aimed at reducing the spillage of light into the surrounding areas. Rössing Uranium and the O&M Contractor should aim to avoid eyeshot of any point source of light on the facility when viewed from outside the

desalination plant perimeter. Lighting for the purposes of security should employ motion detector sensors as opposed to being permanently left on during the evenings.

6.10 NOISE IMPACT MANAGEMENT

The O&M contractor shall remain mindful of the need to minimise noise pollution as a result of plant operations and especially during night time operations and during the Damara Tern breeding season (October to April). Rössing Uranium shall ensure that the O&M Contractor does not utilise the premises for any activity not directly associated with the operation or maintenance of the plant.

Operational noise is not expected to be a problem during the day time. Night time operational noise during periods of mild ocean conditions may be audible by neighbouring residences and may disturb roosting or nesting birds. The O&M Contractor shall ensure that all doors, especially any large service doors on the main desalination plant building, are kept firmly shut when not actively in use. The O&M Contractor shall routinely inspect the structures and various items of plant to ensure that no noise causing vibration is occurring. Where such vibration is detected, measures shall be taken to address such noise or vibration. All diesel power equipment, pumps, fans, air compressors, or generators must be maintained in a good state of repair to prevent a potential noise increase.

All operational staff will be instructed to minimise noisy activities during dusk and night-time hours. Except in the event of an emergency or drill, no loudspeakers, amplified music, or sirens shall be used in day-to-day operations. The O&M contractor shall also maintain the main access road or any frequently travels gravel road to prevent the formation of corrugations or potholes which could increase the noise associated with the traffic to and from the desalination plant.

A detailed Operation and Maintenance (O&M) Manual will be compiled for the Desalination Plant by a mechanical contractor for the project. The O&M Manual will be implemented once the operational phase of the plant has commenced. 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 the O&M Contractor 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 SEMP.

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.

Staff employed to ensure the uninterrupted, smooth operation of the desalination plant, must be assessed and trained on an on-going basis to ensure an effective level of competency for successfully operating the desalination plant to acceptable standards.

6.10.1 Noise monitoring requirements

It is recommended that short term 24-hour to 1-week sampling be conducted at the Correctional Services accommodations (Green Houses), Damara Tern and Guano Platform areas during the operational phase at least on an annual basis but also during breeding season at the Damara Tern area. This monitoring may, under agreement, be undertaken by Rössing Uranium's OHSEC team.

Monitoring should be conducted in accordance with the procedures specified by the International Finance Corporation (2007) and SANS 10103 (2008). Samples, at least 24-hours in duration should include the following parameters: L_{Aeq} , L_{A90} , and the un-weighted octave band sound pressure levels (L_{Zeq}). In the interpretation and reporting of sampled environmental noise levels, use should be made of a trained specialist. In addition to ambient noise monitoring it is recommended that source noise measurements of main building facades and sources located outside buildings be sampled to verify L_W 's applied in this study.

The results from the noise monitoring shall be compared with the baseline readings and communicated to Rössing Uranium. Where noise levels appear to be on the increase, an attempt should be made to identify the reasons for the increase and imminent measures to reduce such noise escalation.

6.11 COASTAL PROCESSES

The O&M Contractor shall monitor and report changes in shoreline dynamics around the seawater intake or brine discharge structures. Should these changes persist for more than a few months or appear to be rapidly changing, the O&M Contractor shall inform Rössing Uranium, who should consult with a specialist and determine if the change is associated with the structures and secondly if an intervention is required. Where interventions are required that may require earthworks or other construction activities, the provision made under the construction phase of this SEMP shall apply.

7 DECOMMISSIONING PHASE

The plant will be designed to have a 10 year operational life, which coincides with the current Rössing Uranium Life of Mine plan. At the end of the design life period, the plant may be refurbished for continued operation, upgraded, or may be decommissioned, broken down and the site rehabilitated, or sold as a going concern to another mining house or NamWater, depending on the situation and needs at that time. Given that the plant will be producing water to potable water standards and will already be tied in with the existing NamWater system, decommissioning of the plant would seem to be a wasted opportunity.

However, in the event that the plant is decommissioned and dismantled and the site rehabilitated, the provision made under the construction phase of this SEMP shall be amended as required and apply to all de-construction activities. In the event of decommissioning, Rössing Uranium shall make every effort to have the various materials in the plant reclaimed for recycling or reuse elsewhere and reduce the volume of waste going to landfill.

ANNEXURE A

Environmental awareness

ANNEXURE A1

Environmental do's and don'ts

PROTECTION OF THE ENVIRONMENT IS YOUR RESPONSIBILITY/ BESKERMING VAN DIE OMGEWING IS JOU VERANTWOORDELIKHEID



REMAIN WITHIN WORKING AREAS
BLY BINNE WERKGEBIEDE



NO SWIMMING
SWEM VERBODE



DO NOT HARM OR DAMAGE PLANTS AND ANIMALS
MOENIE PLANTE EN DIERE BESKADIG NIE



SMOKE CAUTIOUSLY
ROOK VERSIGTIG



BE AWARE OF FIRES
PASOP VIR VUUR



PREVENT OIL POLLUTION
VOORKOM OLIE-BESOEDILING



CONTROL DUST
BEHEER STOF



LIMIT NOISE
VERMINDER GERAAS



USE TOILETS
GEBRUIK DIE TOILETTE



USE THE EATING AREAS
EET BINNE DIE EETGEBIED



USE RUBBISH BINS
GEBRUIK ASBLIKKE



DON'T SPEED/
SECURE LOADS
RY STADIG/ MAAK VRAGTE VAS



KNOW THE EMERGENCY NUMBERS
KEN DIE NOOD NOMMERS



ASK QUESTIONS
VRA VRAE

