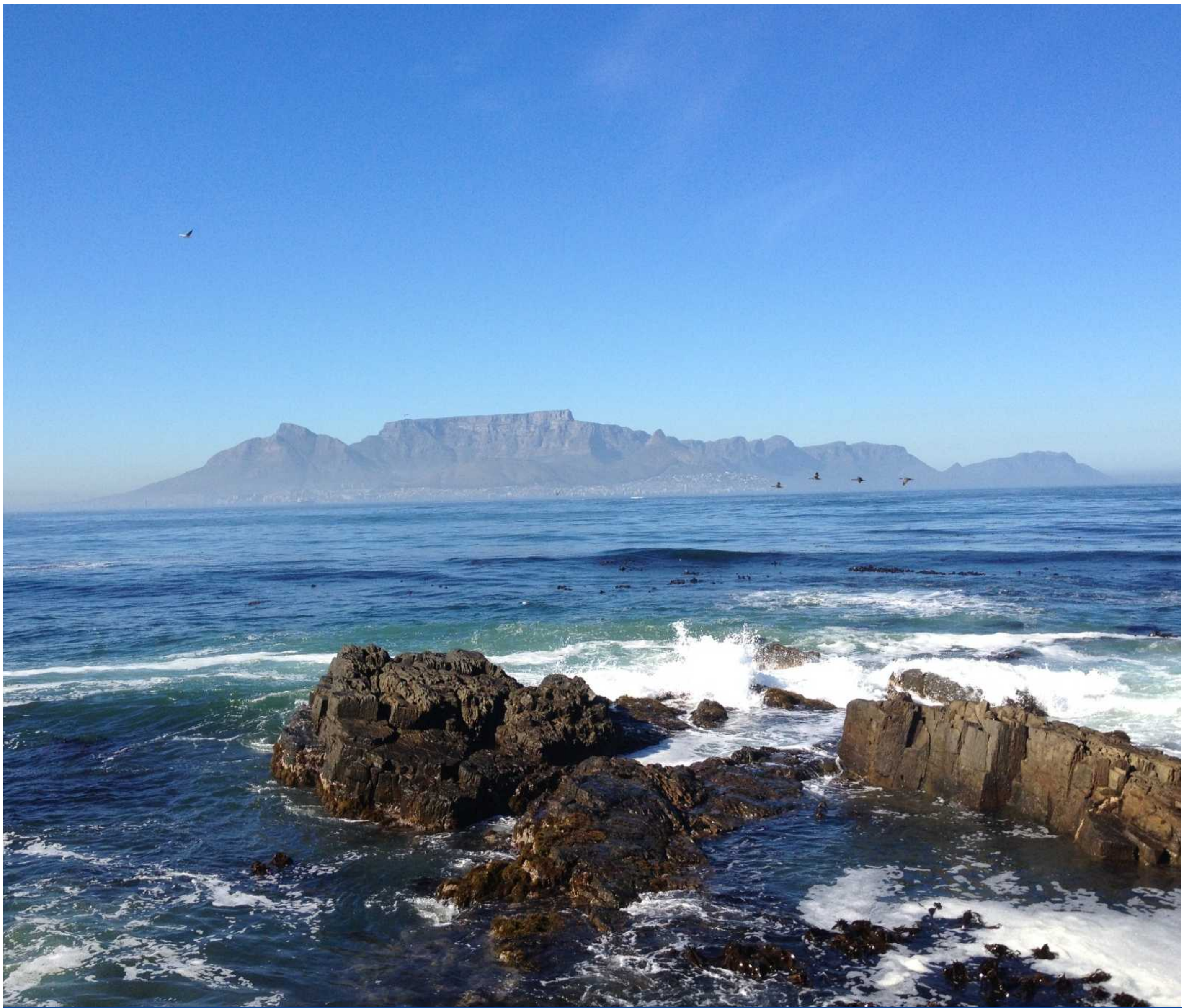

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WSP

ROBBEN ISLAND SEWAGE PACKAGE PLANT
DEPARTMENT OF PUBLIC WORKS

Final Basic Assessment Report

September 2014

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

	(For official use only)
File Reference Number:	14/12/16/3/3/3/83
Application Number:	
Date Received:	

Basic assessment report in terms of the Environmental Impact Assessment Regulations, 2010, promulgated in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended.

Kindly note that:

1. This basic assessment report is a standard report that may be required by a competent authority in terms of the EIA Regulations, 2010 and is meant to streamline applications. Please make sure that it is the report used by the particular competent authority for the activity that is being applied for.
2. This report format is current as of 1 September 2012. It is the responsibility of the applicant to ascertain whether subsequent versions of the form have been published or produced by the competent authority
3. The report must be typed within the spaces provided in the form. The size of the spaces provided is not necessarily indicative of the amount of information to be provided. The report is in the form of a table that can extend itself as each space is filled with typing.
4. Where applicable tick the boxes that are applicable in the report.
5. An incomplete report may be returned to the applicant for revision.
6. The use of "not applicable" in the report must be done with circumspection because if it is used in respect of material information that is required by the competent authority for assessing the application, it may result in the rejection of the application as provided for in the regulations.
7. This report must be handed in at offices of the relevant competent authority as determined by each authority.
8. No faxed or e-mailed reports will be accepted.
9. The signature of the EAP on the report must be an original signature.
10. The report must be compiled by an independent environmental assessment practitioner.
11. Unless protected by law, all information in the report will become public information on receipt by the competent authority. Any interested and affected party should be provided with the information contained in this report on request, during any stage of the application process.
12. A competent authority may require that for specified types of activities in defined situations only parts of this report need to be completed.
13. Should a specialist report or report on a specialised process be submitted at any stage for any part of this application, the terms of reference for such report must also be submitted.

14. Two (2) colour hard copies and one (1) electronic copy of the report must be submitted to the competent authority.
15. Shape files (.shp) for maps must be included on the electronic copy of the report submitted to the competent authority.

SECTION A: ACTIVITY INFORMATION

Has a specialist been consulted to assist with the completion of this section?	YES	NO

If YES, please complete the form entitled "Details of specialist and declaration of interest" for the specialist appointed and attach in Appendix I.

1. PROJECT DESCRIPTION

a) Describe the project associated with the listed activities applied for

The proposed project entails the construction of a Sewage Package Plant (SPP) on Robben Island. The SPP will be used to treat sewage effluent generated on the island, which will be transported to the nearby existing sea outfall pipe (constructed in 2000) where sewage is currently discharged at a distance of 465m from shore. The current marine outfall on Robben Island was designed to discharge an effluent comprising raw macerated sewerage. This has historically been under permit to comply with the Marine Water Quality Guidelines for the South African Coastal Zone (DWAF, 1995) within an acceptable distance from the offshore discharge point through dilution.

A treatment facility is now required to ensure that the effluent reaches the required discharge concentrations. The facility will be designed to achieve the General Limit Values (GN 665 of 2013) for the disposal of wastewater to a water resource in terms of in terms of Section 39 of the National Water Act, 1998 (Act No 36 of 1998).

The primary motivation for the project is that currently there is no waste water treatment infrastructure on Robben Island. The SPP will therefore serve to provide vital infrastructure for the island.

The treatment throughout capacity of the plant will be approximately 300m^3 per day, or 108,000m^3 per annum and will be based upon the design of the Ampac® Submerged Bio media Sewage Treatment Plant. Raw sewage will be collected in the existing inflow collection sump, where it will be macerated and transferred into the treatment plant. Following treatment, effluent will be transported via an existing pipeline to the existing marine pump station where it will be transferred to the existing marine outfall pipeline and discharged to sea. The plant will also have include a 240m^3 storage tank to store treated effluent for irrigation of nearby sports fields in the future.

As a by-product of the process, an estimated 120m^3 of sludge will be generated annually. The sludge will be inert as a result of the bacteriological breakdown that occurs during extended biological breakdown within the chambers. This means that the sludge will be a "spent" by-product with no metabolic activity. Sludge will be transferred to a drying bed (DB) located directly adjacent to the facility and disposed of via the normal refuse system (appropriately licenced landfill site) or to a municipal waste water treatment works (WWTW).

Ancillary infrastructure will include a new sewer pump and blowers to support the existing pump station.

The sewage package plant and associated infrastructure will require a boundary area of 1400m^2 (the area contained within the security fence) which includes the sewage treatment plant and adjoining irrigation tanks and two drying beds for the inert sludge by-product. The plant footprint will be 310m^2, and the drying beds will be 50m^2. A total development footprint of 600m^2 has been assumed (including pipelines and pump station). The plant will be partially submerged in the ground to a depth of 2.5m. Some short lengths of pipeline will be required (~45 m in length), plus an additional 50m of pipeline between the plant, pumps and drying beds. The pipeline to the existing outfall will not be replaced/constructed.

The listed activities for the development in terms of NEMA include:

- GN 544 (16) for the construction or earth moving activities within 100m inland of the high water mark or sea for buildings greater than 50 square meters.
- GN 544 (18) for the infilling or depositing of material more than 5 cubic metres, or dredging and excavation of material within 100m of the high water mark.

In terms of NEM:WA the listed activities include:

- GN 921: Category A (1) the storage of general waste in lagoons.

b) Provide a detailed description of the listed activities associated with the project as applied for

Listed activity as described in GN R.544, 545 and 546	Description of project activity
GN 544 (Activity 16)	The proposed Sewage Package Plant will be constructed within ~50m of inland of the high watermark or sea and will have a footprint of $600m^2$ within a fenced area of $1400m^2$.
GN 544 (Activity 18)	Due to the locality of the plant and pipelines to the sea, it is expected that various materials such as rocks, pebbles, shells, soil etc. will be removed within a distance of ~50m inland from the high-water mark and will be more than $5m^3$.

2. FEASIBLE AND REASONABLE ALTERNATIVES

"alternatives", in relation to a proposed activity, means different means of meeting the general purpose and requirements of the activity, which may include alternatives to—

(a) the property on which or location where it is proposed to undertake the activity;
(b) the type of activity to be undertaken;
(c) the design or layout of the activity;
(d) the technology to be used in the activity;
(e) the operational aspects of the activity; and
(f) the option of not implementing the activity.

Describe alternatives that are considered in this application as required by Regulation 22(2)(h) of GN R.543. Alternatives should include a consideration of all possible means by which the purpose and need of the proposed activity (NOT PROJECT) could be accomplished in the specific instance taking account of the interest of the applicant in the activity. The no-go alternative must in all cases be included in the assessment phase as the baseline against which the impacts of the other alternatives are assessed.

The determination of whether site or activity (including different processes, etc.) or both is appropriate needs to be informed by the specific circumstances of the activity and its environment. After receipt of this report the, competent authority may also request the applicant to assess additional alternatives that could possibly accomplish the purpose and need of the proposed activity if it is clear that realistic alternatives have not been considered to a reasonable extent.

The identification of alternatives should be in line with the Integrated Environmental Assessment Guideline Series 11, published by the DEA in 2004. Should the alternatives include different locations and lay-outs, the co-ordinates of the different alternatives must be provided. The co-ordinates should be in degrees, minutes and seconds. The projection that must be used in all cases is the WGS84 spheroid in a national or local projection.

a) Site alternatives

Alternative 1 (preferred alternative)		
Description	Lat (DDMMSS)	Long (DDMMSS)
The <u>preferred alternative</u> entails the placement of the SPP and drying bed (DB) at a site which is located at the eastern side of Robben Island, bounded to the northeast by Murray's Bay beach (50m), to the north by the Dog Unit (the main living quarters renamed Robert Sobukwe House) (30m), to the west by Murray's Road (80m) and to the south by the Robben Island village proper (500m) (Figure 2). The site has been selected as the preferred site for a number of reasons: - The site is in close proximity to the existing marine outfall which will reduce the length of pipe required and disturbance to the island. - The site is adjacent to the existing collection sump where all effluent reticulation on the island is currently routed to, prior to maceration and discharge. - The site is also in close proximity to the existing marine pump station which means that the size of the additional pump required can be minimised. - There are no significant heritage resources in this area. - The area is not accessed directly by visitors to the island. - The visual aspects in terms of traffic passing on Murray's Road can be appropriately managed. - Existing access road from Murray's Bay Road. - The site location maintains an appropriate distance from Robben Island Village.	48' 16,12 S	22' 37,74 E
Alternative 2		
Description	Lat (DDMMSS)	Long (DDMMSS)
An alternative site placement option that was considered entailed the construction of the drying beds further inland (approximately 600m to the northwest within a disused reservoir or the piggery), whilst the SPP remains adjacent the existing collection sump and marine pump station (for technical reasons outlined above). This proposed northwestern location for the drying beds was initially sited as the preferred option by the project proponent however the appointed Archaeology Specialist deemed the option to be less preferable due to the reservoir and piggery being older than 60 years and being located on a World Heritage Site and were therefore expected to have considerable heritage value. On heritage grounds this option became the least favoured option. This option would also require significant pipeline laying from the SPP to the beds and would therefore have greater environmental impact. The location of the alternative drying location is shown in the Location Map provided in Appendix A.	48' 16,12 S 33'48,10 S	22' 37,74 E (SPP) 18' 22,16E (DB)
Alternative 3		
Description	Lat (DDMMSS)	Long (DDMMSS)
No further alternatives were considered for the location of the SPP due to the fact that the SPP must be located in close proximity to the existing marine outfall and collection sump.	N/A	N/A

In the case of linear activities:

Alternative: Latitude (S): Longitude (E):
Alternative S1 (preferred)

<u>*A pipeline already exists from the SPP to the marine outfall; therefore the construction of a pipeline is not part of the development application. Location points A, B and C of the EXISTING pipeline shown below, are reflected on the Site Layout Map in Appendix A.*</u>

• Starting point of the activity <u>*(A)*</u>	33°48'14.83"S	18°22'37.68"E
• Middle/Additional point of the activity <u>*(B)*</u>	33°48'17.87"S	18°22'40.33"E

• End point of the activity *(C)*	33°48'20.08"S	18°22'43.35"E
Alternative S2 (if any)		
• Starting point of the activity		
• Middle/Additional point of the activity		
• End point of the activity		
Alternative S3 (if any)		
• Starting point of the activity		
• Middle/Additional point of the activity		
• End point of the activity		

For route alternatives that are longer than 500m, please provide an addendum with co-ordinates taken every 250 meters along the route for each alternative alignment.

In the case of an area being under application, please provide the co-ordinates of the corners of the site as indicated on the lay-out map provided in Appendix A.

Coordinates provided relate to Layout Map Provided in Appendix A.

b) Lay-out alternatives

Alternative 1 (preferred alternative)		
Description	Lat (DDMMSS)	Long (DDMMSS)
The SPP (4 m high) will be partially submerged within the ground to a depth of 2m. This will serve to reduce the visibility of the plant. Visitors to the island travel from the port (north of the proposed SPP location) to the Robben Island Village proper via Murray Road and therefore will pass the proposed SPP location, as such visibility of the unit should be minimised as much as possible. An additional new pump station and blowers will be required which is to be built between the SPP and the Dog Unit to minimise visual disturbance. By locating additional new pump station in close proximity to the existing station it has been possible to reduce the size of the pump and blowers required. This has further assisted in minimising the visibility of the proposed SPP and associated infrastructure. The drying bed (DB) will be located directly adjacent on the seaward side of the proposed SPP to reduce the visual impact of the facility from Murray's Bay Road. This preferred alternative layout is believed to be the most efficient in terms of minimising disturbance and the need for additional infrastructure.	Corner 1: 33°48'15.34"S Coroner 2: 33°48'15.34"S Corner 3: 33°48'15.34"S Corner 4: 33°48'15.50"S Corner 5: 33°48'15.50"S Corner 6: 33°48'14.83"S	Corner 1: 18°22'36.75"E Corner 2: 18°22'36.75"E Corner 3: 18°22'36.75"E Corner 4: 18°22'37.64"E Corner 5: 18°22'37.64"E Corner 6: 18°22'37.68"E
Alternative 2		
Description	Lat (DDMMSS)	Long (DDMMSS)
The second layout alternative entails the placement of the drying beds to the southeast of the proposed SPP (on the Murray's Bay Road side). The SPP, pump and blowers are placed as per the preferred option. The SPP is not submerged into the ground, and reaches an elevation of 4m. This option became the least preffered option as a result of to the potential loss in visual amenity from Murrays Bay Road.	33°48'15.34"S 33°48'16.95"S 33°48'16.69"S 33°48'15.14"S	18°22'36.75"E 18°22'37.96"E 18°22'38.39"E 18°22'37.18"E

Alternative 3		
Description	Lat (DDMMSS)	Long (DDMMSS)
No further alternative layout was assessed.		

c) Technology alternatives

Alternative 1 (preferred alternative)

Submerged Biomedia Technology

The exact system to be employed will be decided upon through a tender process to be completed by the project applicant The technology employed will treat effluent to the South African Department of Water Affairs (DWA) General Limit Values (GN 665 of 2013) in terms of Section 39 of the National Water Act. No 36 of 1998. The technology will be based on the Ampac® Submerged Aeration Media (SAM) modular treatment unit. This technology, developed by Amitek, is a waste water treatment solution specifically designed for use in situations where there is no municipal sewage infrastructure.

Interlinked stages in the process (shown in the diagram below) include:

- An anaerobic primary settler providing oxidation and sludge stabilisation and wasted sludge storage, as well as the beginning phase of some biological phosphate removal which is completed in the aerobic conditions which follow.
- The anoxic second settler insulates the primary settler from nitrates whilst promoting denitrification and the overall treatment process efficiency and effluent quality. The twin return activated sludge mechanisms improve efficiencies by returning nitrate-rich effluent from the final settler to the anoxic second chamber which in turn re-seeds the anaerobic first chamber by returning nitrate-poor bio-mass to the primary settler.
- The aerobic bio-reactor is provided with submerged bio-media with fine bubble aeration generated oxygen-rich effluent flow to complete complex degradation through nitrification to nitrates before the anoxic final settling denitrification phase.
- Denitrification in the Anoxic final settler converts nitrates to nitrogen gas which is lost to atmosphere, although in minute undetectable quantities. Sludge production is reduced to minimal levels because of the relatively large chambers and long retention times, enabling relatively extended biological action of the bacterial colonies in the chambers. This removes substantial sludge production because bacteria are attached to the submerged bio-media, unlike the activated sludge process where bacteria is suspended in the liquid. This results in virtually no sludge wasting.

The process eliminates bad odour and the plants are fully enclosed thus preventing the escape of odours into the atmosphere. The process may also be submerged to reduce visual impact and requires a fairly small area for development.

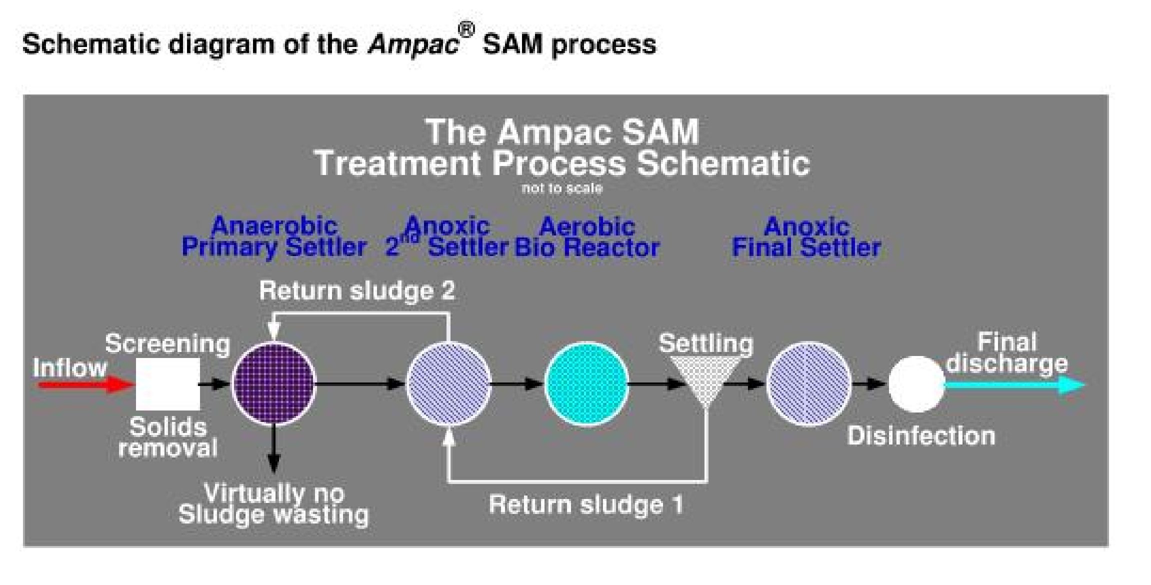


Figure 1 Flow Chart of the preferred treatment process

Alternative 2

Construction of Stabilisation Pond System

Oxidation or Stabilisation Pond systems are among the most common form of wastewater treatment in countries where land and sunlight are readily available and stringent effluent discharge limits are not considered as important as practical effective reduction in the environmental risk posed by sewage. Pond systems however require extensive areas, generally at least 40 days hydraulic retention time, which whilst available in this instance, may not consistently produce a quality suitable for discharge or reuse within the site environs. This option was not deemed feasible due to the fact that the oxidation pond system requires a much larger area plus other considerations such as negative visual impact and odour concerns.
Alternative 3
Construction of Activated Sludge System Activated sludge is the most common form of wastewater treatment for low concentrations of organics, and for achieving high quality, low residual COD effluent. In general, activated sludge plants encompass a variety of mechanisms and processes that use dissolved oxygen to promote the growth of biological floc that substantially removes organic material. Activated sludge plants require a small footprint area, and can produce good quality treated effluent suitable for re-use for watering in the site environs. The option was deemed less preferable to the submerged bio-media technology due to the fact that activated sludge systems usually are not typically positioned underground, and therefore is less preferable from a visual aspect.

d) Other alternatives (e.g. scheduling, demand, input, scale and design alternatives)

Alternative 1 (preferred alternative)
Effluent treatment via small on-site Sewage Package Plant (as described) and treated effluent is released via existing outfall.
Alternative 2
Reticulation to Municipal Sewage Treatment Plant The nearest Municipal Waste Water Treatment Plant (WWTP) Athlone, is > 25km from the site on the mainland. It is not considered technically practical to reticulate a small volume of sewage over such distance.
Alternative 3
Septic Tanks Septic tank-infiltration systems are widely applied for rural households and small communities in South Africa. However, as the sewage load increases, septic tank systems and french drain soakaways are not suitable, potentially leading to untreated effluent discharge to surface or contaminate the groundwater and/ or marine environment resulting in a public health and environmental pollution risk.

e) No-go alternative

The no-go alternative is that no SPP is developed and there is thus no effluent treatment capability on Robben Island. This alternative would entail continuation of status quo in terms of release of untreated effluent directly into the sea via the existing sea outfall pipe posing a risk to the environmental quality of the marine environment. The current method for disposing of waste water from the island is that sewage is captured in a collection sump, before it is screened for solid debris, macerated and discharged to the open ocean. Although the design of the outfall (constructed in 2000) was designed under the prediction that compliance of the effluent with water quality guidelines for direct contact recreation would be achieved within 1km of the discharge location, and that suspended solids would be reduced to 5 mg/l above ambient within 200m of the discharge, historical monitoring of the effluent indicated that values of ammonia (as nitrogen), chemical oxygen demand (COD) and suspended solids were exceeding DWAF requirements within 100m from the outlet. Furthermore, values for various trace metals (copper and zinc) were also in excess of General Waste Water Limits (GWWLs) as well as DWAF and international water quality guidelines. It can therefore be expected that marine communities in the vicinity of the outfall have been impacted to at least some degree by the effluent discharged since 2001. The No-Go Alternative will entail the continued impact on the offshore marine environment and may be a threat to the integrity of the Robben Island World Heritage Site. This was noted by UNESCO in 2004 (http://whc.unesco.org/en/soc/1432). As such, the No-Go alternative is not considered a preferred alternative.

Paragraphs 3 – 13 below should be completed for each alternative.

3. PHYSICAL SIZE OF THE ACTIVITY

a) Indicate the physical size of the preferred activity/technology as well as alternative activities/technologies (footprints):

Alternative:	Size of the activity:
Alternative A1[1] (preferred activity alternative)	600m²
Alternative A2 (if any)	600m²
Alternative A3 (if any)	m²

or, for linear activities:

Alternative:	Length of the activity:
Alternative A1 (preferred activity alternative)	45m (+ 50m additional pipeline length in the SPP)
Alternative A2 (if any)	m
Alternative A3 (if any)	m

b) Indicate the size of the alternative sites or servitudes (within which the above footprints will occur):

Alternative:	Size of the site/servitude:
Alternative A1 (preferred activity alternative)	1,400m²
Alternative A2 (if any)	m²
Alternative A3 (if any)	m²

4. SITE ACCESS

Does ready access to the site exist?	YES	NO
If NO, what is the distance over which a new access road will be built	m	

Describe the type of access road planned:

N/A - Access to the proposed site is available via the existing Murrays Bay Road.

Include the position of the access road on the site plan and required map, as well as an indication of the road in relation to the site.

5. LOCALITY MAP

An A3 locality map must be attached to the back of this document, as Appendix A. The scale of the locality map must be relevant to the size of the development (at least 1:50 000. For linear activities of more than 25 kilometres, a smaller scale e.g. 1:250 000 can be used. The scale must be indicated on the map.). The map must indicate the following:

[1] "Alternative A.." refer to activity, process, technology or other alternatives.

- an accurate indication of the project site position as well as the positions of the alternative sites, if any;
- indication of all the alternatives identified;
- closest town(s;)
- road access frocality om all major roads in the area;
- road names or numbers of all major roads as well as the roads that provide access to the site(s);
- all roads within a 1km radius of the site or alternative sites; and
- a north arrow;
- a legend; and
- locality GPS co-ordinates (Indicate the position of the activity using the latitude and longitude of the centre point of the site for each alternative site. The co-ordinates should be in degrees and decimal minutes. The minutes should have at least three decimals to ensure adequate accuracy. The projection that must be used in all cases is the WGS84 spheroid in a national or local projection).

6. LAYOUT/ROUTE PLAN

A detailed site or route plan(s) must be prepared for each alternative site or alternative activity. It must be attached as Appendix A to this document.

The site or route plans must indicate the following:

- the property boundaries and numbers of all the properties within 50 metres of the site;
- the current land use as well as the land use zoning of the site;
- the current land use as well as the land use zoning each of the properties adjoining the site or sites;
- the exact position of each listed activity applied for (including alternatives);
- servitude(s) indicating the purpose of the servitude;
- a legend; and
- a north arrow.

7. SENSITIVITY MAP

The layout/route plan as indicated above must be overlain with a sensitivity map that indicates all the sensitive areas associated with the site, including, but not limited to:

- watercourses;
- the 1:100 year flood line (where available or where it is required by DWA);
- ridges;
- cultural and historical features;
- areas with indigenous vegetation (even if it is degraded or infested with alien species); and
- critical biodiversity areas.

The sensitivity map must also cover areas within 100m of the site and must be attached in Appendix A.

8. SITE PHOTOGRAPHS

Colour photographs from the centre of the site must be taken in at least the eight major compass directions with a description of each photograph. Photographs must be attached under Appendix B to this report. It must be supplemented with additional photographs of relevant features on the site, if applicable.

9. FACILITY ILLUSTRATION

A detailed illustration of the activity must be provided at a scale of at least 1:200 as Appendix C for activities that include structures. The illustrations must be to scale and must represent a realistic image of the planned activity. The illustration must give a representative view of the activity.

10. ACTIVITY MOTIVATION

Motivate and explain the need and desirability of the activity (including demand for the activity):

1. Is the activity permitted in terms of the property's existing land use rights?	YES	NO	Please explain
The proposed project site land is not currently used for any purpose and is a vacant area supporting sparse grass and isolated shrubs and trees. The site is located on Robben Island which is a National and World l Heritage Site. The proposed construction of a sewage package plant is vital if the Island is to continue to be utilised as an educational and cultural heritage resource since the current infrastructure is operating inefficiently and is resulting in unacceptable water quality impacts. In 2004, the impacts of the marine sewer outfall were recognised as one of the threats to the Robben Island World Heritage site, which if not adequately managed or controlled could adversely impact on the integrity of the area (http://whc.unesco.org/en/soc/1432).			
2. Will the activity be in line with the following?			
(a) Provincial Spatial Development Framework (PSDF)	YES	NO	Please explain
City of Cape Town SPDF (2012) Policy No. 26 aims to "Reduce the impact of urban development on river systems, wetlands, aquifers, aquifer recharge areas and discharge areas". Policy guideline P26.2 specifically indicates the need for land use management decisions to allow for minimisation of sewage discharges into the natural environment. The activity will serve to improve the quality of discharged effluent into Table Bay and therefore is aligned to the SPDF.			
(b) Urban edge / Edge of Built environment for the area	YES	NO	Please explain
The development of an "urban edge" is used to spatially and temporally control development at the edge of urban areas to ensure efficiency of growth, to control the possibility of unfettered urban sprawl. The SPP will not result in urban sprawl. The proposed SPP will be designed to meet the islands existing needs without any significant anticipated increase in throughput capacity in the future due to the fact that the island is a protected National and World Heritage Site, and therefore no urban development other than that required to service the needs of the Island and its heritage can be expected.			

(c) Integrated Development Plan (IDP) and Spatial Development Framework (SDF) of the Local Municipality (e.g. would the approval of this application compromise the integrity of the existing approved and credible municipal IDP and SDF?).	YES	NO	Please explain

The 2012- 2017 Integrated Development Plan (IDP) outlines the City of Cape Town's development objectives during the 5 year period. The vision and mission of the City of Cape Town is threefold:

- To be an opportunity city that creates an enabling environment for economic growth and job creation;
- To deliver quality services to all residents; and
- To serve the citizens of Cape Town.

The City of Cape Town pursues a multi-pronged vision to:

- be a prosperous city that creates an enabling and inclusive environment for shared economic growth and development;
- achieve effective and equitable service delivery; and
- serve the citizens of Cape Town as a well-governed and effectively run administration.

In striving to achieve this vision, the City's mission is to:

- contribute actively to the development of its environmental, human and social capital;
- offer high-quality services to all who live in, do business in, or visit Cape Town as tourists; and
- be known for its efficient, effective and caring government.

The SPP does not compromise the existing IDP. One of the core aims of the IDP is spearheading a focus on infrastructure investment and maintenance to provide a sustainable drive for economic growth and development, greater economic freedom, and increased opportunities for investment and job creation. The SPP will contribute towards both infrastructure development on the island, as well as serve to create a number of temporary jobs and allow the continued use of the island for cultural, education and tourism purposes which is to be benefit of the city.

(d) Approved Structure Plan of the Municipality	YES	NO	Please explain

Robben Island is included in the Table Bay District Approved Structure Plan (ASP) (2012) in terms of Section 4 (10) of the Land Use Planning Ordinance (No 15 of 1985). The ASP is a medium term plan (developed on a +/-10 year planning frame) that will guide spatial development processes within the district. One of the key pillars of the strategy is to "manage urban growth and create a balance between urban development and environmental protection", and as a sub strategy to Protect and enhance the city's rural environment. The development of the SPP will ultimately lead to an improvement in the marine water quality near Robben Island and have a net positive impact on the marine environment. Therefore the development is in line with the ASP.

(e) An Environmental Management Framework (EMF) adopted by the Department (e.g. Would the approval of this application compromise the integrity of the existing environmental management priorities for the area and if so, can it be justified in terms of sustainability considerations?)	YES	NO	Please explain

The approval of the SPP would not compromise the integrity of the existing environmental management priorities of the island. The SPP is to be located on an already highly degraded portion of the island. Once constructed the activity is not expected to have any long term negative impacts on the environment. In fact, an overall improvement in the offshore marine environment can be expected as a result of this project.

(f) Any other Plans (e.g. Guide Plan)	YES	NO	Please explain

Due to its status as a UNESCO World Heritage Site any development on Robben Island is guided by a number of documents:

(i) The Robben Island Maintenance Plan (Department of Public Works, 1 November 2010) describes a framework which ensures that Robben Island Maintains its World Heritage Status and sets out various conservation principles. Although upgrades to the sewage system are not specifically noted, the purpose of the document is to ensure that Robben Island retains its UNESCO conservation status and that the significance of the heritage resource is retained therefore the development is in line with the principle of this document.

(ii) The Integrated Conservation Management Plan (2002) and updated ICMP (2013 – 2018) outline Robben Island Museum's framework for achieving the Island's environmental objectives. Various management plans are included in the ICMP, which includes the Natural Environmental Management Plan (NEMP) among others. The NEMP was produced through a revision of the 2002 EMP compiled by the CSIR. The document provides the legal, institutional and procedural context for the more detailed management specifications set out to manage specific areas of intervention as well as, meeting legal and environmental management objectives.

The plan specifically notes under the "marine and coastal management" section that Robben Island Museum (managing authority) is awaiting guidance on the levels of effluent to reach compliance in terms of the new NEM: Integrated Coastal management Act. Here it is noted that "investigations are underway to identify an alternative sewage treatment to reduce marine impacts and produce treated wastewater for irrigation purposes and sludge for compost to be used on the estate". The development is hence fulfilling the strategic objective and in line with the objective of the Robben Island NEMP.

The Conservation Management Plan includes for the following conservation priorities for the natural environment of Robben Island. Each management specification has been provided with actions required for each area of intervention (island priorities) necessary to meet the provisions of the law as well as the overarching objectives for environmental management on the island. These areas are outlined below together with how the development will ensure alignment (*in italics*):

- To minimise the risk of wildfires to wildlife and habitat as well as to people and the built environment - *mitigated through the incorporation of appropriate fire control measures. The risk of fire from the operation and construction of a sewage package plant is however minimal.*
- To manage the stocking of large herbivores on the Island so as not to exceed the carrying capacity – *not applicable to the Sewage Package Plant project.*
- To manage the conservation of seabirds and other indigenous birds – *The Marine Ecological Impact Assessment has considered the potential impacts from the project in terms of the sea-bird population and has determined that the impacts will have a low impact during construction and a no/ negligible impact during operation. The ongoing conservation of seabirds is considered through various mitigation measures included in the EMPr.*
- To manage the conservation of other indigenous vertebrates and invertebrates – *the development is not anticipated to have any significant impacts on land-based vertebrate or invertebrate populations. The marine impact assessment has identified that the development should have positive impact on marine invertebrate populations in the vicinity of the sewer outfall.*
- To rehabilitate the vegetation to a condition where it will become self-sustaining and can be kept in that condition with minimal management input. *The construction area will be rehabilitated following the construction phase. Rehabilitation requirements will not be extensive due to the limited excavations required; however the use of natural indigenous vegetation is required as the final phase of the construction and is included in the EMPr.*

3. Is the land use (associated with the activity being applied for) considered within the timeframe intended by the existing approved SDF agreed to by the relevant environmental authority (i.e. is the proposed development in line with the projects and programmes identified as priorities within the credible IDP)?	YES	NO	Please explain
The development falls within the Table Bay District Plan (2012) (Approved as a Structure Plan in terms of section 4(10) of the Land Use Planning Ordinance, Ordinance 15 of 1985). The district plan is a medium term plan (developed on a +/- 10 year planning frame) that will guide spatial development processes within the district. The proposed development is in line with the timeframes noted within the IDP however the benefits from the development will continue beyond this timeframe.			
4. Does the community/area need the activity and the associated land use concerned (is it a societal priority)? (This refers to the strategic as well as local level (e.g. development is a national priority, but within a specific local context it could be inappropriate.)	YES	NO	Please explain
The population of Robben Island is around 116 persons. The majority of people visiting the island are tourists and school groups. The SPP is required by the small population of Robben Island and visitors in order to be able to treat sewage to required water quality standards as defined by the National Environmental Management: Integrated Coastal Management Act (No 24 of 2008). It is therefore deemed a social priority in that it provides the necessary sanitation and will lead to an overall improvement in the discharge quality from the island.			
5. Are the necessary services with adequate capacity currently available (at the time of application), or must additional capacity be created to cater for the development? (Confirmation by the relevant Municipality in this regard must be attached to the final Basic Assessment Report as Appendix I.)	YES	NO	Please explain
There is an existing electrical supply, sewer connection and existing access routes available. No additional services will be required.			
6. Is this development provided for in the infrastructure planning of the municipality, and if not what will the implication be on the infrastructure planning of the municipality (priority and placement of services and opportunity costs)? (Comment by the relevant Municipality in this regard must be attached to the final Basic Assessment Report as Appendix I.)	YES	NO	Please explain
The development is being proposed in light of the fact that there are no municipal sewage treatment facilities on the island, or means to transport sewage to an existing wastewater treatment facility on the mainland. The development will result in essential service provision for the island and included for in the future infrastructure planning for the island. There will be no additional draw on municipal resources other than the possible need to dispose of dried sludge (120m^3 per annum) at a municipal WWTW or waste disposal facility.			
7. Is this project part of a national programme to address an issue of national concern or importance?	YES	NO	Please explain
No, the project is not part of a national programme to address an issue of national importance. However the project involves the provision of infrastructure required to adequately service the needs of a resource of national and international importance.			

8. Do location factors favour this land use (associated with the activity applied for) at this place? (This relates to the contextualisation of the proposed land use on this site within its broader context.)	YES	NO	Please explain
Yes, the proposed location of the SPP is ideally located for the land-use required for the following key reasons: - Close proximity to existing sea outfall and pump stations and sewer influent collection pump. - Away from sensitive areas on the island e.g. quarries, prison, tourist congregation areas/ walkways, harbour. - There is road access and service availability.			
9. Is the development the best practicable environmental option for this land/site?	YES	NO	Please explain
The development is the best practicable environmental option for the island in terms of sewage treatment. The SPP will be designed to meet DWA Water Quality Effluent Guidelines. Furthermore, should a treatment facility not be developed an alternative option would need to be implemented. This could feasibly include: - Septic tanks: This would require transport of sewage waste via boat to the mainland for treatment of a municipal treatment facility. Risks associated with leakage of effluent to groundwater and possible spill to ocean in transit. - Pipeline to mainland: This would entail significant disturbance of the marine environment for pipeline laying and has been considered not feasible.			
10. Will the benefits of the proposed land use/development outweigh the negative impacts of it?	YES	NO	Please explain
Yes, the benefits of the activity include improved service amenity to the island and its visitors as well as significant positive benefits to the local marine environment. Taking into consideration potential cumulative impacts of pollution in Table Bay, and that marine communities in the vicinity of the outfall are likely to have been negatively affected by the existing sewage discharges, the benefits resulting from the installation of the proposed SPP far outweigh any negative impact such that the upgrade of the sewage handling facilities will result in significant improvement in the quality of the effluent relative to the current discharge. The impact footprint for discharges from the proposed SPP would thus be considerably smaller than the existing sewage handling system, and a recovery of marine communities over the medium- to long-term can be expected.			
11. Will the proposed land use/development set a precedent for similar activities in the area (local municipality)?	YES	NO	Please explain
No, It is very unlikely that the development would be used as a precedent for other development since the rest of the local municipality is already well serviced by the City of Cape Town WWTW facilities.			
12. Will any person's rights be negatively affected by the proposed activity/ies?	YES	NO	Please explain
No, the development should not negatively affect the rights of any person's. The SPP is being developed to provide service amenity to allow for the continued operation of the Robben Island Museum, and the educational value that it provides to visitors of the island and South Africa as a whole. Any impact on the heritage value of the site, and visual aspects have been minimised through site location and design to avoid negatively affecting the rights of any persons such as the ex-political prisoners.			
13. Will the proposed activity/ies compromise the "urban edge" as defined by the local municipality?	YES	NO	Please explain
The development will not affect the urban edge. The development is adjacent to an existing building complex (Robert Sobukwe Complex).			
14. Will the proposed activity/ies contribute to any of the 17 Strategic Integrated Projects (SIPS)?	YES	NO	Please explain
The project will not directly contribute to any of the 18 National Strategic Infrastructure Projects (SIPS).			

15. What will the benefits be to society in general and to the local communities?	Please explain
The benefit will be the continued use of Robben Island as an educational, heritage and tourism location for South Africans and visitors to the country and an overall improvement in the effluent outfall from the island.	
16. Any other need and desirability considerations related to the proposed activity?	Please explain
No waste water treatment facilities are currently available for the Island. In the absence of competent external sewage management services, the site is at risk. A competent sewage management service will mitigate and minimise environmental and human health risks posed by the sewage generated by the construction team, and subsequent operational team. The proposed sewage treatment plant is necessary to handle the sewage generated by the project with its associated employees and visitors, and to protect the environment from untreated sewage discharges.	
17. How does the project fit into the National Development Plan for 2030?	Please explain
The development of the proposed SPP will contribute, indirectly, towards the National Development Goal of Improving education, training and innovation. Furthermore, tourism and culture sector is highlighted as one of a number of key drivers for change in the NDP. The total contribution of tourism activity to South Africa's gross value added was estimated at over 9 percent in 2008. Culture, the arts and other parts of the creative economy have the potential to generate employment and export earnings. As one of South Africa's nine UNESCO World Heritage Sites, the island is one of South Africa's leading tourism destinations and the contribution of Robben Island to the national Economy is likely to be significant.	
18. Please describe how the general objectives of Integrated Environmental Management as set out in section 23 of NEMA have been taken into account.	
Section 23 of NEMA states that the general objective of integrated environmental management is to— a) promote the integration of the principles of environmental management set out in section 2 into the making of all decisions which may have a significant effect on the environment; b) identify, predict and evaluate the actual and potential impact on the environment, socioeconomic conditions and cultural heritage, the risks and consequences and alternatives and options for mitigation of activities, with a view to minimising negative impacts, maximising benefits, and promoting compliance with the principles of environmental management set out in section 2; c) ensure that the effects of activities on the environment receive adequate consideration before actions are taken in connection with them; d) ensure adequate and appropriate opportunity for public participation in decisions that may affect the environment; e) ensure the consideration of environmental attributes in management and decision making which may have a significant effect on the environment; and f) Identify and employ the modes of environmental management best suited to ensuring that a particular activity is pursued in accordance with the principles of environmental management set out in section 2. The general objectives of Integrated Environmental Management were taken into account by considering and evaluating all potential negative and positive impacts of the proposed project on the environment, socio-economic conditions and cultural heritage. Where necessary specialists were appointed to address the key potential issues, namely heritage (both archaeology and palaeontology), marine impact assessment with separate marine dispersion modelling study. The public, organs of state and I&APs have also been given adequate opportunity to comment on the proposed project and to participate in the Basic Assessment process. Minimisation of potential negative impacts and optimisation of potential positive impacts will be ensured by way of the implementation of the EMP.	

19. Please describe how the principles of environmental management as set out in section 2 of NEMA have been taken into account.
The NEMA Principles serve as the framework within which environmental management implementation plans must be formulated and also acts as a reference guideline for decision makers. The principles provide a guideline to development. A holistic evaluation of the proposed SPP indicated that the provision of a treatment facility on the island would have greater beneficial effects than would be in a no-go or status quo option. There were no impacts considered to be significantly adverse, and those minor negative impacts associated with the proposed SPP can be easily mitigated through site placement, on-site management and regular maintenance. Therefore the proposed development is deemed acceptable. The development of the treatment facility which replaces the existing wastewater handling system will result in effluent of significantly improved quality from present entering the marine environment and therefore a significant improvement in environmental quality from the status quo. As the impact footprint for discharges from the proposed SPP would thus be considerably smaller than that for the current raw sewage discharge, a recovery of marine communities in the vicinity of the existing outfall over the medium- to long-term can be expected. There will be no inappropriate disturbance of the marine environment, since an outfall already exists. Existing pump stations will also be utilised to minimise the need for new development and visual design mitigations have been included to ensure that there will be no loss to the nation's cultural heritage. The outfall will mean that that the island can continue to be used for cultural, heritage and tourism purposes without any significant impact on the environment. The most significant potential impact would be that the treatment facility malfunctions and that effluent does not reach required quality limits as defined by the South African Marine Water Quality Guidelines (SAMWQG) for the Coastal Marine Environment. This is however highly unlikely but in the event of this occurring this would prove no–worse than the existing status quo (albeit for the short duration of the failure), and will be cross-checked via implementation of monitoring programme for the effluent and marine environment. The proposed project is deemed to be socially, economically and environmentally sustainable.

11. APPLICABLE LEGISLATION, POLICIES AND/OR GUIDELINES

List all legislation, policies and/or guidelines of any sphere of government that are applicable to the application as contemplated in the EIA regulations, if applicable:

Title of legislation, policy or guideline	Applicability to the project	Administering authority	Date
The Constitution of the Republic of South Africa (Act No. 108 of 1996)	The constitution is critical to the application of any environmental law, such that: In terms of the South African Constitution, *"Everyone has the right: to an environment that is not harmful to their health or well-being; and to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that prevent pollution and ecological degradation; promote conservation; and secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development."*	The Government of South Africa	1996
The National Environmental Management Act (Act No. 107 of 1998) and Regulation 544	The National Environmental Management Act (NEMA) provides the underlying framework for environmental law in South Africa and governs the management and protection of the environment as well as the processes to be followed in terms of obtaining authorisations as required under its framework.	DEA	1998
National Heritage Act (Act No. 25 of 1999)	The National Heritage Act (NHRA) serves to protect any archaeological/ paleontological/ heritage features which may be present on site. As	SAHRA	1996

	previously mentioned, Robben Island is a World and National Heritage site and requires a permit from SAHRA to destroy, damage, deface, excavate, alter, remove from its original position, subdivide or change the planning status of a National Heritage Site. The proposed SPP would therefore require a permit from SAHRA before construction on site may commence.		
National Environmental Management: Integrated Coastal Management Act (Act No. 24, 2008)	The National Environmental Management: Integrated Coastal Management Act (ICMA) Section 69 states that *"no person may discharge effluent that originates from a source on land into coastal waters except in terms of a general authorisation contemplated in subsection (2) or a coastal waters discharge permit (CWDP) issued under this section". Obtaining an CWDP in terms of section 69 of the ICMA replaces the need to obtain a water use licence in terms of the Section 21 (f) and (h) of the National Water Act.*	DEA: Coastal Management Division	2008
National Environmental Management: Waste Act (No 58 Of 2008)	The Environmental Management: Waste Act (NEMWA) governs waste management activities and ensures the safe collection, transport and disposal, recycling or re-use of waste materials.	DEA	2008
GN No 665 (2013) General Authorisations In Terms of Section 39 Of The National Water Act, 1998 (Act No. 36 Of 1998)	Section 2 of GN 665 identifies water treatment standards for the discharge of waste or water containing waste into a water resource through a pipe, canal, sewer or other conduit; and disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process. Section 2.7 indicates the need to comply with the General Limit values listed for disposal up to 2,000m^3 per day into non-listed water resources. The plant will be designed to achieve GLVs as listed in this Act. The need for a Water Use Licence is replaced by the need to obtain a Coastal Water Discharge Permit under the ICMA.	DWAF	2013

12. WASTE, EFFLUENT, EMISSION AND NOISE MANAGEMENT

a) Solid waste management

Will the activity produce solid construction waste during the construction/initiation phase?
If YES, what estimated quantity will be produced per month?

YES	NO
~10 m^3	

How will the construction solid waste be disposed of (describe)?

Construction of the proposed SPP will result in small amounts of construction related waste, including building rubble, small amounts of waste paint etc. The waste will be stored on site in a designated and demarcated area within appropriate receptacles. This will be disposed to a licenced landfill facility by the contractor.

Where will the construction solid waste be disposed of (describe)?

The construction solid waste will be delivered to the mainland via means of a boat together with other domestic waste produced on the island and then delivered to an appropriately licenced general landfill facility.

Will the activity produce solid waste during its operational phase?	YES	NO
If YES, what estimated quantity will be produced per month?	~10 m^3	

How will the solid waste be disposed of (describe)?

The process will form a limited volume of inert waste sludge which is estimated at 120m^3 per annum which will be collected in one of two 20m^2 drying beds adjacent to the SPP. This will be removed by private contractor by means of a tanker truck with a large vacuum pipe, referred to as a 'honey-sucker' to an approved waste site (such as Municipal WWTW). In addition, some solid waste will be generated at the inlet from the separation screen/ basket which serves the purpose of retaining inorganic solid material which enters the effluent stream. This will be removed from the island and taken to Vissershok hazardous landfill site.

If the solid waste will be disposed of into a municipal waste stream, indicate which registered landfill site will be used.

Solis waste will be disposed of by a registered waste contractor to a licenced landfill facility.

Where will the solid waste be disposed of if it does not feed into a municipal waste stream (describe)?

Sludge may be deposited at the local municipal wastewater treatment plant.

If the solid waste (construction or operational phases) will not be disposed of in a registered landfill site or be taken up in a municipal waste stream, then the applicant should consult with the competent authority to determine whether it is necessary to change to an application for scoping and EIA.

Can any part of the solid waste be classified as hazardous in terms of the NEM:WA?	YES	NO

If YES, inform the competent authority and request a change to an application for scoping and EIA. An application for a waste permit in terms of the NEM:WA must also be submitted with this application.

Is the activity that is being applied for a solid waste handling or treatment facility?	YES	NO

If YES, then the applicant should consult with the competent authority to determine whether it is necessary to change to an application for scoping and EIA. An application for a waste permit in terms of the NEM:WA must also be submitted with this application.

b) Liquid effluent

Will the activity produce effluent, other than normal sewage, that will be disposed of in a municipal sewage system?	YES	NO
If YES, what estimated quantity will be produced per month?		
Will the activity produce any effluent that will be treated and/or disposed of on site?	YES	NO

If YES, the applicant should consult with the competent authority to determine whether it is necessary to change to an application for scoping and EIA.

Please note that the Promulgation of GN 922 and 923 the facility falls below the daily threshold of 2000m^3 for listing notice 1. Treated effluent will be disposed to the marine environment.

An application for a Coastal Water Discharge Permit (CWDP) in terms of Section 69 of the Integrated Coastal Management Act (Act No. 24 of 2008) (ICMA) is being made concurrently with this Basic Assessment. The required 40 day public comment period was advertised and completed concurrently with the draft BAR comment phase; No comments were received on the CWDP application.

Will the activity produce effluent that will be treated and/or disposed of at another facility?	YES	NO

If YES, provide the particulars of the facility:

Facility name:	N/A
Contact person:	

Postal address:			
Postal code:			
Telephone:		Cell:	
E-mail:		Fax:	

Describe the measures that will be taken to ensure the optimal reuse or recycling of waste water, if any:

The SPP will be fitted with a 240m^3 storage tank for treated effluent which will allow the beneficial re-use of the water for irrigation purposes on the island (sports fields) in the future. This will require registration in terms of Section 21 (e) of the National Water Act prior to use for irrigation (to be completed in the future).

c) Emissions into the atmosphere

Will the activity release emissions into the atmosphere other that exhaust emissions and dust associated with construction phase activities?	YES	NO
If YES, is it controlled by any legislation of any sphere of government?	YES	NO

If YES, the applicant must consult with the competent authority to determine whether it is necessary to change to an application for scoping and EIA.

If NO, describe the emissions in terms of type and concentration:

Minor dust impacts may occur during the construction of the SPP. It may be possible that some odour may be produced during the operational phase if the SPP is not efficiently managed. The odour has been largely eliminated though design (plants are fully enclosed) and through the bacteriological process. Technical specifications indicate that the odour should be no more than an average manhole within a typical residential street.

d) Waste permit

Will any aspect of the activity produce waste that will require a waste permit in terms of the NEM:WA?	YES	NO

If YES, please submit evidence that an application for a waste permit has been submitted to the competent authority

A Waste Management Licence (WML) is required in terms if NEM:WA (No 59 of 2008) Category A (1) related to the storage of general waste (inert) sludge in a pond / lagoon. A revised Integrated EA - WML application has been submitted in this regard.

e) Generation of noise

Will the activity generate noise?	YES	NO
If YES, is it controlled by any legislation of any sphere of government?	YES	NO

If YES, the applicant should consult with the competent authority to determine whether it is necessary to change to an application for scoping and EIA.

If NO, describe the noise in terms of type and level:

Noise generation can be expected during the construction phase due to construction activities such as vehicular movement, and welding. The impacts of this will however be short term. The construction period is anticipated to last around 3 months. For the operational phase, the SPP will require the installation of a pump station, which will be in addition to the two existing pumps stations. The new pump will however be enclosed and therefore the noise emanating from the additional pump will be minimal. During operational phase. A back-up generator will be installed to ensure that the SPP maintains optimal hydraulic flow. This will only be used in emergency situations. Further noise generation can be expected from the air blowers, which will be minimal.

13. WATER USE

Please indicate the source(s) of water that will be used for the activity by ticking the appropriate box(es):

Municipal	Water board	Groundwater	River, stream, dam or lake	Other	The activity will not use water

Small volumes of water will be required for the SPP this will be sourced from the existing water supplied by the island's desalination plant. The SPP will in the future allow for some grey water re-use through the use of treated effluent for irrigation of sports fields and other landscaped areas. This will reduce the draw on the potable water generated at the desalination plant in the future.

If water is to be extracted from groundwater, river, stream, dam, lake or any other natural feature, please indicate the volume that will be extracted per month:	N/A litres	
Does the activity require a water use authorisation (general authorisation or water use license) from the Department of Water Affairs?	YES	NO

If YES, please provide proof that the application has been submitted to the Department of Water Affairs.

14. ENERGY EFFICIENCY

Describe the design measures, if any, that have been taken to ensure that the activity is energy efficient:

The proposed sewage treatment plant is designed to maximise potential for gravity flow of sewage from the various ablution facilities around the operational area that are to be reticulated to the sewage treatment plant, to minimise pumping energy demand. Aeration blowers and pumps are efficient low energy demand installations.

Describe how alternative energy sources have been taken into account or been built into the design of the activity, if any:

No alternative energy uses have been utilised, however the use of gravity flow for sewage to, and through the treatment process, limits the need for electrical energy.

SECTION B: SITE/AREA/PROPERTY DESCRIPTION

Important notes:

1. For linear activities (pipelines, etc) as well as activities that cover very large sites, it may be necessary to complete this section for each part of the site that has a significantly different environment. In such cases please complete copies of Section B and indicate the area, which is covered by each copy No. on the Site Plan.

Section B Copy No. (e.g. A): n/a

2. Paragraphs 1 - 6 below must be completed for each alternative.

Please note that alternatives have not been considered in this impact assessment since it would not be feasible to place the sewage package plant elsewhere on the island due to the requirement for the new facility to remain in close proximity to the existing sewage reticulation as well as the marine outfall infrastructure (sumps, pumps and outfall). In addition, the alternative technology options are not considered feasible for use on the island therefore the preferred site alternative and preferred technology type (which has already undergone detailed feasibility) will be the only scenario under consideration in the impact assessment. Please see description of alternatives in Section A (2).

3. Has a specialist been consulted to assist with the completion of this section? YES NO

If YES, please complete the form entitled "Details of specialist and declaration of interest" for each specialist thus appointed and attach it in Appendix I. All specialist reports must be contained in Appendix D.

Property description/physical address:

Province	Western Cape
District Municipality	City of Cape Town
Local Municipality	City of Cape Town
Ward Number(s)	54
Farm name and number	N/A
Portion number	N/A
SG Code	C01600000000143600000

Where a large number of properties are involved (e.g. linear activities), please attach a full list to this application including the same information as indicated above.

Current land-use zoning as per local municipality IDP/records:

The land is not currently used for any purpose and is a vacant piece of land. The site is located on Robben Island which is a World and National Heritage Site.

In instances where there is more than one current land-use zoning, please attach a list of current land use zonings that also indicate which portions each use pertains to, to this application.

Is a change of land-use or a consent use application required? YES NO

Baseline Environmental Characteristics

A description of the receiving environment for the Western Cape region in which the proposed site will be developed including physical, biological and socio- economic factors. The purpose of this section is to gain better understanding of the environment within and adjacent to the proposed site in order to identify potential impacts of the proposed development.

Climate

The Cape Peninsula has a Mediterranean climate. The winter months are from May to August. The area is a winter rainfall area, with occasional rainfall events occurring in the summer season. The area is also characterised by strong Northerly and North-Westerly winds during the winter months, which normally bring cold fronts to the area. The summer months are characterised by warm and dry conditions with a predominant South Easterly winds. The minimum and maximum temperatures are 16°C and 26°C, respectively, for the summer months, while during the winter months the minimum temperature is 7°C and maximum 20°C.

Topography, Geology and soils

Topography

Robben Island is a low lying rocky outcrop positioned strategically at the entrance to Table Bay and the City of Cape Town, some 9.5 km north-northwest of Cape Town harbour and 7.5km west of Bloubergstrand. The Island is roughly oval in shape and is approximately 2km wide on its east-west axis and 4km long on its north-south axis. It covers an area of 5.4km^2 (540ha). Maximum altitude on the island, at Minto Hill, is 29m above sea level; originally part of the mainland, it formed the pinnacle of an ancient, now submerged mountain that was linked by a saddle to the mountain known as the Blaauwberg. (Blue Mountain).The site is located around 5m above sea level.

Geology

The Geology of Robben Island is what makes Robben Island unique and provides several of the Island's landmarks. Geologically Robben Island is composed of lower strata of Malmesbury shale topped by a thick limestone and calcrete deposit covered by sand and shell fragments. Cementation of calcareous sands has probably been the key process by which dunes have been stabilised to give Robben Island its topography.

Soils

Soils are very sandy over most of Robben Island, and although very porous, have a poor water holding capacity. This is one of the reasons why no surface water (except in Van Riebeeck's and Rangatira quarries) is evident on the island, but also why there is an exploitable groundwater resource.

Surface water

The only surface water on the Island is found at Van Riebeeck's Quarry and at Rangatira Quarry which are artificially formed surface water bodies located 1.5 to 2km north of the proposed site location.

Ground water

Historically settlers relied on groundwater pumped from boreholes on the Island. Robben Island has good ground water supply through an aquifer which has been in use for almost 400 years. The Island covers an area of 4.74km^2 and receives a mean annual rainfall of 405mm. About 75% of rainfall occurs during the wet winter months between May and October. Recharge on the island is due to direct precipitation due to the sandy soils.

The aquifer comprises Quaternary-aged calcrete, conglomerates and partly consolidated sands which overly the upper weathered and fractured shales, siltstones and greywackes of the Late Precambrian aged Malmesbury Group. The geohydrology of Robben Island is considered typical of many small islands around the world where a relatively thin lens of fresh water overlies denser saline groundwater. Historical reports indicate that the quality of groundwater on Robben Island has deteriorated significantly from over-abstraction, hence a desalination plant has been developed to reduce the draw on groundwater resources.

Marine Environment

Table Bay marine environment is characteristically that of the West Coast region of South Africa and part of the southern Benguela Current ecosystem. The marine environment is characterised by a rocky shore and sandy beaches. Table Bay receives effluent and contaminants via pipelines and storm water outfalls from the City of Cape Town. The Port of Cape Town also contributes to the contamination of the bay from spills, repair facilities and other related activities. This plays a role in the marine environment and the species composition of the bay.

The intertidal environment comprises rocky shores (boulders and sharp jagged slate bedrock) with a small sandy beach on the sheltered east coast just south of Murray's Bay. The coastline is approximately 12km long and is habitat to a host of sea and shorebirds. Offshore and pelagic birds may be observed from the island occasionally when blown closer to the land by onshore winds.

The shallower marine environments off the coast of Cape Town are important fish breeding and juvenile nursery habitats. The marine environment of Robben Island is significant in terms of its seabird population which are sensitive to changes in fish population dynamics. The island is protected under NEM: Protected Areas Act which extends to 1 nautical mile around the island.

Further detailed baseline information related to the project site is provided in the Marine Impact Assessment Specialist Study (Appendix D).

Ecology

Flora
The study site is situated in the Fynbos Biome fringed with an area of azonal vegetation and vegetation types are classified as FS 6 (Cape Flats Dune Strandveld) and AZd 3 (Cape Seashore Vegetation) (Mucina and Rutherford, 2006).
Cape Flats Dune Strandveldis commonly found on the mainland of the West Coast of the Western Cape. However, due to anthropogenic influences there has been a proliferation of alien and invasive species on the island such as Rooikrans, Manatoka and Eucalyptus which were imported by early settlers. Almost half of the Island comprises of species that were introduced from both the Western Cape mainland as well as other countries. This is evident in the wooded Eastern and Southern areas of the island. This invasive vegetation now provides shelter for many of nesting bird species.

Fauna

Birds
Robben Island has eight species of seabird (sensu stricto) that breed on the Island, and six of these are endemic to southern Africa. These six species are of global importance, namely, the African Penguin, Bank Cormorant, Crowned Cormorant, Hartlaub’s Gull, Swift Tern and African Black Oystercatcher *Haematopus moquini*; and need to be most intensely monitored. In 2001, the African Penguin colony at Robben Island was the third largest for the species, which is classified as Endangered on a global scale.

The colony of Hartlaub’s Gull at Robben Island is the largest for the species, which is the 10th rarest of approximately 50 species of gull in the world. Similarly, in many years Robben Island supports the largest colonies of Crowned Cormorant and the southern African race of Swift Tern. In 2000, the colony of Bank Cormorants at Robben Island was one of only three in South Africa to number more than 100 pairs; it is also listed as Vulnerable. About 2% of the world population of African Black Oystercatcher breeds at Robben Island. In addition, the Robben Island shoreline is visited by large numbers of migrant birds each summer. Robben Island also has a variety of terrestrial birds. In all, more than 140 species of bird have been recorded at Robben Island.

The study area is located within the Robben Island National Historical Monument Important Bird Area (IBA) SA110. The IBA is a fully protected area and has a global IBA status with the following applicable categories A1, A4i, ii, iii (Barnes, 1998) Category A1 (Global IBA) = globally threatened species occur in the area and the criterion for this category is: *The site regularly holds significant numbers of a globally threatened species, or other species of global conservation concern.* Species of conservation concern under this criterion and found on Robben Island are:

- Globally Endangered: African Penguin Spheniscus demersus, Bank Cormorant *Phalacrocorax neglectus*
- Globally Near-threatened species: Crowned Cormorant *Phalacrocorax coronatus*, African Black
- Oystercatcher *Haematopus moquini*
- Nationally near-threatened: Cape Cormorant *Phalacrocorax capensis*

Mammals
The Introduction of large herbivores on Robben Island by early colonial settlers has led to a relatively high diversity of species, some are indigenous to Southern Africa and others are mostly European species. There are six species of large herbivores including southern African Steenbok, bontebok, eland, springbok, Ostrich and the European fallow deer. Smaller mammals include domestic (feral) cats and the European rabbits and black rats. There have historically been some challenges on the island with finding and maintaining the balance between the populations of these small mammal species.

Reptiles

Reptile species on the island include representatives from all three major orders: lizards, snakes and tortoises. The alien woody vegetation on the island provides good reptile habitat, with a large amount of fallen and decomposing material accumulating on the ground (CSIR, Robben Island Management Plan, 2002).

Heritage, Archaeological and cultural sites

On- shore cultural heritage
Robben Island is both a National Heritage Site and UNESCO World Heritage Site since 1999. Management of the island presupposes a focus on heritage factors.Outstanding Universal Value (OUV). The core business of Robben Island is heritage and conservation of this heritage. The Island must therefore be managed according to World Heritage standards.

The islands rich cultural history extends beyond the most-well known of era - typically being the imprisonment of the former President Nelson Mandela. Further cultural history also includes:

- Settlement by indigenous Khoisan people, as the Island was originally connected to the Mainland and may have been accessible at times when the sea-level was lower.
- From 1498 onwards, when the first European explorers stopped at the Cape, the Island provided food and shelter for sailors.
- Use as a colonial prison from 1657 to 1921.
- Establishment of a colonial hospital from 1846 to 1931, including a General Infirmary, Mental Asylum and Leper Hospital.
- Use as a military installation and naval base, from 1939 to 1959.
- And, eventually, an Apartheid Maximum Security Prison (MSP) from 1961.

The prison no longer houses inmates but has become a museum, attracting tourists from all over the world.

The building adjacent to the proposed SPP location is the Dog Unit, a former dog quarantine station was founded in 1893, kennels and living quarters for the staff were built. During WWII these buildings served as staff quarters for South African female military personnel stationed on the island, known as the SWANS. Around 500m south of the proposed SPP location is a Leper Church.

Murray Road was and still is the main thoroughfare from the landing/ harbour (1942 onwards) in Murray's Bay to the Robben Island village proper. The harbour was commissioned to facilitate the erection of military installations from the start of the Second World War.

Further baseline information related to the project site is provided in the Archaeological Impact Assessment Specialist Study (Appendix D).

1. GRADIENT OF THE SITE

Indicate the general gradient of the site.

Alternative S1:

Flat	1:50 – 1:20	1:20 – 1:15	1:15 – 1:10	1:10 – 1:7,5	1:7,5 – 1:5	Steeper than 1:5

Alternative S2 (if any):

Flat	1:50 – 1:20	1:20 – 1:15	1:15 – 1:10	1:10 – 1:7,5	1:7,5 – 1:5	Steeper than 1:5

Alternative S3 (if any):

Flat	1:50 – 1:20	1:20 – 1:15	1:15 – 1:10	1:10 – 1:7,5	1:7,5 – 1:5	Steeper than 1:5

2. LOCATION IN LANDSCAPE

Indicate the landform(s) that best describes the site:

2.1 Ridgeline		2.4 Closed valley		2.7 Undulating plain / low hills	
2.2 Plateau		2.5 Open valley		2.8 Dune	
2.3 Side slope of hill/mountain		2.6 Plain		2.9 Seafront	x

3. GROUNDWATER, SOIL AND GEOLOGICAL STABILITY OF THE SITE

Is the site(s) located on any of the following?

	Alternative S1:		Alternative S2 (if any):		Alternative S3 (if any):	
Shallow water table (less than 1.5m deep)	YES	NO	YES	NO	YES	NO
Dolomite, sinkhole or doline areas	YES	NO	YES	NO	YES	NO
Seasonally wet soils (often close to water bodies)	YES	NO	YES	NO	YES	NO
Unstable rocky slopes or steep slopes with loose soil	YES	NO	YES	NO	YES	NO
Dispersive soils (soils that dissolve in water)	YES	NO	YES	NO	YES	NO
Soils with high clay content (clay fraction more than 40%)	YES	NO	YES	NO	YES	NO
Any other unstable soil or geological feature	YES	NO	YES	NO	YES	NO
An area sensitive to erosion	YES	NO	YES	NO	YES	NO

If you are unsure about any of the above or if you are concerned that any of the above aspects may be an issue of concern in the application, an appropriate specialist should be appointed to assist in the completion of this section. Information in respect of the above will often be available as part of the project information or at the planning sections of local authorities. Where it exists, the 1:50 000 scale Regional Geotechnical Maps prepared by the Council for Geo Science may also be consulted.

4. GROUNDCOVER

Indicate the types of groundcover present on the site. The location of all identified rare or endangered species or other elements should be accurately indicated on the site plan(s).

Natural veld - good condition[E]	Natural veld with scattered aliens[E]	Natural veld with heavy alien infestation[E]	Veld dominated by alien species[E]	Gardens
Sport field	Cultivated land	Paved surface	Building or other structure	Bare soil

If any of the boxes marked with an "[E] "is ticked, please consult an appropriate specialist to assist in the completion of this section if the environmental assessment practitioner doesn't have the necessary expertise.

5. SURFACE WATER

Indicate the surface water present on and or adjacent to the site and alternative sites?

Perennial River	YES	NO	UNSURE
Non-Perennial River	YES	NO	UNSURE
Permanent Wetland	YES	NO	UNSURE
Seasonal Wetland	YES	NO	UNSURE
Artificial Wetland	YES	NO	UNSURE
Estuarine / Lagoonal wetland	YES	NO	UNSURE

If any of the boxes marked YES or UNSURE is ticked, please provide a description of the relevant watercourse.

N/A

6. LAND USE CHARACTER OF SURROUNDING AREA

Indicate land uses and/or prominent features that currently occur within a 500m radius of the site and give description of how this influences the application or may be impacted upon by the application:

Natural area	Dam or reservoir	Polo fields
Low density residential	Hospital/medical centre	Filling station [H]
Medium density residential	School	Landfill or waste treatment site
High density residential	Tertiary education facility	Plantation
Informal residential[A]	Church	Agriculture
Retail commercial & warehousing	Old age home	River, stream or wetland
Light industrial	Sewage treatment plant[A]	Nature conservation area
Medium industrial [AN]	Train station or shunting yard [N]	Mountain, koppie or ridge
Heavy industrial [AN]	Railway line [N]	Museum
Power station	Major road (4 lanes or more) [N]	Historical building
Office/consulting room	Airport [N]	Protected Area
Military or police base/station/compound	Harbour	Graveyard
Spoil heap or slimes dam[A]	Sport facilities	Archaeological site
Quarry, sand or borrow pit	Golf course	Other land uses (describe)

Robben Island Museum is a World Heritage Site and projected in terms of the National Environmental Management: Protected Areas Act (NEM:PAA) to a distance of one nautical mile around the perimeter of the island. The preferred location of the Sewage Package Plant is adjacent to the Robert Sobukwe complex The Robert Sobukwe buildings were erected during World War II (WW II) for various purposes including barracks and mess facilities and Hygiene office. The latter designated as Robert Sobukwe's house. In the mid-1970's, two long parallel dog kennels were built in front of the Sobukwe House to house guard dogs which were used for night permitted patrols of the Maximum Security Prison. On the southern side of the complex is a long building which was originally used as a school for the coloured wardens (1960s), but later became a hostel for dog handlers in 1967. The proposed location for the SPP (adjacent to the dog unit hostel) has been chosen to be located near to the existing sewer outfall sump and pump machinery. The Robert Soboukwe complex does not form part of the Robben Island tour, and therefore does not have foot traffic associated with it.

The study site is bordered to the east (approximately 45m) by the Atlantic Ocean – with a rocky shore. There is a clumping

of trees which forms a border between the proposed development and the beach. The trees provide a natural barrier from the development area and the rocky beach, where African penguins are known to congregate. The main tar road which leads from Murray's Bay Harbour to the Robben Island Village lies approximately 70m to the west of the proposed site location.

If any of the boxes marked with an "N "are ticked, how will this impact / be impacted upon by the proposed activity?

N/A

If any of the boxes marked with an "An" are ticked, how will this impact / be impacted upon by the proposed activity? Specify and explain:

N/A

If any of the boxes marked with an "H" are ticked, how will this impact / be impacted upon by the proposed activity? Specify and explain:

N/A

Does the proposed site (including any alternative sites) fall within any of the following:

Critical Biodiversity Area (as per provincial conservation plan)	YES	NO
Core area of a protected area?	YES	NO
Buffer area of a protected area?	YES	NO
Planned expansion area of an existing protected area?	YES	NO
Existing offset area associated with a previous Environmental Authorisation?	YES	NO
Buffer area of the SKA?	YES	NO

The island is protected in terms of NEM:PAA due to its status as a National and World Heritage Site. The protected status extends to 1 nautical mile (nm) around the island. Note the existing outfall extends into the buffer of the protected area however this is not part of the development considered in this application.

If the answer to any of these questions was YES, a map indicating the affected area must be included in Appendix A.

7. CULTURAL/HISTORICAL FEATURES

Are there any signs of culturally or historically significant elements, as defined in section 2 of the National Heritage Resources Act, 1999, (Act No. 25 of 1999), including Archaeological or paleontological sites, on or close (within 20m) to the site? If YES, explain:	YES	NO
	Uncertain	
See summary of specialist investigation below.		

If uncertain, conduct a specialist investigation by a recognised specialist in the field (archaeology or palaeontology) to establish whether there is such a feature(s) present on or close to the site. Briefly explain the findings of the specialist:

Robben Island is a UNESCO World Heritage Site and therefore has significant importance both locally and internationally. In 1961 the South African Apartheid Regime built a maximum security prison on the Island which held famous political leaders and anti-apartheid activists. The prison no longer houses inmates but has become a museum, attracting tourists from all over the world. Prior to 1961 the Island had been used as a dumping ground for criminals, prostitutes and the physically and mentally ill. The remains of an Insane asylum and leaper grave yard are amongst the cultural landmarks that are still present. World War II structures are still scattered over the Island.

The structures on Robben Island are older than 60 years and therefore would require a permit under the National Heritage Resources Act (Act No. 25 of 1999) before the sites can be disturbed. Due to the significance of the site from a heritage perspective, heritage meaning archaeological, paleontological or architectural significance, the proposed project and excavations that will occur as part of the construction of the SPP require assessment in terms of impact on the heritage of the site. As such, two specialist studies were commissioned to identify the presence of any heritage aspects and propose mitigation measures that have to be implemented to manage these impacts.

<u>Archaeology Impact Assessment</u>

An Archaeological Impact Assessment (AIA) study was undertaken by specialist heritage and archaeologist consultant Dr Ute Seemann. The study entailed desktop review and site survey. The site visit reviewed all possible structures of historical importance on the development footprint. The structures of interest included fresh water tanks which were deemed to have no historical value, and some concrete platform and brick pillars which remain unidentified but definitely not of WWII vintage.

The study concludes that the proposed SPP site has no remains of visible historical/archaeological features or portable artefacts. The study also notes that the areas is highly disturbed with evidence of recent human impact (the site has been used as a recreational sports area for many years) and is visually impacted with existing sewerage infrastructure, fresh water underground pipes, electrical underground cables, wooden poles, remains of fencing material, and tracks etc.

Mitigation for the appropriate course of action should an item of archaeological significance be uncovered is provided in the EMPr.

A full copy of the AIA is included in Appendix D.

<u>Palaeontology Impact Assessment</u>

A Palaeontology Impact Assessment (PIA) study was undertaken by specialist paleontological consultant Dr John E Almond of Natura Viva cc. The study was conducted via means of a desktop study. Through in-depth research regarding the nature of the underlying site geology it was determined that significant impacts on buried or subsurface fossil remains are not anticipated here due to the small development footprint and shallow excavation. It was concluded that the proposed Sewage Package Plant and associated infrastructure will not generate significant impacts on local palaeontological heritage resources that might compromise the Outstanding Universal Value of the Robben Island World Heritage Site.

Consequently no further palaeontological heritage studies or specialist mitigation are recommended for this sewage plant project, pending the discovery or exposure of any substantial fossil remains (e.g. vertebrate bones and teeth, fossil plant-rich horizons, dense concentrations of marine shells) during the construction phase.

Mitigation for the appropriate course of action should an item of paleontological significance be uncovered is provided in the EMPr.

A full copy of the PIA is provided in Appendix D.

Will any building or structure older than 60 years be affected in any way?	YES	NO
Is it necessary to apply for a permit in terms of the National Heritage Resources Act, 1999 (Act 25 of 1999)?	YES	NO

If YES, please provide proof that this permit application has been submitted to SAHRA or the relevant provincial authority.

Robben Island is a World and National Heritage site and requires a permit from SAHRA to destroy, damage, deface, excavate, alter, remove from its original position, subdivide or change the planning status of a National Heritage Site.

A permit for the purposes of excavations for the Phase 1 Archaeological Investigation was obtained from SAHRA (shown in Appendix J.2).

The Final Basic Assessment will be submitted to SAHRA in order to obtain a Heritage Permit in terms of the Built environment (Pers comm, Greg Ontong).

8. SOCIO-ECONOMIC CHARACTER

a) Local Municipality

2011 Census Suburb Robben Island	2011
Population	116
Households	60
Average Household Size	1.93

Please provide details on the socio-economic character of the local municipality in which the proposed site(s) are situated.

The proposed project is located on Robben Island within the City of Cape Town, therefore a description of the economic profile of the island only is provided below.

Level of unemployment:

4% (see below)

Economic profile of local municipality:

According to the 2011 Census there are approximately 116 persons living on Robben Island and around 60 households. The island dwellers are predominantly black (60%) and include caretakers, security facility and island workers. Around 96% of the island dwellers are employed (likely to be employed by Robben Island Museum). Only 25% of the island workers earn R3 200 or less per month. The average household size is 1.93 persons. All housing on the island is formal with access to piped water, formal sanitation facilities, electricity and refuse collection.

The island is a significant contributor to the economy of Cape Town through direct and indirect revenues associated with tourism.

Level of education:

Residents of the island - According to the 2011 census. 66% of those aged 20 years or older have completed Grade 12 or higher.

b) Socio-economic value of the activity

What is the expected capital value of the activity on completion?	±R6.9m (Excl. VAT)

What is the expected yearly income that will be generated by or as a result of the activity?	R Not intended as revenue earning	
Will the activity contribute to service infrastructure?	YES	NO
Is the activity a public amenity?	YES	NO
How many new employment opportunities will be created in the development and construction phase of the activity/ies?	20 +	
What is the expected value of the employment opportunities during the development and construction phase?	R 300 000	
What percentage of this will accrue to previously disadvantaged individuals?	>80 %	
How many permanent new employment opportunities will be created during the operational phase of the activity?	1-2	
What is the expected current value of the employment opportunities during the first 10 years?	R 1 700 000	
What percentage of this will accrue to previously disadvantaged individuals?	> 90%	

9. BIODIVERSITY

Please note: The Department may request specialist input/studies depending on the nature of the biodiversity occurring on the site and potential impact(s) of the proposed activity/ies. To assist with the identification of the biodiversity occurring on site and the ecosystem status consult http://bgis.sanbi.org or BGIShelp@sanbi.org. Information is also available on compact disc (cd) from the Biodiversity-GIS Unit, Ph (021) 799 8698. This information may be updated from time to time and it is the applicant/ EAP's responsibility to ensure that the latest version is used. A map of the relevant biodiversity information (including an indication of the habitat conditions as per (b) below) and must be provided as an overlay map to the property/site plan as Appendix D to this report.

a) Indicate the applicable biodiversity planning categories of all areas on site and indicate the reason(s) provided in the biodiversity plan for the selection of the specific area as part of the specific category)

Systematic Biodiversity Planning Category	If CBA or ESA, indicate the reason(s) for its selection in biodiversity plan

Critical Biodiversity Area (CBA)	Ecological Support Area (ESA)	Other Natural Area (ONA)	No Natural Area Remaining (NNR)	The entire Island is designated as a Critical ESA according to the City of Cape Town Biodiversity Network (BioNet) (2013) designated on the basis that it is an “unselected area that is in natural vegetation which is essential ecological support for CBA 1, CBA 2 and protected sites. ESAs are defined as a result of their local, national and international significance, required to make existing remnants ecologically more viable and for larger fauna movement. Loss would result in the remnants or faunal species being lost & exorbitant interventionary ecosystem management costs. According to SANBI the management objective for CESA areas is to: obtain appropriate legal status, such as open space zoning, maintain open space where appropriate restore degraded land to natural or near natural consolidation of other remnants.

b) Indicate and describe the habitat condition on site

Habitat Condition	Percentage of habitat condition class (adding up to 100%)	Description and additional Comments and Observations (including additional insight into condition, e.g. poor land management practises, presence of quarries, grazing, harvesting regimes etc).
Natural	%	
Near Natural (includes areas with low to moderate level of alien invasive plants)	%	
Degraded (includes areas heavily invaded by alien plants)	100 %	The vegetation of the proposed site consists of two primary vegetation types, including Cape Flats Dune Strandveld and Cape Seashore Vegetation closer to the coastline (as described by Mucina & Rutherford,2006).Dune Strandveld is classified as endangered in recognition of the fact that the ecosystem has ‘undergone degradation of ecological structure, function or composition as a result of human intervention’ and is ascribed protection from NEM:BA (SANBI, 2011). Cape Seashore vegetation is described as least threatened. In reality, the vegetation of the site is highly degraded though infestation with alien vegetation which has replaced the natural vegetation to a large extent. Alien species include rooikrans, spider gum and manitoka trees with evidence of anthropogenic influence.
Transformed (includes cultivation, dams, urban, plantation, roads, etc)	%	

c) Complete the table to indicate:
   (i) the type of vegetation, including its ecosystem status, present on the site; and
   (ii) whether an aquatic ecosystem is present on site.

<table>
<tr><th colspan="2">Terrestrial Ecosystems</th><th colspan="7">Aquatic Ecosystems</th></tr>
<tr><td rowspan="5">Ecosystem threat status as per the National Environmental Management: Biodiversity Act (Act No. 10 of 2004)</td><td>Critical</td><td colspan="3" rowspan="4">Wetland (including rivers, depressions, channelled and unchanneled wetlands, flats, seeps pans, and artificial wetlands)</td><td colspan="2" rowspan="4">Estuary</td><td colspan="2" rowspan="4">Coastline</td></tr>
<tr><td>Endangered (Dune Strandveld)</td></tr>
<tr><td>Vulnerable</td></tr>
<tr><td></td></tr>
<tr><td>Least Threatened (Cape Seashore vegetation)</td><td>YES</td><td>NO</td><td>UNSURE</td><td>YES</td><td>NO</td><td>YES</td><td>NO</td></tr>
</table>

d) Please provide a description of the vegetation type and/or aquatic ecosystem present on site, including any important biodiversity features/information identified on site (e.g. threatened species and special habitats)

<u>Vegetation</u>

The vegetation at the proposed construction site although classified as Cape Flats Dune Standveld and Cape Seashore vegetation is highly degraded. The area under consideration is covered by alien vegetation, mostly bluegum and manatoka trees, fynbos scrub and some ground cover which is able to tolerate the limestone soil. The site's natural vegetation is heavily disturbed by sewerage and fresh water underground pipes, three sewage pump stations, electrical underground cables, wooden poles, the remains of a brick structure and cement platform, remains of fencing material, rabbit holes and tracks etc . In addition the open area adjacent to the site has been used as a sports, training and recreation ground by residents of the island for more than a hundred years and therefore the natural habitat is largely degraded. A thickly wooded area comprising alien invasive species such as manatoka trees, acts as a natural barrier between the rocky sea-shore and proposed SPP location.

Please note: no removal of indigenous tree species is anticipated for the purposes of construction of the SPP and pipeline. The development location has been determined to avoid the need to remove indigenous vegetation. An Alien Invasive Removal programme in currently in place on Robben Island under the Conservation Management Plan which considers the sensitivity of invasive clearing in respect of their use as habitat for birdlife.

<u>Marine (Intertidal) Environment</u>

The marine environment in the vicinity of the proposed development island comprises rocky shores (boulders and sharp jagged slate bedrock). A full description of the marine and intertidal baseline environment is provided in the Marine Impacts Assessment (Appendix D).

Please note: The marine environment will not be physically impacted by construction activities. No construction on the beach, the location of the proposed SPP and ancillary equipment is located some ~50m before the beach zone.

SECTION C: PUBLIC PARTICIPATION

1. ADVERTISEMENT AND NOTICE

Publication name	Die Burger and Cape Towner	
Date published	Die Burger: 27 June 2013 Cape Towner: 4th July 2013	
Site notice position	Latitude	Longitude
	33°47'56.16"S	18°22'34.26"E
Date placed	2013/07/19	

Include proof of the placement of the relevant advertisements and notices in Appendix E1.

A Public Participation Report is attached in Appendix E.

2. DETERMINATION OF APPROPRIATE MEASURES

Provide details of the measures taken to include all potential I&APs as required by Regulation 54(2)(e) and 54(7) of GN R.543.

A Summary of the Public Participation Process is provided below:

- Written notification letters was provided to authorities and municipal ward councillors on the 20th June 2013;
- Distribution of the Background Information Document (BID) to surrounding landowners and registered stakeholders undertaken on the 19th July 2013, providing stakeholders with the option to register as an I&AP.
- Newspaper advertisements were placed in one regional and one local newspaper in both English and Afrikaans.
  - Die Burger – Advert placed on the 27th June 2013
  - Cape Towner- Advert placed on the 4th July 2013
- Site notices were be placed at the local Kiosk on Robben Island and at the Security Offices at the Robben Island Harbour on the 19th July 2013.
- Stakeholders were provided with 21 days in which to register themselves as an I&AP for the project and provide a comment. Stakeholders were provided with electronic link to the reports; and hardcopies were provided where requested or required.
- All reports will be provided to registered stakeholders for their consideration for the required comment periods of 40 day. The draft BAR consultation phase ran from the 26th May to 4th July. Comments received have been included in Appendix E, Issues Trail, and responses provided to each comment raised. Where changes to the BAR have been deemed necessary this are included here in red text.
- Should it be deemed necessary, all registered stakeholders will be invited to a public meeting where any and all comments may be raised and recorded so that they can be addressed in an issues trail and associated reports?
- A public meeting was not convened since no significant public interest was received at the Registration or Draft BAR comment phase.
- Stakeholders were provided with an additional 21 days with which to comment on the Final BAR prior to submission of the Final BAR to the DEA for Authorisation.

Key stakeholders (other than organs of state) identified in terms of Regulation 54(2)(b) of GN R.543:

Title, Name and Surname	Affiliation/ key stakeholder status	Contact details (tel number or e-mail address)
Les Underhill	Earthwatch (UCT-ADU)	les.underhill@uct.ac.za
Richard Sherley	UCT	richard.sherley@uct.ac.za richard.sherley@gmail.com
Nolubabalo Tongo	Robben Island Museum	nolubabalot@robben-island.org.za
Sabelo Madlala	Robben Island Museum	sabelom@robben-island.org.za
Mario Leshoro	Robben Island Museum	mariol@robben-island.org.za
Estelle Esterhuizen	Robben Island Museum	estellee@robben-island.org.za

Include proof that the key stakeholder received written notification of the proposed activities as Appendix E2. This proof may include any of the following:

- e-mail delivery reports;
- registered mail receipts;
- courier waybills;
- signed acknowledgements of receipt; and/or
- or any other proof as agreed upon by the competent authority.

3. ISSUES RAISED BY INTERESTED AND AFFECTED PARTIES

Summary of main issues raised by I&APs	Summary of response from EAP
One comment was received during the stakeholder registration period with respect to the proposed project from Dr Richard Sherley from the University of Cape Town. The concern is around the proximity of the development to penguin moulting sites, and the pathways the penguins use to travel inland. The concern primarily relates to the danger which the construction may pose to the penguins, that they either a) Become startled and flee to water during the annual moult (a period in which they are not waterproof) or; b) Become entrapped in construction sites/ excavations.	The mitigation measures proposed to protect the impacts of the construction phase on the penguins has been incorporated into the BAR and EMP. Specifically: a) The construction site will be continuously fenced and no open holes or excavations will be left overnight in an area accessible to the penguins. b) (A map of the proposed fencing is provided in the EMPr located in Appendix G. Utmost care will be taken to avoid completing any noisy activities in the nearby vicinity to penguins. The importance of avoiding disturbance to the penguins will be included in ECO training materials. c) Contractors will be required to cease works should they come into contact with a penguin nesting site or an entrapped penguin and contact a representative SANCCOB who must determine the appropriate next steps.

4. COMMENTS AND RESPONSE REPORT

The practitioner must record all comments received from I&APs and respond to each comment before the Draft BAR is submitted. The comments and responses must be captured in a comments and response report as prescribed in the EIA regulations and be attached to the Final BAR as Appendix E3.

5. AUTHORITY PARTICIPATION

Authorities and organs of state identified as key stakeholders:

Authority/Organ of State	Contact person (Title, Name and Surname)	e-mail	Postal address
Department of Environmental Affairs	Mthathla Rabotata	mrabothata@environment.gov.za	
DEA: Coastal Management- Integrated Coastal Management	Razeena Omar	romar@environment.gov.za	PO Box 52126 Victoria and Alfred Waterfront Cape Town 8002
DEA: Coastal Management- Integrated Coastal Management	Mulalo Tshikotshi	mtshikot@environment.gov.za	PO Box 52126 Victoria and Alfred Waterfront Cape Town 8002
DEADP: Land Management	Zaahir Toefy	zaahir.toefy@westerncape.gov.za	Private Bag X9086 Cape Town 8000
DEADP: Land Management (Admin Personelle)	Labeeba de jageer	labeebadejager@westerncape.gov.za	
DEADP: Waste Management	Eddie Hanekom	eddie.hanekom@westerncape.gov.za	Private Bag X9086 Cape Town 8000
Department of Environmental Affairs (Oceans and Coasts)	Bruce Dyer	Bdyer@environment.gov.za	Cape Town Stadium 4th Floor 1 Fritz Sonnenberg Road GREEN POINT 8001
Department of Environmental Affairs (Oceans and Coasts)	Azwianewi Makhado	Amakhado@environment.gov.za	
City of Cape Town : Environment and Heritage Management District A	Dimitri Georgeades	dimitri.georgeades@capetown.gov.za	PO Box 4529 Cape Town 8000
Municipal Ward Councillor	Beverley Schäfer	beverly.schafer@capetown.gov.za	
Municipal Manager	Achmat Ebrahim	city.manager@capetown.gov.za	Private Bag X9181 Cape Town 8000
Cape Nature	Rhett Smart	landuse@capenature.co.za	Private Bag X5014 Stellenbosch 7599
SANCCOB	Nola Persons		P.O. Box 11116 Bloubergstrand 7443 South Africa

SAHRA	Mariagrazia Galimberti	mgalimberti@sahra.org.za	PO Box 4637 Cape Town 8000
SAHRA (Robben Island)	Greg Ontong	gontong@sahra.org.za	
Department of Water Affairs	M Mxi	mxim@dwa.gov.za	52 Voortrekker Road Spectrum Building Bellville 7530
Department of Water Affairs	Ashia Peterson	petersona@dwa.gov.za	
Department of Water Affairs	Marion Claassen	claassenm@dwa.gov.za	

Include proof that the Authorities and Organs of State received written notification of the proposed activities as appendix E4. Please note proof of notification of authorities is included in Appendix E2.

In the case of renewable energy projects, Eskom and the SKA Project Office must be included in the list of Organs of State.

6. CONSULTATION WITH OTHER STAKEHOLDERS

Note that, for any activities (linear or other) where deviation from the public participation requirements may be appropriate, the person conducting the public participation process may deviate from the requirements of that sub-regulation to the extent and in the manner as may be agreed to by the competent authority.

Proof of any such agreement must be provided, where applicable. Application for any deviation from the regulations relating to the public participation process must be submitted prior to the commencement of the public participation process.

A list of registered I&APs must be included as appendix E5.

Copies of any correspondence and minutes of any meetings held must be included in Appendix E6.

SECTION D: IMPACT ASSESSMENT

The assessment of impacts must adhere to the minimum requirements in the EIA Regulations, 2010, and should take applicable official guidelines into account. The issues raised by interested and affected parties should also be addressed in the assessment of impacts.

1. IMPACTS THAT MAY RESULT FROM THE PLANNING AND DESIGN, CONSTRUCTION, OPERATIONAL, DECOMMISSIONING AND CLOSURE PHASES AS WELL AS PROPOSED MANAGEMENT OF IDENTIFIED IMPACTS AND PROPOSED MITIGATION MEASURES

Provide a summary and anticipated significance of the potential direct, indirect and cumulative impacts that are likely to occur as a result of the planning and design phase, construction phase, operational phase, decommissioning and closure phase, including impacts relating to the choice of site/activity/technology alternatives as well as the mitigation measures that may eliminate or reduce the potential impacts listed. This impact assessment must be applied to all the identified alternatives to the activities identified in Section A(2) of this report.

Impact Assessment Methodology

A rating of the significance of environmental impacts has been undertaken according to WSP's Impact Assessment Methodology, included in Appendix F. Further details on the scoring methodology is also provided in Appendix F. The purpose of the significance rating is to highlight relevant issues and impacts requiring priority management and mitigation, and to eliminate the insignificant issues and impacts from the investigation. Each category is divided into a number of different levels. These levels are then assigned various levels of significance which is a synthesis of the aspects produced in terms of their nature, duration, intensity, extent, and probability. The outcome of which is a significance rating of:

- Low - Where the impact will not have an influence on the outcome
- Low- Medium – Where impact should not influence the decision but requires mitigation
- Medium - Where it should have an outcome on the decision unless it is strongly mitigated
- Medium - high - Where it would influence the outcome if a strong mitigation measure cannot be implemented
- High - Where it would influence the outcome regardless of any possible mitigation

Environmental Aspect	Type of Impact and Summary	Significance of impact – Post Mitigation	Proposed Mitigations
Ecology Ecology/ Biodiversity (Terrestrial Flora)	Direct	Please note a detailed breakdown of impact rating for both "pre" and "post" mitigation scenarios is provided in the impact assessment included as Appendix F.	
	During construction, direct impacts to flora include removal of indigenous flora species leading to a loss in biodiversity. In addition to this, there is a risk that excavation required for placement of SPP may result in the loss of valuable topsoil.	Low (-ve). Natural vegetation is limited within the proposed SPP location. The vegetation is degraded with scattered alien infestation, and therefore is not viewed as sensitive or pristine.	Through removal of alien invasive species during construction and replacement with indigenous vegetation. Topsoil must be preserved and re-used wherever possible. The location of the SPP and ancillary infrastructure must minimise the need to uproot any indigenous tree species. Any rehabilitation following construction must be completed using indigenous vegetation.
	During operation, the direct impacts to vegetation may include trampling	Negligible. The development footprint is small and there will be	Dedicated pathways must be incorporated into design to prevent

Environmental Aspect	Type of Impact and Summary	Significance of impact – Post Mitigation	Proposed Mitigations
	of vegetation.	minimal foot traffic associated with it. In addition the areas is already heavily utilised as a sports ground and any impact is expected to be negligible.	any long terms trampling of the natural vegetation.
	During decommissioning, the risks are that the development footprint will not be rehabilitated and that vegetation quality will be diminished.	Negligible.	A vegetation rehabilitation plan must be developed for the decommissioning period using locally appropriate indigenous vegetation.
	Indirect		
	No indirect impacts associated with flora and fauna anticipated.	n/a	n/a
	Cumulative		
	The cumulative impact of the development on flora would be the overall impact of the development on the strandveld vegetation type. In terms of the limited size/footprint of this development, the development is not expected to have any significant cumulative impact.	n/a	n/a
Ecology/ Biodiversity (Terrestrial Fauna)	Direct		
	During construction (particularly camp set-up) there is the possibility that the nest of a seabird such as the African Penguin, bank cormorant or swift tern may be encountered. In addition, the machinery, excavations may present a danger to birdlife such that they may be physically harmed by becoming entrapped or falling into an excavation pit. Construction of the sewage package plant and associated discharge pipeline may therefore result in disturbance of penguin, cormorant and tern nesting sites with implications for reproductive success.	Low (-ve) The construction will be short-term with only localised impacts. Construction will not be occurring directly on the sea frontage and trees which occur between the SPP location and the beach provide a natural barrier to construction activities from water birds habituating the shoreline in this area of the Robben Island coastline. Whilst African penguins do breed in the vicinity of the SPP, the area is not among the most densely populated areas on the island. Of the islands total population of 1,364 penguins in 2013, only 7% (105) presently nest in the 250 metre radius of the proposed SPP location. There will be no construction near the shoreline and no requirements to traverse the penguin highways (mapped as Figure 14 of the specialist report) are anticipated as part of the construction. Since the construction activities will be relatively localised, they can be well contained/ fenced off, and will be over a short duration (due to the pre-assembled/ modular nature of the SPP) the impact is projected to be of low- significance. Information obtained (per comm. Professor Peter Braham) suggests that the Bank Cormorants typically breed on the Faure Jetty as well as the main harbour. These are located at such a distance (980m	Penguins are naturally inquisitive creatures, and therefore mitigations must be included to prevent the access of penguins into the construction site. This must be achieved through use of a "penguin-proof" construction phase fence which shall continuously surround construction activities. No open excavation pits will be allowed overnight, and must be kept covered. If a nest is encountered during construction, all work in the vicinity of the nest must cease and a representative of SANCCOB contacted to determine the appropriate course of action. Seek to commence construction activities outside known breeding seasons for species located in the vicinity of the SPP, namely the penguins, cormorant and terns. Ensure that construction activities avoid known penguin nesting sites. Monitor establishment of potential Hartlaub's gulls and Swift terns breeding areas in the vicinity of the construction site during December/early January and if necessary deter them from starting to breed near the construction site by commencing construction camp establishment activities thereby increasing activity levels in the area which is likely to encourage these species to breed elsewhere on the island.

Environmental Aspect	Type of Impact and Summary	Significance of impact – Post Mitigation	Proposed Mitigations
		and 560 m respectively) that construction activities are not anticipated to impact the Bank Cormorants in any way. Records do indicated that Swift Terns and Hartlaubs Gulls have bred approximately 600m south of Soboukwe house, however impacts on these species are also deemed insignificant since these bird species typically choose new nesting sites every year. Therefore should construction coincide with the beginning of their breeding season (December/ Jan), care should be taken to deter the terns and the gulls from setting up nest in the development area.	
	Indirect		
	During construction, the noise and activity may cause disturbance or upset to local birdlife, such as the African penguin which are particularly vulnerable during moulting periods.	Low - medium (-ve) Robben island is a significant breeding ground for the African penguin. The impact will however be short-term (3 months). Noisy construction activities will also be limited.	All workers will be trained on the significance of the penguins on Robben Island and must take due care and responsibility when working in their vicinity.
	During operation the sewage package plant may become a location for possible nesting sites for birdlife such as the African penguin.	Negligible. The SPP will be fenced and this will prevent entry into the SPP complex. In addition the penguins are already accustomed to the existing outfall and pump stations. In the long term there will be limited interference from people, only maintenance staff which will be limited to one or two persons.	The sewage package plant design includes for a security fence. This must be penguin proof to prevent entry during operation.
	Cumulative		
	The development presents a risk to the African penguin population.	Low (-ve). The 500m radius of the development area does provide habitat for some of the penguins' resident on Robben Island - it is not the area with the largest population. The potential impact will be short term with limited external interference in the future.	None anticipated.
Heritage (Archaeology and Palaeontology)	Direct		
	During construction the primary risks to heritage resources include the damage, destruction, loss of value to archaeology resources which may be discovered during excavations - including archaeological finds, graves and Middens.	Low (-ve) The Archaeology Impact Assessment concluded that the development of the sewage package plant in the proposed location would not impinge on the heritage value of the island and no remains of visible historical or archaeological features were found on the site during a survey. The AIA is included in Appendix D.	Archaeological or Paleontology finds during construction, must be safeguarded - preferably in situ - and reported by the ECO as soon as possible to Heritage Western Cape, so that appropriate mitigation (i.e. recording, sampling or collection) by an archaeological or paleontological specialist can be considered and implemented. Work may only resume once clearance is given in writing by the relevant specialist.
	Further potential impact associated with construction includes damage or destruction to fossiliferous palaeontology resources during excavations.	The PIA Screening study (Appendix D) indicated that the construction of the proposed SPP is not likely to significantly affect the paleontological resources of the island to due to the low depth of excavation and the small development footprint.	As above.

Environmental Aspect	Type of Impact and Summary	Significance of impact – Post Mitigation	Proposed Mitigations
	Indirect		
	None identified	n/a	n/a
	Cumulative		
	The primary cumulative impact is that development on the island (such as the proposed SPP) results in an overall negative impact on the heritage value of Robben Island.	Low (-ve). This is extremely unlikely, since the SPP is required to allow for the provision of sewage services and the continued use of the island as World and national heritage site. Due to its status, development on the island is tightly controlled and therefore the development is extremely unlikely to reduce the heritage amenity of the island.	n/a
Air Quality and Noise	Direct		
	During operation, the sewage package plant may present a risk of odour which presents a nuisance.	Low (-ve). The sludge pond waste will be inert and not have any strong odour. The treatment facility will be enclosed and therefore limit strong odours.	Odour mitigation has been built into design. The bacteriological process eliminates bad odour and the plants are fully enclosed thus preventing the escape of odours into the atmosphere. Proper and regular maintenance and management of the sewage package plant must be ensured.
	Indirect		
	Noise from general construction activities are also likely as construction machinery will be involved in undertaking the required excavations and in constructing the sewage plant and its housing. This may present a nuisance to island employees, tourists/ victors and residents.	Low (-ve). The construction activities will be short term. In addition to this, no visitors to the island are expected to be in the vincity of the construction camp, and no residents live within a 500m radius.	Noise generating activities must be kept to a minimum and must remain within the prescribed 70 dB(A). Noises that could cause a major disturbance should only be carried out outside of visitor hours and before 8pm.
	During construction indirect impacts on air quality as a result of the proposed development will include localised effects of increased traffic from exhaust fumes and also dust generated from use of untarred roads. Stockpiles in unsheltered areas may present a risk is they are susceptible to wind blowing.	Low (-ve). Once in operation the facility will generate very low noise and air emissions.	Dust suppression (water) to be applied to gravel roads when they are generating excessive dust due to vehicle travel. Travel on gravel roads should be limited to 30km/hr to minimise dust generation.
	During decommissioning impacts include possible disturbance to air quality though generation of dust; and noise associated with demolition of structures.	n/a	n/a
	Cumulative		
	None anticipated.	n/a	n/a
Marine Environment	Direct		
	During construction the main risks to the marine environment include a possible contamination from spillages or hazardous liquids during construction. In addition, erosion of construction areas during rainfall events may result in the inflow of sediment laden runoff into the sea, possibly resulting in some turbidity in the local marine environment.	Low (-ve)	Controls to prevent contaminated run-off into the marine environment must be enforced. Erosion management controls must be enforced. The prevention of erosion of soil can be minimised through means such as appropriate placement of stockpiles, and minimising removal of topsoil.
	During operation, the main impact to	Low- medium (+ve). The risk to	During operation, mitigation

Environmental Aspect	Type of Impact and Summary	Significance of impact – Post Mitigation	Proposed Mitigations
	the marine environment includes the risk that the treatment plant does not treat to the required water quality standards, or alternatively that the predicted dilution is not achieved resulting in elevated levels of pollution in the marine environment. A full marine impact assessment was completed according to each main pollutant concern; this is included in Appendix D. Furthermore, there is a risk that the location of the package plant and drying beds on the shoreline of the island. The facility, and in particular, the drying beds may be at risk from extreme storm events that could damage the structures resulting in potential spillage from the sludge drying beds.	the environment as a result of the sewage package plant is extremely low if mitigations measures are incorporated, since the technology used will be the best available technology, which has been designed according to a rigorous engineering feasibility and technical design. In addition, marine dispersion modelling (also Included in Appendix D) has been completed using best available assumptions to ensure that marine water quality objectives can be achieved. In reality, the existing environmental in the locality of the outfall has been degraded as a result of the release of raw sewage into the environment not reaching required dilution capacity. The development of the SPP is viewed as a positive impact on the marine environment as compared to the status quo. The risk of storm surges affecting the drying beds is minimal. The drying beds are in line with other existing buildings in the vicinity which have not been subjected to damage from extreme weather events. In addition the facilities will be and are located well above the high water mark. In addition, the proposed location is on the lee side of the normal storm direction and there is no history of storm damage on the eastern side of the island. This was hence the reasoning behind the siting of the old wooden jetty and harbour on the eastern side of the island.	measures which must be incorporated including the incorporation of a detailed monitoring programme for both quality of treated water exiting the SPP, and quality of water in the marine environment according to all main pollutant types to ensure that the plant is operating according to spec, and that marine water quality parameters are achieved at the outfall. Ensuring regular maintenance and capable management of the sewage package plant to ensure that it runs optimally. Provision to be made to include provision for fitment of secure covers to the drying beds, which will be secured in the extremely unlikely event of a south-eastern storm to prevent washing out of sludge.
	Indirect		
	None identified.	n/a	n/a
	Cumulative		
	The cumulative impact on the marine environment is the impact of the development in relation to existing marine quality issues in the vicinity of Robben Island (Table Bay). The SPP should result in a lessened pollution load into the marine environment of the Bay which is already under significant pressure and therefore will have a positive cumulative impact on the environment.	Low – Medium (+ve)	Assumes that the SPP functions according to required specifications and relevant mitigations noted above are incorporated.
Surface and Groundwater Quality	Direct		
	During construction direct impacts on surface and groundwater quality may include possible risks of contamination from hazardous	Low (-ve). With careful management during construction, the risk of contamination to surface water (runoff) and groundwater can	Primary mitigations during construction will include: Ensuring that workers have

Environmental Aspect	Type of Impact and Summary	Significance of impact – Post Mitigation	Proposed Mitigations
	building materials (e.g. paints, cement, fuels). Although there are no formal surface water resources in the proposed site, the risk of contamination to soil is significant as it may infiltrate soils and enter groundwater aquifers, or alternatively, it may run-off during rainfall events into the sea. Further risks include the direct risk of contamination from a lack of proper sanitation facilities for construction workers.	be reduced to present minimal risk.	adequate safe, and environmentally friendly toilet facilities. Ensuring that all activities where potential spillage of hazardous materials may result are carried out on a hard standing, or over a drip tray. Hazardous liquids (e.g. fuels) will be contained within a bunded area. Spill procedures must also be in place.
	During operation the main risk to surface (including run-off) and groundwater is through failure of the machinery (such as pumps, pipes and treatment facility) resulting in a possible leakage of sewage into the soil or overland. This is particularly pertinent to the collection sump which is at risk of overflowing if the pump is tardy or malfunctions. In addition, there is a risk of contamination to land if the treated effluent which may be used for irrigation purposes does not meet the required water quality standards.	Low (-ve). With careful management during operation, the risk of contamination to surface water (runoff) and groundwater can be reduced to present minimal risk.	Competent operation and regular maintenance of sewerage pipes. pump station and machinery and plant equipment must be completed to ensure that there is no failure in machinery or infrastructure or running specifications e.g. inflow rates. A detailed O+M manual and required training must be provided to maintenance personnel. Warning mechanisms must be implemented to monitor maintenance attendance and electrical blow-out alerts. An automatic standby diesel generator must be installed to ensure continuous power to the pump stations. Effluent treatment monitoring programme must be implemented to ensure that SPP is consistently treating to the required standards for release to land and the marine environment.
	Indirect		
	None identified.	n/a	n/a
	Cumulative		
	The cumulative risks associated with surface and groundwater resources would be related to the existing water pressures on the island. The island's groundwater aquifer is significantly under pressure due to over abstraction in the past.	Low (+ve). A positive result of the project will include a reduced pressure of the existing freshwater supply on the island due to the potential to irrigate land with the treated effluent in the future rather than water which has been generated by the island's desalination plant; with knock on reduced energy requirement.	n/a
Waste	Direct		
	Risks to the environment during construction include potential contamination of surrounding environment from waste through accidental or illicit activities including illegal dumping of general or hazardous construction wastes.	Low (-ve). Waste generation will be minimal since there is no demolishing of existing structures.	Impacts of waste generation can be mitigated through appropriate training in the principles of waste management and provision of necessary waste infrastructure during construction. Littering must be prohibited. All construction wastes must be removed from site once construction has been completed.
	During operation, primary risks associated with waste is the potential	Low (-ve) Waste inert sludge is the main	Solid waste must be stored in an appointed area in covered, tip proof

Environmental Aspect	Type of Impact and Summary	Significance of impact – Post Mitigation	Proposed Mitigations
	nuisance associated waste generated during operation including the inert sludge produced as a spent by-product (general waste), and solid (non-biodegradable) waste from screening of effluent before it enters the SPP.	waste type generated which has already been minimised as far as possible though the choice of technology. Only extremely minimal hazardous waste limited to possibly waste paints or oily rags from maintenance will be generated.	metal drums for collection and disposal at a licenced landfill facility. Hazardous wastes must be stored in appropriate hazardous waste receptacles and disposed of to a licenced hazardous waste facility. The technology type (submerged bio media) results in a reduced volume of sludge waste thereby minimising waste to landfill. Solid waste including grit and screenings shall be handled, stored, transported and disposed of in such a manner which does not cause flies or other nuisance any health hazard or secondary pollution.
	During decommissioning, the primary risk is that construction rubble will not be appropriately disposed of.	n/a	n/a
	Indirect		
	None identified.	n/a	n/a
	Cumulative		
	None identified.	n/a	n/a
Geotechnical	Direct		
	None identified.	n/a	n/a
	Indirect		
	For both construction and operation there is a risk of geological faulting during construction if the SPP is placed on collapsible soils with potential failure in the infrastructure.	Low (-ve).	Thorough geotechnical investigation to be completed prior to construction to identify the presence of faults and unstable areas which will be considered in sewage works design.
	Cumulative		
	None anticipated	n/a	n/a
Visual	Direct		
	None anticipated	n/a	n/a
	Indirect		
	Visual impacts associated with construction sites are generally attributed to poor house-keeping (e.g. presence of excavation scars, poorly managed construction waste, untidy storage of construction materials, visible portable latrines).	Low (-ve). Construction phase impacts will be generally offset by the fact that the construction period will be short (3 months); The SPP will also have very little foot or vehicle traffic associated with during construction and operation it and therefore is expected to create minimal disturbance.	Visual impacts during construction must be minimised through good housekeeping. Screening of unsightly aspects from public view including excavations, construction material storage areas, waste storage areas and ablutions).
	During operation, there is a risk that the development of the SPP will lead to a loss in visual aesthetics on the island and lead to a loss in "sense of place".	Negligible. The SPP will be adjacent to other existing buildings as well as existing pump station and therefor, along with the design mitigations incorporated will not result in any significant visual impacts.	Visual impacts to be mitigated through design which includes partial submerging of the SPP (2 m underground) and the siting of the SPP away from the major tourist attractions such as the prison and the quarries.
	Cumulative		
	None anticipated. Development on the island is tightly controlled to ensure that the "sense of place" of the island is retained. Visual aesthetics are thus carefully	n/a	n/a

Environmental Aspect	Type of Impact and Summary	Significance of impact – Post Mitigation	Proposed Mitigations
	managed.		
Land-use	Direct		
	None identified.	n/a	n/a
	Indirect		
	During operation. Change in land use from status quo may result in loss of amenity.	Low (-ve). The land is currently open space and is not used for any other purpose other than informal recreational purposes as a football pitch for residents. Locating the SPP at the edge of the open space next to the existing buildings will minimise loss in land-use as an informal recreational-use area.	n/a
	Cumulative		
	None identified.	n/a	n/a
Socio-economic	Direct		
	The development will have a direct social impact on the community and visitors to Robben Island in provision of essential services required for the continued use of the island as an education, cultural and tourism resource.	Low (+ve).	None identified.
	Indirect		
	None identified.	n/a	n/a
	Cumulative		
	The cumulative impact of the development will result in the continued positive economic spin-off as a result of tourism and trade from the Island.	Low (+ve)	n/a
Health & Safety	Direct		
	Health and safety risks posed to workers by construction environment.	Low (-ve)	Workers to be provided with appropriate training and tools necessary to complete works. This includes relevant personal protective equipment and oversight from senior personnel.
	During operation, risks include possibility that unauthorised access results in danger to unauthorised visitors or children. Furthermore, there is a risk that personnel come into contact with raw sewage or chemicals (e.g. chlorine for disinfection) which presents a human health risk.	Low (-ve)	Demarcate the installation area with appropriate markings and security fencing to prevent unauthorised personnel or vehicle entry. The plant should remain a prohibited area for non-essential personnel; No public admission should be allowed to the site. Ensure all manholes are secure and closed, to prevent accidents. Hazardous goods used in the process must be stored in a locked demarcated storage area. Provide appropriate training and PPE to prevent skin contact with any harmful effluent or chemicals.
	Indirect		
	None identified.	n/a	n/a
	Cumulative		
	None identified.	n/a	n/a

A complete impact assessment in terms of Regulation 22(2)(i) of GN R.543 must be included as Appendix F.

2. ENVIRONMENTAL IMPACT STATEMENT

Taking the assessment of potential impacts into account, please provide an environmental impact statement that summarises the impact that the proposed activity and its alternatives may have on the environment after the management and mitigation of impacts have been taken into account, with specific reference to types of impact, duration of impacts, likelihood of potential impacts actually occurring and the significance of impacts.

Alternative A (preferred alternative)

Alternative A is the preferred alternative for the proposed sewage package plant:

Potential direct impacts that may be associated with the provision of sewage treatment capacity on Robben Island are summarised in the following table.

Impact type	Description	Significance (construction)	Significance (operation)
Direct	Terrestrial vegetation impact (direct damage or disturbance to vegetation)	low	negligible
	Terrestrial Fauna (primarily disturbance to seabird populations)	low-medium	negligible
	Surface water and groundwater Impact (stormwater; groundwater pollution potential)	low	low
	Waste Generation (potential for contamination)	low	low
	Air Quality Impact (dust and air quality)	n/a	low
	Social- economic impact (essential service provision)	n/a	low (+)
	Heritage Impact (chance of relics being uncovered or destroyed)	low	n/a
	Health & Safety (risk to personnel and public)	low	low
	Marine Impact (improvement in marine environmental quality)	low	low-medium (+)
	Visual Impact (impact on the visual aesthetics of the island)	low	negligible
	Noise Impact (construction and operational noise impacts)	low	n/a
	Air Quality Impact (air quality e.g. odour)	low	low
	Geotechnical Impact (construction limitations)	low	n/a
	Land-Use Impact (change of land-use, aesthetic and economic impacts)	n/a	low
Cumulative	Marine environment (water quality)		Low-medium (+)
	Surface Water Impact (discharges including stormwater)		Low (+)
	Heritage (sense of place)	n/a	low
	Socio-economic		Low (+)

The level of proposed impacts have been determined to be mainly “low” and “low-medium” ratings, with no medium or higher negative impact ratings following mitigation. A number of positive impacts were identified in the low and low-medium range relating to improvements in existing water quality as well as improved efficiency of water use on the island when the water is eventually used for irrigation purposes. Many mitigation measures have been built into the design of the sewage package plant, particularly with relation to visual and aesthetic aspects. This is to minimise any temporary or long lasting effects which may harm the historical, cultural aspects as well as the quality of experience gained by visitors to the island. Detailed operation and maintenance requirements for the SPP as well as the proposed monitoring programme will ensure that the SPP works to the required specifications. The operation of the SPP will be subject to the conditions of a Coastal Water Discharge Permit which will also ensure the SPP operates in an environmentally sound manner, meeting required water quality specifications. During construction, mitigations included such as continuous fencing and covering up of excavation pits and awareness training provided to staff and contractors will assist in minimising the impact on the biodiversity of the island, specifically, the African penguin population.

Overall the project is expected to have net positive benefit for the marine environment due to the improved quality of effluent existing into the marine environment from the outfall as compared to the status quo.

No-go alternative (compulsory)

The no-go alternative is that no SPP is developed and there is thus no effluent treatment capability on Robben Island. The environmental impact associated with the status quo is no–longer acceptable since the effluent does not reach the discharge limits set by the DEA, required in terms of a Coastal Waters Discharge Permit in terms of the Integrated Coastal Management Act (ICMA). Therefore the no-go option would be result in the release of unacceptable levels of pollution into the environment which forms part of a protected area under NEM: Protected Areas Act at a distance of 1 nautical mile from the island.

SECTION E. RECOMMENDATION OF PRACTITIONER

Is the information contained in this report and the documentation attached hereto sufficient to make a decision in respect of the activity applied for (in the view of the environmental assessment practitioner)?	YES	NO

If "NO", indicate the aspects that should be assessed further as part of a Scoping and EIA process before a decision can be made (list the aspects that require further assessment).

N/A

If "YES", please list any recommended conditions, including mitigation measures that should be considered for inclusion in any authorisation that may be granted by the competent authority in respect of the application.

The assessment is based on the assumption that the modelling predictions from the marine dispersion study will be achieved in reality. This therefore assumed that the SPP will consistently treat sewage generated on the island to levels which meet the General Limit Values (for disposal of wastewater to a water resource) and once it is released to the marine environment, that it reaches South African Marine Water Quality Guidelines DWAF, 1995: Maintenance of the Ecosystem. The impact assessment therefore assumes that the primary mitigation against continued degradation of the marine environment is a correctly functioning facility. It is thus imperative that the predictions on which this assessment is based (in terms of water quality outputs) are verified once the plant is in operation. This must be completed via means of a monitoring programme for both effluent output and marine water quality. It is therefore recommended that the monitoring and reporting requirements are included in the conditions of the assessment for the operational phase.

For the construction phase, the following recommendations are made:

- Maintaining good house-keeping through the duration of the construction phase;
- Continual fencing of construction camp to ensure that people and African penguins cannot enter the camp.
- Screening of unsightly aspects from public view including excavations (where practical), construction material storage areas, waste storage areas and ablutions).
- The rehabilitation of all areas of natural vegetation that have been disturbed as a result of construction activities.
- Designation of construction materials and fuel storage areas.
- Effective control of waste and containment of stormwater.
- Implement dust suppression measures (with water or other technique) when appropriate.
- Appointment of a heritage specialist during excavation phase of construction period.

It is understood that the Ampac Sewage Package Plant will be developed in accordance with state of the art technologies and practices and that the associated impacts will be adequately addressed through facility design and institution of "good practice" management procedures as well as monitoring programmes. The engineering contractors have considered in detail: the technology options in relation to the island throughput requirements, treated sewage quality requirements, requirements for recycling and re-use and environmental management and mitigation especially in respect of visual impacts, sludge handling, disinfection and odour control amongst other operational and maintenance issues.

It is the opinion of the EAP that the project does not present any significant risk to the environment. The very minor impacts associated with the development are far outweighed by both the improvement in marine water quality and the continued use of the island to visitors/ tourists, residents and workers as a historical and cultural resource, and one of only eight UNESCO World Heritage Sights in South Africa.

Is an EMPr attached?	YES	NO

The EMPr must be attached as Appendix G.

The details of the EAP who compiled the BAR and the expertise of the EAP to perform the Basic Assessment process must be included as Appendix H.

If any specialist reports were used during the compilation of this BAR, please attach the declaration of interest for each specialist in Appendix I.

Any other information relevant to this application and not previously included must be attached in Appendix J.

Jacqui Fincham

NAME OF EAP

SIGNATURE OF EAP

22 May 2014

DATE

SECTION F: APPENDIXES

The following appendixes must be attached:

Appendix A: Maps

Appendix B: Photographs

Appendix C: Facility illustration(s)

Appendix D: Specialist reports (including terms of reference)

Appendix E: Public Participation

Appendix F: Impact Assessment

Appendix G: Environmental Management Programme (EMPr)

Appendix H: Details of EAP and expertise

Appendix I: Specialist's declaration of interest

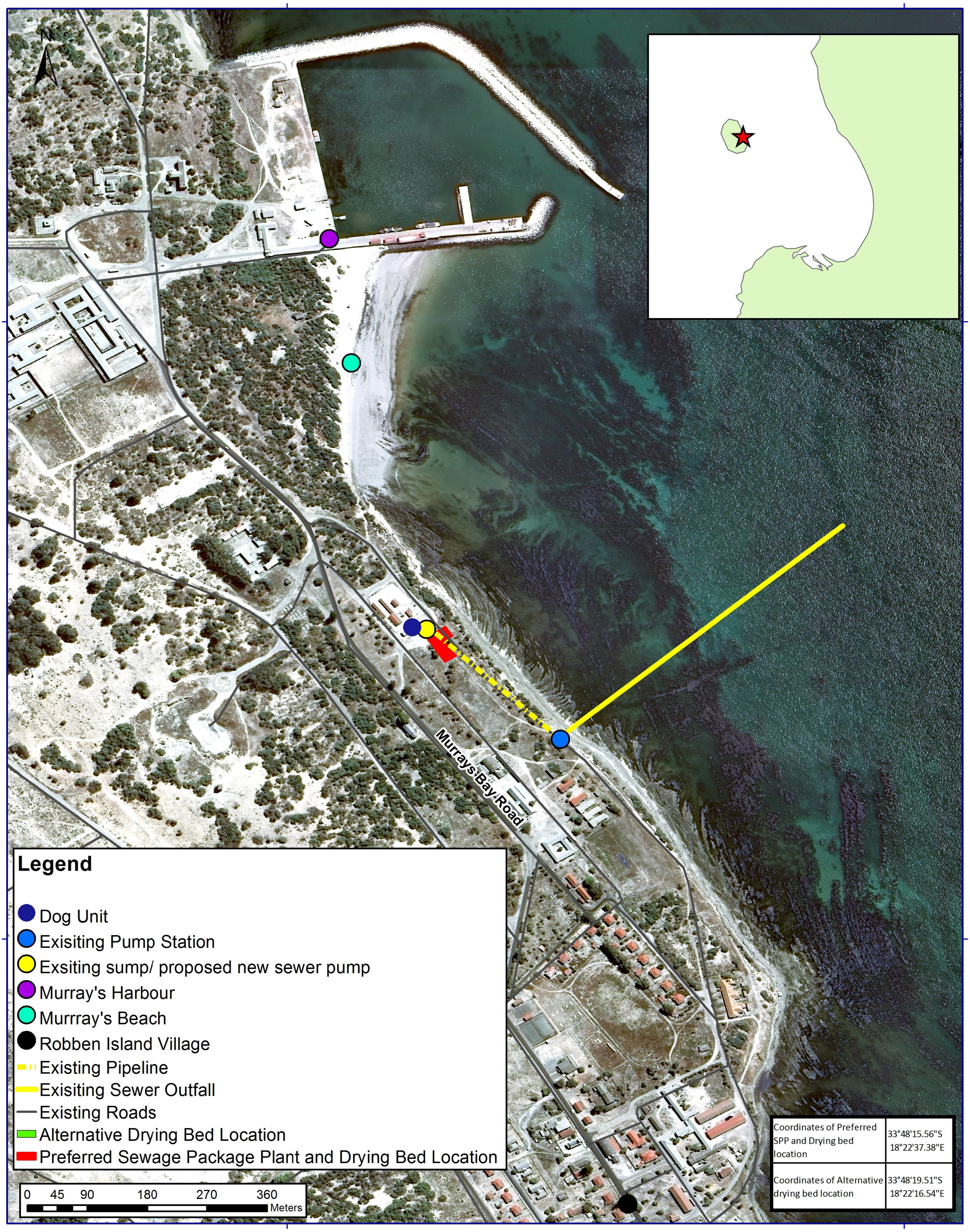
Appendix J: Additional Information

APPENDIX A - SITE LAYOUT MAPS

1. Site Locality
2. Site Layout
3. Sensitivity Map (Biodiversity)
4. Sensitivity (Historical Aspects)

Robben Island Sewage Package Plant

Site Locality



Project: Basic Assessment:Robben Island Sewage Package	**Data Source:** South African Department of Rural Development and Land Reform - Chief Directorate: National Geo-spatial Information	**Date:** 11 March 2014	WSP
Project No: 34718			
Drawn by: G. Daynes			
Reviewed by: K. Sims	**Projection:** Geographic - WGS1984		www.wspenvironmental.co.za

Robben Island Sewage Package Plant

Layout Plan

Project: Basic Assessment:Robben Island Sewage Package	**Data Source:**	**Date:**	WSP
Project No: 34718	South African Department of Rural Development and Land Reform - Chief Directorate: National Geo-spatial Information	11 March 2014	
Drawn by: G. Daynes			
Reviewed by: K. Sims	**Projection:** Geographic - WGS1984		www.wspenvironmental.co.za

Biodiversity Overlay Map

Legend

- South African municipal bound
- South African parent farm cada
- 20m Contour lines - northern R
- 20m contour lines - southern R
- National biomes
  - Albany Thicket Biome
  - Azonal Vegetation
  - Desert Biome
  - Forests
  - Fynbos Biome
  - Grassland Biome
  - Indian Ocean Coastal Belt
  - Nama-Karoo Biome
  - Savanna Biome
  - Succulent Karoo Biome
  - Waterbodies
- World Imagery
- Low Resolution 15m Imagery
- High Resolution 60cm Imagery
- High Resolution 30cm Imagery

1: 17 032

0.9 0 0.43 0.9 Kilometers

WGS_1984_Web_Mercator_Auxiliary_Sphere

This map is a user generated static output from an Internet mapping site and is for reference only. Data layers that appear on this map may or may not be accurate, current, or otherwise reliable.

THIS MAP IS NOT TO BE USED FOR NAVIGATION

Notes

Enter Map Description

SANBI
Biodiversity for Life

Biodiversity Network and Threatened ecosystems

Legend

Cape Town Bionet Protected A

- PROTECTED: IN PERPETUITY
- PROTECTED: NOT IN PERPETUI
- CONSERVATION AREA

Threatened ecosystems origin

- Critically Endangered
- Endangered
- Vulnerable

World Imagery

Low Resolution 15m Imagery

High Resolution 60cm Imagery

High Resolution 30cm Imagery

1: 112 570

5.7 0 2.86 5.7 Kilometers

WGS_1984_Web_Mercator_Auxiliary_Sphere

This map is a user generated static output from an Internet mapping site and is for reference only. Data layers that appear on this map may or may not be accurate, current, or otherwise reliable.

THIS MAP IS NOT TO BE USED FOR NAVIGATION

Notes

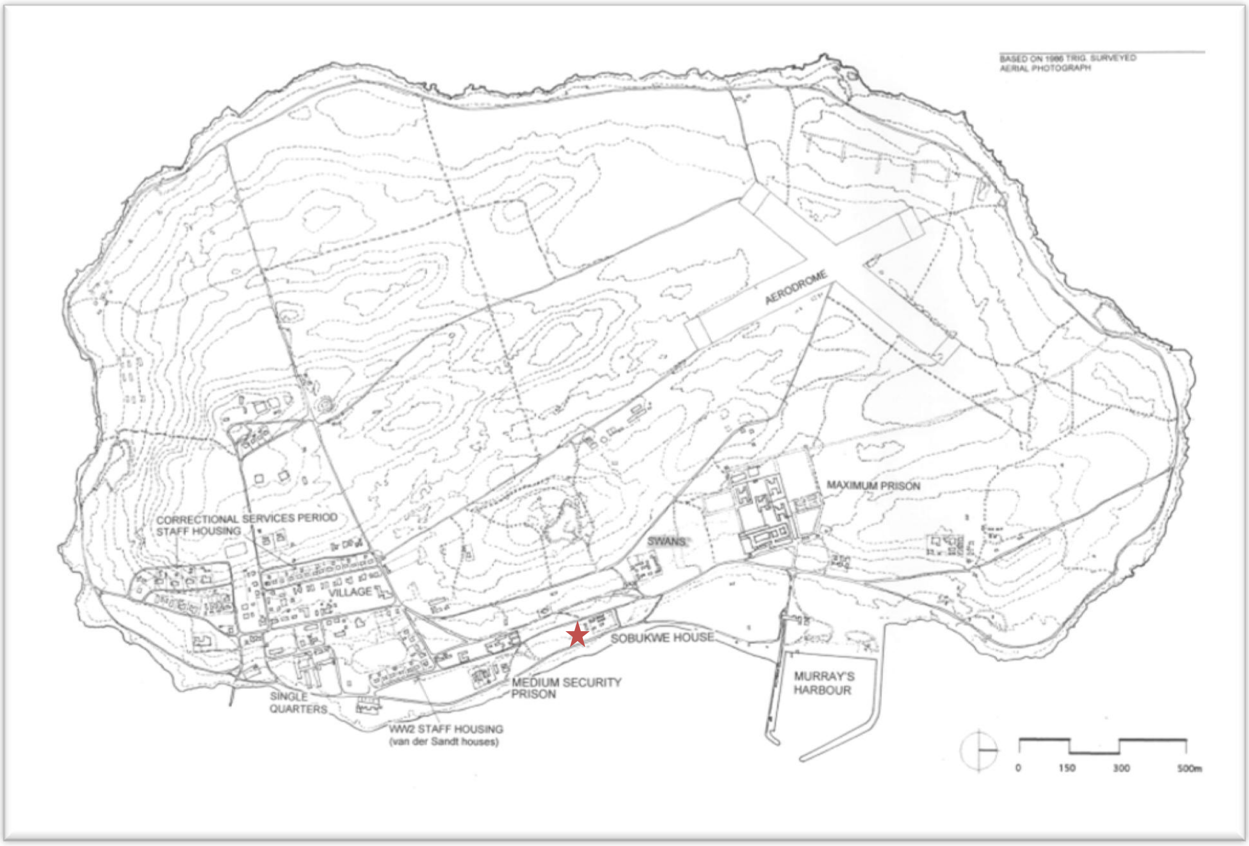


Figure 1 Location of proposed SPP in relation to political imprisonment landscape on Robben Island (Source: Robben Island Integrated Conservation Management Plan).

APPENDIX B - SITE PHOTOGRAPHS

APPENDIX B - SITE PHOTOGRAPHS

Figure 1. Panorama of the site under investigation, facing east with Robert Soboukwe House behind photographer

Figure 2. Looking northeast from the proposed SPP location towards the sea.

Figure 3.Looking north towards Murray's Beach and the harbour from the location of the existing sewer outfall

Figure 4.Looking south along the coast towards the sewage outfall control valve

Figure 5. Looking out to sea, northeast, along the existing sewer outfall.
[Visible structures are supports from demolished pipe lines]

Figure 6. Looking northwest toward Robert Soboukwe House. Rope indicative of existing pipeline layout route.

Figure 9. Looking southeast from the Robert Soboukwe House onto the site of the SPP and DB

Figure 10. Looking northwest from the location of the proposed SPP at the dog unit complex

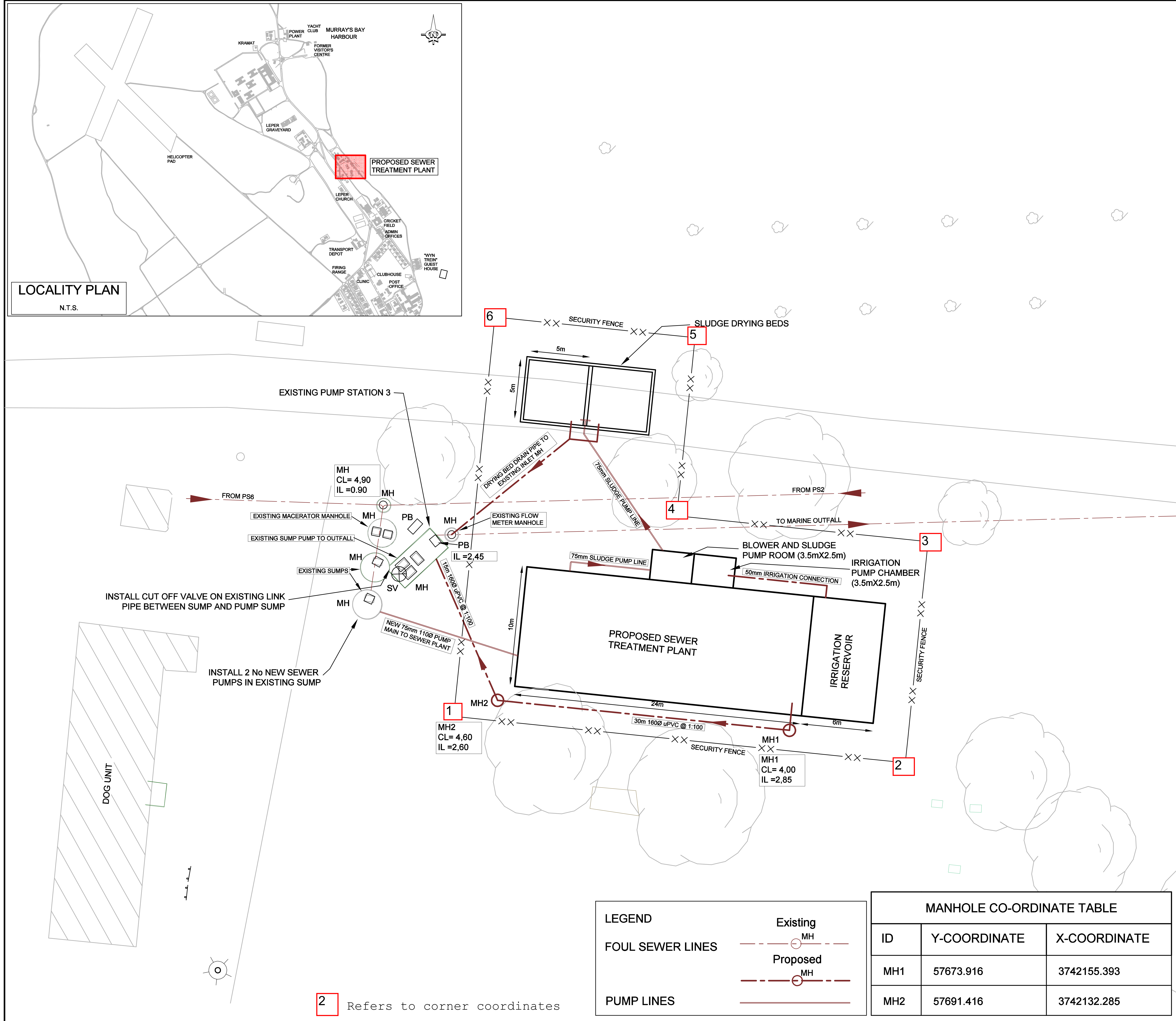
Figure 11. Looking west (Inland) from the proposed SPP location

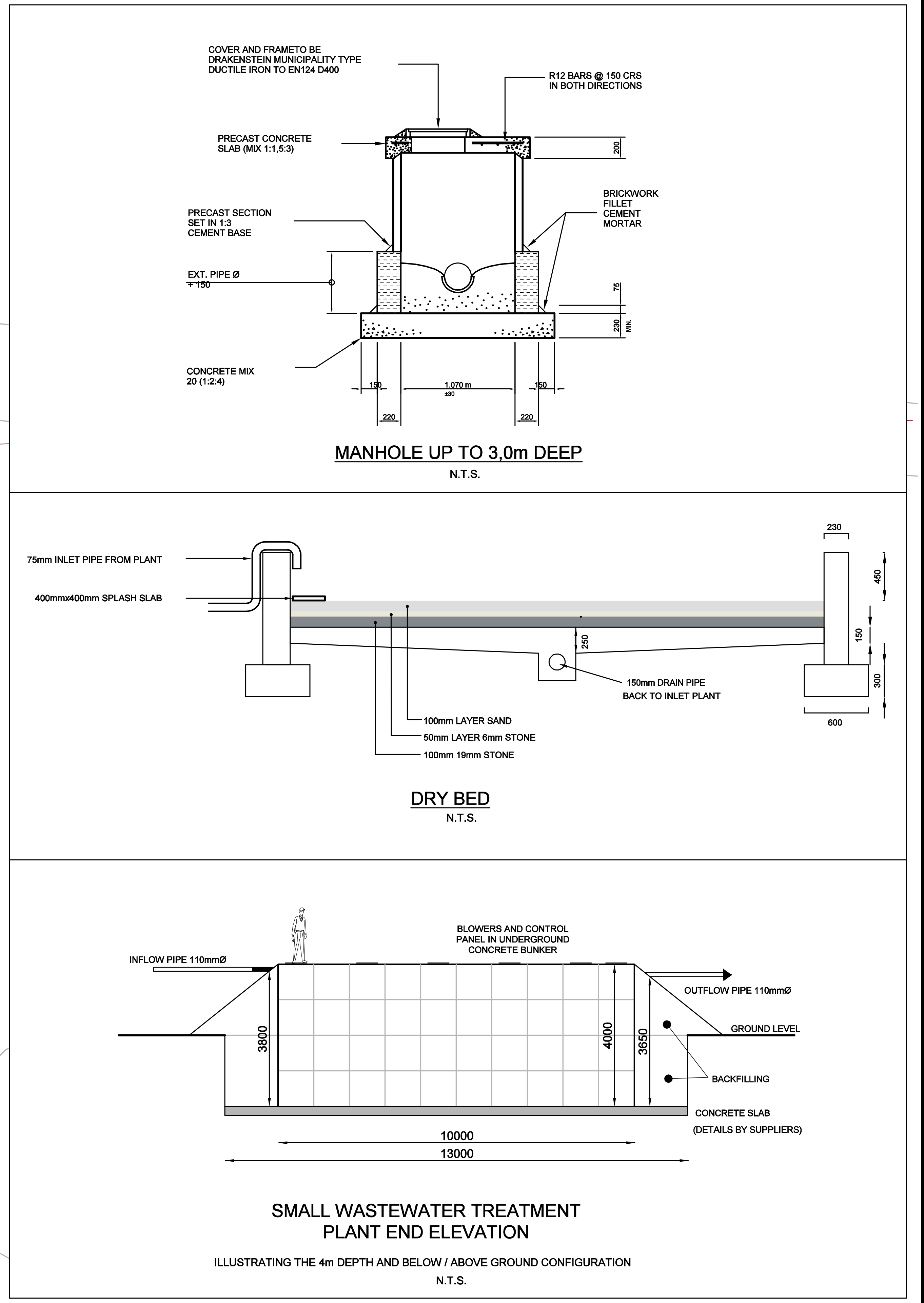
Figure 12. Looking to the east from Murrays Bay Road

APPENDIX C - SITE PLAN MAPS

1. Sewage Package Plant Layout
2. Existing Pipeline Layout to Outfall

Figure 1





LEGEND

	Existing MH
FOUL SEWER LINES	Proposed MH
PUMP LINES	

MANHOLE CO-ORDINATE TABLE

ID	Y-COORDINATE	X-COORDINATE
MH1	57673.916	3742155.393
MH2	57691.416	3742132.285

Amendments

No.	Description	Date	Initial

Designed
Checked
Drawn
Checked

EFG Engineers (Pty) Ltd
Transport, Infrastructure, Municipal Services & Development
3A Queen Street, Durbanville 7550
P O Box 3800, Durbanville 7551
Tel: 021 975 3880
Fax: 021 975 3850
web: www.efgeng.co.za

EFG Engineers (Pty) Ltd — Date

Client — Date

Planned For:
public works
Department: Public Works
REPUBLIC OF SOUTH AFRICA

ROBBEN ISLAND

PROPOSED SEWER TREATMENT PLANT
LAYOUT PLAN

Sheet 1 of 1

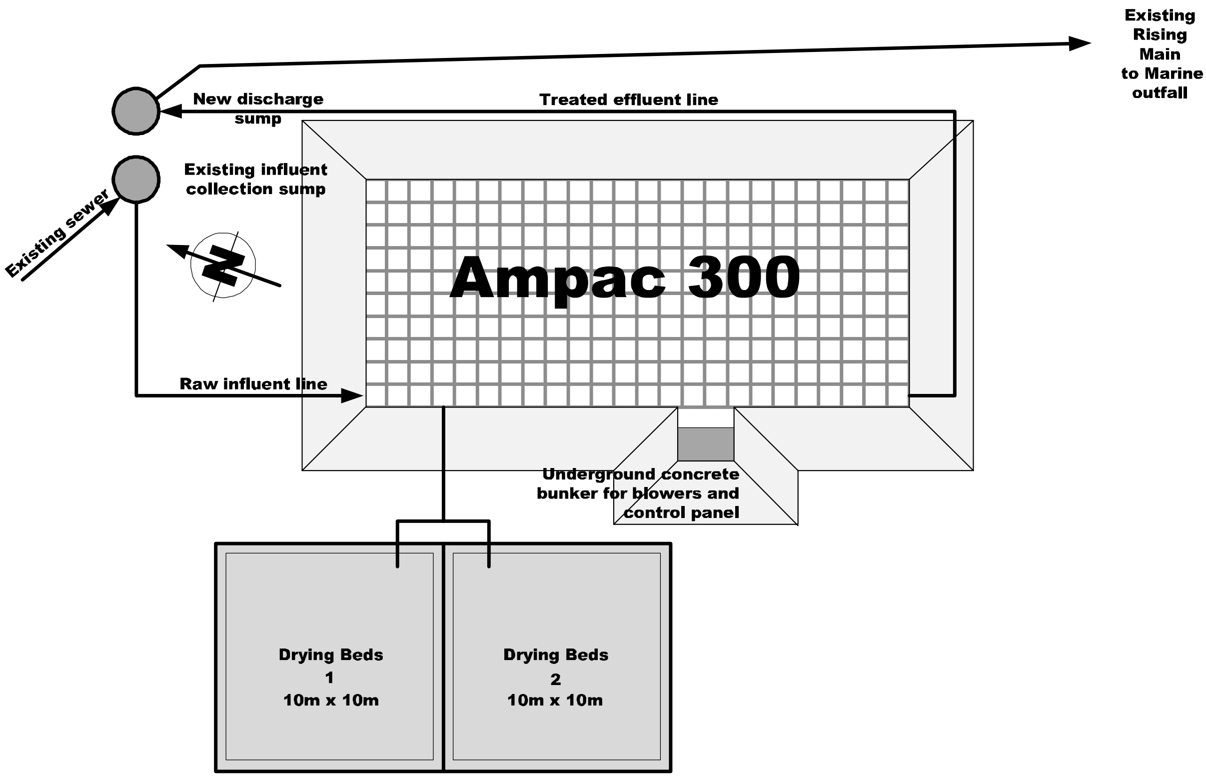
Scale:	1 : 250
Date:	11-02-2014
Status:	PRELIMINARY
Plan No:	P 471 SE-LO 01

A2
REV 0

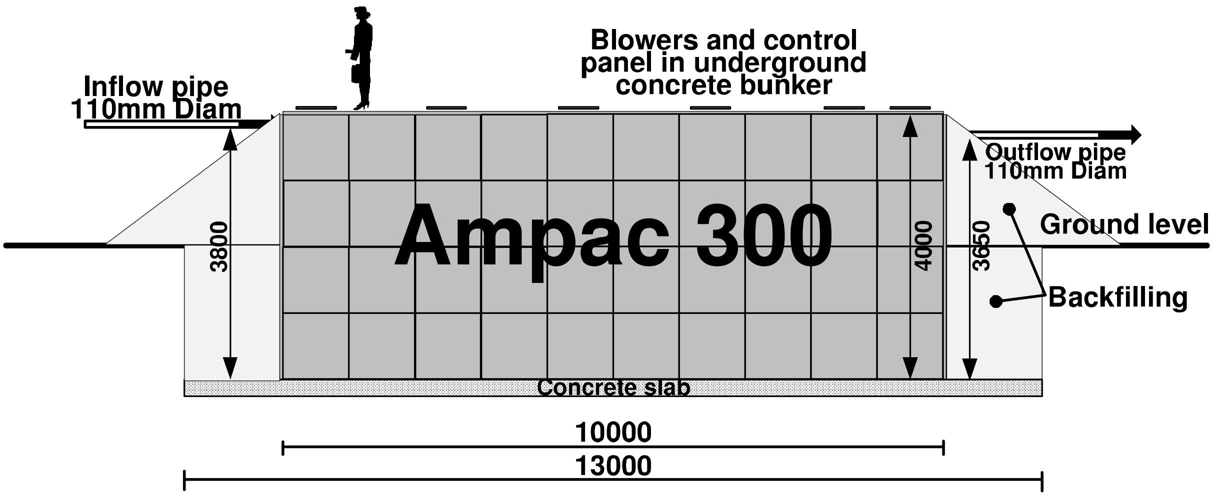
X:\Projects\471-Robben Eiland\Amitek Sewer Treatment\Drawings


MW 75
FIRE MAIN
SOBUKWES HOUSE
PUMP STATION 3
3xTANKS
ENTRANCE TO BUNKER
SEWER PIPE
SEWER OUTFALL PIPE
SEWER OUTFALL PIPE TO OCEAN
SEWER OUTLET PUMP STATION
MW 75
FIRE MAIN
LEPER CHURCH
LIME QUARRY
SCALE 1 : 1000
Figure 2

Figure 3



Ampac end elevation illustrating the 4m depth and below / above ground configuration



APPENDIX D – SPECIALIST REPORTS

1. Desktop Paleontological Impact Assessment
2. Archaeological Impact Assessment
3. Marine Dispersion Study (Diffuser Performance)
4. Marine Ecological Assessment

PALAEONTOLOGICAL SPECIALIST STUDY: DESKTOP BASIC ASSESSMENT

Proposed Sewage Package Plant on Robben Island, Cape Town, Western Cape

John E. Almond PhD (Cantab.)
***Natura Viva* cc, PO Box 12410 Mill Street,**
Cape Town 8010, RSA
naturaviva@universe.co.za

January 2014

1. SUMMARY

It is proposed to construct a Sewage Package Plant (SPP) and associated infrastructure on the south-eastern coast of Robben Island near Cape Town in order to treat sewage generated on the island. The study area for the proposed SPP is underlain by a thin (probably a few meters or less) veneer of aeolian sands of the **Witsand Formation** (Sandveld Group) of Holocene to Recent age. These unconsolidated sands directly overlie latest Precambrian (Ediacaran) submarine fan deposits of the **Tygerberg Formation** (Malmesbury Group). The metasedimentary bedrocks here have been planed-off at 3-7 m amsl by wave action during periods of high sea level in the Pleistocene Epoch. Pleistocene raised beach deposits (*e.g.* storm gravels) are not recorded along this comparatively protected stretch of coastline.

A wide range of invertebrate, vertebrate and plant subfossils, as well as microfossils, have been recorded from the Holocene dune sands of the Witsand Formation in the Western Cape. However, since (1) most of the taxa concerned are of wide distribution, (2) only shallow excavations (≤ 2.5 m) are envisaged during the construction phase, and (3) the SPP development footprint is small (1400 m^2), significant impacts on buried or subsurface fossil remains are not anticipated here. Direct impacts on bedrocks of the Tygerberg Formation within the development footprint will probably be very limited in extent. There are unconfirmed reports of simple invertebrate burrows preserved within Tygerberg sandstones on Robben Island that are potentially of great scientific interest as the first and only known macrofossils recorded from the entire Malmesbury Group. However, if valid, these observations will have been made in bedrock exposures along the shoreline, perhaps in the intertidal zone, and are unlikely to be directly affected by the proposed onshore development, or by the effluent pipeline where this runs offshore.

It is concluded that the proposed Sewage Package Plant and associated infrastructure will not generate significant impacts on local palaeontological heritage resources that might compromise the Outstanding Universal Value of the Robben Island World Heritage Site.

Consequently no further palaeontological heritage studies or specialist mitigation are recommended for this sewage plant project, *pending* the discovery or exposure of any substantial fossil remains (*e.g.* vertebrate bones and teeth, fossil plant-rich horizons, dense concentrations of marine shells) during the construction phase. The ECO responsible for these developments should be alerted to the possibility of important fossil remains being found either on the surface or exposed by fresh excavations during construction.

In the case of any substantial fossil finds during construction, these should be safeguarded - preferably *in situ* - and reported by the ECO as soon as possible to Heritage Western Cape, so that appropriate mitigation (*i.e.* recording, sampling or collection) by a palaeontological specialist can be considered and implemented (Contact details: Heritage Western Cape. Protea Assurance Building, Green Market Square, Cape Town 8000. Private Bag X9067, Cape Town 8001. Tel: 086-

142 142. Fax: 021-483 9842. Email: hwc@pgwc.gov.za). These recommendations should be incorporated into the Environmental Management Plan (EMP) for the sewage infrastructure project.

The specialist involved in palaeontological mitigation work would require a fossil collection permit from SAHRA (Contact details: Mrs Colette Scheermeyer, P.O. Box 4637, Cape Town 8000; Tel: 021 462 4502; Email: cscheermeyer@sahra.org.za). Fossil material must be curated in an approved repository (*e.g.* museum or university collection) and all fieldwork and reports should meet the minimum standards for palaeontological impact studies developed by SAHRA.

2. INTRODUCTION & BRIEF

It is proposed to construct a small Sewage Package Plant (SPP) and associated infrastructure on the south-eastern coast of Robben Island near Cape Town in order to treat sewage generated on the island (Fig. 1). The treated effluent will be transported *via* an existing onshore pipeline to the existing sea outfall pipeline and discharged out to sea. The site for the sewage package plant will have an area of 1400 m^2, within which the plant will have a footprint of 600 m^2. The on-land plant will be partially submerged to a depth of approximately 2.5 m subsurface. Sludge produced as part of the treatment process will be dried on drying beds on the island. The sludge can be used as fertiliser or disposed of *via* the normal refuse system.

The proposed SPP development project (DEA ref number: 14/12/16/3/3/3/83) requires authorisation in terms of National Environmental Management Act (NEMA) (Act No. 107 of 1998), EIA Regulations. Robben Island is a National and World Heritage Site and therefore the competent authority in terms of Environmental Authorisation in terms NEMA will be the National Department of Environmental Affairs (DEA).

The company WSP Environmental (Pty) Ltd, Cape Town (Contact details: Ms Surina Brink , 3rd Floor, 35 Wale Street, Cape Town, 8001, South Africa. Tel: +27 21 481 8794. Fax: +27 21 481 8799. Mob: +27 82 468 0962. E-mail: Surina.brink@WSPGroup.co.za) has been appointed by the developer as the independent Environmental Assessment Practitioner (EAP) to undertake the Basic Assessment for this sewage plant project.

The study area on Robben Island is underlain by potentially fossiliferous sediments of the Holocene to Recent Witsand Formation (Sandveld Group) overlying Late Precambrian metasediments of the Tygerberg Formation (Malmesbury Group). In accordance with the National Heritage Resources Act, 1999, a palaeontological heritage basic assessment as part of a comprehensive Heritage Impact Assessment for this project has been commissioned by WSP Environmental (Pty) Ltd, Cape Town.

1.1. Legislative context of this palaeontological study

The various categories of heritage resources recognised as part of the National Estate in Section 3 of the National Heritage Resources Act (1999) include, among others:

- geological sites of scientific or cultural importance;
- palaeontological sites;
- palaeontological objects and material, meteorites and rare geological specimens.

According to Section 35 of the National Heritage Resources Act, dealing with archaeology, palaeontology and meteorites:
(1) The protection of archaeological and palaeontological sites and material and meteorites is the responsibility of a provincial heritage resources authority.
(2) All archaeological objects, palaeontological material and meteorites are the property of the State.
(3) Any person who discovers archaeological or palaeontological objects or material or a meteorite in the course of development or agricultural activity must immediately report the find to the

responsible heritage resources authority, or to the nearest local authority offices or museum, which must immediately notify such heritage resources authority.
(4) No person may, without a permit issued by the responsible heritage resources authority—
(a) destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite;
(b) destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite;
(c) trade in, sell for private gain, export or attempt to export from the Republic any category of archaeological or palaeontological material or object, or any meteorite; or
(d) bring onto or use at an archaeological or palaeontological site any excavation equipment or any equipment which assist in the detection or recovery of metals or archaeological and palaeontological material or objects, or use such equipment for the recovery of meteorites.
(5) When the responsible heritage resources authority has reasonable cause to believe that any activity or development which will destroy, damage or alter any archaeological or palaeontological site is under way, and where no application for a permit has been submitted and no heritage resources management procedure in terms of section 38 has been followed, it may—
(a) serve on the owner or occupier of the site or on the person undertaking such development an order for the development to cease immediately for such period as is specified in the order;
(b) carry out an investigation for the purpose of obtaining information on whether or not an archaeological or palaeontological site exists and whether mitigation is necessary;
(c) if mitigation is deemed by the heritage resources authority to be necessary, assist the person on whom the order has been served under paragraph *(a)* to apply for a permit as required in subsection (4); and
(d) recover the costs of such investigation from the owner or occupier of the land on which it is believed an archaeological or palaeontological site is located or from the person proposing to undertake the development if no application for a permit is received within two weeks of the order being served.

Minimum standards for the palaeontological component of heritage impact assessment reports have been developed by SAHRA (2013).

3. APPROACH TO THE PALAEONTOLOGICAL HERITAGE ASSESSMENT

The information used in this desktop study was based on the following:

1. A short project outline (BID) and maps provided by WSP Environmental (Pty) Ltd, Cape Town;

2. A review of the relevant scientific literature, including published geological maps and sheet explanations, satellite images, and geological field guides (*e.g.* Theron & Hill 1993);

3. The author's database on the formations concerned and their palaeontological heritage.

4. An informative unpublished report on fossils in dunes and coversands prepared for Heritage Western Cape by John Pether (2008).

In preparing a palaeontological desktop study the potentially fossiliferous rock units (groups, formations *etc*) represented within the study area are determined from geological maps and satellite images. The known fossil heritage within each rock unit is inventoried from the published scientific literature, previous palaeontological impact studies in the same region, and the author's field experience (Consultation with professional colleagues as well as examination of institutional fossil collections may play a role here, or later following field assessment during the compilation of the final report). This data is then used to assess the palaeontological sensitivity of each rock unit to development. The potential impact of the proposed development on local fossil heritage is then determined on the basis of (1) the palaeontological sensitivity of the rock units concerned and (2) the nature and scale of the development itself, most significantly the extent of fresh bedrock excavation envisaged. When rock units of moderate to high palaeontological sensitivity are present within the development footprint, a Phase 1 field assessment study by a professional palaeontologist is usually warranted to identify any palaeontological hotspots and make specific recommendations for any mitigation required before or during the construction phase of the development.

On the basis of the desktop and Phase 1 field assessment studies, the likely impact of the proposed development on local fossil heritage and any need for specialist mitigation are then determined. Adverse palaeontological impacts normally occur during the construction rather than the operational or decommissioning phase. Phase 2 mitigation by a professional palaeontologist – normally involving the recording and sampling of fossil material and associated geological information (*e.g.* sedimentological data) may be required (a) in the pre-construction phase where important fossils are already exposed at or near the land surface and / or (b) during the construction phase when fresh fossiliferous bedrock has been exposed by excavations. To carry out mitigation, the palaeontologist involved will need to apply for a palaeontological collection permit from the relevant heritage management authority, *i.e.* SAHRA for the Northern Cape (Contact details: Mrs Colette Scheermeyer, P.O. Box 4637, Cape Town 8000. Tel: 021 462 4502. Email: cscheermeyer@sahra.org.za). It should be emphasized that, *providing appropriate mitigation is carried out*, the majority of developments involving bedrock excavation can make a *positive* contribution to our understanding of local palaeontological heritage.

3.1. Assumptions & limitations

The accuracy and reliability of palaeontological specialist studies as components of heritage impact assessments are generally limited by the following constraints:

1. Inadequate database for fossil heritage for much of the RSA, given the large size of the country and the small number of professional palaeontologists carrying out fieldwork here. Most development study areas have never been surveyed by a palaeontologist.

2. Variable accuracy of geological maps which underpin these desktop studies. For large areas of terrain these maps are largely based on aerial photographs alone, without ground-truthing. The maps generally depict only significant ("mappable") bedrock units as well as major areas of superficial "drift" deposits (alluvium, colluvium) but for most regions give little or no idea of the level of bedrock outcrop, depth of superficial cover (soil *etc*), degree of bedrock weathering or levels of small-scale tectonic deformation, such as cleavage. All of these factors may have a major influence on the impact significance of a given development on fossil heritage and can only be reliably assessed in the field.

3. Inadequate sheet explanations for geological maps, with little or no attention paid to palaeontological issues in many cases, including poor locality information;

4. The extensive relevant palaeontological "grey literature" - in the form of unpublished university theses, impact studies and other reports (*e.g*. of commercial mining companies) - that is not readily available for desktop studies;

5. Absence of a comprehensive computerized database of fossil collections in major RSA institutions which can be consulted for impact studies. A Karoo fossil vertebrate database is now accessible for impact study work.

In the case of palaeontological desktop studies without supporting Phase 1 field assessments these limitations may variously lead to either:

(a) *underestimation* of the palaeontological significance of a given study area due to ignorance of significant recorded or unrecorded fossils preserved there, or

(b) *overestimation* of the palaeontological sensitivity of a study area, for example when originally rich fossil assemblages inferred from geological maps have in fact been destroyed by tectonism or weathering, or are buried beneath a thick mantle of unfossiliferous “drift” (soil, alluvium *etc*).

Since most areas of the RSA have not been studied palaeontologically, a palaeontological desktop study usually entails *inferring* the presence of buried fossil heritage within the study area from relevant fossil data collected from similar or the same rock units elsewhere, sometimes at localities far away. Where substantial exposures of bedrocks or potentially fossiliferous superficial sediments are present in the study area, the reliability of a palaeontological impact assessment may be significantly enhanced through field assessment by a professional palaeontologist. In the case of the Robben Island sewage plant project the major limitation for fossil heritage assessment is the lack of previous field-based palaeontological studies in the area.

Fig. 1. Google earth© satellite image of Robben Island (A) showing detail of the study area for the proposed Sewage Package Plant on the east coast of the island (B), approximately one kilometre south of the harbour at Murray's Bay (Detailed image kindly supplied by WSP

Environmental (Pty) Ltd, Cape Town). The proposed SPP footprint and existing landside pipeline to the sea outlet pipeline are indicated in red.

A **B**

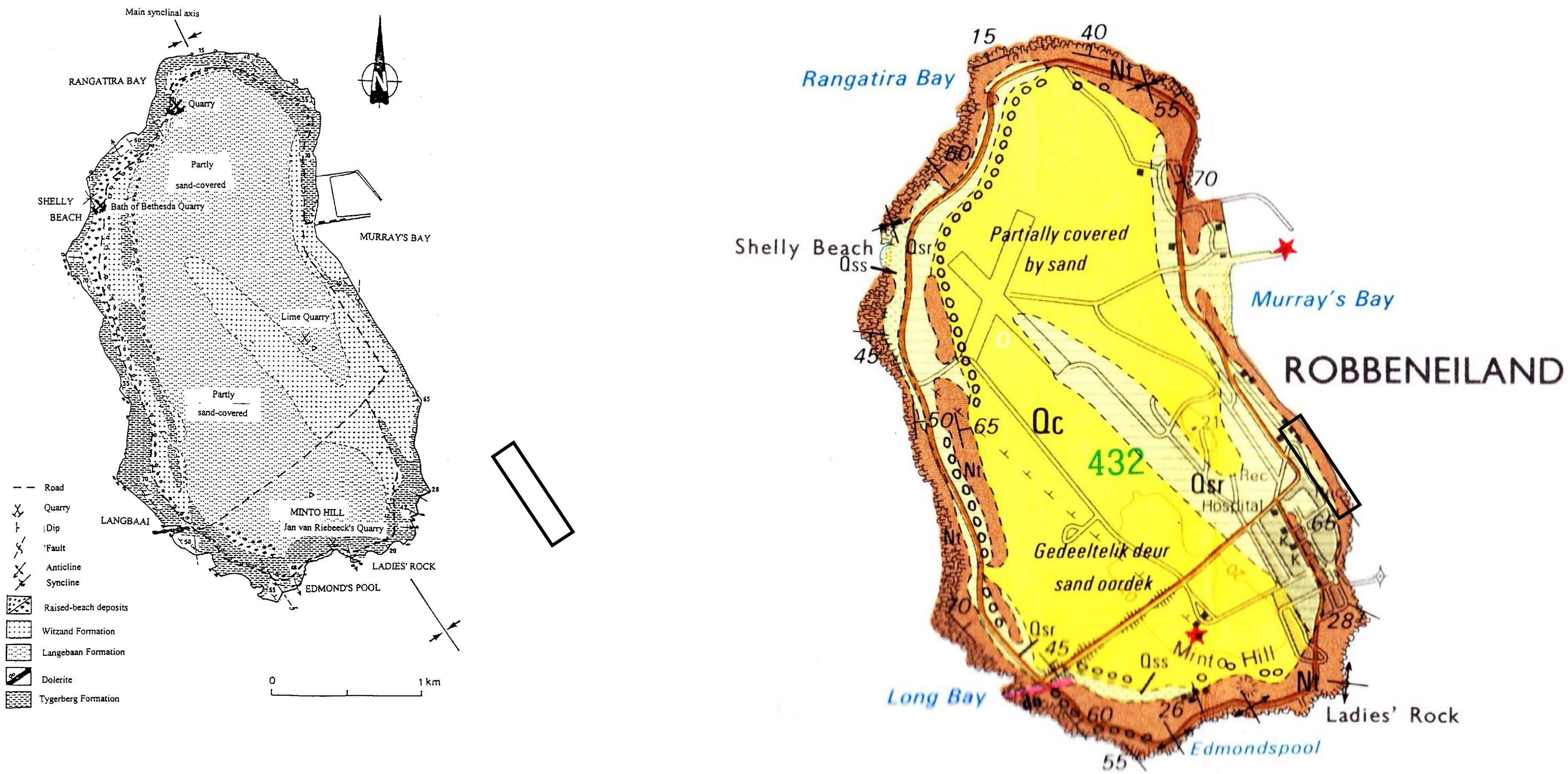


Fig. 2. Two geological maps of Robben Island with the present Sewage Package Plant study area on the east coast marked by a black rectangle: (a) From Theron & Hill (1995); (b) From 1: 50 000 geological map 3318CD (Council for Geoscience, Pretoria).

4. GEOLOGICAL BACKGROUND

The study area for the proposed Sewage Package Plant is situated on the south-eastern coast of Robben Island, approximately one kilometre south of the harbour in Murray's Bay (Figs. 1 & 2). The SPP footprint and landside sector of the pipeline to the sea outlet pipeline are located on a gently seaward-sloping, vegetated coastal bench or platform at 3 – 7 m amsl situated between the modern rocky coast and the coastal road (Fig. 1B).

The geology of Robben Island has been reviewed in 1: 50 000 and 1: 250 000 sheet explanations for the Cape Town area (Theron 1984 and Theron *et al.* 1992 respectively), in a recent study focusing on structural geology by Rowe *et al.* (2010), as well as in informative but unpublished excursion guides produced for the Western Cape Branch of the Geological Society of South Africa (*e.g.* Theron & Hill 1995).

As shown in both geological maps of Robben Island reproduced here in Figure 2, the study area is underlain at depth by low-grade metasediments of the **Malmesbury Group**. These bedrocks are assigned to the **Tygerberg Formation** and are of inferred to be latest Precambrian (Ediacaran) age, constrained by the youngest detrital zircons of 560 Ma and the intrusion of the Cape Granites at 552-540 Ma (Gaucher *et al.* 2009). . They build the substructure of the entire island and are well exposed along the coast. Steeply SW-dipping, north-south striking beds of the Tygerberg Formation are clearly visible in the intertidal and shallow subtidal zone adjacent to the SPP development footprint on satellite images (Fig. 1B). Tygerberg Formation rocks on Robben Island are described in some detail by Rowe *et al. (*2010) whose detailed mapping (ibid., their Figure 2) indicates that in the SPP study area this unit is represented by sandstone facies. The medium- to coarse-grained sandstones are described as tan to light grey in hue, thin- to medium-bedded, and well-jointed. Sphaeroidal weathering along joint surfaces is a characteristic feature. Sedimentary structures include parallel lamination, trough cross-bedding and local horizons of convolute bedding. The beds are cross-cut by pressure-solution cleavage planes that are more widely spaced than in finer-grained, pelitic facies of the Tygerberg Formation and do not obscure the original bedding. Inferred depositional processes include fluidisation, grain flow and high-density turbidity currents with high rates of deposition within a submarine fan setting, possibly in proximity to a subduction zone / deep-sea trench (Von Veh 1982, Rozendaal *et al.* 1999, Rowe *et al.* 2010).

The Tygerberg bedrocks in the interior of Robben Island are mantled by Late Caenozoic coastal sediments of the **Sandveld Group** (Fig. 3). The coastal bench in the study area has been cut into Tygerberg rocks by prolonged wave action, most recently during the last interglacial sea-level highs of the Late Pleistocene Epoch (*c*. 125 000 BP) when sea levels reached an average of 6-7 m higher than at present. Successive Mid to Late Pleistocene episodes of marine planation will have eroded away traces of Plio-Pleistocene aeolianites (wind-blown sands) and any older superficial deposits of the Sandveld Group from Malmesbury bedrocks close to the coast. These older aeolianites, referred to the **Langebaan Formation** (Qc / dark yellow in Fig. 2B), are still preserved, however, over much of the interior of the island, but only outside the study area. Along the eastern coast of Robben Island, including most of the present study area, younger (Holocene to Recent) carbonate-rich aeolian sands of the **Witsand Formation** (Qsr / pale yellow in Fig. 2B) directly overlie the Malmesbury bedrocks, as well as Langebaan aeolianites further away from the coast. The Witsand Formation aeolianites in the Cape Town region are described by Theron (1984) and Theron *et al.* (1992) and for Robben Island in particular by Theron and Hill (1995). The pale, shelly, unconsolidated sands are mainly structured by the prevailing south-easterly winds during the dry summer months, with dune plumes prograding towards in the interior in a north-westerly direction (See map Fig. 2B). The thickness of the aeolian sands in the study area is uncertain, but unlikely to exceed a few meters. Gravelly raised beach terrace deposits of Pleistocene age are mapped at various points along the margins of Robben Island but not on the east coast, probably because this shore was more protected from storm wave activity (Theron & Hill 1995).

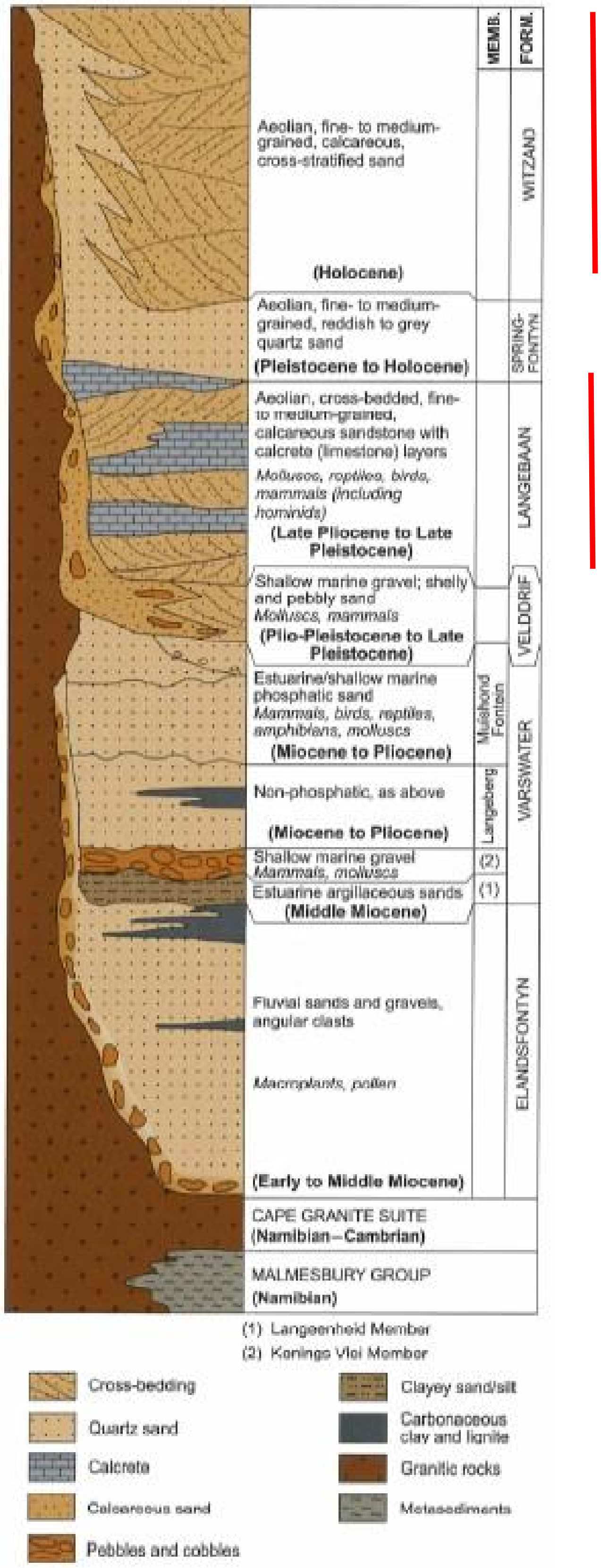


Fig. 3. Generalised stratigraphic column for the Late Caenozoic Strandveld Group of the West Coast (From Roberts *et al.* 2006). The solid vertical red bars indicate the Plio-Pleistocene Langebaan Formation aeolianites and younger, Holocene to Recent Witsand aeolianites that mantle the Tygerberg Formation bedrocks on Robben Island.

5. PALAEONTOLOGICAL HERITAGE

Recent research shows that the **Malmesbury Group** metasediments are actually of Late Proterozoic (Ediacaran) age originally. Given their low metamorphic grade (low greenschist facies and below), they are therefore potentially fossiliferous where levels of tectonic deformation are low (Belcher & Kisters 2003, Gresse *et al.* 2006). Groups of fossils that may have originally been preserved within siliciclastic or minor carbonate sediments here include trace fossils, stromatolites, organic-walled microfossils (*e.g.* acritarchs) as well as the enigmatic vendobiontans. However, extensive deformation, including intense folding, faulting, quartz veining and cleavage development, as well as regional metamorphism during the Late Proterozoic to Cambrian Saldanian Orogeny (mountain-building event) have probably obliterated most organic remains, with the possible exception of some trace fossils and microfossils. Micropalaeontological analysis of these difficult rocks is now in progress (G. Germs, pers. comm. 2008). The more pelitic (clay-rich) Malmesbury rocks have additionally suffered extensive chemical weathering under humid tropical conditions during Cretaceous and Tertiary times so that away from the coast fresh bedrock is almost universally covered with a deep mantle of multi-hued, kaolinitic and ochreous saprolite (*in situ* weathered rock) and surface gravels (sometimes silcretized) (*e.g.* Almond 2010).

So far there are no confirmed records of Precambrian fossils from the Malmesbury Group, including the **Tygerberg Formation**. However, there is a tantalizing report of bioturbation by sand-infilled invertebrate burrows within sandstone facies of the Tygerberg Formation on Robben Island (Nakashole 2004). This report was not confirmed by Rowe *et al.* (2005, p. 61) and certainly needs following up. Tygerberg Formation bedrocks beneath Sandveld Group cover at Duinefontein, on the mainland coast some 15 km NE of Robben Island, feature Pliocene fossil borings of the ichnogenus *Gastrochaenolites* that were generated by marine bivalves when these rocks were last exposed on the sea bed (Pether 2007, Hart 2010).

The Holocene to Recent dune sands of the **Witsand Formation** contain a wide range of subfossil remains of both palaeontological and archaeological interest. The fossils have been usefully reviewed in an unpublished report by Pether (2008; see also Rogers 1980, 1982, Roberts *et al.* 2006). They include land snails (*e.g. Trigonephrus globulus*), terrestrial vertebrate bones (*e.g.* tortoises, moles, rodents, ostrich and occasionally large mammals), ostrich egg shells, freshwater vertebrates (frogs, snails, fish), plant remains (reeds, coalified roots, charcoal), comminuted invertebrate skeletal remains (*e.g.* molluscs, echinoid spicules) and various groups of microfossils (pollens, diatoms, ostracods, foraminiferans) as well as archaeological materials (*e.g.* Later Stone Age artefacts, shell middens).

6. CONCLUSIONS & RECOMMENDATIONS

The study area for the proposed SPP along the south-eastern coast of Robben Island is underlain by a thin (probably a few meters or less) veneer of aeolian sands of the **Witsand Formation** (Sandveld Group) of Holocene to Recent age. These unconsolidated sands directly overlie latest Precambrian (Ediacaran) submarine fan deposits of the **Tygerberg Formation** (Malmesbury Group). The bedrocks here have been planed-off at 3-7 m amsl by wave action during periods of high sea level in the Pleistocene Epoch. Pleistocene raised beach deposits (*e.g.* storm gravels) are not recorded along this comparatively protected stretch of coastline.

A wide range of invertebrate, vertebrate and plant subfossils, as well as microfossils, have been recorded from the Holocene dune sands of the Witsand Formation in the Western Cape. However, since (1) most of the taxa concerned are of wide distribution, (2) only shallow excavations (≤ 2.5 m) are envisaged during the construction phase, and (3) the SPP development footprint is small (1400 m^2), significant impacts on buried or subsurface fossil remains are not anticipated here. Direct impacts on underlying bedrocks of the Tygerberg Formation within the development footprint will probably be very limited in extent. There are unconfirmed reports of simple invertebrate burrows preserved within Tygerberg Formation sandstones on Robben Island that are potentially of great scientific interest as the first and only known macrofossils recorded from the entire Malmesbury Group. However, if valid, these observations will have been made in bedrock exposures along the shoreline, perhaps in the intertidal zone, and are unlikely to be directly affected by the proposed onshore development, or by the effluent pipeline where this runs offshore.

It is concluded that the proposed Sewage Package Plant and associated infrastructure will not entail significant impacts on local palaeontological heritage resources that might compromise the Outstanding Universal Value of the Robben Island World Heritage Site.

Consequently no further palaeontological heritage studies or specialist mitigation are recommended for this sewage plant project, *pending* the discovery or exposure of any substantial fossil remains (*e.g.* vertebrate bones and teeth, fossil plant-rich horizons, dense concentrations of marine shells) during the construction phase. The ECO responsible for these developments should be alerted to the possibility of important fossil remains being found either on the surface or exposed by fresh excavations during construction.

In the case of any substantial fossil finds during construction, these should be safeguarded - preferably *in situ* - and reported by the ECO as soon as possible to Heritage Western Cape, so that appropriate mitigation (*i.e.* recording, sampling or collection) by a palaeontological specialist can be considered and implemented (Contact details: Heritage Western Cape. Protea Assurance Building, Green Market Square, Cape Town 8000. Private Bag X9067, Cape Town 8001. Tel: 086-142 142. Fax: 021-483 9842. Email: hwc@pgwc.gov.za). These recommendations should be incorporated into the Environmental Management Plan (EMP) for the sewage infrastructure project.

The specialist involved in palaeontological mitigation work would require a fossil collection permit from SAHRA (Contact details: Mrs Colette Scheermeyer, P.O. Box 4637, Cape Town 8000; Tel: 021 462 4502; Email: cscheermeyer@sahra.org.za). Fossil material must be curated in an approved repository (*e.g.* museum or university collection) and all fieldwork and reports should meet the minimum standards for palaeontological impact studies developed by SAHRA.

7. ACKNOWLEDGEMENTS

Ms Surina Brink of WSP Environmental (Pty) Ltd, Cape Town, is thanked for commissioning this desktop study and for providing the necessary background information.

8. REFERENCES

ALMOND, J.E. 2010. Eskom Gamma-Omega 765kV transmission line: Phase 2 palaeontological impact assessment. Sector 2, Omega Substation to Kappa Substation (Western Cape Province). 100pp. Natura Viva cc, Cape Town.

ALMOND, J.E. & PETHER, J. 2008. Palaeontological heritage of the Western Cape. Interim SAHRA technical report, 124 pp. Natura Viva cc., Cape Town.

BELCHER, R.W. & KISTERS, A.F.M. 2003. Lithostratigraphic correlations in the western branch of the Pan-African Saldania Belt, South Africa: the Malmesbury Group revisited. South African Journal of Geology 106: 327-342.

BUGGISCH, W., KLEINSCHMIDT, G. & KRUMM, S. 2010. Sedimentology, geochemistry and tectonic setting of the Neoproterozoic Malmesbury Group (Tygerberg Terrane) and its relation to neighbouring terranes, Saldania Fold Belt, South Africa. Neues Jahrbuch für Geologie und Paläontologie – Abhandlungen 257, 85-114.

DALE, D.C. & MCMILLAN, I.K. 1999. On the beach. Field guide to the Late Cainozoic micropalaeontological history of the Saldanha region, South Africa, 127 pp.

GAUCHER, C., FRIMMEL, H.E., GERMS, G.J.B. 2009. Tectonic events and palaeogeographic evolution of southwestern Gondwana in the Neoproterozoic and Cambrian. In: Gaucher, C., Sial, A.N., Halverson, G.P., Frimmel, H.E. (Eds) Neoproterozoic-Cambrian Tectonics, Global Change and Evolution: a focus on southwestern Gondwana. Developments in Precambrian Geology 16, pp. 295–316. Elsevier.

GRESSE, P.G., VON VEH, M.W. & FRIMMEL, H.E. 2006. Namibian (Neoproterozoic) to Early Cambrian successions. In: Johnson, M.R., Anhaeusser, C.R. & Thomas, R.J. (Eds.) The geology of South Africa, pp. 395-420. Geological Society of South Africa, Marshalltown.

HART, T. 2010. Environmental impact assessment for three proposed nuclear power station sites and associated infrastructure: heritage impact assessment, 101 pp. ACO, Cape Town.

HAUGHTON, S.H. 1931. The Late Tertiary and Recent deposits of the West Coast of South Africa. Transactions of the Geological Society of South Africa 34, 19-58.

KLEIN, R.G. 1980. Environmental and ecological implications of large mammals from upper Pleistocene and Holocene sites in southern Africa. Annals of the South African Museum 81: 223-283.

KLEIN, R.G. 1983. Palaeoenvironmental implications of Quaternary large mammals in the Fynbos region. In: Deacon, H.J., Hendey, Q.B., Lambrechts, J.J.N. (Eds.) Fynbos palaeoecology: a preliminary synthesis. South African National Scientific Programmes Report No. 10, pp. 116-133.

KLEIN, R.G. 1984. The large mammals of southern Africa: Late Pliocene to Recent. In: Klein, R.G. (Ed.) Southern African prehistory and paleoenvironments, pp 81-106. Balkema, Rotterdam.

KLEIN, R.G. 1986. The brown hyaenas of the Cape Flats. Sagittarius 1(4): 8-13.

KLEIN, R.G., AVERY, G., CRUZ-URIBE, K., HART, T., MILO, R.G. & VOLMAN, T.P. 1999. Duinefontein 2: an Acheulean site in the Western Cape Province of South Africa. Journal of Human Evolution 37, 153-190.

KLEIN, R.G., AVERY, G., CRUZ-URIBE, K. & STEELE, T.E. 2007. The mammalian fauna associated with an archaic hominin skullcap and later Acheulean artifacts at Elandsfontein, Western Cape Province, South Africa. Journal of Human Evolution 52, 164-186.

MACRAE, C. 1999. Life etched in stone. Fossils of South Africa. 305pp. The Geological Society of South Africa, Johannesburg.

NAKASHOLE, A.N. 2004. Sedimentology of the Malmesbury Group's Tygerberg Formation on Robben Island, off Cape Town. Unpublished BSc Honours Thesis, University of Cape Town, South Africa, 41 pp.

PETHER, J. 2007. Construction of a pebble-bed modular reactor, Koeberg: brief palaeontological impact assessment, 5 pp.

PETHER, J. 2008. Fossils in dunes and coversands. Unpublished general information document, prepared for Heritage Western Cape. (Mr J. Pether, Geological and Palaeontological Consultant, P. O. Box 48318, Kommetjie, 7976. jpether@iafrica.com).

PETHER, J., ROBERTS, D.L. & WARD, J.D. 2000. Deposits of the West Coast. Pp. 33-54 in Partridge, T.C. & Maud, R.R. (Eds.) The Cenozoic of Southern Africa. Oxford Monographs on Geology and Geophysics No 40. Oxford University Press. Oxford, New York.

ROBERTS, D.L. 2001. The geology of the Melkbosstrand and environs. Explanation to 1: 50 000 geology sheet 3318CB, 50 pp. Council for Geoscience, Pretoria.

ROBERTS, D.L. 2006a. Sandveld Group. SA Committee for Stratigraphy, Catalogue of South African Lithostratigraphic Units 9, 25-26. Council for Geoscience, Pretoria.

ROBERTS, D.L. 2006b. Langebaan Formation (including the Diazville and Kraal Bay Members). SA Committee for Stratigraphy, Catalogue of South African Lithostratigraphic Units 9, 9-12. Council for Geoscience, Pretoria.

ROBERTS, D.L. & BERGER, L. 1997. Last interglacial (c. 117 kyr) human footprints from South Africa. South African Journal of Science 93: 349-350.

ROBERTS, D.L. & BRINK, J. 2002. Dating and correlation of Neogene coastal deposits in the Western Cape (South Africa): implications for neotectonism. South African Journal of Geology 105: 337-352.

ROBERTS, D.L., BOTHA, G.A., MAUD, R.R. & PETHER, J. 2006. Coastal Cenozoic deposits. Pp. 605 – 628 in Johnson, M.R., Anhaeusser, C.R. & Thomas, R.J. (Eds.) The geology of South Africa. Geological Society of South Africa, Johannesburg & Council for Geoscience, Pretoria.

ROBERTS, D.L., BATEMAN, M.D., MURRAY-WALLACE, C.V., CARR, A.C. & HOLMES, P.J. 2009. West coast dune plumes: climate driven contrasts in dunefield morphogenesis along the western and southern South African coasts. Palaeogeography, Palaeoclimatology, Palaeoecology 271, 24-38.

ROGERS, J. 1980. First report on the Cenozoic sediments between Cape Town and Eland's Bay. Geological Survey of South Africa Open File Report 136.

ROGERS, J. 1982. Lithostratigraphy of Cenozoic sediments between Cape Town and Eland's Bay. Palaeoecology of Africa 15, 121-137.

ROGERS, J. 1983. Lithostratigraphy of Cenozoic sediments on the coastal plain between Cape Town and Saldanha Bay. Technical Report of the Joint Geological Survey/University of Cape Town Marine Geoscience Unit 14, 87-103.

ROGERS, J., PETHER, J., MOLYNEUX, R., GENIS, G., KILHAM, J.L.C., COOPER, G. & CORBETT, I.B. 1990. Cenozoic geology and mineral deposits along the west coast of South Africa and the Sperrgebiet. Guidebook PR!, Geocongress '90, Geoloogical Society of South Africa, 111 pp.

ROWE, C.D., BACKEBERG, N.R., VAN RENSBURG, T., MACLENNAN, S.A., FABER, C., CURTIS, C. & VIGLIETTI, P.A. 2010. Structural geology of Robben Island: implications for the tectonic environment of Saldanian deformation. South African Journal of Geology 113, 57-72.

ROZENDAAL, A., GRESSE, P.G., SCHEEPERS, R. & LE ROUX, J.P. 1999. Neoproterozoic to early Cambrian crustal evolution of the Pan-African Saldania Belt, South Africa. Precambrian Research 97, 303-323.

THERON, J.N., GRESSE, P.G., SIEGFRIED, H.P. & ROGERS, J. 1992. The geology of the Cape Town area. Explanation to 1: 250 000 geology sheet 3318 Cape Town, 140 pp. Council for Geoscience, Pretoria.

THERON, J.N. 1984. The geology of Cape Town and environs. Explanation to 1: 50 000 geological sheets 3318CD & DC, 3418AB, AD & BA, 77 pp. Council for Geoscience, Pretoria.

THERON. J.N. & HILL, R.S. 1905. Robben Island Excursion. Guidebook of the Geological Society of South Africa, Western Cape Branch, 18 pp (unpublished).

VON VEH, M.W. 1983. Aspects of the structure, tectonic evolution and sedimentation of the Tygerberg Terrane, southwestern Cape Province. Bulletin of the Precambrian Research Unit, University of Cape Town, B32, 88 pp.

9. QUALIFICATIONS & EXPERIENCE OF THE AUTHOR

Dr John Almond has an Honours Degree in Natural Sciences (Zoology) as well as a PhD in Palaeontology from the University of Cambridge, UK. He has been awarded post-doctoral research fellowships at Cambridge University and in Germany, and has carried out palaeontological research in Europe, North America, the Middle East as well as North and South Africa. For eight years he was a scientific officer (palaeontologist) for the Geological Survey / Council for Geoscience in the RSA. His current palaeontological research focuses on fossil record of the Precambrian - Cambrian boundary and the Cape Supergroup of South Africa. He has recently written palaeontological reviews for several 1: 250 000 geological maps published by the Council for Geoscience and has contributed educational material on fossils and evolution for new school textbooks in the RSA.

Since 2002 Dr Almond has also carried out palaeontological impact assessments for developments and conservation areas in the Western, Eastern and Northern Cape under the aegis of his Cape Town-based company *Natura Viva* cc. He is a long-standing member of the Archaeology, Palaeontology and Meteorites Committee for Heritage Western Cape (HWC) and an advisor on palaeontological conservation and management issues for the Palaeontological Society of South Africa (PSSA), HWC and SAHRA. He is currently compiling technical reports on the provincial palaeontological heritage of Western, Northern and Eastern Cape for SAHRA and HWC. Dr Almond is an accredited member of PSSA and APHP (Association of Professional Heritage Practitioners – Western Cape).

Declaration of Independence

I, John E. Almond, declare that I am an independent consultant and have no business, financial, personal or other interest in the proposed development project, application or appeal in respect of which I was appointed other than fair remuneration for work performed in connection with the activity, application or appeal. There are no circumstances that compromise the objectivity of my performing such work.

John E. Almond

Dr John E. Almond
Palaeontologist
***Natura Viva* cc**

Archaeological Impact Assessment (AIA)
Report on the survey of a site on Robben Island
situated south of the Dog Unit (Robert Sobukwe House) between Murray's Bay and Murray's Road

Prepared for
WSP Environmental (Pty) Ltd
35 Wale Street, Cape Town 8001
on behalf of their client, the Public Works Department
e-mail: Surina.brink@WSPGroup.co.za

Robben Island, 2013 (Google Earth)

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April 2013

EXECUTIVE SUMMERY

In March 2013 Dr Ute A Seemann was appointed to survey a site on Robben Island for historical/ archaeological surface remains. The Department of Public Works proposes to erect a Sewage Package Plant at this site, which is bounded to the north-east by Murray's Bay beach, north by the Dog Unit (the main living quarters renamed Robert Sobukwe House), to the west by Murray's Road and to the south by the Robben Island village proper. The site is heavily disturbed by sewerage and fresh water underground pipes, three sewage pump stations, electrical underground cables, wooden poles, the remains of a brick and cement structure, alien vegetation, rabbit holes and –tracks etc . In addition it has been used as a sports-, training- and recreation ground for more than a hundred years.

No remains of visible historical/archaeological features or portable artefacts were found.

Recommendation: The site to be released for further development.

CONTENT

PAGE

LIST OF ILLUSTRATIONS

1. THE BRIEF

At the request of WSP Environmental (Pty) Ltd, Ms Surina Brink and Ms Jacqui Fincham, on behalf of their client, the Department of Public Works, Dr Ute A Seemann was commissioned to survey a site on Robben Island south of the Dog Unit buildings (Robert Sobukwe House) for historical/archaeological features. The Public Works Department plans to built a Sewage Packing Plant near the present concrete sewer pump stations.

2. BASELINE DESCRIPTION

The basic co-ordinates of the site are approximately 33^{o}48’20”S and 18^{o}22’40”E. (Fig. 1).

Fig. 1.
Google map of Robben Island, 2013.

The area under consideration is covered by alien vegetation, mostly bluegum and *manatoka* trees, local *fynbos* scrub and some ground cover which is able to tolerate the limestone soil. The site is heavily disturbed by sewerage and fresh water underground pipes, three sewage pump stations, electrical underground cables, wooden poles, the remains of a brick structure and cement platform, remains of fencing material, rabbit holes and –tracks etc . In addition it has been used as a sports-, training- and recreation ground for more than a hundred years.

3. HISTORIC BACKGROUND

The historic background of the site has been extensively documented elsewhere[1] and needs not to be repeated here. Suffice to say that – in the context of this report – the Dog Unit, a former dog quarantine station was founded in 1893, kennels and living quarters for the staff were built. During WWII these buildings served as staff quarters for South African female military personnel stationed on the island, known as the SWANS.

In 1905 a freshwater pipe was laid from the windmill near the children's home of the leper colony to the vicinity of the dog kennels (Fig. 2). It seems that up to 1931 three small mortuary buildings were situated below Murray Road (Fig. 3, circled in pink), marked as due for demolition later that year. Murray Road was and is the main thoroughfare from the landing place / the harbor facilities (from 1942 onwards) in Murray's Bay to the Robben Island village proper. The harbor had been commissioned to facilitate the erection of military installations from the start of the Second World War.

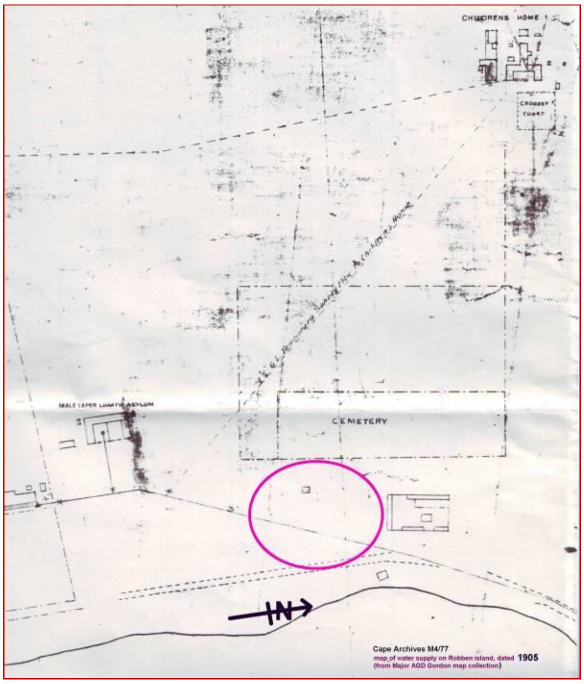

Fig. 2
Supply and fresh water distribution, Robben Island, dated 1905 (Reference: Cape Archives M4/77)

[1] Deacon, Harriet. 1992. The Island, a History of Robben Island 1488 to 1990. Cape Town and Johannesburg: David Philip & Mayibuye Books, University of the Western Cape. This book is a well balanced account of the island's history.

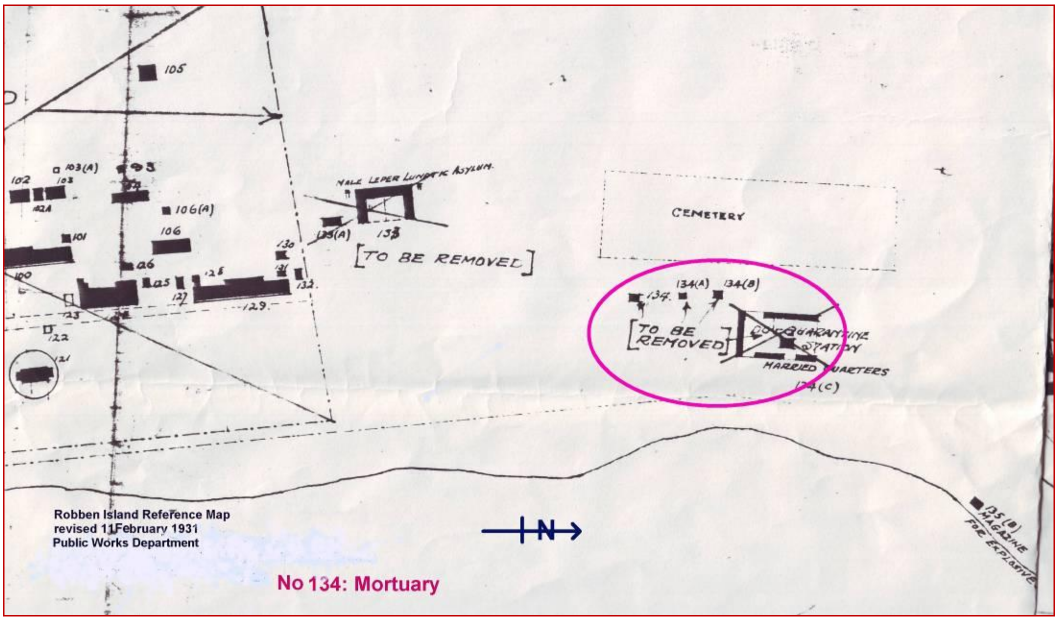

Fig. 3
Map Robben Island, dated 1931. The mortuary buildings listed as 134, 134a and 134b were to be demolished, circled in pink. (Reference: Public Works Department).

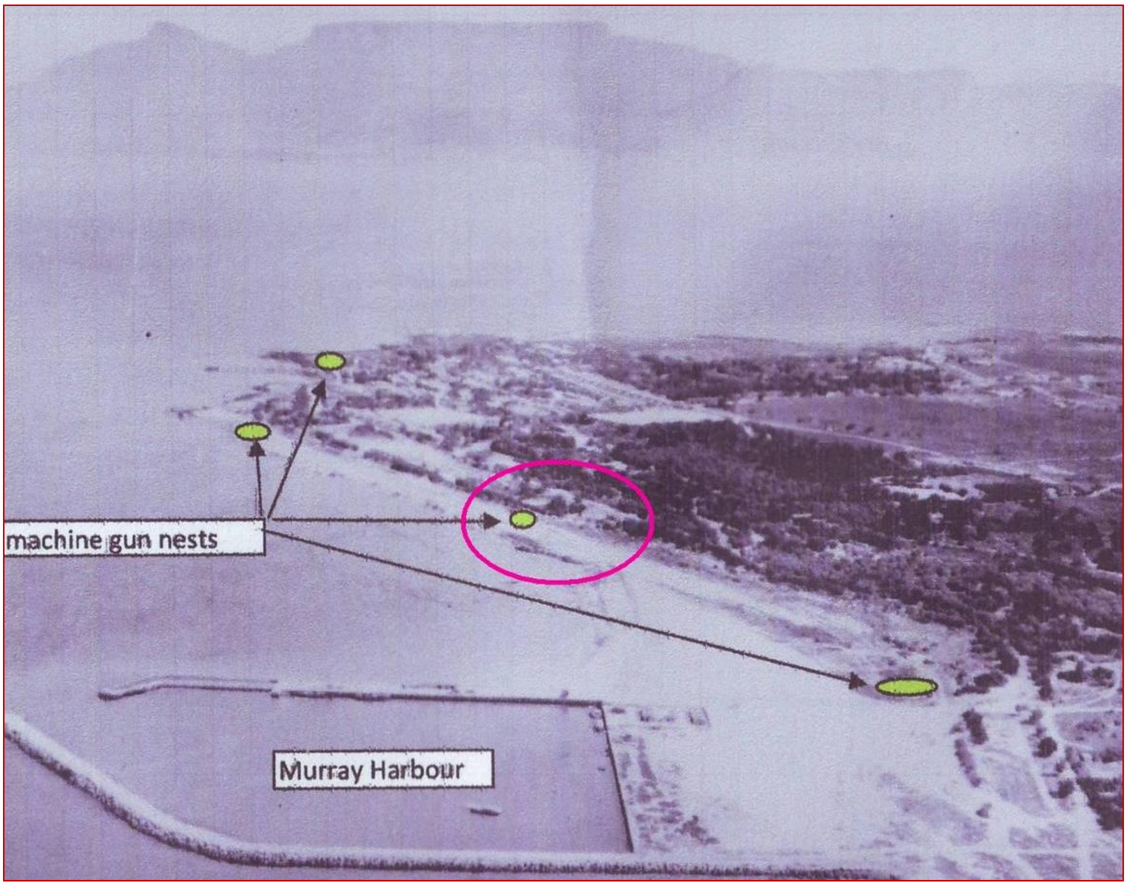

Fig. 4.
Aerial photograph Robben Island dated 1942. Site under investigation circled pink. (Reference: photograph In possession of Mr Andre vom Hagen)

In the above aerial photograph, taken in 1942, the location of a machine gun nest is highlighted, and is situated close to the beach in the area under investigation. It is described as "Machine Gun Nest No 3 – five gun bunkers, armed with Bren machine guns with effective range of 550m and maximum range of 1,690m, rate of fire 500-520 rpm."[2]

The military left the island in about 1945/6.

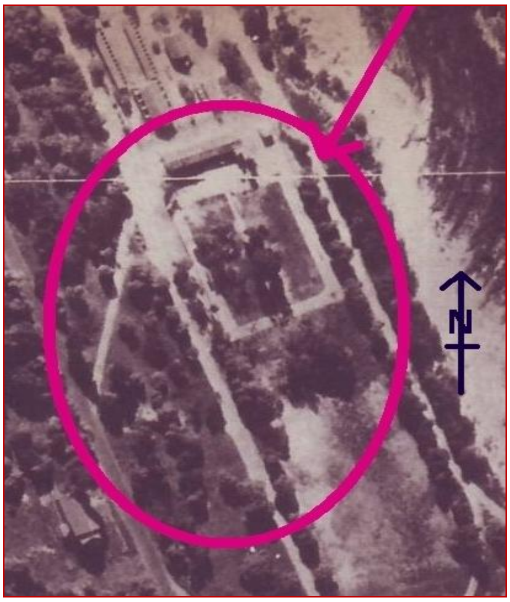

Fig. 5
Aerial photograph, dated 1974. The survey site is marked in pink, and was probably used as a sports fand recreation ground.

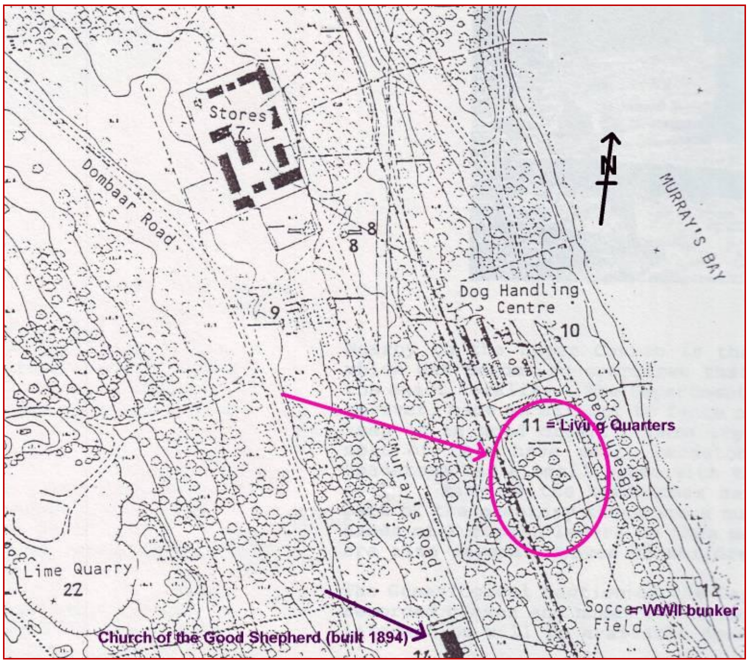

Fig. 6
In this 1993 survey map areas of archaeological interest are marked as
11 – Living quarters for the staff of the Dog Unit
12 – remains of WWII bunker, outside of the area under investigation.
(Reference: Patricia Riley. 1993. Conservation Survey of Robben Island. National Monuments Council).

4. SITE SURVEY

The site was visited by myself and my assistant Ms Andrea van Onselen on 20 March 2013.

No restrictions to the survey were encountered.

The results of the survey are listed in Figure 8 below. Only three land marks were noted.

[2] Map and Schedule of WWII Structures & Defences on Robben Island (1935-45). In the possession of Mr Andre vom Hagen and Col Lionel Crook, SA Legion, Rosebank).

Fig. 7
The survey area (Google, 2013). The survey path is marked in green.

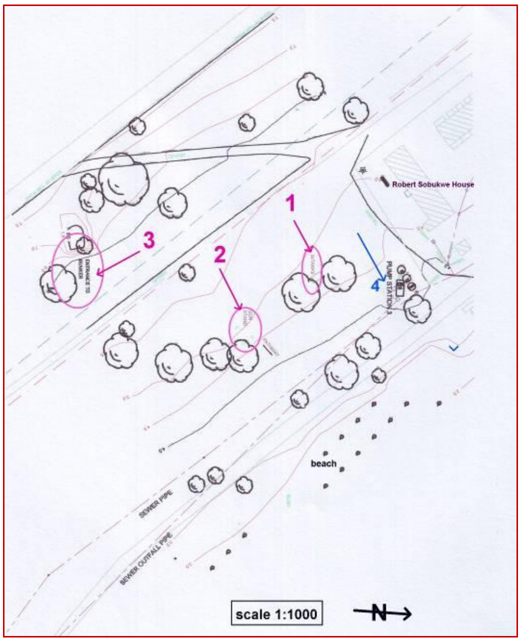

Fig. 8
Survey map, 20 March 2013 (Reference: EFG Engineers (Pty) Ltd).
1. Fresh water tanks
2. Concrete platform and brick pillars, unidentified.
3. Remains of concrete WWII bunker / look-out point.

Fig. 9
Panorama of the site under investigation, facing east: to the left – in the back - the three concrete sewage pump stations, center: 3 fresh water tanks on a platform, to the right an electrical distribution box, wooden poles.
Note the primary gravel roads and paths.

Fig. 10.
View to the north. In the back Robert Sobukwe House. Note the degraded *veld* and the remains of the fencing area.

Fig. 11. The fresh water tanks in the survey. They are of no historical value.

Fig. 12. Degraded *veld* below a *manatoka* tree.

Fig. 13.
Unidentified concrete platform and brick pillars, but definitely NOT of WWII vintage

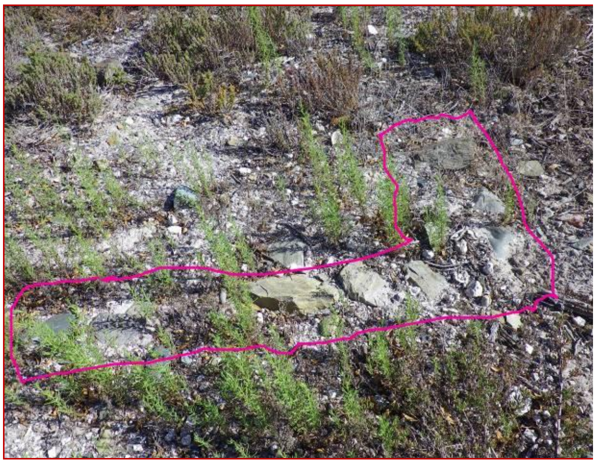

Fig. 14.
Outlined in pink: row of bluestone paving stones, unidentified.

5. RECOMMENDATION

IMPORTANCE OF THE FINDS: NIL
SIGNIFICANCE: NIL

Fig. 15.
Position of the proposed Sewer Package Plant, 2013. (Reference: WSP Environmental (Pty) Ltd).

RECOMMENDATION: PERMISSION FOR THE EXCAVATION OF TEST HOLES FOR THE DEVELOPMENT OF THE SEWER PACKAGE PLANT TO BE GRANTED.

6. BIBLIOGRAPHY

Deacon, Harriet. 1992. The Island, a History of Robben Island 1488 to 1990. Cape Town and Johannesburg: David Philip & Mayibuye Books, University of the Western Cape.

7. ACKNOWLEDGEMENTS

We thank the following persons for their advice and assistance:

Major ADJ Gordon for supplying WWII maps and discussion of WWII military installations on Robben Island, and advising us that the small concrete platform with two brick pillars found on the site was NOT a gun emplacement,

Col LA Crook, SA Legion Rosedale Complex, supply of WWII maps and confirming Major Gordon's impression.

Cdr Mac Eoin Bissett, Naval Museum, Simon's Town

EFG Engineers (Pty) Ltd, James Marais for the survey map dated 20 March 2013.

ROBBEN ISLAND MARINE OUTFALL

Specialist Study for Basic Assessment of Diffuser Performance

2014/02/12

Quality Management

Issue/revision	Issue 1	Revision 1	Revision 2	Revision 3
Remarks				
Date	25 Nov 2013	12 Feb 2014	25 April 2014	
Prepared by	Maria le Roux	Maria le Roux	Frans V Eeden	
Signature				
Checked by	Koos Schoonees	Koos Schoonees	Koos Schoonees	
Signature				
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Signature				
Project number	17127	17127		
Report number				
File reference	P:\17127.R – Robben Island EIA\11 - Reports\11.2 - WSP reports\	P:\17127.R – Robben Island EIA\11 - Reports\11.2 - WSP reports\	P:\17127.R – Robben Island EIA\11 - Reports\11.2 - WSP reports\	

Robben Island Marine Outfall

Specialist Study for Basic Assessment of Diffuser Performance

2014/02/12

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Table of Contents

1 Introduction

The Department of Public Works plans to upgrade service facilities on Robben Island. As part of the upgrading, a waste water treatment works will be constructed and domestic effluent will be treated to General Waste Water Limits. The treated effluent will be discharged through an existing ocean outfall. This outfall is situated approximately 650 m south-east of Murrays Harbour at Robben Island. Refer to Figure 1.1 for the location of the existing pipeline.

Figure 1.1: Location of existing marine outfall

WSP Environmental has requested WSP Africa Coastal Engineers to conduct a specialist study for the Basic Assessment (BA) that is being carried out for the upgrading of the facilities. The aim of this specialist study is to assess the hydraulic and environmental performance of the existing outfall, discharging the treated effluent to confirm compliance to the marine water quality objectives of the area.

According to section 2.6 of the Draft Assessment Criteria for Coastal Waters Discharge Permits (a draft document prepared by DEA summarising the technical criteria required to obtain a permit), the following studies and modelling have to be performed in terms of the initial dilution of an ocean outfall:

- An initial dilution model using measured or simulated real-time data on the physical conditions;

- Refined analytical/statistical estimations of the achievable secondary dilutions; and
- Provide a 2-D or 3-D numerical model for the prediction of far field dilutions and subsequent reduction of the concentrations of the wastewater constituents.

"Initial dilutions" is the dilution of the wastewater plume generated by jet momentum and the positive buoyancy effects that occur between the outlet ports of a marine outfall's diffuser and the sea surface.

In order to simulate real-time data of the physical conditions at the discharge site, a calibrated numerical model is required. The results of an uncalibrated numerical model are of no value. It is very expensive to create a real-time model and in this case the cost for such a model (including the required current and wind measurements) will most likely exceed the cost of the outfall itself. Furthermore it will be difficult to calibrate the model precisely due to the complexity of the coastline configuration at the site.

For this specific project, WSP modelled the initial dilutions by means of an analytical, conservative initial dilution modelling due to the following:

- It is standard practice to use an analytical model to assess performance (initial dilutions) of an offshore diffuser. The analytical method is conservative since it models a straight line in the worst case scenarios. Therefore the impact zone as modelled with be greater than a real-time model.
- The discharge flow of Robben Island's marine outfall is relatively small flow and the effluent will be treated to General Waste Water Limits. Due to the small flow volume and treated effluent, the impact on the marine environment will be minimal.
- Robben Island's existing outfall was designed to dilute an effluent composition with much higher constituent concentrations compared to the effluent composition which is going to be discharged after the upgrade of the wastewater treatment plant and which this environmental impact study is performed for.

The DEA's criteria also require analytical estimations of the secondary dilutions which WSP performed by means of an analytical prediction method developed by Brooks (1960) for conservative and non-conservative substances. As with the initial dilution prediction, the secondary dilutions will also be conservative.

In addition, the DEA's criteria also require that 2-D or 3-D numerical modelling for the far field dilutions should be performed. "Secondary" and "Far field" dilutions are in principle the same concept, which is the further dilution (dispersion) of the wastewater plume after the initial dilution occurs. Instead, WSP used a conservative analytical prediction model to determine the secondary dilution. In order to perform a 2-D or 3-D numerical model, real-time input is required which could be possibly more expensive than the upgrade of the wastewater treatment plant itself and the results of such a model will not be significant since the required initial dilutions in order to comply with the South African Marine Water Quality Guidelines will be achieved in the initial dilution phase.

2 Physical Processes

Currents

The main oceanographic processes that would influence the behaviour of an effluent plume during the initial dilution process and the subsequent transport and secondary dilution of the waste field are the nearshore circulation characteristics at the discharge location (speed and direction of the currents). In deeper water the layering of the water column (stratification) is also an important aspect if present, as this will inhibit the rise of a buoyant effluent. However, in the shallow water at the existing discharge location, the stratification in the water column was determined to be insignificant during a study of the physical processes undertaken by WAMTECH & Rossouw in *(1999*) during the design phase of the existing marine outfall.

The design current velocities used for calculating the initial and far field dilutions of the effluent were obtained from measurements taken 9 m above the seabed in 17 m water depth. These measurements were taken south of Murray's Bay harbour close to the discharge location. An analysis of the data (*WAMTECH & Rossouw,* *1999*) yielded the occurrence of current velocities, expressed in percentage exceedances as shown in Table 2.1 below.

Table 2.1: Typical current speeds for the study area (*WAMTECH & Rossouw, 1999*)

% Exceedance	Winter (m/s)	Summer (m/s)
50	0.06	0.07
20	0.10	0.11
10	0.14	0.15
5	0.16	0.18
1	0.19	0.24

These results were used to define the nearshore input conditions, representative of the area to determine the achievable initial dilutions for the existing outfall and the 1999 flow scenarios. Considering limited developments along the coast of Robben Island since 1999 and the remoteness from the mainland, it is anticipated that the nearshore circulation characteristics which were determined previously will still be representative at present. The current velocities, used as input conditions during 1999 (Table 2.2 below), were also used to assess the environmental performance of the outfall, whilst discharging the treated effluent from the proposed waste water works.

Table 2.2: Selected current conditions for the estimation of achievable dilutions (*WAMTECH & Rossouw, 1999*)

Ambient condition	**Current velocity (m/s)**	
	Surface current	**Bottom current**
Stagnant conditions	0.01	0.01
Average conditions	0.07	0.04
20% exceedance (relate to the 80% guideline for faecal coliforms)	0.11	0.07
5% exceedance (relate to the 95% guideline for faecal coliforms)	0.17	0.11

Stratification

Stratified conditions (layering in the water column) occur due to a density gradient between the surface and the bottom, consequently inhibiting the rise of a buoyant effluent plume with subsequent reduced initial dilutions and the possibility of trapping the waste field below the seawater surface. However, in the relatively shallow water (-8 m) at the discharge location, stratification was less significant due to dynamic vertical mixing resulting from wave action and was not taken into account in this assessment.

3 Existing Marine Outfall

The existing marine outfall was designed by ZLH Consulting Engineers in 1999 and J.Rossouw and WAMTechnology was sub-contracted for the prototype data acquisition and the hydraulic/environmental design of the outfall respectively. In 2000 the offshore ocean outfall, constructed by Sea and Shore Contractors, was completed. Refer to Appendix A for the general layout drawing (as-built) of the outfall pipeline.

The environmental design criterion was to comply with the water quality guidelines for the South African coastal zone (DWAF, 1995) discharging the effluent through a main pipeline and diffuser with optimum hydraulic behaviour. Optimum hydraulic performance of the outfall system is necessary to minimize possible malfunctioning of the system (varying flows, seawater intrusion, etc.) with reserve capacity.

The existing marine outfall was designed to discharge an effluent which consisted of untreated sewerage as well as a brine effluent from a desalination plant. The 1999 design flow rate and effluent composition are presented in Table 3.1 below.

Table 3.1: Design flow rate and effluent composition of existing marine outfall (*WAMTECH & Rossouw, 1999*)

Design flow	25 l/s
Effluent concentrations	
pH	7.4
BOD (mg/l)	344
Suspended Solids (mg/l)	308
Tot.P (mg/l)	6
Tot.NH4(mg/l)	18
Copper (mg/l)	0.27
Lead (mg/l)	0.16
Zinc (mg/l)	0.42
F.Coli (/100 ml)	7.2×10^6

It should also be noted that the effluent density of the design composition of the existing outfall was 1007 kg/m^3 due to the brine stream from the nearby desalination plant. At present, the brine outflow from the desalination plant is not being discharged through the marine outfall.

The configuration of the existing marine pipeline and diffuser section of the mariner outfall is as follows:

Table 3.2: Existing outfall configuration (*WAMTECH & Rossouw* and *Drawing no. C4833, App A)*

Marine Pipeline	
Pipeline length	465 m
Pipeline Material	HDPE
Pipe diameter (ID)	200 mm (PIPE CLASS 16)
Diffuser	
Diffuser depth	8 m
Diffuser length	10 m
No of ports	3
Port direction	Horizontal discharge to alternate sides of the main diffuser pipe
Number of diffuser sections	3 sections
Tapers in main diffuser pipe (Inside Diameter)	1st taper to 160mm (PIPE CLASS 16)
	2nd taper to 110mm (PIPE CLASS 16)
Main pipe and port diameter per diffuser section	1st section: Main pipe diameter = 200 mm ID; 1 ports; Port dia = 100 mm ID
	2nd section: Main pipe diameter = 160 mm ID; 1 ports; Port dia = 110 mm ID
	3rd section : Main pipe diameter = 110 mm ID; 1 ports; Port dia = 110 mm ID
Port spacing	3.5 m

4 Effluent Characteristics

The effluent will be discharged intermittently at a constant design flow of 25 l/s.

The existing outfall was originally designed to dilute the untreated domestic effluent (refer to Table 3.1) and to comply with the Marine Water Quality Guidelines for the South African Coastal Zone (DWAF, 1995) (as shown in Table 3.1) within an acceptable distance from the offshore discharge point.

However, since the treatment works on Robben Island will be upgraded, the effluent will now be treated to *General Limit Values (GN No 665 of 2013)* on land before being discharged to sea via the existing ocean outfall. This means that the quality of effluent that is planned to be discharged after the upgrade will be significantly less harmful to the marine environment than what the outfall was originally designed for. Table 4.1 lists the constituent concentrations of the *General Limit Values.*

Table 4.1: *General Limit Values (GN No 665 of 2013)*

SUBSTANCE/PARAMETER	GENERAL LIMIT
Faecal Coliforms (per 100 ml)	1000
Chemical Oxygen Demand (mg/l)	75 – after removal of algae
pH	5.5-9.5
Ammonia (ionised and unionised) as Nitrogen (mg/l)	6
Nitrate/Nitrite as Nitrogen (mg/l)	15
Chlorine as Fee Chlorine (mg/l)	0.25
Suspended Solids (mg/l)	25
Electrical Conductivity (mS/m) (Salinity in ppt)	70 mS/m (4 ppt) above intake to a maximum of 150 mS/m (10 ppt) http://www.fivecreeks.org/monitor/sal.shtml
Ortho-Phosphate as phosphorous (mg/l)	10
Fluoride (mg/l)	1
Soap, oil or grease (mg/l)	2.5
Dissolved Arsenic (mg/l)	0.02
Dissolved Cadmium (mg/l)	0.005
Dissolved Chromium (VI (mg/l)	0.05
Dissolved Copper (mg/l)	0.01
Dissolved Cyanide (mg/l)	0.02
Dissolved Iron (mg/l)	0.3
Dissolved Lead (mg/l)	0.01
Dissolved Manganese (mg/l)	0.1
Mercury and its compounds (mg/l)	0.005
Dissolved Selenium (mg/l)	0.02
Dissolved Zinc (mg/l)	0.1
Boron (mg/l)	1

5 Environmental Objectives

5.1 Beneficial Use Areas

An important part of the environmental design of an ocean outfall it to identify the relevant beneficial uses in the coastal area and minimize the impact on the natural resources. Therefore, the goal will be to ensure that any potential impact from a proposed discharge comply with the water quality objectives set for each particular beneficial use area, identified in the project area.

Beneficial use areas for the marine environment according to DWAF (1995) can be classified as shown in Table 5.1 below.

Table 5.1: Coastal areas: beneficial uses (*DWAF, 1995*)

Mariculture	Refers to the farming of marine and/or estuarine organisms in land-based (i.e. 'off-stream' tanks using pumped seawater) or water-based (i.e. 'in-stream') systems.
Industrial use	Waste water discharges, cooling water, desalination, aquariums , ports and harbours
Recreational use	Full contact recreation: Activities such as swimming, diving (scuba and snorkelling), water skiing, surfing, paddle skiing, wind surfing, kite surfing, parasailing and wet biking. Intermediate contact recreation: Activities such as boating, sailing, canoeing, wading, and angling, where users may come in contact with the water or swallow water. Non-contact recreation: all recreational activities taking place in the vicinity of marine waters, but which do not involve direct contact, such as sightseeing, picnicking, walking, horse riding, hiking etc.
Filter feeders	Collection of filter feeders for food consumption.
Natural Environment	The entire area should be considered as natural environment.

An assessment of the relevant beneficial use areas was done in 1999 as part of the design of the existing outfall. According to the assessment, no recreational areas and areas where filter feeder were collected for food were identified, which could be adversely affected by the ocean outfall (*WAMTECH & Rossouw*). Thus, the compliance to the marine water quality guidelines was limited to the *Natural Environment* (maintenance of the ecosystems).

For this assessment, it has been assumed that the beneficial use areas are similar to the areas identified for the 1999 outfall design.

5.2 Marine Water Quality Guidelines

The South African water objectives that have to be adhered to when discharging an effluent depend on the Marine Water Quality Guidelines (MWQG) for specific beneficial use areas and the assimilative capacity of the receiving waters to safely accept the waste load. Different beneficial uses require different water quality guidelines. For example seawater that is fit for maintaining the natural environment, is not necessarily also fit for swimming. A well-mixed and dynamic open coastline has a higher capacity for accepting waste than a sheltered bay.

The "target" water quality guidelines (design criteria) for coastal marine waters are presented in Table 5.2. These guidelines apply to all marine areas, except for bacteriological organisms (faecal coliform and *E-coli* guidelines), which apply to areas used for contact recreation and collection of filter feeders for human consumption.

Recreational areas and areas where filter feeders were collected for food were not identified in close proximity to the outfall in 1999.

Table 5.2: South Africa marine water quality guidelines *(DWAF, 1995)*

Turbidity and colour	Turbidity and colour acting singly or in combination should not reduce the depth of the euphotic zone by more than 10 per cent of background levels measured at a comparable control site.
Suspended solids	The concentration of suspended solids (SS) should not be increased by more than 10 per cent of ambient concentrations.
Temperature	The maximum acceptable variation in ambient temperature is + or - 1°C.
Salinity	Salinity should lie within the range 33 to 36 units.
pH	The pH should lie within the range 7, 3 to 8,2.
Dissolved oxygen	Dissolved oxygen should not fall below 5mg/l (99 per cent of the time) and below 6 mg/l (95 per cent of the time).
Dissolved nutrients	Nutrient levels should not cause excessive or nuisance aquatic plant growth or reduce the dissolved oxygen concentrations below recommended levels (nitrite, nitrate, ammonium, reactive phosphate and reactive silicate).
Inorganic constituents	Levels should not exceed: Ammonia 600 µg N/l (NH3 plus NH 4 +) Cyanide (CN) 12 µg/l Fluoride (F) 5 000 µg/l Arsenic (As) 12 µg/l Cadmium (Cd) 4 µg/l Chromium (Cr) 8 µg/l Copper (Cu) 5 µg/l Lead (Pb) 12 µg/l Mercury (Hg) 0.3 µg/l Nickel (Ni) 25 µg/l Silver (Ag) 5 µg/l Zinc (Zn) 25 µg/l
Faecal coliform or E-coli (recreation)	Maximum acceptable count per 100ml: 100 in 80% of the samples 2000 in 95% of the samples
Faecal coliform or E-coli (filter-feeders)	Maximum acceptable count per 100ml: 20 in 80% of the samples 60 in 95% of the samples

5.3 Ambient water quality

During the 1999 design of the existing outfall, ambient water quality data was not available in the immediate area of Robben Island and conservative assumptions were made, based on available data at other locations along the South African coastline.

Table 5.3: Ambient water quality data assumed for the design of the existing outfall (*WAMTECH & Rossouw, 1999*)

Constituent	Concentration	Source
Salinity	33.6 to 35.8	Hout Bay (Toms, 1985)
Suspended solids	5 mg/l	Assumption
Dissolved oxygen	8 mg/l	Hout Bay (Toms, 1985)
Nutrients: Total nitrogen Phosphate	 0.2 mg/l 0.015 mg/l	Toms (1985)

Toxic inorganics: Copper Zinc Lead	 0,00086 mg/l 0,0069 mg/l 0,000521 mg/l	 SANCOR. (1984)

For the purpose of this assessment, the above concentrations as well as standard concentration values for the South African marine waters prepared by DWAF was used to determine the required dilutions.

5.4 Required dilutions

The term dilution describes the process of reducing the concentration of effluent constituents by mixing the effluent with uncontaminated ambient seawater. *Required dilutions* refers to the dilutions which are required to achieve the acceptable concentration levels in order to comply with the water quality guidelines (*DWAF, 1995*) related to the designated beneficial use areas at a project site. For the Robben Island Outfall the designated beneficial use area is the *Maintenance of the Ecosystem*.

To assess the assimilative capacity of the receiving water, a straight forward conservation of mass approach can be followed, where the required dilution (S) is a function of the effluent concentration and the 'buffer capacity', which is the difference between a guideline value (target value) and the ambient concentration of the specific constant. This can be expressed as follows:

$$S = (C_e – C_b) / (C_g – C_b)$$

Where:

S = Required dilution

C_e = Concentration of constituent in wastewater

C_b = Concentration of constituent in receiving marine environment (ambient concentration)

C_g = Recommended concentration (guideline)

Table 5.4: Required initial dilutions for Robben Island outfall according to the South African MWQG for beneficial uses

	Constituent	Background (Ambient = ocean) C_b	Guideline C_g	Comments	Effluent concentration C_e (General Limits)	Required dilutions S
Basic Amenities	Suspended solids (mg/ℓ)	5**	5.5		25	40
Maintenance of Ecosystems	Dissolved Oxygen*** (mg/ℓ)	8**	5	99% of time	-	-
	COD	***	***	95% of time	75	3.2
	Total Nutrients (mg/ℓ)	0.2**	Nutrient levels should not cause excessive plant growth or reduce dissolved oxygen concentrations below recommended levels		15	****
	Nutrient Phophate (mg/ℓ)	0.015**			10	****
	Ammonia (mg/ℓ)	0.03*	0.6		6	10
	Arsenic (mg/ℓ)	0.002*	0.012		0.02	2
	Cadmium (mg/ℓ)	0.00028*	0.004		0.005	1
	Chromium (mg/ℓ)	0.00007*	0.008		0.05	6
	Copper (mg/ℓ)	0.00086**	0.005		0.01	2
	Lead (mg/ℓ)	0.000521**	0.012		0.01	1
	Mercury (mg/ℓ)	0.000055*	0.0003		0.005	20
	Cyanide (CN^-)	0*	0.012		0.02	2
	Zinc (mg/ℓ)	0.0069**	0.025		0.1	5
	Salinity (sea)	33.6 - 35.8**	33 - 36		4 - 10	7 - 10
	Fluoride (F^-)	1.2*	5		1	0
Recreation	Feacal coliforms (cnt/100 mℓ)	0*	2000	95% of samples	1000	1
		0*	100	80 % of samples	1000	10
Collection of Filter Feeders	Feacal coliforms (cnt/100 mℓ)	0*	60	95% of samples	1000	17
		0*	20	80 % of samples	1000	50

** and **: The background ambient concentrations for the area under investigation could not be obtained for the use of this assessment. General values for the background ambient concentration for the marine environment were obtained from DWAF 1995(*) and WAMTECH & Rossouw, 1999 (**)*

********* *There is not a Marine Water Quality guideline for COD. The guideline for dissolved oxygen is that the background should not fall below 5 mg/l for 99% of the time. The oxygen demand of an effluent on a receiving water body is dependent on physical mixing characteristics and the natural dissolved oxygen content of the receiving water. Based on natural DO levels and the BOD concentrations in an effluent the calculation of the required dilutions can be done according to Toms (1985): Lusher (1984) suggested that it can be assumed that 20% of the BOD will be demanded within one hour after discharge. Fadini Pedro Sérgio (2004) provided a relation of* ***BOD = 0.46COD*** *for raw effluents. The required dilutions for COD were done as follows:*

Convert COD values to BOD values.

The ambient DO concentration was taken as 8 mg/l.

The allowable oxygen demand is the background minus 5 mg/l (guideline).

Required dilution equals 20% of the effluent BOD divided by the allowable oxygen demand.

***** Nutrient loads. The guideline (DWAF, 1995) is narrative and the introducing of nutrients at a specific location should be considered in context of the natural occurrences over large areas of several square kilometres, especially when considering the characteristic upwelling condition along the Western Cape coastline and the nutrient loads transported to the ocean via rivers and stormwater outfalls. Refer to Section 7 of this report.*

As indicated in Table 5.4, the required dilution according to the SA MWQG for all beneficial uses is 50 (governed by the guideline for Faecal coliforms). **Since the outfall is not located in the vicinity of any recreational or filter feeder areas, the required dilution in terms of the relevant beneficial use areas is 40 (governed by the suspended solids guidelines).**

6 Achievable dilutions

6.1 Prediction model

The hydraulic analysis and the prediction of achievable initial dilutions for the outfall system was carried out by using a numerical model developed by WAMTechnology cc (*DWAF, 2004*), applying the basic principles of hydraulics as described in WRc report (1990). Many dilution prediction theories and techniques are available. The choice of the technique ('model') to be applied should take the following into account:

- 'Merging' of the hydraulic performance with the dilution predictions;
- Confidence in the 'accuracy' of the dilution prediction estimates;
- Project/client requirements and specifications, and
- The control, which the engineer has on the technique ('model') and the thorough understanding of the theories that are applied.

The methods developed for dilution estimates for various ambient and diffuser conditions by the United States Environmental Protection Agency (US-EPA, 1985) were used as a basis for the WAMTech model to predict dilutions. Referring to US-EPA (1985), a "plume element" is followed (for each modelling time step) as it gains mass due to entrainment of the ambient water, thus the characteristics of a continuous plume in a dynamic (flowing environment) can be described. In the program, the entrained mass is added to the mass of the element, calculating the mass of a new element. The density of the new element is the average of the previous values and the entrained values, weighted by their relative masses. Horizontal momentum is conserved and the new density creates a vertical acceleration (buoyancy) on the plume element. The segment length is changed in proportion to the total velocity to conserve mass and the radius of the plume is changed to correspond to the new mass and density. The output of the plume path (trajectory) is given as values in the x- and y-planes together with the radius of the plume to provide for the visual output of the geometry of the plume.

The model output includes interactive visual trajectories of the plumes for all the ports of the diffuser and standard graphical outputs of the entire range of diffuser characteristics.

A far-field dilution prediction technique (a straightline analytical prediction method developed by Brooks (1960)), for conservative and non-conservative substances (bacteriological parameters) was incorporated into the nearfield the model for an assessment of achievable dilutions for compliance with environmental quality objectives at distant locations.

6.2 Modelling results

The initial dilutions for the existing outfall configuration (design flow of 25 l/s) were determined, using the ambient current velocities, recorded at the discharge location during 1999. (Refer to section 2).

6.2.1 Initial dilutions

Initial dilution is brought about by the entrainment of surrounding 'clean' seawater into the wastewater jet as it leaves the diffuser port.

Table 6.1 lists the modelled dilution results (including the corresponding distance from the discharge point) for a design discharge flow of 25 l/s and the various ambient current velocities.

Table 6.1: Minimum initial dilution results

Ambient currents	Minimum initial dilutions	Horizontal distance from diffuser (m)
Stagnant conditions	66	3
Average conditions	79	5
20% exceedance	250	8
5% exceedance	756	18

These results indicate that the required dilutions of 40 for the existing diffuser configuration (shown in Table 3.2) can be achieved within 10 meters from the discharge location for the range of recorded current velocities at the site. Refer to Appendix B and C which illustrated the plume trajectory and initial dilutions of the modelled effluent plume. Figure 6.1 illustrates the extent of the sacrificial zone (where the required dilutions for compliance to the water quality guidelines are not achieved). Outside the red area, the effluent will be diluted sufficiently to comply with the marine water guidelines.

Figure 6.1: Sacrificial area (mixing zone) of the outfall

6.2.2 Secondary dilutions

When an effluent is discharged into a receiving water body, depending on the density of the effluent, it will remain in the water column (neutral buoyancy) while various physical, chemical and biological processes bring about the reduction of concentrations of constituents. The physical dilution of an effluent at a distant location can be considered as two distinct processes, i.e.

- The initial dilution process (S_i) during the injection period of the effluent into the receiving water (controlled during desing); and
- Secondary dilution (S_e) or subsequent dilution (dispersion and diffusion) when the plume (waste field) is transported by currents to distant locations. This process cannot be influenced by the design of the outfall and is primarily dependent on the prevailing currents (magnitude and direction).

For microbiological organisms, a further reduction in concentrations is brought about by the decay of these organisms in seawater and the effect of the sun during daytime;

- Dilutions due to the decay of microbiological organisms (S_d).

Thus the total dilutions at a distant location for conservative substances are:

$$S_{total} = S_i \times S_e$$

And for non-conservative substances:

$$S_{total} = S_i \times S_e \times S_d$$

Although the results of the initial dilution modelling indicated that the required dilutions will be achieved during the initial dilution process, an indication of the dilutions which can be achieved at distant locations are shown in Table 6.2.

Table 6.2: Total dilutions of faecal coliforms (T90-value of 1.5 hrs)

Distance from diffuser (m)	Ambient current velocity (0.01 m/s) Stagnant Conditions		Ambient current velocity (0.17 m/s) 5% exceedance ambient conditions	
	Time (min)	Total dilutions: Secondary (Se) and Initial (Si)	Time (min)	Total dilutions: Secondary (Se) and Initial (Si)
100	167	1953	10	1418
200	333	4614	20	2243
300	500	7630	29	2858
400	667	10902	39	4047

The required dilution for the treated sewerage is 50 in terms of the SA MWQG for *all beneficial use areas*. From the above analytical prediction model which is very conservative, it can be seen that a minimum dilution of 1953 will be achieved within 100 m radius from the diffuser which is almost 40 times more than the required dilutions according to the South African Marine Water Quality Guidelines.

The impact from nutrients in the effluent is expected to have a minimal effect on the total nutrient balance along the "open" coastline of Robben Island. Refer to the 'required dilutions' for nutrients: "*Nutrient levels should not cause excessive plant growth or reduce dissolved oxygen concentrations below recommended levels*". If the effluent concentration of nitrate and nitrite are taken as the upper limit of General Limit Values, that is 15 mg/l, the concentrations will be reduced to 0.2 mg/l within 10 m from the discharge location for > 50% of the time and to < 0.1 mg/l within 100 m from the outfall. Refer to Toms (1984), natural occurrence of nitrate plus nitrite concentrations can > 1.5 mg/l during upwelling along the coastline of the Western Cape. Also when considering the total loads from the small outfall, when comparing to the total loads from the major ocean outfalls in the region (Green Point and Camps Bay) which discharge raw sewage without negative impacts after a few decades of discharge, the loads from the Robben Island outfall can be considered as negligible.

7 Impact Description and Assessment

7.1 General

In this chapter the physical effects (impact) of the reduced effluent concentrations to be discharged through the existing ocean outfall at Robben Island will be assessed. As background to the impact assessment, the different criteria that will be used in the impact assessment are defined in Section 7.2. Thereafter the impact is assessed in Section 7.3.

7.2 Criteria of the Impact

The criteria for impact assessment are explained below:

Nature of the Impact

This is an appraisal of the type of effect the proposed activity would have on the affected environmental component. The impact can be positive (a benefit), negative (or adverse; a disadvantage or a cost), or neutral. It will be indicated to what extent these impacts contribute to cumulative impacts.

Scale

Scale is an indication of the physical and spatial size of the impact. This is classified on the following scale:

Local	The impacted area extends only as far as the activity itself, e.g. a footprint
Site	The impact could affect the whole, or a measurable portion of the site.
Off-site	The impact could affect the area surrounding the development, including the neighbouring properties.
Regional	The impact would affect the broader region (e.g. neighbouring towns) beyond the boundaries of the adjacent properties.
National	The impact would affect the whole country (if applicable)

Duration

Duration refers to the time frame over which the impact is expected to occur, which is measured in relation to the lifetime of the proposed project. The categories describing the duration are:

Short term	The impact will either disappear with mitigation or will be mitigated through a natural process in a period shorter than 2 years.
Medium term	The impact will last up to the end of the construction phase, where after it will be entirely negated.
Long term	The impact will continue for the entire operational lifetime of the development, but will be mitigated by direct human action or by natural processes thereafter.
Permanent	This is the only class of impact that will be non-transitory. Such impacts are regarded to be irreversible, irrespective of what mitigation is applied.

Intensity

Intensity refers to the degree, magnitude or extent to which the impact alters the functioning of an element of the environment or a life-support service that is provided by the environment. Intensity is classified on the following scale:

Negligible	Virtually no impact will be experienced.
Low	The impact alters the environment in such a way that the natural processes or functions can continue with minor effect.
Medium	The affected environment is altered, but functions and processes continue, albeit in a modified way.
High	Functions or processes of the affected environment are disturbed to the extent where they cease completely.

Probability

Probability describes the likelihood of the impacts actually occurring (based on previous experience with similar projects or based on professional judgement). The probability classes are rated on the following scale:

Improbable	The possibility of the impact occurring is very low, due either to the circumstances, design or experience.
Probable	There is a possibility that the impact will occur to the extent that provisions must therefore be made.
Highly probable	It is most likely that the impacts will occur at some stage of the development. Plans must be drawn up to mitigate the activity before the activity commences.
Definite	The impact will take place regardless of any prevention plans.

Determination of Significance – without mitigation

Significance is determined through a synthesis of the above impact characteristics, and is an indication of the overall importance of the impact. The significance of the impact "without mitigation" is the prime determinant of the nature and degree of mitigation required and is one of the most important factors to take into account during decision-making. Significance is rated on the following scale:

No significance	The impact is not substantial and does not require any mitigation action.
Low	The impact is of little importance, but may require limited mitigation.
Medium	The impact is of importance and is therefore considered to have a negative impact. Mitigation is required to reduce the negative impacts to acceptable levels.

High	The impact is of great importance. Failure to mitigate, with the objective of reducing the impact to acceptable levels, could render the entire development option or entire project proposal unacceptable. Mitigation is therefore essential.

In deciding on the significance all the impact criteria including scale, duration, intensity and probability are taken into account. When taking into account the influence of scale on significance, it is borne in mind that an impact with a small scale does not necessarily imply that the impact can be regarded as insignificant. In spite of small scale, some impact, by their nature or intensity, may still be regarded as highly significant.

Determination of Significance – with mitigation

This is the predicted significance of the impact after the successful implementation of the suggested mitigation measures. Significance with mitigation is rated on the following scale:

No significance	The impact will be mitigated to the point where it is regarded to be insubstantial.
Low	The impact will be mitigated to the point where it is of limited importance.
Medium	Notwithstanding the successful implementation of the mitigation measures, the impact will remain of significance. However, taken within the overall context of the project, such a persistent impact does not constitute a fatal flaw.
High	Mitigation of the impact is not possible on a cost-effective basis. The impact continues to be of great importance, and, taken within the overall context of the project, is considered to be a fatal flaw in the project proposal

Confidence

Confidence describes the level of certainty in the accuracy of the predictions with respect to any of the assessment criteria (and by implication, with respect to significance). Confidence is indicated according to the following scale:

Low	The prediction is made in the absence of key information. There is a high degree of uncertainty associated with the prediction of the impact.
Medium	The majority of the necessary information for predicting the impact was available. There is some uncertainty associated with the prediction of the impact.
High	Virtually all the necessary information for predicting the impact was available, with exception of insignificant pieces of information that would not materially affect the outcome of the prediction.
Definite	All necessary information was available for the prediction of the impact. There is no uncertainty associated with the prediction of the impact.

7.3 Impact Assessment

Presently, untreated effluent is discharged via the existing ocean outfall at Robben Island. Since the effluent will be treated and therefore the concentrations reduced, the impact on the environment in terms of the present situation will be positive.

Table 7.1: Physical impact of the reduced effluent concentrations to be discharged through the existing ocean outfall at Robben Island

	Source of impact	Nature of impact	Scale	Duration	Intensity	Probability	Confidence	Significance	
								Without mitigation	With mitigation
Operation	Effluent discharged through existing ocean outfall	Positive	Local	Long term	Low	Definite	High	No significance	NA

The outfall was designed in 1999 to comply with the MWQG for untreated domestic and industrial (brine) effluent. Since the domestic effluent is now proposed to be treated to General Waste Limits and the brine stream from the desalination plant will not discharged through the outfall anymore, the impact to the marine environment is low. Therefore no mitigation is required.

However, it is important that the outfall should be operated according to its design discharge flow. The following operational and management procedures are necessary to ensure the outfall achieve the required environmental performance as assessed in this investigation:

- The domestic effluent has to be treated to General Waste Limits;
- Monitoring of the constituent concentrations in the effluent before it is discharged through the marine outfall is important since the achievable dilutions depends on the effluent quality that is being discharged; and
- The design flow for the marine outfall is 25 l/s. It is important to maintain this discharge for optimum hydraulic performance to ensure that the required dilutions are achieved for compliance to the environmental design criteria.

8 Conclusions

Water Quality Guidelines

The South African Water Quality Guidelines for Coastal Marine Waters (DWAF, 1995) were applied to obtain target values for the identified constituents in the effluent streams, which may impact the ecosystem and other designated beneficial use areas.

Beneficial Use Areas

The only relevant beneficial use area is the “natural environment” and includes the entire area.

Effluent characteristics

Flow rate: An intermittent discharge rate of 25 l/s.

Effluent quality: Domestic treated effluent to comply with General Waste Water Limits. The constituents considered as critical are:

- Suspended Solids and turbidity (Guideline concentration: 10% above ambient conditions).
- BOD (COD).

The other constituents listed in the General Waste Water Limits can be considered as either non-critical or not applicable for the proposed outfall system.

Required dilutions

Suspended Solids : 40

Location and outfall configuration

Existing outfall (1999). A 200 mm diameter main pipe, discharging through a 3 port diffuser 465 m offshore in a water depth of -8 m to MSL.

Achievable initial dilutions

The achievable initial dilutions (discharge rate 25 l/s), ranged from 66 to more than 700 for the anticipated range of current velocities of 0.01 m/s to 0.18 m/s.

Secondary dilutions and transport of the effluent field

Secondary dilutions exceeding 1500 at a distance of 100 m from the outfall.

Compliance to the water quality guidelines

Natural environment: Compliance to the water quality guidelines (MWQG) will be within 10 m from the diffuser.

Physical impact of the reduced effluent concentrations to be discharged through the existing ocean outfall at Robben Island

	Source of impact	Nature of impact	Scale	Duration	Intensity	Probability	Confidence	Significance	
								Without mitigation	With mitigation
Operation	Effluent discharged through existing ocean outfall	Positive	Local	Long term	Low	Definite	High	No significance	NA

The nature of the impact is positive because the effluent will now be treated to General Waste Limits whilst previously, untreated domestic effluent and brine were discharged. No mitigation measures are required because the impact is positive.

9 Recommendations

The outfall was designed in 1999 to comply with the MWQG for untreated domestic and industrial (brine) effluent. Since the domestic effluent is now proposed to be treated to General Waste Limits and the brine stream from the desalination plant will not discharged through the outfall anymore, the impact to the marine environment is low. Therefore no mitigation is required.

However, it is important that the outfall should be operated according to its design discharge flow. The following operational and management procedures are necessary to ensure the outfall achieve the required environmental performance as assessed in this investigation:

- The domestic effluent has to be treated to General Waste Limits;

- Monitoring of the constituent concentrations in the effluent before it is discharged through the marine outfall is important since the achievable dilutions depends on the effluent quality that is being discharged; and
- The design flow for the marine outfall is 25 l/s. It is important to maintain this discharge for optimum hydraulic performance to ensure that the required dilutions are achieved for compliance to the environmental design criteria.

References

BROOKS, N H (1960) Diffusion of sewage effluent in an ocean current. Proceedings of the First International Conference on Waste Disposal in the Marine Environment. Pergamon Press. pp 246-267

DEPARTMENT OF WATER AFFAIRS AND FORESTRY (DWAF, 1995). South African water quality guidelines for coastal marine waters (Volume 1, 2 and 3)

DEPARTMENT OF WATER AFFAIRS AND FORESTRY (DWAF) (2004). Operational policy for the disposal of land-derived water containing waste to the marine environment of South Africa. Water Quality Management Series. Edition 1. Pretoria.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY (US-EPA) (1985). Initial mixing characteristics of municipal ocean discharges. Environmental Research Laboratory, Naragansett, Report No EPA/SW/MT-86/012(a & b). Washington.

WAMTECHNOLOGY & J. ROSSOUW (WAMTECH & Rossouw, 1999). Robben Island: Marine Outfall. Environmental conditions, Outfall hydraulics and dilutions. August 1999. Report No: PW34/ZLH/98/R1. Stellenbosch.

WRc (1990): Design guide for marine treatment schemes. Water Research Centre, Swindon, United Kingdom. Report No. UM1009, Volumes I and II.

GOVERNMENT GAZETTE 1984. GOVERNMENT GAZETTE 18 MAY 1984 NO. 9225. REGULATION NO. 991 18 MAY 1984. REQUIREMENTS FOR THE PURIFICATION OF WASTE WATER OR EFFLUENT.

Fadini Pedro Sérgio, Jardim Wilson F, Guimarães José Roberto (2004). Evaluation of organic load measurement techniques in a sewage and waste stabilisation pond. Year: 2004 Volume: 15 - Issue: 1

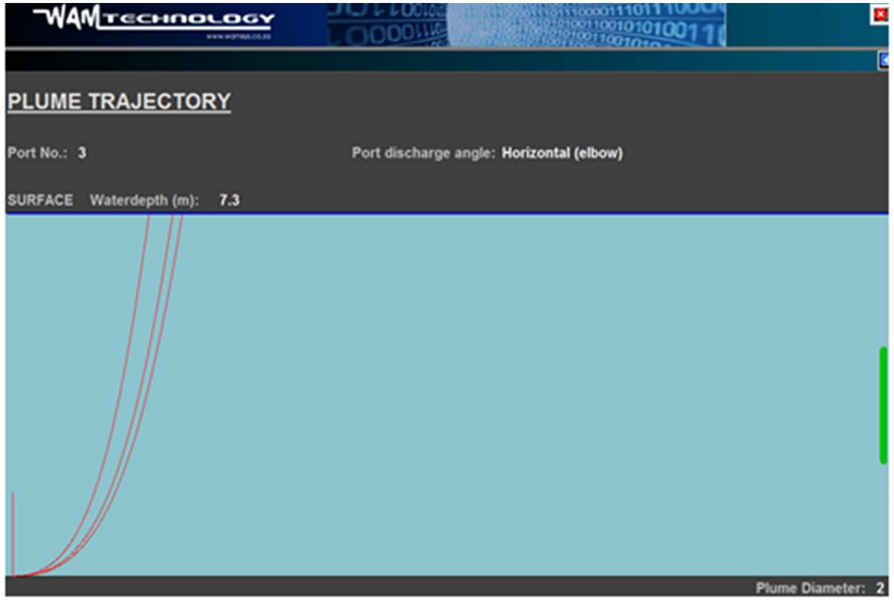
SANCOR (1984). Review of metal concentrations in Southern African coastal waters, sediments and organisms. South African National Scientific Programmes Report No 108. 1984

TOMS, G (1985). Application on the report "Water Quality Criteria for the South African Coastal Zone" to the Hout Bay Outfall Proposal. CSIR Report T/SEA 8504/2.

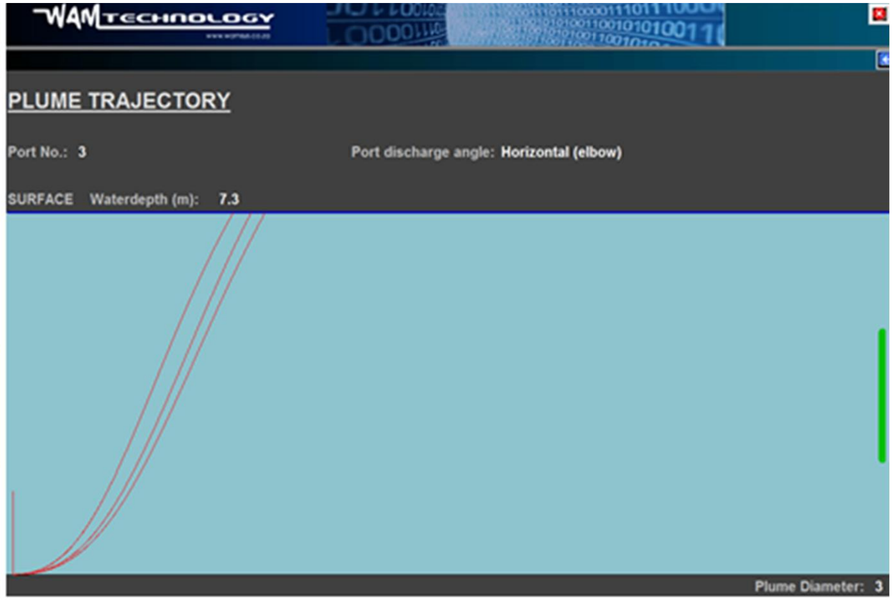
Appendices

Appendix A: As-built drawing no C4833

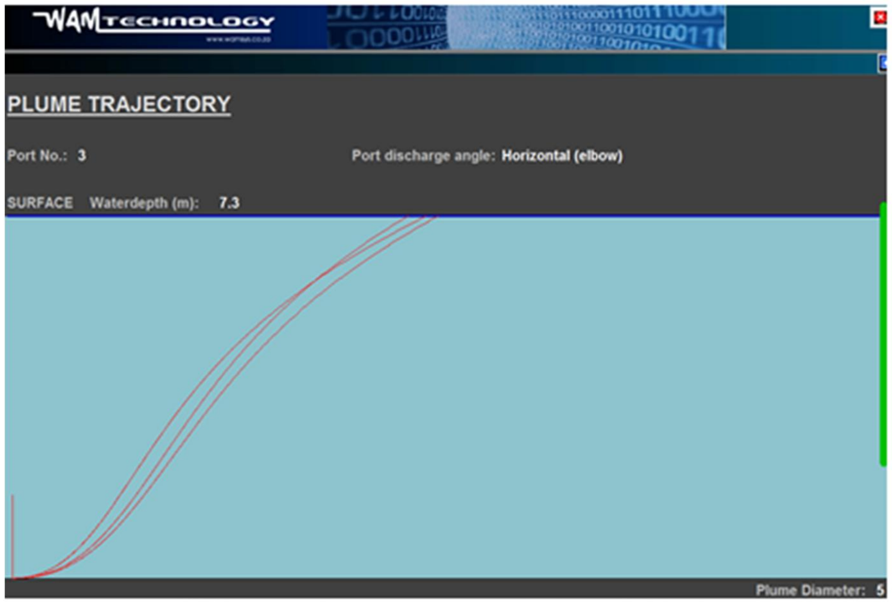
Appendix B: Modelled plume trajectory



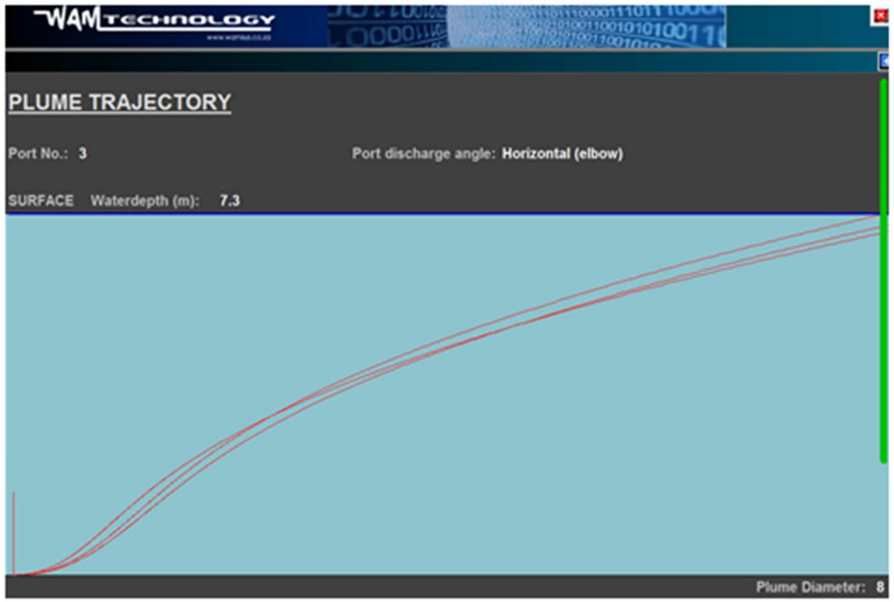
Stagnant ambient conditions: current velocity = 0.01m/s



Average ambient conditions: current velocity = 0.07m/s

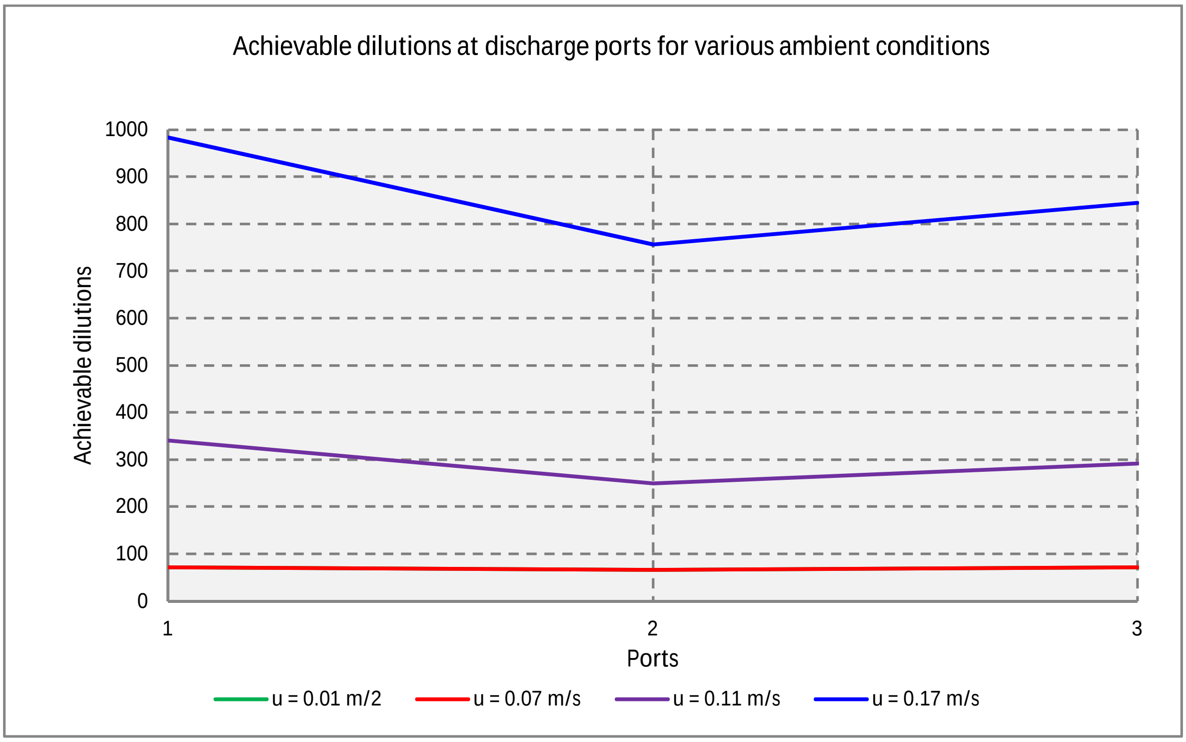


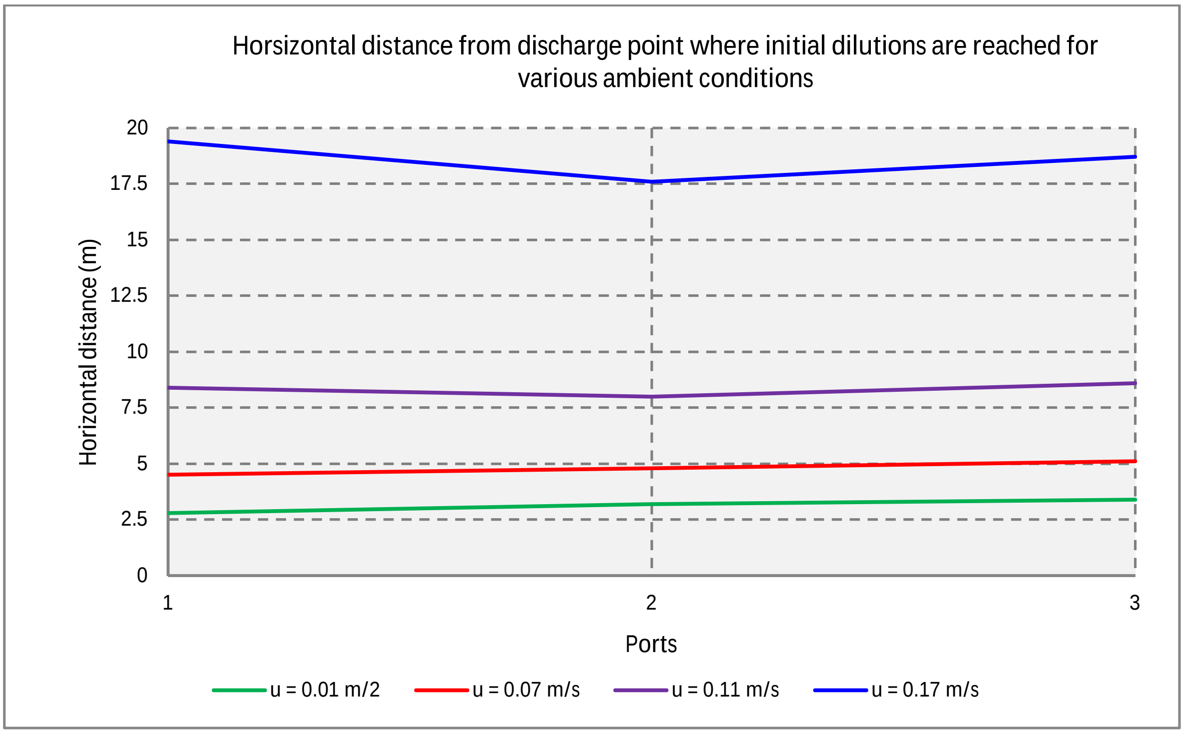
20% exceedance: current velocity = 0.11m/s



5% exceedance: current velocity = 0.17m/s

Appendix C: Modelled achievable dilutions





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BASIC ASSESSMENT
FOR A MARINE OUTFALL AT
ROBBEN ISLAND, SOUTH AFRICA

Marine Ecological Assessment

Prepared for:

WSP Environmental (Pty) Ltd

On behalf of

Department of Public Works

January 2014 (Revised July 2014)

BASIC ASSESSMENT

FOR A MARINE OUTFALL AT

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Andrea Pulfrich

Pisces Environmental Services (Pty) Ltd

January 2014 (Revised July 2014)

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TABLE OF CONTENTS

ABBREVIATIONS and UNITS

ANZECC	Australian and New Zealand Environment Conservation Council
BA	Basic Assessment
BAR	Basic Assessment Report
BOD	Biological Oxygen Demand
cm	centimetres
cm/s	centimetres per second
COD	Chemical Oxygen Demand
DAFF	Department of Agriculture, Forestry and Fisheries
DEA	Department of Environmental Affairs
DPW	Department of Public Works
DWAF	Department of Water Affairs and Forestry
EIA	Environmental Impact Assessment
EMP	Environmental Management Programme
EPA	(United States) Environmental Protection Agency
GPA	Global Programme of Action
GWWL	General Waste Water Limits
GLV	General Limit Values (GN 665 of 2013)
HABs	Harmful Algal Blooms
HDPE	High Density Polyethylene
IUCN	International Union for the Conservation of Nature
km	kilometre
km^2	square kilometre
l/s	litres per second
m	metres
m^2	square metres
m^3	cubic metres
mm	millimetres
mg/l	milligrams per litre
PAHs	Polycyclic aromatic hydrocarbons
PCBs	Polychlorinated biphenyls
ppt	parts per thousand
SW	southwest
SSW	South-southwest
SPP	Sewage Package Plant
TAC	Total Allowable Catch
UNEP	United Nations Environment Programme
WHO	World Health Oragnisation
µg/l	micrograms per litre
µM	microMols
°C	degrees Centigrade
%	percent
~	approximately
<	less than
>	greater than

Expertise and Declaration of Independence

This report was prepared by Dr Andrea Pulfrich of Pisces Environmental Services (Pty) Ltd. Andrea has a BSc (Hons) and MSc degree in Zoology from the University of Cape Town and a PhD in Fisheries Biology from the Institute for Marine Science at the Christian-Albrechts University, Kiel, Germany.

As Director of Pisces since 1998, Andrea has considerable experience in undertaking specialist environmental impact assessments, baseline and monitoring studies, and Environmental Management Programmes relating to marine diamond mining and dredging, hydrocarbon exploration and thermal/hypersaline effluents. She is a registered Environmental Assessment Practitioner and member of the South African Council for Natural Scientific Professions, South African Institute of Ecologists and Environmental Scientists, and International Association of Impact Assessment (South Africa).

This specialist report was compiled as a desktop study on behalf of WSP Environment and Energy, PO Box 2613, Cape Town. The compilation followed a review process of published (peer reviewed) and unpublished literature and the assessment of potential impacts based on proposed activities and identification of impacts (and their mitigation) within the available literature.

This specialist report was compiled on behalf of WSP Environment & Energy for their use in preparing a Basic Assessment for the proposed marine outfall at Robben Island, South Africa undertaken by the Department of Public Works. I do hereby declare that Pisces Environmental Services (Pty) Ltd is financially and otherwise independent of the Applicant and WSP.

Andrea Pulfrich

Dr Andrea Pulfrich

1. GENERAL INTRODUCTION

The Department of Public Works plans to upgrade service facilities on Robben Island. As part of the upgrading, a Sewage Package Plant (SPP) will be constructed and domestic effluent will be treated to General limit Values (GN 665 of 2013) before discharge to the sea. The treated effluent will be discharged through an existing ocean outfall situated approximately 750 m south-east of Murray's Harbour at Robben Island. The existing marine outfall comprises a 200-mm diameter HDPE, which extends 465 m offshore to a depth of 8 m. The terminal end of the pipeline is fitted with a diffuser to aid in the dispersion of the effluent in the water column.

1.1. Scope of Work

This specialist report was compiled as a desktop study on behalf of WSP, for their use in preparing a Basic Assessment Report (BAR) for the proposed installation of a Sewage Package Plant and associated infrastructure for the release of treated effluent via the existing marine outfall on Robben Island, in Table Bay.

The Scope of Work for this study is to:

- Provide a description of the baseline marine biology in the project area, emphasising, but not limited to, sensitive and threatened habitats, and threatened or rare marine fauna and flora. All pertinent characteristics of the marine environment should be described including:
  - Marine Baseline Conditions
  - Waves, Tides and Currents
  - Surf-zone Currents and Processes
  - Upwelling and Nutrients
  - Turbidity and Organic Inputs
  - Low Oxygen Events
  - Rocky shore Communities
  - Sandy beach Communities
  - Pelagic Communities
  - Marine Mammals and Seabirds
  - Extractive and non-extractive uses of the area
  - Future-use scenarios
- Review all relevant, available local and international publications and information sources on the disturbances and risks associated with sewage effluents.
- Identify and describe all factors resulting from the construction and operation of the sewage plant and associated infrastructure that may influence the marine and coastal environments in the region, based on existing information and data collected during the site visit.
- Using the assessment criteria as supplied by WSP, assess the impacts of the proposed development on the marine biology of the project area during the construction and operational phases of the sewage plant. All identified marine and coastal impacts must be summarised, categorised and ranked in appropriate Impact tables, to be incorporated in the overall Basic Assessment (BA).
- Make recommendations for mitigation and monitoring of impacts.

- Compile an EMP for the marine aspects of the construction and operational phases of the disposal system.

1.2. Approach to the Study

As determined by the Scope of Work, this study has adopted a 'desktop' approach. Consequently, the description of the natural baseline environment in the study area is based on a review and collation of existing information and data from the scientific literature and previous reports conducted in the area. The information for the identification of potential impacts was drawn from various scientific publications and information sourced from the Internet. The sources consulted are listed in the Reference chapter.

All identified marine impacts are summarised, categorised and ranked in appropriate impact assessment tables, to be incorporated in the overall BA for the proposed project.

1.3. Assumptions and Limitations

The treated effluent generated by the new SPP will be discharged through an existing ocean outfall situated approximately 750 m south-east of Murray's Harbour. There will therefore be no new construction activities undertaken below the high water mark as part of the proposed project. As all impacts relating to the construction phase are located above the high water mark, and therefore beyond the scope of this marine assessment, construction impacts have not been assessed as part of this study.

It is assumed that at the time of the upgraded of the island's waste water handling facilities in 2001, an EIA and associated Environmental Management Plan were compiled. However, these documents could not be sourced to inform this study.

2. PROJECT DESCRIPTION

The Department of Public Works (DPW) propose to upgrade the existing sewage handling system on Robben Island with the construction of a Sewage Package Plant (SPP). The plant, which will be located adjacent to the existing sewage collection unit ~600 m south of Murray's Harbour in an area of ~2,500 m^2, will be partially submerged to a depth of approximately 2.5 m and have a footprint of 600 m^2. With a treatment capacity of 108,000 m^3 per annum, the SPP will treat all sewage and domestic waste water generated on the island to the South African Department of Water Affairs (DWA) General Limit Values (GLVs) effluent quality standards. The treated effluent will be transported via an existing pipeline to the existing sea outfall pipeline and discharged to sea (Figure 1). The estimated 20 m^3 of sludge produced annually as part of the treatment process will be dried on drying beds on the island, and either used as fertiliser or disposed of via the normal refuse system.

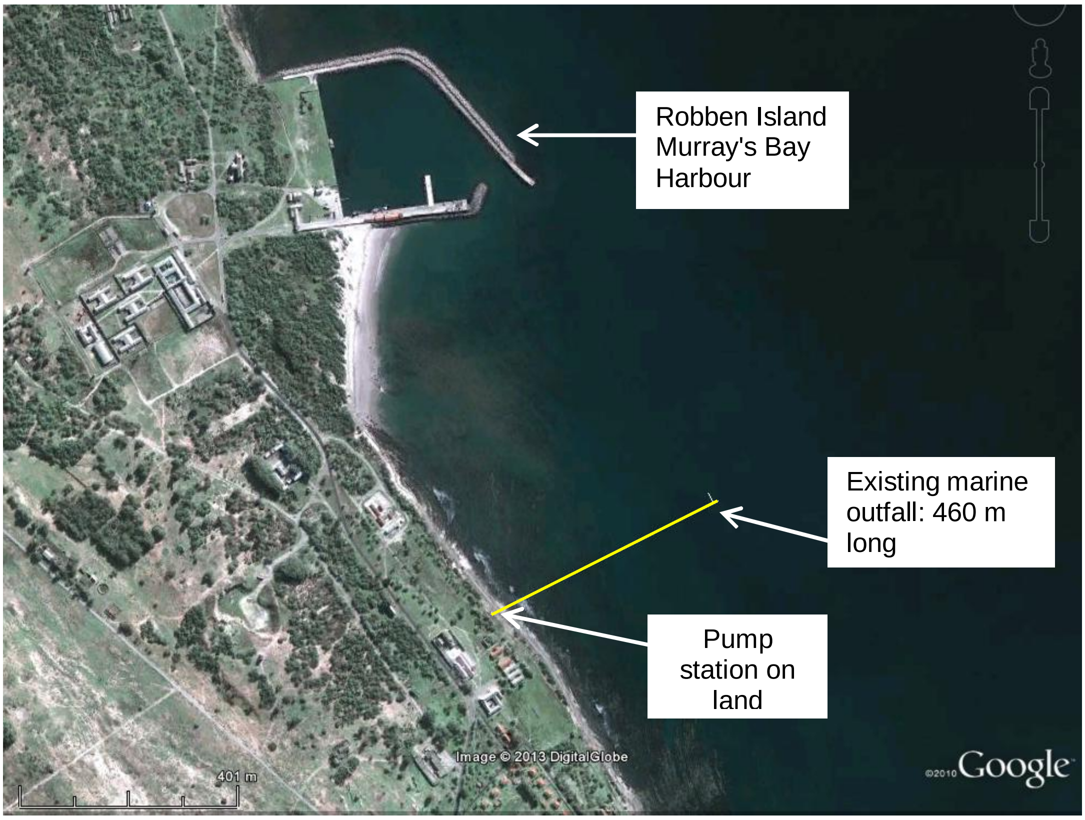


Figure 1: The location of the existing marine outfall in relation to Murray's Bay Harbour on Robben Island (adapted from WSP 2013).

A modular treatment plant, comprising relatively large chambers and based on a flow through system is proposed. The system enables long retention times thereby allowing the biological action of the bacterial colonies in the chambers to reduce sludge production to minimal levels, thus virtually eliminating the need for sludge removal. Following initial screening and solids removal, the treatment process involves a number of inter-linked processes (Figure 2).

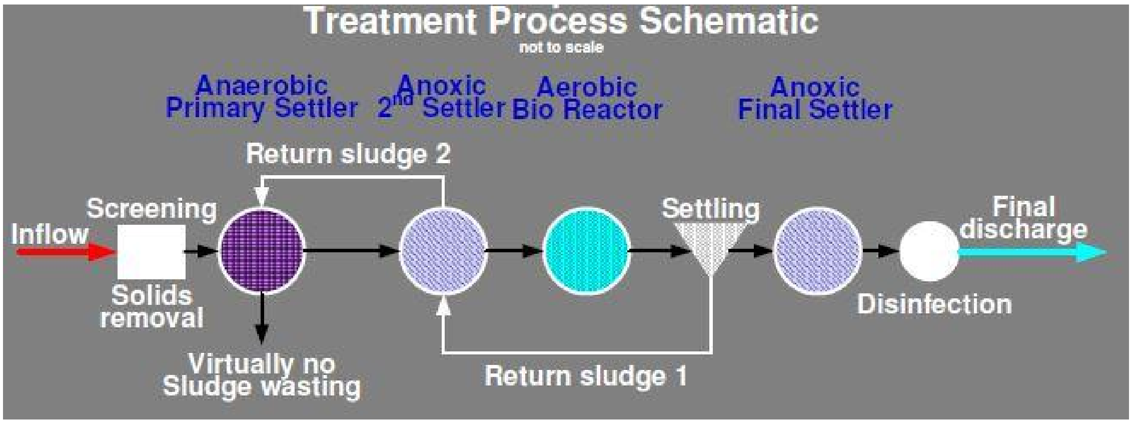


Figure 2: Schematic of the proposed modular waste water treatment process (Source: Amitek 2013)

1. An anaerobic primary settler containing facultative bacterial colonies that initiate contamination reduction of the raw product through biological removal of phosphates. The primary settler provides anaerobic oxidation, sludge stabilisation and wasted sludge storage.
2. An anoxic second settler, which promotes denitrification and releases nitrogen to the atmosphere in undetectable quantities. Nitrate-rich sludge returned from the final settler enhances the efficiency of the denitrification process thereby improving the quality of the effluent. Nitrate-poor biomass generated in the second settler is then used to re-seed the primary settler.
3. An aerobic bio-reactor in which bacterial growth is stimulated on a submerged biomedium through aeration with fine bubbles. This generates an oxygen-rich effluent flow, which completes the process of denitrification to nitrates. Biological phosphate removal is also completed under these aerobic conditions.
4. An anoxic final settler in which denitrification is completed. Removal of the settled nitrate-rich sludge and return thereof to the second settler results in clarification of the effluent.
5. Final disinfection by chlorine dosing at 1 – 2 ppm with HTH calcium hyperchlorite. This ensures that any remaining microorganisms or pathogens are destroyed before the treated water is released into the environment.

The effluent will be discharged intermittently through the existing marine outfall pipeline at a constant design flow of 25 l/s. The pipeline was installed in 2001 as part of the construction of the current sewage collection and disposal facility. To ensure adequate dilution and to comply with the South African water quality guidelines for the coastal zone (DWAF 1995), the outfall was designed with a 10-m long diffuser comprising three sections tapering from 200 mm diameter, through 160 mm to 110 mm. The first diffuser section was fitted with a single 100 mm and the second and third sections with a single 110 mm port discharging horizontally to alternate sides of the main diffuser pipe thereby ensuring optimum hydraulic behaviour of the effluent. It must be emphasised that the current discharge was designed to comply with the

Table 1: General Waste Water Limits (Water Act 1989), and effluent composition of existing marine outfall (WAMTECH & Rossouw 1999).

SUBSTANCE/PARAMETER	GENERAL LIMIT VALUES	CURRENT DISCHARGE
Faecal Coliforms (per 100 ml)	1,000	7,200,000
Chemical Oxygen Demand (COD)*	75 – after removal of algae	
Biological Oxygen Demand (COD)		344 mg/l
pH	5.5-9.5	7.4
Ammonia (ionised and unionised) as Nitrogen	6 mg/l	18 mg/l
Nitrate/Nitrite as Nitrogen	15 mg/l	
Chlorine as Free Chlorine	0.25 mg/l	
Suspended Solids	25 mg/l	308 mg/l
Salinity in ppt	4 ppt above intake to a maximum of 10 ppt	
Ortho-Phosphate as phosphorous	10 mg/l	6 mg/l
Fluoride	1 mg/l	
Soap, oil or grease	2.5 mg/l	
Dissolved Arsenic	0.02 mg/l	
Dissolved Cadmium	0.005 mg/l	
Dissolved Chromium (VI)	0.05 mg/l	
Dissolved Copper	0.01 mg/l	0.27 mg/l
Dissolved Cyanide	0.02 mg/l	
Dissolved Iron	0.3 mg/l	
Dissolved Lead	0.01 mg/l	0.16 mg/l
Dissolved Manganese	0.1 mg/l	
Mercury and its compounds	0.005 mg/l	
Dissolved Selenium	0.02 mg/l	
Dissolved Zinc	0.1 mg/l	0.42 mg/l
Boron	1 mg/l	

* COD is typically higher than BOD

South African water quality guidelines for the coastal zone, which assume adequate dilution of the effluent at the discharge point. The effluent composition (assuming no dilution) was thus in most cases considerably higher than the General Limit Values (Table 1). As the effluent will now be treated to General Limit Values before being discharged to sea, *the quality of effluent after the upgrade will be significantly improved relative to the originally designed discharge.*

3. DESCRIPTION OF THE MARINE ENVIRONMENT

3.1. Geophysical Characteristics

Robben Island is roughly oval in shape, 3.3 km long in the north-south axis, and 1.9 km wide, with an area of 5.07 km². As the summit of an ancient, now submerged mountain, the island is linked by an undersea saddle to the Blouberg. The island's flat profile is the product of wave action during a higher sea level stand, with its highest point (Minto Hill) lying only 24 m above sea-level. The island's lower strata consists of Precambrian metamorphic rocks belonging to the Malmesbury Group, overlain by a thick limestone and calcrete deposit much of which is covered by a thin veneer of Quaternary windblown sands and shell fragments (www.uct.ac.za/depts/geolsci/dlr/robben).

Robben Island has a total shoreline of 9 km of which 91% is rocky. A small pocket of fine sand occurs on the eastern shore of the island in Murray's Bay, just south of the Harbour. The rocky shores of the island are characterised by wave-cut platforms in the low-shore and steep storm beaches composed of large cobbles on the high-shore (Figure 3).

Figure 3: The shoreline of Robben Island is characterised by rocky platforms and steep cobble beaches (left) (Source: www.uct.ac.za/depts/geolsci/dlr/robben), with and isolated sandy beach south of Murray Harbour.

Robben Island lies within Table Bay, a log spiral bay anchored by rocky headlands at Mouille Point in the south and Blouberg in the north (Figure 4). The bay is relatively shallow with a maximum depth of 35 m at its centre. The seabed is characterised by large portions of partly exposed bedrock, which in places may be covered by a thin layer of coarse sediment. Fine sand is generally confined to the eastern nearshore region between Blouberg and the Port of Cape Town, although smaller pockets occur at the bay entrance and on the eastern shore of Robben Island (Woodborne 1983; Monteiro 1997). The major sources of the sand in Table Bay are seasonal (mainly winter) inputs from the Diep and Salt Rivers and local erosion of Malmesbury shales (Quick & Roberts 1993). Sediment is transported out of Table Bay by local wave and storm driven transport, with the overall residence time for surficial sediments estimated at 2-3 years (Monteiro 1997).

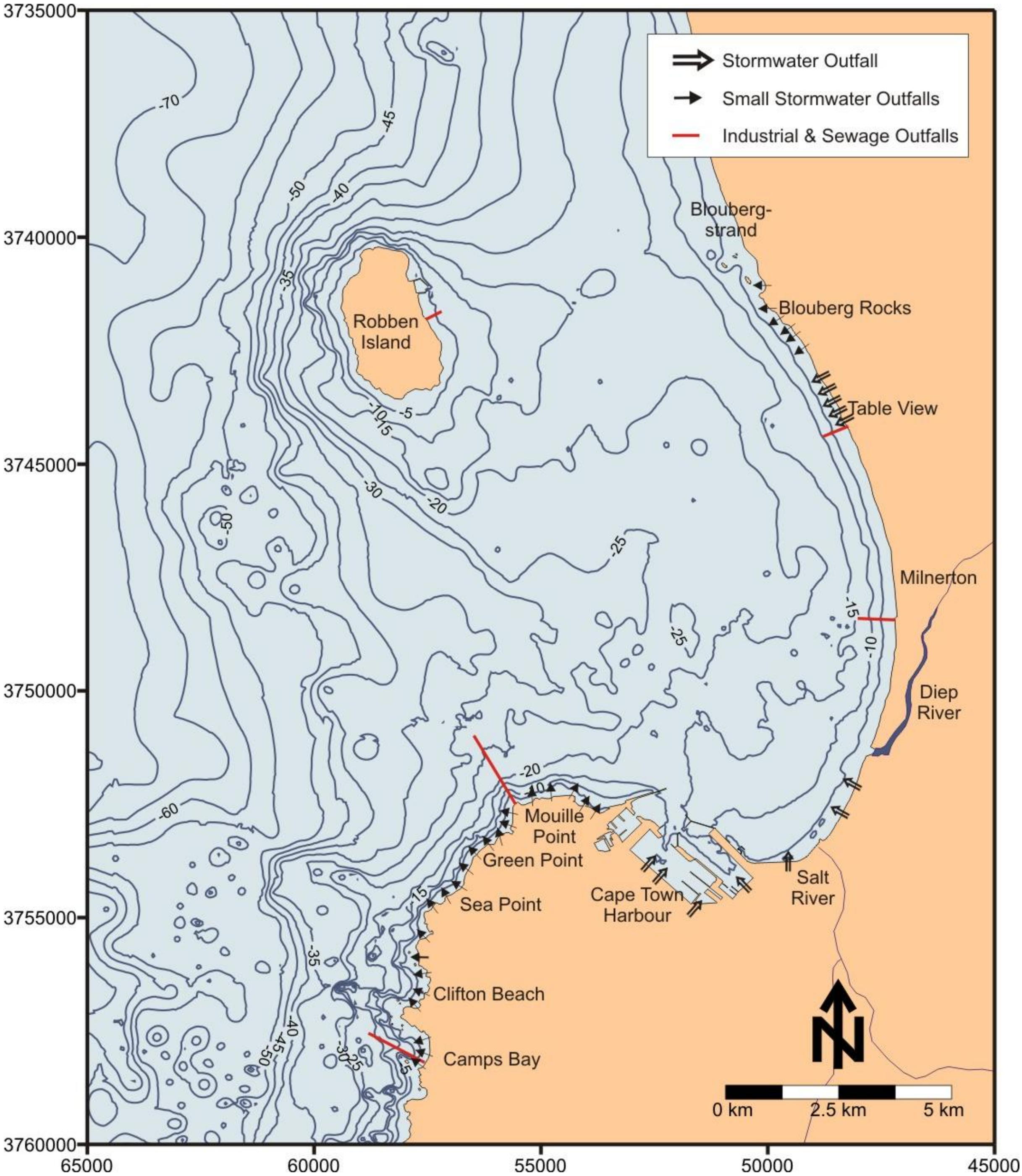


Figure 4: The bathymetry of Table Bay showing the undersea saddle linking Robben Island to Blouberg. The location of marine outfall pipelines and storm water discharges are also shown.

3.2. Biophysical Characteristics

Table Bay and Robben Island lie within the southern Benguela upwelling system (Figure 5). The circulation and water properties of the bay are thus characteristic of the region. Surface currents are mainly wind driven with typical velocities of 20 – 30 cm/s. Velocities generally decrease with depth to on average <5 cm/s near the seabed (Quick & Roberts 1993). During summer southeasterly wind conditions generate an anti-clockwise circulation pattern in the Bay with the current flowing out between Robben Island and Table View. Circulation patterns in the winter under predominantly northwesterly wind conditions are clockwise. Nearshore currents in the bay are wave driven, with virtually all swells throughout the year coming from the SW - S direction, and generating northward flow. Winter swells, however, are strongly dominated by those from the SW - SSW, which occur almost 80% of the time, and typically exceed 2 m in height, averaging about 3 m, and often attaining over 5 m. The location of Robben Island in the bay will result in refraction of these waves around the island thereby generating localised changes in the wave direction. The eastern portion of the island, where the outfall is located, is well protected from these offshore swells, but will be subjected to significant sea waves generated within Table Bay by the prevailing moderate to strong southerly winds characteristic of the region. On the eastern shores of Robben Island, surface currents are highly variable and characterised by localised boundary currents along the outer edge of the kelp beds (Roberts 2002). As with most of the southern Africa West Coast the shores of Robben Island can thus be classified as exposed to very exposed, rating between 11-17 on the 20 point exposure scale (McLachlan 1980).

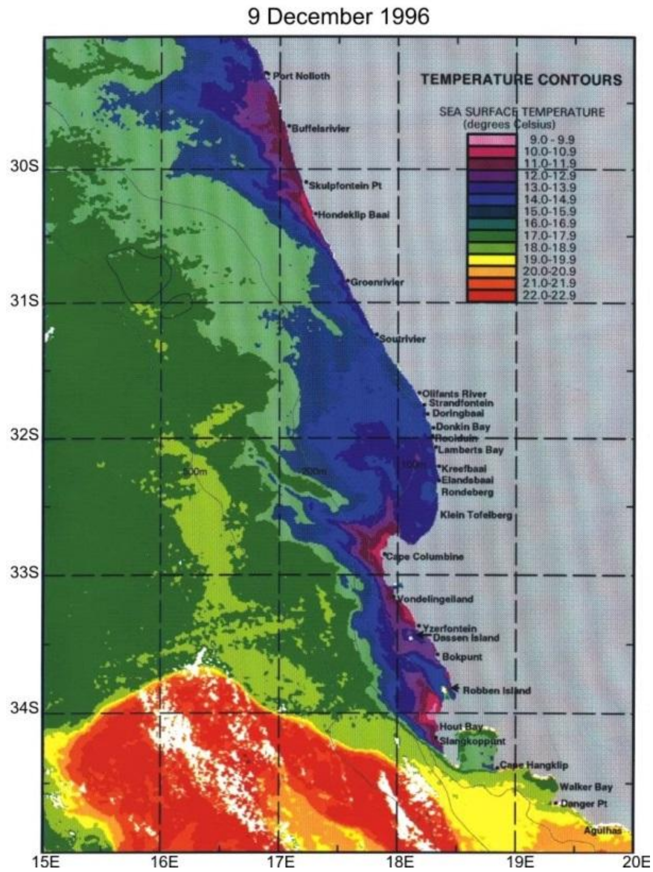


Figure 5: Satellite sea-surface temperature images showing upwelling intensity along the South African west coast in December 1996 (from Lane & Carter 1999).

Due to the generally low current velocities flushing periods in Table Bay are normally long with an average period of 4 days (Quick & Roberts 1993). In common with the rest of the southern African coast, tides are semi-diurnal, with a total range of some 1.5 m at spring tide, but only 0.6 m during neap tide periods.

3.3. Marine Ecology

The major force driving the ecology of the Table Bay region is coastal upwelling. During upwelling the comparatively nutrient-poor surface waters are displaced by cold, enriched deep water. The major contributing nutrients are various forms of nitrates, phosphates and silicates, with concentrations attaining 20 µM nitrate-nitrogen, 1.5 µM phosphate and 15-20 µM silicate (Chapman & Shannon 1985). Modification of these peak concentrations depends upon phytoplankton uptake which varies according to phytoplankton biomass and production rate. The range of nutrient concentrations can thus be large but, in general, concentrations are high.

The nutrients support dense stands of macroalgae such as kelps, which provide both a food source and habitat for a wide diversity of nearshore invertebrates and fish. The nutrients also support substantial seasonal primary phytoplankton production, which in turn serves as the basis for a rich food chain up through zooplankton, pelagic baitfish (anchovy, pilchard, round-herring and others), to predatory fish (hake and snoek), mammals (primarily seals and dolphins) and seabirds (jackass penguins, cormorants, pelicans, terns and others) (Field & Griffiths 1991).

High phytoplankton productivity in the upper layers again depletes the nutrients in these surface waters, resulting in a wind-related cycle of plankton production, mortality, sinking of plankton detritus and eventual nutrient re-enrichment occurring below the thermocline as the phytoplankton decays (Bailey *et al*. 1985). Similarly, all the higher order consumers are subject to natural mortality, and a proportion of the annual production of all these trophic levels, particularly the plankton communities, die naturally and sink to the seabed.

Biogeographically, the coastline of Robben Island falls into the South-western Cape Bioregion, which extend from Cape Columbine to Cape Point (Emanuel *et al*. 1992; Lombard *et al.* 2004) (Figure 6). Marine ecosystems comprise a range of habitats each supporting a characteristic biological community. Habitats around Robben Island include:

- A sandy beach extending ~400 m south of Murray's Harbour,
- Subtidal sandy substrates off the beach and beyond the subtidal extent of the coastal reefs,
- Rocky shores extending virtually all around the Island and into the subtidal,
- Kelp beds on rocky subtidal substrates around the Island,
- The water body around the island and in Table Bay, and
- Artificial surfaces of the harbour.

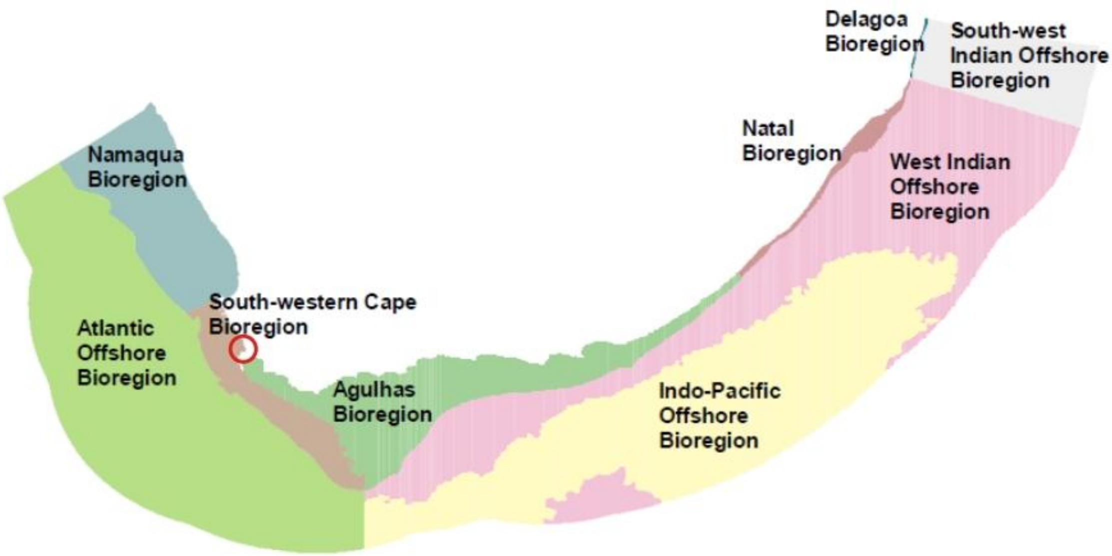


Figure 6: The South African inshore and offshore bioregions in relation to the project area (red circle) (adapted from Lombard *et al*. 2004).

The marine communities within these habitats are largely ubiquitous throughout the bioregion, being particular only to substrate type or depth zone. These biological communities consist of many hundreds of species, often displaying considerable temporal and spatial variability (even at small scales). The biological communities 'typical' of these habitats are described briefly below, focussing both on dominant, commercially important and conspicuous species, as well as potentially threatened or sensitive species, which may be affected by the marine outfall.

3.3.1 Sandy Beach Habitats and Biota

3.3.1.1 Intertidal Sandy Beaches

The composition of the biota of intertidal beaches is largely dependent on sand particle size, beach slope and degree of wave energy. Three morphodynamic beach types are described: dissipative, reflective and intermediate beaches (McLachlan *et al.* 1993). Generally, dissipative beaches are flat with fine sand where the wave energy dissipates in the surf zone, resulting in less turbulent conditions in the intertidal. These beaches usually harbour the richest intertidal faunal communities. Reflective beaches are coarse grained (>500 µm sand) with steep intertidal beach faces. The relative absence of a surf zone causes the waves to break directly on the shore causing a high turnover of sand. The result is depauperate faunal communities. Intermediate beach conditions exist between these extremes and have a very variable species composition (McArdle & McLachlan 1991; McLachlan *et al.* 1993; Jaramillo *et al.* 1995). This variability is mainly attributable to the amount and quality of food available. Beaches with a high input of e.g. kelp wrack have a rich and diverse drift-line fauna, which is sparse or absent at beaches lacking a drift-line (Branch and Griffiths 1988, Field and Griffiths 1991). The beach on Robben Island is likely to be an intermediate beach.

Numerous methods of classifying beach zonation have been proposed, based either on physical or biological criteria. The general scheme proposed by Branch & Griffiths (1988) is used below (Figure 7), supplemented by data from various publications on West Coast sandy beach biota (e.g. Bally 1987, Brown *et al.* 1989, Soares *et al.* 1996, 1997, Nel 2001, Nel *et al*. 2003, Soares 2003, Branch *et al.* 2010, Harris 2012). The supralittoral zone is situated above the high water spring tide level, and receives water input only from large waves at spring high tides or through sea spray. This zone is characterised by a mixture of air breathing terrestrial and semi-terrestrial fauna, often associated with and feeding on kelp deposited near or on the driftline. Terrestrial species include a diverse array of beetles and arachnids and some oligochaetes, while semi-terrestrial fauna include the oniscid isopod *Tylos granulatus*, and amphipods of the genus *Talorchestia*. Below this lies the intertidal zone or mid-littoral zone, which has a vertical range of about 2 m. This mid-shore region is characterised by the cirolanid isopods *Pontogeloides latipes*, *Eurydice* (*longicornis*=) *kensleyi*, and *Excirolana natalensis*, the polychaetes *Scolelepis squamata*, *Orbinia angrapequensis*, *Nepthys hombergii* and *Lumbrineris tetraura*, and amphipods of the families Haustoridae and Phoxocephalidae. In some areas (e.g. Blouberg), juvenile and adult sand mussels *Donax serra* may also be present in considerable numbers.

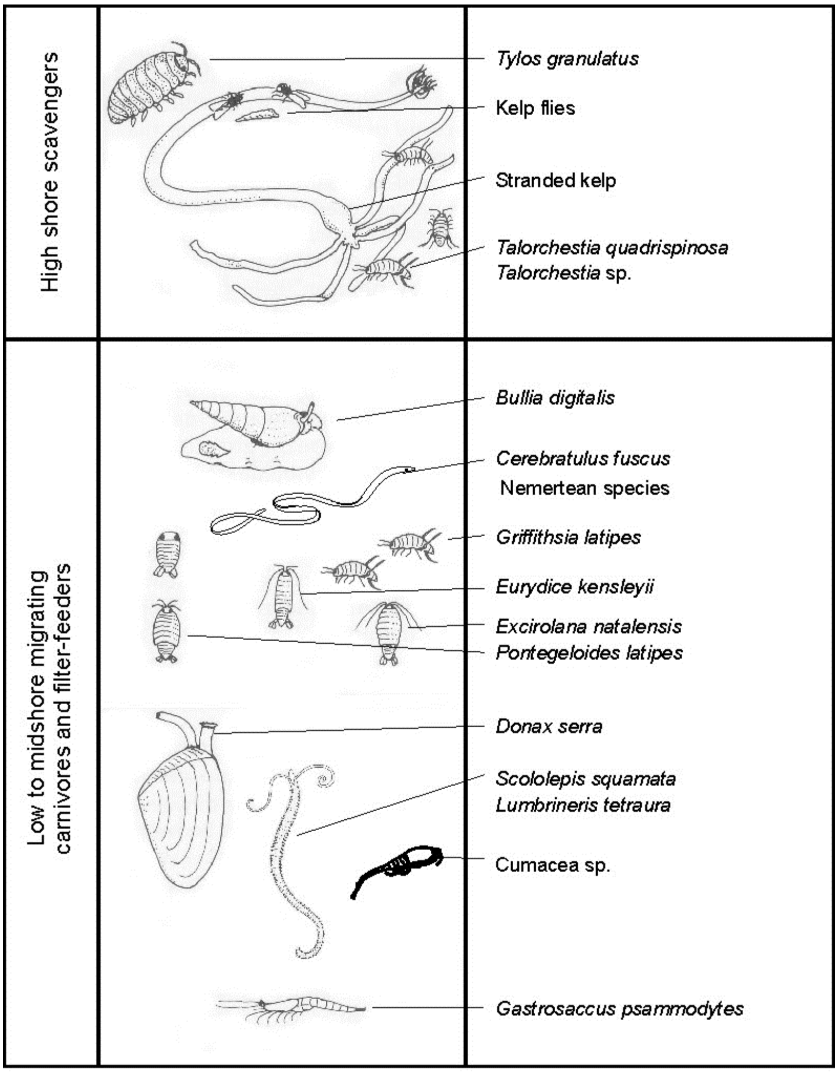


Figure 7: Schematic representation of the typical West Coast intertidal beach zonation (adapted from Branch & Branch 1981). Species commonly occurring on the Cape beaches are listed.

3.3.1.2 Subtidal Sandy Habitats

The benthic biota of soft bottom substrates constitutes invertebrates that live on, or burrow within, the sediments, and are generally divided into macrofauna (animals >1 mm) and meiofauna (<1 mm). The zonation described for intertidal beaches continues into the subtidal regions, where the structure and composition of benthic soft-bottom communities is primarily determined by water depth and sediment grain size. Other factors such as current velocity, organic content, and food abundance, however, also play a role (Snelgrove & Butman 1994; Flach & Thomsen 1998; Ellingsen 2002). This array of environmental factors and their complex interplay is ultimately responsible for the structure of benthic communities in unconsolidated substrates by defining a distinct habitat in which the animals occur.

Subtidally, three zones are defined. The inner turbulent zone extends from the Low Water Spring mark to about -2 m depth. The mysid *Gastrosaccus psammodytes* (Mysidacea, Crustacea), the ribbon worm *Cerebratulus fuscus* (Nemertea), the cumacean *Cumopsis robusta* (Cumacea) and a variety of polychaetes including *Scolelepis squamata* and *Lumbrineris tetraura*, are typical of this zone, although they generally extend partially into the midlittoral above. In areas where a suitable swash climate exists, the gastropod *Bullia digitalis* (Gastropoda, Mollusca) may also be present in considerable numbers, surfing up and down the beach in search of carrion. The transition zone spans approximately 2 - 5 m depth beyond the inner turbulent zone. Extreme turbulence is experienced in this zone, and as a consequence this zone typically harbours the lowest diversity on sandy beaches. Typical fauna include amphipods such as *Cunicus profundus* and burrowing polychaetes such as *Cirriformia tentaculata* and *Lumbrineris tetraura.* In the outer turbulent zone, which extends below 5 m depth, turbulence is significantly decreased and species diversity is again much higher. In addition to the polychaetes found in the transition zone, other polychaetes in this zone include *Pectinaria capensis*, and *Sabellides ludertizii*. The sea pen V*irgularia schultzi* (Pennatulacea, Cnidaria) is also common as is a host of amphipod species and the three spot swimming crab *Ovalipes punctatus* (Brachyura, Crustacea).

3.3.2 Rocky Habitats and Biota

3.3.2.1 Intertidal Rocky Shores

The benthic communities of rocky intertidal shores are in essence ubiquitous throughout the biogeographic province, differing only with exposure to wave action. Specifically, wave action enhances filter-feeders (McQuaid & Branch 1985) by increasing the concentration and turnover of particulate food (Bustamante & Branch 1996), leading to an elevation of overall biomass despite a low species diversity (Bustamante *et al*. 1995). Conversely, sheltered shores are diverse with a relatively low biomass, and only in relatively sheltered embayments does drift kelp accumulate and provide a vital support for very high densities of kelp-trapping limpets, for example *Cymbula granatina* that occur exclusively there (Bustamante *et al*. 1995). In the subtidal, these differences diminish as wave exposure is moderated with depth.

Like sandy beaches, rocky intertidal shores on the southern African West Coast can be divided into zones on the basis of their characteristic biological communities. Tolerance to the physical stresses associated with life on the intertidal, as well as biological interactions such as herbivory, competition and predation interact to produce five zones. The biological zones, however, also correspond roughly to zones based on tidal heights (Figure 8).

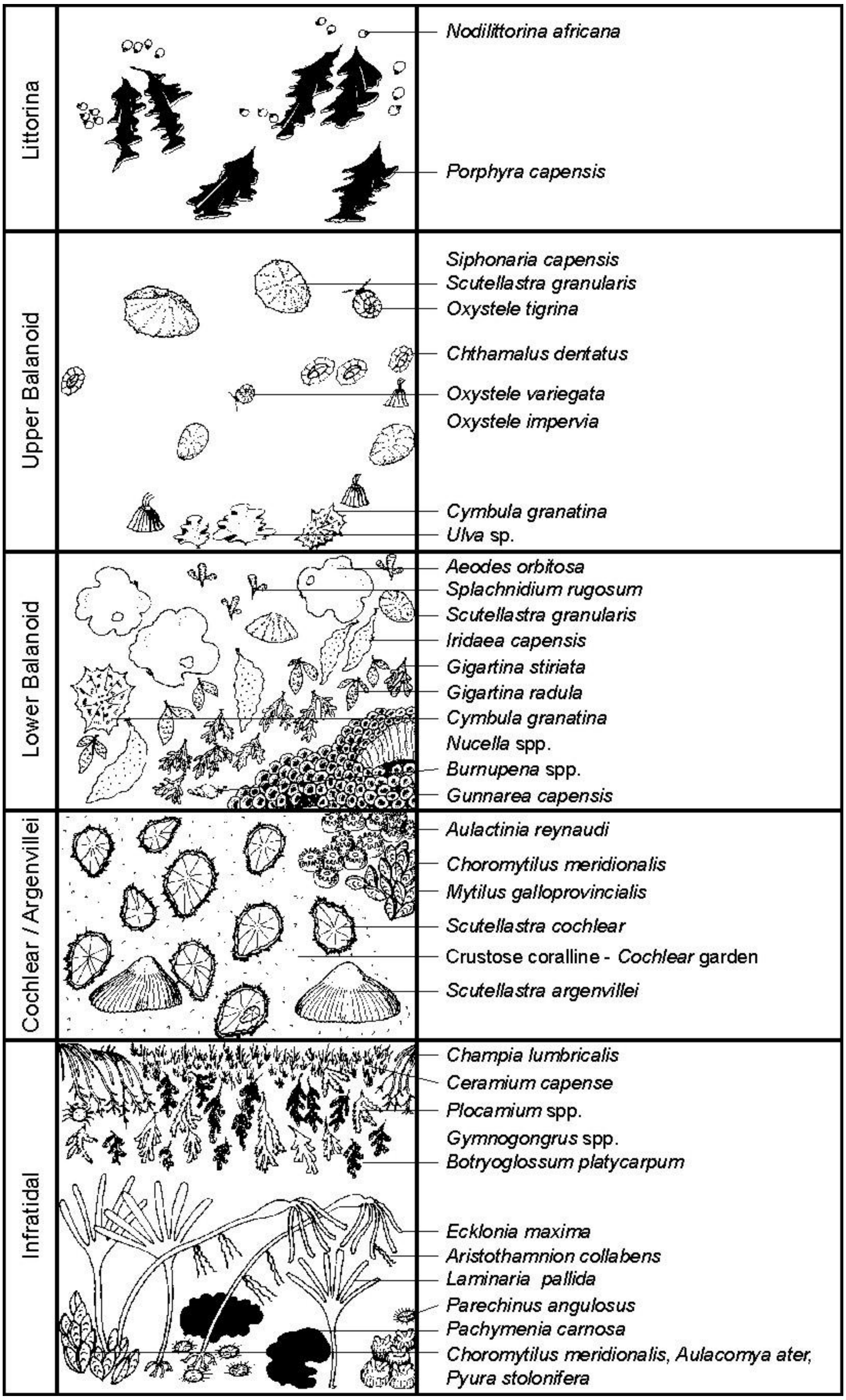


Figure 8: Schematic representation of the West Coast intertidal zonation. Species commonly occurring in Table Bay are listed (adapted from Branch & Branch 1981).

Figure 6: Typical rocky intertidal zonation on the southern African west coast.

The supralittoral fringe, is the uppermost part of the shore most exposed to air, thus perhaps having more in common with the terrestrial environment. The supralittoral is characterised by low species diversity, with the tiny gastropod *Afrolittorina (=Littorina) knysnaensis*, and the red alga *Porphyra capensis* (Rhodophyta) constituting the most common macroscopic life. The upper midlittoral is characterised by the limpets *Scutellastra granularis* and *Siphonaria capensis* (Gastropoda, Mollusca), which are present on almost all shores. The gastropods *Oxystele variegata*, *Nucella dubia*, and *Helcion pectunculus* are variably present, as are low densities of the barnacles *Chthalamus dentatus*, *Tetraclita serrata* and *Octomeris angulosa* (Cirripedia, Crustacea). Flora is best represented by the leafy green alga *Ulva* spp. (Chlorophyta), with *Hildenbrandia rubra* (Rhodophyta) present in damp depressions.

Toward the lower shore, biological communities in the lower midlittoral/lower Balanoid zone are determined by exposure to wave action. Sheltered shores are dominated by grazers, principally the limpets *S. granularis*, *Cymbula granatina* and a diversity of foliose algae. The algae diversity abounds with a variable representation of: green algae - *Codium* and *Cladophora* spp., brown algae (Phaeophyta) - *Splachnidium rugosum, Chordariopsis capensis*, and red algae *Nothogenia erinacea*, *Aeodes orbitosa*, *Mazzaella (=Iridaea) capensis*, *Gigartina polycarpa* (=*radula*), *Sarcothalia* (=*Gigartina*) *stiriata*, *Champia lumbricalis* (often epiphytized by *Aristothamnion collabens*) and some *Polysiphonia,* and articulated and crustose corallines. The gastropods *Burnupena* spp. and the starfish *Parvulastra exigua* (Asteroidea) are also common. Filter-feeder biomass, however, is low on sheltered shores and represented primarily by the Cape reef worm *Gunnarea capensis* in sediment influenced area.

In contrast, on more exposed shores wave action enhances filter-feeders (McQuaid & Branch 1985) by increasing the concentration and turnover of particulate food (Engledow & Bolton

1994; Bustamante & Branch 1996), leading to an elevation of overall biomass (Bustamante *et al.* 1995). The communities are dominated by foliose algae, particularly by the red algae *Plocamium cornutum*, which occurs prolifically as a secondary canopy on the mussel beds. Several algal species are associated with the *Gunnarea* reefs, notably *Ceramium* sp., *Leathesia difformis*, *Caulacanthus ustulatus* and *Cladophora.* On more exposed shores, almost all of the primary space can be occupied by the dominant alien invasive mussel *Mytilus galloprovincialis*. First recorded in 1979 (although it is likely to have arrived in the late 1960's), it is now the most abundant and widespread invasive marine species along the entire West Coast and parts of the South Coast (Robinson *et al.* 2005). *M. galloprovincialis* has partially displaced the local mussels *Choromytilus meridionalis* and *Aulacomya ater* (Hockey & Van Erkom Schurink 1992), and competes with several indigenous limpet species (Griffiths *et al.* 1992, Steffani & Branch 2003a, b). Recently, another alien invasive has been recorded, the acorn barnacle *Balanus glandula*, which is native to the west coast of North America where it is the most common intertidal barnacle. The presence of *B. glandula* in South Africa was only noticed a few years ago as it had always been confused with the native barnacle *Cthamalus dentatus* (Simon-Blecher *et al.* 2008). There is, however, evidence that it has been in South Africa since at least 1992 (Laird & Griffith 2008). At the time of its discovery, the barnacle was recorded from 400 km of coastline from Elands Bay to Misty Cliffs near Cape Point (Laird & Griffith 2008) and is thus likely to also occur on Robben Island. When present, the barnacle is typically abundant at the mid zones of semi-exposed shores.

Along the well-marked sublittoral fringe or Argenvillei zone on semi-exposed and exposed shores, the limpet *Scutellastra argenvillei* dominates except where it has been displaced by *M. galloprovincialis*. The kelps *Laminaria pallida* and *Ecklonia maxima* dominate the algal diversity in this zone, and where limpet densities are lower, there is variable representation of the flora and fauna described for the lower midlittoral above. This includes the anemone *Aulactinia reynaudi* (Actiniaria, Cnidaria), other patellid limpets (*S. granularis*, *S. barbara*, *Cymbula granatina*, C. *miniata*), numerous whelk species (*Nucella* spp. and *Burnupena* spp.) and the sea urchin *Parechinus angulosus* (Echinoidea, Echinodermata). On more exposed shores, the mussels *Aulacomya ater* or the tunicate *Pyura stolonifera* (Ascidiacea) may also occur. Most of these species extend into the subtidal below.

The invasion of west coast rocky shores by another mytilid, the small *Semimytilus algosus*, was recently noted (de Greef *et al.* 2013). It is hypothesized that this species has established itself in the last ten years. Its current range extends from the Groen River mouth in the north to Bloubergstrand in the south. Where present, it completely dominates primary rock space in the lower intertidal zone, while *M. galloprovincialis* dominates higher up the shore. Many shores on the West Coast have thus now been effectively partitioned by the three introduced species, with *B. glandula* colonizing the upper intertidal, *M. galloprovincialis* dominating the mid-shore, and now *S. algosus* smothering the low-shore (de Greef *et al.* 2013).

Most semi-exposed to exposed rocky shores on the Southern African West coast are strongly influenced by sediments, and may include considerable amounts of sand intermixed with the benthic biota. This intertidal mixture of rock and sand is referred to as a mixed shore, and constitutes a substantial proportion of the rocky intertidal regions along the Southwestern Cape coastline.

3.3.2.2 Subtidal Reefs

The biological communities of the sublittoral habitat can be broadly grouped into an inshore zone (from the supralittoral fringe to a depth of ~10 m), and an offshore zone (below 10 m depth). The shift in communities from the flora-dominated inshore zone to the fauna-dominated offshore zone is not knife-edge, however, representing instead a continuum of species distributions, merely with changing abundances. As wave exposure is moderated with depth, wave action is less significant in structuring the communities than in the intertidal, with prevailing currents, and the vertical distribution of oxygen and nutrients playing more important roles.

From the sublittoral fringe to a depth of between 5 m and 10 m, the benthos is largely dominated by algae, in particular two species of kelp. The canopy forming kelp *Ecklonia maxima* extends seawards to a depth of about 10 m. The smaller *Laminaria pallida* forms a sub-canopy to a height of about 2 m underneath *Ecklonia*, but continues its seaward extent to about 30 m depth, although further north increasing turbidity limits growth to shallower waters (10 - 20 m) (Velimirov *et al*. 1977; Jarman & Carter 1981). *Ecklonia maxima* is the dominant species in the south forming extensive beds from west of Cape Agulhas to north of Cape Columbine (Stegenga *et al.* 1997; Rand 2006) (Figure 9).

Kelp beds absorb and dissipate much of the high wave energy reaching the shore, thereby providing important partially-sheltered habitats for a high diversity of marine flora and fauna, resulting in diverse and typical kelp-forest communities being established. Through a combination of shelter and provision of food, kelp beds support recruitment and complex trophic food webs of numerous species, including commercially important rock lobster and abalone stocks.

Growing beneath the kelp canopy, and epiphytically on the kelps themselves, are a diversity of understorey algae, which provide both food and shelter for predators, grazers and filter-feeders associated with the kelp bed ecosystem. Representative under-storey algae include *Botryocarpa prolifera*, *Neuroglossum binderianum*, *Botryoglossum platycarpum*, *Hymenena venosa* and *Epymenia obtusa*, various coralline algae, as well as subtidal extensions of some algae occurring primarily in the intertidal zones (Bolton 1986). Epiphytic species include *Carradoria virgata*, *Suhria vittata* and *Carpoblepharis flaccida*.

The sublittoral invertebrate fauna is dominated by suspension and filter-feeders, such as the ribbed mussel *Aulacomya ater* and Cape reef worm *Gunnarea capensis*, and a variety of sponges and sea cucumbers. Grazers are less common, with most herbivory being restricted to grazing of juvenile algae or debris-feeding on detached macrophytes. The dominant herbivore is the sea urchin *Parechinus angulosus*, with lesser grazing pressure from limpets. Key predators in the sub-littoral include the commercially important West Coast rock lobster *Jasus lalandii* and the octopus *Octopus vulgaris*. The rock lobster acts as a keystone species as it influences community structure via predation on a wide range of benthic organisms (Mayfield *et al*. 2000). Of lesser importance as predators, although numerically significant, are various starfish, feather and brittle stars, and gastropods, including the whelks *Nucella* spp. and *Burnupena* spp.

Figure 9: The canopy-forming kelp *Ecklonia maxima* provides an important habitat for a diversity of marine biota (Photo: Geoff Spiby).

3.3.3 Pelagic Communities in Table Bay

The pelagic communities are typically divided into plankton (phytoplankton, zooplankton and ichthyoplankton) and fish, and their main predators marine mammals (seals, dolphins and whales). Table Bay forms part of the southern Benguela ecosystem and, as there are few barriers to water exchange, pelagic communities are typical of those of the region.

3.3.3.1 Plankton and Ichthyoplankton

The phytoplankton is typically dominated by large-celled diatoms and dinoflagellates (Figure 10). The most common diatom genera are *Chaetoceros*, *Nitschia*, *Thalassiosira*, *Skeletonema*, *Rhizoselenia*, *Coscinodiscus* and *Asterionella* whilst common dinoflagellates are *Prorocentrum*, *Ceratium* and *Peridinium* (Shannon & Pillar 1985) Some of the dinoflagellate species which are known to cause harmful algal blooms (HAB) (e.g. *Ceratium furca*, *C. lineatum*, *Promocentrum micans*, *Dinophysis* sp, *Noctiluca scintillans*, *Gonyaulax tamarensis*, *G polygramma*, *Alexandrium catanella*, *Mesodinium rubrum*) also occur episodically and dense HABs have been observed in Table Bay (Pitcher & Calder 2000). Mean phytoplankton biomass ranges between 3 and 4 µg chl *a*/l but varies considerably with phases in the upwelling cycle and in HABs (Brown *et al*. 1991).

Zooplankton comprises predominantly copepods (*Centropages, Calanoides, Metridia, Nannocalanus, Paracalanus, Ctenocalanus* and *Oithona*) and euphausiids (*Euphausia lucens* and *Nyctiphanes capensis*) (Hutchings *et al*. 1991, Shannon & Pillar 1986) (Figure 10). The zooplankton generally graze phytoplankton and therefore biomass and biomass distributions depend upon this component of the plankton.

Ichthyoplankton in the southern Benguela area comprises mostly fish eggs and larvae, mainly from anchovy and pilchard, and to a lesser extent from hake and mackerel (Shannon & Pillar 1986). As Table Bay falls within the main recruitment areas for these commercially and ecologically important species, it is likely that relatively high densities of fish eggs and larvae could be present in the plankton (Crawford *et al*. 1989).

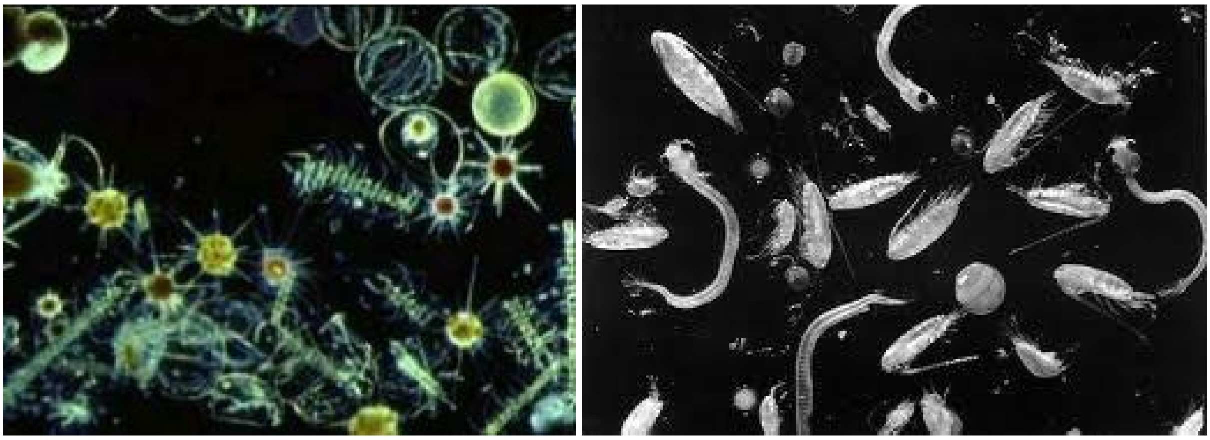


Figure 10: Phytoplankton (left, photo: hymagazine.com) and zooplankton (right, photo: mysciencebox.org) is associated with upwelling cells.

3.3.3.2 Pelagic Fish

Small pelagic shoaling species include the sardine/pilchard (*Sadinops ocellatus*) (Figure 11, left), anchovy (*Engraulis capensis*), chub mackerel (*Scomber japonicus*), horse mackerel (*Trachurus capensis*) (Figure 11, right) and round herring (*Etrumeus whiteheadi*). These species typically occur in mixed shoals of various sizes (Crawford *et al*. 1987) within the 200 m contour and would thus be expected in Table Bay and around Robben Island. Most of the pelagic species exhibit similar life history patterns involving seasonal migrations between the west and south coasts. The spawning areas are distributed on the continental shelf south of St Helena Bay (Shannon & Pillar 1986). The eggs and larvae of those that spawn on the Agulhas Bank in spring and summer, are subsequently carried around Cape Point and up the coast in northward flowing surface waters. At the start of winter every year, juveniles of most small pelagic species recruit back into coastal waters south of the Orange River to utilise the shallow shelf region as nursery grounds before gradually migrating southwards, towards the major spawning grounds east of Cape Point. Recruitment success relies on the interaction of oceanographic events, and is thus subject to spatial and temporal variability. Consequently, the abundance of adults and juveniles of these small, short-lived (1-3 years) pelagic fish is highly variable both within and between species.

Two species that migrate along the West Coast following the shoals of anchovy and pilchards are snoek *Thyrsites atun* and chub mackerel *Scomber japonicas*. Their appearance along the West coast is highly seasonal, with snoek reaching the area between St Helena Bay and the Cape Peninsula between May and August. They spawn in these waters between July and October before moving offshore and commencing their return northward migration (Payne &

Crawford 1989). They are voracious predators occurring throughout the water column, feeding on both demersal and pelagic invertebrates and fish. Chub mackerel similarly migrate along the southern African West Coast reaching South-Western Cape waters between April and August. They move inshore in June and July to spawn before starting the return northwards offshore migration later in the year. Their abundance and seasonal migrations are thought to be related to the availability of their shoaling prey species (Payne & Crawford 1989).

Figure 11: Cape fur seal preying on a shoal of pilchards (left). School of horse mackerel (right) (photos: www.underwatervideo.co.za; www.delivery.superstock.com).

The structure of the nearshore and surf zone fish community varies greatly with the degree of wave exposure. Species richness and abundance is generally high in sheltered and semi-exposed areas but typically very low off the more exposed beaches (Clark 1997a, 1997b).

The surf-zone and outer turbulent zone habitats of sandy beaches are important nursery habitats for marine fishes (Modde 1980; Lasiak 1981; Clark *et al.* 1994). However, the composition and abundance of the individual assemblages is heavily dependent on wave exposure (Clark 1997a, b). Surf-zone fish communities off the South African West Coast have relatively high biomass, but low species diversity. Typical surf-zone fish include harders (*Liza richardsonii*), white stumpnose (*Rhabdosargus globiceps*), Cape sole (*Heteromycteris capensis*), Cape gurnard (*Chelidonichthys capensis*), False Bay klipfish (*Clinus latipennis*), sandsharks (*Rhinobatos annulatus*), eagle ray (*Myliobatis aquila*), and smooth-hound (*Mustelus mustelus*) (Clark 1997b).

Fish species commonly found in kelp beds off the West Coast include hottentot *Pachymetopon blochii* (Figure 12, left), twotone fingerfin *Chirodactylus brachydactylus* (Figure 12, right), red fingers *Cheilodactylus fasciatus*, galjoen *Dichistius capensis*, rock suckers *Chorisochismus dentex,* maned blennies *Scartella emarginata* and the catshark *Haploblepharus pictus* (Sauer *et al.* 1997; Brouwer *et al*. 1997; Branch *et al*. 2010).

Figure 12: Common fish found in kelp beds include the Hottentot fish (left, photo: commons.wikimedia.org) and the twotone fingerfin (right, photo: www.parrphotographic.com).

3.3.4 Seabirds

Important seabirds in the Table Bay area include the African penguin *Spheniscus demersus* (Figure 13, left) and the Bank cormorant *Phalacrocorax neglectus*. Both species are endemic to southern Africa and are classified as 'Endangered' under the International Union for the Conservation of Nature (IUCN) criteria. African Penguins re-colonised Robben Island in 1983 after an absence of about 180 years. Numbers of penguins have increased from nine pairs in 1983 to over 4,000 pairs in 1996. Today the island harbours the 3rd largest penguin colony, with the breeding population in 2000 comprising 5,705 pairs (Crawford *et al.* 2000). Numbers of breeding pairs peaked in 2004 at 8,524, but have declined again to 1,364 in 2013 (www.dict.org.za) reflecting the global decline of the species. The location of the breeding colonies is shown in Figure 14. Recent satellite tracking research has shown that penguins forage mainly to the east and south of the island making them particularly vulnerable to oil spill associated with vessel traffic in and out of the Port of Cape Town (http://penguin-tracks.blogspot.com) (Figure 15).

Figure 13: The African Penguin (Left, photo: Klaus Jost) and African Black Oystercatcher (Right, photo: patrickspilsbury.blogspot.com) nest on Robben Island.

Figure 14: Current African Penguin nesting sites (yellow shading) on Robben Island from DEA 2013 Census Data. Penguin highways (blue) in the vicinity of the proposed sewage package plant (red) and existing discharge pipeline (white) are also shown (source: P. Barham, HH Wills Physics Laboratory, pers. comms; Sherley et al. 2014)

Figure 15: Foraging tracks of three African Penguins tracked in Table Bay in August 2013 (Source: penguin-tracks.blogspot.com).

The island also holds the largest numbers of breeding Bank Cormorant *Phalacrocorax neglectus* in the Western Cape (120 pairs in 2000) (Crawford *et al.* 2000) and significant populations of Crowned Cormorant *Phalacrocorax coronatus,* African Black Oystercatcher *Haematopus moquini* (35 breeding pairs in 2000) (Figure 13, right), Hartlaub's Gull *Larus hartlaubii* and Swift Tern *Sterna bergii*. Bank Cormorants breed on the Faure Jetty as well as on the breakwater of Murray Harbour (Figure 16). Although Swift terns and Hartlaub's gulls have been recorded breeding on the Faure Jetty and about 600 m South of Sobukwe House, these species tend to move to new breeding locations each year.

Figure 16: Bank and Crowned cormorants nesting on the Murray Harbour breakwater.

Historically, Robben Island supported huge numbers of seabirds. The high level of human-induced disturbance and activity has, however, resulted in several species abandoning breeding there. Nonetheless, the island still remains an extremely important conservation area for seabirds. If management measures are successful in directing tourism activities away from sensitive seabird areas, it is expected that many breeding seabirds will return.

3.3.5 Marine Mammals

Thirty three species of cetaceans (dolphins and whales) are known (based on historic sightings or strandings records) or likely (based on habitat projections of known species parameters) to occur in the waters off the southwestern Cape. Apart from the resident species such as the endemic Heaviside's dolphin and dusky dolphin, the southern Benguela also hosts species that migrate between Antarctic feeding grounds and warmer breeding ground waters, as well as species with a global distribution. Table 2 lists those resident, semi-resident and migrant cetaceans likely to be sighted in Table Bay and around Robben Island (Best 1981; Findlay *et al.* 1992). A brief review of the distribution and seasonality of the key cetacean species likely to be found within the project area is provided below.

Table 2 .

Table 2: Common whales and dolphins found in inshore waters of the Southern African West Coast (from Lane & Carter 1999).

Common Name	Scientific Name	IUCN Conservation Status
RESIDENT		
Heaviside's dolphin	*Cephalorhynchus heavisidii*	Data Deficient
Dusky dolphin	*Lagenorhynchus obscurus*	Data Deficient
Common dolphin	*Delphinus delphis*	Least Concern
Killer whale	*Orcinus orca*	Data Deficient
Bryde's whale	*B brydei (subspp)*	Data Deficient
SEMI-RESIDENT/MIGRANT		
Humpback whale	*Megaptera novaeangliae*	Least Concern
Southern Right whale	*Eubalaena australis*	Least Concern

Two genetically and morphologically distinct populations of Bryde's whales live off the coast of southern Africa; and "offshore population" and an "inshore population" (Best 2001; Penry 2010). The "offshore population" lives beyond the shelf (>200 m depth) off west Africa and is unlikely to occur in Table Bay. The "inshore population" occurs on the continental shelf and Agulhas Bank ranging from ~Durban in the east to at least St Helena Bay off the west coast. This species is unique amongst baleen whales in the region by being non-migratory.

The most abundant baleen whales in the Benguela are southern right whales and humpback whales (Figure 17). In the last decade, both species have been increasingly observed to remain in the Cape Columbine – Yzerfontein area well after the 'traditional' South African whale season (June – November) into spring and early summer (October – February) where they have been observed feeding in upwelling zones, especially off Saldanha and St Helena Bays (Barendse *et al.* 2010, 2011; Mate *et al.* 2011). It was previously thought that whales feed only rarely while migrating (Best *et al.* 1995), but these localised summer concentrations suggest that these whales may in fact have more flexible foraging habits.

Figure 17: The Humpback whale (left) and the Southern Right whale (right) are the most abundant large cetaceans occurring along the southern African West Coast (Photos: www.dive-photoguide.com; www.aad.gov.au).

The majority of humpback whales passing through the Benguela are migrating to breeding grounds off tropical west Africa, between Angola and the Gulf of Guinea (Rosenbaum *et al.* 2009; Barendse *et al.* 2010). Animals migrating north strike the coast at varying places mostly north of St Helena Bay (South Africa) resulting in increasing whale density on shelf waters as one moves northwards. On the southward migration, many humpback whales follow the Walvis Ridge offshore then head directly to high latitude feeding grounds, while others follow a more coastal route (including the majority of mother-calf pairs) possibly lingering in the feeding grounds off west South Africa in summer (Elwen *et al.* 2013, Rosenbaum *et al.* in press). Therefore, although humpbacks migrate through the Benguela, there is no evidence of a clear 'corridor' and whales appear to be spread out widely across the shelf and into deeper pelagic waters, especially during the southward migration (Barendse *et al.* 2010; Best & Allison 2010; Elwen *et al*. 2013). Abundance estimates in 2005 put the number of animals in the west African breeding population to be in excess of 9,000 individuals (IWC 2012) and it is likely to have increased by about 5% per annum since this time at (IWC 2012). Humpback whales are thus likely to be frequently encountered in Table Bay, with numbers peaking in July – February associated with the breeding migration and subsequent feeding in the Benguela.

The southern African population of southern right whales historically extended from southern Mozambique (Maputo Bay) to southern Angola (Baie dos Tigres) and is considered to be a single population within this range (Roux *et al.* 2011). The most recent abundance estimate (2008) estimated the population at ~4,600 individuals including all age and sex classes, which is at least 23% of the original population size (Brandaõ *et al.* 2011). As the population is continuing to grow at ~7% per year (Brandaõ *et al.* 2011), the population size in 2013 would number more than 6,000 individuals. When the population numbers crashed, the range contracted down to just the south coast of South Africa, but as the population recovers, it is repopulating its historic grounds including Namibia (Roux *et al.* 2001) and Mozambique (Banks *et al.* 2011). Southern right whales are seen regularly in the nearshore waters of the West Coast (<3 km from shore), extending north into southern Namibia (Roux *et al.* 2001, 2011). Right whales have been recorded off the West Coast in all months of the year, but with numbers peaking in winter (June - September).

Killer whales have a circum-global distribution being found in all oceans from the equator to the ice edge (Best 2007). They occur year round in low densities off western South Africa (Best *et al.* 2010). Killer whales are found from the coast to deep open ocean environments and may thus occasionally be encountered at low levels in Table Bay.

The common dolphin is known to occur offshore in West Coast waters (Findlay *et al.* 1992; Best 2007), but the extent to which they will be encountered is likely to be low. Group sizes of common dolphins can be large, averaging 267 (± *SD* 287) for the South Africa region (Findlay *et al.* 1992). They are more frequently seen in the warmer waters offshore; seasonality is unknown.

Dusky dolphins (Figure 18, right) are likely to be the most frequently encountered small cetacean in Table Bay as they are very "boat friendly" and often approach vessels to bowride. The species is resident year round throughout the Benguela ecosystem in waters from the coast to at least 500 m deep (Findlay *et al.* 1992). Although no information is available on the size of the population, they are regularly encountered in near shore waters between Cape Town and Lamberts Bay (Elwen *et al.* 2010a; NDP unpubl. data) with group sizes of up to 800 having been reported (Findlay *et al.* 1992). Dusky dolphins are resident year round in the Benguela.


Figure 18: The endemic Heaviside's Dolphin Cephalorhynchus heavisidii (left) (Photo: De Beers Marine Namibia), and Dusky dolphin Lagenorhynchus obscurus (right) (Photo: scottelowitzphotography.com).

Heaviside's dolphins (Figure 18, left) are relatively abundant in the Benguela ecosystem with in the region of 10,000 animals estimated to live in the 400 km of coast between Cape Town and Lamberts Bay (Elwen *et al.* 2009). Individuals show high site fidelity to small home ranges, 50 - 80 km along shore (Elwen *et al*. 2006). This species occupies waters from the coast to at least 200 m depth, (Elwen *et al.* 2006; Best 2007), and may show a diurnal onshore-offshore movement pattern (Elwen *et al*. 2010b), although this varies throughout the species range. Heaviside's dolphins are resident year round.

The Cape fur seal (*Arctocephalus pusillus pusillus*) (Figure 19) is the only species of seal resident along the west coast of Africa, and is common in Table Bay. Vagrant records from four other species of seal more usually associated with the subantarctic environment have also been recorded: southern elephant seal (*Mirounga leoninas),* subantarctic fur seal (*Arctocephalus tropicalis),* crabeater *(Lobodon carcinophagus)* and leopard seals (*Hydrurga leptonyx)* (David 1989). A non-breeding population has established itself in the Port of Cape Town, and the northern shores of Robben Island are occasionally used as a haul-out site. The nearest breeding colonies are at Seal Island in False Bay and at Robbensteen between Koeberg and Bok Punt just to the north of Table Bay (Wickens 1994).

Seals are highly mobile animals with a general foraging area covering the continental shelf up to 120 nautical miles offshore (Shaughnessy 1979), with bulls ranging further out to sea than females. The timing of the annual breeding cycle is very regular occurring between November and January. Breeding success is highly dependent on the local abundance of food, territorial bulls and lactating females being most vulnerable to local fluctuations as they feed in the vicinity of the colonies prior to and after the pupping season (Oosthuizen 1991).

Figure 19: Colony of Cape fur seals *Arctocephalus pusillus pusillus* (Photo: Dirk Heinrich).

3.4. Resources, and Commercial and Recreational Fisheries

Robben Island is located within the West Coast Rock Lobster Sanctuary which extends from Melkbos Point to "Die Josie" near Chapmans Peak and extend 12 nautical miles seawards of the high water mark. Furthermore, the marine environment around Robben Island is protected within a one nautical mile buffer zone around the island. It is legally protected as a National Heritage Site through the National Environmental Management Act (Act No 107 of 1998); National Environmental Management: Biodiversity Act (Act No 10 of 2004); and the National Environmental Management: Protected Areas Act (Act No 57 of 2003) (amongst others). Protection in terms of the latter implies that mining or prospecting will be completely prohibited from taking place within the buffer zone.

Despite the one nautical mile exclusion zone around the island, and its inclusion in the West Coast Rock Lobster Sanctuary, the waters around the island have for many years been targeted by rock lobster and abalone poachers, and consequently these populations have been severely depleted. Nonetheless an annual Total Allowable Catch (TAC) of 20 tons is currently still allocated to the commercial harvest of abalone in Zone F around Robben Island (Rob Tarr, DAFF, pers. comm.), with Zone E (Cape Point to Table Bay) and Zone G (Blouberg to St Helena) set at 12 tons and 18 tons, respectively. The total TAC for all areas for the 2012/13 season was 150 tons.

Several other fisheries operate in the adjacent waters of Table Bay and some important resources occur in Table Bay. The Bay supports a small commercial linefishery for hottentot (*Pachymetopon blochii*) (Pulfrich and Griffiths 1988) and large numbers of snoek (*Thyrsites atun*) are also sometimes caught in the bay (M. Griffiths, Linefish Section, MCM, pers. comm).

A large white mussel (*Donax serra*) population occurs at Big Bay just north of the rocky shores at Blouberg (Farquhar 1995), and on the northern end of Milnerton Beach (P. Nel, Marine Biology Research Unit, UCT, pers. comm.). The white mussel is harvested recreationally for bait and represents an important resource in the area. Along the West Coast, the mussel has a typical distribution pattern according to size, from small to large down the beach from the mid-water to the low-water mark and below. A large portion of the adult stock is usually located subtidally (De Villiers 1975, Donn 1990, Farquhar 1995). It was estimated that on a stretch of 900 m along Bloubergstrand 15.8 tons of white mussel were collected annually (Farquhar 1995).

3.5. Unique Biodiversity Resources

The benthic communities in Table Bay and around Robben Island are typical for the West Coast, and cannot therefore be classified as locally, regionally or internationally unique biodiversity resources. This similarly applies to the pelagic fish and marine mammals occurring in Table Bay, as these are widespread throughout the South African west (and south) coast. Table Bay itself also does not appear to be critically important as either a foraging or breeding area for these fauna.

The resident seabird community on Robben Island is a strong exception to this, especially the endemic African penguin and Bank cormorant. It is estimated that approximately 36% of the global population of penguins forage in continental shelf waters adjacent to Table Bay. These birds come from the breeding sites at Dassen and Robben Islands and, to a lesser extent, Boulders Beach in False Bay. Robben Island is an important breeding site for Bank Cormorants as it represents the third largest breeding colony for this species. Both of these species have undergone severe declines in population size over the last century and are currently classified as ‘endangered’ under the IUCN criteria (Crawford *et al*. 1998). Both species are seriously at risk from oil spills, and due to their population size, endemism and conservation classification represent internationally significant biodiversity resources.

4. EXISTING ENVIRONMENTAL IMPACTS

Because of its physical isolation, Robben Island has been used as a place of punishment and segregation for over 300 years (Hart 2002). Furthermore, at least 72 shipwrecks from thirteen flag states, dating from the early 17th century to date, are reported in the water around the island (Werz 1993). The environment on and around the island is thus not pristine and the existing environmental impacts in the marine environment must be taken into consideration when assessing the potential impacts of the marine outfall. Some of these are discussed briefly below.

4.1. Faure Jetty and Murray's Bay Harbour

The area where the harbour is today was originally a sheltered bay and landing area, used by the Dutch East India Company when establishing its first structures on the island in *circa* 1654. The abandoned buildings were later used by John Murray as a base for his whaling operation. During the 19th and early 20th centuries the human habitation became concentrated primarily on the southeast end of the island, where it was serviced by a series of jetties. The Faure Jetty, which was built in 1896 survives to this day (Figure 20, left). Although, it has become too unstable for safe human use, it is used as a roosting area by a variety of birds. It also supports the brine discharge pipeline from the island's desalination plant.

Construction of the Murray Bay harbour commenced in 1940 and involved substantial reclamation of a large portion of Murray Bay and the building of two breakwaters to create a sheltered harbour, the basis of that which exists today (Figure 20, right). The breakwaters serve as an important roosting and nesting site for Bank Cormorants and Cape Cormorants, amongst others (http://the-conservationist.blogspot.com).

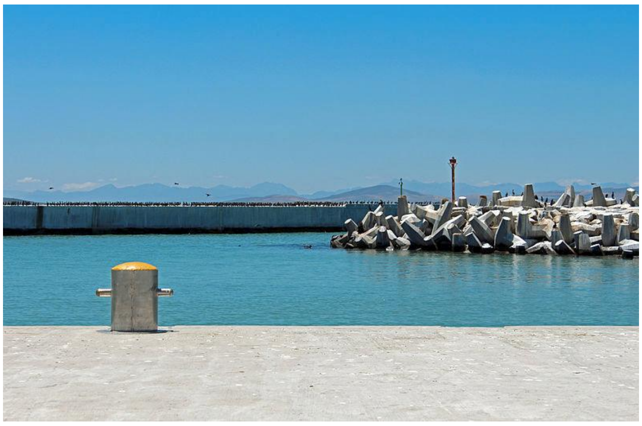



Figure 20: The old Faure Jetty (Left, photo: www.culturalheritagevalues.com) and the new Murray's Harbour and breakwaters (right, photo: www.commons.wikimedia.org).

4.2. Sewage Plant and Marine Outfalls

Prior to the visitor upgrades initiated in 1998, the waste water handling system on the island consisted of a collection system, septic tanks and outfall sewers. With the exception of one which disposed directly into Murray's Bay Harbour, the outfalls were constructed to discharge into the sea at depth along the eastern coast of the island. However, as a result of storm damage, all of these ‘deep water’ outfalls, bar the one in the penguin area to the north of the harbour, drained into intertidal rock pools and onto the beach at low tide (Figure 21). Furthermore, excessive sludge build-up and corrosion of the septic tanks were resulting in blockages and bypassing, with uncontrolled outflows frequently occurring leading not only to human health risks but localised pollution of the marine environment (Eco-Africa 1998).

Figure 21: Some of the old sewage discharge pipelines discharging into the intertidal area on the eastern shore of Robben Island.

To address these issues and cater for higher visitor numbers, the island’s waste water handling facilities were upgraded in 2001 and the current marine outfall was constructed. The marine outfall was initially designed to discharge an effluent comprising *untreated sewerage* (and third sections with a single 110 mm port discharging horizontally to alternate sides of the main diffuser pipe thereby ensuring optimum hydraulic behaviour of the effluent. It must be emphasised that the current discharge was designed to comply with the

Table 1), as well as a brine effluent from a desalination plant (see below). To ensure adequate dilution the outfall was designed with a 10-m long diffuser discharging at a depth of 7.0 – 7.5 m, ~460 m offshore and ~250 m beyond the seaward edge of the kelp bed (WamTech & Roussouw 1999). Discharges were anticipated to be intermittent and in the order of 25 l/s, with peak discharges of 50 l/s. The maximum expected velocity of effluent exiting the diffuser ports was 1.09 m/s. The seaward section of the pipeline traverses mostly rocky seabed, with the last 300 m of the pipe crossing the intertidal being buried in patches of shelly sand, gravel and boulders. The diffuser is located on rocky substratum overlaid with sand. The pipeline is held in position by concrete collars and is encased in a concrete blanket over its entire length (Prochazka 2003).

At the time of its design, it was predicted that compliance of the effluent with water quality guidelines for direct contact recreation would be achieved within 1 km of the discharge location, and that suspended solids would be reduced to 5 mg/l above ambient within 200 m of the discharge (WamTech & Roussouw 1999). In 2004, however, the impacts of the marine sewer outfall were recognised as one of the threats to the Robben Island World Heritage site, which if not adequately managed or controlled could adversely impact on the integrity of the area (http://whc.unesco.org/en/soc/1432). Although improvement in the management of water-borne sewage by the Department of Public Works (DPW), owner of the property, were noted in 2009 (http://whc.unesco.org/en/soc/659), monitoring of the effluent indicated that values of ammonia (as nitrogen), chemical oxygen demand (COD) and suspended solids were significantly above DWAF requirements within 100 m from the outlet. Furthermore, values for various trace metals (copper and zinc) were also well in excess of General Waste Water Limits (GWWLs) as well as DWAF and international water quality guidelines. When compared with the GWWLs the effluent was significantly non-compliant particularly with regards to feacal coliform bacteria and chlorine. For chlorine in particular, values were several orders of magnitude above limits as far as 100 m from the outfall. It can therefore be expected that marine communities in the vicinity of the outfall have been impacted to at least some degree by the effluent discharged since 2001.

4.3. Desalination Plant

Fresh water on the island was initially supplied by springs, but with increased water demand at the turn of the century, boreholes were drilled to exploit groundwater resources. However, due to individual boreholes being pumped at too high a rate, seawater intrusion of the underlying aquifer system occurred. To overcome the problem of gradually deteriorating groundwater quality, a groundwater treatment plant was installed in the mid-1980s to treat the brackish water by reverse osmosis. A new reverse osmosis desalination plant was installed in 1998 to replace the dysfunctional groundwater treatment plant. The feedwater intake pipe for the plant is located near Ladies' Rock on the southeast side of the island. With implementation of the sewage outfall, the intention was to discharge the brine through the waste water effluent outfall. Although available waste water quality analyses (2010 – 2012) suggest that the brine (containing significant concentrations of chlorine) was discharged with the sewage effluent at that stage, this has been discontinued. The discharges of the past are, however, expected to have had some degree of impact on marine communities in the vicinity of the discharge. The brine is currently being discharged through a pipeline routed along the old Faure Jetty, with the only co-pollutants in the brine being an organic, and readily biodegradable, scale inhibitor (M. Gildenhuys, pers. comm.). The discharge is located above the sea surface to enable mixing and dispersion.

4.4. Current Pollution Status of Table Bay

Table Bay serves as a safe anchorage for tankers and container vessels waiting to enter the Port of Cape Town. The shores of Robben Island are thus prone to the accumulation of marine litter disposed of through the emptying of ships' bilges, material discarded into the sea along the coastline of Table Bay and from fishing boats. The Island is also vulnerable to operational spills from nearby anchored or passing vessels, as well as vessels that may become wrecked within the Bay

Table Bay receives effluents and contaminants from a number of point source outfalls (Figure 1). These range from sewage and industrial pipelines, through point and diffuse stormwater outfalls, spillages and discharges from shipping associated with the Port of Cape Town, to atmospheric deposition (Henry *et al*. 1989; Bartlett *et al*. 1988; Monteiro 1997). In 1993 it was reported that ~30,000 m^3 of domestic sewage effluent was discharged daily from the Green Point outfall (Quick & Roberts 1993). Volumes are likely to have increased since then. In addition, there are minor outflows from the Salt and Diep Rivers, and from shipping. Monteiro (1997) tracked deposition of sewage derived organic matter in Table Bay sediments on the basis of organic carbon and stable isotope ratios of carbon and nitrogen. Results showed that organic carbon content in sediments were low (<0.1% in bulk sediments), with areas of highest concentrations characterised by marine rather than terrestrial (=plant plus sewage) derived carbon and nitrogen. Terrestrial derived organic matter was restricted to nearshore areas adjacent to the Salt and Diep river mouths where sediment organic carbon concentrations were particularly low due to continuous advection out of the system by wave driven currents.

The low organic enrichment concurs with the absence of any significant depositional area characterised by fine sediments (< 63 µm silts and clays) in Table Bay, the general paucity of sediment in the system (Woodborne 1983), and the apparent short residence time of surficial sediment in Table Bay (2-3 years, Monteiro 1997). There was thus little biogeochemical evidence to support the contention that Table Bay was, or is, being negatively impacted by sewage discharged from the Green Point outfall. However, there are indications that the bay is more exposed to water quality problems emanating from the Salt and Diep rivers.

Table Bay currently hosts one industrial outfall located on the eastern side of the bay, which discharges 2,625 m^3/day from the Chevron refinery (Quick & Roberts 1993). The outfall discharges trace metals into Table Bay, and occasionally also releases relatively large amounts of oil and grease (~ 9.5 tons/year). Recent upgrades to the waste water treatment plant has, however, greatly improved the quality of the outfall. A second outfall, which had discharged 1,300 m^3/day from the Kynoch fertilizer plant was discontinued in the early 2000s due to closure of the plant. Other sources of trace metals are the Salt and Diep Rivers, the Green Point sewage outfall, and the Port of Cape Town. Bartlett et al. (1985) calculated the supply of the trace metals copper, cadmium and lead to be 16,000, 1,000 and 7,000 kg/year, respectively. Despite these large inputs there was no convincing evidence of trace metal accumulation in Table Bay sediments (Monteiro 1997), and in most cases values were well below ANZECC (2000) sediment quality guideline trigger values for the protection of benthos. The biological communities would thus unlikely be negatively impacted by these contaminants. It appears that trace metal contaminants are transported out of Table Bay more or less at the same rate they are supplied. Only limited data exist on water column trace metal concentrations (Bartlett *et al*. 1985), which suggest that, on the whole, the water mass in Table Bay does not contain significantly elevated trace metal concentrations from discharged industrial effluents.

Trace metal distribution maps did, however, indicate areas of elevated concentrations, notably high copper concentrations at the Green Point outfall, peaks in cadmium associated with the Chevron and Green Point outfalls, and two areas of elevated concentrations of lead. Water column trace metal concentration data for Table Bay are limited (Bartlett *et al.* 1985), but distribution maps indicated that highest concentrations were generally distributed nearshore particularly around the Green Point – Harbour – Salt and Diep River and towards Blouberg, probably as a result of the outfalls in the area. With few exceptions (mercury at the Green Point outfall), concentrations were all below target values for the beneficial use of the maintenance of marine ecosystems (DWAF 1995).

Over the period August 1991 to October 1999, 11 spills or discharges of oils from shipping were recorded in Table Bay (MCM, unpublished data). The estimated total volume discharged into the sea was 135 tonnes with an average spill size of 12.3 tonnes and an average occurrence of 1.4 spills/year. These spill data are, however, probably an underestimate of the actual frequency of discharges of oil by shipping as the observations are limited in time and space, are solely conducted during daylight and due to budgetary constraints. Deliberate 'illegal' discharges of oils made at night would thus go undetected. Unfortunately more recent spill data could not be sourced. Further sources of hydrocarbons to the Bay were from storm water runoff (Mason 1988). Such minor spills and discharges are relatively small when compared with larger spills associated with sinking of vessels immediately outside of Table Bay such as the 'Apollo Sea' (June 1994, ~2,600 tonnes) and ‘MV Treasure' (June 2000, ~1,260 tonnes). Nonetheless, they contribute to chronic oiling of the coastline, and specifically African penguins.

Marine pollution can be traced by investigating pollution impacts on specific species or species groups. For example, trace metal and hydrocarbon burdens in mussels collected from sites distributed around Table Bay have been measured regularly since 1985 by DAFF as part of their 'mussel watch' programme. Due to differential uptake and elimination rates mussels can bioaccumulate inorganic (trace metals) and organic (hydrocarbons) contaminants, and body burdens represent a time-integrated estimate of environmental contaminant levels. The mussel flesh trace metal concentrations throughout Table Bay are indicative of trace metal pollution in the system when compared to non-industrialised areas in South Africa, and internationally (Widdows & Donkin 1992; Fowler 1990). Whereas levels of lead in mussel tissue have declined since 1985, zinc and cadmium levels appear to be increasing.

Another species, which is well researched and reported on in terms of oil pollution, is the African penguin (Crawford *et al*. 2000, amongst others). The effect of oiling on penguins (and seabirds in general) primarily results in the death of adults through hypothermia during foraging, decreased breeding success due to oiling of one or both parents during egg incubation and/or chick rearing, and mortalities of fledged juveniles during first excursions to the sea around breeding sites. Oiled penguins can be cleaned and rehabilitated, but their breeding success may be reduced by 30% compared to unoiled birds (Avian Demography Unit, University of Cape Town, unpublished data).

5. SOURCES OF RISK TO THE MARINE ENVIRONMENT FROM SEWAGE DISCHARGES

The waste water handling facilities on Robben Island were upgraded in 2001. The outfall design included a diffuser to ensure adequate dilution of the effluent. Not long afterwards, however, the marine sewer outfall and its associated marine impacts was recognised as a major threat to the integrity of the Robben Island World Heritage site. The current proposed upgrade to the waste water treatment plant will alleviate many of the issues previously surrounding the disposal of untreated sewage to the marine environment. However, for the sake of completeness the impacts associated with the discharge of raw sewage are discussed briefly below.

Disposal of primary treated (screening, de-gritting, removal of floatables and primary sedimentation) sewage into the marine environment through deepwater outfalls is a relatively common practice, particularly for larger coastal cities (Port Said: UNEP 1991; Hong Kong: Smith-Evans & Dawes 1996; Durban: Bailey 2000; Boston: Signell *et al*. 2000; Cubatão: Braga *et al.* 2000; Athens: Siokou-Frangou *et al*. 2009; amongst others). The discharge of domestic waste water and consequent deterioration of water quality is one of the most significant threats to coastal environments worldwide (GPA 2001), with adverse effects on public health, socio-economics, food quality and security, aesthetics and marine ecology being well documented (Luker & Brown 1999; Danulat *et al*. 2002; WHO 2003).

The potential deleterious effects of pollutants in sewage effluents on the receiving water quality are diverse, and depend on the discharge volume, the nature of the discharge and its chemical composition. Untreated sewage typically comprises water, nutrients (nitrogen and phosphorus), suspended solids (including organic matter), and pathogens (e.g. bacteria, viruses and protozoa). Other constituents that may be present include intestinal worms and parasites, oils and greases, runoff from streets, parking lots and roofs, heavy metals (including mercury, cadmium, lead, chromium, copper), and toxic chemicals (e.g. PCBs, PAHs, pesticides, phenols and chlorinated organics).

Effects of sewage pollution on marine biota occur at the cellular, individual, population and community levels of organisation, with the majority of studies documenting effects at the community level (Underwood & Peterson 1988). Pearson and Rosenberg (1978) developed a conceptual framework on how benthic communities respond to organic enrichment. Different assemblages of benthic macroinvertebrates develop along an organic enrichment gradient, according to distance, or time, from the source of organic input or enrichment. Sediments close to the source are virtually devoid of macrofauna. Moving further away from the discharge point, the establishment of numerous small opportunistic, pollution-tolerant species results in an increase in abundance and biomass. Beyond the highly enriched areas, abundance of opportunistic species decreases in favour of a higher diversity of species, which form a second biomass peak. In areas unaffected by the discharge, species numbers and biomass decline to normal levels for unpolluted waters. Spatially, impacts may be restricted to the immediate vicinity around the outfall (May 1985; Fairweather 1990; Underwood *et al*. 1990, 1992; Koop & Hutchings 1996), but in other cases may extend for several kilometres (Gray 1996; Raimondi & Reed 1996; Costanzo *et al*. 2001; Savage *et al*. 2002). Impacts may, however, also have temporal components, which may be short-lived 'pulses', or prolonged events.

5.1. Nutrients

The abnormally high inputs of dissolved inorganic nutrients (e.g. phosphorus and nitrogen) typical of sewage effluents, usually lead to eutrophication. The excessive algal growth can take the form of phytoplankton blooms, which can limit the sunlight available to other primary producers (Pastorok & Bilyard 1985; Mitchell 1998; see also Warwick 1993 for review). However, since silica does not increase simultaneously, the ratio of nutrients is altered, thereby influencing phytoplankton species composition and succession (Meyer-Reil & Köster 2000). Species of algae that do not require silica dominate, and diatoms requiring silica are discriminated against. Such alterations in the ratio of macronutrients are thought to be responsible for the occurrence of toxic algal blooms in nutrient enriched environments (Meyer-Reil & Köster 2000). Certain dinoflagellate and diatom species can be either directly toxic to fish, or can accumulate in filter-feeders, which if eaten, can cause gastrointestinal disorders or paralytic shellfish poisoning in man (O'Sullivan 1971). When the blooms decay the increased oxygen demand can result in the development of anoxic conditions, with potentially devastating effects on other marine life (Matthiessen & Law 2002).

Similarly, the increased nutrients can cause a decline in cover of large foliose macro-algae and an increase in cover of ephemeral green and blue-green algae (Littler & Murray 1975, 1978; Kindig & Littler 1985; May 1985; Fairweather 1988; Lopez-Gappa *et al.* 1990; Soltan *et al*. 2001), which in turn can result in a reduction in algal biodiversity due to dominance by certain species (Borowitzka 1972; Pastorok & Bilyard 1985; Smith 1996; Bishop *et al*. 2002; Terlizzi *et al*. 2002). Increased cover of ephemeral algae in turn can lead to increased abundances of invertebrate grazers (Bishop *et al*. 2002). Roberts (1996) and Roberts *et al.* (1998) reported significant reductions in foliose and crustose algae and sponges around a sewage outfall, where despite no significant decline in overall cover of total fauna, the community changed from one where algae and sponges dominated to one dominated by silt and ascidians. Similar sewage-induced shifts have been described for kelp holdfast communities, which changed from a community dominated by omnivorous biota, to one dominated by bivalve and ascidian suspension feeders (Smith 1996; Smith & Simpson 1992, 1993; Roach *et al*. 1995; but see also Littler & Murray 1978; Fairweather 1990; Chapman *et al.* 1995). In contrast, Fairweather (1988) and Lopez-Gappa *et al*. (1990) reported a decline in the abundances of ascidians and mussels, respectively, in polluted intertidal areas. Changes in the variability of impacted communities, however, appear to depend on the spatial scale investigated (Fairweather 1990; Chapman *et al*. 1995).

In some case, however, high availability of dissolved organic carbon and nutrients close to the sewage outfalls favour bacterial production rather than primary production as well as the abundance of ciliates preying upon bacteria (Saridou *et al*. 2009; Zeri *et al*. 2009). Particularly in the Eastern Mediterranean, areas affected by the effluents tend to be dominated by microbial food webs.

Point-source sewage outfalls can result in the development of a dynamic and diverse fish community in the vicinity of the discharge (Bailey 2000; Guidetti *et al*. 2002, 2003). Whereas in some cases increases in diversity and abundance were reported (Russo 1982; Grigg 1994; Hall *et al*. 1997; Guidetti *et al*. 2002), in others a significant decline in species richness occurred (Smith *et al*. 1999). These apparently contradictory results can be explained by differences in effluent volumes, the type of pre-treatment of the product, the nature of pollutants discharged, and concentrations of dissolved and particulate organic matter in the effluent. In the Mediterranean, sewage effluent was found to affect the total abundance and density of several ecological categories of shallow-water reef fishes, as well as altering the aggregation patterns and spatio-temporal structures of the fish assemblages (Guidetti *et al*. 2002). Sewage can also affect the mortality, fecundity and size of fish, lead to toxic effects and alter behavioural responses (Gray 1989; Adams *et al*. 1993; EPA 1993a).

Sewage plumes from point-source outfalls can also cause significant degradation of larval habitat. The early life stages of fishes are particularly vulnerable to nutrient enrichment and pollutants, with potential effects ranging from changes in the species composition and abundance of larval fish, susceptibility to infections and deformities, to mortality (Arfi et al. 1981; Gray 1996; Gray *et al.* 1996; Kingsford & Gray 1996). As larvae can be swept into sewage plumes by longshore currents from great distances, a significant proportion of offspring from local populations may be affected. Any pollution-related impacts on survivorship of larvae could in turn affect subsequent year-class strength, particularly if the species is of commercial or recreational importance (Gray *et al*. 1996; Kingsford *et al*. 1996).

5.2. Organic Matter

The disposal of raw sewage typically also results in objectionable floating matter, an increase in suspended solids and a concomitant increase in turbidity. Increased turbidity in turn can negatively effect primary productivity. Furthermore, the decomposition of high organic loads require a high oxygen demand thereby influencing the dissolve oxygen concentration in near-bottom waters and in the sediments themselves (Matthiessen & Law 2002).

Sublittoral soft-bottom habitats are especially vulnerable to sewage input, principally in relation to three main sedimentological factors: organic matter, silt content, and degree of oxygenation (Cardell *et al*. 1999). As their associated communities respond well to anthropogenic disturbances, most of the studies undertaken to date on sewage effects on marine environments concern soft-bottom benthic assemblages (e.g. Pearson & Rosenberg 1978; Diener *et al*. 1995; Estacio *et al*. 1997; Cardell *et al*. 1999). Organic enrichment of unconsolidated habitats by sewage discharges may result in changes in the abundance, biomass and diversity of benthic macrofauna (Pearson & Rosenberg 1978), bioaccumulation of organic and inorganic compounds (Phillips 1977, 1978) and alteration of trophic interactions among species, with potential cascade effects on higher order consumers (Otway 1995; Otway *et al*. 1996 and references therein). In cases of extreme pollution (and hypoxic or anoxic conditions), low diversity pollutant tolerant communities will replace more sensitive communities (Cardell et al. 1999; Savage et al. 2002; Siokou-Frangou *et al*. 2009; Trevor et al. 2010). These communities are often dominated by surface and sub-surface deposit feeders (Cardell *et al*. 1999).

5.3. Pathogens

Pathogenic bacteria can survive in the sea from a few days to several weeks; viruses can survive in water, fish or shellfish for several months while the hepatitis virus can remain viable in the sea for over a year (GESAMP 2001). The discharge of sewage polluted by human and animal pathogens is of particular concern in coastal area used for the cultivation of bivalves, as pathogens in the seawater can be taken up by the filter-feeders, concentrate in their tissues and thus present a potential health hazard. Where sewage is discharged near bathing beaches, the contaminated waste water can be responsible for swimming-related illnesses (Cabelli 1979).

5.4. Heavy Metals

Heavy metals associated with waste water outfalls (particularly Cd, Pb, Zn, Cr, Hg) tend to enrich in suspended material and finally in seabed sediments. Areas of restricted water exchange and unconsolidated habitats impacted by the discharge could thus be affected by heavy metal accumulation (Mitchell 1998; Nergis *et al*. 2012). Many benthic invertebrates feed on this suspended or deposited material, with the risk that metals are enriched in their bodies and passed on to higher trophic levels. Such bioassimilation and bioaccumulation of metals in aquatic organisms can have potential long-term negative implications for human and ecosystem health. Furthermore, the movement of these persistent organic pollutants within environmental compartments, and the potential for long-range transport can result in serious threats not only at the point of release, but also to organisms distant to the pollution source (Nergis *et al*. 2012).

5.5. Xenobiotic Substances

Xenobiotic substances are foreign chemicals (e.g. dioxins, organochlorides and polychlorinated biphenyls) or natural compounds (e.g. human hormones) found within organisms that are not normally naturally produced by or expected to be present within those organisms.

Treated domestic sewage discharges have been identified as a major cause of oestrogenic effects in both freshwater and marine environments (Routledge *et al*. 1998; Allen *et al*. 1999, and references therein; Atkinson *et al*. 2003). Many of the effects can be attributed to natural and synthetic oestrogenic hormones derived from glucuronide-conjugated material excreted by women and livestock. De-conjugation is thought to occur in sewage treatment works, leading to the reappearance of fully potent hormones in the environment. Generally these dilute rapidly around the discharge (Allen *et al*. 1999; Atkinson *et al*. 2003), although in some cases (e.g. alkylphenol ethoxylate surfactants and their degradation products) the substances become adsorbed to and persist in bottom sediments, thereby acting as a slow release source of oestrogenic activity and causing feminisation (vitellogenesis) in affected organisms.

As oestrogens are pervasive in the environment and resistant to bacterial degradation (Katzenellenbogen 1995), oestrogens discharged to coastal marine systems in sewage effluents could have potential physiologic or ecologic effects on marine organisms. Oestrogen-mimicking compounds in the coastal marine environment are increasingly considered environmental pollutants that disrupt basic physiologic functions in organisms. Effects (often from the picomolar range of concentrations) include blocked embryonic development (Hathaway & Black 1969; Shoemakers *et al.* 1981), altered enzymatic activities (Ghosh & Ray 1993a, 1993b), cellular damage or apoptosis (Wiens *et al*. 1999; Viarengo *et al*. 2000), reduced testicular size or spermatogenesis and production of vitellogenin in males (Richmond 1993; Harries *et al*. 1997; Robinson *et al*. 2003), skewed sex determination, poor development, and overall reduction in reproduction and recruitment (Sumpter & Jobling 1995; MacLatchy *et al.* 1997; Peters *et al*. 1997; Shurin & Dodson 1997).

Vitellogenesis in male and immature female fish is thought to cause significant metabolic stress due to the drain on energy reserves, and can also lead to kidney and liver damage and necrosis (Herman & Kincaid 1988, cited in Allen *et al*. 1999). In reality, organisms are exposed to a complex mixture of natural and synthetic compounds, which could have additive or interactive effects. Considering that many invertebrates are at the base of aquatic food chains, human-derived oestrogens in marine ecosystems could greatly affect ecosystem functioning.

5.6. Biocides (chlorine)

Chlorination is the most common form of sterilisation for secondary and tertiary treated waste waters. Chlorine is either applied in gaseous form or as hypochlorite salts, but as free and combined chloride residues are highly toxic to aquatic life, the effluent must be neutralised before it is discharged to remove all or part of the total combined chloride residues.

The chemistry associated with seawater chlorination when using chlorine-based products is complex. The reader is referred to ANZECC (2000), Lattemann & Höpner (2003) and UNEP (2008) for more details. Chlorine does not persist for extended periods in water but is very reactive. However, the chlorinated compounds, which constitute the combined chlorine, are far more persistent than the free chlorine. A major disadvantage of chlorination is the formation of organohalogen compounds. However, as only a few percent of the total added chlorine is recovered as halogenated by-products, and as by-product diversity is high, the environmental concentration of each substance can be expected to be relatively low. Dechlorination will further considerably reduce the potential for by-product formation. Nonetheless, there is some evidence that chlorinated-dechlorinated seawater increased mortality of test species and chronic effects of dechlorinated seawater were observed, which were assumed to be due to the presence of halogenated organics formed during chlorination (see UNEP 2008 for references).

Marine organisms are extremely sensitive to residual chlorine, making it a prime choice as a biocide to prevent the fouling of marine water intakes. Many of the chlorinated and halogenated by-products that are formed during chlorination are also carcinogenic or otherwise harmful to aquatic life (Lattemann & Höpner 2003). Values listed in the South African Marine Water Quality Guideline (DWAF 1995) show that 1,500 µg/ℓ is lethal to some phytoplankton species, 820 µg/ℓ induced 50% mortality for a copepod and 50% mortality rates are observed for some fish and crustacean species at values exceeding 100 µg/ℓ (see also ANZECC 2000). The lowest values at which lethal effects are reported are 10 – 180 µg/ℓ for the larvae of a rotifer, followed by 23 µg/ℓ for oyster larvae (*Crassostrea virginica*). Sublethal effects include valve closure of mussels at values <300 µg/ℓ and inhibition of fertilisation of some urchins, echiuroids, and annelids at 50 µg/ℓ. Eppley *et al.* (1976) showed irreversible reductions in phytoplankton production, but no change in either plankton biomass or species structure at chlorine concentrations greater than 10 µg/ℓ. Bolsch & Hallegraeff (1993) showed that chlorine at 50 µg/ℓ decreased germination rates in the dinoflaggelate *Gymnodinium catenatum* by 50% whereas there was no discernable effect at 10 µg/ℓ. This indicated that particularly the larval stages of some species may be vulnerable to chlorine pollution. The minimum impact concentrations reported in the South African Water Quality Guidelines are in the range 2 to 20 µg/ℓ at which fertilisation success in echinoderm (e.g. sea urchin) eggs is reduced by approximately 50% after 5 minute exposures.

5.7. Depressed Salinities

By far the greatest proportion by volume of a sewage discharge comprises fresh or brackish water, which, depending on the volume discharged, may result in a short-term decrease in salinity in the immediate vicinity of the outfall. The physical factors (salinity, light and nutrients) associated with inflow of freshwater into the marine environment affect primary productivity. Primary production and phytoplankton biomass are generally elevated near riverine plumes relative to the open-ocean waters (Dustan & Pinckney 1989; Grimes & Finucane 1991; Grimes & Kingsford 1996), with production typically increasing with the size of the plume (Grimes & Kingsford 1996). In the case of a sewage effluent containing elevated nutrient levels, increased productivity can be expected. Salinity gradients are also reported to influence the structure of phytoplankton assemblages, with salinity levels determining which taxa dominate the community. Similarly, freshwater inflows can affect zooplankton assemblage both spatially, in terms of both horizontal and vertical distributions (Kaartvedt & Nordby 1992), and temporally (Nyan Taw & Ritz 1978).

Macroalgae are typically tolerant of a wide range of salinities, but information on the effects of alterations in freshwater inflow on macroalgae, particularly habitat-forming species, is limited. Species from estuarine environments that experience frequent fluctuations in freshwater inputs are likely to be more tolerant than those from the more stable intertidal or subtidal marine environments, making predictions of the effects of freshwater input on growth and survival of macroalgae complex (Gillanders & Kingsford 2002). The effect of reduced salinities on subtidal macroalgal species will depend on the volume of inflow and the depth of the low salinity wedge (Kennelly & Underwood 1992).

Freshwater input is known to greatly influence recruitment, growth, movement, mortality and fecundity of marine invertebrates (Thomas & White 1969; Staples & Vance 1985; Roller & Stickle 1993; Jury *et al*. 1994; Rippengale & Kelly 1995; Richmond & Woodin 1996; Irlandi *et al*. 1997; Metaxas 1998; Witman & Grange 1998). Heavy mortalities of benthic invertebrates following strong pulses of freshwater inflow have been reported for starfish, molluscs, lobsters, and polychaetes (Thomas & White 1969) and sea urchins (Andrew 1991; see also Irlandi *et al*. 1997), with mortalities typically attributed to limited osmoregulatory capabilities of stenohaline organisms (Roller & Stickle 1993, Jury *et al*. 1994; see also Branch *et al.* 1990). Lobsters, however, are reportedly able to sense and avoid areas of reduced salinity by moving away from the impacted area (Roller & Stickle 1993, Jury *et al*. 1994). The benthic and pelagic stages of jellyfishes are also vulnerable to changes in salinity, with growth, asexual reproduction, strobilation and mortality rates of polypoid forms, and biomass and mortality rates of medusae being affected by reduced salinities associated with river inflow (Lu *et al*. 1989; Purcell *et al*. 1999; Kingsford *et al*. 2000).

Variations in salinity also influence developmental patterns and mortality rates of many marine invertebrate larvae (reviewed by Roller & Stickle 1993 and Richmond & Woodin 1996), with reduced salinities negatively affecting growth rates. Similarly, decreasing salinity caused declines in abundance and diversity of meiofaunal assemblages, and changes in community structure of macrofauna living in the top 2-3 cm of sediment (Coull 1988; Gillanders & Kingsford 2002).

5.8. Physical Presence of Pipelines

During the installation of an effluent pipeline any (sandy or rocky) biota in the structural footprint, is typically effectively eliminated. Furthermore, the area of seabed available for colonisation by marine benthic communities is reduced. However, the loss of substratum as a result of the effluent pipeline installation is temporary, as the pipeline and associated structures themselves provide an alternative substratum for colonising communities. Assuming that the hydrographical conditions around the structures would not be significantly different to those on the seabed, a similar community to the one on adjacent rocky seabeds can be expected to develop. Should the pipeline, however, be located primarily on unconsolidated sediments, biota developing on the structures would be significantly different from the original soft sediment macrobenthic communities.

The composition of the fouling community on artificial structures depends on the age (length of time immersed in water) and the composition of the substratum, and usually differs from the communities of nearby natural rocky reefs (Connell & Glasby 1999; Connell 2001). Colonization of hard substratum goes through successional stages (Connell & Slayter 1977). Early successional communities are characterized by opportunistic algae (e.g. *Ulva* sp., *Enteromorpha* sp.). These are eventually displaced by slower growing, long-lived species such as mussels, sponges and/or coralline algae, and mobile organisms, such as urchins and lobsters, which feed on the fouling community. With time, a consistent increase in biomass, cover and number of species can usually be observed (Bombace *et al*. 1994; Relini *et al*. 1994; Connell & Glasby 1999). Depending on the supply of larvae and the success of recruitment, the colonization process can take up to several years. For example, a community colonizing concrete blocks in the Mediterranean was found to still be changing after five years with large algae and sponges in particular increasing in abundance (Relini *et al*. 1994). Other artificial reef communities, on the other hand, were reported to reach similar numbers of species (but not densities and biomass) to those at nearby natural reefs within eight months (Hueckel *et al.* 1989.

Point-source sewage outfalls have been reported to result in the development of a dynamic and diverse macrofaunal community both along the pipeline (Diener & Riley 1996; Diener et al. 1997), and around the discharge (Bailey 2000). For example, in the Orange County Sanitation District in California the sewage outfall pipeline and associated ballast create one of the largest artificial reefs in southern California. The outfall structure altered current flow and sediment characteristics (grain size and sediment geochemistry) near the pipe, which in turn influenced the structure of the infaunal community of adjacent unconsolidated habitats. The physical structure of the pipe served as a habitat for a diversity of invertebrates and predatory fish, which preyed on the macrobenthic community in the surrounding area thereby altering its structure (Diener & Riley 1996; Diener *et al*. 1997).

5.9. Potential for Recovery

Numerous studies have investigated the change in communities following either a cessation of inshore waste water discharges (Smith *et al.* 1981; Underwood & Chapman 1996; Wilson *et al.* 1998) or the upgrade of treatment plants following the introduction of primary, secondary and tertiary treatment process (Swartz *et al*. 1986; Savage *et al*. 2002). Responses vary widely. Typically the recovery processes in the intertidal involve the recolonization of sites where macroalgae had disappeared (Hardy *et al*. 1993), a significant increase in diversity (Bokn *et al*. 1996), an increase in algal cover and a greater complexity in community stratification (Gorostiaga & Diez 1996). In some cases the trends described by Pearson & Rosenberg (1978) for communities in unconsolidated sediments reversed; pollutant tolerant species declined or disappeared resulting in a decline in abundance and biomass. The pollutant-tolerant species were replaced by the more sensitive species, which with time moved closer to outfall (Swartz *et al*. 1986). Archambault *et al.* (2001) reported a clear increase in the number of species and a decline in the cover of ephemeral green algae in the lower intertidal around a decommissioned outfall, two years following cessation of effluent discharges (see also Smith *et al*. 1981). In contrast, Soulsby *et al*. (1985) found that ephemeral algae did not decrease in abundance following the closure of a sewage discharge, but attributed this to the ambient nutrient regimen of their study area. Similarly, Underwood & Chapman (1996) could not detect significant changes in community structure of subtidal reef communities above natural heterogeneity following cessation of inshore effluent discharges, concluding that communities were possibly not stressed due to continual removal and dilution of the effluents by wave action, currents and tides.

In cases where impacts of sewage discharge had been observed over larger spatial scales, recovery of communities following introduction of further treatment of sewage prior to discharge were still measureable up to 8 years later (Soltan *et al*. 2001; Savage *et al*. (2002).

5.10. Disturbance of Nesting Seabirds during Plant Construction

Disturbance of adult birds or nesting areas during the breeding season could negatively affect reproductive success, which in turn may have significant consequences to the population size of endangered species.

The onshore activities required for the construction and installation of the proposed sewage package plant will result in some disturbance through excavations, air, noise and vibration pollution, generation of dust, and human activity. This disturbance will however be relatively limited due to the short construction period required (3 months). Disturbance resulting from the excavation activities will be further limited to a two week period. The construction time has been minimised through the installation of a modular (pre-assembled) unit. There is no requirement to complete any works in the vicinity of the shoreline, which is separated from the main construction area by dense bushes. Regardless of the localised nature of the construction activities, there is still a possibility that the proposed development may lead to disturbance of birdlife within 200 – 300 metres of the construction activities. Of the 1,364 penguins currently on the island, only 7% (105) nest in the census areas falling within a 250 m radius of the proposed package plant site. Although this recent census data (DEA, 2013) has revealed that the area is not among the most densely populated in terms of the African penguin breeding populations, there is potential that the penguins or other sea-birds nesting within the area may be disturbed or displaced during construction. Although there are no-known nests in the construction development footprint, close monitoring and mitigation during construction camp set-up should be undertaken to ensure that no nests are eliminated or damaged in the vicinity of the construction area.

The location of the two 'penguin highways' do not coincide with the development footprint of construction camp area, but do pass nearby the proposed plant site to the north or Robert Soboukwe House (see Figure 14). Mitigations will be required to ensure that the camp is completely enclosed by appropriate fencing and that no penguins can accidentally become trapped in the construction works. It should also be noted, that although the outlet pipe is shown as traversing the penguin highway on Figure 14, this pipe currently exists and no new construction will occur in this location as a result of the proposed installation of the SPP.

No Bank Cormorants are known to breed within the possible “zone of impact” (200 – 300 m); and typically breed on the Faure Jetty or at the main harbour (from March to October). Construction at the proposed site therefore should not result in the disturbance of the Bank Cormorant. Hartlaubs Gulls and Swift Terns have been known to breed 600m south of Soboukwe house, but tend to breed in different locations each year, therefore to prevent disturbance during breeding season, if necessary the birds should be deterred from setting up their nests at the beginning of breeding season (late December/early January) (pers comm. Prof Peter Barnham) until they move to set up nest elsewhere on the island.

5.11. The Robben Island Outfall in Perspective

The current marine outfall on Robben Island was designed to discharge an effluent comprising macerated sewerage, as well as a brine effluent from a desalination plant. Roberts (2002) predicted that 50 x dilution would be achieved within 50 m of the outfall under worse-case scenario calm conditions. Compliance of the effluent with water quality guidelines for direct contact recreation was predicted to be achieved within 1 km of the discharge location, with suspended solids reduce to 5 mg/l above ambient within 200 m of the discharge. At the time of its construction, an environmental monitoring programme was put in place to assess the impacts of the sewage discharge on the nearshore marine environment to the east of Robben Island. A baseline survey was conducted in January 2001 prior to the commencement of the discharge, with a further three monitoring surveys being conducted in May 2002, October 2002 and February 2003. Analyses undertaken included sediment particle size, heavy metal concentrations in sediments, meiofauna and epibenthic macrofauna (Prochazka 2001, 2003). The results indicated that 10 months after the start of sewage disposal:

- the proportion of sand in the sediments around the diffuser (<30 m radius) increased significantly;
- there was no marked increase in the organic content of the sediment around the diffuser;
- heavy metal concentrations in the sediments were below the maximum allowable effects range low (ERL) levels stipulated by the South African Sediment Quality Guidelines (see also Toefy 2010); and
- there was an increase in the abundance of filter-feeders, grazers and detritivors around the diffuser, but a decline of predators and scavengers.

The approach used in most defensible EMP studies undertaken to detect environmental impacts of ocean outfalls is based on comparisons using the before-after/control-impact (BACI) designs as recommended by Green (1979) and Underwood (1992, 1993, 1994). Although a before-after sampling approach was implemented for the Robben Island monitoring, unfortunately sampling was not concurrently conducted at suitable control sites, making it impossible to determine whether observed changes in community composition around the pipeline were in response to the sewage discharge or the result of natural variability. It was concluded that there was no substantial change in assemblage composition as a result of the discharge of sewage into the area. This conclusion should be treated with caution, however, firstly because of the inadequate sampling design and secondly because monitoring did not extend beyond 10 months following the start of discharges. The importance of long-term studies of sewage impacts was emphasised by Pastorok & Bilyard (1985). Although primary producers are known to respond rapidly to sewage enrichment, community level impacts over and above natural temporal variability are usually only detectable over a period of several years. In particular, accumulation of heavy metals in sediments and subsequent bioassimilation in organisms is usually only detectable in the medium- to long-term (Philip & Prichard 1996).

Although the impacts of the sewer outfall were recognised as a threat to the integrity of the Robben Island World Heritage site in 2004, the magnitude and extent of the impacts on marine biota over the past decade have not been quantified. As the effluent appears to have regularly exceeded the South African Marine Water Quality Guidelines as far as 100 m from the outfall for at least ten years, it is safe to assume that marine communities in the vicinity of the outfall have to some degree been affected by the sewage discharges.

It is anticipated that the diversity of subtidal communities has declined throughout the last decade and become dominated by pollution-tolerant suspension-feeding species. Judging by the high BOD of the effluent, the development of anoxic conditions in the sediments may also be expected, particularly during calm periods when wave conditions are insufficient to ensure adequate flushing rates and turn-over of the water column. This effect may, however, be naturally mitigated by the coarse nature of the sediments around the diffuser (Toefy 2010). The effects of the sewage may also have become apparent in rocky intertidal and sandy habitats inshore of the outfall (i.e. in the area between the outfall and the southern breakwater of Murray Harbour), particularly during the summer months when wind-generated surface currents could transport suspended solids and floating organic matter onto the island. During a site visit in January 2014, it was noted that intertidal areas in the vicinity of the outfall were characterised by a proliferation of ephemeral green algae (primarily *Ulva* spp.) thus suggesting eutrophication of intertidal communities.

As part of the upgrade of the waste water handling system, the effluent will be treated to General Limit Values (GN 665 of 2013) before being discharged to sea. The quality of effluent will thus be significantly improved relative to the current discharge. The modelling study undertaken by WSP Africa Coastal Engineers to assess the performance of the diffuser given the improved effluent (WSP Coastal 2013) identified that a required dilution of 40 would be achieved within 10 m of the discharge location. In other words, the improved effluent would achieve compliance with the *South African Marine Water Quality Guidelines (SAMWQG) for the Coastal Marine Environment* within a 10 m radius of the discharge point. With implementation of the proposed SPP, the area impacted by the effluent would thus decrease from the current estimated minimum of 31,416 m^2[1] to only 314 m^2. Although the required dilution for the treated sewerage is 50 in terms of the SAMWQG for all beneficial use areas, the modelling study further predicted that subsequent dispersion and diffusion would achieve dilutions exceeding 1,900 within 100 m of the outfall, even under stagnant conditions.

As the impact footprint for discharges from the proposed SPP would thus be considerably smaller than that for the current raw sewage discharge, a recovery of marine communities over the medium- to long-term can be expected.

[1] This estimate is conservative and based on the results of the September 2012 sample analyses, which (of the variables measured) indicated non-compliance for ammonia, COD and suspended solids 100 m from the outlet.

6. ASSESSMENT OF IMPACTS

6.1. Assessment Procedure

The potential environmental impacts were evaluated according to their severity, duration, extent and significance of the impact. Cumulative impacts were also taken into consideration. WSP Environmental's Risk Assessment Methodology was used for the ranking of the impacts.

This system derives environmental significance on the basis of the consequence of the impact on the environment and the likelihood of the impact occurring. Consequence is calculated as the average of the sum of the ratings of severity, duration and extent of the environmental impact. Likelihood considers the frequency of the activity together with the probability of an environmental impact occurring. Tables 3 - 10) describe the process in detail:

Consequence

Consequence is calculated as the average of the ratings for severity, duration and extent of the environmental impact.

Table 3: Assessment and Rating of Severity

Rating	Description
1	Negligible / non-harmful / minimal deterioration (0 – 20%)
2	Minor / potentially harmful / measurable deterioration (20 – 40%)
3	Moderate / harmful / moderate deterioration (40 – 60%)
4	Significant / very harmful / substantial deterioration (60 – 80%)
5	Irreversible / permanent / death (80 – 100%)

Table 4: Assessment and Rating of Duration

Rating	Description
1	Less than 1 month / quickly reversible
2	Less than 1 year / quickly reversible
3	More than 1 year / reversible over time
4	More than 10 years / reversible over time / life of project or facility
5	Beyond life of project of facility / permanent

Table 5: Assessment and Rating of Extent

Rating	Description
1	Within immediate area of activity
2	Surrounding area within project boundary
3	Beyond project boundary
4	Regional / provincial
5	National / international

Table 6: Determination of Consequence

Determination of Consequence (C)	(Severity + Duration + Extent) / 3

Likelihood

Likelihood considers the frequency of the activity together with the probability of the environmental impact associated with that activity occurring.

Table 7: Assessment and Rating of Frequency

Rating	Description
1	Less than once a year
2	Once in a year
3	Quarterly
4	Weekly
5	Daily

Table 8: Assessment and Rating of Probability

Rating	Description
1	Almost impossible
2	Unlikely
3	Probable
4	Highly likely
5	Definite

Table 9: Determination of Likelihood

Determination of Likelihood (L) =	(Frequency + Probability) / 2

Environmental significance

Environmental significance is the product of the consequence and likelihood values.

Table 10: Determination of Environmental Significance and key to colour coding

Environmental Significance (Impact) = C × L

Low (-ve) (1 – 4.9)	Low (+ve) (1 – 4.9)
Low-medium (-ve) (5 – 9.9)	Low-medium (+ve) (5 – 9.9)
Medium (-ve) (10 – 14.9)	Medium (+ve) (10 – 14.9)
Medium-high (-ve) (15 – 19.9)	Medium-high (+ve) (15 – 19.9)
High (-ve) (20 – 25)	High (+ve) (20 – 25)

6.2. Identification of Impacts

In their study of sewage outfalls discharging into shallow water in Sydney, Australia, Underwood *et al*. (1990, 1992) concluded that the discharge of secondarily treated sewage has only a marginal, if any, effect on shallow subtidal assemblages and no documented effect on intertidal assemblages. Nonetheless, the potential impacts to the marine environment as a result of the proposed discharge of treated sewage at Robben Island may include:

- modification of primary productivity due to changes in nutrient levels in the water column;
- changes in diversity and benthic floral and faunal community structure due to changes in nutrient levels;
- modification of community structure of soft-sediment macrofauna as a result of changes in organic content and/or oxygen levels in the sediments;
- alterations in diversity, abundance and community structure of fish assemblages around the outfall due to inputs of organic matter;
- potential health hazard to humans of pathogens discharged in the effluent;
- accumulation in the sediments of heavy metals discharged in the effluent;
- bioassimilation and bioaccumulation of heavy metals and xenobiotic substances in marine fauna;
- toxic effects of biocides discharged with the effluent on marine biota; and
- effects on marine biota of depressed salinities around the discharge.

Furthermore, construction of the sewage treatment plant and installation of the associated land-based discharge pipelines, may result in:

- disturbance of seabird nesting sites thereby resulting in reduction in breeding success, and/or
- obstruction of penguin highways in the vicinity of the proposed sewage treatment plant.

6.3. Assessment of Impacts associated with the Upgrade of the Waste Water Treatment Facility

Using information from the international literature, the potential impacts of sewage discharges were discussed in Section 5. The upgrade of the waste water treatment plant will result in significant *improvement* in the quality of the effluent relative to the current discharge, as the waste water will be treated prior to discharge and contaminant concentrations reduced. Relative to the current discharge, all associated impacts can therefore be rated as *positive*.

The assessment assumes that effluents from the new SPP will be treated to the DWA General Limit Values (GLV) effluent quality standards, and that should sub-standard discharges occur, these will be immediately identified and remedied.

Impact Description	Impact Status	Severity	Duration	Extent	Consequence (A+B+C)/3	Frequency	Probability	Likelihood (E+F)/2	Environmental Significance
Decrease in nutrient levels in the discharge from the proposed SPP relative to those in the current raw sewage discharge would decrease the likelihood of plankton blooms and seabed hypoxia and improve turbidity	+ve	4	4	2	3.3	5	4	4.5	15.0 MEDIUM to HIGH
Decreased nutrient levels in the discharge from the proposed SPP may result in recovery of biodiversity and community structure of subtidal benthic macrofauna and flora impacted by the current raw sewage discharge	+ve	4	5	2	3.7	5	4	4.5	16.5 MEDIUM to HIGH
Reduced levels of organic matter in the discharge from the SPP relative to those in the current raw sewage discharge may result in recovery of the structure and diversity of soft-sediment macrofauna	+ve	3	4	2	3.0	5	4	4.5	13.5 MEDIUM
Reduced levels of organic matter and heavy metals discharged from the SPP relative to the current raw sewage discharge may improve sediment quality (e.g. oxygen levels, heavy metals)	+ve	2	3	1	2.0	5	4	4.5	9.0 LOW to MEDIUM

Impact Description	Impact Status	Severity	Duration	Extent	Consequence (A+B+C)/3	Frequency	Probability	Likelihood (E+F)/2	Environmental Significance
Reduced levels of organic matter in the discharge from the SPP relative to the current raw sewage discharge may modify the diversity, abundance and structure of fish assemblages	+ve	2	3	2	2.3	5	4	4.5	10.5 MEDIUM
Reduced levels of colifom bacteria and other pathogens in the discharge from the SPP relative to the current raw sewage discharge will improve environmental health and alleviate existing health hazards to humans	+ve	4	4	2	3.3	5	5	5.0	16.7 MEDIUM to HIGH
Xenobiotic substances in the discharge from the SPP can bioaccumulate in higher order consumers	-ve	2	3	1	2.0	5	2	3.5	7.0 LOW to MEDIUM
Biocides used to disinfect the effluent are highly toxic to marine biota	-ve	2	2	1	1.7	5	2	3.5	5.8 LOW to MEDIUM
The fresh water in the discharge from the SPP will reduce salinities around the outfall and affect the osmoregulatory abilities of marine organisms	-ve	1	3	1	1.7	5	2	3.5	5.8 LOW to MEDIUM

* Note, the above assessment of impacts undertaken above does not included pre- and post-mitigation assessment, as the correctly functioning treatment facility in itself can be seen as the primary mitigation measure for the current discharge, thereby preventing further adverse effects on and degradation of the marine environment in the vicinity of the outfall.

Impact Description	Impact Status	Severity	Duration	Extent	Consequence (A+B+C)/3	Frequency	Probability	Likelihood (E+F)/2	Significance: Pre mitigation	Significance: Post mitigation
Construction of the sewage package plant and associated discharge pipeline may result in disturbance of penguin, cormorant and tern nesting sites with implications for reproductive success.	-ve	2	3	1	2.0	2.0	3.0	2.5	LOW to MEDIUM 5.0	
	-ve	2	3	1	2.0	2.0	2.0	2.0		LOW 4.0
Construction of the sewage package plant and associated discharge pipeline may obstruct movement along penguin highways	-ve	2	3	1	2.0	2.0	3.0	2.5	LOW to MEDIUM 5.0	
	-ve	2	3	1	2.0	2.0	2.0	2.0		LOW 4.0

6.4. Mitigations

The above impact assessment has been completed against the existing baseline environmental conditions. As monitoring of the current discharge revealed a number of exceedances in marine water quality in the vicinity of the outfall, it is safe to assume that the marine environment in the area has been significantly degraded as a result of the disposal of raw sewage via the existing outfall over a significant period of time. In light of this, the proposed sewage package plant is expected to have a *net positive benefit* to the existing marine water quality and ecosystem health.

It must be noted, however, that both of these assertions rely on the assumption that:

- the upgraded treatment facility operates according to the required treatment limits; and
- the resulting impact on the marine water quality is in line with the dispersion modelling completed by WSP (2013) for the proposed SPP discharge.

Should the impact assessment have been completed against a (theoretical) pristine environmental baseline, the discharge would in any case, only have resulted in impacts of low significance. This assessment was completed as part of this study but has not been included in this report.

The assessment of impacts undertaken above does not included pre- and post-mitigation assessment, as the correctly functioning treatment facility in itself can be seen as the primary mitigation measure for the current discharge, thereby preventing further adverse effects on and degradation of the marine environment in the vicinity of the outfall.

A monitoring programme is included as the primary mechanism by which to ensure that these assertions are correct, as detailed below.

7. ENVIRONMENTAL STATEMENT AND CONCLUSIONS

7.1. Environmental Statement

Taking into consideration potential cumulative impacts in Table Bay, and that marine communities in the vicinity of the outfall are highly likely to have been negatively affected by the existing sewage discharges, the impacts resulting from the installation of the proposed SPP were mostly rated as positive impacts of medium to high significance. As the waste water from the proposed SPP would be treated prior to discharge and contaminant concentrations reduced, the upgrade of the sewage handling facilities will result in significant improvement in the quality of the effluent relative to the current discharge. The few potentially negative impacts were all rated as being of low to medium significance. The impact footprint for discharges from the proposed SPP would thus be considerably smaller than the existing sewage handling system, and a recovery of marine communities over the medium- to long-term can be expected.

7.2. Recommendations

I. To ensure that the SPP continues to result in an improvement in marine ecosystem health relative to the current situation, it is recommended that routine monitoring of the constituent concentrations in the effluent be implemented before it is discharged through the marine outfall. This is particularly important as the achievable dilutions calculated by WSP (2013) depend on the quality of the effluent being discharged.

   Requirements in terms of effluent quality monitoring are detailed in Point 1.1.1 of Table 11 of the Marine Specific EMP (Section 8).

II. This assessment of potential impacts of the upgraded discharge on marine communities is based on the results of the dilutions modelling study undertaken by WSP (2013). The predictions of these models, whilst considered to be robust, need to be validated by field observations and subsequent monitoring. If monitoring fails to mirror predicted results, the forecasted impacts will need to be re-assessed. For this reason it is recommended that the quality of the receiving waters be monitored following commissioning of the SPP, and at intervals thereafter, to ensure that model predictions are realised and that compliance with marine water quality guidelines are consistently achieved.

   Requirements in terms of water quality monitoring of the receiving environment are detailed in Point 1.1.2 of Table 11 of the Marine Specific EMP (Section 8).

7.3. Conclusions

If all environmental guidelines and appropriate monitoring recommendations advanced in this report and detailed in the Marine specific EMP in Section 8, are implemented, there is no reason why the proposed upgrade of the sewage handling system on Robben Island should not proceed. In fact, considering that many constituents of the current raw sewage discharge exceed Marine Water Quality Guidelines as well as GWWLs, and taking into account the potential impacts this may already have had on the marine biota on the eastern shores of the island, it is imperative that the upgrade to the sewage handling system are undertaken as soon as possible.

8. ENVIRONMENTAL MANAGEMENT PROGRAMME

Internationally, monitoring programmes for waste water discharges to the marine environment typically (as a minimum) include comprehensive analyses of both the waste water and the receiving waters, as well as the sediments in the vicinity of the outfall (see for example Philip & Pritchard 1996; Bailey 2000). Additional monitoring includes baseline studies conducted prior to the construction of the discharge pipeline, as well as ongoing analyses during discharge to determine and monitor biophysical changes to the marine environment. Analyses conducted as part of comprehensive monitoring programmes include regular measurement of physical parameters (waste water flow, solids content, turbidity (TSS) and temperature), chemical parameters (COD, BOD, dissolved oxygen, nutrients, heavy metals, organic carbon, salinity) and biological parameters (coliform bacteria and pathogens in water column and sediments, changes to plankton, fish, and benthic organisms in unconsolidated sediments and/or on rocky habitats, and toxicity testing in indicator species).

Considering the capacity of the proposed SPP, and that the effluent would in future conform to General Limit Values prior to discharge to the marine environment, a comprehensive monitoring programme comprising all the elements outlined above is not deemed necessary. As a minimum, however, monitoring of the constituent concentrations in the effluent before it is discharged through the marine outfall is recommended. Furthermore, to validate the predictions of the achievable dilutions models, monitoring of the receiving waters following commissioning of the SPP is recommended, to ensure that model predictions and the impacts forecasted in this assessment are realised, and that compliance with marine water quality guidelines are consistently achieved.

The marine–specific EMP provided below covers both generic environmental management procedures associated with the plant and its discharges as well as an environmental monitoring plan. The EMP does not provide details on managing general plant operations, and it is assumed that all operational performance parameters and maintenance procedures are meticulously adhered to, and that any sub-standard discharges that may occur are immediately identified and remedied.

Table 11: Marine Specific EMP Requirements

ACTIVITIES	OBJECTIVES (AIMS TO ACHIEVE) & REQUIRED MANAGEMENT ACTIONS (HOW THEY CAN BE ACHIEVED)	*PHASED TARGET DATES*	*RESPON-SIBLE PERSON*	*PERFOR-MANCE REPORT*
1. Environmental Management Procedures	Environmental objectives are to: • Employ the EMP process so that SPP operations and discharges are conducted in an environmentally responsible manner. Increase understanding about potential impacts of discharges and environmental management			
1.1 Construction Activities				
1.1.1 Disturbance of breeding seabirds	• Ensure that construction activities avoid known penguin nesting sites. • Monitor establishment of potential Hartlaub's gulls and Swift terns breeding areas in the vicinity of the construction site during December/early January and if necessary deter them from starting to breed near the construction site by using people to scare them off at the start of the breeding season until they start to breed elsewhere on the island.			
1.1 Environmental Monitoring				

ACTIVITIES	OBJECTIVES (AIMS TO ACHIEVE) & REQUIRED MANAGEMENT ACTIONS (HOW THEY CAN BE ACHIEVED)	*PHASED TARGET DATES*	*RESPON-SIBLE PERSON*	*PERFOR-MANCE REPORT*
1.1.1 Measurement of effluent	• Ensure that the sewage effluent conforms with the General Limit Values to discharge to the sea. • Monitor discharge water quality weekly until sufficient data have been collected to allow a statistically robust prediction that the levels will fall below the guideline levels 95% of the time. (The minimum measurement period would be 12 months, and the more the variations in the data collected over this period the longer the monitoring would need to continue). Thereafter monitor at bi-weekly (2 week) intervals. The following parameters should be measured: – Total suspended solids – Salinity – pH – Dissolved oxygen – Biological Oxygen Demand – Dissolved nutrients (nitrite, nitrate, ammonium, reactive phosphate and reactive silicate) – Faecal coliform bacteria – Chlorine • Ensure that the analyses are carried out by a laboratory certified (by the South African National Accreditation Service) to conduct the analyses. • Have the monitoring results scientifically evaluated by an appropriately qualified independent t consultant on an annual basis. • Submit the monitoring results together with the evaluation to the DWA and DEA on an annual basis.			

ACTIVITIES	OBJECTIVES (AIMS TO ACHIEVE) & REQUIRED MANAGEMENT ACTIONS (HOW THEY CAN BE ACHIEVED)	*PHASED TARGET DATES*	*RESPON-SIBLE PERSON*	*PERFOR-MANCE REPORT*
1.1.2 Measurement of receiving water body	• Ensure that the South African Marine Water Quality Guidelines DWAF 1995): Maintenance of the Ecosystem are achieved for ALL constituents of the effluent, within 100 m of the diffuser. • On commissioning of the Sewage Package Plant, monitor the quality of the receiving waters once every 2 weeks at distances of 10 m, 50 m and 100 m from the diffuser to verify the predictions of the dilution model. Monitoring should continue until sufficient data have been collected to allow a statistically robust prediction that the levels will fall below the guideline levels 95% of the time. (The minimum measurement period would be 4 months, and the more the variations in the data collected over this period the longer the monitoring would need to continue). The following parameters should be measured within a predetermined grid around the diffuser: – Total suspended solids – Salinity – pH – Dissolved oxygen – Biological Oxygen Demand – Dissolved nutrients (nitrite, nitrate, ammonium, reactive phosphate and reactive silicate) – Faecal coliform bacteria • Monitoring should continue on a quarterly basis thereafter (every 3 months). • Ensure that the analyses are carried out by a laboratory certified (by the South African National Accreditation Service) to conduct the analyses. • Have the monitoring results scientifically evaluated by an appropriately qualified independent t consultant on completion of the monitoring programme. • Submit the monitoring results together with the evaluation to the DWA and DEA on an annual basis.			

9. LITERATURE CITED

Adams, S.M., Brown, A.M., & R.W. Goede, 1993. A quantitative health assessment index for rapid evaluation of fish condition in the field. Transactions of the American Fisheries Society, 122: 63 - 73.

Andrew, N.L., 1991. Changes in subtidal habitat following mass mortality of sea urchins in Botany Bay, New South Wales. Australian Journal of Ecology, 16: 353 — 362.

ANZECC, 2000. Australian and New Zealand guidelines for fresh and marine water quality. Volume 2, Aquatic ecosystems. National water quality management strategy; no.4. Australian and New Zealand Environment and Conservation Council, Agriculture and Resource Management Council of Australia and New Zealand ,Canberra, Australia. ISBN 0 642 19562 5 (www.deh.gov.au/water/quality/nwqms/introduction/).

Archambault, P., Banwell, K. & A.J. Underwood, 2001. Temporal variation in the structure of intertidal assemblages following the removal of sewage. Marine Ecology Progress Series, 222: 51 – 62.

Arfi, R., Champalbert, G. & G. Patriti, 1981. Systeme planctonique et pollution urbaine: Un aspect des populations zooplanctoniques. Marine Biology, 61: 133 - 341.

Atkinson, S., Atkinson, M. & A.M. Tarrant, 2009. Estrogen from Sewage in Coastal Marine Environments. Environmental Health Perspectives, 111(4); 531 – 535.

Bellan, G., Bourcier, M., Salen-Picard, C., Arnoux, A. & S. Casserley, 1999. Benthic ecosystem changes associated with wastewater treatment at Marseille: implications for the protection and restoration of Mediterranean coastal shelf ecosystems. Water Environmental Research, 71(4): 483 - 493.

Bishop, M.J., Underwood, A.J. & P. Archambault, 2002. Sewage and environmental impacts on rocky shores: necessity of identifying relevant spatial scales. Marine Ecology Progress Series, 236: 121 – 128.

Bokn, T.L., Moy, F.E. & M. Walday, 1996. Improvement of the shallow water communities following reductions of industrial outlets and sewage discharge in the Hvaler estuary, Norway. Hydrobiologia, 326/327: 297 - 304.

Bolsch, C.J., Hallegraeff, G.M., 1993. Chemical and physical treatment options to kill toxic dinoflagellate cysts in ship's ballast water. Journal of Marine Environmental Engineering, 1: 23 - 29.

Bombace, G., Fabi, G., Fiorentini, L. & S Speranza, 1994. Analysis of the efficacy of artificial reefs located in five different areas of the Adriatic Sea. Bulletin of Marine Science, 55: 559 - 580.

Borowitzka, M.A., 1972. Intertidal algal species diversity and the effect of pollution. Australian Journal of Marine Freshwater Research, 23: 73 - 84.

Braga, E.S., Bonetti, C.V.D.H., Burone, L. And J.B. Filho, 2000. Eutrophication and bacterial pollution caused by industrial and domestic wastes at the Baixada Santista Estuarine System – Brazil. Marine Pollution Bulletin, 40(2): 165 – 173.

Branch, G.M., Eekhout, S. & A.L. Bosman, 1990. Short-term effects of the 1988 Orange River floods on the inter-tidal rocky-shore communities of the open coast. Transactiond of the Royal Society of South Africa, 47: 331 - 354.

Cabelli, V.J., Dufour, A.P., McCabe, L.J. & M.A. Levin, 1982. Swimming-associated gastroenteritis and water quality. *Am J Epidemiol.* 115: 606-616.

Cardell, M.J., Sarda, R. & J. Romero, 1999. Spatial changes in sublittoral soft-bottom polychaete assemblages due to river inputs and sewage discharges. Acta Oecologica 20: 343 – 351.

Chapman, M.G., Underwood, A.J. & G.A Skilleter, 1995. Variability at different spatial scales between a subtidal assemblage exposed to the discharge of sewage and two control assemblages. Journal of Experimental Marine Biology and Ecology, 189: 103 – 122.

Connell, S.D., 2001. Urban structures as marine habitats: an experimental comparison of the composition and abundance of subtidal epibiota among pilings, pontoons and rocky reefs. Marine Environmental Research, 52: 115 - 125.

Connell, S.D. & T.M. Glasby, 1999. Do urban structures influence local abundance and diversity of subtidal epibiota? A case study from Sydney Harbour. Marine Environmental Research, 47: 373 - 387.

Connell, S.D. & R.O. Slayter, 1977. Mechanisms of succession in natural communities and their role on community stability and organisation. American Naturalist, 111: 1119 - 1144.

Costanzo, S.D., O'Donohue, M.J., Dennison, W.C., Loneragan, N.R. & M. Thomas, 2001. A new approach for detecting and mapping sewage impacts. Marine Pollution Bulletin 42: 149–156.

Coull, B.C., 1988. Ecology of the marine meiofauna. In: Introduction to the study of meiofauna, Higgins R.P. & H. Thiel (eds). Washington: Smithsonian Institution Press, 18—38.

Danulat, E., Muniz, P., García-Alonso, J. & B. Yannicelli, 2002. First assessment of the highly contaminated harbour of Montevideo, Uruguay. Mar Pollut Bull, 44: 554-65.

Department of Water Affairs and Forestry (DWAF), 1995. South African water quality guidelines for coastal marine waters. Volume 1. Natural Environment. Volume 2. Recreation. Volume 3. Industrial use. Volume 4. Mariculture. Pretoria.

Diener, D.R. & B. Riley, 1996. Wastewater outfalls as artificial reefs and effects on adjacent infaunal communities. Transactions of the American Geophysical Union, 76: 05121 - 10.

Diener, D.R., Riley, B., Robertson, G., Maurer, D., Gerlinger, T. & I. Haydock, 1997. An outfall as an artificial reef: Impacts to the benthic environment and a balanced indigenous population. Proceedings of the California and World Oceans Conference 1997. 12 pp.

Diener, D.R., Fuller, S.C., Lissner, A., Haydock, C.I., Maurer, D., Robertson, G. & R. Gerlinger, 1995. Spatial and temporal patterns of the infaunal community near a major ocean outfall in Southern California. Marine Pollution Bulletin, 30: 861 – 878.

Dustan, P. & J. L. Pinckney, 1989. Tidally induced estuarine phytoplankton patchiness. Limnology and Oceanography, 34: 410—419.

EPA, 1993. Deformities and associated sublethal effects in fish exposed to sewage-borne contaminants: literature review (Report 93/72, EPA). Sydney: Environment Protection Authority.

Eppley, R.W., Renger E.H., Williams, P.M., 1976. Chlorine reactions with seawater constituents and inhibition of photosynthesis of natural marine phytoplankton. Estuarine and Coastal Marine Science 7, 291-301.

Estacio, F.J., Garcıa-Adiego, E.M., Fa, D.A., Garcıa-Gomez, J.C.,Daza, J.L., Hortas, F. & J.L. Gomez-Ariza, 1997. Ecological analysis in a polluted area of Algeciras Bay (Southern Spain): external ''versus'' internal outfalls and environmental implications. Marine Pollution Bulletin, 34: 780 – 793.

Fairweather, P.G., 1988. Sewage and the biota on seashores; assessment of impact in relation to natural variability. Environmental Monitoring and Assessment, 14: 197 - 210.

Fairweather, P.G., 1990. Sewage and the biota on seashores: assessment of impact in relation to natural variability. Environmental Monitoring and Assessment 14: 197 - 210.

GESAMP, 2001. *Protecting the Oceans from Land-based Activities - Land-based Sources and Activities Affecting the Quality and Uses of the Marine, Coastal and Associated Freshwater Environmen*t, GESAMP Reports and Studies 71

GPA, 2001. National Report for the Intergovernmental Review of the GPA 2001. Kenya. 18 September 2001.

Ghosh, D. & A.K. Ray, 1993a. 17ß-Hydroxysteroid dehydrogenase activity of ovary and hepatopancreas of freshwater prawn, *Macrobrachium rosenbergii*, in relation to ovarian condition and estrogen treatment. General and Comparative Endocrinology, 89: 248 – 254.

Ghosh, D. & A.K. Ray, 1993b. Subcellular action of estradiol-17ß in a freshwater prawn, *Macrobrachium rosenbergii*. General and Comparative Endocrinology, 90: 273 – 281.

Gillanders, B.M & , M.J. Kingsford, 2002. Impacts of changes in flow of freshwater on estuarine and open coastal habitats and associated organisms. Oceanography and Marine Biology: An Annual Review, 40: 233 — 309.

Gorostiaga, J.M. & I Diez, 1996. Changes in the sublittoral benthic marine macroalgae in the polluted area of Abra de Bilbao and proximal coast (Northern Spain). Marine Ecology Progress Series, 130: 157 - 167.

Gray, C.A., 1996. Intrusions of surface sewage plumes into continental shelf waters: interactions with larval and presettlement juvenile fishes. Marine Ecology Progress Series 139: 31 – 45.

Gray, C.A., Otway, N.M. & A.G. Miskiewicz, 1996. Numerical responses of larval fishes to deepwater sewage disposal: a field assessment. Marine Pollution Bulletin, 33: 190 – 200.

Gray, J.S., 1989. Effects of environmental stress on species rich assemblages. Biological Journal of the Linnean Society, 37: 19 - 32.

Green, R.H., 1979. Sampling design and statistical methods for environmental biologists. John Wiley and Sons. New York

Grigg, R.W., 1994. Effects of sewage discharge, fishing pressure and habitat complexity on coral ecosystems and reef fishes in Hawaii. Marine Ecology Progress Series, 103: 25–34.

Grimes, C.B. & J.H. Finucane, 1991. Spatial distribution and abundance of larval and juvenile fish, chlorophyll and macrozooplankton around the Mississippi River discharge plume, and the role of the plume in fish recruitment. Marine Ecology Progress Series, 75: 109 — 119.

Grimes, C.B. & M.J. Kingsford, 1996. How do riverine plumes of different sizes influence fish larvae: do they enhance recruitment? Marine and Freshwater Research, 47: 191 — 208.

Guidetti, P., Fanelli, G., Fraschetti, S., Terlizzi, A. & F. Boero, 2002. Coastal fish indicate human-induced changes in the Mediterranean littoral. Marine Environmental Research, 53: 77 – 94.

Guidetti, P., Terlizzi, A., Fraschetti, S. & F. Boero, 2003. Changes in Mediterranean rocky-reef fish assemblages exposed to sewage pollution. Marine Ecology Progress Series, 253: 269 – 278.

Hall, J.A., Frid, C.L.J. & M.E. Gill, 1997. The response of estuarine fish and benthos to an increasing discharge of sewage effluent. Marine Pollution Bulletin, 34: 537 – 535

Hardy, F.G., Evans, S.M. & M.A. Tremayne, 1993. Long-term changes in the marine macroalgae of three polluted estuaries in north-east England. Journal of Experimental Marine Biology and Ecology, 172: 81 - 92.

Harries, J.E., Sheahan, D.A., Jobling, S., Matthiessen, P., Neall, P., Sumpter, J.P., Tylor, T, & N. Zaman, 1997. Estrogenic activity in five United Kingdom rivers detected by measurement of vitellogenins in caged male trout. Environmental Toxicology and Chemistry, 16: 534 – 542.

Hart, T., 2002. Stage 1 Heritage Impact Assessment of the Northern Breakwater and Harbour Wall, Murray's Bay Harbour, Robben Island. Prepared for Planning Partners by the Archaeological Contracts Office, University of Cape Town, pp11.

Hathaway, R.R. & R.E. Black, 1969. Interconversions of estrogens and related developmental effects in sand dollar eggs. General and Comparative Endocrinology, 12: 1 – 11..

Hueckel, G.J., Buckley, R.M. & B.L. Benson, 1989. Mitigating rocky habitat loss using artificial reefs. Bulletin of Marine Science, 44: 913 - 922.

Irlandi, F., Macia, S. & I. Seraty, 1997. Salinity reduction from freshwater canal discharge: effects on mortality and feeding of an urchin (*Lytechinus variegatus*) and a gastropod (*Lithopoma tectum*). Bulletin of Marine Science, 61: 869 — 879.

Jury, S.H., Kinnison, M.T., Howell, W.H. & W.H. Watson, 1994. The behaviour of lobsters in response to reduced salinity. Journal of Experimental Marine Biology and Ecology, 180: 23 — 37.

Kaartvedt, S. & F. Nordby, 1992. Impact of a controlled freshwater discharge on zooplankton distribution in a Norwegian fiord. Journal of Experimental Marine Biology and Ecology, 162: 279 — 293.

Katzenellenbogen, J.A., 1995. The structural pervasiveness of estrogen activity. Environmental Health Perspective, 103(suppl 7): 99 – 101.

Kennelly, S.J. & A.J. Underwood, 1992. Fluctuations in the distributions and abundances of species in sublittoral kelp forests in New South Wales. Australian Journal of Ecology, 17: 367 — 382.

Kindig, A.C. & M.M. Littler, 1980. Growth and primary productivity of marine macrophytes exposed to domestic sewage effluents. Marine Environmental Research, 3: 81 - 100.

Kingsford, M.J. & C.A. Gray, 1996. Influence of pollutants and oceanography on abundance and deformity of wild fish larvae. In: Schmitt, R.J. & C.W. Osenberg (eds) Detecting ecological impacts. Academic Press, London, p 235 – 255.

Kingsford, M.J., Suthers, I.M. & C.A. Gray, 1996. Exposure to sewage plumes and the incidence of deformities in larval fishes. Marine Pollution Bulletin, 33: 201 – 212.

Kingsford, M.J., Pitt, K.A. & B.M Gillanders, 2000. Management of jellyfish fisheries, with special reference to the order Rhizostomeae. Oceanography and Marine Biology: an Annual Review, 38: 85 — 156.

Koop, K. & P. Hutchings, 1996. Disposa of sewage to the ocean – a sustainable solution ? Marine Pollution Bulletin, 33: 121 – 123.

Lattemann, S. & T. Höpner, 2003. Seawater desalination: Impacts of brine and chemical discharge on the marine environment, Vol. Balaban Desalintation Publications, Italy. pp. 142 + Appendices.

Littler, M.M. & S.M. Murray, 1975. Impact of sewage on the distribution, abundance and community structure of rocky intertidal macro-organisms. Marine Biology, 30: 277 - 291.

Littler, M.M. & S.M. Murray, 1978. Influence of domestic waste on energetic pathways in rocky intertidal communities. Journal of Applied Ecology, 15: 583 - 595.

Lopez Gappa, J.J., Tablado, A. & N.H. Magaldi, 1990. Influence of sewage pollution on a rocky intertidal community dominated by the mytilid *Brachidontes rodriguezi*. Marine Ecology Progress Series, 63: 163 - 175.

Lu, N., Liu, C. & P. Guo, 1989. Effect of salinity on larvae of edible medusae (*Rhopilema esculenta Kishinouye*) at different developmental phases and a review on the cause of jellyfish resources falling greatly in Liadong Bay. Acta Ecologica Sinca, 9: 304 — 309.

Luger, M. & C. Brown, 1999. The impact of Treated Sewage Effluent on Urban Rivers. An ecological, Social and Economic Perspective. www.southernwaters.co.za.

MacLatchy, D., Peters, L., Nickle, J. & G. Van Der Kraak, 1997. Exposure to ß-sitosterol alters the endocrine status of goldfish differently than 17ß-estradiol. Environmental Toxicology and Chemistry, 16: 1895 – 1904.

Matthiessen, P. & R.J. Law, 2002. Contaminants and their effects on estuarine and coastal organisms in the United Kingdom in the late twentieth centurey. *Environmental Pollution, Volume 120, Issue 3, December 2002, Pages 739-757.*

May, V., 1985. Observation on algal floras close to two sewage outfalls. Cunninghammia, 1: 385 - 394.

Metaxas, A., 1998. The effect of salinity on larval survival and development in the sea urchin *Echinometra lucunter*. Invertebrate Reproduction and Development, 34: 323 — 330.

Meyer–Reil, L.-A. & M. Köster, 2000. Eutrophication of marine waters: effects on benthic microbial communities. Marine Pollution Bulletin, 41(1-6): 255 – 263.

Mitchell, P., 1998. The impact of aerated sewage lagoon effluent on water quality in Field Lake. Alberta Environmental protection. Pub. No. T/820. www3.gov.ab.ca/env/info/ infocentre/publist.cfm.

Nergis, Y., Sharif, M., Choudhry, A.F., Hussain, A. & J.A. Butt. 2012. Impact of industrial and sewage effluents on Karachi coastal water and sediment quality. Middle-East Journal of Scientific Research, 11(10): 1443 – 1454.

Nyan Taw & D.A. Ritz, 1978. Zooplankton distribution in relation to the hydrology of the Derwent River estuary. Australian Journal of Marine and Freshwater Research, 29: 763 — 775.

O'Sullivan, A.J., 1971. Ecological effects of sewage discharge in the marine environment. Proceedings of the Royal Society, London. B. 177: 331 – 351.

Otway, N.M., 1995a. Assessing impacts of deepwater sewage disposal: a case study from New South Wales, Australia. Marine Pollution Bulletin, 31: 347 – 354.

Otway, N.M., Gray, C.A, Craig, J.R., McVea, T.A. & J.E. Ling, 1996. Assessing the impacts of deepwater sewage outfalls on the spatially and temporally variable marine communities. Marine Environmental Research, 41: 45 - 71.

Parsons, R., 2000. The groundwater resources of Robben Island. http://www.ewisa.co.za/literature/files/163Parsons.PDF

Pastorok, R.A. & G.R. Bilyard, 1985. Effects of sewage pollution on coral reef communities. Marine Ecology Progress Series, 21: 175 – 189.

Pearson, T.H. & R. Rosenberg, 1978. Macrobenthic succesion in relation to organic enrichment and pollution of the marine environment, *Oceanography and Marine Biology: An Annual Rev*iew, 16: 229–311.

Peters, E.C., Gassman, N.J., Firman, J.C., Richmond, R.H. & E.A. Power, 1997. Ecotoxicology of tropical marine ecosystems. Environmental Toxicology and Chemistry, 16(1): 12 – 40.

Phillips, D.J.H., 1977. The use of biological indicator organisms to monitor trace metal pollution in marine and estuarine environments - a review. Environmental Pollution, 13: 281 - 317.

Phillips, D.J.H., 1978. The use of biological indicator organisms to quantitate organochlorine pollutants in aquatic environments - A review. Environmental Pollution, 16: 167 - 229.

Prochazka, K., 2001. Marine biological monitoring of the Robben Island Marine Sewage Outfall: Baseline Report. Report to Ove Arup Consulting Engineers, pp17.

Prochazka, K., 2003. Marine biological monitoring of the Robben Island Marine Sewage Outfall: Final Report. Report to Ove Arup Consulting Engineers, pp22.

Purcell, J.F., White, J.R., Nemazie, D.A. & D.A. Wright, 1999. Temperature, salinity and food effects on sexual reproduction and abundance of the scyphozoan *Chrysaora quinquecirrha*. Marine Ecology Progress Series, 180: 187 — 196.

Raimondi, P.T. & D.C. Reed, 1996. Determining the spatial extent of ecological impacts caused by local anthropogenic disturbances in coastal marine habitats. In: Schmitt, R.J. & C.W. Osenberg (eds) Detecting ecological impacts. Academic Press, London, p 179–198

Relini, G., Zamboni, N., Tixi, F. & G. Torchia, 1994. Patterns of sessile macrobenthos community development on an artificial reef in the Gulf of Genoa (northwestern Mediterranean). Bulletin of Marine Science, 55: 745 - 771.

Richmond, R.H., 1993. Coral reefs: present problems and future concerns resulting from anthropogenic disturbance. American Zoologist, 33: 524 – 536.

Richmond, C.F. & S.A. Woodin, 1996. Short-term fluctuations in salinity— effects on planktonic invertebrate larvae. Marine Ecology Progress Series, 133: 167 — 177.

Rippingale, R.J. & S.J. Kelly, 1995. Reproduction and survival of *Phyllorhiza punctata* (Cnidaria: Rhizostomeae) in a seasonally fluctuating salinity regime in Western Australia. Marine and Freshwater Research, 46: 1145 — 1151.

Roach, A.C., Banwell, K.A., Dasey, M.W., Gum, W.L. and G.W. Henry, 1995. Effects of Sewage Outfalls on Marine Organisms at Port Kembla and Bellambi, Illawarra Region, NSW. Environment Protection Authority, Sydney, 73 pp.

Robinson, C.D., Brown, E., Craft, J.A., Davies, I. M., Moffat, C.F., Pirie, D., Robertson, F., Stagg, R.M. & S. Struthers, 2003. Effects of sewage effluent and ethynyl oestradiol upon molecular markers of oestrogenic exposure, maturation and reproductive success in the sand goby (*Pomatoschistus minutus*, Pallas). Aquatic Toxicology 62: 119 – 134.

Roberts, D.E., 1996. Effects of the North Head deep-water sewage outfall on nearshore coastal reef macrobenthic assemblages. Marine Pollution Bulletin, 33: 303 – 308.

Roberts, D.E., Smith, A., Ajani, P. & A.R. Davis, 1998. Rapid changes in encrusting marine assemblages exposed to anthropogenic point-source pollution: a 'Beyond BACI' approach. Marine Ecology Progress Series, 163: 213 – 224.

Roberts, M., 2002. Dye dispersion study of the Robben Island Marine Sewer outfall: Worst case conditions. Report to Ove Arup Consulting Engineers, pp73.

Roller, R.A. & W.B. Stickle, 1993. Effects of temperature and salinity acclimation of adults on larval survival, physiology, and early development of *Lytechinus variegatus* (Echinodermata: Echinoidea). Marine Biology, 116: 583 — 591.

Routledge, E.J., Sheahan, D., Desbrow, C., Brighty, G.C., Waldock, M. & J.P. Sumpter, 1998. Identification of estrogenic chemicals in STW effluent. 2. In vivo responses in trout and roach. Environmental Science and Technology, 32: 1559 – 1565.

Russo, A.R., 1982. Temporal changes in fish community structure near a sewage ocean outfall, Mokapu, Oahu, Hawaii. Marine Environmental Research 6: 83 – 98.

Russo, A.R., 1989. Fish community structure on a deep ocean outfall, Barber's Point, Oahu, Hawaii. Int Rev Ges Hydrobiol., 74: 499 – 506

Saridou, M., Verriopoulos, G., Siokou-Frangou, I. & A. Giannakourou, 2009. Microbial food web in the Saronikos Gulr marine area affected by the Psittalia sewage outfalls. 9th Hell. Symp. Ocean. Fish., Book of abstracts.

Shoenmakers, H.J.N., Bohemen, C.G.V. & S.J. Dieleman, 1981. Effects of oestradiol-17ß on the ovaries of the starfish *Asterias rubens*. Developmental Growth and Differentiation, 23(2): 125 – 135.

Shurin, J.B. & S.I. Dodson, 1997. Sublethal toxic effects of cyanobacteria and nonylphenol on environmental sex determination and development in *Daphnia*. Environmental Toxicology and Chemistry, 16: 1259 – 1267.

Signell, R.P., Jenter, H.L. & A.F. Blumberg, 2000. Predicting the physical effects of relocating Boston's sewage outfall. Estuarine, Coastal and Shelf Science, 50: 59-72.

Siokou-Frangou, I., Krasakopoulou, E., Asimakopoulou, G., Giannakourou, A., Kontoyiannis, H., Pagou, K., Panayotidis, P., Pavlidou, A., Simboura, N., Zenetos, A., Zeri C. & S. Zervoudaki, 2009. Impact of Athens metropolitan area sewage outfalls on the Saronikos Gulf ecosystem.

Symposium of Impact of large coastal Mediterranean cities on marine ecosystems – Alexandria, Egypt 10-12 February 2009.

Smith, A.K., Ajani, P.A. & D.E. Roberts, 1999. Spatial and temporal variations in fish assemblages exposed to sewage and implications for management. Marine Environmental Research 47: 241 – 260.

Smith, S.D.A., 1996. The effects of domestic sewage effluent on marine communities at Coffs Harbour, New South Wales, Australia. *Marine Pollution Bulletin*. 33: 309 - 316.

Smith, S.D.A. and R.D. Simpson, 1992. Monitoring the shallow sublittoral using the fauna of kelp (*Ecklonia radiata*) holdfasts. *Marine Pollution Bulletin*. 24: 46-52.

Smith, S.D.A. and R.D. Simpson, 1993. The effects of pollution on the holdfast macrofauna of the kelp *Ecklonia radiata*: discrimination at different taxonomic levels. *Marine Ecology Progress Series* 96: 199-208.

Smith, S.V., Kimmerer, W.J., Laws, E.A., Brock, R.E. & T.W. Walsh, 1981. Kaneohe Bay sewage diversion experiment: perspectives on ecosystem responses to nutritional perturbation. Pacific Science, 35: 279 – 395.

Soltan, D., Verlaque, M., Boudouresque, C.F. & P. Francour, 2001. Changes in macroalgal communities in the vicinity of a Mediterranean sewage outfall after setting up of a treatment plant. Marine Pollution Bulletin, 42: 59 – 70.

Soulsby, P.G., Lowthion, D., Houston, M.A. & H.A.C Montgomery, 1985. The role of sewage effluent in the accumulation of macroalgal mats on intertidal mudflats in two basins in Southern England. Netherland Journal of Sea Research, 19: 257 – 263.

Staples, D.J. & 0.J. Vance, 1985. Short-term and long-term influences on the immigration of postlarval banana prawns *Penaeus merguiensis*, into a mangrove estuary of the Gulf of Carpentaria, Australia. Marine Ecology Progress Series, 23: 15 — 29.

Sumpter, J.P. & S. Jobling, 1995. Vitellogenesis as a biomarker for estrogenic contamination of the aquatic environment. Environmental Health Perspective, 103(suppl 7): 173 – 178.

Swartz, R.C., Cle, F.A., Schults, D.W., & W.A. DeBen, 1986. Ecological changes in the Southern California Bight near a large sewage outfall: benthic conditions in 1980 and 1983. Marine Ecology Progress Series, 31: 1 – 13.

Terlizzi, A., Fraschetti, S., Guidetti, P. & F. Boero, 2002. The effects of sewage discharge on shallow hard substrate sessile assemblages. Marine Pollution Bulletin, 44: 544 – 550.

Thomas, M.L.H. & C.N. White, 1969. Mass mortality of estuarine fauna at Biddeford P.E. associated with abnormally low salinities. Journal of the Fisheries Research Board of Canada, 26: 701 — 704.

Toefy, R., 2010. Extant benthic foraminifera from two bays along the SW coast of South Africa, with a comment about their use as indicators of pollution. Unpublished PhD Thesis, University of the Western Cape, South Africa, pp308.

Trevor, D., Caston, M. & S. Zwelabo, 2010. An assessment of the effect of industrial and sewage effluent on aquatic invertebrates: a case study of a southern Urban stream, Zimbabwe. Journal of Sustainable Development, 3(2): 210 – 214.

UNEP, 1991. Environmental Impact Assessment: sewage treatment plant for Port Said. UNEP Regional Seas Reports and Studies, No. 133, 35pp.

UNEP, 2008. Desalination Resource and Guidance Manual for Environmental Impact Assessments. United Nations Environment Programme, Regional Office for West Asia, Manama, and World Health Organization, Regional Office for the Eastern Mediterranean, Cairo.

Underwood, A.J., 1992. Beyond BACI: the detection of environmental impact on populations in the real but variable world. *Journal of Experimental Marine Biology and Ecology,* 161: 145-178.

Underwood, A.J., 1993. The mechanics of spatially replicated sampling programmes to detect environmental impacts in a variable world. *Australian Journal of Ecology,* 18: 99 - 116.

Underwood, A.J., 1994. On beyond BACI: sampling designs that might reliably detect environmental disturbances. *Ecological Applications,* 4: 3-15.

Underwood, A.J., Chapman M.G. & M.H. Atkinson, 1990. Intertidal and subtidal macrobenthos at Plantation Point, Jervis Bay. Report to NSW Public Works, Sydney.

Underwood, A.J., Chapman M.G. & L. Howitt, 1992. Intertidal and subtidal macrobenthos at Plantation Point, Jervis Bay. Report to Public Works Department, Sydney.

Underwood, A.J. & C.H. Peterson, 1988. Towards an ecological framework for investigating pollution. Marine Ecology Progress Series 46: 227 – 234.

Viarengo, A., Marro, A., Marchi, B. & B. Burlando, 2000. Single and combined effects of heavy metals and hormones on lysosomes of haemolymph cells from the mussel *Mytilus galloprovincialis*. Marine Biology, 137: 907 – 912.

Wiens, M., Seack, J., Koziol, C., Hassanein, H.M.A., Steffen, R., Korzhev, M., Schroder, H.C. & W.E.G. Muller, 1999. 17ß-Estradioldependent regulation of chaperone expression and telomerase activity in the marine sponge *Geodia cydonium*. Marine Biology, 133: 1 – 10.

Witman, J.D. & K.R. Grange, 1998. Links between rain, salinity, and predation in a rocky subtidal community. Ecology, 79: 2429 — 2447.

Warwick, R.M., 1993. Environmental impact studies on marine communities: pragmatical considerations. Aust. J. Ed., 18: 63 - 80.

WHO (World Health Organization), 2003. Looking back: looking ahead: five decades of challenges and achievements in environmental sanitation.

WSP 2013. Robben Island Marine Outfall. Specialist Study EIA: Assessment of Diffuser Performance. Unpublished Report. pp27.

Werz, B.E.J.S., 1993. Shipwrecks of Robben Island, South Africa: an exercise in cultural resource management in the underwater environment. The International Journal of Nautical Archaeology, 22(3): 245–256

Wilson, R.S., Heislers, S. & G.C.B Poore, 1998. Changes in benthic communities of Port Phillip Bay, Australia, between 1969 and 1995. Marine and Freshwater Research, 49: 847 – 861.

Zeri, C., Kontoyiannis, H. & A. Giannakourou, 2009. Distribution, fluxes and bacterial consumption of total organic carbon in a populated Mediterranean Gulf. *Cont.Shelf Res.,* 29, 886–895.

APPENDIX E – PUBLIC PARTICIPATION REPORT

1. Proof of Advertisements (Appendix E1)
2. Proof of Notification of stakeholders and distribution of BID documents (Appendix E2)
3. - Background Information Document
4. - Site Notice
5. - Proof of Placement of Site Notice
6. - Proof of post/ email notification.
7. Issues Trail (Appendix E3) to be updated in the final BAR
8. I&AP Register (Appendix E5)
9. Meeting minutes
10. Correspondence received

APPENDIX E – PUBLIC PARTICIPATION REPORT

Robben Island- Sewage Package Plant

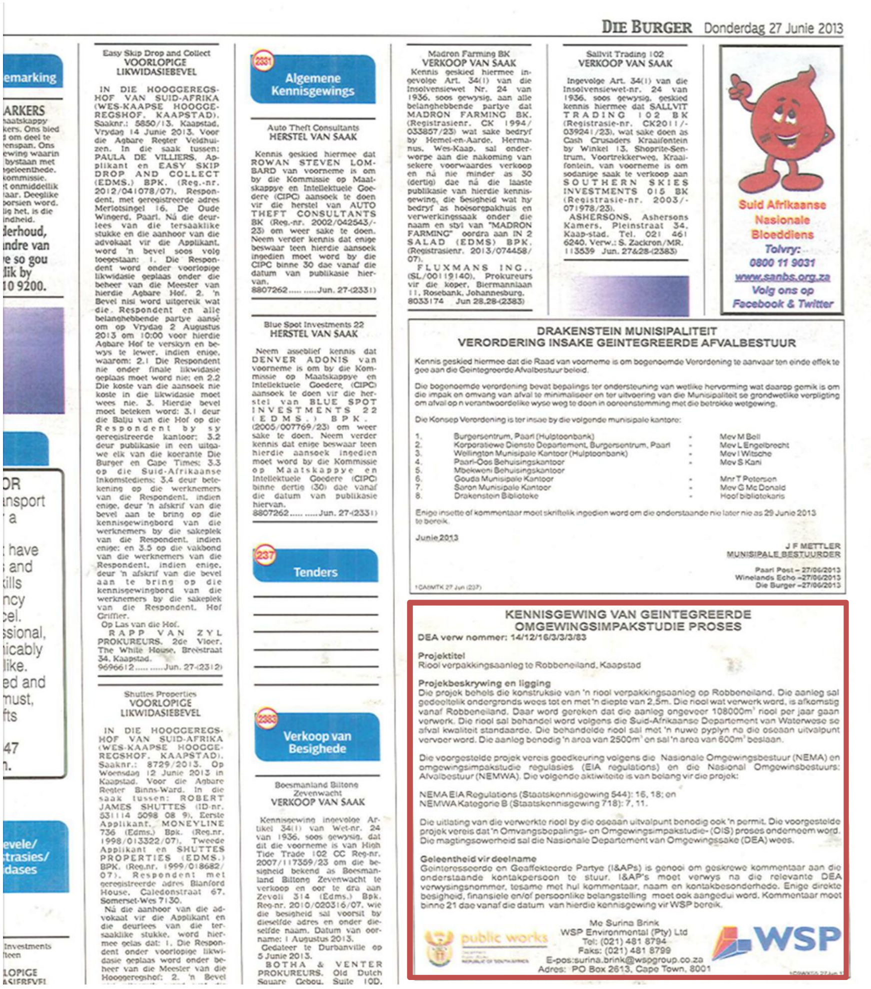
The below presents proof of the public participation process undertaken by WSP Environmental for the Proposed Sewage Package Plant. The contents are arranged as follows:

1. Proof of Advertisements (Appendix E1)
2. Proof of Notification of stakeholders and distribution of BID documents (Appendix E2)
   - Background Information Document
   - Site Notice
   - Proof of Placement of Site Notice
   - Proof of post/ email notification.
3. Issues Trail (Appendix E3)
4. I&AP Register (Appendix E5)
5. Meeting minutes
6. Correspondence received

PROOF OF ADVERTISEMENT

Appendix E.1

Die Burger 27th June 2013



KENNISGEWING VAN GEINTEGREERDE OMGEWINGSIMPAKSTUDIE PROSES

DEA verw nommer: 14/12/16/3/3/3/83

Projektitel
Riool verpakkingsaanleg te Robbeneiland, Kaapstad

Projekbeskrywing en ligging
Die projek behels die konstruksie van 'n riool verpakkingsaanleg op Robbeneiland. Die aanleg sal gedeeltelik ondergronds wees tot en met 'n diepte van 2,5m. Die riool wat verwerk word, is afkomstig vanaf Robbeneiland. Daar word gereken dat die aanleg ongeveer 108000m³ riool per jaar gaan verwerk. Die riool sal behandel word volgens die Suid-Afrikaanse Departement van Waterwese se afval kwaliteit standaarde. Die behandelde riool sal met 'n nuwe pyplyn na die oseaan uitvalpunt vervoer word. Die aanleg benodig 'n area van 2500m³ en sal 'n area van 600m³ beslaan.

Die voorgestelde projek vereis goedkeuring volgens die Nasionale Omgewingsbestuur (NEMA) en omgewingsimpakstudie regulasies (EIA regulations) en die Nasional Omgewinsbestuurs: Afvalbestuur (NEMWA). Die volgende aktiwiteite is van belang vir die projek:

NEMA EIA Regulations (Staatskennisgewing 544): 16, 18; en
NEMWA Kategorie B (Staatskennisgewing 718): 7, 11.

Die uitlating van die verwerkte riool by die oseaan uitvalpunt benodig ook 'n permit. Die voorgestelde projek vereis dat 'n Omvangsbepalings- en Omgewingsimpakstudie- (OIS) proses onderneem word. Die magtingsowerheid sal die Nasionale Departement van Omgewingssake (DEA) wees.

Geleentheid vir deelname
Geinteresseerde en Geaffekteerde Partye (I&APs) is genooi om geskrewe kommentaar aan die onderstaande kontakpersoon te stuur. I&AP's moet verwys na die relevante DEA verwysingsnommer, tesame met hul kommentaar, naam en kontakbesonderhede. Enige direkte besigheid, finansiele en/of persoonlike belangstelling moet ook aangedui word. Kommentaar moet binne 21 dae vanaf die datum van hierdie kennisgewing vir WSP bereik.

public works

Me Surina Brink
WSP Environmental (Pty) Ltd
Tel: (021) 481 8794
Faks: (021) 481 8799
E-pos: surina.brink@wspgroup.co.za
Adres: PO Box 2613, Cape Town, 8001

WSP

Cape Towner 4th July 2013

Long road to entertainment success

■ Duane Alexander

NOTICE OF INTEGRATED ENVIRONMENTAL AUTHORISATION AND WASTE MANAGEMENT LICENSE PROCESS

DEA ref number: 14/12/16/3/3/3/83

Project Title

Robben Island Sewage Package Plant on Robben Island, Cape Town.

Project Description and Locality

The construction of a Sewage Package Plant (SPP). It is currently proposed that the plant will be partially submerged to a depth of approx. 2.5m The SPP will treat sewage generated on the island. It is estimated that the treatment capacity of the plant will be 108000m3 per annum. Effluent will be treated to the South African Department of Water Affairs (DWA) effluent quality standards. The treated effluent will be transported via a new pipeline to the existing sea outfall pipeline. The sewage package plant will require an area of 2900m2; with a footprint of 600m2.

The construction of the SPP and associated pipelines and treatment of sewage trigger activities listed in the NEMA EIA Regulations and NEMWA: Waste Management Activities (GN 718). The following activities are triggered:

NEMA EIA Regulations (GN 544): 15, 18; and

NEMWA Category B (GN 718): 7, 11.

In addition, please note that a Coastal Waters Discharge Permit will also be applied for to the discharge the treated effluent to the sea. Due to the triggering of activities within Category B of NEMWA, a Scoping/EIA process needs to be undertaken. Notice is hereby given for the Integrated Environmental Authorisation and Waste Management License process that will be undertaken. The Competent Authority for the authorisation process is the National Department of Environmental Affairs (DEA).

Opportunity to participate

I&AP's are invited to provide written comments to the contact person below. I&APs should refer to the relevant DEA reference number above and provide their comments together with their name, contact details (preferred method of notification e.g. email, fax) and indicate any direct business financial or personal interest which they may have in the application within 21days from the date of this notice.

Ms Surina Brink
WSP Environmental (Pty) Ltd
Tel: (021) 481 8794
Fax: (021) 481 8799
Email:surina.brink@wspgroup.co.za
Address: PO Box 2613, Cape Town, 8001

Notification of Stakeholders – Appendix E.2

BACKGROUND INFORMATION DOCUMENT

Environmental Authorisation Process for the proposed Sewage Package Plant on Robben Island

BACKGROUND INFORMATION DOCUMENT

DEA ref number: 14/12/16/3/3/3/83

Project Background and Description

The project entails the construction of a Sewage Package Plant (SPP) on Robben Island. It is currently proposed that the plant will be partially submerged to a depth of approximately 2.5m. The SPP will treat sewage generated on the island. It is estimated that the treatment capacity of the plant will be $108000m^3$ per annum. Effluent will be treated to the South African Department of Water Affairs (DWA) effluent quality standards. The treated effluent will be transported via a new pipeline to the existing sea outfall pipeline and discharged to sea. The sewage package plant will require an area of $2500m^2$, with a footprint of $600m^2$. Sludge will be produced as part of the treatment process and will be dried on drying beds on the island. The sludge can be used as fertiliser or disposed of via the normal refuse system.

Due to the SPP's proposed location adjacent to the existing sewage collection unit, which is in close proximity to the sea, as well as the proposal to treat waste, the project requires authorisation in terms of National Environmental Management Act (NEMA) (Act No. 107 of 1998), EIA Regulations and the National Environmental Management Act: Waste Act (NEM:WA) (Act No. 59 of 2008). Robben Island is a National and World Heritage Site and therefore, the competent authority in terms of Environmental Authorisation in terms NEMA will be the National Department of Environmental Affairs (DEA). The sewage treated at the plant would be seen as the treatment of hazardous waste. The competent authority for the Waste Management License is therefore also DEA. Due to the fact that the DEA is the competent authority in both cases, an Integrated Environmental Authorisation application form has been submitted to the DEA. The purpose of this application form is to initiate the process in order to obtain Environmental Authorisation in terms of NEMA and NEM:WA.

Legal Framework

NEMA, EIA Regulations:

GN 544, 18 June 2010 (Listing Notice 1) 16: The proposed Sewage Package Plant will be constructed within ~50m of the edge of the sea and will have a footprint of $600m^3$.

GN 544, 18 June 2010 (Listing Notice 1) 18 (iv): The proposed Sewage Package Plant will be partially submerged to an approximate depth of 2.5m. In addition, pipelines will need to be constructed from the site to the starting point of the discharge outlet located on the sea shore.

NEMWA Waste Management Activities:

GN 718, Category B 7: It is expected that the plant will treat approximately $300m^3$ of sewage daily ($108000m^3$ per annum).

GN 718, Category B 11: There is not an existing plant and therefore, the SPP will need to be constructed on site.

In addition, please note that a Coastal Waters Discharge Permit will also be applied for to discharge the treated effluent to the sea. Based on the above triggers, a *Scoping and Environmental Impact Assessment (EIA) process* must be undertaken in order to assess the potential impacts associated with the project. An Integrated Environmental Authorisation application form has been submitted to the Department of Environmental Affairs and the following reference numbers were obtained; DEA ref number: 14/12/16/3/3/3/83.

Purpose of this Document

This Background Information Document (BID) introduces all stakeholders to the proposed project. This document forms part of the stakeholder consultation process undertaken as a component of the Environmental Authorisation process and is intended to provide stakeholders with adequate information to comment on the project.

The BID details the project, the environmental authorisation process, the role of stakeholders in the process as well as to encourage stakeholders to comment on the project, ask questions and raise issues that should be included in the project documents. Aside from this document, at various stages of the environmental authorisation process, information and reports will be made available for stakeholders to comment on.

WSP Environment and Energy (WSP) has been appointed by the Department of Public Works as the Environmental Assessment Practitioner (EAP) to undertake the Environmental Authorisation process for the project and to facilitate stakeholder engagement.

To become a registered stakeholder and ensure all comments and queries regarding this project are accurately documented and addressed, please forward your contact details and comments by **15 July 2013** on the attached response sheet to:

CONSULTANT:	**Surina Brink**
COMPANY:	**WSP Environment and Energy**
ADDRESS:	**P.O. Box 2613, Cape Town, 8000, RSA**
TEL:	**0214818794**
FAX:	**0214818799**
EMAIL:	**Surina.brink@WSPGroup.co.za**

Stakeholder Consultation Process

The purpose of stakeholder engagement is to consult with interested and affected parties in the public and private sectors in the decision-making process on projects which may affect them. The process aims to develop and maintain open channels of communication between the project team and stakeholders. This process provides stakeholders with the opportunity to express their views and concerns regarding the proposed project through project correspondence. The environmental assessment practitioner documents the views and concerns of stakeholders, and makes the project team and relevant authority aware of issues that need to be considered during the compilation and evaluation of the potential risks and impacts associated with the project.

Who is a Stakeholder?

Any person, group of persons or organisation interested and/or affected by the proposed development.

Register your interest by completing and returning the Registration and Comments Form attached herewith.

What does the Environmental Authorisation Process consist of?

Stakeholder Engagement

The first steps are to notify the public and previously identified stakeholders of the proposed project and invite all stakeholders to a public meeting through the following mediums:

- Newspaper advertisements:
  - Cape Towner- Advert placed on the 20th June 2013
  - Die Burger – Advert placed on the 20th June 2013
- Site notices will be placed at the local Kiosk on Robben Island and at the Security Offices at the Robben Island Harbour;
- Written notification letters to authorities and municipal ward councillors; and
- Distribution of the BID to surrounding landowners and registered stakeholders.

All reports will be provided to registered stakeholders for their consideration. Should it be deemed necessary, all registered stakeholders will be invited to a public meeting where any and all comments may be raised and recorded so that they can be addressed in an issues trail and associated reports.

Environmental Considerations

Robben Island's natural vegetation consists of a dry version of strandveld but with the introduction of exotic species such as bluegum trees, fallow deer and rabbits, the natural environment has been destroyed. With the construction of the proposed SPP it is not anticipated to affect a large area, resulting in limited disturbance to the localised natural vegetation. The environmental features present at the site which would need to be assessed during the Scoping and EIA process are the heritage/cultural significance of the site and the potential impact on the marine environment at the sea outfall discharge point. To this end, it is proposed that the following assessments are undertaken in support of the EIA process and additional permits that are required:

Paleontological Desktop Assessment and Archaeological Impact Assessment

Due to the significance of the site from a heritage perspective, heritage meaning archaeological, paleontological or architectural significance, the proposed project and excavations that will occur as part of the construction of the SPP will have an impact on the heritage of the site. As such, these studies are required to identify the presence of any heritage aspects and propose mitigation measures that have to be implemented to manage these impacts. These studies will also feed into the SAHRA permit application that has to be submitted to SAHRA.

Dispersion Modelling and Marine Impact Assessment

The SPP will discharge treated effluent via the Robben Island Sea Outfall Pipeline to the ocean. To understand the impacts associated with this activity, a dispersion modelling exercise would need to be undertaken to ascertain the extent of dispersion from the outfall point. Due to the quantities of sewage being treated daily, it is not expected that the dispersion plume will be large and as such, in-depth dispersion modelling will not be undertaken.

The results from the modelling exercise will feed into the Marine Impact Assessment that will be undertaken to quantify the potential impact on the benthic and marine community that falls within the dispersion plume. These two assessments, along with engineering input, will provide the information required for the Coastal Water Discharge Permit.

Figure 1. Panorama view of the site under consideration.

Locality Map

Figure 2. Locality of Robben Island (Image source: Google Maps, 2012).

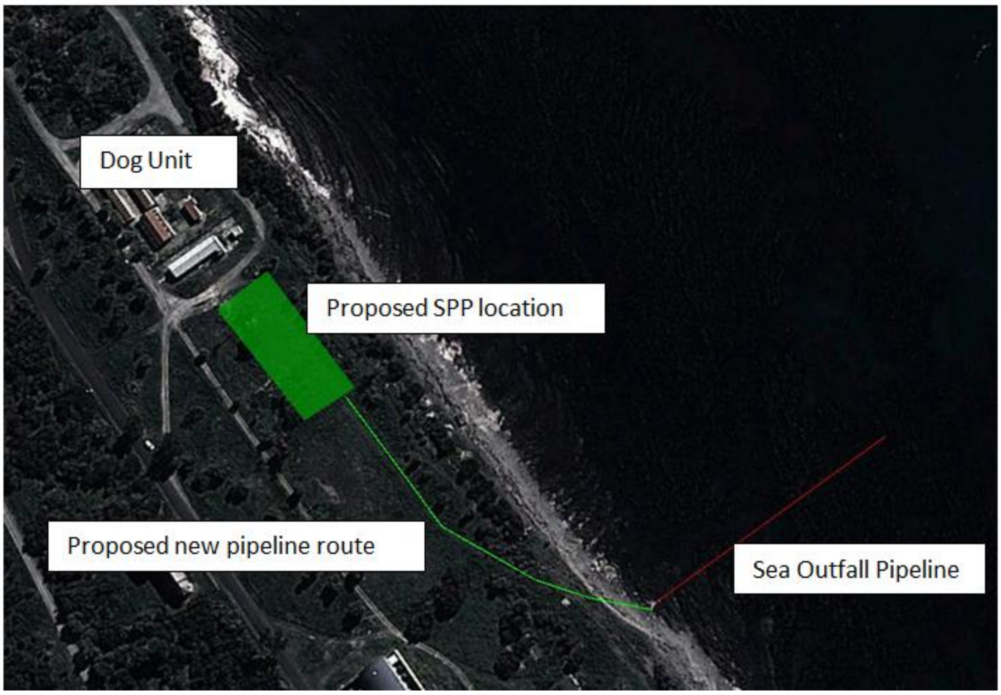


Figure 3. Location of the SPP on Robben Island (Image source: Google Maps, 2012).

Registration and Comments Sheet

To be a registered stakeholder and ensure all comments and queries regarding this project are accurately documented and addressed please forward your comments and contact details with the attached response sheet to:

Surina Brink
WSP Environmental (Pty) Ltd
Address: P.O. Box 2613, Cape Town, 8000
Tel: 0214818794
Fax: 0214818799
Email: Surina.brink@WSPGroup.co.za

Please insert your personal details below:

Name:	
Organisation & Designation:	
Address:	
Tel:	
Fax:	
E-mail:	

Please list your interest in the Proposed Sewage Package Plant and provide comments below:

SITE NOTICE

ENVIRONMENTAL AUTHORISATION

DEA ref number: 14/12/16/3/3/3/83

Proponent: Department of Public Works

Project Location: Robben Island

Independent Environmental Assessment Practitioner:

WSP Environment and Energy | PO Box 2613 | Cape Town, 8000

Project Description and Locality

The project entails the **construction of a Sewage Package Plant** (SPP). It is currently proposed that the plant will be partially submerged to a depth of approx. 2.5m. The SPP will treat sewage generated on the island. It is estimated that the treatment capacity of the plant will be 108000m^3 per annum. Effluent will be treated to the South African Department of Water Affairs (DWA) effluent quality standards. The treated effluent will be transported via a new pipeline to the existing sea outfall pipeline. The sewage package plant will require an area of 2500m^2, with a footprint of 600m^2.

The construction of the SPP and associated pipelines and treatment of sewage trigger activities listed in the NEMA EIA Regulations and NEMWA: Waste Management Activities (GN 718). The following activities are triggered:

NEMA EIA Regulations (GN 544): 16, 18; and

NEMWA Category B (GN 718): 7, 11.

In addition, please note that a **Coastal Waters Discharge Permit** will also be applied for to discharge the treated effluent to sea. Due to the triggering of activities within Category B of NEMWA, a **Scoping/EIA process** needs to be undertaken. Notice is hereby given for the **Integrated Environmental Authorisation** and **Waste Management License** process that will be undertaken. The Competent Authority for the authorisation process is the National Department of Environmental Affairs (DEA).

Opportunity to participate

I&AP's are invited to provide written comments to the contact person below. I&APs should refer to the relevant DEA reference number above and provide their comments together with their name, contact details (preferred method of notification e.g. email, fax) and indicate any direct business financial or personal interest which they may have in the application by the 12th of August 2013.

In order to ensure that you are registered as a stakeholder or would like to participate and find out more about the project, please submit your name, contact information and interest in the matter by 12 August 2013 to Surina Brink

What is stakeholder engagement?

A process in which potential stakeholders are informed about the project and given an opportunity to comment on, or raise issues relevant to the proposed activities.

Who are stakeholders?

Any person, group of persons or organisation interested in and / or affected by an activity; and any organ of state that may have jurisdiction over any aspect of the activity.

For more information contact:

Surina Brink| Tel: 0214818794 | Fax: 0214818799 | Email: Surina.brink@WSPGroup.co.za

UNITED BY OUR DIFFERENCE WSP

www.wspenvironmental.co.za

SITE NOTICE PLACEMENT

Location: Security Offices at the Robben Island Harbour on the 19th July 2013.

Proof of Notification of Stakeholders

I&AP Registration

Our reference number: 37418

20 June 2013

DEA ref number: 14/12/16/3/3/3/83

Dear Stakeholder

Notice of Scoping/EIA process for the proposed construction of a Sewage Package Plant on Robben Island, Cape Town

The project entails the construction of a Sewage Package Plant (SPP) on Robben Island. It is currently proposed that the plant will be partially submerged to a depth of approximately 2.5m. The SPP will treat sewage generated on the island. It is estimated that the treatment capacity of the plant will be $108000m^3$ per annum. Effluent will be treated to the South African Department of Water Affairs (DWA) effluent quality standards. The treated effluent will be transported via a new pipeline to the existing sea outfall pipeline and discharged to sea. The sewage package plant will require an area of $2500m^2$, with a footprint of $600m^2$. Sludge will be produced as part of the treatment process and will be dried on drying beds on the island. The sludge can be used as fertiliser or disposed of via the normal refuse system.

Due to the SPP's proposed location adjacent to the existing sewage collection unit, which is in close proximity to the sea, as well as the proposal to treat waste, the project requires authorisation in terms of National Environmental Management Act (NEMA) (Act No. 107 of 1998), EIA Regulations and the National Environmental Management Act: Waste Act (NEM:WA) (Act No. 59 of 2008). Robben Island is a National and World Heritage Site and therefore, the competent authority in terms of Environmental Authorisation in terms NEMA will be the National Department of Environmental Affairs (DEA). The sewage treated at the plant would be seen as the treatment of hazardous waste. The competent authority for the Waste Management License is therefore also DEA. Due to the fact that the DEA is the competent authority in both cases, an Integrated Environmental Authorisation application form has been submitted to the DEA. The purpose of this application form is to initiate the process in order to obtain Environmental Authorisation in terms of NEMA and NEM:WA.

Legal Framework

The following activities are applicable to the proposed project:

NEMA, EIA Regulations: GN 544, 18 June 2010 (Listing Notice 1) 16, 18; and
NEMWA Waste Management Activities: GN 718, Category B 7, 11.

In addition, please note that a Coastal Waters Discharge Permit will also be applied for to discharge the treated effluent to the sea. Based on the above triggers, a Scoping and Environmental Impact Assessment (EIA) process must be undertaken in order to assess the potential impacts associated with the project. An Integrated Environmental Authorisation application form has been submitted to DEA and the following reference numbers were obtained; DEA ref number: 14/12/16/3/3/3/83.

Environmental Impact Assessment Process

WSP Environmental (Pty) Ltd (WSPE hereafter) has been appointed by the Department of Public Works to undertake the function of environmental assessment practitioner (EAP) to facilitate the stakeholder engagement process and undertake the Environmental Authorisation in accordance with the NEMA EIA regulations.

The stakeholder engagement will be undertaken according to the NEMA (No. 107 of 1998), with reference to GN R. 543 of 2010, which stipulates that written notice should to be given to the following:

- Municipal councilor of the ward in which the site is located;
- The municipality which has jurisdiction in the area;
- The owner in control of the land for which the application is being made;
- The occupiers of the site where the activity is to be undertaken;
- The owners or occupiers of the land adjacent to the site;
- Any organ of state having jurisdiction in respect of any aspects of the activity; and
- Any other party as required by the competent authority, the Department of Environmental Affairs.

WSP Environmental (Pty) Ltd
3rd Floor
35 Wale Street
Cape Town 8001
Tel: +27 (0)21 481 8700
Fax: +27 (0)21 481 8799
http://www.wspenvironmental.co.za
Reg. No: 1995/08790/07

WSP Group Ltd
Offices worldwide

In line with this requirement, please find attached a Background Information Document (BID) pertaining to the proposed project. Should you have any questions, please do not hesitate to contact the undersigned.

You have until the **15th of July 2013** to make representations or request additional information should you so wish. An I&AP registration form has been provided at the back of the BID, please complete this form and fax, e-mail or post the form using the contact details provided. To be formally registered as an interested and affected party with respect to this application you are required to complete the registration form providing your name and address. The preferred method of notification should be indicated (postal address or facsimile or email or all three). Failure to register will indicate that you no longer wish to participate in this Stakeholder Engagement process.

Regards,

Surina Brink
Environmental Consultant
Tel: (021) 481 8794
Fax: (021) 481 8799
Email: Surina.brink@wspgroup.co.za

Postal Distribution

ORGANISATION/ IAP	NAME	SURNAME	TELEPHONE	FAX NO.	POSTAL ADDRESS
DEA: Coastal Management- Integrated Coastal Management	Mulalo	Tshikotshi	0218192455		PO Box 52126 Victoria and Alfred Waterfront Cape Town 8002
DEADP: Land Management	Zaahir	Toefy			Private Bag X9086 Cape Town 8000
DEADP: Waste Management	Eddie	Hanekom			Private Bag X9086 Cape Town 8000
City of Cape Town : Environment and Heritage Management District A	Dimitri	Georgeades	021 400 6518	021 425 4448	PO Box 4529 Cape Town 8000
Municipal Manager	Achmat	Ebrahim	021 400 1332	021 400 1332	Private Bag X9181 Cape Town 8000
Cape Nature	Rhett	Smart	021 566 8017	021 866 1523	Private Bag X5014 Stellenbosch 7599
SANCCOB	Nola	Persons	084 822 0189		P.O. Box 11116 Bloubergstrand 7443 South Africa
SAHRA	Mariagrazia	Galimberti	0214624502	0214684509	PO Box 4637 Cape Town 8000
Department of Water Affairs	The Director				Private Bag X 16 Sanlamhof 7532

VLAEBERG 8018
20 JUN 2013
FOLIO 3

Email Distribution

Robben Island - Proposed Sewage Package Plant EIA Notification - Message (HTML)

File Message McAfee E-mail Scan

From: Brink, Surina
Sent: Thu 2013/06/20 01:15 PM
To: Brink, Surina
Cc:
Bcc: 'Amakhado@environment.gov.za'; 'beverly.schafer@capetown.gov.za'; 'les.underhill@uct.ac.za'; 'Bdyer@environment.gov.za'; 'dimitri.georgeades@capetown.gov.za'; 'richard.sherley@uct.ac.za'; 'richard.sherley@gmail.com'; 'nolubabalot@robben-island.org.za'; 'sabelom@robben-island.org.za'; 'mariol@robben-island.org.za'; 'estellee@robben-island.org.za'
Subject: Robben Island - Proposed Sewage Package Plant EIA Notification

Message | 37418_Robben Island SPP invitation to comment Letter - Stakeholders.pdf

Dear Stakeholder,

Please find attached the Background Information Document (BID) relating to proposed Sewage Package Plant to be constructed on Robben Island.

Please do not hesitate to contact me, should you have any queries.

Kind regards,

Surina Brink
Environmental Consultant

WSP Environmental (Pty) Ltd
3rd Floor, 35 Wale Street, Cape Town, 8001, South Africa
Tel: +27 21 481 8794
Fax: +27 21 481 8799
Mob: +27 82 468 0962

We are WSP. United by our difference
Web: www.wspenvironmental.co.za

SURVEY

Building Services | Civil engineering | Coastal engineering | Environmental | Industrial engineering | Structural engineering | Systems | Home Page

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Please recycle all printed documents.

DRAFT BASIC ASSESSMENT - PROOF OF DELIVERY (Email, post, hand delivery)

From: Sims, Kirsten
Sent: Mon 2014/05/26 12:36 PM
To: Sims, Kirsten
Cc:
Bcc: 'Bdyer@environment.gov.za'; 'Amakhado@environment.gov.za'; 'beverly.schafer@capetown.gov.za'; 'city.manager@capetown.gov.za'; 'mxim@dwa.gov.za'; 'petersona@dwa.gov.za'; 'claassenm@dwa.gov.za'; 'les.underhill@uct.ac.za'; 'richard.sherley@uct.ac.za'; 'richard.sherley@gmail.com'; 'nolubabalot@robben-island.org.za'; 'sabelom@robben-island.org.za'; 'LindaP@robben-isalnd.org.za'; 'Cecilenem@robben-isalnd.org.za'; 'jfd.dekock@dpw.gov.za'
Subject: PUBLIC COMMENT PERIOD: Draft Basic Assessment and Coastal Waters Discharge Permit Robben Island Sewage Package Plant

Message | Appendix A & B Comments Sheet.doc

Our reference number: 37418

26 May 2013

DEA ref number: 14/12/16/3/3/3/83

To whom it may concern,

Notice of change of environmental authorisation process for the proposed construction of a Sewage Package Plant on Robben Island, Cape Town and release of Draft Basic Assessment Report

You are receiving this as a registered stakeholder or commenting authority with regards to the environmental authorisation process for the Sewage Package Plant on Robben Island, Cape Town.

1. **Notification of Downgrade to Basic Assessment And Waste Management License**

This letter serves to notify registered I&APs that the abovementioned project has been downgraded from an Integrated Scoping & EIA to a Basic Assessment process on the basis of regulations promulgated on the 29th of November 2013 by the Minister of Water and Environmental Affairs in terms of the National Environmental Management: Waste Act (NEMWA) (Act No. 59 of 2008) and the National Environmental Management Act (NEMA) (Act No. 107 of 1998). The new promulgated regulations applicable to the project are:

- GN 921 NEMWA List of waste management activities that have, or are likely to have, a detrimental effect on the environment;
- GN 922 NEMA Amendment to Environmental Impact Assessment Regulations, Listing Notice 1 of 2010;
- GN 923 NEMA Amendment to Environmental Impact Assessment Regulations, Listing Notice 2 of 2010.

As a result of changes to these regulations; the following regulatory triggers are now applicable to the proposed Sewage Package Plant (SPP):

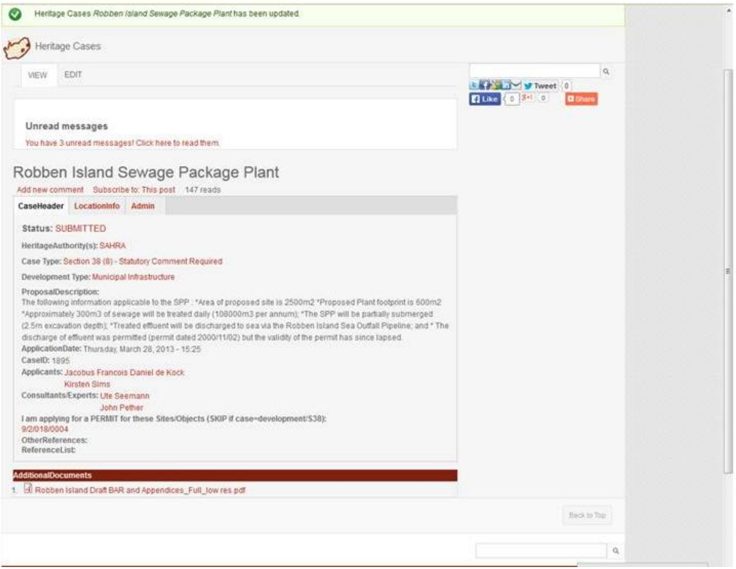
Act	Regulation	Description	Relevance
NEMA	GN 544; (Activity 16)	Construction or earth moving activities within 100m inland of the high water mark or sea for buildings greater than 50 square meters.	The proposed Sewage Package Plant will be constructed within ~50 m of the edge of the sea and will have a footprint of 600 m³.
	GN 544; (Activity 18)	Infilling or depositing of material more than 5 cubic meters, or dredging and excavation of material within 100m of the high water mark.	The proposed Sewage Package Plant will be partially submerged to a depth of 2.5 m. Due to the locality of the plant and pipelines to the sea, it is expected that various materials such as rocks, shells, soil

From: Sims, Kirsten
Sent: Mon 2014/05/26 01:43 PM
To: 'Mariagrazia Galimberti'; 'gontong@sahra.org.za'
Cc:
Subject: PUBLIC COMMENT PERIOD: Draft Basic Assessment and Coastal Waters Discharge Permit Robben Island Sewage Package Plant

Dear Mariagrazia and Greg

Please be advised that the Draft Basic Assessment has been uploaded onto the SAHRA website for your comment. A screenshot of the upload page has been included for your convenience.

Below please also find the cover letter pertaining to the proposed project for your information. The dBAR comment period will run until the 4th July.


Heritage Cases *Robben Island Sewage Package Plant* has been updated.

Heritage Cases

VIEW EDIT

Unread messages

You have 3 unread messages! Click here to read them.

Robben Island Sewage Package Plant

Add new comment Subscribe to: This post 147 reads

CaseHeader LocationInfo Admin

Status: SUBMITTED

HeritageAuthority(s): SAHRA

Case Type: Section 38 (8) - Statutory Comment Required

Development Type: Municipal Infrastructure

ProposalDescription:
The following information applicable to the SPP : *Area of proposed site is 2500m2 *Proposed Plant footprint is 600m2 *Approximately 300m3 of sewage will be treated daily (108000m3 per annum); *The SPP will be partially submerged (2.5m excavation depth); *Treated effluent will be discharged to sea via the Robben Island Sea Outfall Pipeline; and * The discharge of effluent was permitted (permit dated 2000/11/02) but the validity of the permit has since lapsed.

ApplicationDate: Thursday, March 28, 2013 - 15:25

CaseID: 1895

Applicants: Jacobus Francois Daniel de Kock
Kirsten Sims

Consultants/Experts: Ute Seemann
John Pether

I am applying for a PERMIT for these Sites/Objects (SKIP if case=development/S38):
9/2/018/0004

OtherReferences:
ReferenceList:

AdditionalDocuments

1. Robben Island Draft BAR and Appendices_Full_low res.pdf

DOCUMENT DELIVERY NOTE

WSP

P O Box 2613
Cape Town
8000
South Africa

Tel +27(0)21 481 8700
Fax +27(0)21 481 8799
E-mail: wspcpt@wspgroup.co.za
http://www.wspgroup.co.za

TO:	
Cape Nature	
Rhett Smart	**Job No.** 34718
	Date. 26 May 2014

ATTENTION: Rhett Smart **CONTRACT:** Department of Public Works

No. Copies	Document Ref.	Title and Description	Size
1 X Draft Basic Assessment Report	14/12/16/ 3/3/3/83	Draft BAR for the Robben Island Sewage Package Plant	A4 Hardcopy

REMARKS:

Issued by: Kirsten Sims

Received by: [signature]

Date: 26/05/2014

DOCUMENT DELIVERY NOTE

WSP

P O Box 2613
Cape Town
8000
South Africa

Tel +27(0)21 481 8700
Fax +27(0)21 481 8799
E-mail: wspcpt@wspgroup.co.za
http://www.wspgroup.co.za

TO:	
City of Cape Town	Job No. 34718
Dmitri Georgeades	
	Date. 26 May 2014

ATTENTION: Dmitri Georgeades **CONTRACT:** Department of Public Works

No. Copies	Document Ref.	Title and Description	Size
1 x CD copy	14/12/16/ 3/3/3/83	Draft BAR for the Robben Island Sewage Package Plant and Coastal Waters Discharge Permit	CD

REMARKS:

Issued by: Kirsten Sims

Received by: S Hustwidko

Date: 26.5.2014.

DOCUMENT DELIVERY NOTE

WSP

P O Box 2613
Cape Town
8000
South Africa

Tel +27(0)21 481 8700
Fax +27(0)21 481 8799
E-mail: wspcpt@wspgroup.co.za
http://www.wspgroup.co.za

TO:	
DEA: Ocean & Coast Mulalo Tshikotshi Razeena Omar	**Job No.** 34718
	Date. 26 May 2014

ATTENTION: Mulalo Tshikotshi **CONTRACT:** Department of Public Works

No. Copies	Document Ref.	Title and Description	Size
1 X Draft Basic Assessment Report (Hardcopy) 1 x CD copy	14/12/16/ 3/3/3/83	Draft BAR for the Robben Island Sewage Package Plant and Coastal Waters Discharge Permit	A4 Hardcopy and CD

REMARKS:

Issued by: Kirsten Sims

Received by: Mulalo TSHIKOTSHI

Date: 26 /05 / 2014

DOCUMENT DELIVERY NOTE

WSP

P O Box 2613
Cape Town
8000
South Africa

Tel +27(0)21 481 8700
Fax +27(0)21 481 8799
E-mail: wspcpt@wspgroup.co.za
http://www.wspgroup.co.za

TO:	
Department of Environmental Affairs and Development Planning	
Zaahir Toefy (Director Land Management) Labeeba de Jager (Land Management) Eddie Henekom (Waste Management)	**Job No.** 34718
	Date. 26 May 2014

ATTENTION: Z Toefy **CONTRACT:** Department of Public Works

No. Copies	Document Ref.	Title and Description	Size
3 X Draft Basic Assessment Report	14/12/16/ 3/3/3/83	Draft BAR for the Robben Island Sewage Package Plant	A4 Hardcopy

REMARKS:

Issued by: Kirsten Sims **Received by:** __________

Date: __________

DPE WORLDWIDE EXPRESS

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Cape Town Tel: 021 386-5070
Durban Tel: 031 569-6566

SOUTH AFRICA
Johannesburg Tel: 011 573-3000
Port Elizabeth Tel: 041 581-5105
East London Tel: 043 722-3170

TAX INVOICE

1 ACCOUNT NUMBER	C1593
CUSTOMER REFERENCE	DL13659
SHIPPER DETAILS	WSP GROUP - ENVIRONMENT ENVIRONMENT 3RD FLOOR 35 WALE STREET CAPE TOWN SOUTH AFRICA
PHONE	021 481 8700
SENDER'S NAME	BRONWYN FISHER

CPT 302200598291

2 CONSIGNEE DETAILS	DEPARTMENT OF ENVIRONMENTAL AFFAIRS - ENVIRONMENTAL IMPACT EVALUATION DIRECTORATE 315 PRETORIUS STREET FEDSURE FORUM BUILDING NORTH TOWER PRETORIA 0001
COUNTRY	SOUTH AFRICA
PHONE	012 310 3911
RECEIVERS NAME	HERMAN ALBERTS

3 SERVICE TYPE (x)

IMPORTANT
NO SERVICE MARKED DEFAULTS TO EXPRESS SERVICE. ATTACH ORIGINAL & THREE COPIES OF COMMERCIAL INVOICES WITH THE NON-DOCUMENT PACKAGES FOR CUSTOMS PURPOSES.

DOMESTIC OVERNIGHT	☑	INT'L COURIER	☐
PRIORITY DELIVERY	☐	INT'L AIR FREIGHT	☐
DOMESTIC SAME DAY	☐	INT'L IMPORTS	☐
DOMESTIC AIR FREIGHT	☐	RE MAIL	☐
ROAD FREIGHT	☐	REMOTE DELIVERY	☐

5 DESCRIPTION OF CONTENTS
DOCUMENTS

NO. OF PIECES	WEIGHT KG
2	2 KG

DIMENSION + SPECIAL INSTRUCTIONS
KEEP PIECES TOGETHER

4 SENDER'S AUTHORISATION AND SIGNATURE

DANGEROUS GOODS ARE NOT ALLOWED

I HEREBY DECLARE THAT THIS CONSIGNMENT DOES NOT CONTAIN DANGEROUS GOODS AND THE SENDER AGREES TO BE BOUND BY THE STANDARD CONDITIONS OF CARRIAGE. A COPY OF WHICH WILL BE MADE AVAILABLE ON REQUEST.

SENDER'S SIGNATURE
DATE 23 / 05 / 2014
TIME AM / PM

RECEIVED FOR DPE WORLDWIDE BY
DATE 23/5/14
TIME AM / PM

CUSTOMS DUTIES/TAXES PAYABLE BY CONSIGNEE
DECLARED VALUE FOR CUSTOMS R
INSURANCE REQUIRED Yes No

PROOF OF DELIVERY (POD)
RECEIVER'S SIGNATURE
DATE DD / MM / YYYY
PRINT NAME (CAPITAL LETTERS VERY IMPORTANT)
TIME AM / PM

CHARGES	
WEIGHT CHARGE	
OTHER	
VAT	
TOTAL	

Draft BAR follow up request for comments (2 weeks)

From: Sims, Kirsten
Sent: Thu 2014/06/19 04:22 PM
To: Sims, Kirsten
Cc:
Bcc: 'Bdyer@environment.gov.za'; 'Amakhado@environment.gov.za'; 'beverly.schafer@capetown.gov.za'; 'city.manager@capetown.gov.za'; 'mxim@dwa.gov.za'; 'petersona@dwa.gov.za'; 'claassenm@dwa.gov.za'; 'les.underhill@uct.ac.za'; 'richard.sherley@uct.ac.za'; 'richard.sherley@gmail.com'; 'nolubabalot@robben-island.org.za'; 'sabelom@robben-island.org.za'; 'LindaP@robben-isalnd.org.za'; 'romar@environment.gov.za'; 'Cecilenem@robben-isalnd.org.za'; 'jfd.dekock@dpw.gov.za'; 'halberts@environment.gov.za'; 'mrabothata@environment.gov.za'; 'mtshikot@environment.gov.za'; 'Mariagrazia Galimberti'; 'gontong@sahra.org.za'; 'derrick@camdekon.co.za'; 'James Marais'; Dimitri Georgeades; 'zaahir.toefy@westerncape.gov.za'; 'labeebadejager@westerncape.gov.za'; 'eddie.hanekom@westerncape.gov.za'; 'landuse@capenature.co.za'
Subject: PUBLIC COMMENT PERIOD: Draft Basic Assessment and Coastal Waters Discharge Permit Robben Island Sewage Package Plant

Dear Interested & Affected Party,

WSP Environmental wishes to notify you that there are 2 weeks remaining to comment on the draft Basic Assessment Report and Coastal Waters Discharge Permit (CWDP) for the proposed development of a Sewage Package Plant at Robben Island. The commenting period closes on the 4th July 2014.

To download the draft BAR please visit: http://www.wspgroup.com/en/Welcome-to-WSP-Africa/WSP-Africa/About-WSP-Africa/public-documents/
To download the CWDP please visit: http://www.wspgroup.com/en/Welcome-to-WSP-Africa/WSP-Africa/About-WSP-Africa/public-documents/

Regards,

Kirsten Sims
Senior Consultant

WSP

WSP, Environment & Energy, Africa
3rd Floor, 35 Wale Street, Cape Town, 8001, South Africa
Tel: +27 21 481 8648
Mob: +27 79 522 7171
Fax: +27 21 481 8799

www.wspgroup.co.za

WSP is one of the world's leading engineering and design consultancies. We provide services to transform the built environment and restore the natural environment. We have 15,000 employees, based in more than 300 offices, across 35 countries, on

Draft BAR follow up request for comments (5 days)

From: Sims, Kirsten
Sent: Mon 2014/06/30 08:57 AM
To: Sims, Kirsten
Cc:
Bcc: 'Bdyer@environment.gov.za'; 'Amakhado@environment.gov.za'; 'beverly.schafer@capetown.gov.za'; 'city.manager@capetown.gov.za'; 'mxim@dwa.gov.za'; 'petersona@dwa.gov.za'; 'claassenm@dwa.gov.za'; 'les.underhill@uct.ac.za'; 'richard.sherley@uct.ac.za'; 'richard.sherley@gmail.com'; 'nolubabalot@robben-island.org.za'; 'sabelom@robben-island.org.za'; 'LindaP@robben-isalnd.org.za'; 'romar@environment.gov.za'; 'Cecilenem@robben-isalnd.org.za'; 'jfd.dekock@dpw.gov.za'; 'halberts@environment.gov.za'; 'mrabothata@environment.gov.za'; 'mtshikot@environment.gov.za'; 'Mariagrazia Galimberti'; 'gontong@sahra.org.za'; 'derrick@camdekon.co.za'; 'James Marais'; 'Dimitri Georgeades'; 'zaahir.toefy@westerncape.gov.za'; 'labeebadejager@westerncape.gov.za'; 'eddie.hanekom@westerncape.gov.za'; 'landuse@capenature.co.za'
Subject: Reminder: PUBLIC COMMENT PERIOD: Draft Basic Assessment and Coastal Waters Discharge Permit Robben Island Sewage Package Plant

Dear Interested & Affected Party,

WSP Environmental wishes to notify you that there are five days remaining to comment on the draft Basic Assessment Report and Coastal Waters Discharge Permit (CWDP) for the proposed development of a Sewage Package Plant at Robben Island. The commenting period closes at midnight on the 4th July 2014.

To download the draft BAR please visit: http://www.wspgroup.com/en/Welcome-to-WSP-Africa/WSP-Africa/About-WSP-Africa/public-documents/
To download the CWDP please visit: http://www.wspgroup.com/en/Welcome-to-WSP-Africa/WSP-Africa/About-WSP-Africa/public-documents/

Regards,

Kirsten Sims
Senior Consultant

WSP, Environment & Energy, Africa
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www.wspgroup.co.za

DRAFT BASIC ASSESSMENT NOTIFICATION LETTER

Our reference number: 37418

26 May 2013

DEA ref number: 14/12/16/3/3/3/83

To whom it may concern,

Notice of change of environmental authorisation process for the proposed construction of a Sewage Package Plant on Robben Island, Cape Town and release of Draft Basic Assessment Report

1. Notification of Downgrade to Basic Assessment And Waste Management License

This letter serves to notify registered I&APs that the abovementioned project has been downgraded from an Integrated Scoping & EIA to a Basic Assessment process on the basis of regulations promulgated on the 29th of November 2013 by the Minister of Water and Environmental Affairs in terms of the National Environmental Management: Waste Act (NEMWA) (Act No. 59 of 2008) and the National Environmental Management Act (NEMA) (Act No. 107 of 1998). The new promulgated regulations applicable to the project are:

- GN 921 NEMWA List of waste management activities that have, or are likely to have, a detrimental effect on the environment;
- GN 922 NEMA Amendment to Environmental Impact Assessment Regulations, Listing Notice 1 of 2010;
- GN 923 NEMA Amendment to Environmental Impact Assessment Regulations, Listing Notice 2 of 2010.

As a result of changes to these regulations; the following regulatory triggers are now applicable to the proposed Sewage Package Plant (SPP):

Act	Regulation	Description	Relevance
NEMA	GN 544; (Activity 16)	Construction or earth moving activities within 100m inland of the high water mark or sea for buildings greater than 50 square meters.	The proposed Sewage Package Plant will be constructed within ~50 m of the edge of the sea and will have a footprint of 600 m^3.
	GN 544; (Activity 18)	Infilling or depositing of material more than 5 cubic meters, or dredging and excavation of material within 100m of the high water mark.	The proposed Sewage Package Plant will be partially submerged to a depth of 2.5 m. Due to the locality of the plant and pipelines to the sea, it is expected that various materials such as rocks, shells, soil etc. will be removed within a distance of 100m inland from the high-water mark and will be more than 5 m^3.
NEM:WA	GN 921; Category A (1)	The storage of general waste in lagoons.	The proposed Sewage Package Plant will produce around 20m^3 of inert sludge waste per annum which will be contained and dried within a 60m^2 drying bed prior to final disposal.
NHRA	Section 27 (18)	The National Heritage Act (NHRA) serves to protect any archaeological/paleontological/heritage features which may be present on site. Robben Island is a World and National Heritage site and requires a permit from SAHRA to destroy, damage, deface, excavate, alter, remove from	The proposed SPP would therefore require a permit from SAHRA before construction on site may commence.

WSP Environmental (Pty) Ltd
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35 Wale Street
Cape Town 8001
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Fax: +27 (0)21 481 8799
http://www.wspenvironmental.co.za
Reg. No: 1995/08790/07

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	its original position, subdivide or change the planning status of a National Heritage Site.	

Due to the SPP's proposed location adjacent to the existing sewage collection unit, which is in close proximity to the sea, as well as the proposal to store inert (general) sludge in the drying beds, the project requires authorisation in terms of NEMA EIA Regulations and NEM:WA. Robben Island is a National and World Heritage Site and therefore, the competent authority in terms of Environmental Authorisation in terms NEMA will be the National Department of Environmental Affairs (DEA). The project will also require a Waste Management License which will be conducted as an Integrated Basic Assessment process. An Integrated Environmental Authorisation application form has been submitted to DEA and the following reference numbers were obtained; DEA ref number: 14/12/16/3/3/3/83. WSP Environmental (Pty) Ltd remains as the environmental assessment practitioner (EAP) on this project.

All stakeholders please note that the reference number for this project remains unchanged and therefore all existing registered stakeholders will remain Interested & Affected Parties (I&APs) as part of the project, and will therefore continue to have involvement in the public consultation and comment process.

In terms of stakeholder engagement as required by Regulation 54(2)(e) and 54(7) of GN R.543, the following engagement has been completed to date:

- Distribution of the Background Information Document (BID) to surrounding landowners and registered stakeholders undertaken on the 19th July 2013, providing stakeholders with the option to register as an I&AP.
- Newspaper advertisements were placed in one regional and one local newspaper in both English and Afrikaans.
- Advert placed in the Cape Towner on the 4th July 2013.
- Advert placed in Die Burger on the 27th June 2013.
- Site notices were be placed at the local Kiosk on Robben Island and at the Security Offices at the Robben Island Harbour on the 19th July 2013.
- Written notification letters was provided to authorities and municipal ward councilors (dated 20th June 2013).

2. Notification of Draft Basic Assessment 40 Day Comment Period

This letter also serves to notify that the Draft Basic Assessment is now available for review. All I&APs and Commenting Authorities have 40 days from the date of this letter in which to review documentation. These comments will then be incorporated into the Final BAR for consideration by the DEA.

Should you have any comments with regards to the proposed development these should be provided in writing (via email, fax or letter) to the by no later than 4th July 2014 using the attached Comments and Response Form (**Appendix A**).

3. Notification of Coastal Waters Discharge Permit 40-day Comment Period

The operation of the proposed SPP requires a Coastal Waters Discharge Permit in terms of Section 69 of the Integrated Coastal management Act (2008) in order to discharge treated effluent into the marine environment. The Coastal Waster Discharge Permit is attached to the Draft Basic Assessment as **Appendix J.1.** All I&APs may also take the opportunity to comment separately with regards to the Permit Application using the form attached as **Appendix B**.

Should you have any comments with regards to the proposed development these should be provided in writing (via email, fax or letter) to the by no later than 4th July 2014.

Regards,

Kirsten Sims
Senior Consultant
Contact:
Tel: (021) 481 8748
Fax: (021) 481 8799
Kirsten.sims@wspgroup.co.za

Appendix A - Draft BAR Comments Sheet

Please use the space provided below to comment on the Draft BAR. Please ensure that your comments are provided before the 4th July 2014 to ensure that your comments can be incorporated. Please forward to the contact person listed below:

Kirsten Sims
WSP Environmental (Pty) Ltd
Address: P.O. Box 2613, Cape Town, 8000
Tel: 0214818648
Fax: 0214818799
Email: Kirsten.sims@WSPGroup.co.za

Please insert your personal details below:

Name:	
Organisation & Designation:	
Address:	
Tel:	
Fax:	
E-mail:	

Detail your comment or query in the space provided below:

WSP Environmental (Pty) Ltd
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35 Wale Street
Cape Town 8001
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Appendix B – Coastal Water Discharge Permit Comments Sheet

Please use the space provided below to comment on the Draft BAR. Please ensure that your comments are provided before the 4th July 2014 to ensure that your comments can be incorporated. Please forward to the contact person listed below:

Kirsten Sims
WSP Environmental (Pty) Ltd
Address: P.O. Box 2613, Cape Town, 8000
Tel: 0214818648
Fax: 0214818799
Email: Kirsten.sims@WSPGroup.co.za

Please insert your personal details below:

Name:	
Organisation & Designation:	
Address:	
Tel:	
Fax:	
E-mail:	

Detail your comment or query in the space provided below:

ISSUES/ RESPONSE TRAIL – Appendix E.3

Source	Organisation/ Person/ Designation	Issue		Response from EAP
Acknowledgement of Receipt of Application	DEA/ Dr Mark Gordon: Chief Director Integrated Environmental Authorisations	The EMPr submitted as part of the application for environmental authorisation must include:		
		-	Plant rescue and protection plan which allows for the maximum transplant of conservation important species from the area to be transformed. This plan must be compiled by a vegetation specialist familiar with the site in consultation with the ECO and be implemented prior to the commencement of the construction phase.	The vegetation in the vicinity of the proposed location for the SPP area is degraded with alien invasive species and as a result the vegetation is not of high quality. No indigenous trees or rare plant species will be uprooted for the purposes of the project; therefore this is not deemed applicable to the development.
		-	An open space management plan to be implemented during the construction and operation of the facility.	The development of an open space management plan is not deemed to be relevant to this application since the proposed site is located within an area of "open space" or recreational value. The site being proposed is adjacent to existing infrastructure, utilities and buildings. The area is not visually open. In addition, once constructed the SPP will be partially submerged and appropriately obscured from view reducing its visual impact.
		-	A re-vegetation and habitat rehabilitation plan to be implemented during the construction and operation of the facility	Re-vegetation and rehabilitation is included in the EMPr, In addition to this, the tender specification for the contractor also stipulates the requirement that the contractor must submit a plan of action to the engineer and ECO prior to the removal of vegetation in all areas where the contractor intends to, or is required to clear the natural vegetation and soil, either within the work area, or at designated or instructed areas outside the work area, a plan of action shall first be submitted to the engineer for his approval. The contractor shall be held responsible for re-establishment of begetation within the work area boundaries for all areas disturbed during construction. This includes, for example, service roads, stockpile areas etc. This responsibility shall extend until expiry of the defects liability period.
		-	An alien invasive management plan to be implemented during construction and operation of the facility.	Robben Island Museum (RIM) has developed an alien invasive management plan for the whole island as part of the Island's Integrated Conservation Management Plan, therefore this will not be included as part of the EMPr. Only alien species which must be removed directly for the purposes of construction will be removed from site. The management of

			alien invasive species will be on-going through the RIM management plan.
		- A stormwater management plan to be implemented during construction and operation of the facility.	Stormwater controls will be included as part of the EMPr (primarily to prevent contamination) however, the development of a standalone plan is not deemed necessary since the construction site is relatively small, the facility is enclosed and there will be no hardstanding or stormwater drains associated with the site.
		- An erosion management plan for monitoring and rehabilitating erosion events associated with the facility.	Erosion management controls are included as part of the EMPr however, the development of a standalone plan is not deemed necessary since the construction site will be relatively small and flat and once in operation the risk of erosion will be minimal.
		- A traffic management plan for the site access to ensure that no hazards will result from the increased traffic flow.	A Traffic Management Plan has not been developed since the construction vehicles will not be travelling on public roads and traffic flow for the construction for the SPP will be minimal. Access to the island is limited by the ferry operation and therefore the construction methods proposed will be limited to prefabricated elements and a focus will be made to limit movements to and from the island thereby limiting the associated number of truck movements needed to the site. Traffic movements related to the operation of the facility will be limited to the maintenance which will be limited resulting to an insignificant impact.
		- An environmental sensitivity map indicating environmentally sensitive areas and features identified during the EIA process.	No environmentally sensitive features exist on the development site; therefore a specific map has not been included in the EMP. A biodiversity overlay map has been produced and has been included within Appendix A of the BAR.
Response to stakeholder notification/ BID	University of Cape Town/ Dr Richard Sherley	The proposed sewage package plant is very close to a beach used as important moulting sites by African Penguins (Endangered) and close to pathways used by these birds to move from sea to their nests further inland. The location of the sewage outfall is exact adjacent to one of the beaches most frequently used by the moulting penguins and so depending on the time of year construction takes place, it has the potential to cause very high levels of disturbance to the moulting birds when connecting the current outfall pipeline to the proposed SPP location. During this period they are vulnerable. Furthermore, penguins are very inquisitive particularly when looking for nesting sites and have seen that they will enter constriction sites, they will also jump into pits or channels looking for nesting sites or fleeing from people, where they may become trapped. This has happened previously on Robben Island. To mitigate this risk, construction area should be fenced off at all times so that birds cannot enter it and any pits or channels dug must be covered when workers leave the site.	Noted. These suggested mitigation measures have been included in the EMPr. Contractors will also be trained on the significance of the African Penguin during ECO training and toolbox talks. In addition, in the event that a nest is discovered during camp set-up, a representative of SANCCOB will be contacted to assist before any further works can be commenced in the vicinity of the penguin.
Draft BAR	DEADP: Land management Region 2/ Mr A Yasin/ 25 June	*IMPACTS ON THE MARINE ENVIRONMENT:* Below to be included in the EMP 1) A routine monitoring	The requirements listed are included in the **Section 4** of the EMPr. Monitoring will be undertaken that will include:

	programme of the effluent concentrations must be implemented at the outlet of the sewage package plant, prior to the effluent being discharged through the marine outfall to ensure compliance with general limit values. 2) A routine monitoring programme of the receiving waters must be implemented during the operational phase of the proposed sewage package plant to ensure compliance with marine water quality guidelines.	▪ Included in EMP Section 4.1: ▪ Water Quality Monitoring Requirements for Effluent Quality in order to ensure compliance to General Limit Values ▪ Monitoring for Marine Water Quality is also listed in Section 4 of the EMP to ensure compliance against Marine Water Quality Guidelines.
	IMPACT ASSESSMENT: The assessment of impact does not include pre and post mitigation reporting that the potential impacts may have on the environment. This must be included in the final BAR in order to ascertain mitigation measures which will not be suitable.	A full assessment of "pre" and "post" mitigation impacts was included as Appendix F according to WSP's Impact Assessment Methodology. The BAR report presents the summary of impacts post mitigation, as described in Section D of the BAR.
	GENERAL Various dust suppression methods (such as shade netting to mitigate dust) must be used to mitigate dust during construction activities. All noise and sounds generated must comply with the relevant SANS codes and standards. The following mitigation measures regarding temporary fuel stored during construction must be implemented: - The combined capacity of all fuel temporarily stored during the proposed development must not exceed $30m^3$. - The temporary fuel storage tanks must be bunded (110% the tanks capacity) to contain any possible spills and prevent any infiltration of fuel into the ground. - Drip Trays must be provided for all vehicles, construction equipment and generator that may require re-fuelling on-site to avoid possible spillages.	Dust suppression including water spraying and shade netting has been included in the Air Quality (Construction) section of the EMP, Section 2.1.7. Noise Management with reference to SANS 10103 has been included in Section 2.1.8 of the EMP. The combined capacity of fuel stored on site will not be greater than $30m^3$. No bulk fuel storage facility will be required at the construction site or during operation. Fuel required during construction will be sourced from the existing fuel store on the Island or from a limited number of 20 litre containers that will be kept on site in a locked container. Drip trays will be provided for all vehicles and machinery parked in areas where there is no hardstanding. This requirement is included in the EMP in Section 2.1.6 for construction and section 2.2.5 for operation.
	The alternative drying bed location is not shown on the site locality plan map (dated 11 March 2014) the aforementioned must be included in the final BAR.	The alternative drying bed location has been included as **Figure 2** in Appendix A.
	It is reiterated that the mitigation measures provided for all impacts identified and assessed during the EIA process as incorporated into the BAR and EMP must be implemented to prevent environmental despoliation.	Noted.
	You are reminded of the applicant's general duty of care towards the remediation of environmental damage. Section 28(1) of NEMA specifically states that – "*every person who causes or has*	Noted.

		caused significant pollution or degradation of the environment must take reasonable measure to prevent such pollution or degradation from occurring, continuing to recur or in so far as such harm to the environment is authorised by law cannot reasonably be avoided or stopped to minimise and rectify such pollution degradation of the environment".	
Draft BAR	SAHRA/ Greg Ontong / 8th July	SAHRA notes that this development was not mapped on SAHRIS as per the agency's requirement.	The development has been mapped (16 July 2014) on SAHRIS according to the agency's requirement.
		In regard to the construction phase, the following objectives are to be pursued (As defined by WSP Environmental Consultants, in the draft report).- • Maintaining good house-keeping through the duration of the construction phase; • Continual fencing of construction camp to ensure that people and African penguins cannot enter the camp. • Screening of unsightly aspects from public view including excavations (where practical), construction material storage areas, waste storage areas and ablutions). • The rehabilitation of all areas of natural vegetation that have been disturbed as a result of construction activities. • Designation of construction materials and fuel storage areas. • Effective control of waste and containment of storm water. • Implement dust suppression measures (with water or other technique) when appropriate.	Noted. These requirements have all been included in the EMP, and are included in the Final BAR.
		In regard to the above it is recommended that the following form part of the final report: • That the spatial references, i.e. GPS co-ordinates, referred to in the report are plotted in the context of site plan and site map. SAHRA is, however, unable to comment on the intended built interventions proposed without proper documentation in the form of technical drawings illustrating the extent of interventions in the report. This technical documentation should be part of the submission. • The report also does not reference the Robben Island: Integrated Conservation Management Plan which prescribes conservation principles that need to be taken into account in any intervention that is proposed on the Island.	The technical drawing of the final plant is subject to procurement tender. The Package plant design will be based upon that of the Amitek Modular Unit. Technical drawing illustrating the design of the Amitek Unit is provided within Figure **2** of **Appendix C of the Final Basic Assessment Report**, Site Plan. The Robben Island Integrated Conservation Management Plan is referenced in Section 10 (f) (Activity Motivation). It is noted that development SPP is in line with the strategic objective to identify an alternative sewage treatment to reduce marine impacts and produce treated wastewater for irrigation purposes and sludge for compost to be used on the estate". The conservation principles have been included in Section 10 (f) of the final BAR. The development does not

			contradict the conservation principles outlined in the Robben Island ICMP.
		• As part of the construction phase, SAHRA would recommend that a suitably qualified heritage consultant be part of the construction phase and a Construction Management Plan as part of the documentation to ensure that no Historic Fabric of Significance is compromised during construction.	The requirement to engage a suitably qualified heritage consultant during the excavation phase of the construction phase has been included in the EMP (Section 2.1.11). A construction management plan has been developed in consultation with the appointed engineering consultant. This is included in **Appendix C** of the Final EMPr.
Draft BAR	Rhett Smart/ Cape Nature/ 10th July	▪ Although the terrestrial biota on Robben Island is not of high conservation significance, the island is a very important site for coastal bird species, particularly for breeding colonies. This includes Species of Conservation Concern such as the African Penguin (*Spheniscus demersus*) and the Bank Cormorant (*Phalacrocorax neglectus)*, both listed as Endangered. The marine faunal specialist report does mention the significance of the island for breeding bird populations; however it does not assess the potential impact on breeding bird colonies. The marine faunal specialist report only assesses impacts to the sub-tidal marine environment, but in the absence of an avifaunal specialist report, the impacts on castle avifauna should have also been included in the report. Unless a separate avifaunal specialist study is undertaken, the marine faunal specialist report should be amended to include as a minimum a map indicating all the breeding bird colonies on the island, in particular Species of Conservation Concern, and in addition assess the impacts of the proposed sewage package plant on the bird colonies. There should already be sufficient existing data on bird colonies on the island, if not additional studies may be required.	The Marine Ecology specialist report (**Appendix D** of Final BAR) has been updated by Dr Andrea Pulfrich (independent marine specialist) to include an assessment of the impacts of the development in terms of sensitive breeding bird colonies located at the east of the island in the vicinity of the proposed SPP. The report also includes a map, comprising data obtained from Professor Peter Barnham, Dr Richard Sherley and the DEA Ocean and Coast (2013 African Penguin Census Map). A description of the baseline, potential impacts and impact assessment has been included as well as recommendations for inclusion in the EMPr. The results of the impact assessment indicate that the Impacts on bird-breeding success and disturbance can be reduced from “Low-Medium” risk to “Low” risk post-mitigation. Whilst African penguins do breed in the vicinity of the SPP, the area is not among the most densely populated areas on the island. Of the islands total population, only 7.6% presently nest in the 250 metre radius of the proposed SPP location. There will be no construction along the shoreline and no requirements to traverse the penguin highways (mapped as **Figure 14** of the specialist report). Since the construction activities will be relatively localised, contained/ fenced off, and will be of a short duration (due to the pre-assembled/ modular nature of the SPP) the impact is projected to be of low-significance. Information obtained (Pers Coms. Professor Peter Braham) suggests that the Bank Cormorants typically breed on the Faure Jetty as well as the main harbour. Due to the distance of these structures from the proposed construction side it is anticipated that the construction activities would not impact the Bank Cormorants in any way. Impacts on the Swift Terns and Hartlaubs Gulls can be minimised since these birds typically choose new nesting sites every year and can potentially be encouraged through higher activity at the construction site to breed in a

		location some distance from the site.
	■ Another aspect of concern is the location of the package plant and drying beds on the shoreline of the island. The facility may be at risk from extreme storm events that could damage the structures. The technology proposed is agreed as the preferred alternative and is more likely to withstand damage and any potential spillage, however the potential for the sludge drying beds to be affected needs to be assessed. This could result in dispersal of the sludge along the coastal rocks and the beach which could result in negative impacts. Mitigation measures to address this need to be described in detail. Location of the sludge drying beds further inland will reduce this potential impact.	The drying beds are in line with other existing buildings in the vicinity which have not been subjected to damage from extreme weather events. In addition the facilities will be located well above the high water mark. Furthermore, the proposed location is on the lee side of the normal storm direction and there is no history of storm damage on the eastern side of the island. This was hence the reasoning behind the siting of the old wooden jetty and harbour on the eastern side of the island. Provision will however be made to secure covers to the drying beds in the extremely unlikely event of a south-eastern storm to prevent washing out of sludge. This has been included as a requirement in the operational phase of the EMPr (section 2.2.7)
	■ CapeNature supports the recommendation in the marine faunal specialist report that a monitoring programme needs to be established in order to monitor water quality. We recommend however that this monitoring programme should be expanded from that proposed which only monitors water quality, to also include monitoring of marine biodiversity, with samples of plankton and invertebrates at the outfall as a minimum. The monitoring programme must include current baseline data to indicate the potential changes as a result of the installation of the sewage package plant.	A response from Dr Andrea Pulfrich, the marine ecological specialist for the proposed project has indicated that the initiation of a bio-monitoring monitoring programme for the marine environment should not form a practical component of the monitoring for the proposed SPP for the following reasons: 1) A bio-monitoring programme has not been completed to date and therefore since the environmental conditions will be **improving** with the addition of the SPP there should not be a need to commence such a programme at this stage. 2) A bio- monitoring programme would not contribute towards the overall objective of the project – to ensure that there is no release of treated effluent which does not meet the required water quality standards. 3) Bio-monitoring programmes, (even in basic form) entail significant expense and financial allocation over a very long timeframe. The expense, in the opinion of the specialist, would be better allocated to ensuring a comprehensive water monitoring programme to ensure that the effluent is meeting the required quality specifications.

I& AP DATABASE – Appendix E.4

ORGANISATION/ IAP	NAME	SURNAME	TELEPHONE	FAX NO.	EMAIL	POSTAL ADDRESS	PHYSCIAL ADDRESS	NOTIFICATION BID
Authorities								
Department of Environmental Affairs	Mthathla	Rabotata			mrabothata@environment.gov.za			
DEA: Coastal Management- Integrated Coastal Management	Razeena	Omar	021 819 2432	021 819 2444	romar@environment.gov.za	PO Box 52126 Victoria and Alfred Waterfront Cape Town 8002		Letter
DEA: Coastal Management- Integrated Coastal Management	Mulalo	Tshikotshi	0218192455		mtshikot@environment.gov.za	PO Box 52126 Victoria and Alfred Waterfront Cape Town 8002		Letter
DEADP: Land Management	Zaahir	Toefy			zaahir.toefy@westerncape.gov.za	Private Bag X9086 Cape Town 8000		Letter
DEADP: Land Management (Admin Personelle)	Labeeba	de jageer			labeebadejager@westerncape.gov.za			
DEADP: Waste Management	Eddie	Hanekom			eddie.hanekom@westerncape.gov.za	Private Bag X9086 Cape Town		Letter
Department of Environmental Affairs (Oceans and Coasts)	Bruce	Dyer	082 935 3153		Bdyer@environment.gov.za	Cape Town Stadium 4th Floor 1 Fritz Sonnenberg Road		Emal
Department of Environmental Affairs (Oceans and Coasts)	Azwianewi	Makhado			Amakhado@environment.gov.za			Email
City of Cape Town : Environment and Heritage Management District A	Dimitri	Georgeades	021 400 6518	021 425 4448	dimitri.georgeades@capetown.gov.za	PO Box [illegible] Cape Town 8000		Letter
Municipal Ward Councillor	Beverley	Schäfer	0214170113	0866575368	beverly.schafer@capetown.gov.za			Email
Municipal Manager	Achmat	Ebrahim	021 400 1332	021 400 1332	city.manager@capetown.gov.za	Private Bag X9181 Cape Town 8000		Letter
Cape Nature	Rhett	Smart	021 566 8017	021 866 1523	landuse@capenature.co.za	Private Bag X5014 Stellenbosch 7599		Letter
SANCCOB	Nola	Persons	084 822 0189			P.O. Box 11116 Bloubergstrand 7443 South Africa		Letter
SAHRA	Mariagrazia	Galimberti	0214624502	0214684509	mgalimberti@sahra.org.za	PO Box 4637 Cape Town 8000		Letter
SAHRA (Robben Island)	Greg	Ontong	0214652198		gontong@sahra.org.za			-
Department of Water Affairs	M	Mxi	0219416135		mxim@dwa.gov.za	52 Voortrekker Road Spectrum Building		Letter
Department of Water Affairs	Ashia	Peterson			petersona@dwa.gov.za			
Department of Water Affairs	Marion	Claassen			claassenm@dwa.gov.za			
RIM Environmental Partners								
Earthwatch (UCT-ADU)	Les	Underhill	720621140		les.underhill@uct.ac.za			Email
UCT	Richard	Sherley	079 576 7072		richard.sherley@uct.ac.za richard.sherley@gmail.com			Email
RIM	Nolubabalo	Tongo	074 116 7869		nolubabalot@robben-island.org.za			Email
RIM	Sabelo	Madlala	0734421092		sabelom@robben-island.org.za			Email
RIM	Linda	P			LindaP@robben-isalnd.org.za			-
RIM	Cecile	M			Cecilenem@robben-isalnd.org.za			-
Department of Public Works								
Department of Public Works	FD	De Kock	0214022044		jfd.dekock@dpw.gov.za	Private Bag X 9027 Cape Town		Letter

Correspondence Received – Appendix E.5

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

Private Bag X 447· PRETORIA · 0001· Fedsure Building · 315 Pretorius Street · PRETORIA
Tel (+ 27 12) 310 3911 · Fax (+ 2712) 322 2682

Reference: 14/12/16/3/3/3/83
Enquiries: Mmatlala Rabothata
Tel: 012 395 1768 **Fax:** 012 320 7539 **E-mail:** mrabothata@environment.gov.za

Surina Brink
WSP Environmental
PO Box 2613
CAPE TOWN
8000

Fax: 021 481 8799
Tel: 021 481 8794

PER FACSIMILE / MAIL

Dear Sir/Madam

ACKNOWLEDGEMENT OF RECEIPT AND ACCEPTANCE OF NEW APPLICATION FOR ENVIRONMENTAL AUTHORISATION (SCOPING & EIA PROCESS) FOR THE PROPOSED ROBBEN ISLAND SEWAGE PACKAGE PLANT WITHIN CITY OF CAPE TOWN IN WESTERN CAPE PROVINCE

The Department confirms having received the Integrated Application Form; details of EAP and Declaration of Interest; and the locality map on 22 May 2013 for environmental authorisation for the abovementioned project. The Application is accepted.

However, you are requested to submit the project schedule, indicating the different phases and expected timelines of the project (as per point 2.2 of the Application Form template).

In addition, please consider the following during compilation of reports for this application for environmental authorisation:

- All applicable Departmental Guidelines must be considered throughout the application process. These can be downloaded from the Department's website: www.environment.gov.za, Environmental Impact Management button, listed under "EIA Administration": Integrated Environmental Management Information Series link. These include, but are not limited to, the following topics: Scoping, Environmental Impact Reporting, Stakeholder Engagement, Specialist Studies, Impact Significance, Cumulative Effects Assessments, Alternatives in EIA and Environmental Management Plans.
- Please be advised that in terms of the EIA Regulations and NEMA the investigation of alternatives is mandatory. Alternatives must therefore be identified, investigated to determine if they are feasible and reasonable. It is also mandatory to investigate and assess the option of not proceeding with the proposed activity (the "no-go" option).

- Should water, solid waste removal, effluent discharge, stormwater management and electricity services be provided by the municipality, you are requested to provide this office with written proof that the municipality has sufficient capacity to provide the necessary services to the proposed development. Confirmation of the availability of services from the service providers must be provided together with the reports to be submitted.
- In the reports to be submitted it must clearly be demonstrated in which way the proposed development will meet the requirements of sustainable development. You must also consider energy efficient technologies and water saving devices and technologies for the proposed development. This could include measures such as the recycling of waste, the use of low voltage or compact fluorescent lights instead of incandescent globes, maximising the use of solar heating, the use of dual flush toilets and low-flow shower heads and taps, the management of storm water, the capture and use of rainwater from gutters and roofs, the use of locally indigenous vegetation during landscaping and the training of staff to implement good housekeeping techniques.
- A detailed and complete EMPr must be submitted with the EIR. This EMPr must not provide recommendations but must indicate actual remediation activities which will be binding on the applicant. Without this EMPr the documents will be regarded as not meeting the requirements and will be returned to the applicant for correction.
- The applicant/EAP is required to inform this Department in writing upon submission of any draft report, of the contact details of the relevant State Departments (that administer laws relating to a matter affecting the environment) to whom copies of the draft report were submitted for comment. Upon receipt of this confirmation, this Department will in accordance with Section 24O(2) & (3) of the National Environmental Management Act, 1998 (Act 107 of 1998) inform the relevant State Departments of the commencement date of the 40 day commenting period, or 60 days in the case of the Department of Water Affairs for waste management activities which also require a licence in terms of the National Water Act, 1998 (Act 36 of 1998).
- Should it be necessary to apply for a permit in terms of the National Heritage Resources Act, 1999 (Act 25 of 1999), please submit the necessary application to SAHRA or the relevant provincial heritage agency and submit proof thereof with the Basic Assessment Report/Environmental Impact Assessment Report. The relevant heritage agency should also be involved during the public participation process and have the opportunity to comment on all the reports to be submitted to this Department.

You are required to submit the final site layout plan together with the Final EIR to the Department. All available biodiversity information must be used in the finalisation of the layout plan.

The Environmental Management Programme (EMPr) submitted as part of the application for environmental authorisation must include the following:

- All recommendations and mitigation measures to be recorded in the Final EIR.
- A plant rescue and protection plan which allows for the maximum transplant of conservation important species from areas to be transformed. This plan must be compiled by a vegetation specialist familiar with the site in consultation with the ECO and be implemented prior to commencement of the construction phase.
- An open space management plan to be implemented during the construction and operation of the facility.
- A re-vegetation and habitat rehabilitation plan to be implemented during the construction and operation of the facility including timeframes for restoration which must indicate rehabilitation within the shortest possible time after completion of construction activities to

reduce the amount of habitat converted at any one time and to speed up the recovery to natural habitats.

- An alien invasive management plan to be implemented during construction and operation of the facility. The plan must include mitigation measures to reduce the invasion of alien species and ensure that the continuous monitoring and removal of alien species is undertaken.
- A storm water management plan to be implemented during the construction and operation of the facility. The plan must ensure compliance with applicable regulations and prevent off-site migration of contaminated storm water or increased soil erosion. The plan must include the construction of appropriate design measures that allow surface and subsurface movement of water along drainage lines so as not to impede natural surface and subsurface flows. Drainage measures must promote the dissipation of storm water run-off.
- An effective monitoring system to detect any leakage or spillage of all hazardous substances during their transportation, handling, use and storage. This must include precautionary measures to limit the possibility of oil and other toxic liquids from entering the soil or storm water systems.
- An erosion management plan for monitoring and rehabilitating erosion events associated with the facility. Appropriate erosion mitigation must form part of this plan to prevent and reduce the risk of any potential erosion.
- A traffic management plan for the site access roads to ensure that no hazards would results from the increased truck traffic and that traffic flow would not be adversely impacted. This plan must include measures to minimize impacts on local commuters e.g. limiting construction vehicles travelling on public roadways during the morning and late afternoon commute time and avoid using roads through densely populated built-up areas so as not to disturb existing retail and commercial operations.
- An environmental sensitivity map indicating environmental sensitive areas and features identified during the EIA process.
- Measures to protect hydrological features such as streams, rivers, pans, wetlands, dams and their catchments, and other environmental sensitive areas from construction impacts including the direct or indirect spillage of pollutants.

You are requested to submit two (2) electronic copies (the main report must be separated from the Appendices (each appendix saved separately) (CD/DVD) and two (2) hard copies of both the Draft and Final Report to the Department. The hard copies must be double-sided printed; double-punched and must be bound using a lever arch file (two or four holes).

The EAP must, in order to give effect to regulation 56 (2), before submitting the final EIR to the Department give registered interested and affected parties access to, and an opportunity to comment on the report in writing within 21 days.

In terms of regulation 67 of the EIA Regulations, 2010 this application will lapse if the applicant (or the EAP on behalf of the applicant) fails to comply with a requirement in terms of the Regulations for a period of six months after having submitted the application, unless the reasons for failure have been communicated to and accepted by this Department.

You are hereby reminded of Section 24F of the National Environmental Management Act, Act No 107 of 1998, as amended, that no activity may commence prior to an environmental authorisation being granted by the Department.

Yours sincerely

MRabothata

Mr Mark Gordon
Chief Director: Integrated Environmental Authorisations
Department of Environmental Affairs
Letter signed by: Ms Mmatlala Rabothata
Designation: Environmental Officer: Integrated Environmental Authorisations
Date: 05/06/13

CC:	JFD De Kock	Department of Public Works	Tel: 021 402 2044	Fax: 021 418 7039
	Achmat Ebrahim	City of Cape Town	Tel: 021 400 1330	Fax: 021 400 1332

Western Cape Government
Environmental Affairs and Development Planning

DIRECTORATE: LAND MANAGEMENT
REGION 2

REFERENCE NUMBER: 16/3/1/6/6/A7/21/3137/13
ENQUIRIES: Mr. L. Lucas
DATE OF ISSUE: 08 JUL 2013

The Director
Department of Environmental Affairs
Private Bag X447
PRETORIA
0001

Attention: Ms. M. Rabothata

Tel : (012) 395 1768
Fax: (012) 320 7539

Dear Madam

RE: THE PROPOSED CONSTRUCTION OF A SEWAGE PACKAGE PLANT & ASSOCIATED INFRASTRUCTURE, ROBBEN ISLAND.

1. The background information document dated 20 June 2013 and received by this Directorate on 24 June 2013, refers. (Department of Environmental Affairs reference number: 14/12/16/3/3/3/83).

2. This letter serves as an acknowledgement of receipt of the aforementioned document by this Directorate.

3. Having considered the information, this Directorate hereby confirms the following:

   3.1. This Department will be a commenting authority and comment on the Environmental Impact Assessment Process. Comments will be provided directly to the Department of Environmental Affairs (DEA) and copied to the Environmental Assessment Practitioner.

   3.2. Copies of all documents submitted to the DEA should concurrently be submitted to this Directorate for commenting and record purposes.

4. Kindly quote the above-mentioned reference number in any future correspondence in respect of the application.

5. This Directorate reserves the right to revise or withdraw comments or request further information from you based on any information that might be received.

Yours faithfully

W Fairford

HEAD OF DEPARTMENT

Copy to: Ms. S. Brink (WSP environmental (Pty Ltd.))

Fax: (021) 481 8799

Please insert your personal details below:

Name: Estelle Esterhuizen
Organisation & Designation: Robben Island Museum, Nature Conservator
Address: Robben Island Museum, Robben Island, 7400
Tel: 021 409 5178 / 084 363 5514
Fax:
E-mail: estellee@robben-island.org.za

Please list your interest in the Proposed Sewage Package Plant and provide comments below:

Involvement with all environmental elements of the project as per designation as Nature Conservator on the island.

Registration and Comments Sheet

To be a registered stakeholder and ensure all comments and queries regarding this project are accurately documented and addressed please forward your comments and contact details with the attached response sheet to:

Surina Brink
WSP Environmental (Pty) Ltd
Address: P.O. Box 2613, Cape Town, 8000
Tel: 0214818794
Fax: 0214818799
Email: Surina.brink@WSPGroup.co.za

Please insert your personal details below:

Name:	Dr Richard Sherley
Organisation & Designation:	University of Cape Town
Address:	Animal Demography Unit and Marine Research Institute, Department of Biological Sciences, University of Cape Town, Private Bag, Rondebosch, 7701.
Tel:	021 650 5073
Fax:	
E-mail:	richard.sherley@uct.ac.za

Please list your interest in the Proposed Sewage Package Plant and provide comments below:

The proposed site for the sewage package plant is very close to beaches used as important moulting sites by African penguins (a species listed as globally Endangered by the IUCN) and close to pathways used by these birds to move from the sea to their nests further inland. The site of the current sea outfall pipeline is exactly adjacent to one of the beaches most frequently used by moulting penguins, and so, depending on the time of year when the work takes place, connecting the current outfall pipeline to the proposed SPP location has the potential to cause a high level of disturbance to moulting birds. African penguins moult all of their feathers simultaneously once a year in a very energetically-costly process. During this period, they do not go to sea to feed, as their plumage is not waterproof. They therefore suffer high energetic costs of thermoregulation in the cold sea water whenever they have to enter it. This, combined with the fact that they do not feed for ca. 14 days, means that they are vulnerable to any disturbance that may force them to enter the water. The excess energy lost (keeping warm) in this event is not trivial and can increase the probability that they die before completing the moult or cannot regain sufficient body condition once they are able to go back to sea to feed. Adult penguin survival rates in the Western Cape are currently at an all time low and every effort needs to be made to avoid reducing it further.

Futhermore, African penguins are very inquisitive, particularly when looking for nesting sites and we have seen in the past on Robben Island and elsewhere that they will enter construction sites to seek out suitable (shaded) nesting sites. They will also jump down into pits or channels that are dug into the ground (e.g. for the laying of pipes) either to explore for possible nest sites or when fleeing from nearby people. Again, this is not trivial, as they may be able to get into these pits or channels and not out, and if the construction site is left unattended for several days (e.g. over weekends or during spells of bad weather), they may not be found and may die of starvation. This HAS happened before with construction work on Robben Island. To mitigate this risk, the construction area should be fenced off at all time so that birds cannot enter it and ANY pits or channel dug MUST be covered when workers leave the site.

I would strongly recommend the inclusion of the above, and disturbance to African penguins generally, as points into the Environmental Considerations above.

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

Private Bag X 447· PRETORIA · 0001· Fedsure Building · 315 Pretorius Street · PRETORIA
Tel (+ 27 12) 310 3911 · Fax (+ 2712) 322 2682

Reference: 14/12/16/3/3/3/83
Enquiries: Mmatlala Rabothata
Tel: 012 395 1768 **Fax:** 012 320 7539 **E-mail:** mrabothata@environment.gov.za

Kirsten Sims
WSP Environmental
35 Wales Street
CAPE TOWN
8001

Fax: 021 481 8799
Tel: 021 481 8700

PER FACSIMILE / MAIL

Dear Sir/Madam

ACKNOWLEDGEMENT OF RECEIPT OF AMENDED APPLICATION AND DRAFT BASIC ASSESSMENT REPORT FOR ENVIRONMENTAL AUTHORISATION (BASIC ASSESSMENT PROCESS) FOR THE PROPOSED ROBBEN ISLAND SEWAGE PACKAGE PLANT WITHIN CITY OF CAPE TOWN IN WESTERN CAPE PROVINCE

The Department confirms having received the amended application form and draft Basic Assessment Report for environmental authorisation for the abovementioned project on 26 May 2014.

You are hereby reminded that the activity may not commence prior to an environmental authorisation being granted by the Department.

Yours sincerely

Mr Ishaam Abader
Deputy Director-General: Legal, Authorisations, Compliance and Enforcement
Department of Environmental Affairs:
Letter signed by: Ms Mmatlala Rabothata
Designation: Environmental Officer: Integrated Environmental Authorisations
Date: 25|06|14

CC: JFD de Kock | Department of Public Works | Fax: 021 418 7039

Western Cape Government
Environmental Affairs and Development Planning

DIRECTORATE: LAND MANAGEMENT
REGION 2

DEA&DP REFERENCE NUMBER: 16/3/1/6/6/A7/21/3125/14
DEA REFERENCE NUMBER: 14/12/16/3/3/3/83
ENQUIRIES: MR. A. YASIN
DATE OF ISSUE: 25 JUN 2014

The Director
Department of Environmental Affairs
Private Bag X447
PRETORIA
0001

Attention: Ms. M. Rabothata

Tel: (012) 395 1768
Fax: (012) 320 7539

Dear Madam

COMMENTS ON THE DRAFT BASIC ASSESSMENT REPORT (BAR) FOR THE PROPOSED CONSTRUCTION OF A SEWAGE PACKAGE PLANT AND ASSOCIATED INFRASTRUCTURE, ROBBEN ISLAND.

The request for comments on the aforementioned document (DEA Ref No.:14/12/16/3/3/3/83) dated 15 May 2014 and received by this Department on 26 May 2014 refers.

This Directorate has the following comments:

1. Impacts on Marine Environment

1.1 A routine monitoring programme of the effluent concentrations must be implemented prior to the effluent being discharged through the marine outfall to ensure compliance with general limit values.

1.2 A routine monitoring programme of the receiving waters must be implemented during the operational phase of the proposed sewage package plant to ensure compliance with marine water quality guidelines.

1.3 The abovementioned must be included in the Environmental Management Plan.

2. Impact Assessment

2.1 The assessment of impacts investigated does not include the pre and post mitigation reporting that the potential impacts may have on the environment. This must be included in the Final BAR in order to ascertain which potential mitigation measures will not be suitable.

3. General

3.1 Various dust suppression methods (such as shade netting screens) must be used to mitigate dust during the construction activities.

3.2 All noise and sounds generated must comply with the relevant SANS codes and standards.

3.3 The following mitigation measures regarding temporary fuel storage during construction must be implemented:

3.3.1. The combined capacity of all fuel temporarily stored during the proposed development must not exceed 30 m^3;

3.3.2. The temporary fuel storage tanks must be bunded (110% the tanks capacity) to contain any possible spills and to prevent any infiltration of fuel into the ground; and

3.3.3. Drip trays must be provided for all vehicles, construction equipment and generators that may require re-fuelling on site to avoid the possible spillage of fuel/oil.

3.4 The alternative drying bed location is not shown on the Site Locality Plan dated 11 March 2014. The aforementioned must be included in the final BAR.

3.5 It is reiterated that the mitigation measures provided for all impacts identified and assessed during the EIA process (as incorporated in the BAR and the Environmental Management Plan) must be implemented in order to prevent environmental despoliation.

3.6 Furthermore, you are reminded to remind the applicant of their general duty of care towards the remediation of environmental damage, Section 28(1) of NEMA specifically states that –

"Every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment."

In light of the above, the concerns highlighted above must be addressed in the Final BAR.

This Directorate reserves the right to revise or withdraw comments or request further information from you based on any information that might be received.

Your interest in the future of our environment is greatly appreciated.

Yours faithfully

A Gabriel

HEAD OF DEPARTMENT

CC: Ms. S. Brink (WSP Environmental (Pty) Ltd.) Fax: (021) 481 8799

SOUTH AFRICAN HERITAGE RESOURCES AGENCY
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PO BOX 2771, CAPE TOWN, 8001
TEL (021) 465 2198 - FAX (021) 465 5789

Our Ref: 9/2/018/0004
SAHRIS Ref: Case ID: 1895
Enquiries: Mr. Gcobani Sipoyo
Date: 07 July 2014

Ms. Jacqui Fincham
WSP, Environment & Energy, Africa
3rd Floor, 35 Wale Street,
Cape Town, 8001

South Africa

Tell: 021 481 8795
Cell: 082 541 5038
Jacqui.fincham@wspgroup.co.za

RE: ROBBEN ISLAND SEWAGE PACKAGE: DRAFT BASIC ASSESSMENT REPORT REF: 14/12/16/3/3/3/83

A Draft Basic Assessment Report- **ROBBEN ISLAND SEWAGE PACKAGE: DRAFT BASIC ASSESSMENT REPORT REF: 14/12/16/3/3/3/83** was submitted which relates to the construction of a sewage package plant on Robben Island which will be used to treat sewage from the island to ensure compliance with the National Water Act, no. 36 of 1998. The entire plant will cover a total footprint of 1400m2 and will include a sewage treatment plant, irrigation tanks, two drying beds and pipelines. SAHRA notes that this development was not mapped on SAHRIS as per the agency's requirement.

In support of the intended development, specialist studies were commissioned by WSP which included a paleontological and an archaeological impact assessment. The archaeologist, Dr Ute Seeman, undertook a site survey of the area proposed for the development and noted that it had already been heavily disturbed by previous surface activities, i.e. the establishment of underground electrical cabling and pipelines and the construction of three sewage pump stations. Evidence of a brick structure and a cement platform are also present on site. The age of these structures is not clearly defined in the report but they certainly date post World War II.

According to the SAHRA palaeosensitivity map the area where the proposed sewage plant is located is of moderate fossil sensitivity and a desktop study was required. Dr Almond in his desktop paleontological impact assessment states that the study area is underlain by a veneer of aeolian sands of the Witsand Formation of Holocene to recent age. Since the proposed sewage package plant is not expected to be deeper than 2.5meters, no impact is expected on paleontological resources.

(Please refer to the following reports- *Almond, J., January 2014. PALAEONTOLOGICAL SPECIALIST STUDY: DESKTOP BASIC ASSESSMENT Proposed Sewage Package Plant on Robben Island, Cape Town, Western Cape* and *Seeman, U., April 2013. Archaeological Impact Assessment -*

(AIA) Report on the survey of a site on Robben Island situated south of the Dog Unit (Robert Sobukwe House) between Murray's Bay and Murray's Road)

Discussion:

In regard to the construction phase, the following objectives are to be pursued-

- *Maintaining good house-keeping through the duration of the construction phase;*
- *Continual fencing of construction camp to ensure that people and African penguins cannot enter the camp.*
- *Screening of unsightly aspects from public view including excavations (where practical), construction material storage areas, waste storage areas and ablutions).*
- *The rehabilitation of all areas of natural vegetation that have been disturbed as a result of construction activities.*
- *Designation of construction materials and fuel storage areas.*
- *Effective control of waste and containment of storm water.*
- *Implement dust suppression measures (with water or other technique) when appropriate,*
- *As defined by WSP ENVIRONMENTAL CONSULTANTS, in the above draft report.*

In regard to the above it is recommended that the following form part of the final report:

- That the spatial references, i.e. GPS co-ordinates, referred to in the report are plotted in the context of site plan and site map. SAHRA is, however, unable to comment on the intended built interventions proposed without proper documentation in the form of technical drawings illustrating the extent of interventions in the report. This technical documentation should be part of the submission.
- The report also does not reference the ***Robben Island: Integrated Conservation Management Plan*** which prescribes conservation principles that need to be taken into account in any intervention that is proposed on the Island.
- As part of the construction phase, SAHRA would recommend that a suitably qualified heritage consultant be part of the construction phase and a ***Construction Management*** Plan as part of the documentation to ensure that no ***Historic Fabric of Significance*** is compromised during construction.

Comment:

SAHRA Built Environment therefore, has no objection to development of a sewage package plant as contained within the content of the **ROBBEN ISLAND SEWAGE PACKAGE: DRAFT BASIC ASSESSMENT REPORT REF: 14/12/16/3/3/3/83** provided that the recommendations as set out in the **DRAFT BASIC ASSESSMENT REPORT REF: 14/12/16/3/3/3/83** assessment by the WSP consultants are duly followed when work is carried out on site. In addition, taking into consideration the archaeological and palaeontological imperatives, SAHRA has no objection to the proposed development provided that, if any any evidence of archaeological sites or remains (e.g., remnants of stone-made structures, indigenous ceramics, bones, stone artefacts, ostrich eggshell fragments, marine shell and charcoal/ash concentrations), unmarked human burials, fossils or other categories of heritage resources are found during the proposed activities, SAHRA APM Unit (Colette Scheermeyer 021 462 4502) must be alerted immediately, and a professional archaeologist or palaeontologist, depending on the nature of the finds, be contacted as soon as possible to inspect the findings.

If the newly discovered heritage resources prove to be of archaeological or paleontological significance a Phase 2 rescue operation might be necessary.

Should you have any queries please do not hesitate to contact the SAHRA Built Environment Unit Manager, Mr. Gregory Ontong at gontong@sahra.org.za, Mr. Gcobani Sipoyo, Heritage Officer at gsipoyo@sahra.org.za or Dr. Mariagrazia Galimberti Heritage Officer: Archaeology, Palaeontology and Meteorites Unit at mgalimberti@sahra.org.za. We look forward to receiving your final document and application.

Yours faithfully,

Gregory Ontong
Manager: Built-Environment Unit
South African Heritage Resource Agency

CapeNature

SCIENTIFIC SERVICES

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reference SSD14/2/6/1/4/2/sewage_Robben Island
date **10 July 2014**

WSP Environmental (Pty) Ltd
P.O. Box 2613
Cape Town
8000

Attention: Surina Brink
By email: surina.brink@wspgroup.co.za

Dear Surina

Draft Basic Assessment Report for the Proposed Development of a Sewage Package Plant on Robben Island, Western Cape
(DEA ref. no.: 14/12/16/3/3/3/83)

CapeNature would like to thank you for the opportunity to comment on the proposed development and would like to make the following comments. Please note that our comments only pertain to the biodiversity related impacts and not to the overall desirability of the proposed development.

Robben Island has had a long history of disturbance and as a result most of the terrestrial vegetation has been heavily disturbed or transformed. The entire island is classified as Critical Ecological Support Area by the Biodiversity Network for the City of Cape Town. There are no surface freshwater features on the island.

Currently sewage disposal on Robben Island consists of disposal of raw, macerated sewage through a marine outfall pipeline. The proposal is to install a sewage package plant to treat the sewage and allow for disposal of the treated effluent through the existing marine outfall and disposal of the dried, inert sludge through fertiliser application and/or the general/ hazardous waste disposal stream.

Currently there is likely to have been an impact on marine biodiversity at the point source for the marine outfall mainly through increased nutrient load and organic matter. The treated effluent as opposed to the raw sewage being released into the marine environment is likely to have a positive impact on the marine biodiversity in the vicinity of the outfall by reducing the current impacts, as was indicated in the marine faunal specialist report.

In terms of impacts on the terrestrial environment, there is no vegetation of high conservation value on the proposed footprint of the development, therefore impacts on vegetation can be considered to be of low significance. There was an alternative location presented for the location of the sludge drying beds further inland, but this was rejected due to potential impacts on heritage sites.

Although the terrestrial biota on Robben Island is not of high conservation significance, the island is a very important site for coastal bird species, particularly for breeding colonies. This includes Species of Conservation Concern such as the African Penguin (*Spheniscus* *demersus*) and the Bank Cormorant (*Phalacrocorax neglectus*), both listed as Endangered. The marine faunal specialist report does mention the significance of the island for breeding bird populations, however it does not assess the potential impact on breeding bird colonies.

The marine faunal specialist report only assesses impacts to the sub-tidal marine environment, but in the absence of an avifaunal specialist report, the impacts on castle avifauna should have also been included in the report. Unless a separate avifaunal specialist study is undertaken, the marine faunal specialist report should be amended to include as a minimum a map indicating all the breeding bird colonies on the island, in particular Species of Conservation Concern, and in addition assess the impacts of the proposed sewage package plant on the bird colonies. There should already be sufficient existing data on bird colonies on the island, if not additional studies may be required.

Another aspect of concern is the location of the package plant and drying beds on the shoreline of the island. The facility may be at risk from extreme storm events that could damage the structures. The technology proposed is agreed as the preferred alternative and is more likely to withstand damage and any potential spillage, however the potential for the sludge drying beds to be affected needs to be assessed. This could result in dispersal of the sludge along the coastal rocks and the beach which could result in negative impacts. Mitigation measures to address this need to be described in detail. Location of the sludge drying beds further inland will reduce this potential impact.

CapeNature supports the recommendation in the marine faunal specialist report that a monitoring programme needs to be established in order to monitor water quality. We recommend however that this monitoring programme should be expanded from that proposed which only monitors water quality, to also include monitoring of marine biodiversity, with samples of plankton and invertebrates at the outfall as a minimum. The monitoring programme must include current baseline data to indicate the potential changes as a result of the installation of the sewage package plant.

CapeNature reserves the right to revise initial comments and request further information based on any additional information that may be received.

Yours sincerely

Rhett Smart
For: Manager (Scientific Services)

cc. Mmatlala Rabothata, Department of Environmental Affairs

APPENDIX F – IMPACT ASSESSMENT

1. Methodology
2. Impact Assessment

METHDOLOGY FOR ASSESSMENT OF IMPACTS

1.1. Assessment Procedure

The potential environmental impacts were evaluated according to their severity, duration, extent and significance of the impact. Cumulative impacts were also taken into consideration. WSP Environmental's Risk Assessment Methodology was used for the ranking of the impacts.

This system derives environmental significance on the basis of the consequence of the impact on the environment and the likelihood of the impact occurring. Consequence is calculated as the average of the sum of the ratings of severity, duration and extent of the environmental impact. Likelihood considers the frequency of the activity together with the probability of an environmental impact occurring. Tables 1-7 describe the process in detail:

Consequence

Consequence is calculated as the average of the ratings for severity, duration and extent of the environmental impact.

Table 1: Assessment and Rating of Severity

Rating	Description
1	Negligible / non-harmful / minimal deterioration (0 – 20%)
2	Minor / potentially harmful / measurable deterioration (20 – 40%)
3	Moderate / harmful / moderate deterioration (40 – 60%)
4	Significant / very harmful / substantial deterioration (60 – 80%)
5	Irreversible / permanent / death (80 – 100%)

Table 2: Assessment and Rating of Duration

Rating	Description
1	Less than 1 month / quickly reversible
2	Less than 1 year / quickly reversible
3	More than 1 year / reversible over time
4	More than 10 years / reversible over time / life of project or facility
5	Beyond life of project of facility / permanent

Table 3: Assessment and Rating of Extent

Rating	Description
1	Within immediate area of activity
2	Surrounding area within project boundary
3	Beyond project boundary
4	Regional / provincial
5	National / international

Table 4: Determination of Consequence

Determination of Consequence (C)	(Severity + Duration + Extent) / 3

Likelihood

Likelihood considers the frequency of the activity together with the probability of the environmental impact associated with that activity occurring.

Table 5: Assessment and Rating of Frequency

Rating	Description
1	Less than once a year
2	Once in a year
3	Quarterly
4	Weekly
5	Daily

Table 6: Assessment and Rating of Probability

Rating	Description
1	Almost impossible
2	Unlikely
3	Probable
4	Highly likely
5	Definite

Table 7: Determination of Likelihood

Determination of Likelihood (L) =	(Frequency + Probability) / 2

Environmental significance

Environmental significance is the product of the consequence and likelihood values.

Table 1: Determination of Environmental Significance

KEY TO COLOUR CODING

Low (-ve) (1 – 4.9)	Low (+ve) (1 – 4.9)
Low-medium (-ve) (5 – 9.9)	Low-medium (+ve) (5 – 9.9)
Medium (-ve) (10 – 14.9)	Medium (+ve) (10 – 14.9)
Medium-high (-ve) (15 – 19.9)	Medium-high (+ve) (15 – 19.9)
High (-ve) (20 – 25)	High (+ve) (20 – 25)

BIOPHYSICAL ENVIRONMENT

IMPACT	Impact Description	A Severity	B Duration	C Extent	D Consequence (A+B+C)/3	E Frequency	F Probability	G Likelihood (E+F)/2	(DxG) Environmental Significance (Without Mitigation)	(DxG) Environmental Significance (With Mitigation)
Biodiversity - Flora										
-ve	The construction leads to unnecessary loss of Indigenous vegetation and natural habitat.	2.0	3.0	1.0	2.0	2.0	2.0	2.0	4.0	
		2.0	2.0	1.0	1.7	1.0	1.0	1.0		1.7
-ve	Loss of topsoil resource during excavation / construction activities.	2.0	3.0	1.0	2.0	2.0	2.0	2.0	4.0	
		2.0	2.0	1.0	1.7	1.0	1.0	1.0		1.7
-ve	Vegetation is damaged through trampling during operational phase.	2.0	4.0	2.0	2.7	4.0	2.0	3.0	8.0	
		2.0		2.0	1.3	2.0	1.0	1.5		2.0
Biodiversity - Terrestiral Fauna										
-ve	Construction of the sewage package plant and associated discharge pipeline may result in disturbance of penguin, cormorant and tern nesting sites with implications for reproductive success.	2.0	3.0	1.0	2.0	2.0	3.0	2.5	5.0	
		2.0	3.0	1.0	2.0	2.0	2.0	2.0		4.0
-ve	Construction of the sewage package plant and associated discharge pipeline may obstruct movement along penguin highways	2.0	3.0	1.0	2.0	2.0	3.0	2.5	5.0	
		2.0	3.0	1.0	2.0	2.0	2.0	2.0		4.0
-ve	Terrestrial seabird species such as African penguins are at risk through risk of entrapment in excavations or machinery.	2.0	2.0	1.0	1.7	3.0	2.0	2.5	4.2	
		2.0	2.0	1.0	1.7	3.0	1.0	2.0		3.3
-ve	During operation African penguins may enter and harm themselevs in the SPP complex.	2.0	3.0	1.0	2.0	3.0	3.0	3.0	6.0	
		2.0	3.0	1.0	2.0	3.0	1.0	2.0		4.0
Heritage										
-ve	Damage, destruction, loss of value to the resources of Robben Island National and World Heritage site including aracheological sites graves and Middens.	4.0	4.0	2.0	3.3	2.0	2.0	2.0	6.7	
		3.0	4.0	2.0	3.0	2.0	1.0	1.5		4.5
-ve	Damage or destruction to fossiliferous palaeontology resources during excavations.	3.0	4.0	2.0	3.0	2.0	2.0	2.0	6.0	
		2.0	4.0	2.0	2.7	2.0	1.0	1.5		4.0
Air Qaulity & Noise										
-ve	Excessive noise durng construction disturbs visitors, birdlife and residents and negatively impacts tourisitic value of the site.	2.0	2.0	1.0	1.7	3.0	3.0	3.0	5.0	
		2.0	2.0	1.0	1.7	2.0	2.0	2.0		3.3
-ve	Fires from construction camp lead to localised distrubace in air qaulity.	2.0	2.0	2.0	2.0	3.0	3.0	3.0	6.0	
		2.0	2.0	2.0	2.0	2.0	2.0	2.0		4.0
-ve	Vehicles generate excessive dust and nuisance when travelling to and from site during the construction period.	2.0	2.0	1.0	1.7	4.0	3.0	3.5	5.8	
		2.0	2.0	1.0	1.7	3.0	2.0	2.5		4.2
-ve	Dust is generated from stockpiles in unsheletered areas.	2.0	2.0	1.0	1.7	4.0	3.0	3.5	5.8	
		2.0	2.0	1.0	1.7	3.0	2.0	2.5		4.2
-ve	Odour is generated during operation of the SPP which presents a nuisance to residents and visitors	3.0	2.0	1.0	2.0	2.0	2.0	2.0	4.0	
		3.0	2.0	1.0	2.0	2.0	2.0	2.0		4.0
Marine Water Qaulity										
-ve	Potential accidental spillage or release of building materials, paints, cements into the ocean or inter tidal zone during constuction.	2.0	3.0	2.0	2.3	3.0	3.0	3.0	7.0	
		2.0	3.0	2.0	2.3	2.0	1.0	1.5		3.5
-ve	Erosion of construction related stockpiles	2.0	2.0	1.0	1.7	3.0	3.0	3.0	5.0	
		2.0	2.0	1.0	1.7	2.0	2.0	2.0		3.3
+ve	Decrease in nutrient levels in the discharge from the proposed SPP relative to those in the current raw sewage discharge would decrease the likelihood of plankton blooms and seabed hypoxia and improve turbidity									
		4.0	4.0	2.0	3.3	5.0	4.0	4.5		15.0
+ve	Decreased nutrient levels in the discharge from the proposed SPP may result in recovery of biodiversity and community structure of subtidal benthic macrofauna and flora impacted by the current raw sewage discharge									
		4.0	5.0	2.0	3.7	5.0	4.0	4.5		16.5
+ve	Reduced levels of organic matter in the discharge from the SPP relative to those in the current raw sewage discharge may result in recovery of the structure and diversity of soft-sediment macrofauna.									
		3.0	4.0	2.0	3.0	5.0	4.0	4.5		13.5
+ve	Reduced levels of organic matter and heavy metals discharged from the SPP relative to the current raw sewage discharge may improve sediment quality (e.g. oxygen levels, heavy metals).									
		2.0	3.0	1.0	2.0	5.0	4.0	4.5		9.0
+ve	Reduced levels of organic matter in the discharge from the SPP relative to the current raw sewage discharge may modify the diversity, abundance and structure of fish assemblages.									
		2.0	3.0	2.0	2.3	5.0	4.0	4.5		10.5
+ve	Reduced levels of colifom bacteria and other pathogens in the discharge from the SPP relative to the current raw sewage discharge will improve environmental health and alleviate existing health hazards to humans.									
		4.0	4.0	2.0	3.3	5.0	5.0	5.0		16.7
-ve	Biocides used to disinfect the effluent are highly toxic to marine biota.									
		2.0	2.0	1.0	1.7	5.0	2.0	3.5		5.8
-ve	The fresh water in the discharge from the SPP will reduce salinities around the outfall and affect the osmoregulatory abilities of marine organisms.									
		1.0	3.0	1.0	1.7	5.0	2.0	3.5		5.8
-ve	Xenobiotic substances in the discharge from the SPP can bioaccumulate in higher order consumers.									
		2.0	3.0	1.0	2.0	5.0	2.0	3.5		7.0
Surfacewater and Groundwater										
-ve	Construction activities result in the contamination of groundwater resources through spillages into the soil.	3.0	3.0	3.0	3.0	3.0	2.0	2.5	7.5	
		3.0	3.0	3.0	3.0	2.0	1.0	1.5		4.5
-ve	Leakage from the SPP results in contamination of the groundwater.	3.0	3.0	3.0	3.0	2.0	2.0	2.0	6.0	
		3.0	3.0	3.0	3.0	3.0	1.0	2.0		6.0
-ve	Pollution of sufacewater if the treated effluent used of rirrigation does not meet the required water qaulity standards leading to potential pollution in surrounding water resources.	3.0	3.0	3.0	3.0	3.0	2.0	2.5	7.5	
		3.0	3.0	3.0	3.0	3.0	1.0	2.0		6.0
+ve	Re-use of treated effluent in the future reduces pressure on freshwater resources.	3.0	4.0	4.0	3.7	4.0	4.0	4.0	14.7	
Waste										
-ve	Risks to the environment during construction include potential contamination of surrounding environment from waste through accidental or illicit activities.	3.0	2.0	2.0	2.3	4.0	3.0	3.5	8.2	
		3.0	2.0	2.0	2.3	4.0	1.0	2.5		5.8
-ve	Risks to the environment during operation include potential contamination of surrounding environment from waste through accidental or illicit activities.	3.0	3.0	2.0	2.7	4.0	3.0	3.5	9.3	
		3.0	3.0	2.0	2.7	4.0	1.0	2.5		6.7
Geotechnical										
-ve	Risk of geological faulting during construction if the SPP is placed on collapsible soils with potential failure in the infrastructure.	3.0	3.0	3.0	3.0	2.0	2.0	2.0	6.0	
		3.0	3.0	3.0	3.0	1.0	1.0	1.0		3.0
-ve	Risk of geological faulting during operation if the SPP is placed on collapsible soils with potential failure in the infrastructure.	3.0	3.0	3.0	3.0	2.0	2.0	2.0	6.0	
		3.0	3.0	3.0	3.0	1.0	1.0	1.0		3.0
Visual Impact										
-ve	The construction of the SPP leads to a disturbance in the visual amenity of the island to visitors and residents.	2.0	2.0	2.0	2.0	4.0	3.0	3.5	7.0	
		2.0	2.0	2.0	2.0	4.0	1.0	2.5		5.0
-ve	The operation of the SPP and pipeline leads to a disturbance in the visual amenity of the island to visitors and residents.	2.0	4.0	2.0	2.7	4.0	3.0	3.5	9.3	
		2.0	4.0	2.0	2.7	4.0	1.0	2.5		6.7
Socio-economic										
-ve	Development results in contribution to direct service provision on the island	4.0	4.0	3.0	3.7	5.0	5.0	5.0	18.3	
+ve	Employment opportunities to construct SPP.	2.0	2.0	4.0	2.7	5.0	5.0	5.0	13.3	
+ve	Employment opportunities to operate SPP.	2.0	4.0	4.0	3.3	5.0	5.0	5.0	16.7	
Health & Safety										
-ve	Risk of injury or death to workers or tresspassers during construction activities.	3.0	2.0	2.0	2.3	3.0	2.0	2.5	5.8	
		3.0	2.0	2.0	2.3	3.0	1.0	2.0		4.7
-ve	Risk of injury or death to workers or tresspassers during operational activities.	3.0	3.0	2.0	2.7	3.0	2.0	2.5	6.7	
		3.0	3.0	2.0	2.7	3.0	1.0	2.0		5.3

APPENDIX G – ENVIRONMENTAL MANAGEMENT PROGRAMME

UNITED
BY OUR
DIFFERENCE
WSP

ROBBEN ISLAND SEWAGE PACKAGE PLANT
DEPARTMENT OF PUBLIC WORKS

Environmental Management Programme

2014/08/26

Quality Management

Issue/revision	Issue 1	Revision 1	Revision 2	Revision 3
Remarks	Draft	Final		
Date	March 2014	July 2014		
Prepared by	Kirsten Sims	Kirsten Sims		
Signature				
Checked by	Jacqui Fincham	Jacqui Fincham		
Signature				
Signature				
Project number	24959	24959		
Report number				
File reference				

Robben Island Sewage Package Plant Department of Public Works

Environmental Management Programme

2014/08/26

Client

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1 Introduction

1.1 Background

This Environmental Management Programme (EMPr) is intended as a practical working document, developed as part of the Basic Assessment (BA) authorisation process. The environmental issues relating to the construction works of the proposed project are considered systematically, and procedures in the form of Method Statements are outlined for dealing with issues as they would arise during the course of the works. The aim of the EMPr is to ensure that measures are implemented to manage and mitigate potential impacts which may be present during the construction, operations and decommissioning (if applicable) of the site.

This EMPr document has been compiled in conjunction with the BA Report and will be submitted to the Department of Environmental Affairs (DEA) as an appendix to the BA Report. The EMPr has been developed in accordance with minimum legal requirements of Section 33 of the NEMA EIA Regulations for the, construction, operational and closure/rehabilitation phases of the proposed project.

The EMPr will include the following:

- Details and the expertise of the person who prepared the EMPr;
- Information on any proposed management or mitigation measures that will be taken to address the environmental impacts that have been identified in the BA Report, including environmental impacts or objectives in respect of planning and design, pre-construction and construction activities, operation and undertaking of the activities, rehabilitation of the environment and closure where relevant;
- A detailed description of the aspects of the activity that are covered by the EMPr;
- An identification of the people who will be responsible for the implementation of the mitigation measures;
- Where appropriate, time periods within which the mitigation measures contemplated in the EMPr must be implemented;
- Proposed mechanisms for monitoring compliance with the EMPr and reporting thereon;
- Measures to rehabilitate the environment affected by the undertaking of any listed or otherwise activity, to its natural or predetermined state;
- A description of the manner in which it is intended to modify, remedy or control any activity which causes pollution, degradation or migration of pollutants;
- Provide timeframes within which measures detailed in the EMPr should be implemented;
- The process for managing any degradation or damage to the environment;
- An environmental awareness plan detailing the manner in which employees will be managed in terms of informing them of inherent risks which may result from the activity; and
- Where appropriate, closure plans and closure objectives.

1.2 Project Location

The proposed site is located at the eastern side of Robben Island (Figure 1), in Table Bay. The site is bounded to the northeast by Murray's Bay beach (50 m), to the north by the Dog Unit (30 m), to the west by Murray's Road (80 m) and to the south by the Robben Island village (500 m).

The proposed development site is currently undeveloped land, although there is existing infrastructure associated with the marine outfall including pump stations and sumps.

Figure 1. The Robben Island and the Sewage Package Plant proposed location area.

1.3 Project Description

1.3.1 Current operations

The development of the proposed Sewage Package Plant (SPP) will serve to replace the existing sewage handling system. The current method for disposing of waste water from the island is that sewage is captured in an interceptor sewer line. The effluent is macerated before being discharged to the open ocean. There are no active operations currently occurring at the site. There is an existing sewer outfall pipeline which extends 460m into the sea, and some ancillary infrastructure such as pumps and a sump.

1.3.2 Proposed Activity

A SPP is proposed to treat domestic effluent produced on the island. The new treatment facility will allow sewage to be treated to a quality which meets the General Limit Values (GN 665, 2013). The treatment throughput capacity of the plant will be 300m^3 per day, or 108,000m^3 per annum and will be based upon the design of the Ampac® Submerged Bio-media Sewage Treatment Plant. The treated effluent will be transported via the existing pipeline to the existing marine outfall pipeline and discharged to sea. Some of the treated water will be retained in a 240m^3 storage tank adjoined to the SPP for irrigation of nearby sports fields in the future.

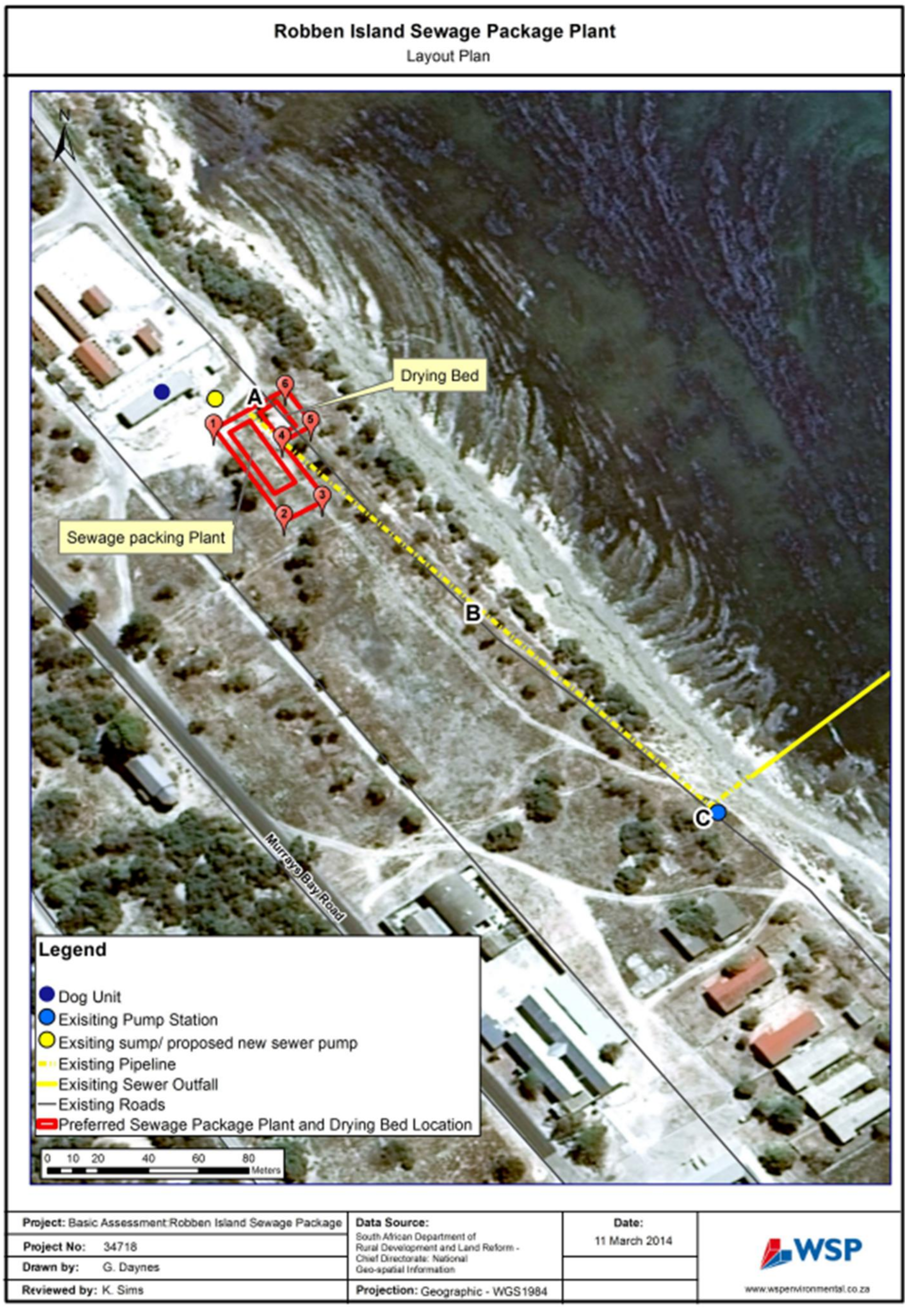

Figure 2 Plan showing proposed redevelopment changes to existing buildings.

As a by-product of the process, an estimated 120m^3 of sludge will be generated annually. This will be stored in a drying bed (DB) located directly adjacent to the facility and either used as fertiliser or disposed of via the normal refuse system or municipal waste water treatment works (WWTW).

Other ancillary infrastructure will include a newer sewer pump and blowers to support the existing pump station.

The sewage package plant and associated infrastructure will require a footprint of 1,400 m^2 which includes the sewage treatment plant, adjoining irrigation tanks and a drying bed for the inert sludge by-product. The plant footprint will be 310m^2, and the drying beds will be 50m^2. A total development footprint of 600m^2 has been assumed (including around 90m^2 of pipelines from the sumps and pumps to the sewage package plant. The plant will be partially submerged in the ground to a depth of 2.5m. The existing pipeline to the existing outfall is approximately 220m in length.

1.3.3 Construction Phase

The construction phase is anticipated to take three months, and will consists of four primary phases, namely:

- **Excavation:** To be completed to a depth of 2.2 m**.**
- **Concrete works:** Casting of concrete floors of package plant and drying beds.
- **Package plant**: Assembly of modular units of sewer plant and secure to concrete floor; installation of pipe reticulation.
- **Finishing:** Remove and dispose of any construction materials or waste; revegetation.

A Construction Management Plan (CMP) methodology and proposed project timeframes are attached as **Appendix C**.

1.4 Legal Framework

The National Environmental Management Act (NEMA) is South Africa's overarching environmental legislation and has, as its primary objective, to provide for co-operative governance by establishing principles for decision making on matters affecting the environment, institutions that will promote co-operative governance and procedures for co-ordinating environmental functions exercised by organs of state and to provide for matters connected therewith.

The construction of the Sewage Package Plant triggers activities listed in the EIA Regulations (2010) as promulgated in accordance with the National Environmental Management Act (NEMA) (Act No. 107 of 1998). Government Notice (GN) R544 (Listing Notice 1) activity numbers 16 and 18 are triggered by the proposed redevelopment.

In addition, the drying beds will require a Waste Management Licence in terms of GN 921 of the National Environmental Management: Waste Act (NEMWA) (No 58 of 2008). Category A, Activity 1 is triggered and therefore means that the proposed development requires a waste management licence (WML).

The release of effluent to the marine environment requires a Coastal Water Discharge Permit (CWDP) in terms of the Integrated Coastal Management Act (ICMA) (No 24 of 2008). The reference number for the CWDP is 2012/2006/WC/ Robben Island Museum.

Activities triggered by the proposed redevelopment are listed in Table 1 below.

An integrated EA and WML process has been undertaken for the proposed development. Because of the status of Robben Island as a National and World Heritage site, the competent authority for this project is the Department of Environmental Affairs (DEA).

Table 1 NEMA activities applicable to the project.

Government Notice	Description of activity	Applicability of the activity
NEMA Listing Notice 1 (GN No. R544)		
16	The construction or earth moving activities within 100m inland of the high water mark or sea for buildings greater than 50 square meters.	The proposed Sewage Package Plant will be constructed within ~50m of the edge of the sea and will have a total footprint of 600m^{2}.
18	The infilling or depositing of material more than 5 cubic metres, or dredging and excavation of material within 100m of the high water mark.	Due to the locality of the plant and pipelines to the sea, it is expected that various materials such as rocks, shells, soil etc. will be removed within a distance of 100m inland from the high-water mark and will be more than 5m^{3}.
NEMWA Category A (GN 921)		

1	The storage of general waste in lagoons.	An inert sludge (120m^3) will be produced as a result of the treatment process; this will be stored in a drying bed and removed on a periodic basis.

1.5 Project Proponent

Table 2 Details of the project applicant.

Project Proponent details	
Project Applicant	**Department of Public Works**
Contact person:	**JFD De Kock**
Postal Address:	**Private Bag X9027, Cape Town**
Telephone:	**021 402 2044**
Fax:	**021 418 7039**
E-mail:	**jfd.dekock@dpw.gov.za**

1.6 Environmental Assessment Practitioner

WSP were appointed by The Department of Public Works to undertake the function of EAP to facilitate the environmental authorisation process and have been the authors of this EMPr. WSP is a leading international environmental consultancy with a broad range of expertise in the environmental industry. Relevant details of the EAP are presented in Table 3 below.

Table 3 Environmental Assessment Practitioner for the proposed Robben Island SPP

Environmental Assessment Practitioner	
Environmental Assessment Practitioner	**WSP Environmental**
Contact person	**Jacqui Fincham**
Qualification/ Associations	**BSc (H), ICB Registered Assessor**
Physical address	**3rd Floor, 35 Wale street, Cape Town, 8001**
Postal address	**PO BOX 2613, Cape Town, 8000**
Telephone	**021 481 8795**
Fax	**021 481 8799**
E-mail	**Jacqui.Fincham@wspgroup.co.za**

1.7 Assigned Responsibility

1.7.1 Applicant Responsibility

Department of Public Works (the Applicant) is responsible for appointing a Designated Environmental Officer (DEO) who has overall responsibility for the following:

- Ensuring that engineers and contractors comply with the approved EMPr;
- Ensuring compliance with the provisions for duty of care and remediation damage in accordance with Section 28 in terms of NEMA (no 107 of 1998) and its obligations regarding the control of emergency incidents in terms of section 30 of NEMA;
- Notifying the DEA of any incident as defined in section 30(1) (a) of NEMA (Control of Emergency Incident); and
- Appointing a suitable qualified, registered Environmental Assessment Practitioner (EAP) to act as the independent Environmental Control Officer (ECO).

Please note that reference to Department of Public Works Responsibility also applies to contractors employed by them in all phases of project development.

1.7.2 Project Manager Responsibility

Department of Public Works must appoint a Project Manager to oversee and manage the construction of the proposed facility. The Project Manager is responsible for the following:

- Appointing the appropriately qualified contractor to coordinate, supervise and expedite different action plans;
- Ensuring adherence to DEA conditions of authorisation and any other legislation relevant to the construction of the sewage package plant;
- Ensuring adherence to all statutory safety, health and environment standards and ensuring the construction complied with the EMPr;
- Avoiding/ mitigating adverse environmental impacts to the site by appropriate site design and construction;
- Ensuring transparency in the operation and management of the site;
- Managing the contractors compliance and ensure documentation management; and
- Ensuring that the contractor has a copy of the EMPr and all agreed method statements.

1.7.3 Contractors Responsibility

The Contractor is responsible for the following:

- Managing and operating the facility with due care and diligence;
- Complying with all elements of the EMPr;
- Ensuring stakeholder interest is reported to the ECO; and
- Maintaining relevant documentation for review by the ECO.

1.7.4 ECO Responsibility

The ECO is responsible for the following:

- Determining conformance of the site construction activities with the requirements of the EMPr;
- Liaising with DEA and stakeholders (if required);
- Identification of potential areas for improvement during construction;
- Undertaking on-going monitoring of the construction site through regular site visits and recording key findings;

- Advising the project manager and contractors on environmental matters during the construction phase of the development;
- Monitoring implementation of the EMPr by the contactor;
- Advising the project manager on the actions or issues impacting on the environment and provide appropriate recommendations to address or rectify these matters; and
- Ensuring that the conditions stipulated in the Environmental Authorisation, waste management licence and any other laws and standards relevant to the construction are being complied with.

1.8 Summary of Main Impacts

The development of the proposed sewage package plant and drying beds require a Basic Assessment process to be completed. A full impact assessment was completed as part of the BAR. The development of the SPP will need to be managed to ensure that the environment is not degraded by the construction or operations of the site.

Table 4. Summary of main impacts identified during the environmental assessment.

Impact	Phase	Description of impact
Air Quality & Noise	Construction	■ Dust emissions from construction (limited) ■ Noise generated by vehicles associated with the transport of construction goods (limited); and ■ Noise associated with incidental construction activities, such as cement mixing, compaction and the on-site generator.
	Operation	■ Odour during operation (negligible as system will be fully enclosed preventing the escape of odours to the atmosphere). ■ Noises from aeration pumps (limited, as facility is enclosed).
	Decommissioning	■ Dust emissions from demolition. ■ Noise from demolition of structures; and ■ Vehicular movement associated with removal /transfer of goods from site.
Waste and hazardous substances	Construction	■ Waste generated during construction activities.
	Operation	■ Generation and removal of inert (general) sludge and solid non-biodegradable screenings from SPP ■ Hazardous wastes: including minimal wastes from maintenance including oily rags, filters etc.
	Decommissioning	■ Building rubble from demolition of structures.
Biodiversity (flora)	Construction	■ Damage/ removal of indigenous flora during construction. ■ Introduction of exotic/ alien species during construction. ■ Loss in topsoil resource during construction.
	Operation	■ Damage to natural vegetation.
	Decommissioning	■ None identified.

Biodiversity (Terrestrial Fauna)	Construction	▪ Disturbance to African Penguin population of Robben Island. ▪ Risk of harm to African Penguin population from construction activities.
	Operation	▪ Risk of Penguins/ seabird entering the SPP facility and harming themselves.
	Decommissioning	▪ Disturbance to African Penguin/ seabird population of Robben Island. ▪ Risk of harm to African Penguin/ seabird population from demolition activities.
Storm and Groundwater Management	Construction	▪ Water or soil contamination through spillage of hazardous substances e.g. cements, paints, solvents, machinery fuel/ lubricants etc.
	Operation	▪ Leakage from the Sewage package Plant results in contamination of the groundwater and potentially the ocean.
	Decommissioning	▪ Water or soil contamination through spillage of hazardous substances e.g. cements paints, solvents, machinery fuel / lubricants.
Heritage – Archaeology & Palaeontology	Construction	▪ Damage or disturbance to below ground archaeological heritage resources. ▪ Damage or destruction to fossiliferous palaeontology resources during excavations. ▪ Disturbance to existing sense of place or impact on cultural heritage.
	Operation	▪ N/A
	Decommissioning	▪ N/A
Marine Environment	Construction	▪ Accidental spillages of waste material during construction of new infrastructure, including deposition of dust and/or rainfall wash of dust/material into marine environment. ▪ Erosion of construction related stockpiles into marine environment.
	Operation	▪ Release of effluent which does not meet required treatment limits continues to impact upon marine environment.
	Decommissioning	▪ N/A
Visual	Construction	▪ The construction of the SPP leads to a disturbance in the visual amenity of the island to visitors and residents.
	Operation	▪ The operation of the SPP leads to a disturbance in the visual amenity of the island to visitors and residents.
	Decommissioning	▪ None identified.
Health & Safety	Construction	▪ H&S Risks to contractors during construction.
	Operation	▪ H&S Risks to employees/ contractors during operation

		■ Toxicity risks from hazardous substances / chemicals used on site e.g. chlorine; raw sewage.
	Decommissioning	■ H&S Risks to contractors during construction

2 Environmental Management Programme

This document is project specific and the proposed environmental management and mitigation measures proposed throughout the Basic Assessment processes have been captured within Table 5, 6 and 7 below. Table 5 addresses the Construction Phase, Table 6 addresses the Operational Phase and Table 7 addresses the Decommissioning Phase. The tables present the potential impacts and associated management and mitigation measures and the responsible person.

2.1 Construction Phase

In order to ensure compliance with findings of the Basic Assessment the following actions are applicable to the construction phase.

Table 5 Construction Environmental Management Plan

Environmental Aspect	Environmental Management and Mitigation Measures	Responsible Person(s)
2.1.1 Administrative Requirements		
Objectives	■ **To define roles and responsibilities for environmental management;** ■ **To ensure suitable environmental training and induction to all employees; and** ■ **To promote environmental awareness.**	
Environmental Awareness, Roles and Responsibilities for Environmental Management	■ The Department of Public Works must appoint a DEO to be responsible for ensuring: ■ Weekly monitoring of activities during construction to ensure compliance with the EMPr. ■ Ensuring environmental awareness among members of the construction workforce through daily/weekly toolbox talks. ■ Ensuring that all contractor(s) and members of the workforce are aware of the requirements of the EMPr. ■ Implementing preventative and corrective actions in accordance with the requirements of the EMPr and outcomes of environmental audits. ■ Reporting of environmental incidents within the environmental incidents register that may occur on-site and off-site during transportation of hazardous waste, in accordance with the requirements of the EMPr and relevant environmental legislation. ■ Ensure that method statements are compiled and submitted to the ECO for approval prior to initiating with a construction phase.	**Department of Public Works** **DEO**

Environmental Training and Induction	▪ All staff must be trained in avoiding damage and disturbance to the natural environment during construction. ▪ All Staff must be trained in the relevant Department of Public Works or Robben Island Museum procedures, for example the RIM Policy on Access and Control, or relevant fire procedures. ▪ Ensure all employees are supplied with the correct personal protective equipment. ▪ As far as possible, local labourers will be appointed for skilled and semi-skilled positions. ▪ Principles of equality, BBBEE, gender equality and non-discrimination must be implemented where possible. ▪ Workers must be regularly briefed by the site manager on the do's and don'ts of working on Robben Island in terms of conduct. ▪ Ensure compliance to the Occupational Health and Safety Act (85 of 1993) requirements.	**Department of Public Works** **DEO**
Environmental Awareness	▪ An environmental awareness programme is in place for all on-site personnel describing the key environmental issues and potential impacts thereof. This must include specific training provided by the heritage specialist relating to heritage and paleontological aspects of the study.	**Department of Public Works** **DEO**
Duty of Care	▪ The Department of Public Works must take reasonable measures to prevent pollution or degradation of the environment from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment.	**Department of Public Works**
Indicator / Compliance Mechanism	▪ Environmental incidents register. ▪ Close-out on incidents received. ▪ Induction training and register. ▪ Environmental awareness programme.	**Department of Public Works** **DEO** **Independent ECO**

2.1.2 Work Commencement and Construction Camp Establishment

Objectives	▪ **Ensure sound environmental management during the erection of the construction camp.** ▪ **An independent ECO must be appointed to monitor the construction activities on site.** ▪ **The ECO should work closely with the nominated Department of Public Works DEO.**	
Construction	▪ Method statements should be submitted to the ECO for approval prior to the commencement of any construction activity.	**Department of**

Camp activities	▪ Appropriate waste facilities (heavy, non-tip bins with lids) must be provided at the construction camp in order to ensure that no littering of the site occurs. The bins provided must allow for the segregation of waste which should be emptied on a regular basis. ▪ Before construction can begin, the contractor shall submit to the engineer and ECO for his/ her approval, plans of the exact location, extent and construction details of these facilities and the impact mitigation measures the contractor proposes to put in place. The camp site shall be selected such that it avoids the need to remove any indigenous tree species. ▪ Detailed, electronic colour photographs shall be taken of the proposed site before any clearing may commence. These records are to be kept by the engineer for consultation during rehabilitation of the site. ▪ The construction camp must be continuously fenced with 20mm PVC mesh fencing to prevent entry into camp by endangered African Penguins. ▪ Fencing should also effectively screen unsightly aspects from public and visitors view including excavations (where practical), construction material storage areas, waste storage areas and ablutions). ▪ Should an African Penguin nesting site be encountered during camp set up activities or otherwise, works in the vicinity of the nest must cease and a representative of the Southern African Foundation for the Conservation of Coastal Birds (SANCCOB) must be consulted to safely relocate the nest. ▪ Appropriate ablution facilities must be provided which may include dry composting toilets such as "enviroloos" or chemical toilets supplied by a contractor. Soak-aways and septic tanks <u>may not</u> be used. ▪ Toilets must be provided with locks and doors and shall be secured to prevent them from blowing over and located in close proximity to the construction area. ▪ A chemical/hazardous substance storage and working area must be identified and designated and placed on/in impermeable layer and within bunding to prevent unauthorised entry or possible risk of spillage. ▪ Good housekeeping shall be exercised at all times on site. ▪ Potentially contaminated stormwater runoff during construction should be captured where feasible and treated/disposed of as contaminated wastewater. ▪ All building waste must be collected and disposed of appropriately at a licenced landfill site the end of the construction phase.	**Public Works** **DEO** **Independent** **ECO**
Indicator / Compliance Mechanism	▪ Method statements completed and submitted. ▪ ECO appointed to undertake monthly audits during construction. ▪ Weekly audit reports by DEO. ▪ Waybills of safe removal of waste/ spoil/ rubble/ wastewater. ▪ Machinery maintenance and safety certificate must be required from each separate hire company for each piece of equipment hired,	**Department of Public Works** **DEO** **Independent ECO**

	where applicable.	

2.1.3 Flora and Fauna Management

Objectives	▪ **To avoid harm, damage or loss to indigenous vegetation**	**Responsibility**
Vegetation management objectives	▪ The natural vegetation encountered on the site is to be conserved and left as intact as possible. Only alien trees and shrubs directly affected by the works, and such others as may be indicated by the engineer and ECO in writing may be felled or cleared. Where natural vegetation has been cleared out of necessity, same specie indigenous trees as previously existing in the area shall be re-established. ▪ The area where the site offices will be erected will require rehabilitation at the end of the construction period. This should be completed with indigenous vegetation that is naturally occurring in the area of vegetation. ▪ A shaded nursery must be incorporated into the camp set-up where indigenous plants removed from the footprint of the SPP are stored and maintained for the duration of the construction period and re-used for rehabilitation of the construction area. ▪ Topsoil shall be removed from all areas where physical disturbance of the surface will occur and shall be stored and adequately protected for re-use during rehabilitation. Storage of topsoil must be done in such a manner that the soil can be backfilled onto the SPP in the correct order with the top layers being returned to the top layer. ▪ The topsoil stockpiles shall be stored, ensuring that they do not interfere with the flow of water to cause damming or erosion, or itself be eroded by the action of water. Stockpiles of topsoil shall not exceed a height of 2m, and if they are to be left for longer than 6 months, shall be analysed, and if necessary, upgraded before replacement. Stockpiles shall be protected against infestation by weeds. ▪ Extreme care must be taken not to harm or disturb the African Penguin populations, particularly during moulting periods (Typically November to January). ▪ Construction area must be continuously fenced to avoid disturbing / harming penguin colony. ▪ All open holes /excavation pits must be covered at night time with a solid barrier. If possible, the use of trenching techniques which minimise the area of open excavation should be utilised. ▪ Should an African Penguin nesting site be encountered during site clearing activities or otherwise, works in the vicinity of the nest must cease and a representative of the Southern African Foundation for the Conservation of Coastal Birds (SANCCOB) must be consulted to safely relocate the nest. ▪ If an African Penguin nesting site is discovered in the construction zone, or if an injured, trapped or distressed penguin is discovered in	**Department of Public Works** **DEO**

	the vicinity of the construction works, works in the vicinity of the penguin/s must be stopped and the engineer informed of the discovery. SANCOBB and Cape Nature must be contacted to determine the appropriate course of action.	
Indicator / Compliance Mechanism	■ ECO appointed to undertake monthly audits during construction. ■ Signed Site Establishment Plan. ■ Written permission signed by engineer and ECO to fell trees. ■ Records of SANCOBB engagement and close-out.	**Department of Public Works DEO** **Independent ECO**

2.1.4 Marine Environment

Objectives	■ **To avoid harm, damage to marine environment**	**Responsibility**
Marine management objectives	■ All effluent water from the camp / office sites shall be disposed of in a properly designed and constructed system, situated so as not to adversely affect water sources (groundwater, marine resources). ■ Any cement mixing that may occur on site must be undertaken on a non-permeable sheet/layer and sufficiently bunded to prevent spillage. ■ Topsoil piles to be covered on windy days to minimise wind blowing or sedimentation of marine or surface water resources.	**Department of Public Works DEO**
Indicator / Compliance Mechanism	■ Electronic or hard copy of Complaints/Incidents/Non-conformance registers. ■ Close-out on incidents received. ■ Minimum of monthly independent ECO audit reports.	**Department of Public Works DEO** **Independent ECO**

2.1.5 Surface Water and Management

Objectives	■ **Ensure sound environmental management regarding surface water during construction; and** ■ **Ensure the prevention of stormwater pollution.**	
Surface water commitments	■ A drainage system must be identified for the construction camp. ■ All potential stormwater contaminants must be bunded in the site camp to prevent run-off into the ocean. No liquid or substance other than uncontaminated rainwater runoff shall emanate from the construction site.	**Department of Public Works DEO**
Indicator / Compliance Mechanism	■ Electronic or hard copy of Complaints/Incidents/non-conformance register. ■ Close-out on incidents received.	**Department of Public Works DEO**

	▪ Minimum of monthly independent ECO audit reports. ▪ Six Monthly monitoring reports.	**Independent ECO**

2.1.6 Fire and Spill Prevention

Objectives	▪ **To ensure fires and spillages on-site do not cause unnecessary destruction to surrounding environment or injury to personnel.**	
Fire and spill prevention	▪ Knowledge of the appropriate RIM fire procedures may be required to be demonstrated to the ECO. ▪ Any construction equipment that has the potential to leak oil must be placed on a drip tray. ▪ All equipment should be in good working order to prevent spillage occurring. ▪ Cement mixing must be undertaken on a hard surface to prevent spillage to the environment. ▪ Firefighting measures, such as fire extinguishers, must be serviced (annually) and located on-site close to high risk areas (e.g. generators) and the workforce must be made aware of fire prevention and firefighting measures. ▪ No uncontrolled fires will be permitted on-site. The contractor shall ensure that energy sources are available at all times for construction and supervision personnel for heating and cooking purposes if required for lunch times.	**Department of Public Works** **DEO**
Indicator / Compliance Mechanism	▪ Electronic or hard copy of Complaints/Incidents/non-conformance registers. ▪ Firefighting measures (extinguishers). ▪ Spill kits available and staff trained on use. ▪ Close-out on incidents received. ▪ Minimum of monthly independent ECO audit reports. ▪ Six Monthly monitoring reports.	**Department of Public Works** **DEO** **Independent ECO**

2.1.7 Air Quality

Objectives	▪ **Ensure sound environmental management regarding air quality and odour during construction thereby preventing air pollution.**	
Air Quality objectives	▪ The contractor must ensure that necessary equipment is in place to control dust generated during construction, where required. ▪ Dust suppression measures shall be implemented if and when required. Shade netting must be installed in construction areas which may generate dust and dust caused by strong winds shall be controlled by means of water spraying.	**Department of Public Works** **DEO**

	▪ A complaints register must be maintained on site and made accessible to neighbours and surrounding land users. ▪ No burning of waste, such as plastic bags, cement bags and litter is permitted. ▪ A speed limit of 30 km/hr must be imposed on all construction related traffic on the island.	
Indicator / Compliance Mechanism	▪ Electronic or hard copy of Complaints/Incidents/Non-Conformance registers. ▪ Close-out on incidents received. ▪ Minimum of monthly independent ECO audit reports.	**Department of Public Works** **DEO** **Independent ECO**

2.1.8 Noise Management

Objectives	▪ **To manage the noise that may arise from site during construction** ▪ **To adhere to the South African National Standards (SANS) 10103:2008 noise limits.**	
Noise management objectives	▪ Noisy activities which may exceed 50dB(A) should only be carried out outside of visitor hours and before 8 pm to avoid disturbance to visitors or residents on Robben Island. ▪ Construction activities may not exceed SANS 10103 noise levels. The SANS recommended residual sound levels for the type of receptor districts described for Suburban Residential Districts is 50 dB(A) LAeq during the day; and 40 dB(A) LAeq during the night. ▪ Provision of Personal Protective Equipment (PPE) equipment in noisy areas, such as near the generator. ▪ Care must be taken to avoid unnecessary disturbance to African Penguin present on the beach and avoid noisy works in the vicinity of the African penguin.	**Department of Public Works** **DEO**
Indicator / Compliance Mechanism	▪ Electronic or hard copy Complaints /Incidents/Non-Conformance register) ▪ Staff wearing appropriate PPE ▪ Minimum of monthly independent ECO audit reports. ▪ Six Monthly monitoring reports.	**Department of Public Works** **DEO** **ECO**

2.1.9 Waste Management

Objectives	▪ **To manage waste in a manner that prevents detrimental impacts on the environment.** ▪ **Ensure sound environmental management regarding waste management during the construction phase of the project.**	

Waste management objectives	▪ Waste must be disposed of at an appropriate landfill site by an approved contractor. ▪ The construction camp should be kept in an orderly state at all times. Littering is prohibited. ▪ Under no circumstances is waste to be burnt or buried on-site. ▪ Construction rubble is to be disposed of at an appropriate landfill site. ▪ Separation of wastes for recycling must be encouraged throughout the construction period. ▪ Suitably covered and tip-proof receptacles must be available at all times and conveniently placed for the disposal of waste generated during construction. . These receptacles must be emptied on a regular basis. ▪ All construction materials and wastes, shall be removed from the site on completion of the contract.	**Department of Public Works** **DEO**
Indicator / Compliance Mechanism	▪ Electronic or hard copy Complaints /Incidents/non-conformance register) ▪ Close-out on incidents received. ▪ Appropriate waste disposal facilities. ▪ Minimum of monthly independent ECO audit reports.	**Department of Public Works** **DEO** **Independent ECO**
2.1.10 Hazardous Waste Storage and Transport		
Objectives	▪ **To transport store and handle hazardous waste in a safe manner.**	
Hazardous Waste management objectives	▪ Ensure all staff is trained in hazardous waste handling and disposal and that the potential health or hazards of handling such waste are explained. ▪ Hazardous material storage must be in a designated controlled, bunded area with hardstanding. ▪ Staff must be supplied with appropriate PPE to handle hazardous wastes/ substances. ▪ Transport of hazardous waste materials must be limited as far as possible and should be transported in appropriate containers. ▪ MSDS for hazardous substances must be readily available and displayed within areas where the substances are permanently stored. MSDS should include information pertaining to environmental impacts and measures to minimise and mitigate against any potential environmental impact which may result from a spill or leakage. ▪ Hazardous waste must be kept in a separate and appropriate container (i.e. a covered skip) and disposed of at the Vissershok haz-	**Department of Public Works** **DEO**

	ardous landfill site. Safe disposal certificates must be obtained. ▪ Records of hazardous waste being taken off-site must be kept as evidence. ▪ Hazardous waste materials (e.g. non-boidegradable wastes from screenings; paint pots, oils, old transformers for fluorescent tubes) to be disposed of via a licensed hazardous waste contractor. Ensure safe waste disposal certificates are obtained from the contractor. ▪ Ensure that the DWA “Minimum Requirements for Handling, Classification and Disposal of Hazardous Waste” with specific reference to Section 10: “Waste handling, storage and transportation” are taken into account. ▪ The transport vehicle must be provided with the appropriate hazchem placards and must be properly fitted to the vehicle. ▪ The registered service provider must be licenced with the municipality.	
Indicator / Compliance Mechanism	▪ Safe disposal certificates for hazardous wastes. ▪ Proof of waste service provider’s accreditation with the municipality. ▪ Minimum of monthly independent ECO audit reports.	**Department of Public Works** **DEO** **Independent ECO**
2.1.11 Cultural Heritage / Paleontological Aspects		
Objectives	▪ **To ensure that appropriate steps are taken should any cultural and/or heritage aspects be identified on site.**	
	▪ A heritage specialist must be engaged throughout the construction process and “on call” during all excavation works in the case that any object of heritage or paleontological significance is unearthed. ▪ Should any item or artefact of archaeological or heritage significance be discovered during excavation activities, the contractor will be required to cease works and contact the heritage specialist who will liaise with SAHRA to determine best course of action before the site is disturbed any further. Permission to re-commence works must be provided in writing. ▪ Substantial fossil finds during construction, must be safeguarded - preferably in situ - and reported by the ECO as soon as possible to SAHRA, so that appropriate mitigation (i.e. recording, sampling or collection) by a paleontological specialist can be considered and implemented	**Department of Public Works** **DEO** **ECO**
Indicator / Compliance	▪ Proof of contract with heritage specialist for excavation works.	**Department of**

Mechanism	▪ Proof of notification/liaison/close-out with SAHRA should any artefacts be uncovered. ▪ Minimum of monthly independent ECO audit reports.	**Public Works** **DEO** **Independent ECO**

2.1.12 Training and Socio-Economic Aspects during Construction

Objectives	▪ **To ensure that staff has adequate training and are provided with necessary safety equipment. Furthermore, to enhance positive impacts on the local community with regards to job creation.**	
Training and Socio-economic commitments	▪ The ECO must ensure that all direct and sub-contracted site personnel have a basic level of environmental awareness training that has been offered to them. ▪ The engineer/ECO must be available to explain more difficult and technical environmental issues at project commencement. ▪ The need for a 'clean-site' policy must be explained to workers. ▪ The ECO must ensure that all site staff have been informed of the details of the EMPr document as well as the conditions of the Environmental Authorisation. ▪ Regular 'reminder' sessions must be included within the weekly-monthly toolbox talks being run by project manager to ensure that staff are reminded about environmental and safety issues and emergency procedures. ▪ Ensure all employees are supplied with the correct personal protective equipment.	**Independent ECO**
Indicator / Compliance Mechanism	▪ **Electronic or hard copy of environmental incidents and complaints register.** ▪ **Close-out on incidents and complaints received.** ▪ **Induction training and register.** ▪ **Personal protective equipment registers.** ▪ **Minimum of monthly independent ECO audit reports.**	**DEO** **Independent ECO**

2.2 Operational Phase

In order to ensure compliance with findings of the Basic Assessment the following actions are applicable to the Operational phase.

Environmental Aspect	Environmental Management and Mitigation Measures	Responsible Person(s)	Timeframe/ phase

2.2.1 Administrative Requirements		
Objectives	■ **To define roles and responsibilities for environmental management;** ■ **To ensure suitable environmental training and induction to all employees; and** ■ **To promote environmental awareness.**	
Environmental Awareness, Roles and Responsibilities for Environmental Management	■ DEO must undertake six monthly (biannual) monitoring of activities during operation to ensure compliance with the EMPr (this aspect is likely to be undertaken by RIM Environmental Manager/Officer). ■ All new staff to obtain induction training on the site EMPr requirements and company procedures/ codes of conduct as well as the O+M/ Hazop procedures associated with the SPP. ■ Implementing preventative and corrective actions in accordance with the requirements of the EMPr and outcomes of environmental audits. <u>Contractors, Sub-contractors, Suppliers and Employees</u> ■ All contractors, sub-contractors, suppliers and employees must adhere to the EMPr at all times. ■ Provide evidence to the DEO that the EMPr is being implemented and adhered to (through weekly internal monitoring during operation).	**Department of Public Works** **DEO**
Environmental Training and Induction	■ All staff must be trained in the handling of hazardous chemicals/ substances and safe handling procedures. ■ All staff must be trained on the relevance of working on a World Heritage Site and the appropriate codes of conduct which must be followed. ■ Ensure all employees are supplied with the correct personal protective equipment. ■ Ensure compliance to the Occupational Health and Safety Act (85 of 1993) requirements. ■ All contractors, sub-contractors and employees must acknowledge their under-standing of the EMPr and environmental responsibilities by signing an induction attendance record.	**Department of Public Works** **DEO**
Duty of Care	■ The Department of Public Works must take reasonable measures to prevent pollution or degradation of the environment from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment.	**Department of Public Works**
Indicator / Compliance Mechanism	■ Environmental incidents register. ■ Close-out on incidents received. ■ Environmental awareness programme. ■ Bi-annual monitoring reports.	**Department of Public Works** **DEO**

2.2.2 Flora and Fauna Management

Objectives	■ **To avoid harm, damage or loss to indigenous vegetation**	**Responsibility**
Vegetation management objectives	■ Only indigenous vegetation natural to the area and as agreed to by Robben Island Museum and the Department of Public Works may be used for the purposes of landscaping during the operational phase. ■ Staff must take extreme care not to harm or disturb the African Penguin populations, particularly during moulting periods (Typically November to January). ■ The SPP and drying bed facility must be fenced with penguin proof security fencing to avoid unauthorised entry by persons or birdlife (i.e. African penguin).	**Department of Public Works** **DEO**
Indicator / Compliance Mechanism	■ Environmental incidents register. ■ Close-out on incidents received. ■ Biannual monitoring reports.	**Department of Public Works** **DEO**

2.2.3Marine Environment

Objectives	■ **To avoid harm, damage to marine environment**	**Responsibility**
Marine management objectives	■ A marine water quality monitoring programme must be implemented at commencement of operations to ensure that the SPP is meeting both effluent treatment standards and marine water quality standards. (See Section 4.1) ■ An O+M manual will be provided for the specific installation along with required training. ■ The O+M manual will stipulate standard, weekly or monthly maintenance tasks for the plant and de-sludging activities as well as safety precautions and HAZOP procedures for potential operational difficulties and solutions. ■ A suitable specialist will be retained to O+M the installation on a contract basis to provide life cycle management and ensure on-going plant performance. ■ Dedicated site personnel will be on site on a “permanent” basis to ensure the completion of daily, weekly or monthly O+M tasks. ■ Daily, weekly and monthly O+M checks must be completed as indicated by the plant O+M manual. Records to be maintained. ■ Annual reporting from the O+M contractor regarding plant performance and possible options to improve performance, efficiency or environmental sustainability.	**Department of Public Works** **DEO**

Indicator / Compliance Mechanism	■ Marine water quality monitoring reports (as indicated in *section 4.1*) ■ Annual reporting indicating compliance with the conditions of the Coastal Wasters Discharge Permit ■ O+M Manual for facility ■ Records of daily, weekly and monthly O+M checks. ■ Annual report from O+M contractor indicating performance management objectives and options for improvement. ■ Records of maintenance for the sewage package plant. ■ Electronic or hard copy of Complaints/Incidents/Non-conformance registers. ■ Close-out on incidents received. ■ Biannual monitoring reports.	**Department of Public Works** **DEO**
2.2.4 Surface Water and Management		
Objectives	■ Ensure sound environmental management regarding surface water during the operational phase of the project; and ■ Ensure the prevention of stormwater pollution.	
Surface water commitments	■ Drains at the drying beds must be regularly checked to avoid blockage of water flow to the sump. ■ Contamination of stormwater must be avoided at all times. ■ All leakages, spillages and incidents must be cleaned-up and reported as per the relevant spill response procedures. ■ All maintenance or servicing of machinery must take place over hard standing or a drip tray. ■ All incidents involving stormwater contamination must be recorded in the incidents register. ■ Ensure that drying bed containment wall is not compromised. If found to be compromised take immediate action and rectify immediately.	**Department of Public Works** **DEO**
Indicator / Compliance Mechanism	■ Electronic or hard copy of Complaints/Incidents/non-conformance register. ■ Close-out on incidents received. ■ Biannual monitoring reports.	Department of Public Works DEO
2.2.5 Fire and Spill Prevention		
Objectives	■ To ensure fires and spillages on-site do not cause unnecessary destruction to surrounding environment or injury to personnel.	
Fire and spill	■ All equipment should be in good working order to prevent spillage	**Department of**

prevention	occurring. The emergency generator and all equipment or vehicles capable of leaking oil must be placed on a drip tray. ▪ Spill kit must be available at all times. ▪ Any incidents involving a significant spill (e.g. of untreated sewage) must be recorded in the incidents register and reported to the DEO. ▪ Should any hazardous spills occur on site the relevant clean-up specialists must be contacted and the relevant response procedure employed by DPW. Absorbent material must be placed over the spill and subsequently disposed of as hazardous material. ▪ In the event of a spill the sea must be protected from any spillage run- off. ▪ All incidents involving significant spills must be recorded in the incidents register and reported to the DEO. ▪ In the event of a spill or a leak of raw sewage into the ground and or water courses this must be reported (within 14 days) to all the relevant authorities including the Directorate: Pollution Management in accordance with Section 30(10) and Section 20(3) of the NWA. ▪ Firefighting measures, such as fire extinguishers, must be serviced (annually) and located on-site. ▪ Firefighting measures, such as fire extinguishers, must be located on-site and the workforce must be made aware of fire prevention and firefighting measures. ▪ No uncontrolled fires will be permitted on-site. ▪ Smoking can only take place within designated areas, as designated by the Department of Public Works. ▪ All firefighting equipment must be adequately maintained and up to date. ▪ The workforce must be made aware of fire prevention and firefighting measures. ▪ All incidents involving fires must be recorded in the incidents register.	**Public Works** **DEO**
Indicator / Compliance Mechanism	▪ Electronic or hard copy of Complaints/Incidents/non-conformance register. ▪ Firefighting measures (extinguishers). ▪ Spill kits available and staff trained on use. ▪ Close-out on incidents received. ▪ Biannual monitoring reports.	**Department of** **Public Works** **DEO**

2.2.6 Noise Management

Objectives	▪ To manage the noise that may arise from site during operation. ▪ To adhere to the South African National Standards (SANS) 10103:2008 noise limits.	
Noise manage-	▪ Bi-annual OHS auditing as per the OHS Act	**Department of**

ment objectives	▪ Provision of PPE equipment. ▪ Testing to ensure that any significant impulse sounds fall within absolute noise limits as defined in the OHS Act.	**Public Works** **DEO**
Indicator / Compliance Mechanism	▪ Electronic or hard copy Complaints /Incidents/Non-Conformance register) ▪ Staff wearing appropriate PPE ▪ Biannual monitoring reports.	**Department of** **Public Works DEO**

2.2.7 Waste Management

Objectives	▪ To manage waste in a manner that prevents detrimental impacts on the environment. Ensure sound environmental management regarding waste management during the operational phase of the project.	
Waste management objectives	▪ Relevant DPW / RIM waste procedures must be followed. ▪ The facilities should be kept in an orderly state at all times. Littering is prohibited. ▪ Solid waste must be stored in an appointed area in covered, tip proof metal drums for collection and disposal at a licenced landfill facility. ▪ Solid waste including grit and screenings and sludge shall be handled, stored, transported and disposed of in such a manner which does not cause flies or other nuisance any health hazard or secondary pollution. ▪ Waste must be disposed of at an appropriate landfill site or waste water treatment works (sludge) by an approved contractor. ▪ A waste disposal certificate must be obtained for hazardous waste disposal and kept on record. ▪ Records must be maintained of all waste removed from site including: – Nature of wastes generated; – Amounts of each different types of waste generated within a specific period; and – Method of disposal. ▪ In the event of a storm event; the drying beds must be covered with a secure tarpaulin cover in order to prevent a wash away of the contents of the drying bed.	**Department of** **Public Works /** **DEO**
Indicator / Compliance Mechanism	▪ Proof of waste service providers' accreditation with the City of Cape Town. ▪ Proof that waste collectors have permits to collect and manage waste collected from Department of Public Works	**Department of** **Public Works DEO**

	▪ Electronic or hard copy Complaints /Incidents/non-conformance register. ▪ Close-out on incidents received. ▪ Safe Disposal Certificates ▪ Biannual monitoring reports	
2.2.8 Training and Socio-Economic Aspects		
Objectives	▪ To ensure that staff has adequate training and are provided with necessary safety equipment. Furthermore, to enhance positive impacts on the local community with regards to job creation.	
Training and Socio-economic commitments	▪ Regular 'reminder' sessions must be undertaken by DEO to ensure that staff are reminded about on-site environmental and safety issues and emergency procedures. ▪ The need for a 'clean-site' policy and excellent housekeeping must be explained to workers.	**DEO**
Indicator / Compliance Mechanism	▪ Electronic or hard copy of environmental incidents and complaints register. ▪ Close-out on incidents and complaints received. ▪ Bi-annual monitoring reports. ▪ Induction training and register. ▪ Personal protective equipment registers.	**DEO**

2.3 Decommissioning Phase

A detailed decommissioning and rehabilitation plan should be developed prior to decommissioning of the sewage package plant. This plan should include, but should not be limited to, conditions regarding removal of infrastructure, management of waste and dust suppression.

Table 7: Environmental Management Plan – Decommissioning Phase

Description of Activity	Environmental Management and Mitigation Measures	Responsible Person(s)
2.3.1 Decommissioning		
Objectives	▪ **To ensure that all environmental impacts have been mitigated and the site is returned to its natural, pre-construction state.**	
Decommissioning Commitments	▪ A detailed decommissioning plan must be submitted to DEA at least 30 days prior to the decommissioning of the SPP. ▪ Prior to decommissioning all pipelines must be emptied. Waste effluent must be stored in an appropriate receptacle before being removed for hazardous waste disposal at an appropriate landfill of WWTP facility.	**DEO**

	▪ Prior to decommissioning the surrounding land-users/ I&APs must be notified. ▪ All solid waste must be disposed of at an appropriate landfill site, and no litter/rubble/waste is to be left at site. ▪ All hazardous waste must be disposed of at a licenced hazardous landfill facility and safe disposal certificates must be obtained. ▪ Rehabilitation measures using indigenous vegetation natural to the site as agreed to by the landowner must be put into place. ▪ Re-use applications to be identified for any office goods or building materials. Sending the materials to landfill must be seen as the last option. ▪ Provision of PPE equipment. ▪ Evidence of training of staff on use of PPE. ▪ No evidence of spillage or building rubble / redundant equipment must be evident following site closure.	
Indicator / Compliance Mechanism	▪ Proof of revegetation plan signed off by the landowner. ▪ Electronic environmental incidents and complaints register. ▪ Close- out on incidents and complaints received**.** ▪ Safe Disposal certificates.	**DEO**

3 Environmental Awareness Plan

The Applicant has a responsibility to ensure that all those people involved in the project are aware of and familiar with the environmental requirements for the project (this includes sub-contractors, casual labour, etc.). The EMPr shall be part of the terms of reference for all contractors, sub-contractors and suppliers. All contractors, sub-contractors and suppliers have to assure that they understand the EMPr and that they will comply with the conditions herein. All senior and supervisory staff members shall familiarise themselves with the full contents of the EMPr. They shall familiarise themselves and understand the specifications of the EMPr and shall be able to assist other staff members in matters relating to the EMPr.

It is proposed that weekly monitoring is undertaken during construction with independent auditing being provided by an appointed ECO on a minimum of a monthly basis depending on the duration of the construction phase. During the operation of the site the Applicant's Environmental Manager/Officer (CEM/CEO) will undertake 6 monthly audits of the site.

An environmental awareness training programme for all staff members shall be put in place by the DEO. All staff members shall be appropriately briefed about the EMPr and relevant occupational health and safety issues.

4 Monitoring and Reporting

The following monitoring and reporting must be undertaken:

4.1 Marine Water Quality Monitoring

ACTIVITIES	OBJECTIVES (AIMS TO ACHIEVE) & REQUIRED MANAGEMENT ACTIONS (HOW THEY CAN BE ACHIEVED)	Responsibility	Period

Environmental Management Procedures	**Environmental objectives are to:** • Employ the EMPr process so that SPP operations and discharges are conducted in an environmentally responsible manner. • Increase understanding about potential impacts of discharges and environmental management		
Environmental Monitoring			
Measurement of effluent	• Ensure that the sewage effluent conforms with the General Limit Values prior to discharge to the sea. • Monitor discharge water quality weekly until sufficient data has been collected to allow a statistically robust prediction that the levels will fall below the guideline levels 95% of the time. (**The minimum measurement period would be 12 months,** and the more the variations in the data collected over this period the longer the monitoring would need to continue). Thereafter monitor at 2 weekly intervals. • The following parameters should be measured: – Total suspended solids – Salinity – pH – Dissolved oxygen – Biological Oxygen Demand – Dissolved nutrients (nitrite, nitrate, ammonium, reactive phosphate and reactive silicate) – Faecal coliform bacteria – Chlorine • Ensure that the analyses are carried out by a laboratory certified (by the South African National Accreditation Service) to conduct the analyses. • Have the monitoring results scientifically evaluated by an appropriately qualified independent t consultant on an annual basis. • Submit the monitoring results together with the evaluation to the DWA and DEA on an annual basis.	**Department of Public Works**	**Operation**
1.1.2 Measurement of receiving water body	• Ensure that the South African Marine Water Quality Guidelines DWAF 1995): Maintenance of the Ecosystem are achieved for ALL constituents of the effluent, within 100 m of the diffuser. • On commissioning of the Sewage Package Plant, monitor the quality of the receiving waters once every 2 weeks at distances of 10 m, 50 m and 100 m from the diffuser to verify the predictions of the dilution model. • Monitoring should continue until sufficient data have been collected to allow a statistically robust prediction that the levels will fall below the guideline levels 95% of the time. (**The minimum measurement period would be 4 months**, and the more the variations in the data collected over this period the longer the monitoring would need to continue). Thereafter monitoring should con-	**Department of Public Works**	

	tinue on a 3 month basis (i.e. quarterly). • The following parameters should be measured within a predetermined grid around the diffuser: – Total suspended solids – Salinity – pH – Dissolved oxygen – Biological Oxygen Demand – Dissolved nutrients (nitrite, nitrate, ammonium, reactive phosphate and reactive silicate) – Faecal coliform bacteria • Ensure that the analyses are carried out by a laboratory certified (by the South African National Accreditation Service) to conduct the analyses. • Have the monitoring results scientifically evaluated by an appropriately qualified independent consultant on completion of the monitoring programme. • Submit the monitoring results together with the evaluation to the DWA and DEA.		
Compliance Indicators	• Chemical analyses (SANAS) and expert evaluation reports • Proof of report submission to the DEA/ DWA		

5 Complaints Register and Environmental Incidence Book

The Applicant must record any complaints received from residents or workers on Robben Island. The complaint should be brought to the attention of the site manager, DEO, Engineer's Representative (ER) and ECO, who will respond accordingly during the construction phase.

The following information will be recorded:

- Time, date and nature of the complaint;
- Weather conditions during the time of the complaint e.g. wind direction and strength, sunny / overcast / raining, hot mild temperature etc.

If applicable;

- Response and investigation undertaken; and
- Actions taken and by whom.

All complaints received will be investigated and a response (even if pending further investigation) should be given to the complainant within 21 days.

All environmental incidents occurring on the site will be recorded. The following information will be provided:

- Time, date, location and nature of the incident,
- Actions taken and by whom.

6 Method Statements

Method statements should be completed for all the phases which relate to specific sensitive actions, or on request from authorities or the independent ECO. The DEO shall compile the method statements and submit it to the Engineer and independent ECO for approval, prior to the commencement of the proposed activity. All the method statements should be included in the on-site Environmental File. The Department of Public Works must ensure that the person undertaking the works are aware of and adhere to the method statements.

A Method Statement must include:

- A brief description of the work to be undertaken;
- A detailed description of the process of work, methods and materials;
- A map of the locality of work (if applicable); and
- The sequencing of actions with due commencement dates and completion date estimates.

A template to be used for the method statements is attached in **Appendix A**.

7 Non-Compliance with the EMPr (Penalties/Incentives for staff)

The Application shall act immediately when such notice of non-compliance is received and correct whatever is the cause for the issuing of the notice. Complaints received regarding activities on the construction site pertaining to the environment shall be recorded in a dedicated register and the response noted with the date and action taken. This record shall be submitted with the monthly reports during construction. Any avoidable non-compliance with the above-mentioned measures shall be dealt with through appropriate punitive measures. **Appendix B** provides details indicative fines and penalties to be applied.

8 EMPr Amendments

No EMP amendment (relaxation or revision of any EMPr Mitigation Measure) shall be allowed without approval from the relevant authorities (DEA). Motivations for EMPr amendments may be discussed with WSP. WSP may propose EMPr amendments on behalf of the proponent or issue EMPr instructions (for corrective actions, remediation and rehabilitation). These amendments or instructions issued by WSP shall be implemented within the time frame specified.

9 Conclusion

In terms of NEMA, everyone is required to take reasonable measures to ensure that they do not pollute the environment. Reasonable measures include informing and educating employees about the environmental risks of their work and training them to operate in an environmentally responsible manner. Furthermore, in terms of NEMA, the cost to repair any environmental damage shall be borne by the person responsible for the damage.

If the above-mentioned management recommendations are adopted it is anticipated that most of the negative environmental impacts associated with the construction of the Sewage Package Plant by the Department of Public Works can be mitigated. The appointed DEO will need to monitor the site throughout the construction and operation of the facility to ensure that the required environmental controls are in place and working effectively.

Appendix A Method Statement Template

<table>
<tr><td>What:</td><td colspan="4">Subject of Method Statement</td></tr>
<tr><td rowspan="3">Who:</td><td>Site contractor/engineer:</td><td colspan="3"></td></tr>
<tr><td>Submitted to:</td><td></td><td>Approved by:</td><td></td></tr>
<tr><td>Date Submitted on:</td><td></td><td>Date Approved:</td><td></td></tr>
<tr><td rowspan="2">When:</td><td>Date works start:</td><td></td><td>Date works complete:</td><td></td></tr>
<tr><td colspan="4">Programme restrictions: Critical path, seasonal restrictions</td></tr>
<tr><td>Where:</td><td colspan="4">Area of works: submit a plan or sketch if appropriate- stockpile, restriction of works, cement mixing area etc.</td></tr>
<tr><td>How:</td><td colspan="4">Describe the activity and how this will be managed</td></tr>
</table>

Appendix B Scale of Fines and Penalties

Fines
Fines will be issued for the transgressions listed below.

	Transgression	Fine
A	**Any persons, vehicles, plant, or thing related to the Contractors operations within the designated boundaries of a “no-go” area**	**R4,000**
B	**Any vehicle driving in excess of designated speed limits.**	**R1,000**
C	**Any vehicle being driven, and items of plant or materials being parked or stored outside the demarcated boundaries of the site.**	**R2,000**
D	**Persistent and un-repaired oil leaks from machinery.**	**R3,000**
E	**Litter on site.**	**R1,000**
F	**Deliberate lighting of illegal fires on site.**	**R5,000**
G	**The eating of meals on site outside the defined eating area. Individual not making use of the site ablution facilities.**	**R1,000**
H	**Dust or excess noise on or emanating from site.**	**R1,000**
I	**Any person, vehicle, item of plant, or anything related to the Contractors operations causing a public nuisance.**	**R2,000**

Additional fines may be issued per incident at the discretion of the Engineer. Such fines will be issued in addition to any remedial costs incurred as a result of non-compliance with the Environmental Specifications. The Engineer will inform the Contractor of the contravention and the amount of the fine, and will deduct the amount from monies due under the Contract.

For each subsequent similar offence the fine may, at the discretion of the Engineer, be doubled in value to a maximum value of R50,000.00.

The Engineer shall be the judge as to what constitutes a transgression in terms of this clause, subject to the provisions of the General Conditions of Contract. In the event that transgressions continue the Contractors attention is drawn to the provisions of General Conditions of Contract under which the Engineer may cancel the Contract.

Penalties
Where the Contractor inflicts non-repairable damage upon the environment or fails to comply with any of the environmental specifications, he shall be liable to pay a penalty fine over and above any other contractual consequence. The Contractor is deemed NOT to have complied with this Specification if:

a. Within the boundaries of the site, site extensions and haul/ access roads there is evidence of contravention of the Specification.
b. Environmental damage ensues due to negligence.
c. The Contractor fails to comply with corrective or other instructions issued by the Engineer within a specific timeframe.
d. The Contractor fails to respond adequately to complaints from the public or any I&AP.

Payment of any fines in terms of the contract shall not absolve the offender from being liable from prosecution in terms of any law.

An Environmental Performance Guarantee of 5% of Contract Value shall be deposited by the Contractor with the Engineer. This fund shall be used in the event of penalties or rehabilitation costs for non-conformance or contraventions of the EMPr. The balance shall be given back to the Contractor at Contract closure. The following penalties are suggested for transgressions:

	Transgression	Penalty
A	**Erosion**	**A penalty equivalent in value to the cost of rehabilitation plus 20%**
B	**Damage to indigenous vegetation**	**A penalty equivalent in value to the cost of restoration plus 20%.**
C	**Damage to sensitive environments**	**A penalty equivalent in value to the cost of restoration plus 20%.**
D	**Damage to cultural sites**	**A penalty to a maximum of R 100 000 shall be paid for any damage to any cultural/ historical sites**

Appendix C Construction Management Plan

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BY OUR
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ROBBEN ISLAND

Construction Procedures: Sewage Package Plant

A: SITE ESTABLISHMENT

Estimated timeframe for camp establishment and importation of required materials is 5 weeks (Appendix A).

1. Set Up of Site Prior to Contract
a. Construction site to be demarcated as indicated by Site Engineer (indicated on Construction Camp Layout Plan) (Appendix B).
b. Secure 2.1m high “Ready Fence” temporary fencing around construction site and material storage area. Fencing to comprise PVC mesh with a mesh size of 20mm buried 100mm into ground on outside of security fence.
c. Place shipping containers for storage and chemical toilets in agreed positions.
d. Cladding of temporary fencing with shade cloth to shield materials storage area from public view.
e. Install wooden boarding around concrete batching area.

2. Material Storage Area (Set-up)
Area to consist of three storage containers located directly adjacent existing building at the south of the Soboukwe complex. Storage area consists of the following:
i) 3 x lockable marine container stores ;
ii) Impermeable concrete batching area (will be surrounded by wooden boarding for soundproofing);
iii) 2 x temporary toilets connected to existing sewer system; and
iv) Dedicated areas for storage of sand and 19mm stone in bulk bags
a. Water to be stored in 2000 litre trailer mounted water tank
b. Sand and 19mm stone to be stored in 1.0m^3 bulk bags in demarcated sand and stone storage area.
c. Cement in bags as well as used bags to be stored in lockable shipping container
d. Diesel fuel to be stored in 20 litre containers in lockable shipping container
e. General store (lockable marine container)
f. Dedicated impermeable area for ready mix concrete truck
g. Dedicated area for water cart
h. Marked area for personnel to lunch &/ rest
i. Dedicated areas for parking of excavator and mixer truck after hours
j. Modular panels and pipes for the SSP will be shipped to the island in a shipping container and stored in the container on site.
k. 2.4m x 0.3m Shutter boards will be stored inside general store container

3. Construction Site (Set-up)

a. Demarcated area for excavations
b. Demarcated area for stockpiles

1. Importation of Construction Materials

Materials required will be transported to the island via boat and transported via the main access road to the construction camp. Materials will be transported prior to the start of construction and will include:

a. ± 40m³ concrete sand
b. ± 50m³ 19mm Crushed concrete stone
c. Cement – in ±500 bags
d. Pre-fabricated modular units of package plant and pipes
e. uPVC pipes and fittings
f. 2.4m x 0.3m shutter boards for concrete pouring

2. Importation of Plant Prior to Construction Activities

Plant equipment to be transported via boat includes:

a. 20t steel tracks mounted excavator
b. Concrete mixing truck (1.0m³ capacity)
c. 2000l water cart for dust suppression and mixing of concrete
d. Dewatering pump (if required)
e. Small generator for hand tools
f. Small tools as required e.g. handheld / walk behind rammer for soil compaction

B: CONSTRUCTION

Estimated construction period is 9 weeks. The construction period includes excavation, concrete works, assembly, backfilling and finishing) (Appendix A).

1. Excavations

a. Remove and stockpile topsoil from areas to be excavated as indicated on plan in Appendix B. Excavated material estimated at approximately 600m³, to be stored in designated stockpile area. Plant Excavated areas should be limited to as minimal as possible.
c. Stockpile to have max height of 2.0m with 1:2 slope and to be straw stabilized.
d. Excavation depth to be to 200mm below finished floor level of new sewer plant (2000mm below ground level)
e. Level off base of excavation and compact to required density by means of hand held rammers with small petrol engines or walk behind wheel rollers.

2. Concrete works

a. Erect shuttering for new floor (wooden formwork for concrete pouring).
b. Mix concrete using a 3.0m³ self-propelled concrete mixing truck on impermeable surface.
c. Cast concrete floors of package plant and drying beds.
d. Remove shuttering after concrete has cured.

3. Package Plant Assembly

a. Assemble modular units of sewer plant and secure to concrete floor
b. Install internal pipe reticulation and fittings
c. Backfill around package plant to required level, using excavated topsoil material
d. Backfilled material to be compacted in layers not exceeding 300mm thick
e. Excavate trenches for all subsurface pipework for:
   (i) Effluent pipe from inlet sump to plant
   (ii) Treated effluent from plant to outfall pump sump
   (iii) Sludge from plant to drying beds
   (iv) Seepage from drying beds to inlet sump
f. Lay pipes and backfill trenches

4. Finishing

a. Remove and dispose of all excess material and rubble at appropriate landfill facility

b. General wastes to be disposed of using the formal refuse removal system on the island

c. Hazardous waste to be disposed using a licenced hazardous waste contractor and records of safe disposal maintained.

c. Trim all disturbed areas, place topsoil and re-vegetate using natural indigenous vegetation.

d. Vegetation to be maintained until fully established.

e. Erect permanent (“Penguin Proof”) security fence and gate around new plant

f. Remove temporary security fence

g. Ensure site is clean, free from litter, construction materials etc.

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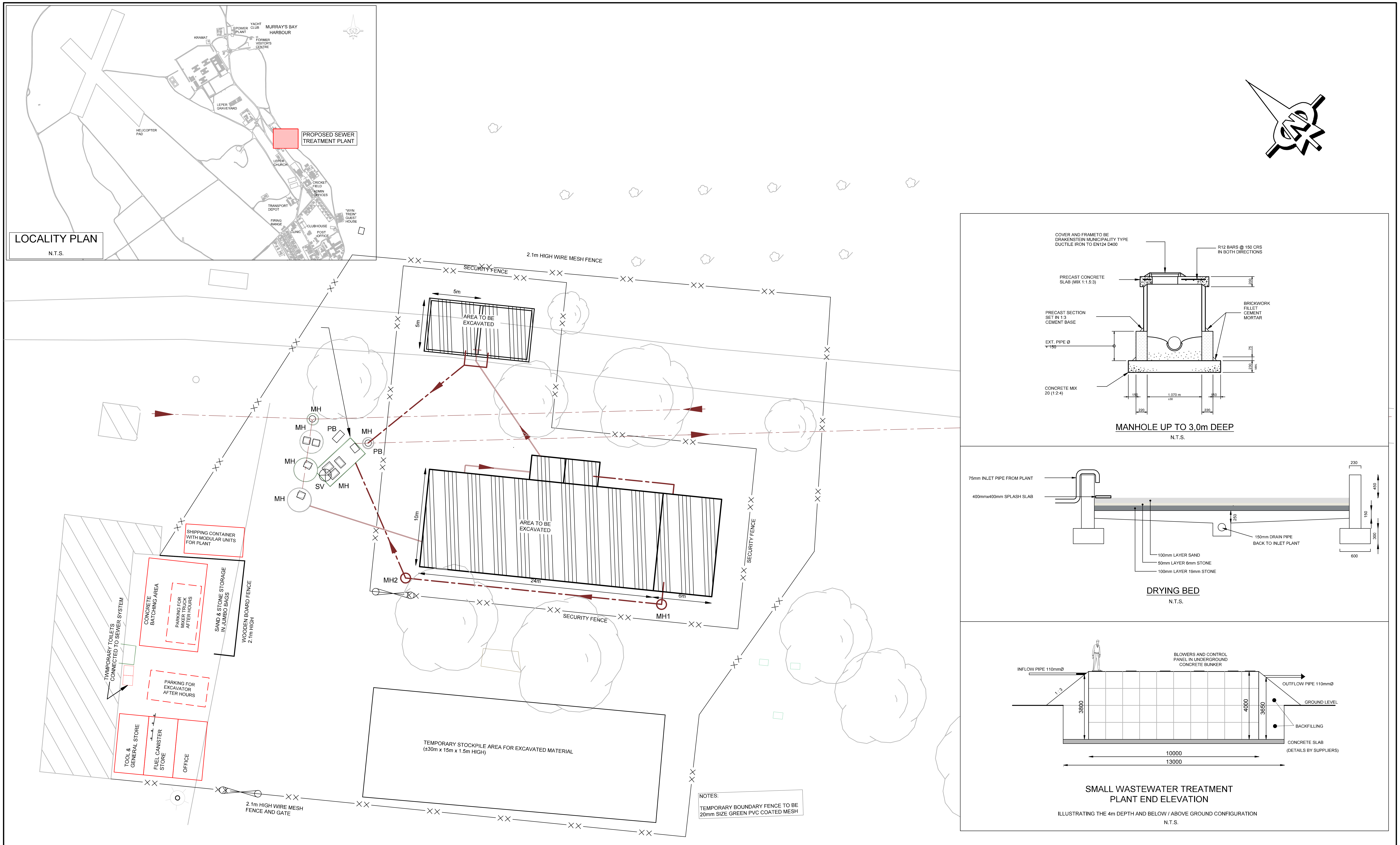
Appendix A:

ROBBEN ISLAND: SEWAGE PACKAGE PLANT TIMEFRAMES FOR SET-UP AND CONSTRUCTION

Activity	Period											
	Month 1				Month 2				Month 3			
Site Establishment												
Importing of Material												
Importing of Plant and Equipment												
Excavations												
Concrete Work												
Assembling of Package Plant												
Backfilling												
Finishing												

Appendix B:

ROBBEN ISLAND: SEWAGE PACKAGE PLANT CONSTRUCTION CAMP SET-UP



Amendments

No.	Description	Date	Initial

Designed

Checked

Drawn

Checked

EFG Engineers (Pty) Ltd
Transport, Infrastructure, Municipal Services & Development
3A Queen Street, Durbanville 7550
P O Box 3800, Durbanville 7551
Tel: 021 975 3880
Fax: 021 975 3850
web: www.efgeng.co.za

EFG Engineers (Pty) Ltd — Date

Client — Date

Planned For:

public works
Department: Public Works
REPUBLIC OF SOUTH AFRICA

ROBBEN ISLAND

PROPOSED SEWER TREATMENT PLANT:
CAMP SITE LAYOUT PLAN

Sheet 2 of 2

Scale: 1 : 250

Date: 11-02-2014

Status: PRELIMINARY

Plan No: P 471 SE-LO 02

A2

REV 0

X:\Projects\471-Robben Eiland\Amitek Sewer Treatment\Drawings

APPENDIX H - DETAILS OF EAP DECLARATION OF INTEREST

4.2 The Environmental Assessment Practitioner

I, Jacqui Fincham ______________________ , declare that –

General declaration:

I act as the independent environmental practitioner in this application
I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant
I declare that there are no circumstances that may compromise my objectivity in performing such work;
I have expertise in conducting environmental impact assessments, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
I will comply with the Act, regulations and all other applicable legislation;
I will take into account, to the extent possible, the matters listed in regulation 8 of the regulations when preparing the application and any report relating to the application;
I have no, and will not engage in, conflicting interests in the undertaking of the activity;
I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
I will ensure that information containing all relevant facts in respect of the application is distributed or made available to interested and affected parties and the public and that participation by interested and affected parties is facilitated in such a manner that all interested and affected parties will be provided with a reasonable opportunity to participate and to provide comments on documents that are produced to support the application;
I will ensure that the comments of all interested and affected parties are considered and recorded in reports that are submitted to the competent authority in respect of the application, provided that comments that are made by interested and affected parties in respect of a final report that will be submitted to the competent authority may be attached to the report without further amendment to the report;
I will keep a register of all interested and affected parties that participated in a public participation process; and
I will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not
all the particulars furnished by me in this form are true and correct;
will perform all other obligations as expected from an environmental assessment practitioner in terms of the Regulations; and
I realise that a false declaration is an offence in terms of regulation 71 and is punishable in terms of section 24F of the Act.

Disclosure of Vested Interest **(delete whichever is not applicable)**

I do not have and will not have any vested interest (either business, financial, personal or other) in the proposed activity proceeding other than remuneration for work performed in terms of the Environmental Impact Assessment Regulations, 2010;

I have a vested interest in the proposed activity proceeding, such vested interest being:

N/A

Signature of the environmental assessment practitioner:

WSP Environmental

Name of company:

WSP Environmental

Date: 22 September 2014

APPENDIX I – DECLARATION OF INTEREST

1. Koos Schoones (SPECIALIST – Marine Dispersion)
2. Dr Andrea Pulfrich (SPECIALIST – Marine Ecological)
3. Dr Ute Seeman (SPECIALIST - Heritage Archaeologist)
4. Dr John Almond (SPECIALIST Palaeontology)

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

	(For official use only)
File Reference Number:	14/12/16/3/3/3/83
NEAS Reference Number:	
Date Received:	

Application for authorisation in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Environmental Impact Assessment Regulations, 2010

PROJECT TITLE

Proposed Sewage Package Plant located on Robben Island

Specialist: Contact person:	Koos Schoonee (pp Maria La Roux) Regional Director, WSP Coastal Engineers		
Postal address:	WSP, Stein House, Brandwacht Office Park, Trumali Street, Stellenbosch		
Postal code:	7600		
Telephone:	021 883 9260	Cell:	
E-mail:	Koos.Schoonees@WSPGroup .co.za	Fax:	021 883 3212
Professional affiliation(s) (if any)	ECSA: Professional Engineer		

Project Consultant:	Jacqui Fincham		
Contact person:	Kirsten Sims		
Postal address:	PO Box 2613, Cape Town		
Postal code:	8000	Cell:	
Telephone:	021 4818648	Fax:	021 4818799
E-mail:	Kirsten.sims@wspgroup.co.za		

4.2 The specialist appointed in terms of the Regulations_

I, ***Koos Schoonees***, declare that

-- General declaration:

I act as the independent specialist in this application
I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant
I declare that there are no circumstances that may compromise my objectivity in performing such work;
I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
I will comply with the Act, regulations and all other applicable legislation;
I have no, and will not engage in, conflicting interests in the undertaking of the activity;
I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
all the particulars furnished by me in this form are true and correct; and
I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of section 24F of the Act.

Signature of the specialist:

WSP, Coastal Engineers, Africa

Name of company (if applicable):

2014-04-25

Date:

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

	(For official use only)
File Reference Number:	14/12/16/3/3/3/83
NEAS Reference Number:	
Date Received:	

Application for authorisation in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Environmental Impact Assessment Regulations, 2010

PROJECT TITLE

Proposed Sewage Package Plant located on Robben Island

Specialist:	Dr Andrea Pulfrich		
Contact person:	Dr Andrea Pulfrich		
Postal address:	PO Box 31228, Tokai		
Postal code:	7966		
Telephone:	+27 21 782 9553		
E-mail:	apulfrich@pisces.co.za		
Professional affiliation(s) (if any)	• South African Council for Natural Scientific Professions (Pr.Sci.Nat. No: 400327/06) • South African Institute of Ecologists and Environmental Scientists • International Association of Impact Assessment (South Africa) • Registered Environmental Assessment Practitioner (Certification Board for Environmental Assessment Practitioners of South Africa).		

Project Consultant:	Jacqui Fincham		
Contact person:	Kirsten Sims		
Postal address:	PO Box 2613, Cape Town		
Postal code:	8000	Cell:	
Telephone:	021 4818648	Fax:	021 4818799
E-mail:	Kirsten.sims@wspgroup.co.za		

4.2 The specialist appointed in terms of the Regulations_

I, Andrea Pulfrich , declare that

-- General declaration:

I act as the independent specialist in this application

I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant

I declare that there are no circumstances that may compromise my objectivity in performing such work;

I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;

I will comply with the Act, regulations and all other applicable legislation;

I have no, and will not engage in, conflicting interests in the undertaking of the activity;

I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;

all the particulars furnished by me in this form are true and correct; and

I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of section 24F of the Act.

Andrea Pulfrich

Signature of the specialist:

WSP, Coastal Engineers, Africa

Name of company (if applicable):

13 May 2014

Date:

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

	(For official use only)
File Reference Number:	14/12/16/3/3/3/83
NEAS Reference Number:	
Date Received:	

Application for authorisation in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Environmental Impact Assessment Regulations, 2010

PROJECT TITLE

Proposed Sewage Package Plant located on Robben Island

Specialist:	Dr Ute Seeman, Heritage Archaeologist & Consultant		
Contact person:	Dr Ute Seeman		
Postal address:	1203 Simon's Bay Estate, Oatlands Road, Simon's Town		
Postal code:	7975	Cell:	073 1632 754
Telephone:	(021)786-3656	Fax:	
E-mail:	useemann@telkomsa.net		
Professional affiliation(s) (if any)			

Project Consultant:	Jacqui Fincham		
Contact person:	Kirsten Sims		
Postal address:	PO Box 2613, Cape Town		
Postal code:	8000	Cell:	
Telephone:	021 4818648	Fax:	021 4818799
E-mail:			
	Kirsten.sims@wspgroup.co.za		

4.2 The specialist appointed in tenns of the Regulations

I, *Dr Ute Seeman*, declare that

– General declaration:

I act as the independent specialist in this application
I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant
I declare that there are no circumstances that may compromise my objectivity in performing such work;
I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
I will comply with the Act, regulations and all other applicable legislation;
I have no, and will not engage in, conflicting interests in the undertaking of the activity;
I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
all the particulars furnished by me in this form are true and correct; and
I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of section 24F of the Act.

DR Ute A. Seeman

Signature of the specialist:

N/A Heritage Archaeologist & Consultant

Name of company (if applicable):

25 April 2014

Date:

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

	(For official use only)
File Reference Number:	14/12/16/3/3/3/83
NEAS Reference Number:	
Date Received:	

Application for authorisation in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Environmental Impact Assessment Regulations, 2010

PROJECT TITLE

Proposed Sewage Package Plant located on Robben Island

Specialist:	Dr John Almond		
Contact person:	Dr John Almond		
Postal address:	Box 12140 Mill Street		
Postal code:	8010		
Telephone:	+27 21 462 3622		
E-mail:	naturaviva@universe.co.za		
Professional affiliation(s) (if any)	PhD in Palaeontology from the University of Cambridge, UK. Accredited member of PSSA and APHP (Association of Professional Heritage Practitioners – Western Cape).		

Project Consultant:	Jacqui Fincham		
Contact person:	Kirsten Sims		
Postal address:	PO Box 2613, Cape Town		
Postal code:	8000	Cell:	
Telephone:	021 4818648	Fax:	021 4818799
E-mail:	Kirsten.sims@wspgroup.co.za		

4.2 The specialist appointed in terms of the Regulations_

I, John Almond , declare that

-- General declaration:

I act as the independent specialist in this application
I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant
I declare that there are no circumstances that may compromise my objectivity in performing such work;
I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
I will comply with the Act, regulations and all other applicable legislation;
I have no, and will not engage in, conflicting interests in the undertaking of the activity;
I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
all the particulars furnished by me in this form are true and correct; and
I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of section 24F of the Act.

John E. Almond

Signature of the specialist:

Natura Viva cc

Name of company (if applicable):

20 May 2014

Date:

APPENDIX J.2 – SAHRA EXCAVATION PERMIT

Our Ref: 9/2/018/0004

Enquiries: Mariagrazia Galimberti
Tel: 021 462 4502
Email: mgalimberti@sahra.org.za
CaseID: 1896

Date: Monday July 01, 2013

PermitID: 359

PERMIT: Excavation

In terms of Section 35(4) of the National Heritage Resources Act (Act 25 of 1999)

Permit Holder: Dr Ute Seemann

1203 Simon's Bay Estate
Oatlands Road
Simon's Town
7975

Site: Robben Island, Table Bay (9/2/018/0004) approximately at 33° 48' 21.276" S, 18° 22' 12.9396" E

Conditions:

1. This permit is issued to Dr Seeman for the supervision of trenching of four test trail pits to establish the depth of the bedrock and the type of material on the site where the sewer package plant is proposed.
2. If Dr Seeman is not to be present on site at all times, then SAHRA must be provided with the names and qualifications of the authorised representatives.
3. Adequate recording methods as specified in the Regulations and Guidelines pertaining to the National Heritage Resources Act must be employed. Note that the position of all excavations and objects collected must be marked on a plan of site.
4. All archaeological material collected and excavated, as well as field notes and records, will be curated by the Iziko Museum.
5. A final report on the results of the excavations and analyses must be submitted to SAHRA on or before the 1st of July 2014.
6. Reprints of all published papers or copies of theses and/or reports resulting from this work must be lodged with the heritage authority.
7. If a published report has not appeared within three years of the lapsing of this permit, the report required in terms of the permit will be made available to researchers on request.
8. It is the responsibility of the permit holder to obtain permission from the landowner for each visit, and conditions of access imposed by the landowner must be observed.
9. SAHRA shall not be liable for any losses, damages or injuries to persons or properties as a result of any activities in connection with this permit.
10. SAHRA reserves the right to cancel this permit by notice to the permit holder.

This permit is valid from **01/07/2013 to 31/07/2014.**

MGalimberti

Mariagrazia Galimberti

Enquiries: Mariagrazia Galimberti
Tel: 021 462 4502
Email: mgalimberti@sahra.org.za
CaseID: 1896

Date: Monday July 01, 2013

PermitID: 359

Heritage Officer: Archaeology
South African Heritage Resources Agency

Colette Scheermeyer
SAHRA Head Archaeologist
South African Heritage Resources Agency

Additional Info:

Please note that this permit may be suspended should an appeal against the decisions be received by SAHRA within 14 days from the date of the permit. SAHRA may not be held responsible for any costs or losses incurred in the event of the suspension or retraction of this permit.