ROBBEN ISLAND MUSEUM

PROPOSED WASTEWATER TREATMENT WORKS ON ROBBEN ISLAND, TABLE BAY, WESTERN CAPE (REF: 14/12/16/3/3/3/404)

FINAL BASIC ASSESSMENT REPORT

20 OCTOBER 2022

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WSP
THE PAVILION, 1ST FLOOR
CNR PORTSWOOD AND BEACH ROAD, WATERFRONT
CAPE TOWN, 8001
SOUTH AFRICA

T: +27 21 481 8700
F: +086 606 7121
WSP.COM

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Checked by	Jacqui Fincham	Jacqui Fincham		
Signature	–	Fincham, Jacqui (ZAJF01028) Digitally signed by Fincham, Jacqui (ZAJF01028) DN: cn=Fincham, Jacqui (ZAJF01028), ou=Active, email=Jacqui.Fincham@wsp.com Date: 2022.10.20 11:28:07 +02'00'		
Authorised by	Jacqui Fincham	Jacqui Fincham		
Signature	–	Fincham, Jacqui (ZAJF01028) Digitally signed by Fincham, Jacqui (ZAJF01028) DN: cn=Fincham, Jacqui (ZAJF01028), ou=Active, email=Jacqui.Fincham@wsp.com Date: 2022.10.20 11:28:29 +02'00'		
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SIGNATURES

PREPARED BY

Digitally signed by Mol, Nadia (ZANM05255)
Date: 2022.10.20 12:12:58 +02'00'

pp

Jennifer Green
Senior Consultant

REVIEWED BY

Fincham, Jacqui (ZAJF01028)

Digitally signed by Fincham, Jacqui (ZAJF01028)
DN: cn=Fincham, Jacqui (ZAJF01028), ou=Active, email=Jacqui.Fincham@wsp.com
Date: 2022.10.20 11:28:43 +02'00'

Jacqui Fincham
Director (Environmental Assessment Practitioner)

This Final Basic Assessment Report (Report) for the proposed Robben Island Wastewater Treatment Plant has been prepared by WSP Group Africa Proprietary Limited (WSP) on behalf and at the request of Robben Island Museum (Client), as part of the application process for Environmental Authorisation.

Unless otherwise agreed by us in writing, we do not accept responsibility or legal liability to any person other than the Client for the contents of, or any omissions from, this Report.

To prepare this Report, we have reviewed only the documents and information provided to us by the Client or any third parties directed to provide information and documents to us by the Client. We have not reviewed any other documents in relation to this Report, except where otherwise indicated in the Report.

DOCUMENT DESCRIPTION

CLIENT

Robben Island Museum

PROJECT NAME

Proposed Robben Island Wastewater Treatment Plant, Western Cape, South Africa

REPORT TYPE

Final Basic Assessment Report

WSP PROJECT NUMBER

41103532

PRODUCTION TEAM

ROBBEN ISLAND MUSEUM

Project Manager	Seithati Dutywa
Infrastructure and Facilities Management	Vusimuzi Bila

WSP

Project Director / EAP	Jacqui Fincham
Consultant	Jennifer Green

SUBCONSULTANTS

Archaeology	Ute Seemann
Marine Ecology	Pisces Environmental Services: Andrea Pulfrich
Marine Outfall	WSP Group Africa (Pty) Ltd: Roy van Ballegooyen
Odour	WSP Group Africa (Pty) Ltd: Loren Dyer
Palaeontology	John Almond
Visual	LOGIS: Lourens du Plessis

ACRONYMS

AEL	Atmospheric Emission Licence
AIS	Alien and Invasive Species
AWWF	Average Wet Weather Flow
BA	Basic Assessment
BAR	Basic Assessment Report
BBBEE	Broad Based Black Economic Empowerment
BPEO	Best Practicable Environmental Option
BSP	Biodiversity Spatial Plan
CA	Competent Authority
CARA	Conservation of Agricultural Resources Act (Act 43 of 1983)
CBA	Critical Biodiversity Area
CIA	Cumulative Impact Assessment
CR	Critically Endangered
CRR	Comments and Responses Report
CV	Curriculum vitae
DEA	Department of Environmental Affairs
DFFE	Department of Forestry, Fisheries and the Environment
DEA&DP	Department of Environmental Affairs and Development Planning
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
ECE	Element Consulting Engineers
ECO	Environmental Control Officer
EHS	Environmental, Health and Safety
EIA	Environmental Impact Assessment
EMF	Environmental Management Framework
EMPr	Environmental Management Programme
EN	Endangered

ESA	Ecological Support Area
ESA	Early Stone Age
GA	General Authorisation
GG	Government Gazette
GN	Government Notice
GNR	Government Notice Regulation
GPS	Global Positioning System
HWC	Heritage Western Cape
IBA	Important Bird Area
IEA	Integrated Environmental Authorisation
ICAO	International Civil Aviation Organisation
IDP	Integrated Development Plan
LSA	Later Stone Age
LUPA	Land Use Planning Act (Act 3 of 2014)
MSA	Middle Stone Age
MSDS	Material Safety Data Sheets
NDP	National Development Plan
NEMA	National Environmental Management Act (Act 107 of 1998)
NEMAQA	National Environment Management Air Quality Act (No. 39 of 2004)
NEMBA	National Environmental Management Biodiversity Act (Act 10 of 2004)
NEMPAA	National Environmental Management Protected Areas Act (Act 57 of 2003)
NEMWA	National Environmental Management Waste Act (Act 59 of 2008)
NFEPA	National Freshwater Ecosystem Priority Areas
NHRA	National Heritage Resource Act (Act 25 of 1999)
NID	Notice of Intent to Develop
NWA	National Water Act (Act 36 of 1998)
OEC	Obstacle Evaluation Committee
OHSA	Occupational Health and Safety Act (Act 85 of 1993)
PPE	Personal Protective Equipment
PPP	Public Participation Process
PSDF	Provincial Spatial Development Framework

RBC	Rotating Biological Contactors
RIM	Robben Island Museum
SAAF	South African Air Force
SA CATS	South African Civil Aviation Technical Standards
SACAA	South African Civil Aviation Authority
SAHRA	South African Heritage Resources Agency
SAIIAE	South African Inventory of Inland Aquatic Ecosystems
SANBI	South African National Biodiversity Institute
SAPAD	South Africa Protected Areas Database
SCC	Species of Conservation Concern
SDF	Spatial Development Framework
SEA	Strategic Environmental Assessment
SER	Stakeholder Engagement Report
STD	sexually transmitted disease
WCBSP	Western Cape Biodiversity Spatial Plan
WML	Waste Management Licence
WSP	WSP Group Africa (Pty) Ltd
WUL	Water Use Licence
WWTW	Wastewater Treatment Works

CONTENTS OF THIS REPORT

As per the Environmental Impact Assessment (EIA) Regulations 2014, as amended, Appendix 1 of Government Notice Regulation (GNR) 326 identifies the legislated requirements that must be contained within a Basic Assessment Report (BAR) for the Competent Authority (CA) to consider and come to a decision on the application. **Table A** below details where the required information is located within the draft BAR (this report).

Table A: Legal Requirements as detailed in Appendix 1 of GNR 326 of the 2014 EIA Regulations, as amended

APPENDIX 1 OF GNR 326	DESCRIPTION	RELEVANT REPORT SECTION
3(1) (a)	Details of the EAP who prepared the report and the expertise of the EAP, including a curriculum vitae	**Section 1.3** **Appendix A**
3(1) (b)	The location of the activity	**Section 4.1**
3(1) (c)	A plan which locates the proposed activity or activities applied for as well as associated structures and infrastructure at an appropriate scale	**Section 4.1 and 4.2**
3(1) (d)	A description of the scope of the proposed activity	**Section 4.2 and 4.3**
3(1) (e)	A description of the policy and legislative context within which the development is proposed	**Section 2**
3(1) (f)	A motivation for the need and desirability for the proposed development including the need and desirability of the activity in the context of the preferred location	**Section 4.4**
3(1) (g)	A motivation for the preferred site, activity and technology alternative	**Section 5**
3(1) (h)	A full description of the process followed to reach the proposed alternative within the site	**Section 5**
3(1) (i)	A full description of the process undertaken to identify, assess and rank the impacts the activity will impose on the preferred location through the life of the activity	**Section 3.4**
3(1) (j)	An assessment of each identified potentially significant impact and risk	**Section 7**
3(1) (k)	Where applicable, a summary of the findings and impact management measures identified in any specialist report complying with Appendix 6 to these Regulations and an indication as to how these findings and recommendations have been included in the final report	**Section 3.3 and 3.4** **Section 6** **Section 7** **Section 8** **Section 9.1 and 9.2**
3(1) (l)	An environmental impact statement	**Section 9**
3(1) (m)	Based on the assessment, and where applicable, impact management measures from specialist reports, the recording of the proposed impact management objectives, and the impact management outcomes for the development for inclusion in the Environmental Management Programme (EMPr).	**Section 7** **Appendix G**

APPENDIX 1 OF GNR 326	DESCRIPTION	RELEVANT REPORT SECTION
3(1) (n)	Any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation.	**Section 9**
3(1) (o)	A description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed	**Section 3.6**
3(1) (p)	A reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation	**Section 9**
3(1) (q)	Where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required, the date on which the activity will be conducted, and the post construction monitoring requirements finalised	**N/A**
3(1) (r)	An undertaking under oath or affirmation by the EAP	**Appendix B**
3(1) (s)	Where applicable, details of any financial provisions for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts	**N/A**
3(1) (t)	Any specific information that may be required by the competent authority	**N/A**
3(1) (u)	Any other matters required in terms of section 24(4)(a) and (b) of the Act	**N/A**

GENERAL SITE INFORMATION

This is a repeat application for an Environmental Authorisation that has expired (Ref: 14/12/16/3/3/3/83).

TECHNICAL DETAILS OF THE PROPOSED ROBBEN ISLAND WASTEWATER TREATMENT WORKS	
Location of Site	Eastern side of Robben Island, Table Bay, Western Cape
Municipality	City of Cape Town
SG Code	C01600000000143600000
Total area of Site (Robben Island)	518 ha
Size of Buildable Area i.e. project infrastructure footprint (only preferred layout, inclusive of all associated infrastructure)	1070 m^2

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TABLES

FIGURES

APPENDICES

1 INTRODUCTION

All changes made from the Draft BAR have been underlined for easy reference in this Final BAR.

1.1 BACKGROUND AND TERMS OF REFERENCE

This is a repeat application for an Environmental Authorisation that has expired (Ref: 14/12/16/3/3/3/83).

There is currently no formal Wastewater Treatment Works (WWTW) on Robben Island. All sewage is pumped by six pump stations to a collection sump near Robert Sobukwe's former residence, where it is macerated and pumped along the outfall sewer pipeline to discharge through a diffuser 465 m offshore.

The proponent, Robben Island Museum (RIM), therefore proposes to construct a WWTW with a daily throughput capacity of 300m^3 per day on the eastern side of Robben Island in Table Bay. Treated effluent will gravitate to the existing sewage collector sump at the proposed WWTW site from where it will be pumped along the existing outfall sewer pipeline to discharge through a diffuser 465 m offshore. The project site is bounded to the northeast by Murray's Bay beach (80 m), to the north by the Dog Unit (Robert Sobukwe Complex) (30 m), to the west by Murray's Road (50 m) and to the south by the Robben Island village (400 m) (**Figure 1-1**).

A Basic Assessment (BA) was previously undertaken by WSP in 2014/15. An Environmental Authorisation (EA) was secured for the proposed WWTW on 27 March 2015 and an extension was granted on 27 March 2018 (Ref: 14/12/16/3/3/3/83). The WWTW authorised in the EA was for a treatment capacity of 108,000 m^3 per annum with all the effluent generated on the Island discharged via a marine outfall into the coastal environment after treatment. The design allowed for a maximum discharge volume of 300m^3 per day. The EA states "*this activity must commence within a period of five (5) years from the date of EA issued on 27 March 2015 (i.e. the EA lapses on 27 March 2020). If the commencement of the activities does not occur within that period, the authorisation lapses and a new application for environmental authorisation must be made in order for the activity to be undertaken.*" Due to unforeseen circumstances, the project did not commence by the expiry date of 27 March 2020 and the EA subsequently lapsed. RIM is therefore required to apply for a new EA.

The proposed WWTW requires an Integrated Environmental Authorisation (EA) and Waste Management Licence (WML) in terms of the National Environmental Management Act (Act 107 of 1998), as amended (NEMA) and the associated Environmental Impact Assessment (EIA) Regulations, 2014, as amended as well as the National Environmental Management Waste Act (Act 59 of 2008) (NEMWA). WSP Group Africa (Pty) Ltd (WSP) has been appointed by RIM as the independent Environmental Assessment Practitioner (EAP) to facilitate the BA process in accordance with the EIA Regulations, 2014, as amended.

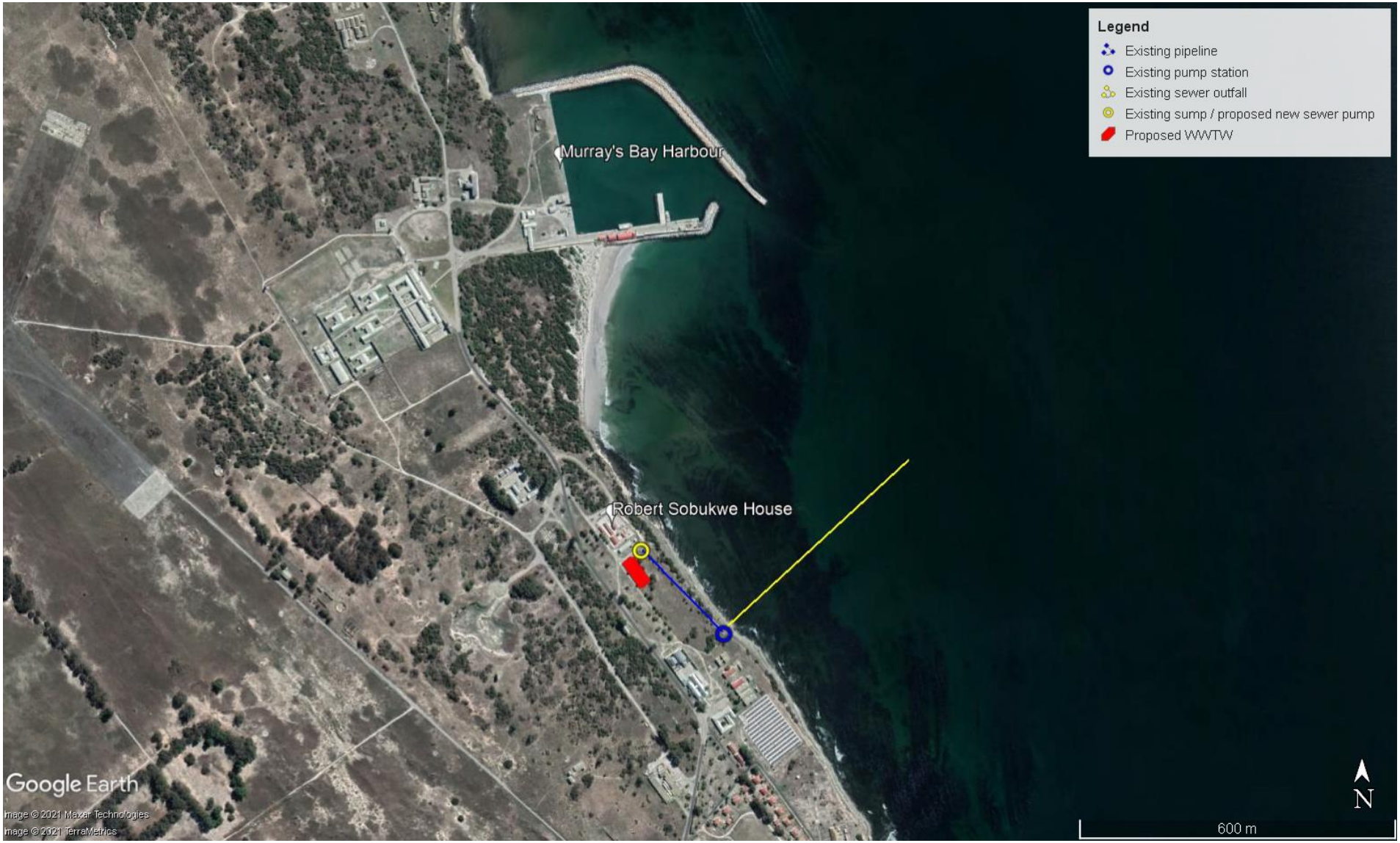

Figure 1-1: Location of the existing and proposed WWTW infrastructure on Robben Island

1.2 PURPOSE OF THE BA PROCESS

The BA process is an interdisciplinary procedure to ensure that environmental and social considerations are included in decisions regarding projects. Simply defined, the process aims to identify the possible environmental and social effects of a proposed activity and how those impacts can be mitigated. In the context of this report, the purpose of the BA process is to inform decision-makers and the public of potential negative and positive consequences of the proposed construction of the WWTW infrastructure. This provides the competent authority (CA) sufficient information to make an informed decision with regards to granting or refusing the IEA applied for.

1.3 DETAILS OF KEY ROLE PLAYERS

1.3.1 PROJECT PROPONENT

RIM is the project proponent (Applicant) with regards to this application for the construction and operation of the Robben Island WWTW. **Table 1-1** provides the relevant details of the project proponent.

Table 1-1: Details of Project Proponent

PROPONENT: RED ROCKET SOUTH AFRICA (PTY) LTD

Organisation:	Robben Island Museum
Contact Person:	Seithati Dutywa
Postal Address	P O Box 51806, V & A Waterfront, 8002
Telephone:	021 413 4242
Email:	SeithatiB@robben-island.org.za

1.3.2 COMPETENT AND COMMENTING AUTHORITIES

Section 24C(2)(d) and (e) of NEMA stipulates that the Minister must be identified as the competent authority if the activity:

(d) is undertaken, or is to be undertaken, by—

(i) a national department;

(ii) a provincial department responsible for environmental affairs or any other organ of state performing a regulatory function and reporting to the MEC; or

*(iii) **a statutory body**, excluding any municipality, performing an exclusive competence of the national sphere of government; or*

*(e) will take place **within a national proclaimed protected area** or other conservation area under control of a national authority.*

Due to the fact that RIM is a State-Owned Company (SOC), the competent authority will be the Department of Forestry, Fisheries and the Environment (DFFE). Furthermore, Robben Island is legally protected as a National Heritage Site through the National Heritage Resources Act (Act No 25 of 1999), the World Heritage Convention Act (Act No 49 of 1999); the Cultural Institutions Act (Act No 119 of 1998), 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).

Table 1-2 provides the relevant details of the competent and commenting authorities on the Project.

Table 1-2: Competent and Commenting Authorities

ASPECT	COMPETENT / COMMENTING AUTHORITY
Competent Authority: Integrated Environmental Authorisation	Department of Forestry, Fisheries, and the Environment (DFFE)
Commenting Authorities	DFFE: Biodiversity Conservation Unit
	DFFE: Oceans and Coasts
	Department of Environmental Affairs: World Heritage Management
	Department of Water and Sanitation (DWS)
	Department of Tourism
	South African Civil Aviation Authority (SACAA)
	South African Heritage Resources Agency (SAHRA)
	Western Cape Department of Environmental Affairs and Development Planning (DEA&DP)
	South African National Parks (SAN Parks)
	CapeNature
	City of Cape Town: Environment & Heritage Management
	City of Cape Town Municipality
	Southern African Foundation for the Conservation of Coastal Birds (SANCCOB)

1.3.3 ENVIRONMENTAL ASSESSMENT PRACTITIONER

WSP was appointed in the role of Independent EAP to undertake the BA processes for the proposed construction of the WWTW. The CV of the EAP is available in **Appendix A**. The EAP declaration of interest and undertaking is included in **Appendix B**. **Table 1-3** details the relevant contact details of the EAP.

Table 1-3: Details of the EAP

EAP	WSP GROUP AFRICA (PTY) LTD
Company Registration:	1999/008928/07
Contact Person:	Jacqui Fincham

EAP	WSP GROUP AFRICA (PTY) LTD
Qualifications:	BSc Hons Biotechnology
EAP Registration:	EAPASA (2019/362)
Physical Address:	1st Floor The Pavilion, Corner of Portswood Rd & Beach Rd, Victoria & Alfred Waterfront, Cape Town
Postal Address:	PO Box 2613, Cape Town, 8000
Telephone:	+27 21 481 8795
Fax:	+27 21 481 8799
Email:	Jacqui.Fincham@wsp.com

STATEMENT OF INDEPENDENCE

Neither WSP nor any of the authors of this Report have any material present or contingent interest in the outcome of this Report, nor do they have any business, financial, personal or other interest that could be reasonably regarded as being capable of affecting their independence. WSP has no beneficial interest in the outcome of the assessment.

1.4 SPECIALISTS

Specialist input was required in support of this application for EA. The details of the specialists are provided in **Table 1-4** below. The Curriculum Vitae of the specialists are attached in **Appendix F** and their declarations in **Appendix C**.

Table 1-4: Details of Specialists

ASSESSMENT	NAME OF SPECIALIST	COMPANY	SECTIONS IN REPORT	SPECIALIST REPORT ATTACHED AS
Archaeology	Dr Ute Seemann	Independent Consultant	Section 6.2	Appendix F
Marine Ecology	Andrea Pulfrich	Pisces Environmental Services (Pty) Ltd	Section 6.1	Appendix F
Marine Outfall	Roy van Ballegooyen	WSP Group Africa (Pty) Ltd	Section 6.1	Appendix F
Odour	Loren Dyer	WSP Group Africa (Pty) Ltd	Section 6.2	Appendix F
Palaeontology	Dr John Almond	Natura Viva CC	Section 6.2	Appendix F
Visual	Lourens du Plessis	LOGIS	Section 6.2	Appendix F

1.5 BASIC ASSESSMENT REPORT STRUCTURE

The structure of the Final BAR (this report) is presented in **Table 1-5** below.

Table 1-5: Structure of this report

SECTION	CONTENTS
1 – Introduction	Provides a brief background and outlines the purpose of this document, as well as identifying the key role players, content of the report and the assumptions and limitations applicable to the assessment.
2 – Governance Framework	Provides a brief summary and interpretation of the relevant legislation in terms of the proposed project.
3 – Basic Assessment Process	Provides a description of the BA process being undertaken and the methodology employed.
4 – Project Description	Describes the project location and surrounding area, project history, and a project description.
5 – Project Alternatives	Provides a summary description of the proposed project alternatives.
6 – Baseline Environment	Describes the biophysical and socio-economic characteristics of the affected environment against which potential project impacts are assessed.
7 – Environmental Impact Assessment	Describes the specialist studies undertaken and assesses the potential impacts of the project as well as project alternatives. The significance of the impacts and proposed mitigation measures are presented.
8 – Cumulative Impact Assessment	Describes the cumulative impacts identified by the EAP and Specialists and assesses the cumulative impacts. The significance of the impacts and proposed mitigation measures are presented.
9 – Environmental Impact Statement	Provides the Environmental Impacts Statement including principal findings as well as recommendations and the authorisation opinion.
10 –Way Forward	Outlines the stakeholder engagement details associated with the public review period.

2 GOVERNANCE FRAMEWORK

2.1 NATIONAL LEGAL AND REGULATORY FRAMEWORK

The South African regulatory framework establishes well-defined requirements and standards for environmental and social management of industrial and civil infrastructure developments. Different authorities at both national and regional levels carry out environmental protection functions. The applicable legislation and policies are shown in **Table 2-1** and

Table 2-2 below.

Table 2-1: Applicable Legislation

APPLICABLE LEGISLATION	DESCRIPTION OF LEGISLATION
The Constitution of South Africa (No. 108 of 1996)	Section 24(b) of the Constitution provides that "*everyone has the right 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 [and] promote conservation*." The Constitution cannot manage environmental resources as a stand-alone law, hence additional legislation has been promulgated in order to manage the various spheres of both the social and natural environment. Each promulgated Act and associated Regulations are designed to focus on various industries or components of the environment to ensure that the objectives of the Constitution are effectively implemented and upheld in an on-going basis throughout the country. In terms of Section 7, a positive obligation is placed on the State to give effect to the environmental rights.
National Environmental Management Act (No. 107 of 1998)	In terms of Section 24(2) of the National Environmental Management Act (No. 107 of 1998) (NEMA), the Minister may identify activities which may not commence without prior authorisation. On 7 April 2017, the Minister thus published GNR 327 (Listing Notice 1), 325 (Listing Notice 2) and 324 (Listing Notice 3) listing activities that may not commence prior to authorisation. The regulations outlining the procedures required for authorisation are published in GNR 326 EIA Regulations (2014, as amended). Listing Notice 1 and Listing Notice 3 identify activities that require a BA process to be undertaken, in terms of the EIA Regulations, prior to commencement of that activity. Listing Notice 2 identifies activities that require a Scoping and EIA process to be undertaken, in terms of the EIA Regulations, prior to commencement of that activity. **Listed Activities 15, 17 and 19A of GNR 327** are considered applicable to the Robben Island WWTW and therefore a BA process must be followed to obtain an IEA.
Listing Notice 1: GNR 327	***Activity 15:*** *The development of structures in the coastal public property where the development footprint is bigger than 50 square metres, excluding—* *(i) the development of structures within existing ports or harbours that will not increase the development footprint of the port or harbour;* *(ii) the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies;* *(iii) the development of temporary structures within the beach zone where such structures will be removed within 6 weeks of the commencement of development and where coral or indigenous vegetation will not be cleared; or* *(iv) activities listed in activity 14 in Listing Notice 2 of 2014, in which case that activity applies.* **Applicability:** The proposed WWTW infrastructure will be 1070m^2 and is located on Robben Island, which is defined to be Coastal Public Property. Therefore, this activity is triggered.

APPLICABLE LEGISLATION	DESCRIPTION OF LEGISLATION
	Activity 17: *Development—* *(i) in the sea;* *(ii) in an estuary;* *(iii) within the littoral active zone;* *(iv) in front of a development setback; or* *(v) if no development setback exists, within a distance of 100 metres inland of the high-water mark of the sea or an estuary, whichever is the greater;* *in respect of—* *a) fixed or floating jetties and slipways;* *b) tidal pools;* *c) embankments;* *d) rock revetments or stabilising structures including stabilising walls; or* *e) infrastructure or structures with a development footprint of 50 square metres or more —* *but excluding—* *(aa) the development of infrastructure and structures within existing ports or harbours that will not increase the development footprint of the port or harbour;* *(bb) where such development is related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies;* *(cc) the development of temporary infrastructure or structures where such structures will be removed within 6 weeks of the commencement of development and where coral or indigenous vegetation will not be cleared; or* *(dd) where such development occurs within an urban area.* **Applicability:** The proposed WWTW infrastructure will be greater than 50m^2 and will be constructed within a distance of 100 metres inland of the high-water mark of the sea. This activity is therefore triggered.
	Activity 19A: *The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 5 cubic metres from –* *(i) the seashore;* *(ii) the littoral active zone, an estuary or a distance of 100 metres inland of the high-water mark of the sea or an estuary, whichever distance is the greater; or* *(iii) the sea; —* *but excluding where such infilling, depositing , dredging, excavation, removal or moving—* *(f) will occur behind a development setback;* *(g) is for maintenance purposes undertaken in accordance with a maintenance management plan;* *(h) falls within the ambit of activity 21 in this Notice, in which case that activity applies;* *(i) occurs within existing ports or harbours that will not increase the development footprint of the port or harbour; or* *where such development is related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies.*

APPLICABLE LEGISLATION	DESCRIPTION OF LEGISLATION
	Applicability: The proposed WWTW will be constructed within 100m of the high-water mark of the sea and more than 5 m^3 of material will be excavated as part of construction. This activity is therefore triggered.
National Environmental Management Waste Act (No. 59 of 2008)	The National Environmental Management Waste Act (No. 59 of 2008) (NEMWA) is subsidiary and supporting legislation to NEMA. NEMWA is a framework legislation that provides the basis for the regulation of waste management. NEMWA also contains policy elements and gives a mandate for further regulations to be promulgated. On 29 November 2013, GN 921: *NEMWA List of waste management activities that have, or are likely to have, a detrimental effect on the environment* was published. The proposed WWTW, specifically the proposed drying beds for the sludge, will trigger Category A, Item (1) "the storage of general waste in lagoons" of GNR 921 and will therefore require a Waste Management Licence (WML). In addition, waste handling, storage and disposal during the construction and operational phase of the project must be undertaken in accordance with the requirements of this Act and the Best Practicable Environmental Option (BPEO) which will be incorporated into the site-specific Environmental Management Programme (EMPr).
National Environmental Management Biodiversity Act (No. 10 of 2004)	The National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA) was promulgated in June 2004, within the framework of NEMA, to provide for the management and conservation of national biodiversity. NEMBA's primary aims are for the protection of species and ecosystems that warrant national protection, the sustainable use of indigenous biological resources, and the fair and equitable sharing of benefits arising from bioprospecting involving indigenous biological resources. In addition, NEMBA provides for the establishment and functions of the South African National Biodiversity Institute (SANBI). SANBI was established primarily to report on the status of the country's biodiversity and conservation status of all listed threatened or protected species and ecosystems. The National Coastal and Marine Spatial Biodiversity Plan[1] comprises a map of Critical Biodiversity Areas (CBAs), Ecological Support Area (ESAs) and accompanying sea-use guidelines. The CBA Map presents a spatial plan for the marine environment, designed to inform planning and decision-making in support of sustainable development. The sea-use guidelines enhance the use of the CBA Map in a range of planning and decision-making processes by indicating the compatibility of various activities with the different biodiversity priority areas so that the broad management objective of each can be maintained. The intention is that the CBA Map (CBAs and ESAs) and sea-use guidelines inform the MSP Conservation Zones and management regulations, respectively. Robben Island falls within an Marine Protected Area (MPA), with Critical Biodiversity Area 1 (CBA 1), Critical Biodiversity Area 2 (CBA 2), and Ecological Support Area (ESA) lying adjacent to the boundary of the MPA on the east and north. The Threatened or Protected Species (TOPS) Regulations were promulgated on 1 June 2007 in terms of Section 91(1)(g), (h) and (i) of NEMBA. TOPS aims to further regulate the permit system set out in NEMBA, provide for the prohibition and regulation of restricted activities, and provide for the protection of wild populations of listed and threatened or protected species. The minister published amendments to the TOPS on 29 April 2014, which was updated to include for the regulations and registration of a number of activities for the capture, farming and handling of threatened or protected species (e.g. captive breeding facilities, sanctuaries, game farms and nurseries).

[1] The latest version of National Coastal and Marine Spatial Biodiversity Plan (v1.1 was released in June 2021) (Harris *et al.* 2020). The Plan is intended to be used by managers and decision-makers in those national government departments whose activities occur in the coastal and marine space, e.g., environment, fishing, transport (shipping), petroleum, mining, and others. It is relevant for the Marine Spatial Planning Working Group where many of these departments are participating in developing South Africa's emerging marine spatial plans. It is also intended for use by relevant managers and decision-makers in the coastal provinces and coastal municipalities, EIA practitioners, organisations working in the coast and ocean, civil society, and the private sector.

APPLICABLE LEGISLATION	DESCRIPTION OF LEGISLATION
National Environmental Management Protected Areas Act (No. 57 of 2003)	The purpose of the National Environmental Management Protected Areas Act (No. 57 of 2003) (NEMPAA) is to, inter alia, provide for the protection and conservation of ecologically viable areas representative of South Africa's biological diversity and its natural landscapes and seascapes. To this end, it provides for the declaration and management of various types of protected areas. Section 50(5) of NEMPAA states that "*no development, construction or farming may be permitted in a nature reserve or world heritage site without the prior written approval of the management authority*." Robben Island is a word heritage site and falls under the management of RIM. The proposed WWTW falls within Robben Island MPA per NEMPAA. The Robben Island MPA is an inshore and offshore conservation region around and near Robben Island. The Regulations for the Management of the Robben Island Marine Protected Area (GNR794) were published on 23 May 2019 in terms of Sections 48A(2) and 86(1)(a), (b), (c) and (d) NEMPAA. SAN Parks is the management authority for the Robben Island MPA and will be consulted during the public participation process.
National Environmental Management: Integrated Coastal Management Act (No. 24 of 2008)	The National Environmental Management: Integrated Coastal Management Act (NEMICMA) 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*". The current outfall was authorised by the Department of Water Affairs. The ICM Act requires all operators that operated under a Department of Water Affairs authorisation to apply for a Coastal Waters Discharge Permit (CWDP). RIM applied for this in 2015. Due to the fact that an assessment framework was to be compiled and there was a huge backlog of applications, the CWDP for Robben Island was not issued. In 2020/21 financial year the application was reviewed, and a draft decision issued to RIM. This decision will be finalised and issued following the determination on this current Environmental Authorisation application taking note of the changes in the WWTW design. RIM has therefore applied for a CWDP in order to discharge treated effluent into the ocean and is awaiting issuance of the CWDP.
National Water Act (No. 36 of 1998)	The purpose of the National Water Act (No. 36 of 1998) (NWA) is to provide a framework for the equitable allocation and sustainable management of water resources. Both surface and groundwater sources are national resources, which cannot be owned by any individual, and rights to which are not automatically coupled to land rights, but for which prospective users must apply for authorisation and register as users. The NWA also provides for measures to prevent, control and remedy the pollution of surface and groundwater sources. The Act aims to regulate the use of water and activities (as defined in Part 4, Section 21), which may impact on water resources through the categorisation of 'listed water uses.' Defined water use activities require the approval of DWS in the form of a General Authorisation (GA) or Water Use Licence (WUL) authorisation. Obtaining a CWDP in terms of section 69 of NEMICMA replaces the need to obtain a WUL in terms of the Section 21 (f) and (h) of the National Water Act. 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 (GLV) listed for disposal up to 2,000m^3 per day into non-listed water resources. The WWTW has been designed to achieve GLVs as listed in this Act.
National Heritage Resources Act (No. 25 of 1999)	The National Heritage Resource Act (Act No. 25 of 1999) (NHRA) serves to protect national and provincial heritage resources across South Africa. The NHRA provides for the protection of all archaeological and palaeontological sites, the conservation and care of cemeteries and graves by the South African Heritage Resource Agency (SAHRA), and lists activities which require any person who intends to undertake to notify the responsible heritage resources

APPLICABLE LEGISLATION	DESCRIPTION OF LEGISLATION
	agency and furnish details regarding the location, nature, and extent of the proposed development. Robben Island Museum is responsible for managing, maintaining, developing and marketing Robben Island as a National Heritage and World Heritage Site in terms of the National Heritage Resources Act of 1999 and the National World Heritage Act of 1999. 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 WWTW would therefore require a permit from SAHRA before construction on site may commence. Construction activities should be conducted carefully, and all activities ceased if any archaeological, cultural and heritage resources are discovered. SAHRA should be notified and an investigation conducted in accordance with the Chance Find Procedure to be established for the Project before any activities can commence.
National Environment Management Air Quality Act (No. 39 of 2004)	The National Environment Management: Air Quality Act (No. 39 of 2004) (NEMAQA) came into effect on 11 September 2005. Persons undertaking such activities listed under GNR 893, as amended, are required to possess an Atmospheric Emissions License (AEL). The National Dust Control Regulations (GNR 827) were promulgated in terms of Section 32 of NEMAQA, which aim at prescribing general measures for the control of dust in both residential and non-residential areas. Although no AEL will be required for the construction and operation of the WWTW, the dust control regulations will be applicable during construction.
Civil Aviation Act (No. 13 of 2009)	Civil aviation in South Africa is governed by the Civil Aviation Act (Act 13 of 2009). This Act provides for the establishment of a stand-alone authority mandated with controlling, promoting, regulating, supporting, developing, enforcing and continuously improving levels of safety and security throughout the civil aviation industry. This mandate is fulfilled by SACAA as an agency of the Department of Transport (DoT). SACAA achieves the objectives set out in the Act by complying with the Standards and Recommended Practices (SARPs) of the International Civil Aviation Organisation (ICAO), while considering the local context when issuing the South African Civil Aviation Regulations. All proposed developments or activities in South Africa that potentially could affect civil aviation must thus be assessed by SACAA in terms of the Civil Aviation Regulations and South African Civil Aviation Technical Standards (SA CATS) to ensure aviation safety. Potential impacts from the power lines must be reviewed by these authorities. The Obstacle Evaluation Committee (OEC) which consists of members from both the SACAA and South African Air Force (SAAF) fulfils the role of streamlining and coordinating the assessment and approvals of proposed developments or activities that have the potential to affect civil aviation, military aviation, or military areas of interest. The Robben Island Airstrip is located approximately 1 km north west of the proposed WWTW. The DEA Screening Tool Report identified Civil Aviation as having medium sensitivity for the proposed WWTW. SACAA and Air Traffic Navigation Services (ATNS) will be included in the public participation process.
Occupational Health and Safety Act (No. 85 of 1993)	The National Occupational Health and Safety Act (No. 85 of 1993) (OHSA) and the relevant regulations under the Act are applicable to the proposed project. This includes the Construction Regulations promulgated in 2014 under Section 43 of the Act. Adherence to South Africa's OHSA and its relevant Regulations is essential.

Table 2-2: Applicable Policies and Plans

APPLICABLE POLICY	DESCRIPTION OF POLICY
National Development Plan	The National Development Plan (NDP) aims to eliminate poverty and reduce inequality by 2030. The main objectives to achieve this aim are categorised as follows:

APPLICABLE POLICY	DESCRIPTION OF POLICY
	— Economy and Employment — Economic infrastructure — Environmental sustainability and resilience — Inclusive rural economy — South Africa in the region and the world — Transforming Human Settlements — Improving education, training and innovation — Health care for all — Social protection — Building Safer Communities — Building a capable and developmental state — Fighting corruption — Nation building and social cohesion Under "Economic Infrastructure", the NDP identifies "improving infrastructure" as an imperative for South Africa in the coming decade. It recognises that "i*nfrastructure is not just essential for faster economic growth and higher employment. It also promotes inclusive growth, providing citizens with the means to improve their own lives and boost their incomes. Infrastructure is essential to development."* The development of the proposed WWTW will contribute, indirectly, towards the National Development Goal of Improving education, training and innovation. Furthermore, the 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% 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.
New Economic Growth Path	Government released the New Economic Growth Path Framework on 23 November 2010. The aim of the framework is to enhance growth, employment creation and equity. The policy's principal target is to create five million jobs over the next 10 years and reflects government's commitment to prioritising employment creation in all economic policies. The framework identifies strategies that will enable South Africa to grow in a more equitable and inclusive manner while attaining South Africa's developmental agenda. Central to the New Growth Path is a massive investment in infrastructure as a critical driver of jobs across the economy. In this regard the framework identifies investments in five key areas namely: energy, transport, communication, water and housing. The WWTW will provide a limited number of jobs during construction. The WWTW is required by the small population of Robben Island and visitors in order to be able to treat sewage to the required water quality standards as defined by NEMICMA. 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.
National Infrastructure Plan	The South African Government adopted a National Infrastructure Plan (NIP) in 2012. The NIP aims to transform the South African economic landscape while simultaneously creating significant numbers of new jobs and strengthening the delivery of basic services. It outlines the challenges and enablers which needs to be addressed in the building and developing of infrastructure. The Presidential Infrastructure Coordinating Commission (PICC) was established by the Cabinet to integrate and coordinate the long-term infrastructure build. The WWTW will provide a limited number of jobs during construction and will improve the delivery of basic services.
African Penguin Biodiversity Management Plan (GN 824 of 31 October 2013)	The aim of the African Penguin Biodiversity Management Plan is "to halt the decline of the African Penguin population in South Africa within two years of the implementation of the management plan and thereafter achieve a population growth which will result in a down listing of the species in terms of its status in the IUCN Red List of Threatened Species." The

APPLICABLE POLICY	DESCRIPTION OF POLICY
	plan details threats to the African Penguin population and sets out an action plan to mitigate potential impacts and threats to African Penguins. During construction and operation of the WWTW, RIM must consult the African Penguin Biodiversity Management Plan in order to carefully manage and avoid further harmful disturbance to African Penguins.

2.2 PROVINCIAL AND MUNICIPAL LEGAL AND REGULATORY FRAMEWORK

Table 2-3: Provincial and Municipal Plans

APPLICABLE PLAN	DESCRIPTION OF PLAN
Western Cape Spatial Development Framework	The Western Cape Provincial Spatial Development Framework, 2014 (PSDF) is an approved structure plan in terms of the Spatial Planning and Land Use Management Act (Act 16 of 2013) (SPLUMA) and the Land Use Planning Act (Act 3 of 2014) (LUPA) and aims to give spatial expression to the NDP and One Cape 2040 initiatives. It provides guidelines for district, metropolitan and local municipal spatial initiatives such as Integrated Development Plans (IDPs) and Spatial Development Frameworks (SDFs). The PSDF is a broad-based document and does not control development or land use proposals at a micro-scale (e.g. individual properties). It is, however, relevant in setting out overarching planning policy guidelines adopted by the Provincial Government, and major development applications need to take guidance from and be evaluated in terms of these policy guidelines. The Western Cape PSDF is underpinned by three interrelated themes, namely: – Sustainable use of the Western Cape's spatial assets (resources); – Opening up opportunities in the Provincial space-economy (space economy); and – Developing integrated and sustainable settlements (settlement). The WCPSDF also includes the following spatial agenda: – Grow the Province's economy in partnership with the private sector, non-government and community based organisations; – Use infrastructure investment as the primary lever to ensure urban and rural spatial transitions; and – Improve the sustainable use of the Province's spatial assets and resources. The following primary objectives commit the Province to safeguarding these assets: i. Protect biodiversity and agricultural resources. ii. Minimise the consumption of scarce environmental resources, particularly water, fuel, and land – in the latter case especially pristine and other rural land, which is the Western Cape's 'gold-mine-above-the-ground' (i.e. a non-renewable resource). iii. Conserve and strengthen the sense of place of important natural, cultural and productive landscapes, artefacts and buildings. The proposed WWTW is in line with these primary objectives as it contributes to protecting biodiversity, specifically the marine environment. A competent sewage management service will mitigate and minimise environmental and human health risks posed by the sewage generated on the Island. The WWTW is required by the small population of Robben Island and visitors in order to be able to treat sewage to the required water quality standards as defined by NEMICMA. 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. The WWTW will therefore also lead to an overall improvement in the offshore marine environment.

APPLICABLE PLAN	DESCRIPTION OF PLAN
	Additionally, the proposed WWTW will contribute to the objective of conserving the sense of place of important cultural landscapes. The site is located on Robben Island which is a National and World Heritage Site. The proposed construction of a WWTW 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).
City of Cape Town Municipality Integrated Development Plan (2017 – 2022)	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 and to provide assistance to those who need it most; – To deliver quality services to all residents; and – To serve the citizens of Cape Town as a well-governed and corruption-free 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. 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 WWTW 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.
City of Cape Town Municipality Spatial Development Framework	The City of Cape Town SDF (2012) Policy No. 24 aims to "Reduce the impact of urban development on river systems, wetlands, aquifers, aquifer recharge areas and discharge areas". Policy guideline P24.2 specifically indicates the need for land use management decisions to allow for minimisation of sewage discharges into the natural environment. The proposed WWTW will serve to improve the quality of discharged effluent into Table Bay.
Table Bay District Approved Structure Plan (2012)	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 WWTW will ultimately lead to an improvement in the marine water quality near Robben Island and have a net positive impact on the marine environment.
Cape Town Bioregional Plan	The entire Island is designated as a Critical ESA according to the City of Cape Town Biodiversity Network (BioNet) 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. The proposed WWTW is located on a degraded portion of the island and any negative environmental impacts will be appropriately mitigated.

2.3 OTHER GUIDELINES AND BEST PRACTICE RECOMMENDATIONS

2.3.1 ROBBEN ISLAND MUSEUM INTEGRATED CONSERVATION MANAGEMENT PLAN 2018-2023

The Integrated Conservation Management Plan (2018-2023) (ICMP) aims "to preserve and promote Robben Island as an inspirational national treasure and World Heritage Site that symbolises the triumph of the human spirit over extreme adversity and injustice." In order to achieve this vision, the following missions have been identified:

- To conserve and manage the cultural and natural resources in order to retain the significance and the Outstanding Universal Value of the site;
- To promote an inclusive and holistic understanding of the Island's multi-layered history;
- To develop responsible and sustainable tourism products and services that offer a unique visitor experience;
- To share, educate and communicate the values, experience and legacy of Robben Island; and
- To ensure Robben Island Museum adheres to good practices for managing a World Heritage Site.

To pursue the Vision and to follow the Missions Statement for RIM, a set of clear actionable interventions are required. These are encapsulated in five Strategic Goals addressing institutional arrangements, heritage interpretation and dissemination, operations and funding, marketing and tourism, outreach and monitoring and research. The Strategic Goals of the ICMP are:

SG1: To strengthen governance of Robben Island Museum to ensure effective management.

SG2: To conserve and maintain the natural and cultural heritage of Robben Island.

SG3: To disseminate information about Robben Island to a broad audience.

SG4: To develop and promote Responsible Tourism operations.

SG5: To foster stakeholder relations and partnerships.

The Strategic Goals are operationalised through Action Categories. The Action Plan included in the ICMP lists the Action Categories under each Strategic Goal and unpacks them into specific actions, outcomes and indicators.

Action categories under SG2 relate to the natural environment (Action 9), the built environment (Action 10) and disaster risk (Action 11). Specific actions in these action categories relevant to the proposed WWTW are outlined below together with how the development will ensure alignment (in *italics*):

- 9.3: Continue to implement speed-bumps and no-go signs to reduce mortality and disturbance of penguins- *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.*
- 9.8: Rehabilitate and restore natural vegetation - *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.*
- 10.2: Plan infrastructure and logistics to ensure equitable access and operational safety for visitors - *There is currently no formal WWTW on Robben Island. All sewage is pumped by six pump stations to a collection sump near Robert Sobukwe's former residence, where it is macerated and pumped along the outfall sewer pipeline to discharge through a diffuser 465 m offshore. In order for the island to continue to be utilised as an educational and cultural heritage resource, it is vital that the proposed WWTW is constructed given that 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. A competent sewage management service will mitigate and minimise environmental and human health risks posed by untreated sewage discharges.

3 BASIC ASSESSMENT PROCESS

3.1 OBJECTIVES OF THE BASIC ASSESSMENT PROCESS AS PER THE PROCEDURAL FRAMEWORK

As defined in Appendix 1 of the EIA Regulations, 2014 (as amended), the objective of the impact assessment process is to, through a consultative process:

- Determine the policy and legislative context within which the proposed activity is located and how the activity complies with and responds to the policy and legislative context;
- Identify the alternatives considered, including the activity, location, and technology alternatives;
- Describe the need and desirability of the proposed alternatives;
- Through the undertaking of an impact and risk assessment process, inclusive of cumulative impacts which focused on determining the geographical, physical, biological, social, economic, heritage, and cultural sensitivity of the sites and locations within sites and the risk of impact of the proposed activity and technology alternatives on these aspects to determine—
    - The nature, significance, consequence, extent, duration, and probability of the impacts occurring to; and
    - The degree to which these impacts—
        - Can be reversed;
        - May cause irreplaceable loss of resources; and
        - Can be avoided, managed, or mitigated.
- Through a ranking of the site sensitivities and possible impacts the activity and technology alternatives will impose on the sites and location identified through the life of the activity to–
    - Identify and motivate a preferred site, activity and technology alternative;
    - Identify suitable measures to avoid, manage or mitigate identified impacts; and
    - Identify residual risks that need to be managed and monitored.

3.2 DFFE WEB-BASED ENVIRONMENTAL SCREENING TOOL

DFFE has developed the National Web-based Environmental Screening Tool in order to flag areas of potential environmental sensitivity related to a site as well as a development footprint and produces the screening report required in terms of regulation 16 (1)(v) of the EIA Regulations (2014, as amended). The *Notice of the requirement to submit a report generated by the national web-based environmental screening tool in terms of section 24(5)(h) of the NEMA, 1998 (Act No 107 of 1998) and regulation 16(1)(b)(v) of the EIA regulations, 2014, as amended* (GN 960 of July 2019) states that the submission of a report generated from the national web-based environmental screening tool, as contemplated in Regulation 16(1)(b)(v) of the EIA Regulations, 2014, published under Government Notice No. R982 in Government Gazette No. 38282 of 4 December 2014, as amended, is compulsory when submitting an application for environmental authorisation in terms of regulation 19 and regulation 21 of the EIA Regulations, 2014 as of 04 October 2019.

The Screening Report generated by the National Web-based Environmental Screening Tool contains a summary of any development incentives, restrictions, exclusions or prohibitions that apply to the proposed development footprint as well as the most environmentally sensitive features on the footprint based on the footprint sensitivity screening results for the application classification that was selected.

A screening report for the proposed WWTW was generated on 30 June 2022 and is attached as **Appendix H**. The Screening Report for the project identified various sensitivities for the site. The report also generated a list of specialist assessments that should form part of the BA based on the development type and the environmental

sensitivity of the site. Assessment Protocols in the report provide minimum information to be included in a specialist report to facilitate decision-making.

Table 3-1 below provides a summary of the sensitivities identified for the development footprint.

Table 3-1: Sensitivities identified in the screening report

THEME	VERY HIGH SENSITIVITY	HIGH SENSITIVITY	MEDIUM SENSITIVITY	LOW SENSITIVIY
Animal Species Theme				✓
Aquatic Biodiversity Theme				✓
Archaeological and Cultural Heritage Theme	✓			
Civil Aviation Theme			✓	
Defence Theme			✓	
Palaeontology Theme			✓	
Plant Species Theme				✓
Terrestrial Biodiversity Theme	✓			

Based on the selected classification, and the environmental sensitivities of the proposed development footprint, the following list of specialist assessments have been identified for inclusion in the assessment report:

- Landscape/Visual Impact Assessment
- Archaeological and Cultural Heritage Impact Assessment
- Palaeontology Impact Assessment
- Terrestrial Biodiversity Impact Assessment
- Aquatic Biodiversity Impact Assessment
- Marine Impact Assessment
- Avian Impact Assessment
- Geotechnical Assessment
- Socio-economic Impact Assessment
- Plant Species Assessment
- Animal Species Assessment

3.2.1 MOTIVATION FOR SPECIALIST STUDIES

The report recognises that "*it is the responsibility of the EAP to confirm this list and to motivate in the assessment report, the reason for not including any of the identified specialist study including the provision of photographic evidence of the footprint situation.*"

As summarised in **Table 1-4** above, the following specialist assessments have been undertaken for the project based on the environmental sensitivities identified by the Screening Report and are attached as **Appendix F**:

- Archaeology;

- Marine Ecology;
- Marine Outfall;
- Odour;
- Palaeontology; and
- Visual.

Seven (7) of the identified specialist studies have not been undertaken as part of the BA process for the proposed Robben Island WWTW. Motivation for the exclusion of these specialist studies is provided below.

TERRESTRIAL BIODIVERSITY IMPACT ASSESSMENT

The site is situated within the endangered Cape Flats Dune Strandveld ecosystem in the West Strandveld Bioregion. However, the site does not fall within a Critical Biodiversity Area. The DFFE Screening Tool Report identified terrestrial biodiversity as being of very high sensitivity for the site as it falls within a national protected area and an Ecological Support Area.

The footprint of the land-based WWTW infrastructure will be 1070m^2 (approximately 0.1 ha) and is to be located on a degraded portion of the island. Land cover consists primarily of low scrubland, alien grass species, and variety of alien or invasive tree species (mostly *Acacia cyclops*) and *Searsia* spp. (**Figure 3-1**). The site and immediate environs are heavily disturbed, with alien invasive plant species, and anthropogenic disturbance, including old water tanks, septic tank manholes, electrical boxes, disused telephone line poles, and maintenance jeep tracks.

Once constructed, the activity is not expected to have any long-term negative impacts on terrestrial biodiversity. A Terrestrial Biodiversity Impact Assessment is therefore not deemed necessary.

Figure 3-1: Land cover at the location of the WWTW (red circle indicates approximate location)

AQUATIC BIODIVERSITY IMPACT ASSESSMENT

The DFFE Screening Tool Report identified aquatic biodiversity as being of low sensitivity for the site. The site does not support any watercourses or wetlands and, as such, no aquatic biodiversity is expected to be impacted as part of the WWTW development. An overall improvement in the offshore marine environment can be expected as a result of this project. An Aquatic Biodiversity Impact Assessment is therefore not deemed necessary.

AVIAN IMPACT ASSESSMENT

Seabirds (including the African Penguin) have been considered and assessed as part of the Marine Ecology Assessment (**Appendix F**). A standalone Avian Impact Assessment is therefore not deemed necessary.

GEOTECHNICAL ASSESSMENT

A Geotechnical Investigation was undertaken outside of the BA process in January 2021. A geotechnical specialist will be appointed to carry out inspections of founding material prior to casting.

SOCIO-ECONOMIC IMPACT ASSESSMENT

The population of Robben Island is around 116 persons.[2] The majority of people visiting the island are tourists and school groups. The WWTW 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 NEMICMA. 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.

The positive and negative socio-economic impacts of the proposed project have been assessed by the EAP in this BAR. It is not deemed necessary that a separate Socio-Economic Assessment be undertaken for the project given its small size and limited socio-economic impact.

PLANT AND ANIMAL SPECIES ASSESSMENT

The DFFE Screening Tool Report identified plant and animal species as being of low sensitivity for the site. Due to the current degraded state of the site and surrounding area, no endangered plant or animal species are likely to be found on the site or impacted as part of the proposed expansion. Plant and Animal Assessments are therefore not deemed necessary.

3.3 APPLICATION FOR INTEGRATED ENVIRONMENTAL AUTHORISATION

The application phase consisted of completing the appropriate application form as well as the submission and registration of the application for IEA with the DFFE. A pre-application meeting with DFFE was requested on 17 August 2021. The appointed DFFE case officer confirmed telephonically and via e-mail on 24 August 2021 that a pre-application meeting would not be necessary for the Project.

The application form was submitted to the DFFE on **28 July 2022**. A reference number will be included in the Final BAR following acknowledgment of receipt from the DFFE.

3.4 BASELINE ENVIRONMENTAL ASSESSMENT

The description of the environmental attributes of the Project area was compiled through a combination of desktop reviews and site investigations. Desktop reviews made use of available information including existing reports, aerial imagery, and mapping. The EAP undertook a site investigation on 17 September 2021 to verify site conditions for the proposed Robben Island WWTW.

[2] 2011 census data

3.5 IMPACT ASSESSMENT METHODOLOGY

3.5.1 ASSESSMENT OF IMPACTS AND MITIGATION

The assessment of impacts and mitigation evaluates the likely extent and significance of the potential impacts on identified receptors and resources against defined assessment criteria, to develop and describe measures that will be taken to avoid, minimise or compensate for any adverse environmental impacts, to enhance positive impacts, and to report the significance of residual impacts that occur following mitigation.

The key objectives of the risk assessment methodology are to identify any additional potential environmental issues and associated impacts likely to arise from the proposed project, and to propose a significance ranking. Issues / aspects will be reviewed and ranked against a series of significance criteria to identify and record interactions between activities and aspects, and resources and receptors to provide a detailed discussion of impacts. The assessment considers direct,[3] indirect,[4] secondary[5] as well as cumulative[6] impacts.

A standard risk assessment methodology is used for the ranking of the identified environmental impacts pre-and post-mitigation (i.e. residual impact). The significance of environmental aspects is determined and ranked by considering the criteria[7] presented in **Table 3-2**.

Table 3-2: Impact Assessment Criteria and Scoring System

CRITERIA	SCORE 1	SCORE 2	SCORE 3	SCORE 4	SCORE 5
Impact Magnitude (M) The degree of alteration of the affected environmental receptor	Very low: No impact on processes	Low: Slight impact on processes	Medium: Processes continue but in a modified way	High: Processes temporarily cease	Very High: Permanent cessation of processes
Impact Extent (E) The geographical extent of the impact on a given environmental receptor	Site: Site only	Local: Inside activity area	Regional: Outside activity area	National: National scope or level	International: Across borders or boundaries
Impact Reversibility (R) The ability of the environmental receptor to rehabilitate or restore after the activity has caused environmental change	Reversible: Recovery without rehabilitation		Recoverable: Recovery with rehabilitation		Irreversible: Not possible despite action
Impact Duration (D) The length of permanence of the impact on the environmental receptor	Immediate: On impact	Short term: 0-5 years	Medium term: 5-15 years	Long term: Project life	Permanent: Indefinite
Probability of Occurrence (P) The likelihood of an impact occurring in the absence of pertinent environmental management measures or mitigation	Improbable	Low Probability	Probable	Highly Probability	Definite

[3] Impacts that arise directly from activities that form an integral part of the Project.
[4] Impacts that arise indirectly from activities not explicitly forming part of the Project.
[5] Secondary or induced impacts caused by a change in the Project environment.
[6] Impacts are those impacts arising from the combination of multiple impacts from existing projects, the Project and/or future projects.
[7] The definitions given are for guidance only, and not all the definitions will apply to all the environmental receptors and resources being assessed. Impact significance was assessed with and without mitigation measures in place.

CRITERIA	SCORE 1	SCORE 2	SCORE 3	SCORE 4	SCORE 5
Significance (S) is determined by combining the above criteria in the following formula:	$[S = (E + D + R + M) \times P]$ $Significance = (Extent + Duration + Reversibility + Magnitude) \times Probability$				
IMPACT SIGNIFICANCE RATING					
Total Score	0 – 30		31 to 60		61 – 100
Significance Rating (Negative (-)	**Low (-)**		**Moderate (-)**		**High (-)**
Significance Rating (Positive (+)	**Low (+)**		**Moderate (+)**		**High (+)**

VISUAL IMPACT ASSESSMENT METHODOLOGY

The methodology for the assessment of potential visual impacts states the nature of the potential visual impact (e.g., the visual impact on users of major roads in the vicinity of the proposed infrastructure) and includes a table quantifying the potential visual impact according to the following criteria:

Extent - How far the visual impact is going to extend and to what extent it will have the highest impact. In the case of this type of development the extent of the visual impact is most likely to have a higher impact on receptors closer to the development and decrease as the distance increases.

- (1) Very low: Long distance > 150m
- (2) Low: Medium to long 100-150m
- (3) Medium: Short distance 50 - 100m
- (4) High: Very Short < 50m

Duration - The timeframe over which the effects of the impact will be felt.

- (1) Very short: 0-1 years
- (2) Short: 2-5 years
- (3) Medium: 5-15 years
- (4) Long: >15 years
- (5) Permanent

Magnitude - The severity or size of the impact.

- (0) None
- (2) Minor
- (4) Low
- (6) Moderate
- (8) High
- (10) Very High

Probability - The likelihood of the impact actually occurring.

- (1) Very improbable: Less than 20% sure of the likelihood of an impact occurring
- (2) Improbable: 20-40% sure of the likelihood of an impact occurring
- (3) Probable: 40-60% sure of the likelihood of an impact occurring
- (4) Highly probable: 60-80% sure of the likelihood of that impact occurring
- (5) Definite: More than 80% sure of the likelihood of that impact occurring

Significance - The significance weighting for each potential visual impact (as calculated above) is as follows:

- (0-12) Negligible:

  Where the impact would have no direct influence on the decision to develop in the area. The impact would be of a very low order. In the case of negative impacts, almost no mitigation and or remedial activity would be needed, and any minor steps, which might be needed, would be easy, cheap, and simple.
- (13-30) Low:

  Where the impact would have a very limited direct influence on the decision to develop in the area. The impact would be of a low order and with little real effect. In the case of negative impacts, mitigation and / or remedial activity would be either easily achieved or little would be required, or both.
- (31-60) Moderate:

  Where the impact could influence the decision to develop in the area. The impact would be real but not substantial. In the case of negative impacts, mitigation and / or remedial activity would be both feasible and fairly easily possible.
- (61-80) High:

  Where the impact must have an influence on the decision to develop in the area. The impacts are of a substantial order. In the case of negative impacts, mitigation and / or remedial activity would be feasible but difficult, expensive, time-consuming or some combination of these.
- (81-100) Very High:

  Where the impact will definitely have an influence on the decision to develop in the area. The impacts are of the highest order possible. In the case of negative impacts, there would be no possible mitigation and / or remedial activity possible.

The **significance** of the potential visual impact is equal to the **consequence** multiplied by the **probability** of the impact occurring, where the consequence is determined by the sum of the individual scores for magnitude, duration and extent (i.e., **significance = consequence (magnitude + duration + extent) x probability**).

Status – The perception of Interested and Affected Parties towards the proposed development.

- Positive
- Negative
- Neutral

Reversibility – The possibility of visual recovery of the impact following the decommissioning of the proposed development

- (1) Reversible
- (3) Recoverable
- (5) Irreversible

3.5.2 IMPACT MITIGATION

The impact significance without mitigation measures will be assessed with the design controls in place. Impacts without mitigation measures in place are not representative of the proposed development's actual extent of impact and are included to facilitate understanding of how and why mitigation measures were identified. The residual impact is what remains following the application of mitigation and management measures and is thus the final level of impact associated with the development. Residual impacts also serve as the focus of management and monitoring activities during Project implementation to verify that actual impacts are the same as those predicted in this report.

The mitigation measures chosen are based on the mitigation sequence/hierarchy which allows for consideration of five (5) different levels, which include avoid/prevent, minimise, rehabilitate/restore, offset and no-go in that order. The mitigation sequence/hierarchy is shown in **Figure 3-2** below.

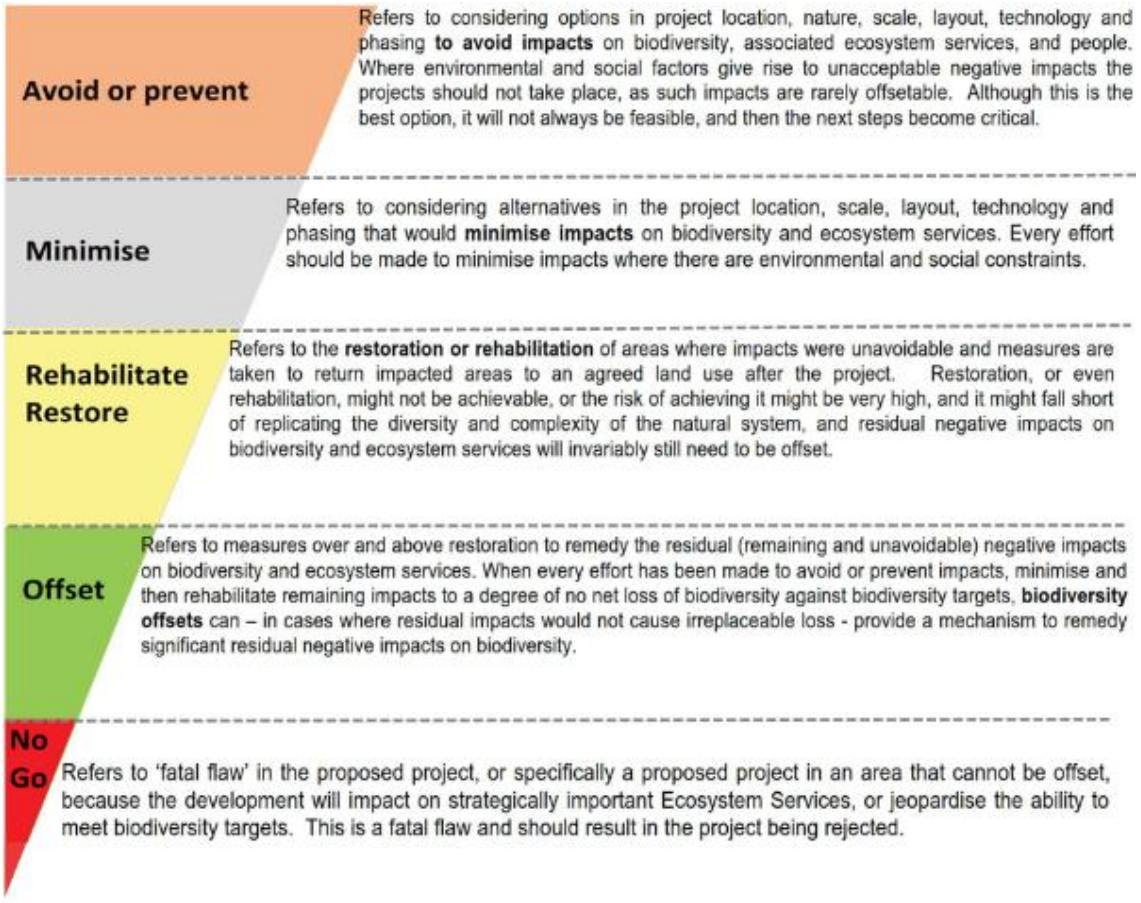

Figure 3-2: Mitigation Sequence/Hierarchy

The idea is that when project impacts are considered, the first option should be to avoid or prevent the impacts from occurring in the first place if possible, however, this is not always feasible. If this is not attainable, the impacts can be allowed, however they must be minimised as far as possible by considering reducing the footprint of the development for example so that little damage is encountered. If impacts are unavoidable, the next goal is to rehabilitate or restore the areas impacted back to their original form after project completion. Offsets are then considered if all the other measures described above fail to remedy high/significant residual negative impacts. If no offsets can be achieved on a potential impact, which results in full destruction of any ecosystem for example, the no-go option is considered so that another activity or location is considered in place of the original plan.

3.6 STAKEHOLDER ENGAGEMENT PROCESS

Stakeholder engagement (public participation) is a requirement of the BA process. It consists of a series of inclusive and culturally appropriate interactions aimed at providing stakeholders with opportunities to express their views, so that these can be considered and incorporated into the BA decision-making process. Effective engagement requires the prior disclosure of relevant and adequate project information to enable stakeholders to understand the risks, impacts, and opportunities of the proposed project. The objectives of the stakeholder engagement process can be summarised as follows:

- Identify relevant individuals, organisations and communities who may be interested in or affected by the proposed project;
- Clearly outline the scope of the proposed project, including the scale and nature of the existing and proposed activities;

- Identify viable proposed project alternatives that will assist the relevant authorities in making an informed decision;
- Identify shortcomings and gaps in existing information;
- Identify key concerns, raised by Stakeholders that should be addressed in the specialist studies;
- Highlight the potential for environmental impacts, whether positive or negative; and
- To inform and provide the public with information and an understanding of the proposed project, issues, and solutions.

A Stakeholder Engagement Report (SER) has been included in **Appendix D**, detailing the project's compliance with Chapter 6 of the NEMA EIA Regulations 2014, as amended.

3.6.1 STAKEHOLDER CONSULTATION

Refer to the SER (**Appendix D**) for details of the public participation plan and stakeholder consultation undertaken to date.

3.6.2 PUBLIC REVIEW

The Draft BAR was placed on public review for a period of 30 days from **28 July 2022** to **29 August 2022**, at the following public places:

- RIM website (https://www.robben-island.org.za/news#press); and
- WSP website (https://www.wsp.com/en-ZA/services/public-documents).

WSP have collated comments received during the public review phase (**28 July 2022** to **29 August 2022**) and compiled a comments and responses table (Table 2-4) which is captured within the Stakeholder Engagement Report (SER) that is attached to this Final BAR as **Appendix D**.

3.7 ASSUMPTIONS AND LIMITATIONS

General assumptions and limitations relating to the BA process are listed below:

- The information provided by RIM and the specialists is assumed to be accurate;
- WSP's assessment of the significance of impacts of the proposed project on the affected environment has been based on the assumption that the activities will be confined to those described in **Section 4**. If any substantial changes to the project description are made, impacts may need to be reassessed;
- Where detailed design information is not available, the precautionary principle (i.e. a conservative approach that overstates negative impacts and understates benefits) has been adopted;
- The competent authority would not require additional specialist input, as per the proposals made in this report, in order to make a decision regarding the application; and
- All information is assumed to be accurate and relevant at the time of writing this report.

Key assumptions and limitations relevant to the specialist assessments include:

- Archaeology
  - N/A.
- Marine Outfall
  - The existing marine outfall is fully functional as designed.
  - It is assumed that the effluent generated from the proposed new WWTW complies with the General Limit Values (GNN 665 of 2013).
- Marine Ecology
  - The treated effluent generated by the new WWTW 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. An exception to this is potential construction impacts to breeding seabirds in the vicinity of the proposed WWTW.

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

— Odour

- Unless otherwise stated, design and operational information was provided by RIM. Any errors, limitations, or assumptions inherent in these datasets extend to this study.
- The capacity of the proposed WWTW is 200 kl/day.
- WWTW component dimensions were extracted from technical drawings and the Google Earth files provided by RIM. Where component dimensions conflicted, the Google Earth imagery was assumed to be accurate as it depicts the component size within the available development space in which it is expected to fit.
- Facility wide NH3 emission rates were apportioned between the individual WWTW components based on the proportional surface area of each component.
- H2S emission rates were back calculated using quantified odour emission rates and an H2S ODT of 0.2 µg/m3. This assumes that 1 OUE is equivalent to an H2S concentration of 0.2 µg/m3 and that the odorous emission mixture comprises 100% H2S.
- Dispersion modelling simulated the dispersion of odour and constituent gases (specifically NH3 and H2S) under a normal operating scenario (as designed) only. This ORA does not account for upset conditions (including maintenance periods) or alternative design scenarios.
- The vapour space within covered or enclosed components of the proposed WWTW are assumed to reach a state of equilibrium and thus were not assessed as potential odour sources. Odorous gases will be released when component covers are removed for access or maintenance reasons. Although this will be transient, maintenance should be scheduled.

— Palaeontology

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

- Visual
  - This assessment was undertaken during the planning stage of the project and is based on information available at that time. It is assumed that all information regarding the project details provided by the Applicant is correct and relevant to the proposed project. This desktop screening Visual Impact Assessment and all associated mapping has been undertaken according to the worst-case scenario without any layout provided.

4 PROJECT DESCRIPTION

This section provides a description of the location of the project area and the site location alternatives considered for the project. The descriptions encompass the activities to be undertaken during the construction and operational phases as well as the consideration for site accessibility, water demand, supply, storage, and site waste management. This section also considers the need and desirability of the project in accordance with Appendix 1 of GNR 326.

4.1 LOCATION OF THE PROPOSED PROJECT

The site is located on Robben Island which is a World and National Heritage Site. Robben Island is situated in Table Bay, approximately 10 km north of the V&A Waterfront in Cape Town. The island covers an area of 5.18 km^2 and is relatively flat, only a few meters above sea level. The proposed WWTW falls within Ward 54 of the City of Cape Town Municipality, which is located in the Western Cape Province. The SG Digit Code is C01600000000143600000.

The proposed WWTW is located on the eastern side of Robben Island. The site is bounded to the northeast by Murray's Bay beach (80 m), to the north by the Dog Unit (Robert Sobukwe House) (30 m), to the west by Murray's Road (50 m) and to the south by the Robben Island village (400 m) and nearby sensitive ecosystems. The land is not currently used for any purpose and is a vacant piece of land.

Table 4-1 below provides the corner co-ordinates of the proposed WWTW infrastructure.

Table 4-1: Co-ordinates of corner points of the WWTW

CORNER	LATITUDE	LONGITUDE
NW corner	33°48'15.98"S	18°22'35.84"E
NE corner	33°48'15.63"S	18°22'36.44"E
SE corner	33°48'17.04"S	18°22'37.81"E
SW corner	33°48'17.47"S	18°22'37.20"E

A pipeline already exists from the WWTW 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 (**Table 4-2**), are reflected on **Figure 4-1**.

Table 4-2: Co-ordinates of the existing pipeline

PIPELINE	LATITUDE	LONGITUDE
Starting Point (A)	33°48'14.83"S	18°22'37.68"E
Middle (B)	33°48'17.87"S	18°22'40.33"E
End (C)	33°48'20.08"S	18°22'43.35"E

Figure 4-1 and **Figure 4-2** below indicate the layout of the proposed WWTW infrastructure.

Figure 4-1: Layout of the WWTW and existing sewer outfall

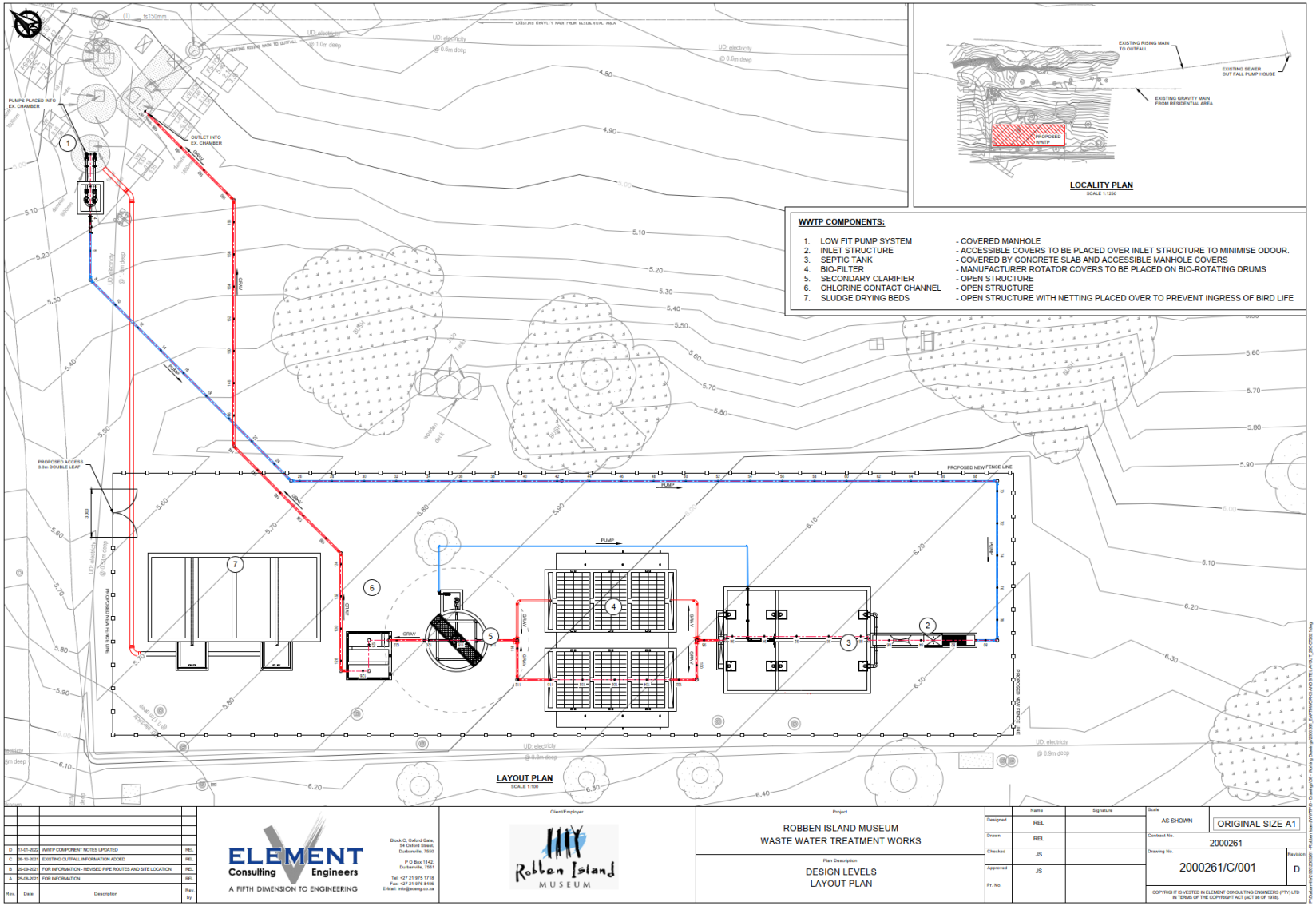

Figure 4-2: Layout of the Proposed WWTW infrastructure

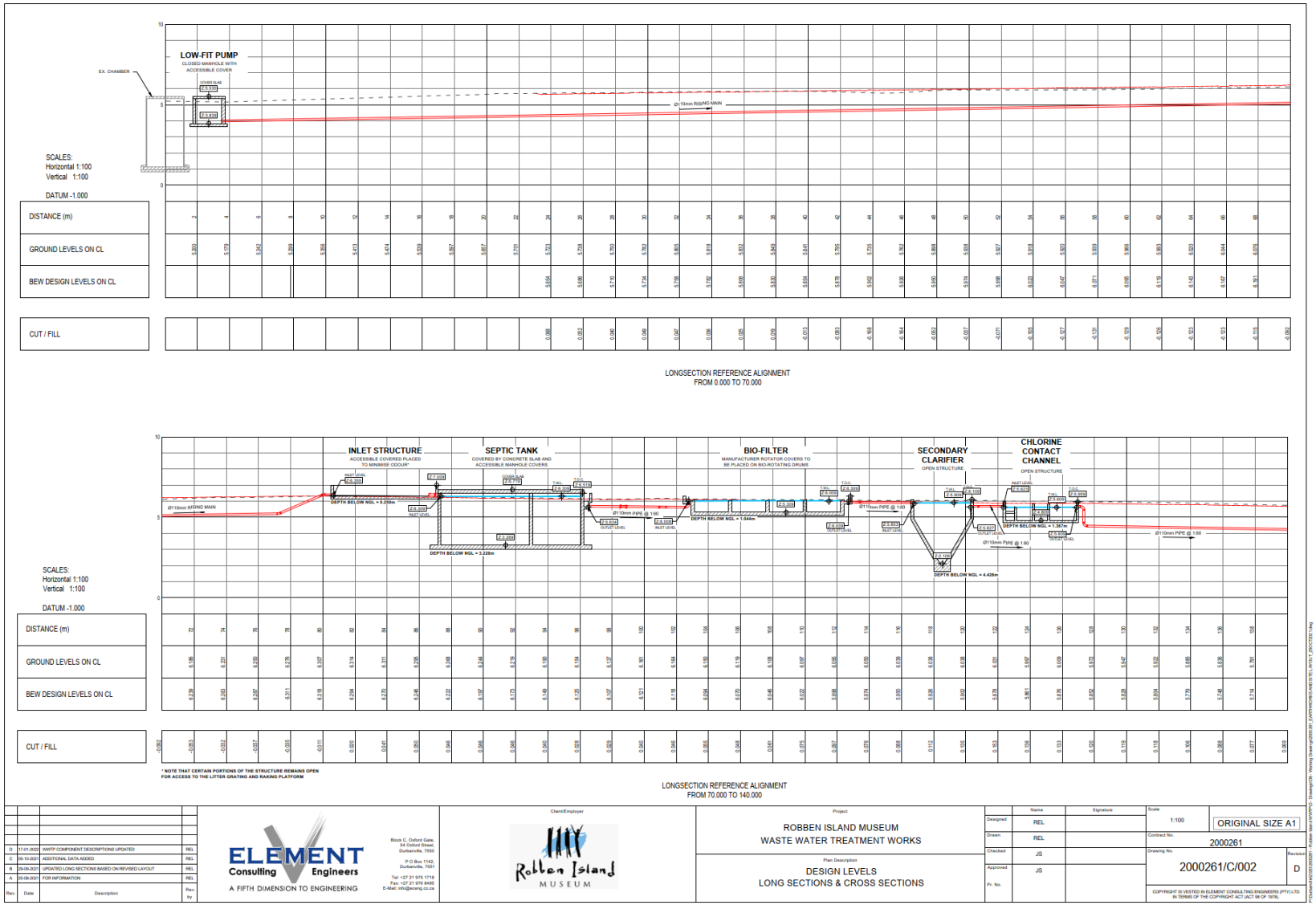

Figure 4-3: Cross-section of the Proposed WWTW Infrastructure

4.2 PROJECT INFRASTRUCTURE

Element Consulting Engineers (ECE) were appointed on 26 February 2020 by RIM to design and implement the proposed Wastewater Treatment Plant. A Design Report was prepared by ECE in March 2021.

As indicated above, an IEA was secured for the proposed infrastructure in 2015 (DFFE Ref: 14/12/16/3/3/3/83). The details of the WWTW described within the EA were for a WWTW with a treatment capacity of 108,000 m^3 per annum with all the effluent generated on the island discharged via a marine outfall into the coastal environment after treatment. The design allowed for a maximum discharge volume of 300m^3 per day. ECE have amended the design with the following key changes:

- The daily throughput capacity has been decreased from 300m^3 a day to 200m^3 a day. However, the plant is scalable, which means that additional units can be added to increase the capacity of the plant, if required in future. The current application for IEA is therefore for approval of a WWTW with a throughput capacity of 300m^3 per day to accommodate for a potential future scenario.
- Phosphate removal is no longer incorporated at the Robben Island WWTW. Phosphate removal is generally not considered necessary when general limits must be achieved.
- The location of the land-based WWTW infrastructure has been moved further inland (westwards), resulting in a smaller overall footprint of 1070m^2.
- The facility is no longer fully enclosed in a box and submerged. Certain components of the WWTW will be covered and the facility will be above ground.

Figure 4-4 below provides an illustrative example of the proposed WWTW infrastructure and **Figure 4-5** shows a 3D rendering of the proposed WWTW on Robben Island.

Figure 4-4: Typical example of WWTW

Figure 4-5: 3D rendering of the proposed WWTW for Robben Island

The following section is extracted from the Design Report (March 2021) prepared by ECE and describes the primary components of the proposed WWTW infrastructure.

4.2.1 INLET STRUCTURE

Raw sewage will flow through a simple civil concrete inlet structure upstream of the primary settling tank with a hand rake screen which provides a facility to remove non-organic objects from the sewage (**Figure 4-6**). The screen must be cleaned daily with a rake and the screenings disposed of in a solid waste bin. Any grit entering the WWTW will settle in this primary settling tank and be removed with the settled sludge.

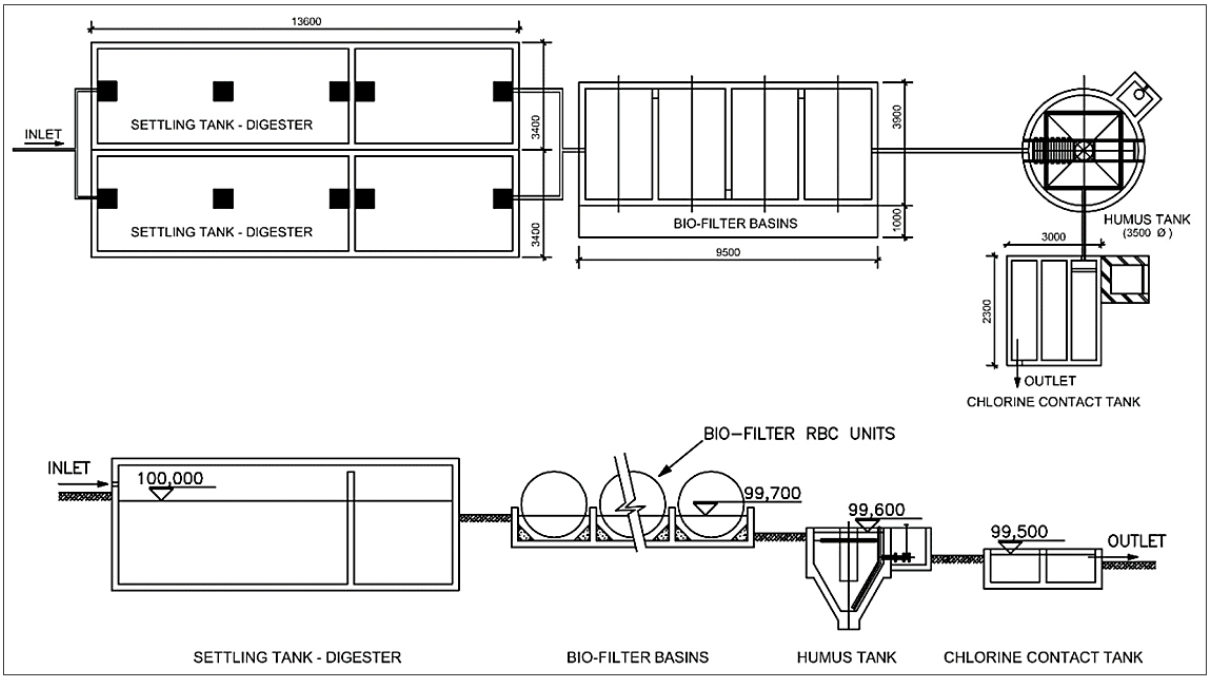

Figure 4-6: Schematic layout of the proposed WWTW

4.2.2 PRIMARY SETTLING TANK (ANAEROBIC AND ANOXIC REACTOR)

After screening, raw sewage will flow into a septic tank. The capacity of the septic tank should allow for at least 24 hours retention of the Average Wet Weather Flow (AWWF). Therefore, a capacity of 200 kl will be provided. The septic tank will make provision for the accumulation of settled material and has design features incorporated to ensure that this activity does not cause unnecessary blockages across the tank.

The septic tank will comprise two chambers:

- Anaerobic Primary Settler- oxidation and gross removal of organic material by settlement.
- Anoxic second settler- allows for de-nitrification to take place during which nitrogen is removed and the organic material is further reduced.

4.2.3 ROTATING BIOLOGICAL CONTACTORS (AEROBIC REACTOR)

From the septic tank, the sewage will gravitate to the Rotating Biological Contactors (RBCs) within the aerobic reactor where further organic reduction and ammonia nitrification is achieved under aerobic conditions (**Figure** 4-7**).** The aerobic conditions are achieved by the rotation of discs, on which the micro-organism are attached and growing, at a low speed of approximately 3 to 4 RPM. There will be six rotors, each capable of treating 30 kl of domestic sewage per day.

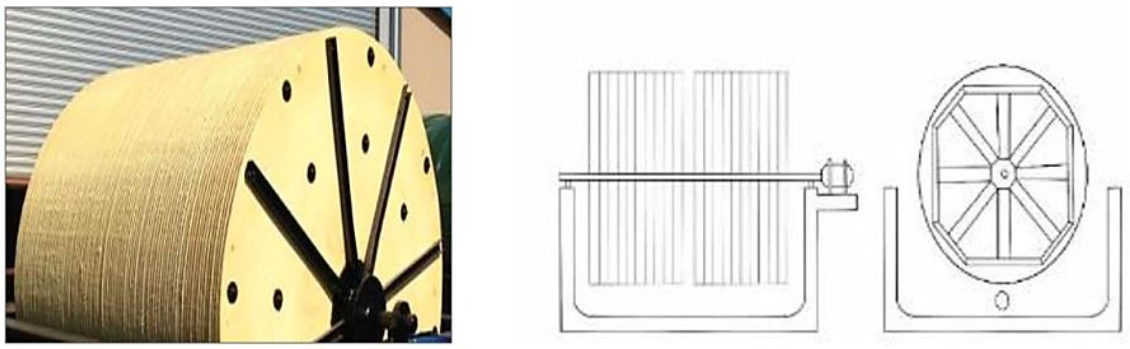

Figure 4-7: Illustrative representation of Rotating Biological Contactors

4.2.4 SECONDARY SETTLING TANK (HUMUS TANK)

From the RBC, sewage will gravitate to the secondary settling tank or humus tank (**Figure 4-8**) where settleable sludge will be removed under gravity to a sludge sump from where it will be recycled with a de-sludge pump to the first chamber of the septic tank for anaerobic digestion. Phosphate removal will not be incorporated at the Robben Island WWTW.

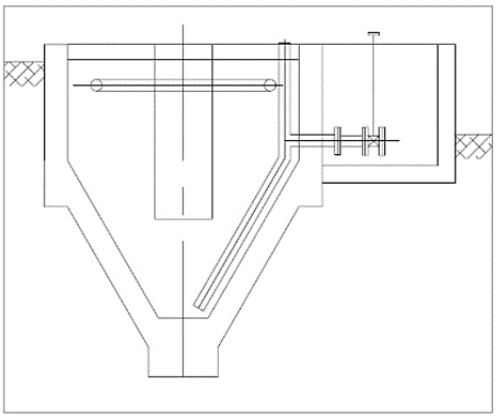

Figure 4-8: Cross Section of the Humus Tank

4.2.5 DISINFECTION

The effluent from the secondary settling tank will gravitate to the chlorine contact channel where it will be dosed with a disinfectant. This will be done by means of a pod system and dosing by means of chlorine tablets. The chlorination contact channel will be sized to ensure at least 30 minutes contact time between the effluent and the disinfectant at the AWWF.

4.2.6 RISING MAIN FOR FINAL EFFLUENT REUSE

Intermittently flushing of the sewer pipelines is required to clean pipelines to prevent clogging due to low sewage flow condition. The proposal is to flush the pipelines with water that is abstracted from the WWTW or thee pump station sump to sea and to use this to flush the system where required by means of a tanker.

Treated effluent will gravitate to the existing sewage collector sump at the proposed WWTW site from where it will be pumped along the existing outfall sewer pipeline to discharge through a diffuser 465 m offshore. The proposed WWTW will deliver treated effluent that conforms to the DWA general wastewater limit values, as shown in **Table 4-3**, to enable release into the environment. **Table 4-3** has been amended to correctly reflect the Wastewater limit values applicable to discharge of wastewater into a water resource, as per GN 665, September

2013, Revision of General Authorisations in terms of Section 39 of the National Water Act, 1998 (Act no. 36 of 1998). It is noted that the marine environment General Authorisation Regulations (promulgated in July 2022) provide new updated General and Special Standard Limits specifically for the General Authorisation process for the marine environment. However, these 2022 limits are generally a lot less stringent that the earlier 2013 limits that were focussed on generally freshwater and estuarine environments (i.e. water resources). As such, the supporting specialist studies and associated recommendations have made reference to the more stringent limits ensuring a more conservative approach to the assessment.

Table 4-3: Limits of Determinates in Discharged Effluent

SUBSTANCE / PARAMETER	LIMIT
Faecal Coliforms (per 100 ml)	1000
Chemical Oxygen Demand (mg/l)	75
PH	5.5-9.5
Ammonia (ionized and un-ionized) as Nitrogen (mg/l)	6
Nitrate/Nitrite as Nitrogen (mg/l)	15
Chloride as Free Chloride (mg/l)	0.25
Suspended Solids (mg/l)	25
Electrical Conductivity (mS/m)	70 mS/m above intake
Orthophosphate 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

4.2.7 SLUDGE MANAGEMENT

Surplus matter (i.e. settled sludge) will be processed through a sludge management system (as required). It is anticipated that the WWTW will generate approximately 66 m^3 of settled sludge annually, 70% of which will be water. The system will include drying beds for sun and wind assisted sludge drying. For this purpose, the beds must remain uncovered; however, netting will be placed over the drying beds to prevent the ingress of birdlife.

4.3 PROCESS FLOW

Figure 4-9 below provides a process flow diagram of the proposed WWTW.

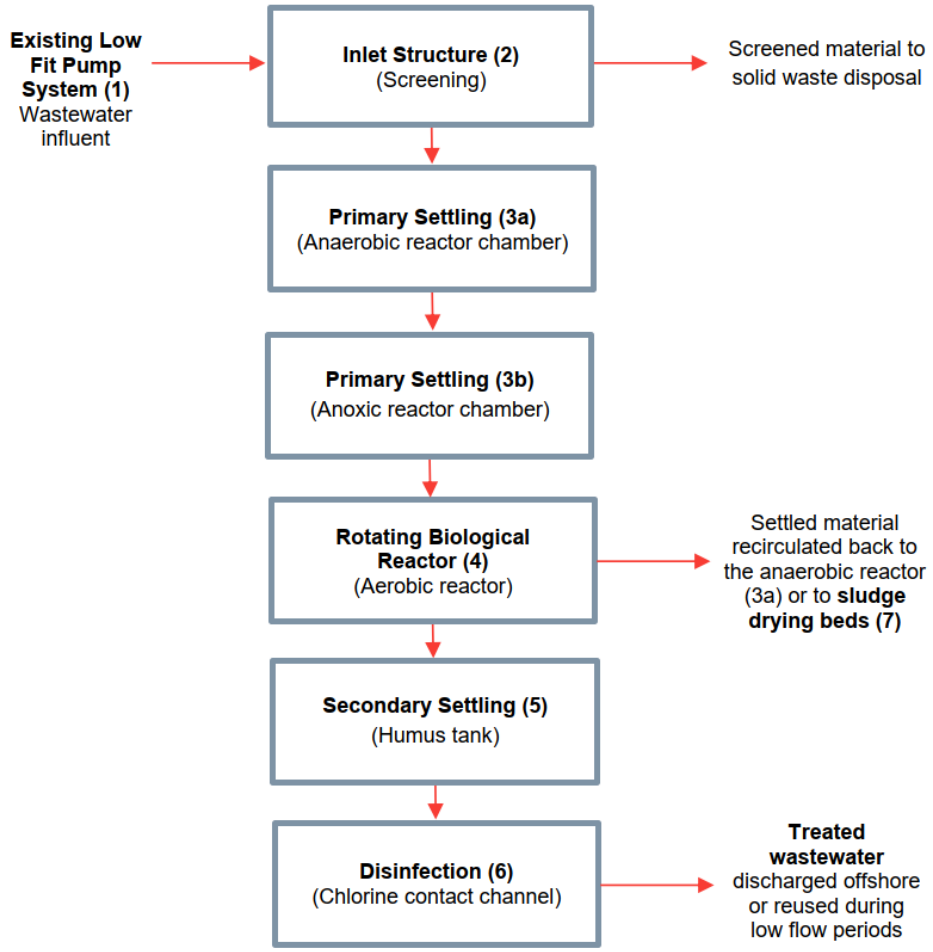

Figure 4-9: Process Flow for the Proposed WWTW

4.4 PROPOSED PROJECT DEVELOPMENT ACTIVITIES

4.4.1 CONSTRUCTION PHASE

CONSTRUCTION SCHEDULE

Construction is anticipated to take 6 months from appointment of a contractor. The construction period includes excavation, concrete works, assembly, backfilling and finishing.

LABOUR REQUIREMENTS

During site preparation and installation of Project related infrastructure, the selected Contractor, working on behalf of Robben Island, is anticipated to require 20-30 people to undertake the required works. Approximately 5% of workers would be highly skilled, 15% medium skilled, and 80% low skilled.

SITE ESTABLISHMENT AND TRANSPORTATION OF MATERIALS AND EQUIPMENT TO SITE

The selected Contractor will establish a temporary site camp including, but not be limited to laydown areas for equipment and materials, storage facilities, ablutions and waste storage and handling area (**Figure 4-10**). The location and extent of the Contractors camp, to be established within the Project area, will be undertaken in line with specifications detailed within the EMPr. Temporary fencing will be established around the construction site and material storage area.

Plant equipment and 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, inter alia, concrete sand, crushed concrete stone, cement, pre-fabricated modular units of package plant, pipes and fittings and shutter boards for concrete pouring.

Construction waste will be stored on site in a designated and demarcated area within appropriate receptacles. 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. Hazardous waste will be delivered to a licensed hazardous landfill facility.

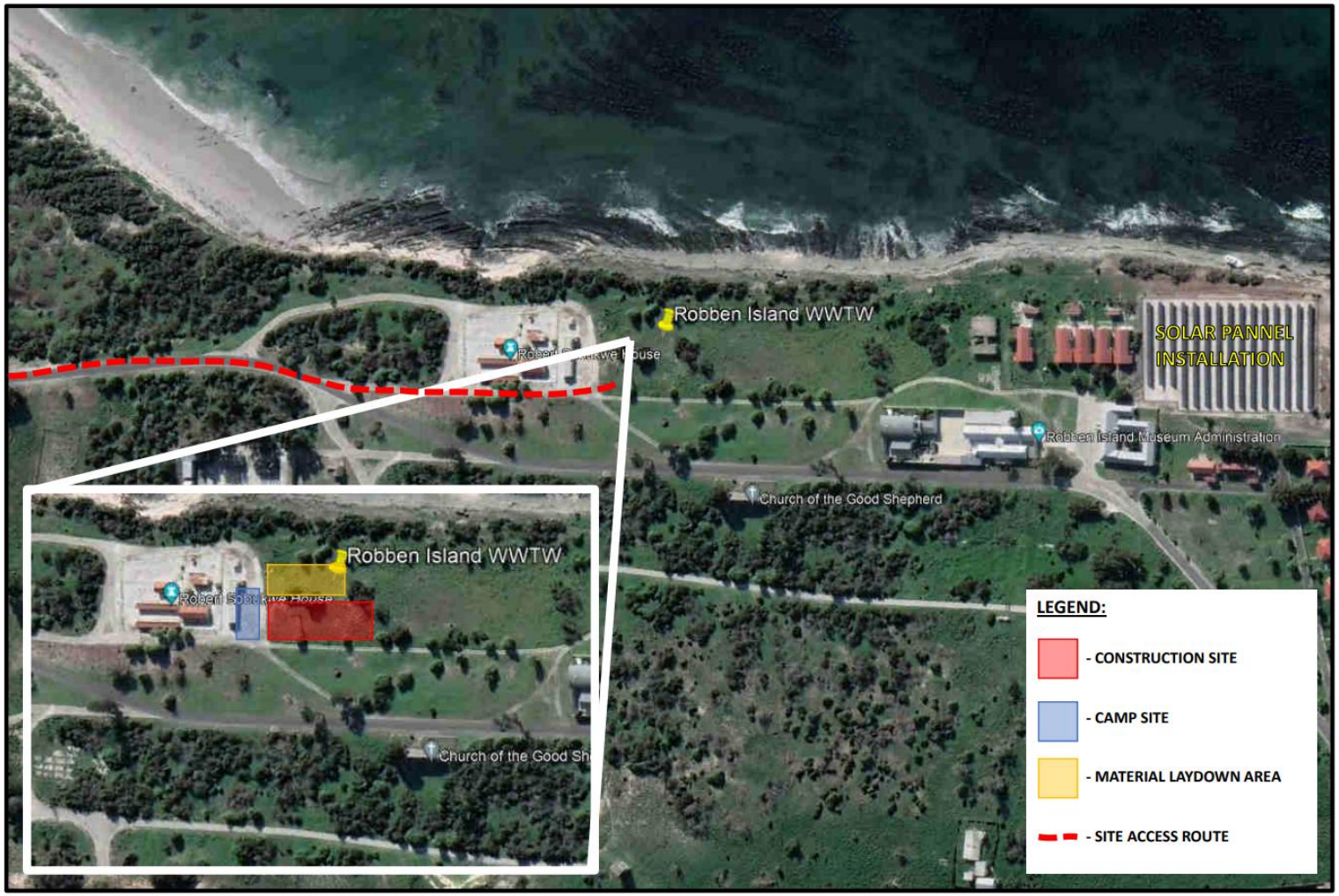

Figure 4-10: Site Locality Map and Construction Camp Layout

VEGETATION CLEARING

Due to the nature of the vegetation within the Project area, which is predominantly low bushes and grass, limited vegetation clearing will be required. Clearing of vegetation will be limited to the WWTW footprint area. Only one dead tree, in the northwest of the footprint will be removed as a result of the WWTW, no other shrub or tree will be removed. As confirmed by the DFFE: Forestry Management, no protected trees species and/natural forests are present on the development site.

EXCAVATIONS

The WWTW will be submerged and excavations will therefore be required. Excavations will vary from 3 to 5m deep across the footprint of the WWTW to ensure that there is a gravity feed from the south to the north of the plant. Approximately 450 to 500m^3 of excavated material (spoil) will be generated as a result of excavations. Excavated material will be used to create a planted earth mound/berm along the western perimeter of the development envelope. This mound will be organically designed to resemble a natural topographic feature ('dune shaped') (See **Section 9.1.6** for more detail).

INSTALLATION OF WASTEWATER TREATMENT PLANT

The installation of the WWTW will entail the assembling of modular units of the plant and securing these to a concrete floor, installation of the internal pipe reticulations and fittings and backfilling around the WWTW to the required level using excavated material. Trenches will also be required to be excavated for all subsurface pipework, including the effluent pipe from inlet sump to plant, the pipe carrying treated effluent from plant to outfall pump sump, the pipe carrying sludge from plant to drying beds and the pipe carrying seepage from the drying beds to the inlet sump.

The pipeline to the existing outfall will not be replaced/constructed. The temporary fencing will be dismantled once construction of the WWTW is complete and a permanent perimeter "penguin proof" security fence will be erected around the WWTW infrastructure.

DEMOBILISATION

Upon completion of the installation phase, any temporary infrastructure will be removed, and the affected areas rehabilitated.

4.4.2 OPERATIONAL PHASE

RIM will be responsible for managing the operations of the WWTW.

WASTE MANAGEMENT

Liquid Waste

Treated effluent will gravitate to the existing sewage collector sump at the proposed WWTW site from where it will be pumped along the existing outfall sewer pipeline to discharge through a diffuser 465 m offshore.

RIM applied for this in 2015. Due to the fact that an assessment framework was to be compiled and there was a huge backlog of applications, the CWDP for Robben Island was not issued. In 2020/21 financial year the application was reviewed, and a draft decision issued to RIM. This decision will be finalised and issued following the determination on this current Environmental Authorisation application taking note of the changes in the WWTW design. The DFFE: Oceans and Coasts have commented on the current application and have advised that RIM must adhere to the current license that was issued by DWS until the CWDP has been issued. After the environmental authorisation for the current application has been issued, then the Department will finalise the application for a CWDP, based on the information for the upgraded WWTW.

Solid Waste

Some solid waste will be generated at the inlet from the hand rake screen which serves the purpose of retaining non-organic solid material which enters the effluent stream. This will be removed from the island and taken to a licensed hazardous landfill site.

Additionally, as a by-product of the process, an estimated 66m^3 of sludge will be generated annually, approximately 70% of which will be water. 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 located directly adjacent to the facility for sun and wind assisted sludge drying. For this purpose, the beds must remain uncovered; however, netting will be placed over the drying beds to prevent the ingress of birdlife.

According to the Sewage/Sludge Status Quo Report (2020/21) produced by the Western Cape Department of Environmental Affairs and Development Planning (DEA&DP), the waste from the drying bed will be able to be used as fertiliser. However, this will need to be confirmed through appropriate testing before the sludge can be used as fertiliser.

According to section 4(2) of GN R.634 of 2013 (DEA(a), 2013), all waste generators must ensure that their waste is classified in accordance with SANS 10234 (based on the Global Harmonised System) within 180 days of generation, except if it is listed in Annexure 1 (Wastes that do not require Classification and Assessment) of GNR 634. Furthermore, waste must be re-classified every 5 years.

Once the WWTW is operational, RIM will be responsible for ensuring that the sludge is tested (within 180 days) to ensure that the content of heavy metals is within acceptable limits in line with the Sewage/Sludge Status Quo Report (2020/21). If the results of the testing confirm that the sludge is suitable to be used as fertiliser as is anticipated, then a maximum of 10m^3 of dried sludge per year will be spread out over an area adjacent to the WWTW, 15 or 20 mm thick, depending how wide it is spread or throughout the island as required.

Should the results of the testing indicate that the sludge is not suitable to be used as fertiliser, then the sludge will be disposed of appropriately at a licensed landfill site or to a municipal WWTW off the island.

4.4.3 DECOMMISSIONING PHASE

Decommissioning will be considered when the WWTW is regarded obsolete and will be subject to a separate authorisation and impact assessment process. This is not expected to occur in the near future.

4.5 SITE ACCESS AND SERVICES

Access to the proposed site is available via the existing Murrays Bay Road. Small volumes of water will be required for the WWTW, which will be sourced from the existing water supplied by the island's desalination plant. There is an existing electrical supply and sewer connection. The proposed WWTW 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 WWTW, to minimise pumping energy demand. Aeration blowers and pumps are efficient low energy demand installations.

4.6 NEED AND DESIRABILITY OF THE PROJECT

The DEA&DP Guideline (2013) states that the essential aim of need and desirability is to determine the suitability (i.e. is the activity proposed in the right location for the suggested land-use/activity) and timing (i.e. is it the right time to develop a given activity) of the development. Therefore, need and desirability addresses whether the development is being proposed at the right time and in the right place. Similarly, the 'Best Practicable Environmental Option' (BPEO) as defined in NEMA is "*the option that provides the most benefit and causes the least damage to the environment as a whole, at a cost acceptable to society, in the long term as well as in the short term.*"

There is currently no formal WWTW on Robben Island. All sewage is pumped by six pump stations to a collection sump near Robert Sobukwe's former residence, where it is macerated and pumped along the outfall sewer pipeline to discharge through a diffuser 465 m offshore.

The site is located on Robben Island which is a National and World Heritage Site. In order for the island to continue to be utilised as an educational and cultural heritage resource, it is vital that the proposed WWTW is constructed given that 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.[8] A competent sewage management service will mitigate and minimise environmental and human health risks posed by untreated sewage discharges. The approval of the WWTW would not compromise the integrity of the existing environmental management priorities of the island. The WWTW 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.

The population of Robben Island is around 116 persons. The majority of people visiting the island are tourists and school groups. The WWTW 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 NEMICMA. 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.

The land on which the WWTW will be constructed is considered suitable and in line with the land use required as it is in close proximity to the existing sea outfall and pump stations and sewer influent collection pump, it is located away from sensitive areas on the island e.g. quarries, prison, tourist congregation areas/ walkways, harbour and there is existing road access and service availability. No physical or economic displacement will be required.

The proposed WWTW is supported by prevailing policies and plans (refer to **Section 2**). Furthermore, negative environmental impacts associated with the activity will be mitigated to acceptable levels in accordance with the EMPr (**Appendix G**). Refer to **Section 7** below for the Environmental Impact Assessment and recommended mitigation measures.

[8] http://whc.unesco.org/en/soc/1432

5 PROJECT ALTERNATIVES

In terms of the EIA Regulations, feasible alternatives are required to be considered. All identified, feasible alternatives are required to be evaluated in terms of social, biophysical, economic, and technical factors. A key challenge of the BA Process is the consideration of alternatives. Most guidelines use terms such as 'reasonable', 'practicable', 'feasible' or 'viable' to define the range of alternatives that should be considered.

Effectively there are two types of alternatives:

- Incrementally different (modifications) alternatives to the project; and
- Fundamentally (totally) different alternatives to the project.

"Alternatives", in relation to a proposed activity, means different ways 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 (i.e. no-go).

The relevant alternatives to the proposed Project are discussed below.

5.1 ACTIVITY ALTERNATIVE

There is currently no formal WWTW on Robben Island. All sewage is pumped by six pump stations to a collection sump near Robert Sobukwe's former residence, where it is macerated and pumped along the outfall sewer pipeline to discharge through a diffuser 465 m offshore.

Activity alternatives considered for the Project are briefly detailed below.

RETICULATION TO MUNICIPAL SEWAGE TREATMENT PLANT

The nearest Municipal Wastewater Treatment Plant, 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.

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.

WASTEWATER TREATMENT WORKS

The preferred activity alternative is effluent treatment via a small on-site WWTW (as described) where treated effluent is released via an existing outfall.

Only one activity has been assessed (i.e. WWTW). Alternative activities for the current Project are not reasonable or feasible as the purpose of this Project is to treat and discharge effluent generated on Robben Island in a way that does not pose a significant risk to environmental and human health.

5.2 TECHNOLOGY ALTERNATIVES

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 40days 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.

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 not deemed preferable due to the fact that activated sludge systems usually are not typically positioned underground, and therefore create a greater visual impact. Furthermore, an activated sludge plant is not suited to a small community with a large number of guests (tourists) only during peak hours.

SUBMERGED BIOMEDIA TECHNOLOGY

Submerged Biomedia Technology was the preferred technology assessed as part of the 2015 BA process undertaken by WSP and approved in the 2018 EA (Ref: 14/12/16/3/3/3/83). Submerged Biomedia Technology is based on the Ampac® Submerged Aeration Media (SAM) modular treatment unit. This technology, developed by Amitek, is a wastewater treatment solution specifically designed for use in situations where there is no municipal sewage infrastructure.

Interlinked stages in the process 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.

This technology alternative would be submerged and fully enclosed. This alternative is not preferred as it requires deep excavations. Excavations of this scale are very costly and would require large machinery to be transported to the island in order to break the rock required as part of excavations, which is not practical. Furthermore, deep excavations may result in ponding and the ingress of water given the close proximity of the site to the coastline.

The potential for ongoing water abstraction costs and higher maintenance costs was considered another detractor from this alternative.

ROTATING BIOLOGICAL CONTACTOR TECHNOLOGY (PREFERRED ALTERNATIVE)

Rotating biological contactor technology is considered the preferred wastewater treatment solution for this project, offering the best balance between robustness, a relatively small footprint, simple and low-cost operation and maintenance with low power requirements, lesser visual and noise impact and a plant which produces a final effluent of acceptable quality.

The plant is also scalable, which means that additional RBC units can be added to increase the capacity of the plant, if required in future. The plant will be constructed complete with preceding reinforced concrete septic tank, a humus tank, recycling pumps, disinfection infrastructure and sludge drying beds.

This process is relatively silent, has a low sludge production and requires a small area for development. It also has very low electricity consumption requirements. As this alternative is not fully submerged, deep excavations are avoided, which limits ponding and unwanted ingress of stormwater into the system as well as significantly reduces costs. Furthermore, this technology is more suitable for low volumes of wastewater, such as those expected for Robben Island.

Only one technology has been assessed as part of this BA process, namely rotating biological contactor technology, as this is considered the most appropriate technology.

5.3 LOCATION ALTERNATIVES

Only one location has been considered for the placement of the WWTW (see **Figure 1-1**). The site is located on 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 (500m).

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 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.
- The site is accessible via Murray's Bay Road and existing jeep tracks.
- The site location maintains an appropriate distance from Robben Island Village.

No further alternatives were considered for the location of the WWTW due to the fact that the WWTW must be located in close proximity to the existing marine outfall and collection sump. Furthermore, the WWTW site was previously considered acceptable as it was authorised in the 2018 EA (Ref: 14/12/16/3/3/3/83).

5.4 LAYOUT ALTERNATIVES

Two alternative layouts were considered for the proposed WWTW on Robben Island (**Figure 5-1**). These include:

- Option 1: L-shaped layout of 1470m^2, approximately 30m from the coastline at its closest point; and
- Option 2: Rectangular layout of 1070m^2, approximately 70m from the coastline at its closest point (preferred alternative).

As part of the detailed design, consideration was given to the land survey data and the proposed gravity feed requirements of the treatment works. For the original proposed layout that was considered (Option 1), the contours are flat. However, the WWTW works on a gravitational basis and the inlet would therefore need to be lifted in order for the design to work. This would present a visual impact. In addition, once the water is treated, it would need to be pumped back to the outlet to reach the outfall, which would incur additional costs. A WWTW layout further inland (westwards) and with a smaller overall footprint was therefore considered (Option 2).

The proposed WWTW layout selected as the preferred alternative and assessed within this BAR was selected considering the following primary factors:

- Smaller footprint of the WWTW (1070m² versus 1470m²);
- The WWTW relies on gravitational flow and the preferred alternative provides a higher starting point thus allowing the WWTW to better utilise gravitational flow and tie into existing infrastructure;
- Deep excavations are avoided (limits ponding and unwanted ingress of stormwater into the system);
- Rock excavations are avoided (reduces cost);
- Increased distance from the high-water mark; and
- Higher elevation means reduced impact of groundwater on WWTW.

Based on the above, Option 2 was selected as the preferred alternative for the proposed Project. Only the preferred alternative has been assessed in detail in the BAR.

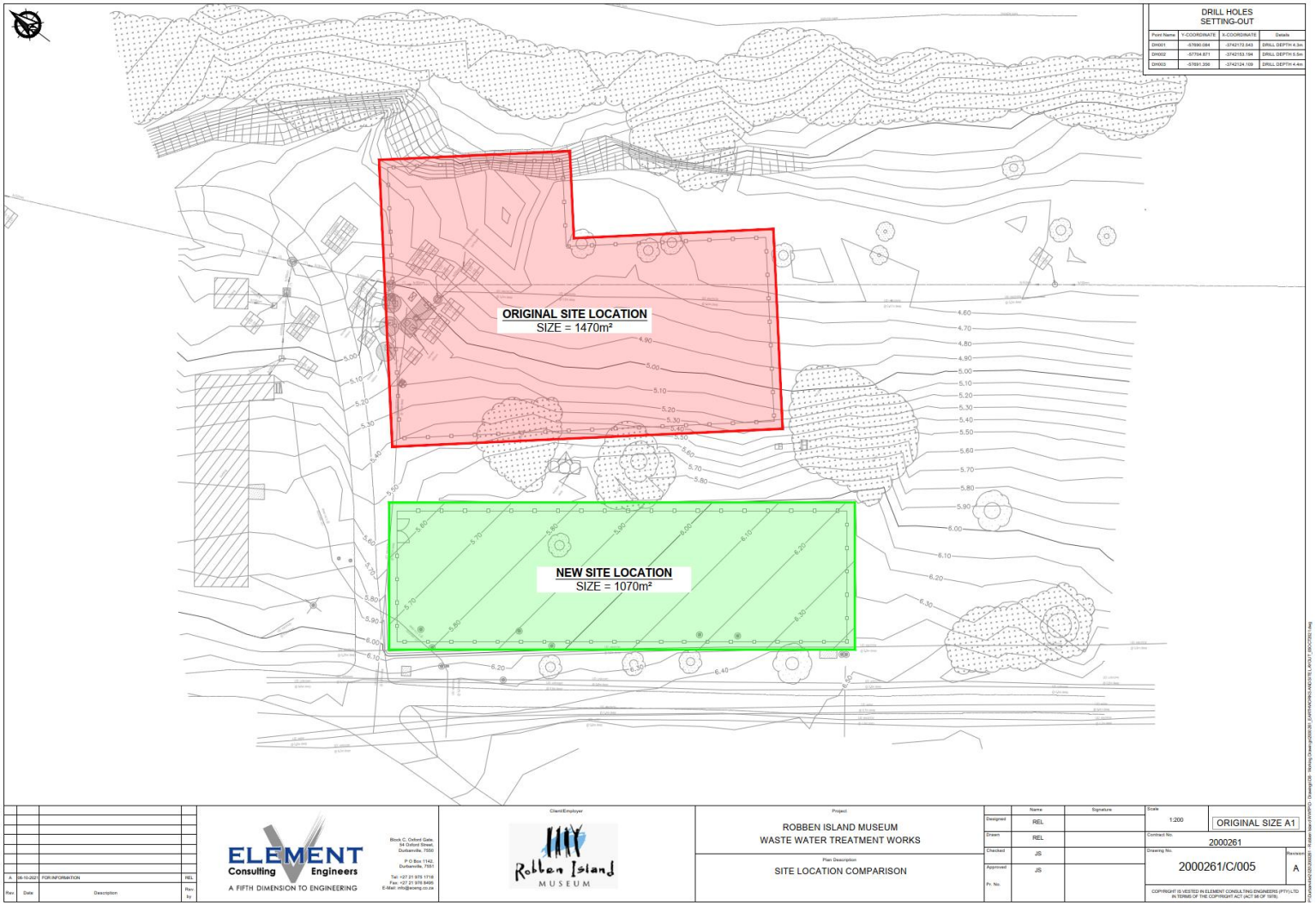

Figure 5-1: Alternative layouts considered for the WWTW

5.5 NO-GO ALTERNATIVE

The no-go alternative is that no WWTW is developed and there is thus no effluent treatment capability on Robben Island. This alternative would entail the continuation of the 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 wastewater 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 discharge limits set by the DFFE, required in terms of a Coastal Waters Discharge Permit in terms of NEMICMA 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 DFFE 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 and Marine Protected Area. This was noted by UNESCO in 2004.[9] As such, the No-Go alternative is not considered a preferred alternative and is not deemed viable.

[9] http://whc.unesco.org/en/soc/1432

6 BASELINE ENVIRONMENT

The following chapter presents an overview of the biophysical and socio-economic environment in which the proposed Project is located. It is important to gain thorough appreciation of the Project area and its surroundings, as it will provide for a better understanding of the receiving environment in which the Project is being considered.

The description of the baseline environment is essential in that it represents the conditions of the environment before the construction of the proposed Project (i.e. the current, or status quo, environment) against which environmental impacts of the proposed Project can be assessed and future changes monitored.

The area has previously been studied to some extent and is recorded in various sources. Consequently, some components of the baseline have been generated based on literature review. However, where appropriate, baseline information has been supplemented or generated by specialists appointed to undertake baseline and impact assessments for the proposed Project.

The following characteristics of the receiving environment for the proposed Project area are described in **Table 6-1** below.

Table 6-1: Characteristics of the receiving environment

RECEIVING ENVIRONMENT	CHARACTERISTICS
Terrestrial Biophysical	Climate Topography Geology and Soils Groundwater Surface Water Marine Environment Vegetation Fauna Avifauna Conservation Areas
Social and Economic	Socio-Economic Heritage, Archaeological and Cultural Sites Palaeontology Landscape and Visual

6.1 BIOPHYSICAL ENVIRONMENT

6.1.1 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 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.

6.1.2 TOPOGRAPHY

The following is extracted from the Marine Ecology Assessment compiled by Pisces Environmental Services (Pty) Ltd and attached as ***Appendix F****.*

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. 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 5.18 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 site is located around 5m above sea level.

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 6-1**).

Figure 6-1: 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 an isolated sandy beach south of Murray Harbour)

6.1.3 GEOLOGY AND SOILS

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 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.

6.1.4 GROUNDWATER

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 geohydrology of Robben Island is considered typical of many small islands around the world where a relatively thin lens of fresh water overlies more dense saline groundwater. The site is underlain by a fractured aquifer with a median yield of between 0.5 and 2.0 l/s (excluding dry boreholes) according to the 1:1 000 000 Hydrogeological Map series of South Africa. 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. 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.

6.1.5 SURFACE WATER

Robben Island does not support any natural watercourses or wetlands. The only surface water on Robben 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.

6.1.6 MARINE ENVIRONMENT

The following is extracted from the Marine Ecology Assessment compiled by Pisces Environmental Services (Pty) Ltd and attached as ***Appendix F****.*

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. 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). The ecosystem types around Robben Island and within Table Bay were described in the 2018 National Biodiversity Assessment (Sink *et al.* 2019). The island itself and its surrounding shallow subtidal regions belong to the Cape Island and Cape Kelp Forest ecosystem types and fall within the Cape Bay ecosystem type. The associated substratum types are the Southern Benguela Islands, Southern Benguela Kelp Forest and Southern Benguela Bays, respectively. The outfall pipeline extends across all three of these ecosystem types and substratum types.

Table Bay and Robben Island lie within the southern Benguela upwelling system (**Figure 6-2**). 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).

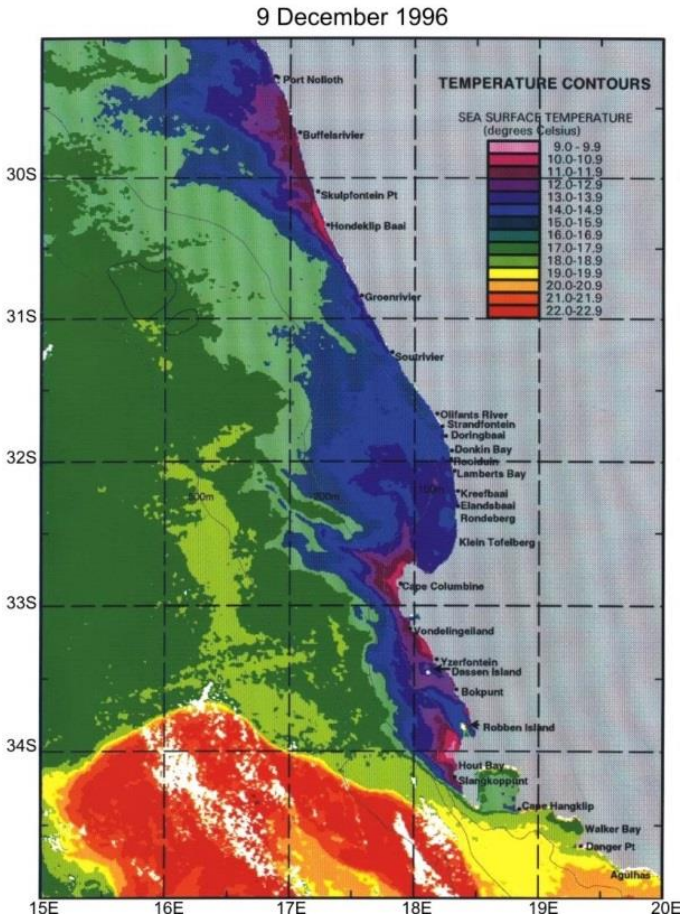

Figure 6-2: Satellite sea-surface temperature images showing upwelling intensity along the South African west coast in December 1996 (from Lane & Carter 1999).

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.

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 Southern Benguela Shelf Ecoregion, which extends from Cape Point to Lüderitz in Namibia, and includes the western edges of the Agulhas Bank (Sink *et al*. 2019) (**Figure 6-3**). In the context of the Southern Benguela System, the benthic communities in Table Bay are typical for the West Coast and not unique to the Bay. 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.

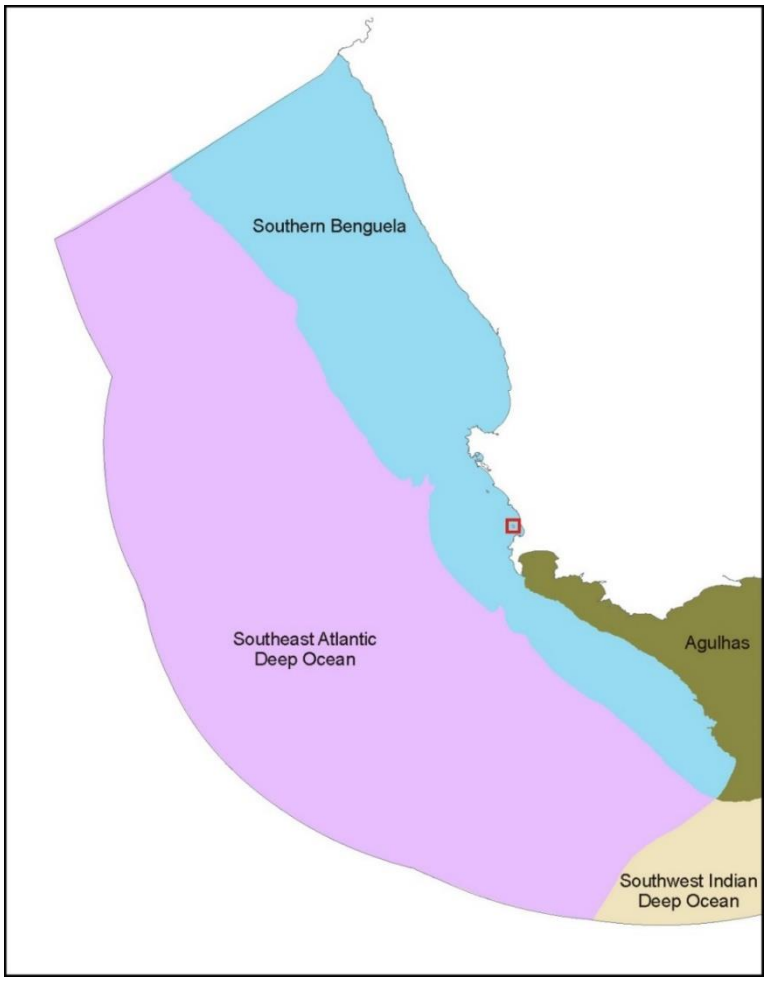

Figure 6-3: The South African inshore and offshore bioregions in relation to the project area (red square) (adapted from Sink *et al*. 2019).

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). Refer to the Marine Ecology Assessment compiled by Pisces Environmental Services (Pty) Ltd (**Appendix F**) for a description of the marine communities.

6.1.7 VEGETATION

The study site is situated in the Fynbos Biome fringed with an area of azonal vegetation. Vegetation types are classified as Cape Flats Dune Strandveld and Cape Seashore Vegetation (Mucina and Rutherford, 2006). Cape Seashore vegetation is described as least threatened. 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 Flats Dune Strandveld is 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 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 nesting bird species. Alien species include rooikrans, spider gum and manitoka trees with evidence of anthropogenic influence

6.1.8 FAUNA

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. Small indigenous species include the Cape Golden Mole and the Pygmy Mouse.

Smaller mammals considered to be "problem terrestrial vertebrates" (RIM Integrated Conservation Management Plan, 2013) include domestic (feral) cats, European rabbits (*Oryctolagus cuniculus*) and black rats (*Rattus rattus frugivorous*). There have historically been some challenges on the island with finding and maintaining the balance between the populations of these small mammal species.

REPTILES AND AMPHIBIANS

Reptiles such as the Cape Legless Skink, Angulate Tortoise, Cape Dwarf Chameleon and Mole Snake and amphibians such as the Sand Rain Frog and Clicking Stream Frog can be found on the island. 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).

MARINE MAMMALS

The following is extracted from the Marine Ecology Assessment compiled by Pisces Environmental Services (Pty) Ltd and attached as ***Appendix F.***

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 6-2** 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.

Two genetically and morphologically distinct populations of Bryde's whales live off the coast of southern Africa; an "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.

Table 6-2: Common whales and dolphins found in inshore waters of the Southern African West Coast and their South African (Child *et al.* 2016) and Global IUCN Red List conservation status.

Common Name	Scientific Name	RSA Regional Assessment	IUCN Conservation Status
RESIDENT			
Heaviside's dolphin	*Cephalorhynchus heavisidii*	Least Concern	Near Threatened
Dusky dolphin	*Lagenorhynchus obscurus*	Least Concern	Least Concern
Common dolphin	*Delphinus delphis*	Least Concern	Least Concern
Killer whale	*Orcinus orca*	Least Concern	Data Deficient
Bryde's whale	*Balaenoptera brydei*	Vulnerable	Least Concern
SEMI-RESIDENT/MIGRANT			
Humpback whale B2 population	*Megaptera novaeangliae*	Vulnerable	Not Assessed
Humpback whale	*Megaptera novaeangliae*	Least Concern	Least Concern
Southern Right whale	*Eubalaena australis*	Least Concern	Least Concern

The most abundant baleen whales in the Benguela are southern right whales and humpback whales. 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.

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.

Figure 6-4: 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 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 6-5**) 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 6-5: 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 6-5**) are relatively abundant in the Benguela ecosystem within 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*) 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 6-6: Colony of Cape fur seals Arctocephalus pusillus pusillus (Photo: Dirk Heinrich)

6.1.9 AVIFAUNA

The following is extracted from the Marine Ecology Assessment compiled by Pisces Environmental Services (Pty) Ltd and attached as ***Appendix F.***

Of the fifteen species of seabirds that breed in southern Africa (**Table 6-3**), nine are known to breed on Robben Island.

Table 6-3: Breeding resident seabirds present along the West Coast (adapted from CCA & CMS 2001). IUCN Red List and National Assessment status are provided (Sink et al. 2019). Species reported breeding on Robben Island are highlighted.

Common Name	Species Name	National	Global Assessment
African Penguin	*Spheniscus demersus*	Endangered	Endangered
African Black	*Haematopus moquini*	Least Concern	Near Threatened
White-breasted	*Phalacrocorax carbo*	Least Concern	Least Concern
Cape Cormorant	*Phalacrocorax capensis*	Endangered	Endangered
Bank Cormorant	*Phalacrocorax neglectus*	Endangered	Endangered
Crowned Cormorant	*Phalacrocorax coronatus*	Near Threatened	Near Threatened
White Pelican	*Pelecanus onocrotalus*	Vulnerable	Least Concern
Cape Gannet	*Morus capensis*	Endangered	Endangered
Kelp Gull	*Larus dominicanus*	Least Concern	Least Concern
Greyheaded Gull	*Larus cirrocephalus*	Least Concern	Least Concern
Hartlaub's Gull	*Larus hartlaubii*	Least Concern	Least Concern
Caspian Tern	*Hydroprogne caspia*	Vulnerable	Least Concern
Swift Tern	*Sterna bergii*	Least Concern	Least Concern
Roseate Tern	*Sterna dougallii*	Endangered	Least Concern
Damara Tern	*Sterna balaenarum*	Vulnerable	Vulnerable

Important seabirds in the Table Bay area include the African penguin *Spheniscus demersus*, Cape Cormorant *Phalacrocorax capensis* and the Bank cormorant *P. neglectus*. All three species are endemic to southern Africa

and are classified as 'Endangered' under the International Union for the Conservation of Nature (IUCN) criteria as well as the South African National Assessment (Sink *et al.* 2018). 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. The island is one of only seven remaining penguin colonies (Dassen Island, Robben Island, Boulders, Stoney Point, Dyer Island and Bird and St. Croix Islands), 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 2,600 in 2010 (Crawford *et al.* 2011; Sherley *et al*. 2014), 1,216 in 2019 (Miller 2020) and only 1,009 in 2021 (DFFE, unpublished data) reflecting the global decline of the species. Despite increased chick survival following the experimental three-year fisheries closure around Robben Island (Sherley *et al*. 2015; Sherley *et al*. 2018), poor prey availability due to depletion of fish stocks by commercial fisheries (Crawford *et al*. 2006), and a shift in prey biomass eastwards in response to climatic changes has led to high adult mortality and continued population declines (Sherley *et al.* 2017).

Figure 6-7: The African Penguin (Left, photo: Klaus Jost) and African Black Oystercatcher (Right, photo: patrickspilsbury.blogspot.com) nest on Robben Island.

The location of the breeding colonies in 2013 is shown in **Figure 6-8**. While decreasing in numbers, penguins continue to increase the areas of the island where they breed, now also breeding along the south of the island from Alpha One to the light house. Recent GPS tracking research has shown that penguins forage mainly to the north 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 6-9**).

Figure 6-8: Current African Penguin nesting sites on Robben Island from DEA 2013 Census Data. Penguin highways and seabird breeding sites in the vicinity of the proposed WWTW (red) and existing discharge pipeline (white) are also shown (source: P. Barham, pers. comms; Sherley et al. 2011, 2014)

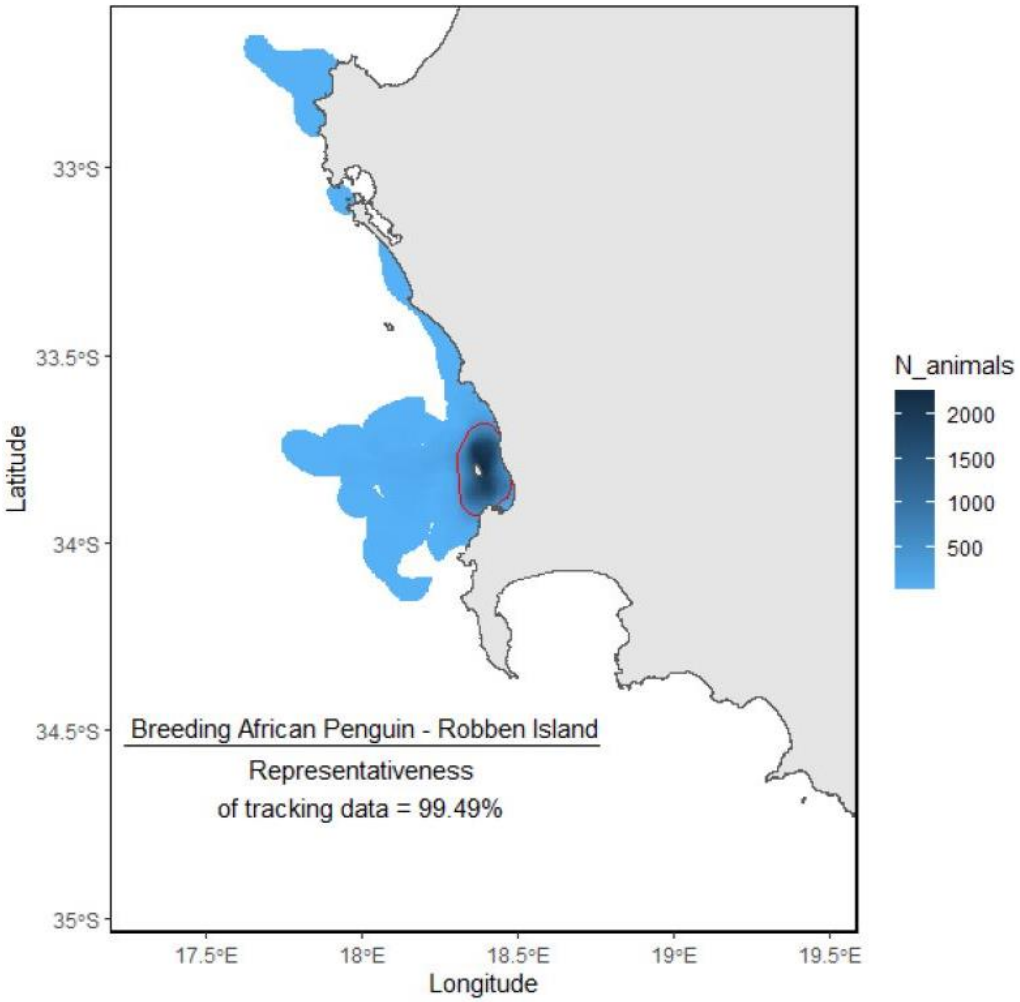

Figure 6-9: Important core usage area (red polygon) and general distribution (blue shaded area) of breeding African Penguins from Robben Island (Source: BirdLife South Africa 2021)

The island also holds the largest numbers of breeding Bank Cormorant *Phalacrocorax neglectus* in the Western Cape (120 pairs in 2000, but only 20 pairs today) (Crawford *et al.* 2000; P. Barham, pers. comm.), which breed on the short arm of the breakwater of Murray's Harbour (**Figure 6-10**) (Sherley *et al.* 2011). A significant populations of Cape Cormorants *Phalacrocorax capensis* (6,000 breeding pairs in 2020) also breed on the harbour wall as well as along the north-western side of the island, with small breeding clusters of Crowned Cormorant Phalacrocorax coronatus occurring in alien vegetation. African Black Oystercatcher Haematopus moquini (~250 breeding pairs in 2009), Kelp Gull Larus dominicanus (>2,000 breeding pairs in 2020), Hartlaub's Gull Larus hartlaubii and Swift Tern Sterna bergii. Swift Terns and Hartlaub's Gulls have been recorded breeding on the Faure Jetty and about 600 m south of Sobukwe House, but these species tend to move to new breeding locations each year. In recent years, however, Robben Island has been host to the majority of the Western Cape's breeding population of Swift Terns, with the bulk of the pairs nesting close to the western shoreline. In 2021 a large colony developed to the south of Sobukwe House. Since 2007 the colony of Hartlaub's Gulls has been located within the settlement at the southeast of the island (Sherley *et al*. 2011). Sandwich terns *Sterna sandvicensis* and Caspian Terns *Sterna caspia* have also been reported to occasionally breed on the island in small numbers.

Figure 6-10: Cape cormorants nesting on the Murray's 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.

6.1.10 CONSERVATION AREAS

The following is extracted from the Marine Ecology Assessment compiled by Pisces Environmental Services (Pty) Ltd and attached as ***Appendix F****.*

MARINE PROTECTED AREAS

'No-take' MPAs offering protection of the offshore biozones (sub-photic, deep-photic and shallow-photic) were until recently absent around the South African coast. This resulted in substantial portions of the shelf-edge marine biodiversity in the area being assigned a threat status of 'Critically endangered', 'Endangered' or 'Vulnerable' (Lombard *et al.* 2004; Sink *et al.* 2012). Using biodiversity data mapped for the 2004 and 2011 National Biodiversity Assessments a systematic biodiversity plan was developed for the Southwest Coast (Majiedt *et al.* 2013) with the objective of identifying both coastal and offshore priority areas for MPA expansion. The biodiversity data were used to identify numerous focus areas for protection. These focus areas were carried forward during Operation Phakisa, which identified potential offshore MPAs. A network of 20 MPAs was gazetted on 23 May 2019, thereby increasing the ocean protection within the South African Exclusive Economic Zone (EEZ) to 5%. Robben Island is located within one of these approved MPAs.

The 612 km^2 Robben Island MPA was proclaimed in 2019 to protect the surrounding kelp forests - one of the few areas that still supports viable stocks of abalone. The island harbours the 3rd largest penguin colony, with the breeding population peaking in 2004 at 8,524, but declining since. The island also holds the largest numbers of breeding Bank Cormorant in the Western Cape (120 pairs in 2000) and significant populations of Crowned Cormorant, African Black Oystercatcher (35 breeding pairs in 2000), Hartlaub's Gull and Swift Tern. The MPA consists of four distinct zones – a Restricted Zone (RIRZ) and three controlled zones - Offshore Controlled Zone (RIOCZ), a Middle Controlled Zone (RIMCZ) and an Inner Controlled Zone (RIICZ). The proposed marine outfall would fall within the RIICZ (

Figure 6-11).

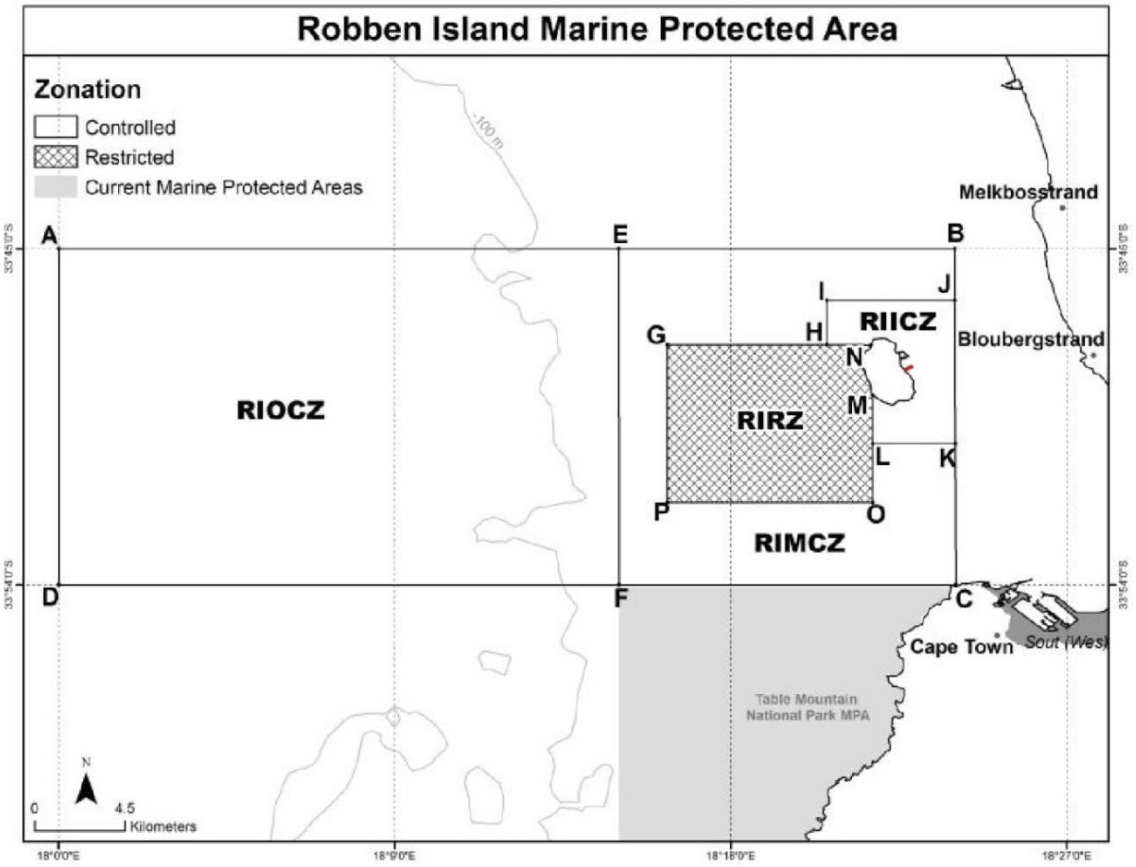

Figure 6-11: The Robben Island Marine Protected Area showing the zonation and the location of the proposed waste water discharge pipeline (red line) (adapted from Government Gazette 2019)

SENSITIVE AREAS

Despite the development of the offshore MPA network a number of 'Vulnerable' and 'Endangered' ecosystem types are currently 'poorly protected' or 'not protected' at all and further effort is needed to improve protection of these threatened ecosystem types (Sink *et al.* 2019). Around Robben Island, the Cape Kelp Forest ecosystem type is considered 'vulnerable' whereas the Cape Island and Cape Bay ecosystem types have been rated as 'endangered'. Ideally, all highly threatened ('Critically Endangered' and 'Endangered') ecosystem types should be well protected. Currently, however, most of the habitats within Table Bay are moderately protected receiving between 10% -20% protection within the protected areas network but with the 'near threatened' intermediate sandy shores south of Melkbos considered poorly protected (Sink *et al.* 2019) (**Figure 6-12**).

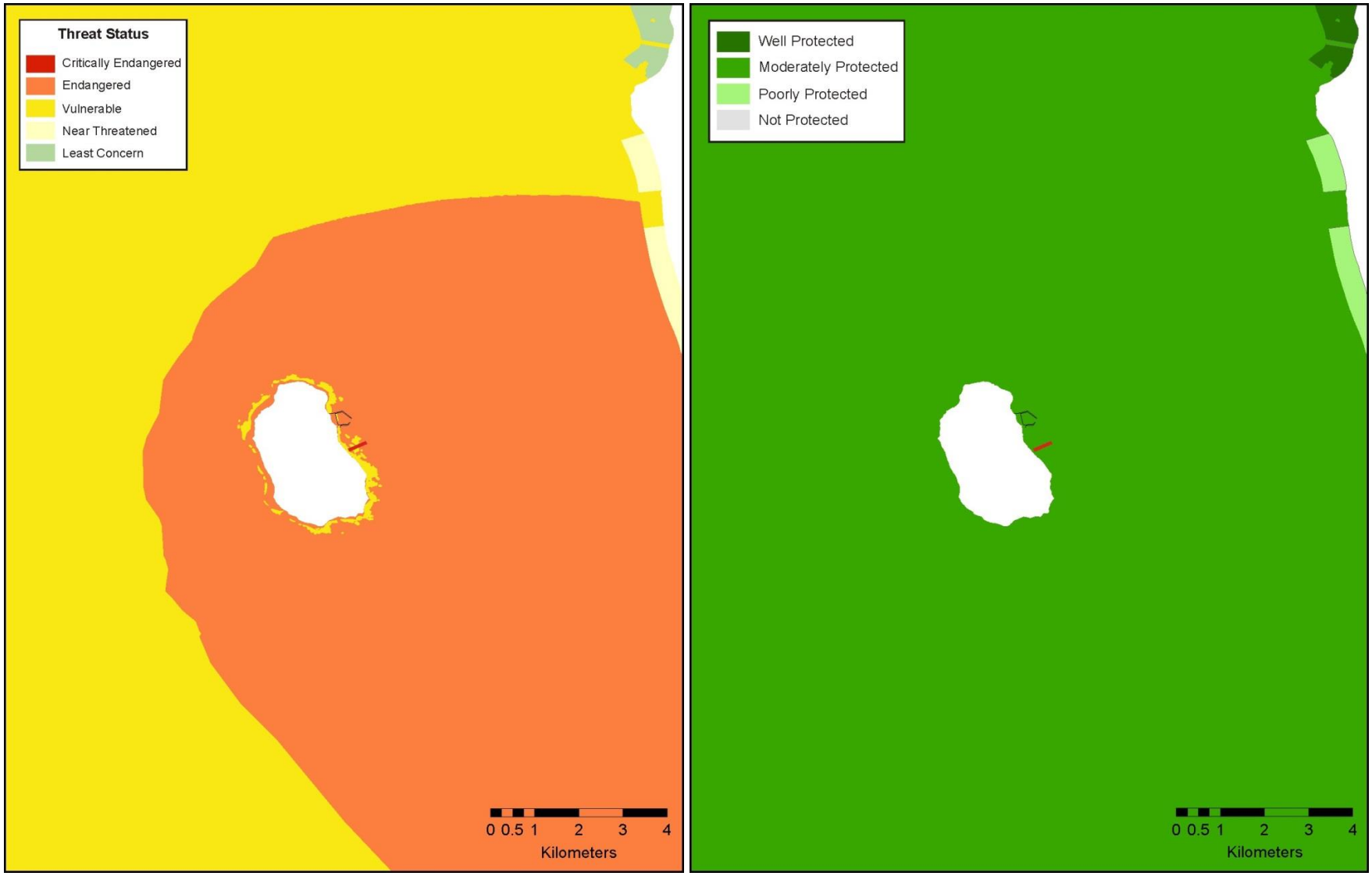

Figure 6-12: Threat Status (left) and Protection Levels (right) of marine ecosystem types as assessed by Sink et al. (2019) in relation to the proposed waste water discharge pipeline (red line)

ECOLOGICALLY OR BIOLOGICALLY SIGNIFICANT AREAS (EBSAS)

As part of a regional Marine Spatial Management and Governance Programme (MARISMA 2014-2020) the Benguela Current Commission (BCC) and its member states have identified a number of Ecologically or Biologically Significant Areas (EBSAs) both spanning the border between Namibia and South Africa and along the South African West, South and East Coasts, with the intention of implementing improved conservation and protection measures within these sites. South Africa currently has 12 EBSAs solely within its national jurisdiction with a further three having been proposed. It also shares eight trans-boundary EBSAs with other countries (Namibia (3) and Mozambique (2)) and high seas (3)). The principal objective of these EBSAs is identification of features of higher ecological value that may require enhanced conservation and management measures. They currently carry no legal status. The impact management and conservation zones within the EBSAs are currently being reviewed and additional zones may be proposed.

Robben Island falls within the Cape Canyon and Associated Islands EBSA, which includes the Benguela Muds MPA, the Cape Canyon MPA, the West Coast National Park MPA and the Robben Island MPA. The area is considered important for pelagic fish, foraging marine mammals and several threatened seabird species and serves to protect nine 'Endangered' and 12 'Vulnerable' ecosystem types, and two that are 'Near Threatened'. There are also several small coastal MPAs within the EBSA.

BIODIVERSITY PRIORITY AREAS

The National Coastal and Marine Spatial Biodiversity Plan[10] comprises a map of CBAs, ESAs and accompanying sea-use guidelines. The CBA Map presents a spatial plan for the marine environment, designed to inform planning and decision-making in support of sustainable development. The sea-use guidelines enhance the use of the CBA Map in a range of planning and decision-making processes by indicating the compatibility of various activities with the different biodiversity priority areas so that the broad management objective of each can be maintained. The intention is that the CBA Map (CBAs and ESAs) and sea-use guidelines inform the MSP Conservation Zones and management regulations, respectively.

As Robben Island falls within an MPA, with Critical Biodiversity Area 1 (CBA 1), Critical Biodiversity Area 2 (CBA 2), and Ecological Support Area (ESA) lying adjacent to the boundary of the MPA on the east and north (see **Figure 6-13**). CBA 1 indicates irreplaceable or near-irreplaceable sites that are required to meet biodiversity targets with limited, if any, option to meet targets elsewhere, whereas CBA 2 indicates optimal sites that generally can be adjusted to meet targets in other areas. ESAs represent EBSAs outside of MPAs and not already selected as CBAs.

Activities within these management zones are classified into those that are compatible, those that are incompatible, and those that may be compatible subject to certain conditions. These zones have been incorporated into the most recent iteration of the national Coastal and Marine CBA Map (v1.1 released June 2021) (Harris et al. 2020).

[10] The latest version of National Coastal and Marine Spatial Biodiversity Plan (v1.1 was released in June 2021) (Harris *et al.* 2020). The Plan is intended to be used by managers and decision-makers in those national government departments whose activities occur in the coastal and marine space, e.g., environment, fishing, transport (shipping), petroleum, mining, and others. It is relevant for the Marine Spatial Planning Working Group where many of these departments are participating in developing South Africa's emerging marine spatial plans. It is also intended for use by relevant managers and decision-makers in the coastal provinces and coastal municipalities, EIA practitioners, organisations working in the coast and ocean, civil society, and the private sector.

Figure 6-13: the Robben Island marine outfall in relation to Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs) (Version 1.1) (Harris *et al.* 2020)

IMPORTANT BIRD AREAS (IBAS)

There are numerous coastal Important Bird Areas (IBAs) in the general project area (**Table 6-4**) (https://maps.birdlife.org/marineIBAs). Various marine IBAs have also been proposed in South African territorial waters, with Robben Island falling within the proposed Bird Island / Dassen Island / Heuningnes river and estuary system / Lower Berg river wetlands marine IBA.

Table 6-4: Coastal Important Bird Areas (IBAs) and their criteria listings (www.BirdLife.org.za)

Site Name	IBA Criteria
West Coast National Park and Saldanha Bay Islands (ZA 084)	A1, A4i, A4ii, A4iii
Dassen Island (ZA088)	A1, A4i, A4ii, A4iii
Robben Island (ZA089)	A1, A4i, A4ii, A4iii
Rietvlei Wetland: Table Bay Nature Reserve (ZA090)	A1, A4i
Boulders Beach (ZA096)	A1
False Bay Nature Reserve (ZA095)	A1, A4i, A4iii

A1. Globally threatened species

A2. Restricted-range species

A3. Biome-restricted species

A4. Congregations

i. applies to 'waterbird' species

ii. This includes those seabird species not covered under i.

iii. modelled on criterion 5 of the Ramsar Convention for identifying wetlands of international importance. The use of this criterion is discouraged where quantitative data are good enough to permit the application of A4i and A4ii.

6.2 SOCIAL AND ECONOMIC

6.2.1 SOCIO-ECONOMIC

According to the 2011 Census, there are approximately 116 persons living on Robben Island and around 60 households (**Table 6-5**). The island dwellers are predominantly black (60%) and include caretakers, security facility and island workers.

Table 6-5: Population groups currently living on Robben Island as per the 2011 Census

Population Group	People	Percentage (%)
Black African	70	60.34
Coloured	27	23.28
White	16	13.79
Other	3	2.59

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. According to the 2011 census, 66% of those aged 20 years or older have completed Grade 12 or higher. 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. Robben Island receives approximately one thousand (1 000) visitors a day, taking the standard tour.[11]

6.2.2 HERITAGE, ARCHAEOLOGICAL AND CULTURAL SITES

Robben Island is both a National Heritage Site and UNESCO World Heritage Site since 1999. The islands rich cultural history extends beyond the most-well known 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 WWTW location is the Dog Unit, a former dog quarantine station founded in 1893. 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 WWTW 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. The harbour was commissioned to facilitate the erection of military installations from the start of the Second World War.

[11] This figure is relevant as of March 2020 and is likely to have changed since the global COVID-19 pandemic and the subsequent impact on the tourism industry in South Africa.

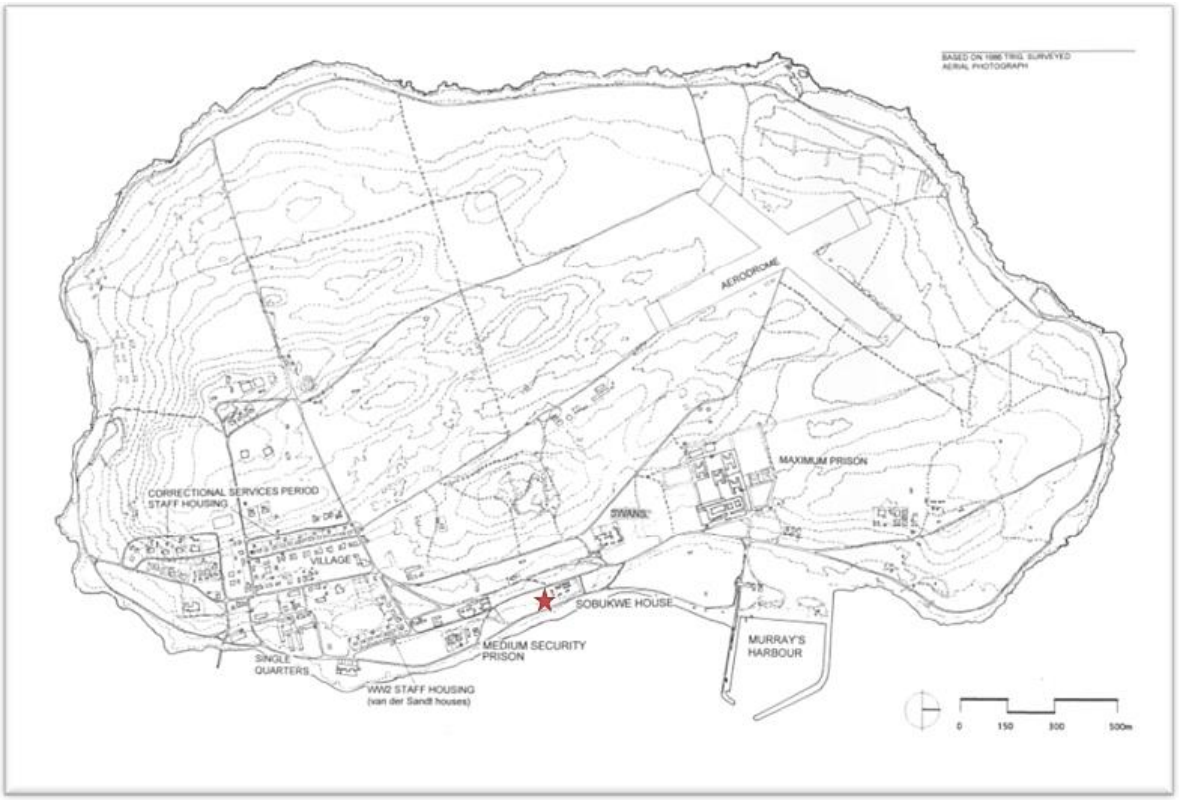

Figure 6-14: Location of the proposed WWTW in relation to the political imprisonment landscape on Robben Island (source: RIM ICMP, 2013)

6.2.3 PALAEONTOLOGY

The following is extracted from the Palaeontology Assessment compiled by Natura Viva cc and attached as ***Appendix F****.*

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).

6.2.4 LANDSCAPE AND VISUAL

The site and immediate environment is heavily disturbed, with alien invasive plant species, and anthropogenic disturbance, including old water tanks, septic tank manholes, electrical boxes, disused telephone line poles, and jeep tracks used by RIM for maintenance work.

The preferred location of the WWTW is adjacent to a disused building and 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 Robert Soboukwe complex does not form part of the Robben Island tour, and therefore does not have foot traffic associated with it.

The Church of the Good Shepherd, a national heritage site, is located approximately 80m south of the site. The church was built by lepers in 1895 to the designs of the distinguished architect Sir Herbert Baker. A main tourist road (Murray Bay Road) runs north-south, 45m to the west of the site, linking Murray's Bay Harbour in the north to Robert Sobukwe House and the Church of the Good Shepherd in the south. This road is used extensively by bus tours taking visiting tourists around the island. A visitor Walking Tour route passes close by the site, allowing a viewing of the Robert Sobukwe Complex, but not within view of the site (**Figure 6-15**).

Other infrastructure further afield includes Robben Island Museum, Murray's Bay Harbour and the Robben Island residential area.

Figure 6-15: Robben Island Walking Tour and Bus Tour Routes in relation to the proposed WWTW and sensitive visual receptors (source: LOGIS, 2022)

7 ENVIRONMENTAL IMPACT ASSESSMENT

This Chapter identifies the perceived environmental and social effects associated with the proposed Project. The assessment methodology is outlined in **Section 3.5**. The issues identified stem from those aspects presented in **Chapter 6** of this document as well as the Project description provided in **Chapter 4**. The impact assessment is based on the preferred alternative at all Project phases. This section only assesses the preferred option along with the no-go alternative. The impact mitigation hierarchy criteria, as per **Section 0**, for each mitigation measure are indicated in brackets after each measure indicated.

Furthermore, a decommissioning assessment will be considered as part of the decommissioning process that will be subject to a separate authorisation and impact assessment process. The impact assessment in this section encompasses the geographical, physical, biological, social, economic, heritage and cultural aspects in accordance with Appendix 1 of GNR 326.

Please note that location alternatives have not been considered in this impact assessment since it would not be feasible to place the WWTW 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 currently considered feasible for use on the island therefore the preferred site alternative and preferred technology type (which has already undergone detailed design and feasibility studies) will be the only scenario under consideration in the impact assessment.

7.1 AIR QUALITY

7.1.1 CONSTRUCTION PHASE

DUST AND PARTICULATE MATTER

The National Dust Control Regulations (GNR 827) prescribe general measures for the control of dust in both residential and non-residential areas and will be applicable during construction of the WWTW. **Table 7-1** provides the acceptable dust fall rates as prescribed by GNR 827.

Table 7-1: Acceptable dust fall rates (GNR 827)

RESTRICTION AREAS	DUST FALL RATE (D) (mg/m^2/day – 30 DAYS AVERAGE)	PERMITTED FREQUENCY OF EXCEEDING DUST FALL RATE
Residential area	D < 600	Two within a year, not sequential months
Non-residential area	600 < D < 1200	Two within a year, not sequential months

During the construction phase, there will be a requirement to excavate and infill as well as the construction of an earth berm. These earth moving activities using construction equipment will generate dust and vehicular emissions (carbon monoxide (CO), hydrocarbons, particulate matter (PM) and nitrogen oxides (NO_x). Furthermore, these emissions will occur as a result of transportation of equipment and materials to site and the installation thereof. The emissions will, however, have short-term impacts on the immediate surrounding areas that can be easily mitigated and thus the authorisation of such emissions will not be required. All construction phase air quality impacts will be minimised with the implementation of dust control measures contained within the EMPr (**Appendix G**).

The impact of the construction phase on the generation of dust and particulate matter (PM) is shown in **Table 7-2** below.

Table 7-2: Construction Impact on Generation of Dust and PM

Potential Impact / GENERATION OF DUST AND PM	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
Without Mitigation	2	1	3	1	4	**28**	**Low**	(-)	High
With Mitigation	1	1	3	1	3	**18**	**Low**	(-)	High
Mitigation and Management Measures	— Dust-reducing mitigation measures must be put in place and must be strictly adhered to, for soil/material stockpiles especially. This includes wetting of exposed soft soil surfaces and not conducting activities during high wind periods which will increase the likelihood of dust being generated; — All stockpiles or areas of exposed ground (if any) must be restricted to designated areas and may not exceed a height of two (2) metres; — Ensure that all vehicles, machines and equipment are adequately maintained to minimise emissions; — It is recommended that the clearing of vegetation from the site should be selective, be kept to the minimum feasible footprint area, and be undertaken just before construction so as to minimise erosion and dust potential; — No burning of waste, such as plastic bags, cement bags and litter is permitted; and — All issues/complaints must be recorded in the complaints register.								

7.1.2 OPERATIONAL PHASE

ODOUR

Volatile organic compounds (VOCs), H2S and NH3 are emitted from wastewater treatment, collection, and storage systems, through the evaporation of compound molecules at the liquid surface (Department of Agriculture, Water and Environment, 2011). Sources of atmospheric emissions from WWTW include aeration during primary treatment, aerobic digestion, mechanical thickening of sludge, anaerobic digestion, sludge drying and flaring (as applicable). Odour problems associated with WWTW can be complex with odour originating from several components in the plant area which are commonly located outside.

According to Márquez, et al (2022), biological treatment is an environmentally friendly method of transforming organic material into harmless by-products (e.g. carbon dioxide or mineral salts such as sulphates) and is also considered the most influential component of the wastewater treatment process in the elimination of soluble pollutants. The biodegradation of organic matter results in the generation of sewage sludge, liquid effluent, and malodorous gases. Volatile sulphur compounds (such as H_2S) are primarily responsible for the unpleasant odours associated with wastewater treatment and can account for up to 90% of the malodorous gas emissions (Márquez, et al., 2022). The odour impact caused by WWTW on surrounding areas is closely related to the organic load of the wastewater influent as well as the quantity of sludge produced. Intrinsically, impacts can vary widely between individual facilities. Different chemical and biological processes and processing conditions, such as pH^4, temperature and retention time, also have a great effect on the odour character. Long retention times and low oxygen levels or even complete anaerobic conditions favour the generation of malodorous sulphur compounds (Belgiorno, Naddeo, & Zarra, 2013).

Márquez, et al (2022) noted that odour emissions tend to decrease as the wastewater moves through the treatment process and the biological stability of the material increases; however, also highlighted the sludge handling activities (which occur toward the end of the treatment process) as the major source of odour, regardless of the biological treatment process utilised.

1) Quantified Emission Sources

Activity data (i.e. WWTW component specifications, layout thereof, throughputs, etc.) required to calculate emissions was provided by RIM. Any errors, limitations, or assumptions inherent in this data therefore also extend to this study.

Many of the components of the proposed Robben Island WWTW will be enclosed or covered to aid with odour containment. No documented odour control efficiency statistics for covering or enclosing wastewater treatment operations were found in the available literature. This study therefore assumes that the vapour space of enclosed or covered components will reach a state of equilibrium (i.e. where molecules in the liquid evaporate into the vapour space above the liquid surface, the vapour space becomes saturated due to containment, and those molecules condense and return to the liquid at the same rate) and in principle, enclosed or covered components will not be a source of odour. It is understood that component covers will only be removed for maintenance purposes, which is not considered to be normal operations. Nonetheless, emission rates for covered/enclosed components are still provided in the sections that follow; however, it is highlighted that covered/enclosed components were not used as input to the dispersion modelling simulation of normal operations.

WWTW components (some of which have multiple subsections) quantified for this assessment are shown in **Figure 7-1** and listed as follows:

- Inlet structure (2)
- Primary settling (3), comprising of both anaerobic (a) and anoxic reactors (b)
- Biological treatment (4) – RBC
- Secondary settling (5) – clarifier
- Disinfection (6) – chlorine contact channels
- Sludge management (7) – drying beds

Figure 7-1: Emission sources

2) Sensitive Receptors

Sensitive receptors (i.e. places where sensitive individuals may be impacted, such as residences, or places accessed by the general public) selected for evaluation in this assessment are listed in **Table 7-3** and presented in **Figure 7-2**.

Table 7-3: Sensitive receptors

ID	Receptor Name	Receptor Type	Distance from site (km)	Direction	Latitude (°S)	Longitude (°E)
SR1	Robben Island Museum	Tourism	0.53	Northwest	33.799860	18.372384
SR2	Robert Sobukwe House	Tourism	0.06	Northwest	33.803843	18.376464
SR3	Church	Religious	0.08	South	33.805486	18.376654
SR4	Robben Island Village	Residence	0.38	Southwest	33.807887	18.379303
SR5	Robben Island Clinic	Medical	0.48	South-southwest	33.809339	18.377784

Figure 7-2: Sensitive receptors

3) Modelling

Dispersion modelling simulations of odour, NH_3 and H_2S were undertaken for normal operating conditions only. Simulated ground-level concentrations are compared with relevant international guidelines (in the absence of local standards) to assess impact.

Model simulated concentrations at sensitive receptors are presented in **Table 7-4**. Isopleth maps showing the dispersion of odour, NH_3 and H_2S are presented in **Figure 7-3** to **Figure 7-5**. Predicted concentrations are evaluated against applicable international guidelines. Key findings are as follows:

Odour

- P98 1-hour odour concentrations at sensitive receptors fall below the 1-hour UK odour criteria limit of 1.5OU_E/m^3. In line with the UK IAQM guidanceError! Reference source not found., the impact significance for sensitive receptors is determined to be 'negligible'.
- Peak odour concentrations are predicted to occur along the southwestern fenceline of the proposed WWTW development site.
- Offsite exceedances of the UK odour criteria limit (1.5 OU_E/m^3) are predicted up to 20 m to the southwest, northwest and northeast of the proposed WWTW boundary.

NH_3

- P100 1-hour NH_3 concentrations at sensitive receptors fall below the TCEQ NH_3 1-hour odour-based guideline of 3 600 µg/m^3.
- Peak NH_3 concentrations are predicted to occur along the northeastern fenceline of the proposed WWTW development site however these are not predicted to exceed the TCEQ NH_3 1-hour odour-based guideline and are thus not expected to result in odour nuisance.

H_2S

- P100 1-hour H_2S concentrations at sensitive receptors fall below the WHO H_2S 30-minute odour nuisance guideline of 7 µg/m^3 (applied in the absence of a 1-hr average criterion).
- Peak H_2S concentrations are predicted to occur along the northwestern and northeastern fencelines of the proposed WWTW development site.
- Offsite exceedances of the WHO odour nuisance guideline (7 µg/m^3) are predicted up to 15 m southwest, northwest and northeast of the proposed WWTW boundary.
- It must be noted that the WHO H_2S odour nuisance guideline is applicable to a 30-minute averaging period and the comparison of the worst-case 1-hour model output to this shorter-term threshold is considered environmentally conservative.

Based on the above findings, odour is anticipated along the unpaved roads that run adjacent to the proposed WWTW development site. These roads are used by maintenance staff only and are not roads used by the Island's residents or tourists.

Table 7-4: Simulated concentrations for sensitive receptors

Pollutant		Odour	NH_3	H_2S
Averaging period		1-hour	1-hour	1-hour
Standard / Guideline		1.5	3 600	7[(a)]
Reference		United Kingdom	TCEQ ESL	WHO
Percentile		P98	P100	P100
Unit		OU_E/m^3	$\mu g/m^3$	$\mu g/m^3$
Domain peak		3.48	25.45	9.65
Boundary peak		3.48	25.45	9.65
Sensitive receptor	SR1	0.004	0.074	0.042
	SR2	0.154	1.116	0.631
	SR3	0.007	0.694	0.413
	SR4	0.002	0.122	0.070
	SR5	0.001	0.065	0.038

Note:

(a) – Applicable to a 30-minute averaging period

Red – exceeds the applicable guideline limit value

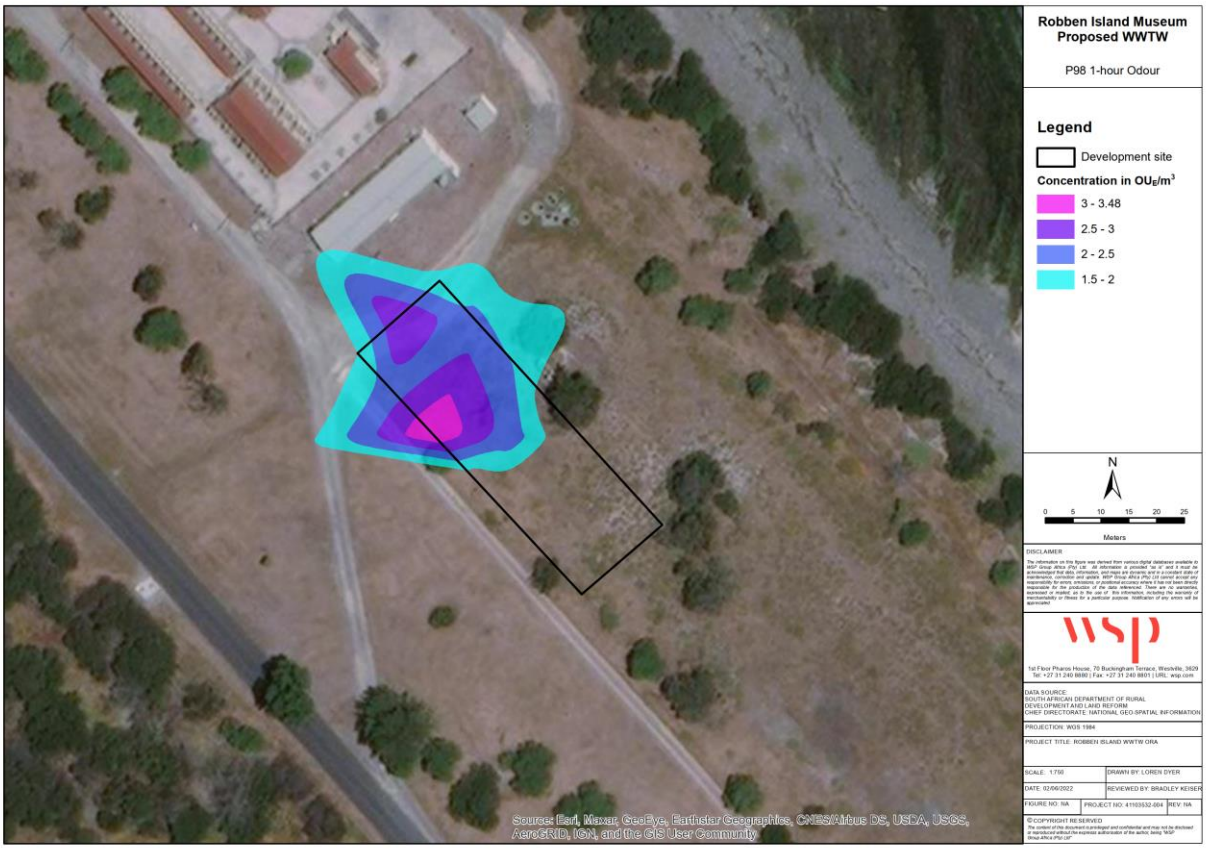

Figure 7-3: P98 1-hour odour

Figure 7-4: P100 1-hour NH_3

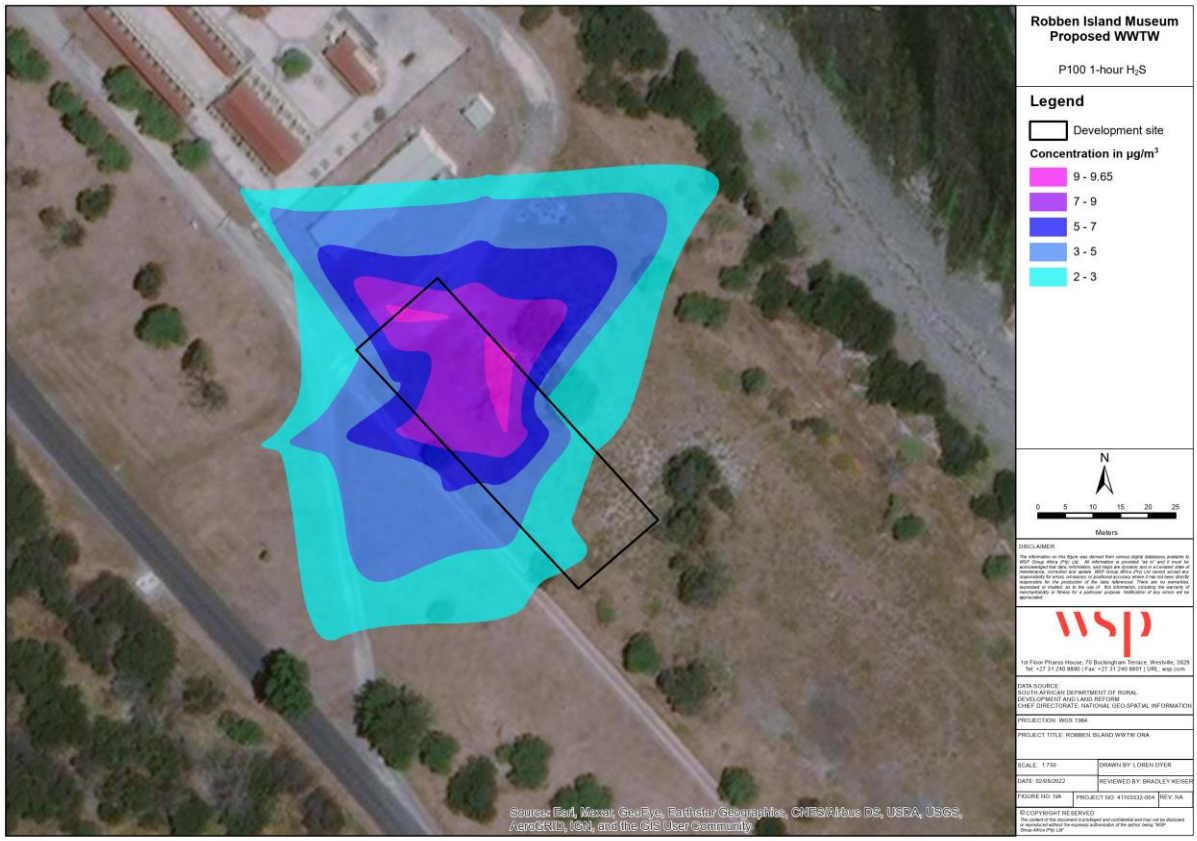

Figure 7-5: P100 1-hour H_2S

The impact of the operation phase on the generation of odour is shown in **Table 7-5** below.

Table 7-5: Operational Impact on Odour

Potential Impact / ODOUR	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
Without Mitigation	2	2	1	4	1	**9**	**Low**	(-)	High
With Mitigation	2	2	1	4	1	**9**	**Low**	(-)	High
Mitigation and Management Measures	— Develop a vegetative environmental buffer (VEB) along the Western boundary of the proposed development site. A VEB will ameliorate odours by slowing wind and allowing dilution of odour, encouraging particulate and aerosol deposition, physical interception of dust and aerosols onto which odorous compounds can adhere, and offering a sink for the chemical constituents of odour. WSP recommends the use of indigenous leafy trees that maintain their leaves throughout the year. Multiple rows of trees (with taller and shorter but bushier species alternating) will increase effectiveness of the barrier. Additional value of the VEB is protection from bioaerosols, noise mitigation and improved visual aesthetics. — Masking agents offer an additional odour neutralisation option should complaints arise despite the above recommendation. The efficacy of commercial additives varies widely, and local options can be investigated.								

Potential Impact ODOUR	Magnitude	Extent	Reversibility	Duration	Probability	Significance	Character	Confidence
	— Complaints and any actions arising from a complaint must be recorded in a complaints register maintained by site management. If required, fenceline measurements of H2S will provide a real-time indicator of odour impact. — Warning communities to expect potential odour events during upset conditions (e.g. during desludging or when extended maintenance is scheduled) will generate increased trust and facilitate communication between parties. When possible, maintenance/desludging of the WWTW should be scheduled for times when fewer tourists are expected in the area or strategically planned so as not to coincide with proximate community events, if any. — Maintenance/desludging of the WWTW should be scheduled for times when fewer tourists are expected in the area, or strategically planned so as not to coincide with proximate community events, if any. — Meteorological scheduling of maintenance/desludging for periods with dry and cool conditions should also be considered (where practicable) particularly when prolonged repair work or sludge drying is anticipated. Drier conditions will accelerate sludge drying, shortening the duration in which peak impacts may occur. Odorous emissions are generally higher in warmer months due to increased gas volatility.							

7.2 NOISE EMISSIONS

7.2.1 CONSTRUCTION PHASE

ELEVATED NOISE

Elevated noise levels are likely to be generated by the construction activities (machinery and vehicles) and the workforce. It is important to note that noise impacts (nuisance factor) may vary in the different areas as a result of the surrounding land uses and will be temporary in nature. Due to the temporary and limited nature of the Project activities, coupled with the fact that there are a limited number of noise receptors around the Project area, the impact is regarded as low. The construction impact on noise is indicated in **Table 7-6** below.

Table 7-6: Construction Impact on Noise

Potential Impact: NOISE	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
Without Mitigation	2	1	3	1	4	**28**	**Low**	(-)	High
With Mitigation	2	1	1	1	3	**15**	**Low**	(-)	High
Mitigation and Management Measures	— The equipment must be in maintained in good working order, within service dates, and inspected before use; and — Install noise reducing fittings on machinery (if required).								

7.2.2 OPERATIONAL PHASE

ELEVATED NOISE

Noise impacts during the operational phase will be minimal as the only potential noise source is the motor that runs the RBC, which is very quiet and cannot be heard beyond 10m. Maintenance activities will occur as and when required and will be extremely short-term. The construction impact on noise is indicated in **Table 7-7** below.

Table 7-7: Operational Impact on Noise

Potential Impact: NOISE	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
Without Mitigation	2	1	1	1	3	**15**	**Low**	(-)	High
With Mitigation	2	1	1	1	3	**15**	**Low**	(-)	High
Mitigation and Management Measures	— The WWTW equipment must be in maintained in good working order.								

7.3 SOIL EROSION AND CONTAMINATION

7.3.1 CONSTRUCTION PHASE

SOIL EROSION

During the construction phase, measures should be implemented to manage stormwater and water flow on the site. If the stormwater and water flow is not regulated and managed on site, it could cause erosion of soil around the cleared areas.

During the construction phase, the Project activities could leave soils exposed and susceptible to erosion. The construction impact on soil erosion is indicated in **Table 7-8** below.

Table 7-8: Construction Impact on Soil Erosion

Potential Impact: SOIL EROSION	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
Without Mitigation	2	1	3	2	3	**24**	**Low**	(-)	High
With Mitigation	1	1	3	2	3	**21**	**Low**	(-)	High
Mitigation and Management Measures	— Only the WWTW footprint areas should be cleared of vegetation; — Implement stormwater management measures immediately after vegetation clearance that will help to reduce the speed of the water. These measures must also assist with the prevention of water pollution, erosion and siltation; — The berm and any exposed earth should be rehabilitated promptly, and this could include planting suitable vegetation (vigorous indigenous grasses) that mimics the surrounding environment to protect the exposed soil;								

	— If excavations or foundations fill up with stormwater, these areas should immediately be drained and measures to prevent access to these areas should be implemented; — Erosion control measures should be implemented during the construction phase on large, exposed areas and where stormwater is temporarily channelled.

SOIL CONTAMINATION

During construction activities, construction vehicles/trucks/machinery as well as hazardous substances stored on the site might spill and contaminate the soil. The impact of the construction phase on soil pollution is indicated in **Table 7-9** below.

Table 7-9: Construction Impact on Soil Contamination

Potential Impact: SOIL CONTAMINATION	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
Without Mitigation	2	1	3	2	3	**24**	**Low**	(-)	High
With Mitigation	1	1	3	2	3	**21**	**Low**	(-)	High
Mitigation and Management Measures	— All vehicles, machinery and equipment must be properly maintained to prevent leaks; — Vehicles are to be repaired immediately upon developing leaks; — Drip trays to be supplied for all idle vehicles and machinery; — Drip trays are to be inspected daily for leaks and effectiveness and emptied when necessary. This is to be closely monitored during rain events to prevent overflow; — Ensure appropriate handling of hazardous substances; — Keep adequate spill kits onsite and train personnel to use them appropriately; and — Fuels and chemicals must be stored in adequate storage facilities that are secure, enclosed and bunded. —								

7.3.2 OPERATIONAL PHASE

SOIL EROSION

There are no anticipated soil erosion impacts expected during the operational phase as maintenance activities will occur as and when required and will be extremely short-term. However, erosion and stormwater controls should be set up around the WTW during construction to protect it during the operational phase.

7.4 GROUNDWATER

7.4.1 CONSTRUCTION PHASE

DETERIORATION IN GROUNDWATER QUALITY

There is a potential to affect the groundwater quality in the area. This is influenced by spills and leaks and the storage of chemicals and fuels. Any contaminants that are not cleaned from the ground will seep into underground water resources. The impact of construction on change in water quality is shown in **Table 7-10** below.

Table 7-10: Construction Impact on Deterioration in Groundwater Quality

Potential Impact: DETERIORATION IN GROUNDWATER QUALITY	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
Without Mitigation	4	2	3	2	3	**30**	**Moderate**	(-)	High
With Mitigation	2	2	3	2	2	**18**	**Low**	(-)	High
Mitigation and Management Measures	— During construction, contractors used for the Project must have spill kits available to ensure that any fuel or oil spills are cleaned-up and disposed of correctly; — Where possible material must be pre-fabricated and then transported to site to avoid the risks of contamination associated with mixing, pouring and the storage of chemicals and compounds on site; — All chemicals and toxicants during the construction and operation phase must be stored in bunded areas; — All machinery and equipment should be inspected regularly for faults and possible leaks; these should be serviced off-site; — All contractors and employees should undergo induction which is to include a component of environmental awareness. The induction is to include aspects such as the need to avoid littering, the reporting and cleaning of spills and leaks and general good "housekeeping"; — Adequate sanitary facilities and ablutions must be provided for all personnel throughout the Project area. Use of these facilities must be enforced (these facilities must be kept clean so that they are a desired alternative to the surrounding vegetation); and — Have action plans on site, and training for contactors and employees in the event of spills, leaks and other impacts to the aquatic systems.								

7.4.2 OPERATIONAL PHASE

DETERIORATION IN GROUNDWATER QUALITY

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.

The impact of operations on change in water quality is shown in **Table 7-11** below.

Table 7-11: Operational Impact on Deterioration in Groundwater Quality

Potential Impact: DETERIORATION IN GROUNDWATER QUALITY	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
Without Mitigation	3	3	3	2	3	**33**	**Moderate**	(-)	High
With Mitigation	2	2	3	2	2	**18**	**Low**	(-)	High
Mitigation and Management Measures	— 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								

Potential Impact:	Magnitude	Extent	Reversibility	Duration	Probability	Significance	Character	Confidence
DETERIORATION IN GROUNDWATER QUALITY								
	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. — Effluent treatment monitoring programme must be implemented to ensure that the WWTW is consistently treated to the required standards for release to land and the marine environment.							

7.5 BIODIVERSITY

7.5.1 CONSTRUCTION PHASE

DESTRUCTION OF VEGETATION

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 WWTW may result in the loss of valuable topsoil. However, natural vegetation is limited within the proposed WWTW location and the vegetation is degraded with scattered alien infestation, and therefore is not viewed as sensitive or pristine.

The impact of the construction phase on the impact on vegetation is shown in **Table 7-12** below.

Table 7-12: Assessment of significance of potential impacts on the terrestrial flora associated with the construction phase of the project.

Potential Impact:	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
DESTRUCTION OF VEGETATION									
Without Mitigation	2	2	1	2	3	**21**	**Low**	(-)	High
With Mitigation	1	2	1	2	3	**18**	**Low**	(-)	High
Mitigation and Management Measures	— Clearing of vegetation must be restricted to the footprint of the proposed WWTW. — Alien invasive species must be removed during construction and replaced with indigenous vegetation. — Topsoil must be preserved and re-used for the berm construction. — The location of the WWTW and ancillary infrastructure must minimise the need to uproot any indigenous tree species. — Any rehabilitation following construction must be completed using indigenous vegetation.								

7.5.2 OPERATIONAL PHASE

DESTRUCTION OF VEGETATION

During operation, the direct impacts to vegetation may include trampling of vegetation in the event that maintenance staff drive or walk off the service roads. The development footprint is small and minimal foot traffic is associated with the WWTW during the operational phase.

The impact of the operational phase on vegetation is shown in **Table 7-12** below.

Table 7-13: Assessment of significance of potential impacts on the terrestrial flora associated with the operational phase of the project.

Potential Impact: DESTRUCTION OF VEGETATION	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
Without Mitigation	1	2	1	3	3	**21**	**Low**	(-)	High
With Mitigation	1	2	1	3	2	**14**	**Low**	(-)	High
Mitigation and Management Measures	— All maintenance activities and staff to remain off vegetated areas and retain all workings within the site footprint.								

7.6 AVIFAUNA

7.6.1 CONSTRUCTION PHASE

DISTURBANCE OF NESTING SITES

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 and 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 WWTW and associated discharge pipeline may therefore result in disturbance of penguin, cormorant and tern nesting sites with implications for reproductive success.

The construction impact on sea birds and nesting sites is shown in **Table 7-14** below.

Table 7-14: Construction Impact on Sea Birds

Potential Impacts: DISSURBANCE TO SEA BIRDS ND NESTING SITES	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
Without Mitigation)	3	1	3	1	4	**32**	**Low**	(-)	High
With Mitigation)	2	1	3	1	3	**21**	**Low**	(-)	High
Mitigation and Management Measures	— As far as practicable schedule construction activities to avoid peak seabird breeding periods (March – October) and penguin moulting periods (summer months). — Ensure that construction activities avoid known penguin nesting sites. Construction 'no-go' areas should be delineated in collaboration with SANCCOB's seabird ranger on the island. — During the peak penguin breeding season (March – October) limit construction activities from 90 minutes after sunrise to 90 minutes before sunset, when penguins are not using the highway to the east of the proposed plant site. — Ensure that a penguin-proof perimeter fence is installed around the site boundary prior to commencement of construction activities to prevent penguins accidentally becoming trapped within the construction site or falling into excavations. — Monitor establishment of potential Hartlaub's Gulls and Swift Terns breeding areas in the vicinity of the								

Potential Impacts:	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
DISSURBANCE TO SEA BIRDS ND NESTING SITES									
	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. This will require a TOPS permit. — Ensure that sludge drying beds are suitably covered with screens to prevent birds getting into the sludge.								

OBSTRUCTION OF POTENTIAL MOVEMENT OF PENGUINS

Construction of the WWTW may obstruct movement of penguins. However, the small size of the facility does not present a major obstruction and penguins will be able to navigate around the fenced WWTW. The impact of construction activities on penguin movements is shown in **Table 7-15** below.

Table 7-15: Impact of construction activities on penguin movement

Potential Impacts:	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
OBSTRUCTION OF PENGUIN HIGHWAYS									
Without Mitigation)	2	1	3	1	2	14	Low	(-)	High
With Mitigation)	2	1	1	1	2	10	Low	(-)	High
Mitigation and Management Measures	— All workers will be trained on the significance of the penguins on Robben Island and must take due care and responsibility when working in the vicinity. — Ensure that a penguin-proof perimeter fence is installed around the site boundary prior to commencement of construction activities to prevent penguins accidentally becoming trapped within the construction site.								

7.6.2 OPERATIONAL PHASE

DISTURBANCE OF SEA BIRDS

During operation the WWTW may become a location for possible nesting sites for birdlife such as the African penguin. The WWTW will be fenced and this will prevent entry by penguins into the WWTW 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 operational impact on avifauna is shown in **Table 7-16** below.

Table 7-16: Operation Impact on Avifauna

Potential Impacts:	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
DISTURBANCE TO SEA BIRDS									
Without Mitigation)	2	1	3	1	2	14	Low	(-)	High
With Mitigation)	2	1	1	1	2	10	Low	(-)	High
Mitigation and Management Measures	— The WWTW design includes a security fence. This must be penguin proof that (as far as possible) prevents penguins								

Potential Impacts:	Magnitude	Extent	Reversibility	Duration	Probability	Significance	Character	Confidence
DISTURBANCE TO SEA BIRDS								
	from burrowing under and gaining access to the site during operation.							

7.7 MARINE ENVIRONMENT

The environment on and around the island is not pristine and the existing environmental impacts in the marine environment (such as the desalination plant, the sewage plant and marine outfalls and Murray's Bay Harbour) must be taken into consideration when assessing the potential impacts of the marine outfall. Refer to the Marine Ecology Assessment compiled by Pisces Environmental Services (Pty) Ltd (**Appendix F**) for a discussion on existing environmental impacts.

7.7.1 CONSTRUCTION PHASE

There are no anticipated impacts from the WWTW to the marine environment during the construction phase since the pipeline exists and no upgrades or changes are proposed.

7.7.2 OPERATIONAL PHASE

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.

DECREASE IN PLANKTON BLOOMS

Decrease in nutrient levels in the discharge from the proposed WWTW relative to those in the current raw sewage discharge as a result of the improved treatment processes from the current system would decrease the likelihood of plankton blooms and seabed hypoxia, improve turbidity and potentially reduce macroalgal growth on the outfall pipeline.

The operational impact on plankton blooms is shown in **Table 7-17** below.

Table 7-17: Operation Impact on Plankton Blooms

Potential Impacts:	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
DECREASED PLANKTON BLOOMS									
Without Mitigation)	4	1	1	5	5	**55**	**Moderate**	(+)	High

Potential Impacts: DECREASED PLANKTON BLOOMS	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
With Mitigation)	4	1	1	5	5	55	Moderate	(+)	High
Mitigation and Management Measures	— No mitigation necessary given the positive impact (with the possible exception of phosphate should plankton blooms increase) other than adherence to CWDP.								

RECOVERY OF BIODIVERSITY

Decreased nutrient levels in the discharge from the proposed WWTW may result in recovery of biodiversity and community structure of subtidal benthic macrofauna and flora impacted by the current raw sewage discharge.

The operational impact on recovery of biodiversity is shown in **Table 7-18** below.

Table 7-18: Operation Impact on Recovery of Biodiversity

Potential Impacts: RECOVERY OF BIODIVERSITY	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
Without Mitigation)	4	1	1	5	5	55	Moderate	(+)	High
With Mitigation)	4	1	1	5	5	55	Moderate	(+)	High
Mitigation and Management Measures	— No mitigation necessary, given positive impact, other than adherence to CWDP.								

RECOVERY OF THE STRUCTURE AND DIVERSITY OF SOFT-SEDIMENT MACROFAUNA

Reduced levels of organic matter in the discharge from the WWTW relative to those in the current raw sewage discharge may result in recovery of the structure and diversity of soft-sediment macrofauna.

The operational impact on structure and diversity of soft-sediment macrofauna is shown in **Table 7-19** below.

Table 7-19: Operation Impact on structure and diversity of soft-sediment macrofauna

Potential Impacts: RECOVERY OF THE STRUCTURE AND DIVERSITY OF SOFT-SEDIMENT MACROFAUNA	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
Without Mitigation)	4	1	1	5	5	55	Moderate	(+)	High
With Mitigation)	4	1	1	5	5	55	Moderate	(+)	High
Mitigation and Management Measures	— No mitigation necessary, given the positive impact, other than adherence to CWDP.								

IMPROVED SEDIMENT QUALITY

Reduced levels of organic matter and heavy metals discharged from the WWTW relative to the current raw sewage discharge may improve sediment quality (e.g. oxygen levels, heavy metals).

The operational impact on improved sediment quality is shown in **Table 7-20** below.

Table 7-20: Operation Impact on improved sediment quality

Potential Impacts: IMPROVED SEDIMENT QUALITY	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
Without Mitigation)	4	1	1	4	4	40	Moderate	(+)	High
With Mitigation)	4	1	1	4	4	40	Moderate	(+)	High
Mitigation and Management Measures	— No mitigation necessary, given the positive impact, other than adherence to CWDP.								

MODIFICATION OF THE DIVERSITY, ABUNDANCE AND STRUCTURE OF FISH ASSEMBLAGES

Reduced levels of organic matter in the discharge from the WWTW relative to the current raw sewage discharge may modify the diversity, abundance and structure of fish assemblages.

The operational impact on modification of the diversity, abundance and structure of fish assemblages is shown in **Table 7-21** below.

Table 7-21: Operation Impact on modification of the diversity, abundance and structure of fish assemblages

Potential Impacts: MODIFICATION OF THE DIVERSITY, ABUNDANCE AND STRUCTURE OF FISH ASSEMBLAGES	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
Without Mitigation)	4	1	1	5	4	44	Moderate	(+)	High
With Mitigation)	4	1	1	5	4	44	Moderate	(+)	High
Mitigation and Management Measures	— No mitigation necessary, given the positive impact, other than adherence to CWDP.								

IMPROVED ENVIRONMENTAL HEALTH

Reduced levels of colifom bacteria and other pathogens in the discharge from the WWTW relative to the current raw sewage discharge will improve environmental health and alleviate existing health hazards to humans.

The operational impact on improved environmental health is shown in **Table 7-22** below.

Table 7-22: Operation Impact on improved environmental health

Potential Impacts: IMPROVED ENVIRONMENTAL HEALTH	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
Without Mitigation)	4	1	1	4	4	40	Moderate	(+)	High
With Mitigation)	4	1	1	4	4	40	Moderate	(+)	High
Mitigation and Management Measures	— No mitigation necessary, given the positive impact, other than adherence to CWDP.								

BIOACCUMULATION OF XENOBIOTIC SUBSTANCES

Xenobiotic substances[12] in the discharge from the WWTW can bioaccumulate in higher order consumers. The operational impact on bioaccumulation of xenobiotic substances is indicated in **Table 7-23** below.

Table 7-23: Operational Impact on bioaccumulation of xenobiotic substances

Potential Impact: BIOACCUMULATION OF XENOBIOTIC SUBSTANCES	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
Without Mitigation	2	2	2	4	2	**20**	**Low**	(-)	High
With Mitigation	2	2	2	4	2	**20**	**Low**	(-)	High
Mitigation and Management Measures	<u>Measurement of effluent</u> — 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 consultant on an annual basis. — Submit the monitoring results together with the evaluation to the DWS and DFFE on an annual basis. — Should concentrations of phosphates be higher than anticipated (as suggested in the modelling report) specific mitigation measures to reduce phosphate concentrations may need to be implemented. <u>Measurement of receiving water body</u> — 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.								

[12] A xenobiotic is a chemical substance found within an organism that is not naturally produced or expected to be present within the organism. It can also cover substances that are present in much higher concentrations than are usual. Natural compounds can also become xenobiotics if they are taken up by another organism, such as the uptake of natural human hormones by fish found downstream of sewage treatment plant outfalls.

	— On commissioning of the Waste Water Treatment Works, monitor the quality of the receiving waters once every 2 weeks at distances of 10 m, 50 m and 100 m to the north, south, west and east of 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) for at least three years. — 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 three-year monitoring programme. — Submit the monitoring results together with the evaluation to the DWS and DFFE on an annual basis.

DAMAGE TO MARINE BIOTA

Effluent will be disinfected using sodium hypochlorite dosed into the chlorine contact chamber. Typically, around 25ltr/month of sodium hypochlorite is used for 30kl/day of sewage. This estimate is adjusted based on water testing, as it varies slightly from site to site.

Biocides (sodium hypochlorite) used to disinfect the effluent are highly toxic to marine biota. The operational impact on marine biota is indicated in **Table 7-24** below.

Table 7-24: Operational Impact on marine biota

Potential Impact: DAMAGE TO MARINE BIOTA	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
Without Mitigation	3	1	5	1	3	**30**	**Low**	(-)	High
With Mitigation	1	1	1	4	1	**7**	**Low**	(-)	High
Mitigation and Management Measures	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 consultant on an annual basis. — Submit the monitoring results together with the evaluation to the DWS and DFFE on an annual basis. — Should concentrations of phosphates be higher than anticipated (as suggested in the modelling report) specific mitigation measures to reduce phosphate concentrations may need to be implemented. <u>Measurement of receiving water body:</u> — 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 Waste Water Treatment Works, monitor the quality of the receiving waters once every 2 weeks at distances of 10 m, 50 m and 100 m to the north, south, west and east of 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) for at least three years. — 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 three-year monitoring programme.

	— Submit the monitoring results together with the evaluation to the DWS and DFFE on an annual basis.

REDUCED SALINITIES

The fresh water in the discharge from the WWTW will reduce salinities around the outfall and affect the osmoregulatory abilities of marine organisms. The operational impact on reduced salinities is indicated in **Table 7-25** below.

Table 7-25: Operational Impact on reduced salinities

Potential Impact: REDUCED SALINITIES	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
Without Mitigation	3	1	1	4	3	**27**	**Low**	(-)	High
With Mitigation	3	1	1	4	3	**27**	**Low**	(-)	High
Mitigation and Management Measures	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 consultant on an annual basis. — Submit the monitoring results together with the evaluation to the DWS and DFFE on an annual basis. — Should concentrations of phosphates be higher than anticipated (as suggested in the modelling report) specific mitigation measures to reduce phosphate concentrations may need to be implemented. 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 Waste Water Treatment Works, monitor the quality of the receiving waters once every 2 weeks at distances of 10 m, 50 m and 100 m to the north, south, west									

	and east of 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) for at least three years. — 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 three-year monitoring programme. — Submit the monitoring results together with the evaluation to the DWS and DFFE on an annual basis.

7.8 VISUAL

7.8.1 CONSTRUCTION PHASE

VISUAL DISTURBANCE

Visual impacts associated with construction sites are generally attributed to poor housekeeping (e.g. presence of excavation scars, poorly managed construction waste, untidy storage of construction materials, visible portable latrines). Construction phase impacts will be generally offset by the fact that the construction period will be short (6 months); The WWTW will also have very little foot or vehicle traffic during construction and operation and is therefore expected to create minimal disturbance.

The construction impact on the visual landscape is indicated in **Table 7-26** below.

Table 7-26: Construction Impact on Visual Landscape

Potential Impact: VISUAL DISTURBANCE DURING CONSTRUCTION	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
Without Mitigation	2	2	3	1	2	**16**	**Low**	(-)	High
With Mitigation	1	2	1	1	1	**5**	**Low**	(-)	High
Mitigation and Management Measures	— Clearance of indigenous vegetation should be minimised and rehabilitated; — The site should be kept neat and tidy. Littering should be fined;								

	— Screening of unsightly aspects from public view including excavations, construction material storage areas, waste storage areas and ablutions).

7.8.2 OPERATIONAL PHASE

The potential for visual disturbance is relatively low, given the limited development envelope size and vertical height of the WWTW. That said, the facility is positioned immediately adjacent to a national monument (Robert Sobukwe House) and in close proximity to a heritage site (The Church of the Good Shepherd). Both the aforementioned are considered sensitive visual receptors. Considering also that Robben Island is a UNESCO World Heritage Site, welcoming thousands of visitors annually, the potential visual impact of any development on the island must be considered and mitigated where at all possible. The island is essentially an open air museum and any further development on the island could affect the historical integrity of the island.

The vegetation on-site will play a role in screening the facility from certain angles, most notably from the shoreline, which is heavily treed. It is therefore anticipated that the only sensitive receptors of concern are the Robert Sobukwe House, the church, and the main tourist road connecting the aforementioned i.e. a visual exposure or Zone of Visual Influence of less than 100m. The extent of visual exposure within this zone is expected to be high (<50m) to low (>50m).

Figure 7-6: Proposed WWTW infrastructure and site viewpoints

View from point (a) looking south with the existing septic tanks in the foreground. The approximate development envelope is illustrated in red.

View from point (b) looking south-east . The approximate development envelope is illustrated in red.

Figure 7-7: Site viewpoints (a and b)

View from point (c) looking north. The approximate development envelope is illustrated in red.

View from point (d) looking east. The approximate development envelope is illustrated in red.

Figure 7-8: Site viewpoints (c and d)

POTENTIAL VISUAL IMPACT ON SENSITIVE VISUAL RECEPTORS IN CLOSE PROXIMITY TO THE FACILITY

The visual impact on *any potential* sensitive visual receptors in close proximity to the proposed infrastructure (i.e. within 50m) is expected to be of **moderate** significance, and could be mitigated to **negligible.** The table below illustrates this impact assessment.

The operational impact on sensitive visual receptors in close proximity is indicated in **Table 7-27** below.

Table 7-27: Operational Impact on Visual Landscape

Potential Impact: VISUAL DISTURBANCE DURING OPERATION	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
Without Mitigation	8	4	3	4	3	**48**	**Moderate**	(-)	High
With Mitigation	4	4	1	4	1	**12**	**Low**	(-)	High
Mitigation and Management Measures	Site development & Operation: — Retain / re-establish and maintain large indigenous trees, natural features and noteworthy natural vegetation in all areas outside of the activity footprint. — Plan ancillary infrastructure in such a way and in such a location that clearing of vegetation is minimised. Consolidate existing infrastructure as much as possible, and make use of already disturbed areas rather than pristine sites wherever possible. — Keeping infrastructure at design heights. — Introducing landscaped screening measures such as vegetated earth mounds, (see **Section 9**). — Avoid the use of highly reflective material. Construction: — Rehabilitate all construction areas, when no longer required. — Keep vegetation clearing to a minimum. Operations: — Retain / re-establish and maintain natural vegetation in all areas outside of the development footprint. — Maintain the general appearance of the facility as a whole (i.e. repaint when required). — Monitor rehabilitated areas, and implement remedial action as and when required.								

POTENTIAL VISUAL IMPACT ON THE VISUAL CHARACTER OF THE LANDSCAPE AND SENSE OF PLACE OF THE REGION

Sense of place refers to a unique experience of an environment by a user based on his or her cognitive experience of the place. Visual criteria and specifically the visual character of an area (informed by a combination of aspects such as topography, level of development, vegetation, noteworthy features, cultural / historical features, etc.) play a significant role.

A visual impact on the sense of place is one that alters the visual landscape to such an extent that the user experiences the environment differently, and more specifically, in a less appealing or less positive light.

In general, the landscape character of the development site and environs presents as transformed and disturbed. The visual quality of the area is generally low due in large part to the presence of alien plant species, derelict and disused utility infrastructure, and other man-made structures. However, the island has distinct sense of place and visual character that is tied to the many cultural historic sites and structure, and that must be protected. Therefore, the study area is considered sensitive to visual impacts due to its cultural historic significance.

The anticipated visual impact on the visual character and sense of place of the study area is expected to be of moderate significance. However, effective mitigation is possible within this environment and for a facility of this scale. The table below illustrates this impact assessment.

The operational impact on sensitive visual receptors in close proximity is indicated in **Table 7-28** below.

Table 7-28: Operational Impact on Visual Landscape

Potential Impact: VISUAL DISTURBANCE DURING OPERATION	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
Without Mitigation	8	2	3	4	3	**42**	**Moderate**	(-)	High
With Mitigation	4	2	3	4	1	**10**	**Low**	(-)	High
Mitigation and Management Measures	Planning: — Retain / re-establish and maintain natural vegetation in all areas outside of the development footprint. — Plan ancillary infrastructure in such a way and in such a location that clearing of vegetation is minimised. — Wherever possible, use materials, coatings, or paints that have little or no reflectivity and blends with the natural environment. — Commercial messages, symbols and/logos are not permitted on structures (with the exception of 'no-entry' signage on perimeter fencing) Construction: — Rehabilitate all construction areas. — Ensure that vegetation is not cleared unnecessarily to make way for infrastructure. Operations: — Maintain the general appearance of the facility as a whole. — Monitor rehabilitated areas for plant growth, evidence of erosion etc., and implement remedial action as and when required. — Use all spoil material salvaged from the construction works to create a planted earth mound/berm along the western perimeter of the development envelope. This mound should be organically designed to resemble a natural topographic feature ('dune shaped') and planted with hardy indigenous vegetation.								

7.9 WASTE MANAGEMENT

7.9.1 CONSTRUCTION PHASE

IMPROPER WASTE MANAGEMENT

Construction-related waste is not anticipated to trigger the need for a Waste Management Licence (WML) in terms of NEMWA (Refer to **Section 2**). Waste management at the Project site will be undertaken in line with the EMPr to consider the correct disposal of general and hazardous waste generated on the Project. 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.

The construction impact on improper waste management and littering is indicated in **Table 7-29** below.

Table 7-29: Construction Impact on Improper Waste Management

Potential Impact: IMPROPER WASTE MANAGEMENT AND LITTERING	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
Without Mitigation	3	1	3	1	4	**32**	**Moderate**	(-)	High
With Mitigation	2	1	1	1	3	**15**	**Low**	(-)	High
Mitigation and Management Measures	— Waste management must be a priority and all waste must be collected and stored adequately; — A minimum of one toilet must be provided per 10 persons; — The Contractor should supply sealable and properly marked domestic waste collection bins and all solid waste collected shall be disposed of at a licensed disposal facility; — Hazardous waste must be stored separately in covered containers and appropriately disposed of at a licensed disposal facility; — Recycling should take place, where possible; and — All construction wastes must be removed from site once construction has been completed.								

7.9.2 OPERATIONAL PHASE

IMPROPER WASTE MANAGEMENT

During operation, primary risks associated with waste is the potential 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 WWTW. Waste inert sludge is the main waste type generated which has already been minimised as far as possible though the choice of technology. An estimated 66m^3 of sludge will be generated annually, approximately 70% of which will be water. 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 located directly adjacent to the facility. According to the Sewage/Sludge Status Quo Report (2020/21) produced by DEA&DP, the waste from the drying bed will be able to be used as fertiliser. However, this will need to be confirmed through appropriate testing before the sludge can be used as fertiliser.

Only extremely minimal hazardous waste limited to possibly waste paints or oily rags from maintenance will be generated.

The operational impact on improper waste management is indicated in **Table 7-30** below.

Table 7-30: operational Impact on Improper Waste Management

Potential Impact: IMPROPER WASTE MANAGEMENT	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
Without Mitigation	3	1	3	1	4	**32**	**Moderate**	(-)	High
With Mitigation	2	1	1	1	3	**15**	**Low**	(-)	High
Mitigation and Management Measures	— RIM will be responsible for ensuring that the sludge is tested to ensure that the content of heavy metals is within acceptable limits in line with the Sewage/Sludge Status Quo Report (2020/21). If the results of the testing confirm that the sludge is suitable to be used as fertiliser as is anticipated, then a maximum of 10m^3 of dried sludge per year will be spread out over an area adjacent to the WWTW, 15 or 20								

	mm thick, depending how wide it is spread. Should the results of the testing indicate that the sludge is not suitable to be used as fertiliser, then the sludge will be disposed of appropriately at a licensed landfill site or to a municipal WWTW off the island. — Hazardous waste must be stored separately in covered containers and appropriately disposed of at a licensed disposal facility; — 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. — All solid general waste shall be disposed of at a licensed disposal facility.

7.10 GEOTECHNICAL

7.10.1 CONSTRUCTION PHASE

GEOLOGICAL FAULTING

For both construction and operation, there is a risk of geological faulting during construction if the WWTW is placed on collapsible soils with potential failure in the infrastructure.

The construction geotechnical impact is indicated in **Table 7-31** below.

Table 7-31: Construction Impact on Geotechnical

Potential Impact: GEOLOGICAL FAULTING	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
Without Mitigation	2	1	3	1	4	**28**	**Low**	(-)	High
With Mitigation	2	1	1	1	3	**15**	**Low**	(-)	High
Mitigation and Management Measures	— Thorough geotechnical investigation to be completed prior to construction to identify the presence of faults and unstable areas which will be considered in detaileddesign.								

7.10.2 OPERATION PHASE

GEOLOGICAL FAULTING

The operation geotechnical impact is indicated in **Table 7-32** below.

Table 7-32: Operational Impact on Geotechnical

Potential Impact: GEOLOGICAL FAULTING	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
Without Mitigation	2	1	3	1	4	**28**	**Low**	(-)	High
With Mitigation	2	1	1	1	3	**15**	**Low**	(-)	High

Potential Impact:	Magnitude	Extent	Reversibility	Duration	Probability	Significance	Character	Confidence
GEOLOGICAL FAULTING								
Mitigation and Management Measures	— Thorough geotechnical investigation to be completed prior to construction to identify the presence of faults and unstable areas which will be considered in detailed design.							

7.11 HERITAGE (ARCHAEOLOGY AND PALAEONTOLOGY)

7.11.1 CONSTRUCTION PHASE

DAMAGE TO HERITAGE RESOURCES

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. The Archaeology Impact Assessment (**Appendix F**) concluded that the development of the WWTW 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.

Further potential impact associated with construction includes damage or destruction to fossiliferous palaeontology resources during excavations. The PIA Screening study (**Appendix F**) indicated that the construction of the proposed WWTW is not likely to significantly affect the paleontological resources of the island due to the low depth of excavation and the small development footprint.

The potential for any heritage impacts is indicated in **Table 7-33** below.

Table 7-33: Construction Impact on Damage to Heritage Resources

Potential Impact:	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
DAMAGE TO HERITAGE RESOURCES									
Without Mitigation	2	1	3	5	2	**22**	**Low**	(-)	High
With Mitigation	1	1	3	1	2	**12**	**Low**	(-)	High
Mitigation and Management Measures	— 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. — A Chance Find Procedure must be developed to manage any heritage chance finds.								

7.11.2 OPERATIONAL PHASE

There are no anticipated heritage impacts during the operational phase, as any existing resources would have been discovered during excavations and other intrusive construction activities.

7.12 SOCIO-ECONOMIC

7.12.1 CONSTRUCTION PHASE

CREATION OF EMPLOYMENT AND THE OPPORTUNITY FOR SKILLS DEVELOPMENT AND ON-SITE TRAINING

The construction phase of the WWTW will extend over a period of approximately 3 months and create in the region of 20-30 employment opportunities. Approximately 80% of the jobs will be low-skilled, 15% semi-skilled and 5% skilled.

The impact on employment and skills development is shown in **Table 7-34**.

Table 7-34: Construction Impact on Employment, Skills Development and Business Opportunities

Potential Impact: CREATION OF EMPLOYMENT AND THE OPPORTUNITY FOR SKILLS DEVELOPMENT	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
Without Mitigation	2	2	0	2	3	**18**	**Low**	(+)	High
With Mitigation	2	3	0	2	4	**28**	**Low**	(+)	High
Mitigation and Management Measures	— Where reasonable and practical, the proponent should appoint local contractors and implement a 'locals first' policy, especially for semi and low-skilled job categories. — Where feasible, efforts should be made to employ local contactors that are compliant with Broad Based Black Economic Empowerment (BBBEE) criteria. — The recruitment selection process should seek to promote gender equality and the employment of women wherever possible. *Note that while preference to local employees and companies is recommended, it is recognised that a competitive tender process may not guarantee the employment of local labour for the construction phase.*								

PRESENCE OF CONSTRUCTION WORKERS AND POTENTIAL IMPACTS ON FAMILY STRUCTURES AND SOCIAL NETWORKS

The presence of construction workers can pose a potential risk to family structures and social networks. While the presence of construction workers does not in itself constitute a social impact, the manner in which construction workers conduct themselves can impact on local communities. The most significant negative impact is associated with the disruption of existing family structures and social networks. This risk is linked to potentially risky behaviour, mainly of male construction workers, including:

— An increase in alcohol and drug use.
— An increase in crime levels.
— The loss of girlfriends and/or wives to construction workers.
— An increase in teenage and unplanned / unwanted pregnancies.
— An increase in prostitution.
— An increase in sexually transmitted diseases (STDs), including HIV.

The total number of workers will be low, namely ~ 20-30. It is also recognised that the unique location of the site, on Robeen Island will further limit the service providers able to support this project. The potential impact of construction workers on the local community is therefore likely to be negligible.

The impact of the presence of construction workers on family structures and social networks is show in **Table 7-35**.

Table 7-35: Construction Impact on Family Structures and Social Networks

Potential Impact: PRESENCE OF CONSTRUCTION WORKERS AND POTENTIAL IMPACTS ON FAMILY STRUCTURES AND SOCIAL NETWORKS	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
Without Mitigation	2	2	3	2	2	**18**	**Low**	(-)	High
With Mitigation	1	1	3	2	2	**14**	**Low**	(-)	High
Mitigation and Management Measures	— The proponent and the contractor(s) should develop a code of conduct for the construction phase. The code should identify which types of behaviour and activities are not acceptable. Construction workers in breach of the code should be subject to appropriate disciplinary action and/or dismissed. All dismissals must comply with the South African labour legislation. — The proponent and the contractor should implement an awareness programme for communicable diseases (including HIV/AIDS and COVID-19) for all construction workers at the outset of the construction phase. — The contractor must ensure that all construction workers from outside the area are transported back to their place of residence within 2 days of their contract coming to an end.								

Residual impacts include impacts on family and community relations that may, in some cases, persist for a long period of time. Also, in cases where unplanned / unwanted pregnancies occur or members of the community are infected by an STD, specifically HIV and or AIDS, the impacts may be permanent and have long term to permanent residual/cumulative impacts on the affected individuals and/or their families and the community.

7.12.2 OPERATIONAL PHASE

PROVISION OF ESSENTIAL SERVICES

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.

The impact on essential services is shown in **Table 7-36**.

Table 7-36: Operational Impact on Essential Services

Potential Impact: PROVISION OF ESSENTIAL SERVICES	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
Without Mitigation	2	2	0	4	3	**24**	**Low**	(+)	High
With Mitigation	2	2	0	4	3	**24**	**Low**	(+)	High
Mitigation and Management Measures	— N/A.								

Residual impacts include the creation of permanent employment and skills and development opportunities for members from the local community and creation of additional business and economic opportunities in the area.

7.13 HEALTH AND SAFETY

7.13.1 CONSTRUCTION PHASE

SAFETY RISK TO WORKERS

During construction, the employees are exposed to health and safety hazards from the mechanical machines and equipment used on the site. Furthermore, there is a potential for snakes and other dangerous animals in the area, to which the employees must be warned about and trained on how to handle situations if any encounters occur. The construction impact on health and safety is indicated in **Table 7-37** below.

Table 7-37: Construction Impact on Employee Health and Safety

Potential Impact: EMPLOYEE HEALTH AND SAFETY	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
Without Mitigation	3	2	3	4	4	**48**	**Moderate**	(-)	High
With Mitigation	2	1	3	4	2	**20**	**Low**	(-)	High
Mitigation and Management Measures	— An HSE officer must be appointed to monitor safety conditions during construction activities; — Ensure employees are properly trained to use specific equipment or machinery; — Train personnel on how to deal with snake encounters; — Provide suitable personal protective equipment (PPE); — Conduct site and safety induction to raise awareness of the risks associated with the site; — Conduct regular toolbox talks as refreshers to improve health and safety; — Develop safe work instruction method statements that should be used by employees in completing their tasks; — Train all relevant personnel on handling, use and storage of hazardous substances; — Provide Material Safety Data Sheets (MSDS) for all hazardous substances kept onsite; and — All visitors should undergo site induction and be made aware of the risks associated with the site.								

7.13.2 OPERATIONAL PHASE

SAFETY RISK TO WORKERS

The operational phase health and safety impacts are expected to be limited given the facility will be fenced and access controlled. 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. The impact is expected to be low following mitigation and is indicated in **Table 7-38** below.

Table 7-38: Operation Impact on Employee Health and Safety

Potential Impact: EMPLOYEE HEALTH AND SAFETY	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
Without Mitigation	2	1	3	3	3	**27**	**Low**	(-)	High
With Mitigation	2	1	3	4	2	**20**	**Low**	(-)	High
Mitigation and Management Measures	— 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. — Provide suitable PPE. — 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. — Conduct site and safety induction to raise awareness of the risks associated with the site; and — Develop safe work instruction method statements that should be used by employees in completing their tasks.								

7.14 NO-GO ALTERNATIVE

The no-go alternative will mean none of the negative and positive impacts described above will come into effect. Similarly =, none of the positive impacts associated with the marine water quality and marine ecology and socio-economics will be achieved.

8 CUMULATIVE IMPACT ASSESSMENT

Although the BA process is essential to assessing and managing the environmental and social impacts of individual projects, it often may be insufficient for identifying and managing incremental impacts on areas or resources used or directly affected by a given development from other existing, planned, or reasonably defined developments at the time the risks and impacts are identified. Cumulative impacts are those that result from the successive, incremental, and/or combined effects of an action, project, or activity when added to other existing, planned, and/or reasonably anticipated future ones.

Cumulative impacts with existing and planned facilities may occur during construction and operation of the proposed WWTW. While one project may not have a significant negative impact on sensitive resources or receptors, the collective impact of the projects may increase the severity of the potential impacts.

Potential cumulative impacts identified are summarised below. Other planned or existing projects that can interact with the Project include the upgrade of the Alpha 1 Lounge and the restoration and maintenance of the Blue Stone Quarry wall, both of which are expected to be completed construction by March 2023. However it should be noted that the site is isolated on an island with no other projects occurring within close proximity to the proposed WWTW site.

SOCIO-ECONOMIC

The cumulative impact of the development of the WWTW will result in the continued positive economic spin-off as a result of tourism and trade from the Island. This impact is expected to be negligible.

SENSE OF PLACE

The proposed WWTW is located adjacent to existing infrastructure (i.e. Robert Sobukwe House). The potential for cumulative impacts associated with combined visibility (whether two or more developments will be visible from one location) and sequential visibility (the effect of seeing two or more developments along a single journey, e.g., road or walking trail) does therefore exist. However, the cumulative impact on the area's sense of place is likely to be negligible. Development on the island is tightly controlled to ensure that the "sense of place" of the island is retained. The only other development projects are the maintenance of the Blue Stone Quarry wall, the upgrade of the Alpha 1 Lounge, the desalination plant and the Solar PV plant, none of which are in close proximity to the proposed WWTW.

HERITAGE

The primary cumulative impact related to heritage is that development on the island (such as the proposed WWTW) results in an overall negative impact on the heritage value of Robben Island. This is extremely unlikely, since the WWTW is required to allow for the provision of sewage services and the continued use of the island as a world and national heritage site for tourism. 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.

BIODIVERSITY

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 the WWTW, the development is not expected to have any significant cumulative impact. None of the other development projects on the island will affect vegetation.

MARINE ECOLOGY

Recovery of biodiversity and community structure of subtidal benthic macrofauna and flora over time in response to improved wastewater quality. The operational impact on plankton blooms is shown in **Table 8-1** below.

Table 8-1: Cumulative Impact on Improved Wastewater Quality

Potential Impacts: IMPROVED WASTEWATER QUALITY	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
Without Mitigation)	4	1	1	5	5	**40**	**Moderate**	(+)	High
With Mitigation)	4	1	1	5	5	**45**	**Moderate**	(+)	High
Mitigation and Management Measures	— N/A								

AVIFAUNA

Disturbance of nesting seabirds during construction will be cumulative relative to current and future disturbance by island visitors and researchers. The cumulative impact on nesting seabirds is shown in **Table 8-2** below.

Table 8-2: Cumulative Impact on nesting sea birds

Potential Impacts: DISTURBANCE OF NESTING SEABIRDS	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
Without Mitigation)	3	1	3	4	3	**33**	**Moderate**	(-)	High
With Mitigation)	2	1	3	2	3	**24**	**Low**	(-)	High
Mitigation and Management Measures	— 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. — Ensure that a penguin-proof perimeter fence is installed around the site boundary prior to commencement of construction activities to prevent penguins accidentally becoming trapped within the construction site or within excavations.								

9 ENVIRONMENTAL IMPACT STATEMENT

The essence of any impact assessment process is aimed at ensuring informed decision-making, environmental accountability, and to assist in achieving environmentally sound and sustainable development. In terms of NEMA, the commitment to sustainable development is evident in the provision that "*development must be socially, environmentally and economically sustainable…. and requires the consideration of all relevant factors…*". NEMA also imposes a duty of care, which places an obligation on any person who has caused, is causing, or is likely to cause damage to the environment to take reasonable steps to prevent such damage. In terms of NEMA's preventative principle, potentially negative impacts on the environment and on people's environmental rights (in terms of the Constitution of the Republic of South Africa, Act No. 108 of 1996) should be anticipated and prevented, and where they cannot be prevented altogether, they must be minimised and remedied in terms of "reasonable measures".

In assessing the environmental feasibility of the proposed construction of the WWTW, the requirements of all relevant legislation have been considered. The identification and development of appropriate mitigation measures that should be implemented to minimise potentially significant impacts associated with the project, has been informed by best practice principles, past experience, and the relevant legislation (where applicable).

The conclusions of this BA are the result of comprehensive assessments. These assessments were based on issues identified through the BA process and public participation undertaken to date. The BAR will be subject to public review, which will be undertaken according to the requirements of NEMA with every effort made to include representatives of all stakeholders within the process. The BAR will be updated and finalised taking into consideration all comments received during the public review period before being submitted to the CA for consideration.

9.1 SPECIALIST CONCLUSIONS

9.1.1 PALAEONTOLOGY

It is concluded that the proposed WWTW 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 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 Environmental Control officer (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 SAHRA, so that appropriate mitigation (i.e. recording, sampling or collection) by a palaeontological specialist can be considered and implemented. These recommendations should be incorporated into the EMPr for the project.

9.1.2 ARCHAEOLOGY

In March 2013, Dr Ute A Seemann conducted a survey for historical/ archaeological surface remains of the proposed WWTW site on Robben Island. The site was found to be heavily disturbed by sewage and freshwater 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. No remains of visible historical/archaeological features or portable artefacts were found during the survey. The recommendation of the AIA was for the site to be released for further development.

Dr Seemann confirmed in 2021 that the AIA would remain unchanged and should not be updated for the purposes of this application. The site has not changed from an archaeological resources perspective and, as such, the impacts and mitigation measures identified remain unchanged. The site has lain undisturbed for the intervening years and there is no requirement for reassessment.

9.1.3 MARINE ECOLOGY

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 WWTW were mostly rated as positive impacts of moderate significance. As the wastewater from the proposed WWTW 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 very low to low significance. The impact footprint for discharges from the proposed WWTW 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.

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

- the upgraded treatment facility operates according to the required treatment limits and meets the specified general limit values; and
- the resulting impact on the marine water quality is in line with the dispersion modelling completed by van Ballegooyen (2021) for the proposed WWTW discharge.

If all environmental guidelines and appropriate mitigation measures and monitoring recommendations 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.

9.1.4 MARINE OUTFALL DISPERSION MODELLING

There is compliance with the existing water quality guidelines within a predicted 10 m of the outfall diffuser for all effluents constituents other than Phosphate. Phosphate is predicted to comply within between 30 m and 100 m of the outfall diffuser, depending on the assumed phosphate concentration in the wastewater effluent from the proposed new WWTW. However, this non-compliance beyond a 10 m radius of the outfall may be considered non-substantive, as phosphate is generally not a limiting nutrient in the environment under consideration (Lwandle, 2017).

It should be noted that the largest predicted mixing zones are generally for quiescent (stagnant conditions) that are unlikely to be a common occurrence for the marine outfall location. Furthermore, the discharge of effluents from the WWTW will be intermittent (i.e. a cumulative 3 hours and 20 minutes per day for the sewage flow volumes envisaged). The “no-flow” periods between the intermittent discharges will give the effluent time to disperse and there is a very low likelihood of the accumulation of effluent around the outfall diffuser.

9.1.5 ODOUR

This study assessed the potential impacts associated with normal operations using a Level 2 (AERMOD) dispersion modelling assessment. An emissions inventory was developed for odour and odorous constituent gases (namely, NH3 and H2S) using emission factors developed by peer reviewed studies and reputable international environmental bodies (e.g. Australian NPI) for input into the dispersion model. Quantified sources include the various WWTW components; however, components that will be covered or enclosed for odour containment purposes were excluded from the model simulation. Simulated dispersion outputs were compared to international guidelines (as applicable) to assess the degree of impact. Key findings are as follows:

- Simulated concentrations at sensitive receptors fall below the relevant international nuisance guidelines.

- Peak concentrations occur along the southwestern, northwestern and southeastern fencelines of the proposed WWTW development site.
- Offsite exceedances of odour nuisance guidelines are predicted beyond the boundary of the proposed WWTW development site; however, these are limited to within 20 m of the operational fenceline. This impact area extends to the gravel roads that run adjacent to the proposed development site. These roads are only used by maintenance staff and are not roads used by the Island's residents or tourists.
- Based on odour impact rating criteria provided by the UK IAQM guidance, the predicted impact significance for sensitive receptors is determined to be 'negligible'.
- Based on impact rating criteria guidance provided by South Africa's national department for environmental management (Department of Environmental Affairs and Tourism, 2002), the predicted impact significance for the immediate vicinity of the proposed WWTW is determined to be 'very low'.

WSP recommends that RIM consider developing a vegetated environmental berm around the proposed WWTW to create a natural barrier and chemical sink for odorous constituent gases. Complaints and any actions arising from a complaint must be recorded in a complaints register maintained by site management. If required, fenceline measurements of H_2S will provide a real-time indicator of odour impact. Warning communities to expect potential odour events during upset conditions (e.g. during desludging or when extended maintenance is scheduled) will generate increased trust and facilitate communication between parties. When possible, maintenance/desludging of the WWTW should be scheduled for times when fewer tourists are expected in the area or strategically planned so as not to coincide with proximate community events, if any.

9.1.6 VISUAL

Robben Island is a UNESCO World Heritage Site, and welcomes over 1000 tourists every day. It is therefore incumbent on the custodians of this site to ensure that any further development of the island, regardless of size, is subjected to an environmental impact assessment process that endeavors to protect the environmental, cultural historic and aesthetic integrity of the island.

Although the proposed WWTW is a relatively small and unobtrusive structure, the construction and operation of the WWTW will have a visual impact on sensitive visual receptors, but only on those receptors in very close proximity to the WWTW (i.e. within a 50m radius of the proposed project development site). The visual receptors include tourists travelling along the Murray Bay Road, as well as those visiting the Church of the Good Shepherd and Robert Sobukwe House. Whilst the majority of visitors may accept this as part and parcel of required infrastructural development on the island, best environmental practice would require that attempts are made to screen this facility from direct view of tourists, and retain the pre-1995 look and feel of the island.

Various generic mitigation procedures have been proposed in the impact assessment chapter, but it is submitted that the most effective way to ameliorate the impact would be by using all spoil material salvaged from the construction works to create a planted earth mound/berm along the western perimeter of the development envelope. This mound should be organically designed to resemble a natural topographic feature ('dune shaped') and planted with hardy indigenous vegetation. At a planted height of 1.5m, the planted earth mound will effectively screen any view of the WWTW from the aforementioned sensitive receptors. A local botanist should be consulted for advice on an appropriate indigenous planting palette.

It is further recommended that the general site be cleared of other disused and derelict structures, such as telephone poles which litter the area. These mitigation measures are graphically presented **Figure 9-1**.

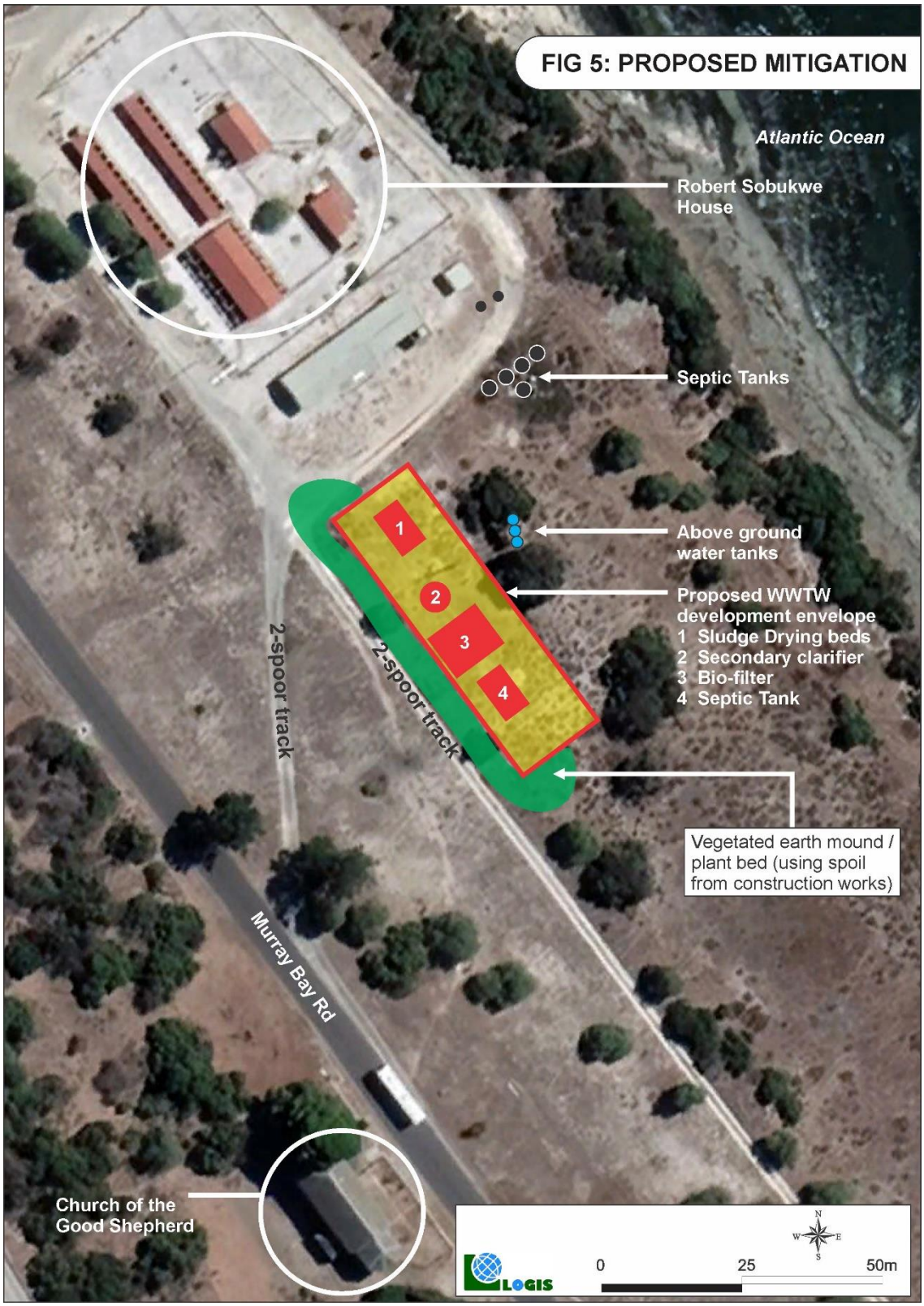

Figure 9-1: Visual specialist recommendations (source: LOGIS, 2022)

9.2 IMPACT SUMMARY

A summary of the identified impacts and corresponding significance ratings for the proposed WWTW is provided in **Table 9-1** below.

Table 9-1: Impact Summary

REF.	IMPACT DESCRIPTION	PHASE	WITHOUT MITIGATION		WITH MITIGATION	
			SIGNIFICANCE	STATUS	SIGNIFICANCE	STATUS
Air Quality	Generation of Dust and PM	Construction	**Low**	(-)	**Low**	(-)
	Odour	Operation	**Low**	(-)	**Low**	(-)
Noise	Noise Emissions	Construction	**Low**	(-)	**Low**	(-)
	Noise Emissions	Operation	**Low**	(-)	**Low**	(-)
Soil Erosion & Contamination	Soil Erosion	Construction	**Low**	(-)	**Low**	(-)
	Soil Contamination	Construction	**Low**	(-)	**Low**	(-)
	Soil Contamination	Operation	**Low**	(-)	**Low**	(-)
Groundwater	Deterioration of Groundwater Quality	Construction	**Moderate**	(-)	**Low**	(-)
	Deterioration of Groundwater Quality	Operation	**Moderate**	(-)	**Low**	(-)
Biodiversity	Destruction of Vegetation	Construction	**Low**	(-)	**Low**	(-)
	Destruction of Vegetation	Operation	**Low**	(-)	**Low**	(-)
Avifauna	Disturbance of Nesting Sites	Construction	**Low**	(-)	**Low**	(-)
	Obstruction of Penguin Highways	Construction	**Low**	(-)	**Low**	(-)
	Disturbance of Sea Birds	Operation	**Low**	(-)	**Low**	(-)
Marine Environment	Decreased Plankton Blooms	Operation	**Moderate**	(+)	**Moderate**	(+)
	Recovery of Biodiversity	Operation	**Moderate**	(+)	**Moderate**	(+)

REF.	IMPACT DESCRIPTION	PHASE	WITHOUT MITIGATION		WITH MITIGATION	
			SIGNIFICANCE	STATUS	SIGNIFICANCE	STATUS
	Recovery of the Structure and Diversity of Soft-Sediment Macrofauna	Operation	**Moderate**	(+)	**Moderate**	(+)
	Improved Sediment Quality	Operation	**Moderate**	(+)	**Moderate**	(+)
	Modification of the Diversity, Abundance and Structure of Fish Assemblages	Operation	**Moderate**	(+)	**Moderate**	(+)
	Improved Environmental Health	Operation	**Moderate**	(+)	**Moderate**	(+)
	Bioaccumulation of Xenobiotic Substances	Operation	**Low**	(-)	**Low**	(-)
	Damage to Marine Biota	Operation	**Low**	(-)	**Low**	(-)
	Reduced Salinities	Operation	**Low**	(-)	**Low**	(-)
Visual	Visual Disturbance	Construction	**Low**	(-)	**Low**	(-)
	Sensitive Visual Receptors	Operation	**Moderate**	(-)	**Low**	(-)
	Visual Character and Sense of Place	Operation	**Moderate**	(-)	**Low**	(-)
Waste	Improper Waste Management	Construction	**Moderate**	(-)	**Low**	(-)
	Improper Waste Management	Operation	**Moderate**	(-)	**Low**	(-)
Geotechnical	Geological Faulting	Construction	**Low**	(-)	**Low**	(-)
	Geological Faulting	Operation	**Low**	(-)	**Low**	(-)
Heritage	Damage to Heritage Resources	Construction	**Low**	(-)	**Low**	(-)

REF.	IMPACT DESCRIPTION	PHASE	WITHOUT MITIGATION		WITH MITIGATION	
			SIGNIFICANCE	STATUS	SIGNIFICANCE	STATUS
Socio-economic	Creation of Employment and Skills Development	Construction	**Low**	(+)	**Low**	(+)
	Presence of Construction Workers and Impact on Family Structures and Social Networks	Construction	**Low**	(-)	**Low**	(-)
	Provision of Essential Services	Operation	**Low**	(+)	**Low**	(+)
Health and Safety	Employee Health & Safety	Construction	**Moderate**	(-)	**Low**	(-)
	Employee Health & Safety	Operation	**Low**	(-)	**Low**	(-)

9.3 ALTERNATIVES ASSESSMENT

Project alternatives in terms of activity, technology, location and layout were considered as part of the BA process. Only the preferred alternative has been assessed (i.e. a Wastewater Treatment Plant). Alternative activities for the current Project are not reasonable or feasible as the purpose of this Project is to treat and discharge effluent generated on Robben Island.

Only one technology has been assessed as part of the current BA process, namely rotating biological contactor technology, as this is considered the most appropriate technology. The previous BA process undertaken in 2014 assessed the use of submerged biomedia technology. This technology alternative would be submerged and fully enclosed. This alternative is not preferred as it requires deep excavations, which are costly and may result in ponding and the ingress of water.

Two alternative layouts were considered for the proposed WWTW on Robben Island. The proposed WWTW layout selected as the preferred alternative and assessed within this BAR was selected considering the following primary factors:

- Smaller footprint of the WWTW (1070m² versus 1470m²);
- The WWTW relies on gravitational flow and the preferred alternative provides a higher starting point thus allowing the WWTW to better utilise gravitational flow and tie into existing infrastructure;
- Deep excavations are avoided (limits ponding and unwanted ingress of stormwater into the system);
- Rock excavations are avoided (reduces cost);
- Increased distance from the high-water mark; and
- Higher elevation means reduced impact of groundwater on WWTW.

The no-go alternative would entail the continuation of the 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 wastewater 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 discharge limits set by the DFFE, required in terms of a Coastal Waters Discharge Permit in terms of NEMICMA 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 DFFE 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 and Marine Protected Area. This was noted by UNESCO in 2004.[13] As such, the No-Go alternative is not considered a preferred alternative and is not deemed viable.

9.4 RECOMMENDATIONS

The following recommendation are made in respect of the proposed WWTW:

- 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;
- A buffer zone of 5 m must be maintained around the Robert Sobukwe House and 30 m around the possible WW2 bunker (**Figure 9-2**). No parking of vehicles, placing of construction material or other activity may occur within these buffer zones in order to ensure no direct impacts. These buffer zones must be clearly marked using danger tape. No workers may be allowed to enter the bunker;
- To keep construction disturbance of endangered seabirds occurring on the island to a minimum, the following mitigation measures should be implemented:
  - If feasible, schedule construction activities so as to avoid the main seabird breeding periods (March to October), and penguin moulting periods (summer months);
  - Prior to commencement of construction, ensure that there are no known nests in the development footprint;
  - Construction should be limited to hours when the penguins are not moving around (~90 minutes after sunrise to 90 minutes before sunset) to minimise the impact on birds using the path along the coast;
  - Ensure that a penguin-proof perimeter fence that (as far as possible) prevents penguins from burrowing under and gaining access to the site during operation is installed around the site boundary prior to commencement of construction activities to prevent penguins accidentally becoming trapped within the construction site;
  - 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 the presence of people to scare them off at the start of the breeding season until they start to breed elsewhere on the island; and
  - Ensure that settling tanks are suitably covered with screens to prevent birds getting into the tanks.
- To ensure that the WWTW 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 van Ballegooyen (2021) depend on the quality of the effluent being discharged;
- It is recommended that the actual phosphate concentration of the WWTW effluent be monitored. Should they be higher than anticipated, there may be a need to introduce mitigation measures. However, as phosphate is generally not a limiting nutrient in the environment under consideration, such mitigation measures may not be strictly necessary especially if the phosphate concentration is restricted to 4 to 6 mg/ℓ (as is expected for

[13] http://whc.unesco.org/en/soc/1432

the new WWTW). While the capital costs of such measures are modest, the operational costs are unlikely to be so;

- The Marine Ecology Assessment is based on the results of the dilutions modelling study undertaken by van Ballegooyen (2021). 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 WWTW, and at intervals thereafter, to ensure that model predictions are realised and that compliance with marine water quality guidelines are consistently achieved;
- It is recommended that the condition of the outfall be assessed either directly (e.g. diver surveys) or indirectly (performance assessment via monitoring activities), to confirm that it is indeed operating as specified (and as simulated in the modelling study);
- Use all spoil material salvaged from the construction works to create a planted earth mound/berm along the western, southern and northern perimeter of the development envelope. This mound should be organically designed to resemble a natural topographic feature ('dune shaped') and planted with hardy indigenous vegetation. At a planted height of 1.5m, the planted earth mound will effectively screen any view of the WWTW from the aforementioned sensitive receptors. A local botanist should be consulted for advice on an appropriate indigenous planting palette;
- General site be cleared of other disused and derelict structures, such as telephone poles which litter the area;
- Develop a vegetative environmental buffer (VEB) on the earth mound/berm along the perimeter of the proposed development site. A VEB will ameliorate odours by slowing wind and allowing dilution of odour, encouraging particulate and aerosol deposition, physical interception of dust and aerosols onto which odorous compounds can adhere, and offering a sink for the chemical constituents of odour. WSP recommends the use of indigenous leafy vegetation that extend to height and that maintain their leaves throughout the year. Multiple rows of bushes and shrubs (with taller and shorter but bushier species alternating) will increase effectiveness of the barrier. Planting established plants will allow for more immediate protection. Additional value of the VEB is protection from bioaerosols, noise mitigation and improved visual aesthetics;
- Masking agents offer an additional odour neutralisation option should complaints arise despite the above mitigation. The effectiveness of commercial additives vary widely and local options can be investigated;
- Complaints and any actions arising from a complaint must be recorded in a complaints register maintained by site management. If required, fenceline measurements of H_2S will provide a real-time indicator of odour impact;
- Warning communities to expect potential odour events during upset conditions (e.g. during desludging or when extended maintenance is scheduled) will generate increased trust and facilitate communication between parties. When possible, maintenance/desludging of the WWTW should be scheduled for times when fewer tourists are expected in the area or strategically planned so as not to coincide with proximate community events (i.e. church services, etc.); and
- All proposed mitigation measures included in this BA Report and in the EMPr (**Appendix G**) must be implemented in order to reduce possible impacts to an acceptable level.

9.5 SITE SENSITIVITIES

The following site sensitivities were identified on the site, as a result of the Project location and proposed activities and will require specific applications or measures for mitigation to minimise impact.

- Robert Sobukwe House:
  - A buffer zone of 5 m must be maintained around the Robert Sobukwe House. No parking of vehicles, placing of construction material or other activity may occur within this buffer zone in order to ensure no direct impacts. This buffer zone must be clearly marked using danger tape.
- Possible World War 2 (WW2) bunker:
  - A buffer zone of 30 m must be maintained around the possible WW2 bunker. No parking of vehicles, placing of construction material or other activity may occur within this buffer zone in order to ensure no direct impacts. This buffer zone must be clearly marked using danger tape. No workers may be allowed to enter the bunker.

- Due to the proximity of the bunker, an archaeologist must monitor the ground clearance and excavation phase. The monitoring must include inspections of the bunker after any intense drilling to ensure the structure is still intact. A monitoring report must be submitted to SAHRA upon completion of the construction phase.

Figure 9-2 below shows the location of Robert Sobukwe House and the possible WW2 bunker with their respective buffer zones in relation to the proposed WWTW and associated infrastructure.

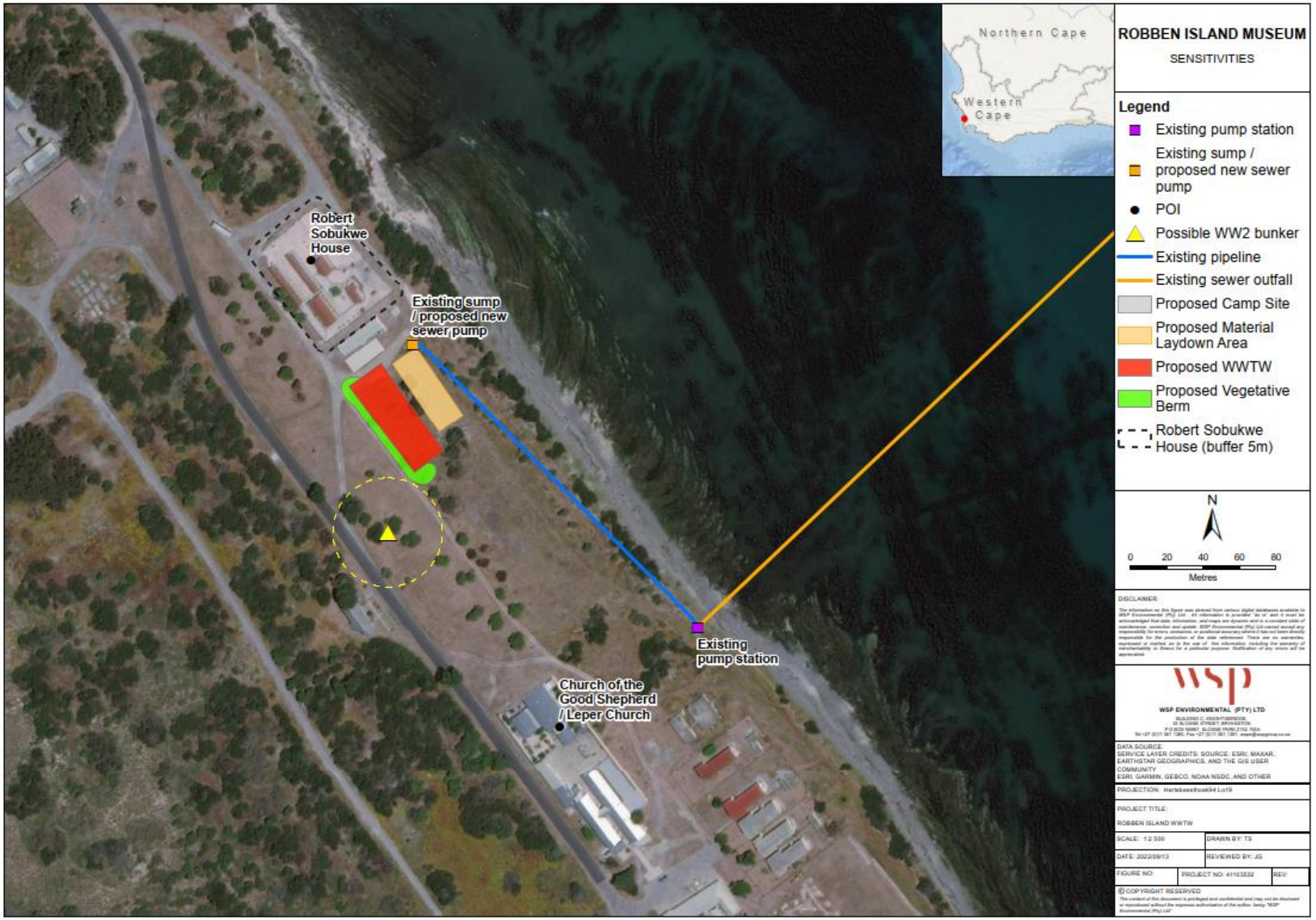

Figure 9-2: Site Sensitivities

9.6 CONCLUSION AND AUTHORISATION OPINION

The overall objective of the BA is to provide sufficient information to enable informed decision-making by the authorities. This was undertaken through consideration of the proposed Project components, identification of the aspects and sources of potential impacts and subsequent provision of mitigation measures.

It is the opinion of WSP that the information contained in this document (read in conjunction the EMPr) is sufficient for DFFE to make an informed decision for the environmental authorisation being applied for in respect of this Project.

Mitigation measures have been developed, where applicable, for the above aspects and are presented within the EMPr (**Appendix G**). It is imperative that all impact mitigation recommendations contained in the EMPr, of which the environmental impact assessment took cognisance, are legally enforced.

Considering the findings of the respective studies, no fatal flaws were identified for the proposed Project. Should the avoidance and mitigation measures prescribed be implemented, the significance of the considered impacts for all negative aspects pertaining to the environmental aspects is expected to be low. It is thus the opinion of the EAP that the Project can proceed, and that all the prescribed mitigation measures and recommendations are considered by the issuing authority.

EA AUTHORISATION PERIOD

Appendix 1(3)(1)(q) of the NEMA EIA Regulations 2014, as amended requires "*where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required, the date on which the activity will be concluded, and the post construction monitoring requirements finalised*" must be included in the BA Report.

The EA is required for a period of 5 years from the date of issuance of the EA to the end of the construction period (including rehabilitation), when the proposed activities applied for are completed. This is a reasonable period as it allows RIM to conduct its internal processes which can only begin after issuance of the EA.

10 CONCLUSION

RIM proposes to construct a WWTW with a daily throughput capacity of 300m^3 per day on the eastern side of Robben Island in Table Bay. This report provides a description of the proposed Project and details the aspects associated with the construction and operation. The report also includes the methodology followed to undertake the BA process. A detailed description on the existing environment (biophysical as well as socio-economic) is provided based on findings from the specialist surveys and existing information. Stakeholder engagement undertaken from the onset of the assessment to date, has been conducted in a transparent and comprehensive manner (**Appendix D**). This report has been subjected to a public review period in line with NEMA EIA Regulations, 2014 as amended. Outcomes of all comments received from the public review period have been recorded and responded to in the Final BAR. Based on the environmental description, specialist surveys as well as the stakeholder engagement undertaken to date, a detailed impact assessment was undertaken and, where relevant, the necessary management measures have been recommended.

In summary, the BA process assessed both biophysical and socio-economic environments and identified appropriate management and mitigation measures. The biophysical impact assessment revealed that there are no moderate or major environmental fatal flaws and no significant negative impacts associated with the proposed Project should mitigation and management measures be implemented. In addition, it should be noted that there are positive (albeit limited) socio-economic impacts associated with the Project.

The Draft BAR was made available for public review from **28 July 2022** to **29 August 2022**. Two site visits were facilitated for the commenting and competent authorities on the 23 August and 29 September respectively. All issues and comments submitted to WSP were incorporated in the Stakeholder Engagement Report attached as **Appendix D** to this Final BAR. The Draft BAR was also submitted to the competent authorities.

It is the opinion of WSP that the information contained in this Final BAR is sufficient for the DFFE to make an informed decision for the EA being applied for in respect of this Project.

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