mineral resources

Department:
Mineral Resources
REPUBLIC OF SOUTH AFRICA

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

And

ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT

(Part A, Volume 1: Background on the Project and Baseline Environment (Section 1 – 3 g (iv))

SUBMITTED FOR ENVIRONMENTAL AUTHORIZATIONS IN TERMS OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 AND THE NATIONAL ENVIRONMENTAL MANAGEMENT WASTE ACT, 2008 IN RESPECT OF LISTED ACTIVITIES THAT HAVE BEEN TRIGGERED BY APPLICATIONS IN TERMS OF THE MINERAL AND PETROLEUM RESOURCES DEVELOPMENT ACT, 2002 (MPRDA) (AS AMENDED).

NAME OF APPLICANT: West Coast Resources (Pty) Ltd

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FILE REFERENCE NUMBER SAMRAD: NC 0043-MR/102 and NC 0044-MR/102

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Appendix I – Quantum Calculation

Acronyms

Acronyms

ADT- Articulated Dumping Trucks

AEM- Airborne Electro-Magnetic

AMSL- Above Mean Sea Level

AMD- Acid Mine Drainage

/a- Per annum

BEE- Black Economic Empowerment

BPG- Best Practice Guide

BID- Background Information Document

BMR- Buffel's Marine Right

BCLME- Benguela Current Large Marine Ecosystem

BMR- Buffels Mining Right

BPG- Best Practice Guide

CAGR- Compound Annual Growth Rate

Cpht- Carats per hundred tonnes

CFS- Coarse Feldspathic Sand

CRD- Coarse Residue Deposit

CSIR- Council for Scientific and Industrial Research

CRM- Cultural Resource Management

DEA - Department of Environmental Affairs (Oceans and Coast)

DAFF- Department of Agriculture, Forestry, and Fisheries

DENC- Department of Environment, Nature and Conservation

DBCM- De Beers Consolidated Mines

DMS- Dense Media Separator

DMR - Department of Mineral Resources

DOT - Department of Transport

DWS- Department of Water and Sanitation

DWA - Department of Water Affairs

DBNM- De Beers Namaqualand Mines

DCA- Diamond Coastal Abalone

EA- Environmental Audit

ECO- Environmental Control Officer

EEZ-Exclusive Economic Zone

EIA - Environmental Impact Assessment

EIAR- Environmental Impact Assessment Report

EM - Environmental Manager

EMS- Environmental Management Systems

EMP - Environmental Management Plan/Programme

EMPR - Environmental Management Programme Report

EAP- Environmental Assessment Practitioner

EW- Environmental Workshop

E-East

ESE-East South East

ECRU- Estuary and Coastal Research Unit

ESA- Early Stone Age

FRD- Fine Residue Deposit

FAMDA- Fishing and Mariculture Development Association

KFR- Kleinzee Final Recovery

FGS- Fine Green Sand

GDP- Gross Domestic Product

GIS- Geographic Information System

HAB- Harmful Algal Blooms

HWS- High Water Spring tide

HWM- High Water Mark

HIA- Heritage Impact Assessment

HWC- Heritage Western Cape

HDI- Historically Disadvantaged Individuals

Ha- Hectares

HDPE- High Density Polythylene

IAPs- Interested and Affected Parties

IAPR- Interested and Affected Parties Register

ICMA- Integrated Coastal Management Act, 2008 (Act No. 24 of 2008)

IDC- Industrial Development Corporation

IDP- Integrated Development Plan

IEMA- Institute of Environmental Management and Assessment

IPAP- Industrial Policy Action Plan

IWMP- Integrated Waste Management Plans

IWRMP- Integrated Water Resource Management Principles

IMS- Integrated Management System

IEMA- Institute of Environmental Management and Assessment

IWWMP- Integrated Water and Waste Management Plan

KNR- Koingnaas Rights

KLM- Local Economic Development

KNC- Koingnaas Complex

LDA- Large Diameter Auger

LoM- Life of Mine

LDV- Leyland DAF Vans

LWM- Low Water Mark

LSA- Late Stone Age

LM- Local Municipality

M&CM- Marine & Coastal Management: Department of Environment Affairs

NGO's- Non- Governmental Organisations

MWP - Mine Works Program

MTM- Marine Transport and Manufacturing

MPA- Marine Protected Areas

MPSG- Marine Protection Service and Ocean Governance

MPRDA- Mineral and Petroleum Resources Development Act, 2008 (Act No. 49 of 2008)

MLRA- Marine Living Resources Act (1998)

MSA- Middle Stone Age

MAR- Mean Annual Run-off

m^3- cubic meter

m^3/a- Cubic meter per annum

MAP- Mean Annual Precipitation

MAR- Mean Annual Runoff

N- North

NCCMP- Northern Cape Coastal Management Programme

NMC - Namaqualand Metamorphic Complex

NMP - Namaqualand Metamorphic Province

NDM- Namakwa District Municipality

NDP- National Development Plan

NNW- North North West

NM- Namaqualand Mines

NPR- Namaqualand Prospecting Right

NEMBA- National Environmental Management Biodiversity Act, 2004 (Act No. 10 of 2004)

NEMA- National Environmental Management Act, 1998 (Act No. 107 of 1998)

NWA- National Water Act, 1998 (Act No. 36 of 1998)

NEMPAA- National Environmental Management Protected Areas Act, 2003 (Act No. 57 of 2003)

NEMWA- National Environmental Management Waste Act, 2008 (Act No. 59 of 2008)

NCP- Northern Cape Province

NHRA- National Heritage Resources Act (Act No. 25 of 1999)

Nm^3- Million meters cubed

NDM- Namaqualand District Municipality

NKLM-Nama Khoi Local Municipality

NDVI- Normalised Difference Vegetation Index

Mm - Millimetre

NGO- None-profit Government Organisation

OOGE- Offshore Oil and Gas Exploration

PIM- Particulate Inorganic Matter

POM- Particulate Organic Matter

PCD-Pollution Control Dam

PGDS- Provincial Grouth and Development Strategy

PSDF- Provincial Spatial Development Framework

QP- Peak

RCM- Run-of-Mine

S- South

SAHRA - South African Heritage Resources Agency

SBC- Samsons Bak Complex

SBKNC- Samsons Bak Kooingnaas Complex

SBR-Samsons Bak Rights

SACW- South Atlantic Central Water

SADR- South African Diamond Regulator

SANBI- South African National Biodiversity Institute

SANParks- South African National Parks

SAPS - South African Police Services

SSE- South South East

SMME- Small Medium and Micro Enterprises

Sp.- species (singular)

Spp.- species (plural)

SFRI- Sea Fisheries Research Institute (now DAFF)

SHE- Safety, Health and Environment

SBC- Samsons Bak Complex

SFRI- Sea Fisheries Research Institude

SPC- Site Plan Consulting

SDF- Spatial Development Framework

SIA- Social Impact Assessment

SAWS- South African Weather Services

SDF- Standard Design Flood

SEA- Strategic Environmental Assessment

TAC- Total Allowable Catch

TSPM- Total Suspended Particulate Matter

TMR- Tailing Mineral Resource

ToR- Terms of Reference

TC- Concentration

UCT- University of Cape Town

WCR- West Coast Resources

WULA- Water Use License Application

WMA- Water Management Areas

WB- Water Balance

WB- Ater Balance

WRD- Water Return Dam

Glossary

Anti-cyclonic:	An extensive system of winds spiralling outward anti-clockwise (in Southern Hemisphere) from a high-pressure centre.
Benthic:	Referring to organisms living in or on the sediments of aquatic habitats (lakes, rivers, ponds, etc.).
Benthos:	The sum total of organisms living in, or on, the sediments of aquatic habitats.
Benthic organisms:	Organisms living in or on sediments of aquatic habitats.
Biodiversity:	The variety of life forms, including the plants, animals and micro-organisms, the genes they contain and the ecosystems and ecological processes of which they are a part.
Biomass:	The living weight of a plant or animal population, usually expressed on a unit area basis.
Biota:	The sum total of the living organisms of any designated area.
Bivalve:	A mollusk with a hinged double shell.
Community structure:	All the types of taxa present in a community and their relative abundance.
Community:	An assemblage of organisms characterized by a distinctive combination of species occupying a common environment and interacting with one another.
Conservation:	The act of maintaining all or part of a resource (whether renewable or non-renewable) in its present condition in order to provide for its continued or future use. Conservation includes sustainable use, protection, maintenance, rehabilitation, restoration and enhancement of the natural and cultural environment.

Critically Endangered: A taxon is critically endangered when the best available evidence indicates that it meets any of the criteria for critically endangered, and it is therefore considered to be facing an extremely high risk of extinction in the wild.

Cultural Resource Management: A process that consists of range of interventions and provides a framework for informed and value-based decision-making. It integrates professional, technical and administrative functions and interventions that impact on cultural resources. Activities include planning, policy development, monitoring and assessment, auditing, implementation,

	maintenance, communication and many other others. All these activities are (or will be) based on sound research.
Cultural Resources:	A broad, generic term covering any physical, natural and spiritual properties and features adapted, used and created by humans in the past and present. Cultural resources are the result of continuing human cultural activity and embody a range of community values and meanings. These resources are non-renewable and finite. Cultural resources include traditional systems of cultural practice, belief or social interaction. They can be, but are not necessarily identified with defined locations.
Cyclonic:	An atmospheric system characterized by the rapid inward circulation of air masses about a low-pressure centre; circulating clockwise in the Southern Hemisphere.
Dissolved oxygen (DO):	Oxygen dissolved in a liquid, the solubility depending upon temperature, partial pressure and salinity, expressed in milligrams/litre or milliliters/litre.
Epifauna:	Organisms, which live at or on the sediment surface being either attached (sessile) or capable of movement.
Ecosystem:	A community of plants, animals and organisms interacting with each other and with the non-living (physical and chemical) components of their environment.
Endangered (EN):	A taxon is endangered when the best available evidence indicates that is meets any of the criteria for endangered, and it is therefore considered to be facing a very high risk of extinction in the wild.
Euphotic/photic zone:	The zone in the ocean that extends from the surface down to a depth where light intensity falls to one percent of that at the surface; i.e. there is to sufficient sunlight for photosynthesis to occur.
Extinct (EX):	A taxon is Extinct when there is no reasonable doubt that the last individual has died. A taxon is presumed Extinct when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), and throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.
Habitat:	The place where a population (e.g. animal, plant, micro-organism) lives and its surroundings, both living and non-living.
Heritage Resources:	The various natural and cultural assets that collectively form the heritage. These assets are also known as cultural and natural resources. Heritage resources (cultural resources) include all human-made phenomena and intangible products that are the results of the human mind. Natural, technology or industrial features may also be part of heritage resources, as places that have made an outstanding contribution to the cultures, traditions and lifestyles of the people or groups of people of South Africa.

Iron Age:	Refers to the last two (2) millennia and 'Early Iron Age' to the first thousand years AD. 'Late Iron Age' refers to the period between the 16th century and the 19th century and can therefore include the Historical Period.
In-Situ Conservation:	The conservation and maintenance of ecosystems, natural habitats and cultural resources in their natural and original surroundings.
Hypoxic:	Deficiency in oxygen.
Landscape Character:	The individual elements that make-up the landscape, including prominent or eye-catching features such as hills, valleys, woods, trees, water bodies, buildings and road. They are generally quantifiable and can be easily described.
Infauna:	Animals of any size living within the sediment. They move freely through interstitial spaces between sedimentary particles or they build burrows or tubes.
Intertidal:	The area of seashore which is covered at high tide and uncovered at low tide.
Macrofauna:	Animals >1 mm.
Macrophyte:	A member of the macroscopic plant life of an area, especially of a body of water; large aquatic plant.
Meiofauna:	Animals <1 mm.
Mariculture:	Cultivation of marine plants and animals in natural and artificial environments.
Marine environment:	Marine environment includes estuaries, coastal marine and near-shore zones, and open-ocean-deep-sea regions.
Pelagic:	of or pertaining to the open seas or oceans; living at or near the surface of ocean.
Population:	Population is defined as the total number of individuals of the species or taxon.
Phase I Studies:	Refers to surveys using various sources of data in order to establish the presence of all possible types and ranges of heritage resources in any given Project Area (excluding paleontological remains as these studies are done by registered and accredited palaeontologists).
Phase II Studies:	Include in-depth cultural heritage studies such as archaeological mapping, excavating and sometimes laboratory work. Phase II work may include the documenting of rock art, engraving or historical sites and dwellings, the sampling of archaeological sites or shipwrecks; extended excavations of archaeological sites; the exhumation of human remains and the relocation of graveyards, etc. Phase II work involve permitting processes, require the input of different specialists and the co-operation and approval of SAHRA.

Pre-Historical:	Refers to the time before any historical documents were written or any written language developed in a particular area or region of the world. The historical period and historical remains refer, for the Project Area, to the first appearance or use of 'modern' Western writing brought to the Eastern Highveld by the first Colonists who settled here from the 1840's onwards.
Protected Area:	A geographically defined area designated and managed to achieve specific conservation objectives. Protected areas are dedicated primarily to the protection and enjoyment of natural or cultural heritage, to the maintenance of biodiversity, and to the maintenance of life-support systems. Various types of protected areas occur in South Africa.
Recruitment:	The replenishment or addition of individuals of an animal or plant population through reproduction, dispersion and migration.
Sediment:	Unconsolidated mineral and organic particulate material that settles to the bottom of aquatic environment.
Sensitive Receptors:	Sensitivity of visual receptors (viewers) to a proposed development.
Species:	A group of organisms that resemble each other to a greater degree than members of other groups and that form a reproductively isolated group that will not produce viable offspring if bred with members of another group.
Subtidal:	The zone below the low-tide level, i.e. it is never exposed at low tide.
Supratidal:	The zone above the high-tide level.
Surf-zone:	Also referred to as the 'breaker zone' where water depths are less than half the wavelength of the incoming waves with the result that the orbital pattern of the waves collapses and breakers are formed.
Suspended material:	Total mass of material suspended in a given volume of water, measured in mg/ℓ.
Suspended sediment:	Unconsolidated mineral and organic particulate material that is suspended in a given volume of water and measured in mg/ℓ.
Sustainability:	The ability of an activity to continue indefinitely, at current and projected levels, without depleting social, financial, physical and other resources required to produce the expected benefits.
Taxon (Taxa):	Any group of organisms considered to be sufficiently distinct from other such groups to be treated as a separate unit (e.g. species, genera, families).
Turbidity:	Measure of the light-scattering properties of a volume of water, usually measured in nephelometric turbidity units.
Vulnerable:	A taxon is vulnerable when it is not Critically Endangered or Endangered but is facing a high risk of extinction in the wild in the medium-term future.
Visibility:	The area from which project components would potentially be visible. Visibility depends upon general topography, aspect, tree cover or other visual obstruction, elevation and distance.

Visual Exposure:	Visibility and visual intrusion qualified with a distance rating to indicate the degree of intrusion and visual acuity, which is also influenced by weather and light conditions.
Visual Impact:	Visual effects relate to the changes that arise in the composition of available views as a result of changes to the landscape, to people's responses to the changes, and to the overall effects with respect to visual amenity.
Visual Intrusion:	The nature of intrusion of an object on the visual quality of the environment resulting in its compatibility (absorbed into the landscape elements) or discord (contrasts with the landscape elements) with the landscape and surrounding land uses.

1. IMPORTANT NOTICE

In terms of the Mineral and Petroleum Resources Development Act (Act 28 of 2002 as amended), the Minister must grant a prospecting or mining right if among others the mining "will not result in unacceptable pollution, ecological degradation or damage to the environment".

Unless an Environmental Authorisation can be granted following the evaluation of an Environmental Impact Assessment and an Environmental Management Programme report in terms of the National Environmental Management Act (Act 107 of 1998) (NEMA), it cannot be concluded that the said activities will not result in unacceptable pollution, ecological degradation or damage to the environment.

In terms of section 16(3) (b) of the EIA Regulations, 2014, any report submitted as part of an application must be prepared in a format that may be determined by the Competent Authority and in terms of section 17 (1) (c), the competent Authority must check whether the application has taken into account any minimum requirements applicable or instructions or guidance provided by the competent authority to the submission of applications.

It is therefore an instruction that the prescribed reports required in respect of applications for an environmental authorisation for listed activities triggered by an application for a right or permit are submitted in the exact format of, and provide all the information required in terms of, this template. Furthermore, please be advised that failure to submit the information required in the format provided in this template will be regarded as a failure to meet the requirements of the Regulation and will lead to the Environmental Authorisation being refused.

It is furthermore an instruction that the Environmental Assessment Practitioner (EAP) must process and interpret his/her research and analysis and use the findings thereof to compile the information required herein. (Unprocessed supporting information may be attached as appendices). The EAP must ensure that the information required is placed correctly in the relevant sections of the Report, in the order, and under the provided headings as set out below, and ensure that the report is not cluttered with un-interpreted information and that it unambiguously represents the interpretation of the applicant.

2. OBJECTIVE OF THE ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

The objective of the environmental impact assessment process is to go through a consultative process

a) Determine the policy and legislative context within which the activity is located and document how the proposed activity complies with and responds to the policy and legislative context;

b) Describe the need and desirability of the proposed activity, including the need and desirability of the activity in the context of the preferred location;

c) Identify the location of the development footprint within the preferred site based on an impact and risk assessment process inclusive of cumulative impacts and a ranking process of all the identified development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects of the environment;

d) Determine the —

(i) Nature significance, consequence, extent, duration and probability of the impacts occurring to inform identified preferred alternatives; and

(ii) Degree to which these impacts —

(aa) Can be reversed;

(bb) May cause irreplaceable loss of resources, and

(cc) Can be avoided, managed or mitigated;

a) Identify the most ideal location for the activity within the preferred site based on the lowest level of environmental sensitivity identified during the assessment;

b) Identify, assess, and rank the impacts the activity will impose on the preferred location through the life of the activity;

c) Identify suitable measures to manage, avoid or mitigate identified impacts; and

d) Identify residual risks that need to be managed and monitored.

PART A

SCOPE OF ASSESSMENT AND ENVIRONMENTAL IMPACT ASSESSMENT REPORT

3. CONTACT PERSON AND CORRESPONDENCE ADDRESS

a) Details of

i. Details of the EAP

Name of the Practitioner: Babalwa Fatyi

Tel No.: 012 998 7642

Fax No.: 012 998 7641 and 086 543 1698

E-mail address: babalwa@myezo.co.za

ii. Expertise of the EAP

(1) The qualifications of the EAP

(With evidence attached as **Appendix 1**)

The EAP's qualifications are outlined as follows:

- BSc Walter Sisulu University (former University of Transkei), 1996.
- BSc (Hons) Wits), 1997.
- MSc Wits (Cum Laude), 1999.

The EAP is also registered with the following bodies:

- Registered in terms of Article 11 of the Natural Scientific Professions Act, 1993 (Act 106 of 1993). Professional title: Pr.Sci.Nat
- Environmental Auditor: Institute of Environmental Management and Assessment (IEMA), Lincoln, UK.

The EAP also holds certificates in the disciplines outlined below:

- National Environment Management: Integrated Coastal Management Act, 24 of 2008: Presented by Imbewu Sustainability Legal Specialists (1 day), (2010).
- Implementing Integrated Management Systems: ISO 9001, ISO 14001 and OHSAS 18001 - Potchefstroom University (2006).

- Mining Qualifications Authority: Executive preparation programme focusing on understanding key elements and principles of mining: presented by University of Johannesburg (2005).
- Waste Management for Environmental Managers: Presented by Centre for Environmental Management - Potchefstroom University (2003).
- Implementing Environmental Management Systems (SABS/ISO 14001): Presented by Centre for Environmental Management - Potchefstroom University (2002) as well as updates in ISO14001 (2015).
- Environmental Auditing: Techniques and Methodologies. Presented by Eagle Environmental (1999).

The above mentioned qualifications, registrations and certificates are included as Appendix 1.

(2) Summary of the EAP'S past experience

(Attach the EAP's Curriculum Vitae as **Appendix 2**).

Babalwa Fatyi is a Registered Professional Natural Scientist (400123/01). She is also registered with Institute of Environmental Management and Assessment, Lincoln, UK (0025153).

Babalwa is experienced in a wide range of environmental services, cutting across various sectors. She has been involved in the application of integrated environmental management tools. Application of legislative requirements within the environmental field is her key strength and implementation of the environmental management programmes and identification of opportunities, through which youth and communities could be engaged in the execution of the environmental programmes is her innate ability. Her work experience has allowed her an insight with respect to sector specific sustainable development requirements ranging from authorisations, implementation and monitoring. She has also worked for a prominent mining company where her role involved overseeing the firm's compliance with its environmental obligations.

Babalwa partners with large blue-chip companies as well as smaller companies requiring her expertise and they collaboratively design strategies and methodologies for sustainable development for the successful execution of the projects at hand.

Babalwa has undertaken several environmental management and public consultation projects, in terms of the National Environmental Management Act (Act No 107 of 1998) (NEMA), as amended, as well as numerous environmental authorisations in terms of the Mineral and Petroleum Resources Development Act (Act No 28 of 2002) (MPRDA), Water Use Licence Applications (WULA) under the National Water Act (Act No. 36 of 1998) (NWA), as well as National Environmental Management Waste Act No. 59 of 2008 (NEMWA). As such, she has undertaken a series of similar environmental authorisation application processess including the compilation of Environmental Impact Assessment reports (EIAr), Environmental Managment Programme reports (EMPr).

The EAP has also undertaken environmental performance assessment audits since year 2000 and the audits she has undertaken range from due diligence, performance assessment and legal compliance audits to closure application audits to ascertain environmental liability prior to issuing closure certificates. She has also facilitated workshops for issues gathering, as well as environmental awareness building. She has compiled more than 20 Environmental Management Plans (EMPs) and programmes within mining and other related industries.

A list of the projects she has undertaken are outlined in the Curriculum Vitae, included as Appendix 2. In addition, a company profile is also included as Appendix 2.

Company Profile

Myezo Environmental Management Services, (Pty) Ltd (Myezo) is an environmental consulting company that provides a range of Environmental Services, cutting across various sectors.

Services offered

Myezo (www.myezo.co.za) offers its clients a pool of environmental expertise to meet their authorisation, implementation and monitoring needs, as outlined below.

- Environmental impact assessments.
- Environmental management programme reports including development/ implementation of environmental management plans.
- Environmental management system.
- Water use licences.
- Integrated waste management plans.
- Stakeholder identification, engagement and management
- Environmental workshops
- Environmental auditing

The company strives to provide our stakeholders with a peace of mind through mutual win-win implementable environmental solutions. We are determined to openly engage, empower and facilitate stakeholder engagements designed to achieve integrated environmental solutions and transparent governance.

Myezo, as an organisation, produces project outcomes with jointly tested and assessed alternative solutions that not only comply with project regulatory requirements, but are tailored to promote easy implementation, monitoring and continuous improvement.

Our company profile is included as Appendix 2.

b) Description of the Property

The description of the properties affected by the application for environmental authorisation are outlined in Table b - 1 below.

Table b - 1: Description of the property

Aspect	**Description**	
Farm Name:	Somnaas 474, Koingnaas 475, Zwart Lintjes Rivier 484, Langklip 489, Elands Klip 333, Noup 473, Samson's Bak 330, Schulp Fontein 472, Zwart Duinen 332, Michell's Bay 495 and Farm No. 496 (known as Kliphuis), Kanoep 491, Adjacent Sea Strips now described as Unalienated State land	
Application area (ha)	36 696.37 ha	
Magisterial district:	Namakwa District	
Distance and direction from nearest town	Northern Cape Province, 50 km west of Kamieskroon and extends north and south of Hondeklip Bay	
21-digit Surveyor General Code for each farm portion	Elands Klip 333	C05300000000033300000
	Koingnaas 475	C05300000000047500000
	Noup 473	C05300000000047300000
	Langklip 489	C05300000000048900000
	Schulp Fontein 472	C05300000000047200000

Aspect	Description	
Farm Name:	Somnaas 474, Koingnaas 475, Zwart Lintjes Rivier 484, Langklip 489, Elands Klip 333, Noup 473, Samson's Bak 330, Schulp Fontein 472, Zwart Duinen 332, Michell's Bay 495 and Farm No. 496 (known as Kliphuis), Kanoep 491, Adjacent Sea Strips now described as Unalienated State land	
	Zwart Duinen 332	C05300000000033200000
	Zwart Lintjes River 484	C05300000000048400000
	Mitchell's Bay 495	C05300000000049500000
	Kliphuis 496	C05300000000049600000
	Samson's Bak 330	C05300000000033000000
	Kanoep 491	C05300000000049100000

c) Locality Map (Show nearest town, scale not smaller than 1:250000 attached as Appendix 3).

The Locality Map is attached as Appendix 3. The mining area is categorised into Marine and Land based operations. The delineation of the areas, which will be covered under the environmental authorisation application are shown under the layout plan, in Appendix 4.

The applicable activities for which environmental authorisation will be applied for, are part of an amendment of an existing mining right, for mining of diamonds over certain properties, situated approximately 50 km west of Kamieskroom and extending north and south of Honderklip Bay on the West Coast within the Northern Cape Province. All the other maps and figures in this Section are named after the report Section number e.g. Section d and the sub-heading number under that Section, e.g. 2.1 followed by the number of the Figure e.g. 1 or 2 etc. Therefore the Figure under Section d 2.1 will be Figure d 2.1 – 1 (d – Section, 2.1 – sub-section, 1 – Figure number).

d) Description of the scope of the proposed overall activity

Provide a plan drawn to a scale acceptable to the competent authority but not less than 1:10 000 that shows the location and area (hectares) of all the aforesaid main and listed activities and infrastructures to be placed on site.

Appendix 4 shows the infrastructure network at Koingnaas, including electrical reticulation, buildings, plants, roads, dumps, pipelines, pump stations, scheduled mine block outlines and existing and planned plant locations.

A summary of the historical background and planned prospecting, mining, treatment and rehabilitation programs and procedures as documented in the Mine Works Program (MWP) is provided below.

d) 1. <u>Background on the proposed mining operations</u>

West Coast Resources (Pty) Ltd (WCR) is a private company owned by Trans Hex Operations (Pty) Ltd (Trans Hex), RE:CM and Calible Limited (RAC), the Government of South Africa, Dinoka Investment Holdings (Pty) Ltd and the Namaqualand Diamond Trust Fund, a broad based community trust representing historically disadvantaged persons from the Namaqualand community. Trans Hex has entered into an agreement with the other shareholders of WCR to oversee and manage the operations of WCR. WCR is re-establishing a diamond mining operation in the Koingnaas area on the Namaqualand coast, which was previously mined by De Beers and under the existing mining environmental authorisation of July 2012. As part of their operations, WCR intend to mine deposits that are located on land as well as specific deposits that extend seaward from the land, potentially for several hundred metres.

WCR has existing converted mining rights and prospecting rights over the area, including a number of properties situated approximately 50 kilometres west of Kamieskroon and extending north and south of Hondeklip Bay on the West Coast of the Northern Cape Province, South Africa. The mining rights comprise of the existing mining rights, covering the Koingnaas Complex (KNC) and Samsons Bak Complex (SBC), which were converted in July 2012 (under File No. SNC 522 MRC and SNC 525 MRC), respectively, and several farms resorting under the existing Namaqualand Prospecting Right (NPR) (File No. SNC 672 PRC).
The Koingnaas mining area, has been extensively mined over the last 60 years. It comprises the southern Michell's Bay area and the northern Koingnaas area.

Notably, the prospecting right area includes a portion of Michells Bay Farm that fall south of a line 200m north of the Spoeg River as shown in Appendix 4 (Drawing 001). However WCR is discussing to relinquishing the prospecting rights over this area to South African National Parks(SANParks).The execution of the Section 102 amendment application will give effect to the outcome of discussion between WCR and National SanParks.

Although extensively mined in the past, the Koingnaas area is still prospective on a local scale and is typified by high diamond densities. Surf-zone mining has been minimal in the past and that resource remains virtually untouched. Standard open cast alluvial mining methods will be applied to land mining initially.

A vast database of historic exploration information was built up over more than 50 years at the former De Beers Namaqualand Mines (NM) and includes comprehensive geophysical surveys, percussion and large diameter sample drilling as well as pitting and trench bulk sampling. Different prospecting techniques utilized at the Koingnaas area over time are briefly summarised below.

d) 2. <u>Prospecting: Onshore land based operations</u>

Extensive exploration drilling, bulk sampling and mining by DBCM and WCR have been ongoing on the Koingnaas rights over the past 60 years (Figure (d (i) 2.5-1). This prospecting and production results form the basis for the onshore part of the mine plan for land mining. Most of the following prospecting methodologies are approved under the current EMP and will be applied to onshore prospecting activities hence forth.

d) 2.1 <u>Surface mapping</u>

This will be done by geological identification of features such as rock outcrops, alluvial gravels, topographic depressions, etc. Fieldwork is carried out using four-wheel drive vehicles.

d) 2.2 <u>Geophysical surveys</u>

This involves fieldwork and remote sensing including aerial photography, grid-based ground resistivity, ground gravimetry, ground magnetometry, airborne AEM, airborne gravity, airborne magnetometry, etc. Surf-zone geophysical surveys (tractor-cable resistivity method) will be conducted on selected beaches in order to map the bedrock relief and differentiate the overlying sediment package.

d) 2.3 <u>Small diameter drilling</u>

Small diameter drilling (150 - 200mm) using percussion, reverse circulation or mud drilling methods to assess stratigraphy and the presence or absence of diamondiferous gravels. Reverse circulation and mud probe drilling was utilised to confirm the extent and nature of the gravels in the target areas. The mud drilling methodology was amended to air-core technology in more recent times which allowed for better core recovery and improved geological understanding in the clay channel deposits.

d) 2.4 Large diameter drilling

Large diameter drilling using an auger drill, casing puller and support crews to sample gravels in areas of deep overburden. Evaluation techniques were optimised per target depending on the thickness and nature of overburden. In areas of shallow overburden, pits and trenches were preferred, with individual sample supports being locally optimised based on expected grades. Where deep overburden was encountered (>5 m) Large Diameter Auger (LDA) drilling was employed to sample the gravels. Historically, Soilmech large LDA rigs were utilised. These holes were cased telescopically andtherefore, the thicker the overburden the smaller the area of gravel sampled. In recent years large Bauer bucket augers were utilised together with drilling mud to prevent sidewall collapse of the hole.

d) 2.5 SONIC drill

SONIC drill rig has been purchased for future exploration and is currently drilling in the Koingnaas area, as shown in Photo d – 1, Photo d – 2 and Photo d – 3 respectively.

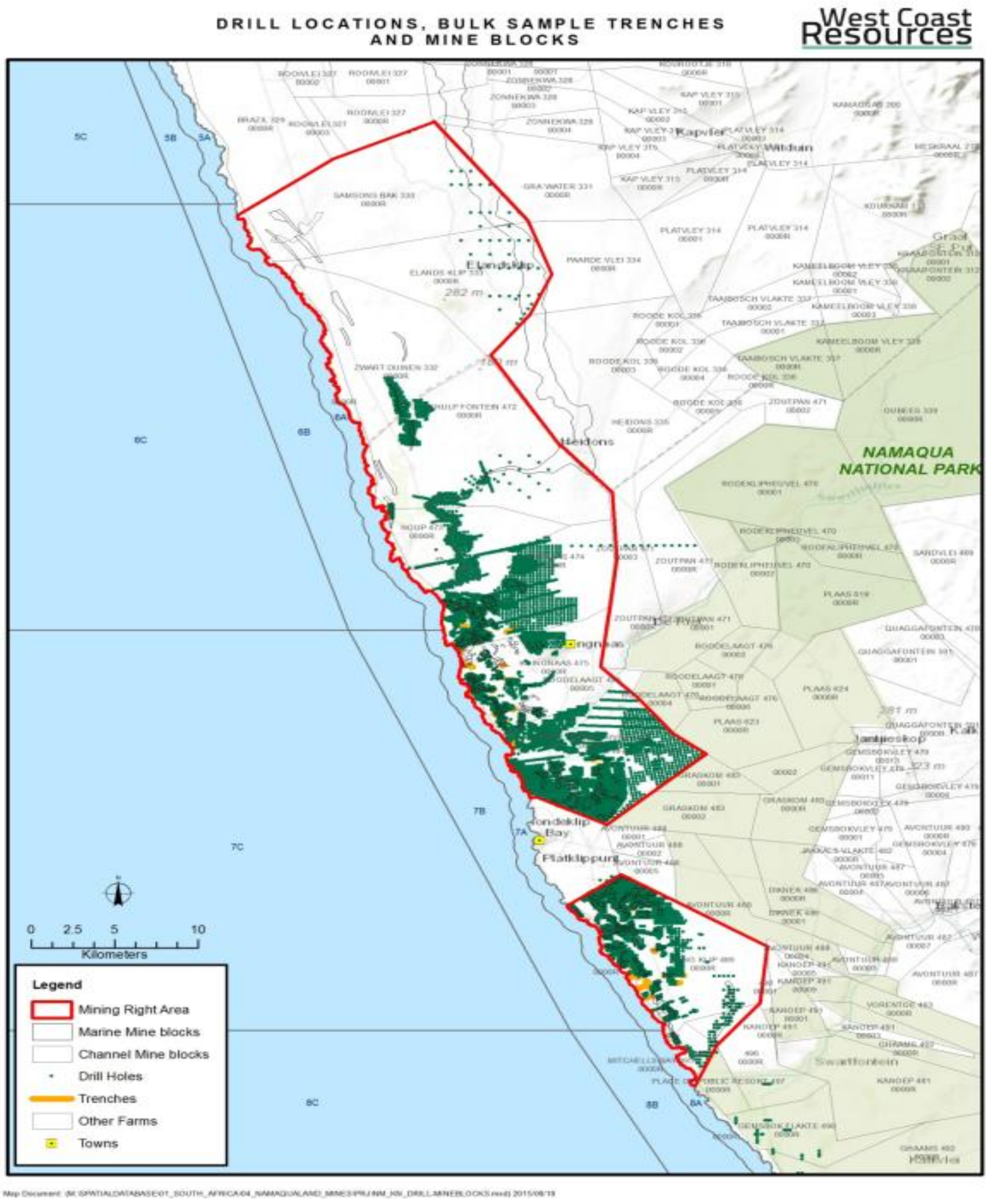

Figure (d) (i) 2.5 - 1: Map of the Koingnaas mining right area showing the extent of drill and trench coverage on the Koingnaas Complex and Samson's Bak Complex Rights

Photo d - 1: Soilmec auger drilling system employed until the mid-1990's

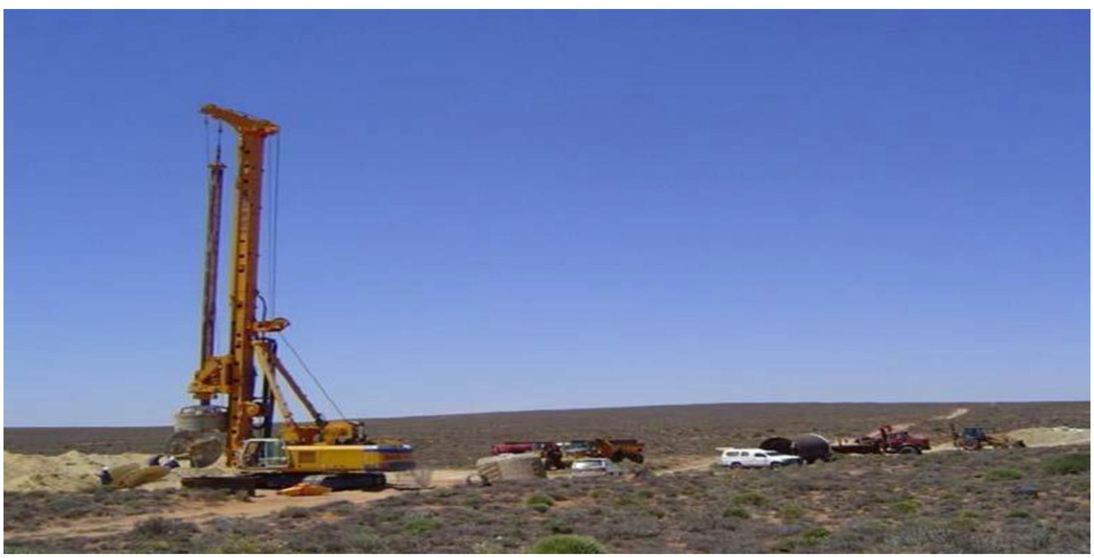

Photo d - 2: Bauer BG36 auger drilling system employed from the late 1990's

Photo d - 3: New SonicSamp drill in operation at Koingnaas

d) 2.6 Trench and pit bulk sampling

This will be done using excavators, trucks and support crews to sample gravels in areas of shallow overburden. Trench and pit sampling was/is undertaken in areas with shallower overburden with large bulk sample trenches or lines of pits excavate across drill-proven deposits at right angles to the coastline. LDA samples were treated through the former Koingnaas 10 tones per hour (tph) Prospect Dense Media Separator (DMS) - plant and trench and pit samples through a DMS-bulk-sample plant at Koingnaas. A new 10tph mobile DMS prospecting plant has been acquired by WCR for future exploration, as shown in Photo d – 4.

Photo d - 4: New WCR 10tph mobile DMS Prospecting Plant in transit (top) and in operation (bottom)

d) 3. Land Mining

Prospecting and production results form the basis for the onshore part of the mine plan for land mining. The land mining operations follow a sequence of five delivery stages as outlined below. The following mining methodologies are approved under the current EMP and will be undertaken for the on shore mining activities:

- Planning
- Mining
- Processing
- Mine residue disposal
- Ancillary operations undertaken including bulldozing, ripping, drill-and-blast, road construction and upgrading, excavating and trenching

d) 3.1 __Mine planning__

A computer-based mine planning system is used to produce the Life of Mine Plan. The production rates as described in the Life of Mine Plan are subject to change due to a variety of factors including:

- Changes in the costs of production;
- Changes in the diamond market; and
- Discovery of new deppsits.

In addition the planning of mining operations also involves timely road and infrastructure upgrade and/or construction which may include excavation, ripping, bulldozing, drill-and-blast, roadfill and grading.

d) 3.2 Mining

A basic open pit mining (truck-and-shovel) method is used for land mining operations as indicated in Illustration 1. Strip mining or block mining is normally employed during which the mineable area is divided into a series of parallel strips or blocks with the following mining sequence:

- Overburden stripping
- Mechanical extraction of ore
- Bedrock cleaning
- Loading and hauling
- Rehabilitation

d) 3.2.1 Overburden stripping

- Overburden stripping involves the stripping of the topsoil and other barren sand and clay deposits using either bulldozers, excavators and haulage trucks or belt conveyors. Overburden is either stockpiled for rehabilitation (topsoil specifically) or placed directly in another part of the mine undergoing reclamation. Mining of overburden starts at the first mining strip or block and progressesalong the strip or block exposing the ore for eventual mining. Waste overburden from subsequent strips or blocks will be placed in adjacent mined-out strips or blocks where feasible.
- Overburden from the first mine cut in the strip sequence will in all likelihood be backfilled to some of the multitude of existing mining voids and no new overburden dump disturbance will be created. Stripping will be carried out in advance of ore excavation with the objective of creating a six-month reserve of pre-stripped area. This will allow blending of ore to match plant and production requirements.
- Overburden excavation is more difficult when calcretised, compacted and cemented layers are encountered and, at times, this will require drilling and blasting. In certain areas, large cobbles and boulders may also hinder stripping efforts.
- Hydraulic mining methods may be applied to strip overburden in areas of excessive overburden. Thehydraulic mining method utilizes high pressure water jets of 28-40 bar from a high pressure pump station with constant location which delivers seawater by steel and flexible high pressure lines to a track mounted, remote controlled mobile water monitor gun jet (Illustration 2).

- The slurry produced is channelled to a slurry pump station where the slurry pump is mounted on a pontoon. The slurry will be returned to the beach for beach reclamation mining purposes. Hard safety barricades are used to protect monitors and active production faces.

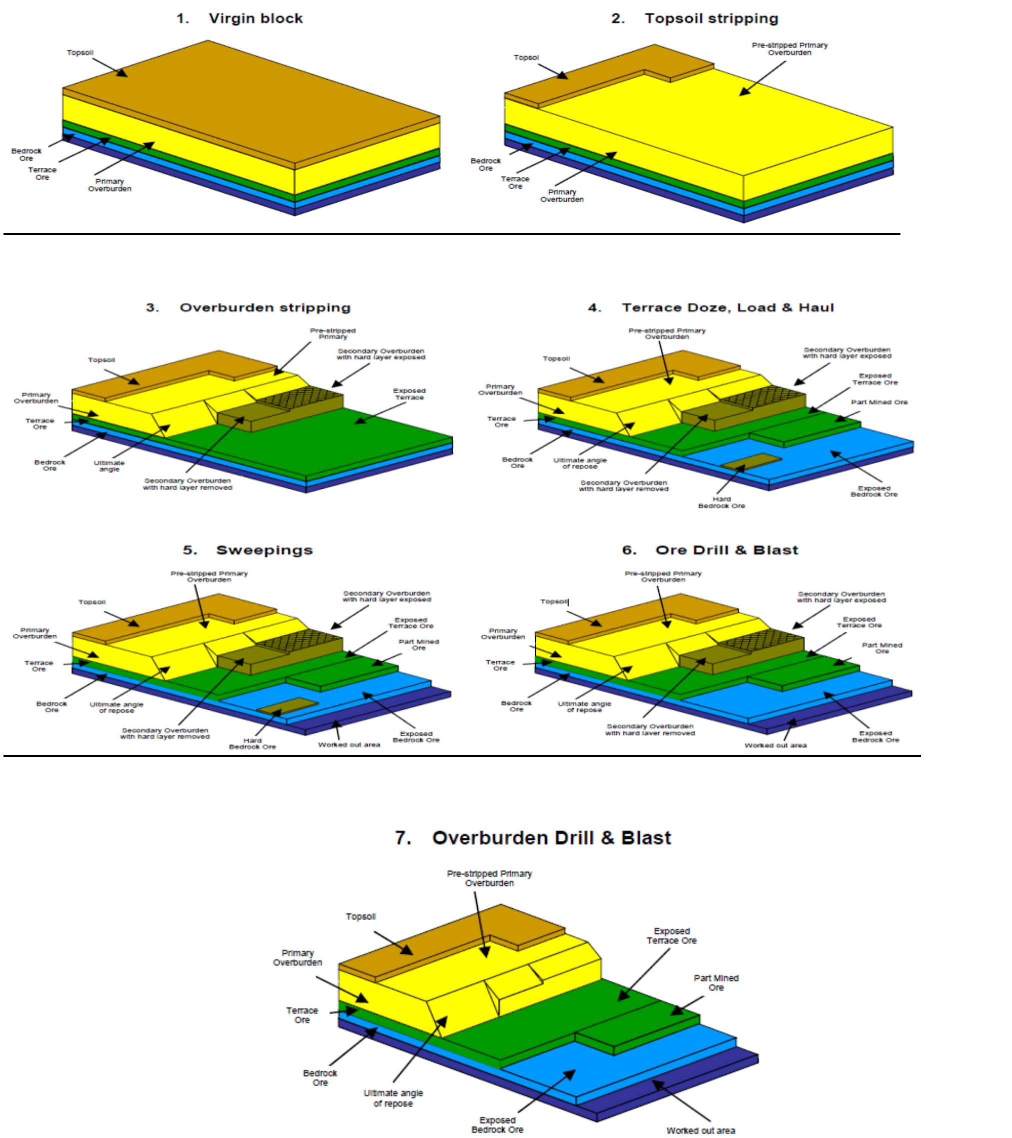

Illustration 1: Open pit mining methods

Illustration 2: Diagram illustrating the hydraulic mining method (top) and discharge of slurry to sea for beach accretion and seawall mining (middle and bottom).

d) 3.2.2 Mechanical extraction of ore

The overburden stripping is followed by the bulk mechanical extraction of the diamond bearing ore. This exposed ore, which is generally a metre or more thick, will be extracted using track dozers and mechanical excavators. Cemented ores will be ripped with a bulldozer or drilled and blasted before loading. Inspection and sample pits and trenches may be excavated in order to predetermine ore thickness and grade. The diamond-bearing ore is loaded into rear dump trucks and transported to the treatment plants. The use of infield screening techniques may be employed to reduce the amount of oversize waste that is hauled to the treatment plants and to facilitate back-fill and rehabilitation where feasible.

Directional or navigational drilling as a mining tool to mine deeply buried alluvial deposits such as the deep Cretaceous channel systems in the Koingnaas mining area may be employed. This method is well suited to extract ore bodies situated in impenetrable areas, under water or ore bodies with unsuitable shape for conventional mining methods. Systematic pre-planned pilot holes are normally drilled across the orebody after which the holes are reamed to up to 1,3m diameter and the ore extracted (Illustration 3).

Illustration 3: Directional drill rig; insets showing reaming of pilot hole (bottom right) and ore extraction method (bottom left).

d) 3.2.3 Bedrock cleaning

Bedrock cleaning follows extraction of the ore. This process entails the sweeping of the exposed bedrock surface to remove all ore that may contain diamonds, either manually with picks, shovels and jackhammers and/or mechanically with small excavators and transvac machines.

d)3.2.4 Loading and hauling

Subsequent to bedrock cleaning, the diamond-bearing sweepings are transported to the treatment plants either by secure haulage trucks or in sealed containers.

d) 3.2.5 Rehabilitation

Rehabilitation of the mined area is then undertaken by means of standard, approved backfill methods. It is generally carried out by back-dumping into mined out areas, flattening/sloping steep-sided overburden dumps and dangerous benches, and covering the resulting surface with topsoil. Experimentation is an integral part of rehabilitation methods and various soil treatments, seeding and netting are carried out in some cases.

d) 3.3 Processing

The Koingnaas Mine will start up with the construction of a new 200 tonne per hour (tph) screening and scrubbing plant at Mitchell's Bay which will feed the -12+1.6 mm fraction to the existing 50 tph Mitchell's Bay Dense Media Separator (DMS) plant. Concentrate from the DMS will be treated through the Kleinzee Final Recovery (KFR) at Kleinzee. A second 200 tph screening plant may be deployed as and if required. Additional mobile scalping screens and Finlay type screens may also be required and will be deployed as necessary.

At the screening and scrubbing plant, mined gravel will be tipped onto the front end Run-Of-Mine (ROM) feeder feeding a vibrating grizzly. The very coarse +150 mm material will be discarded by means of a vibrating grizzly and the -150 mm material will be fed to a jet sump and a scrubber via a desliming screen. The scrubber feeds onto a double deck sizing screen with the -12 + 1.6 mm screened product trucked to a 50 tonnes per hour (tph) DMS plant for concentration. The +150 mm and +12 mm screened products will be discarded to either mining voids or dumps, depending on the availability of either, whereas the -1.6 mm slimes material will be pumped to the nearest available mining voids registered as slimes disposal sites wherever possible.

Process flow charts for the 200 tph scrubbing and screening plant and the existing DMS plant Mitchell's Bay plants are indicated in the process flow sheets under Appendix 4. The existing and proposed future slimes dam locations for the Koingnaas Mining area are shown in Appendix 4.2.

At beach mining sites, Articulated Dump Trucks (ADT's) will transport the gravel to a nearby scalping and screening plant, fed by seawater, where the gravel may be fed directly to the feeding screen or stockpiled and fed by front-end loader to the screen. Sand and seawater will be released back to the sea. The screened material is transported to the nearest DMS plant. The mobile wet screening plant will be positioned near the mining area and power will be supplied by a 200 KvA generator. Oversized tailings generated by the screening plant will accumulate at the plant for further use in rock berm construction for the coffer dams.

Current planning is to construct a 450 tph jig plant to treat the Koingnaas Tailings Mineral Resource (TMR) in Year 4 of operations. Existing infrastructure will be utilized and the plant will have a generic diamond treatment plant flow sheet.

d) 3.4 Mine residue disposal

The major mining-related wastes produced are fine residue and coarse residue. Coarse residue arises from beneficiation of the ore at the various production (Mitchell's Bay, Koingnaas and possible others) and sampling plants. The course discard produced is end-tipped from overland conveyor onto a coarse residue deposit (CRD) located in close proximity of the plant (Illustration 4) or transported to nearby open voids. All coarse and fine residues generated by the mobile prospecting plant will be rehabilitated to either the bulk sample site itself or the nearest identified open void.

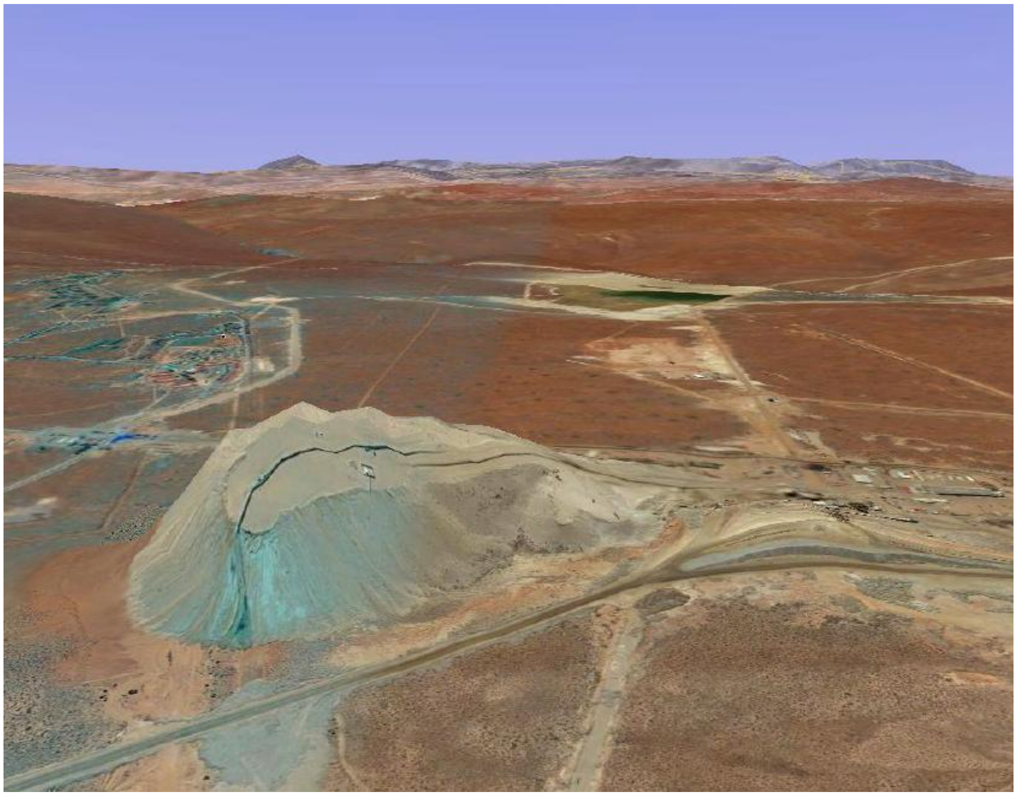

Illustration 4: Existing CRD at Koingnaas

All fine residue produced at plant sites are disposed of in dedicated fine residue deposit (FRD, slimes dams). The fines are deposited by open-end spigotting (Illustration 5). As mining progresses to other areas and possible new plants are introduced new slimes dams will be introduced according to the same design and maintenance standards as the current CRD's and according to the required and approved design specifications.

Illustration 5: Examples of past FRD facilities at the Michell's Bay plant (left) and Koingnaas plant (right).

d) 3.5 Ancillary operations undertaken including bulldozing, ripping, drill-and-blast, road construction

Standard infrastructural development and maintenance methods involving all of the above activities are carried out on a continuous basis in order to ensure safe and adequate transport and other infrastructural provision to the mine.

d) 4. Surf zone Mining

A number of beach-mining activities planned for the surf zone are not covered under the current EMP and therefore triggers the need to conduct an EIA. The triggering activities are listed and described in detail in the next sections of the report.

The surf zone is defined as that area extending from the high-water mark to 31.49 m (100 Cape feet) beyond the low-water mark. Mining in this zone, and to water depths of about 10 m, is primarily shore-based. The operations are confined to small bays, and are typically conducted using small-scale, diver-assisted suction equipment.

Surf zone mining has been ongoing in the Koingnaas and Samson's Bak areas for many years as approved under the current authorizations. Surf zone mining is undertaken by diver-operated suction hoses, which feed the diamondiferous gravels to shore-based pumping units comprising a tractor, modified to drive a centripetal pump and a rotary classifier (Illustration 6). Operations would be confined to small bays at depths of <10 m.

The classifier, which is positioned in the intertidal area, sorts the pumped material and extracts the size fraction of interest. The diamond-bearing gravel is bagged and transported on a daily basis to the nearest processing facility for diamond extraction.

Over-sized tailings (+12 mm) are accumulated around the classifier and the fine tailings (-2 mm) are returned directly to the sea as a sediment slurry. The oversize tailing heaps which accumulate around the classifier are dispersed during the high tide, or mechanically redistributed over the beach at the end of mining operations. Care is taken to deposit oversized tailing below the High Water Mark (HWM) to allow natural redistribution by wave action. A shore-based operation typically consists of two to four divers, their assistants, and the necessary equipment.

To gain access to the water, the contractors attempt to locate their equipment as close to the sea as possible in the supertidal and intertidal regions. The topography of the bays targeted by shore contractors enables the storage of classifiers and hoses on site above the HWM. The equipment storage areas are usually restricted to an area of <5 m^2 thereby limiting damage to sensitive strandveld vegetation.

Only once a bedrock feature yielding a viable reserve has been identified, would operations take on a larger, more permanent scale by sequentially mining the blocks following the feature. The *modus operandi* and scale of operation would therefore depend largely on whether prospecting or mining is taking place and on the depth of overburden that needs to be removed before the target gravels can be accessed.

Illustration 6: Shore-based contractor working from the intertidal zone to depths of ~10 m. The tractor-driven pump and classifier are parked above the HWM and the mined gravel is loaded onto a trailer for transport to the processing plant.

d) 5. <u>Beach mining</u>

A number of beach-mining activities planned for the beach and offshore channel mining are not covered under the current EMP and therefore triggers the need to conduct an EIA. The triggering activities are listed and described in detail in the next sections of the report (Section d (i) and d (ii)).

Beach mining operations of mineralized gravel deposits found in various places between the low and high water marks along the coast have been on-going for many years. WCR are currently continuing with these approved activities above the low water mark on a limited scale. Different beach mining methods will also be applied.

<u>d) 5.1 Coffer dam/sea-wall method:</u>

WCR plans to extend its mining activities in some beach areas below sea level by constructing protective sea-walls and/or berms (coffer dams; Illustration 7 and Illustration 8). Depending on the quality of the resource and the coastal and seafloor configuration the surface extent of the scheduled mining blocks may stretch to approximately 100 m or more, seaward from the high-water mark.

Land mining equipment will be used for sea-wall construction and maintenance. Different material types such as rock, sand and clay may be used to prevent ingress of seawater. Materials will be sourced from adjoining land mining sites and including bedrock, overburden and/or coarse and fine residue dump sites, or excess dune and/or beach sand deposits.

A specialist report on coastal protection for beach mining in the Koingnaas area has been prepared by WSP Coastal and Port Engineering Division. This report contains details of wind, wave, sea-curent and sea-level patterns, wave refraction, shoreline bathymetry modelling and sand grain size distribution studies and provides a complete description of beach reclamation methods for the Koingnaas area including beach accretion with sand and/or rock berms.

Illustration 7 and Illustration 8, provide an example of typical coffer dam beach mining operations.

Illustration 7: Small scale beach mining operations

Illustration 8: Medium-scale beach mining operation using heavy machinery for gravel extraction and a central processing area.

e) 5.2 Beach accretion methods:

d) 5.2.1. Rock and/or sand berms**,** or seawalls, typically up to 7 m above MSL and 20 - 30 m wide can be constructed with earthmoving machinery in order to accrete the beach and protect the mining excavation. The crest of these seawalls is typically at 7 m above MSL, and is 20 m to 30 m wide. Large sand volumes are required to construct and maintain the seawalls because sand is constantly eroded from the seawall by wave action. The rate of erosion and replenishment increases as the walls are built further into the sea.

Rock berms are typically used to construct revetments or breakwaters with the structure usually consisting of an outer layer of large armour rock while under layers typically consist of progressively smaller material. A berm is usually constructed seaward from the shore by end-tipping the core material from trucks. Once a sufficient section of core is built, it is covered with the larger armour layer while an excavator is used to dress the slope to the correct profile. the berm can be extended in phases as far offshore as conditions allow (Illustration 9). As in the case of beach mining materials will be sourced from adjoining land mining sites and including bedrock, overburden and/or coarse and fine residue dump sites, or excess dune and/or beach sand deposits.

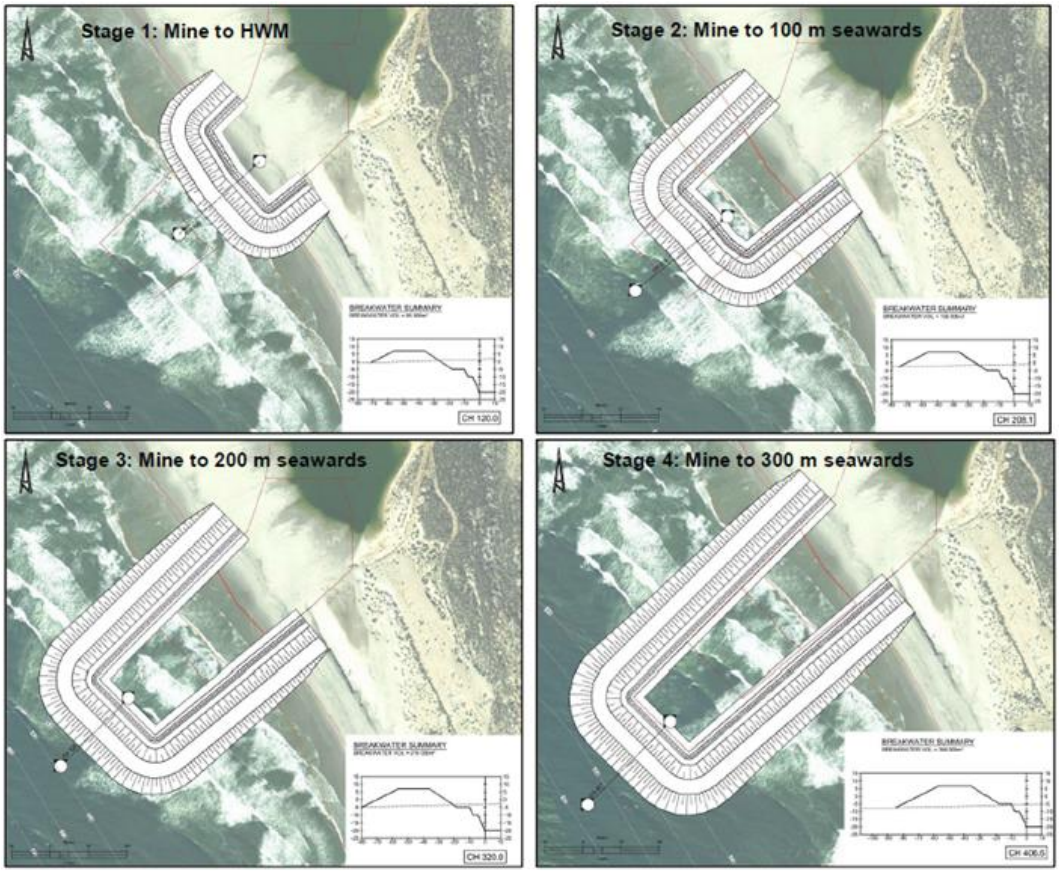

Illustration 9: Illustration of phased rock berm/coffer dam construction and extension along offshore channels (WSP Report, Ann. 6).

d) 5.2.2. Dredgers *(conventional dredge or Sea-walker) or hydraulic mining* with slurry pumps can be used to strip overburden sand and discharge the slurry onto the beach where wave action distributes the sand along the coast. The rate of accretion is dependent on the dredging rate (cf. Illustration 2).

d) 5.2.3. Conveyors can also be used to move sand, and coarser material, from further inland onto the beach. The front of the conveyor is moved or extended seaward as the accretion occurs. Wave action distributes the material along the coast. This method is effective if the source of sand is an existing large stockpile or dump.

For each site, the most economically and technically viable method will be selected bearing in mind the temporary nature of the mining, the quantity and characteristics of available construction materials (rock, sand and clay), possible phasing of the mining to facilitate recovery of diamonds at an early stage, the need to minimise seepage into the mining area and the costs of protective measures. Specific beach mining methods are proposed for specific areas but any of the proposed methods maybe applied at any specific site depending on the outcome of a final geotechnical assessment of sea and seafloor conditions.

Beach and channel mining operations are conducted along shorelines where mineralization is generally erratic and onsequently the beach mining may at times resemble prospecting operations rather than full-scale mining. Only once a bedrock feature yielding a viable reserve has been identified, do operations take on a larger, and more permanent scale. The modus operandi and scale of operation at each individual site will therefore depend largely on whether prospecting or mining is taking place and on the depth of overburden that needs to be removed before the target gravels can be accessed (e.g. proposed rock berm construction for Rooiwal Bay).

d) 6. Processing Infrastructure

The Koingnaas Mine will start up with the construction of a new 200 tonne per hour (tph) screening and scrubbing plant at Mitchell's Bay which will feed the -12+1.6 mm fraction to the existing 50 tph Mitchell's Bay Dense Media Separator (DMS) plant. Concentrate from the DMS will be treated through the Kleinzee Final Recovery (KFR) at Kleinzee. A second 200 tph screening plant may be deployed as and if required. Additional mobile scalping screens and Finlay type screens may also be required and will be deployed as necessary.

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Current planning is to construct a 450 tph jig plant to treat the Koingnaas Tailings Mineral Resource (TMR) in Year 4 of operations. Existing infrastructure will be utilized and the plant will have a generic diamond treatment plant flow sheet.

d) 7. Rehabilitation

Rehabilitation is conducted concurrent to mining activities. Rehabilitation is generally carried out by back-dumping into mined-out areas, flattening and/or sloping steep-sided overburden dumps and dangerous benches, and covering the resulting surface with topsoil. Experimentation is an integral part of rehabilitation methods and various soil treatments, seeding and netting procedures and tests are carried out in some cases.

d) 8. Regional infrastructure

The KNC and SBC mining areas are accessed via existing public roads. The three most used are secondary roads from Springbok to Kleinsee, Port Nolloth to Kleinsee and Garies to Koingnaas. The District Municipality maintains these roads. A 60 km tar road links Koingnaas and Kleinsee. Most of the roads in these towns are tarred. A 40 km gravel road connects Kleinsee to Komaggas.

The closest rail end is located at Bitterfontein, approximately 180 km south of Springbok from where goods are transported by road further north. The Sishen-Saldanha railway line is located to the east of the Bitterfontein line.

A large number of the mine employees are sourced from and live in surrounding communities such as Hondeklip Bay, Koingnaas, Kleinzee and the regional towns of Namaqualand. The nearby towns of Hondeklip Bay and Koingnaas are proclaimed towns that fall under the Kammiesberg Municipality.

Eskom electricity is supplied to WCR from the national power grid via Upington, Aggeneys and Springbok and to a sub-station at Gromis, near Kleinsee. From this sub-station, power is distributed to WCR operations.

d) 9. Existing mine infrastructure

Koingnaas is an existing mining area with most infrastructure requirements already in place. Infrastructure at each mine site and processing operation comprising electric power supply, roads, potable, fresh and seawater supplies, fuel supply and storage and workshops, have been established and maintained. The main haul roads run from the various mining areas to the main treatment plants and are well constructed. Smaller light vehicle roads connect offices, workshops and other frequently visited destinations. Numerous tracks are created and used during prospecting. When no longer required, roads are closed off and ripped to facilitate natural re-vegetation. Tracks are left to recover naturally. Roads to beach mining areas also exist as these areas have been mined to the shore-line before and these will require minimum maintenance and extension onto the beach in future. Some of the plants and workshops will be recommissioned depending on requirement and any additional plants and/or infrastructure that may be required in future will, in all likelihood, also be established on these same sites in order to utilise existing supply routes and electricity and water connections. An outline of the infrastructure network is shown in Appendix 4.3.

d) 10. Operational requirements

Below is an overview of the current operational requirements.

d) 10.1 Surface and groundwater use

With the exception of the ephemeral Swartlintjes- and Spoeg Rivers, no significant occurrence of surface water is to be found within the Koingnaas Right Area.The lack of permanently flowing rivers within the study area implies that surface water is not generally available for use, and the quality thereof has not been tested. All of Koingnaas and Samson Bak's freshwater supply comes from the local Somnaas-Noup aquifer. Although three boreholes are equipped to supply water, due to the abundance of the aquifer, only No. 12 (27 m deep) and 15 (24.5 m deep) are currently being utilised. Upon request from the district authority, water supply to Hondeklip Bay from Koingnaas has also been implemented.Farming operations in the region obtain groundwater from boreholes situated on various properties.

d) 10.2 Waste management activities

Namaqualand Mines activities will generate waste (general, industrial and hazardous) which is handled in a manner that will not have any impact to the surrounding environment. The norms and standards for National Environmental Management Waste act, 2008 Regulation for 2013 are considered in the execution of activities.

WCR has a waste license and permits which were obtained from the Department of Environment Nature Conservation (DENC) for domestic refuse (soft scrap dump and hard scrap dump). The Class G:C:B. license was issued in 2001 whereas some others were issued in 2010 and allow also for disposal of soft and hard scrap.

d) 10.3 Domestic waste

Domestic waste generated will be collected in clearly labelled bins and skips, and will temporarily be stored within designated areas on-site. General waste will be disposed of off-site in a licensed facility. Bins will be lifted once a week or as necessary as per contract with a waste removal company. WCR is also committed to undertake recycling where possible. The management of domestic waste will be undertaken in accordance with the procedures that will be developed on an ongoing basis as part of operational controls.

d) 10.4 Hazardous waste disposal (excluding mine waste)

Hazardous waste to be managed on the site will include oily wastes from the workshops and servicing areas, petroleum products, various cleaning materials used in the workshops, tyres, light bulbs (including fluorescent tubes), electronic waste and other related materials used either in mining equipment or in maintaining such equipment. Waste will be stored in designated areas (bunded and lined where necessary) for removal. All hazardous waste will be removed off site by a contracted waste company, with disposal to a licensed landfill site. The frequency with which the industrial waste will be removed will be in accordance with the procedures that WCR will design.

d) 10.5 Process water abstraction and management

d) 10.5.1 Process/sea water abstraction

Process water for use in the Koingnaas and Michell's Bay areas is sourced from the nearby sea, with each of the plants having dedicated sea intake points for this purpose.

d) 10.5.2 Process water management

The process water will be managed through containment in appropriately designed and sized dams, designed by engineers. The Intergrated Water and Waste Management Plan (IWWMP), which was compiled in support of an application for a water use license was designed to have a site specific, implementable and management plan addressing all the identified water use and waste management related aspects (e.g. process water balances, storm water management, groundwater management, water re-use, water conservation and demand management, waste minimisation and recycling) of a specific activity, in order to meet set goals and objectives, in accordance with Integrated Water Resource Management Principles. In addition, the plan makes provision for a management plan to guide a water user regarding the water and waste related measures which must be implemented on site in a progressive, structured manner in the short, medium and long term.

All dirty water drains and trenches will be constructed in such a way as to convey all contaminated water to a Pollution Control Dam (PCD), which is situated at the low point on the mine area. This implies all water will flow by gravity into the dam. In cases where the water cannot flow by gravity to the PCD, sumps will be created in these areas from where the water will be pumped to the PCD.

There may be inflows into the workings due to direct rain, surface runoff from the remaining exposed upslope areas (if any), intersected groundwater and recharge from the in-pit spoils. Such will then be pumped to the various PCDs and re-used for dust suppression purposes or recycled through the plant. Some of the water will evaporate.

d) 10.6 Storm water management

All storm water management infrastructure will be designed to ensure clean and dirty water systems are separated. The storm water management system was developed to be in accordance with Regulation GN 704. The following principles were kept in mind:

- The surface area of clean water areas should be maximised and the size of dirty water management areas minimised within the mine boundary area;
- All storm water management measures should be designed to separate clean water from dirty water (and vice versa);
- All storm water management structures should be designed to require minimum maintenance, including maintenance required after floods exceeding the design capacity;
- After closure dirty water will have to be managed to prevent polluting the clean stream for as long as there is a possibility for pollution
- For the IWWMP, haul and access roads were not included as part of the dirty water management except, where the roads are established on dirty water areas; and
- Concurrent rehabilitation will be essential to reduce the recharge of rain water through the spoils and to increase clean surface runoff to the clean environment. Storm water from the emergency stockpile, stockyard, crushing plant/tip area, workshop and plant will be channelled to the

containment dam via drains. This water will be reused for dust suppression and as plant process water. Surface water management infrastructure is designed to cater for 5 year intervals. This will require that clean and dirty water berms and trenches be placed in locations to minimise the dirty water catchment during a 5 year stage.

- All the potentially dirty excess water from the mine will be pumped to the balancing dam located south of the plant area.This excess water will reduce the make-up water required from across the boundary of the mine.
- In general, throughout the mine plan, water make-up is required during the dry season and excess water will have to be treated during the wet season.

d) 10.7 Dirty water berms and trenches

The surfaces that are isolated and treated as dirty water management areas include the open void(s) and spoils and stockpiles (overburden), mine residue facilities and plant area. The storm water management measures taken consist of measures to secure the dirty areas and divert clean upslope water past the contaminated areas. Upslope dirty water diversion canals are proposed to cut off dirty run-off from the active opencast mining area preventing it from discharging into the natural drainage lines

d) 10.8 Clean water berms and trenches

- All clean water management measures will be sized for a 1:50 year storm event. Areas such as the parking areas, office areas and other related infrastructure that represent a low to negligible risk to the environment in terms of surface water quality impacts will have run-off drained back to the natural drainage lines by constructing berms and trenches to divert all clean water. Normal maintenance of the storm water management measures will be required to prevent scouring, erosion or silting up or damage to drains and canals.

- Berm and trenches are generally combined where the cut material from the trench is used to build the berm. Where a berm trench combination is applied the trench faces uphill to be able to divert the larger amount of surface water.

d) 10.9 Pumps and Pipes

- Pumps will be used to pump water through pipes to the operational areas. The location of the pumps and the pipelines are indicated on the engineering design diagrams accompanying the water use licences. These pumps are also incorporated into the water balance flow diagrams. A pump flow rate was chosen after calculating the flow rate through a specific pipe diameter at a velocity of 1.5 m/s.

- In the water balance calculation these flow rates are applied for 24 hours per day to make the water model balance.
- Pipelines will be in use during the operation for the circulation of water from the slime dams to the PCD and the return water dam for re-use in the operation.
- A pit pump will generally be diesel or electricity driven and pumps next to fixed structures like PCD's and sumps will be electrically driven. To take this design to the next level a list of all the pumps with their associated flows and pressures and a detailed quote from the supplier is required.

d) 10.10 Water Balance

The Water Balance (WB) of a development project is used to illustrate the cumulative flow of water through the system. The system comprises of many different individual components which each comprise of their own significant flows.The WB aims to ultimately provide cumulative flow for each component within the system.

The purpose of water balance calculations include:

- Providing the necessary information that will assist in defining and driving water management strategies.
- Auditing and assessment of the water reticulation system, with the main focus on water usage and pollution sources. This includes identifying and quantifying points of high water consumption or wastage, as well as pollution sources. Seepage and leakage points can also be identified and quantified when the balances are used as an auditing and assessment tool.
- Assisting with the design of storage requirements and minimizing the risk of spillage.
- Assisting with the water management decision-making process by simulating and evaluating various water management strategies before implementation.

d) 10.10-1 Clean water catchment area

Runoff from the clean water catchment will be allowed to freely flow back to the environment. Rainfall was regarded as the source of the clean water.

The results, were used to interpolate the Peak Flows and Mean Annual Runoff for the underground working area. The hydrological characteristics of these areas are summarised as follows:

d) 10.10-2 Dirty water

Dirty Water Management will take into account GN704 guidelines relating to water management in mines. In general the on-site surface water management will maintain the activity footprint as small as possible, separate clean and dirty water runoff, prevent clean water runoff flowing onto the activity footprint and prevent dirty water runoff from the activity area from entering clean water runoff areas.

d) 10.10-3 Water sources

Sea water will be abstracted and used at the plant.

d) 10.10-4 Natural losses

Evaporation losses were calculated based on the estimated 1775.89 mm/annum.

d) 10.10-5 Operational assumptions

The following operational assumptions were made:

- Storage dam will be placed at the open-cast mining area, to collect seawater to be used at the plant. Seawater is abstracted for processing diamond mining and released back to the sea.
- PCD dam to be located at the lowest elevation of the operational area- screening plant facility, with 100 m by 100 m dimensions

d) 10.10-6 Water balance calculations

Rainfall and evaporation data was used to quantify the annual rainfall and evaporation in cubic meters per annum (m^3/annum).

Natural water sources are as follows:

- Rainfall (mm) was multiplied by the surface area and the runoff coefficient to determine the runoff for the following area:
  - Slimes dam area (Disposal area)
  - Water Return Dam (WRD)/ Pollution Control Dam (PCD) (Operational area)
- Direct rainfall in the recommended PCD was quantified using rainfall data and surface area of the dam.

d) 10.10-7 Natural Water losses

- Evaporation losses were quantified by multiplying evaporation with the surface area of exposed water storage areas.
- Plant losses

d) 10.10-8 Component water circuit

Water balance calculations were conducted for each component as summarised in the tables below:

Table (d) 10.10-8 - 1: Processing plant water balance

Water-Balance	**Source: Water-In (m^3/annum)**		**Loss: Water-Out (m^3/annum)**		
Description	**Seawater-Storage dam**	**Return Water from PCD/RWD**	**RWD/PCD**	**Slime Dams**	**Plant Losses**
Screening Plant	3120000	716065	1223040	2496000	117025
Total (m^3/a)	3836065		3836065		
Surplus/Deficit	0				

Table (d) 10.10-8 - 2: Operational area water balance components

Water-Balance	**Source: Water-In (m3/annum)**	**Source: Water-In (m^3/annum)**	**Loss: Water-Out (m^3/annum)**		
Description	**Plant**	**Rainfall**	**Evaporation**	**Dust suppression**	**Return to Plant (losses)**
Slime Dams	2496000	1084.6	17758.9	489216	1990110
Total (m^3/a)	2497084.6		2497084.6		
Surplus/Deficit	0				

Table (d) 10.10-8 - 3: PCD or RWD

Water-Balance	**Source: Water-In (m^3/annum)**		**Loss: Water-Out (m^3/annum)**		
Description	**Plant**	**Rainfall**	**Evaporation (at 10% $Area_{O/C}$)**	**Dust suppression**	**Return to Plant (losses)**
PCD or RWD	1223040	1084.6	17759	489216	717150
Total (m^3/a)	1224124.6		1224124.6		
Surplus/Deficit	0				

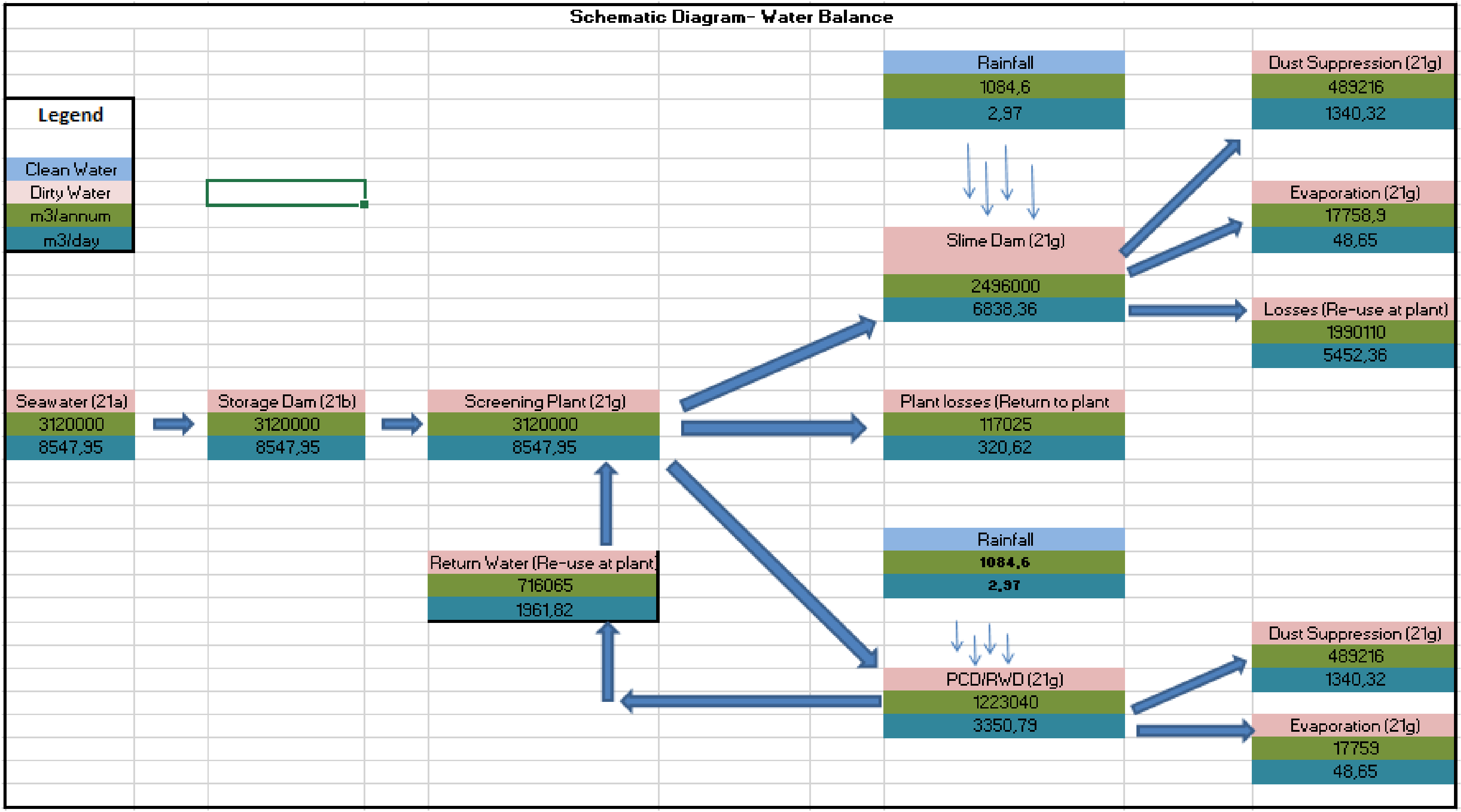


Figure (d)(i)10.10-8 - 1: Water Balance Sketch

Dewatering sites and volume

Section 21 (j) of the National Water Act, 1998 (Act 36 of 1998) entails: removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people.

The amount of water that will be removed from underground will be 600 000 m^3/a. This process of dewatering will take place on the following farm areas each with 150 000 m^3/a; Somnaas 474, Langklip 489, Zwartlinjies River 484 and Koingnaas 475.

Table (d) 10.10-8 - 4: Dewatering

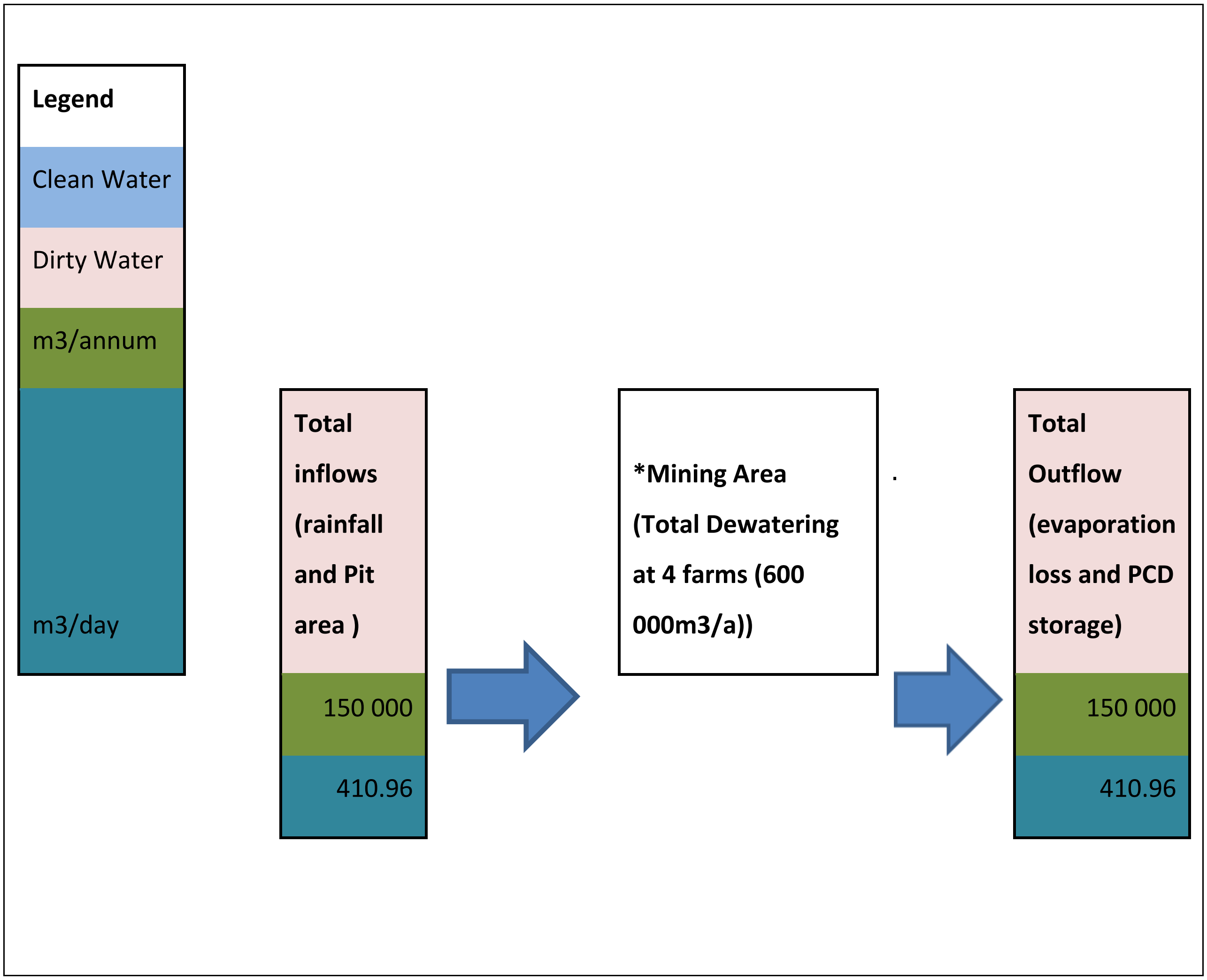
Type of water use	Description	Farm name	Co-ordinates	Volumes
Section (j): removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people.	Removing Water from underground /dewatering.	Somnaas 474	E 17° 13' 25.86" S 30° 9' 47.76"	150 000 m^3/a
Section (j): removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people.	Removing Water from underground / dewatering.	Koingnaas 475	E 17° 17' 57.67" S 30° 17' 51.83"	150 000 m^3/a
Section (j): removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people.	Removing Water from underground / dewatering.	Langklip 489	E 17° 19' 31.75" S 30° 22' 37.70"	150 000 m^3/a

Type of water use	Description	Farm name	Co-ordinates	Volumes
Section (j): removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people.	Removing Water from underground / dewatering.	Zwartlinjies River 484	E 17° 20' 54.06" S 30° 25' 51.08"	150 000 m^3/a

Table (d) 10.10-8 - 5: Component Water Balance at the Opencast area

Water-Balance	Source: Water-In (m^3/annum)	Loss: Water-Out (m^3/annum)
Description	Total inflows (rainfall and pit area)	Total outflow (evaporation and PCD storage)
Mining Area (Pit)	150000	150000
Total (m^3/a)	150000	150000

Table (d) 10.10-8 - 6: Water Balance for the dewatering component for S 21 (j)



*Dewatering activities at 4 different operational areas at a rate of 150 000 m^3 per site.
At a combined capacity of 600 000 m^3.

An identification of any areas to be avoided, including buffers;

Flood calculations were conducted for each catchment area in order to quantify the final volumes discharging at the ocean.

<u>Foodcalculations</u>

A Standard Design Flood (SDF) calculation method was used to estimate the peak flows. A SDF is specific to a particular watershed, and specific to a particular length of time corresponding to the duration of the effective rainfall.

The approach can be simplified as follows:

- In-stream flow volumes
    - ➢ The SDF method was used to calculate in-stream flow volumes for the 1:5, 1:50 and 1:100 24 hours storm events.
    - ➢ This information is later used for the delineation of flood lines.
- The delineated catchment area for which flood calculations were conducted are summarised as follows:
    - ➢ Effective Catchment 1 (F40B, F0C, and F40D)
    - ➢ Effective Catchment 2 (F40E and F40F)
    - ➢ F40A Catchment
    - ➢ F40D Catchment
    - ➢ F40F Catchment
- For in-stream calculations, the following catchment characteristics have an influence on the hydrological yield:
    - ➢ Area
    - ➢ Length of watercourse
    - ➢ Height difference along the slope
    - ➢ Slope
    - ➢ Drainage Basin Characteristics – Region 15

The region is generally arid rainfall less than 150mm per year and the soil are generally sandy with a low runoff potential. The hydrological characteristics are presented in Table (d) 10.10-8 – 7 and Table (d) 10.10-8 – 8.

Effective catchment 1

The hydrological characteristics for this area are summarised as follows:

Table (d) 10.10-8 - 7: Catchment characteristics

Area of catchment	1753 km²
Length of longest watercourse	70.164 km
1085 height difference	529 m
Average slope	0.0101 m/m

Table (d) 10.10-8 - 8: Drainage basin characteristics

Drainage basin number	15
Mean annual daily max rain	22 mm
Days on which thunder was heard	11 days
Runoff coefficient C2	5 %
Runoff coefficient C100	20 %
Basin mean annual precipitation	130 mm
Basin mean annual evaporation	2100 mm
Basin evaporation index MAE/MAP	16.15

Effective catchment 2

The hydrological characteristics for this area are summarised as follows:

Table (d) 10.10-8 - 9: Catchment characteristics

Area of catchment	1747 km²
Length of longest watercourse	66.1 km
1085 height difference	731 m
Average slope	0.0147 m/m

Table (d) 10.10-8 - 10: Drainage basin characteristics

Drainage basin number	15
Mean annual daily max rain	22 mm
Days on which thunder was heard	11 days
Runoff coefficient C2	5 %
Runoff coefficient C100	20 %
Basin mean annual precipitation	130 mm
Basin mean annual evaporation	2100 mm
Basin evaporation index MAE/MAP	16.15

F40A

The hydrological characteristics for this area are summarised as follows:

Table (d) 10.10-8 - 11: Catchment characteristics

Area of catchment	1016 km²
Length of longest watercourse	35.3 km
1085 height difference	124 m
Average slope	0.0047 m/m

Table (d) 10.10-8 - 12: Drainage basin characteristics

Drainage basin number	15
Mean annual daily max rain	22 mm
Days on which thunder was heard	11 days
Runoff coefficient C2	5 %
Runoff coefficient C100	20 %
Basin mean annual precipitation	130 mm
Basin mean annual evaporation	2100 mm
Basin evaporation index MAE/MAP	16.15

F40D

The hydrological characteristics for this area are summarised as follows:

Table (d) 10.10-8 - 13: Catchment characteristics

Area of catchment	740 km^2
Length of longest watercourse	29.1 km
1085 height difference	142 m
Average slope	0.0065 m/m

Table (d) 10.10-8 - 14: Drainage basin characteristics

Drainage basin number	15
Mean annual daily max rain	22 mm
Days on which thunder was heard	11 days
Runoff coefficient C2	5 %
Runoff coefficient C100	20 %
Basin mean annual precipitation	130 mm
Basin mean annual evaporation	2100 mm
Basin evaporation index MAE/MAP	16.15

F40F

The hydrological characteristics for this area are summarised as follows:

Table (d) 10.10-8 - 15: Catchment characteristics

Area of catchment	683 km²
Length of longest watercourse	22.5 km
1085 height difference	110 m
Average slope	0.0065 m/m

Table (d) 10.10-8 - 16: Drainage basin characteristics

Drainage basin number	15
Mean annual daily max rain	22 mm
Days on which thunder was heard	11 days
Runoff coefficient C2	5 %
Runoff coefficient C100	20 %
Basin mean annual precipitation	130 mm
Basin mean annual evaporation	2100 mm
Basin evaporation index MAE/MAP	16.15

Table (d) 10.10-8 - 17: Summary of Flood Calculations

Catchment Description	**Area (km^2)**	**Notes**	**1:50 year**	**1: 100 year**
			Peak Flow (Q_{p50}) in m^3/s	**Peak Flow (Q_{p100}) in m^3/s**
Effective Catchment 1	1753	The define water course within this area is Swartlintjies River originates in both F40B and F40C quaternary catchment.	398.15	504.21
Effective Catchment 2	1747	Spoeg River originates within F40E quaternary catchment flowing to the F40F catchment which the study area falls within especially the Lang Klip 489 farm and Mitchell's Bay 495 farm which Spoeg transverses.	459.91	582.43
F40A catchment	1016	No define water course within this quaternary catchment.	289.36	366.44
F40D Catchment	740	Swartlintjies River flows for 29.1 km within this catchment to discharge to the sea.	266.61	337.63
F40F Catchment	683	Spoeg river flows for 22.5 km in the south westerly direction before it discharges to the sea.	287.66	364.29

FloodlineDelineation

The run-off that is generated within a catchment through precipitation depends on the following Characteristics:

- Characteristics of the storm event;
- The response characteristics of the catchment; and
- The influence of temporal storage on the run-off.

The temporal distribution of the run-off is reflected in a hydrograph.The flood peak (QP) is reached as soon as the entire catchment contributes to the flood, which is also referred to as the time of concentration (TC). Flood lines are usually determined for areas where proposed infrastructure could be influenced by in-stream flood volumes and their respective levels. Swartlintjies and Spoeg Rivers were modelled and based on flow technical data, flood lines were delineated.

d. 10.11 Groundwater management

The movement of groundwater has been assessed as part of the geohydrological specialist study in detail to determine the impact from potential seepage from the slimes dams on the groundwater quality. The ground water quality was evaluated from 19 existing boreholes. The study area is characterised saline ground water with majority of boreholes falling in Class III of Department of Water and Sanitation (DWS) water quality guidelines. Details regarding ground water management are provided under Section L of this EIA Report and specified in the Geohydrological Report, which is included as Volume 4 of this EIA Report.

i) Listed and specified activities (Provide a plan drawn to a scale acceptable to the competent authority but not less than 1: 10 000 that shows the location, and area (hectares) of all the aforesaid main and listed activities, and infrastructure to be placed on site and attach as Appendix 4)

Before proceeding with the mining operations, an assessment of what environmental authorisations are covered under these rights was undertaken. This was done in the light of the new legal dispensation, which had culminated into the development of "one environmental system," incorporating MPRDA, NEMA, NWA and NEMWA. The transitional arrangement and statement issued on 09 December 2014, by the Ministers in charge of the "One Environmental System", which states that: any environmental management programme (EMP) issued prior to December 2014, is deemed to have an existing environmental authorisation in terms of NEMA. This application for environmental authorization has been undertaken for triggered listed activities for the KNC and SBC and some of the areas covered under the Namaqualand Prospecting Right for all activities and including those previously approved in the current EMP.The identified triggered listed activities are indicated in Table (d) (i) – 1.

Table (d) (ii) -2 details the potential areas to be disturbed in the mining zones selected for beach and offshore channel mining. The table also indicates the type of design proposed for the different coastal environments.

The plans showing the proposed areas for which activities will be undertaken are outlined under Appendix 4:

- Appendix 4: Surface infrastructure layout plan (Drawing 001)
- Appendix 4.1: Layout of mobile wet screening plant.
- Appendix 4.2: Existing and proposed slimes dam location sites.
- Appendix 4.2.1: Existing and proposed slimes dam location sites (North).
- Appendix 4.2.2: Existing and proposed slimes dam location sites (South).
- Appendix 4.3: Existing and planned infrastructure network.
- Appendix 4.3.1: Schematic electrical network for the Kleinzee - Koingnaas area.
- Appendix 4.4: Proposed 200 tph Screening and Scrubbing Plant.
- Appendix 4.5: Existing 50 tph Michell's Bay Plant.
- Appendix 4.6: New 10 tph mobile Dense Media Separator (DMS) prospecting plant.

The following figures illustrate some of the features for the areas to be mined:

- Figure (d) (ii) 1.1 – 5: Illustration of phased rock berm/coffer dam construction and extension along offshore channels at Koingnaas Site 68/69, Somnaas and Langklip Central.
- Figure (d) (ii) 1.1 – 7: Illustration of a dynamically stable rock berm construction and extension along offshore channels at Rooiway Bay.
- Figure (d) (ii) 1.1 – 8 and Figure (d) (ii) 1.1 – 9 : Generic rock berm design for all other coffer dams.

Table (d) (i) - 1: The identified triggered listed activities

NAME OF ACTIVITY	**AERIAL EXTENT OF THE ACTIVITYHA OR M²**	**LISTEDACTIVITY** (Mark with an **X** where applicable or affected).	**APPLICABLE LISTING NOTICE** ***(GNR 544, GNR 545 or GNR 546)/Not listed)***
<u>MINING ACTIVITIES</u>: Excavations • Construction of coffer dam walls around excavate beach and/or offshore channel mine blocks using boulders, bedrock, gravel, sand and other related materials. • Excavation by means of bulldozers, excavators and haulage trucks. • Directional drilling • Hydraulic mining	Total areas to be mined are summarised in Table d (ii) -2. • Section d) 4 and d) 5: Beach mining methodologies to be applied, see Figures (d) (ii) 1.1 – 4, 1.1-5,1.1-6, 1.1-7, and 1.1-8. Table d(ii)-1 indicates the volumes required for berm construction. • Section d) 3.2: Truck-and-shovel mining methodology, see Illustration 1 • Section d) 3.2.2:	X	R983 (Listing Notice 1), 04 December 2014; Activity No. 17 (i), (iii), (v), (c), (d), (f): Development: (i) In the sea; (iii) Within the littoral active zone; (v) If no development setback exists, within a distance of 100 metres from the water mark of the sea or an estuary, whichever is the greater; in respect of- (c)Embankment; (d) Rock revetments or stabilising structures including stabilising walls; (f) Infrastructure with a development footprint of 50 square metres or more but excluding;

NAME OF ACTIVITY	**AERIAL EXTENT OF THE ACTIVITYHA OR M²**	**LISTEDACTIVITY** (Mark with an **X** where applicable or affected).	**APPLICABLE LISTING NOTICE** **(*GNR 544, GNR 545 or GNR 546)/Not listed)***
	Directional drilling, see Illustration 3 • Section d) 3.2.1: Hydraulic mining, see Illustration 2.		(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;
Excavation and blasting activities • Movement of rock boulders, gravel, sand to the mine site by trucks, dredge, conveyor or slurry pump. • Infilling and depositing of rock boulders, sand and clay into	Table (d) (ii) -1 and Table (d) (ii)-2: Total volumes and areas to be mined. Section d) 5.1 and d) 5.2:- Infilling and depositing of rock boulders, sand and clay into the seashore as rock/sand berms to construct coffer dams, see Figures (d) (ii) 1.1 – 4, 1.1-5,1.1-6, 1.1-7, and 1.1-	X	R983 (Listing Notice 1), 04 December 2014; Activity No. 19 (ii), (iii): 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- (ii) the seashore; or (iii) the littoral active zone, an estuary or a

NAME OF ACTIVITY	**AERIAL EXTENT OF THE ACTIVITYHA OR M²**	**LISTEDACTIVITY** (Mark with an **X** where applicable or affected).	**APPLICABLE LISTING NOTICE** **(*GNR 544, GNR 545 or GNR 546)/Not listed)***
the seashore as rock/sand berms; • Dredging or hydraulic mining of sand overburden in adjacent mining areas and pumped to the shoreline for beach accretion; • Construction of coffer dams using boulders, rocks, gravel, sand and other related materials	8. Section d) 3.2.1 and d) 5.2.2: Dredging or hydraulic mining, see Illustration 2.		distance of 100 metres inland of the high-water mark of the sea or an estuary, whichever distance is the greater, but excluding where such infilling, depositing, dredging, excavation, removal or moving- (a) will occur behind a development setback; (b) is for maintenance purposes undertaken in accordance with a maintenance management plan; or (c) falls within the ambit of activity 21 in this Notice, in which case that activity applies.
Loading, hauling and transport activities that require environmental authorisation: The construction and maintenance of	Section d) 3.5: Access roads wider than 8 m from the land and beach mining areas to the processing plant.	X	R983 (Listing Notice 1), 04 December 2014; Activity No. 24 (i), (ii): The development of:

NAME OF ACTIVITY	AERIAL EXTENT OF THE ACTIVITYHA OR M²	**LISTEDACTIVITY** (Mark with an **X** where applicable or affected).	**APPLICABLE LISTING NOTICE** **(*GNR 544, GNR 545 or GNR 546)/Not listed)***
access roads to beach mining areas, sea-water intake pumps, land mining areas, overburden dumps, tailing dumps and slimes dams and processing plants.			(i) a road for which an environmental authorisation was obtained for the route determination in terms of activity 5 in Government Notice 387 of 2006 or activity 18 in Government Notice 545 of 2010; or (ii) a road with a reserve wider than 13,5 m, or where no reserve exists where the road is wider than 8 m; but excluding- (a) roads which are identified and included in activity 27 in Listing Notice 2 of 2014; or (b) roads where the entire road falls within an urban area.
Loading, hauling and transport activities that require environmental authorisation. Upgrade of existing access roads to	Widening of existing roads by more than 6 m	X	R983 (Listing Notice 1), 04 December 2014; Activity No. 56: The widening of a road by more than 6 m, or the lengthening of a road by more than 1 km

NAME OF ACTIVITY	**AERIAL EXTENT OF THE ACTIVITYHA OR M²**	**LISTEDACTIVITY** (Mark with an **X** where applicable or affected).	**APPLICABLE LISTING NOTICE** **(*GNR 544, GNR 545 or GNR 546)/Not listed)***
land and beach mining areas, overburden dumps, tailing dumps and slimes dams and processing plants.			(i) where the existing reserve is wider than 13,5 m; or (ii) where no reserve exists, where the existing road is wider than 8 m; excluding where widening or lengthening occurs inside urban areas.
The construction and maintenance of sea water abstraction pumps and pipelines for pumping to treatment plants and the construction of slimes delivery or deposition pipelines.	Section d) 3.2.1 and d) 5.2.2: For hydraulic mining activities pipelines of approximately 1000 m length and 150 to 200 mm diameter will be established. Section d) 3.2.3 and d) 3.2.4: Pipelines of approximately 1000 m length and more will carry sea water from the sea-intake points as well as return	X	R983 (Listing Notice 1), 04 December 2014, Activity No. 9: The development of infrastructure exceeding 1000 m in length for the bulk transportation of water or storm water- (i) With an internal diameter of 0,36 m or more; or (ii) With a peak throughput of 120 litres per second or more;

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	process water from the process water tanks to the processing plant. The pipes are made of steel bar or HDPE with diameters of 200 to 350 mm.		excluding where- (a) Such infrastructure is for bulk transportation of water or storm water or storm water drainage inside a road reserve; or (b) Where such development will occur within an urban area.
Processing activities: The construction of slimes delivery pipelines including the following activities: • Vegetation clearance • Construction of access roads • Construction of pipe lines.	For hydraulic mining activities pipelines of approximately 120 m length and 150 to 200 mm diameter will be established. Section d) 3.2.3 and d) 3.2.4: Pipelines of approximately 2000 m length will carry return process water from the process water tanks to the processing plant. The pipes are made of steel bar or HDPE	X	R983 (Listing Notice 1), 04 December 2014, Activity No. 10: The development and related operation of infrastructure exceeding 1000 m in length for the bulk transportation of sewage, effluent, process water, waste water, return water, industrial discharge or slimes with an internal diameter of 0,36 m or more; or (ii) with a peak throughput of 120 litres per second or more; excluding where-

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	with diameters of 200 to 350 mm.		(a) such infrastructure is for bulk transportation of sewage, effluent, process water, waste water, return water, industrial discharge or slimes inside a road reserve; or (b) where such development will occur within an urban area.
Processing activities: The expansion of sea water abstraction pipelines.	Section d) 3.2.3 and d) 3.2.4: Expansion of sea water abstraction pipelines by more than 1000 m.	X	R983 (Listing Notice 1), 04 December 2014, Activity No. 45: The expansion of infrastructure for the bulk transportation of water or storm water where the existing infrastructure- (i) has an internal diameter of 0,36 m or more; or (ii) has a peak throughput of 120 litres per

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			second or more; and (a) where the facility or infrastructure is expanded by more than 1000 m in length; or (b) where the throughput capacity of the facility or infrastructure will be increased by 10% or more; excluding where such expansion- (aa) relates to transportation of water or storm water within a road reserve; or bb) will occur within an urban area.
Processing activities: The expansion of slimes delivery pipelines	Section d) 3.3 and d) 3.4: Expansion of slimes delivery pipelines by more than 1000 m.	X	R983 (Listing Notice 1), 04 December 2014, Activity No. 46: The expansion and related operation of infrastructure for the bulk transportation of sewage, effluent, process water, waste water,

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			return water, industrial discharge or slimes where the existing infrastructure- (i) has an internal diameter of 0,36 m or more; or (ii) has a peak throughput of 120 litres per second or more; and (a) where the facility or infrastructure is expanded by more than 1000 m in length; or (b) where the throughput capacity of the facility or infrastructure will be increased by 10% or more; excluding where such expansion- (aa) relates to transportation of sewage, effluent, process water, waste water, return water, industrial discharge or slimes within a road reserve; or

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			(bb) will occur within an urban area.
Activities associated with mine residue disposal: The clearance of the area for proposed new slimes dams and new plants at Mitchell's Bay, Koingnaas and elsewhere (mobile plant) as required.	New slimes dams will cover an area greater than 1 ha (Appendix 4.2). New plant sites will also cover an area greater than 1 ha (cf. Appendix 4.5 and 4.6).	X	R983 (Listing Notice 1), 04 December 2014, Activity No. 27: The clearance of an area of 1 hectares or more, but less than 20 ha of indigenous vegetation, except where such clearance of indigenous vegetation is required for- (i) the undertaking of a linear activity; or (ii) maintenance purposes undertaken in accordance with a maintenance management plan.
Activities associated with mining (loading and hauling activities): including excavations, processing activities, mine residue disposal	Existing roads will be used as far as possible. New roads will be built where required, the routes will be further finalised	X	R985 (Listing Notice 3), 04 December, Activity No. 4 a (ii) (gg) (hh):The development of a road wider than 4 metres with a reserve less than 13,5 m in (a)*Free State, Limpopo, Mpumalanga*

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The creation of access roads to the mining areas, mine residue dumps, slimes dams and processing plants.	during the environmental impact reporting phase.		*and Northern Cape Provinces*: ii. Outside urban areas, in: (gg) Areas within 10 km from national parks or world heritage sites or 5 km from any other protected area identified in terms of NEMPAA or from the core areas of a biosphere reserve, excluding disturbed areas
• Excavations • Sea-wall construction • Coffer dam and berm construction • Beach accretion	Table d (ii) -1 and Table d (ii) - 2 : Total volumes and total areas to be mined. Section d) 4, d) 5.1 and d) 5.2:- Infilling and depositing of rock boulders, sand and clay into the seashore as rock/sand berms to construct coffer dams, see Figure (d) (ii) 1.1 –	X	R984 (Listing Notice 2),04 December 2014, Activity No. 14 (i) (ii) (iii): The development and related operation of- (i) an island; (ii) anchored platform; or (iii) any other structure or infrastructure on, below or along the sea bed; excluding: (a) development of facilities, infrastructure or

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	5, d-6, d-7, Figure (d) (ii) 1.1 – 8 and Figure (d) (ii) 1.1 – 9. Section d) 3.2.1 and d) 5.2.2: Dredging or hydraulic mining and beach accretion, see Illustration 2.		structures for aquaculture purposes; or (b) the development of temporary structures or infrastructure where such structures will be removed within 6 weeks of the commencement of development and where indigenous vegetation will not be cleared.
Surf-zone, beach and offshore-beach mining, sea-wall construction Land mining including: • Mine block excavation • Ore screening and treatment • Coarse and fine residue disposal • Land prospecting/exploration including: • SONIC drilling	Table (d) 10.10-8 - 2-1, (ii)-2 Total areas and volumes to be mined for surf zone and beach activities. The total extent of the land mining operations is	X	R984 (Listing Notice 2), 04 December 2014, Activity No. 17: Any activity including the operation of that activity which requires a mining right as contemplated in Section 22 of the Mineral and Petroleum Resources Development Act, 2002 (Act No.28 of 2002), including associated infrastructure, structures and earthworks, directly related to the extraction of a mineral

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• Large diameter LDA auger drilling • Tunnelling • Bulk sample extraction from drill holes and tunnels • Bulk sample excavation, from trenches, pits and tunnels including transport and treatment • Bulk sample extraction by means of directional drilling.	shown in Drawing 001. For surf zone and beach mining: Section d) 4, d) 5, d) ii) 1.1 and 1.2: Development of coffer dams and/or beach accretion and mining at Rooiwal Bay and Koingnaas site 68/69, Somnaas, Langklip Bay and other sites For land based mining operations: Section d) 3 and d) ii) 1.3, Appendix 5: Establishment and mining of new mining areas/blocks		resource, including activities for which an exemption has been issued in terms of Section 106 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002).

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	Section d) 3.3: Establishment of screening and scrubbing plants and treatment plants (Appendix 4.5 and 4.6). Section d) 3 and d) ii) 2.1: Establishments of slimes dam (Appendix 4.2) For land based prospecting operations: Section d) 2 and d) ii) 1.4: Drilling of small and large diameter SONIC and/or auger drill holes and recovering bulk samples from drill core and by pitting and tunnelling on surface or in depth from drill holes.		

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	Section d) 2.6: Bulk sample extraction, transport and treatment by trenching, pitting or tunnelling Section d) 3.2.2: Bulk sample extraction by means of directional drilling (Illustration 3).		
Processing activities including associated structures and infrastructure e.g. construction and/or establishment of screening and processing plants, crushing plants, pans and classifiers, mobile treatment plants.	Land based mining: Section d) 3.3 and d) ii) 1.3.2: 1. 200 tph screening and scrubbing plant (see Appendix 4.4) feeding the existing 50 tph Michell's Bay Dense Media Separator (DMS) plant (see	X	R984 (Listing Notice 2), 04 December 2014, Activity No. 21: Any activity including the operation of that activity associated with the primary processing of a mineral resource including winning, reduction, extraction, classifying, concentrating,

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	Appendix 4.5). 2. 450 tph tailings treatment plant to treat the Koingnaas TMR. Plant throughput and volumes described in Section d) 3.3 and d) ii) 1.3.2 and Appendix. 4.5. Land based prospecting: 10 tph front end / 2 tph DMS mobile prospecting plant (see Appendix 4.6) will produce about 0.5 tph of oversize rejects and 49 tph of slimes. Surf zone and beach mining: • Two shore-based pumping units to process 7 895 m³		crushing, screening and washing but excluding the smelting, beneficiation, refining, calcining or gasification of the mineral resource in which case activity 6 in this Notice applies.

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	of screened ore per annum • Offshore-beach mining to process and estimated 126 000 m³ per annum • Mining rate, throughput and volumes described in Section d) 4, d) 5, d) ii) 1.1 and 1.2 and d) ii) 1.3.2 and Appendix. 4.5.		
Excavation and blasting • Movement of rock boulders, gravel, sand to the mine site by trucks, dredge, conveyor or slurry pump. • Infilling and depositing of rock	The total areas and volumes are included in Table 9d) (ii) -1 and Table d (ii) -2. See full descriptions in Section d) 4, d) 5, d) ii) 1.1 and 1.2 Figure (d) (ii) 1.1 – 5, Figure	X	R984 (Listing Notice 2), 04 December 2014, Activity No. 26 (i), (ii), (iii), (iv), (v), (c),(d): Development - (i) in the sea; (ii) in an estuary;

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boulders, sand and clay into the seashore as rock/sand berms • Dredging or hydraulic mining of sand overburden in adjacent mining areas and pumped to the sea shore • Construction of coffer dams.	(d) (ii) 1.1 – 6, Figure (d) (ii) 1.1 – 7, Figure (d) (ii) 1.1 – 8 and Figure (d) (ii) 1.1 – 9 show the various beach mining methodologies to be applied. .		(iii) within the littoral active zone; (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 – (c) inter- and sub-tidal structures for entrapment of sand; (d) breakwater structures; but excluding the development of structures within existing ports or harbours that will not increase the development footprint of the port or harbour.
Decommissioning of marine operations that require environmental	<u>Beach and surf zone mining</u>: Decommissioning of large	X	R983 (Listing Notice 1), 04 December 2014: Activity No. 22:

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authorisation: Decommissioning of surf zone, beach and off shore channel mining activities, including decommissioning of: • Coffer dams • Rock source quarries • Buildings and earthworks associated with the marine operations e.g. tailings dumps, slimes dams, slimes pipelines • Access and service roads Decommissioning of land mining and prospecting operations that require environmental authorisation: Decommissioning of land mining and	coffer dam mine blocks at Noup, Somnaas, Visbeen, Koingnaas, Langklip and Rooiwal beach zone area if not rehabilitated entirely by natural marine processes. Coffer dams and coastal protection will be constructed over life of mine of 5 - 7 years (Section d4, d5) and will be rehabilitated entirely or partly by natural marine processes. Land mining and prospecting: Decommissioning of all mine block excavations, bulk sample trenches, pits, tunnels, drill holes, roads, structures or		The decommissioning of any activity requiring- (i) a closure certificate in terms of section 43 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002); or (ii) a prospecting right, mining right, mining permit, production right or exploration right, where the throughput of the activity has reduced by 90% or more over a period of 5 years excluding where the competent authority has in writing agreed that such reduction in throughput does not constitute closure.

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prospecting activities, including: • Mine excavations • Overburden dumps, tailings dumps, slimes dams • Sea-water pumps and pipe lines, slimes pumps and pipelines • Buildings and associated structures and electrical works no longer required • Treatment plants and associated structures and electrical works no longer required • Access and service roads	buildings as discussed fully in Section d) 2 and d) 3.		
For mining activities:	The construction of water supply dams with a combined	X	R983 (Listing Notice 1), 04 December 2014: R983 (Listing Notice 1), 04 December 2014:

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Water supply dams	capacity greater than 50 000 m³.		Activity No.13: The development of facilities or infrastructure for the off-stream storage of water, including dams and reservoirs, with a combined capacity of 50 000 cubic metres or more, unless such storage falls within the ambit of activity 16 in Listing Notice 2 of 2014.
For mining activities: Water supply dams	The construction of water supply dams with a dam wall higher than 5 m.	X	R984 (Listing Notice 2), 04 December 2014: Activity No.16 The development of a dam where the highest part of the dam wall, as measured from the outside toe of the wall to the highest part of the wall, is 5 m or higher or where the high water mark of the dam covers an area of 10 ha or more.

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Prospecting activities that will not require environmental authorisation: These prospecting activities include the following: • Drilling activities	See Section d) 2 and d) ii) 1.4: The total onland prospecting area will cover approximately 24 086.47 ha. In areas of deep overburden (>5 m) large diameter auger (LDA) drilling with sample sizes ranging from 1.30 m² (5 m overburden) to 0.68 m² (40 m overburden) was/is employed to sample gravels. For lower grade targets larger tools such as the Bauer GB50 hydraulic grab (sample size of 1.77 m²) and the Bauer BG36 (and BG48 auger rigs (sample size of 4.91 m²) were/are used.	No listed activity triggered This activity has been authorised, as there is an existing prospecting right (Namaqualand Prospecting Right (NPR) (DMR Ref No. SNC 672 PRC).	

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	The Bauer tools utilize drilling mud to prevent sidewall collapse. A SONIC drill rig is currently drilling and will continue to drill in the Koingnaas area. A temporary mobile DMS prospecting plant (10 tph front end / 2 tph DMS) will produce about 0.5 tph of oversize rejects and 49 tph of slimes.		
• Establishment of ablution facilities; • Establishment of storage and parking areas; • Construction of access routes.	The onland prospecting area will cover approximately 24 086.47 ha. Existing access routes as shown in Appendix 4.3 will be utilised.	No listed activity triggered.	

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	The establishment of parking areas, equipment storage areas and ablution facilities will be temporary and the area to be cleared will be approximately <5 m², therefore no listed activity will be triggered.		
Loading, hauling and transport activities that do not require environmental authorisation The upgrade and maintenance of existing access roads to the mining blocks, the treatment plants, and mine residue dumps areas and slimes dams.	There is an existing extensive network of roads, approximately 30 roads that will be utilised (as shown in Appendix 4.3). These roads have existing authorisation and only minor upgrades which do not trigger listed activities will be undertaken.	No listed activity triggered.	

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Processing activities including associated structures and infrastructure that do not require environmental authorisation including the following: • Processing plants at Koingnaas and Michell's Bay; • Workshops, administration and other buildings; • Housing and recreational facilities; • Powerlines; • Railways; • Sewage plant; • Pollution control dams, paddocks,	Existing treatment plants and infrastructure at Koingnaas and Michell's Bay include small onsite administration offices. There is an existing rugby field, church, café and recreational club. There is an existing 220 kV transmission line from the Eskom national power grid via Upington, Aggeneys and Springbok. Power is distributed by overhead lines throughout the mine from a sub-station which is located at Gromis, near Kleinsee.	No listed activity triggered.	

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and evaporation dams.	There is an existing Bitterfontein and Sishen - Saldahna railway line. There is an existing sewage plant registered with the then Department of Water Affairs (DWA) and now Department of Water and Sanitation (DWS). There are also existing pollution control dams, paddocks, and evaporation dams.		
Activities associated with the clearance of vegetation that do not require environmental authorisation:	The establishment of these areas and equipment storage areas will be temporary and the area to be cleared would be approximately <5 m²,	No listed activity triggered.	

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Clearance of vegetation for establishment and widening of access roads, pipe lines, establishment of temporary mobile plant sites, parking areas and storage facilities for prospecting and land and beach mining activities	therefore no listed activity will be triggered.		
Activities at the plant sites that do not require environmental authorisation Diesel storage and re-fuelling stations for vehicles, machinery and equipment	There are existing diesel storage tanks and associated facilities at the Koingnaas and Michell's Bay plants, therefore this activity will not trigger any listed activity.	No listed activity triggered.	

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Surf zone, beach and off shore channel mining including: • Movement of rock boulders, gravel, sand to the mine site by trucks, dredge, conveyor or slurry pump. • Infilling and depositing of rock boulders, sand and clay into the seashore as rock/sand berms; • Dredging or hydraulic mining of sand overburden in adjacent mining areas and pumped to the shoreline for beach accretion; • Construction of coffer dams using boulders, rocks, gravel, sand and	Total volumes and areas to be mined are summarised in Table (d) (ii) -1 and Table d(ii)-2. See Sections d) 4 and d) 5 and d) ii) 1.1.and 1.2 for complete descriptions, which show the various beach mining methodologies to be applied seaward of the low water mark.	X	National Environmental Management Act: Integrated Coastal Management Act, 2008 (Act No. 24 of 2008) Govt. Notice No. 138 of 11 Feb 2009, Section 63: Environmental authorisation for coastal activities (1) Where an environmental authorisation in terms of Chapter 5 of the National Environmental Management Act is required for coastal activities, the competent authority must take into account all relevant factors, including; (a) the representations made by the applicant and by interested and affected parties; (b) the extent to which the applicant has in the past complied with similar authorisations; (c) whether coastal public property, the coastal protection zone or coastal access land will be

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other related materials.			affected, and if so, the extent to which the proposed development or activity is consistent with the purpose for establishing and protecting those areas; (d) the estuarine management plans, coastal management programmes and coastal management objectives applicable in the area; (e) the socio-economic impact if the activity— (i) is authorised; (ii) is not authorised; (f) the likely impact of the proposed activity on the coastal environment, including the cumulative effect of its impact together with those of existing activities; (g) the likely impact of coastal environmental

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			processes on the proposed activity; and (h) The objects of this Act, where applicable. (2) The competent authority may not issue an environmental authorisation if the development or activity for which authorisation is sought – (a) is situated within coastal public property and is inconsistent with the objective of conserving and enhancing coastal public property for the benefit of current and future generations; (b) is situated within the coastal protection zone and is inconsistent with the purpose for which a coastal protection zone is established as set out in Section 17; (c) is situated within coastal access land and is inconsistent with the purpose for which coastal access land is designated as set out in section

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			18; (d) is likely to cause irreversible or long-lasting adverse effects to any aspect of the coastal environment that cannot satisfactorily be mitigated; (e) is likely to be significantly damaged or prejudiced by dynamic coastal processes; (f) would substantially prejudice the achievement of any coastal management objective; or (g) Would be contrary to the interests of the whole community. (3) Notwithstanding subsection (2), the competent authority may issue an environmental authorisation in respect of an activity or a development that does not meet the criteria

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			referred to in subsection (2)(a), (b) or (c) If - (a) the very nature of the proposed activity or development requires it to be located within coastal public property, the coastal protection zone or coastal access land; or (b) The proposed activity or development will provide important services to the public when using coastal public property, the coastal protection zone, coastal access land or a coastal protected area. (4) If an application for an environmental authorisation cannot be approved by the competent authority because of a provision of subsection (2), but the competent authority believes that issuing the authorisation would be in the public interest, the competent authority may refer the application for consideration by

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			the Minister in terms of section 64. (5) The competent authority must ensure that the terms and conditions of any environmental authorisation are consistent with any applicable coastal management programmes and promote the attainment of coastal management objectives in the area concerned. (6) Where an environmental authorisation is not required for coastal activities, the Minister may, by notice in the Gazette list such activities requiring a permit or licence.
Surf zone, beach and off shore mining activities including the following: • Movement of rock boulders, gravel, bedrock, sand to the mine/sea-wall site by trucks,	Total areas to be mined are summarised in Table (d) (ii) -1. See Sections d) 4 and d) 5 and d) ii) 1.1.and 1.2 for complete descriptions, which show the various beach mining	X	National Environmental Management Act: Integrated Coastal Management Act, 2008 (Act No. 24 of 2008) Govt. Notice No. 138 of 11 February 2009, Section 65: (1) Subject to sections 67 and 95, no person

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dredge, conveyor or slurry pump. • Infilling and depositing of rock boulders, bedrock sand and clay into the seashore as rock or sand berms; • Dredging or hydraulic mining of sand overburden in adjacent mining areas and pumped to the shoreline for beach accretion; • Construction of coffer dams using boulders, rocks, bedrock, gravel, sand and other related materials.	methodologies to be applied seaward of the low water mark		may occupy any part of, or site on, or construct or erect any building, road, barrier or structure on or in, coastal public property except under and in accordance with a coastal lease awarded by the Minister in terms of this Chapter. (2) Subject to section 95, no person may claim an exclusive right to use or exploit any specific coastal resource in any part of, or that is derived from, coastal public property unless he or she— (a) is empowered by national legislation to do so; or (b) is authorized to do so in terms of— (i) a coastal concession awarded by the Minister in terms of this Chapter; or (ii) An authorization issued under the Marine Living Resources Act.

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			(3) A coastal lease or coastal concession may be awarded by the Minister either— (a) on application by a person; or (b) If the Minister so determines in any specific case, through a prescribed bid process. (4) An application for a coastal lease or coastal concession must be lodged in the prescribed manner. (5) A coastal lease or coastal concession awarded in terms of this Chapter does not relieve the lessee or concessionaire from the obligation to: (a) Obtain any other authorization that may be required in terms of this Act or other legislation; or (b) Comply with any other legislation.

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Processing activities: Discharge of fine and coarse tailings from processing plants	At surf zone and beach mining sites: Sections d) 4, d) 6 and d) ii) 1.3.2: Large size fraction tailings (+25 mm) will be accumulated around the classifier to be dispersed during the high tide, or mechanically redistributed over the beach below the High Water Mark (HWM) to allow natural redistribution by wave action. Fine tailings (-2 mm) will be returned directly to the sea as a sediment slurry (Appendix 4.1).	X	National Environmental Management Act: Integrated Coastal Management Act, 2008 (Act No. 24 of 2008) Govt. Notice No. 138 of 11 Feb 2009, Section 69: Discharge of effluent into coastal waters (1) 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 issued under this section by the Minister after consultation with the Minister responsible for Water Affairs in instances of discharge of effluent into an estuary. (2) The Minister may by notice in the Gazette authorise persons in general, or a category of persons, to discharge effluent into coastal

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	At beach and offshore channel mining sites: Sections d) 5, d) 6 and d) ii) 1.3.2: ADT's will transport the gravel to the nearby mobile screening plant fed by seawater where the gravel may be fed directly to the feeding screen or stockpiled and fed by front-end loader to the screen. Sand and sea water is discharged back to sea. The screened material is transported to the nearest DMS plant.		waters, and in instances of discharge of effluent into an estuary, only after consultation with the Minister responsible for Water Affairs. (3) Any person who wishes to discharge effluent into coastal waters in circumstances that are not authorised under a general authorisation referred to in subsection (2) must apply to the Department for a coastal waters discharge permit.(4) Any person who at the commencement of this Act is discharging effluent into coastal waters and who is not authorised to do so in terms of a general authorisation under subsection (2) must apply to the Department for a coastal waters discharge permit - *(a)* within 24 months of the date of commencement of this Act if the discharge is in

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			terms of a licence or authorisation under the National Water Act; or *(b)* within 36 months of the date of commencement of this Act if the discharge is a continuation of an existing lawful water use within the meaning of Section 32 or 33 of the National Water Act. (5) Unless a person referred to in subsection (4) is directed otherwise by a person.
Activities associated with boat launching sites that will not require environmental authorisation: Boat launching sites	This activity will not require environmental authorisation as there are no new boat launching sites that are planned other than the one in	No listed activity triggered	

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	Brazil, which is in the process of being gazetted as regulated by the Department of Environmental Affairs (DEA).		
Activities associated with waste management that do not require environmental authorisation: Disposal of inert waste	There are four waste dumps, located within the Koingnaas Mining Right area. There are existing waste permits issued to WCR for domestic/general waste, hard scrap (recyclable dumps), garden refuse, salvage dumps and building rubble dumps	No listed activity triggered	
Activities associated with waste management that do not require environmental authorisation:	There are four waste dumps located within the Koingnaas Mining Right area.	No listed activity triggered	

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Disposal of domestic waste	There are existing waste permits issued to WCR for domestic/general waste, hard scrap (recyclable dumps), garden refuse, salvage dumps and building rubble dumps.		
Operational activities: Management of waste before disposal	There are existing waste licences. However, there is no sorting, shredding, grinding, crushing, screening or bailing of waste being undertaken. This may be required in the future. The operational area is in excess of 1000 m².	X	National Environmental Management: Waste Act, 2008 (Act 59 of 2008), Category A2: The sorting, shredding, grinding, crushing, screening or bailing of general waste at a facility that has an operational area in excess of 1000 m².
Processing activities: • Disposal of screened material and	The +12 mm and + 150 mm screened products generated	X	National Environmental Management: Waste Act, 2008 (Act 59 of 2008), Category A 10:

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oversize waste • Construction of slimes dams	by the 200 tph screening and scrubbing plant will be discarded to mining dumps or existing mining voids (Section d) 6, Appendix 4, 4.2). The +1.6mm waste generated at the DMS treatment plants will be discarded to existing coarse residue dumps or available nearby mining voids. The -1.6mm material will be discarded to registered slimes dams. Slimes dams covering an area greater than 1 ha, with a total capacity of less than 25 000 tons (see Appendix 4.2).		The disposal of general waste to land covering an area of more than 50 m² but less than 200 m² and with a total capacity not exceeding 25 000 tons.

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Processing activities: Construction of slimes dams	See Section d) 3.4: The <1.6 mm material will be pumped to the slimes dams. Slimes dams will cover an area greater than 1 ha, with a total capacity of less than 25 000 tons (as shown in Appendix 4.2).	X	National Environmental Management: Waste Act, 2008 (Act 59 of 2008), Category A 12: The construction of a facility for a waste management activity listed in Category A of this Schedule (not in isolation to associated waste management activity).
• Establishment of temporary stockpiles and/or residue deposits during mining operations; • Re-mining of residue stockpiles and/or residue deposits; • Establishment of temporary stockpiles and/or residue deposits for rehabilitation purposes i.e. for the slimes dams that will not be re-mined;	For a beach mining site a proposed stockpile area extent is shown in Appendix 4.1. Existing and proposed slimes dams greater than 1 ha are shown in Appendix 4.2.1, 4.2.2. Certain mine residue deposits (CRD's) at the existing	X	National Environmental Management: Waste Act, 2008 (Act 59 of 2008), Category A 15: The establishment or reclamation of a residue stockpile or residue deposit resulting from activities which require a prospecting right or mining permit, in terms of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002)

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• Establishment of stockpiles and and/or residue deposits that will remain post- mining.	Koingnaas and Michell's Bay plant sites will be re-mined and reclaimed. Some overburden dumps will be used in continuous rehabilitation. No new fixed residue dumps other than those existing for authorised operations are foreseen.		
Activities associated with mine residue disposal: The disposal of fine and coarse residue to slimes dams, residue stockpiles and residue deposits for waste generated from mining and	See Section d) 6 and d) ii) 2.1: Waste rock dumps and slimes dams will cover an area greater than 1 ha, with a total capacity exceeding 25 000 tons (Figure (d) (ii) 1.1-9,	X	National Environmental Management: Waste Act, 2008 (Act 59 of 2008), Category B 8: The disposal of general waste to land covering an area in excess of 200 m² and with a total capacity exceeding 25 000 tons.

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processing activities.	Appendix 4, 4.2, 4.2.1, 4.2.2).		
Activities associated with mine residue disposal: Construction of residue facilities and associated structures and infrastructures.	See Section d) 6 and d) ii) 2.1: Waste rock dumps and slimes dams will cover an area greater than 1 ha, with a total capacity exceeding 25 000 tons (Figure d-10, Appendix 4, 4.2, 4.2.1, 4.2.2).	X	National Environmental Management: Waste Act, 2008 (Act 59 of 2008), Category B 10: The construction of a facility for a waste management activity listed in Category B of this Schedule (not in isolation to associated waste management activity).
Activities associated with mine residue disposal and reclamation: Establishment of temporary stockpiles and/or residue deposits during mining operations; Re-mining of residue stockpiles or	See Section d) 6 and d) ii) 2.1: For a beach mining site a proposed stockpile area extent is shown in Appendix 4.1 and Drawing 001. Existing and proposed slimes dams greater than 1 ha are	X	National Environmental Management: Waste Act, 2008 (Act 59 of 2008), Category B 11: The establishment or reclamation of a residue stockpile or residue deposit resulting from activities which require a mining right; exploration right or production right in terms of the Mineral and Petroleum Resources

NAME OF ACTIVITY	AERIAL EXTENT OF THE ACTIVITYHA OR M²	LISTEDACTIVITY (Mark with an X where applicable or affected).	APPLICABLE LISTING NOTICE (GNR 544, GNR 545 or GNR 546)/Not listed)
residue deposits; Establishment of temporary stockpiles and/or residue deposits for rehabilitation purposes i.e. for the slimes dams that will not be re-mined; Establishment of stockpiles and and/or residue deposits that will remain post-mining.	shown in Appendix 4.2.1, 4.2.2. Certain mine residue deposits (CRD's) at the existing Koingnaas and Michell's Bay plant sites will be re-mined and reclaimed. Some overburden dumps will be used in continuous rehabilitation. Mobile treatment plant stockpiles and residue dumps will be processed and rehabilitated on an ongoing basis.		Development Act, 2002 (Act No. 28 of 2002).
Storage of general waste on site.	This activity does not require	No listed activity triggered	National Environmental Management: Waste

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	environmental authorisation but facilities must be registered with the competent authority.		Act, 2008 (Act 59 of 2008), Category C 1: The storage of general waste at a facility that has the capacity to store in excess of 100 m³ of general waste at any one time, excluding the storage of waste in lagoons or temporary storage of such waste.
Storage of hazardous waste on site.	This activity does not require environmental authorisation, but facilities must be registered with the competent authority.	No listed activity triggered	National Environmental Management: Waste Act, 2008 (Act 59 of 2008), Category C 2: The storage of hazardous waste at a facility that has the capacity to store in excess of 80 m³ of hazardous waste at any one time, excluding the storage of hazardous waste in lagoons or temporary storage of such waste.
Storage of waste tyres on site.	This activity does not require environmental authorisation, but facilities must be registered	No listed activity triggered	National Environmental Management: Waste Act, 2008 (Act 59 of 2008), Category C 3:

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	with the competent authority.		The storage of waste tyres in a storage area exceeding 500 m².
The establishment of motor vehicle scrap yards.	This activity does not require environmental authorisation but facilities must be registered with the competent authority.	No listed activity triggered	National Environmental Management: Waste Act, 2008 (Act 59 of 2008), Category C 4: The scrapping or recovery of motor vehicles at a facility that has an operational area in excess of 500 m².
Storage of sea water in a dam at the following farms: Somnaas 474; Koingnaas 475; Langklip 489, Zwart Lintjes Rivier 484 and Mitchell's Bay 495	The volume of water stored will be 12 480 m³ per annum.	X	National Water Act, 1998 (Act No. 36 of 1998), Section 21(b): Storage of water
The disposal of fine residue and waste water to: • Slimes dams from the processing	The slimes dam area will be greater than 1 ha. The location of the slimes	X	National Water Act, 1998 (Act No. 36 of 1998), Section 21 (g): Disposing of waste in a manner which may

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plants, • Mining voids during hydraulic mining and/or overburden stripping and/or to the beach during beach accretion, and • Return water dams.	dams are shown in Appendix 4.2, 4.2.1, 4.2.2. -1.6 mm slimes material will be pumped to the slimes dams. The total volume of waste water to be stored in the slimes dams will be 9 984 000 m^3 per annum.		detrimentally impact on a water resource.
Removal of ground water/dewatering of mine blocks on land at any mine site where the problem occurs, and pumping to adjoining mining voids Dewatering (sea water and seepage water) of beach mining and offshore channel mine blocks pumped back to the sea	Approximately 600 000 m^3 per annum of underground water may be removed/pumped.	X	National Water Act, 1998 (Act No. 36 of 1998), Section 21(j): Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people.

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Clearing of sites for the construction of access roads, mine residue dumps, treatment plants, pipe lines and pump stations This activity is currently not applicable but further input will be derived from previous Heritage Studies and from future studies as the need arises.	The slimes dam areas will cover an area greater than 1ha; The screening and scrubbing plant at Michell's Bay will cover an area greater than 1 ha but will be located in a mined-out area.	No listed activity triggered	The National Heritage Resources Act (Act No. 25 of 1999) (NHRA). This Act requires that an environmental assessment is undertaken for any development exceeding 0.5 ha. All identified archaeological sites must be registered with the South African Heritage Resources Agency (SAHRA). A permit in terms of Section 40 of NHRA is required for disturbance of archaeological sites. Permits in terms of Section 41 of the NHRA are required for disturbance of grave sites. These permits are obtained from SAHRA (or the provincial heritage agency).

ii) Description of the activities to be undertaken

(Describe Methodology or technology to be employed, and for a linear activity, a description of the route of the activity).

The DMR sequence was changed to enable consistent flow of activity description since this is not a new mine and there is already existing activities. It was clearer to put all activities to be undertaken under this one section and to simultaneously describe the methodology.

ii) 1. Triggering Activities associated with Mining and Prospecting

ii) 1.1 Beach and offshore channel mining

A full description of the mining methods is provided in Sections d) 4 and d) 5. Beach and offshore channel mining operations of mineralized gravel deposits found in various places between the low and high water marks along the coast has been on-going for many years. Historic results of beach mining operations have been favorable throughout and it is therefore planned to continue and expand this kind of mining in future. Apart from mining favorable sandy beaches the focus will be particularly on the extensions of high-grade fluvial channels crossing the surf-zone to deeper water environments. Previous mining, drilling and sampling of these channels to the beach zone by DBCM provide confirmation of the economic viability of these channel deposits. Their presence, dimensions and positions on the beaches have been confirmed by means of beach-resistivity surveys. Exploration and past mining results indicate that these deposits extend offshore to as yet undetermined extent and current planning is for these channels to be mined by means of coffer dam mining techniques to the 250 m water mark and beyond as determined by circumstances. Surf-zone, beach and offshore channel mining will be both in-house and partly contract-based.

The areas targeted for mining are shown in Appendix 3. Figure (d) (ii) 1.1 – 1, Figure (d) (ii) 1.1 - 2 and Figure (d) (ii) 1.1 – 1, show the location of the surf zone, beach and offshore channel resource areas. The planned mine block for these areas are shown in Appendix 5.

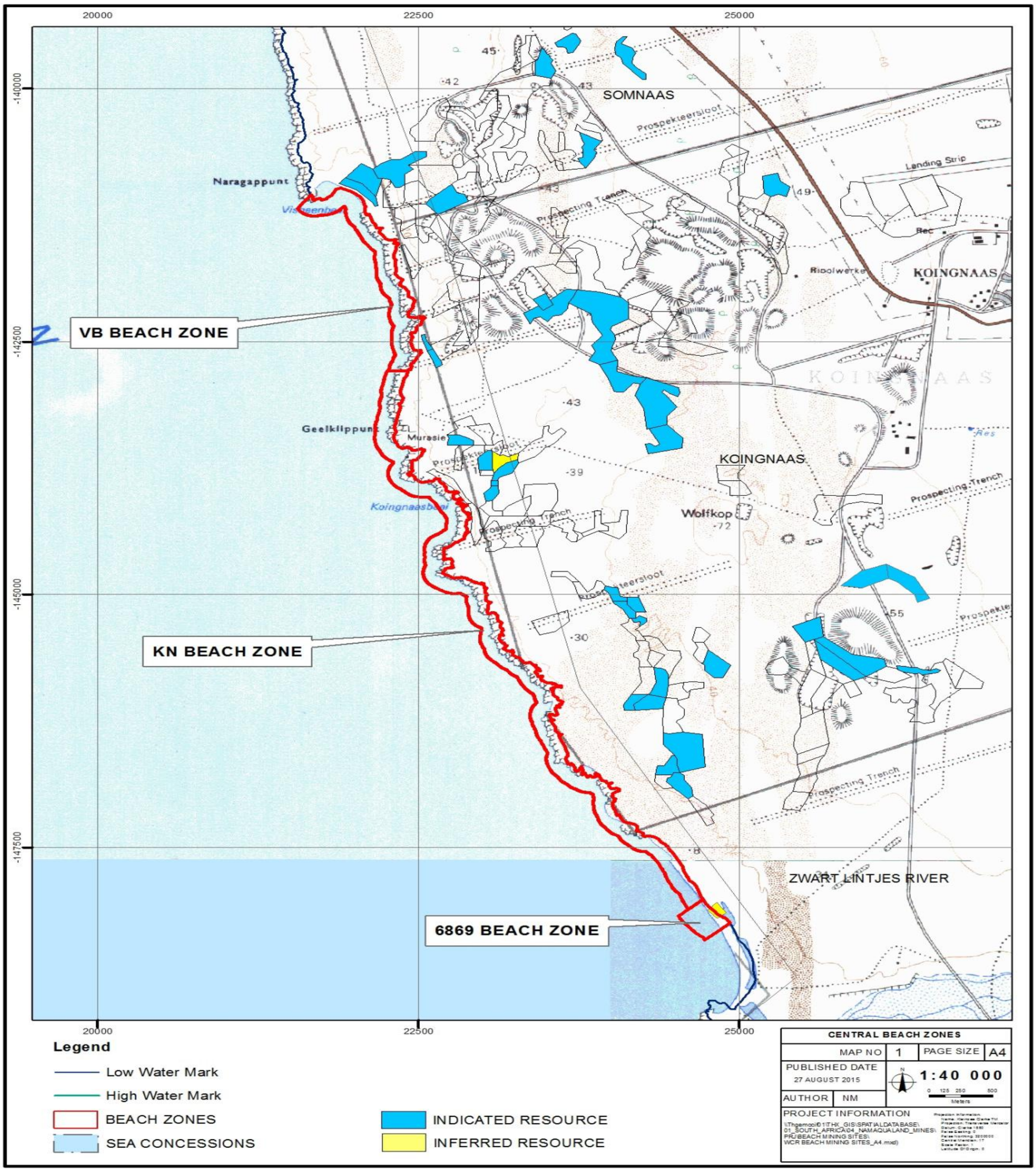


Figure (d) (ii) 1.1 - 1: Location of surf-zone, beach and offshore channel resource areas (Beach Zones) in the central parts of the rights area (Noup to Somnaas).

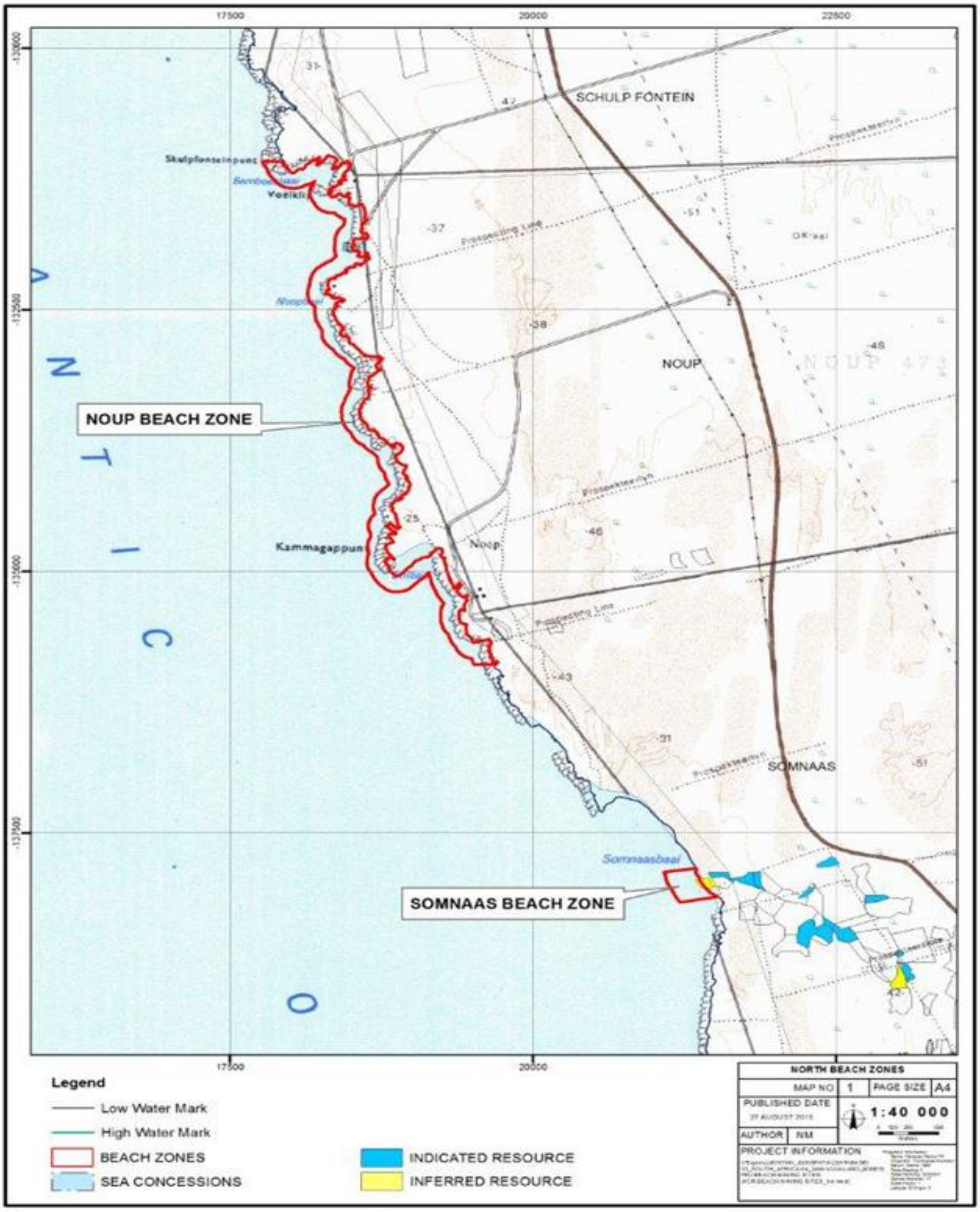


Figure (d) (ii) 1.1 - 2: Location of surf-zone, beach and offshore channel resource areas in the central parts of the rights (Somnaas to Koingnaas)

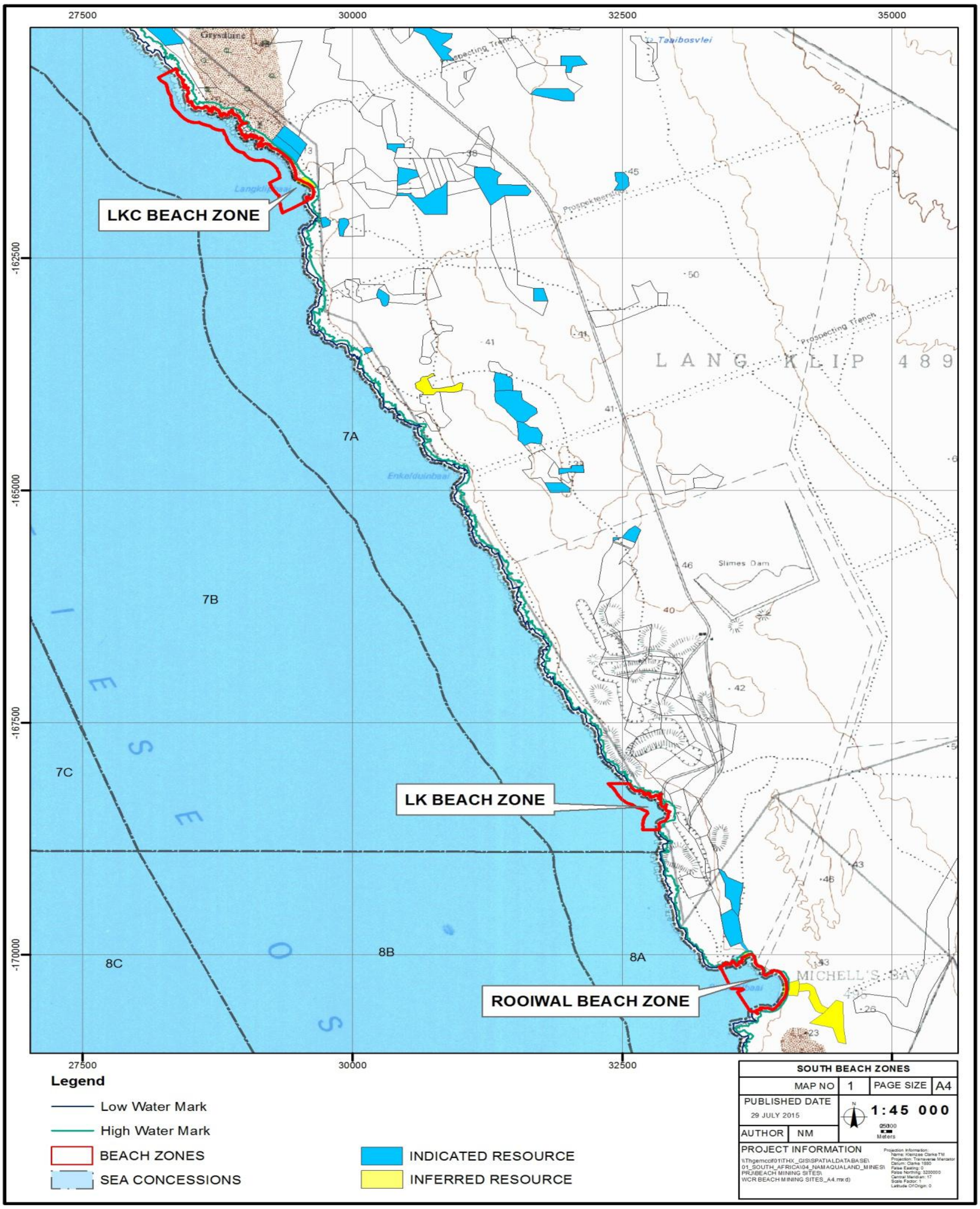


Figure (d) (ii) 1.1 - 3: Location of surf-zone, beach and offshore channel resource areas (Beach Zones) in the southern parts of the rights area (Langkip to Rooiwal Bay)

There are two alternative approaches to accessing diamond resources seaward of the low water mark, namely:

- Temporary accretion of the beach in the immediate vicinity of the mining target using overburden material available on the beach or from adjacent onland mining sites; or
- The construction of a rock berm or coffer dam using non-native rocks and boulders sourced from rock stockpiles nearby. Both statistically stable and dynamically stable rock berms are being considered.

Up to six potential resources areas have been identified. In each case, the nature of the specific target area determines which of the available approaches are more suitable. For example, the exposed nature of the coastline and high longshore sediment transport rates, in combination with insufficient overburden sands available on the beach to maintain accretion under the resulting high erosion rates, negates the application of beach accretion using sand anywhere but in very sheltered bays.

Using information summarised from WSP (2015), the alternative mining approaches are detailed below.

ii) 1.1.1 The Koingnaas Channel 68/69 design

Along the typically wave-exposed coastline of the project area, rock berms or coffer dams are the only feasible alternative to effectively reclaiming a mining area located beyond the low water mark. The procedure for construction of a protective rock berm is described briefly below.

- On both the northern and southern side of the mining target area a rock berm is built by progressively end-tipping rock- and boulder core material from trucks perpendicular to the oncoming waves and shoreline. Dozers and excavators subsequently shape the profile and dress the slope with a suitable armour layer of larger rocks;
- The berms extend from above the storm high water mark into the surf zone until the seaward extent of the mining block is reached and a shore-parallel berm is constructed linking the two shore-perpendicular berms;
- Once the berm is in place and the mining block is enclosed overburden stripping and gravel extraction can be undertaken using conventional open-cast mining approaches;
- Once the area has been mined out, the rock berm would be progressively extended offshore to enclose the next mining block, potentially enabling mining up to 300 m seawards of the low water mark.

The material used to construct such breakwaters typically consists of an underlying core of quarried material, which gets progressively coarser towards the outside and is covered by an outer layer of large armour rock. Geotextile sandbags commonly used for coastal protection works may also be used in areas of low wave energy, as temporary emergency measures or above the high water mark on the wall itself.

The seaward extent of the berm and prevailing wave conditions determine the size/mass of the rock required for the armour layer. The berm can be extended in phases as far offshore as conditions allow.

Although four stages have been assumed for this project, the material requirements for Stages 3 and 4 would necessitate the use of very large armour rocks that would be difficult to produce, transport and place, thereby reducing the feasibility of these structures. Possible alternatives for Stage 4 include the use of concrete armour units on the seaward face of the berm, or constructing the berm as a dynamically reshaping profile using smaller rocks (see later).

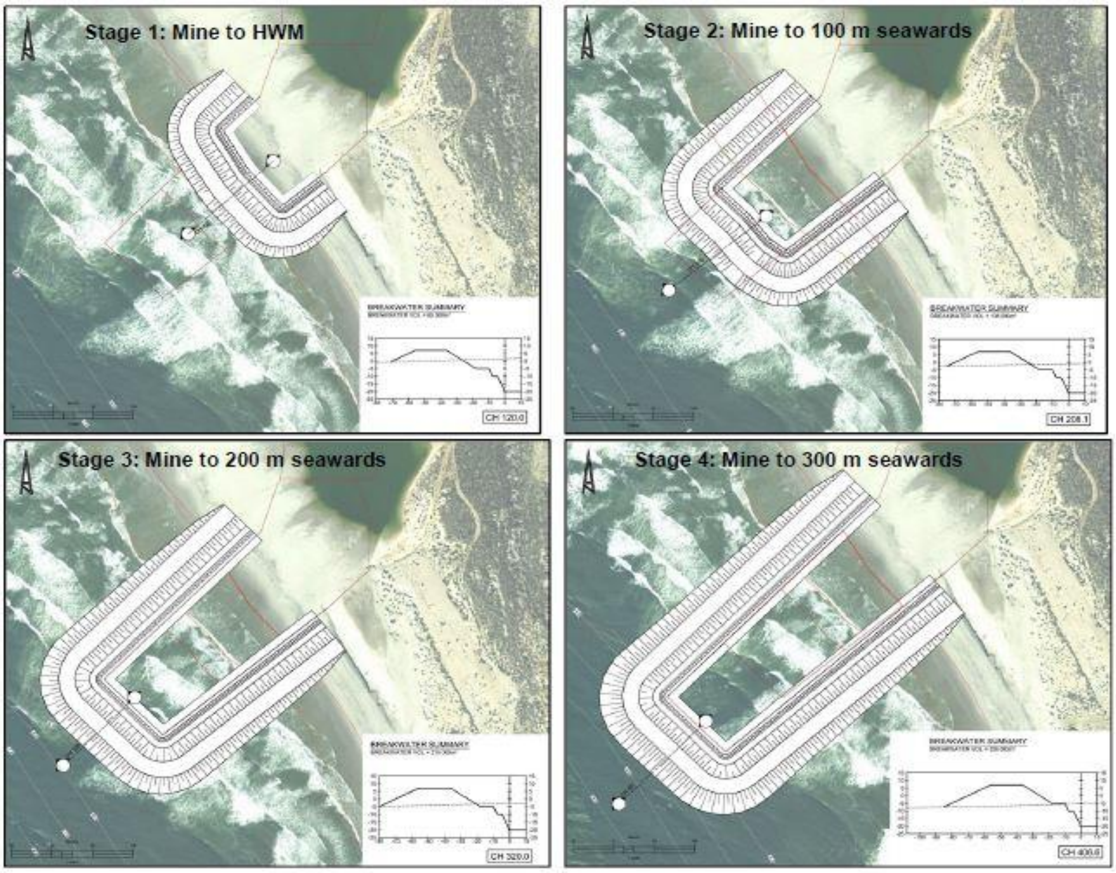


Figure (d) (ii) 1.1 - 4: Proposed phased rock berm construction at Koingnaas 68/69, Somnaas and Langklip Central (Source: WSP 2015)

The estimated required rock volumes, required at different stages of construction, for this option, are presented in Table (d) (ii) - 1.

Table (d) (ii) - 1: Estimated rock volumes required for various construction phases

Construction phase	Material requirements (m^3)
Stage 1	65000
Stage 2	135000
Stage 3	216000
Stage 4	356000

Despite the comparatively high volumes of material required for berm construction (Table (d) (ii) – 1), the design-life of such berms is typically 1-2 years and they can thus be considered temporary structures.

Similar beach mining operations have previously been successfully undertaken near the Olifant's River and along the coastline near Alexander Bay. For the current project, WCR is intending to implement this mining approach at the sandy beach target sites known as Koingnaas 68/69, Somnaas and Langklip Central. The estimated area to be disturbed at each of these sites amounts to ~118,000 m^2.

ii) 1.1.2Rooiwal Bay (Mitchell's Bay) design

Rooiwal Bay (Mitchell's Bay) is a small protected bay located north of the Spoeg River. The mouth of the bay is some 700 m across. The bay hosts a narrow sandy beach backed by steep soil cliff and a shallow reef in the mouth. An irregular, deep, channel reaching at least 20 m depth is present in the northern part of the bay, with a second depression occurring in the southern part of the bay.

One of the proposed mining approaches to be implemented to access the diamond deposits on the seabed and adjacent beaches at Mitchell's Bay, involves accretion of the beach using overburden sands stripped from adjacent mine block LKB-04 on land. Mining of the accreted area would liberate further material that can be placed into the sea to gain additional accretion. Three stages of beach accretion are being considered, with the shoreline moving seawards by 150 m during each successive stage. Sand volumes required for each stage comprised 1.3 million, 2.5 million and 5.9 million cubic metres, respectively for the 150 m, 300 m and 450 m accretion.

However, as the beach is accreted and the shoreline maintains equilibrium with the wave-driven currents, sand placed on the beach would be redistributed by currents and transported westwards out of the bay, where it would redeposit on the seabed and adjacent shoreline.

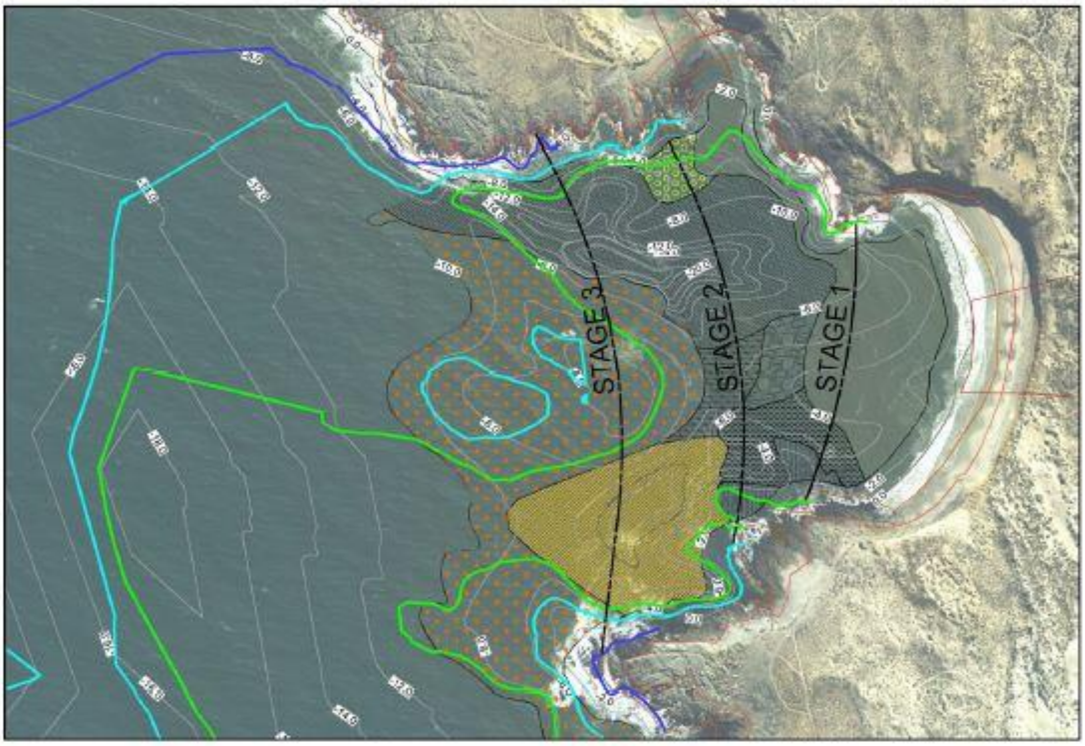


Figure (d) (ii) 1.1 - 5: Three phases of proposed shoreline accretion within Rooiwal Bay. The associated deposition of sand for Stage 1 is shown in green, Stage 2 in cyan and Stage 3 in blue (Source: WSP 2015).

While this alternative for Rooiwal Bay is considered feasible from an engineering perspective, it is dependent on the mining of the inland deposits for a source of the accretion material. The estimated area to be disturbed using this approach would be 541,755 m^2, excluding indirect effects due to redistribution of eroded sediments.

ii) 1.1.3 Closure of Rooiwal Bay with a Dynamically Stable Rock Berm

The alternative approach proposed for Rooiwal Bay is the construction of a dynamically stable rock berm across the mouth of the bay and perpendicular to the predominant wave action. To avoid erosion of the berm profile during storms, it needs to be relatively wide and therefore requires large volumes of material for construction and covers a larger footprint than a conventional rock berm.

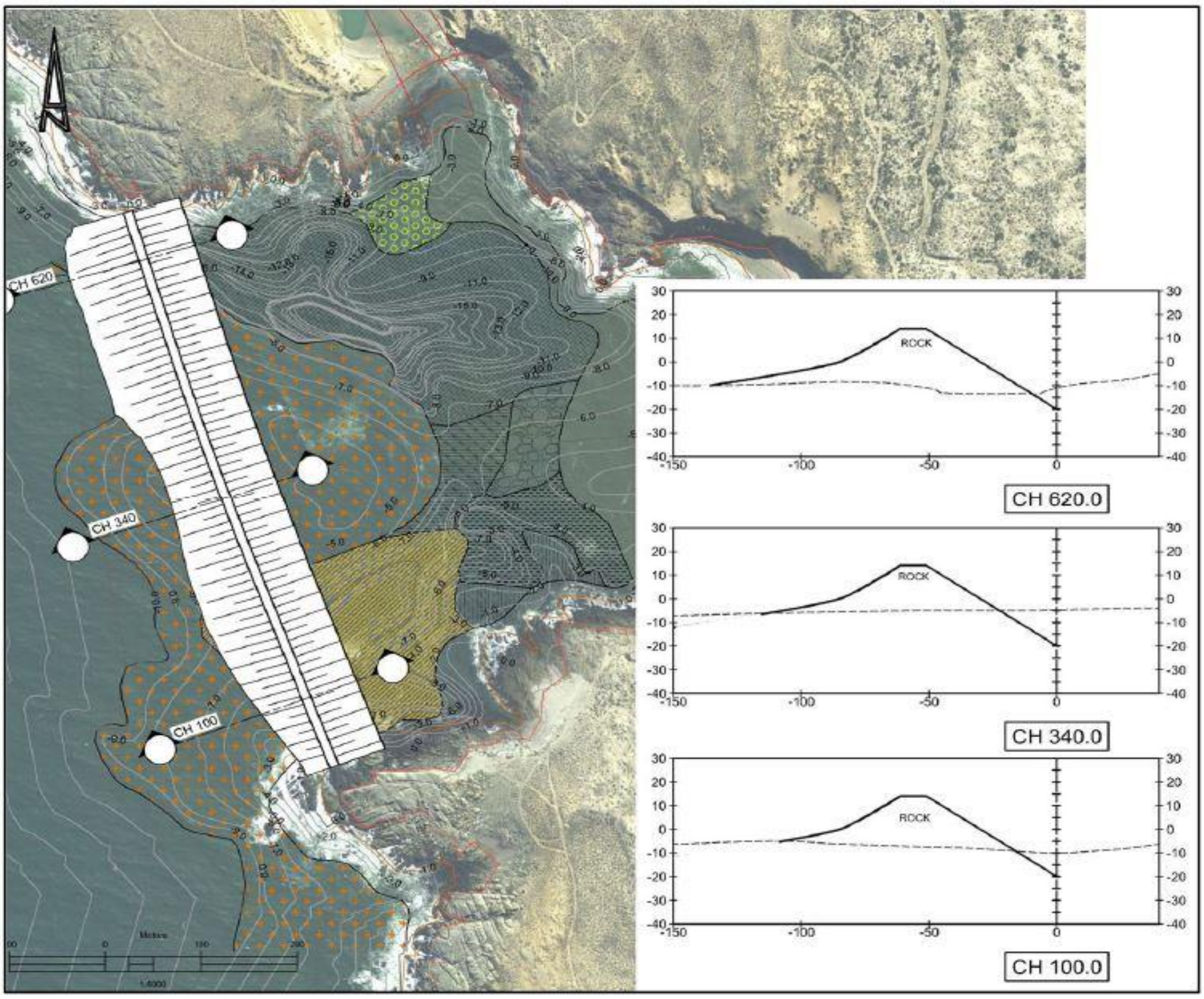


Figure (d) (ii) 1.1 - 6: Layout and sections for a proposed dynamically stable rock berm for the closure of Rooiwal Bay (Source: WSP 2015).

To implement this approach in Rooiwal Bay, a berm crest of 14 m in height would be required to protect the mining area from extreme wave conditions. With a berm width of 10 m at the crest and as much as 140 m at the base, at minimum 660,000 m^3 of large cobbles/small boulders would be required. This volume does not cater for wastage through erosion of material during the construction phase, or for ongoing replenishment of eroded material during the life of the structure. While considered technically feasible, this alternative has high costs associated with it and the high loss rate of material off the partly completed berm during construction may result in the structure being impossible to build. The estimated area to be disturbed using this approach, would be 541,755 m^2, excluding indirect effects due to loss of construction material.

Closure of Rooiwal Bay with a statically stable rock berm is not considered feasible due to the need for either very large armour rocks or concrete armour units on the seaward side of the berm facing the oncoming waves.

ii) 1.1.4 Generic design

A more generic design involving either statistically stable rock berms, or these in combination with dynamically stable berms, is being considered for other potential mining sites characterised by either a rocky shoreline or a shoreline of mixed sand and rock. The generic design is proposed for the Noup, Visbeen, Koingnaas, Langklip Central and Langklip target areas.

The generic designs assume an initial mining area of 200 x 200 m, with sequential extension into adjacent blocks as mining progresses and the resource in a block is mined out. The type of design applied is determined largely by the depth of the seabed at the seaward extreme of the shore parallel berm. Two alternative generic designs are being considered, namely:

ii) 1.1.4.1 Statically stable rock berm

In areas of seabed depth up to 2.5 m below mean sea level at the seaward edge of the mining target, a conventional, statically stable rock berm comprising a core of finer material and an armour layer of larger rocks facing the prevailing waves would be constructed. For protection of the Stage 1 mining block, these berms would comprise a shore-parallel and shore-perpendicular component (grey shading in (Figure (d) (ii) 1.1 - 7). Extension of operations into subsequent mining blocks would require the construction of a further shore-parallel berm to protect the adjacent area (lighter shading in Figure (d) (ii) 1.1 - 8).

ii) 1.1.4.2 Alternative combination berm

In areas of seabed depth up to 4 m below mean sea level at the seaward edge of the mining target, a conventional, statically stable groyne would be built perpendicular to the shore to the required depth. Large armouring would be required at the seaward edge of this groyne to prevent erosion. To protect the Stage 1 mining block, the seaward end of the groyne would connect to a shore-parallel dynamic re-shaping berm (grey shading in Figure (d) (ii) 1.1 - 8). A further shore-parallel dynamic re-shaping berm would then be added for the protection of the Stage 2 mining block (lighter shading in Figure (d) (ii) 1.1 - 7).

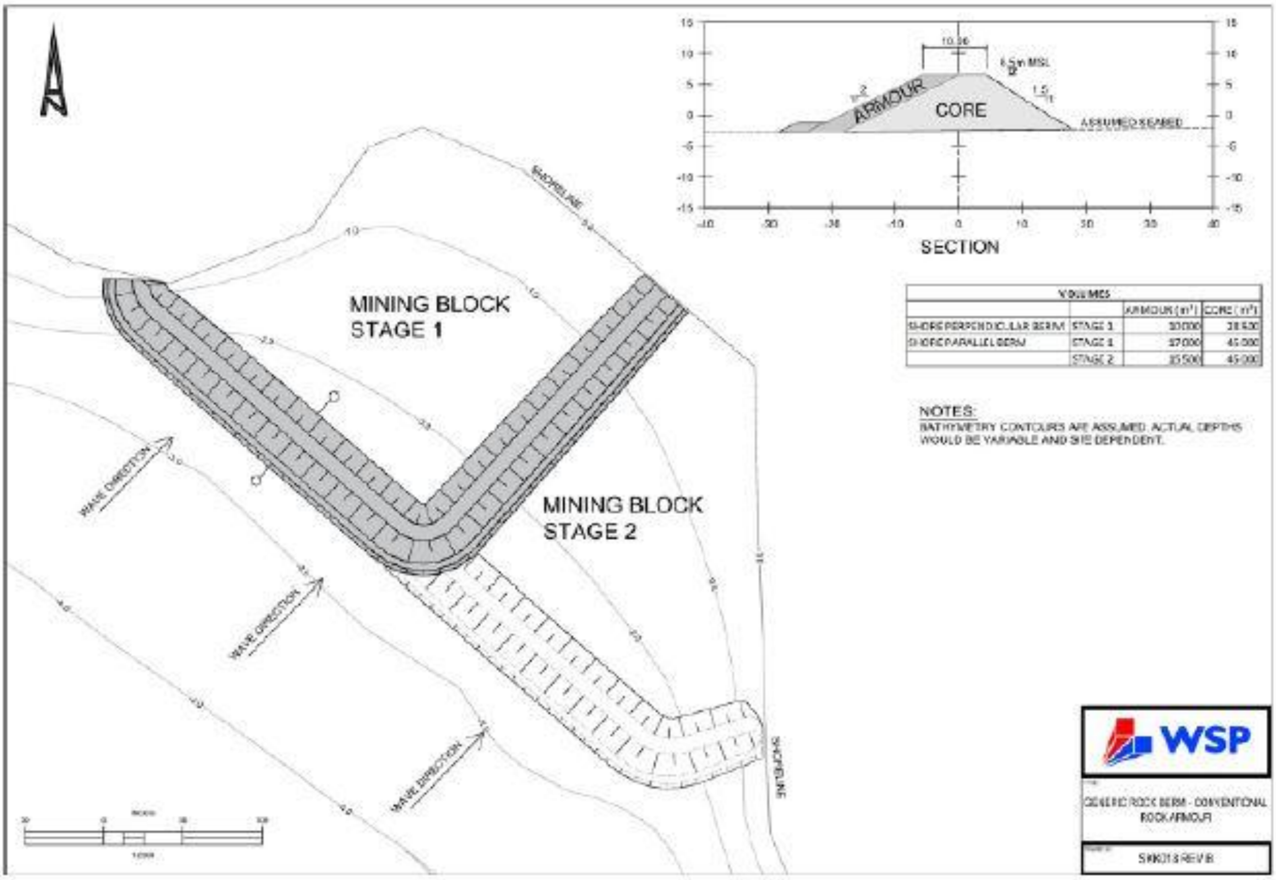


Figure (d) (ii) 1.1 - 7: Layout of a generic rock berm with a conventional statically stable armour slope (Source: WSP 2015).

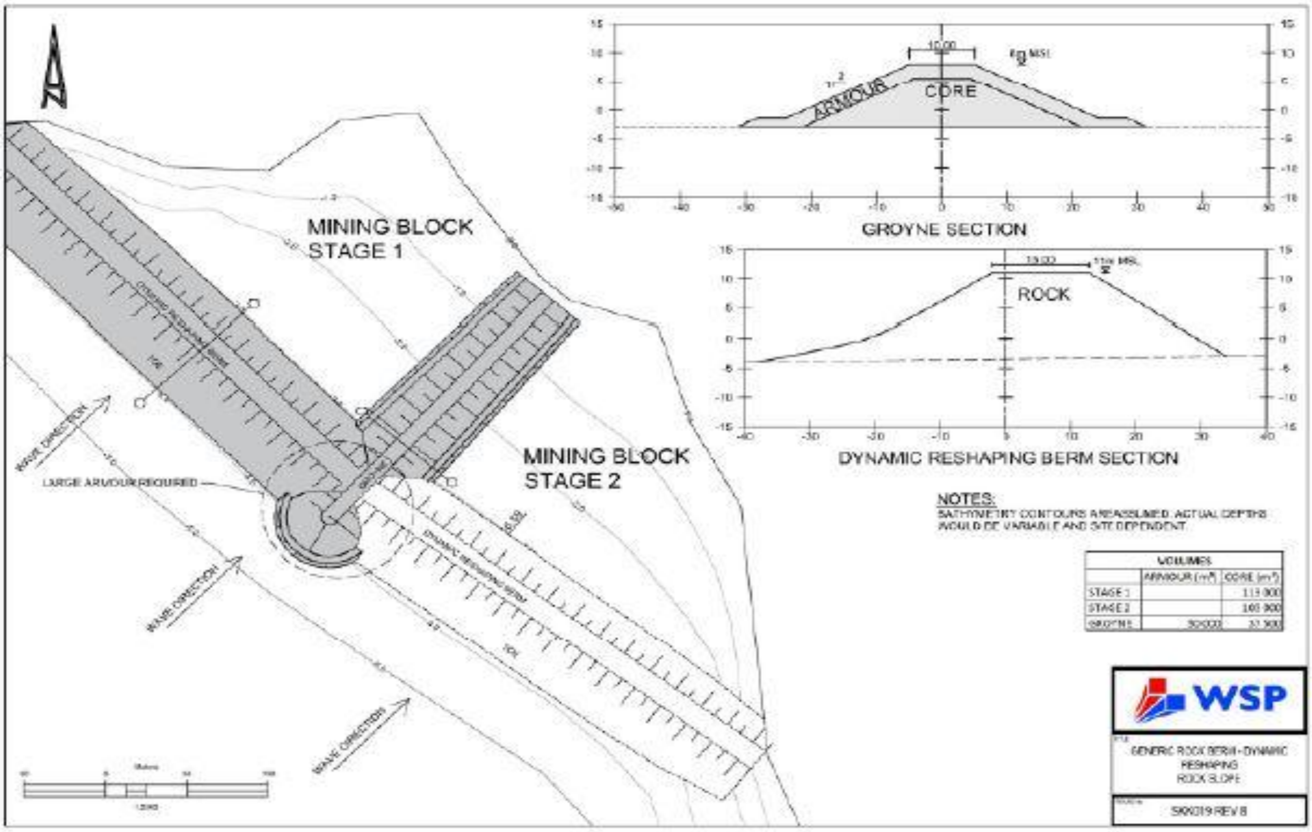


Figure (d) (ii) 1.1 - 8: Layout of an alternative generic design using a conventional statically stable groyne in combination with a dynamic re-shaping shore-parallel berm (Source: WSP 2015).

For each site, the most economically and technically viable concept/s will be selected bearing in mind the temporary nature of the mining, the quantity and characteristics of available construction materials (rock, sand and clay), possible phasing of the mining to facilitate recovery of diamonds at an early stage, the need to minimise seepage into the mining area and the costs of protective measures. The potential areas to be disturbed by these proposed operations are provided in Table (d) (ii) – 2;Summary of beach and offshore mining zones

Table (d) (ii) - 2: Summary of beach and offshore mining zones

Summary of beach and offshore channel mining zones						
Mining Zone	WSP Design	Total area	Disturbed area		Lat	Long
		(m²)	(%)	(m²)		
Noup	Generic	1 589 380	25%	397 345	30º07' 19.3669''S	17º 11' 37.3571''E
Somnaas	6869 design	117 900	100%	117 900	30º09' 48.7636''S	17º 13' 14.9978''E
Visbeen	Generic	448 457	75%	336 343	30º11' 51.8757''S	17º 13' 48.9559''E
Koingnaas	Generic	1 340 284	50%	670 142	30º13' 50.3518''S	17º 14' 27.4843''E
Koingnaas 68/69	68/69 design	117 900	100%	117 900	30º15' 20.3220''S	17º 15' 24.7136''E
Langklip Central	Generic	391 679	50%	195 839	30º22' 17.5314''S	17º 17' 59.0459''E
	6869 design	117 900	100%	117 900	30º22' 40.3227''S	17º 18' 22.5000''E
Langklip	Generic	165 443	25%	41 361	30º26' 14.5875''S	17º 20' 25.3633''E
Rooiwal Bay	Design	541 755	100%	541 755	30º 27' 17.0131''S	17º21'0450556''E
Total Mining zone coastal area		4 830 697	53%	2 536 485		
Total Mining right coastal area		15 337 463	17%	2 536 485		

ii) 1.2 Surf zone mining

A shore-based,surf-zone mining operation typically consists of two to four divers, their assistants, and the necessary equipment**.** It isis a relatively small scale operation that has been ongoing in the Koingnaas and Samson's Bak areas for many years as approved under the current authorizations. Surf zone mining is undertaken by diver-operated suction hoses, which feed the diamondiferous gravels to shore-based pumping units comprising a tractor, modified to drive a centripetal pump and a rotary classifier (Illustration 6). Operations are confined to small bays at depths of <10 m. The classifier, which is positioned in the intertidal area, sorts the pumped material and extracts the size fraction of interest. The diamond-bearing gravel is bagged and transported on a daily basis to the nearest processing facility for diamond extraction.

Over-sized tailings (+12 mm) are accumulated around the classifier and the fine tailings (-2 mm) are returned directly to the sea as a sediment slurry. The oversize tailing heaps which accumulate around the classifier are dispersed during the high tide, or mechanically redistributed over the beach at the end of mining operations. Care is taken to deposit oversized tailing below the High Water Mark (HWM) to allow natural redistribution by wave action. Surf zone mining is described in detail in Section (d) 4 and Illustration 6.

ii) 1.3 Land Mining

ii) 1.3.1 Mining Operations

The following operations are fully described in the current approved Mining Work Program (MWP) for the Koingnaas Mine and in Section d (3) above and Appendix 5 Figure (d) (ii) – 10 and Figure (d) (ii) - 11.

Various opencast mining methods are used to expose the diamond bearing alluvial gravels that lie beneath the mainly sandy, but occasionally hard, overburden. The mining operation can be divided into five phases; first there is stripping of the topsoil and overburden, this is followed by bulk mechanical extraction of the diamond-bearing ore, then follows cleaning of the exposed bedrock, loading and hauling of run-of-mine gravels to the treatment plants and finally, the rehabilitation of the mined area. Ore material will be screened infield in the mine-out area and coarse rejects returned directly to the mining void. Ancillary operations include dozing, ripping, drilling and blasting, road construction, excavating and trenching.

Apart from these conventional methods directional or navigational drilling as a mining tool to mine deeply buried alluvial deposits such as the deep Cretaceous channel systems in the Koingnaas mining area may be employed. This method is well suited to extract ore bodies situated in impenetrable areas, under water or ore bodies with unsuitable shape for conventional mining methods. Systematic pre-planned pilot holes are normally drilled across the orebody after which the holes are reamed to up to 1,3 m diameter and the ore extracted (Section d) 3.2.2, Illustration 3).

Furthermore, hydraulic mining or stripping methods may be applied to strip excessive overburden. Thehydraulic mining method utilizes high pressure water jets of 28-40 bar from a high pressure pump station with constant location which delivers seawater by steel and flexible high pressure lines to a track mounted, remote controlled mobile water monitor gun (Section d) 3.2.1, Illustration 2). The slurry produced is channelled to a slurry pump station where the slurry pump is mounted on a pontoon. The slurry will be returned to the beach or nearby mining voids or used for beach reclamation purposes. Hard safety barricades are used to protect monitors and active production faces.

ii) 1.3.2 Ore Treatment

Diamond-bearing ore exposed by stripping is mined out and transported by haul trucks to the closest

Treatment plant, either at Michell's Bay or Koingnaas (Section d) 3.3 above). The coarse residue is disposed of on the coarse residue deposit (CRD) at the plant by means of a system of conveyor belts or transported to nearby mining voids. Fine residue is disposed of on the fine residue deposit (FRD, i.e. slimes dam or nearby mining void) as slurry. Various CRDs and FRDs are maintained for continuous production purposes and emergency situations as described as described in Section d) ii) 2.1 below. Concentrate from the treatment plants is sorted in the final recovery building (situated at Kleinzee).

ii) 1.4 Land Prospecting

These operations are fully described in the current approved Mining Work Program (MWP) for the Koingnaas Mine and in Section d) 2 above and Appendix 4.6.

Prospecting activities can be divided into two categories.

ii) 1.4.1 Continuous exploration

This is carried out in the main mining areas and is aimed at extending the Life of Mine. It is a program ofsystematic prospecting and evaluation of the areas immediately adjacent to existing operations by means of drilling and/or trench or pit bulk sampling as fully explained in Section d) 2 (Figure (d) 2.5-1). Findings may lead to incremental additions to the proven ore reserve. Reviews of the ore reserve are periodically undertaken to ensure optimal depletion of the resource.

ii) 1.4.2 Primary exploration

This is a much broader prospecting program and is targeted at areas throughout the coastal plain. Primary exploration aims to conceive, explore, discover, and evaluate potential deposits in virgin territory, outside the current mining areas. New finds may extend the life of mine by identifying new mining areas.

Typical prospecting methods employed are:

- Surface mapping by geologists of features such as rock outcrops, alluvial gravels, topographic

- Depressions, etc. Fieldwork is carried out using four-wheel drive vehicles;
- Geophysical surveys involving fieldwork and remote sensing including aerial photography, ground resistivity, gravimetry, magnetometry, etc;
- Small diameter drilling (150 – 200 mm) using percussion, reverse circulation, mud or Sonic drilling methods to assess stratigraphy and the presence or absence of diamondiferous gravels;
- Large diameter drilling using an auger drill, casing puller and support crews to sample gravels in areas of deep overburden; and
- Trenching using excavators, trucks and support crews to sample gravels in areas of shallow overburden.
- A mobile bulk sampling plant is deployed in order to process bulk samples where-ever necessary.

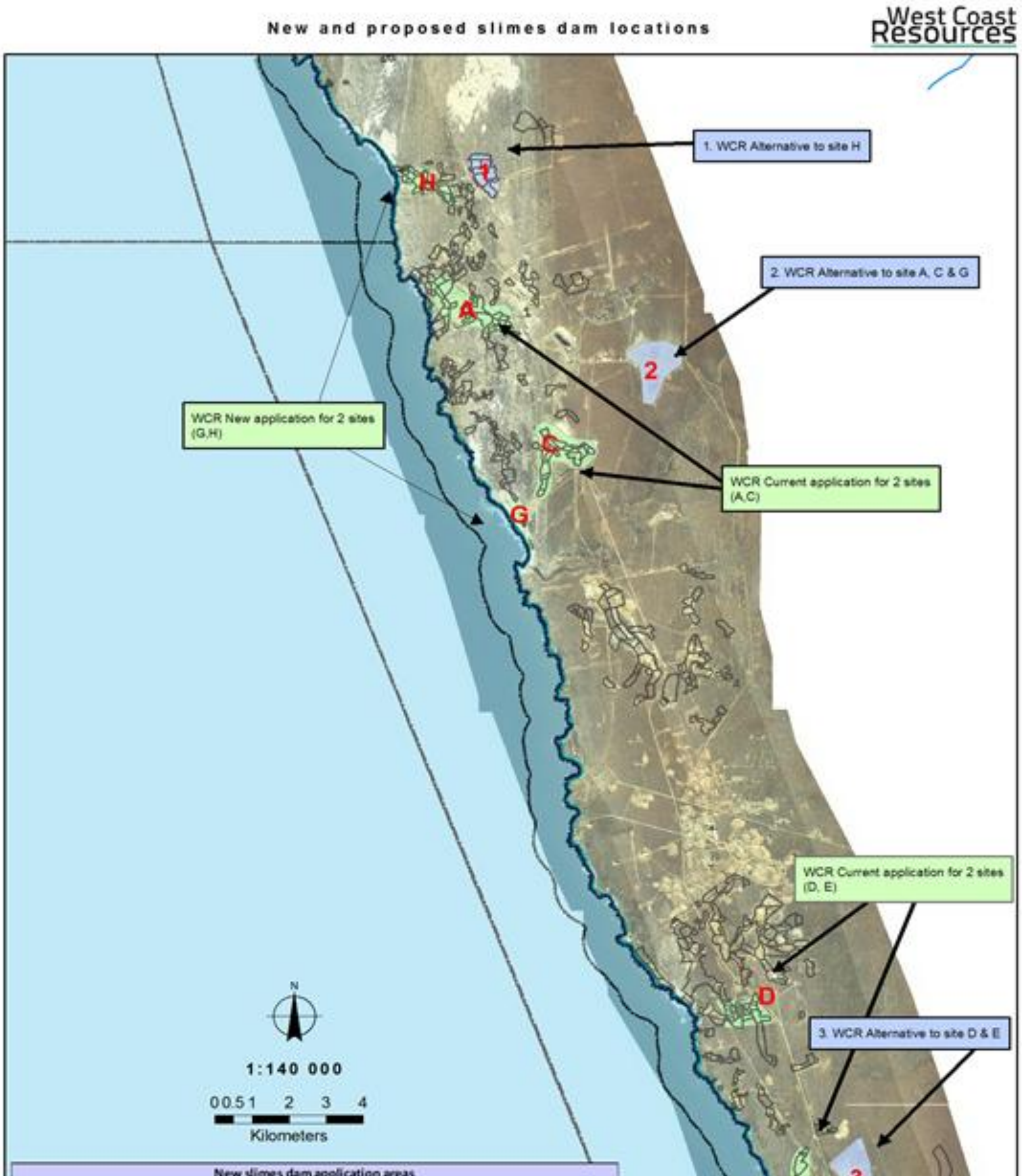
ii) 2. Triggering activities associated with processing

ii) 2.1 Sites for slimes disposal

Over the history of the Koingnaas mine slimes generated by the processing plants were disposed either to slimes dams constructed on surface, or was backfilled into selected mining voids in the vicinity of the plants. The slimes generated by the plants at Koingnaas and Michell's Bay are classified as Sand-Silt under the USCS system. The historic slimes facilities that were created on surface by De Beers have a negative impact on the environment due to wind-blown dust that is generated. Placement of future slimes facilities should therefore take cognisance of this fact and attempt to minimize the negative impact of wind-blown dust and sand.

The general philosophy that WCR has adopted is that any material excavated, moved or processed as part of any new mining or plant activity should be placed in such a way that it is part of the final rehabilitation solution. This will ensure that all operations are aligned with good environmental practices and will reduce the final closure liabilities. Backfilling existing mining voids with slimes generated from the processing plants is seen as the most effective and environmentally friendly way of disposing of slimes material.

Existing mining voids in mined out areas were identified in central areas where processing plants would be placed for the life of the operation. The bedrock profiles in each of these areas were checked to ensure that the bedrock slope dipped towards the coast and that the site was within 1 km from the coastline.These attributes would ensure that any seapage of seawater associated with the slimes would end up back in the ocean. There are no fresh water sources, other than rain water in the region of the selected slimes sites. Placing of the fine fraction of the waste below natural ground level or behind existing overburden dumps will reduce windblown dust. No chemicals are used in the beneficiation process. The material is mainly transported quartz particles, with no Acid Mine Drainage (AMD) potential. A detailed civil engineering design was completed for each of the sites. The proposed slimes facilities are indicated Figure (d) (ii) 1.1 - 9.



New slimes dam application areas							
	Coord System: Cape Lo17		Geo WGS84				
Site	LO_X	LO_Y	Lat	Long	Hectares	Volume	Area m²
A	-3341867.78	23531.88	30º 11' 54.24"S	17º 14' 39.84"E	206.20	10 309 939.19	2061987.84
C	-3345990.10	25921.37	30º 14' 07.80"S	17º 16' 09.48"E	184.77	9 238 465.42	1847693.08
D	-3361615.12	30941.60	30º 22' 34.86"S	17º 19' 18.84"E	99.94	4 996 894.61	999378.92
E	-3367214.48	32852.26	30º 25' 36.48"S	17º 20' 30.84"E	260.96	13 047 959.31	2609591.86
G	-3347525.27	24884.93	30º 14' 57.24"S	17º 15' 30.96"E	22.90	1 145 238.02	229047.60
H	-3338436.46	22412.73	30º 10' 02.64"S	17º 13' 57.72"E	88.66	4 432 984.83	886596.97
Alternative slimes dam areas							
1	-3338090.93	23928.87	30º 09' 51.48"S	17º 14' 54.24"E	75.52	3 776 146.30	755229.26
2	-3343476.52	28523.64	30º 12' 46.08"S	17º 17' 46.32"E	151.50	7 575 213.70	1515042.74
3	-3366257.97	33973.04	30º 25' 05.16"S	17º 21' 12.96"E	170.03	8 501 416.17	1700283.23

Figure (d) (ii) 1.1 - 9: Proposed slimes facilities

ii) 2.2 Process sea-water abstraction and pumping

Process water for use in the Koingnaas and Michell's Bay areas is sourced from the sea nearby. A pump station pumps water from the abstraction site to the storage reservoir and from there to the beneficiation plant. The sea water abstraction procedure is also described in Section d) 10.5.1 and illustrated in Appendix 4.5.

f) Policy and Legislative Context

Table e - 1 included herewith shows the applicable legislation and guidelines used to compile the report.

A more comprehensive table of this legislation is provided as Appendix e-1.

Table e - 1: Applicable legislation and guidelines

APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT	REFERENCE WHERE APPLIED
Mineral and Petroleum Resources Development Amendment Act, (Act No. 49 of 2008) (MPRDA).	An application for environmental authorisation has been lodged with DMR.
Mineral and Petroleum Resources Development Act, (Act No. 28 of 2002).	Financial provision has been calculated and is indicated in the Quantum Report, which is included in the Environmental Impact Assessment Report.
National Environmental Management Act, (Act No.107 of 1998).	An application for environmental authorisation has been lodged with DMR.
National Environmental Management Act, (Act No.107 of 1998): Environmental Impact Assessment Regulations, 2014.	An application for environmental authorisation has been lodged with DMR. The applicable listed activities are discussed in Section d (i) of the Scoping Report.
National Environmental Management Laws Amendment Act, (Act No.107 of 1998).	An application for environmental authorisation has been lodged with DMR.

APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT	REFERENCE WHERE APPLIED
National Environmental Management: Waste Act, 2008 (Act No.59 of 2008) List of Waste Management Activities: Govt Notice No. 921 of 29 Nov 2013 as amended by Government Notice No. R332 of 2 May 2014 and as also amended by Govt. Notice No. R633 of 24 July 2015.	An application for environmental authorisation has been lodged with DMR. The applicable listed activities are included in Section d (i) of the Scoping Report.
National Environmental Management: Air Quality Act (Act No. 39 of 2004).	The provisions of the Act have been included in the compilation of mitigation measures in Section h (viii) and (i) (ix).
National Environmental Management: Air Quality Amendment Act (Act No. 20 of 2014).	This was olny considered for matters pertaining to general dust management.
National Environmental Management: Air Quality Act (Act No. 39 of 2004); National Ambient Air Quality Standards, 2009.	
National Environmental Management: Air Quality Act, (Act No. 39 of 2004); National Dust Control Regulations, 2013.	
National Environmental Management: Biodiversity Act, (Act No. 10 of 2004).	The provisions of the Act and Regulations have been used in the compilation of mitigation measures in Section h (viii) and (i) (ix).
National Environmental Management: Biodiversity Act, (Alien and Invasive Species Regulations, 2014).	The mitigation measures section considers that alien invasive species management.
National Environmental Management: Biodiversity Act, (Publication of national list of invasive alien species).	
National Environmental Management: Integrated Coastal Management Act, (Act No. 24 of 2008).	An application for environmental authorisation has been lodged with DMR. The applicable

APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT	REFERENCE WHERE APPLIED
	listed activities are included in Section d (i) of the Scoping Report. The provisions of the Act have also been used in the compilation of mitigation measures in Section h (viii) and (i) (ix).
National Environmental Management: Integrated Coastal Management Amendment Act, (Act No. 36 of 2014).	
Northern Cape Nature Conservation Act, (Act No. 9 of 2009).	The Biodiversity assessments considered this legislation.
National Development Plan: Operation Phakisa.	The National Development Plan goals and objectives have been considered in the development of socio-economic strategies.
Namakwa District Municipality Integrated Development Plan, 2015-2016.	The IDP was considered in the development of the socio-economic mitigation measures for the project.
Environmental Management Framework and Strategic Environmental Management Plan for Namakwa District Municipality, 2011.	These frameworks will be considered in the assessments and development of mitigation measures.
Northern Cape Coastal Management Programme (NCCMP) (Breetzke, 2015)	The goal of NCCMP is to provide priority areas and tangible obectives to achieve the vsion for the Northern Cape Coastline over a 5 year cycle. The NCCMP was considered in the matters of mine access considerations.

g) Need and desirability of the proposed activities

(Motivate the need and desirability of the proposed development including the need and desirability of the activity in the context of the preferred location).

WCR concluded a transaction with DBCM in October 2014, whereby, WCR acquired, amongst others, the KNC and SBC mining rights. Both these rights have been exploited by DBCM for over 60 years and the diamond resources on land are largely depleted. What remains are generally very low grade or buried under thick overburden. The key to the remaining high value diamond resources that DBCM could not access is: 1) its proximity to the Trans Hex owned marine concessions and, 2) deposits that DBCM discovered towards the end of the life of their operation, 3) continued research and development (R&D) as well as exploration/prospecting by means of drilling and bulk sampling in order to discover and evaluate remaining known and possibly undiscovered gravel deposits, so as to extend the current limited life of mine. The majority of the remaining, defined, possibly high value deposits are situated directly adjacent to the coast, on the beaches or in the shallow marine environment.

The shareholders of WCR together with the Industrial Development Corporation (IDC) has invested over R250 million to date to recapitalize the operations at Koingnaas. This investment has resulted in the creation of 166 permanent employment opportunities, the majority of which has been filled by people from the nearby towns and the broader Namaqualand community. An additional 54 jobs were created over the past 12-month period, during construction operations of the first Plant. The Life of Mine of the operation is in excess of 10 years provided the key diamond resources can be accessed.

Beach mining using the specified mining techniques of coffer dams, berms and accretion in the selected areas is absolutely critical to the sustainability of the operation currently established at Koingnaas. Without access to the resources in the coastal zone, mining could only be sustained on a very small scale for a short period of time.

The inter-linkage between the proposed project and the National Development Plan (Operation Phakisa Oceans Economy)

Operation Phakisa is a result driven approach, involving setting clear plans and targets, on-going monitoring of progress and making these results public. It includes four critical areas to explore and further unlock the potential of South Africa's vast coastline, which are mainly:

- Marine Transport and Manufacturing
- Offshore Oil and Gas Exploration
- Aquaculture
- Marine Protection Services and Ocean Governance

Studies undertaken in 2010, indicated that the oceans around South Africa were estimated to have a potential to contribute about R54 billion to the Gross Domestic Product and an estimated 316 000 jobs. Further analysis undertaken in 2013 found that nine sectors of South Africa's Ocean Economy could generate an estimated GDP contribution of 129 to R177 billion by 2033 and double the number of jobs estimated in 2010. Operation Phakisa was thus formed as an initiative by the South African Government to unlock the potential of the oceans in contributing to the social and economic gain of the country (http://www.operationphakisa.gov.za).

The proposed project of surf zone, beach and offshore channel mining activities, therefore implements in principle the objectives and goals of Operation Phakisa which include the sustainable exploitation of the oceans for resources which will in turn aid in alleviating poverty, generation of economic opportunities, creation of jobs, as well as further curb corruption and crime through the protection of the ocean environment from illegal activities. It is estimated that more than 500 employment opportunities will be created from the proposed project.

The proposed project also interlinks with the objectives of Operation Phakisa with regards to Marine Protection Services and Oceans Governance as WCR is also engaged in talks with San Parks to relinquish areas for public access in the form of the MPA that is being committed in the Section 11 MPRDA process.

The inter linkage between the proposed project and the Namakwa District Municipality Interated Development Plan (IDP)

The IDP for the Namakwa District Municipality (NDM) is aligned with the National Development Plan, which has identified various central development challenges. In order to accelerate the economy forward, the need is to shift the focus towards the development of productive economic sectors, which are labour absorbing such as:

- Resolving the energy challenge.
- Re-vitalising agriculture and the agro-processing value chain.
- Advancing beneficiation and adding value to our mineral wealth.
- Fighting corruption and enhancing accountability.
- More effective implementation of a higher impact Industrial Policy Action Plan (IPAP).
- Encouraging private sector investment in the Province.
- Moderating workplace conflict.
- Unlocking the potential of small, medium and macro enterprises (SMMEs), cooperatives.

- Township and rural enterprises.
- Intensify sustainable SMME development training programmes for the financial years.

One of the key focus areas of the NDM is with regards to economic development including the optimal utilization of Natural Resources in a sectoral manner which includes the promotion of small mining activities; wealth and job creation and SMME Development. The proposed project seeks to address some of the major challenges identified above, including the creation of jobs and economic opportunities and promote the optimal utilization of natural resources as explained above.

h) Motivation for the preferred development footprint within the approved site including a full description of the process followed to reach the proposed development footprint within the approved site.

NB: This section is about the determination of the specific site layout and the location of infrastructure and activities on site, having taken into consideration the issues raised by interested and affected parties, and the consideration of alternatives to the initially proposed site layout.

i)Details of the development footprint alternatives considered

With reference to the site plan provided as Appendix 4 and the location of the individual activities on site, provide details of the alternatives considered with respect 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) 1. Sites for land mining

The proposed sites for the onshore mining land mining were identified through exhaustive and costly exploration programmes - the outcome is fixed and there are no alternatives (Section d) 2, d) 3, Appendix 5 – Figures (d) (ii) 10 and (d) (ii) 12).

i) 2. Sites for surf zone, beach and offshore mining

The proposed sites for the surf zone, beach and off shore mining were identified through exploration programmes, prospecting and bathymetry studies undertaken (Section d) 4, d) 5, Appendix 5).

i) 3. Sites for slimes dams and processing plants

The existing environmental features such as relief and drainage lines were taken into consideration during slimes dam design. Post-mining land-use was also considered. The sites that were selected are outlined below.

The site consideration for the slimes dams entailed a process of assessing their position in respect to environmental sensitive features such as drainage lines, which shows the position of the total number of slimes dams that were originally considered. The number was then reduced based on the key considerations outlined below.

The slimes dams were categorised according to selected zones along the length of the mining right area. The zones represent the areas that each slimes dam will serve along that particular stretch of the mining area. The following criteria were taken into consideration:

- Existing slimes dams that are already full and could potentially overflow with runoff potentially threatening nearby water resources, such as the Swartlintjes River.
- The availability of infrastructure and ease of access so as to prevent long haulage distances.
- The topographical, bathymetric and overall geomorphological features – in order to prevent drainage towards water resources. Physical geography, geology and geotechnical engineering considerations were taken into account. All the alternatives that were considered and rejected or provisionally eliminated because of their environmental sensitivity, ahead of detailed impact assessments, are shown in Figure (g) (iv) (a) 1 - 1. Figure (g) (i) 4.1 - 1 shows the slimes dam positions that are currently being considered.
- Subsequently Site 2 in Figure (g) (i) 4.1 – 2 was later not favoured after the EIA Specialist input indicated it could potentially pose a threat to Swartlintjies Estuary.
- The general designs will be selected considering the need to minimise seepage into the mining areas.

i) 4. Details of all alternatives considered

With reference to the site plan provided as Appendix 4 and the location of the individual activities on site, provide details of the alternatives considered with respect 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.

The alternatives considered include the following:

- Site alternatives i.e. location of slimes dams
- Design alternatives i.e. designs for the coffer dams
- Activity alternatives i.e. mining methodology, processing methodologies
- The option of not implementing the activity i.e. “No-go alternative”

i) 4.1 Site Alternatives

There are existing tailings dumps and slimes disposal facilities at the Koingnaas and Michell's Bay plant site that can be used. As such, the planning and alternatives regarding slimes dams were planned around these considerations. It was established that new slimes dams would also be required. With this in mind potential future sites P1 to P6 were identified as alternative to sites A, B, C, D, E and F as indicated in Figure (g) (i) 4.1 - 1. The main associated risk considerations were seepage and potential drainage into rivers such as the Swartlintjes River, proximity to the plant and the available sizes of the voids. This process culminated in the final selection of slimes dams as shown in Figure (g) (i) 4.1 - 2 (same as Figure (g) (i) 4.1 - 2 below) namely sites A, C, D, E, G, H. with alternatives being sites 1, 2 and 3 (Figure (g) (i) 4.1 - 2).

Sites numbered 1, 2 are alternatives for sites H, A, C and G and site number 3 is an alternative for Sites D and E. Sites A, C, D, E, G, H have therefore been chosen as the preferred sites designed to accommodate all the anticipated mine residue over the Life of Mine of approximately 11 years. These slimes dams were incorporated into the integrated water and waste management plan, which was compiled as part of the water use licence application and any impacts associated with these water uses will be managed.

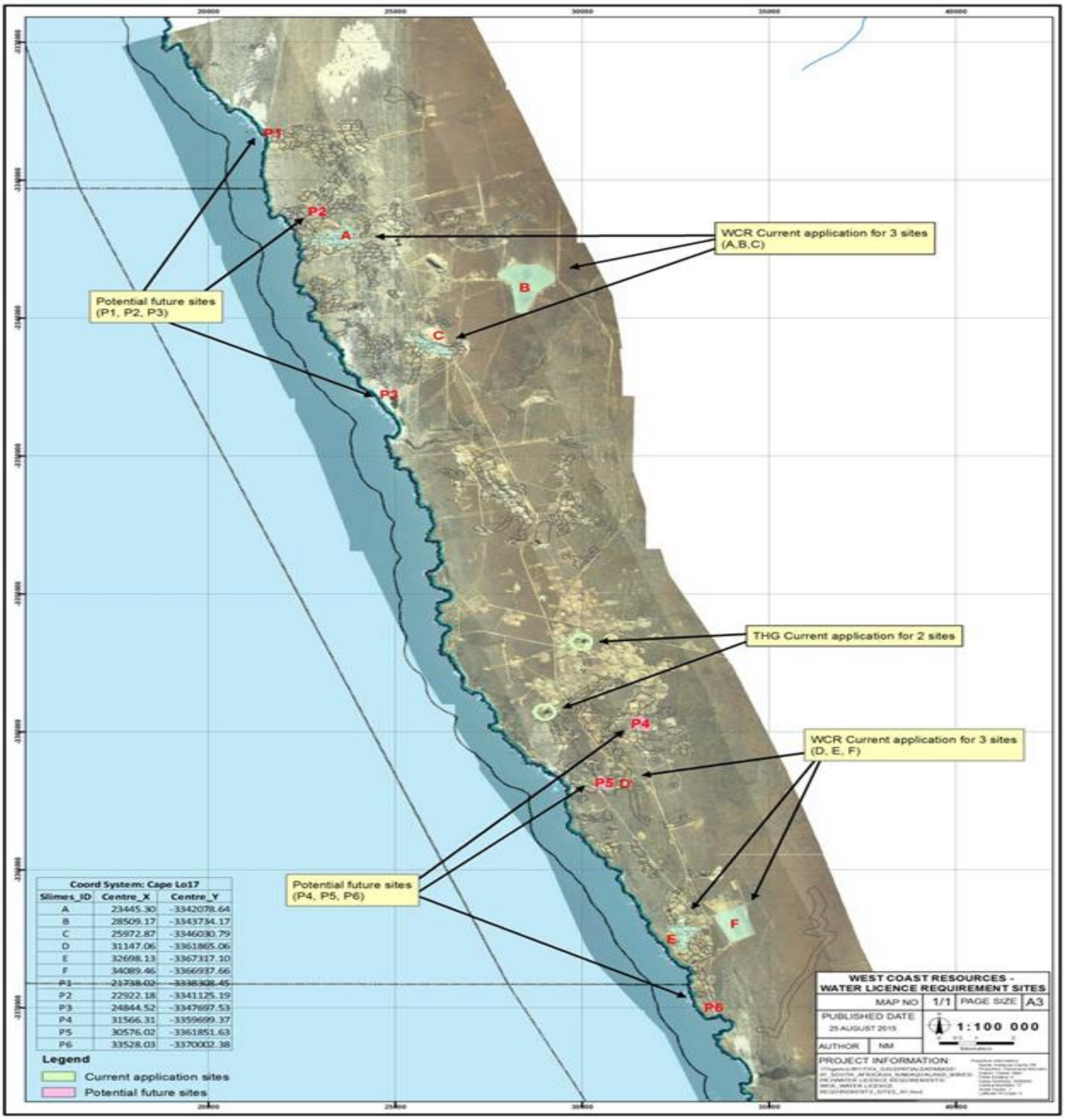
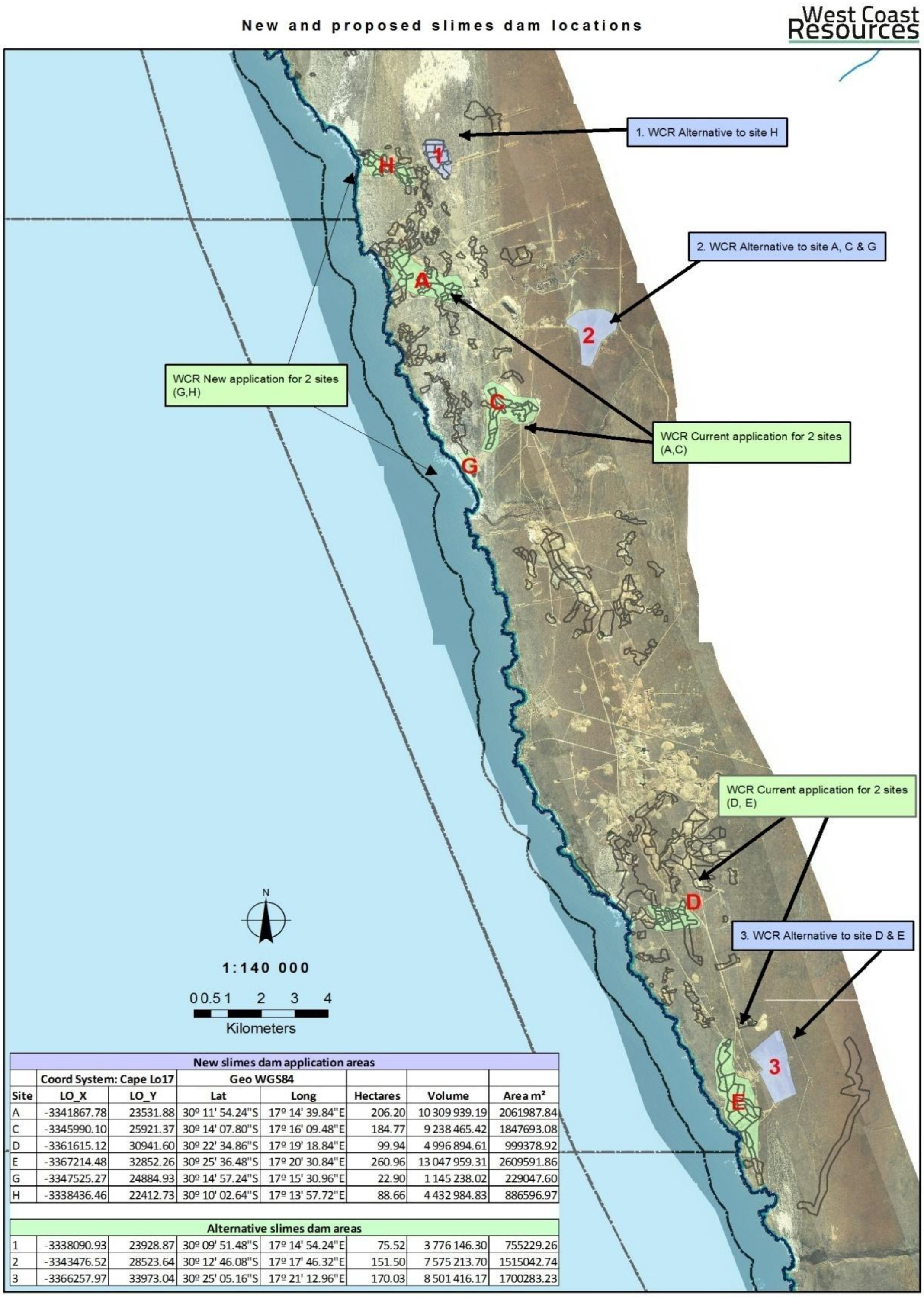


Figure (g) (iv) 4.1 - 1: First process of identification of slimes dams, later replaced by the selection



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3	-3366257.97	33973.04	30º 25' 05.16"S	17º 21' 12.96"E	170.03	8 501 416.17	1700283.23

Figure (g) (iv) 4.1 - 2: Current slimes dam alternative sites of which six are preferred (A, C, H, G, D and E)

<table>
<tr><th colspan="3">Alternative A (Preferred Alternative) – Coordinates as in Figure (g) (i) - 2</th></tr>
<tr><td>Description</td><td>Lat (DDMMSS)</td><td>Long (DDMMSS)</td></tr>
<tr><td>The slimes dam will be located close to the existing Koingnaas plant and will cover an extent of approximately 206.20 hectares.

Advantages

1) The slimes dam will be located in an area that is already disturbed therefore the vegetation clearance required will be very minimal and impacts such as soil compaction will also be minimal due to the fact that the area is not a pristine area.

2) The slimes dam will be located at the Koingnaas plant where there is an already existing road infrastructure network, therefore there will be no need for the construction of new roads to the plant.

3) Haulage distance will be reduced as the slimes dam will be located near the areas to be mined.

4) At 60 m volume fill, the dumps can be easily sloped out and mined out areas can be easily sloped inwards, therefore seepage would drain to mined out areas.</td><td>30° 11' 54.24''</td><td>17° 14' 39.84''</td></tr>
<tr><th colspan="3">Alternative C (Preferred alternative)</th></tr>
<tr><td>Description</td><td>Lat (DDMMSS)</td><td>Long (DDMMSS)</td></tr>
<tr><td>The slimes dam will be located close to the existing Koingnaas plant and will cover an extent of approximately 184.77 ha.

Advantages

1) The slimes dam will be located in an area that is already disturbed therefore the vegetation clearance required will be very minimal and impacts such as soil compaction will also be minimal due to the fact that the area is not a pristine area.</td><td>30° 14' 07.80''</td><td>17° 16' 09.48''</td></tr>
</table>

2) The slimes dam will be located at the Koingnaas plant where there is an already existing road infrastructure network, therefore there will be no need for the construction of new roads to the plant. 3) Haulage distance will be reduced as the slimes dam will be located near the areas to be mined. 4) Drainage will be into the sea therefore minimising impacts on rivers such as the Swartlintjes River.		
Alternative D		
Description	Lat (DDMMSS)	Long (DDMMSS)
The slimes dam will be located close to the existing Mitchell's Bay plant and will cover an extent of approximately 206.20 hectares. **Advantages** 1) The slimes dam will be located in an area that is already disturbed therefore the vegetation clearance required will be very minimal and impacts such as soil compaction will also be minimal due to the fact that the area is not a pristine area. 2) The slimes dam will be located at the Mitchell's Bay plant where there is an already existing road infrastructure network, therefore there will be no need for the construction of new roads to the plant. 3) Haulage distance will be reduced as the slimes dam will be located near the areas to be mined. 4) At 60 m volume fill, the dumps can be easily sloped out and mined out areas can be easily sloped inwards, therefore seepage would drain to mined out areas.	30^{o} 22' 34.86''	17^{o} 19' 18.84''
Alternative E		
Description	Lat (DDMMSS)	Long (DDMMSS)
The slimes dam will be located close to the Mitchell's Bay plant and will cover an extent of approximately 260 ha.	30^{o} 25' 36.48''	17^{o} 20' 30.84''

The advantages of this site are the same as alternative D above.		
Alternative G		
Description	Lat (DDMMSS)	Long (DDMMSS)
The slimes dam will be located near to the Koingnaas plant and will cover an extent of approximately 22 hectares. The advantages of this site are the same as alternative C above.	30° 14' 57.24	17° 15' 30.96''
Alternative H		
Description	Lat (DDMMSS)	Long (DDMMSS
The slimes dam will be located such that it serves the Koingnaas plant and will cover an extent of approximately 88 hectares. **Disadvantages** The advantages of this site are the same as alternative C above.	30° 10' 02.64	17° 13' 57.72
Alternative 1		
Disadvantages 1) There is an increased potential for the creation of dust plumes if this area is utilised due to exposed side slopes. 2) There is an extended haulage distance from the areas to be mined. 3) Drainage preparation and long delivery pipes and up-gradient pumping would result in high costs. The discharge inflows and pipe diameter and length all exacerbate the costs 4) There is potential for seepage and drainage into water resources.	30° 09' 51.48''	17° 14' 54.24''

Alternative 2		
1) There is an increased potential for the creation of dust plumes if this area is utilised due to exposed side slopes. 2) There is an extended haulage distance from the areas to be mined. 3) Drainage preparation, long delivery pipe lines and up-gradient pumping would result in high costs. The discharge inflows and pipe diameter and length all exacerbate the costs. 4) There is a potential for seepage and drainage into water resources.	30^{o} 12' 46.08''	17^{o} 17' 46.32
Alternative 3		
Disadvantages 1) There is an extended haulage distance from the areas to be mined. 2) Drainage preparation and long delivery pipe lines and up gradient pumping would result in high costs. The discharge inflows and pipe diameter and length all exacerbate the costs.	30^{o} 25' 05.16	17^{o} 21' 12.96

i) 4.2. General Design Alternatives

WCR plans to extend its mining activities in beach areas below sea level by constructing protective sea-walls and/or berms (coffer dams). The design alternatives considered include the following:

- Construction of coffer dams using either rock berms or sand bags.
- Beach accretion with sand.

For rock berms, rock is typically used to construct revetments or breakwaters with the structure usually consisting of an outer layer of large armour rock while under-layers typically consist of progressively finer material. A berm is usually constructed seaward from the shore by end-tipping the core material from trucks. Once a sufficient section of core is built, it is covered with the larger armour-layer while an excavator is used to dress the slope to the correct profile. The berm can be extended in phases as far offshore as conditions allow.

For each site, the most economically and technically viable concept/s will be selected bearing in mind the temporary nature of the mining, the quantity and characteristics of available construction materials (rock, sand and clay), possible phasing of the mining to facilitate recovery of diamonds at an early stage, the need to minimise seepage into the mining area and the costs of protective measures. Specific beach mining methods are proposed for specific areas, e.g. Channel 68/69 and Rooiwal Bay. (Section d) (ii) – 1). Therefore, any of the proposed methods may be applied at any specific site depending on the outcome of a final geotechnical assessment of sea - and seafloor conditions.

<table>
<tr><th colspan="3">Alternative 1 (Preferred Alternative): Construction of coffer dams using breakwater rock berms and other fine materials to achieve adequate armouring</th></tr>
<tr><td>Description</td><td>Lat (DDMMSS)</td><td>Long (DDMMSS)</td></tr>
<tr><td>This includes construction of the coffer dams (sea wall development) and pushing material out onto the surf zone and then mining behind the wall. Material would be required for dam wall construction. This material could be either rock boulders and other different particle sizes for adequate seal and armouring:

• Rock boulders are typically used to reduce the velocity of water so that mining operations can be undertaken without disturbance due to water flows into the operations.

Advantages

1) Rocks can be easily obtained from the sea.
2) The rocks would also be available in land at reasonable hauling distances. Some of the material would be sourced inland through blasting and this would be creating mixed – shore beaches.
3) The boulders will be relocated from one mined area to the next thus avoiding removal of numerous boulders.
4) High waved action might redistribute boulders back into the sea next to the same areas they were extracted from.</td><td>The coordinates of the areas that will be affected by this type of mining are provided in Table d (ii) - 2.</td><td></td></tr>
</table>

<table>
<tr><td colspan="3">Alternative 1 (Preferred Alternative): Construction of coffer dams using breakwater rock berms and other fine materials to achieve adequate armouring</td></tr>
<tr><td>Disadvantages

1) It is possible that the rate at which rock is lost will exceed the rate at which material can be placed, particularly in areas of deep water. Furthermore, severe storms can erode the profile.

2) The berm needs to be wide in order to absorb such erosion. Large volumes of rock are required to construct the berm, and the footprint of the berm would cover a larger area.

3) On-going maintenance, involving replenishment of eroded rock, would be required for the life of the structure therefore rendering high maintenance costs.

This alternative is shown in Appendix 4.</td><td></td><td></td></tr>
<tr><td colspan="3">Alternative 2 (Preferred alternative): Beach accretion with sand, only an alternative at Rooiwal Bay.</td></tr>
<tr><td>Description</td><td>Lat (DDMMSS)</td><td>Long (DDMMSS)</td></tr>
<tr><td>Artificial temporary accretion of the beaches has been identified as a method to allow the blocks that presently lie seaward of the low-water mark to be accessed for conventional open-cast mining. Beach accretion methods include:

• Large sand berms, or sea walls, typically up to 7 m above mean sea level (AMSL) and 20 - 30 m wide can be constructed with earthmoving machinery in order to accrete the beach and protect the mining excavation. Large sand volumes are required to construct and maintain the sea walls because sand is constantly eroded from the sea wall by wave action. The rate of erosion and replenishment increases as the walls are built further into the sea.
• Dredgers or hydraulic mining with slurry pumps can be used to strip overburden sand and discharge the slurry</td><td></td><td></td></tr>
</table>

Alternative 1 (Preferred Alternative): Construction of coffer dams using breakwater rock berms and other fine materials to achieve adequate armouring		
onto the beach where wave action distributes the sand along the coast. • The rate of accretion is dependent on the dredging rate. • Conveyors can also be used to move sand, and coarser material, from further inland onto the beach. The front of the conveyor is moved or extended seaward as the accretion occurs. Wave action distributes the material along the coast. This method will be effective because source of the sand is an existing large stockpiles or dump in some areas and, as such, it can be a form of land rehabilitation by alternate lively using the redundant old existing dumps and putting the rehabilitation liability into the beach operations. **Advantages** Sand can be a suitable material for beach accretion when: • Plentiful supply is available. • Haulage distances are short. • The mining operation already requires extensive stripping of sand overburden. **Disadvantages** 1) Sand is easily transportable by the sea and frequent. replenishment is required to replace the sand lost during storms. 2) Large volumes are required in order to achieve accretion. 3) The accreted shoreline rapidly will attain a new equilibrium shape, due to longshore movement of sand, which can result in accretion in areas where it is not required, or desired. 4) Impacts on benthic communities such as alteration of benthic communities.		

i) 4.3. Design alternatives at the specific mining areas

Design alternatives have been considered for possible mining at the following locations:

Diamond deposits on the seabed and adjacent beaches within Rooiwal Bay are shown Figure (d) (ii) 1.1 - 3Figure (d) (ii) 1.1 - 3. Two areas have been identified for mining at Rooiwal Bay and these include the small northern channel area; and the greater bay area.

Sandy beach sites known as Koingnaas site 68/69, Somnaas and Langklip Central.A generic protection design to be applied on the rocky shoreline and mixed sand and rock shoreline elsewhere along the coastline on Noup, Visbeen, Koingnaas, Langklip Central and Langklip as shown in Figure (d) (ii) 1.1 – 6, Figure (d) (ii) 1.1 - 7 and Figure (d) (ii) 1.1 – 8.

i) 4.3.1. Design alternatives for mining at Rooiwal Bay

The northern channel in Rooiwal Bay is partly sheltered from severe wave energy. It will be feasible to construct a conventional, statically stable rock berm across the mouth of this channel. However, the mining area gained will be comparatively small. Three design alternatives have therefore been considered that would allow conventional open-cast mining of the greater part of the bay, these include the following:

- Beach accretion with sand. This option is considered feasible. It is likely that costs will be lower than for the other options. However, this option is dependent on the mining of the inland deposits. This option is therefore considered as the preferred alternative.
- Closing off the entire bay with a dynamically stable rock berm. Construction is likely to prove difficult due to high loss rates of rock off the partly completed berm. This alternative is considered costly and very challenging; therefore it is the second preferred alternative.
- Closing off the entire bay with a conventional, statically stable, rock berm breakwater. Engineering design calculations indicate that this option would only be feasible if concrete armour units are used. These are likely to be too costly and potentially not feasible. This option is therefore not recommended.

Alternative 1 (First Preferred alternative): Beach accretion with sand		
Description	Lat (DDMMSS)	Long (DDMMSS)
Possible mining of inland areas at Rooiwal Bay, will require stripping of large volumes of fine sand overburden material. This material can be used to accrete the beach. Mining of this accreted area would liberate further material that can be placed into the sea to gain additional accretion. Sand placed in the bay would be re-distributed by currents. Placing sand on the beach would result in the shoreline accreting, with the new shoreline being in equilibrium with wave-driven current (long shore currents). The accreted shoreline would therefore be oriented approximately perpendicular to the oncoming waves. This would hold for accretion resulting from dumping of sand from trucks, or resulting from hydraulic mining discharge. Three stages of beach accretion were considered, as shown in Figure d-6 with the shoreline moved seaward by 150 m for each successive stage. The following volumes of sand fill were calculated, without taking into account any losses: • Stage 1 – 150 m accretion: 1.3 million cubic metres • Stage 2 – 300 m accretion: 2.5 million cubic metres • Stage 3 – 450 m accretion: 5.9 million cubic metres These volumes are the accretion volumes required. They do not account for re-stripping of material, for example to mine inside the accreted bay during Stage 2	30º 27' 17.0131"S	17º 21' 04.5056"E

Alternative 1 (First Preferred alternative): Beach accretion with sand		
some of the sand placed for Stage 1 would be re-used. The sand would extend on the seabed seaward of the bay. As the accretion distance increases, progressively more sand would be transported out of the bay and become deposited on the seabed and adjacent coastline. This would also result in the rate of accretion reducing as the accretion distance increases, even though the rate of sand discharge/dumping/placement remains the same. The filled beach will assume a dynamically stable cross sectional profile that is in equilibrium with the wave forces. The shape of the profile will change in response to erosive and accretive wave conditions. The slope of this profile will determine the volume of sand required to fill the bay, and how far the toe of the profile will extend outside the bay. If the toe of the profile extends too far out of the bay, then sand may "leak" from the profile and be transported away from the site, along the coast. This would require that the profile is continually replenished with additional sand in order to maintain the desired "new" shoreline position. **Advantages** 1) Costs will generally be lower as compared to other options. 2) No overburden dumps will be created due to stripping of inland mine blocks as the sand will be placed on the beach		

Alternative 1 (First Preferred alternative): Beach accretion with sand		
Disadvantages 1**)** The sand would extend on the seabed seaward of the bay. As the accretion distance increases, progressively more sand would be transported out of the bay and become deposited on the seabed and adjacent coastline. 2)Sand would remain on the deeper areas of the seabed for some time, until wave action has re-worked it towards the shore. 3) During the accretion process, sand would be dispersed by wave action along the coastline outside the bay. This would increase the amount of sand on what is a predominantly rocky coastline. This would result in the disturbance of intertidal and subtidal marine areas and alteration of benthic communities.		

Alternative 2 (Second Alternative): Dynamically stable rock berm construction (closure of entire bay) at Rooiwal Bay		
Description	Lat (DDMMSS)	Long (DDMMSS)
Extensive potential additional mining area exists within the greater Rooiwal Bay and the diamond grades are not known at present. Therefore, mining this area with conventional open-cast methods would require closing-off the entire bay with a berm, as shown in Figure (d) (ii) 1.1 – 7. Dynamically stable rock berms are not used as frequently for coastal protection as conventional rock berms, therefore design guidelines are more limited. At this stage, the method of Van der Meer (1996) was used	30º 27' 17.0131''S	17º 21' 04.5056''E

Alternative 2 (Second Alternative): Dynamically stable rock berm construction (closure of entire bay) at Rooiwal Bay		
to estimate the profile shape. The following design measurements are to be applied: • Design wave height of 6.9 m, with 16 s period. This determines the height of the berm crest. A berm crest of 14 m was determined for this wave condition. This seems high, but it must be borne in mind that overtopping of the berm should not occur. Crest levels would be lower in those areas where the berm is exposed to smaller waves, such as in the centre of the bay. • Median rock size (Dn50) of 0.3 m, corresponding to a mass (M50) of 70 kg. The size (mass) determines the slope of the profile, with larger material resulting in a steeper slope. The selected size (0.3 m) corresponds to a large cobble/small boulder. Actual rock sizes should vary around this median. • Estimated total rock volumes required is estimated at 660 000 m³. **Advantages** 1. The required rock sizes can be greatly reduced 2. The rocks move in response to changing wave and water level conditions and the resulting dynamically stable profile, or rock beach, adjusts to maintain equilibrium with the prevailing wave conditions. 3. After mining is completed, rehabilitation could be easily achieved by reducing the berm crest by dozing it landwardsand allowing natural erosion to redistribute the rock on the seabed. Alternatively, the material above water could be loaded and hauled to mining voids at the plant site.		

Alternative 2 (Second Alternative): Dynamically stable rock berm construction (closure of entire bay) at Rooiwal Bay		
Disadvantages 1) It is a rather costly option as estimates of between R165 million and R375 million would be require for costs of rock supply and placement. 2) It is possible that the rate at which rock is lost will exceed the rate at which material can be placed, particularly in areas of deep water. Furthermore, severe storms can erode the profile. 3) The berm needs to be wide in order to absorb such erosion. Large volumes of rock are required to construct the berm, and the footprint of the berm would cover a larger area. 4) Ongoing maintenance, involving replenishment of eroded rock, would be required for the life of the structure therefore rendering high maintenance costs.		

Alternative 3: Construction of conventional, statically stable, rock berm (closure of entire bay) at Rooiwal Bay		
Description	Lat (DDMMSS)	Long (DDMMSS)
A protective berm will be required to close off the channel from the sea. A rock berm would be required, as sand-size material would erode easily. A method to construct the berm would be to end-tip rock from the western side towards the east to close the channel. The channel is located inside Rooiwal Bay where wave energy is reduced. However, the coastline east of the channel is exposed to wave energy entering the bay over the deep water in the north of the bay. A berm would be exposed to an increasing amount of wave	30º 27'17.0131"S	17º 21' 04.5056"E

Alternative 3: Construction of conventional, statically stable, rock berm (closure of entire bay) at Rooiwal Bay		
energy the further into the bay (southward) it is built. A layout of the berm is shown in Figure d-7. The berm is oriented approximately east-west across the junction of the channel and the bay proper. The length of berm required is estimated to be 140 m. Waves would therefore attack the berm at an angle. This would reduce the stability of the stones in the armour layer, the stones would tend to move eastward with the incoming wave direction. The total rock volume would be approximately 21 000 m^3 (Armour = 9 500 m^3, Core 11 500 m^3). **Advantages** 1) Rock berms are more stable than sand 2) After mining is completed, rehabilitation could be easily achieved by allowing natural erosion to redistribute the rock on the seabed. **Disadvantages** This alternative would only be feasible if concrete armour units are used. Therefore, it is a rather costly alternative as suitable rock might not be easily available, or would need to be quarried. 2) Associated costs such as haulage distances, plant required for placing the rock, trucks, excavators and cranes for large rocks would also further increase costs associated with this alternative. Two layers of armour rock would be required however, stones larger than about 3 tonnes become difficult to transport, handle and place without a crane.		

Alternative 3: Construction of conventional, statically stable, rock berm (closure of entire bay) at Rooiwal Bay		
3) Ongoing maintenance (replenishment), would be required if smaller rock is used as the rocks would be easily washed off the slope.		

i) 4.3.2. Design alternatives for coffer dam mining at Koingnaas Site 68/69, Somnaas and Langklip

The proposed mining area is shown in Figure (d) (iii) 1.1 - 1. Each mining area follows a paleo-channel that enters the bay from the coast. The position of the proposed mine blocks are well established up to the LWM. It is possible that mining may extend up to 300 m seaward of the HWM as consecutive blocks are mined.

Typical mine blocks would have dimensions of 100 m by 100 m. The gravels are overlain by some 15 m of clay. The remaining overburden is sand. The mining excavation will thus be deep.

For construction of coffer dams using rock berms the following procedure will be undertaken:

- A rock berm will be constructed into the surf zone on both the northern and southern side of the planned mining area.
- Material will be placed by end-tipping from trucks. A dozer and excavator will be used to place the material and shape the profile;
- The berms are oriented perpendicular to the oncoming waves and shoreline. In this way only the tip of the advancing berm is exposed to high wave energy;
- The berms extend seawards until the seaward extent of the mining block is reached. At this location, a berm is constructed parallel to the coastline to link the two shore-perpendicular berms;
- The mining block is then enclosed within the berm, with access onto the berm from the shoreline;
- The berm extends landward to above the storm HWM in order to prevent wave run-up on the adjacentbeaches from flooding the mining area.
- Design alternatives that have been considered include:
- Construction of coffer dams using rock berms.

Alternative 1 (Preferred Alternative): Phased rock berm construction and extension along offshore channels at Koingnaas Site 68/69, Somnaas and Langklip		
Description	Lat (DDMMSS)	Long (DDMMSS)
The mining would likely progress seaward in stages: the most landward block would be mined first; then the berms would be extended seaward to enclose the next block, which would then be mined. This sequence would continue until the most seaward block has been mined, as shown in Figure (d) (ii) 1.1 - 2. For the purposes of this project, four stages are assumed: • Stage 1: Mine to HWM (65 000 m³). • Stage 2: Mine to 100 m seaward of HWM (135 000 m³). • Stage 3: Mine to 200 m seaward of HWM (216 000 m³). • Stage 4: Mine to 300 m seaward of HWM (356 000 m³). The following are considered in the construction of the phased rock berm coffer dam structures: • Design water level is +1.4 m MSL. • Slope of seaward face of berms is 1:2 (slightly flatter than repose angle). • Rock relative density of 2.65 tonnes/m³. • The structure would have a comparatively fine core (to reduce seepage). • The design life of the berm is short – 1 to 2 years. It can therefore be considered as a temporary structure. • Depth limited wave conditions are assumed for Stages 1 to 3. The Stage 4 berm would extend beyond the surf zone and would be subject to unbroken waves.	30º 15' 20.3220"S 30º 09' 48.7636' S 30º 26' 14.5875"S	17º15' 24.7136"E 17º 13'14.9978'E 17º 20'25.3633"E

Alternative 1 (Preferred Alternative): Phased rock berm construction and extension along offshore channels at Koingnaas Site 68/69, Somnaas and Langklip		
The feasibility of Stages 3 and 4, where mining would extend 200 m and 300 m seaward of the HWM respectively, is considered questionable. This is as a result of the deep water that would-be encountered at the seaward toe of the berms as they extend into and beyond the surf zone: -5 m and -8 m to MSL for Stages 3 and 4 respectively. It is considered possible to design and construct an appropriate rock berm to allow mining up to Stage 3. To mine up to Stage 4 will require considerable investment in construction of an appropriate coastal protection structure that would likely require the use of concrete armour units or a dynamically stable rock berm. **Advantages** 1) The structure would have a comparatively fine core, to reduce seepage 2) The design life of the berm is short i.e. 1 to 2 years. It can therefore be considered as a temporary structure. **Disadvantages** 1) This would be a costly option as concrete armour units (if used) would be very expensive. Furthermore, large volumes of rock are required to construct the berms for stages 3 and 4, these would be difficult and expensive to quarry, transport and place. 2) Ongoing maintenance, involving replenishment of eroded rock, would be required for the life of the structure therefore rendering high maintenance costs.		

i) 4.3.3. Design alternatives for coffer dam construction (generic rock berm designs) to be applied on the rocky shoreline and mixed sand and rock shoreline elsewhere along the coastline

A generic design is required for coffer dams that would be used to protect small beach mining operations. These mining operations could be employed at any location within the WCR mining area, but are most applicable to the rocky shoreline and mixed sand and rocky shoreline along the coastline (see Appendix 5 – Figure (d) (ii) 1.1 – 12 to (d) (ii) 1.1 - 18). The berms need to resist wave attack and prevent flooding of the mining excavation. At this stage only conceptual designs have been developed and these are described in general terms that would need to be refined for each particular site. The following assumptions are made:

- The mining areas are small. WCR have indicated areas up to 200 m by 200 m would be mined at a time.
- Mining will occur quickly (<6 months duration).
- Life of protective berms is short (<1 year).
- Mining excavations are shallow (<5 m below NGL).
- The mining areas are confined to the inter-tidal area and the surf zone, and do not extend to water depths greater than 4 m.
- Materials and equipment are on hand for maintenance of the berms after storms.
- The berms would be located in shallow water (in general terms: within the surf zone), where the greatest wave heights are determined by the local water depth.
- The method described in the Rock Manual (CIRIA, 2007) was used to determine depth-limited design wave heights for several possible berm locations/water depths. Two alternatives were considered and both are considered preferable, as shown in Figure (d) (ii) 1.1 - 8, including the following:
- Generic rock berm with conventional statically stable rock armour slope.
- Alternative rock berm would be dynamic reshaping of rock slope with shore perpendicular groyne.

Alternative 1 (Preferred Alternative): •Generic rock berm with conventional statically stable rock armour slope		
Description	Lat (DDMMSS)	Long (DDMMSS)
A possible layout is indicated in Figure (d) (ii) 1.1 – 7 for a situation where the mining site is located in a bay, with rocky headlands on either side. The layout of the berm shown is for a theoretical mining site and indicative volumes are shown in Figure (d) (ii) 1.1 - 7. These volumes are for an assumed mining area of approximately 200 m by 200 m and sea bed depths up to -2.5 m MSL at the location of the shore-parallel berm. The grey highlighted part in Figure (d) (ii) 1.1 - 7 is that required to protect the stage 1 mining block. The lighter shaded berm is the additional shore-parallel berm required for protection of the Stage 2 mining block. The berm could be constructed outward from the headland, before turning parallel to the coast. This connects to the shore with a shore-perpendicular berm. The cross-section design, and thus required rock volumes, would be a function of the water depth at the specific site. The mining could occur in stages, with additional berms constructed or extended as additional mining is undertaken. **Advantages** 1) It may be possible to re-use berm material by stripping it from the areas where mining has been completed and using it to construct new berms. 2) Impacts on the intertidal and subtidal marine areas and alteration of benthic communities would be minimal as rock berms are not as highly susceptible to erosion as other methods such as beach accretion.	Table (d) 10.10-8 - 3	

Alternative 1 (Preferred Alternative): •Generic rock berm with conventional statically stable rock armour slope		
Disadvantages 1) This alternative requires large armour stones for berms located in water deeper than -3 m MSL, e.g. median mass of 5.3 to 7.5 tonnes for water depths of 3 m to 4 m. Such heavy stones may be difficult to produce in sufficient quantities, as well as requiring large and specialised machinery to load, transport, and place. 2) Applying a generic design without adapting it to the site conditions can result in an over-designed structure, which would result in high costs, or an under-designed structure that has a probability of failure. Failure could fatally result in loss of lives).		
Alternative 2: Alternative rock berm - dynamic reshaping rock slope with shore perpendicular groyne		
Description	Lat (DDMMSS)	Long (DDMMSS)
The layout for the alternative, dynamic re-shaping berm is shown in Figure (d) (ii) 1.1 - 8 . Indicative volumes required for an assumed mining area of approximately 200 m by 200 m and seabed depths up to -4.0 m MSL at the location of the shore-parallel berm are shown in Figure (d) (ii) 1.1 – 8 and Table (ii) – 2. The protection works consist of the shore perpendicular groyne constructed as a conventional rock structure, and a dynamic reshaping shore-parallel berm. The berms required for stage 1 mining block are highlighted in grey. The additional shore-parallel dynamic reshaping berm required for protection of the stage 2 mining block is shown in lighter shading.	Table (d) 10.10-8 - 3	

Alternative 1 (Preferred Alternative): •Generic rock berm with conventional statically stable rock armour slope		
The dynamic reshaping berm needs to be sufficiently wide (thick), particularly as it will take several storm events in order for a stable shape to be attained. After initial construction, where material would be end-tipped at the angle of repose, each subsequent high wave and water-level event will shape the profile. During this time it may be necessary to place additional material in order to maintain a safe crest width and elevation. For a berm located in water depths of 3 m to 4 m to MSL, the crest elevation of between 11 m and 12 m would be required. **Advantages** 1) This alternative requires smaller armour stones for berms as compared to generic rock berm with conventional statically stable rock armour slope. **Disadvantages** 1) The design life of the berms is relatively short and thus over a period of a few years they would be eroded by large storms.		

i) 4.4 Other activity alternatives that were considered include the following:

Mining method alternatives for both sea- and land-based operations were considered for onshore, surf zone and offshore environments. These include the following:

1. Hydraulic mining.
2. Sea-walker technology
3. Directional or navigational drilling.
4. Continuous research and development on alternative mining technologies.

Alternative 1 (Preferred Alternative): hydraulic mining		
Description	Lat (DDMMSS)	Long(DDMMSS)
The hydraulic mining would be considered for mining deep channels such as the LKB_04 Channel on Mitchell's Bay where excessive overburden has been defined. The hydraulic mining methods would be used for overburden stripping and/or beach accretion in such cases (see Section d) 3.2.1, Illustration 2). The hydraulic mining method utilizes high pressure water jets of 28-40 bar depending on material properties. A high pressure pump station with constant location delivers seawater by steel and flexible high pressure lines to the track-mounted, remote controlled mobile water monitor guns. A top-down herringbone mining/stripping method is preferred as this allows for safe cutting angles, safe operating conditions and safe access around monitors. For courses and mining a bottom-up mining will be applied. The slurry produced is channelled to a slurry pump station where the slurry pump is mounted on a pontoon. The slurry is then returned to the beach for beach mining purposes. Hard safety barricades are used to protect monitors and active production faces. **Advantages** 1) The method is well suited to extract ore bodies situated in impenetrable areas, under water or ore bodies with unsuitable shape for conventional mining methods. 2) The method may become an economically viable mining method to extract ore from both the Megaladon channel and its tributaries on land as well as for the offshore submarine channels. 3) Possibility to design a methodology that allows for safe cutting angles.		

Disadvantages 1) Hydraulic mining, where employed, will require electrical power and will impact on electricity cost. The eventual cost will depend on the size and location of the operation**.** 2) Viability to be aligned to the changing nature of the resources. 3) Management of the movement of slurry and risks associated with pump failures and potential contamination of water resources. 4) Excessive overburden is a prerequisite. 5) High costs associated with high pressure water jets and high pressure pump stations.		
Alternative 2: Sea Walker Technology		
Description		
The "AquaWalker" is a mobile mining platform comprised of an 8 m triangular walking platform with a remotely operated mounted suction pump and/or sometimes excavator. A standard gravel pump is mounted on the front of the machine, below water level, with a canaflex hose and suction head connected to the pump. Divers support the suction head, as in the case of a boat unit, and gravel is pumped through a classifier to screen the material onboard. In the case of the AquaWalker the screened gravel is pumped to shore where it is bagged and transported to the plant. **Advantages** 1) The advantage of the AquaWalker above floating vessels is mainly the stable working platform that it provides for the operator. The machine can operate in difficult sea conditions and is able to pump the material directly to shore, thus cutting transport cost.		

Disadvantages 1. This technology can only mine shallow gravels on or near the seafloor and will not be able to penetrate the expected 20 m or more of sand and clay overburden in the current offshore channel mining targets. 2. It is an as yet untested technology on the West Coast of South Africa.		

Alternative 3 (Preferred Alternative): Directional/Navigational Drill-Mining		
Description	Lat (DDMMSS)	Long(DDMMSS)
Directional or navigational drilling (Section d) 3.2.2) is a mining method applied to deeply buried ore deposits such as the deep Cretaceous channel systems in the Koingnaas mining area and has already been investigated and tested locally by De Beers. Systematic pre-planned pilot holes are normally drilled across the ore body after which the holes are reamed to up to 1, 3 m diameter and the ore extracted. Directional drill-mining could be considered for mining deeply buried channel gravels such as the LKB_04 channel, any other on- and off-shore Cretaceous channel, and specifically the deeply buried gravels of the Megalodon channel feature. **Advantages** 1) Can be used to mine from the land to offshore or onland under very deep cover. 2) Suitable for the Megaladon channel and its tributaries onland as well as offshore submarine channels. 3) Existing research and successful application in Australia with a drill hole spanning the bottom of Tamar River for a distance of over 2 km.		

For land mining operations, open cast mining will be utilised as the in situ gravel ore body, although discontinuous, is near surface and relatively flat lying with a large horizontal extent, making it amenable to open cast-strip mining.

i) 4.5. No go alternative

This alternative includes the option of not implementing the planned mining activities i.e. not undertaking any of the proposed land mining and particularly surf, beach zone and offshore channel mining activities or any of the associated structures and infrastructure development such as the construction of slimes dams, slimes delivery pipelines, access routes and processing plants at Koingnaas and Mitchell's Bay. The major probable advantage of not implementing any of these activities is that there will be negligible impact on the flora and fauna of the proposed land and beach mining areas. However, more importantly, the disadvantages include a loss in initiatives such as Operation Phakisa, which involves the sustainable exploitation of the oceans for resources which will in turn alleviate poverty, generate economic opportunities, create jobs and curb corruption and crime through the protection of the ocean environment from illegal activities. It is estimated that more than 500 employment opportunities will be created by the proposed project. Furthermore, if the project is not implemented, the planned relinquishment of certain areas by WCR to San Parks for public access in the form of the MPA might not realize.

ii) Details of the public Participation Process Followed

Describe the process undertaken to consult interested and affected partied including public meetings and one on one consultation.

NB: The affected parties must be specifically consulted regardless of whether or not they attended public meetings. (Information to be provided to affected parties must include sufficient detail of the intended operation to enable them to assess what impact the activities will have on them or on the use of their land).

Table (g) (ii) - 1 below shows the public participation process undertaken followed.

Table (g) (ii) - 1: Public participation process

Activity/Task	**Objectives**	**Execution Process**	**Deliverable**
1. Stakeholder profiling, data collection and identification of relevant stakeholders and Interested and Affected Parties (IAPs).	• To ensure that all the relevant stakeholders and Interested and Affected Parties (IAPs) are identified in accordance with the National Environmental Management Act (NEMA), EIA Regulations, 2014. • To understand the socio-economic and geographic environment and key role players within these sectors. ➢ Identification of relevant stakeholders and IAPs. The stakeholder profiling was done to identify all the relevant stakeholders upfront, from various stakeholder sectors, as guided by the NEMA regulations, including the following: ➢ Mining sector including other mining companies undertaking mining activities in adjacent area e.g. Alexkor SOC Ltd. ➢ Forestry and Fisheries (including organisations and businesses engaged in aqua-cultural activities e.g. abalone ranching businesses. ➢ Telecommunications, where	• The stakeholder engagement was commenced to alert key stakeholders about the proposed continuation of the mining activities at the application area. The following approach was employed. • Understanding of scope of works from applicant. • Sourcing project maps from the Title Deeds office and Geographic Information Systems (GIS) database sources; Identification of project locality and neighbouring activities and uses. • Understanding of the site ➢ Delineating municipal boundaries and associated ward details. ➢ Literature review of existing documents and reports including the Municipal Integrated Development Plan (IDP), Environmental, Framework, Local Economic Development Plans, Municipal by-laws, and Provincial	• Interested and Affected Parties Register (IAPR) Appendix h-3 • Project locality plans. • Municipal boundary maps

Activity/Task	Objectives	Execution Process	Deliverable
	applicable) (Telkom), electricity (Eskom); Water supply; Waste management. ➢ Transport such as (Department of Transport). ➢ Conservation such as Sanparks. ➢ Community development and social service (e.g. municipalities), Non-Governmental Organisations (NGO's). ➢ Relevant private companies.	ordinances. • Literature review of specialists /experts reports that have contributed to the understanding of West Coast beaches. • Information sourced from specialist studies undertaken in the area e.g. Marine Studies and Bathymetry Studies. • Analysis and review of applicable legislation; • Utilising regional and local setting maps to identify: Landowners, adjacent landowners and occupiers of land adjacent to the proposed mining activities and associated processing areas; Municipal Councillors of Namakhoi Local Municipality and Kamiesberg Local municipality, which are the wards in which the project activities are located, as well as the municipalities in which has jurisdiction in the area. • National and provincial government departments were sourced from previous	• Updated IAPR. • Preliminary engagement emails (Appendix h-4).

Activity/Task	Objectives	Execution Process	Deliverable
		experience and knowledge of the government departments, who administer law relating to matters affecting the environmental aspects relevant to an application for this environmental authorisation. As such the Departments of Agriculture, Forestry, and Fisheries (DAFF); Department of Environment, Nature and Conservation (DENC), Department of Environmental Affairs (DEA) (Oceans and Coast) were preliminarily identified as well as suite of other government structures, Non-profit government organisations and community based organisations, and business and industry. Therefore, care was taken to include organs of the state, which have jurisdiction in respect of the activity to which the application relates.	

Activity/Task	Objectives	Execution Process	Deliverable
1.1 Data Verification	• To validate the preliminary collected data and check credibility to ensure that the relevant Stakeholders and IAPs are contacted	• Validation of collated information was done and will still be done through the next project stages such as scoping through literature review of existing documents and reports including the Municipal IDP, existing Environmental Management Programmes (EMPr), Mining Works Programme (MWP) and Social and Labour Plans. • Contacting key stakeholders to preliminarily introduce the project and verify collected data.	
2. Stakeholder engagement: The information collected during stakeholder profiling was used to determine the best engagement strategies. The literacy levels and circumstances that could hinder effective participation had been noted during these stages. As such it was determined that the language barrier could be a risk at grass root level.	The main objectives of the stakeholder engagement were as follows: • To inform stakeholder authorities about the proposed project; • To clarify legislative and administrative requirements; • To gather issues and concerns regarding the project and ensure that they are addressed in the Scoping Report; • To facilitate review and informed input into the scoping report;	The strategy for stakeholder engagement is planned as follows: • Pre-consultation meetings before submission of the application form; • Adverts and site notices to engage stake holders during the scoping process.; • Notification of stake holders about the report and adverts during the EIAR phase.	• Submitted written issues and concerns. • Presentations held during meetings. (Appendix h-5-2). • Agendas of meetings. (Appendix h-5-2). • Outcomes of the stakeholder meetings as shown in Appendix h-5-3 (Outcomes of Stakeholders Meetings). • Background Information Document as shown in Appendix h-6.

Activity/Task	Objectives	Execution Process	Deliverable
As a control it was decided to have an Afrikaans communicator and the key engagements at Environmental Impact Assessment Reporting (EIAR) stage, will be summarised in Afrikaans. The adverts and site notices will also be presented in Afrikaans.	• To organise meeting and do a presentation of the project to the stakeholders; • To compile the minutes of the meeting; • To ensure incorporation of issues in the Scoping Report and Environmental Impact Assessment Report; • To facilitate compilation of Issues and Response Report.	**To date the activities outlined below were executed:** There were pre-consultation meetings held with competent and commenting authorities. The meetings were held as follows: • Department of Mineral Resources (DMR) on 09 March 2015; • DAFF on 14 September 2015; • DENC on 15 September 2015; • DEA (Department of Environmental Affairs, Oceans and Coasts) on 18 September 2015. • DEA (Department of Environmental Affairs, Oceans and Coasts) on 18 September 2015.	
		The meeting organisation entailed telephonic communication to organise meetings, sending emails to confirm the dates and confirmation of meetings and circulation of proposed agenda. The ward councillors were preliminary notified about the project	

Activity/Task	Objectives	Execution Process	Deliverable
		via telephonic contact and subsequent emails and were engaged as well during the distribution of the scoping report.	
		Telephonic engagements to solicit data were also done in Afrikaans. There were no mobility aspects that could hinder stakeholders from participating.	The emails also worked effectively in this region, however other modes of communication such as faxes were used. Documents were also placed at strategic places to allow access.
3. Notification of stakeholders (adverts and site notices)	• To ensure that stakeholders are notified about the project and as such are given an opportunity to provide comments and suggested solutions for some of the identified issues. • To ensure that the scoping report is reviewed by the stakeholders.	An advert was placed on the Namakwalander newspaper on 04 March 2016. Site notices were erected on site and at other strategic places on 04 March 2016. Due to suspected technical glitches on the newspaper printing process, which resulted in other papers not having the copy of the advert, a re-advertisement process was done and the advert was re-run on the same newspaper on 11 March 2016. Site notices were re-erected on site and other strategic places on 11 March 2016. Copies of the scoping report	• Proof of advert (Appendix h-1). • Proof of site notices (Appendix h-2). • Reply slip (English and Afrikaans) (Appendix h-7). • Report distribution record (Appendix h-4.1). • Notification Letter about the scoping report (to authorities) (Appendix h-4.1). • Notification Letter to IAPs (English and Afrikaans) (Appendix h-4.3.2). • Report Notification list

Activity/Task	Objectives	Execution Process	Deliverable
		were sent to authorities on 16 March 2016, via email web link. The email was structured as follows: 1. Notification Letter. 2. Notification Letter. 3. Volume 1: (Section 2a to biii Description of overall activities). 4. Volume 2: Section h (v) to Section k (Environmental attributes). 5. Volume 3: Public participation and supporting documents (Appendix 1 to h-7, including Appendix 2.19.1- Appendix 2.19.2). An email notifying the stakeholders about the report availability was emailed to Ward Councillors and registered stakeholders on 14 March 2016. The copies of the scoping reports were placed at areas where stakeholders could visit to review them at the following places: 1. Koingnaas Mine Office (for all other interested and affected parties). 2. Springbok Library (for interested stakeholders since Springbok is	(Appendix h-4.3). • Report web link (Appendix h-4.1). • Proof of submission of hard copies of the report (Appendix h-6.2). • Comments received (Appendix h-4.2 and Appendix H-4.4).

Activity/Task	Objectives	Execution Process	Deliverable
		the main town. 3. West Coast Resource’s Offices in Cape Town (for other stakeholders and authorities who have their offices in Cape Town such as DEA: Oceans and Coasts. The comments that were either, faxed or emailed to the EAP were incorporated into the scoping report that was provided to stakeholders.	
EIAr Consultation	• To follow upon the comments that were received.	Copies of the scoping report were sent to authorities on 16 March 2016, via email web link. The email was structured as follows: 6. Notification Letter. 7. Volume 1 of 4 (Part A, Volume 1: Background on the Project and BaselineEnvironment (Section 1 – 3 g (iv). 8. Volume 2 of 4 (Part B:Environmental Management Programme Report) and Part A, Volume 2: Impacts and risks identified andmanagement measures (Section 3 g (v) – 3v) 9. Volume 3 of 4: Public	• Minutes of meetings and presentations • Presentations • Invitation letters and agendas (Appednix h)

Activity/Task	**Objectives**	**Execution Process**	**Deliverable**
		participation and supporting documents (Appendix 1 to h-7, including Appendix 2.19.1-Appendix 2.19.2). 10. Volume 4 of 4 (Specialist report). An email notifying the stakeholders about the report availability was emailed to Ward Councillors and registered stakeholders on 14 March 2016. The copies of the scoping reports were placed at areas where stakeholders could visit to review them at the following places: 4. Koingnaas Mine Office (for all other interested and affected parties). 5. Springbok Library (for interested stakeholders since Springbok is the main town. 6. West Coast Resource's Offices in Cape Town (for other stakeholders and authorities who have their offices in Cape Town such as DEA: Oceans and Coasts.	

Activity/Task	Objectives	Execution Process	Deliverable
		The comments that were either, faxed or emailed to the EAP were incorporated into the scoping report that was provided to stakeholders. A meeting was held with DCA on 23 May 2016 to discuss ToR for Aquaculture Study and the comment that were submitted to the EAP regarding impacts of mining activities. A meeting was held with DAFF on 03 June 2016 to discuss raised issues and finalise formulation of ToR for Aquaculture Study and provide feedback on the meeting that was held with DCA. A meeting was also held with DEA on 24 May 2016 to discuss the monitoring protocol for the beach mining activities. The notification of stakeholders about the EIAr was done through letters and emails. The distribution list for the report is also included in Appendix H. The reports were also placed at the same locations as the scoping report. The Aquaculture study was sent to DCA and Mr Jonker and they were notified about the expectected EIAr	

Activity/Task	**Objectives**	**Execution Process**	**Deliverable**
		review timelines.	
EIAr Consultation	28 September 2016	A meeting with PCC was held on 28 September 2016 to discuss the findings of the Environmental Impact Assessment (EIA). The meeting was organised through WCR, as official members of the PCC. A presentation was given during the meeting. Collation of Comments Comments on the EIAr were received on 28 to 31 October 2016. The following entities submitted their comments: 1 DENC; 2 SAN Parks; and 3 DCA. 4.Dawid Markus	• Presentation of the EIAr findings • PCC meeting attendees • PCC minutes

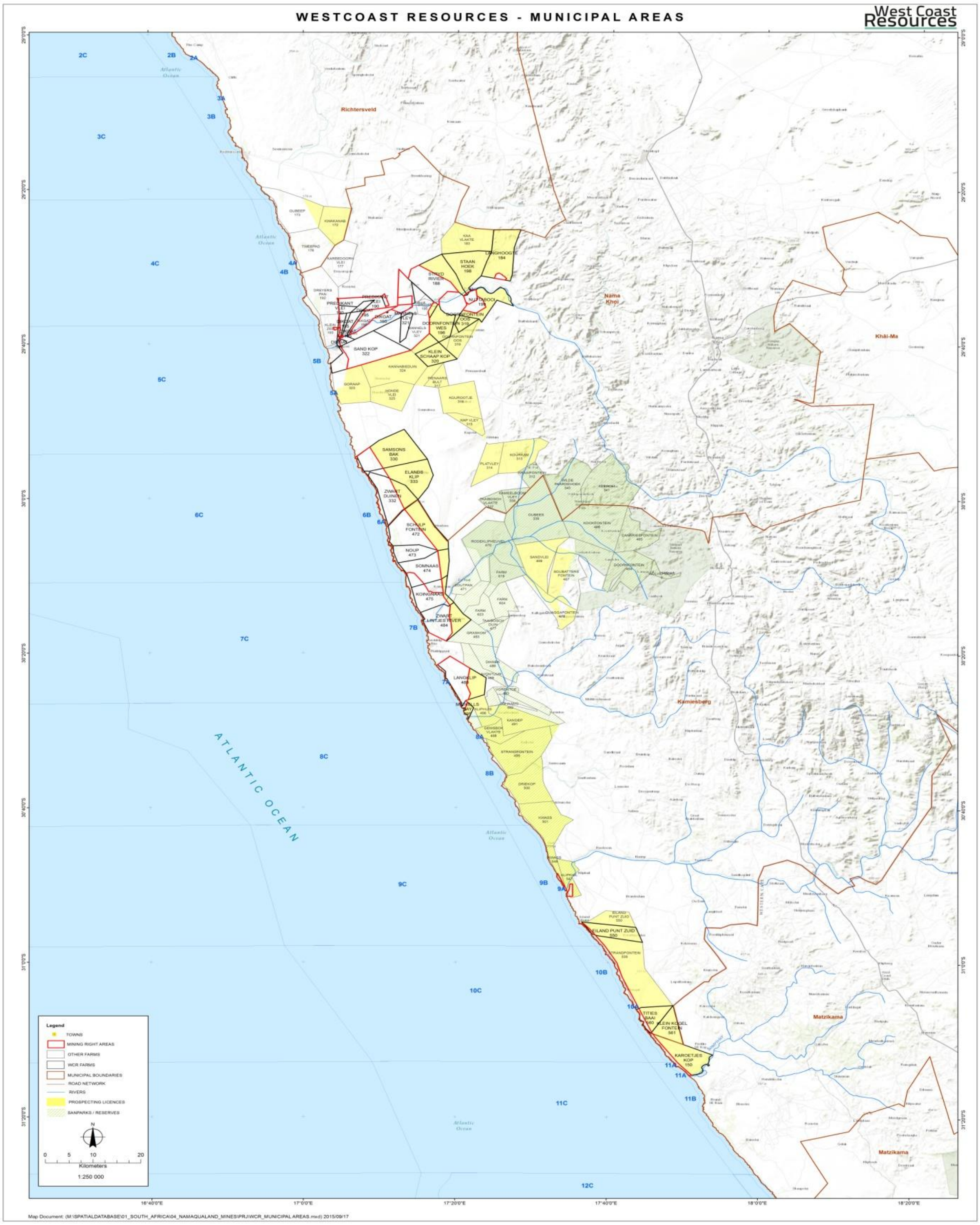

Figure (g) (iv) 4.1 - 3: Municipal boundaries

iii) Summary of issues raised by I&Aps

(Complete the table summarising comments and issues raised, and reaction to those responses).

Outcomes of meetings where most of these issues were raised are included as Appendix 5. A comprehensive summary of the issues raised is shown Table (g) (i) 4.1 - 3.

A summary of the issues raised is summarised below.

- Overlap of proposed mining activities with proposed MPAs and with Operation Phakisa.
- Potential conflict with abalone ranching rights holders regarding water quality and habitat loss, particularly those companies that have already started seeding juveniles.
- Increased turbidity near mining site(s) may compromised water quality at the seawater intakes to land-based abalone farms. The impacts of suspended sediment plumes and elevated turbidity as a result of mining operations need to be assessed.
- Increased turbidity near mining site(s) may impact filter feeders.
- Requirements for discharge permits regarding discharges to the sea (particularly from diver-assisted shore units) is unclear.
- Blasting in the marine environment should be avoided and materials used for the construction of berms re-used as much as possible.
- Concern regarding the introduction of non-native material onto the beach during berm construction;
- Concern regarding the disturbance to marine habitats and associated biota through mining in subtidal areas. The impacts associated with coffer dam construction vs. accretion need to be carefully considered.
- As seal colonies are unique habitats within the project area these should be mapped, and information available at DAFF and DEA should be used.
- Quantitative marine baseline studies focussing on the specific mining sites need to be undertaken;
- Provide DEA with information on the experimental design of baseline and monitoring studies prior to commencement of surveys.
- WCR to give consideration to co-ordination of monitoring programmes with DEA and sharing of research information. Baseline and monitoring studies should focus both on rocky habitats (including an assessment on the impacts on reef structure) as well as sandy beach habitats.
- The recovery of these habitats following mining needs to be understood from the perspective of species recruitment and colonisation.

- Monitoring programmes should be co-ordinated to ensure an upfront understanding of sensitive habitats in the project area, with subsequent avoidance of these in the mine plans.
- WCR to give consideration to implementing a strategic environmental assessment (SEA)approach in partnership with other role players in the area so as to gain a broader understanding of the coastline rather than focusing on the project specific sites.
- Decommissioning and closure is required of old mining sites no longer used; As active rehabilitation below the low water mark is not practicable, there is concerns that wave action may not be sufficient to ensure natural rehabilitation of berms.
- Impacts of mining activities on abalone ranching community and the economic effect of such impact on the regional socio-economic contribution of this mariculture economic activity.
  - It is believed that it would be unlikely that the DCA abalone ranching initiative would be viable if we DCA were excluded from the majority of the suitable seeding sites in NC Zone 4 for significant periods of time.
  - It is believed that the DCA abalone ranching initiative would not be viable if there is significant habitat destruction and/or if seeded abalone is destroyed through mining operations.
- Ensuring that rehabilitation objectives are met.
- Ensuring that there are land claim aspects within the application area are understood and dealt with according to the proper process guided by the administrative and legislative requirements.
- Ensuring transparency in communication with stakeholder and human rights are upheld.
- It is believed that WCR does not conduct environmental impact assessment and this must be done and the company must propose management measures that will mitigate against the negative environmental impacts.
- WCR to look for opportunities to support community livelihoods.
- Post mining land use considerations must be done in collaboration/consultation with the community.
- The pre- consultative meeting with regulatory authority, to discuss design and process approaches and possible interactions with aquaculture industry were acknowledged and appreciated.
- Potential conflict with aquaculture, abalone ranching rights holders is a concern.
- Promotion of dialogue between ranching rights holders and WCR should be done.
- Establishment of efforts to co-exist with the abalone ranching rights holders in the study area are key.

- Recognition of the current investments into the pilot projects, of which some are registered as operation Phakisa Projects, and opportunities presented by this aquaculture investment, to increase jobs, food security and revenue for the country is required.
- Socio economic study to address the potential water quality threat to the land based Abalone facilities and ranching rights holders should be considered.
- The physical copies of the EIAr and EMPr are placed too far away from the community of Hondeklip Bay to review.
- Mr Markus Dewid, a representative from Hondeklip Bay claims, because of the distance-issue, there was only a notification sent out and no chance to review the report and calls it procedurally not fair.
- There is a call to respect the rule of law and that the EIA report and the EMP was never available for review to the IAPs on the merits.
- He then continues on to give an explanation on the importance of "good governance".
- He then continues his communication and request that the report be made available at the Hondeklip Bay Library for the community to have the means to have access to it and time to review it.
- He then concluded his communication by requesting the following: "Please must stop the whole process because it was not procedural fair."
- The area that will be disturbed has been checked against the Northen Cape Critical Biodiversity Map, but the total area that will be disturbed should be indicated.
- Coastal and sea mining activities should be planned and spaced in such a way that there will always be a nearby, undisturbed habitat of the same type as the one that is being disturbed nearby.
- The proposed mitigation measure of the placement of slimes dams close to the ocean so that any seepage will take place directly into the ocean needs more careful consideration and investigation. The effects of such seepage on the coastal environment and sands and the duration of any such effects should be indicated.
- The final EIA should include a more thorough description of the endangered or rare plant species in the area.
- Even though West Coast Resources has given assurances at the PCC meeting that public access will remain open, they need to manage the security of the minerals.
- There is a concern on the usage of groungwater, as it is not enough to supply Koingnaas and Hondeklip Bay. The usage of groundwater is a concern even beyond life of mine.

- The publication of the EIAr in terms of its placement and the fact that it was not translated in Afrikaans was a concern, especially to the local community who may not have access to internet and the low rate of literacy.
- There is no indication of a meeting or consultation with San Parks, which is a majour stakeholder and falls adjacent to the mining activities and its impacts on the Namaqua National Park.
- Sedimentation of intertidal and subtidal reefs due to redistribution of sediments has been seen as a concern.
- A monitoring system should be done on the turbility and the dust plumes that will be generated by the operations.
- Out of the 16 potential abalone seeding sites in the NC Zone 4 concession area, 13 are immediately adjacent to and/or overlaps the mining concession area. This is a concern on the conflict of interests.
- DCA's financial viability venture will potentially be significantly affected by the planned mining operations, both in terms of potential ecological impacts and restricted access to seeding sites.
- There is also a concern expressed by DCA that WCR, are not willing to meet them halfway in negotiating a better way of coexistence.
- A concern on extensive environmental damage to several the coastal and marine environments, within the buffer zone of the Namaqua National Park.
- There is also a concern on the mining impact on the swartlintjies estuary.
- Possible loss of biodiversity in the intertidal, shallow subtidal habitat of a marine embayment.
- Air and water pollution associated with mining activities and the impact thereof on the Namaqua National Park and proposed Namaqua Marine Protected Area

Table (g) (ii) - 2: Summary of issues raised by I&Aps

Interested and Affected Parties . List the names of persons consulted in this column, and Mark with an X where those who must be consulted were in fact consulted.		**DateComments Received**	**Issues raised**	**EAPs response to issues as mandated by the applicant**	**Consultation Status (consensus dispute, not finalised etc.)**
AFFECTED PARTIES					
Landowner/s	X	N/A	None	None	The applicant, WCR, is the landowner of the affected properties.
West Coast Resources (Pty) Ltd					
Lawful occupier/s of the land	X	N/A	None thus far	None	WCR is the land owner.
Municipal councillor	X		No comments		
Municipality	X		No comments		
Organs of state (Responsible for infrastructure that may be affected Roads Department, Eskom, Telkom, DWA	X	Required licenses and water authorisations are being sought. A			

Interested and Affected Parties . List the names of persons consulted in this column, and Mark with an X where those who must be consulted were in fact consulted.		**DateComments Received**	**Issues raised**	**EAPs response to issues as mandated by the applicant**	**Consultation Status (consensus dispute, not finalised etc.)**
		water use application was submitted to DW&S. The communication is ongoing and aspects raised will be addressed in the future studies.			
Department of Water and Sanitation	**X**		An acknowledgement of the application for a water use licence.	None thus far.	Licences for water use applications have been lodged with the Department of Water and Sanitation.
South African National Parks		28 October 2016	There is no consultation of SANParks during the initial stakeholder process (2015),	The Sanparks involvement is ongoing as part of the relinquishment of land	A meeting was held with SANParks for 25 November 2016. The matter of land relinquishment

Interested and Affected Parties . List the names of persons consulted in this column, and Mark with an X where those who must be consulted were in fact consulted.		**DateComments Received**	**Issues raised**	**EAPs response to issues as mandated by the applicant**	**Consultation Status (consensus dispute, not finalised etc.)**
			even though SANParks is a state entity, major land owner, and direct neighbour to the proposed site. An indication of West Coast mineral rights in the southern Lang vlakte section, which might fall within the boundary of Namaqua National Park (map resolution to small). Extensive environmental damage to several the coastal and marine environments, within the buffer zone of the Namaqua National Park. Concerns about the increased saline conditions of the	(Drawing 001). The map showing the mining and prospecting rights areas was submitted to SanParks. The prospecting right on Michell's Bay is included in the area under the WCR mining right application. This included a portion of the farm that extends to the south of the Spoeg River. However,as part of the sale agreements with DBCM the surface rights and prospecting rights to the portion of Michell's Bay that fall south of a line 200m north of the Spoeg River under	will still be ongoing, outside of the EIA process. The prospecting right areas South of the Spoeg River, and about 200 m north of this same river, as shown in Drawing 001, is the subject of discussion between WCR and SANParks.

Interested and Affected Parties . List the names of persons consulted in this column, and Mark with an X where those who must be consulted were in fact consulted.		**DateComments Received**	**Issues raised**	**EAPs response to issues as mandated by the applicant**	**Consultation Status (consensus dispute, not finalised etc.)**
			groundwater through seepage from slime dams. Mining impact on the Zwart Lintjes estuary. Loss of biodiversity in the intertidal, shallow subtidal habitat of a marine embayment. Air and water pollution associated with mining activities and the impact thereof on the Namaqua National Park and proposed Namaqua Marine Protected Area.	discussion to be elenquished. With regards to bullet three, there is a Monitoring study done by the Marine specialist in Volume 4 of 4, Section 7.1.2 and on the also, there are mitigation measures in the EMP, Volume 2 of 4, Part B, Table (d) (ix) 1-1, under topic Surfzone related Impacts, point umber 1. Regarding concern on increased saline conditions of ground water through seepage as indicated in bullet four, this is addressed in the EMP in Volume 2 of 4, Part B, Table (d) (ix) 1-1, under topic Fine Tailings Disposal (Slimes	

Interested and Affected Parties . List the names of persons consulted in this column, and Mark with an X where those who must be consulted were in fact consulted.		DateComments Received	Issues raised	EAPs response to issues as mandated by the applicant	Consultation Status (consensus dispute, not finalised etc.)
				dams). With regards to bullet 5 on the impacts to be caused by mining on the Swartlintjies, there is a specialist study done for monitoring of the estuary and this is on the EIAr in Part A, Volume 4 of 4, Section 7.1.2, subsection 5.3 of the Marine Monitoring Report, under heading Environmental Management. The Dust Plume report in Volume 4 of 4, Section 4 addresses the last point on the last bullet on air pollution. The Water specialist report under Volume 4 of the EIAr report as	

Interested and Affected Parties . List the names of persons consulted in this column, and Mark with an X where those who must be consulted were in fact consulted.		DateComments Received	Issues raised	EAPs response to issues as mandated by the applicant	Consultation Status (consensus dispute, not finalised etc.)
				well as the Estuary management report deal with the matter of water pollution.	
Communities					
Hondeklip Bay Community	**X**	18 April 2016	The EIA process. The beach mining has already started without Environmental Authorization. Huge damages have already been done to the beach. Environment and the marine life. The current beach mining has a negative effect on the locals and the	Acknowledge receipt of the comments and expressed concerns which were faxed on 18 April 2016. The comments have been noted and were included in the scoping report which was submitted to DMR. The subsequent stage of the process was to investigate the issues further to determine the	The listed activities requiring and the EIA ara clearly defined in Volume 1 of 4 (Part A of Volume 1, Section ii) 1:Triggering Activities associated with Mining and Prospecting.

Interested and Affected Parties . List the names of persons consulted in this column, and Mark with an X where those who must be consulted were in fact consulted.		**DateComments Received**	**Issues raised**	**EAPs response to issues as mandated by the applicant**	**Consultation Status (consensus dispute, not finalised etc.)**
			fishermen. Beaches are not accessible for those depending on the sea for a living and there is a danger of every time trespassing for those who need to catch fish. **Rehabilitation** It is a global phenomenon in which large operators transferring liabilities to less responsible operators. This leads to the ultimate burden for clean up being born by local communities and the state. The community is calling upon the all relevant Government Departments	actual environmental impacts and to develop mitigation measures and associated monitoring plans. This was done in the EMP which is found in Volume 2 of 4 (Part B, Volume 2) Section 6 of the report. Table (g) (v) 1-1: Impact assessment Table, Part B. Table (g) (vii) 1-1: Mitigation measure, Part B, and Table (g) (ix) 1-1: Measures to rehabilitate the environment , point 5 (g). The commenting stage wasexpected to be completed	

Interested and Affected Parties . List the names of persons consulted in this column, and Mark with an X where those who must be consulted were in fact consulted.		DateComments Received	Issues raised	EAPs response to issues as mandated by the applicant	Consultation Status (consensus dispute, not finalised etc.)
			and specific DMR to recognize the rights of those representing the environment, and the rights of the communities. We therefore want to have a voice in the process of environmental review and transfer of mineral rights. No Restoration of these areas has taken place since mining operations took place within the area. Nothing has been done so far to ensure that this land is returned to a valuable state. **Land claim**	in 29 Octoberr 2016.	

Interested and Affected Parties . List the names of persons consulted in this column, and Mark with an X where those who must be consulted were in fact consulted.		DateComments Received	Issues raised	EAPs response to issues as mandated by the applicant	Consultation Status (consensus dispute, not finalised etc.)
			The community wants their land claim to be resolved before any authorization can take place. The mining companies including West Coast Resources are not committed to operating in accordance with the principles of sustainable development. This means ensuring that activities undertaken today meet the needs of the present without compromising the ability of future generations. They are only interested to meet their own needs and that is		

Interested and Affected Parties . List the names of persons consulted in this column, and Mark with an X where those who must be consulted were in fact consulted.		DateComments Received	Issues raised	EAPs response to issues as mandated by the applicant	Consultation Status (consensus dispute, not finalised etc.)
			making a profit. **Beach mining** West Coast Resources does to take account of, the longer term economic, social and environmental implications of their decision making - not just for business but to society at large. Their business activities are not in an ethical, transparent and consultative way because they have already started with beach mining without the relevant authorizations.		This is addressed in Volume 4 of 4 (Specialist studies, Marine Monitoring report, under Section 2.2. Beach and channel offshore mining). The aspect of sustainability are covered under the EMP, Volume 2, Part B, whereby stakeholders will be engaged, and a community liaison office role will be undertaken.

Interested and Affected Parties . List the names of persons consulted in this column, and Mark with an X where those who must be consulted were in fact consulted.		DateComments Received	Issues raised	EAPs response to issues as mandated by the applicant	Consultation Status (consensus dispute, not finalised etc.)
			The mines are not guided by the Universal Declaration of Human Rights when implementing these Sustainability Principles. The mines encourage or support conflict and human as well as environmental suffering. Ensure impact assessment is undertaken prior to beginning any mining activity is not what happens at the moment. Negative impacts on the environment are not mitigated and profit is the only concern. Impact assessments are not		

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			undertaken in accordance with the best practice social and environmental principles of the International Association for Impact Assessment (IAIA) and equivalent standards of the World Bank. **Environmental protection** WCR does not promote community development that supports the livelihoods of both present and future generations, Including beyond the life of the operation. There is no commitment to environmental		The aspect of community livelihood is addressed in the EIAr, under Volume 2 of 4 (Part A, Volume 2), Table g (v) 1-1 under socio-economic impacts in surfzones related impacts in point 8 and Volume 2 of 4 (Part B, Volume 2, EMP).

Interested and Affected Parties . List the names of persons consulted in this column, and Mark with an X where those who must be consulted were in fact consulted.		DateComments Received	Issues raised	EAPs response to issues as mandated by the applicant	Consultation Status (consensus dispute, not finalised etc.)
			protection through the conduct of rigorous social and environmental assessment and rehabilitation/management plans, developed in partnership with key stakeholders, including indigenous peoples.		
Mr. Markus Dewit (Hondeklip Bay)		02 November 2016	Mr. Markus expressed these concerns in an e-mail, addressed at the Environmental Assessment Practitioner (EAP), and highlighted the following issues: 2.1. The physical copies of the	In terms of regulation 21, subregulation (1) of the National Environmental Management Act. (Act 107 of 1998): Environmental Impact Assessment regulations, 2014, the following is stipulated: *"If S&EIR must be applied to*	

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			EIAr and EMPr are placed too far away for him and the community of Hondeklip Bay to review. 2.2. He claims, because of the distance-issue, there was only a notification sent out and no chance to review the report and calls it procedurally not fair. 2.3. He requests that we respect the rule of law and the intention of the legislation and states "The Environmental Impact Assessment (EIA) and Environmental Management Programme report (EMPr) is	*an application, the applicant must, within 44 days ofreceipt of the application by the competent authority, submit to the competent authority a scoping reportwhich has been subjected to a public participation process of at least 30 days and which reflects theincorporation of comments received,including any comments of the competent authority."* During the Scoping phase of this project, the process, stipulated above was indeed followed. Inclusive of the	

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			and was never available for review to the I&AP's on the merits. " 2.4. He then continues on to give an explanation on the importance of "good governance". 2.5. He then continues his communication and request that the report be made available at the Hondeklip Bay Library for the community to have the means to have access to it and time to review it. 2.6. He then concludes his communication by requesting	comments received, that were incorporated into the report, were those of yourself. It is important to note that the Scoping report that was subjected to the public participation process, was made available in the exact same manner than what the EIAr and EMPr were made available recently. The physical copies were available for public review at the same venues than that of the Scoping report. During the public participation process of the Scoping report, Mr. Markus did not express or submit any	

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			the following: "Please must stop the whole process because it was not procedural fair."	concerns similar than that which he is expressing as per section 2.1 of this document. Not Mr. Markus, nor anyone else commented on the accessibility of the Scoping report that was made available for public review. In contrast to his comments expressed as per section 2.1 of this document, he did indeed have access to the Scoping report and submitted his comments (which were addressed and incorporated into the Scoping report) within the 30 day period as stipulated in Regulation 21 (1) of the	

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				National Environmental Management Act. (Act 107 of 1998): Environmental Impact Assessment regulations, 2014 Given the successful public participation process that was followed for the Scoping report, it can be reasonably concluded that, if the same processes were followed for the public participation process for the EIAr and EMPr, with regards to the physical placement and online availability of the reports for public review, then it would, in its eventuality, be compliant	

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				with Regulation 23 (1)(a) of the National Environmental Management Act. (Act 107 of 1998): Environmental Impact Assessment regulations, 2014 which stipulates the following: *"The applicant must within 106 days of the acceptance of the scoping report submit tothe competent authority* *(a) an environmental impact report inclusive of any specialist reports, and an EMPr, whichmust have been subjected to a public articipation process of at least 30 days andwhich reflects the*	

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				incorporation of comments received, including any comments of the competent authority" As well as Regulation 40, subregulations (2)(d) and (3) of the same Act which stipulates the following: *"(2) The public participation process contemplated in this regulation must provide access toall information that reasonably has or may have the potential to influence any decision with regard to anapplication unless access to that information is protected by*	

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				law and must include consultation with *(d) all potential, or, where relevant, registered interested and affected parties."* *"(3)Potential or registered interested and affected parties, including the competentauthority, may be provided with an opportunity to comment on reports and plans contemplated insubregulation (1) prior to submission of an application but must be provided an opportunity to commenton such reports once an application has been*	

Interested and Affected Parties . List the names of persons consulted in this column, and Mark with an X where those who must be consulted were in fact consulted.		DateComments Received	Issues raised	EAPs response to issues as mandated by the applicant	Consultation Status (consensus dispute, not finalised etc.)
				submitted to the competent authority." 3.2. Other regulations and processes that were followed to make sure the public participation process was as procedurally fair as possible include (in relevance to this issue), but is not limited to the following: 3.2.1. According to Regulation 41 (2)(a) of the National Environmental Management Act. (Act 107 of 1998): Environmental Impact Assessment regulations, 2014, following needs to be done:	

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				"The person conducting a public participation process must take into account anyrelevant guidelines applicable to public participation as contemplated in section 24J of the Act and mustgive notice to all potential interested and affected parties of an application or proposed applicationwhich is subjected to public participation by *(a) fixing a notice board at a place conspicuous to and accessible by the public at* *the boundary, on the fence or along the corridor of*	

Interested and Affected Parties . List the names of persons consulted in this column, and Mark with an X where those who must be consulted were in fact consulted.		**DateComments Received**	**Issues raised**	**EAPs response to issues as mandated by the applicant**	**Consultation Status (consensus dispute, not finalised etc.)**
				(i) the site where the activity to which the application or proposedapplication relates is or is to be undertaken; and *(ii) any alternative site"* Hondeklip Bay were informed through site notices that were strategically placed for people to see. These site notices were in English and Afrikaans. Appendix H-2. They were alerting the public to the availability of the scoping report and where it was and that they could request it. By doing this, we addressed, the above stated, Regulation 41	

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				(2)(a) of the National Environmental Management Act. (Act 107 of 1998): Environmental Impact Assessment regulations, 2014. 3.2.2. The fact that the site notification signs were multilingual and as widely spread out as it was, shows that we also took into consideration Regulation 41 (2)(e) of the same Act which states that: *"The person conducting a public participation process must take into account anyrelevant guidelines*	

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				applicable to public participation as contemplated in section 24J of the Act and mustgive notice to all potential interested and affected parties of an application or proposed applicationwhich is subjected to public participation by *(e) using reasonable alternative methods, as agreed to by the competentauthority, in those instances where a person is desirous of but unable toparticipate in the process due to*	

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				(i) illiteracy; *(ii) disability; or* *(iii) any other disadvantage.* Community members could see the notifications placed in various conspicuous places in two different languages and in a manner where it could easily and continuously be accessed and/or referred to if dialogues about possible concerns were initiated among community members. In addition to the site notification signs, an advert that served as a notification to I&AP's about the scoping report and the	

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				EIAr and the EMPr was in a local newspaper by the name of The/Die Namaqualander on 11 March, 2016. This was compliant to Regulation 41 (2)(c) of the NationalEnvironmental Management Act. (Act 107 of 1998): Environmental Impact Assessment regulations, 2014, which stipulates that: *"The person conducting a public participation process must take into account anyrelevant guidelines applicable to public participation as contemplated*	

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				in section 24J of the Act and mustgive notice to all potential interested and affected parties of an application or proposed applicationwhich is subjected to public participation by *(c) placing an advertisement in* *(i) one local newspaper; or* *(ii) any official Gazette that is published specifically for the purpose ofproviding public notice of applications or other submissions made interms of these Regulations;"* 3.2.3. It was also our reasonable conclusion that the	

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				community would successfully be reached, since there was a submission that was received by Myezo, from Mr. Markus on 18 April 2016, via a fax to e-mail service. In this submission, he presented the concerns that were submitted as those of the Hondeklip Bay community. The submitted concerns were captured and addressed in the EIA report.It was as such understood that the community was indeed reached and hadpresented their unified submission by means of this submission, rather than as	

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				individuals. It was then against this same understanding that the EIArwas sent to the registered parties and as such to Mr. Markus. We feel it is more than reasonable to believe that the Hondeklip Bay community would then be able, in the same manner than what they were during the Scoping phase, to be reached and have them voice and present their unified opinions, on the EIAr and EMPr, to Myezo in a similar fashion that of the Scoping phase comments	

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				submission made by Mr, Markus. We were confident that this communication channel proved itself to be the most effective manner in which the voices of the Hondeklip Bay could be heard, since we received it as a single, unified expression of their concerns. 3.3. Mr. Markus requests from Myezo we respect the rule of law and the intention of the regulation. It is therefore important that we make reference to Regulation 40 (1) of the National Environmental Management Act. (Act 107 of	

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				1998): Environmental Impact Assessment regulations, 2014, which stipulates that: *"The public participation process to which the* *(a) basic assessment report and EMPr, and where applicable the closure plan, submitted in terms of regulation 19; and* *(b) scoping report submitted in terms of regulation 21 and the environmental* *impact assessment report and EMPr submitted in terms of regulation 23; was subjected*	

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				to must give all potential registered interested and affected parties, including the competent authority, a period of at least 30 days to submit comments on each of the basic assessment report, EMPr, scoping report and environmental impact assessment report, and where applicable the closure plan, as well as the report contemplated in regulation 32, if such reports or plans are submitted at different times." The notification to interested and affected parties about the	

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				review period for theEIAr and EMPr that was sent out on the 27th of September 2016 states that the deadline for returning any comments is on the 29th of October 2016 (Appendix H-4.31) Mr. Markus was also sent this notification letter via e-mail and we received a read/receive notification that he did indeed read this e-mail on the 27th of September 2016. shows the date at which his concerns were received. This was three (3) days past the commenting period deadline. This should be treated as important	

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				information given the fact that we urge ourselves to respect the rule of law and intention of the regulations. Nevertheless, WCR have committed to hold a meeting with the community prior to the commencement of the operations and ensure that the issues that were raised are an captured in the EIAr are vontinously being implemented and monitoring as per the EMPr is done.	
Traditional Leaders	N/A				

Interested and Affected Parties . List the names of persons consulted in this column, and Mark with an X where those who must be consulted were in fact consulted.		DateComments Received	Issues raised	EAPs response to issues as mandated by the applicant	Consultation Status (consensus dispute, not finalised etc.)
Dept. Environmental Affairs (Oceans and Coast)	X	18 September 2015	1) Identification of Marine Protected Areas (MPA) (Comment raised by Bertus Cilliers (BC) of West Coast Resources (Pty) Ltd, (WCR): As part of contextualizing the project role within the space of coastal and management and conservation, It was indicated that 19 Marine Protected Areas (MPA')s were submitted and now two additional ones would be included which incorporates the Namaqualand MPA's.	BC (the applicant) clarified that WCR has committed to give up all of Sea Concession 9a and 90% of 8a and 8b to contribute to the MPA, as it does not have high mineral resource content. BC further stated that a Section 11 application in terms of Mineral and Petroleum Resources Development Act (MPRDA) for the ceding of rights from de Beers to WCR has currently been lodged with DMR.	The Department of Environmental Affairs (DEA) (Oceans and Coast) was notified through the EIA process and received an apportunity to comment on the EIArwhich was submitted to them in Septemter 2016.
			2) Composition of WCR and socio-economic considerations and benefits (Question raised by Tshepiso Monnakgotla	Bertus Cilliers (BC) (the applicant) stated that the government sector makes up about 20% of WCR. BC further stated that De Beers	The EIAr addressed the socio-economic aspect in the report, in Volume 4 of 4, Social Impact Assessment Report, on Section 4.3, and also in Table g (iv) 1-1,

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			(TM), of DEA): TM enquired as to who is included in the shareholding within the Government Sector.	initially had negotiations with the Department of Public Enterprise and promises and commitments were made regarding Black Economic Empowerment (BEE) consideration and economic development objectives and as such, WCR, as part of the purchase deal, honoured those prior commitments. The government is represented by the Department of Public Enterprise and they will then decide how shareholding interests are handled. The strategic goal was that such process should not delay the process of mining and should not impact on the benefit of the deal, which is associated with job creation.	surfzone related impacts, point 8Socio-economic impacts (Construction and operation of the coffer dams and the slime dams and Table g (vii) 1-1.

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			3) Validity and credibility of specialist studies (Question raised by Maya Pfaff (MP), of DEA): Maya Pfaff (MP) recommended that the specialist studies e.g. desktop marine baseline studies must focus on the current sites and the current methodologies and not be based on historical data. Dr Alan Boyd (AB) also alluded to this and emphasized that local output data should be the one being processed and not only focusing on extrapolations from other similar geographic environments. MP and AB further stated that the attendees	The detailed specialist studies have not commenced. The environmental setting data in the form of desktop ''baseline'' studies was done under specialist input. However, subsequent detailed monitoring studies will only be done after input from stakeholders in the scoping report. The regional information is provided to contextualize the trends in anticipated impacts and to be used as a foundation in the formulation of detailed terms of reference.	The application for environmental authorisation completed EIAr Phase and thus consultation with IAPs was done. The EIAr addressed the concerns and the Specialist studies are in Volume 4 of 4 of this EIAr, under section 1.5).

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			understood that for input into planning decisions and timeframes desktop marine baseline studies had been conducted. It was expressed as a potential risk the fact that specialist studies were undertaken prior to stakeholder input. However, it was acknowledged that the stakeholders will still receive an opportunity to review the desktop marine baseline studies and inform the prescription of methodologies and terms of reference for detailed environmental impact assessment stage. MP further stated that she had previously undertaken work with Dr. Andrea Pulfrich		

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			(AP), the specialist who conducted the desktop marine baseline studies, and recommended that impacts on reef structures should be further investigated as these were usually excluded from AP's studies. MP further requested if it would be facilitated that they receive sampling design data from AP.		
			4) Consideration of co-ordination of monitoring programmes and sharing of research information (Comment raised by Dr Alan Boyd (AB), of DEA): Dr. Alan Boyd (AB) recommended that there should be partnership with regards to co-ordination of	Babalwa Fatyi (BF) (the EAP), and BC (the applicant) stated that the suggestion was noted. Sampling data will be available once sampling had commenced. The specialist will consider the inputs within the boundaries of this study, which is for EIA regulated	The EIAr stage completed the required consultation and the monitoring protocol is addressed in Volume 4 of 4, section 5.1, under Baseline studies and Impact Monitoring and ynder the EMP, Volume 2 of 4, Part B Volume 2 of the EIAr.

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			monitoring programmes to promote contribution to the understanding of the coastline. DEA (Oceans and Coast) conducts a lot of research and work along the coast, and any collected data will contribute in the comprehensive data manipulation to ascertain various trends under various treatments and variables. BC highlighted that WCR is open to building partnerships and sharing data.	processes. However, WCR is willing to engage the DEA research team so that studies are not just isolated pieces of information but are driven from strategic perspective of contributing to answering a bigger issue of national interest. These current engagements for the proposed mining project are seen to be opening doors for various collaborations in research as well.	
			4.1) Sharing of research information - conducting of Strategic Environmental Assessment (SEA) in partnership with other role players (Comment	BF (the EAP) commented on the importance of this general overview and gave an illustration about the Benguela Current Large Marine Ecosystems (BCLME) studies which were	The consultation status was finalised through the EIAr stage. The process of data sharing will however be still an ongoing process.

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			raised by Toufiek Samaai (TS), of DEA): Toufiek Samaai (TS) recommended that strategic environmental assessments (SEA's) should be undertaken in partnership with other role players, to have a broader understanding of the coastline rather than focusing on the specific sites, as these EIA focus studies do not give a broad overview of the status of the coastline. This is a request for future consideration and on - going partnerships.	previously undertaken in collaboration with BCLME programme and De Beers and other key stakeholders. These were then used as a foundation in the broader understanding of the coastline and environmental management programme reports (EMPR) found data for mining purposes was used form this generic EMPR. The SEA would indeed be beneficial but would not be undertaken as part of this study for WCR since the EIA that is being done is a legislated requirement to support Section 102 of MPRDA for the amendment of an authorized EMP. The Section 102 is under the	

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				auspices of DMR as a competent authority. For future considerations, it would perhaps be a worthwhile exercise for the custodians and beneficiaries of the coastline to execute the SEA, under public private partnership scenarios'. BF further stated that a pre consultation meeting had been held with DMR regarding the EIA process to be undertaken. BF also indicated that if an SEA would be undertaken they would need to include the other mines mining in the area. However, the comment had been noted. BC highlighted that WCR is opened to building partnerships and sharing	

Interested and Affected Parties . List the names of persons consulted in this column, and Mark with an X where those who must be consulted were in fact consulted.		**DateComments Received**	**Issues raised**	**EAPs response to issues as mandated by the applicant**	**Consultation Status (consensus dispute, not finalised etc.)**
				data.	
			5) Development of beach management plans for management of impacts (Comment raised by Toufiek Samaai (TS), of DEA): TS stated that the movement should be above EIA's to management plans for combating disturbance along the coastline. The heaps of tailings from classifiers have caused cumulative damage and this is a great concern. It would be prudent to have an Environmental Control Officer (ECO).	BF (EAP) indicated that the management plans approach is where WCR is heading. Contractors will be allocated a specific site and a Local Environmental Management Plan will be developed for each site and the contractor will be responsible for implementation of the plan at each site and the ECO, Abegail Makgato (AM) of WCR, in this instance, audits and monitors the compliance. The compliance levels are then factored into the renewal of contracts and revenue splits since rehabilitation liabilities must be carried by the party who caused the damage. It is	The application for environmental authorisation completed the EIAr Phase and thus consultation with IAPs was finalised. The EMP Volume 2 of 4, Part B provides management measures.

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				however, understood that WCR carries the overall responsibility, but will use these internal controls for accountability and enforcement on site.	
			6) Provision of access to the coast (Comment raised by Tshepiso Monnakgotla (TM), of DEA). TM stated that there should be provision of access to the coast as it is a national asset. The current access is through a MoU done with DeBeers for sea colony. DEA wants to negotiate access for research as well.	BC (the applicant) indicated that since it is a diamond mining area issues of safety and security are critical, therefore certain areas are restricted. However, they are engaged in talks with San Parks to relinquish areas for public access in the form of the MPA that is being committed in the Section 11 process with DMR.	The issues of access is addressed in the aquaculture report and socio-economic report in Volume 4 of 4 of this EIAr and Volume 2 of 4, Part A Table (g) (v) 1-1 undersurfzone related mining activities, point 3 (g).
			7) Consideration of waste	BC stated that there are	The application for environmental

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			management issues during mining activities (Comment raised by MP, of DEA): MP recommended that re-fuelling at the beach and dumping of vehicle wreckages should be prohibited, as she had observed wreckages at some areas. It is observed that sand bags are sometimes made up of plastics and these are left on the beaches. MP is concerned that due to mine diamond security, vehicles that are inside the mine are not taken out and these break down and corrode and a system of managing this would be	certain zones not owned by WCR, therefore they are not responsible for all dumping and waste, however they are committed to practicing sound environmental management principles. BF further stated that these issues would be considered and principles be built into the Safety, Health and Environment (SHE) Strategy for WCR.	authorisation is currently in the EIAr Phase and thus consultation with IAPs is still ongoing. The consultation status is therefore not finalised and will be finalised after the EIAr commenting period.

Interested and Affected Parties . List the names of persons consulted in this column, and Mark with an X where those who must be consulted were in fact consulted.		**DateComments Received**	**Issues raised**	**EAPs response to issues as mandated by the applicant**	**Consultation Status (consensus dispute, not finalised etc.)**
			beneficial.		
			8) Impact of Mining methodologies to be used (Questions raised by Herman Oosthuizen (HO), TS and MP, of DEA): HO enquired as to the preferred mining methodology between coffer dams and beach accretion. The CSIR report on Namdeb, reported on huge movement of beach sand during sea wall mining. TS enquired as to whether the rock boulders would be re-used and whether or not blasting would be undertaken. MP commented to bringing material onto the beaches creates mixed-shore	BC (the applicant) indicated that the outcomes of the bathymetry studies indicated that the energy of the sea is effectively broken by big rocks, therefore WCR will use more of these. When the rock berms are removed, the rocks will be re-used on the next block. Not all the rocks will be recovered through, for this recycling, since some would be lost to high wave action. Where blasting is required, this will only be done inland. It is understood that mixed shore systems are threatened and if their creation would be structured well, perhaps then this mining method would	The mining methodologies are described in Volume 1 of 4 Part A of the EIAr. The consultation process was finalised through the EIAr review stage.

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			beaches and this is not always the best option.	contribute to creation of more offset of the lost ones.	
			9) Viability of creation of artificial habitats to offset of habitat disturbance (Comment raised by HO, of DEA): HO suggested that consideration of off-setting of the habitat disturbance and loss as a result of removal of boulders by forming islands where the communities can use these as a habitat should be considered. Reference was made to bird colony which disappeared due to high sediment load and exposure to fluctuating wave action.	BF (the EAP) indicated that it had been observed at De Punt, where rock boulders had been moved during previous mining activities, that habitats had been created for various faunal communities and these communities tend to thrive under the boulders and are provided with an opportunity to recover without the ''harsh'' wave action. BC indicated that the WSP methodology of using rock boulders would then make it possible for these islands to be formed when moving to new mine areas.	The specialist study, Volume 4 of 4, Section A7 of the report provides for the management of habitats. The monitoring protocol allows for the understanding of the anticipated impacts. The EMP Volume 2 of 4, Part B, under the mechanisms for monitoring compliance address monitoring.

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			10) Consideration of application for pre-authorisation according to Section 71b of Integrated Coastal Management Act (ICMA) before undertaking EIA (Comment raised by Sibusiso Mbethe (SM), of DEA): Sibusiso Mbethe (SM) stated that the formation of the artificial islands i.e. coffer dam construction would be considered as reclamation in terms of ICMA, so WCR might need to apply for pre-authorisation in accordance with ICMA. The pre-authorisation would need to be undertaken before the EIA application and authorisation would be granted by the	BF stated that further advice on the matter would be sought. If the term "reclamation", as defined in the ICMA, is applicable to the proposed project then, a separate process is necessary, this will be pursued under the relevant competent authority and ICMA will be engaged.	The application for environmental authorisation completed in the EIAr Phase and thus consultation with IAPs is finalised.

Interested and Affected Parties . List the names of persons consulted in this column, and Mark with an X where those who must be consulted were in fact consulted.		**DateComments Received**	**Issues raised**	**EAPs response to issues as mandated by the applicant**	**Consultation Status (consensus dispute, not finalised etc.)**
			Minister. He also indicated that the Marine Living Resources Act should be considered.		
			11) Consideration of need for application for discharge permits (Comment raised by Feroza Alberto (FA), of DEA): Feroza Alberto (FA) stated that an application for discharge permit for slimes seepage, jig plants and classifier release of process water back into the sea should be considered. However, the matter should be further discussed with the relevant directorate officials because there is still uncertainty about the classifiers which are	BF stated that further advice would be sought from the relevant officials as advised.	The consultation was finalised through the EIAr review stage.

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			returning into sea, sea water which has not originated on land.		
			12) Recovery of benthic communities and consideration of rocky shore habitat's impacts (Comment raised by MP, of DEA): MP stated that the recovery of benthic communities must be understood from perspective of species recruitment and colonisation. These studies must not focus only on the sand beaches but consideration should also be	BF (EAP) stated that starting in 2002, Trans-Hex Operations (Pty) Ltd had been engaged in monitoring programmes and eight beaches had been sampled. BF indicated that AP had been engaged to undertake monitoring programmes to assess the impacts of activities, Council of Scientific and Industrial Research (CSIR) studies had also been undertaken and it had been noted that benthic communities recover after approximately five years.	The application for environmental authorisation was finalised through the EIAr review stage. The desktop specialist study was done to devise a monitoring protocol. This protocol is outlined in the EIAr under Volume 4 and the EMP, which is Volume 2 of 4, Part B (Volume 2).

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			given to rocky shore habitats' impacts. The reefs are clogged due to sediment. Bays are impacted, as such, the knowledge of where to dispose sand and the type of areas which are sensitive and should be avoided, is important. Therefore, the monitoring programmes should be co-ordinated so that there is benefit in their contribution to this understanding, upfront, so that disturbances are avoided.		
			13) Impacts of mining on tourism (Comment raised by TM, of DEA): TM stated that WCR should consider the impact of mining on tourism, as DEA	BF (EAP) stated that this recommendation had been noted.	The application for environmental authorisation is currently in the EIAr Phase and thus consultation with IAPs is still ongoing. The consultation status is therefore not finalised and will be finalised after

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			advocates for sustainable development. The coast is a national asset and beneficiaries should have access to it and the regulators, researchers, and developers should work together to observe this strategic reality and meet the objectives of Operation Phakisa.		the commenting period. A socio-economic study and Aquaculture studies were done are included as Volume 4 Part B of this EIAR. The post mining land use plan is included in Volume 2, Part B.
			14) Sensitivity of dunes (Comment raised by HO, of DEA): HO enquired if there were dune systems and indicated that dune stabilization and rehabilitation studies need to be undertaken.	BF stated that studies were done for Sea Concession 11 (a), 12 (a), and 13 (a) in the past and the ecological assessment of these dunes were done and a buffer zone away from the dunes has to be maintained to avoid their disturbance. The physical characteristics and	The application for environmental authorisation comleted EIAr Phase and thus consultation with IAPswasfinalised after the EIAr commenting period. Table (g) (v) 1-1, addresses the marine impacts. These are also detaild in Volume 4, Section 1.2 of the report.

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				behavioral patterns were observed. These dunes have high sensitivity ratings.	
			15) Mapping of seal colonies: There should be mapping of seal colonies as they are unique habitats within the area. He indicated that Department of Agriculture, Forestry and Fisheries (DAFF) has most of this information, however DEA can also assist with the information they have.	BF (EAP) indicated that information for sensitivity mapping for abalone ranching sites, sea weed sites and rock lobster sites had been received from DAFF. BF further stated that they welcomed the assistance from DEA (Oceans and Coast) with regards to further information.	Completed.The sensitive features of the project are mapped in the EIAr Section (g) (iv).
			16) Boat launching sites (Comment raised by HO and MP, of DEA): HO and MP enquired with regards to the boat launching sites WCR will need, and	AM (applicant) stated that DENC are in the process of gazetting Brazil site as well and this site might be used by WCR and Trans-Hex and is already incorporated in the	The application for environmental authorisation completed EIAr Phase and thus consultation with IAPs is completed. The boat launching sites are not included as a listed ativity in Section (d) (ii)

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			cautioned them to check if the ones that are to be gazetted are applicable to them.	list to be gazetted. WCR will not be launching on any new sites and will utilize Brazil.	of the EIAr.
			17) Tailings plumes (Comment raised by TS, of DEA): TS advised that plumes and turbidity consideration be factored in the studies.	BF (EAP) stated that this recommendation had been noted.	The application for environmental authorisation completed the EIAr Phase and thus consultation with IAPs isfinalised. The marine study addressed the turbidity aspects (Volume 4, as well as, Section g(v) of the EIAr.
Other Competent Authorities affected	**X**				
Department of Agriculture, Forestry and Fisheries (DAFF)	**X**	14 September 2015	1) Conflicts with abalone ranching right holders (Comment raised by Zimasa Jika, of DAFF): Zimasa Jika (ZJ) indicated that there might be potential	BC (applicant) stated that he had already spoken to the ranchers at Hondeklip Bay but had not spoken to the abalone ranchers at Kleinzee. He further stated that the abalone ranchers at	The application for environmental authorisation completed the EIAr Phase with IAPs is finalised. The Aquacultre and Socio-economic studies included as Volume 4 of the EIAr address this matter as

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			conflicts with existing abalone ranchers. She cautioned that the current sites should be taken cognisance of and she mentioned the current rights at Hondeklip Bay. There are also abalone rights issues at Kleinzee. She also indicated that they had already started seeding into the sea. Data regarding fishing rights with references crayfish, rocklobsters will be requested from Mr Odwa Dubula (OD). Details if the Kelp concession holders can also be requested from the same directorate and ZJ will support the WCR team to get this information. It was highlighted that recreational use should also be noted and	Hondeklip Bay did not have any issues with WCR thus far and saw mining as a positive benefit to them since it would address their greatest threat which is poaching and as such a need for security. Should mining resume, the diamond security that would be provided by WCR would be to their benefit. BC further stated that WCR is interested in sustainable economic development and find synergies in the other projects in the area. Mariculture and renewable energy initiatives being undertaken by Eskom.	well in Section g (v).

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			planning be done around that aspect during the EIA process.		
			2) Discharge into the sea (Comment raised by Michelle Pretorius (MP), of DAFF) Michelle Pretorius (MP) indicated that the relevant discharge permits should be obtained from DEA. She further stated that the land based farms should be mapped so as to check where the water intake areas are located to avoid polluting the water.	BC stated that the area to be mined had been selected as mining activities there had been decommissioned. Abegail Makgato (AM) stated that before DEA issues permits they would first need the environmental authorisation from DMR. BF stated that the issue of mapping had been noted and the project team will ensure the ranching sites in relation to the mining positions are	The application for environmental authorisation completed the EIAr Phase The consultation status is therefore finalised. There is no requirement for discharge at this stage. There was a suggestion from DENC to also assess as an option controlled discharge of slimes into the ocean versus disposing of slimes dam on surface versus. The option of controlled discharge is not favoured.

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				known and adequate mitigations measures considered.	
DAFF		03 June 2016	1) Access control (Comments raised by Asanda Njobeni (AN), DAFF) AN alluded to the fact that the aspect that is pressing and which is not unique to the Northern Cape is that of access. Clarity was sought to ascertain if the MPRDA do give exclusive rights for access to the mining right holder? Government is obligated to act	The aspect of exclusivity would have to be investigated from a legal perspective, but currently the mining operations are governed by Mine Health and Safety and security control requirements. The Mine Health and Safety Act (MHSA) calls for strict control and liability resides with the mining company for safety control within their sites.	The Socio-economic and Aquaculture studies in Volume 4 addresses this matter. The commitments provided in Table (g) (v) 1-1 and Table (g) (vii) of Volume 2, Part A addresses this matter. Access matters were also discussed at the PCC meeting and are indictated in the DENC comments under Volume 3, Appendix H 5.3

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			to release and unlock the commercial value of the ocean's natural resources. The closed gates along the coast that are not hindering the mandate of unlocking the economic potential of this part of the ocean and extract commercially viable species are not seen as a challenge in this context.	Babalwa Fatyi (BF) mentioned that WCR has done a survey of existing open access along the coast. Statistical information that can be shared is available. WCR to share the available information regarding this statistical information. AN appreciated the gesture but noted that access control and availability has to be linked to the need for exploitation of commercially viable species. BF and Bertus Cilliers (BC) indicated that the aquaculture specialist study	

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				will also look at the issue of access and this study will be finalised by end June 2016 to first week of July 2016.	
			2) Sustainability considerations (Comments raised by Asanda Njobeni (AN), of DAFF) The aspect of exclusivity would have to be investigated from a legal perspective, but currently the mining operations are governed by Mine Health and Safety and security control requirements. The Mine Health and Safety Act (MHSA) calls for strict	BC mentioned that WCR has done a survey of existing open access along the coast. Statistical information that can be shared is available. WCR will share the available information regarding this statistical information.	The statistical information will still be shared on specific request. This issue is still ongoing in that regard.

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			control and liability resides with the mining company for safety control within their sites. AN appreciated the gesture but noted that access control and availability has to be linked to the need for exploitation of commercially viable species. BF and BC indicated that the aquaculture specialist study will also look at the issue of access and this study will be finalised by end June 2016 to first week of July 2016.		

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			3) Public access (Comments made by Michelle Pretorius (MP), of DAFF) Michelle Pretoius (MP) enquired how the coastal public areas within the mining right areas are handled within the safety controls.	Kishan Sankar (KS) highlighted that according to Integrated Coastal Management Act (ICMA), reasonable access is required not unless there is conflicting use that prohibits that, such as blasting.	
			4) Collaborative effort (Comments made by Zimasa Jika (ZJ), of DAFF)	The Abalone ranching activities have been allowed in the areas where mining activities are not currently	On going operational discussions are on-going to see how alignment can be reached between mine plan requirements and the Abalone Ranching Project

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			Zimasa Jika (ZJ) gave an example of the collaborative models that had worked in the region in the past, such as Alexkor and De Beers Kleinzee. This can be a lesson all parties can learn from. BF provided feedback on the meeting held. Details of which are in the notes of the meeting as Annexure 3 of the minutes. The manner in which access is handled currently, might be perceived as belittling the other sector and brings superiority complex and impression that the sectors are	being undertaken. The Mine and Health and Safety obligations have been upheld and would pose a risk to have people in the areas where mining is still being undertaken.	Activities. This is part of the operational matters and has been put as a commitment in the EMPr.

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			not equal within their mandatory rights. The parties must learn from each other's activities. The ranchers must be educated to understand why these measures are taken. The engagement should be done with purity on intentions.		
			5) Potential risks (Comments made by Michelle Pretorius (MP), of DAFF) MP stated that If there is no consensus, then the other party that is denied access, might mobilise support from	Ongoing discussions to reach consensus.	

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			the community using their influence and capitalising on current community concerns, of which access has always been an issue.		
		15 April 2016 (Telephonic discussion with Michelle Pretorious)	Ms. Pretorius indicated that she received communication from certain Abalone Ranching right holders. It was also indicated by Ms. Pretorius that the Abalone ranching right holders hold existing rights (Granted by DAFF) for portions that West Coast Resources also has rights for (Granted by DMR). In the communication, the right	Indicated that the comments will be passed to the project team for actioning and the EAP will consider ways of facilitating any required meetings. WCR. A meeting was held with DAFF and DCA and records of which are included as Appendix h of this EIA.	Meetings were held with DAFF and also with DMR to discuss the Abalone Ranching Rights and mining rights feasible collaboration requirements at a regulatory level rather than the EIA Phase. A discussion was also held with DCA and a record of such discussion is incuded as Appendix h. This has been finalised as part of EIA process not but from operational perspective and as such discussions between the ranching operatos and WCR are

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			holders stated that they have held a meeting with WCR to discuss access to the sea concession portions that hold rights for. The abalone ranching right holders also stated that West Coast Resources is denying them access to certain portions of the sea concession that they hold rights for. Moreover, Ms. Pretorius stated that the portions that the abalone ranching right holders are allowed access must be feasible for them to allow a chance to prove economical		underway. The management measures of this EIA stipulate that these collaborative discussions must be undertaken and finalised. She proposed a meeting between DAFF and DMR and also include the ranching right holders as well.

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			viability, of the project as part of the experimental pilot phase. Furthermore, Ms. Pretorius stated that, due to the conflict between the two entities (WCR and Abalone ranching right holders), who hold rights granted by different departments, a meeting will need to be organized between the departments to come to a resolution with regards to the way forward on the access to the mining area.		
		20 April 2016	The DAFF acknowledges and appreciates the pre-consultative meeting held on	The comments have been noted and were included in the scoping report, which was be	The issue will be raised.

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			the 14th September 2015 with the project team to discuss the design and process approach regarding the environmental authorisation and possible interactions with the aquaculture industry. It is noted that the DSR highlights the potential user conflict with the existing aquaculture abalone ranching rights holders in the study area. The DAFF would like to emphasize that a dialogue between the ranching rights holders and West Coast Resources is maintained and that efforts to co-exist in the	submitted to the DMR. The subsequent stage of the process investigated the issues further, to determine the actual environmental impacts and to develop mitigation measures and associated monitoring plans. Opportunities to incorporate the aspect of water quality assessments into the terms of reference for the surface water and estuary management studies, were taken, during this environmental impact assessment report (EIAr) phase. EAP also received comments from Diamond	

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		study area is established. It should be noted that the current rights holders in the area have already invested a significant amount of time, money and effort into the pilot project of which some are registered as Operation Phakisa projects and have the potential to increase the jobs, food security and revenue for the country. It is also acknowledged that the DSR highlights the potential water quality threat to the land based abalone facilities and ranching rights	Coast Abalone (Pty) Ltd. A request for the study, which will address the potential impact of the WCR' activities on the abalone ranching activities was forwarded, as part of their comments and this request was included in the EIAr specialist studies. DAFF has been given feedback about this EIAr stage, and further be allowed an opportunity to comment on the EIAR and proposed mitigation measures.	

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			holders in the study area and the DAFF requests that the specialist studies address this impact.		
		22 April 2016	The DAFF hopes that further engagement is held with the Abalone Ranching industry and the applicant. Reference was made to the EAP offices to discuss the project. Michelle spoke to EAP colleague and he informed her that her concerns would be raised with the project team. EAP to ensure and facilitate a meeting between the two parties concerned to	The message and feedback on DAFF telephonic discussion with our colleague was received and that was passed to the project team/ applicant. The EAP informed DAFF of the way forward and planned engagement.	

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			ensure that they are able to co-exist in this space. DAFF would very much like to be a part of such engagement and seek to set up a meeting with DMR to discuss this further.		
Department of Environment and Nature Conservation (DENC)	X	15 September 2015	1) Proposed mining activities (Question raised by Wilna Oppel (WO), of DENC): Wilna Oppel (WO) enquired as to whether mining would be undertaken in the sea and to what depths.	BC stated that mining would be undertaken in the sea and they would mine about 100 m – 200 m off shore. He further stated that at Rooiwal Bay they would mine at a width of at least 100 m and a depth of at least 20 m below sea level. He further stated that bathymetry studies had been undertaken.	The application for environmental authorisation was completed in the EIAr Phase and thus consultation with IAPs was being finalised. The project description is provided in Volume 1 of 4, Part A.

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			2) Potential for seepage (Question raised by Wilna Oppel (WO), of DENC): WO enquired if there would be any seepage	BC responded that there would be seepage however it would be pumped out, he also stated that the area is underlain by clay therefore there will be little seepage. Bedrock elevation studies were done and those sites that seeps into the aquifer are known. The flow characteristics and topography are considered in the placement of the structures.	The aspect of seepage is addressed in the specialist report in Volume 4 of 4, Section 2.2.5, and also in Volume 2 of 4, Part A Table (g) (v) 1-1 and Table (g) (vii) 1-1.
Denc (Continued)			3) Rehabilitation (Question raised by Wilna Oppel (WO), of DENC):	BC indicated that the area to be mined would be backfilled, approximately 20 million	The application for environmental authorisation finished the EIAr commenting period. Rehabilitation

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			WO indicated that she was worried as to how the rehabilitation would be undertaken and whether or not there would be natural rehabilitation. She expressed a concern that even there are indications of benefits of high wave action which removes the boulders, one cannot ever know the state of those previously disturbed beaches.	tonnes of overburden would need to be removed then it would be used for the construction of the rock berm. The rock boulders would then be re-used after each coffer dam has been constructed. The rocks that are not recovered from building subsequent walls would then be rehabilitated by the sea. Therefore, there will be naturally assisted rehabilitation. An example was made of other similar operations where coffer dams were	measures are in Volume 2 of 4, Part B in the EMPr.

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				removed by the wave action. When visiting the sites after a year of construction, there was no concrete evidence of their prior existence and had been washed away, therefore the coffer dam was naturally re-distributed. BC further stated that with regards to land operations there would be backfilling, as was done at Mitchell's Bay. He further stated that the plan is to design the slimes dams into a void and these the slimes dams would be placed in an already	

Interested and Affected Parties . List the names of persons consulted in this column, and Mark with an X where those who must be consulted were in fact consulted.		**DateComments Received**	**Issues raised**	**EAPs response to issues as mandated by the applicant**	**Consultation Status (consensus dispute, not finalised etc.)**
				disturbed area as far as practically possible. He indicated that they had filled the voids with the old slimes dams in the past and these had re-vegetated naturally. BF stated that the findings of previous studies (Pisces Report) and current desktop marine baseline studies undertaken by Andrea Pulfrich for the proposed project indicated that the benthic community's recovery rate is between three to five years. The studies were done between	

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				2002 and 2004 and sampling and monitoring of eight beaches, which were being mined, those that were previously mined and those that were never mined to act as "controls. It is advised to allow the beaches time to recover before they get re-mined again. It is actually better to undertake extensive mining once-off and then move to another area than disturbing the beaches all the time. The boulders contribute to the recovery rate e.g. benthic	

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				fauna is given time to recover under these boulders, which then create a safe habitat. From the outcomes of this monitoring of eight beaches including a "control" of an undisturbed beaches done by Andrea it was found that there was definite recovery.	
Denc (continued)			4) Biodiversity off sets- Coastal access (Comment raised by Wilna Oppel (WO), of DENC): WO indicated that she was concerned about coastal access as there is approximately 380 km of coast	BC stated that WCR is prepared to relinquish their rights to the south of the project area and were in discussions with Sanparks. WCR has committed to give up all of Sea Concession 9 (a) and 90% of 8 (a) and 8	The application for environmental authorisation and the EIAr commenting period is finalised.

Interested and Affected Parties . List the names of persons consulted in this column, and Mark with an X where those who must be consulted were in fact consulted.	**DateComments Received**	**Issues raised**	**EAPs response to issues as mandated by the applicant**	**Consultation Status (consensus dispute, not finalised etc.)**
		and only about 34 km of coastline access. WO acknowledged the positive spin-off from this relinquishment, but still expressed concern that the process can take a long time and people have been complaining that they cannot access areas e.g. Hondeklip Bay for overnight camping. She is concerned that the area will be further closed off. There is a need to keep the momentum going.	(b) to contribute to the Marine Protected Area (MPA). He further stated that a Section 11 application for the ceding of rights had currently been applied for with DMR.	
		5) Overlapping of activities (Question raised by Wilna	BC indicated that there are activities such as abalone	To be finalised after the review of

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		Oppel (WO), of DENC): WO enquired as to whether there was overlapping with other activities such as Operation Phakisa.	ranching being undertaken at Hondeklip Bay and Kleinzee. He also stated that the abalone ranchers at Hondeklip Bay support the mining activities as the presence of WCR provides security for them as their issues of poaching. He further stated that they are willing to co-exist with the ranchers.	the EIAr by stakeholders.
		6) Desalination plant (Question raised by Wilna Oppel (WO), of DENC): WO enquired if there will be a desalination plant built.	BC indicated that there is no intention of building a desalination plant as they will use sea water and this is not a water use and has not	The application for environmental authorisation finalised the EIAr pase was finalised after the review of the EIAr.

Interested and Affected Parties . List the names of persons consulted in this column, and Mark with an X where those who must be consulted were in fact consulted.	**DateComments Received**	**Issues raised**	**EAPs response to issues as mandated by the applicant**	**Consultation Status (consensus dispute, not finalised etc.)**
		Bronwen Cornelissen (BC) commented that this was enquired out of interest and the fact that it would then contribute to the mine's social and labour plan.	been included in the application for water use to Department of Water and Sanitation (DWS). Any collaborations with the existing developers is welcome as part of the social and labour plan projects which act as an economic engine boost. There is openness to participate in wind energy projects etc.	
		7) Estuary Management Plan (Comment raised by Wilna Oppel (WO), of DENC):	Abegail Makgato (AM) (applicant) enquired about the relevant official to contact with regards to Estuary	The application for environmental authorisation is currently in the EIA Phase and thus consultation with IAPs is still ongoing. The

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		WO indicated that an estuary management plan should be compiled as Swaartlintjes River is now considered a priority area due to the current state of the river i.e. water is pink coloured. The Plan should look at aspects such oil spills, pH balance and high salinity. She indicated that the Orange River Estuary Management Plan could be used as a reference. She further stated that the Orange River Estuary Management Plan had been	Management at DEA, and the relevant persons were given as Ntombovuyo Madlokazi and Daisy Kotsedi.	consultation status will be finalised after the review of the EIAr by stakeholders.

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		finalised; the Buffels River Estuary Management Plan had not yet been undertaken as funding from DEA had not yet been received however it was a priority area. Bronwen Cornelissen (BCor) stated that the Buffels River will be given first preference.		
Denc (Continued)		8) Specialist studies (Question raised by Wilna Oppel (WO), of DENC) and comment raised by Bronwen Cornelissen (BCor) , of DENC: WO enquired if there were any specialist studies done	BF stated that Andrea Pulfrich had included a description on the types of mammals occurring within the coast. BF stated that the comment had been noted and indicated that the water use	The application for environmental authorisation is was finalised through the EIAr review stage. The Marine specialist study was included in Volume 4 of 4, Section 7.1.

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		on seal colonies. She further stated that DEA had the relevant data for the mapping of these seal colonies. BCor stated that WCR and Myezo should consider undertaking heritage and hydrology studies.	licence application motivation report provided the hydrological background.	
Denc (Continued)		9) Dust plumes (Question raised by Bronwen Cornelissen (BCor), of DENC): BCor enquired as to whether there would be creation of dust plumes.	BC indicated that the utilization of slimes dams as backfill material is a measure to combat dust plumes. They tend to be sources of dust plumes and measure such as armouring are advised. The elimination of the risk by putting the slimes into voids	

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			would be a best alternative. WCR will be re-mining the old slimes dams. BF commented that the controls related to then re- capping or armouring those slimes dams that are generated are considered. The pebbles deflate the surface and create micro sites for potential seedling establishment and thus vegetation re-colonisation.	
Denc (Continued)		10) Boat launching sites (Comment raised by Bronwen Cornelissen (BCor), of DENC):	AM stated that there were no new boat launching sites that were planned either than Brazil, which was then	The application for environmental authorisation was finalised in the EIArreview Phase and thus consultation was finalised.

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		BCor stated that they had a problem with the Richtersveld Municipality, as the Council identified eight sites which must be gazetted. These sites included Brazil, Hondeklip Bay and Kamiesberg. He further stated that only an organ of state can be a management authority, therefore Namaqua will be the management authority, then they have to get a contract stating that Trans Hex will run the sites but this will be a public site. Then the person responsible for the site can be a Harbour	already captured in the gazetting plans.	

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		Master. WO stated that the town proclamation is not finished therefore the process will take a long time.		
Denc (Continued)		11) Other licenses and permits (Comment raised by Peter Cloete (PC), of DENC): Peter Cloete (PC) enquired if there would be vegetation clearance. He further stated that according to the Northern Cape Nature Conservation Act, permits would be still	BF stated that the comment had been noted.	The application for environmental authorisation is finished. EIAr Phase and thus consultation with IAPs was finalised. The vegetation clearance authorisation will require that licences are also applied for under the Northern Cape conservation Act.

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		required if there would be vegetation clearance triggering activities in Schedule 2 and Schedule 3. He further stated that this is interlinked with the National Environmental Management Biodiversity Act (NEMBA).		
		12) Coastal setback lines (Comment raised by Babalwa Fatyi (BF), of Myezo): BF enquired if the setback line had been determined as yet.	WO indicated that DENC had not as yet been finalised and this could only be done in about two years' time. BCor stated that the coastal protection zone (150 m from the High Water Mark (HWM)) could be used as a setback	The application for environmental authorisation finished the EIAr Phase and thus consultation with IAPs was finalised.

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			line. It was indicated that the challenge was that the different coastal provinces did their own setback lines and there were discrepancies, furthermore their regulations state that north of the Orange River belongs to South Africa, however the international regulations state that the area is central, Therefore, now they were waiting for the Norms and Standards from DEA.	

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Denc (Continued)		13) Listed activities – Disposal sites (Question raised by Onwabile Ndzomo (ON), of DENC): O.N. enquired if there would be new disposal sites.	AM stated that at the moment there were no new planned sites.	The application for environmental authorisation finished EIAr Phase and thus consultation with IAPs finished.
Denc (Contined)		14) Listed activities – Dams (Comment raised by Onwabile Ndzomo (ON), of DENC): O.N. stated that Myezo should consider the inclusion of the listed Activity No.12 (iv) of Listing Notice 1 of 2014 relating to the		

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		development of dams.		
		15) Waste management (Question raised by Onwabile Ndzomo (ON), of DENC): O.N. enquired where the hazardous waste was disposed. She also enquired where the tyres were disposed. She further enquired if there were any new planned sewage infrastructure.	A.M. stated that this was done at Vissershoek. She further stated that tyres were stockpiled inside the mine then disposed of by an appointed Contractor. She also indicated that the existing sewage ponds would be used and they are believed to be pumping to the Municipal connection and this will be confirmed.	
Denc (Continued)		16) Fuel storage (Question raised by Onwabile	B.C. indicated that they are using the old fuel bowsers and there are no new ones	

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		Ndzomo (ON), of DENC): O.N. enquired if there would be fuel storage on site and if it would trigger any listed activities.	planned.	
		18) Disposal sites to be decommissioned (Comment raised by Bronwen Cornelissen (BCor), of DENC): BCor stated that there are licenced sites at Mitchell's Bay and Samson's Bak which are no longer used and	B.C. and A.M. indicated that they had noted the comment, and the rehabilitation plan will address the matters pertaining to decommissioning.	

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		have been mined. He therefore suggested that these should be decommissioned.		
Denc (Continued)		19) Listed activities according to the Integrated Coastal Management Act (ICMA) of 2008 (Questions raised by Babalwa Fatyi (BF), of Myezo): B.F. asked if Section 63 of ICMA was under the jurisdiction of DENC. B.F. asked if Section 69 of ICMA was relevant to WCR	W.O. stated that the relevant authority would be DMR. WO stated that all existing permits were still valid. She also further indicated that the Sea Shore Act of 1935 was relevant to WCR. W.O. stated that any leases within the admiralty strip lie with the Department of Public Works.	

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		B.F. asked if Section 95 of ICMA was under the jurisdiction of DENC.		
Department of Environment, and Nature Conservation (DENC)	06 June 2016 and 28 October 2016	The areas that will be disturbed should be checked against the Northern Cape Critical Biodiversity Area Map, and the total area that will be disturbed in each category should be indicated. The consultant should note that in addition to the 2008 Namakwa Biodiversity Sector Plan, there is also a new draft Northern Cape CBA map that should be considered (Available from the Northern Cape Department of	The Critical Biodiversity Map (latest version) for the Northern Cape Province was indeed used in the botanical section of the biodiversity study (the link for downloading the shapefiles was obtained from Mr Enrico Oosthuysen). These maps were carefully applied. This as it is included in Volume 1, Part A, Section 1 of the EIA report. Given the level of the survey	The latest Biodiversity Map has been used for this study in an this is addressed in Volume 1 of 4 (Part A, Volume 1, in Section 5: Biodiversity. The Critical Biodiversity Map shown in Figure (g) (iv) (a) 5 - 2 of the EIAr.

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		Environment and Nature Conservation, Enrico Ossthyusen. The impacts of the storage of sea water in a dam (as stated on page 63), should be more thoroughly investigated and explained. 1. Coastal and sea mining activities should be planned and spaced in such a way that there will always be a nearby, undisturbed habitat of the same type as the one that is being disturbed nearby. For example, if a sandy beach nearby that is left completely undisturbed, until the originally mined beach has been	undertaken, and with reference to other studies on the Namaqualand Coast, as much detail as possible was given in the botanical section of the biodiversity assessment with respect to endangered or rare plant species. It is well-known that the vegetation does not harbour many species of conservation concern because it is found over a wide expanse in relatively uniform habitats. Occurrence of important species such as Wooleya farinosa was highlighted in the botanical	

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		rehabilitated to such an extent that it can again support its original inhabitants. 2. Scoping report page 77: The table only gives the total area that will be disturbed at each site. In the final EIA, a table should also specify the specific coastal and benthic habitat types that will be disturbed, how much of each habitat type will be disturbed, and the threat status of the habitat types according to the 2011 National Biodiversity Assessment. 3. Scoping report page 269: The proposed mitigation measure of the placement of slimes dams close to the ocean so that any seepage will take place	section of the biodiversity assessment. By being aware of such 'indicator species' and ensuring sensitivity towards them, other species that may occur in the same plant communities would be conserved by default. It should be noted that the botanical survey was not a comprehensive phytosociological survey (where the majority of species would be noted) as stated on page 53 of the biodiversity assessment report. Should such a survey	

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		directly into the ocean needs more careful consideration and investigation. The effects of such seepage on the coastal environment and sands and the duration of any such effects should be indicated. In my opinion such seepage will cause irreversible damage to soils and coastal environment, and I would not recommend granting and Environmental Authorisation if there is any probability of seepage taking place form slimes dams. Alternatives measures to contain and prevent and seepage should be investigated and implemented before and Environmental Authorisation for such an	be necessary it would have to be specially commissioned and the necessary considerable resources set aside for its compilation as an academic exercise. It would have to be carried out over a number of years. This was not the aim of the study conducted here which was done at a high level to obtain the most information in the shortest time for the environmental process. The detailed response to these DENC issues is	

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		activity could be granted. 4. Scoping report page 218: The final EIA should include a more thorough description of the endangered or rare plant species in the area. 5. Scoping report page 269: I do not agree that the significance of this activity (slimes disposal) is low. The reason behind this rating should be motivated. Scoping report page 271: The life if mine has previously been indicated as 11 years. Therefore, I do not agree to the significance rating of the socio-economic impact of "long term". On the page273	included as Volume 3, Appendix h-4.4-2.	

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		the definition of long term is given as more than 15 years, permanent or beyond closure. **How it has been addressed** A map showing the relation between the mining area and the new Northern Cape CBA map has been included (EIA page 287). It is indicated that the entire study area falls within CBA1 and CBA2 areas (page 288), but the EIA also indicates on the same page that the entire study area is located in an Ecological Support Area (this is old		

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		information, only the most recent information should be used to avoid confusion). The total area that will be disturbed in each category (CBA1 or CBA2) has not been included. Not indicated. Mitigation measures should be in place to ensure that sea water or salt from sea water cannot contaminate any of the ground water aquifers, which are still used to supply water to Koingnaas and Hondeklip Bay. (page 312). **Coastal Access** • At the recent PCC		

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		meeting on 28 September 2016, the WCR representative gave assurance that the portion of Somnaas that I currently open for the public will remain open and that access will not be affected by the mining operations. We want WCR also to consider managed access to areas that does not pose high risk in terms of diamond security. • Socio-Economic Interests "The mitigation says avoid kelp cutting where unnecessary." – Value could be added		

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		if the land-based abalone farmers can utilise the cut kelp for abalone feed? However, this will be based on practicality; perhaps an option, that could be discussed with NC Abalone Working Group. Social Impact Assessment (SIA): • It is indicated that the impacts on the aquaculture industry is not included in the Social Impact Assessment because it has been evaluated		

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		in a different Specialist Study, but the key findings if the Aquaculture Specialist Study should be included in the Social Impact Assessment because it is of a high social impact significance (sustainable aquaculture jobs vs. un-sustainable mining jobs). If only indicated in one of the many additional specialist studies this important impact may be missed. • SIA Page ii: States that Hantam Local Municipality IDP is applicable. This is not correct, the activities will fall in the		

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		Kamiesberg Local Municipality, and therefore it is the Kamiesberg Local Municipality IDP that should be considered. • SIA Page iii: It is stated that "A significant portion of the annual wage bill is and will be earned by HD members from the area and will be spent in local towns of the area", but I think it is important that it should be indicated more clearly how large this portion of the wage bill will be (in percentage or in actual numbers0. • SIA Pag 31: The names of the district municipalities given on page 31 of the Social		

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		Impact Assessment (SIA) under paragraph 3.3 I out-dated. **Water Quality Records** • It indicates that water Quality Records will be recorder and send to ..No indication where to contamination of ground water is included in EMPR (page 12). Contamination of ground water with additional salt should be prevented. Although the ground water in the area is not of good quality, it is still used to supply Koingnaas and Hondeklip Bay with		

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		water. Groundwater will still be used and needed long after the life of mine, and should be protected at all cost. Public Participation: • In the whole of Volume 3 (Public participation and supporting documentation) no indication is given of meetings with the communities, or any evidence of comments from the community members being taken into account. The physical EIA was only available in the Koingnaas mine office, and only in Engligh as far as I know. Many of		

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		the members of the community of Hondeklip Bay and Komaggas does not have access to transport to Koingnaas to go look at the EIA and does not have access to computers and internet to download and view that large EIA documents, and also may not understand English sufficiently to make sense of the EIA. This is a major shortcoming of this EIA, as this means that the miners of these communities were not made aware of the proposed activities and the impacts it may have		

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		on them. Public participation in this regards was not sufficient. • There is also no indication of any meetings or consultation with SanParks, who are major stakeholder, as the proposed mining activities wil take place adjacent to, and will impact on the Namaqua National Park. Sedimentation of intertidal and subtidal reefs due to redistribution of sediments • Pg.505 Part A, Volume 2: Impacts		

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		and risks identified and management measures • "Monitoring at various mining sites in southern Namibia has shown that such mobilised and re-deposited sediments can have severe impacts on intertidal and shallow sub tidal rocky shore habitats bordering the mined beaches and at some distance away, with both temporary and permanent loss of rocky intertidal habitats being reported as a result of shoreline accretion" • Therer are no mitigation measures for above mentioned		

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		impacts, yet the significance rating is medium and not high. The localised effect might be deemed of lesser impact relating to the nature of mining permitting exclusive use, it is however the broader and cumulative and after effects that are of concern. • We want to reiterate the comment from DEA: "Give consideration to co-ordination of monitoring programmes with DEA and sharing of research information." Sharing of monitoring information will lead to better understanding		

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		of anticipated versus actual impacts. **Additional Comments** In the DAFF meeting on the 3rd June 2016, it was also asked that impacts of suspended sediment plumes and elevated turbidity as a result of mining operations need to be assessed (on page 6 of the minutes for this meeting given in Volume 3 of the EIA). Has this been done? They say that a specialist study has been commissioned as part of the EIA to investigate the issues raised.		
INTERESTED AND AFFECTED PARTIES				
Name: Mr Quiryn Snethlage Company: Port Nolloth Seafarms	15 February 2016	Mr. Quiryn snethlage manages sustainable	An Aquaculture specialist Study was done and is	

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Ranching (Pty) Ltd		industries and mariculture and owns abalone and oyster farm in Namaqualand. He requested background information document and wanted to be kept informed of the development. He was given a map of the mining areas in relation to the known abalone ranching sites in Port Nolloth, Kelinzee and Hondeklip Baai.	included as Volume 4 of this EIAr.	
CAD Mapping	05 February 2016	Wanted to know the socio-economic contribution the development of the Mine will play towards the community.	The establishment of the mining company plays a major role in economic development. Below are a few aspects where the role played by the	Finalised. Cad mapping referred to WCR for firther opportunities to act as service providers in site surveys.

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			mining company is most valuable. Job creation, infrastructure development; skills development	

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		Monitoring of the impacts on ecological sensitive environments has to be done. As a suggestion, tools like remote sensing can be used to track the rate of recovery of the disturbed beaches with respect to physical formations and redistribution of boulders.	The impacts of the loss of biota as a consequence of mining of Mitchell's Bay and through berm construction and subsequent mining of the impounded area along the adjacent coast were assessed through a desktop study and are considered to be of medium to high intensity in the mining target areas. Impacts are likely to persist over the medium (open coast berms) to long term (Mitchell's Bay) and are thus considered to be of medium to high significance. During the impact assessment stage, mitigation measures for these impacts will be designed. Provided construction and mining activities are not	A meeting was held with DEA to discuss the monitoring protocol and this is included in the Marine Specialst Study (Volume 4 of this EIAr) finalised and will be finalised as part of the on-going monitoring that is presented in the specialist report by Dr. Andrea Pulfrich. BF

Interested and Affected Parties . List the names of persons consulted in this column, and Mark with an X where those who must be consulted were in fact consulted.	DateComments Received	Issues raised	EAPs response to issues as mandated by the applicant	Consultation Status (consensus dispute, not finalised etc.)
				Not finalised and will be incorporated it not the planning and development of strategies during the EIAr process.
Diamond Coast Abalone (PTY) Ltd	18 April 2016	Diamond Coast Abalone (Pty) Ltd (DCA) is the rights holder for the Northern Cape Zone 4 abalone ranching concession area and of the 16 potential abalone seeding sites identified by DCA in the NC Zone 4 concession area, 13 are adjacent to and/or overlaps the WCR diamond mining concession area.	Acknowledge receipt of DCA comments and expressed concerns, which were emailed on 18 April 2016. The comments have been noted and will be included in the scoping report, which will be submitted to the DMR. The subsequent stage of the process would be to investigate the issues further to determine the actual environmental impacts and to	Finalised as part of the IEAr stage. A map of the seeding sites and how they interact with WCR was sourced from DCA and co-existence strategies were discussed. This aspect of potential impact on abalone ranching concession areas was incorporated , into the Aquaculture and the DCA was issued with a copy of the specialist study and was updated

Interested and Affected Parties . List the names of persons consulted in this column, and Mark with an X where those who must be consulted were in fact consulted.	**DateComments Received**	**Issues raised**	**EAPs response to issues as mandated by the applicant**	**Consultation Status (consensus dispute, not finalised etc.)**
		It is unlikely that the DCA abalone ranching initiative will be viable if DCA is excluded from the majority of the suitable seeding sites in NC Zone 4 for significant periods of time. The DCA abalone ranching initiative will also not be viable if there is significant habitat destruction and/or if seeded abalone is destroyed through mining operations. Diamond Coast Abalone (Pty) Ltd (DCA) is the rights holder for the Northern Cape Zone 4 abalone ranching	develop mitigation measures and associated monitoring plans. DCA will be given feedback about this stage, and DCA will be allowed an opportunity to comment on the EIAR and proposed mitigation measures. This stage is expected to be completed by 29 September 2016. The commenting period is expected to be 01 August 2016 to 02 September 2016.	on the EIA process.

Interested and Affected Parties . List the names of persons consulted in this column, and Mark with an X where those who must be consulted were in fact consulted.	DateComments Received	Issues raised	EAPs response to issues as mandated by the applicant	Consultation Status (consensus dispute, not finalised etc.)
		concession area and has to date seeded 156 000 abalone at five different sites within the area. The DCA initiative was registered as an Operation Phakisa project in 2014. Of the 16 potential abalone seeding sites identified by DCA in the NC Zone 4 concession area, 13 are adjacent to and/or overlaps the WCR diamond mining concession area.		

Interested and Affected Parties . List the names of persons consulted in this column, and Mark with an X where those who must be consulted were in fact consulted.	**DateComments Received**	**Issues raised**	**EAPs response to issues as mandated by the applicant**	**Consultation Status (consensus dispute, not finalised etc.)**
		During a meeting with WCR on the 9th of February 2016, DCA were informed by WCR that they intend to restrict access to some of the sites mentioned above. Section 5(1), 5(2) and 5(3) of the Mineral and Petroleum Resources Development Act sets out the legal nature of a prospecting right, mining right, exploration right or production right, and rights of holders thereof. It specifically establishes the right of mining rights holders to enter land (and sea) areas to which		

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		such right relates for the purposes of mining, prospecting etc. and to remove or dispose of any mineral found during the course of such operations, but we can find no indication that it confers a right to exclude other users from such areas on the rights holder. As the legal owner of most of the land adjacent to the abalone ranching zone awarded to DCA, WCR is most likely entitled to refuse access to this land to DCA, but DCA may be entitled to at least access the abalone		

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		ranching zone by sea. It is unlikely that the DCA abalone ranching initiative will be viable if we are excluded from the majority of the suitable seeding sites in NC Zone 4 for significant periods of time. The DCA abalone ranching initiative will also not be viable if there is significant habitat destruction and/or if seeded abalone is destroyed through mining operations. It is the of DCA opinion that both DCA and WCR can pursue their interests in the		

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		area without impacting significantly on the other parties' operation and that the parties can co-exist. As such DCA are at any time willing to enter into further discussion with WCR to make this vision work. They have for example since the 9th of February 2016 on more than one occasion requested a follow-up meeting with WCR to clarify the situation regarding access to the abalone ranching seeding sites identified by DCA. Unfortunately, DCA have not		

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		been able to secure such a meeting and WCR's suggested solution tabled on the 9th of February 2016 whereby DCA is granted access to 5 sites north of Koingnaas during the next 2 years, with access arranged in an ad hoc manner with WCR 14 days prior to entry is not sufficient. Considering the above we would like to suggest that a specialist study is undertaken to determine the potential impacts of the planned expansion of WCR's mining		

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		activities on the abalone ranching operations in the Northern Cape Province where there is an overlap between the mining and abalone ranching concession areas. Such a study should specifically include an assessment of access issues in addition to the possible impacts that mining activities could have on the habitat required for abalone ranching and the likelihood that seeded abalone could be destroyed.		

Interested and Affected Parties . List the names of persons consulted in this column, and Mark with an X where those who must be consulted were in fact consulted.	DateComments Received	Issues raised	EAPs response to issues as mandated by the applicant	Consultation Status (consensus dispute, not finalised etc.)
Diamond Coastal Abalone (DCA)	25 May 2016	Security of Tenure (Comment raised by Gert Le Roux (GL), of DCA In the meeting held with DCA together with WCR, Gert Le Roux (GL) stated that DCA needs security of tenure because the funding body wants to see this. DCA requests at least five years from the time they seed to harvesting for the market, which is Far east-Singapore, Japan etc. They had seeded on the five areas to the north of Koingnaas and are concerned	It was decided that WCR needs to refer to the sites provided in the DCA, ranching report (NC Zone 4 Abalone Ranching Area).	Not finalised. Operational discussions are still going to agree on collaborative arrangements. The EIA process however, ensured the Aquaculture Specialist Study that was requested by DCA was done and feedback on the outcomes of such studty were shared with DCA.

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		about the impact of mining on those areas. However, all the seeding operations are currently halted. At this stage there is no guarantee that they will have access to the other areas they have targeted. The aquaculture activity will require at least areas that are about 10-20 m deep and if there are these areas that WCR will not be using, then DCA, can use these. The access was initiated here in the past through a lease that was provided by De Beers and which has now supposedly lapsed because it was a six		

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		months agreement. The current process of granting access to the DCA to the five sites north of Koingnaas during the next 2 years, by WCR which entails access arranged in an ad hoc manner with WCR 14 days prior to entry, is not giving the security of tenure that is a key requirement for DCA at this stage. Legal considerations are understood and WCR is the legal owner of most of the land adjacent Zone 4, and may uphold such land owner rights,		

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		but DCA wants to have security of tenure to at least access the abalone ranching zone by sea. **Operational Considerations** Not disregarding safety and mining, but the access agreement and negotiations, thereof, should be driven by the fact that other parties also have rights and not focus only safety considerations (GL).		

Interested and Affected Parties . List the names of persons consulted in this column, and Mark with an X where those who must be consulted were in fact consulted.	DateComments Received	Issues raised	EAPs response to issues as mandated by the applicant	Consultation Status (consensus dispute, not finalised etc.)
		Communication channels From the DCA perspective, the discussions for access are not on-going, because the communication was broken down. Stan Turketti (ST), had via email, closed the aspect of discussion and highlighted the fact that the DCA team had now selected alternative channels of addressing the matter. The regulatory authority channel was deemed as a channel that was used to deal with negotiations and as such the doors were closed by	VM stated that ST is still dealing with the operational matters from a risk perspective. From previous background, DCA was requested to come back after two years for access considerations on the areas to the south (Mitchell's Bay South) because of current mining activities, which would make the compliance with security and safety obligations difficult, if third parties were allowed to work at the same time. The access to the North of Koingnaas	

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		WRC. GL believed that the negotiations that were initially opened with WCR should still be continued and not wait for the specialist evaluations.	was never denied, but is subject to security control measures such as applying for security clearances.	
		Impact on water quality and turbidity concerns and EIA process undertaken. According to GL, there are no EIA authorization requirements for these abalone ranching activities, except for the land operations in Hondeklip Bay, for which an environmental study was done.	It would be appreciated if the environmental studies shared with WCR so that they act from an informed perspective on the overall issues and foundation for the issues raised and how the agreements could be drawn if negotiations in this regard are successful.	

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		The operations are all land based. There are no sea water pumps traversing the WCR mining sites. The water pumping area is all based in Hondeklip Bay. The EIA was only needed for the land based activities. The conditions of the rights are that monitoring must be undertaken. Aquatic Ecosystem Services is currently doing monitoring (Russel Trommers). There are control sites in between the zones, those that will never be seeded. An environmental risk		

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		assessment and environmental management programme was undertaken by Ecosense Environmental Consultants. A marine specialist report on the potential biological impacts associated with abalone ranching along the Northern Cape coast. Trans Hex Operations (Pty) Ltd (Trans Hex) was asked to comment on that process though, but no comments were received.		
		Collaboration and	The maps overlayed with information, where WCR	

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		information sharing A form of co-existence for Abalone activities to continue is crucial. The areas where mining would not cause destruction of habitat would be the target areas by DCA. So there is a request that the mine plan and the aquaculture activities be synchronised. The co-existence would be successfully achieved if, for the areas that WCR would not find appealing, the mining schedules with specific targeted areas, would be	would be mining and the abalone ranching seeding sites, was shared with GL and a copy of the maps provided to him. VM indicated that he would convey the outcomes of the meeting to ST who would see a way to open the communication channels between WCR and DCA.	

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		shared and then the aquaculture team would also present their plans and schedules. The maps would be used as a basis of decision making based on which areas show overlap and therefore the security team would make decision on the possibilities for co-existence. This meeting could not negotiate those matters because they are outside of the EIA delegation team mandate.		
		Terms of Reference GL indicated that Point 4 of the suggestion on the ToR was	BF indicated that suggestions as outlined below on the ToR, were discussed with WCR and	

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		put as a worst case scenario, to say should there be no opportunities for co-existence, then it would need to be checked, where else would abalone activities be able to survive and still thrive.	were welcome. Since the legal framework for the basis of the aquaculture activities and impact would nevertheless be required as part of the EIA specialist input. This was not spelt out on the ToR because it was part of the regulatory requirements to be addressed in the report and was expected on the specialist reporting requirements. 1. A legal review of applicable legislation, with a specific focus on user and access rights 2. A review of suggested	

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			access arrangements 3. A cost comparison of seeding abalone from land vs boat based seeding Identification of alternative areas for ranching in the Northern Cape Province and an assessment of the likelihood that these areas could be zoned for abalone ranching.	
Diamond Coast Abalone (DCA)	29 October 2016	The submitted comments of Diamond Coast Abalone (Pty) Ltd (DC as the rights holder for the Northern Cape Zone 4		Consultation has been finalised even though there has not been a concesus that has been reached as indicated under the submitted DCA

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		abalone ranching concession are provided under Voulme 3, Appendix h4.4-2of this EIAr		comments.
Environmental justice community Network	18 April 2016	Requested to be registered as Mining and Environmental Justice Community Network of South Africa (MEJCON-SA).	Acknowledge receipt of the registration as an IAP, which was received via email on 18 April 2016. MEJCON will be notified of further developments in the project. The environmental impact assessment stage will commence as soon as the scoping report has been approved by DMR and registered IAPs will be notified of the future reports production stages and when they will be	Finalised after the EIAr review phase but the IAP was registered.

Interested and Affected Parties . List the names of persons consulted in this column, and Mark with an X where those who must be consulted were in fact consulted.	**DateComments Received**	**Issues raised**	**EAPs response to issues as mandated by the applicant**	**Consultation Status (consensus dispute, not finalised etc.)**
			required to provide their inputs and comments.	
PCC	28 September 2016	The concern of public access to the coast was raised. The tourism initiatives with SANParks regarding somnaas are valued. The rate at which the sea rehabilitates after mining is not clearly understoond and the impact of sedimentation at rooilway bay is a concern. The impacts of sedimentation of the reefs/bays is a concern because it does not seem to be understood yet how far	Assurance was provided by Mr Pierre Kotze that Somnaas will remain open to the public during the mining activities. Regarding sedimentation of reefs, the assessment was done as part of the marine specialists on the possible impacts of high sediments on bentic communities and rock habitats and changes in biophysical characteristics on open coast beaches. In addition, the groyne / breakwater was considered as	This matter has been completed as part of the EIA, however it is still ongoing as part of the operational matters. It was indicated at this meeting by WCR representation, that the matter will be discussed by Mr Vincent Madlela at the next PCC meeting since there is also ongoing discussions with the Department of Public Works regarding the Somnaas aspect and the tourism initiatives. Monitoring protocol for sandy beaches, rocky shores and subtidal reefs has been developed and is

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		would the plumes go . the bay, but from their perspective it is debatable whether it would really be required – significant effort/cost for only a marginal gain. It was advised that the hydrography unit should be informed since there will be new slimes dams and this will impact on topograpjhical features and the landscape has to be captured anew.	an option to use it to assist in preventing sand moving out of the Rooilwal Bay but due to significant effort/cost at just only a marginal gain, it is not likely that this would be used. However, this option has been assessed. . The numerical modelling was complex due to the very irregular bathymetry in the Rooiwal area, which creates complex wave breaking and resulting current patterns. It was indicated that WCR resources have acquired a drone and therefore under that	part of the Volume 2 Part B as well as Volume 4. WSP report in Volume 4 deals with the aspect of a grayone at Rooilwal bay.

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			process the relevant authorities will be informed for its operational requirements. The hydrography unit was not informed as part of the EIA process though.	

iv) The environmental attributes associated with the development footprint alternatives (The environmental attributed described must include socio-economic, social, heritage, cultural, geographical, physical and biological aspects).

(1) Baseline Environment

(a) Type of environment affected by the proposed activity. (Its current geographical, physical, biological, socio-economic and cultural character)

The environmental setting provided in this section is based on the specialist input by Dr Andrea Pulfrich, 2015), for information pertaining to ecological aspects. The existing approved environmental management programme of 2011 for these concerned project sites, also provided background information. Since this is an amendment, the environmental setting information is still mostly applicable and specific details were updated where relevant. The Mine Works Programme of 2015 (MWP) for the project area and well as, WSP coastal protection report for beach mining in the Koingnaas area, 2015 provided site specific information. The other processed information is sourced from various accessible studies done on the project area and is also from consultant's experience of the surrounding environment.

The environmental setting described below entails the entirety of the study area, encompassing the following farms (Appendix 3):

- Somnaas 474,
- Koingnaas 475,
- Zwart Lintjes Rivier 484,
- Langklip 489,
- Elands Klip 333,
- Noup 473,
- Samsons Bak 330,
- Schulp Fontein 472,
- Zwart Duinen 332,
- Michell's Bay 495,
- Farm No. 496 (known as Kliphuis).
- Kanoep 491

1. Geology

1.1 Regional Geological Settings

The regional geology along the Namaqualand coast as described in the EMP, 2011, is characterised by Precambrian basement overlain by Cainozoic to recent sediments. Proterozoic gneisses or granite-gneisses underlie the greater part of the area, previously broadly classified as the Namaqualand Metamorphic Complex (NMC). This basement consists of an older suite of supracrustal rocks, now seen as bands and xenoliths of metamorphosed sedimentary and volcanic rocks.

Cainozoic sediment deposits are composed of alternating layers of conglomerate, sandstone, limestone, shales, marls, dune rock and sands of various colours (red, orange, greyish-white and beige) ranging from a depth of a few metres to greater than 100 m. Calcrete forms a cap over the sedimentary sequence in places. This calcrete is highly inconsistent in both composition and thickness and varies from calcium-rich grits and sands to almost pure, chalky, calcareous material up to 1 m in thickness.

The Quaternary to Tertiary deposits along this part of the west coast, which include the diamondiferous deposits, have been consolidated into the west coast group on the 1:250 000 Geological Sheet 3017 Garies included as Fifure (g) (iv) (a) 1 – 1: Geology of the Koingnaas are (compiled from 1:250 000 Sheet 3017 Garies and Sheet 2016 Springbok, Council for Geoscience of South Africa) (MWP, 2015). These deposits overlie various gneisses and met sediments of the Namaqualand Metamorphic Province (NMP) the Gariep Supergroup.

The diamondiferous deposits of the Namaqualand coastal plain have formed as a result of the erosion of primary kimberlite pipes located inland on the craton. These diamonds were transported to the west coast by fluvial systems and deposited on the coastal plain where various stages of erosion and reworking have resulted in a complex array of sedimentary deposits, which range in age from older Cretaceous channels to more recent Plio-Pleistocene raised beaches. A number of specific factors have determined the nature of the current in-situ sedimentary diamond deposits that are currently exploited, namely:

- The grade and stone size of the primary kimberlite source.
- The extensive fluvial transport distance from the primary kimberlite source.
- The dominant structural lineaments on the coastal plain resulting from the separation of Africa. from South America 130 million years ago.
- The type and competency of bedrock (gneisses, schists and quartzites) on a local scale as this determines the size and quantity of trap sites developed.
- Changes in sea-level and the associated reworking of the sedimentary deposits.
- The typical diamondiferous deposits observed on the coastal plain are remnant cretaceous palaeo-channels, Plio-Pleistocene linear raised beaches and remnant Miocene palaeo-meanders.

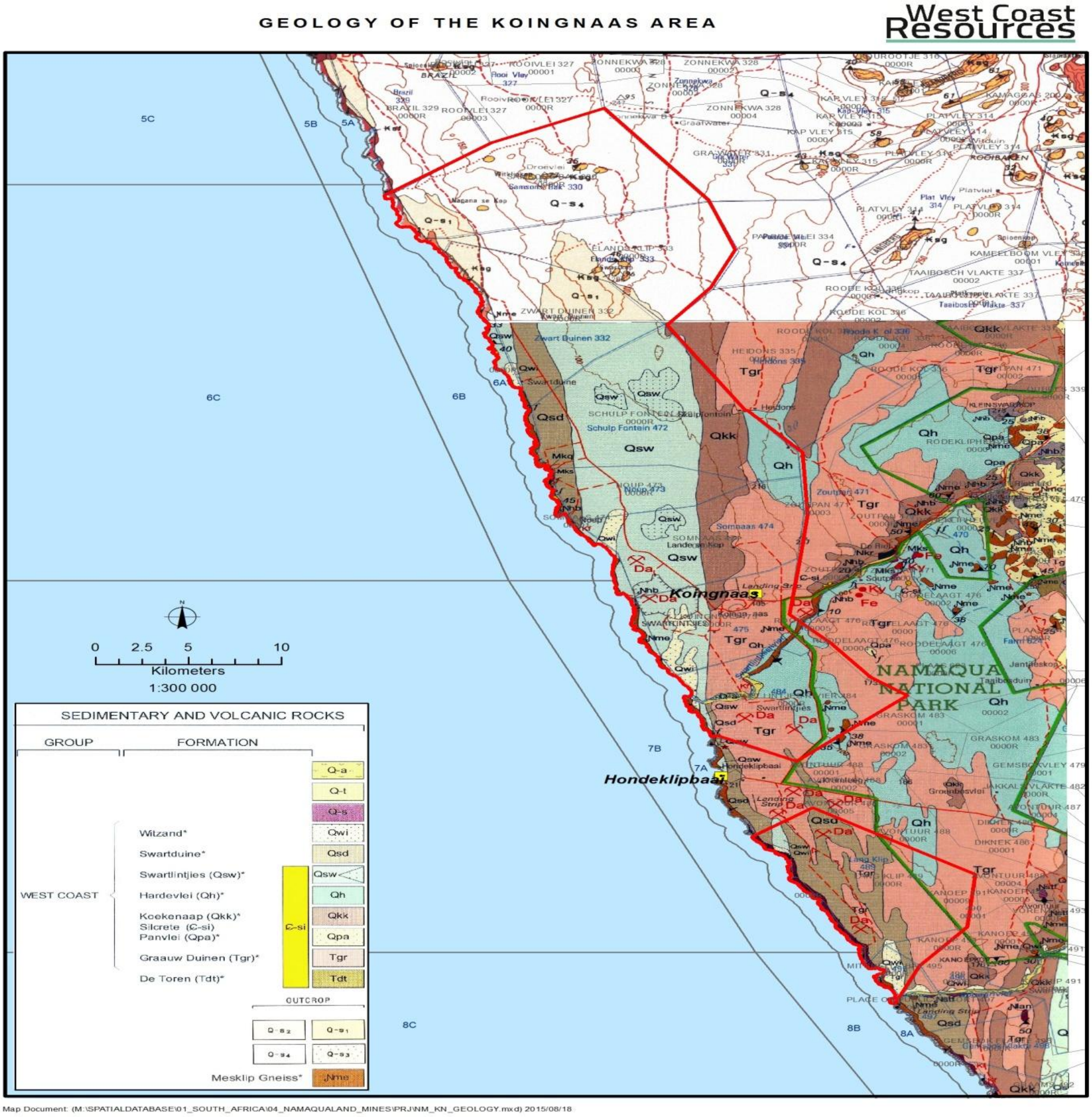


Figure (g) (iv) (a) 1 - 1: Geology of the Koingnaas area (compiled from 1:250 000 Sheet 3017 Garies and Sheet 2016 Springbok, Council for Geoscience of South Africa)

1.2 Local Geology

The KNR and the deposits of the adjacent Hondeklip Bay property are unusual as they do not conform to the west coast mineralisation pattern where diamonds are associated with linear-raised beach deposits as represented in the Buffel's Marine Right (BMR), north of Kleinsee. In the KNR, accumulations of high-grade marine sediments occur mainly in discrete bedrock depressions, which are underlain by older river channel deposits.

The KNR area is underlain by fresh to weathered gneisses and schists. The dominant structural features in the bedrock reflect the break-up fabric resulting from the split between Africa and South America about 130 million years ago (dominantly North North West (NNW)–South South East (SSE). Diamonds occur in small cretaceous age dendritic channel features. The drainage pattern of these channel features were mainly influenced by structural trends within the bedrock. The origin of these channels is only a couple of kilometres inland suggesting a local source on the coastal plain for the diamonds. Subsequently these channel features were re-used by different fluvial phases over time. The current fluvial fill, where preserved, is between 25 million and 55 million years old. Most of the sediments in these channel features were subsequently reworked by marine processes ranging in age from approximately 10,000 to 5 million years old.

Diamonds generally occur close to or on bedrock. The ore is generally less than a meter thick and consists of an angular argillaceous quartz rubble (channel sediments) or well-rounded marine grits and gravel. The marine deposits generally result in an upgrade when it reworks channel sediments. Marine reworking results in a halo of economic grades in close proximity to channel depressions. Grade varies from <5 to >500 carats per hundred tonnes (cpht) (average grade mined is approximately 25 cpht) and stone size is generally 0.22 to 0.25 carats/stone.

Overburden varies in thickness from <5 to 30 m and consist of terrigenous sand, windblown sand, marine sand as well as fluvial clay and peat. Laterite (dorbank) may occur close to or on the surface.

Koingnaas mining area has been extensively mined over the last 60 years. It comprises the southern Michelle's' Bay area and the northern Koingnaas area. The principle diamond source is a remnant cretaceous drainage system (Figure (g) (iv) (a) 1 – 2) incised into the gneiss and schist bedrock.

Figure (g) (iv) (a) 1 - 2: Diamondiferous Cretaceous channels and marine deposits of the Michelle's bay – Kooingnaas area

1.2.1 Koiingnaas area

The channel deposits are generally high grade. In many areas they have been reworked and re-concentrated during subsequent marine high stands. Marine transgressions into the sunken Cretaceous channel estuaries left behind beach gravel deposits overlying channel deposits in the form of a series of marine embayments. Due to the nature of the underlying bedrock and the embayed morphology the effects of longshore drift and redistribution of the diamond population is minimal and the grade of marine deposits is directly related to the underlying channel grade. The average stone size in the Koingnaas area is 0.20 - 0.25 cts/stone.

The channel deposits generally contain 1m-thick basal, matrix- supported, immature, poorly sorted, pebble-cobble gravel dominated by smoky vein quartz clasts. The gravel matrix comprises silt and clay. The channel gravels are often overlain by fluvial silt and clay, eroded to a variable degree by subsequent marine transgression.

The marine deposits comprise of clast-supported, pebble-cobble-boulder gravels. These deposits have been classified into two different packages - the 30 m Package (so-called Coarse Feldspathic Sand – CFS) and the 50 m Package (i.e. Fine Green Sand - FGS). Overburden is comprised of marine, terrigenous and aeolian sands. Total overburden, marine plus fluvial, can be up to 80 m thick.

Most of the diamonds are concentrated at the base of the fluvial and marine deposits and grades are enhanced by bedrock trap sites. Cementation occurs in places and blasting may be required. Where the marine and channel deposits extend offshore they occur in water depths of up to 10 m and with sediment cover of clay and sand of up to 30 m within the zone to 250 m seaward of the Low Water Mark (LWM).

Although extensively mined in the past, the Koingnaas area is still prospective on a local scale and is typified by high stone densities. Surf-zone mining has been minimal in the past and that resource remains virtually untouched.

1.2.2 Presence of dykes, sills and faults

Various geological faults pattern the coastal lowland, forming ridges and depressions running in a north south orientation. No dykes or sills are recorded in the area.

2. Climate

The KNSBC is situated in a semi-arid area. Most of the mining areas are next to the coast and therefore experience the moderating effects of the ocean. Rainfall falls during the autumn and winter months (i.e. from May to August). Coastal fogs occur year round but are more frequent during the winter period. Temperatures are relatively cool but increase markedly during berg wind conditions. The predominant wind direction is southerly. The climate data was sourced from the DWS station F4E001, located in Hondeklip Bay

2.1 Mean monthly and annual rainfall for the site and number of days per month with measurable precipitation

Average rainfall in the region amounts to about 100 mm a year and summer aridity is extreme. Mean monthly and annual rainfall is shown in Table (g) (iv) (a) 2 - 1. Table (g) (iv) (a) 2 – 1 below shows the average maximum 24-hour rainfall intensities per month measured at Koignaas on the coast and the town of Springbok, further inland.

Table (g) (iv) (a) 2 - 1: Mean monthly and annual rainfall

Month	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	Annual
Rainfall (mm) Kleinsee	16	16	11	5	8	4	6	5	6	7	12	15	111
Rain days (No.) Koingnaas	6	4.2	2.2	4	2.2	2	0.6	1.4	1.8	2.8	3.2	4.2	34.6
Rain days (No.) Springbok	4	4.3	3	2.5	1.3	1.1	0.8	1.1	2	2.5	3.8	4.3	30.6

Table (g) (iv) (a) 2 - 2: Maximum rainfall intensities

Month	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June
Intensity/ 24 hr Springbok	57.2	64.3	47	40.6	54.4	34	36	59.2	49	51.8	47	76.2
Intensity/ 24 hr Koingnaas	28.5	21.8	27.5	11	5.5	5.5	4.5	13	2.3	18.5	24.5	16.5

The frequency of fog day’s decreases from the coast towards the interior, a feature of all West Coast deserts. The presence of onshore winds is vital to the advection of sea fogs landwards. Fog extends furthest inland along river courses.

2.2 Mean monthly, maximum and minimum temperatures

Inland, temperatures are usually warmer than at the coast. The table below (Table (g) (iv) (a) 2 - 3) shows the average monthly temperatures for the study area measured for Kleinsee for the period 2005-2007. An average taken of these values shows the temperature to be a relatively constant 12-18ºC all year round.

Table (g) (iv) (a) 2 - 3: Mean monthly maximum temperatures

Month	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Annual
Temperature	15	14	14.5	15.5	17	17	18	17.5	17.5	16.5	16	15.5	16

Prevailing winds are determined by the South Atlantic high pressure system, the atmospheric pressure over the subcontinent and east-moving low pressure systems associated with the west-wind belt south of Africa.

The anticlockwise airflow around the South Atlantic high tends to be guided by the coast, so that near the coast, the wind is predominantly from the south (onshore). In winter the winds decrease considerably and blow more frequently from the north. Berg winds are a feature of the entire Benguela region and may occur throughout the year, but are more frequent in winter. The wind is hot and dry and usually blows from the east or north-east.

2.3 Mean Annual Evaporation

Results shown in Table (g) (iv) (a) 2 - 1 below indicate that between May and July there is less average evaporation, with the minimum of 97.05 mm experienced in July. The higher averages are in November, December and in January, with the maximum of 213.96 mm in January.

The site MAE is estimated at 1 775.89 mm.

2.4 Incidence of extreme weather conditions

Extreme weather conditions are rare and, in general, the coastline climate is fairly consistent. Winds occasionally reach gale force velocity and berg wind conditions can persist for a week or longer, causing higher than usual temperatures. Drought conditions are rare and rainfall is usually higher than average once in every 10 years, causing ephemeral rivers to flow.

Table (g) (iv) (a) 2 - 4: Rainfall and evaporation data

Description	**Rainfall (mm)**	**Evaporation (mm)**
October	8.34	165.95
November	6.61	197.04
December	5.47	211.39
January	1.08	213.96
February	2.80	168.25
March	3.52	158.43
April	10.08	121.37
May	11.84	109.91
June	19.23	97.08
July	16.42	97.05
August	14.44	107.81
September	8.63	127.65
Annual	*108.46*	*1775.89*

2.5 Winds

The wind climate has a strong seasonal character, typical of the west coast of southern Africa. Southerly winds dominate in summer and spring, with north-westerly winds being most common in autumn and winter. The predominant southerly winds cause the upwelling of the Benguella system, which cools and stabilises the near surface air mass and reduces the potential for rainfall occurrence. North-westerly winds occur approximately 18% of the time (during the 8-year wind data record) and usually during the Autumn and Winter months.

The winter wind speed, however, rarely exceeds 12 m/s (<1% of the data record). Southerly to south-easterly winds occur approximately 64% of the time with typical wind speeds of less than 12 m/s. The maximum wind speed recorded (3 hourly) at the offshore NCEP data point (S30.50 E17.00) data point was 17.55 m/s (34.11

knots). These high wind speeds of between 16.0-18.0 m/s have been recorded in both winter and summer months, however, they occur less than 0.1% of the time (WSP, 2015).

Table (g) (iv) (a) 2 - 5: MAR for DWS Catchment Areas

Description	**Surface Area (km^2)**	**Catchment MAR (mm/annum)**	**Calculated MAR (m^3/annum)**
Effective Catchment (F40B, F40C n F40D)	1753	2.4	4 207 200
Effective Catchment (F40E n F40F)	1747	2.4	4 192 800
F40A	1016	0.4	406 400
F40D	740	0.4	296 000
F40F	683	0.4	273 200

Table (g) (iv) (a) 2 – 5 above show the extent of the effective catchment within the study area to receive water from the upstream rivers.

2.6 Mean Annual Runoff

The MAR for the study area was sourced from the Water Research Commission database (WR2005). Table (g) (iv) (a) 2 - 5 below provides activity based MAR and the quantified impact on the Effective and Quaternary Catchment Areas.

Table (g) (iv) (a) 2 - 6: MAR for site infrastructure.

	Farm Location	**Latitude**	**Longitude**	**Surface Area (km^2)**	**Catchment MAR (mm/annum)**	**Calculated MAR (m^3/annum)**
Slime Dams	1. Somnaas 474	30° 10' 2.64" S	17°13'57.72" E	0.89	0.4	356
	2. Somnaas 474 and Koingnaas 475	30° 9' 51.48" S	17°14'54.24" E	0.758	0.4	303.2
	3. Koingnaas 475	30° 11'54.24" S	17°14'39.84" E	2.07	0.4	828
	4. Koingnaas 475	30° 12'46.08" S	17°17'46.32" E	1.52	0.4	608
	5. Koingnaas 475 and Zwartlintjies 484	30° 14' 7.8" S	17°16'9.48" E	1.85	0.4	740
	1. Lang Klip 489	30° 22'34.68" S	17°19'18.84" E	1	0.4	400
	2. Lang Klip 489	30° 25'36.48" S	17°20'30.84" E	2.62	0.4	1048
	3. Lang Klip 489	30° 25' 5.16" S	17°21'12.96" E	1.71	0.4	684

3. Topography

The coastal lowland rises gently from the sea to approximately 150 m above sea level. Over this area it is generally flat and featureless. The Great Escarpment marks the eastern border of the coastal plain. From an altitude of approximately 1500 m, rivers cut their way down and dissect the coastal plain. The foothills of the escarpment and the interior are more undulating than near the coast. The influence of rivers like the Buffels River in creating this landscape is clearly visible.

Various geological faults pattern the rest of the coastal lowland, forming ridges and depressions running in a north-south orientation. Nearer the coast, the predominant southerly winds have played a major role in moving sediment northwards and inland. Dune fields and blow-out depressions are common. Rocky outcrops, where they occur, have been exposed to sandblasting and wind erosion. The topography of the study area consists of the following areas:

- The ‘strand’, which takes the form of a rocky coastline for the most part, with intermittent dune areas.
- Stable and mobile dune fields: coastal dunes and sandveld dunes are distinguished.
- Vast stabilised sandy areas: white and red sand plains are distinguished.

Across the width of the KNBSC, which extends approximately 7 km -10 km inland, the coastal lowland rises very gradually to approximately 140 m above sea level (masl) around the KNR area and 160 masl around the SBR area. Mining in these complexes has changed the topography, through e.g. the construction of roads, buildings, establishment of structures and infrastructure e.g. mine residue deposits (tailings dumps, slimes dams and various stockpiles). Topography and drainage is further in Section g (iv) (a) 7.2.

4. Soil

The broad study area is covered by the following seven land types, as shown on the map in the Figure (g) (iv) (a) 4 - 1 namely:

- **Ah38, Ah48** (Red and yellow, freely-drained, structure less soils, high base status)
- **Ai13, Ai14, Ai19, Ai21**(Yellow, freely-drained, structure less soils, high base status)
- **Ha33** (Bleached, grey, structure less sandy soils)

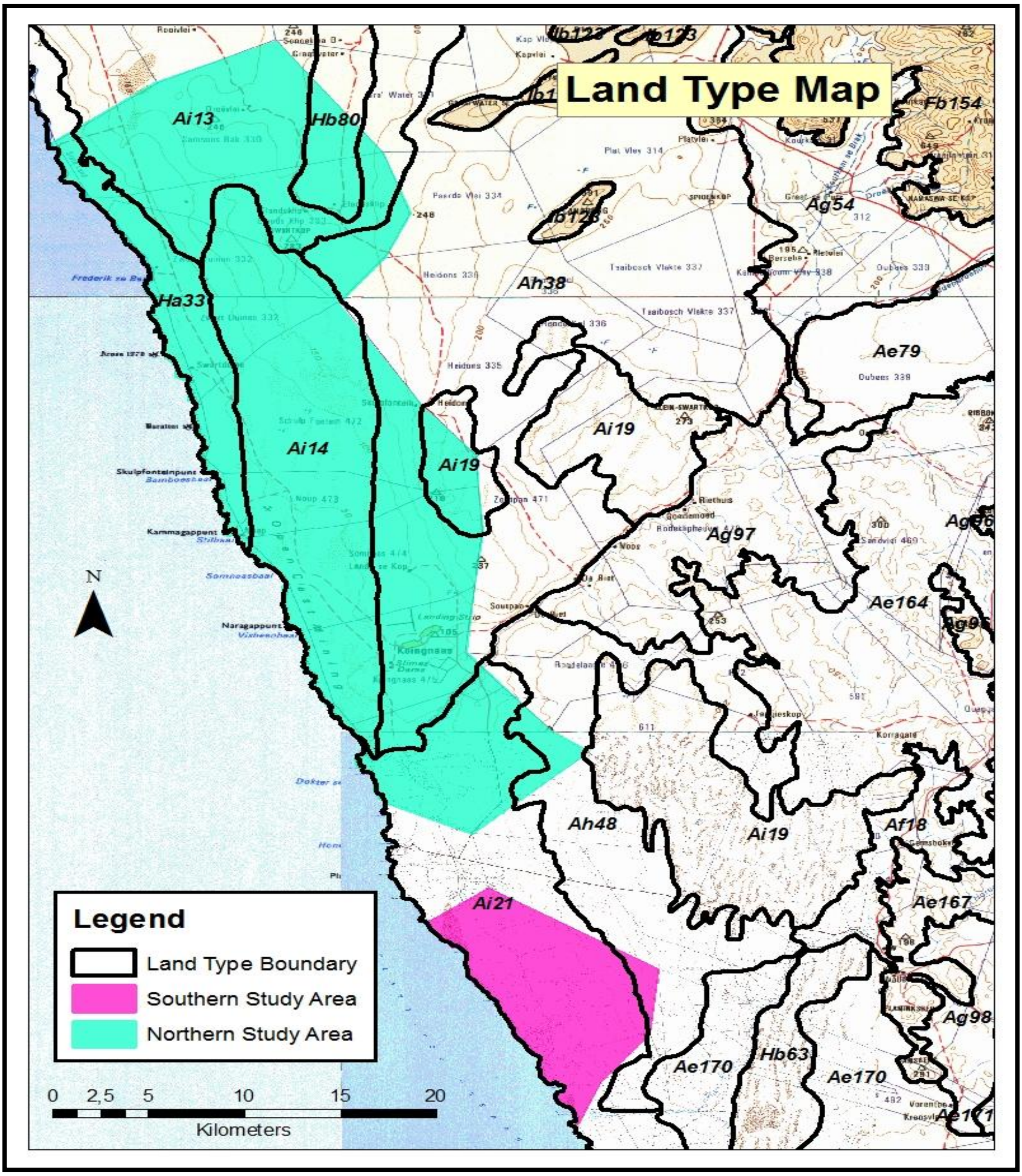


Figure (g) (iv) (a) 4 - 1: Land Types Maps

Existing information was obtained from the map sheet 3017 Garies (Fullstone & Oosthuizen, 1983) from the national Land Type Survey, published at a scale of 1:250 000. A land Type is defined as an area with a uniform terraine type, macroclimate and broad soil pattern. The soils are calssified according to MacVicar *et al* (1977).

A summary of the dominant soil characteristics of each land type is given in Table (g) (iv) (a) 4 - 1 below.

The distribution of soils with high, medium and low agricultural potential within each land type is also given, with the dominant class shown highlighted in bold type.

Table (g) (iv) (a) 4 - 1: Land types occurring (with soils in order of dominance)

Land Type	Depth (mm)	Dominant Soils	Percent of Land Type	Characteristics	Agric-Potential (%)
Ah38	>1200 >1200 >1200	Hutton 31/41 Clovelly 31/41 Vilafontes 11/31	47% 20% 19%	Red, sandy soils, occasionally calcareous Yellow-brown, sandy soils, occasionally calcareous Grey to yellow, sandy soils, occasionally on hardpan calcrete	High: 0.0 **Mod: 77.1** Low: 22.9
Ah48	600-1200 >1200	Hutton 30/31 Clovelly 30/31	69% 22%	Red, sandy soils, on calcrete/weathering rock Yellow-brown, sandy dunesoils	High: 0.0 **Mod: 69.7** Low: 30.3
Ai13	>1200 >1200	Clovelly 30/31 Fernwood 20/21	87% 10%	Yellow-brown, sandy soils Grey, sandy soils	High: 0.0 Mod: 1.7 **Low: 98.3**
Ai14	- 0-300	Rock Hutton 30/33	63% 29%	Exposed rock outcrops Red, sandy soils on rock	High: 0.0 Mod: 3.2 **Low: 96.8**
Ai19	>1200 150-1200 500-1200	Clovelly 30/31 Hutton 30/31 Clovelly 30/31	82% 7% 7%	Yellow-brown, sandy dunesoils Red, sandy soils, on dorbank/calcrete Yellow-brown, sandy soils on weathering rock	High: 0.0 Mod: 14.0 **Low: 86.0**
Ai21	300-1200 >1200	Clovelly 31 Fernwood + Clovelly	45% 30%	Yellow-brown, sandy soils on weathering rock Grey & yellow, sandy dunesoils	High: 0.0 Mod: 10.0 **Low: 90.0**
Ha33	>1200 >1200	Fernwood 20/21 Clovelly 40/41	81% 11%	Grey, sandy dunesoils Yellow-brown, calcareous, sandy soils	High: 0.0 Mod: 10.8 **Low:89.2**

Note: Agricultural potential, as shown in the right-hand column, refers to **soil characteristics only** and no climatic or other restrictions are taken into account

The soils of the project development area are, Aeolian sands with a marine origin of various ages that cover most of the Namaqualand coastal plain can be found. Near the coast, the sands are white in colour and range from mobile dunes through to vegetated hillocks**.**

Further inland the area is characterised by reddish consolidated sands that are much older and less mobile. The reddish colour of the sand is a result of iron oxidation in the older sands. Mobile dune fields are present in various inland areas of the coastal plain.

Deeper sediments include yellowish Pleistocene deposits of terrigenous feldspathic sands which grade upwards into reddish or brownish silty sands. A calcrete layer usually separates these deeper sands from surface aeolian Pleistocene sediments. Near the coast, recent dune sands often overlie the Pleistocene sands. Undisturbed (unmined) soils in the coastal areas are described as generally loosely packed sands, brown in colour which would classify as Namib from the Beachwood family.

Most plant growth is restricted to the relatively shallow topsoil layer. Most of the soils range from sands to sandy loams. The deeper sediments are sodic and salinity increases with depth due to the marine origin of these sands. When brought to the surface, these sands are not suitable for plant growth.

The soils exhibit a very alkaline pH, a characteristic of soils developing in a climatic regime where evapotranspiration greatly exceeds precipitation. Organic carbon levels are low. There are generally adequate levels of available phosphorous given the high pH of these soils. Trace element analyses reveal no apparent plant growth inhibitors (EMP, 2011).

Mined soils are mainly brown in colour, but depending on the source of the material may also be white or grey. At places, conspicuous layering is visible due to the mixing that takes place during dumping. These soils also have higher gravel content than unmined areas. Mined soils often have a hardened surface crust which is likely to inhibit root penetration by plants. The strength seems to be derived from chemical cementation of the soil particles, which is exacerbated by dispersion of clays and physical compaction of the soil structure.

4.1 Agricultural Potential

Dryland agricultural production hard to achieve because of the arid climate and lack of irrigation water. The main limiting factor that influences the agricultural potential rating is the combination of sandy to very sandy soils (with dunes in many areas) along with the very low average annual rainfall.

Accordingly, the agricultural potential for the survey area is low. The only agricultural activities that would be expected to occur would be livestock and/or game farming. The average grazing capacity for this area is low, namely approximately 40 ha per animal unit and the long-term annual average NDVI (Normalized Difference Vegetation Index) is moderate to low (Schoeman & van der Walt, 2004). Consequently even the natural vegetation in the area supports small stock farming.

Soil fertility variables are similar for mined and unmined soils, although as can be expected, the carbon content of mined soils is low Mined soils appear to have adequate levels of most plant nutrients and do not contain any toxic levels of trace elements. The sandy soils of Aeolian origin that occur in the region are considered sensitive due to their vulnerability to erosion (EMP, 2011).

Mobile dunes do not have much vegetation cover, and are shifted by the wind while the vegetated hillocks in the region are stabilised by the rooting systems of the plants that inhabit them. Such areas that are denuded of vegetation are exposed to the eroding action of the wind. Deflation areas and blowouts are a feature of inland areas often associated with overgrazing or mechanical disturbance.

Subsoil brought to the surface during excavating activities does not support vegetation growth well (this appears to be related to the high salinity of the soil and the high sodium content).

4.2 LandCapability

The Land capability system for South Africa (Schoeman *et al.,* 2002, was used to obtain a general idea of the land capability and land use for this area).

The study area falls within *land capability class VII*, with land use options largely restricted to grazing, woodland or wildlife.

Concept: Land in class VII has very severe limitations that make it unsuited to cultivation and that restrict use largely to grazing, woodland or wildlife; restrictions are more severe than those for Class VI because of one or more continuing limitations that cannot be corrected, such as very steep slopes, erosion, shallow soil, stones, wet soils, salts or sodicity and unfavourable climate.

Although the soils have a high sand content and rainfalls are low and not particularly intense, the mined soils have a low infiltration rate, and yield most of the overland flow that causes gullying of slopes. Rain causes the soil surface to slump and form a crust, so that overland flow and surface erosion occurs. As little rainwater is able to enter the soil profile, natural leaching does not take place, and the salts remain in the surface layers of the soil. These salts and the difficult physical conditions inhibit plant growth.

5. Biodiversity

The study area falls within the extensive, arid Succulent Karoo Biome (Rutherford & Westfall, 1994; Mucina *et al.* 2006 in Mucina & Rutherford, 2006) and regionally within the Namaqualand Sandveld Bioregion that lies parallel to the west coast in the western part of the Succulent Karoo Biome (Rutherford, Mucina & Powrie, 2006 in Mucina & Rutherford, 2006; Desmet, Turner & Helme, 2009)(Figure 8). The Succulent Karoo Biome has high levels of plant diversity and endemism and is one of the earth's 'hotspots' of plant diversity and the only entirely arid hotspot in the world (Van Wyk & Smith, 2001). Four vegetation types are found in or near the study area. They are (1) azonal Namaqualand Seashore Vegetation (AZd2) along the coast; (2) azonal Namaqualand Salt Pans

(AZi2); (3) Namaqualand Coastal Duneveld (SKs8) on the semi-mobile coastal dunes and (4) Namaqualand Strandveld (SKs7) found on red to yellow stabilized aeolian sand overlying a basement of marine sediments and granite-gneisses.

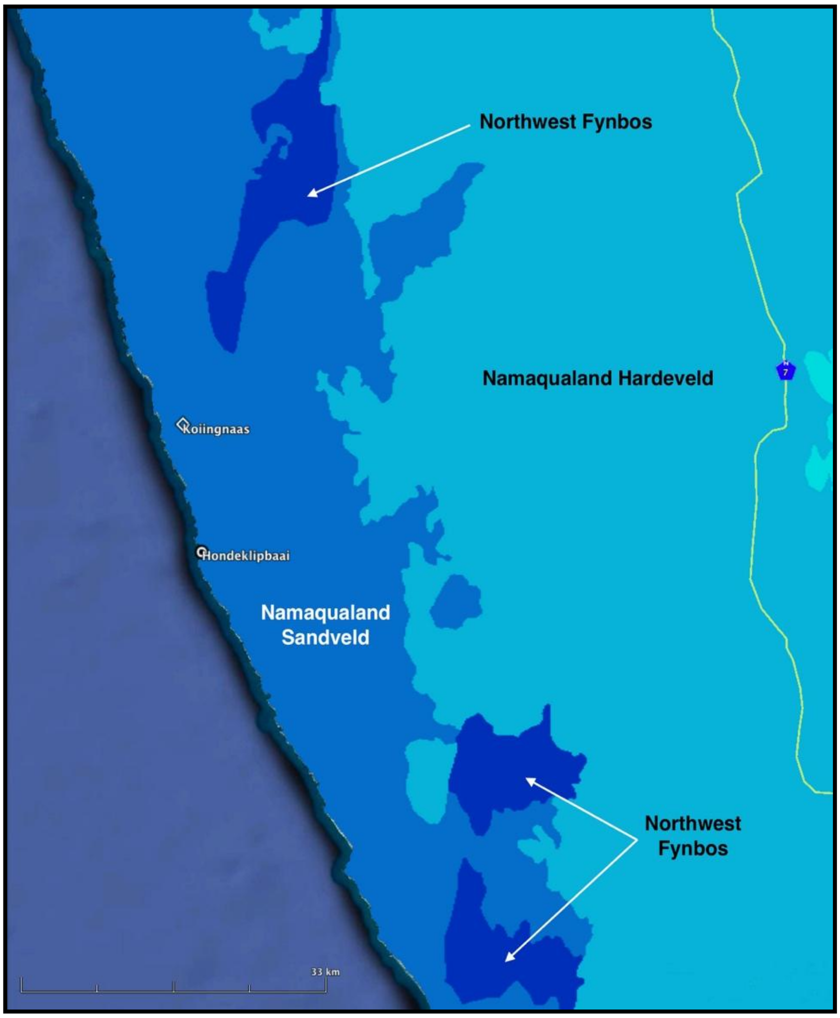


Figure (g) (iv) (a) 5 - 3: Portion of the bioregions map from Mucina, Rutherford and Powrie (2005) with the dark blue indicating the Namaqualand Sandveld bioregion closest to the coast

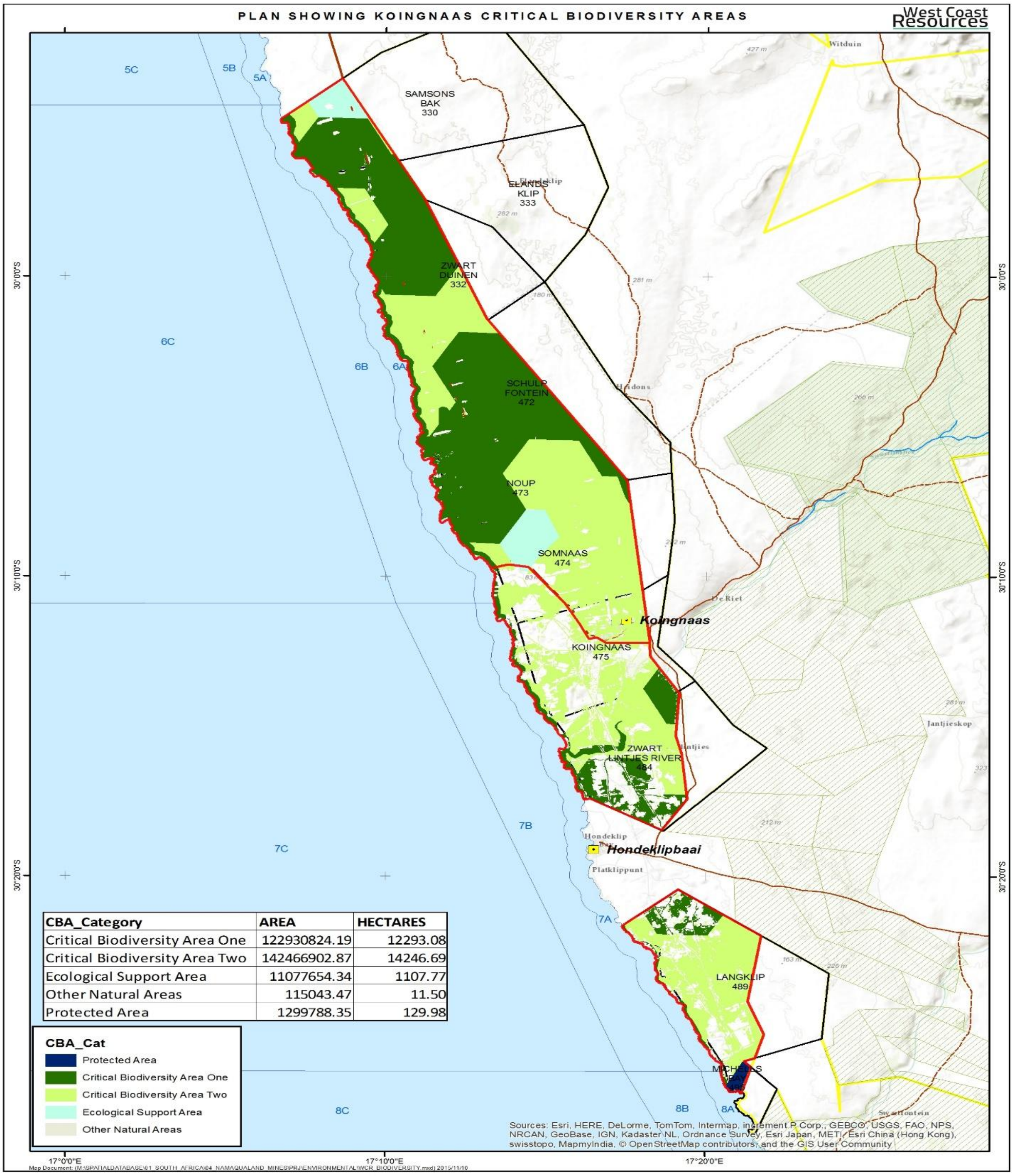


Figure (g) (iv) (a) 5 - 4: Portion of the mapped Critical Biodiversity Areas (CBA's) and Ecological Support Areas (ESAs) for Namaqua District Municipality on the coast. The purple shading represents Critical Biodiversity Areas (1); the light blue areas are Critical Biodiversity Areas (2), the green areas are Ecological Support Areas (ESAs) and the red area is a protected area, in this case Namaqua National Park

Critical Biodiversity Areas

Critical Biodiversity Areas (CBAs) within the Namaqua District Municipality (NDM) were mapped by Desmet and Marsh (2008). The study area largely falls within CBA (1) and CBA (2) within the coastal corridor.

Connectivity along the coastline is of primary concern as there are many species present in the area that are restricted to the coastline and mining development is the main contributing cause of habitat fragmentation in the area. Although the connectivity of the coastal strip is naturally fragmented to some extent by rivers and other features, these are of limited extent and mining along the coastline has significantly fragmented the coastal strip for associated species. The additional contribution of the current developments would be relatively low, given the large amount of existing disturbance within the site.

Linkages between the marine and terrestrial environment are important and large amounts of sand are being blown inland from the sea, thus also creating specific habitats inland that are important for fauna, many of which are listed and local endemics.

Faunal and Vegetation communities

Owing mainly to restricted access to the diamond-mining areas along the Namaqualand coast there have been few detailed botanical studies in the coastal sandveld of Namaqualand. Le Roux (1991) in a study of Brazil recognized three major plant communities: *Zygophyllum cordifolium–Drosanthemum marinum* Shrubland with *Stoeberia beetzii-Wooleya farinosa* Shrubland on flat, shallow sands and *Zygophyllum morgsana-Arctotis decurrens* (syn. *A. merxmuelleri*; *A. scullyi*) Shrubland on unstable to semi-stable white dunes. Low & Desmet (2007) observed that the dunes in the south of the Brazil area are unstable and poorly vegetated but overall the vegetation is in moderate to good condition with 43 species found in the above communities. These species include *Fenestraria rhopalophylla* subsp. *aurantiaca* the "window succulent", also of conservation importance.

The broad vegetation types recognized by Low & Desmet (2007) determined for their study at Brazil and Schulpfontein (that lie immediately north of Samson's Bak). This map is very similar to the National Vegetation Map for the area (Mucina *et al.* 2005, 2009).

The vegetation units recognized by Mucina, Rutherford & Powrie (2005, 2009) and Mucina *et al.* (2006) which occur within the study area are Namaqualand Seashore Vegetation (AZd2), Namaqualand Coastal Duneveld (SKs8), Namaqualand Strandveld (SKs7) and Arid Estuarine Salt Marshes (AZe1) (Figure 14). Namaqualand Salt Pans (AZi2) do not occur in the area investigated. The vegetation types principally affected by mining are Namaqualand Seashore Vegetation (AZd2), Namaqualand Coastal Duneveld (SKs8) and Namaqualand Strandveld (SKs7).

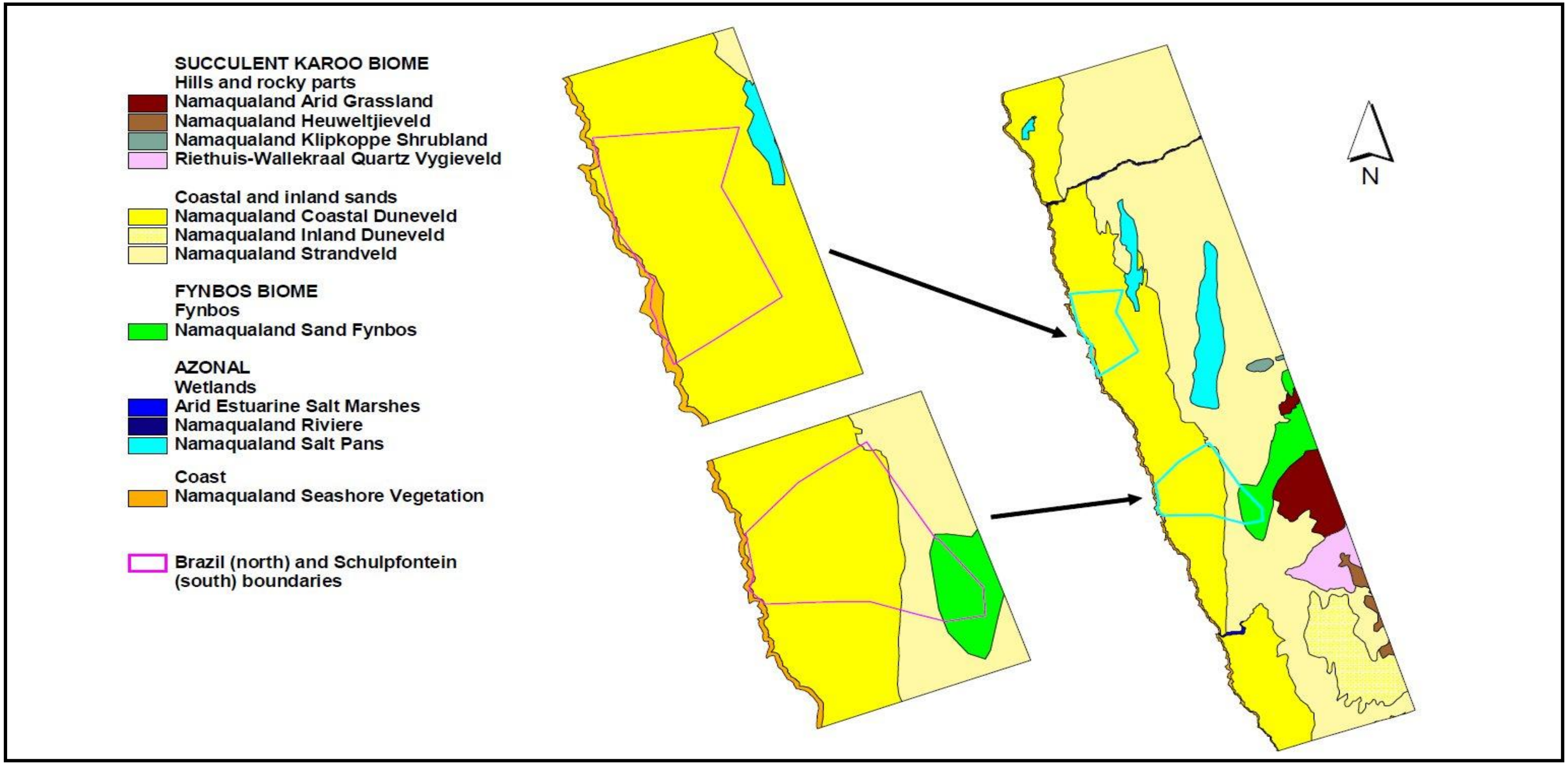


Figure (g) (iv) (a) 5 - 5: Vegetation map from Low & Desmet (2007) indicating the units they recognized for farms Brazil & Schulpfontein near Samson's Bak

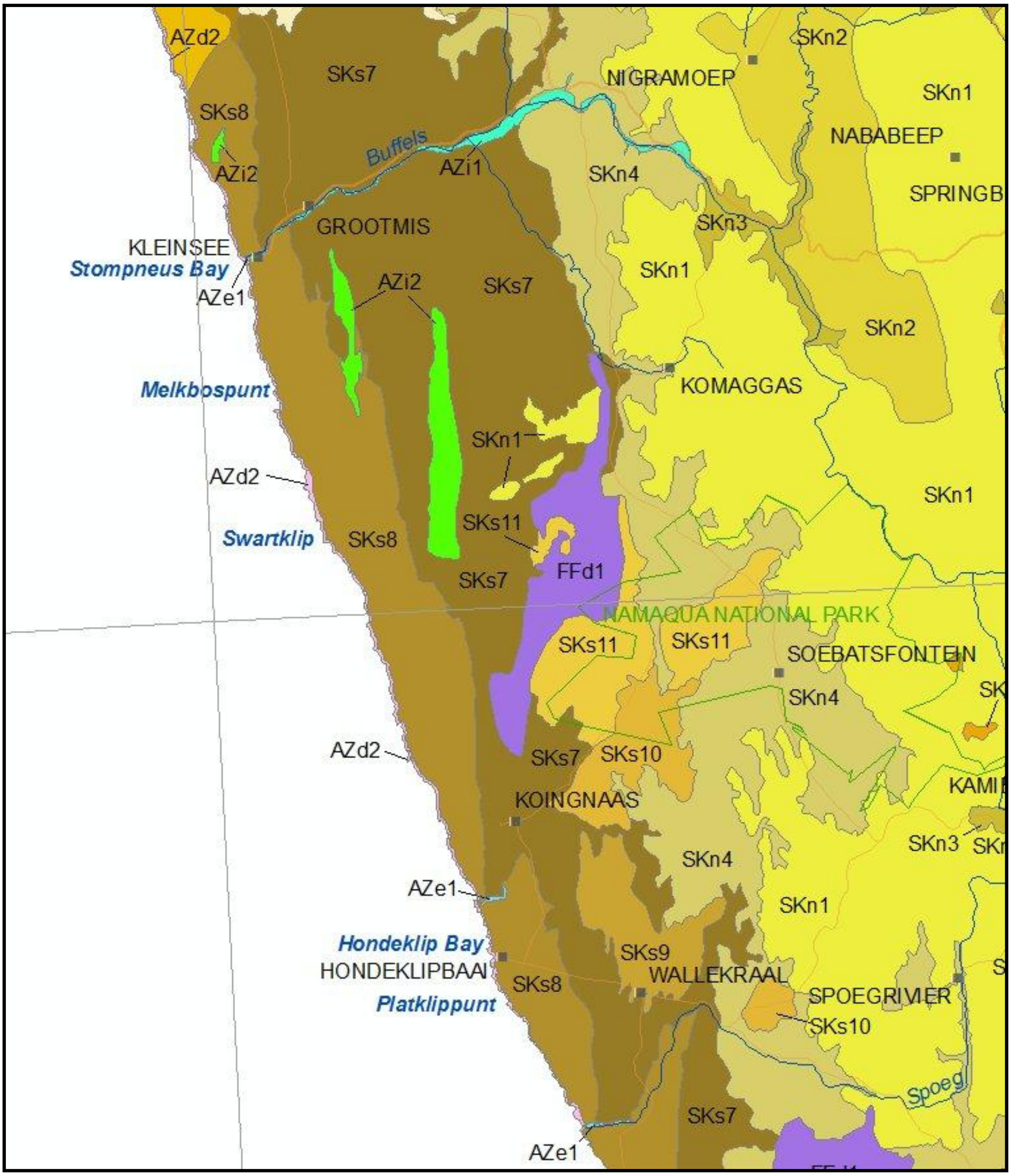


Figure (g) (iv) (a) 5 - 6: Portion of the Vegetation map of South Africa, Lesotho & Swaziland (Mucina *et. al.* 2005, 2009) showing the vegetation found on the Namaqualand coast. Codes for the relevant units are also given

2 Water Resources

6.1 Surface Water Resources

The study area is situated in an arid area where there is little surface water. The main rivers in the area are the: Swartlintjes River and the Spoeg River (Appendix 3).

WRC mining area straddles three quaternary catchments which are, from the north to the south; F40A, F40D and F40F; all of which fall within the Lower Orange Water Management Area. The study area is located on a coastal plain, west of the Kamiesburg Mountains. The topography is fairly flat and homogeneous; and for the most part reflects the gently undulating nature of the predominantly sand covered land surface. The topography of the study area is shown in Figure (g) (iv) (a) 6 - 1. Various dune systems provide some topographic variation to the comparatively featureless landscape. Ground elevation in the mine operational areas ranges from 0 to 200 metres above mean sea level (mamsl). The topography becomes very from the sea going inland. Figure (g) (iv) (a) 6 - 2 shows a topographical cross-section from (Point A) in the sea, through Koingnaas to Point B located inland. Several pans occur in the area. The project area is drained by several rivers that rise in the mountains and flow westwards to the Atlantic Ocean. The main rivers include Zwart Lintjes and Spoeg.

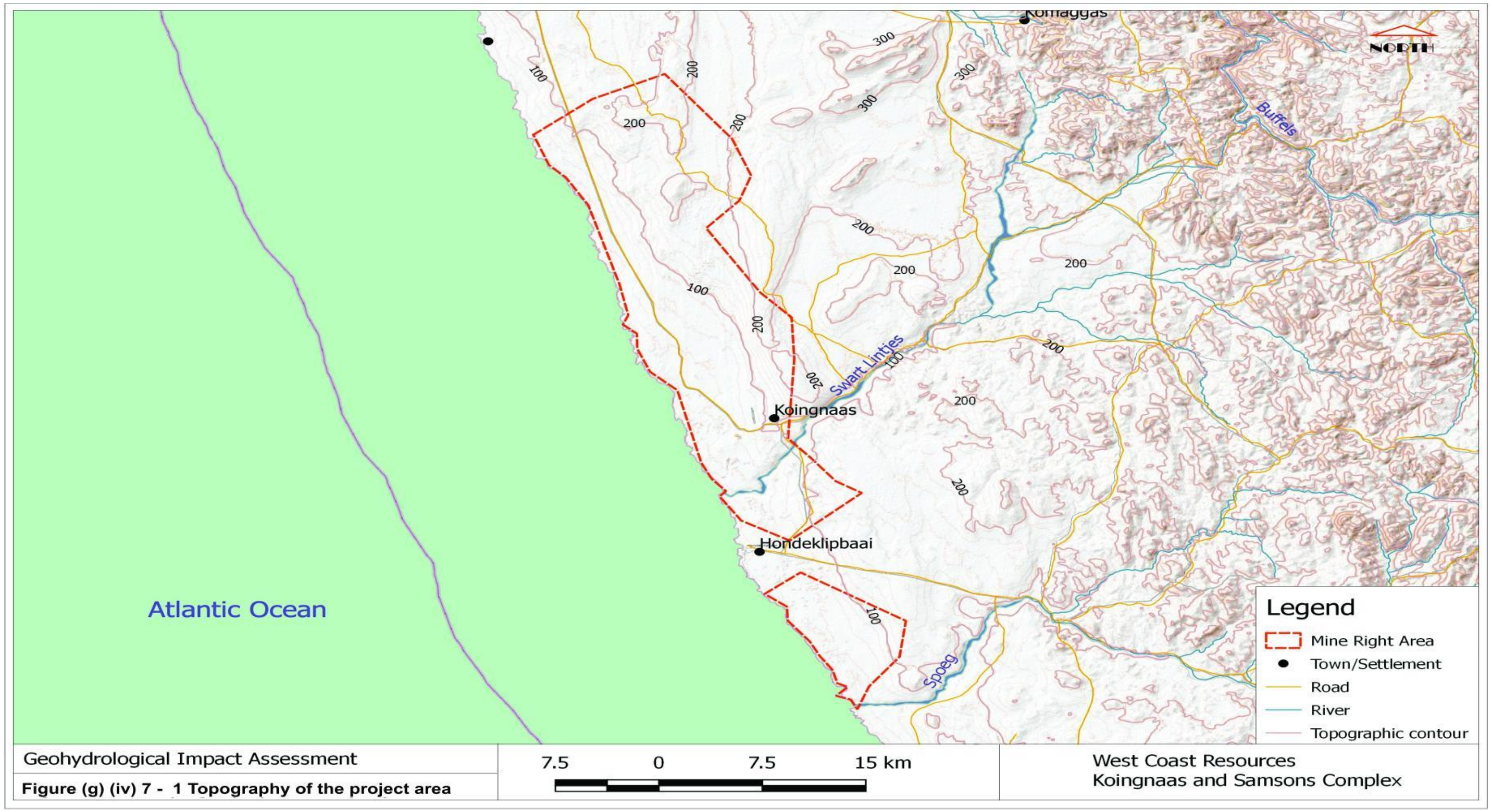


Figure (g) (iv) (a) 6 - 1: Topography of the project area

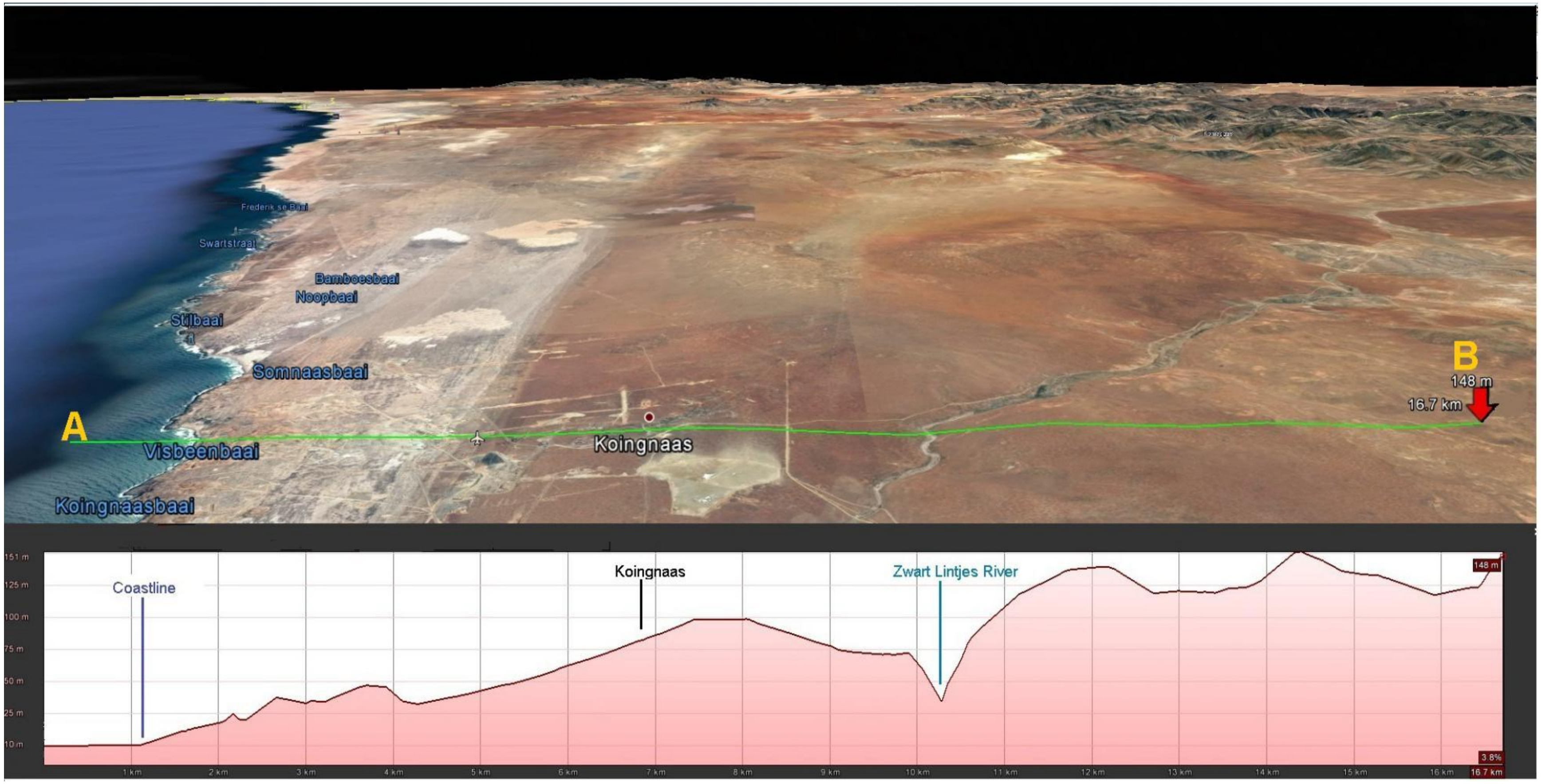


Figure (g) (iv) (a) 6 - 2: A topographical cross-section from (Point A) in the sea through Koingnaas to Point B located inland

The proposed mining activities are located in an arid area where there is little surface water resources.

According to the National Water Resource Strategy (2004) the Lower Orange WMA14 is impacted by upstream development, since it lies further downstream of five water management areas covering the Orange/Vaal basin. There are extensive inter-catchment transfers between most of these areas. For example the F40D quaternary catchment receives water from F40B quaternary catchment where the Swartlintjies River originates.

The study area lies in the F40A, F40D and F40F quaternary catchment regions that are draining to the sea with two significant non-perennial rivers, namely the Swartlintjies and the Spoeg River. However the study area lies mostly in F40A and F40F catchments.

The flow characteristics of the Swartlintjies and the Spoeg Rivers are epheral (Short lived). This makes it difficult to have 12 months of water quality data in any given year. Water quality samples can only be collected during the wet season and shortly after a significant storm event.

6.1.1 Swartlintjes River and Estuary

The Swartlinntjies River originates in the high ground of the escarpment, between Springbok and Kamieskroon. The River makes its way south westward, through Koignaas and into the Atlantic Ocean. An estuary is present at the mouth which is situated 6km north of Hondeklip Bay. Strong flow can occur after prolonged rains, but the river isusually dry (except for a few pools of standing water, due to the high water table, near themouth).

The Swartlintjies River traverse through the two quaternary catchments, F40B (draining in the South Westerly direction) and F40C (draining in the North Westerly direction), to the F40D catchment where Swartlintjies river transverse Koingnaas farm 475 to Zwartlintjies River 484 farm before it discharges to the sea in the south westerly direction. The river is 70 km long in extent from F40C while it extent to 64km from the F40B.

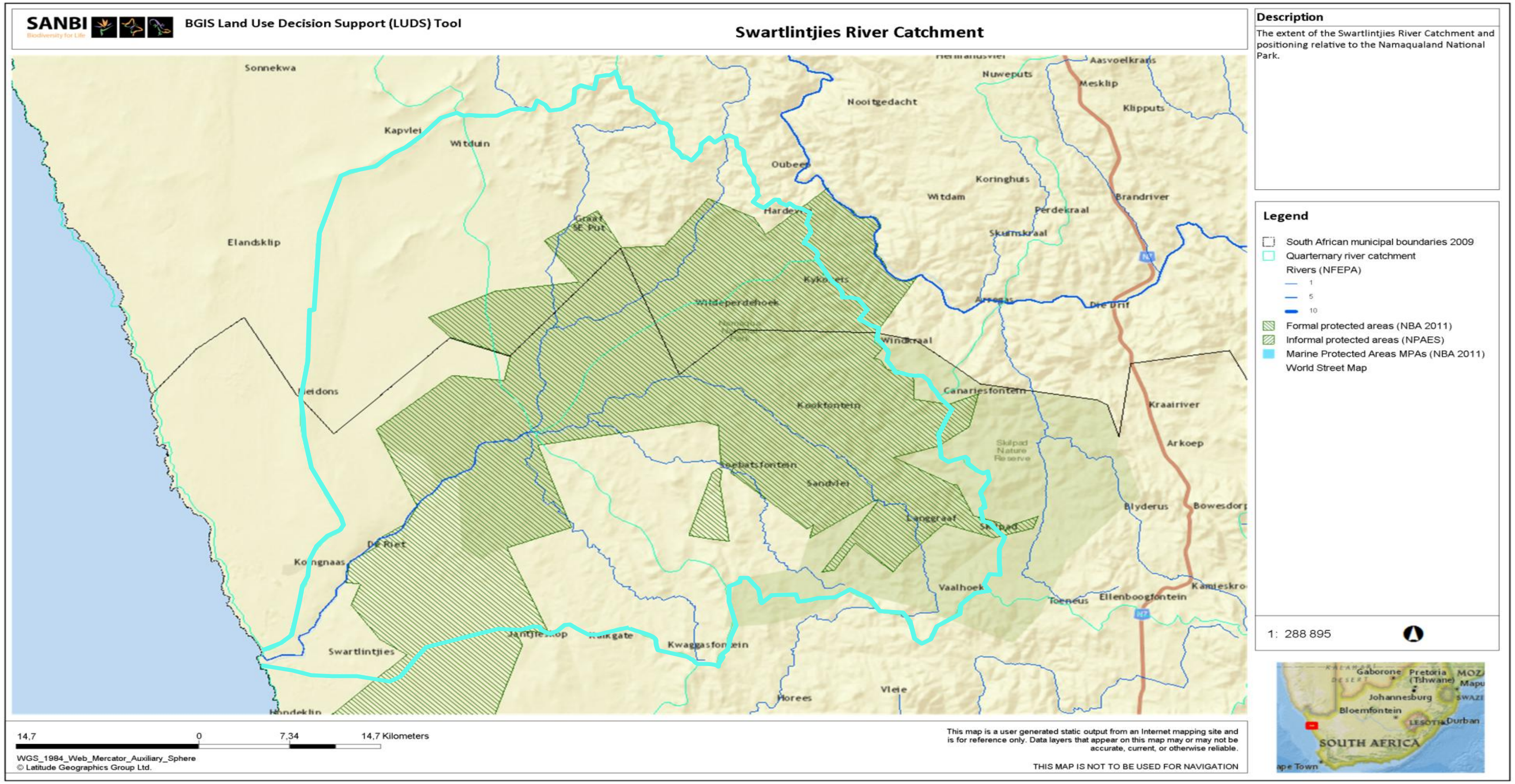


Figure (g) (iv) (a) 6 - 3: The catchment area (in light blue with dotted boundary) of the Swartlintjies River and its tributaries in relation to the Namaqua National Park (Source: Biodiversity GIS Online Map viewer 2016).

Due to the extent of the effective catchment area, strong flow can occur after prolonged rains. But the River is usually dry. Except for a few pools of standing water, due to the high water table towards the mouth of the River.

The Swartlintjies Estuary has been classified as a small ephemeral river outlet and is not considered one of the 289 functional estuaries in South Africa (Van Niekerk & Turpie, 2012). Using the NBA definition for delineating the extent of the Swartlintjies Estuary would result in a very small and meaningless management unit, which is not practically implementable. Consequently, the extent of the estuary, i.e. the EFZ, was determined according to the 5 m contour above mean sea level (MSL) (Figure (g) (iv) (a) 6 - 4).

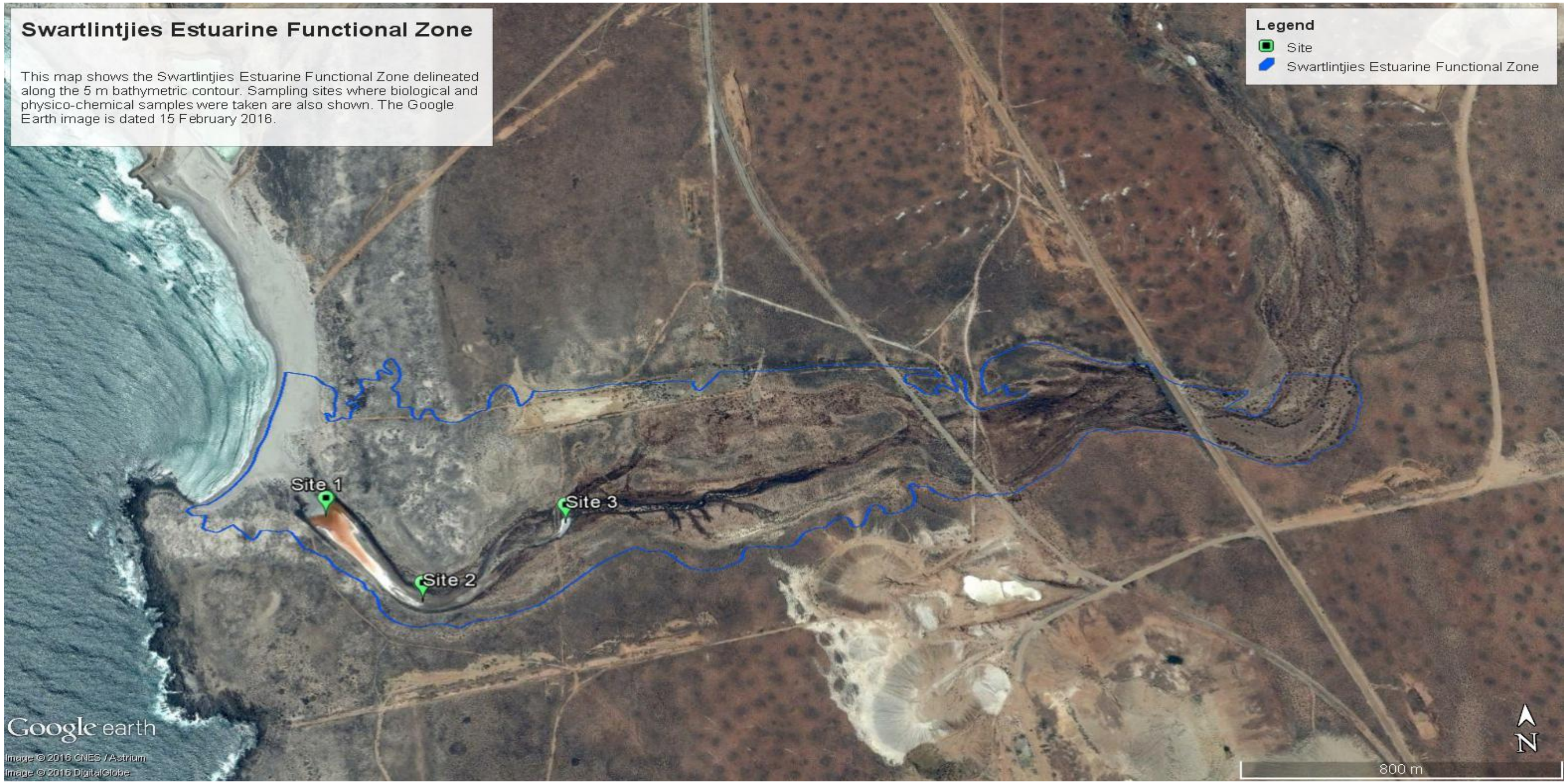


Figure (g) (iv) (a) 6 - 4: The Swartlintjies Estuarine Functional Zone showing biological and physico-chemical sampling sites (Source: Contour lines provided by WCR)

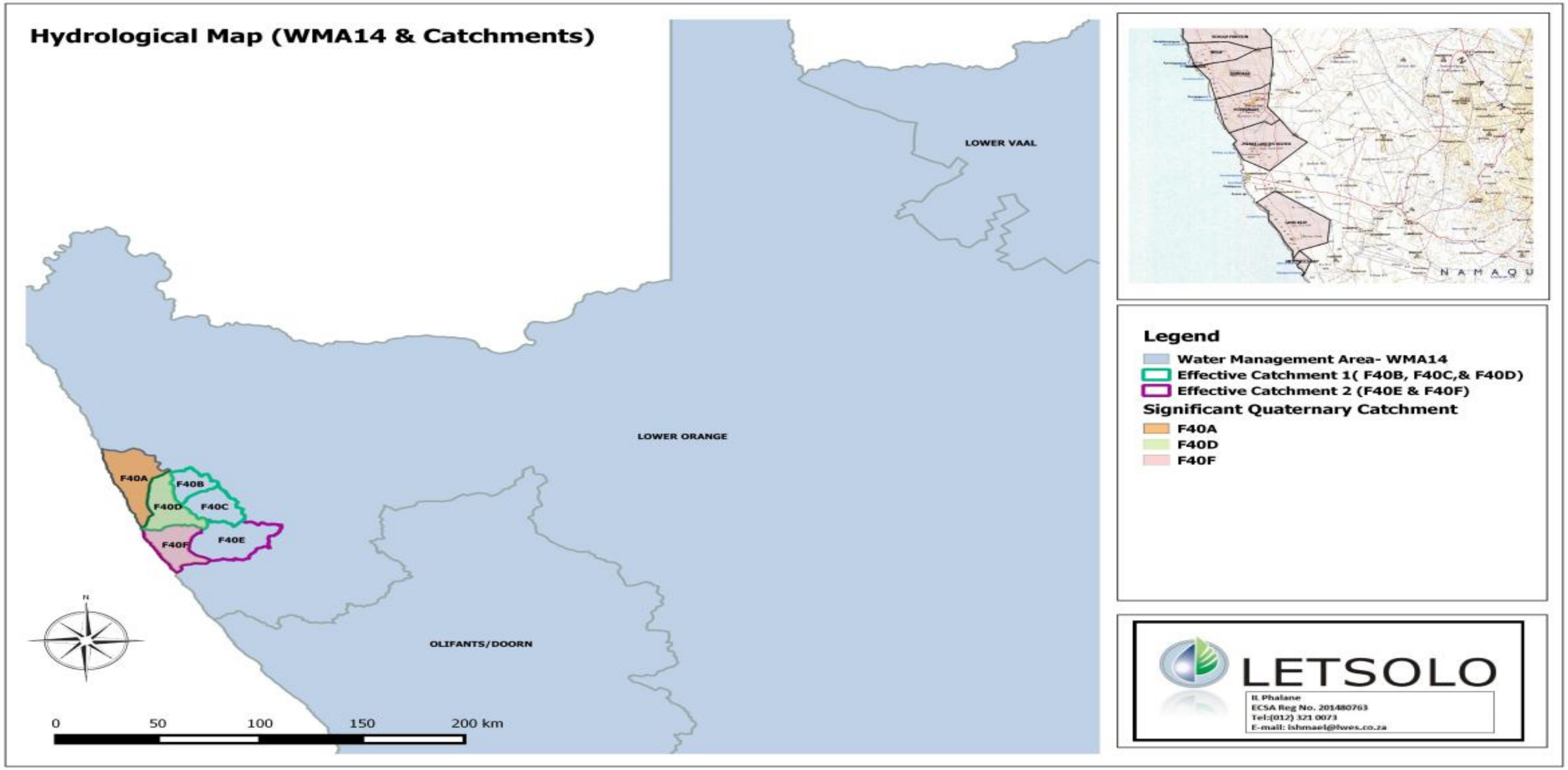


Figure (g) (iv) (a) 6 - 5: Hydrology Map (WMA14 and F40A, F40D, and F40 F Catchment

The Swartlintjies Estuary is situated on the West Coast of South Africa, approximately 6.5 km south of Hondeklip Bay within a strict security area of the Koignaas mining concession, which was previously mined by De Beers and where WCR is currently re-establishing diamond mining operations. The estuary is situated within the cool temperate biogeographic region of South Africa (Harrison, Cooper, & Ramm, 2000) and spans the Kamiesberg and Nama Khoi Local Municipalities (part of the Namaqua District Municipality) in the Northern Cape Province. The estuary is fed by the Swartlintjies River, which is approximately 65 km long with a catchment size of 1748.48 km^2 (RSA DWA, 2009).

The ephemeral Swartlintjies River only flows for short periods of time after rainfall events which occurring mostly between April and August. The Swartlintjies River and its tributaries have zero flow for more than 75% of the time and hence the catchment receives a low Mean Annual Runoff (MAR) of 1.45 Mm^3 (RSA DWA, 2009). The riverbed in the upper catchment is deeply incised and the presence of braided channels indicates that the river should, if unhindered, come down in flood during episodic rainfall events (Heinecken, 1980). As is the case with other west coast rivers, the Swartlintjies is young in geological terms and is fast flowing when in flood. Such floods cause considerable erosion and the river is expected to deposit its silt load in the coastal flood plain (Heinecken, 1980; RSA Department of Agricultural Technical Services, 1975).

Flow in the lower catchment and into the estuary has been severely reduced as a result of the construction of roads through the riverbed. The road connecting Hondeklip Bay with the Koingnaas mining entrance crosses the river 9 km from the mouth connecting the river on either side by a pipe with a diameter of approximately 50 cm. The pipe is not visible on the upstream side of the gravel road and it is suspected that the inlet is buried, causing the road to act as a flood attenuating, and minimally permeable barrier. The haul road situated 3 km upstream of the mouth within the restricted mining concession area of the WCR represents another barrier to the flow of the Swartlintjies River, preventing runoff from much of the catchment from reaching the estuary and the river from reaching the floodplain. In an attempt to connect the river to the estuary, a number of pipes have been buried in the gravel of the haul road. These pipes are, however, ineffectual as the inlets for the pipes are elevated approximately 1 m above the river bed. Two smaller roads situated 1 km and 2.2 km from the mouth are no longer in use but are still in place and are further impeding the very limited flow that would otherwise reach the estuary, (Photo g – 1, Photo g – 2 and Photo g – 3). Rainfall had been followed by spring tide conditions (high tide approximately 1.75 m on 23 June) on the day of the field visit (South African Navy, 2016). The estuary was filled with hypersaline seawater of up to 50 cm depth and a continuous water body extended approximately 450 m inlands from the berm. Stagnant pools and water in narrow channels extended up to approximately 980 m upstream above this point. The presence of recent and bleached dried kelp 500 m upstream coincides with observations made during the Estuarine and Coastal Research Unit (ECRU) survey on 16 October 1980, and indicates that seawater regularly penetrates the river outlet at spring tide. Hypersaline conditions and stagnant water with signs of eutrophication 980 m from the mouth indicates that seawater possibly penetrates 1 km inland during spring tide and evaporates slowly, thereby forming a salt crust until the next spring tide occurs. It is, however, possible that rainfall prior to this EIA field visit also contributed to the amount of water that was present in the upper reaches of the estuary. The impact of the rain was evident in very muddy conditions in depressions on the floodplain and on the banks of the narrow channels.

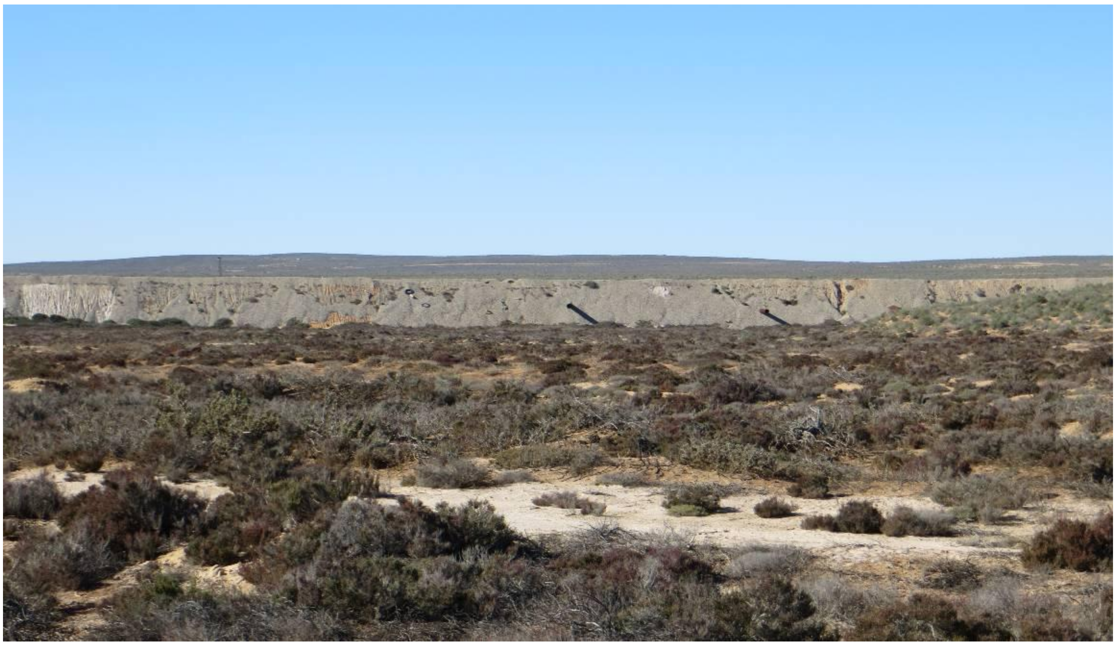
A

B

C

Photo g - 1: Photos of the road that connects Koignaas mine entrance with Hondeklip Bay. The road crosses the river approximately 9 km from the Swartlintjies Estuary mouth and acts as a minimally permeable flood attenuating barrier (C). Stagnation and signs of eutrophication are evident in the upstream water body (B). Photos were taken on 23 June 2016.

A



B

Photo g - 2: Photosof the main haul road situated 3 km upstream of the mouth within the restricted mining concession area of the WCR. This road prevents the river from reaching the floodplain. Photo A faces upstream and photo B shows how the intake pipe is elevated at least 1 m above the riverbed. Photos were taken on 23 June 2016.

A

B

C

Photo g - 3: Photos of the upper reaches of the Swartlintjies Estuary, approximately 1 km upstream from the estuary mouth. Photo A shows the continuous water body extending from the mouth 480 m inland. Photo B shows signs of eutrophication in the water body that were found approximately 1 km from the mouth. Photo C shows the salt crust and salt crystals that overlaid the sediment in all water bodies. Photos were taken on 23 June 2016.

A

B

C

Photo g - 4: Photos of the upper reaches of the Swartlintjies Estuary and its floodplain. Photo A shows muddy banks of the upper estuary channel, demonstrating that rainfalls could have contributed to relatively high water levels in the estuary. Photo B shows muddy sediment on the otherwise dry floodplain (Photo C). Photos were taken on 23 June 2016.

6.1.1.1 Physical and chemical characterisitics of the estuary

The Swartlintjies EFZ covers 1.37 km^2. The lower reaches of the Swartlintjies riverbed is characterised by two extended meanders that widen out into the floodplain that was created by an extensive network of braided flood channels. The floodplain is approximately 400 m wide and 1.8 km long. The riverbed then narrows into a channel that is flanked by low-lying vegetated dunes but widens again slightly towards the mouth, which opens northwards into a small bay (Heinecken, 1980). Low hummock dunes can be found south of the flat sandbar (approximately 0.5 m above Mean High Water Spring tide level) (Heinecken, 1980) that separates the river outlet from the sea. Parts of the barchanoid dunes to the north of the mouth were removed permanently during trench excavation in the past.

6.1.1.2 Geology and sediments of the estuary

The basement rock of the area falls within the Namaqualand –Natal belt of metamorphism and granitisation and is overlain by a number of sedimentary sequences. The sediments of the Swartlintjies Estuary and surroundings are derived from these sequences and are locally known as the Koignaas Complex (Heinecken, 1980). The soil type has been categorised as “Red and yellow, well drained sandy soils with high base status” (SANBI, 2016a). More detailed information was provided by Heinecken (1980), who described three distinct bands of surface soil formations. The triangle of barchanoid dunes north of the estuary were not vegetated in 1980 but have since then been colonised by Namaqualand Seashore Vegetation (SANBI, 2016b). However, these dunes have been largely destroyed by mining activities along the coast. Inland of the barchanoid dunes, a band of vegetated white dunes approximately 400 m wide were followed by vegetated red sands with darker termitaria “heuweltjies” extending inland.

A 1 cm salt crust covered grey riverbed sand mixed with black organic sludge. Particle size analysis of the sediment showed that sand was coarse and poorly sorted at the mouth, suggesting the presence of marine sediments that were transported into the lower estuary by spring tides. At Sites 2 and 3, the sand was medium-grained and sorted moderately and poorly respectively (classification according to Forbes and Demetriades (2003)). The organic content (measured as Total Organic Carbon) of the riverbed sand underlying the water bodies was high at all sites with an average of 11.1±1 %. It is generally accepted that organic content > 4% is indicative of a eutrophic system (Forbes & Demetriades, 2003). Heinecken (1980) also described a black organic sludge near the surface of the dry river bed, although this was covered by a thin layer of light grey fine sand instead of a salt crust. A sediment core taken in the dry riverbed during the ECRU survey showed that black organic sludge was separated by a thin layer of rust coloured fine sand and medium to coarse grained sand at 6 cm and 44 cm depths, respectively. This black organic sludge overlaid fine grey sand (Forbes & Demetriades, 2003).

Trace metal levels in the estuary sediments were compared with guideline screening levels published by The National Oceanic and Atmospheric Administration (NOAA), which cover a broad spectrum of concentrations from toxic to non-toxic levels as shown in Table (g) (iv) (a) 6 - 1. The Effects Range Low (ERL) represents the concentration at which toxicity may begin to be observed in sensitive species. The ERL is calculated as the lower 10th percentile of sediment concentrations reported in literature that co-occur with any biological effect.

The metal concentrations in the sediment collected at the Swartlintjies Estuary were all below the ERL threshold, except for Cadmium at Site 2, which exceeded the threshold by 0.1 µg/g. It was not only Cadmium that was elevated at this site. All of the trace metals that were assayed at this site were elevated, indicating that this location acts as a trace metal sink.

It is unlikely that the high metal levels occur as a result of point source pollution, but rather as a result of accumulation over time. Due to the obstructions to freshwater flow within the lower catchment and EFZ , the estuary has not, for a while, experienced floods with the capacity to flush sediments, salts and trace metals to sea.
Manganese levels in the estuary are high, however, it has been shown that substrate along the west coast of South Africa is naturally high in Manganese. (Overall, the diamond mining industry does not use chemicals for the processing of diamonds and is therefore not considered to pollute the environment (with the exception of salinisation as a result of the seawater used for diamond washing).

Table (g) (iv) (a) 6 - 1: Metal concentrations in sediment collected at Site 1-3 compared to the National Oceanic and Atmospheric Administration (NOAA) sediment quality guidelines (where applicable). Concentrations are parts per million dry weight and ERL = Effects Range Low.

Table (g) (iv) (a) 6 - 1: Metal concentrations in sediment collected

Metal	Effect Range-Low (µg/g)	Site 1	Site 2	Site 3
Arsenic	8.2	0.2	3.6	1.3
Cadmium	1.2	0.3	1.5	0.4
Copper	34	3.7	11.4	3.6
Lead	46.7	2.6	15.1	4
Mercury	0.15	34.6	138.5	34.6
Nickel	20.9	9.1	17.3	10.3
Zinc	150	12.5	67.6	14
Aluminium	-	0.79	3.58	1.48
Manganese	-	299	634.8	268.1

6.1.2 Spoeg River

The ephemeral Spoeg River arises in the high ground of the escarpment, near Garies, and drains along the southern border of the KNR. The river meanders north-west and then west towards the coast into the Atlantic Ocean at Michell's Bay. Like the Swartlintjes, the Spoeg River is ephemeral.

Originating in the F40E catchment is the non-perennial Augabies River flowing north westerly then south for 44.2 km before it discharges to non-perennial Spoeg River within this catchment. The Spoeg River arises in the high ground of the escarpment near Garies. This River drains in a north west and then west towards the Atlantic Ocean at Mitchell's Bay.

The Spoeg River then flows in the north westerly direction again for 28.9 km within F40E catchment to drain into the F40F catchment where it continues to flow for 22.5 km in south westerly then west direction traversing the southern part of Mitchell's Bay 495 farm to discharge at the Sea/ Atlantic Ocean.

6.1.3 Wetlands

The estuaries at the mouth of the Swartlinjies and Spoeg Rivers can be considered wetlands and as such sensitive areas.

6.1.4 Surface Water Quantity and Quality

With the exception of the ephemeral Swartlintjes – and Spoeg Rivers, no significance occurrence of surface water is to be found within the KNR. The lack of permanently flowing rivers within the study area implies that surface water is not generally available for use, and the quality thereof has not been tested.

6.1.5 Surface Water Use

There is some surface water in the Buffels River estuary. This is the result of the high water table caused by the presence of an aquifer in the lower reaches of this river. The lack of any permanently flowing rivers within the study area implies that surface water is not generally available for use. Sub-surface water is extracted from a number of sources and made available for the inland mining operations and the associated towns in the area.

6.1.6 Floodline Delineation

A map super-imposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers.

The river output during the floodline delineation are shown in Table (g) (iv) (a) 6 – 2 and Table (g) (iv) (a) 6 – 3.

Table (g) (iv) (a) 6 - 2: Swartlintjies River Output

Reach	River Sta	Profile	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude # Chl
Upper	20	1 in 50	266.61	26.24	27.25	27.25	27.64	0.005707	2.94	100.39	130	0.96
Upper	20	1 in 100	337.63	26.24	27.4	27.4	27.84	0.005483	3.16	119.18	135.93	0.96
Upper	19	1 in 50	266.61	24.44	26.37	26.37	26.87	0.00618	3.16	84.46	83.87	1
Upper	19	1 in 100	337.63	24.44	26.55	26.55	27.13	0.005682	3.38	100.41	90.91	0.99
Upper	18	1 in 50	266.61	23.69	24.64	24.64	25.03	0.006736	2.78	95.75	122.56	1.01
Upper	18	1 in 100	337.63	23.69	24.78	24.78	25.23	0.006241	2.99	113.17	127.03	0.99
Upper	17	1 in 50	266.61	23.96	25.05	25.05	25.4	0.00711	2.62	101.75	148.58	1.01
Upper	17	1 in 100	337.63	23.96	25.18	25.18	25.58	0.006662	2.79	121.18	158.88	1
Upper	16	1 in 50	266.61	13.9	15.01	15.11	15.46	0.01136	3	89.01	151.12	1.25
Upper	16	1 in 100	337.63	13.9	15.09	15.22	15.65	0.012335	3.29	102.54	160.82	1.32
Upper	15	1 in 50	266.61	13.52	14.16	14.16	14.36	0.008487	2.01	132.33	327.36	1.01
Upper	15	1 in 100	337.63	13.52	14.23	14.23	14.47	0.007942	2.16	156.43	344.58	1
Upper	14	1 in 50	266.61	2.84	3.51	3.59	3.87	0.014357	2.67	99.97	240.87	1.32
Upper	14	1 in 100	337.63	2.84	3.56	3.68	4.01	0.015548	2.96	114.1	249.7	1.4
Upper	13	1 in 50	266.61	4.17	4.93	4.93	5.2	0.006201	2.55	123.47	238.06	0.95
Upper	13	1 in 100	337.63	4.17	5.03	5.03	5.33	0.00595	2.73	148.55	257.57	0.96
Upper	12	1 in 50	266.61	4.79	5.56	5.56	5.81	0.005931	2.45	129.03	260.59	0.93
Upper	12	1 in 100	337.63	4.79	5.65	5.65	5.93	0.005779	2.63	153.7	275.68	0.94

Table (g) (iv) (a) 6 - 3: Spoeg River Output

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Lower	**10**	1 in 50	287.66	75.28	75.72	75.72	75.87	0.008279	2.07	172.83	578.73	1.01
Lower	**10**	1 in 100	364.29	75.28	75.77	75.77	75.94	0.007972	2.2	206.14	612.23	1.01
Lower	**9**	1 in 50	287.66	50.89	51.42	51.74	52.55	0.038691	5.1	63.9	160.42	2.25
Lower	**9**	1 in 100	364.29	50.89	51.48	51.86	52.84	0.040702	5.63	74.05	169.56	2.35
Lower	**8**	1 in 50	287.66	51.55	51.95	51.95	52.1	0.008655	2.03	174.38	606.69	1.02
Lower	**8**	1 in 100	364.29	51.55	52.01	52.01	52.17	0.008342	2.16	207.85	641.64	1.02
Lower	**7**	1 in 50	287.66	41.99	42.63	42.65	42.91	0.007142	2.5	131.04	279.1	1
Lower	**7**	1 in 100	364.29	41.99	42.71	42.75	43.03	0.0073	2.73	153.75	297.49	1.03
Lower	**6**	1 in 50	287.66	44.75	45.29	45.29	45.49	0.008103	2	147.71	386.57	0.99
Lower	**6**	1 in 100	364.29	44.75	45.36	45.36	45.59	0.007625	2.15	174.9	397.6	0.99
Lower	**5**	1 in 50	287.66	38.26	38.88	38.88	39.06	0.007862	2.56	155.62	423.52	1.04
Lower	**5**	1 in 100	364.29	38.26	38.95	38.95	39.16	0.00768	2.71	183.48	438.78	1.05
Lower	**4**	1 in 50	287.66	7.97	8.26	8.62	10.11	0.130487	6.22	49.18	204.76	3.74
Lower	**4**	1 in 100	364.29	7.97	8.3	8.71	10.53	0.134589	6.86	56.92	212.99	3.87

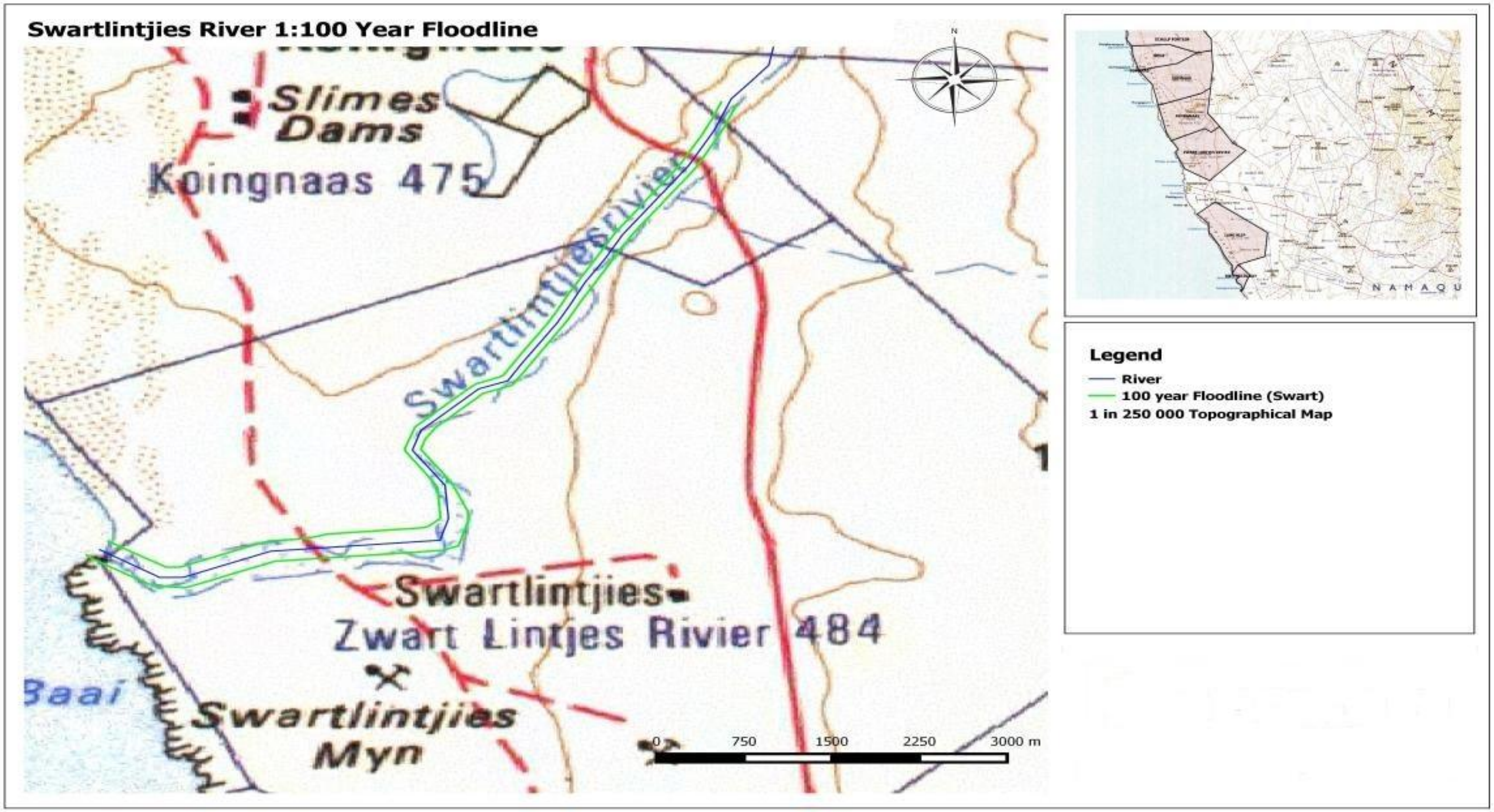


Figure (g) (iv) (a) 6 - 6: Floodline Map (including the 100 m Buffer)

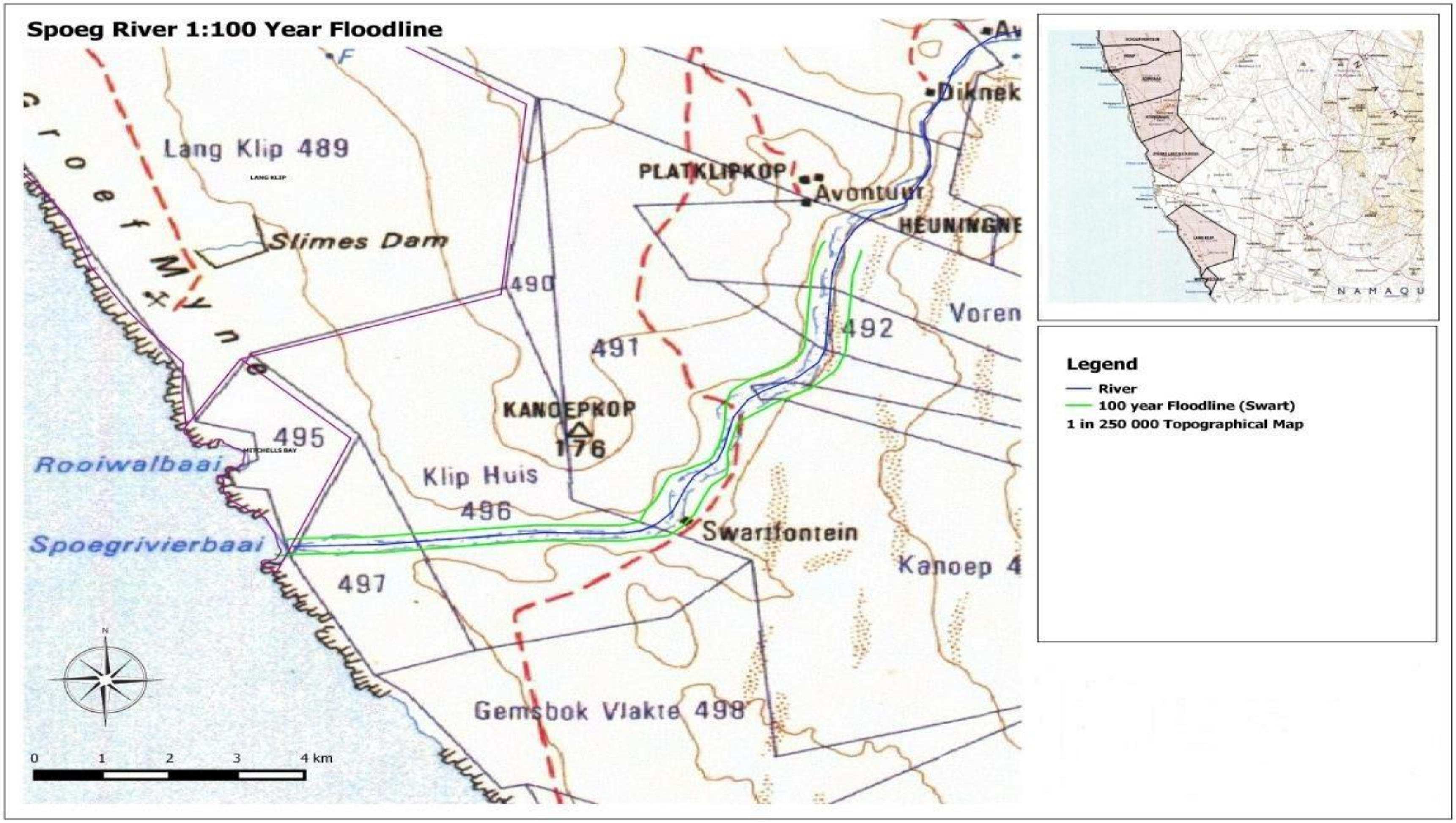


Figure (g) (iv) (a) 6 - 7: Spoeg River Floodline Map (including the 100 m Buffer).

6.2 Groundwater Resources

6.2.1 Depth of water table

Assessment of boreholes on various farms in the area indicates that the regional flow is towards the coast. Local movements towards the Kamma- and Swartlintjes River are not well defined due to the low concentration of data points in these areas.

6.2.2 Presence of acquifers

The Somnaas-Noup aquifer extends into the Samsons Bak Right and further north to the southern edge of the Farm Kannabieduin 324. Koingnaas' freshwater supply comes from a series of three boreholes (known as No. 12, No. 14 and No. 15) tapping this aquifer approximately 12 km north of the township. The boreholes are situated in a sediment- filled palaaeochannel running north-south; the Sonnekwa palaeochannel.

The aquifer consists of discrete fresh and ancient (saline) groundwater held in 'lenses' of fine-lenses of clays and silcretes separate the lenses of saturated sands. The sand horizons are up to 6 m thick.

Despite a considerable amount of work, understanding of this aquifer is limited. Conservative estimates of capacity and recharge conclude that the aquifer is under no threat and that in fact may be suitable for increased exploitation. The aquifer is currently under no threat from mining although prospecting activities have and continue to be undertaken in the area.

6.2.3 Groundwater use

Koingnaas’s freshwater supply comes from the local Somnaas Noup aquifer. Although three boreholes are equipped to supply water, due to the abundance of the aquifer only No. 12 (27 m deep) and 15 (24.5 m deep) are currently being utilised. Upon request from the district authority, water supply to Hondeklip Bay from Koingnaas has also been implemented.

Farming operations in the region obtain groundwater from boreholes situated on various properties. Most farms in the region have at least one operational borehole.

6.2.3.1 <u>Groundwater quantity</u>

Data from the existing boreholes in the area indicate borehole yields ranging from 0.1 to 7 L/s, with an average yield of 0.7 L/s as analysed from 25 boreholes. Water strike depth ranges from 10 m to 160 m blow surface, with an average depth of 62 m, as analysed from 25 boreholes. High yields are associated with well – developed fractures and fissures in the bedrock.

6.2.3.2 <u>Groundwater level</u>

Groundwater levels data in the study area were evaluated from 25 boreholes from the NGA. The water level data were contoured to depict the distribution of the depth to the water-table. The groundwater levels occur between 0 and 123 metres below surface, with an average of 39 metres below surface.

6.2.3.3 Groundwater flow

Piezometric surface map for the study area was created to determine groundwater flow patterns at the site. Groundwater flows predominantly in a westerly direction towards the sea.

6.2.3.4 Data evaluation

Groundwater characterisation was based on the evaluation of existing boreholes mainly from the National Groundwater Archive (NGA) of the Department of Water and Sanitation (DWS). A total of 27 boreholes were identified in the study area. The two boreholes that supply domestic water to Koingnaas (BH 12 and BH 14) plot at the same positions as boreholes 3017AA00003 and 3017AA00001 in the NGArespectively. The location of the boreholes is shown in Figure (g) (iv) (a) 6 - 8: Location of existing boreholes. Figure (g) (iv) (a) 6 - 9.

Information on the boreholes is patchy and is summarized in Table (g) (iv) (a) 6 - 4.

Table (g) (iv) (a) 6 - 4: Information on existing boreholes

Borehole ID	Latitude	Longitude	Borehole depth (m)	Water Level (m)	Water Strike (m)	Yield (L/s)	Bedrock Lithology
3017AD00095	-30.46704	17.41056	72	15	57	0.6	Granite
3017AD00114	-30.40704	17.35775	175	15	160	0.3	Granite
3017AD00087	-30.38373	17.38249	24		12	0.4	Granite
Seepage Pond	-30.37565	17.30747	10	0	10		
3017AD00007	-30.37259	17.35608		45			
3017AD00103	-30.29537	17.38248	40	20	22	0.2	Granite
3017AB00009	-30.22733	17.34914	110	64	70		Granite
3017AB00066	-30.17547	17.34987	20	23	31		Limestone
3017AB00075	-30.17538	17.34996	86	9	73	0.2	Granite
3017AB00068	-30.16593	17.27053	31	14	20		Granite
3017AB00037	-30.12066	17.41081	56	18	70		Granite
3017AA00002	-30.11287	17.22442	20	19	19		
3017AB00013	-30.10901	17.39916	81	14	73	0.2	Granite
3017AA00003 (BH12)	**-30.09037**	**17.24386**		**25**			
3017AA00001 (BH14)	**-30.08176**	**17.24497**	**45**	**25**	**25**	**7.0**	
3017AB00067	-30.03953	17.31553	137	123	125		Gneiss
3017AB00006	-30.00731	17.25192	30	67	73		Sandstone
2917CD00042	-29.98379	17.30189	125	82	91	0.3	Limestone
2917CC00003	-29.95319	17.21578	94	62	64		Granite
2917CD00064	-29.94402	17.30856	98	31	88	0.3	Quartzite
2917CC00028	-29.90178	17.20188	57	86	90	0.2	
2917CD00022	-29.88817	17.28244	85	43	46	0.1	
2917CC00022	-29.86929	17.24355	103	64	66	0.1	
2917CD00060	-29.87288	17.33329	90	42	72	0.1	Granite
2917CD00037	-29.85710	17.34911	24	24	41		Granite
2917CC00016	-29.84895	17.18028	84	36	82	0.2	Quartzite
2917CC00024	-29.82901	17.24133	62	50	58	0.2	
Statistical analysis	**Number of boreholes**		**25**	**26**	**25**	**15**	
	Minimum value		**10**	**0**	**10**	**0.1**	
	Maximum value		**175**	**123**	**160**	**7.0**	
	Mean value		**70**	**39**	**62**	**0.7**	

BH 12 and BH 14 currently supply water to Koingnaas

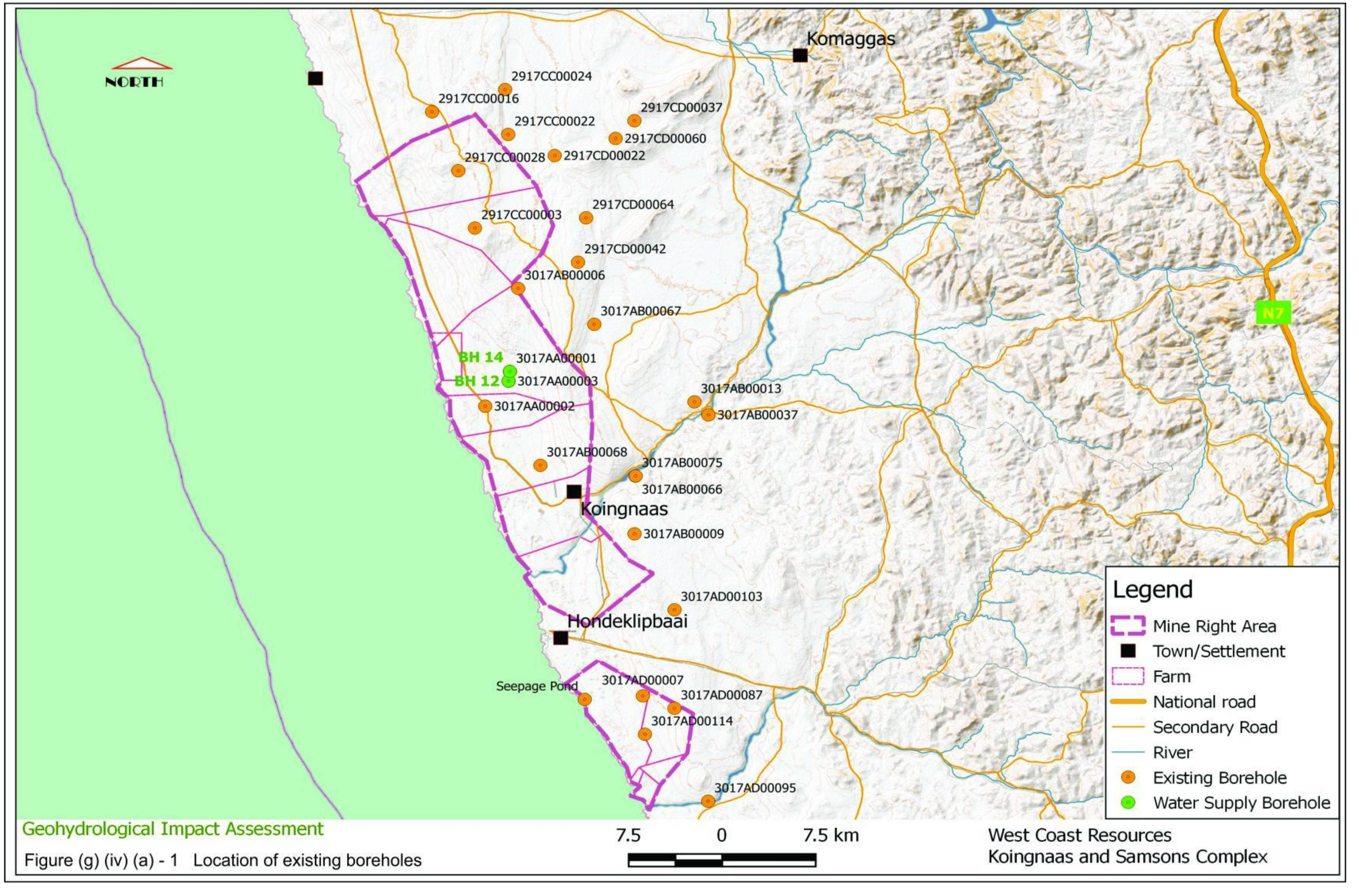


Figure (g) (iv) (a) 6 - 8: Location of existing boreholes

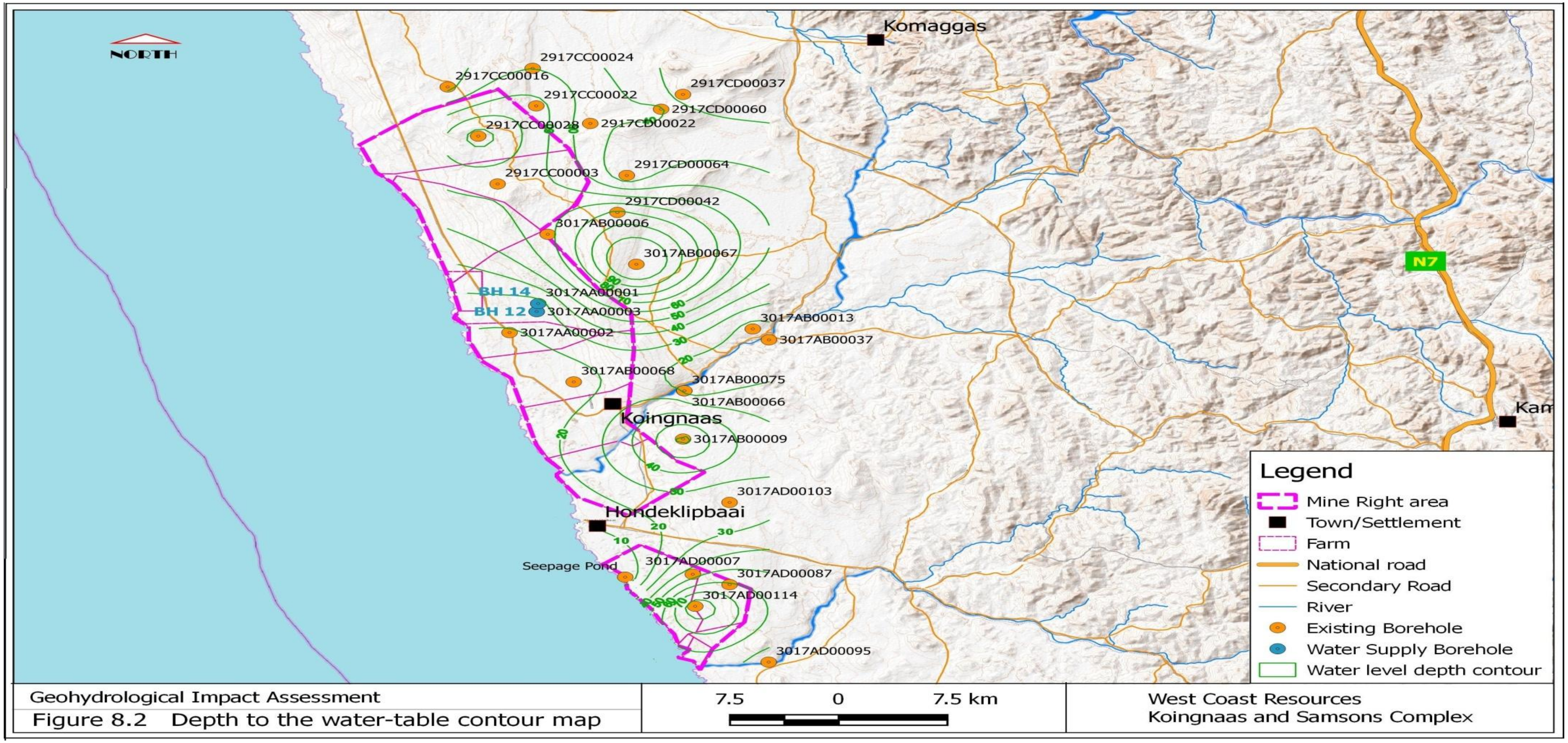


Figure (g) (iv) (a) 6 - 9: Depth to the water-table contour map

6.2.4 Buffels aquifer

About one-third of Kleinsee's freshwater is obtained from subterranean flow in the Buffels River. Sandy sediments in the river valley form an extensive aquifer that is periodically recharged by rainfall over the catchment area. In the past, the mine was totally dependent on water extracted from a Fellman well in the river. In 1994, the construction of a groundwater barrier in the riverbed was completed and has resulted in a rise of the water level at the Fellman well improving the recovery capacity.

6.2.4.1 Primary aquifer

Primary aquifers are associated with the unconsolidated deposits comprising sand and gravel in paleao drainage channels and associated valleys. They vary in thickness from 0 m (bedrock outcrops) to about 30 metres below surface.

6.2.4.2 Secondary aquifer

The secondary aquifers are associated with fractures and fissures in the bedrock of Little Namaqualand gneiss and the Garries Complex. These rocks typically possess extremely small primary porosity and hydraulic conductivity when formed and consequently have little to offer in terms of groundwater resources. Secondary process, however, improve their groundwater potential through fracturing and weathering.

Several different modes of groundwater occurrence have been recognised as follows:

- Jointing and fracturing associated with faulting,
- Weathering in lavas and gneisses,
- Fracturing at contacts between lithologies
- Partings between bedding planes
- Solution cavities in limeston and dolomite

The groundwater yield potential in the study area is low with borehole yield generally less than 0.1 L/s.

The region receives very little groundwater recharge. Vegter's groundwater recharge map estimates recharge at 2 mm per annum, whilst the groundwater water harvest map indicates that 2 500 m^3 of groundwater can be sustainably abstracted per square kilometre per annum in the region.

6.2.5 Groundwater quality

Groundwater quality was evaluated from 19 existing boreholes from the NGA, with a view to establishing the baseline groundwater quality against which potential impacts of mining will be monitored. Table (g) (iv) (a) 6 - 5 gives water quality data for boreholes in and around the study area. The data were evaluated against water quality guidelines for domestic use prescribed by the Department of Water Sanitation.

Analysis of the data indicates that electrical conductivity ranges from 35 mS/m to 7 612 mS/m, with an average value of 1 253 mS/m based on data from 19 boreholes. Electrical conductivity is a very useful parameter for characterising water quality as it relates tothe total amount of dissolved solids in the water. The spatial distribution of electrical conductivity is shown in Figure (g) (iv) (a) 6 - 10.

The study area is characterised by saline groundwater, with the majority of boreholes falling in Class III of DWS water quality guidelines. Groundwater quality generally deteriorates from the north to the south of the study area. The boreholes that supply water to Koingnaas have marginal water quality with electrical conductivity of between 150 mS/m and 277 mS/m. No fresh groundwater has been reported in the proposed mining areas. Fresh water is currently sourced from an aquifer located about 20 kilometres north of Koingnaas. Please note that the positions of the water supply boreholes BH12 and BH14 coincide with monitoring boreholes 90054 and 174910 respectively.

Evaluation of the water quality data for the study area using a Piper diagram shows that the groundwater type is predominantly of the Na-Cl affinity Figure (g) (iv) (a) 6 - 11. Boreholes Bh14 and 174970 display Na-HCO_3 water type, which is indicative of recent groundwater recharge.

Table (g) (iv) (a) 6 - 5: Groundwater quality data

Monitoring Point ID	**Latitude**	**Longitude**	**pH**	**EC** (mS/m)	**Ca** (mg/l)	**Cl** (mg/l)	**F** (mg/l)	**K** (mg/l)	**Mg** (mg/l)	**NO_3** (mg/l)	**Na** (mg/l)	**SO_4** (mg/l)	**PO_4**(mg/l)	**Total Alkalinity** (mg/l)
90054 **(BH12)**	-30.09000	17.24361	7.42	277	77.8	772.5	0.38	13.7	59.9	2.67	396.6	105.7	0.03	65.7
98751	-30.32778	17.34556	7.68	1620	646.0	5708.8	2.39	98.2	413.8	0.29	2532.5	570.7	0.00	83.8
163689	-30.01667	17.29167	7.05	286.1	29.6	766.0	2.05	9.8	11.3	0.21	504.5	105.6	0.01	57.8
163700	-30.33333	17.29306	6.4	842.8	165.8	2416.7	2.44	49.9	99.5	0.40	1410.8	330.9	0.02	41.9
164910	-30.30000	17.39167	7.23	1040	177.0	3297.1	2.07	43.4	189.9	0.09	1866.7	455.9	0.08	34.9
174258	-30.24167	17.35889	8.47	645	43.5	1913.9	1.93	40.4	63.0	0.19	1282.3	287.1	0.01	292.9
174259	-30.17000	17.36667	7.94	816	140.3	2774.0	1.17	55.9	199.3	0.61	1403.4	287.2	0.01	194.7
174261	-30.12778	17.40944	7.93	843	210.1	2831.4	2.08	59.9	226.2	1.44	1341.4	417.5	0.02	152.3
174910**(BH14)**	-30.08139	17.24583	8.18	150	31.5	258.3	0.61	6.8	16.3	22.00	274.0	57.3	0.15	226.7
174911	-30.05944	17.39167	8.03	584	66.1	1877.6	0.81	40.8	79.6	2.02	1131.0	220.0	0.02	169.2
174912	-30.02722	17.27472	8.27	290	82.2	614.8	1.39	17.8	42.2	38.67	496.2	112.0	0.09	332.8
174970	-29.87417	17.39444	7.68	34.7	16.5	58.4	0.59	4.0	3.1	8.02	41.9	8.6	0.02	29.7
174973	-29.85472	17.25000	7.77	123.4	13.5	347.2	0.49	9.7	16.9	1.14	213.8	27.5	0.02	50.0
174974	-29.94694	17.24611	7.76	129.8	17.8	360.6	0.37	10.9	26.8	0.02	202.3	43.4	0.01	69.2
174977	-30.11333	17.31361	8.31	302	35.5	913.2	1.53	27.1	42.7	0.07	545.4	118.3	0.02	143.8
175146	-29.96056	17.38639	7.56	219	25.4	648.8	0.74	17.1	41.4	2.59	305.2	6.4	0.00	33.5
176381	-30.37222	17.35694	7.74	1258	922.3	4106.3	0.37	110.4	137.6	0.30	1342.1	307.7	0.02	81.9
176626	-30.37528	17.30833	8.16	6728	1938.8	23644.1	1.45	260.5	2167.2	0.02	10621.9	3245.3	0.02	219.4
176627	-30.22139	17.31139	7.94	7612	5408.1	35580.6	1.22	384.6	1441.3	0.05	14239.4	1878.4	0.04	220.2
Average value				1253	528.8	4678.4	1.27	66.4	277.8	4.25	2113.2	451.9	0.03	131.6
Guidelines														
Class O			6 - 9	70	80	100	1	25	30	6	100	200		
Class I			5-6 & 9-9.5	150	150	200	1.5	50	70	10	200	400		
Class II			4-5 & 9.5-10	370	300	600	3.5	100	100	20	400	600		
Class III			<4 &>10	>370	>300	>600	>3.5	>100	>100	>20	>400	>600		

BH 12 and BH 14 currently supply water to Koingnaas

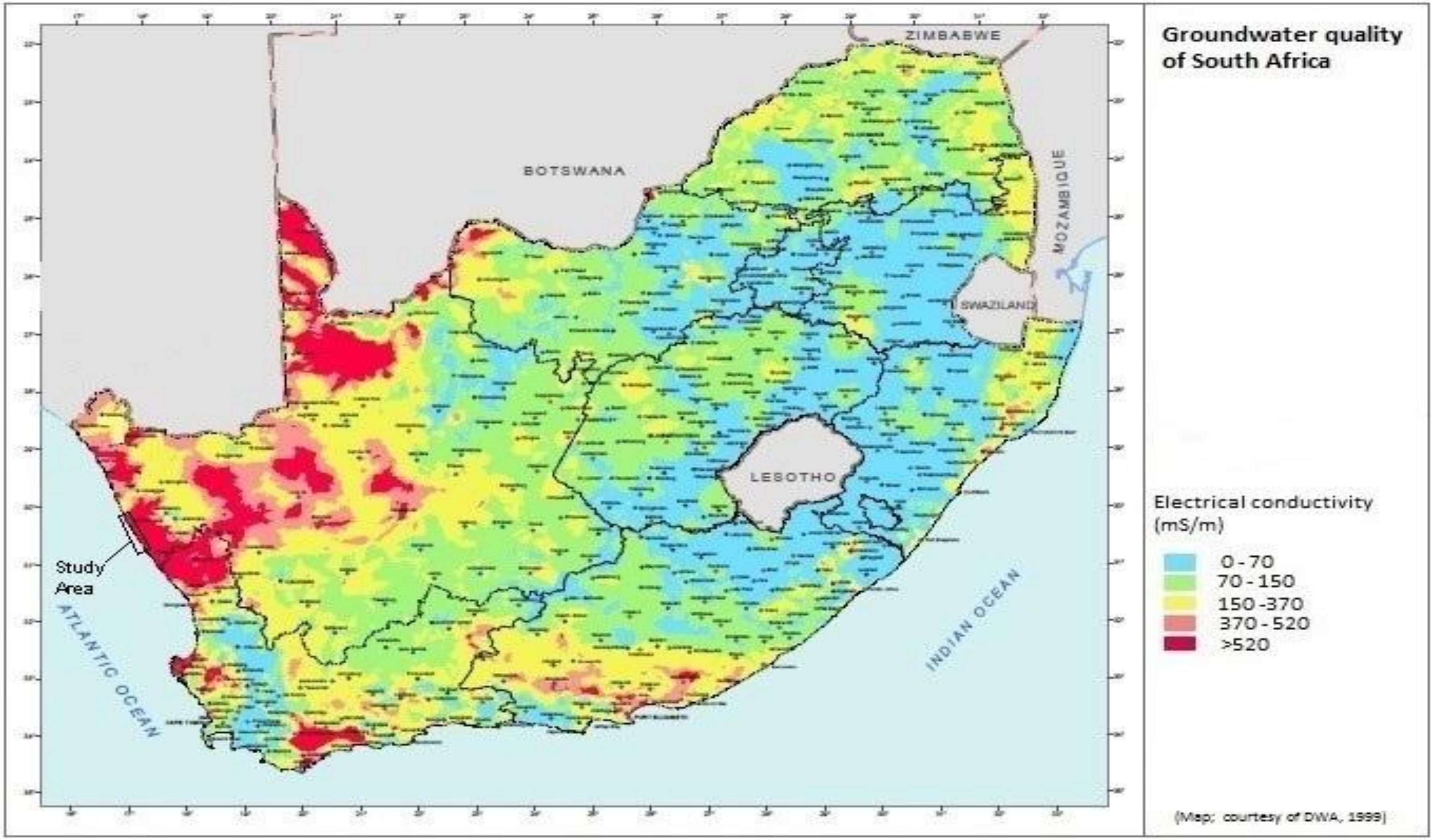


Figure (g) (iv) (a) 6 - 10: Electrical conductivity contour map

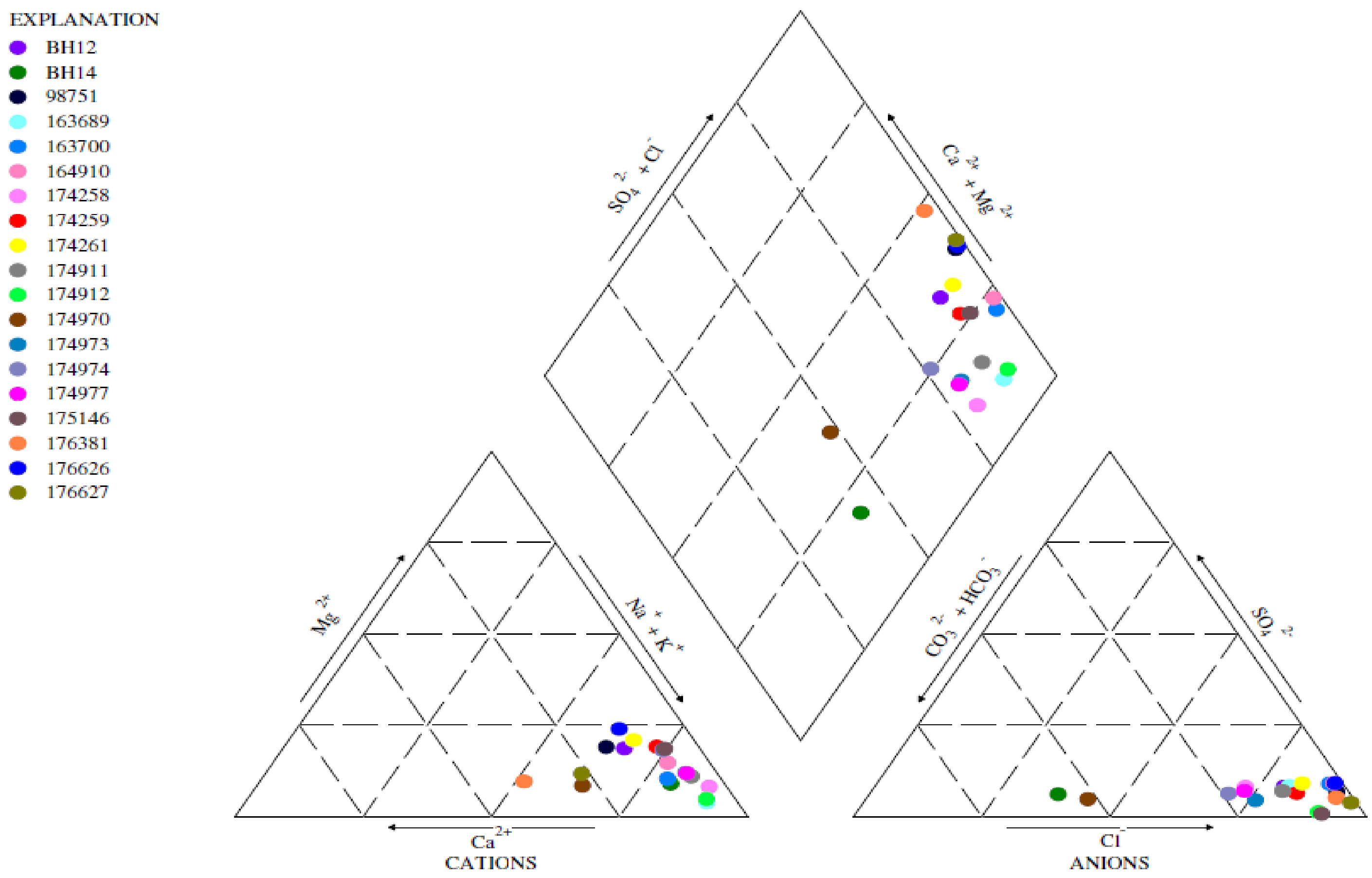


Figure (g) (iv) (a) 6 - 11: Groundwater quality evaluation using a Piper Diagram

Groundwater quality is typical of arid regions, which is generally poor and characterised by high salinity. Electrical conductivity generally exceeds 500 mS/m. Groundwater is predominantly of the Na-CI affinity. The poor water quality is attributed to several factors that include:

- Very low groundwater recharge (estimated at 0 to 2 mm per annum), hence limited flushing out of old water,
- Marine origin of gravels described earlier in Geology Section forming terraces extending about 2 km inland and rising to about 90 m above mean sea level,
- Leaching and dissolution of terrestrial salts emanating from salt outfall from the sea,
- Ancient (old) water in paleao-drainage channels, recharged during periods of less arid regional climate in the past.
- Excessive surface water evaporation relative to rainfall, resulting in the concentration of salts in the water infiltrating the ground.

Figure (g) (iv) (a) 6 - 12: Electrical conductivity (mS/m), shows the groundwarter electrical conductivity distribution in South Africa.

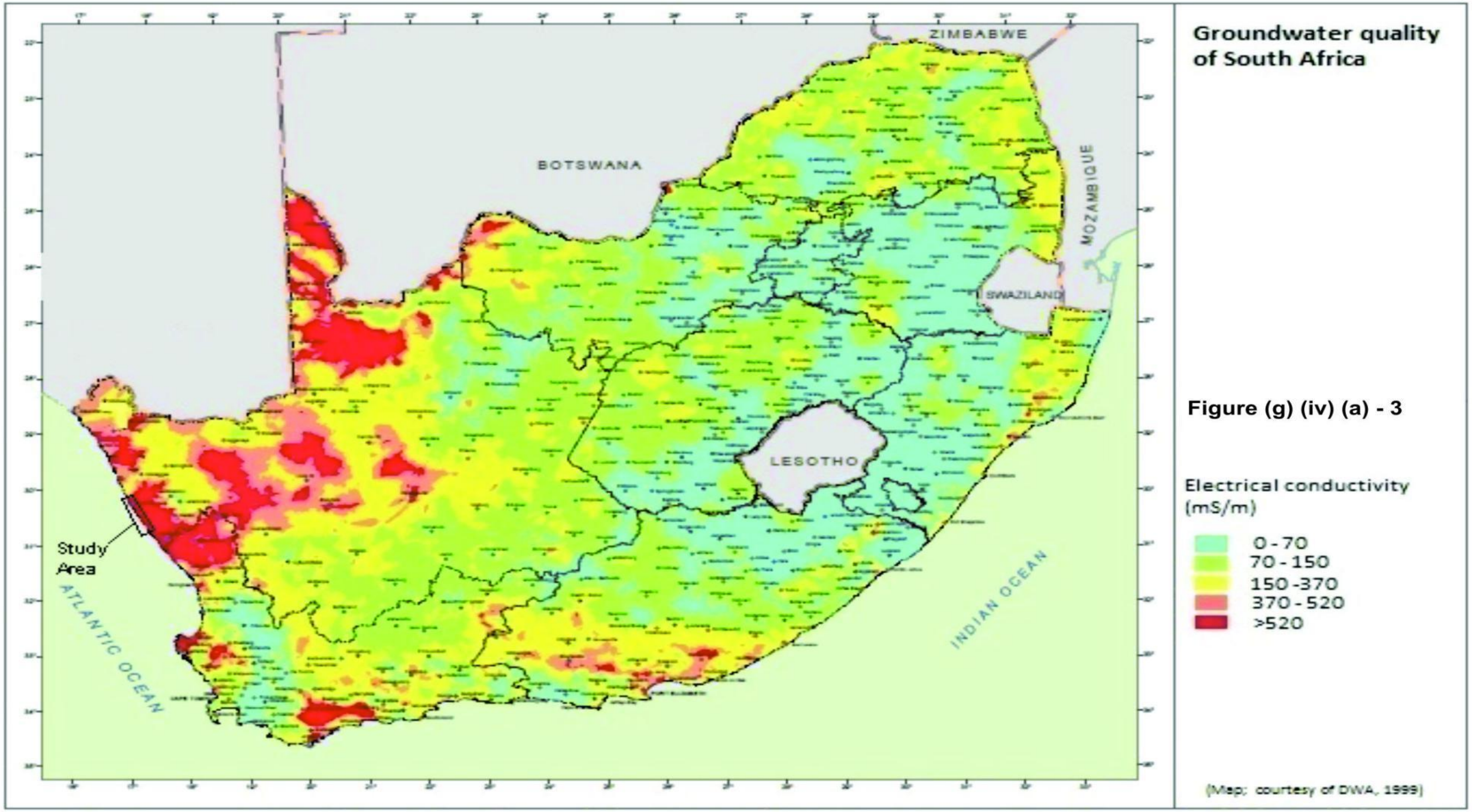


Figure (g) (iv) (a) 6 - 12: Electrical conductivity (mS/m)

6.2.6 Estuary

ManagementHistory

The Swartlintjies Estuary has been situated within a strictly access controlled Koignaas mining concession area for quite some time and management of the estuary has been minimal. De Beers Consolidated Diamond Mines (DBCDM) attempted to artificially open the mouth with bulldozers in 1978 and 1980 for unknown reasons. While the mouth closed immediately after the two attempts in 1978, it stayed open/contained seawater for six months after it had been opened in early 1980. The altered flow regime in combination with the artificial opening of the estuary mouth is likely to have permanently and artificially increased salinity in the soil. Abandoned roads leading through the riverbed and slimes dams impacting on estuary health have not been removed at this point in time.

Currentecosystem health

The Swartlintjies Estuary ecosystem health is largely dependent on episodic flood events that maintain biodiversity by shaping the topography of the floodplain. The estuary has not experienced a flood since several roads associated with mining activities filled the riverbed at various points in the lower catchment of the Swartlintjies River. Fragmentation of the ecosystem is moderate and focused near the slimes dam in the northern EFZ and in the vicinity of roads cutting through the EFZ.

Conservationimportance

Although the Swartlintjies EFZ is not part of a formally protected area, the upper reaches of the river and its tributaries occur within the Namaqua National Park. The Swartlintjies Estuary has not been earmarked for conservation at the time of writing. However, rehabilitation of this estuary by restoring flow to the lower catchment could have major benefits to conserving biodiversity in the EFZ. Rehabilitation could also contribute towards ensuring that endemic plant species such as *Limonium equisetinum*, *Chaetobromus involucratussubsp. Dregeanus* and *Eragrostis sabulosa* remain species of 'least concern'.

The Swartlintjies bay is very small and open, and is influenced by the northward flowing Benguela current. Due to the small size and shape of the bay, as well as the direction of the current, the Swartlintjies Estuary is unlikely to be impacted by these mining operations. It is, however, recommended that the seawall does not extend more than 300 m seaward from the high water mark.

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The 10 m high haul road situated 3 km upstream of the mouth leads through the Swartlintjies EFZ and prevents the river from entering the estuary. Pipes in the haul road connect either side of the river, but the inlet is elevated at least 1 m above the river bed, making it impossible for water to pass through during episodic rainfall events. Prior to mining activities in the area, the Swartlintjies River came down in flood unhindered during episodic rainfalls, creating a braided flood plain with channels of varying depths. These channels were then colonised by plants during dry periods, creating a biodiverse habitat that reflects the topographic mosaic of the floodplain. This shows that the episodic flooding of the Swartlintjies River is an important ecological process for maintaining biodiversity of the Swartlintjies EFZ.

Restoring freshwater flows to the estuary should not be left until mine closure. The pipes in the haul road should be replaced with larger culverts (at least 1 m wide) that allow the Swartlintjies River to flow into the lower EFZ.

Only specialised organisms can exist and thrive in the extreme hypersaline conditions of this estuary (>100 ppt). Artemia is a genus of aquatic crustaceans known as brine shrimp, which are adapted to such conditions and were found in the water column during the field visit. A variety of wading birds and waders were feeding on the brine shrimp throughout the day. No fish or benthic invertebrates were found in the estuary and these groups have therefore been omitted from the sections below.

The National Vegetation Map published by the South African National Biodiversity Institute (SANBI) provides a rough guide to the vegetation types and associated species that can be expected to occur in the Swartlintjies EFZ and surroundings. This rough guide was then ground truthed during the field visit on 23 June 2016, from which a more detailed vegetation map was produced in Google Earth Pro. The vegetation in the EFZ had come to life after the rainfall event prior to the field trip with some species being in flower.

The only species found at the Swartlintjies Estuary which could be considered as semi-aquatic when water is present in the system are the saltmarsh plants such as *Sarcocornia natalense*, *Sarocornia pillansii* and *Eragrostis sabulosa*, which is also present along the coast just above High Spring tide level (Heinecken, 1980).

Seashore vegetation can be found in near the mouth on the dunes and extends as a thin band north and south of the estuary encompassing the beach and dune fields (note that this excludes Namaqualand Coastal Duneveld Vegetation type). Seven species unique to this vegetation type have been identified to date. At the estuary mouth, patches of *Sarcocornia perennis* on slightly elevated beach sand were present avoiding inundation by regular penetration of the sea during spring tide. Filamentous algae were growing on the edge of the water body near the mouth and further upstream.

7 Air Quality

7.1 Ambient conditions

Coastal areas are, for most of the year, subject to an almost constant southerly onshore wind. These winds are responsible for moving large volumes of sand naturally in a northerly direction up the coast. Occasional hot, dry easterly winds (Berg Winds) blow from the escarpment throughout the year but are most common during the winter months.

Berg winds are a feature of the entire Benguela region and may occur throughout the year, but are more frequent in winter. They result from the development of a large high-pressure system over or to the south of the southern part of the subcontinent during autumn and winter. The resultant airflow is downward off the plateau towards the sea and is heated by compression. The wind is hot and dry and usually blows from the east or north-east. These berg winds may persist for a number of days and are responsible for some of the year's warmest and dustiest weather conditions, often carrying dust out to sea.

The dust assessment was conducted by Site Plan Consulting, July 2016. It focussed on the windblown dust (sand) phenomenon which is characteristic of West Coast diamond mining. Given that such sand movement occurs at very low above-ground level, it does not allow standard methods of dust monitoring/ quantification (by for example DustWatch™ equipment), nor the application of standard dust levels for atmospheric dust management, which has been dealt with as a specific. The further element of inhalation (suspended) dust, which is of a health consideration, is not dealt with by this study as it deals specifically with working environment under the Mine Health and Safety Act in terms of which it has specific prescriptions for its monitoring and reporting.

Given that high levels of windblown sand movement is a characteristic of the West Coast, and accordingly as seen in several aerial photography showing repeated periods of sand migration followed by revegetation stabilisation, the extent of natural sand plumes is in itself a system of extensive reduced sensitivity and in this regard the regional sand plumes as shown in Figure (g) (iv) (a) - 4 are relevant.

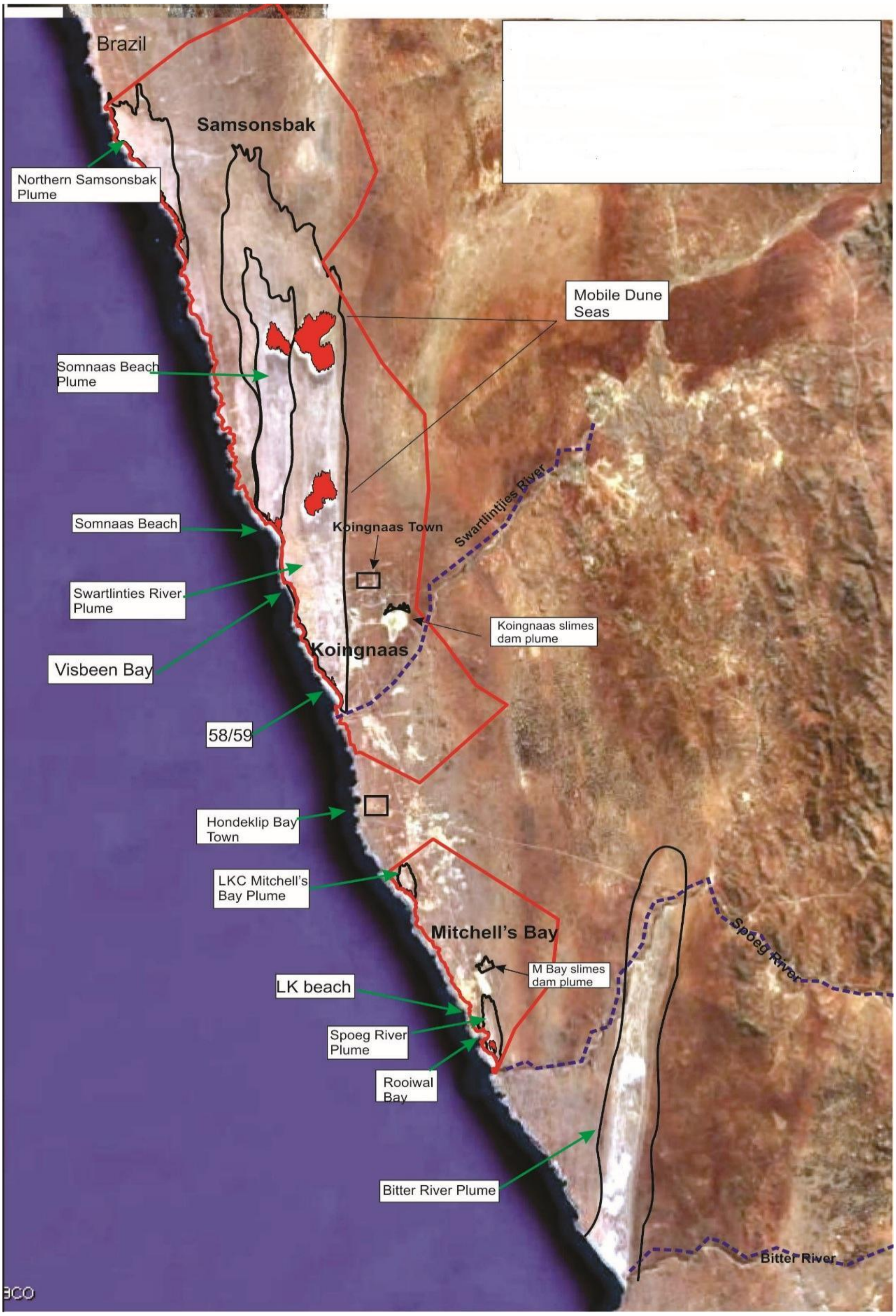

Figure (g) (iv) (a) 7 - 1: Regional dust plumes

- The northern Samsonsbak plume (related to beach orientation)
- The Swartlintjies River-Somnaas Beach plume (natural aggravated by extensive beach mining)
- Mitchell's Bay plume (natural on-shore half-heart bay beach aggravated by intensive mining)
- Spoeg River plume in southern Mitchell's Bay MRA (Photo g-5)
- The Bitter River plume (natural south of the study area)

As shown in Figure (g)(iv)(a)7 – 1 within these large plumes, migrating natural dune seas occur within the Swartlintjies-Somnaas plume and a smaller sea in the Spoeg River plume just south of Rooiwal Bay.

Photo g - 5: Spoeg River plume seen south of Rooiwal Bay

7.1.1 Built environments and specific land uses

As no farmsteads occur on the properties, the only receiving built environments on this coast are:

- Hondeklip Bay town; and
- Koingnaas town,

Both of which to-date have not required specific dust intervention, although the bush line south of Koingnaas town undoubtedly has provided it with protection from the higher dust levels which occurred during the peak operating intensity of earlier mining operations in Koingnaas Mining Right (KMR).

Furthermore, the Koingnaas town is directly downwind of the Koingnaas slimes dam, which has dried since decommissioning of the Koingnaas plant and resulted in the windblown plume north of the slimes dam undoubtedly having increased the dust impact on the town, at least to a nuisance level.

7.1.2 Sensitive areas and buffers

The most sensitive natural areas by virtue of the intensity of plume development are the inland areas immediately north and north-east of half-heart bays such as Somnaas where these areas are subject to focused plume invasion and which beaches will be fed with increased sediment as a result of littoral drift from nearby beach and coffer dam mining. This phenomenon is intensified where there are river mouths south of either such half-heart bays or other on-shore (wind) orientated beaches.

Koingnaas town which is directly downwind from the Koingnaas slimes dam plume with insufficient buffer distance.

The privately owned farm of Brazil which is already becoming subjected to the Northern Samsonsbak half-heart bay plume generation already naturally affecting the adjacent private land of Brazil and emphasizing the need for attenuation when any mining of this northern coast line is contemplated.

7.1.3 Prevailing west coast winds (applicable to natural mining dust plume generation)

Prevailing winds are particularly effective in this area given their constant direction and strength through most seasons, as seen in the wind roses below. However, it is noted that the literature sources cited hereafter dealt specifically with the areas of extremely high wind speed and frequency of the Alexander Bay/ Southern Namibian coast and it is acknowledged from personal observations that the wind of the study area is of lower speed and frequency than that further north but none the less, remains best reflected by the technical assessments of Talkenberg and others.

Given the high wind speed and generally dry conditions with highest wind speeds occurring in the driest part of the day, the threshold wind speed for sand movement is 16km/hour while the average afternoon speeds at Port Nolloth of 26km/hour and Alexander Bay at 22 km/hour.

The sand carrying capacity of the mining area winds expressed as a resultant drift potential (RDP) calculations done by David Berger (UCT) and published in Tinley (page 206) shows the sand roses for the four seasons of Alexander Bay as the origin of the wind-blown plumes.

The annual resultant drift potential at Alexander Bay is almost equal to that of the Bogenfels located in the heart of the Namib Desert Coast characterised by extreme sand excretion.

7.1.4 Sand sources

7.1.4.1 Natural

The primary source of sand plumes on the West Coast is the combination of river mouth sediment discharge via adjacent beaches to the north of such river mouths and the on-beach sediment which is part of the littoral drift. This relationship of sand plume generation to rivers is clearly illustrated in Figures 1 and 2a, b, and c from which the following inset of the Bitter River natural plume is taken.

As primary dunes are generally absent on this portion of the West Coast, the phenomenon of dune blowouts associated with plumes is not a general characteristic of this coast and largely limited to the primary and hummock dune systems to the immediate north of half-heart bays.

By further comparison to Alexkor, it is noted that while the beach origin sands (white sands) compare directly between the two areas in terms of their ability to generate plumes, the surface soils of the inland areas differ completely between Alexkor and the WCR in that:

- Within Alexkor, surface sands present as light yellow/ grey loose sands with no clay content and are very susceptible to wind erosion in vegetation disturbed areas and in the formation of deflation pans.
- Within the WCR, as particularly experienced in the revegetation of the earlier Hondeklip Bay mining areas by THG, the surface sands of the WCR, which present as orange coloured sands, have a significant clay fraction content. This forms a surface crust and does not permit ready surface dust generation, especially not off undisturbed areas and also not off re-top soiled areas where the crust forms readily after placement. Consequently in WCR, by comparison to Alexkor, unshaped and shaped overburden dumps show very limited plume development, if at all. Additionally, this crust, unless broken, does not permit ready germination of in-blown seed.

7.1.4.2 Mining

By comparison to Alexkor, the mining dust generation of this WCR study area is relatively low and does not present the same level of threat to natural eco-systems nor the built environment.

Nonetheless the sand plumes and finer dust impacts derive from the following mining activities in the WCR:

(i) Lines of overburden dumped adjacent to prospecting trenches. At WCR such dust generation occurs on a very limited scale.

(ii) Overburden dumps rounded or unrounded again on a very limited scale.

(iii) Fine tailings ponds (slimes dams). In the case of the WCR, the clay content of the soils of the slimes dam walls, largely inhibits dust generation from the walls and consequently the dust source is primarily the silt content of the dam once dried.

(iv) Heavily trafficked roads if not wetted during mine hauling, again to a lower degree than at Alexkor and with future mining in WCR at a lower level than under DBNM, the significant road-parallel plumes are not expected to occur in future, especially under the current policies for road dust attenuation by water cart wetting in the interest of road safety.

(v) Beach and back-of-beach disturbances by mining (the main mining dust generator in WCR).

In-field screening plants, if run dry. However as currently witnessed at WCR given the clay content, much of the in-field screening is conducted wet with no dust generation.

8 Archaelogy

The information provided in this section is comprehensively discussed under specialist report, produced by ACO Associates 2016, which is included as Volume IV of this report. The majority of visible archaeological sites in the project area date largely to the Later Stone Age (LSA). For reasons that are not entirely clear, but possibly related to climatic factors, LSA sites dating to the Holocene seem to fall within the last 5000 years. Of these, a large number date after the last 2000 years, when it is known that there was a major change in the prevailing social situation in the Cape. This is believed to have coincided with the arrival of pastoralist groups (Khoi Khoi) from the north, who in addition to introducing ceramic technology, also introduced domesticated stock, initially sheep and sometime later cattle. While the route of this migration remains unresolved, it is believed that one possible route for the introduction to southern Africa was from Botswana along the Orange River and down the west coast (Elphick 1977). Spoeg River cave has produced some of the oldest dates so far (2000 years ago) for domestic sheep in southern Africa (Webley 1992, Sealy and Yates 1994).

Late Stone Age sites along the coast of the project area are represented by scatters of marine shell (Photo g-6) Areas immediately adjacent to the coast, especially where there are rocky shorelines, are often covered by extensive shell middens resulting from hundreds of visits by groups of pre-colonial people. These sites which overlie and overlap each other are very difficult to resolve archaeologically. Fortunately this is a near shore phenomenon and further inland, sites have more defined boundaries. Unlike those sites along the immediate shoreline which contain few artefacts, occupation sites are generally believed to show a much wider range of artefactual material, with spatial arrangements indicating specific activity areas. Items that may be expected on such sites include stone artefacts, ostrich eggshell - particularly beads and water containers, grindstones, discrete shell piles, hearths, bone and whale bone structures. There seems to be no specific location which only attracts occupation sites however it has been observed that deflation bays along the coast or further inland were frequently selected for camping sites, and often contain suites of microlithic artefacts.

Within a kilometre of the shore, pre-colonial camp sites are found in a variety of environments and locations, some of which appear to have been favoured over others. Dune tops, dune lees, deflation bays and areas around sheltered bays appear to have strongly attracted pre-colonial people. We have noted clusters of middens and artefact scatters associated with coastal dune seas. These areas seem to have been popular 3000-5000 years ago. There are, however a significant number of sites that are not located at obvious natural foci and can be found on featureless coastal flatlands. This variability makes accurate prediction of location very difficult. What is clear is that people in this marginal landscape were attracted to the coast where food resources were the most reliable.

Later Stone Age sites along the coast are largely identified by scatters of marine shell. In some cases these dumps (called middens by archaeologists) are associated with domestic artefactual debris and are believed to represent occupation sites of long duration. Other sites, lacking a formal stone artefact component may represent visits of short duration.

Shell Middens typically occur within 1 km of the coast and tend to be prolific near estuaries and in dune fields, and adjacent to rocky shores. The immediate coastal dunes, especially close to rocky shorelines were greatly favoured by prehistoric people as marine food was close by. Areas close to sheltered bays contain so many middens that at times it is difficult to distinguish one from the next. Inland of the coast the frequency of shell middens drop away, however the pattern is not always predictable as an area with good game and a source of fresh water can result in middens existing kilometres inland.

Photo g - 6: A late Stone Age shell midden situated close to Zwartlintjies Rivier

8.1 Maritime archaeology

There are shipwrecks in the surf zones on the west coast. These are considered part of the heritage of the area and giving the kinds of beach mining operations envisaged by West Coast Resources, are potentially under threat.

Shipwrecks greater than 60 years of age and within the territorial waters of South Africa are protected under the National Heritage Resources Act and considered to be part of the National Estate. There are an estimated 3000 known shipwrecks off the coast of South Africa, the earliest of which date to those of Portuguese mariners who rounded the Cape after 1500 AD. The amount of unknown or undocumented shipwrecks is unclear. Numerous vessels have been documented as leaving port bound past the Cape but have failed to arrive at their destinations, their whereabouts is unknown.

Inevitably records of the location of documented wrecks are poor as in a disaster situation ships' masters and navigators had other priorities than documenting the ships position at time of sinking. Positions tend to be estimates obtained from survivors and can be scores of kilometres off, even in sight of land. Ships that were wrecked off-shore can be incorrectly positioned in the order of hundreds of kilometres. Ships that were abandoned at sea can drift for many kilometres before they sink, and even then may drift below the ocean surface before the timbers get water-logged. Given these uncertainties assessing the impacts of a given development project is fraught with difficulties. Pro-active searches for wrecks over vast tracts of oceans is a technically demanding and laborious task, hence one is compelled to use what historical evidence there is available.

The data bases that are available (namely the national shipwreck database) reflects the estimated positions of wrecks where the provenance is known or can be roughly estimated. There are numerous shipwrecks off the west coast that potentially range in age from the days of the Portuguese navigators and Dutch East India Company to the late 20th century, the hotspots for these wrecks are rocky shorelines and inlets and peninsulas, off-shore reefs. Further out at sea the coastal shipping route was subject to wartime casualties and ships that were abandoned at sea due to foundering, collision or fire on board. The majority of wrecks however are caused when ships hit a reef, an obstacle or are driven on shore. While a number of late 20th century casualties are reflected on the databases and maps, it is only wrecks that are greater than 60 years of age that are formally protected. The recent discovery of the oldest shipwreck south of the equator is that of the Portuguese galleon, the *Born Jesus (ran aground 1533)* found in a beach mining operation north of Oranjemund attests to the fact that this possibility exists in any place where beach mining takes place.

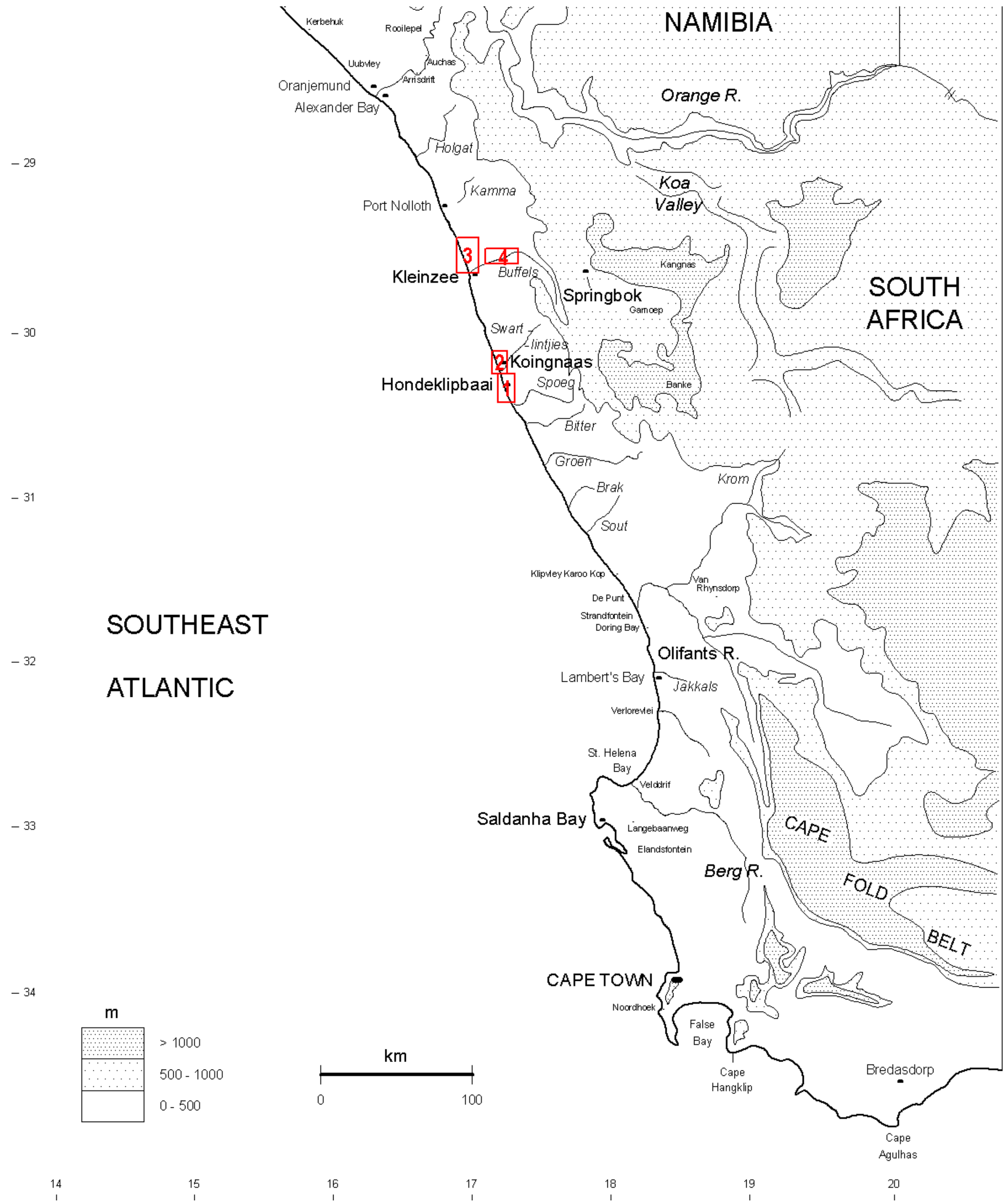

Figure (g) (iv) (a) 8 - 1: West Coast localities and position of maps 1 - 4

8.2 Hondeklipbaai Area (Koingnaas Complex)

Little information was forthcoming from the Hondeklip area of central coastal Namaqualand until Tankard (1966) described aspects of the succession revealed by prospecting. At that stage, the sequence was seen in terms of the preliminary biostratigraphy erected by Haughton (1932) (Zones E to A). Significantly, Tankard (1966) reported the presence of channel-infilling, kaolinitic, non-marine sediments overlying kaolinized gneiss (the “Channel Clays”). The occurrence of abundant phosphatic nodules was observed.

Tankard encountered difficulties in the application of Haughton's (1932) biostratigraphic zones to the more extensive prospecting exposures he saw (*i.e.* the “megatrenches”).

An important advance for the stratigraphy of Namaqualand coastal deposits was Carrington & Kensley's (1969) article describing new molluscan fossils from the central Namaqualand area in which a summary stratigraphic column was presented. Channel-infilling, unfossiliferous, fluviatile clays and clayey sands, considered Mio-Pliocene in age, were recognized as the oldest unit, which was succeeded by remnants of phosphatic beds with abundant shell moulds, considered Pliocene in age.

In contrast to the earlier suggestions of a Mio-Pliocene age for the higher elevation coastal-plain deposits (Wagner & Merensky, 1928; Haughton, 1932), Carrington & Kensley (1969) considered the bulk of the succession to be of Pleistocene age. They identified “transgression complexes” at 75-90, 45-50, 17-21, 7-8, ~5 and ~2 m ASL. and a 29-34 m Beach. Importantly, they found that the bivalve *Donaxrogersi* Haughton, 1926, actually subsumed two species; the thick-shelled, robust *D. rogersi* “proper” and a thin-shelled, generally smaller species (thought by Haughton to be juveniles), which they named *Donaxhaughtoni*. The latter species occurred only in the fine-grained, usually laminated, sands of the “45-50 m complex,” whilst *D. rogersi* occurred only in the coarse, usually cross-bedded, sediments of the younger “17-21 m complex”. This finding constituted a major advance in the biostratigraphic subdivision of the older coastal-plain marine deposits. Additionally, species obtained from the “45-50 m complex” suggested a fauna of warm-water affinity.

Further notes on the deposits of central Namaqualand were provided by Davies (1973) and by Tankard (1975a, 1975b). Tankard (1975a) differed from Carrington & Kensley (1969) in regarding the phosphatic beds in the Hondeklip area as older than the “channel clays”. However, Carrington & Kensley (1969) were correct and the “channel clays” are older than the phosphatic beds. Tankard provided some information on the phosphatic beds that infill hollows in the bedrock and which had come to be known as “E stage,” from Haughton‘s oldest biostratigraphic unit, ”E Zone”. Tankard (1975a, 1975b) proposed correlations of lower, middle and upper “E stage” sub-units with the succession in the Varswater Quarry near Langebaanweg. Kent & Davies (1980) informally named the coastal-plain deposits between the Olifants River and Kleinzee the “Hondeklipbaai sandy gravels”.

Pether (1986) provided a summary of the main findings of his research on the succession at Hondeklipbaai, including suggested correlations farther afield. More intensive faunal sampling carried out during this study led to considerable additions to the marine molluscan fauna of Namaqualand coastal deposits (Kensley & Pether, 1986). The first extinct Tertiary barnacle recorded from South Africa was described from Hondeklip by Pether

(1990). Brunton & Hiller (1990) have described the fossil brachiopods collected by the writer in the Hondeklip study area. Pether (1994b) provided detail on the exposures and palaeontology at Hondeklipbaai.

KC, Map 1, Mitchell's Bay, Waypoint 51, LK_LK_22 exposures

Figure (g)(iv)(a)-1 show West Coast localities and position of maps 1 – 4. The archaeological map showing way points is provided as part of the site environmental sensitive features in (Figure (g) (iv) d – 1 – 3.

This formation, the "Channel Clay", is classically preserved in a narrow, coast-parallel, bedrock palaeochannel debouching into Rooiwalbaai. It has been mined away, remaining outcrop being the "seawall" at the south end of the pit.

These deposits, as seen elsewhere along the coast, are known for their organic content of carbonaceous sediments and lignitic/peaty beds with both plant microfossils (pollen) and "charcoal" macrofossils and plant impressions. More specifically, this exposure is the most pervasively organic-rich and fossiliferous w.r.t. macroscopic plant material that the writer has seen. The preservation is likely due to oxygen-poor groundwater ponding at this location. In less favourable locations the organic matter is largely lost.

Very disturbed material is accessible along the western side of the palaeochannel exposure. Large pieces of fossil wood are readily found. Friable, carbonized, smaller plant fragments occur abundantly as local masses or more distributed in the clayey sands.

BMC, Map 3. Kareedoornvlei, Waypoint 137, KVS_E16 area

An exposure of this formation in the context of the "Megalodon Palaeochannel Complex". Here the formation has been eroded into and overlain in the west by the mid-Miocene 90 m Package. In contrast to the Mitchell's Bay exposure, here this formation is dry and oxidized. Considerably complexity is seen in sedimentary structures and local deformations.

Patches and stringers of black organic matter are readily seen. Closer examination shows the occurrence of plant material with enigmatic vermicular structure.

Most importantly, silicified nodules were readily noticed and these appear to be petrified fossil bone. To the writer's knowledge, no bone fossils have ever been recovered from this formation before.

BMC, Map 3, Dreyers Pan, Waypoint 134, DL92F area

Upper Middle Terrace, 65 m Cliff area. Residual basal marine gravel overlying weathered bedrock with micro relief. The thick overburden section is decalcified and pedogenically reddened. Most of overlying section is of terrestrial origin, with features such as isolated, angular clasts and "stone lines" marking the more obvious palaeosurfaces. Smoothed, "re-absorbed", pedogenetically-cemented burrows prominent in lowermost section. It is possible that marine deposits are preserved in the lowermost section, but recognition of such and its upper contact requires careful scrutiny.

BMC, Map 3, Dreyers Pan, Waypoint 135, DP_114 area

Upper Terrace at foot of Wolfberg, 80-90 m ASL. Section evidently as previous.

BMC, Map 3, Dreyers Pan, Waypoint 136, DP_133Q area

A limited exposure of terrestrial deposits with two distinct units. In a bedrock gully feature incised in the 95 m cliff, edge of Upper Terrace.

BMC, Map 3, Kareedoornvlei, Waypoint 137, KVS_D16 area

Upper Terrace. Of note is the contact between the edge of the “Megalodon” palaeochannel sediments and the oldest marine formation, the 90 m Package.

BMC, Map 3, Kleinzee, Waypoint 140, AK_52T area

Upper Terrace ~90 m ASL.Thin deposits overlying kaolinized bedrock. Much exhumed silcrete in evidence. Likely only residual marine gravels under reworked marine sands. Possibly also residual “Channel Clay” basal conglomerates present here and at AK_34V ~2 km farther south.

KC, Map 2, Koingnaas N boundary, Waypoint 56, KN_KLNA_15 area

In contrast to the preceding, high-elevation exposures, this instance of the 90 m Package occurs close to the sea near Visbeenbaai. The deposits are shelly and pebbly marine calcarenites preserved beneath the 30 m Package in a bedrock depression. They are recognized as older, Miocene deposits solely on the basis of the enclosed shells that are quite distinct from the Pliocene faunas.

The “new” exposure of 90 m Package shelly sands on Koingnaas (Waypoint 56) is different from these previous occurrences. It is a shallower facies, of shoreface palaeodepth, and thus samples littoral taxa that are rare or absent in the shelf facies. Furthermore, its fossil content has stratigraphic “integrity” in that it was apparently cemented prior to the Pliocene transgressions.

In 1985, the late Brian Kensley and the writer sampled some “anomalous” species from 30 m Package lower shoreface sands exposed in an excavation then known as “KL, south face”. These were described and listed as from the 30 m Package (Kensley & Pether, 1986), but hitherto have remained unique finds not found again. It is now apparent that these taxa were reworked from these Miocene deposits nearby.

There are reported stratigraphic aspects of the deposits overlying the Kleinzee Middle Terrace (Section 5.3, Table 1) that have not been independently verified and for which biostratigraphic evidence is lacking. The implication of De Beers observations is that there is a “65 m Package” on the Kleinzee Upper Middle Terrace that is not recognized in the south in the “Koingnaas Complex”. Notwithstanding, the writer’s observations at ~65 m ASL. On Sandkop, just to the south of Kleinzee, indicate a deeper-water shoreface deposit of 15-20 m palaeodepth (Image 20). This would be consistent with the older deposits on the Kleinzee Upper Middle Terrace actually being the 90 m Package.

The 50 m Package

BMC, Map 3, Kleinzee/Dreyers Pan boundary, Waypoints 131 &132, AK75_LM area

The eastern part of the trench exposes the 50 m Package. It is decalcified, but pervasive cross bedding indicates upper shoreface palaeodepths. A pedogenic profile/duripan is developed in the upper part of the section. The 30 m Package also occurs in this exposure - see below.

BMC, Map 3, Kleinzee, Waypoint 133, AK70_MN area

The surface here is ~57 m ASL and a much thicker section is present. The faces could not be inspected in detail, but it is likely that only the lowermost portion is *in situ* 50 m Package, the remainder above the more pale unit being terrestrial in origin.

BMC, Map 3, Kareedoornvlei, Waypoint 139, KV_174_KL area

At ~40 m asl., this site was visited to view the large midden deposit present there. A small exposure nearby shows only terrestrial deposits and evidently only residual 50 m Package deposits remain at depth. A prominent, white, cemented unit occurs and is in a state of “retrograde” dissolution. It is possibly a pan carbonate. Overlying this are deposits wherein ESA tools and bone material occurs on palaeosurfaces.

&KC, Map 1, Langklip, Waypoint 52, LKC_2B area

&KC, Map 1, Zwartlintjies Rivier, Waypoint 54, SL_20_09 area

At both these localities, deeper-water deposits were observed in February, 2006. Shells are more common in the exposure at Waypoint 54 and included species not previously sampled. Also at this locality the 50 m Package section appears to be more complete, as opposed to the usual situation where several metres are missing due to erosion, and unusually it is overlain by pale aeolianite rather than reddened sheetwash and sandsheets.

KC, Map 2, NW Koingnaas and SW Somnaas

As above, with extended sections of the deeper-water 50 m Package in the area.

The 30 m Package

BMC, Map 3, Kleinzee/Dreyers Pan boundary, Waypoints 131 &132, AK75_LM area

The 50 m Package deposits mentioned above are eroded to the immediate west and overlying the gently seaward-dipping contact are pebbly deposits of the 30 m Package. Notably, the pedogenic profile developed in the upper part of the 50 m Package is truncated by the 30 m Package lower contact. The elevation of the surface here is estimated from the 1:50000 map at ~35 m ASL.

BMC, Map 3, Kleinzee, Waypoint 127, AK_45H area

BMC, Map 3, Kleinzee, Waypoint 128, AK_45B area

BMC, Map 3, Kleinzee, Waypoint 130, AK_61H area

These are three shallow trench exposures of cobbly material, at quite low elevations (10-15 masl), decalcified and with a well-developed pedogenic (calcrete) capping. Would appear to be 30 m Package deposits. The original thickness has evidently been reduced by substantial deflation.

&KC, Map 2, Somnaas, Waypoint 55, SN_SN_23 area

An interesting exposure of the 30 m Package where unusually it overlies a terrestrial, colluvial deposit instead of the marine 50 m Package.

KC, Map 2, Koingnaas, Waypoint 124, KN_7 area

KC, Map 2, Koingnaas, Waypoint 125, KN_R8 area

Exposures of decalcified 30 m Package with upper shoreface at section top and thin calcrete capping.

KC, Map 2, area at seaward end of Koingnaas 6869 orebody

Extensive exposures of decalcified 30 m Package, effectively a cliff *cf.* at Rooiwalbaai. However, no clear exposures of on lapping Quaternary beaches were seen.

&KC, Map 1, Hondeklip/Langklip boundary, LK_N6 area

Lower shoreface with transgressive contact and overlying 30 m P deposits. A similar exposure is at Waypoint 50. Further seawards, the thickness of 50 m Package lower-shoreface sands diminishes and the 30 m Package lower-shoreface facies is increasingly developed.

The Quaternary Packages

KC, Map 1, Langklip, Waypoint 142, LKC5-2 area

In the east, relatively thin upper-shoreface exposures of the decalcified 30 m Package are seen. These appear to be overlain seaward by pale, boulder-bearing deposits of the Quaternary beaches (Images 34 and 35). The south faces are obscured, limiting scope for laterally-continuous observations.

Potentially a very informative exposure, but requires “clean-up” to provide some clearer vertical sections.

KC, Map 1, Langklip, Waypoint 126, LKC_R1B area

A lateral section exposed by mining of the Quaternary “RETs”. Under ~1.6 m of grey, aeolian sand, a thick unit of pale, calcareous, marine sand with a capping, karstic pedogenic profile is ostensibly the LIG high stand (Image 36). Towards the east, its boulder-bearing lower contact is exposed and is formed on reddened, pebbly sands with pedogenic features and a basal boulder-cobble gravel on bedrock, probably 30 m P deposits. The exposure does not extend sufficiently far inland to reveal a pre-LIG high stand.

KC, Map 2, Koingnaas, Waypoint 122, KN_15A area

Appears to be early? Quaternary beach deposits cresting out on the underlying 30 m Package.

BMC, Map 3, Kleinzee, Waypoint 129, AK_61A area

A basal boulder and cobble unit and pebbly sands are exposed in a slit trench within an old prospecting trench (Image 38). Shells of modern taxa suggest it is attributable to an earlier Quaternary transgression. Just nearby and farther east the exposure appears to be 30 m P deposits like those at 127 and 128. At the seaward end of the trench a thin, near-surface unit of cobbly gravel (LIG) overlies pedogenically-reddened, decalcified sands, but closer examination is required to ascertain if it is “real” or not.

Potentially a very informative exposure, but requires “clean-up” to provide some clearer vertical sections.

BMC, Map 3, Tweepad, Waypoint 138, TP_240_J

These trenches in the “RETs” are now incomplete exposures due to blown-in sand and collapse. An uppermost transgressive surface that extends inland is partially exposed (LIG) in the northern trench. It is underlain by pale, compact-cemented sands.

In a trench to the south of the previous exposure is a “shingle” unit of discoidal cobbles with a superimposed pedogenic profile, very likely the LIG beach.

Again, potentially very informative exposures, but requiring “clean-up” to provide some clearer vertical sections and indications of lateral extents.

BIC, Map 4, Nuttabooi, Waypoint 145

BIC, Map 4, Mannels Vley, Waypoint 144

BIC, Map 4, Dikgat, Waypoint 143

Other existing sites displaying neotectone activity were noted.

8.2.1.1 Natural exposures

Nature exposures occur at Waypoint 53 (Map 2) on the north bank of the Swartlintjies Rivier. Here is a low outcrop of silicified sandstone (not weathering-profile silcrete) that has features suggesting it is an aeolianite (Image 49). Other examples may occur. It is thought that these and other examples are remnants of more extensive deposits, both fluvial and aeolian in origin, that filled the extant drainages and their buried tributaries during the upper Miocene 15-5 Ma and represent a largely-unknown period of geological history post-dating the 90 m Package.

In this category may also be features of the Precambrian bedrock stratigraphy that could be included in a geohistorical route itinerary. Suggestions to be sought from relevant researchers.

Here the issue is not preservation of pit exposures, but eventual facilitation of access for inclusion in a GeoTourism itinerary.

9 Marine environment

Dr Andrea Pulfrich is in the process of finalising a marine desktop study and this final study will be included in the environmental impact assessment stage of the project. The information provided hereunder is based on the completed sections on this pending final desktop study.

9.1 Sea Surface Temperature, Currents and Circulation Patterns

The project area falls within the nearshore central Benguela region (Cape Columbine to Lüderitz), which is primarily characterised by variable, northward flowing, longshore surface currents, generated by consistent, strong winds and swells from the south and southwest (Shillington *et al*. 1990, Shannon & Nelson 1996).

These nearshore surface currents remain closely aligned with the coastline and the winds, generally flowing in a northerly direction, although periodic reversals can occur.

Winds are the main physical driver of the nearshore region, and physical processes are characterised by the average seasonal wind patterns. Substantial episodic changes in these wind patterns can consequently have strong effects on the entire Benguela region.

The prevailing winds along the southern African West Coast are controlled by the South Atlantic subtropical anticyclone, the eastward moving mid-latitude cyclones south of southern Africa, and the seasonal atmospheric pressure field over the subcontinent. The south Atlantic anticyclone is a perennial feature that forms part of a discontinuous belt of high-pressure systems, which encircle the subtropical southern hemisphere. This undergoes seasonal variations, being strongest in the austral summer, when it also attains its southernmost extension, lying south west and south of the subcontinent. In winter, the south Atlantic anticyclone weakens and migrates north-westwards.

These seasonal changes result in substantial differences between the typical summer and winter wind patterns in the region, as the southern hemisphere anti-cyclonic high-pressure systems, and the associated series of cold fronts, moves northwards in winter, and southwards in summer. The strongest winds occur in summer, during which winds blow 99% of the time, and gales (winds exceeding 63 km/h or 18 m/s) are frequent. In summer, winds are dominated by southerlies, which occur over 40% of the time, averaging 37 – 55 km/h (10 – 15 m/s) and reaching speeds in excess of 100 km/h. South-easterlies are almost as common, blowing about one-third of the time, and also averaging 37 – 55 km/h. The combination of these southerly/south-easterly winds drives the massive offshore movements of surface water, and the resultant strong upwelling of nutrient-rich bottom waters, which characterise this region in summer.

Southerly to south-south easterly winds continue to dominate the wind pattern during winter, but the closer proximity of the winter cold-front systems also results in a significant south-westerly to north-westerly component. This ‘reversal’ from the summer condition results in cessation of upwelling, movement of warmer mid-Atlantic water shore-wards and breakdown of the strong thermo clines, which typically develop during summer. There are also more calms in winter, occurring about 3% of the time, and wind speeds generally do not reach the maximum speeds of summer. The westerly winds blowing in synchrony with the prevailing south-westerly swell direction in winter, however, usually result in far heavier swell conditions.

9.2 Waves and tides

Most of the west coast of southern Africa is classified as exposed, experiencing strong wave action, rating between 13 - 17 on the 20 point exposure scale (McLachlan 1980). West- to north-facing embayments are limited and most of the coastline is therefore impacted by heavy south-westerly swells generated in the roaring forties, as well as significant sea waves generated locally by the prevailing moderate to strong southerly winds characteristic of the region. The Namaqualand coastline is particularly exposed, being rated as “exposed” and “extremely exposed” (Steffani 2001).

The wave regime along the southern African west coast shows only moderate seasonal variation in direction, with virtually all swells throughout the year coming from the south westerly to southerly direction (Figure (g) (iv) (a) 9 -1). Winter swells are strongly dominated by those from the southwest to south-southwest, which occur almost 80% of the time, and typically exceeding 2 m in height, averaging about 3 m, and often attaining over 5 m.

With wind speeds capable of reaching 100 km/h (during heavy winter south-westerly storms, winter swell heights can exceed 10 m. The dominant peak energy period for waves is ~12 seconds, although longer period swells occur about 30% of the time.

Summer swells tend to be smaller on average, typically around 2 m with a more pronounced southerly swell component. These southerly swells tend to be wind-induced, with shorter wave periods (~8 seconds), and are generally steeper than swell waves. The wind-induced southerly waves are relatively local and work together with the strong summer southerly winds to cause the northward-flowing nearshore surface currents, which results in substantial nearshore sediment mobilisation and northwards transport. In common with the rest of the southern African coast, tides along the Namaqualand coast and in the project area are semi-diurnal, with a total range of some 1.5 m at spring tide, but only 0.6 m during neap tide periods.

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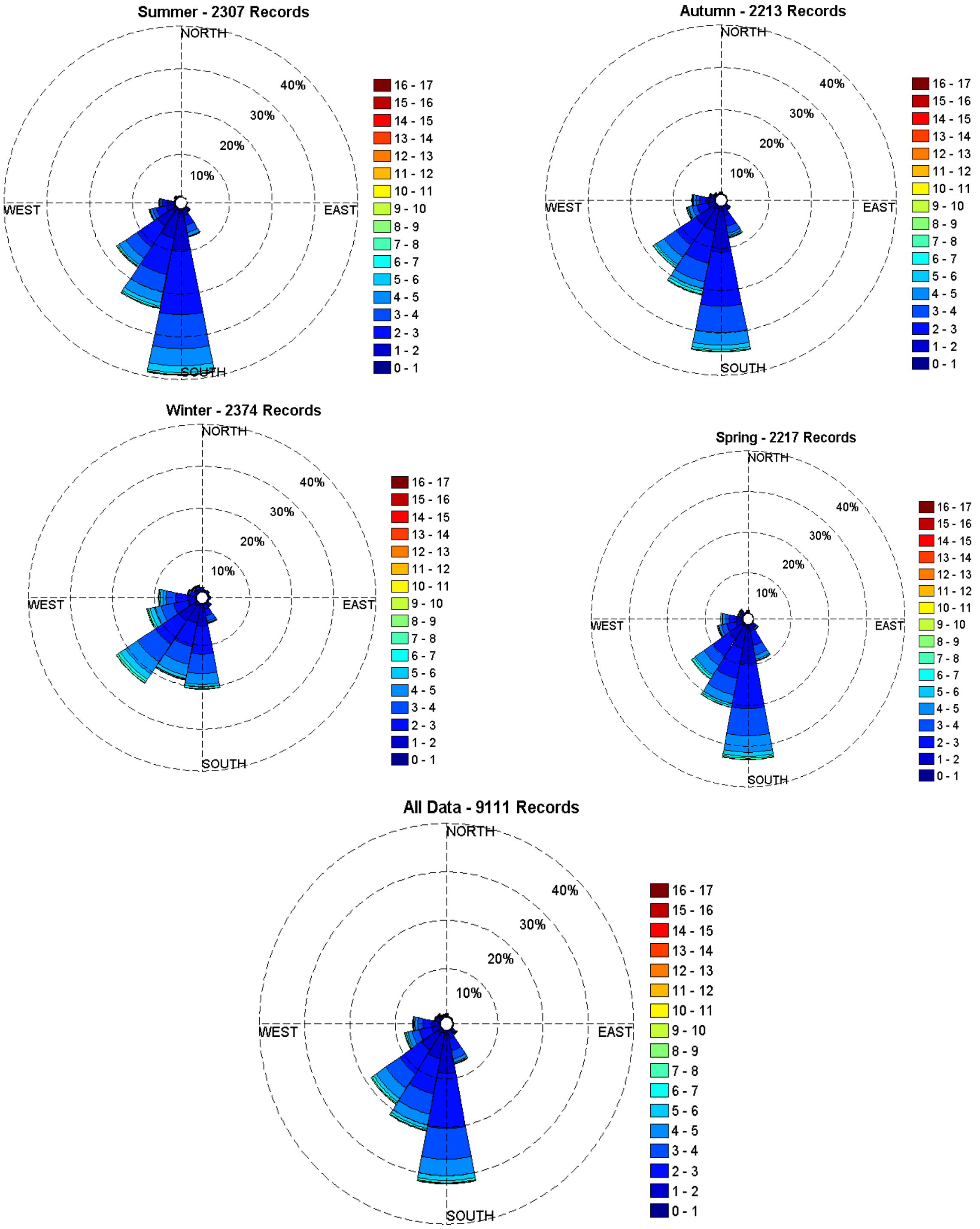

Figure (g) (iv) (a) 9 - 1: VOS Wave Height vs Wave Direction data for the Cape Columbine area 32.0 to 32.9 S and 17.0 to 17.9E (1903-11-01 to 2011-05-24; 9, 111 records) (from CSIR)

9.3 Sea water

South Atlantic Central Water (SACW) comprises the bulk of the seawater in the study area, either in its pure form in the deeper regions, or mixed with previously up welled water of the same origin on the continental shelf (Nelson & Hutchings 1983). Salinities range between 34.5 % and 35.5 % (Shannon 1985).

Seawater temperatures on the continental shelf of the central Benguela typically vary between 6°C and 16°C. Well-developed thermal fronts exist, demarcating the seaward boundary of the upwelled water. Upwelling filaments are characteristic of these offshore thermal fronts, occurring as surface streamers of cold water, typically 50 km wide and extending beyond the normal offshore.

Such fronts typically have a lifespan of a few days to a few weeks, with the filamentous mixing area extending up to 625 km offshore.

The continental shelf waters of the Benguela system are characterised by low oxygen concentrations, especially on the bottom. SACW itself has depressed oxygen concentrations (~80% saturation value), but lower oxygen concentrations (<40% saturation) frequently occur (Bailey *et al*. 1985; Chapman and Shannon 1985).

9.4 Offshore Bathymetry

Offshore bathymetry information was obtained from the British Admiralty Chart BA 2078 and South African chart SAN115. Hydrographic soundings for part of the SAN115 area were also provided in digital format by the South African Navy Hydrographic Office. The offshore seabed slopes very gently from the 200 m depth contour (located more than 60 km form the coast) to the 100 m depth contour (located approximately 5 km from shore). From the 100 depth contour, the seabed slopes steeply to the shoreline (WSP, 2015).

9.5 Upwelling and Plankton Production

Coastal, wind-induced upwelling is the principal physical process that shapes the marine ecology of the Benguela region. The prevailing longshore, equatorwards winds move nearshore surface water northwards and offshore. To balance the displaced water, cold, deeper water wells up inshore.

During upwelling the comparatively nutrient-poor surface waters are displaced by enriched deep water, supporting substantial seasonal primary phytoplankton production. The cold, upwelled water is rich in inorganic nutrients, the major contributors being various forms of nitrates, phosphates and silicates (Chapman and Shannon 1985).

Nutrient concentrations of upwelled water of the Benguela system attain 20 µM nitrate-nitrogen, 1.5 µM phosphate and 15-20 µM silicate, indicating nutrient enrichment (Chapman and Shannon 1985). This is mediated by nutrient regeneration from biogenic material in the sediments (Bailey *et al*. 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.

High phytoplankton productivity in the upper layers again depletes the nutrients in these surface waters. This results 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. Biological decay of plankton blooms can in turn lead to "black tide" events, as the available dissolved oxygen is stripped from the water during the decomposition process (see below). Subsequent anoxic decomposition by sulphur reducing bacteria can result in the formation and release of hydrogen sulphide (Pitcher and Calder 2000).

Although the rate and intensity of upwelling fluctuates with seasonal variations in wind patterns, the most intense upwelling tends to occur where the shelf is narrowest and the wind strongest. The largest and most intense upwelling cell is in the vicinity of Lüderitz, and upwelling can occur there throughout the year (Shannon & O'Toole 1998, Shillington 2003). Several secondary upwelling cells occur, of which the Namaqua cell is centred around Hondeklip Bay (30°S), and the Cape Columbine (33°S) and Cape Point (34°S) upwelling cells are located further south. Upwelling in these secondary cells is seasonal, with maximum upwelling occurring between September and March. The project area is located within the Hondeklip Bay cell, and is thus likely to be periodically influenced by upwelling-related processes. During the winter westerly winds result in relaxation of upwelling and often warmer surface water temperatures (Lutjeharms and Meeuwis 1987).

9.6 Organic Inputs

The Benguela upwelling region is an area of particularly high natural productivity, with extremely high seasonal production of phytoplankton and zooplankton. These plankton blooms in turn serve as the basis for a rich food chain up through pelagic baitfish (anchovy, pilchard, round-herring and others), to predatory fish (snoek), mammals (primarily seals and dolphins) and seabirds (jackass penguins, cormorants, pelicans, terns and others).

All of these species 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. Balanced multispecies ecosystem models have estimated that during the 1990s the Benguela region supported biomasses of 76.9 tons/km^2 of phytoplankton and 31.5 tons/km^2 of zooplankton alone (Shannon *et al*. 2003). Thirty six percent of the phytoplankton and 5% of the zooplankton are estimated to be lost to the seabed annually. This natural annual input of millions of tons of organic material onto the seabed off the southern African West Coast has a substantial effect on the ecosystems of the Benguela region. It provides most of the food requirements of the particulate and filter-feeding benthic communities that inhabit the sandy-muds of this area, and results in the high organic content of the muds in the region. As most of the organic detritus is not directly consumed, it enters the seabed decomposition cycle, resulting in subsequent depletion of oxygen in deeper waters.

9.7 Low oxygen events

The continental shelf waters of the Benguela system are characterised by low oxygen concentrations with <40% saturation occurring frequently (e.g. Visser 1969; Bailey *et al*. 1985). The low oxygen concentrations are attributed to nutrient remineralisation in the bottom waters of the system (Chapman and Shannon 1985). The absolute rate of this is dependent upon the net organic material build-up in the sediments, with the carbon rich mud deposits playing an important role.

Periodic low oxygen events in the nearshore region can have catastrophic effects on the marine communities leading to large-scale stranding of rock lobsters, and mass mortalities of marine biota and fish (Newman & Pollock 1974; Matthews & Pitcher 1996; Pitcher 1998; Cockcroft *et al*. 2000).

9.8 Turbidity

Turbidity is a measure of the degree to which the water loses its transparency due to the presence of suspended particulate matter. Total Suspended Particulate Matter (TSPM) can be divided into Particulate Organic Matter (POM) and Particulate Inorganic Matter (PIM), the ratios between them varying considerably. The POM usually consists of detritus, bacteria, phytoplankton and zooplankton, and serves as a source of food for filter-feeders. Seasonal microphyte production associated with upwelling events will play an important role in determining the concentrations of POM in coastal waters.

PIM, on the other hand, is primarily of geological origin consisting of fine sands, silts and clays. Off Namaqualand, the PIM loading in nearshore waters is strongly related to natural inputs from the Orange River or from 'berg' wind events. Although highly variable, annual discharge rates of sediments by the Orange River is estimated to vary from 8 - 26 million tons/yr (Rogers 1979).

'Berg' wind events can potentially contribute the same order of magnitude of sediment input as the annual estimated input of sediment by the Orange River (Shannon & Anderson 1982; Zoutendyk 1992, 1995; Shannon & O'Toole 1998; Lane & Carter 1999). For example, a 'berg' wind event in May 1979 described by Shannon and Anderson (1982) was estimated to have transported in the order of 50 million tons of sand out to sea, affecting an area of 20 000 km^2.

Concentrations of suspended particulate matter in shallow coastal waters can vary both spatially and temporally, typically ranging from a few mg/ℓ to several tens of mg/ℓ (Bricelj & Malouf 1984; Berg and Newell 1986; Fegley *et al*. 1992). In the vicinity of the Orange River mouth, where river outflow strongly influences the turbidity of coastal waters, measured concentrations ranged from 14.3 mg/ℓ at Alexander Bay just south of the mouth (Zoutendyk 1995) to peak values of 7,400 mg/ℓ immediately upstream of the river mouth during the 1988 Orange River flood (Bremner *et al*. 1990).

The major source of turbidity in the swell-influenced nearshore areas off the West Coast is the redistribution of fine inner shelf sediments by long-period Southern Ocean swells. The current velocities typical of the Benguela (10-30 cm/s) are capable of re-suspending and transporting considerable quantities of sediment equatorwards. Under relatively calm wind conditions, however, much of the suspended fraction (silt and clay) that remains in suspension for longer periods becomes entrained in the slow poleward undercurrent (Shillington *et al.* 1990; Rogers and Bremner 1991).

Superimposed on the suspended fine fraction, is the northward littoral drift of coarser bed load sediments, parallel to the coastline. This northward, nearshore transport is generated by the predominantly south-westerly swell and wind-induced waves. Longshore sediment transport varies considerably in the shore-perpendicular dimension, being substantially higher in the surf-zone than at depth, due to high turbulence and convective flows associated with breaking waves, which suspend and mobilise sediment (Smith and Mocke 2002).

On the inner and middle continental shelf, the ambient currents are insufficient to transport coarse sediments typical of those depths, and re-suspension and shoreward movement of these by wave-induced currents occur primarily under storm conditions. Data from a Waverider buoy at Port Nolloth have indicated that 2-m waves are capable of re-suspending medium sands (200 µm diameter) at ~10 m depth, whilst 6-m waves achieve this at ~42 m depth. Low-amplitude, long-period waves will, however, penetrate even deeper. Most of the sediment shallower than 90 m can therefore be subject to re-suspension and transport by heavy swells (Lane and Carter 1999).

10 Biologicla Environment

The study area lies within the relatively uniform cool Namaqua marine biogeographic region, which extends from Cape Point to Lüderitz in Namibia (Emanuel *et al.* 1992; Lombard *et al.* 2004) Figure (g) (iv) (a) 1 - 23. The major force driving the ecology of this region is coastal upwelling, predominantly occurring in the spring/summer period when the south-easterly is the prevailing wind. The upwelling process supplies inorganic nutrients to the euphotic zone supporting high biological productivity (see previous section). This coast is, however, characterized by low marine species richness and low endemicity (Awad *et al.* 2002).

The biota of nearshore marine habitats on the West Coast is relatively robust, being naturally adapted to an extremely dynamic environment where biophysical disturbances are commonplace. The benthic communities within this region are largely ubiquitous, particular only to substrate type (i.e. hard vs. soft bottom), exposure to wave action, or water depth.

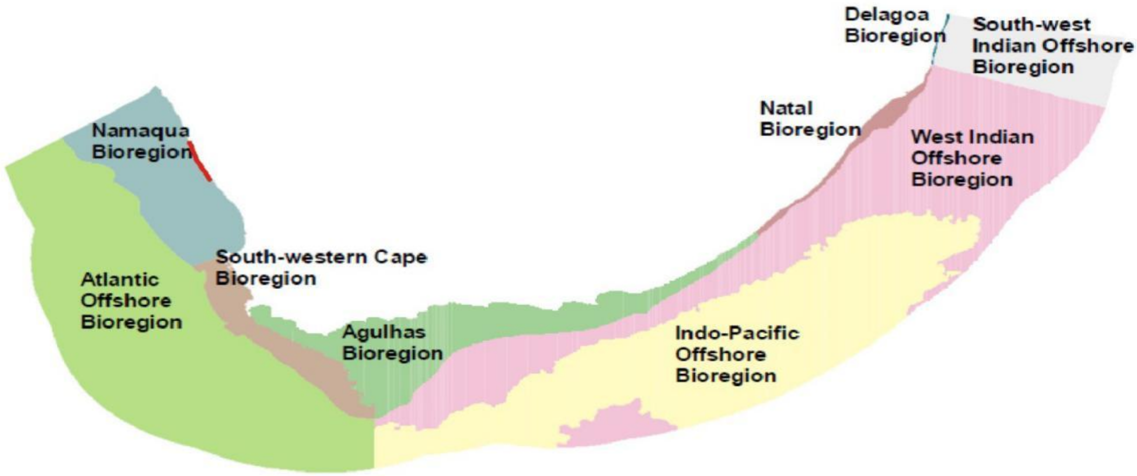

Figure (g) (iv) (a) 10 - 1: The South African inshore and offshore bioregions in relation to the concession areas (red line) (adapted from Lombard *et al*. 2004)

Habitats specific to the study area include:

- Sandy intertidal and subtidal substrates;
- Intertidal rocky shores and subtidal reefs; and
- The water body;

- The biological communities consist of many hundreds of species, often displaying considerable temporal and spatial variability - even at small scales. No rare or endangered species have been recorded (*Awad et al*. 2002). Consequently, this review describes 'typical' biological communities, focussing on dominant, commercially important and conspicuous species only.

10.1 Sandy substrate habitats and biota

Sandy substrates comprise approximately 14.25 km of the coast of concession 6a and 7a. Similar spatial data are unfortunately not available for concessions 8a and 9a. The benthic biota of soft bottom substrates constitutes invertebrates that live on, or burrow within, the sediments, and are generally divided into megafauna (>10 cm), macrofauna (animals >1 mm) and meiofauna (<1 mm).

10.2 Intertidal sandy beaches

Although the coastline of the study area is highly dominated by rocky shores, there are some isolated pocket beaches between the rocky outcrops. Sandy beaches are one of the most dynamic coastal environments. The composition of their faunal communities is largely dependent on the interaction of wave energy, beach slope and sand particle size, which is termed beach morphodynamics. Three morphodynamic beach types are described: dissipative, reflective and intermediate beaches (McLachlan et al. 1993):

- Dissipative beaches are generally relatively wide and flat with fine sands and high wave energy. Waves start to break far from the shore in a series of spilling breakers that 'dissipate' their energy along a broad surf zone. This generates slow swashes with long periods, resulting in less turbulent conditions on the gently sloping beach face. These beaches usually harbour the richest intertidal faunal communities.
- Reflective beaches have low wave energy, and are coarse grained (>500 µm sand) with narrow and steep intertidal beach faces. The relative absence of a surf-zone causes the waves to break directly on the shore causing a high turnover of sand. The result is depauperate faunal communities.
- Intermediate beach conditions exist between these extremes and have a very variable species composition (McLachlan et al. 1993, Jaramillo et al. 1995, Soares 2003). This variability is mainly attributable to the amount and quality of food available.

Beaches with a high input of e.g. kelp wrack have a rich and diverse drift-line fauna, which is sparse or absent on beaches lacking a drift-line (Branch & Griffiths 1988). As a result of the combination of typical beach characteristics, and the special adaptations of beach fauna to these, beaches act as filters and energy recyclers in the nearshore environment (Brown & McLachlan 1990). Due to the exposed nature of the coastline in the study area, most beaches are of the intermediate to reflective type.

Numerous methods of classifying beach zonation have been proposed, based either on physical or biological criteria. The general scheme proposed by Branch & Griffiths (1988) is used below Figure g (iv) (a) 11 -2. Supplemented by data from various publications on West Coast sandy beach biota (e.g. Bally 1987, Brown et al. 1989, Soares et al. 1996, 1997, Nel 2001, Nel et al. 2003, Soares 2003, Branch *etal*. 2010, Harris 2012).

The macrofaunal communities of sandy beaches are generally ubiquitous throughout the Southern African West Coast region, being particular only to substratum type, wave exposure and/or depth zone .

The supralittoral zone is situated above the high water spring (HWS) tide level, and receives water input only from large waves at spring high tides or through sea spray. This zone is characterised by a mixture of air-breathing terrestrial and semi-terrestrial fauna, often associated with and feeding on kelp deposited near or on the drift line. Terrestrial species include a diverse array of beetles and arachnids and some oligochaetes, while semi-terrestrial fauna include the oniscid isopod *Tylos granulatus*, and amphipods of the genus Talorchestia and Africorchestia.

The intertidal or mid-littoral zone has a vertical range of about 2 m. This mid-shore region is characterised by the cirolanid isopods Pontogeloides latipes, Eurydice (longicornis=) kensleyi, and *Excirolana natalensis*, the polychaetes *Scolelepis squamata*, *Orbinia angrapequensis*, *Nepthys hombergii* and *Lumbrineris tetraura*, and amphipods of the families Haustoridae and Phoxocephalidae. In some areas, juvenile and adult sand mussels *Donax serra* may also be present in considerable numbers (Photo g-7).

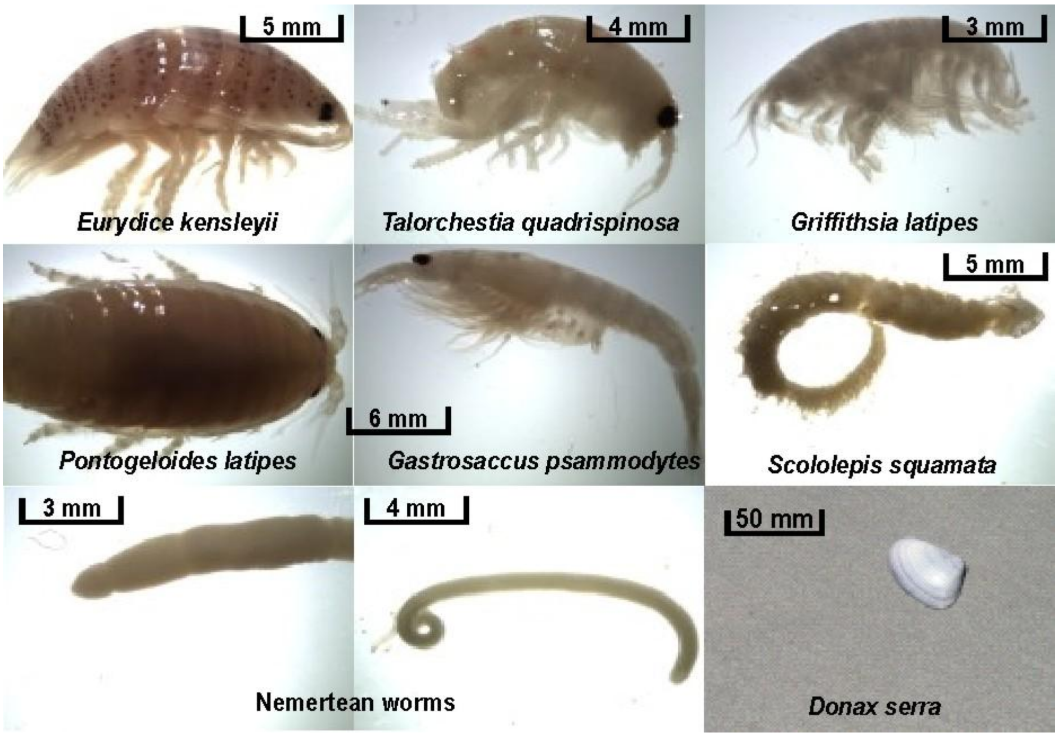

Photo g - 7: Common beach macrofaunal species occurring on exposed West Coast Beaches

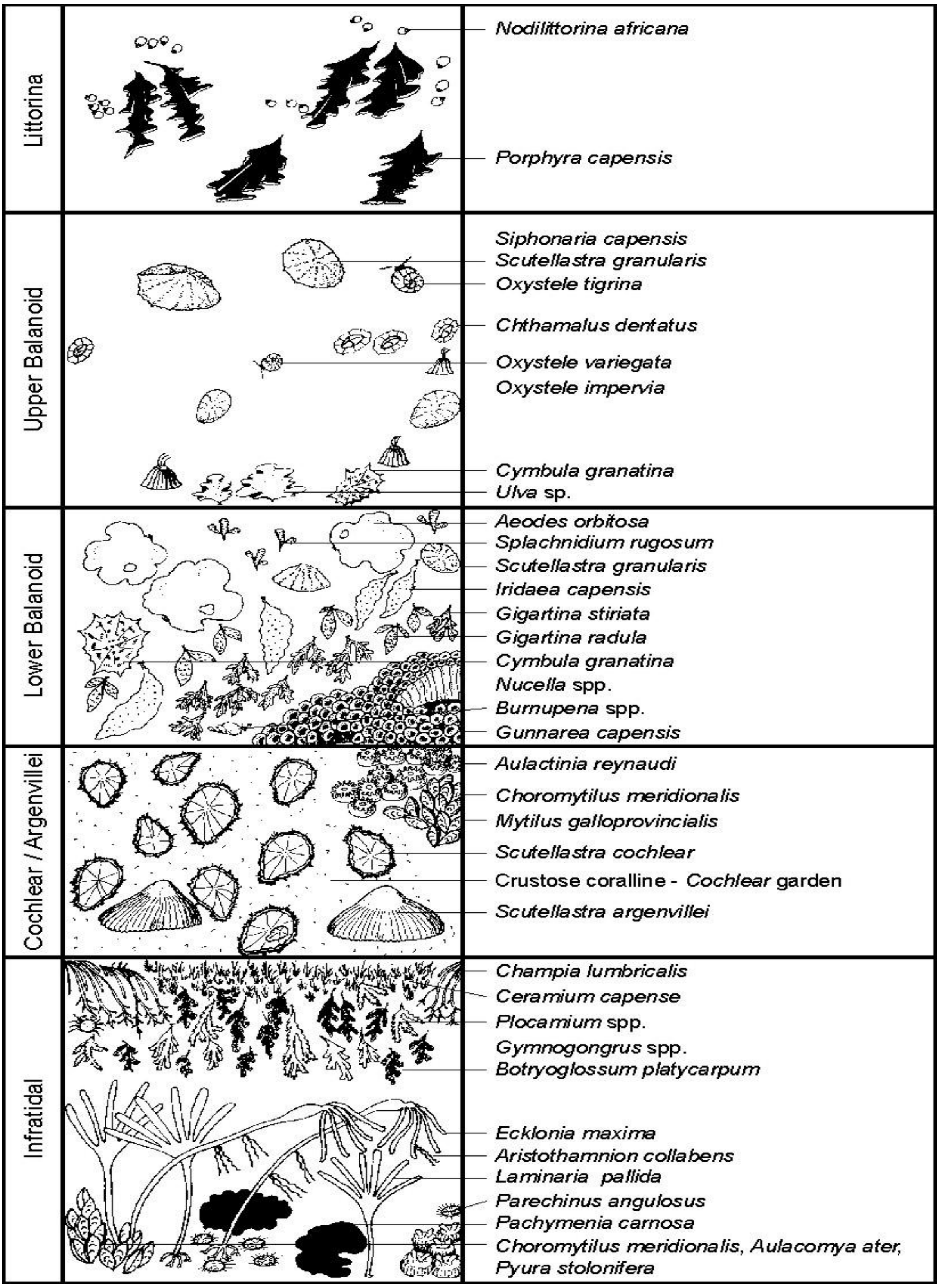

Figure (g) (iv) (a) 10 - 2: Schematic representation of the West Coast intertidal beach zonation (adapted from Branch& Branch 1981). Species commonly occurring on the Namaqualand beaches are listed.

The inner turbulent zone extends from the Low Water Spring mark to about -2 m depth. The mysid *Gastrosaccus psammodytes* (Mysidacea, Crustacea), the ribbon worm *Cerebratulus fuscus* (Nemertea), the cumacean *Cumopsis robusta* (Cumacea) and a variety of polychaetes including Scolelepis squamata and *Lumbrineris tetraura*, are typical of this zone, although they generally extend partially into the midlittoral above. In areas where a suitable swash climate exists, the gastropod *Bullia digitalis* (Gastropoda, Mollusca) may also be present in considerable numbers, surfing up and down the beach in search of carrion.

The transition zone spans approximately 2-5 m depth beyond the inner turbulent zone. Extreme turbulence is experienced in this zone, and as a consequence this zone typically harbours the lowest diversity on sandy beaches. Typical fauna includes amphipods such as *Cunicus profundus* and burrowing polychaetes such as *Cirriformia tentaculata* and *Lumbrineris tetraura*.

The outer turbulent zone extends below 5 m depth, where turbulence is significantly decreased and species diversity is again much higher. In addition to the polychaetes found in the transition zone, other polychaetes in this zone include *Pectinaria capensis*, and *Sabellides ludertizii*. The sea pen Virgularia schultzi (Pennatulacea, Cnidaria) is also common as is a host of amphipod species and the three spot swimming crab Ovalipes punctatus (Brachyura, Crustacea).

10.3 Nearshore and offshore unconsolidated habitats

Numerous studies have been conducted on southern African West Coast continental shelf benthos, mostly focused on mining, pollution or demersal trawling impacts (Christie & Moldan 1977; Moldan 1978; Jackson & McGibbon 1991; Environmental Evaluation Unit 1996; Parkins & Field 1997; 1998; Pulfrich & Penney 1999; Goosen *et al*. 2000; Savage *et al*. 2001; Steffani & Pulfrich 2004a, 2004b; 2007; Steffani 2007a; 2007b; Steffani 2009, 2010; Atkinson *et al*. 2011; Steffani 2012). The description below is drawn from recent surveys by Karenyi (unpublished data), De Beers Marine Ltd surveys in 2008 and 2010 (unpublished data), and Atkinson *et al*. (2011).

Three macro-infauna communities have been identified on the inner- (0-30 m depth) and mid-shelf (30-150 m depth, Karenyi unpublished data) off the Namaqualand coast. The inner-shelf community, which is affected by wave action, is characterised by various mobile predators (e.g. the gastropod *Bullia laevissima* and *polychaete Nereis* sp.), sedentary polychaetes and isopods.

The mid-shelf community inhabits the mudbelt and is characterised by the mud prawns *Callianassa sp.* and *Calocaris barnardi*. A second mid-shelf sandy community occurring in sandy sediments, is characterised by various *polychaetes* including deposit-feeding*Spiophanes soederstromi* and *Paraprionospio pinnata.*

Polychaetes, *crustaceans* and *molluscs* make up the largest proportion of individuals, biomass and species on the west coast. The distribution of species within these communities are inherently patchy reflecting the high natural spatial and temporal variability associated with macro-infauna of unconsolidated sediments (e.g. Kenny *et al.* 1998; Kendall & Widdicombe 1999; van Dalfsen et al. 2000; Zajac *et al*. 2000; Parry et al. 2003), with evidence of mass mortalities and substantial recruitments recorded on the South African West Coast (Steffani & Pulfrich 2004).

Generaly species richness increases from the inner shelf across the mid shelf and is influenced by sediment type (Karenyi unpublished data). The highest total abundance and species diversity was measured in sandy sediments of the mid-shelf. Biomass is highest in the inshore (± 50 g/m^2 wet weight) and decreases across the mid-shelf averaging around 30 g/m^2 wet weight. This is contrary to Christie (1974) who found that biomass was greatest in the mudbelt at 80 m depth off Lamberts Bay, where the sediment characteristics and the impact of environmental stressors (such as low oxygen events) are likely to differ from those further offshore.

Benthic communities are structured by the complex interplay of a large array of environmental factors. Water depth and sediment grain size are considered the two major factors that determine benthic community structure and distribution on the South African west coast (Christie 1974, 1976; Steffani & Pulfrich 2004a, 2004b; 2007; Steffani 2007a; 2007b) and elsewhere in the world (e.g. Gray 1981; Ellingsen 2002; Bergen *et al.* 2001; Post *et al*. 2006). However, studies have shown that shear bed stress - a measure of the impact of current velocity on sediment – oxygen concentration (Post *et al*. 2006; Currie *et al*. 2009; Zettler *et a*l. 2009), productivity (Escaravage *et al.* 2009), organic carbon and seafloor temperature (Day *et al*. 1971) may also strongly influence the structure of benthic communities. There are clearly other natural processes operating in the deepwater shelf areas of the West Coast that can over-ride the suitability of sediments in determining benthic community structure, and it is likely that periodic intrusion of low oxygen water masses is a major cause of this variability (Monteiro & van der Plas 2006; Pulfrich *et al*. 2006). In areas of frequent oxygen deficiency, benthic communities will be characterised either by species able to survive chronic low oxygen conditions, or colonising and fast-growing species able to rapidly recruit into areas that have suffered oxygen depletion. The combination of local, episodic hydrodynamic conditions and patchy settlement of larvae will tend to generate the observed small-scale variability in benthic community structure.

The invertebrate macrofauna are important in the marine benthic environment as they influence major ecological processes (e.g. remineralisation and flux of organic matter deposited on the sea floor, pollutant metabolism, sediment stability) and serve as important food source for commercially valuable fish species and other higher order consumers. As a result of their comparatively limited mobility and permanence over seasons, these animals provide an indication of historical environmental conditions and provide useful indices with which to measure environmental impacts (Gray 1974; Warwick 1993; Salas *et al.* 2006).

Also associated with soft-bottom substrates are demersal communities that comprise epifauna and bottom-dwelling vertebrate species, many of which are dependent on the invertebrate benthic macrofauna as a food source. According to Lange (2012) the continental shelf on the West Coast between depths of 100 m and 250 m, contained a single epifaunal community characterised by the hermit crabs *Sympagurus dimorphus* and *Parapaguris pilosimanu*s, the prawn *Funchalia woodwardi* and the sea urchin *Brisaster capensis*. Atkinson (2009) also reported numerous species of urchins and burrowing anemones beyond 300 m depth off the West Coast.

10.4 Rocky substrate habitats and biota

Rocky and mixed sand and rock substrates comprise approximately 59.1 km of the concession 6a and 7a coastline. Similar spatial data are unfortunately not available for concessions 8a and 9a. The following general description of the intertidal and subtidal habitats for the West Coast is based on Field *et al.* (1980), Branch & Branch (1981), Branch & Griffiths (1988) and Field & Griffiths (1991). It is supplemented by the descriptions of Steffani (2001), Blamey (2003), Pulfrich *et al*. (2003a), and Steffani & Branch (2003a, b, 2005), from the Groen River coastline just south of the project area. The biological communities of rocky intertidal and subtidal reefs are generally ubiquitous throughout the southern African West Coast region, being particular only to wave exposure, turbulence and/or depth zone.

10.5 Intertidal rocky shores

Several studies on the west coast of southern Africa have documented the important effects of wave action on the intertidal rocky-shore community. Specifically, wave action enhances filter-feeders by increasing the concentration and turnover of particulate food, leading to an elevation of overall biomass despite low species diversity (McQuaid & Branch 1985, Bustamante & Branch 1995a, 1996a, Bustamante *et al.* 1997). Conversely, sheltered shores are diverse with a relatively low biomass, and only in relatively sheltered embayments does drift kelp accumulate and provide a vital support for very high densities of kelp trapping limpets, such as *Cymbula granatina* that occur exclusively there (Bustamante *et al*. 1995b). In the subtidal, these differences diminish as wave exposure is moderated with depth.

West Coast rocky intertidal shores can be divided into five zones on the basis of their characteristic biological communities: The Littorina, Upper Balanoid, Lower Balanoid, Cochlear/Argenvillei and the Infratidal Zones. These biological zones correspond roughly to zones based on tidal heights. Tolerance to the physical stresses associated with life on the intertidal, as well as biological interactions such as herbivory, competition and predation interact to produce these five zones.

Supralittoral fringe or Littorina zone - The uppermost part of the shore is the supralittoral fringe, which is the part of the shore that is most exposed to air, perhaps having more in common with the terrestrial environment. The supralittoral is characterised by low species diversity, with the tiny periwinkle *Afrolittorina knysnaensis*, and the red alga *Porphyra capensis* constituting the most common macroscopic life.

Upper Mid-littoral or Upper Balanoid zone - The upper mid-littoral is characterised by the limpet Scutellastra granularis, which is present on all shores. The gastropods *Oxystele variegata*, *Nucella dubia*, and *Helcion pectunculus* are variably present, as are low densities of the barnacles *Tetraclita serrata*, *Octomeris angulosa* and *Chthalamus dentatus.* Flora is best represented by the green algae Ulva spp.

Lower Mid-littoral or Lower Balanoid zone - Toward the lower shore, biological communities are determined by exposure to wave action. On sheltered and moderately exposed shores, a diversity of algae abounds with a variable representation of: green algae – Ulva spp, Codium spp.; brown algae – *Splachnidium rugosum*; and red algae – Aeodes orbitosa, Mazzaella (=Iridaea) capensis, Gigartina polycarpa (=radula), Sarcothalia (=Gigartina) stiriata, and with increasing wave exposure *Plocamium rigidum*and *P. cornutum*, and *Champia lumbricalis*. The gastropods *Cymbula granatina* and Burnupena spp. are also common, as is the reef building polychaete *Gunnarea capensis*, and the small cushion starfish *Patiriella exigua*. On more exposed shores, almost all of the primary space can be occupied by the dominant alien invasive mussel *Mytilus galloprovincialis*. First recorded in 1979 (although it is likely to have arrived in the late 1960's), it is now the most abundant and widespread invasive marine species spreading along the entire West Coast and parts of the South Coast (Robinson *et al*. 2005). M. galloprovincialis has partially displaced the local mussels *Choromytilus meridionalis* and *Aulacomya ater* (Hockey & Van Erkom Schurink 1992), and competes with several indigenous limpet species (Griffiths *et al.* 1992, Steffani & Branch 2003a, b). Recently, another alien invasive has been recorded, the acorn barnacle *Balanus glandula*, which is native to the west coast of North America where it is the most common intertidal barnacle. The presence of *B. glandula* in South Africa was only noticed a few years ago as it had always been confused with the native barnacle *Cthamalus dentatus* (Simon-Blecher *et al.* 2008). There is, however, evidence that it has been in South Africa since at least 1992 (Laird & Griffith 2008).

At the time of its discovery, the barnacle was recorded from 400 km of coastline from Elands Bay to Misty Cliffs near Cape Point (Laird & Griffith 2008). As it has been reported on rocky shores south of Lüderitz in Namibia (Pulfrich 2013), it is likely that it occurs in the study area. When present, the barnacle is typically abundant at the mid zones of semi-exposed shores.

Along the sublittoral fringe, the large kelp-trapping limpet *Scutellastra argenvillei* dominates forming dense, almost monospecific stands achieving densities of up to 200/m2 (Bustamante et al. 1995). Similarly, *C. granatina* is the dominant grazer on more sheltered shores, also reaching extremely high densities (Bustamante *et al.* 1995). On more exposed shores *M. galloprovincialis* dominates. There is evidence that the arrival of the alien *M. palloprovincialis* has led to strong competitive interaction with S. argenvillei (Steffani & Branch 2003a, b, 2005). The abundance of the mussel changes with wave exposure, and at wave-exposed locations, the mussel can cover almost the entire primary substratum, whereas in semi-exposed situations it is never abundant. As the cover of *M. galloprovincialis* increases, the abundance and size of S. argenvillei on rock declines and it becomes confined to patches within a matrix of mussel bed. As a result, exposed sites, once dominated by dense populations of the limpet, are now largely covered by the alien mussel. Semi-exposed shores do, however, offer a refuge preventing global extinction of the limpet. In addition to the mussel and limpets, there is variable representation of the flora and fauna described for the lower mid-littoral above, as well as the anemone *Aulactinia reynaudi,* numerous whelk species and the sea urchin *Parechinus angulosus*. Some of these species extend into the subtidal below.

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

10.6 Rocky subtidal habitat and kelp beds

Biological communities of the rocky sublittoral can be broadly grouped into an inshore zone from the sublittoral fringe to a depth of about 10 m dominated by flora, and an offshore zone below 10 m depth dominated by fauna. This shift in communities is not knife-edge, and rather represents a continuum of species distributions, merely with changing abundances.

From the sublittoral fringe to a depth of between 5 and 10 m, the benthos is largely dominated by algae, in particular two species of kelp. The canopy forming kelp *Ecklonia maxima* extends seawards to a depth of about 10 m. The smaller *Laminaria pallida* forms a sub-canopy to a height of about 2 m underneath Ecklonia, but continues its seaward extent to about 30 m depth, although further north up the west coast increasing turbidity limits growth to shallower waters (10-20 m) (Velimirov *et al.* 1977, Jarman & Carter 1981, Branch 2008). *Ecklonia maxima* is the dominant species in the south forming extensive beds from west of Cape Agulhas to north of Cape Columbine, but decreasing in abundance northwards.

Laminaria becomes the dominant kelp north of Cape Columbine and thus in the project area, extending from Danger Point east of Cape Agulhas to Rocky Point in northern Namibia (Stegenga *et al*. 1997, Rand 2006).

Kelp beds absorb and dissipate much of the typically high wave energy reaching the shore, thereby providing important partially-sheltered habitats for a high diversity of marine flora and fauna, resulting in diverse and typical kelp-forest communities being established. Through a combination of shelter and provision of food, kelp beds support recruitment and complex trophic food webs of numerous species, including commercially important rock lobster stocks (Branch 2008).

Growing beneath the kelp canopy, and epiphytically on the kelps themselves, are a diversity of under storey algae, which provide both food and shelter for predators, grazers and filter-feeders associated with the kelp bed ecosystem. Representative under-storey algae include Botryocarpa prolifera, *Neuroglossum binderianum*, *Botryoglossum platycarpum*, *Hymenena venosa* and Rhodymenia (=Epymenia) obtusa, various coralline algae, as well as subtidal extensions of some algae occurring primarily in the intertidal zones (Bolton 1986). Epiphytic species include *Polysiphonia virgata*, *Gelidium vittatum* (=Suhria vittata) and Carpoblepharis flaccida. In particular, encrusting coralline algae are important in the under-storey flora as they are known as settlement attractors for a diversity of invertebrate species. The presence of coralline crusts is thought to be a key factor in supporting a rich shallow-water community by providing substrate, refuge, and food to a wide variety of infaunal and *epifaunal invertebrates* (Chenelot *et a*l. 2008).

The sublittoral invertebrate fauna is dominated by suspension and filter-feeders, such as the mussels *Aulacomya ater* and *Choromytilus meriodonalis*, and the Cape reef worm Gunnarea capensis, and a variety of sponges and sea cucumbers. Grazers are less common, with most herbivory being restricted to grazing of juvenile algae or debris-feeding on detached macrophytes. The dominant herbivore is the sea urchin Parechinus angulosus, with lesser grazing pressure from limpets, the isopod Paridotea reticulata and the amphipod *Ampithoe humeralis*. The abalone *Haliotis midae*, an important commercial species present in kelp beds is naturally absent north of Cape Columbine.

Key predators in the sub-littoral include the commercially important West Coast rock lobster *Jasus lalandii* and the octopus *Octopus vulgaris*. The rock lobster acts as a keystone species as it influences community structure via predation on a wide range of benthic organisms (Mayfield et al. 2000). Relatively abundant rock lobsters can lead to a reduction in density, or even elimination, of black mussel *Choromytilus meriodonalis*, the preferred prey of the species, and alter the size structure of populations of ribbed mussels Aulacomya ater, reducing the proportion of selected size-classes (Griffiths & Seiderer 1980).

Their role as predator can thus reshape benthic communities, resulting in large reductions in taxa such as black mussels, urchins, whelks and barnacles, and in the dominance of algae (Barkai & Branch 1988, Mayfield 1998).

Of lesser importance as predators, although numerically significant, are various starfish, feather and brittle stars, and gastropods, including the whelks Nucella spp. and Burnupena spp. Fish species commonly found in kelp beds off the West Coast include hottentot *Pachymetopon blochi*i, two tone finger fin *Chirodactylus brachydactylus*, red fingers *Cheilodactylus fasciatus*, *galjoen Dichistius capensis*, rock suckers *Chorisochismus dentex* and the catshark *Haploblepharus pictus* (Branch *et al.* 2010). There is substantial spatial and temporal variability in the density and biomass of kelp beds, as storms can remove large numbers of plants and recruitment appears to be stochastic and unpredictable (Levitt et al. 2002, Rothman et al. 2006). Some kelp beds are dense, whilst others are less so due to differences in seabed topography, and the presence or absence of sand and grazers. Due to their importance as recruitment, nursery, and feeding grounds for numerous species, including the commercially important rock lobster *J. lalandii*, kelp beds are considered a medium sensitivity habitat.

10.7 Fauna and flora estuary

Only specialised organisms can exist and thrive in the extreme hypersaline conditions of this estuary (>100 ppt). Artemia is a genus of aquatic crustaceans known as brine shrimp, which are adapted to such conditions and were found in the water column during the field visit. A variety of wading birds and waders were feeding on the brine shrimp throughout the day. No fish or benthic invertebrates were found in the estuary and these groups have therefore been omitted from the sections below.

The National Vegetation Map published by the South African National Biodiversity Institute (SANBI) provides a rough guide to the vegetation types and associated species that can be expected to occur in the Swartlintjies EFZ and surroundings. This rough guide was then ground truthed during the field visit on 23 June 2016, from which a more detailed vegetation map was produced in Google Earth Pro (Figure (g) (iv) (a) 10 - 3). The vegetation in the EFZ had come to life after the rainfall event prior to the field trip with some species being in flower.

The only species found at the Swartlintjies Estuary which could be considered as semi-aquatic when water is present in the system are the saltmarsh plants such as *Sarcocornia natalense*, *Sarocornia pillansii* and *Eragrostis sabulosa*, which is also present along the coast just above High Spring tide level (Heinecken, 1980).

Seashore vegetation can be found in near the mouth on the dunes and extends as a thin band north and south of the estuary encompassing the beach and dune fields (note that this excludes Namaqualand Coastal Duneveld Vegetation type). Seven species unique to this vegetation type have been identified to date). At the estuary mouth, patches of *Sarcocornia perennis* on slightly elevated beach sand were present avoiding inundation by regular penetration of the sea during spring tide. Filamentous algae were growing on the edge of the water body near the mouth and further upstream.

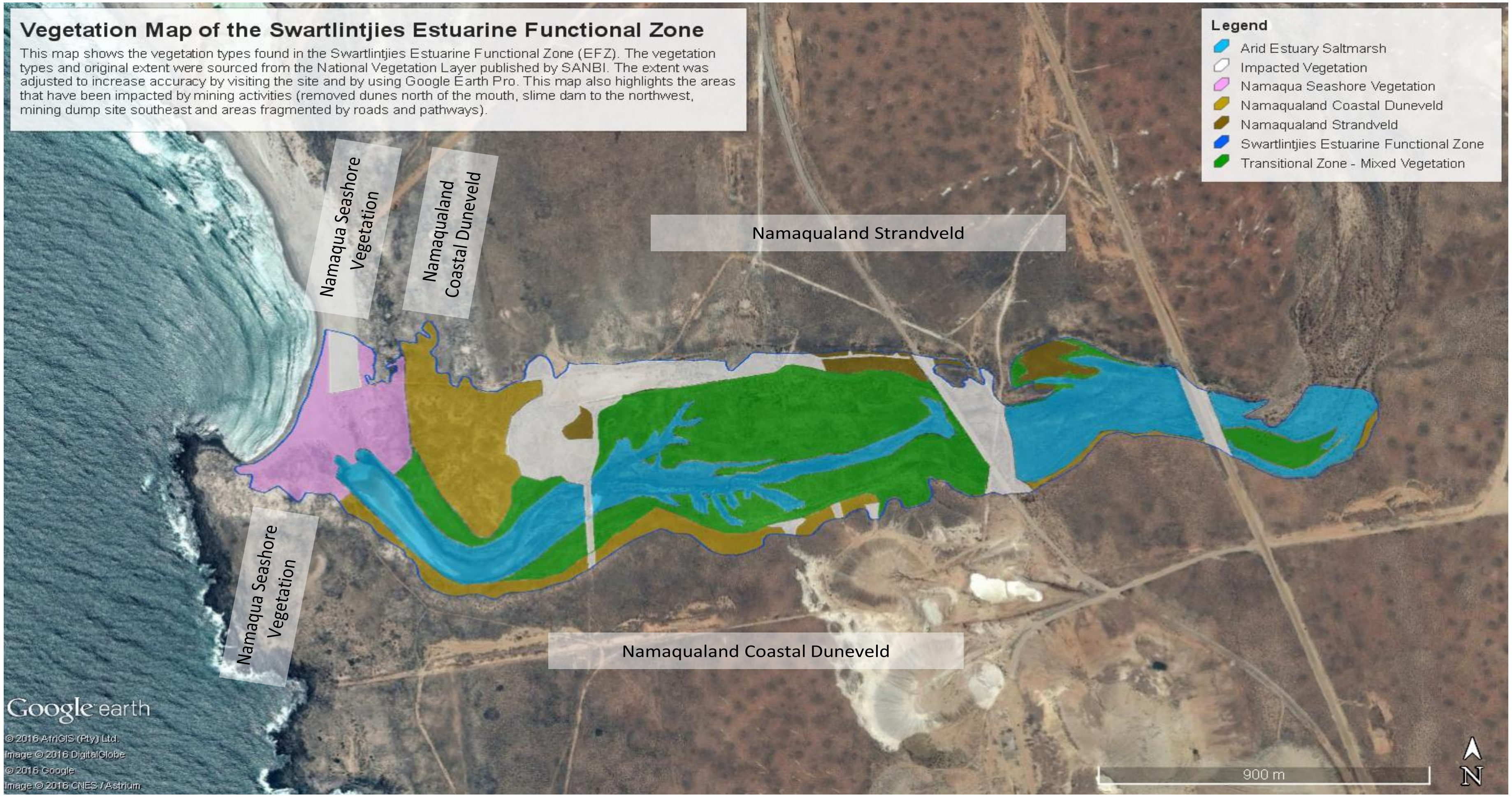

Figure (g) (iv) (a) 10 - 3: Vegetation communities present in the Swartlintjies Estuarine Functional Zone.

11 The Water Body

The study area is located in the central Benguela ecosystem and, as there are few barriers to water exchange, pelagic communities are typical of those of the region. The pelagic communities are typically divided into plankton, fish, and marine mammals (seals, dolphins and whales).

12 Plankton

Plankton is particularly abundant in the shelf waters off the West Coast, being associated with the upwelling characteristic of the area. Plankton range from single-celled bacteria to jellyfish of 2 m diameter, and includes bacterio-plankton, phytoplankton, zooplankton, and ichthyoplankton (Phot g -10).

Phytoplankton are the principle primary producers with mean productivity ranging from 2.5-3.5 g C/m2/day for the midshelf region and decreasing to 1 g C/m^2/day inshore of 130 m (Shannon & Field 1985; Mitchell-Innes & Walker 1991; Walker & Peterson 1991). The phytoplankton is dominated by large-celled organisms, which are adapted to the turbulent sea conditions. The most common diatom genera are Chaetoceros, Nitschia, Thalassiosira, Skeletonema, Rhizosolenia, Coscinodiscus and Asterionella (Shannon & Pillar 1985). Diatom blooms occur after upwelling events, whereas dinoflagellates (e.g. Prorocentrum, Ceratium and Peridinium) are more common in blooms that occur during quiescent periods, since they can grow rapidly at low nutrient concentrations. In the surf zone, diatoms and dinoflagellates are nearly equally important members of the phytoplankton, and some silicoflagellates are also present.

The phytoplankton includes diatoms, dinoflagellates, coccolithophorids and micro flagellates. Phytoplankton biomass in the southern Benguela is generally high in summer during the upwelling season (Photo g-8), but also quite extensive in the autumn and spring, with diatoms generally dominating inshore and small flagellates offshore (Barlow et al. 2005). Maximum diatom concentrations are found in the upper 10 m and thereafter decrease with an increase in depth. Common and widely distributed diatom species include *Asterionella glacialis*, *Leptocylindrus danicus*, *Minidiscus trioculatus*, *Skeletonema costatum*, *Thalassionema nitzschioides*and a number of Navicula, Nitzschia and Thalassiosira species. The most common member of the microflagelattes is a species of Pyramimonas. Dinoflagellates are represented by several members of the genus Gyrodinium, Ceratium, Protoperidilium amongst others. Also present in the area are toxic dinoflagellate species such as *Alexandrium catenella* and various members of the genus Dinophysis, which can cause mass mortalities of fish, shellfish, marine mammals, seabirds and other animals (Pitcher & Calder 2000).

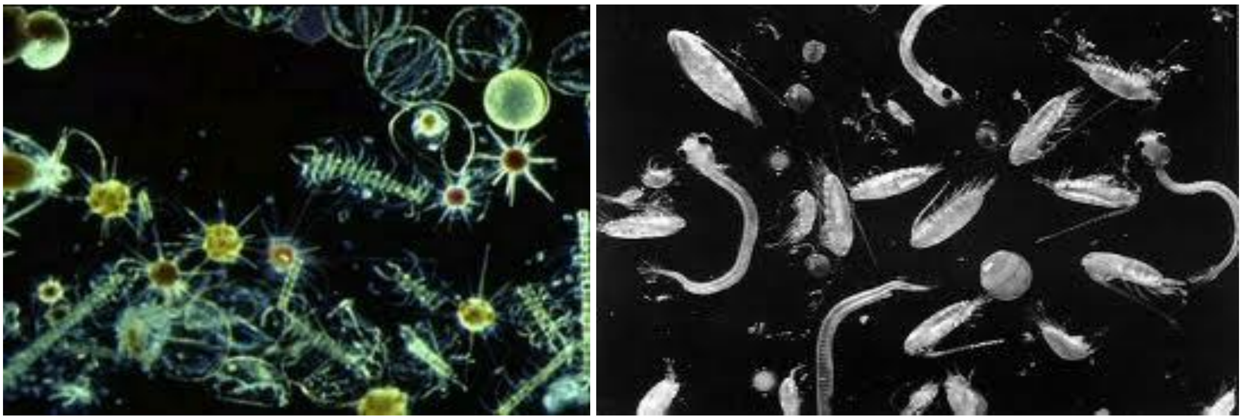

Photo g - 8: Phytoplankton (left, photo: hymagazine.com) and zooplankton (right, photo: mysciencebox.org) is associated with upwelling cells

Zooplankton is characterised by pelagic crustaceans (e.g. copepods, cumaceans, hyperiid amphipods, chaetognaths, mysids, euphausiids), invertebrate larvae (e.g. bivalve, polychaete, etc.), pelagic cnidarians, and ichthyoplankton. Crustacean zooplankters often contribute greatest to the total zooplankton with copepods (e.g. Calanus spp., Centropages spp., Metridia spp.) being the most common organisms in the zooplankton (Verheye & Richardson 1998, Hutchings et al. 2006). Ichthyoplankton constitutes the eggs and larvae of fish. Long-term changes in the southern Benguela include a significant increase in zooplankton over the past five decades, with a decline since 1995 linked to a concomitant increase in pelagic fish biomass as the main predators on zooplankton (Hutchings et al. 2006).

Red-tides are ubiquitous features of the Benguela system (see Shannon & Pillar, 1986). The most common species associated with red tides (dinoflagellate and/or ciliate blooms) are *Noctiluca scintillans*, *Gonyaulax tamarensis*, *G. polygramma* and the ciliate *Mesodinium rubrum*. Gonyaulax and Mesodinium have been linked with toxic red tides. Most of these red-tide events occur quite close inshore although Hutchings et al. (1983) have recorded red-tides 30 km offshore.

The mesozooplankton (≥200 µm) is dominated by copepods, which are overall the most dominant and diverse group in southern African zooplankton. Important species are *Centropages brachiatus*, *Calanoides carinatus*, *Metridia lucens*, *Nannocalanus minor*, Clausocalanus arcuicornis, *Paracalanus parvus*, *P. crassirostris* and *Ctenocalanus vanus*.

All of the above species typically occur in the phytoplankton rich upper mixed layer of the water column, with the exception of M. lucens which undertakes considerable vertical migration.

The *macrozooplankton* (≥1,600 µm) are dominated by euphausiids of which 18 species occur in the area. The dominant species occurring in the nearshore are *Euphausia lucens* and *Nyctiphanes capensis,* although neither species appears to survive well in waters seaward of oceanic fronts over the continental shelf (Pillar et al. 1991).

Standing stock estimates of mesozooplankton for the southern Benguela area range from 0.2-2.0 g C/m², with maximum values recorded during upwelling periods. Macrozooplankton biomass ranges from 0.1-1.0 g C/m², with production increasing north of Cape Columbine (Pillar 1986). Although it shows no appreciable onshore-offshore gradients, standing stock is highest over the shelf, with accumulation of some mobile zooplanktors (euphausiids) known to occur at oceanographic fronts. Beyond the continental slope biomass decreases markedly. Localised peaks in biomass may, however, occur in the vicinity of Child's Bank and Tripp seamount in response to topographically steered upwelling around such seabed features.

Zooplankton biomass varies with phytoplankton abundance and, accordingly, seasonal minima will exist during non-upwelling periods when primary production is lower (Brown 1984; Brown & Henry 1985), and during winter when predation by recruiting anchovy is high. More intense variation will occur in relation to the upwelling cycle; newly upwelled water supporting low zooplankton biomass due to paucity of food, whilst high biomasses develop in aged upwelled water subsequent to significant development of phytoplankton. Irregular pulsing of the upwelling system, combined with seasonal recruitment of pelagic fish species into West Coast shelf waters during winter, thus results in a highly variable and dynamic balance between plankton replenishment and food availability for pelagic fish species. Although ichthyoplankton (fish eggs and larvae) comprise a minor component of the overall plankton, it remains significant due to the commercial importance of the overall fishery in the region. Various pelagic and demersal fish species are known to spawn in the inshore regions of the southern Benguela, (including pilchard, round herring, chub mackerel lanternfish and hakes (Crawford et al. 1987), and their eggs and larvae form an important contribution to the ichthyoplankton in the region. Ichthyoplankton abundance within the Exploration Area is thus expected to be high.

12.1 Fish

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

The surf-zone and outer turbulent zone habitats of sandy beaches are considered to be important nursery habitats for marine fishes (Modde 1980, Lasiak 1981, Kinoshita & Fujita 1988, Clark *et a*l. 1994). However, the composition and abundance of the individual assemblages seems to be heavily dependent on wave exposure (Blaber & Blaber 1980, Potter et al. 1990, Clark 1997a, b). Surf-zone fish communities off the South African West Coast have relatively high biomass, but low species diversity. Typical surf-zone fish include harders (*Liza richardsonii*), white stumpnose (*Rhabdosargus globiceps*) (Photo g-9) Cape sole (*Heteromycteris capensis*), Cape gurnard (*Chelidonichthys capensis*), False Bay klipfish (*Clinus latipennis*), sandsharks (*Rhinobatos annulatus*), eagle ray (*Myliobatis aquila*), and smooth-hound (*Mustelus mustelus*) (Clark 1997b).

Fish species commonly found in kelp beds off the West Coast include hottentot *Pachymetopon blochii*, twotone fingerfin *Chirodactylus brachydactylus* (Photo g-9), red fingers *Cheilodactylus fasciatus*, galjoen *Dichistius capensis*, rock suckers *Chorisochismus dentex*, maned blennies *Scartella emarginata* and the catshark Haploblepharus pictus (Sauer *et al*. 1997; Brouwer *et al.* 1997; Branch *et al.* 2010). Several additional species of fish are also commonly caught in gill-nets set over rocky reef areas between the Orange River and Cape

Columbine. Species of importance include harder *Liza richardsonii,* pilchard *Sardinops sagax*, strepie *Sarpa salpa*, houndsharks *Mustelus mustelus* and cowsharks *Notorynchus cepedianus (*K. Hutchings, UCT, pers. Comm as cited by Dr Andrea Pulfrich, 2016.).

Photo g - 9: Common fish found in kelp beds include the Hottentot fish (left, photo: commons wikimedia.org) and the twotone fingerfin (right, photo: **www.parrphotographic.com**).

Small pelagic species that occur in the area include the sardine (*Sardinops sagax*), anchovy (*Engraulis encrasicolus),* juvenile Cape horse mackerel (*Trachurus trachurus capensis*), and round herring (*Etrumeus whiteheadi*). Although these species generally occur within the 200 m contour, they may often be found very close inshore (*Pecquerie et al.* 2004). Demersal fish include deep water (*Merluccius paradoxus*), shallow water hake (M. capensis) and kingklip (*Genypterus capensis*), and St Joseph shark (*Callorhinchus capensis*) in shallow inshore waters. Linefish species include (juvenile) snoek (*Thyrsites atun*), silver kob (*Argyrosomus inodorus*), white steenbras (Lithognathus lithognathus), blacktail (Diplodus sargus), white stumpnose (*Rhabdosargus globiceps*), Hottentot (*Pachymetopon blochii*), geelbek (*Atractoscion aequidens*) and galjoen (*Dichistius capensis*).

12.2 Seabirds

Large numbers of pelagic seabirds exploit the pelagic fish stocks of the Benguela system. Of the 49 species of seabirds that occur in the Benguela region, 14 are defined as resident, 10 are visitors from the northern hemisphere and 25 are migrants from the southern ocean. The area between Cape Point and the Orange River supports 38% and 33% of the overall population of pelagic seabirds in winter and summer, respectively. There is a number of 14 species of seabirds that breed in Southern Africa; Cape Gannet, African Penguin, four species of Cormorant, White Pelican, three Gull and four Tern species. The breeding areas are distributed around the coast with islands being especially important. The number of successfully breeding birds at the particular breeding sites varies with food abundance.

Birds endemic to the region and liable to occur most frequently in the project area include Cape Gannets, Kelp Gulls, African Penguins, African Black Oystercatcher, Bank, Cape and Crowned Cormorants and Hartlaub's Gull. Of these the Black Oystercatcher and Bank Cormorant are rare. The breeding success of African Black Oystercatcher is particularly susceptible to disturbance from off-road vehicles as they nest and breed on beaches between the Eastern Cape and southern Namibia. Caspian and Damara terns are likewise rare and breed in the study area, especially in the wetland and saltpan areas associated with the Olifants River estuary.

Most of the breeding seabird species forage at sea with most birds being found relatively close inshore (10 - 30 km), although African Penguins and Cape Gannets are known to forage up to 60 km and 140 km offshore, respectively.

12.3 Marine mammals

The marine mammal fauna of the West Coast comprises between 28 and 31 species of cetaceans (whales and dolphins) and four species of seals. The Cape four seal *Arctocephalus pusillus* is the only species of seal resident along the west coast of Africa, occurring at numerous breeding and non-breeding sites on the mainland and on nearshore islands and reefs. 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). There are three Cape fur seal breeding colonies within the broader study area: at Kleinzee (incorporating Robeiland), and at Bucchu Twins near Alexander Bay. The colony at Kleinzee has the highest seal population and produces the highest seal pup numbers on the South African Coast (Wickens 1994).

The colony at Bucchu Twins, formerly a non-breeding colony, has also attained breeding status (M. Meyer, SFRI, pers. comm.). Non-breeding colonies occur at Strandfontein Point (~5 km north or the Groen River mouth) and on Bird Island at Lamberts Bay. All have important conservation value since they are largely undisturbed at present.

Dusky dolphin (*Lagenorhynchus obscurus*) and Heaviside's dolphin (*Cephalorhynchus heavisidii*) are resident year round throughout the Benguela ecosystem coastal waters (Findlay et al. 1992, Elwen 2008, Elwen et al. 2010). In water <500 m deep, Dusky Dolphins are likely to be the most frequently encountered small cetacean. The species is very boat friendly and will often approach boats to bowride. This species is resident year round throughout the Benguela ecosystem in waters from the coast to at least 500 m deep, but may occur as far offshore as 2 000 m depth (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, but further north they are usually found further from shore in slightly deeper waters (Elwen *et al*. 2010a; NDP unpubl data). Abundances estimates are being calculated but currently suggest a relatively large population of several thousand at least. Group sizes up to 800 have been reported in southern African waters (Findlay *et a*l. 1992). Dusky Dolphins are resident year round in the Benguela, although a hiatus in sightings (or low density area) is reported between ~27°S and 30°S, associated with the Lüderitz upwelling cell (Findlay *et al*. 1992).

Heaviside's Dolphins are relatively abundant in the Benguela ecosystem (Elwen *et al*. 2009). Individuals show high site fidelity to small home ranges, 50-80 km along shore (Elwen *et al*. 2006) and may thus be more vulnerable to threats within their home range. This species occupies waters from the coast to at least 200 m depth, (Elwen *et al*. 2006; Best 2007). They may show a diurnal onshore-offshore movement pattern (Elwen *et al*. 2010b), but this varies throughout the species range. Their small group sizes and inconspicuous behaviour when offshore make monitoring their presence very difficult.

However, their echolocation clicks can be detected using PAM technology at ranges up to ~500 m and the characteristic high frequency, narrow band nature of the clicks (Morisaka et al. 2011) makes them easily distinguished form other species in the area. Heaviside's dolphins are resident year round.

Whale species that may be sighted in the area include Southern Right Whale (*Balaena glacialis*), Humpback Whale (*Megaptera novaeangliae*), and Killer Whale (*Orcinus orca*), along with Antarctic Minke (Balaenoptera acutorostrata) and Bryde's (B. brydei) whales (Best 2007). Whales occurring in the nearshore region in the project area will largely be transitory.

All whales and dolphins are given protection under the South African Law. The Marine Living Resources Act, 1998 (No. 18 of 1998) states that no whales or dolphins may be harassed, killed or fished. No vessel or aircraft may, without a permit or exemption, approach closer than 300 m to any whale and a vessel should move to a minimum distance of 300 m from any whales if a whale surfaces closer than 300 m from a vessel or aircraft.

13 Socio-economic

13.1 Regional socio-economic structure

The proposed WEF is located in the Northern Cape Province, which is the largest province in South Africa and covers an area of 361,830 km^{2,} and constitutes approximately 30% of South Africa.

13.2 Population

Despite having the largest surface area, the Northern Cape has the smallest population of 1 145 861 (Census 2011) or 2.28% of the population of South Africa. As indicated in Table (g) (iv) (a) 13 - 1, the population of the NDM increased by from 108 111 in 2001 to 115 842 in 2011, which represents an increase of ~ 7%. The population of the NKLM increased from 44 900 in 2001 to 47 041 in 2011, an increase of ~ 5%. The population of the KLM decreased from 10 754 in 2001 to 10 187 in 2011, which represents a decrease of ~ 5%. This represents an average annual increase of ~ 0.69% and 0.47% for the NDM and NKLM respectively, while the population of the KLM shrank by -0.54% per annum. The increase in the population in the both the NDM and HLM was linked to an increase in the 15-64 and over 65 year age group. There was a decrease in the less than 15 age group in both the NDM and KLM. This is likely to reflect a situation where the majority of job seekers in the 15-64 age group are single males who have not settled down and started a family in the area. The increase in the over 65 age group represents an increase in retirees in the area. As in the case of the NKLM there was an increase in the 15-64 and over 65 year age group. However, this was off-set by the decrease in the younger than 15 year age group.

In terms of local towns in the NKLM, the largest town in the area is Springbok with a population of 12 790, followed by Steinkopf (7 842), Okiep (6 304) and Nababeep (5 374). In terms of towns closer to the study area, the largest town is Kommaggas (3 116) and Kleinzee (728).

The largest town in the KLM is Garies with a population of 2 105, followed by Karkams (1 439) and Kamieskroon (893). In terms of towns near the study area, the closest towns are Hondeklip Bay (543), Soebatsfontein (276) and Koingnaas (105).

The number of households in the NDM, NKLM and KLM increased between 2001 and 2011. This is despite the decrease in the population in the KLM. The size of the household sizes in each area also decreased marginally, namely from 3.5 to 3.2 (NDM), 3.4 to 3.2 (NKLM) and 3.2 to 3.0 (KLM).

The majority of the population is in the NLKM and KLM were Coloured (88.1 and 85.6% respectively), followed by Whites (6.6% and 8.1% respectively) and Black African (4.2% and 5.3% respectively) (Census, 2011). The dominant language within the NKLM and KLM Municipality is Afrikaans (93.2% and 91.8% respectively) with the main other languages being English (1% and 0.9%) and isiXhosa (1%) and Setswana (0.7%) respectively (Census 2011).

The dependency ratio in all three areas decreased from 56.4 to 51.2 (NDM), 52.5 to 49.4 (NKLM) and a high 62.6 to 57.9 (KLM). The decrease represents a positive socio-economic improvement by indicating that there are a decreasing number of people dependent the economically active 15-64 age group. The age dependency ratio is the ratio of dependents, people younger than 15 or older than 64, to the working, age population, those ages 15-64. However, the dependency ratio for the KLM remains higher than the provincial (55.7) and national average (52.7).

In terms of percentage of formal dwellings, the number of formal dwellings in the NDM increased from 89.4% in 2001 to 93.8% in 2011. In the NKLM the number of formal dwellings increased from 88.4% to 94.7% for the same period. In the KLM the increase was from 86.3% to 95.6%. The increase in the number of formal dwellings in the NDM, NKLM and KLM is also reflected in the improvements in service delivery (see Table 3.2). The figures for the NDM, NKLM and KLM are also higher than the provincial figure of 82.4%.

13.3 Education

Based on the information contained in the NCPSDF the average adult education attainment levels in the Northern Cape are lower than the adult education attainment levels of South Africa as a whole. Approximately 19.7% of the Northern Cape adults have no schooling in comparison to South Africa’s 18.1%. The Northern Cape has the second lowest percentage of adult individuals (5.5%) that obtained a tertiary education in South Africa. The LED Strategy for the Northern Cape indicates that Pixley ka Seme has the lowest adult education attainment levels in the Northern Cape with 27.3% of the adult population having no form of schooling, whilst John Taolo Gaetsewe is second with 25.4% having no schooling. The highest number of the adult population with tertiary education (6.4%) is located in Frances Baard.

The Northern Cape also has the smallest portion (11.1%) of highly skilled formal employees in South Africa and Gauteng has the highest (14.3%). Linked to this the Northern Cape has the second largest portion of semi and unskilled formal employees in the country. A lack of skilled people often results in both the public and the private sector being unable to implement planned growth strategies and achieve the desired productivity, service delivery and service quality (NCSDF, 2012).

The education levels in the NDM, NKLM and KLM all improved for the period 2001 t0 2011, with the percentage of the population over 20 years of age with no schooling in the NDM decreasing from 11.7% to 6.6%. For the NKLM the decrease was from a high 4.7% to 2.2%, while the figures for the KLM were 8.6% to 5.2%. It is also worth noting that the figures are all lower than the provincial average of 11.3 %. The percentage of the population over the age of 20 with matric also increased in the NDM, NKLM and KLM, from 15.7% to 18.8% in the NDM, 16.6% to 20.0% in the NKLM and 15.0% to 16.4% in the KLM.

Despite these increases the figures are significantly lower than the provincial (27.7%) and national (28.4%) averages. Low education levels, specifically higher education, therefore remains a challenge in both the NDM, NKLM and KLM.

Table (g) (iv) (a) 13 - 1: Overview of key demographic indicators for NDM, NKLM and KLM

	NDM		**NKLM**		**KLM**	
ASPECT	2001	2011	2001	2011	2001	2011
Population	108111	115842	44900	47041	10754	10187
% Population <15 years	29.3	25.8	28.7	24.9	29.9	26.5
% Population 15-64	64.0	66.1	65.6	66.9	61.4	63.3
% Population 65+	5.4	5.7	5.7	8.2	8.6	10.2
Households	27776	33856	10972	13193	2834	3143
Household size (average)	3.5	3.2	3.6	3.4	3.2	3.0
Formal Dwellings %	89.4%	93.8%	88.4%	94.7%	86.3%	95.6%
Dependency ratio per 100 (15-64)	56.4	51.2	52.5	49.4	62.6	57.9
Unemployment rate (official) - % of economically active population	28.5%	20.1%	33.1%	22.9%	32.0%	30.8%
Youth unemployment rate (official) - % of economically active population 15-34	37.7%	25.4%	43.4%	30.1%	44.3%	40.4%
No schooling - % of population 20+	11.7%	6.6%	4.7%	2.2%	8.6%	5.2%
Higher Education - % of population 20+	5.9%	7.4%	6.6%	7.9%	3.6%	4.3%
Matric - % of population 20+	15.7%	18.8%	16.6%	20.0%	15.0%	16.4%

Source: Compiled from StatsSA Census 2011 Municipal Fact Sheet

13.4 Economic development

Over the past 8 years there has been little to no variance in the Human Development Index (HDI) figures for the Northern Cape, indicating no increase or decrease in the overall standard of living. This trend is unlikely to change in the foreseeable future, mainly due to the marginal economic base of the poorer areas, and the consolidation of the economic base in the relatively better-off areas. It is important to note that the HDI for the Northern Cape (0.55) is substantially below the South African figure of 0.72. The HDI of 0.55 displays a pattern of semi-development, and there is a definite inequality between the different population groups, with the Whites having a higher development lifestyle than the African or Coloured groups.

The goal set by the province is to decrease the percentage of people living below the poverty line to 20% by 2015 NCSDF, 2012. The alleviation of poverty is one of the key challenges for poverty eradication. Higher levels of economic growth are a key challenge for poverty eradication. Investment in people is pivotal to the eradication of poverty and inequality. Investment in people is also, to a large extent, about delivering social and economic infrastructure for education, welfare, he3alth, housing, as well as transport and bulk infrastructure.

In terms of per capita income, the Northern Cape Province has the third highest per capita income of all nine provinces. However, income distribution is extremely skewed, with a high percentage of the population living in extreme poverty. The measure used in the PGDS document to measure poverty is the percentage of people living below the poverty line or breadline is used[1]. The poverty line indicates a lack of economic resources to meet basic food needs.

13.5 Employment

The official unemployment rate in the NDM, NKLM and KLM decreased for the ten year period between 2001 and 2011. In the NKLM the rate fell from 33.1% to 22.9%, a decrease of 10.2%. The rate in the KLM dropped from 32.0% to 30.8%, a decrease of only 1.2%. Youth unemployment in the NDM and HLM also decreased over the same period. The unemployment and youth unemployment levels in the NDM, NKLM and KLM are lower than the provincial and national averages.

13.6 Household income

Based on the data from the 2011 Census, 9.5% of the population of the NKLM have no formal income, 2.5 % earn between 1 and R 4 800, 5.0% earn between R 4 801 and R 9 600 per annum, 17.4% between R 9 601 and 19 600 per annum and 20.8% between R 19 600 and R 38 200 per annum (Census 2011). The figures for the KLM are 10.8% have no formal income, 3.8% earn between 1 and R 4 800, 5.9% earn between R 4 801 and R 9 600 per annum, 22.4% between R 9 601 and 19 600 per annum and 23.9% between R 19 600 and R 38 200 per annum (Census 2011).

The poverty gap indicator produced by the World Bank Development Research Group measures poverty using information from household per capita income/consumption. This indicator illustrates the average shortfall of the total population from the poverty line. This measurement is used to reflect the intensity of poverty, which is based on living on less than R3 200 per month for an average sized household. Based on this measure, 55.2% and 66.8% of the households in the NKLM and KLM respectively live close to or below the poverty line. The low-income levels reflect the limited formal employment opportunities in the NKLM and KLM, specifically the KLM, and the dependence on the agricultural and mining sectors. The low income levels are a major concern given that an increasing number of individuals and households are likely to be dependent on social grants. The low income levels also result in reduced spending in the local economy and less tax and rates revenue for the district and local municipality.

13.7 Municipal services levels

Access municipal services as measured in terms of flush toilets, refuse removal, piped water and electricity, increased in the NDM, NKLM and KLM for the period 2001 to 2011. This represents a positive social benefit for the local communities in the area. The services level indicators for both the NDM and NKLM are, with the exception of households with access to water in the NDM, also on higher than the provincial and national averages for 2011. However the figure for households with access to flush toilets in the KLM is significantly lower than the provincial average of 60.1%. (Table (g) (iv) (a) 13 – 2).

Table (g) (iv) (a) 13 - 2: Overview of access to basic services in NDM, NKLM and KLM

Area	**NDM**		**NKLM**		**KLM**	
Year	2001	2011	2001	2011		
% households with access to flush toilet	53.3	57.9	64.7	63.5	33.0	38.8
% households with weekly municipal refuse removal	73.3	80.1	86.4	89.4	73.9	79.4
% households with piped water inside dwelling	50.0	68.3	61.2	74.9	27.3	41.7
% households which uses electricity for lighting	77.5	86.5	85.8	93.7	54.3	87.4

14 Source: Compiled from StatsSA Census 2011 Municipal Fact Sheet

Health service levels

The KLM IDP notes that according to the Department of Health, Namakwa District the satellite facilities are understaffed and only 3 professional nurses serve all the clinics within the area. The level of service is also complicated by the distances between towns. Apart from Garies all of the facilities in the KLM are in need of upgrading, especially in Soebatsfontein. The facility in Kamassies lacks a waiting area, forcing patients to stand. The overall health facilities need to be upgraded to supply in the demand of services.

Education service levels

Based on information from the Department of Education in the Northern Cape indicated there are fourteen (14) primary schools two (2) high schools and four (14) other schooling institutions (Early Childhood Development Centers) within the KLM municipal area. In terms of the towns within the study area there is a primary school in Hondeklip Bay and Soebatsfontein. The closest high school is in Garies.

Municipal Level Economic Overview

The average growth rate for Gross Geographic Production (GGP) in the KLM from 1996-2011 was 5.4 %. However, between 2007 and 2011 this slowed down to an average growth rate of 4.8%. The largest contributing sector to employment in the local economy (21.12%) was the Retail, Catering and accommodation sector. Growth in the local economy is strongly linked to the tourism industry and construction sector. However, both of these sectors are seasonal and susceptible to external economic changes, such as exchange rates.

Due the limited economic opportunities in the area, the KLM was identified as the War on Poverty area in the Namakwa District. As part of the programme the Department of Social Development funds Soup Kitchens and Drop–In-Centre initiatives that have food security as the core of their programmes. Soups kitchens were established in Hondeklipbaai, Leliefontein, Garies and Kharkams. The aim of the Soup Kitchens is to meet the needs of the poor, vulnerable and destitute who find it difficult to respond to the shocks and stresses that threaten their livelihoods.

The limited economic opportunities in the KLM are reflected in the high number of social grant recipients. The IDP indicates that the KLM had 1 529 registered indigent households which constitutes almost 50% of the total number of households in the LM. Although the social grants are a lifeline to recipients and families hovering on the brink of poverty, it does not enable recipients to break the cycle of poverty.

The IDP identifies a number of reasons the reliance on government grants, including:

- High poverty levels due to high levels of unemployment, and increasing rates of illness (HIV/AIDS and TB);
- Communal farming on municipal peri-urban land is creating environmental challenges
- Local economies of small towns in our municipal area are characterized by weak multipliers, because a great deal of purchasing power is spent in the larger centres, or metropolitan areas situated outside these areas
- The conditions of life of remote settlements of farm workers tend to be poor, with low mobility, and difficult access to health, education, recreation and shopping amenities
- There is an out-migration of skilled people, due to a lack of local economic opportunities.

In terms of the NKLM the key economic sectors in terms of employment are General Government (21.7%), followed by Community, social & personal services and Wholesale & retail trade, catering and accommodation (17.3%), mining and quarrying (16%), Finance, insurance, real estate & business services (8.1%) and Agriculture, forestry & fishing (7.5%).

Water supply

About 89% of Northern Cape households have access to piped water (at least to a community stand within 200 m of the dwelling) an in general 66% of the dwellings in the province have an improved toilet facility inside the dwelling (i.e. a flush toilet). 11% have no sanitation at all. The mine's water supply could provide a source ofwater for the communities, post-closure.

Power supply

It is estimated that about 59% of the Northern Cape population utilise electricity for cooking and 75 % for lighting. Eskom supplies electricity to the Namaqualand region from the national

b) Description of the current land uses

1. Land Use

The current land use is within the KNSBC is mining. Historically, farming in the mine right areas and regionally has always been limited by the arid environment and consists primarily of small stock farming, mostly sheep and goats, with irrigation aided crop cultivation along the river. Some ostrich and game farming is practised within the mine area land owned by the mine, but not used for mining operations, is leased to the farmers. The current and future land use zones that can be developed for the area can be categorised where soil depth allows into:

- Mining,
- Low impact tourism activities,,
- Commercial enterprise zones such as aquaculture,
- Linear surface infrastructure,
- Hiking trails,
- Settlements including Koingnaas and Kleinsee towns. The settlements are under the jurisdiction of the Kamiesberg and Nama Khoi Municipalities.
- Agriculture (livestock).

With these considerations, such rehabilitation mechanisms are part of the plans by WCR to ensure that certain land uses that are practically possible can still be practiced. These considerations will be done within the security and access measures necessary

The adjacent farms are provided in Figure (g) (iv) (b) 1 - 1, gives an indication of some of the mariculture activities surrounding the project area.

1.1 Coastal and Marine Activities

1.1.1 Rock Lobster Fishery

The West Coast rock lobster *Jasus lalandii* is a valuable resource of the South African West Coast and consequently an important income source for West Coast fishermen. Following the collapse of the rock-lobster resource in the 1970s, fishing has been controlled by a Total Allowable Catch (TIC), a minimum size, restricted gear, a closed season and closed areas (Crawford *et al*. 1987, Melville-Smith & Van Sitter 2005). The West Coast rock lobster fishery is seasonally restricted to the period 15 November to the last day in May. Management of the resource is geographically specific, with the TIC annually allocated by Area. The study area falls within Area 2 of the commercial rock lobster fishing zones that extends from Kleinzee to the mouth of the Bark River. The TIC for the season 2013/14 has been set at 2167.06 tons.

Commercial catches of rock lobster in Area 2 are confined to shallower water (<30 m) with almost all the catch being taken in <15 m depth. Actual rock-lobster fishing, however, takes place only at discrete suitable reef areas along the shore within this broad depth zone. Lobster fishing is conducted from a fleet of small dinghies/bakes.

The majority of these works directly from the shore within a few nautical miles of the harbours, with only 30% of the total numbers of bakes partaking in the fishery being deployed from larger deck boats. As a result, lobster fishing tends to be concentrated close to the shore within a few nautical miles of Port Nolloth and Hondeklip Bay. Rock lobster landings for the fishing season 2008/09 to 2012/13 for the sub-areas 1 and 2 of Area 2 are provided in Table (g) (iv) (b) 1 – 1.

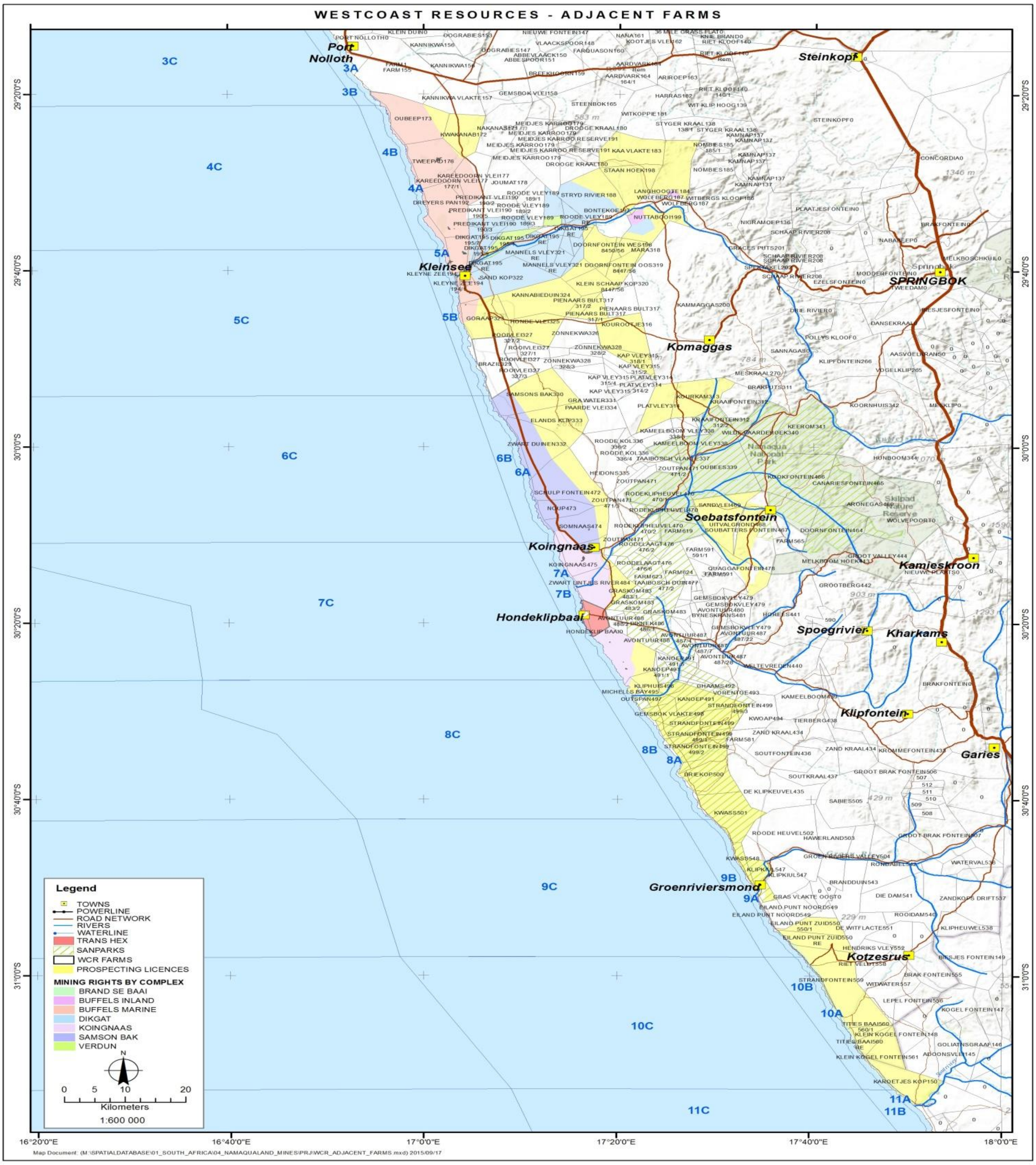

Figure (g) (iv) (b) 1 - 1: Adjacent farms

Table (g) (iv) (b) 1 - 2: Actual rock lobster catch (kg) for subareas 1 and 2 of Area 2 for the 2008/09 to 2012/2013 fishing seasons (Data source: Rock Lobster Section, DAFF)

Area/subarea	2008/09	2009/10	2010/11	2011/12	2012/13
2/1	937	1,286	2,246	1,683	--
2/2	--	--	--	--	--

1.1.2 Kelp Collecting

The West Coast is divided into numerous seaweed concession areas. Access to a seaweed concession is granted by means of a permit from the Fisheries Branch of the Department of Agriculture, Forestry and Fisheries to a single party for a period of five years. The seaweed industry was initially based on sun dried beach-cast seaweed, with harvesting of fresh seaweed occurring in small quantities only (Anderson *et al*. 1989). The actual level of beach-cast kelp collection varies substantially through the year, being dependent on storm action to loosen kelp from subtidal reefs.

Permit holders collect beach casts of both Ecklonia maxima and Laminaria pallida from the drift line of beaches (Table (g) (iv) (b) 1 - 2). The kelp is initially dried just above the high water mark before being transported to drying beds in the foreland dune area. The dried product is ground before being exported for production of agonic acid (alginate).

Table (g) (iv) (b) 1 - 3: Beach-cast collections (in kg dry weight) for kelp concessions north of Lamberts Bay. Data source: Seaweed Section, DAFF)

Concession Number	Concession Holder	2005	2006	2007	2008	2009	2010	2011	2012	2013
13	Eckloweed Industries	65,898	94,914	122,095	61,949	102,925	53,927	40,511	43,297	20,485
14	Eckloweed Industries	165,179	145,670	79,771	204,365	117,136	166,106	72,829	151,561	97,283
15	Rekaofela Kelp	10,300	19,550	0	23,646	0	0	0	160,500	36,380
16	Rekaofela Kelp	35,920	28,600	84,445	16,804	0	0	0	156,000	24,000
18	FAMDA	0	0	0	0	0	0	0	0	0
19	Premier Fishing	0	0	0	0	0	0	0	0	0

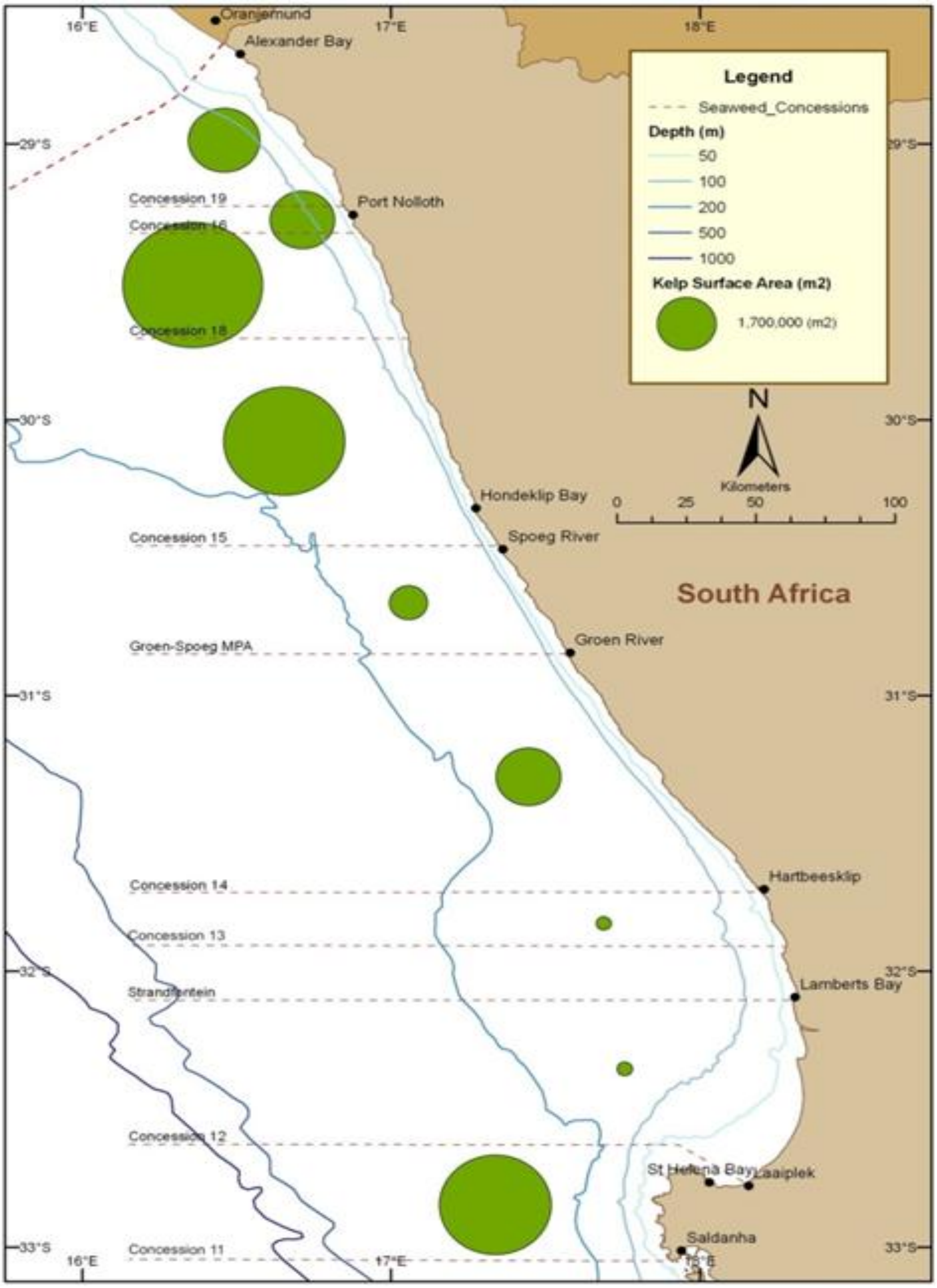

Figure (g) (iv) (b) 1 - 2: Estimated kelp bed areas in the South African kelp concessions between the Orange River mouth and Cape Columbine (From Penney et al. 2007).

Estimates of both kelp bed area and biomass for different stretches of coastline vary considerably depending on the survey method used. The values from Rand (2006) presented are used here to illustrate similarities in kelp bed area per kilometre of rocky coast (Kelp Concessions 15, 16 and 18). It must be kept in mind that the values in this Table (g) (iv) (b) 1 - 3 are based on kelp beds that reach the surface at low spring tide and do not take into account the extensive Laminaria beds that extend into deeper water. As Laminaria is the dominant species in Namaqualand, both kelp bed area and biomass are thus likely underestimates of the available standing stock.

Table (g) (iv) (b) 1 - 4: Estimated total area of kelp beds for each of the kelp concessions between the Orange River mouth and Cape Columbine The (Rand 2006).

Kelp Concession/Area	Kelp bed area (ha)	Length of rocky coastline (km)
19	254.95	48.5
18	976.0	18.25
16	206.44	5.0
15	732.22	104.5
Groen-Spoeg	71.94	~15.0
14	206.64	63.75
13	10.8	4.25
Strandfontein	no data	~15
12	15.9	1.25
11	617.95	28.75

1.1.3 Line fishing

Commercial line fishing is conducted from a variety of vessels ranging from large deckboats to tiny rock lobster bakkies, most of which operate very close to the shore. In Namaqualand, the boats belong mostly to the rock lobster fishery, with most of the fishing undertaken during the rock lobster closed season. As with the rock lobster fishery, line fishing effort is centred around the harbours in the area. The main species targeted by the line-fishermen are Snoek, Yellowtail, Hottentot and Galjoen (Sauer & Erasmus 1997). The estimated annual line fish catch on the West Coast is 6,000 tons of which only 10% is contributed from inshore and offshore fishing in the northern regions. Sauer and Erasmus (1997) estimated that the inshore line fish catch along the Northern Cape coast amounts to <5 t/km/year.

The landings and effort in the line fishery show distinct seasonality, influenced to a large extent by the availability of the target species. Of the species targeted by the line fishery, the Hottentot is available to the fishermen throughout the year. The occurrence of Snoek is more seasonal with the fish being more abundant during late summer and autumn. Yellowtail show a similar seasonality with catches peaking in March/April. Catches of Galjoen are limited to the winter months, there being a closed season from 15 October to the end of February.

Clark *et al.* (2002) identified approximately 330 fishers in the area between Port Nolloth and Doring Bay. The increase in the number of artisanal fishers in the region since the 2002 survey is unknown, but in the interim many of these fishers will have received official recognition and have been granted small scale commercial or "interim relief" rights. From 2002 to 2004, the Northern Cape provincial government initiated a small scale experimental fishery out off Port Nolloth and Hondeklip Bay which targeted Hake, Kingklip, Snoek, and St Joseph Shark in the near-shore zone (www.northern-cape.co.za).

1.1.4 Recreational Fisheries

Recreational and subsistence fishing on the West Coast is small in scale when compared with the south and east coasts of South Africa. The population density in Namaqualand is low, and poor road infrastructure and ownership of much of the land by diamond mining companies in the northern parts of the West Coast has historically restricted coastal access to the towns and recreational areas of Port Nolloth, McDougall's Bay, Hondeklip Bay and the Groen River mouth.

Recreational line-fishing is confined largely to rock and surf angling in places such as Brand-se-Baai and the more accessible coastal stretches in the regions. Boat angling is not common along this section of the coast due to the lack of suitable launch sites and the exposed nature of the coastline. Fishing effort has been estimated at 0.12 angler/km north of Doring Bay. These fishers expended effort of approximately 200,000 angler days/year with a catch-per-unit-effort of 0.94 fish/angler/day (Brouwer et al. 1997, Sauer & Erasmus 1997). Target species consist mostly of Hottentot, White Stumpnose, Kob, Steenbras and Galjoen, with catches being used for domestic consumption or sold.

Recreational rock lobster catches are made primarily by diving or shore-based fishing using bait bags. Hoop-netting for rock lobster from either outboard or rowing boats is not common along this section of the coast (Cockcroft & McKenzie 1997). The majority of the recreational take of rock lobster is made by locals resident in areas close to the resource. Due to the remoteness of the area and the lack of policing, poaching of rock lobsters both by locals as well as seasonal visitors is becoming an increasing problem.

Large numbers of rock lobsters are harvested in sheltered bays along the Namaqualand coastline by recreational divers who disregard bag-limits, size-limits or closed seasons. This potentially has serious consequences for the sustainability of the stock in the area.

1.1.5 Development Potential of the Marine Environment in the Project Area

The economy of the Namaqualand region is dominated by mining. However, with the decline in the mining industry and the closure of many of the coastal mines, the economy of the region is declining and jobs are being lost with potential devastating socio-economic impacts on the region. The Northern Cape provincial government has recognized the need to investigate alternative economic activities to reduce the impact of minerals downscaling and has commissioned a series of baseline studies of the regional economy (Britz & Hecht 1997, Britz et al. 1999, 2000, Mather 1999). These assessments concluded that fishing and specifically mariculture offer a significant opportunity for long term (10+ years) sustainable economic development along the Namaqualand coast. The major opportunities cited in these studies include hake and lobster fishing (although the current trend in quota reduction is likely to limit development potentials), seaweed harvesting and aquaculture of abalone, seaweeds, oysters and finfish.

The Northern Cape provincial government has been and is still active in facilitating the development of the fishing and mariculture sectors by means of a holistic sector planning approach. Partnerships with the then representative community and industry based Fishing and Mariculture Development Association (FAMDA). The Northern Cape Province Fishing and Mariculture Sector Plan which forms part of the 'Northern Cape - Fishing and Mariculture Sector Development Strategy' (www.northern-cape.gov.za, accessed December 2013) was developed.

Abalone ranching (i.e. the release of abalone seeds into the wild for harvesting purposes after a growth period) has been identified as one of the key opportunities to develop in the short- to medium-term and consequently the creation of abalone ranching enterprises around Hondeklip Bay and Port Nolloth forms part of the sector plan's development targets (www.northern-cape.gov.za). In the past, experimental abalone ranching concessions have been granted to Port Nolloth Sea Farms (PNSF), in sea mining areas 5 and 6, effectively a 60 km strip of coastline, and to Ritztrade in the Port Nolloth area (www.northern-cape.co.za). These experimental operations have shown that although abalone survival is highly variable depending on the site characteristics and sea conditions, abalone ranching on the Namaqualand coast has the potential for a lucrative commercial business venture (Sweijd et al. 1998, de Waal 2004). As a result, the government publication 'Guidelines and potential areas for marine ranching and stock enhancement of abalone Haliotis midae in South Africa' (GG No. 33470, Schedule 2, April 2010) identified broad areas along the South African coastline that might be suitable for abalone ranching. Applications for abalone ranching projects have been submitted and permits for pilot projects for some, of the zones have been granted. Amongst the role player in the Namaqualand region, is the Diamond Coastal Abalon (DCA).

Besides abalone sea-ranching, several other potential projects were identified in the sector plan. Most of these are land-based aquaculture projects (e.g. abalone and oyster hatcheries in Port Nolloth and abalone grow-out facility in Hondeklip Bay), but included was a pilot project to harvest natural populations of mussels and limpets in the intertidal coastal zone, along the entire Northern Cape coast. The objective of the project was to determine the stock levels and to ascertain what percentage of the biomass of each species can be sustainably harvested, as well as the economic viability of harvesting the resource.

The Aquaculture sector is supported by the DAFF under the Chief Directorate Aquaculture and Economic Development. The main objective is to develop a sustainable and competitive sector that will contribute meaningfully to job creation, economic development, sustainable livelihood, food security, rural development and transformation in South Africa. The part of the aquaculture sector which might interact with WCR operations is marine aquaculture, which includes species such as abalones, mussels, oyster, and seaweed. The aquaculture sector is also managed by different directorates within the Fisheries branch. The Directorate Aquaculture Technical Services manages aquaculture advisory services, economics, information, development, infrastructure and facilities. The Directorate Sustainable Aquaculture Management helps with aquaculture authorization, environmental assessments, food safety, aquatic animal health and intergovernmental and policy coordination of the sector. The Directorate Aquaculture Research and Development is responsible for diversification and competitiveness and sustainable production. WCR is much aware of the required collaborations to ensure that its operations do not impact negatively on the sector. There is ongoing engagement with the role players to understand the operations and find means of coexisting where appropriate.

Access arrangements

A significant portion of the concession area awarded to DCA is adjacent to and within the WCR diamond mining area. DCA previously concluded a mine area access agreement with De Beers Consolidated Mines (Pty) Ltd to facilitate access to required mining areas. Clarity was sought to ascertain if the MPRDA gives exclusive rights for access to the mining right holder.

Land-based Access

Several of the seeding sites are in access controlled areas namely Dokter se baai, Langklipbaai, Enkelduinbaai and NC4b border. DCA is required to submit a written request to WCR for permission to access these sites several weeks prior to the expected date that access is required. This includes access for seeding and harvesting. Vehicles are mobilised from Hondeklip Bay. Off-road (4x4) vehicles are required to reach the seeding sites of Stilbaai, Somnaasbaai, Langklipbaai, Enkelduinbaai and NC4b Border. Total travel distances from Hondeklip Bay to each of the seeding sites is indicated in Table (g) (iv) (b) 1 - 4).

Table (g) (iv) (b) 1 - 5: Travel distances from Hondeklip Bay (mobilisation base) to each of the seeding sites.

Seeding Site	**Travel Distance from Hondeklip Bay (km)**		**Comments**
	by land	**by sea**	
Voelklip	42.8	24.97	
Noupbaai	42.4	23.58	
Kammagappunt	43	22.12	
Stilbaai	45.6	20.54	4x4 required
Somnaasbaai	45.6	20.54	4x4 required
Geelkip tot Visbeenbaai	34	14.49	
Noord van Swartlintjies	No access from land	8.31	
Dokter se baai	11.85	5.79	need access to WCR security area
De Beers North Boundary	2.96	3.13	
Moordenaarsbaai	1.56	2.28	

Seeding Site	**Travel Distance from Hondeklip Bay (km)**		**Comments**
	by land	**by sea**	
Hondeklip Bay	0	0	
Platklippunt tot Aristea	2.46	3.1	
De Beers South Boundary	5.13	5.28	
Langklipbaai	10.5	8.39	4x4 required; access controlled area
Enkelduinbaai	12.09	12.13	4x4 required; access controlled area
NC4b Border	17.26	15.35	4x4 required; access controlled area

Sea-based Access

To date, boats have not been used during seeding operations undertaken by DCA. If used, boats would be mobilised from Hondeklip Bay. Sea-based access bypasses the problem of access control however the weather window during which boats may safely mobilise and deploy divers on site is a restrictive factor. Approximately 60 to 80 (max) days per year are considered suitable for this method of access (Le Roux, pers comm.). Distances travelled by boat are shorter than those covered on land to most seeding sites. One seeding site is not accessible by land (Noord van Swartlintjies).

Cost of alternatives (boat-based vs land-based seeding)

Land-based access to the seeding sites is considered more efficient and cost-effective than access via boat (le Roux pers comm.). This is primarily due to the necessity of suitable weather conditions that are required for safe travel and deployment of divers at each site. The weather window period of approximately 60-80 days per year is a restrictive factor that makes this method of access less suitable than access by land. Furthermore, the additional cost of the hire or purchase of a boat would increase costs incurred for sea-based access.

It has been assumed that the 60-80 day weather window period relates to many factors and applies equally to both land-based diver access as well as sea-based access.

Constraints for access, whether by sea or land are as follows:

- The primary constraint is sea condition – rough seas would not permit either diving (from the shore) or nearshore access with a boat to allow divers in the kelp zones for seeding.
- High wind stress – either from the prevailing SE (summer condition mainly) or NW (winter condition mainly).

- Delayed access through the mining lease areas by land (WCR) (it takes two weeks to get a permit) subsequently losing a window of opportunity to seed a designated area.

Considerations for DAFF, who must also issue permits (Appendix 3) – if permits are not obtained timeously (from WCR or DAFF) then again windows of opportunity are lost, seed mortality can also occur.

In discussion with DCA by the Aquaculture specialist, (Le Roux, pers comm.) the preferred method of seeding is diver-based from land. The sea-based option using boats is therefore not considered to be an option

(c) Description of specific environmental features and infrastructure on the site

1. Threat Status and Vulnerable Marine Ecosystems

1.1 Threat status

'No-take' MPAs offering protection of the Namaqua biozones (sub-photic, deep-photic, shallow-photic, intertidal and supratidal zones) are currently absent northwards from Cape Columbine (Emanuel *et a*l. 1992, Lombard et al. 2004). Rocky shore and sandy beach habitats are generally not particularly sensitive to disturbance and natural recovery occurs within 2-5 years.

However, much of the Namaqualand coastline has been subjected to decades of disturbance by shore-based diamond mining operations (Penney *et al*. 2007). These cumulative impacts and the lack of biodiversity protection have resulted in many of the coastal habitat types in Namaqualand being assigned a threat status of 'critically endangered' (Lombard et al. 2004; Sink *et al.* 2012)

Using the SANBI benthic and coastal habitat type GIS database, the threat status of the benthic habitats within Concessions 6a, 7a, Figure (g) (iv) (c) 1 - 1, 18a and 8b Figure (g) (iv) (c) 1 – 2 and those potentially affected by proposed beach mining, were identified (Table (g) (iv) (c) 1 - 1). Although 'vulnerable', 'endangered' and 'critically endangered' habitats occur in the two concessions, the only overlap of note with proposed mining targets is the Namaqua Mixed Shore, which is categorised as 'endangered'. Within Concessions 6a and 7a, this habitat type accounts for ~15.4 km and ~12.3 km of coastline, respectively, of which ~2 km will fall within identified mining targets in 7a. Within the portion of Concession 8a not being relinquished to the proposed MPA, the Namaqua Mixed Shore accounts for ~1.0 km of coastline of which 0.15 km fall within identified mining targets within Rooiwal Bay.

Table (g) (iv) (c) 1 - 1: Ecosystem threat status for marine and coastal habitat types in Concessions 6a and 7a (adapted from Sink *et al*. 2011)

Habitat Type	**Threat Status**	**Occurs in Concessions**	**Occurs in Mining Targets**
Namaqua Boulder Shore	CE		
Namaqua Exposed Rocky Coast	LT	X	X
Namaqua Hard Inner Shelf	LT		
Namaqua Inner Shelf Reef	CE		
Namaqua Inshore Hard ground	CE		
Namaqua Inshore Reef	CE		
Namaqua Island	CE		
Namaqua Mixed Shore	E	X	X
Namaqua Muddy Inner Shelf	LT		
Namaqua Muddy Inshore	V		
Namaqua Sandy Inner Shelf	LT		
Namaqua Sandy Inshore	CE	X	
Namaqua Sheltered Rocky Coast	CE	X	
Namaqua Very Exposed Rocky Coast	V	X	
Southern Benguela Intermediate Sandy Coast	LT	X	X
Southern Benguela Dissipative-Intermediate Sandy Coast	LT	X	X
Southern Benguela Dissipative Sandy Coast	LT	X	
Southern Benguela Reflective Sandy Coast	LT	X	X
Southern Benguela Estuarine Shore	LT	X	

CE = Critically Endangered E = Endangered V = Vulnerable LT = Least Threatened

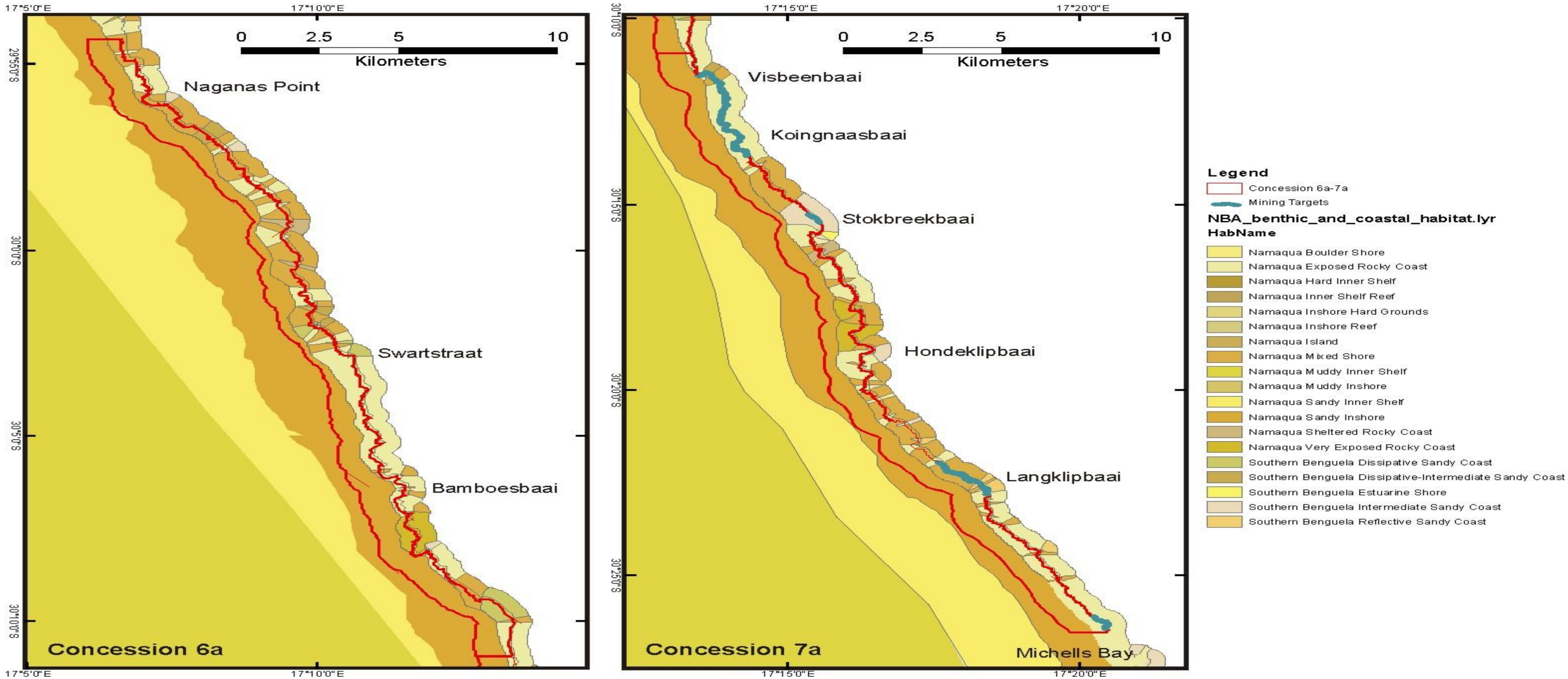

Figure (g) (iv) (c) 1 - 1: Concession 6a (left) and 7a (right) in relation to the benthic and coastal habitat types identified by SANBI.The habitats within the concessions and affected by the proposed cofferdam mining operations are identified in

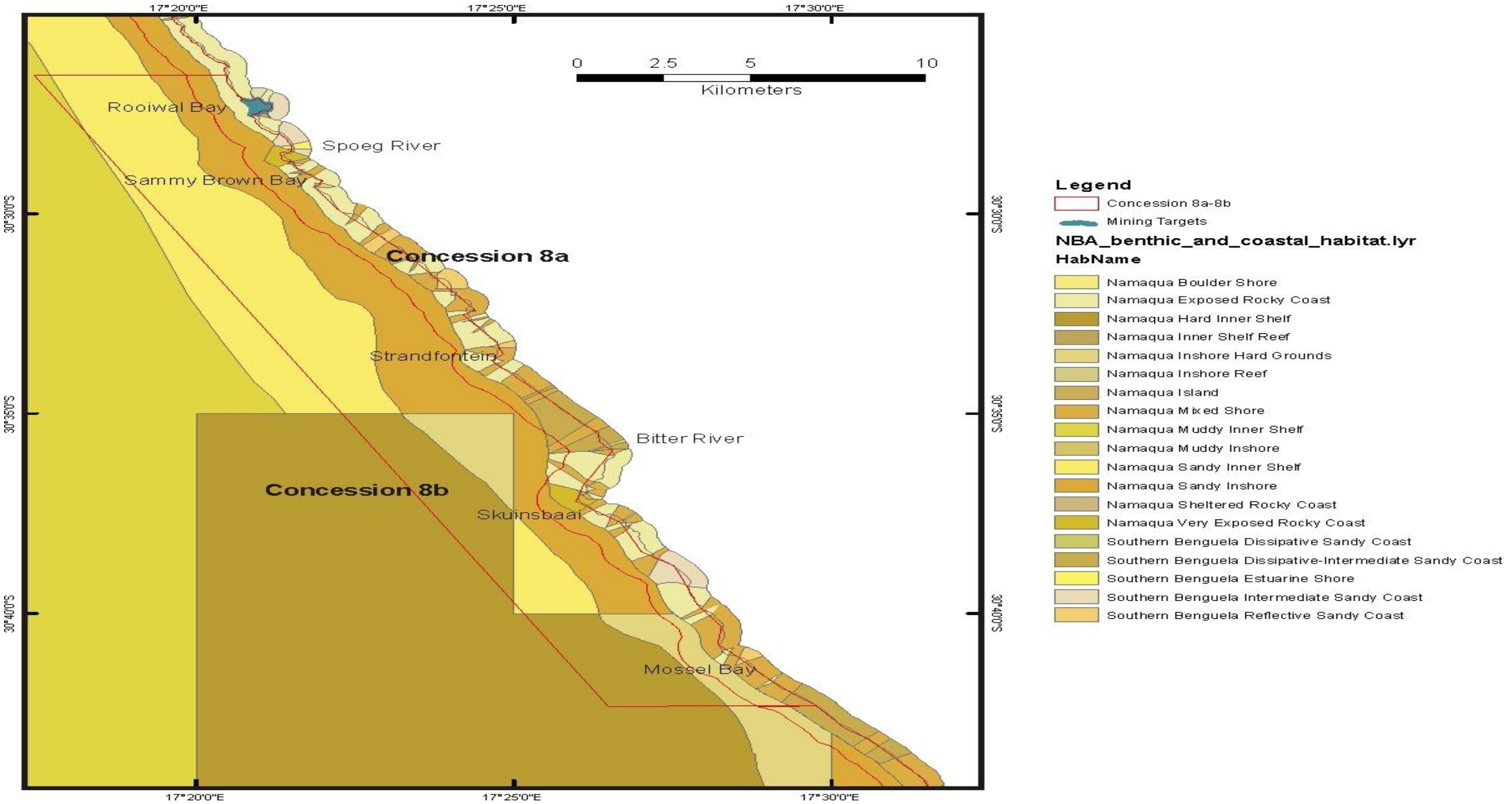

Figure (g) (iv) (c) 1 - 2: Concession 8a and 8b in relation to the benthic and coastal habitat types identified by SANBI. The habitats within the concessions and affected by the proposed cofferdam mining operations are identified in .

1.2 Conservation areas and marine protected areas

Using biodiversity data mapped for the 2004 and 2011 National Biodiversity Assessments a systematic biodiversity plan has been developed for the West Coast with the objective of identifying coastal and offshore priority focus areas for MPA expansion (Sink *et al*. 2011; Majiedt *et a*l. 2013). The biodiversity data were used to identify nine focus areas for protection on the West Coast between Cape Agulhas and the South African – Namibian border. Those within the broad project area shown in Figure (g) (iv) (c) 1 - 3.

Of principal importance in the project area is the proposed Namaqua MPA, which stretches between the Groen and Spoeg Rivers and adjacent to the Namaqua National Park. This area meets habitat targets for 14 habitat types including ‘Critically Endangered’ habitat types such as Namaqua Inshore Reef, Namaqua Inshore Hard Grounds and Namaqua Sandy Inshore. Although the proposed Namaqua MPA inshore protected area overlaps with Concession 8a, 9a and 8b, all but a small area of interest in Concession 8a, which lies outside the proposed MPA, will be relinquished.

1.3 Economic activities

Economic sectors

The Northern Cape economy has shown significant recovery since 2000/2001 when it had a negative economic growth rate of -2.5% (LED Strategy). The provincial economy reached a peak of 3.7% in 2003/2004 and remained the lowest of all provinces. The Northern Cape is the smallest contributing province to South Africa’s economy (only 2% to South Africa GDP per region in 2007).

The mining sector is the largest contributor to the provincial GDP, contributing 28.9% to the GDP in 2002 and 27.6% in 2008. The mining sector is also important at a national level. In this regard the Northern Cape produces approximately 37% of South Africa’s diamond output, 44% of its zinc, 70% of its silver, 140% of its iron-ore, 93% of its lead and 99% if its manganese.

Agriculture and agri-processing sector is also a key economic sector. Approximately 2% of the province is used for crop farming, mainly under irrigation in the Orange River Valley and Vaalharts Irrigation Scheme. Approximately 96% of the land is used for stock farming, including beef cattle and sheep or goats, as well as game farming. The agricultural sector contributed 5.8% to the Northern Cape GDP per region in 2007 which was approximately R1.3 billion, and it employs approximately 19.5% of the total formally employed individuals (NCSDF, 2012). The sector is experiencing significant growth in value-added activities, including game-farming. Food production and processing for the local and export market is also growing significantly.

The main agricultural produce of the Northern Cape include:

- High-value horticultural products such as table grapes, sultanas and wine grapes, dates, nuts, cotton, fodder, and cereal crops are grown along the Orange River.

- Wheat, fruit, groundnuts, maize and cotton in the Vaalharts irrigation scheme in the vicinity of Hartswater and Jan Kempdorp.
- Vegetables and cereal crops at the confluence of the Vaal River and the Orange Rivers in the vicinity of Douglas.
- Wool, mohair, karakul, Karoo lamb, ostrich meat and leather, and venison throughout most of the province.

Economic development in the Northern Cape is hampered by the vastness of the area and the remoteness of its communities in rural areas. Development is also hampered by the low education and skills levels in the province. As a result unemployment in the Northern Cape presents a major challenge.

1.3.1 Unemployment

With limited opportunities in the formal employment sector, unemployment is high and is expected to increase. The area is highly dependent on mining, which with near depleted ore reserves appears to be waning. Other development initiatives need to encourage diversification in the regional economy. The unemployment rate for the Northern Cape has been estimated to be 33%. Nevertheless, there are sectors which provide poverty alleviation and are actively driven to fulfil the objectives of the national development plan. These major economic activities in Namaqualand are mining, agriculture, fishing and tourism.

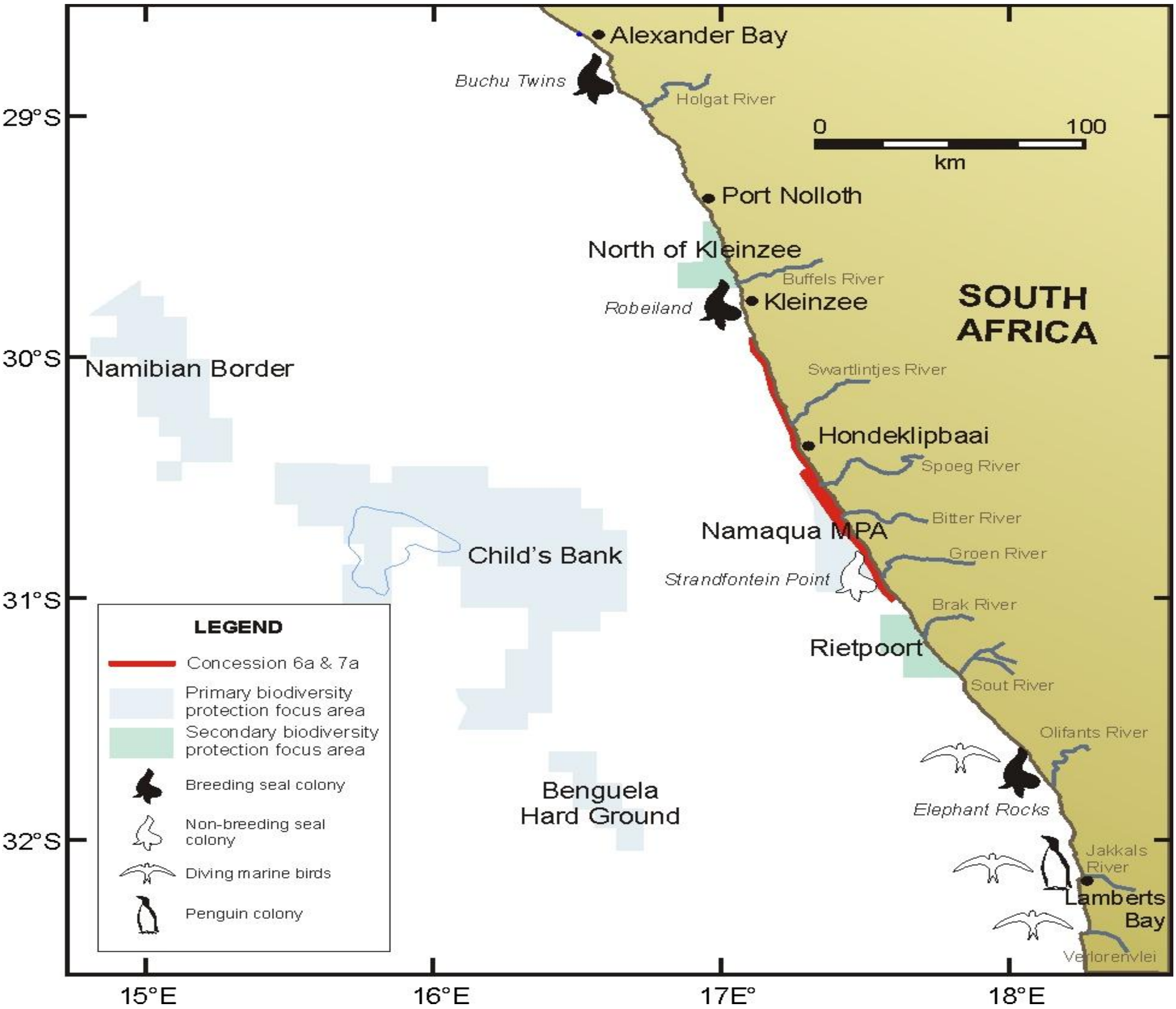

Figure (g) (iv) (c) 1 - 3: Project - environment interaction points on the West Coast, illustrating the location of seabird and seal colonies and priority areas for biodiversity protection in relation to the proposed project area

1.3.2 Mining and mineral processing

1.3.3 Agriculture

Agriculture and agri-processing sector is also a key economic sector. Approximately 2% of the province is used for crop farming, mainly under irrigation in the Orange River Valley and Vaalharts Irrigation Scheme. Approximately 96% of the land is used for stock farming, including beef cattle and sheep or goats, as well as game farming. The agricultural sector contributed 5.8% to the Northern Cape GDP per region in 2007 which was approximately R1.3 billion, and it employs approximately 19.5% of the total formally employed individuals (NCSDF, 2012). The sector is experiencing significant growth in value-added activities, including game-farming. Food production and processing for the local and export market is also growing significantly.

However, farming in the Namaqualand Mines areas is severely limited by the arid environment, and consists primarily of small stock farming, mostly sheep and goats. Drought farming is a way of life although agriculture alone is insufficient to provide more than a subsistence income for a few farmers. However, in other parts of the Northern Cape agriculture is one of the mainstays of the provincial economy. Two major challenges face the agricultural sector in the Northern Cape, both of which if successfully overcome could result in a massive increase to the agricultural sector's contribution to the provincial economy. Firstly, the industry must undergo and achieve transformation so that new and emerging farmers can take their rightful place as equal members of the commercial agricultural fraternity. Secondly, the irrigated agricultural sub-sector needs to achieve a greater level of diversification, not only to spread the aggregate risk across the irrigation sub-sector but also to promote the development of crops that have a high affinity for agro- processing.

1.3.4 Fishing and marine aquaculture

The fishing industry in the WCR's areas is seasonal and offers irregular employment. It is centred on Hondeklip Bay and Port Nolloth. Other marine-based activities along the coast include Oyster farming in Port Nolloth and Kleinsee; and kelp collection. The area's greatest economic opportunity lies in the development of the pump-ashore marine aquaculture industry, which entails the cultivation of a range of high- value marine species, primarily for export to lucrative overseas markets.

1.3.5 Tourism

Regionally, tourism is becoming increasingly important to the Namaqualand economy and is regarded as one of the few potential growth sectors. Since 1994, the Northern Cape tourism industry has blossomed, largely as a result of the opening up of South Africa as a long-haul tourist destination and also because the Northern Cape tourism product caters ideally for today's nature-based eco-tourist who is looking for a new experience. More importantly, a number of major new conservation and tourism developments are currently underway in the Northern Cape and offer a range of new investment opportunities in the province. A strategy that SANhas adopted recently is the "Commercialization as a Conservation Strategy". In the Northern Cape, this strategy will be applied to the Kgalagadi Transfrontier Park and it is anticipated that others will soon follow. These, in the Northern Cape, are the Ai-Ais Richtersveld Transfrontier Conservation Park, the Augrabies, Vaalbos and Tankwa Karoo National Parks, as well as in the newly proclaimed Namaqua National Park.

The following tourism activities currently present in the area could provide initiatives for post closure economic activities at NM:

- Tourism activities such as the Diamond Route and Diamond Coast: Forever Namaqualand initiatives; and
- The creation and expansion of a wilderness area through the Namaqua Park (South African National Parks, Conservation International (CI).

1.3.6 Other sectors contributing to the economy

Other sectors that make important contributions to the economy of Namaqualand are construction, commerce and catering, transport and communications, finance, real estate and government. Small businesses predominate among the regions non-mining activities. More than half of these are general dealerships and most are found in urban areas. Springbok is the economic centre of the region.

1.3.7 Social infrastructure

Most rural villages/communities in the region have poorly developed social infrastructure. Springbok, the regional centre, however is a well developed town, with a diverse social infrastructure incorporating the full scope of amenities one would expect to find in a town of its size.

1.3.8 Regional infrastructure

The KNC and SBC mining areas are accessed via existing public roads. The three most used are secondary roads from Springbok to Kleinsee, Port Nolloth to Kleinsee and Garies to Koingnaas. The District Municipality maintain these roads. A 60 km tar road links Koingnaas and Kleinsee. Most of the roads in these towns are tarred. A 40 km gravel road connects Kleinsee to Komaggas.

The closest rail end is located at Bitterfontein, approximately 180 km south of Springbok from where goods are transported by road further north. The Sishen-Saldhana railway line is located to the east of the Bitterfontein line.

A large number of the mine employees are sourced from and live in surrounding communities such as Hondeklip Bay, Koingnaas, Kleinzee and the regional towns of Namaqualand. The nearby towns of Hondeklip Bay and Koingnaas are proclaimed towns that fall under the Kammiesberg Municipality.

Eskom electricity is supplied to WCR from the national power grid via Upington, Aggeneys and Springbok and to a sub-station at Gromis, near Kleinsee. From this sub-station, power is distributed to WCR operations.

1.3.8.1 Surface water use

All of Koingnaas and Samson Bak's freshwater supply comes from the local Somnaas Noup aquifer. Although three boreholes are equipped to supply water, due to the abundance of the aquifer only No. 12 (27 m deep) and 15 (24.5 m deep) are currently being utilised. Upon request from the district authority, water supply to Hondeklip Bay from Koingnaas has also been implemented. Farming operations in the region obtain groundwater from boreholes situated on various properties.

1.3.8.2 Existing mine infrastructure

Koingnaas is an existing mining area with most infrastructure requirements already in place. Infrastructure at each mine site and processing operation comprising electric power supply, roads, potable, fresh and seawater supplies, fuel supply and storage and workshops, have been established and maintained. The main haul roads run from the various mining areas to the main treatment plants and are well constructed. Smaller light vehicle roads connect offices, workshops and other frequently visited destinations. Numerous tracks are created and used during prospecting. When no longer required, roads are closed off and ripped up to facilitate natural re-vegetation. Tracks are left to recover naturally. Roads to beach mining areas also exist as these areas have been mined to the shore-line before and these will require minimum maintenance and extension onto the beach in future. Some of the plants and workshops will be recommissioned depending on requirement and any additional plants and/or infrastructure that may be required in future will, in all likelihood, also be established on these same sites in order to utilise existing supply routes and electricity and water connections. An outline of the infrastructure network is shown in Appendix 4.3.

1.3.9 The specific identified sensitivity of the site related to the activity and its associated structures and infrastructure

None of the proposed land based, surf zone, beach- and offshore channel mining activities are planned to be carried out within the Swartlintjies EFZ. However, mining activities occurring outside the boundaries of the EFZ could have an impact on the estuary and were assessed in EIA Section.

While the preferred site for future slimes dams is not going to impact on the Swartlintjies Estuary, the alternative slimes dam site 9 km upstream may be problematic. This alternative site is an existing slimes dam and is located within the Swartlintjies River catchment (Figure (g) (iv) (c) 1 - 4). Although the prevailing wind carries most of the dried saline sediment to the northeast, it is likely that the surface runoff during episodic rainfall events may wash the salt into the Swartlintjies River. This salt will eventually reach the EFZ, impacting on biodiversity through accelerated salinisation. This problem is compounded by the 10 m high haul road situated 3 km upstream of the mouth, which runs through the Swartlintjies EFZ and prevents much of the runoff from the catchment reaching the estuary. Pipes in the haul road provide a conduit for water to flow past this barrier, but the inlets for the pipes are elevated at least 1 m above the river bed, which means that very little (if any) water is actually able to pass through this barrier (Figure (g) (iv) (c) 1 – 5). Prior to the commencement of mining activities in the area, the Swartlintjies River would have come down in flood unhindered during episodic rainfalls, creating a braided flood plain with channels of varying depths. These channels were then colonised by plants during dry periods, creating a biodiverse habitat that reflects the topographic mosaic of the flood plain . This suggests that the episodic flooding of the Swartlintjies River is an important ecological process for maintaining biodiversity of the Swartlintjies EFZ.

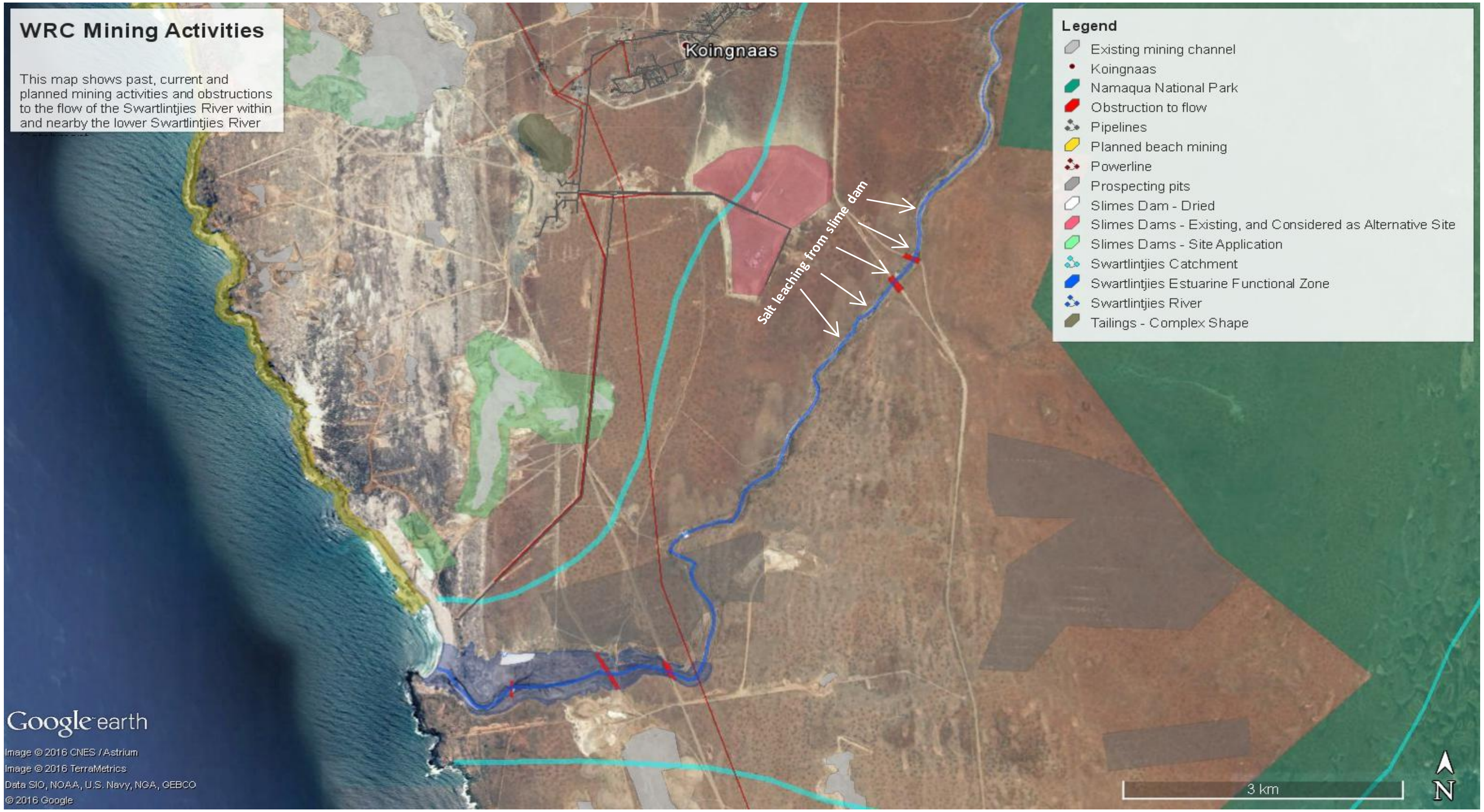

Figure (g) (iv) (c) 1 - 4: Past, current and proposed mining activities that impact on the Swartlintjies Estuary.

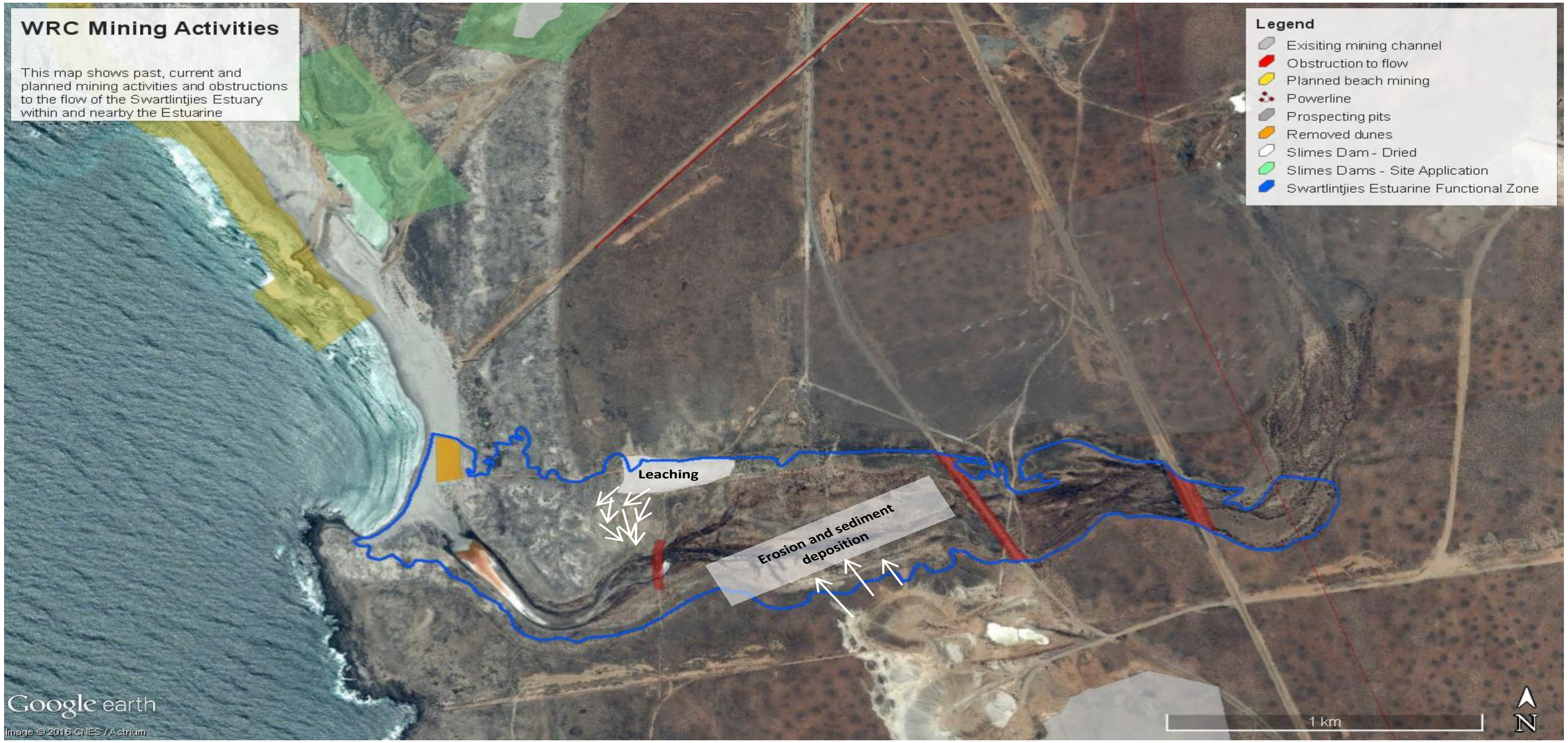

Figure (g) (iv) (c) 1 - 5: Past, current and planned mining activities and impacts on the Swartlintjies Estuarine Functional Zone.

It is nevertheless, unknown whether slimes dams indeed cause significant acceleration of salinisation of the system. It is, however, clear that the obstructions in the catchment and the EFZ have removed any possibility that excess salts can be flushed from the system flush out during episodic flood events. A precautionary approach is therefore highly recommended. This is especially important considering that it remains unknown whether the system will flush sufficiently (magnitude and frequency) under natural conditions (i.e. restored flows).

(d) Environmental and current land use map (Show all environmental and current land features)

Land capability is discussed in Section g (iv) (d) 1 -1 and the Land Use is discussed in Section g (iv) (b). The environmental sensitive features map is provided as Figure (g) (iv) (d) 1-3.

Land Cover

Using information from the latest version of the National Land Cover database (GeoTerraImage, 2015), the classes of land use within the study area can be seen (Figure (g) (iv) (d) 1 - 1). The current land use od shown in Figure (g) (iv) (d) 1 – 2 and the Abalone Seeding sites are shown in Figure (g) (iv) (d) 1-3. The areas to the south of Spoeg River and about 200 m north of the same river, are in the process of being relinquished to SAN Parks through the Section 102 and Section 11 process of the MPRDA.

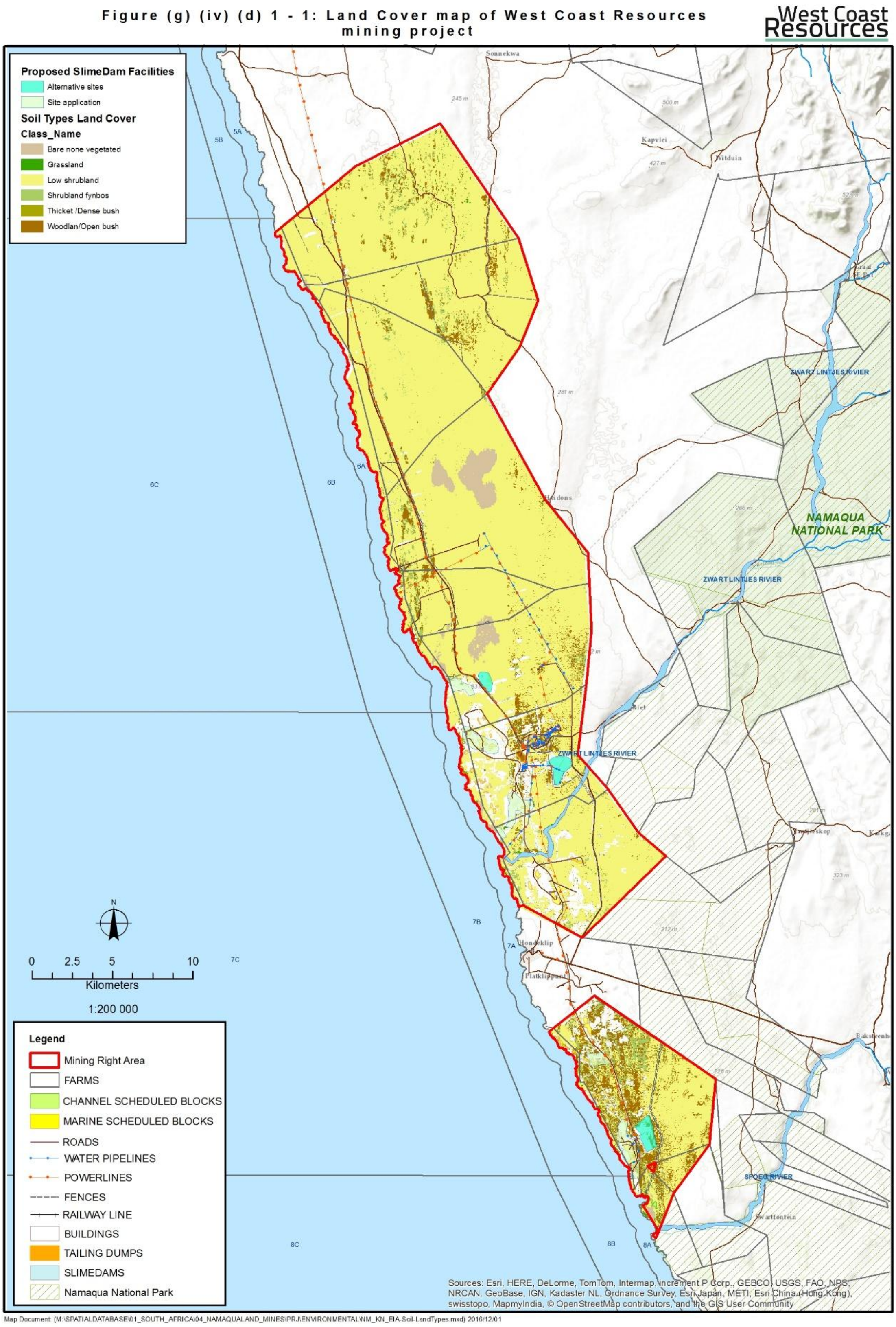

Figure (g) (iv) (d) 1 - 1: Land Cover map of West Coast resources mining project

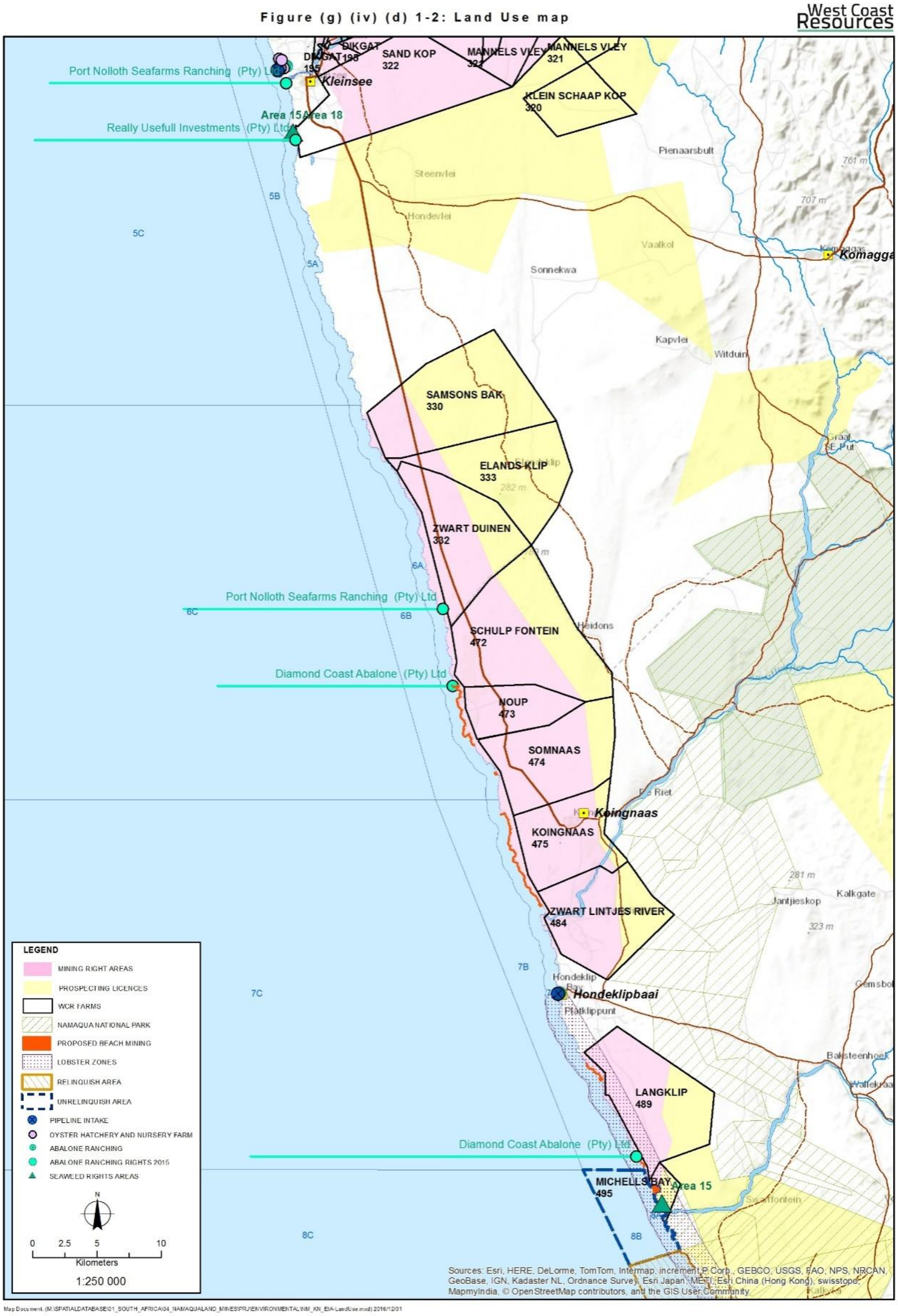

Figure (g) (iv) (d) 1 - 2: Land use map

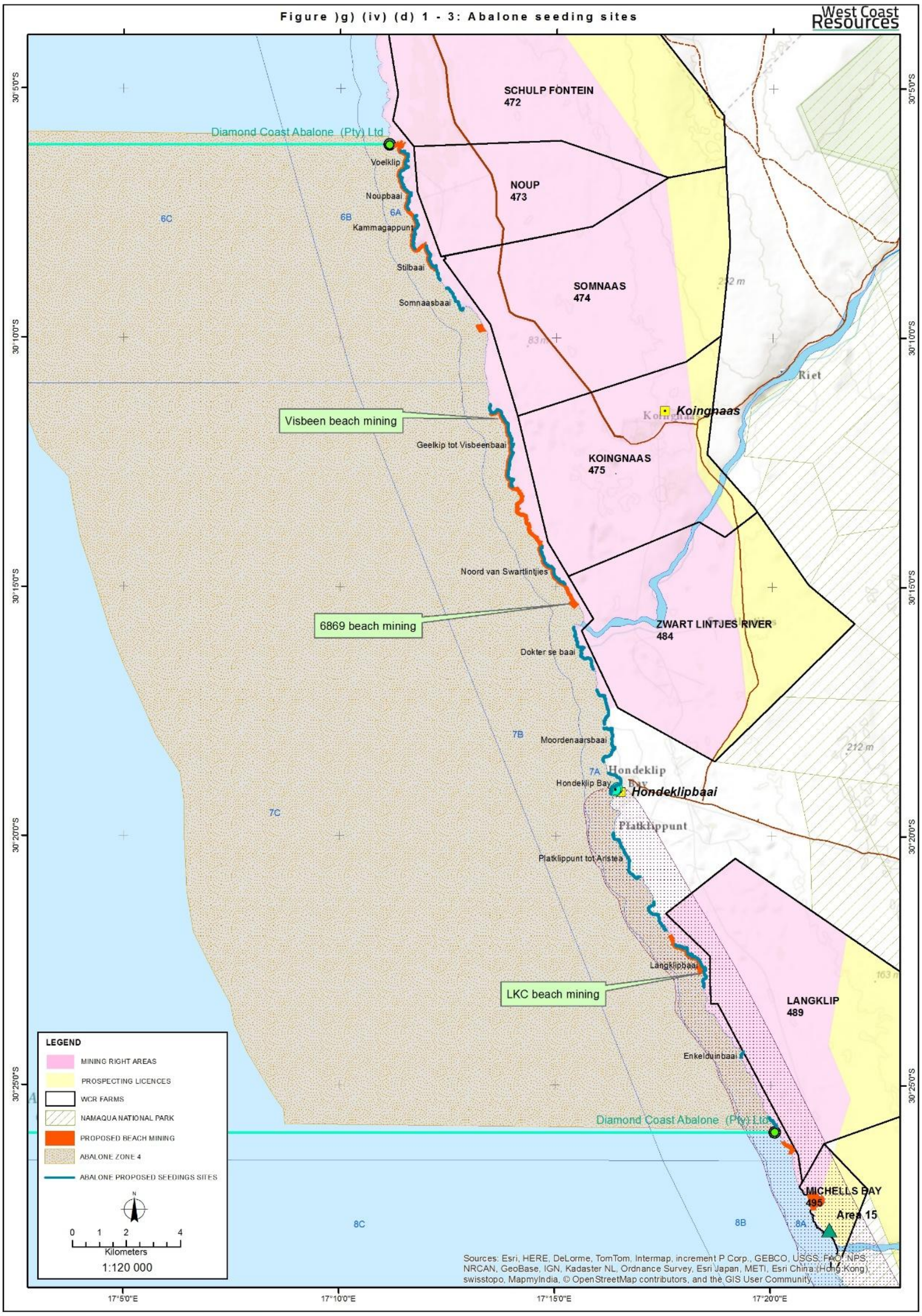

Figure (g) (iv) (d) 1 - 3: Abalone seeding sites

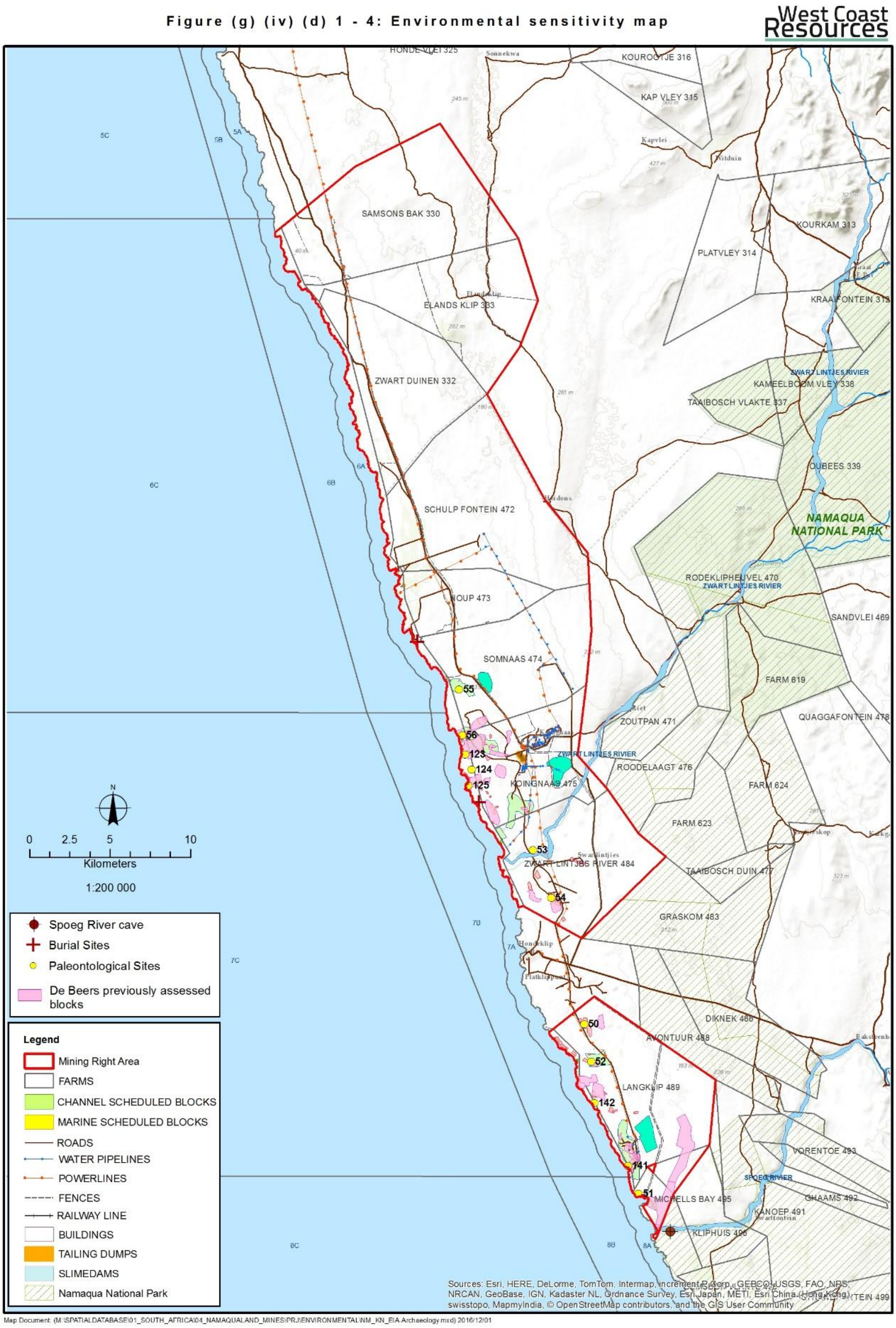

Figure (g) (iv) (d) 1 - 4: Environmental sensitivity maps

Figure (g) (iv) (d) 1 - 5: Koingaas Biodiversity Study Vegetation Recorded at Sample Waypoints

Figure (g) (iv) (d) 1-5(a): Koingnaas Biodiversity study vegetation recorded at sample waypoints

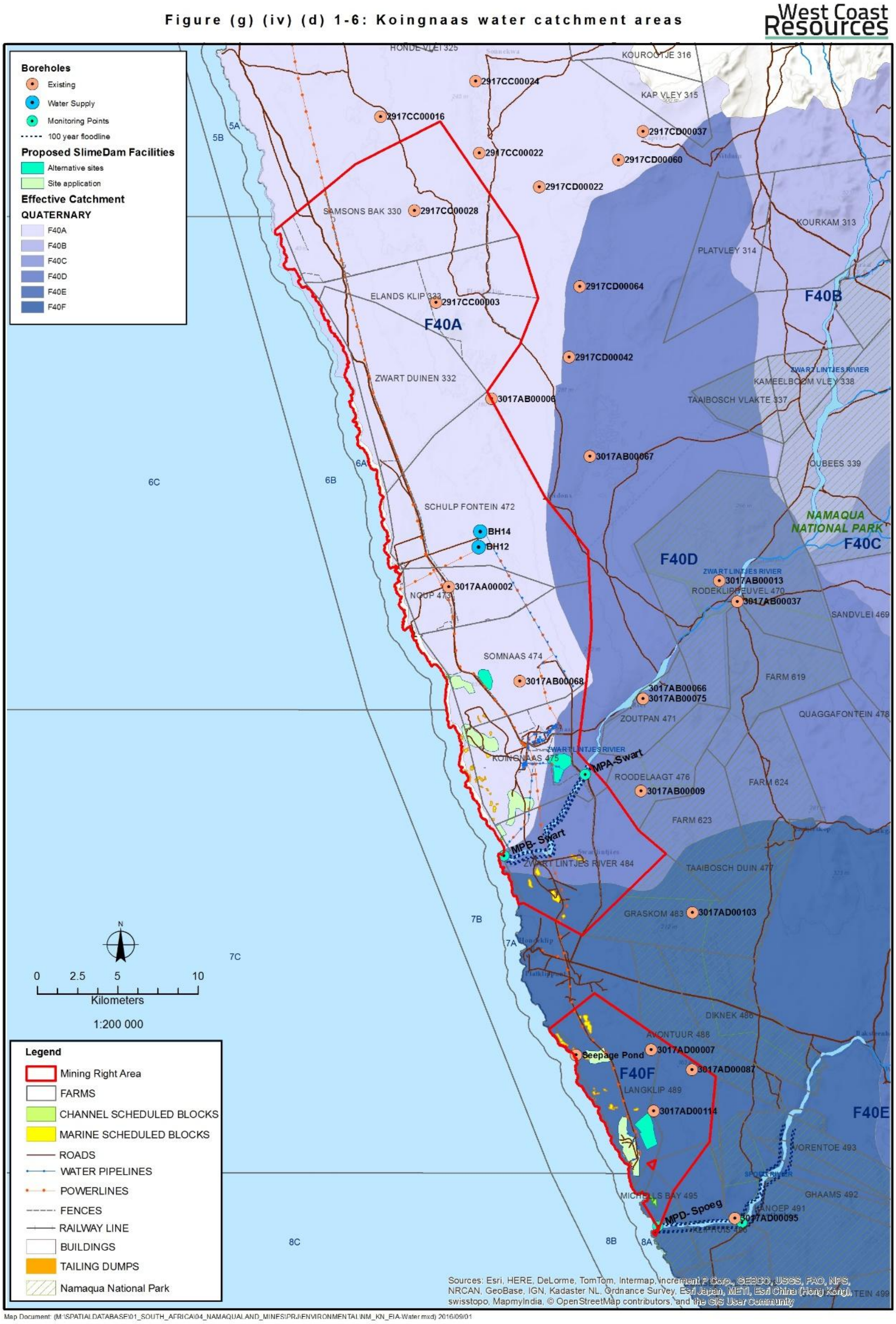

Figure (g) (iv) (d) 1 - 6: Koingnaas water catchment areas