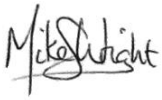
BARKOMOTIVE (PTY) LTD

DC21/0005/2011: Proposed Rorqual Estate Development in Park Rynie, KwaZulu-Natal

Draft Environmental Impact Report

Issue date: 14 May 2015
Revision No.: 2.3
Project No.: 9978

DOCUMENT DESCRIPTION

Date:	14 May 2015
Document Title:	Proposed Rorqual Estate in the Umdoni Local Municipality, KwaZulu-Natal: Draft Environmental Impact Report
Revision Number:	2.3
Author:	Michael Wright (*BSc. (Hons) Agribusiness Wildlife Science*)
Signature:	
Checked by:	Michelle Nevette (*M. Env. Mgt*)
Approved:	Michelle Nevette (*M. Env. Mgt*)
Signature:	
For:	Barkomotive (Pty) Ltd

CONFIDENTIALITY STATEMENT

INDEPENDENT PRACTITIONER DECLARATION

The Independent Environmental Assessment Practitioner:

We, SiVEST Environmental, declare that we –

- Act as the Independent Environmental Assessment Practitioners in this application for the construction and operation of the proposed Rorqual Estate Development;
- Do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the Environmental Impact Assessment Regulations, 2010;
- Have and will not have any vested interest in the proposed activity proceeding;
- Have no, and will not engage in, conflicting interests in the undertaking of the activity; and
- Will provide the competent authority with access to all information at our disposal regarding the application, whether such information is favourable to the applicant or not.

BARKOMOTIVE (PTY) LTD

PROPOSED RORQUAL ESTATE DEVELOPMENT, UMDONI LOCAL MUNICIPALITY
REF. NO: DC21/0005/2011

DRAFT ENVIRONMENTAL IMPACT REPORT

Contents Page

Appendices

E7: Geo-hydrological Assessment - WWTW Site
E8: Estuarine Water Quality & Botanical Assessment
E9: Riverine Baseline Water Quality & Soil Phosphate Sorption Capacity Assessment

F: Public Participation Process

G: Draft Environmental Management Program

G1: Development Master Plan
G2: Draft Construction & Operational Environmental Management Programme
G1.1: Wetland Rehabilitation Strategy
G1.2: Conservation Management Plan
G1.3: Re-vegetation Plan
G1.4: *Cyrtanthus mackenii* Restoration Plan
G1.5: Storm-water Management Plan

H: Environmental Impact Assessment Method

H1: SiVEST EIA Methodology
H2: SiVEST Environmental Rating System

GLOSSARY OF TERMS

Alien Vegetation: Alien vegetation defined as undesirable plant growth, which shall include, but not be limited to all declared category 1 and 2 listed invader species as set out in the Conservation of Agricultural Resources Act (CARA) regulations. Other vegetation deemed to be alien shall be those plant species that show the potential to occupy in number, any area within the defined construction area.

Alien Species: A plant or animal species introduced from elsewhere: neither endemic nor indigenous.

Alternatives: In relation to a proposed activity, means different means of meeting the general purpose and requirements of the activity, which may include alternatives to:

(a) The property on which or location where it is proposed to undertake the activity;
(b) The type of activity to be undertaken;
(c) The design or layout of activity;
(d) The technology to be used in the activity; and
(e) The operational aspects of the activity.

Applicant/Developer: Any person who applies for an authorization to undertake an activity or to cause such activity to be undertaken as contemplated in the National Environmental Management Act (Act No. 107 of 1998), as amended and the Environmental Impact Assessment Regulations, 2010. Remains ultimately responsible for ensuring that the development is implemented according to the requirements of the EMP and the conditions of the Environmental Decision throughout all phases of the project.

Biodiversity: The variety of life in an area, including the number of different species, the genetic wealth within each species, and the natural areas where they are found.

Buffer Zone: Is a collar of land that filters out inappropriate influences from surrounding activities, also known as edge effects, including the effects of invasive plant and animal species, physical damage and soil compaction caused by trampling and harvesting, abiotic habitat alterations and pollution. Buffer zones can also provide more landscape needed for ecological processes, such as fire.

Building Restriction Line: The building restriction line, other than and in addition to any restriction placed on a property by the relevant municipal authority, will apply to each property which fronts onto an identified wetland, to be recorded in the title deed for the property. No structure may be erected within

the building restriction area, defined as the area between the building restriction line and the adjoining property boundary, without the express written confirmation from the relevant authorities.

Construction Activity: Any action taken by the Contractor, his subcontractors, suppliers or personnel during the construction process.

Contractor: The contractor, as the developers agent on site, is bound by the EA and EMP conditions through his/her contract with the developer, and is responsible for ensuring that conditions of the EMP and EA are strictly adhered to at all times. The contractor must comply with all orders (whether verbal or written) given by the ECO, project manager or site agent in terms of the EMPr.

Ecology: The study of the inter relationships between organisms and their environments.

Environment: All physical, chemical and biological factors and conditions that influence an object and/or organism.

Environmental Authorization (EA): Decision pertaining to the Application for Environmental Authorization issued by the Competent Authority. The EA is legally binding on the Applicant and may contain a positive or negative decision on the Application as well as conditions and provisions for each.

Environmental Control Officer (ECO): The ECO is appointed by the developer as an independent monitor of the implementation of the EMP i.e. independent of the developer and contractor.

Environmental Officer (EO): The Contractor shall submit to the Site Agent a nominated representative of the Contractor as an EO to assist with day to day monitoring of the construction activities for the contract.

Environmental Impact: An Impact or Environmental Impact is the degree of change to the environment, whether desirable or undesirable, that will result from the effect of a defined activity. An Impact may be the direct or indirect consequence of an activity and may be simple or cumulative in nature.

Environmental Impact Assessment: In relation to an application, to which Scoping must be applied, it means the process of collecting, organizing, analyzing, interpreting, communicating information and assessing the effects of a development on the environment.

Environmental Impact Report: In-depth assessment of impacts associated with a proposed development. This forms the second phase of an Environmental Impact Assessment and follows on from the Scoping Report.

Environmental Management Program: A legally binding working document, which stipulates environmental and socio-economic mitigation measures that must be implemented by several responsible parties throughout the duration of the proposed project.

Indigenous: Means a species that occurs, or has historically occurred, naturally in a free state within the borders of South Africa. Species that have been introduced to South Africa as a result of human activity are excluded (South Africa (Republic) National Environmental Management: Biodiversity Act, 2004: Chapter 1).

Interested and Affected Party: Any person, group of persons or organization interested in or affected by an activity contemplated in an application, or any organ of state that may have jurisdiction over any aspect of the activity.

Mitigate: The implementation of practical measures to reduce adverse impacts Public Participation Process: is a process in which potential interested and affected parties are given an opportunity to comment on, or raise issues relevant to, specific matters.

Precipitation: Any form of water, such as rain, snow, sleet, or hail that falls to the earth's surface.

Public Participation: The legislated process contemplated in terms GN R543, in which all potential interested and affected parties are informed of the proposed project and afforded the opportunity to input, comment and object. Specific requirements are listed in terms of advertising and making draft reports available for comment.

Road Reserve: The road reserve is a corridor of land, defined by co-ordinates and proclamation, within which the road, including access intersections or interchanges, is situated. A road reserve may, or may not, be bounded by a fence.

Road Width: The area within the Road Reserve including all areas beyond the Road Reserve that are affected by the continuous presence of the road i.e. the verge.

Red Data Species: Are fauna and flora species that require environmental protection based on the International Union for the Conservation of Nature and Natural Resources (IUCN) categories and criteria.

Riparian: The area of land adjacent to a stream or river that is influence by stream induced or related processes.
Scoping Report: An "issues-based" report, which forms the first phase of an Environmental Impact Assessment process.

Seral Community: An intermediate stage found in ecological succession in an ecosystem advancing towards its climax community.

Soil Compaction: Mechanically increasing the density of the soil, vehicle passage or any other type of loading. Wet soils compact easier than moist or dry soils.

Species: Means a kind of animal, plant or other organism that does not normally interbreed with individuals of another kind. The term "species" include any sub-species, cultivar, variety, geographic race, strain, hybrid or geographically separate population (South Africa [Republic] National Environmental Management: Biodiversity Act, 2004: Chapter 1).

Vegetation: Is a collective word for plants occurring in an area.

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.

Watercourse: A river or spring; a natural channel in which water flows regularly or intermittently; a wetland, lake or dam into which, or from which, water flows; and any collection of water which the Minister may by notice in the Government Gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks" (South Africa [Republic] National Water Act, 1998).

LIST OF ABBREVIATIONS

BID – Background Information Document
CBD – Central Business District
DEA – Department of Environmental Affairs
DSR – Draft Scoping Report
EAP – Environmental Assessment Practitioner
EDTEA – Department of Economic Development, Tourism and Environmental Affairs
EIA – Environmental Impact Assessment
EIR – Environmental Impact Report
EMP – Environmental Management Program
FGM – Focus Group Meeting
FSR – Final Scoping Report
GDP – Gross Domestic Product
GIS – Geographic Information System
HIA – Heritage Impact Assessment

I&APs – Interested and Affected Parties
I&RR – Issues and Response Report
IDP – Integrated Development Plan
KSW – Key Stakeholder Workshop
NEMA – National Environmental Management Act, 1998 (Act No. 107 of 1998)
NEMBA – National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)
NFA – National Forests Act, 1998 (Act No. 84 of 1998)
NHRA – National Heritage Resources Act, 1999 (Act No. 25 of 1999)
NWA – National Water Act, 1998 (Act No. 36 of 1998)
PM – Public Meeting
PPP – Public Participation Process
RED – Rorqual Estate Development
SAHRA – South African Heritage Resources Agency
SANBI – South African National Biodiversity Institute
SANRAL – South African National Roads Agency
SDF – Spatial Development Framework
UDM – Ugu District Municipality
ULM – Umdoni Local Municipality

BARKOMOTIVE (PTY) LTD

PROPOSED RORQUAL ESTATE DEVELOPMENT, UMDONI MUNICIPALITY
REF. NO: DC21/0005/2011

DRAFT ENVIRONMENTAL IMPACT REPORT

1 DETAILS OF THE ENVIRONMENTAL ASSESSMENT PRACTITIONER (EAP)

Table 1: Details of SiVEST EAP's involved in the project:

Name	Role	Qualifications	Experience	Expertise
Michelle Nevette	Internal Reviewer	Master of Environmental Management	14	▪ Project Management ▪ Environmental Planning ▪ Environmental Impact Assessment ▪ Strategic Environmental Assessment
Ryan Edwards	Environmental Consultant	Master of Science (Environmental Science)	6	▪ Environmental Impact Assessment ▪ Wetland Ecology
Michael Wright	Environmental Consultant	Bachelor of Science (Hons) (Agribusiness Wildlife Science)	13	▪ Environmental Impact Assessment ▪ Tourism, Hospitality and Leisure ▪ Project Management ▪ Property Consulting
Marelize Berning	Project Assistant	Bachelor of Arts (Environmental Management)	10	▪ Environmental Impact Assessment ▪ Environmental Planning ▪ Environmental Auditing
Michelle Evans	Project Assistant	Master of Science (Environmental Science)	2	▪ Environmental Impact Assessment ▪ Environmental Auditing

Physical Address: SiVEST Environmental Division
4 Pencarrow Crescent
La Lucia Ridge Office Estate

Postal Address: P O Box 1899
Umhlanga Rocks
4320

Direct Phone: + 27 31 581 1573
Fax: + 27 31 566 2371
Email: michaelw@sivest.co.za

Table 2: Environmental Specialist Consultants and Reports

Specialist's Name	Organization	Role	Date
Internal			
Ryan Edwards	SiVEST	Wetland Delineation & Functional Assessment	25 Mar 2013
Greg Mullins	SiVEST	Wetland Delineation & Ecosystem Services Assessment of NW Quadrant & WWTW Site	13 Mar 2012
Roy Mottram and Kurt Barichievy	SiVEST and Mottram & Associates	Agricultural Potential Assessment	Aug 2009
Andrea Gibb	SiVEST	Visual Impact Assessment	3 April 2014
External			
Ryan Edwards	SiVEST	Wetland Rehabilitation Strategy	Apr 2013
Tandi Breetske	RoyalHaskoning DHV	Coastal Assessment	Nov 2012
David Styles	David Styles	Vegetation Assessments	5 Apr 2012
David Styles	David Styles	Re-vegetation Plan	10 Dec 2014
David Styles	David Styles	*Cyrtanthus mackenii* Restoration Plan	24 Jul 2013
Kevan Zunckel	ZEES	Conservation Management Plan	6 Aug 2013
Chris Ross	Davies Lynn & Partners	Geotechnical Investigation	May 2009
Brian Colloty	Sherman Colloty & Associates	Water Quality & Botanical Assessment	Dec 2012
Talia Feiganbaum	Urban-Econ	Socio-Economic Impact Assessment	31 May 2012
Robin Barker	Hatch Goba	Traffic Impact Assessment	Oct 2014
Len van Schalkwyk	eThembeni Cultural Heritage	Heritage Impact Assessment	30 Jun 2009
Dr Mark Graham	Groundtruth	Riverine Baseline Water Quality & Soil Phosphate Sorption Capacity Assessment	15 Apr 2013
Pieter Labuschagne	GCS	Geohydrological Assessment	17 Oct 2012
Nico Kriek	GIBB	Development Phasing Plan	18 Feb 2014
James Croswell	Hatch Goba	Preliminary Engineering Services Report	29 Sep 2011
James Croswell	Hatch Goba	Storm-water Management Plan Report	12 Dec 2014
James Croswell	Hatch Goba	Flood Estimation Report	12 Dec 2014
James Croswell	Hatch Goba	Roads and Storm-water Report	9 Jan 2015
James Croswell	Hatch Goba	Water and Sewer Report	9 Jan 2015
James Croswell	Hatch Goba	Ugu Service Level Agreement (Draft)	1 Aug 2014
James Croswell	Hatch Goba	Umdoni Service Level Agreement (Draft)	19 Sep 2014

2 DETAILS OF THE APPLICANT

Barkomotive (Pty) Ltd
Physical Address: Ellingham Estate, Old Main Rd, Park Rynie, Scottburgh, KwaZulu-Natal, 4180
Postal Address: PO Box 3, Park Rynie, Scottburgh, KwaZulu-Natal, 4182
Tel: 039 976 0970

3 ASSUMPTIONS AND LIMITATIONS

All information provided by the applicant to the Environmental Team was correct and valid at the time it was provided.

It is not always possible to involve all I&APs individually. However, every effort has been made to involve as many interested parties as possible. It is also assumed that individuals representing various associations or parties convey the necessary information to these associations/parties.

4 INTRODUCTION AND BACKGROUND

The applicant, Barkomotive (Pty) Ltd, is proposing to establish the Rorqual Estate Development, a mixed-use development within the Park Rynie area of the Umdoni Municipality. Barkomotive is a standalone company with similar/same shareholders as Ellingham Estate (Pty) Ltd. The property, which comprises the subject of the application, will be transferred from Ellingham Estate (Pty) Ltd to Barkomotive (Pty) Ltd as soon as practically possible. It is possible that the company name, Barkomotive, will be changed to reflect the name of the proposed development, but that is something that will occur either simultaneously with or after the transfer of the property.

The locality of the development is shown in Figure 1 in the attached **Appendix A**.

The proposed development is planned to be established on the following properties:

Property Description	Ownership	Deed No.	Size (Ha)
Remainder of 354 of the farm Park Rynie No. 1666	Ellingham Estate (Pty) Ltd	T4806/1942	18.54ha
Remainder of 5 of the farm Park Rynie No. 1666	Ellingham Estate (Pty) Ltd	T4806/1942	136.58ha
Remainder of 13 of the farm Park Rynie No. 1666	Ellingham Estate (Pty) Ltd	T4806/1942	61.10ha
A Portion of the Remainder of 14 of the farm Park Rynie No. 1666 (East of the N2 freeway)	Ellingham Estate (Pty) Ltd	T4806/1942	30.39ha
A Portion of the Remainder of 14 of the farm Park Rynie No. 1666 (West of the N2 freeway)	Ellingham Estate (Pty) Ltd	T4806/1942	6.95ha
Remainder of 1 of the farm Ocean View No. 6234	Ellingham Estate (Pty) Ltd	T4806/1942	145.38ha
Remainder of 2 of the farm Port Umzinto No. 6230	Ellingham Estate (Pty) Ltd	T4806/1942	69.35ha
564 of the farm Park Rynie No. 1666	Ellingham Estate (Pty) Ltd	T11801/1996	3.85ha
Remainder of 567 of the farm Park Rynie No. 1666	Ellingham Estate (Pty) Ltd	T10856/1979	23.01ha
568 (of 567) of the farm Park Rynie No. 1666	Ellingham Estate (Pty) Ltd	T10856/1979	
568 (of 567) of the farm Park Rynie No. 1666	Ellingham Estate (Pty) Ltd	T10856/1979	
Erf 572 Park Rynie Township	Certificate of Registered State Land	T19362/1985	2.01ha
Portion of the Remainder of 580 of the farm Park Rynie No. 1666	Ellingham Estate (Pty) Ltd	T52412/2000	46.82ha

The development site is 543,97ha in extent, 314,66ha of which is potentially developable and 225,22ha of which will be set aside for conservation. The extent of the project site and the location of the properties proposed for development are shown in **Appendix A**.

Under the National Environmental Management Act, 1998 (Act 107 of 1998), the proposed development requires environmental authorisation from the KwaZulu-Natal Department of Agriculture, Environmental Affairs (EDTEA) subject to a full Scoping and Environmental Impact Assessment.

In this regard, SiVEST Environmental Division has been appointed by Barkomotive (Pty) Ltd as the independent Environmental Assessment Practitioner (EAP) responsible for conducting an Environmental Impact Assessment (EIA) of the proposed development as per requirements of both Acts.

5 DESCRIPTION OF THE PROPOSED SITE

5.1 Location, Land Use and Development Context

The site is located along a strip of coastline to the south of the outskirts of Park Rynie on the KwaZulu-Natal South Coast, approximately 70km south of Durban and 62km north of Port Shepstone, as shown in Figure 1 in the attached **Appendix A**. The King Shaka International Airport is approximately 95km north of the site.

The site on which the proposed Rorqual Estate is to be developed is approximately 540ha in extent. The land predominantly comprises sugarcane farming with small nodes of residential dwellings. The remainder of the Ellingham Farm will continue to be used for sugar cane farming and other agriculture. The site is currently zoned agriculture.

The bulk of the site is seaward of the N2 National Freeway and south of the R612, with the exception of a few parcels of land that occur north of the R612 and landward of the N2.

The coordinates of the centre of the Rorqual Estate are:

- 30º 20’ 15.57” South
- 30º 43’ 27.37“ East

From a regional accessibility and development potential point of view, the following major roads affect the site:

- The N3 Freeway (linking KwaZulu-Natal and Gauteng) is situated approximately 60km north of the site and is the main access route into the KwaZulu-Natal interior.
- The N2 Freeway is situated immediately to the west of the site and runs in a north-south direction along the coast, linking the site with Durban (north) and with the Eastern Cape (south). Along the coast, the N2 Freeway has an important function in serving the tourist market. The location of Park Rynie along the N2 Freeway ensures excellent accessibility and linkages.
- The R603 is situated approximately 26km north of the site and connects the broader Kingsburgh area with Pietermaritzburg.
- At a local level the R612 links the towns of Park Rynie and Umzinto and has a major interchange near Park Rynie with the N2 Freeway, and is the key arterial route into the Ixopo area.
- The R56 is situated approximately 60km north-west of the site, which is the primary corridor between the Eastern Cape and the N3 Freeway.

Scottburgh is situated towards the north of the site, with the KwaZulu-Natal Hinterland (Umzinto, Hazelwood and Shayamoya) being situated towards the west. The Indian Ocean forms the eastern boundary of the site with Pennington, Umdoni, Ifafa Beach, Margate, Port Shepstone being situated towards the south of the site.

The site and the land towards the west and south of the site is utilised predominantly for agricultural purposes. On the eastern side *(between the R102 being the Old South Coast Road and the Indian Ocean)* of the site there is a caravan park and holiday cottages (Rocky Bay). The

present development pattern in the sub-region mainly occurs towards the north, in the direction of Scottburgh and towards the existing infrastructure. Land uses towards the north include *inter alia*, light industrial, commercial and residential developments, whilst land uses adjacent to the sea are characterised by residential developments and tourism related land uses.

Development of the South Coast is characterised by ribbon development with Amanzimtoti, Scottburgh and Margate being the primary nodes along the N2 Freeway. Other urban nodes include, Park Rynie, Kelso, Pennington, Bazley, Ifafa Beach, Elysium, Mtwalume and Umzinto.

The site offers immense opportunity, which is presently not being utilised to its full potential, in that it is well located for development purposes. Therefore, it is the developer's intention to establish a commercial, industrial, leisure, and tourism destination on the properties concerned that will be integrated into the existing growth pattern of the South Coast.

The Umdoni Municipality Spatial Development Framework has indicated that the Rorqual Estate is earmarked for Future Housing and a Secondary Tourism Node. There is potential for industrial and commercial development within the Umdoni Municipal area, specifically in Park Rynie and Umzinto. Economic growth is to be encouraged through tourism, light industrial and commercial developments, with a development corridor to Umzinto.

6 DESCRIPTION OF THE PROPOSED ACTIVITY

6.1 Proposed Land Uses and Layout

The proposed Rorqual Estate Development entails the establishment of a mixed-use development comprising the following land uses:

- Residential 1 – 317 units over 39,69ha
- Residential 2 – 3,489 units over 139,58ha
- Commercial – 34,68ha
- Retirement Village – 455 units over 11,39ha
- Recreation – 1,77ha
- Educational – 27,76ha
- Mixed Use – 290 units (2 storey) over 3,44ha
- Open Space – 225,22ha
- Hotel – 4,56ha
- Business – 6,42ha
- Limited Retail and Parking – 3,48ha
- Apartments and Parking – 2,16ha
- Undetermined – 9,25ha
- Roads – 30,67ha

Total = 539,88ha

The Development Master Plan depicting land use and layout is attached as **Appendix C1**. The development site is 539,88ha in extent, 314,66ha of which is potentially developable and 225,22ha of which will be set aside for conservation.

The following details regarding the development concept have been provided by GIBB Engineering & Science:

6.1.1 Commercial Area

A mixed-use, multi-functional commercial node is proposed on several pockets of land adjacent the intersection of the N2 Freeway and the R612.

The land uses proposed for the multi-functional node can be broken up as follows:

- Proposed land uses: Commercial/light industrial
- Area: 34.68ha

6.1.2 Residential Development

The wetland and environmentally sensitive areas have created six residential development pockets, each with its own character, development opportunities and potential. The development of the residential pockets will consist of the following land uses:

- Residential 1 – consisting of 39.69ha at 8 units/ha = 317 units
- Residential 2 – consisting of 139.58ha at 25 units/ha = 3,489 units
- Retirement village – consisting of 11.39ha at 40 units/ha = 455 units

Throughout the development, provision is made for 5 sites for community facilities.

6.1.3 Business

A total of 5 business nodes sited adjacent to or within the residential nodes have been proposed. These total an area of 6.42ha.

6.1.4 Tourism Uses (The heartland)

The land between the coast and the R102 is viewed as the heartland of the development. The heartland can be divided into two development pockets, each with their own unique character and development potential:

- The portion of land between the ocean and the railway line; and
- The portion of land between the railway line and the R102.
- Area: 4.56ha

Existing tourism facilities on the heartland area include a caravan park and restaurant. Tourism related facilities (e.g. hotels, restaurants and recreation facilities) will be provided for on the area towards the east of the R102 and west of the Indian Ocean. The facilities will be developed around a pedestrian walkway. Vehicular movement will be discouraged (only delivery and emergency vehicles will be allowed access) to ensure that pedestrians have right of way.

The land use proposed for the two development pockets can be broken up as follows:
- Hotels
- Special recreation
- Apartments and parking

6.1.5 Educational

One site of 24.79ha, of which approximately 10ha is developable land, just to the north-west of the N2 intersection, was identified for the development of schools. An open space corridor with wetland separates it from the N3 Highway to the east.

6.1.6 High Street – Parking and Limited Retail

A high street strip will be developed opposite the current access to the Rocky Bay area. The High Street will act as gateway to the residential developments. The high street strip will accommodate a few suitably scaled retail facilities, which will cater for the needs of the permanent residents and the tourist market. It is envisaged that retail will take place on street level and residential units are to be developed on the 2nd and 3rd floors. The residential developments on the high street area will be of higher density in an apartment typology. The area proposed for this totals 3.48ha.

6.1.7 Mixed Use Business/Residential

A mixed-use business/residential node is proposed adjacent the High Street strip, a business node and a residential node. This totals 3.44ha.

6.1.8 Open Space System

The wetlands and intact coastal forest, bushclumps and grassland areas as well as their respective buffer zones will be protected by means of an open space system that will be integrated into the proposed development. In addition, certain areas, particularly the lesser value wetland and their buffers, have been designated private open space servitudes where recreational and low impact encroachment is proposed.

At present, the following preliminary ecosystem buffers have been incorporated into the land use layout plan:

- High value wetlands = 30m buffers
- Moderate value wetlands = 20m buffers
- Low value wetlands = 15m buffers
- Coastal forest = 40-60m buffers
- Coastal grassland = 12m buffers
- Coastal dune thicket = 20m buffers
- Other (bushclumps etc.) = 30-40m buffers

It is assumed that a body corporate or homeowner's association will be instituted, as stated in the Draft Service Level Agreements, to manage relevant open space systems. It is required that either these private sector bodies, or Umdoni Local Municipality, are made responsible for managing all applicable open spaces in accordance with the requirements of the Conservation Management Plan.

6.1.9 Access and Circulation

Provision has been made for:

- Two accesses off the R612, which connects the N2 Freeway to Umzinto.
- Two access off the R612, which connects the N2 Freeway and Park Rynie.
- Three accesses off the R102, which connects the site with Scottburgh towards the north and with Kelso and Pennington towards the south.

6.1.10 Undetermined

Three parcels of land in the south end of the site are categorized as undetermined. Two of these sites straddle the R102 and are close to the railway line. These three areas comprise 1.59ha, 0.96ha and 6.70ha, thus totalling 9.25ha.

Proposed Services and Infrastructure

For this section, reference is made to the Preliminary Engineering Report prepared by Hatch Goba Engineers dated 27 January 2012, attached as **Appendix C2**.

Furthermore, reference is also made to the following Draft Service Level Agreements:

- Ugu District Municipality Draft Service Level Agreement – **Appendix C9.1**
- Umdoni Local Municipality Draft Service Level Agreement – **Appendix C9.2**

6.1.11 Water Supply

The water supply authority for the area is Ugu District Municipality, who will negotiate accordingly with Umgeni Water. The proposed development is planned to receive potable water

from the South Coast water pipeline. Initial discussions with Umgeni Water indicated that the South Coast water pipeline will have sufficient capacity to service the proposed development. Two points of supply are proposed: the Ellingham reservoir and the Ocean View Reservoir. Both of the existing reservoirs will have to be upgraded.

6.1.12 Sewage

At present, the capacity of the Scottburgh Waste-water Treatment Works is over extended and cannot receive the effluent generated by the proposed development. The Ugu District Municipality, the mandated sanitation service providers, are currently investigating the construction of a new regional waste-water treatment works (WWTW) to service the local area. The developer plans to reticulate sewage generated by the development to this works once approved and constructed. The responsibility for obtaining permission to construct the works lies with the Ugu District Municipality. Preliminary discussions have taken place regarding the contribution the Applicant of Rorqual Estate will make towards the cost of this works.

However, in the event that the current management and financial issues within the Ugu District Municipality prove to delay the proposed new Regional WWTW such that the development proposal and EIA application cannot move forward, the developer has proposed the following onsite sanitation alternative:

- To construct a stand-alone private WWTW for the Rorqual Estate at the location shown in the Development Master Plan (attached as **Appendix C1**) at the cost of the developer. The developer proposes to use the treated effluent for irrigation purposes to reduce the need to discharge the treated return flows into the drainage line that ultimately drains into the Rocky Bay estuary.

The 2010 NEMA regulations were amended on 29 November 2013, which led to the insertion of Activities 55A and 55B in Government Notice No. R 544, to account for the construction and expansion of facilities for the treatment of effluent, wastewater and sewage. For this purpose, the proposed WWTW has been assessed comprehensive within this report.

6.1.12.1 Introduction

In terms of the internal reticulation, the proposed development plan is to incorporate a combination of gravity and vacuum systems with a number of vacuum stations eventually delivering effluent to a single centralised pump station from whence the effluent would be pumped to the proposed waste-water treatment works (WWTW).

It would appear from preliminary studies that the ultimate flow will be less than 4,000 kilolitres per day (kl/d), but that the site will be developed in stages. It is proposed that the effluent will be irrigated so that normal GLV will apply to the discharge standards (with possibly a zero requirement for *Escherichia coli* (E. coli).

Flow and Stages of Development

Phase 1: Residential, commercial, retirement village - 1 233 kl/d
Phase 2: Residential and business - 416 kl/d
Phase 3&4: Residential and business - 619 kl/d
Phase 5: Hotels and apartments - 718 kl/d
Phase 6: Residential and business - 749 kl/d
Total = 3 735 kl/d

It has been proposed that the WWTW be constructed in four stages each of nominal 1,000 kl/d capacity. The hydraulic design would readily handle an extra 10%, and by using a degree of conservatism in the selection of design criteria, the plant will cope biologically with the population anticipated. This would enable the first two stages to be constructed to GLV requirements without the need for a license from the DWAS.

Stage 1 would match virtually all of Phase 1; followed by Phase 2 at Stage 2; followed by Phase 3 &4 and the start of Phase 5 after building Stage 3; and the rest of Phase 5 and Phase 6 after the final Stage 4 works extension.

6.1.12.2 Process Selection

It has been recommended that an activated sludge process be used. This is the most flexible of the processes available, produces an effluent of excellent quality if properly designed and operated, and is relatively inexpensive in terms of capital costs, compared to most alternatives. It is also well suited to applications where nutrient removal is required.

In our experience most sewages in KZN are deficient in alkalinity which limits nitrification to the detriment of final effluent quality. Denitrification via an anoxic zone in the aeration tanks will therefore be incorporated into the process.

The process will consist of the following:

- Head of Works with screening, degritting and flowmeter designed for an ADWF of 4,000 kl/d, constructed and installed in two stages (1&2 then 3&4). Each half of the inlet works to be designed for 90 l/s.
- Activated sludge aeration reactors for a treatment capacity of 1,000 kl/d for each stage of extension.
- Chlorine dosage with contact tank, or Ultraviolet (UV) Irradiation for disinfection.
- Mechanical dewatering equipment for disposal of waste activated sludge.

At the time of detailed design the sewer system will be optimised using a combination of vacuum and gravity pipelines. This would have the beneficial effect of reducing the chances of sewage leakage and reducing the number of pump stations required.

6.1.13 Electricity Supply

Eskom is the supply authority and preliminary discussions have taken place with Eskom on an understanding that a new connection point to the area will have to be established. In the short-term, the existing supply should be adequate, but the reinforcement both of the area network as well as the transformer capacity will be required. Eskom is not willing to comment formally until they are in receipt of an approved township application. Eskom has been appointed to undertake a study to confirm whether supply is possible, and meetings in this regard are ongoing. Electricity supply will be the subject of a separate EIA to be conducted by Eskom. Refer to letter from Eskom, dated 28 April 2015, attached as **Appendix C11**.

6.1.14 Storm-water Management

The engineers have examined the catchments upstream of the N2 together with their discharge points under the N2 and in relation to the drainage lines within the site. The offsite flow has not been attenuated or retarded in any way. Assumptions have however been made in respect of the run-off which is expected from the development. *Where particular developments are likely to generate post development flows, which vary significantly from the predevelopment flows, it is proposed that relatively small attenuation facilities will be included within actual development areas.* It is understood that there is a reticence to approve retardation facilities within flood lines, especially where the flood lines fall within identified wetlands. Proposals will need to be made to reduce the potential downstream damage as well as improve the chance of infiltration and also the biodiversity.

6.1.15 Roads and Access

The preliminary position of the major internal roads within the development and access points are shown in the preliminary layout plan. Hatch Goba has undertaken a Traffic Impact Assessment (dated October 2014 and attached in **Appendix E1**).

The report contains three evaluation scenarios for the development:

- Scenario 1 considers the full development (2019)
- Scenario 2 for the development of Stand 4 only (2017)
- Scenario 3 the development of Stands 5, 6 and 7 (2017)

Currently the existing bulk services supplying this area do not sufficiently cater for the full development. The current situation would therefore only be adequate for either Scenario 2 or 3 to be developed.

The findings have indicated the following:

- The development will generate approximately 6,156 vehicle trips during the AM peak and 789 vehicle trips during the PM peak periods.
- A growth rate of 2% per annum over five years was used to calculate the background traffic on the surrounding road network for 2019.
- The existing bulk services would not meet the requirements for the full development.
- Under the existing 2014 traffic evaluation, the five key intersections operate satisfactorily at level of service (LoS) A or B during both the AM and PM peak periods.
- Under the 2019 Scenario 1 evaluation, all intersections operate satisfactorily overall at LoS A, B or C during both the AM and PM peak periods respectively. The proposed intersection layouts are shown in Figure 10(a) and 10(b) of the attached **Appendix E1**.
- Both the Scenario 2 and Scenario 3 evaluations showed that the four key intersections operate satisfactorily overall at LoS A or B provided they are upgraded to signal controlled intersections.

It is recommended that the Ugu District Municipality comment on this traffic impact assessment for the proposed development, provided the intersection upgrades as proposed are implemented as part of the development of the site.

7 A DESCRIPTION OF ALTERNATIVES IDENTIFIED

7.1 Introduction

The EIA Regulations, 2010 guideline document stipulates that the environmental investigation needs to consider feasible alternatives for the proposed development. The Applicant should be encouraged to consider alternatives that would meet the objective of the original proposal and which could have an acceptable impact on the environment. The role of alternatives in the EIA process is therefore to find the most effective way of meeting the need and purpose of the proposal, either through enhancing the environmental benefits of the proposed activity, and/or through reducing or avoiding potentially significant negative impacts.

7.2 Site Alternatives

No site alternatives have been considered as the site is owned by the applicant (Barkomotive/ Ellingham Estate) and the site has been earmarked for residential development according to the Umdoni Municipality Spatial Development Framework: Environmental Assessment and Management Framework, dated May 2009.

7.3 Land Use Alternatives

The applicant has proposed a mixed-use option, which in their opinion maximises the development potential of the site as well as providing employment opportunities and funding for the management, rehabilitation and conservation of the environmental systems onsite. No alternatives to mixed-use development have been considered. Within the mixed-use development framework there is scope for changes in densities and the proportion of different land uses depending on the findings of the numerous specialist studies, particularly the market feasibility study. No land-use alternative to the upmarket mixed-use development is being

proposed at this stage. In addition, no viable land use alternatives to mixed-use development have been proposed by the public to date.

7.4 Layout Alternatives

The layout plan is preliminary, showing only proposed land uses, protected areas, development zones, and major road routings. The layout plan has been revised to accommodate specialist findings, and incorporates the conservation-worthy environmental features, associated buffers and geotechnical constraints.

A separate “Bubble” Development Phasing Plan has also been provided (**Appendix C3**), which demarcates the potential phases that the development will follow. It is proposed that the development be divided into 3 separate phases, which are the following:

- All nodes north of the Mzimayi River
- All nodes between the Mzimayi River and Umzinto River to the south
- All nodes south of the Umzinto River

7.5 Design Alternatives

7.5.1 Internal pipelines and storm-water management system

At the detailed design phase, the recommendations and mitigation measures provided by the wetland and estuarine specialists will be incorporated into the design of the internal water and sewer reticulation and storm-water management system wherever possible to minimise the impacts on watercourses.

7.5.2 Energy and water consumption reduction and recycling

At the detailed design phase, the project engineer will be commissioned to identify feasible energy and water consumption reduction measures for the development and these measures will be incorporated wherever possible.

7.5.3 Effluent treatment and disposal

As discussed in *Section 6.2.2*, the applicant's preferred option is to vacuum pump the sewage to a new municipal waste-water treatment works commissioned and run by the Ugu Municipality. However, due to the current internal issues within the Ugu Municipality, the applicant has included one onsite sanitation alternative. This sanitation alternative, described in *Section 6.2.2* involves the construction of a standalone WWTW for the Rorqual Estate at the site identified for the new local WWTW at the cost of the developer. The developer proposes to use the treated effluent for irrigation purposes of agricultural land nearby.

7.6 No-Go Option

The “no-go” alternative addresses the scenario of the status-quo remaining the same, with no development on the proposed site. Should the proposed development not be approved, the property will continue with sugar cane farming.

8 LEGISLATIVE REQUIREMENTS ASSOCIATED WITH THE PROJECT

8.1 National Environmental Management Act 1998 (Act No. 107 of 1998)

A number of activities associated with the development are listed activities identified in the Environmental Impact Assessment Regulations, 2010, promulgated in terms of Section 24(5), 24M and 44 of the National Environmental Management Act, 1998 (Act No. 107 of 1998). As the proposed development will involve the development and transformation of more than 20ha of undeveloped land and will likely involve substantial provincial and national road upgrades, Listed Activity 15 and 18 of Government Notice No. R. 545 have been triggered which requires that a full scoping and environmental impact assessment be undertaken before a decision can be made on whether the proposed activity should be granted authorisation. The other triggered listed activities are all identified in Government Notices No. R. 544 and R. 546, which requires a Basic Environmental Assessment before authorisation can be granted. The listed activities associated with different components of the development are summarised in Table 3 below.

Table 3: Development activities listed under Government Notices No. R. 544, 545 and 546 .

Development Activities per Regulations dated 18 June 2010	**544 Activities**	**545 Activities**	**546 Activities**
Buildings - hotel, self-catering units, beach facilities, parking areas etc.	14, 16, 23(i), 23(ii)	15	6(a)ii.(hh), 12 (a), 12(c), 16(a)(iii)(ii)(ii)
Sewer infrastructure - pipes, pump stations etc.	9		16(a)(iv)(ii)(ii)
Water infrastructure - pipes, reservoirs etc.	9, 12		
Storm-water infrastructure - pipes, channels, headwalls, soakaways etc.	9, 11(vi), 11(xi)		
Recreational spaces - field platforms and embankments	23		
Access and internal roads and associated infrastructure	9, 11, 18(i), 22, 47	18	4(a).ii.(hh), 19(a).ii.(hh)
Development Activities per amended Regulations dated 29 November 2013	**544 Activities**	**545 Activities**	**546 Activities**
Sewage treatment works	55A and 55B		

Table 4: Listed activities triggered by the proposed development as described in the EIA Regulations, 2010.

Listing Notice	**Regulation**	**Activity**	**Reason**
GNR No. 544 Activities			
GNR 544 of June 2010	9	The construction of facilities or infrastructure exceeding 1000 metres in length for the bulk transportation of water, sewage or storm-water i) With an internal diameter of 0,36 meters or more or ii) With a peak through put of 120 litres per second or more Excluding where: a) Such facilities or infrastructure are for bulk transportation of water , sewage or storm-water or storm-water drainage inside a road reserve b) Where such construction will occur within urban area but further than 32 metres from a watercourse, measured from the edge of the watercourse.	The water supply pipes from the Ellingham Reservoir to the north-east corner of the site is designed as a 400mm (0,4m) diameter pipe, and runs for a length of well over 1km.

Listing Notice	Regulation	Activity	Reason
GNR 544 of June 2010	11	The construction of: i) canals; ii) channels; iii) bridges; iv) dams; v) weirs; vi) bulk storm-water outlet structures; vii) marinas; viii) jetties exceeding 50m2 in size; ix) slipways exceeding 50m2 in size; x) buildings exceeding 50m2 in size; xi) infrastructure or structures covering 50m2 or more where such construction occurs within a watercourse or within 32 metres of a watercourse, excluding where such construction will occur behind the development setback line.	The following are proposed to be constructed: a) Bridges in 3 areas: 2 over the lower Umzinto River and 1 over the Rocky Bay River b) Bulk storm-water outlet structures c) Detention dams d) Buildings exceeding 50m2 in size e) Infrastructure or structures covering 50m2 or more
GNR 544 of June 2010	12	The construction 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 19 of Notice 545 of 2010.	The storage of treated effluent for agricultural irrigation in storage tanks, dams and reservoirs will exceed 50,000 cubic metres.
GNR 544 of June 2010	16	Construction or earth moving activities in the sea, an estuary, or within the littoral active zone or a distance of 100 metres inland of the high-water mark of the sea or an estuary, whichever is the greater, in respect of i) fixed or floating jetties and slipways; ii) tidal pools; iii) embankments; iv) rock revetments or stabilising structures including stabilising walls; v) buildings of 50m2 or more; or vi) infrastructure covering 50m2 or more. – but excluding a) if such construction or earth moving activities will occur behind a development setback line; or b) where such construction or earth moving activities will occur within existing ports or harbours where the construction or earth moving activities will not increase the development footprint or throughput capacity of the port or harbour; or c) where such construction or earth moving activities is undertaken for purposes of maintenance of the facilities mentioned in (i) – (vi) above, or d) where such construction or earth moving activities is related to the construction of a port or harbour, in which case activity 24 of Notice 545 of 2010 applies.	Buildings of 50m2 or more; or infrastructure covering 50m2 or more; and embankments are proposed within 100 metres of the high-water mark of the sea or an estuary.
GNR 544 of June 2010	18	The infilling or depositing of any material of more than 5m^3 into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock from - i) A watercourse; ii) The sea; iii) The seashore; iv) The littoral active zone, an estuary or a distance of 100 metres inland of the high-	Three bridges will be constructed within the proposed development. A hotel and recreation zone are proposed in the Rocky Bay node within 100m of the high-water mark.

Listing Notice	Regulation	Activity	Reason
		water mark of the sea or an estuary, whichever distance the greater But excluding where such infilling, depositing, dredging, excavation, removal or moving i) Is for maintenance purposes undertaken in accordance with a management plan agreed to by the relevant environmental authority.	Several residential housing villages are proposed, which will impact on fingers of degraded wetlands.
GNR 544 of June 2010	22	The construction of a road, outside urban areas, i) with a reserve wider than 13,5 meters or, ii) where no reserve exists where the road is wider than 8 metres, or 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 Notice 545 of 2010.	Numerous roads with sidewalks/aprons will be built throughout the development, many of which will have a road reserve greater than 13,5m.
GNR 544 of June 2010	23	The transformation of undeveloped, vacant or derelict land to - i) residential, retail, commercial, recreational, industrial or institutional use, inside an urban area, and where the total area to be transformed is 5 hectares or more but less than 20 hectares. ii) residential, retail, commercial, recreational, industrial or institutional use, outside an urban area, and where the total area to be transformed is bigger than 1 hectare but less than 20 hectares.	Refer to Activity 15 below. Should only certain phases of the estate be developed, and not others this could potentially be applicable.
GNR 544 of November 2013	55	A. The construction of facilities for the treatment of effluent, wastewater or sewage with a daily throughput capacity of more than 2,000 cubic metres (kilolitres) but less than 15,000 cubic metres (kilolitres).	A total daily effluent throughput of maximum 3735 cubic metres is proposed.
GNR No. 545 Activities			
GNR 545 of June 2010	15	Physical alteration of undeveloped, vacant or derelict land for residential, retail, commercial, recreational, industrial or institutional use where the total area to be transformed is 20 hectares or more.	The total area proposed to be transformed for the mixed-use development is 314ha.
GNR 545 of June 2010	18	The route determination of roads and design of associated physical infrastructure, including roads that have not yet been built for which routes have been determined before 03 July 2006 and which have not been authorised by a competent authority in terms of the Environmental Impact Assessment Regulations, 2006 or 2009, made under section 24(5) of the Act and published in Government Notice No. R. 385 of 2006, - i) it is a national road as defined in section 40 of the South African National Roads Agency Limited and National Roads Act, 1998 (Act No. 7 of 1998); ii) it is a road administered by a provincial authority; iii) the road reserve is wider than 30 metres; or iv) the road will cater for more than one lane of traffic in both directions.	The development will require the upgrading of the R102 and the R612 to two lanes.
GNR No. 546 Activities			
GNR 546 of June 2010	4	The construction of a road wider than 4 metres with a reserve less than 13,5 metres, ii) outside urban areas, in:	The estate requires the development of several primary roads

Listing Notice	Regulation	Activity	Reason
		(hh) areas seawards of the development setback line or within 1 kilometre from the high water mark of the sea if no such development setback line is determined.	within the proposed estate, from which a network of secondary roads will lead to the various development nodes in the estate. Several of these are positioned within 1km of the high water mark.
GNR 546 of June 2010	6	The construction of resorts, lodges or other tourism accommodation facilities that sleep 15 people or more - ii) outside urban areas, in: (hh) Areas seaward of the development setback line or within 1km from the high water mark if no such development setback line is determined. (ii) Areas on the watercourse side of the development setback line or within 100m from the edge of a watercourse where no such setback line has been determined.	There are three hotel plots proposed for the Rocky Bay node, all of which are proposed within 1km of the high water mark.
GNR 546 of June 2010	12	The clearance of an area of 300m^2 or more of vegetation where 75% or more of the vegetation cover constitutes indigenous vegetation - (a) Within any critically endangered or endangered ecosystem listed in terms of Section 52 of the NEMBA. (c) Within the littoral active zone or 100m inland from the high water mark of the sea in an estuary, whichever distance is greater, excluding where such removal will occur behind the development setback line or erven in urban areas.	The hotel and recreation and entertainment areas are proposed within 100m of the high water mark of the sea, and would require the clearance of indigenous vegetation exceeding 300m^2. Furthermore, a second hotel is proposed within 100m of the Rocky Bay River estuary.
GNR 546 of June 2010	16	The construction of - iii) Buildings with a footprint exceeding 10m2 in size, or; (iv) Infrastructure covering 10m2 or more Where such construction occurs within a watercourse or within 32m of a watercourse, measured from the edge of a watercourse, excluding where such construction will occur behind the development setback line. i) Outside urban areas, in: ii) Areas seawards of the development setback line or within 1km from the high water mark of the sea if no such development setback line is determined.	In many of the more degraded fingers of several of the wetland systems throughout the development, residential development nodes impact on both the wetland and wetland buffers.
GNR 546 of June 2010	19	The widening of a road by more than 4m, or the lengthening of a road by more than 1km. ii) outside urban areas, in: (hh) areas seawards of the development setback line or within 1km from the high	The R102 and R612 will need to be widened to become 2-lanes in each direction. The entire R102 adjacent the development is positioned within 1km

Listing Notice	Regulation	Activity	Reason
		water mark of the sea if no such development setback line is determined. (ii) areas on the watercourse side of the development setback line or within 100m from the edge of a watercourse where no such setback line has been determined.	of the high water mark.

8.2 National Environmental Management: Waste Act 2008 (Act No. 59 of 2008)

For reasons explained in *Section 3.2.2* above, the Applicant desires to include one effluent treatment and disposal options in the proposal, namely a private WWTW.

Previously, under the 2010 NEMA regulations, such an activity would require a Waste Management Licence Application. The 2010 NEMA Regulations were subsequently amended on 29 November 2013 to account for this activity in the Amendment Government Notice No. R. 922, with the inclusion of Activities 55A and 55B. The 2014 Regulations have now dealt with this activity in Activity 25 of Government Notice No. R 983.

8.3 National Water Act 1998 (Act No. 36 of 1998)

The following activities associated with the proposed development are considered water uses under Section 21 of the National Water Act:

- Construction of sewer or water pipe bridges across any watercourses.
- Construction of road bridges, causeways or culvert crossings across any watercourses.
- Construction of dams within watercourses.
- The discharge of treated effluent to watercourses.
- The disposal of treated effluent to land for irrigation purposes.

To undertake these activities, a water use license is required from the Department of Water Affairs. This can either be applied for pre or post environmental authorization.

8.4 National Forests Act 1998 (Act No. 84 of 2008)

Due to the extensive fragments of coastal forest onsite, it is expected that a number of trees onsite are protected under the National Forests Act. Under the Act, the applicant is required to apply for a permit from the Department of Forestry and Fisheries to remove and/or relocate any protected species.

8.5 National Environmental Management: Biodiversity Act 2004 (Act No. 10 of 2004)

Due to the presence of coastal forest, dune thicket and grassland onsite, it is highly likely that a number of plants onsite are protected under the Biodiversity Act. Under the Act, the applicant is required to apply for a permit from Ezemvelo KZN Wildlife to remove and/or relocate any protected species.

8.6 KwaZulu-Natal Nature Conservation Management Amendment Act 1999 (Act No. 5 of 1999)

Due to the presence of coastal forest, dune thicket and grassland onsite, it is highly likely that a number of plants onsite are protected under the Nature Conservation Management Amendment Act. Under the Act, the applicant is required to apply for a permit from Ezemvelo KZN Wildlife to remove and/or relocate any protected species.

8.7 KwaZulu-Natal Nature Conservation Ordinance 15 of 1974

Due to the presence of coastal forest, dune thicket and grassland onsite, it is highly likely that a number of plants onsite are protected under the Ordinance. Under the Ordinance, the applicant is required to apply for a permit from Ezemvelo KZN Wildlife to remove and/or relocate this species.

8.8 The National Heritage Resources Act 1999 (Act No. 25 of 1999)

Under the Act, a destruction permit from Amafa will need to be acquired for the destruction of any heritage artefacts found onsite prior to undertaking construction activities.

This is in accordance with the recommendations of the Heritage Impact Assessment conducted by eThembeni Cultural Heritage on 30 Jun 2009.

8.9 Integrated Coastal Zone Management Act 2008 (Act No. 24 of 2008)

With the enforcement of the ICM Act in December 2009, the ICM Act has been legally entrenched as the preferred vehicle for the promotion of sustainable coastal development in South Africa, and therefore provides the overarching legal framework for proposed development and decision-making in the coastal zone. Among the requirements of the ICM Act are considerations of factors such as:

- cumulative environmental impacts,
- the potential risk to the effects of sea-level rise, pollution and coastal erosion, and
- issues pertaining to coastal access.

The proposed development will need to show that it has taken the above-listed factors into consideration.

The Coastal Impact Assessment was conducted by RoyalHaskoning DHV in November 2012.

9 APPROACH TO UNDERTAKING THE STUDY

9.1 Authority Consultation

The KwaZulu-Natal Department of Economic Development, Tourism and Environmental Affairs (EDTEA) are the determining authority on this application.

The Rorqual Estate Development application was originally submitted in accordance with the EIA Regulations (2006) published in GN No. 385, No. 386 and No. 387 in terms of Section 24 (5) of the National Environmental Management Act, 1998 (Act No 107 of 1998) as amended as well as with the relevant legislation and guidelines mentioned above.

The 2006 EIA Regulations had different listed activities. These regulations were superseded by a new set of Regulations dated 2010. As a result, the application was subsequently withdrawn and submitted under the 2010 EIA Regulations. The 2010 EIA regulations were amended on the 29 November 2013. Subsequently the 2010 EIA Regulations have been superseded by a new set of Regulations dated 2014.

Further discussions will be held with KZN EDTEA to address pertinent matters.

The following consultation has taken place with EDTEA:

- The Final Scoping Report and Plan of Study was submitted to EDTEA on 6 July 2012, acknowledged on and approved on 2 August 2012.
- A record of all authority consultation is included within **Appendix F**.
- Consultation with other relevant authorities was and is also being undertaken via meetings and telephonic consultation in order to actively engage them and provide them with information and gain their feedback.

9.2 Environmental Scoping Study

The Scoping Study identified the potential positive and negative impacts associated with the proposed development. The Scoping Study also identified the studies, which were required to be undertaken as part of the EIA stage of the project. The Final Scoping Report was made available for public review from 11 April 2012 to 2 May 2012. The amended Final Scoping Report was submitted to DAEA&RD on 6 July 2012 and approved on 2 August 2012.

The following studies were identified in the Scoping Phase, to be commissioned in the EIA Phase:

- Geotechnical Investigation
- Wetland Delineation and Functional Assessment
- Estuarine Impact Assessment
- Riverine Impact Assessment
- Floodline Delineation
- Vegetation and Ecological Impact Assessment
- Agricultural Potential Assessment
- Agricultural Irrigation Feasibility Assessment and Design and Management Plan of WWTW Site
- Coastal Zone Impact Assessment
- Heritage Impact Assessment
- Market Feasibility and Socio-economic Impact Assessment
- Traffic Impact Assessment
- Visual Impact Assessment

9.3 Environmental Impact Report

The EIR Phase of the project has focused on consulting with Interested and / or Affected Parties (I&APs) as well as conducting specialist studies to address the potential impacts identified during the Scoping Phase.

The purpose of the EIR is to:

- Address issues that have been raised during the scoping phase;
- Assess alternatives to the proposed activity in a comparative manner;
- Assess all identified impacts and determine the significance of each impact; and
- Formulate mitigation measures.

The studies which were required to be undertaken as part of the EIA stage of the project are listed above under Section 9.2. The following further studies were undertaken during the EIR Phase:

- Baseline Water Quality and Soil Phosphate Sorption Capacity Assessment
- Water Quality & Botanical Assessment
- Faunal Assessment
- Conservation Management Plan
- *Cyrtanthus mackenii* Restoration Plan
- Revegetation Plan
- Engineering Services Report
- Preliminary Geohydrological Assessment of WWTW Site
- Town Planning Layout

The Draft EIR will be made available for public review from 18 May 2015 to 28 May 2015.

10 NEED AND DESIRABILITY

10.1 Vision for the Area

Rorqual Estate will be a mixed use "eco-focused" development of a scale that will inject major investment into the area, achieve economic development, vastly expand the tourism industry in this part of the country and lead the way towards integrated and sustainable development.

The Vision Statement for the development is:

"The Rorqual Estate will optimise regional development and co-ordinated service opportunities while securing and integrating its natural features to enhance their intrinsic value as well as their value to the development, in terms of property values and ecosystem services."

Source: Preliminary Conservation Management Plan, 6 August 2013

It is the proponent's intention to develop a project, which will, in time:

- Establish a commercial, industrial, residential, leisure and tourism destination of the properties concerned which combines a range of facilities that will afford people a first class experience in wellness, holidaying, lifestyle and recreation;
- Add value – economically, socially and environmentally to the sub-region and the site and
- Achieve responsible and sustainable development on the site.

The site is well located and easily accessible in terms of weekend getaways from both Durban and Pietermaritzburg.

10.2 Consideration of Planning Framework

The strategic position of the R612 gave rise to the identification of a proposed development corridor in terms of the Umdoni SDF dated May 2009, linking Park Rynie and Umzinto/Umzinto North. The Local Area Plan for the Park Rynie/Umzinto Development Corridor prepared by the municipality examines the corridor in more detail and proposes a number of development possibilities in terms of a Concept Plan. The documents were taken into consideration in the preparation of the Draft Framework Plan as prepared by Gibb.

The following general objectives and guidelines for development along the corridor are proposed:

- The development potential which exists around the interchange should be optimized
- Land on the seaward side of the N2 Freeway should be reserved for uses, which require close proximity to the beach.
- To achieve integration of land uses.
- To provide employment opportunities in close proximity to existing concentrations of people.
- The creation of continuous open space systems as opposed to discreet plots of open space and the integration of such a system with residential areas.
- To achieve integration of different land uses and the multi-use of strategically located land parcels.

10.3 The Concept Development Plan

The concept development plan was shaped by a number of development informants (i.e. existing land use, road network/ hierarchy, etc.). The analysis of these informants, together with suggestions on the provision of certain facilities provided the basic elements of the concept plan.

The land at the intersection of the N2 and the R612 is ideally located for the development of a multi-functional regional node that can act as a catalyst for corridor development to Umzinto. Furthermore this locality offers high visibility and excellent accessibility.

To achieve meaningful investment and development within the area, projects of scale must be undertaken, which is exactly what the Rorqual Estate development promotes. It is a large scale project, combining leisure, tourism, residential, business and industrial uses in a specific manner to create vibrancy, energy, excitement, activity and density.

The proposed land uses have been specifically identified and typified to create an urban form with a leisure residential environment. The scale and intensity of the development is needed to create a landmark for opportunity and investment, in the Park Rynie area.

The proposed development will undoubtedly trigger spin-off effects, which will:

- Increase property values;
- Increase the municipal rates base;
- Provide impetus for other small scale developments;
- Unify the Park Rynie area into a comprehensive destination;
- Provide employment opportunities;
- Promote the Park Rynie area as a competitive destination;
- Enhance environmental awareness; and
- Link the coastal activities with the hinterland.

The proposed development is therefore desirable in that it will bring about development in an area, which will allow the hinterland to share in the benefits of the development. The proposed development can be an engine of growth, capable of rejuvenating other sectors of the economy in the Park Rynie area.

10.4 The Land Allocation Plan

Informed by the site interpretation, a land allocation plan was compiled, which divides the site into smaller development pockets and defines certain development parameters.

There are three core areas, namely:

- Area of land at the intersection of the N2 Freeway and the R612,
- Ocean front, and
- Wetlands and the environmentally sensitive areas.

The core areas will be retained and protected in their natural form and the design will not infringe directly on the natural habitats, which exist, but will only extract visual benefits. The three core areas have informed the development of the Land Allocation Plan. The Land Allocation Plan shows the creation of approximately 5 residential pockets enclosed by or in contact with the natural open space system. The intention is evidently to entrench contact with the natural environment as a means to strengthen the estates theme. The residential pockets will each have their own theme and will have different densities allowing different characteristics to emerge.

The land allocation plan shows that the development of the site will be centred on 5 components being the:

- Multi-Functional Node (mixed use commercial area) at the intersection of the N2 Freeway and R612;
- Heartland – on the seashore (tourism development)
- Residential Developments
- The High Street (mixed use residential and retail) and
- Open Space System

10.5 Alignment with Spatial Development Planning

The proposed project is in line with strategic land use planning for the area, according to the following plans:

- Ugu District Municipality – Environmental Management Framework – Final Inception Report, dated December 2012.
- Ugu District Municipality – Integrated Development Plan 2007/8 – 2011/12 as revised in the 2010/11 IDP Review.
- Umdoni Municipality Spatial Development Framework: Environmental Assessment and Management Framework, dated May 2009.

10.6 Environmental Reasons

10.6.1 Present Use of Property

The estate development property is 539.88ha, of which the infrastructural footprint amounts to 314.66ha. The remainder of the site, comprising 225.22ha, will largely be rehabilitated and restored to better ecological functionality and conservation.

The property is considered to offer low financial feasibility as agricultural land with low crop yields.

The only possible alternative land-uses to infrastructural development (homes, hotels, commercial space etc.) are conservation, forestry or livestock grazing, which are less financially viable than sugarcane farming.

10.6.2 Proposed Impacts

The development is located in a large existing sugar cane farm operation, which includes two rivers and estuaries, a multitude of wetlands, segments of critically endangered grassland and forest patches, and an 850m coastal stretch.

Below is a description of the possible impacts that could occur:

10.6.2.1 Impacts on Geology and Soils

The geology and soils of the site are stable and capable for use for the proposed mixed-use development.

The watercourse soils must be preserved and not be encroached upon.

The Granitic Gneiss rocks are unsuitable for use as concrete aggregate.

To prevent the potential collapse settlement of the sandy and clayey subsoils that occur beneath this site, it is recommended that ground improvement for foundations be carried out or deep foundations extended into the bedrock.

10.6.2.2 Impact on the Protected or Conserved Area

Not applicable, as there are none.

10.6.2.3 Impact on Drainage & Wetlands

A total of 63 wetland units are located on the development site. The proposed development will lead to the restoration of most of the wetlands on-site to a conserved state, following the implementation of a wetland rehabilitation strategy. Twelve of the wetland units, which are

wetland fingers to the main systems, will be impacted on by the development, but will be designated as 'building restriction areas for watercourses'.

Before the wetland rehabilitation process is undertaken, most of the wetlands and drainage areas will be impacted on by development operations, as certain watercourse crossings and stormwater management structures will be constructed, and the development of the residential, business or commercial stands will result in siltation from stormwater runoff. The potential for pollution of the drainage and wetland zones by contractor activities also exists. Although direct mechanical impact on the drainage and wetland systems is unlikely, this is also a possibility.

Those that are proposed to be impacted on somewhat by construction operations will experience a greater degree of disturbance, which will threaten their functionality.

After the construction phase and during the operational phase, the implementation of the wetland rehabilitation strategy will greatly improve the biodiversity and ecological functioning of the drainage and wetland areas to a level beyond which they presently function. The continued monitoring and conservation thereof will likely improve the integrity of these wetlands systems throughout the estate.

10.6.2.4 Impacts on Estuaries and Floodplains

Due to the fact that river banks and floodplains comprise areas that are subject to regular disturbance, and that these systems allow for continuous travel and transportation of seeds and vegetative material, they are often invaded by alien species as is the case on this site.

Problem plants, which suppress and diminish indigenous plant diversity in this area include:

- *Arundo donax* (Spanish Reed)
- *Stenotaphrum secundatum* (Buffalo Grass)

A Red Data Listed plant growing in similar habitat along the river is *Cyrtanthus mackenii* var. *mackenii* (Ifafa Lily). Although it is known in cultivation, it is a rare plant in the wild. Approximately 10 plants were noted, which is a small number, and without intervention it is possible the species could disappear from the site. As such, a Restoration Plan has been drawn up for this.

10.6.2.5 Impacts on the Coastal Zone

A portion of the development is sited on a strip of coastal property between the beach and the railway track, with additional development proposed to be sited between the railway track and the R102, adjacent to Mzimayi Estuary.

There should be no negative effect on the Aliwal Shoal Marine Protected Area through the increased recreational use of the area should effective management, compliance and enforcement of the management plan take place or continue. Increased monitoring will need to be conducted to ensure compliance with controls and will negate any negative impact on the marine environment.

The proposed development is situated inland of a rocky promontory with a rocky beach overlain with a thin veneer of beach sand. A study indicated that the site where a rocky shoreline is currently exposed is an area of low risk for sea level rise impacts.

There are however a few caravan sites that are vulnerable to wave action due to an intact dune system not being in place. In this location the situation can be addressed by the retreat of the proposed development inland, enabling a dune buffer to be placed between the development and the sea. Along portions of the site, a narrow green dune belt exists, and it is recommended that this be retained as a safety buffer and to serve as a natural soft edge to assist in the reduction of salt spray and windblown sand into the development.

The other impact on the coastal zone will be the significant increase in beach-goers along the immediate shoreline, which will result in increased recreational activity and fishing in the immediate area.

10.6.2.6 Impacts on Vegetation and Ecology

Providing the necessary stipulated buffer zones are introduced and maintained, in many respects the vegetation and ecology will be safeguarded. Certain ecological systems, especially the aquatic ones, will be altered, in some respects for their benefit and in other respects to their detriment.

- **Grassland** – both the primary and secondary grasslands will receive greater levels of protection and will undergo restoration and maintained conservation thereafter.

- **Northern coastal forest** – the integrity of this endangered ecosystem will be safeguarded, and the only possible negative effects will be the increase in dust during the construction phase and the increase in human activity through the forest in the form of residents creating walking, running and mountain-biking trails during the operational phase.

- **Swamp forest** – the integrity of this ecosystem will also be safeguarded, and will be allowed to mature to a more climax state.

- **Seral forest** – the integrity of this ecosystem will also be safeguarded, and will be allowed to mature to a more climax state.

- **Coastal zone and beachfront** – this zone will be impacted upon from the change in water quality entering the system from the estuaries, the increase in bulk infrastructure on the border of the admiralty reserve and estuaries, and the increase in human utilisation of the beach and littoral zone environments. As no sea outfalls are proposed, the coastal zone will not be threatened by this detrimental activity.

- **Wetlands** – in general, the impact on the wetlands in the construction phase will be negative, in that several wetland fingers will be directly impacted upon, and the increase in stormwater runoff and its resulting siltation will affect these systems negatively. In addition, the possibility of pollution and hazardous substances entering this system also exists. However, once these wetlands are revegetated, restored and conserved in the operational phase, their overall ecosystem functioning and value will be greatly enhanced as the integrity of the systems are restored on a permanent basis.

- **Floodplain and Estuaries** – The floodplains and estuaries will likely experience both positive and negative changes. The negative changes being the increase in channelled water flow and velocities from the stormwater management infrastructure, and the probability of pollutants to enter these systems. The positive changes being that adequate restored buffer zones from current monoculture to more natural vegetation will be instituted, which will safeguard these environments; the watercourses which create these systems will be restored and enhanced; and agriculture chemicals will be removed from these systems.

- **Rivers** – the rivers will experience much the same impacts as the wetlands discussed above. A futher beneficial aspect will be the removal of eucalyptus species from the river banks and the restoration of the red data plant species, *Cyrtanthus mackenii* (Ifafa Lily),

- **Dune thicket** – the dune thicket will be maintained. The potential benefits to this system will be the removal of invasive alien plant species. The negative effects will be the influence of a larger built environment adjacent the admiralty zone at the Rocky Bay site.

- **Woody vegetation with *Eucalyptus* and other invasive alien trees** – should invasive alien species management be effectively implemented and continued monitoring occurs, as required by both the revegetation strategy and the conservation management plan,

this ecosystem will fortunately benefit greatly, and a woodland or forest environment of greater integrity and enhanced biodiversity will be the result,

- ***Casuarina* trees and other aliens with indigenous** – once again, should invasive alien species management be effectively implemented and continued monitoring occurs, as required by both the revegetation strategy and the conservation management plan, this ecosystem will fortunately benefit greatly, and an ecosystem of greater integrity and enhanced biodiversity will be the result. It is recommended that the *Casuarina* trees are not maintained for their windbreak benefits, and an indigenous solution is implemented instead.

10.6.2.7 Impacts on Fauna

The reduction in the availability of natural habitat on the one hand will limit the free range of movement, and the home range sizes of many faunal species on site. Furthermore, the proposed impacts on the watercourses will affect the environment in which certain aquatic species and hygrophilus vegetation dependent species exist, and these species will be forced to adapt. Certain faunal species that have adapted well to living in caneland environments, such as bushpigs, canerats, and certain snake and bird species, will suffer from the removal of sugarcane from the system.

On the other hand, most faunal species populations will be positively impacted from:

- the restoration of the integrity of certain ecologically important ecosystems
- the development of high value ecological corridors
- the conversion of monoculture land to more biodiverse ecosystems
- the removal of agricultural pesticides and herbicides from the ecosystem
- the proposed interventions are likely to lead to an increase in faunal biodiversity and the population sizes of several existing species, as a more biodiverse environment is developed
- the introduction of new faunal species, particularly avifaunal, amphibian and invertebrate species to the environment

10.6.2.8 Impacts on Agriculture

The proposed development, should the agricultural practices remain as current, will lead to a total loss of agriculture on the development site itself, amounting to 9% of the sugarcane supply to the local mill.

The impact of a low to medium density housing development on the immediate surrounding agricultural areas would be beneficial in that it will create a new local consumer market for create other perishable crops, socio-economic upliftment through job creation and skills development, the increase in value of surrounding agricultural properties, and the effluent from the development could be distributed to the remaining portion of Ellingham Estate and utilized for high value cash crops.

It is expected that the increased irrigation will lead to greater total farm output of the remaining sugarcane land, and the net result will be that the output will remain largely unchanged.

10.6.3 Ecological Costs and Benefits

The potential ecological costs and benefits are:

10.6.3.1 Costs

- Potential further damage to watercourses from larger road and culvert interventions than what currently exist, as well as stormwater interventions
- Stormwater impacts resulting in greater silt deposits and changes in the character of watercourses from channeled and greater water velocities

- Direct permanent impact on numerous wetland fingers
- Loss of vegetated land (natural habitat) to permanent infrastructure, and threat of fragmented natural environments
- Loss of free movement by faunal species on the site, which will now be restricted to conserved zones and ecological linkages
- Potential pollution of the environment from construction and operational waste, wastewater and hazardous material spills
- Potential increase in the threats to critically endangered forest, primary grassland and swamp forest
- Disturbance of the environment resulting in encroachment of invasive alien species
- Greater bulk infrastructural constructions within the coastal zone and near estuaries
- An increase in permanent human activity into the environment
- Increase in the consumption and use of water
- Increase in dust into the air during the construction phase
- Increase in odours into the air from the WWTW
- Increase in noise pollution into the environment during both construction and operational phases
- A visual change to the landscape on both an aesthetic and light pollution level.

10.6.3.2 Benefits

- Restoration of wetland, riparian, grassland, forest and swamp forest buffer areas to greater levels of ecological integrity, value and functioning through the implementation of an ongoing conservation management plan, especially in respect of the greatly altered wetlands by applying the rehabilitation strategy
- The revegetation of previously devegetated or disturbed natural habitats
- The conversion of a largely monoculture dominated environment into a more biodiverse environment with a strong indigenous emphasis
- Protection and restoration of the population of the red data species, *Cyrtanthus mackenii* subsp. *mackenii* (Ifafa Lily)
- Creation of indigenous ecological linkages of better value and quality than what currently exist
- Formalised protection of the critically endangered and sensitive habitats, including critically endangered forest, primary grassland and swamp forest
- Removal of agricultural pesticides from the environment.

10.7 Socio-Economic Reasons

10.7.1 Market & Socio-Economic Report

A Market and Socio-economic Impact Assessment has been undertaken by Urban-Econ (dated 29 May 2013 and attached as **Appendix E2**).

It has been shown that although Umdoni Local Municipality is the smallest municipality in the Ugu District, it is the second biggest contributor economy of the district. This indicates the important role that this municipality plays in the district. Growth and development in this municipality is important for the growth and development of the district as a whole.

The data also reveal that there is a demand for housing, retail and other services that stems from medium, medium-high and high-income households. Population growth trends, employment trends, the increase in the annual household income of households, etc. are some of the indicators that show that demand for housing, retail and other services are increasing in Umdoni and the greater Ugu area.

Demand for the different housing components has been shown to exist in varying degrees. The table below gives a summary of the cumulative demand for the different components of the Rorqual Development. The figures that are shown below represent cumulative demand for the components of the Rorqual Development.

Table 5: Market and Socio-economic Demand for Property in the Estate

Description	5 Years	10 Years	15 Years
Total Housing Demand Units	1,482 units	4,224 units	5,577 units
Total Commercial Demand (m^2)	2,267 m2	7,637 m2	9,898 m2
Total Retail Demand (m^2)	6,326 m2	13,676 m2	18,498 m2

Considering the scale of the development and the phased approach taken to the implementation of the development components, the Rorqual development should not affect the overall feasibility of existing and proposed developments in the present or future. Rather it is anticipated that the uptake rates of the other developments will occur more slowly, as demand is shared across a wider base, but that their overall feasibility will not be affected.

It has been shown that sugar cane production in the Ugu District municipality and South Africa in general is decreasing. This decrease in production was linked to decreased rainfall patterns leading to decreasing sugar cane yields as well as cheap sugar imports. It was shown that only a negligible amount of the decline in sugar production is linked to agricultural land being repurposed for other uses. Additionally it was shown that if the entire Rorqual development is developed, no net negative social impacts will occur as the current occupants living on Rorqual have agreed to be relocated to an alternative site. The decrease in sugar cane production will only account for at most 1.3% of total sugar cane production in the district, not affecting the viability of the sugar industry in the district significantly. However, the new irrigation system should boost production, therefore the net effect will be even less.

The report concludes:

- Local trend data indicates that there is a demand for a housing, retail and other services, which stems from medium-low, medium-high and high income households being targeted by the development.
- This indicates that there is a need for a mixed-use development in Park Rynie and the surrounding areas. Due to the relatively large scale of the development it is proposed that the Rorqual Estate be phased in over time, according to market conditions and projected trends. It is therefore recommended that a phased approach be adopted for this development for the next 5, 10 and 15 years based on market conditions.
- There is a demand for housing, retail and other services through indicators such as population growth trends, employment trends and the increase in the annual household income of households.
- The development will not impact on the feasibility of existing and other proposed developments in the present or near future.
- Demand for the different housing components has been shown to exist in varying degrees.
- Sugar cane production is furthermore decreasing as a result of decreasing rainfall patterns, decreasing sugar cane yields as well as cheap sugar imports. It was shown that only a negligible amount of the decline in sugar production is linked to agricultural land being repurposed for other uses.
- The current occupants living on Rorqual have agreed to relocate to an alternative site and there will thus be non-net negative social impact.

The cumulative impact of the development is:

- The economic impacts of the fully completed Rorqual development by 2027 is based on a CAPEX injection of R3.7 billion.
- In total at the end of 2027, an estimated additional R9 billion will be generated in gross value added or GGP into the region as a result of the capital expenditure of the proposed development. Of this, R5 billion will be directly added and a further R4 billion will be induced investment.
- The capital expenditure of the proposed development will lead to the direct expansion of business sales (production) by R1.1 billion at the end of 2027. There is significant potential for the proposed development to use local suppliers so as to encourage the development of local business. It is expected that the increase in direct business sales will have positive spin-off effects on the supporting businesses, for example, sub-contractors and suppliers of

construction equipment and materials. A total of R2.5 billion in new business sales will be generated as a result of the indirect impact of the developments capital expenditure.

- The modelling suggests that a total of 5,483 temporary employment opportunities that will be created as a result of the proposed development. When calculating employment figures in the input-output model, the model converts total man hours into jobs or employment opportunities. Therefore, the development generates 5,483 full time employment opportunities over the construction period. However, it must be noted that the construction period of the development will require a number contractors to complete the development.
- Additional income generated as a result of the construction phase of the development is totalled at just over R445 million at the end of 2027. Direct wages (derived from on-site jobs) is estimated at R197 million. Many of these jobs are likely to be filled by local inhabitants due to them being the closest source of labour and their skills matching the job requirements (i.e. unskilled jobs). This will significantly increase their disposable incomes. Additional income of R248 million is likely to be generated through indirect mechanisms.

10.7.2 Town Planning Report

Furthermore, the project town planner from GIBB has provided an opinion on the desirability of the project in their Draft Framework Plan dated February 2011, attached as **Appendix C4**. The town planner's statements regarding the desirability of the proposed development are summarised below:

General Locality
The site is ideally situated along the N2 Freeway, which links the site to Durban and the R613, which in turn links the site to the hinterland. It therefore offers a unique opportunity to be developed as a node.

The site is eminently suited for higher intensity use due to its location. It is envisaged that the development will be compatible with the surrounding environment in terms of the current pressures in the area, and that the proposed uses will ensure that the site is used to a higher potential.

Development proposals for the area should be encouraged in order to maximize the opportunities provided by the site, such as locality, topography etc. Furthermore, the proposed development will contribute to the future upliftment of both the Region and Sub-Region.

The development of the site will not only provide short-term employment opportunities due to construction, but also long-term employment opportunities for the local communities, which will assist in addressing the current unemployment concerns within the Region.

Environmental Sensitivity
Preliminary work regarding the environmental sensitivity of the site was done by Environmental Consultants with the outcome being that the site has various environmental sensitivity areas that need to be protected. The environmentally sensitive areas have been taken into consideration during the preparation of the overall Framework Plan and informed the proposed layout plan.

Engineering Services are Available
The project Engineers have conducted preliminary work regarding the availability of services.

Council is Pro Development
The proposed development is in line with the existing Regional Spatial Development Framework for Umdoni Municipality. The council proposes that a base density of 10 units per hectare be applied over the total area of the site (539.88ha), which would result in 5,399 units. The current proposal is for 4,741 residential units together with several other land uses, which is in line with the base density of 10 units per hectare as proposed by the council.

The Framework Plan identified various development pockets and opportunities, views the site in its wider context, recognises the importance of the individual projects and gives a broad overview of the proposed development.

11 DESCRIPTION OF THE AFFECTED BIOPHYSICAL ENVIRONMENT

11.1 Climate

Reference is made to the Bioregion Units of Southern Africa compiled by Mucina and Rutherford (2006). The proposed sites are located within the 'KwaZulu-Natal Coastal Belt' Bioregion Unit (CB3), a coastal strip along the KwaZulu-Natal coast extending from Mtunzini in the north to Port Edward in the south at altitudes ranging from 20 to 450m. The Bioregion Unit has a mean annual temperature of 19.6ºC, mean annual rainfall of approximately 989mm and mean annual potential evaporation of 1659mm (Mucina and Rutherford, 2006). The area is a summer rainfall region with some rainfall occurring in winter associated with the procession of frontal systems along the east coast (Mucina and Rutherford, 2006).

The Proposed Development Area (PDA) is located in the Moist Coastal Forest, Thorn and Palm Veld region of KwaZulu-Natal (KZN) and has, in terms of the Bio Resource Units (BRU) of KZN, a climate that slightly limits agricultural production (Camp, 1995). The Ellingham Estate property has a summer rainfall regime with approximately 59% of the Mean Annual Precipitation (MAP) falling between November and March. The MAP for the Park Rynie area is 996 mm (Camp, 1995).

Temperatures for this region are highest in January and February (+/- 27ºC) whilst June and July are the coldest (+/- 22ºC). Evaporation rates estimated from an A-Pan mimic temperature with the highest readings occurring in mid-summer and the lowest in mid-winter. The PDA is located along the warm, humid coastal belt and there are no limitations due to low temperatures or frost thus the climate is suitable for most crops including sub-tropical crops. Due to the terrain and proximity to the coast these areas experience windy conditions, predominantly from the NE and SW.

11.2 Topography

The topography of the site is highly undulating, with numerous elevated hilltops and ridges with moderately to steeply sloping hillsides interspersed with gently sloping to incised drainage lines. Elevations vary from a maximum of approximately 97.5m MSL to 0m MSL at the coastline.

11.3 Geology and Soils

A preliminary Geotechnical Investigation of the Rorqual Estate site was undertaken in two sections; a Geotechnical Investigation East of the N3 Highway, attached as **Appendix E3** and a Geotechnical Investigation of the NW Quadrant and WWTW site, attached as **Appendix E4**, and undertaken by Davies Lynn & Partners (Pty) Ltd dated May 2009. The findings of the investigation regarding the status quo of the site are discussed below.

11.3.1 Bedrock

The geology of the area is complex. In the southern sector of the site the area is underlain by Granite Gneiss, Granulites and Mafic Suite comprising Charnochite and Amphibolite of the Natal Structural and Metamorphic Province Suite of Rocks. Natal Group Sandstone occurs beneath the central and northern sectors of the site and is in faulted contact with the Granite Gneiss within the central portion.

The Natal Group Sandstone generally comprises a pinkish brown, fine to medium grained sandstone with intercalated maroonish pink, micaceous arkosic horizons and minor maroon siltstone horizons. The sandstone is well bedded with bedding thickness generally in the range of 200mm to 1000mm. In its un-weathered state, the sandstone is a medium hard to very hard rock becoming a soft, friable rock with increased weathering.

11.3.2 Soils

The derived soils capping the granitic basement rocks are relatively thin beneath the elevated hilltop areas, thickening slightly beneath convex slopes and becoming deeper along the concave valley head and valley bottom areas.

The residual soils often comprise fine to coarse grained silty sands overlying weathered granite gneiss. The residual soil profile becomes a reddish and yellowish brown gravelly silty and sandy clay that can extend to depths exceeding 3.0 m below ground level.

Residual soils developed following decomposition of the parent mafic granulite and politic schists rock are moderate brown to reddish brown to medium grey, firm to stiff, often fissured, fine gravelly, sandy silty clay. They vary in thickness, sparsely developed on the hilltop areas and attaining thickness in excess of 2.0 m beneath some hillsides and in the valley head and valley bottom regions.

On the Natal Group Sandstone soil cover is characteristically sandy. The soil cover on hilltops and hillsides is generally shallow. Soil thickness increases to between about 2.0 and 4.0 m in which a residual sandy clay horizon is developed between the sandy topsoil and the underlying bedrock. Characteristics of the sands encountered in the sandy soils derived from the Natal Group Sandstone are; uniform rounded fine grained sand with slight silt content, very loose to loose voided structure exhibiting high collapse potential, non-cohesive, moderate to high permeability and highly erodible.

The Berea Formation comprises sub-soils of Aeolian origin. The subsoil profile consists of topsoil overlying loose sands, clayey sands and sandy clays. A layer of poorly sorted clays, coarse sands and scattered gravels/boulders often mark the base of the Berea Formations. Beneath the Ellingham Site the Basal Berea Red layer is encountered on former wave cut platforms in the underlying bedrock formations. Top soil was observed to extend to depths of between 0.1m and 0.7m below existing ground levels. It is typically described as dry, orange brown to moderate brown to reddish brown to brownish grey, loose, locally very slightly clayey, silty sand. The upper sandy portions of the Berea Formation ranged between 0.3m to greater than 2.3m in thickness and is typically described as Silty Sand and are known to exhibit moderate to severe collapse potential. The lower clayey portions of the Berea Formation ranged between 0.4m and greater than 4m in thickness. These sub-soils are typically described as sandy clay. The base of the Berea Formation comprised typically sandy clay often with scattered rounded pebbles/cobbles and boulders with inclusions of sand and or silt.

The Quaternary Alluvium comprises materials deposited by alluvial action and therefore these materials are typically variable in nature and generally restricted to the floodplains. Within the larger stream basins un-weathered Natal Group Sandstone or Granite Gneiss is exposed at surface. Topsoil which generally overlies the alluvium was observed to extend to depths of between 0.2m and 0.7m below ground levels. Beneath the topsoil, alluvium was recorded to depths of between 0.5m and greater than 3.0m below ground levels.

Groundwater:
Shallow groundwater seepage activity was confined within the narrow drainage lines and generally not encountered in the upper high lying areas. However, in the north-eastern sector of the site storm-water has been channelled from the existing commercial hub and discharges onto the site along the northern and north-eastern boundary. Shallow seepage activity was found on the seaward facing slope on this portion of the site.

Stability:
Following investigation it is evident that most of the land on which development is proposed is stable and suitable for development. However, certain areas have been classified as potentially unstable. These areas are generally restricted to the valley head zones and occur within the hillside mid-slopes and are characteristically poorly drained with steep to moderate slopes. Therefore, it is provisionally recommended that a detailed slope stability assessment be carried out to determine the stability measures required to ensure continued stability. Consequently, stability analysis associated with individual developments will be a requirement in these areas.

In addition to this, good storm-water management is considered essential to long term stability.

Development practices to maintain stability include:

- Careful planning of the development to avoid large cuts and fills and ensure good site drainage;
- Storm-water control facilities such as retention structures and interceptors to reduce concentration of overland flow and infiltration of excess water;
- Suitable subsoil drainage measures, especially in the seaward facing dunal landform in the north-eastern sector, to lower the perched groundwater seepage that occurs beneath the slopes.

Excavatability:
The depths to which the inspection pits were excavated during inspection give a good indication of the depths to which excavations with a TLB or similar plant can be achieved with ease. The classes of excavation which should be expected and catered for during excavations into the various materials are discussed below.

The topsoil, residual and completely weathered materials, colluviums and Berea Formation are considered to classify as soft excavation in terms of SABS 1200 DA criteria. Sidewalls of excavations within the loose Berea Formation sands are prone to caving in. Therefore, care should be taken to ensure safety of workers in trenches greater than 1.3m depth. Excavations within highly to medium weathered Natal Ground Sandstone and Granite Gneiss bedrock are expected to classify as intermediate to hard and as a result allowances for heavy ripping and/or blasting are recommended in these instances. Where excavations within the Natal Group Sandstone and Granite Gneiss geological areas exceeds 3.5m in height, seismic testing is recommended to assess the excavatability of in-situ materials.

11.3.3 Conclusions

Characterization of the general geology and subsoil conditions has been undertaken. Confirmation of the geotechnical characteristics of the major subsoil materials has been obtained through profiling of inspection pits, laboratory testing and our knowledge of the area. The site is considered to be developable and whilst no potentially unstable areas appear to occur on this site, valleyhead areas may become potentially unstable should injudicious development take place and therefore require detailed investigation where development in these areas is considered. The ease of development across the site is related to the landforms and underlying geology. In general the most favourable areas for development are the gently sloping hillsides and hilltop areas which comprise approximately 30 per cent of the area investigated. Steeper slopes provide moderate development potential requiring more extensive earthworks and more elaborate founding measures.

The subsoil materials encountered necessitate that care is exercised in the use of the range of in-situ materials to cater for potential movement associated with consolidation of clayey soils and settlement of fills. Similarly, precautions are required during construction in material selection and placement within platforms ensuring optimum moisture levels and compaction densities.

Earthworks requiring cut to fill platforms are likely to be prevalent across much of the area. Preference should be given to locating structures in the cut portion of the layout to reduce costs associated with foundation construction wherever possible.

For single storey structures the option of either a stiffened reinforced concrete (RC) raft or RC strip footings/ground beam foundation to Engineer's design is recommended to cater for the range in prevailing subsoil conditions. To counteract the effects of potentially collapsible clays and differential conditions arising on cut to fill platforms, the strategic use of concrete pads is advised. Multi-storeyed structures are likely to require piled foundations.

Disposal of storm-water by subsoil percolation methods is not recommended. It is recommended that storm-water be discharged either on to road hardenings, directly into drainage course or to midblock storm-water control systems.

Selected layers will be required to establish layerworks along the proposed road network where subgrade materials other than suitable granular materials occur at or below formation level.

11.3.4 Summary

- The site is stable and capable for use as planned. There is not risk of sinkholes or compaction subsidence as in Dolomitic areas;
- The site has not been undermined;
- The soils beneath the site do exhibit a collapsible grain structure – however the activity of the clayey soils is low;
- The streams are well defined in the area. Development should be controlled so as not to encroach on wetland areas;
- It is inferred that groundwater seepage will occur at depths between 1,0m and 2,5m below ground surface in the central low-lying drainage area within the Site. Seepage occurs in a easterly direction and is confined to the central and southern portions of the site along narrow drainage courses;
- The Granitic Gneiss rocks are fine to coarse grained and weather readily to an arenaceous and angillaceous residium and are unsuitable for use as concrete aggregate;
- Special care is required in the founding of structures in view of the potential for collapse settlement of the sandy and clayey subsoils that occur beneath this site. It is recommended that ground improvement for foundations be carried out or deep foundations extended into the bedrock be undertaken to ensure stability of founding.

11.4 Drainage and Watercourses

A Wetland Assessment was undertaken by SiVEST on 1st March 2014, and the report is attached in **Appendices D1 and D2**.

Four major drainage lines bisect the site referred to as drainage lines A through D, as shown in Figure 4 included in Appendix A of the report. A smaller drainage line, which has largely been transformed by the establishment of Park Rynie is located adjacent and parallel to the R612 and is referred to as Drainage Line G.

Drainage line A comprises a small un-channelled valley bottom wetland that has been substantially impacted by sugarcane farming and by the canalisation of flow under the N2, by cane haulage road crossings and the by the R102. Downstream of the R102, a defined channel forms that drains into an estuarine environment at the beach at Submarine Bay (Happy Wanderers beach). The main section of the un-channelled valley bottom wetland, referred to as wetland unit A0, is bisected by a number of tributary valleys that host un-channelled and channelled valley bottom wetlands.

Drainage line B comprises the lower reaches of the Mzimayi River. The Mzimayi River is a perennial river that originates near the town of Umzinto. Within the site, the Mzimayi is a well-defined bedrock channel bordered by narrow corridors of wetland. The river valley abruptly widens into a floodplain just before flowing off the site, which continues into an estuarine environment at the beach. The Mzimayi River is bisected by a number of small steep tributary streams and wetlands.

Due to the fact that river banks and floodplains like that of the Mzimayi River comprise areas that are subject to regular disturbance, and that these systems allow for continuous travel and transportation of seeds and vegetative material, they are often invaded by alien species. Particular problem plants are the alien *Arundo donax* (Spanish Reed) and *Stenotaphrum secundatum* (Buffalo Grass), which serve to suppress and diminish indigenous plant diversity in this area.

Rocky areas along the Mzimayi River provide habitat for two interesting riverine species. *Drimia calcarata* is a species name which includes two forms. One occurs in dryland grassland and the other occurs along rivers, either on the banks and islands, or more frequently on fissures in rocks where the bulbs may be submerged beneath flowing water.

A Red Listed plant growing in similar habitat along the river is *Cyrtanthus mackenii* var. *mackenii* (Ifafa Lily). Although it is known in cultivation, it is a rare plant in the wild. Its decline is likely the result of silting of rivers along the more southern part of the KZN coastline.

Drainage line C comprises a short, broad, gently sloping un-channelled valley bottom wetland that has been substantially alerted by the establishment of artificial drainage channels and the clearing of wetland vegetation for sugarcane. The wetland drains into a small estuary immediately north of the Rocky Bay Caravan Park. Onsite, the wetland is bisected by a couple of small valley-head like tributary valleys that host un-channelled valley bottom wetlands and valley head seepage wetlands.

Drainage line D comprises a stream channel bordered by a narrow strip of wetland. The channel banks and wetland areas are covered by a narrow strip of riverine and swamp forest that borders the channel through the whole site. After exiting the site, the stream drains under the R102, through the Park Rynie suburb and into the Rocky Bay estuary. Drainage Line C is actually a tributary of D. The Rocky Bay estuary is bordered by substantial reed marsh.

Currently, the majority of the wetlands onsite have been delineated by SiVEST Environmental Division and a map showing the delineated extent of these wetlands as well as the distinct wetland units is attached as Appendix D2 in the report. Sixty-three (63) wetland units have been identified and delineated within the portion of the project site to the east of the N3 Highway to date. The wetlands within the north-west quadrant of the site have also been delineated and an ecosystem services assessment undertaken. Their potential extent is also shown in the wetland map attached as Appendix D2 in the report. The majority of the wetlands have been substantially impacted by cane cultivation. However, along the main trunk valleys, the wetland hydrology is somewhat intact and as a result, extensive marsh environments are still present, the extent and integrity of which could be substantially enhanced through appropriate rehabilitation.

In terms of the National Freshwater Ecosystem Priority Area project (NFEPA), which identifies priority freshwater ecosystems that should remain in a natural or near-natural condition to support the water resource protection goals of the National Water Act (2008), none of the streams, rivers, wetlands and estuaries onsite are considered freshwater ecosystem priority areas (FEPA's).

Furthermore, a floodline determination by means of Flood Estimation Report, dated 12 December 2014 and attached as **Appendix C10**, was conducted by Hatch Goba. This will assist to define the zones which are acceptable for infrastructural impacts when reaching the detailed design stage, and which areas must be avoided.

11.5 Wetlands

11.5.1 Wetlands to East of N2 Highway

A Wetland Delineation and Functional Assessment of all the proposed Rorqual Estate components lying to the east of the N2 Highway was undertaken by SiVEST, dated 25 March 2013 and attached in **Appendix D1**.

The summary finding of the report stated:

Soil sampling of the top 50cm of the soils across the site identified the presence of a number of distinct wetland units across the site, most of which were associated with the four major west-east draining drainage lines. With the exception of Wetland Unit D0, the wetlands identified had been wholly or partly cleared for cane cultivation and in most cases the only intact vegetation

communities present were narrow corridors of disturbed secondary wetland vegetation and riparian within the artificial drainage channels.

Most of the wetlands units were assessed as being of moderately-low importance, with the exception of Wetland Units A0, B0, C0, D0, and D2. Wetland Unit D0 was assessed as being the most valuable wetland unit onsite in terms of ecosystem service provision largely due to the fact that they had received the least amount of disturbance and was characterised by a corridor of intact swamp forest. The rest of the more valuable systems were generally of intermediate importance in terms of the provision of surface water management and water quality enhancement services.

In light of these findings, the proposed development stands to have serious impacts on the moderate to highly important wetland units in their current state, both negative and positive. If the general recommendations provided in **Section 7** above are effectively included in the design and planning of the development, the negative impacts associated with the proposed development will be substantially minimised. Furthermore, there is an opportunity for the proposed development to include the rehabilitation of the wetlands in its planning and improve the health of the wetlands within the development sites. This will result in a significant positive impact on the health of the wetlands and ultimately on the local water resources and biodiversity. Such rehabilitation is required to offset the potential negative impacts that could occur if the mitigation measures recommended above are not strictly adhered to, which is likely. Thus, the rehabilitation is vitally important to ensure that the impacts on the wetland units are minimised and wetland health and functionality is maximised.

Wetland Importance Summary

In terms of the provision of ecosystem services, Wetland Unit D0 was assessed as being of **high importance**; Wetland Units B0 was assessed as being of **moderately-high** importance; and Wetland Units A0, B1a, C0 and D2 were assessed as being of **intermediate** importance (Table 39 of Appendix E2). These above-mentioned wetland units can be considered the most valuable systems onsite. The rest of the wetland units were assessed as being of **low to moderately-low** importance. However, it is important to re-iterate that cumulatively, the moderately-low value wetland units are important, particularly in terms of surface water management and water quality enhancement.

Table 6: Summary of Importance Categories for Each Wetland Unit

Wetland Unit	Importance Category	Highest Scoring Service(s)
A0	Intermediate	Sediment trapping
A1	Moderately-Low	Erosion Control
A1a	Moderately-Low	Erosion Control
A1b	Moderately-Low	Erosion Control
A1c	Moderately-Low	Erosion Control
A2	Moderately-Low	Erosion Control
A3	Moderately-Low	Sediment trapping
A3a	Moderately-Low	Sediment trapping
A3b	Moderately-Low	Erosion Control
A4	Moderately-Low	Erosion Control
A5	Moderately-Low	Erosion Control
B0	Moderately-High	Sediment trapping
B1	Moderately-Low	Erosion control
B1a	Intermediate	Biodiversity maintenance
B1b	Moderately-Low	Erosion control
B1c	Moderately-Low	Nitrate removal
B1d	Moderately-Low	Nitrate removal
B1e	Moderately-Low	Nitrate removal
B2	Moderately-Low	Sediment trapping
B3	Moderately-Low	Sediment trapping
B3a	Moderately-Low	Sediment trapping
B4	Moderately-Low	Sediment trapping
B5	Moderately-Low	Sediment trapping
B6	Moderately-Low	Sediment trapping
B6a	Low	Sediment trapping

Wetland Unit	Importance Category	Highest Scoring Service(s)
B6b	Low	Sediment trapping
B6c	Low	Sediment trapping
B7	Moderately-Low	Sediment trapping
B7a	Low	Sediment trapping
B8	Moderately-Low	Sediment trapping
B8a	Moderately-Low	Sediment trapping
B9	Moderately-Low	Sediment trapping
B9a	Low	Sediment trapping
B9b	Low	Sediment trapping
B9c	Low	Sediment trapping
B9d	Moderately-Low	Sediment trapping
B9e	Moderately-Low	Sediment trapping
B9f	Moderately-Low	Sediment trapping
B9g	Moderately-Low	Sediment trapping
C0	Intermediate	Sediment trapping
C1	Moderately-Low	Sediment trapping, flood attenuation
C2	Moderately-Low	Sediment trapping, flood attenuation
C3	Moderately-Low	Sediment trapping, flood attenuation
C4	Moderately-Low	Sediment trapping
C5	Moderately-Low	Sediment trapping, flood attenuation
D0	High	Biodiversity maintenance
D1	Moderately-Low	Nitrate removal
D2	Intermediate	Nitrate removal
D3	Moderately-Low	Nitrate removal
D4	Moderately-Low	Nitrate removal
D5	Moderately-Low	Nitrate removal
D6	Moderately-Low	Nitrate removal
D7	Moderately-Low	Nitrate removal
D8	Moderately-Low	Nitrate removal
E	Moderately-Low	Water supply
F	Moderately-Low	Water supply
G	Moderately-Low	Flood attenuation, erosion control
H	Low	Sediment trapping

The recommended buffer for each wetland unit is summarized in Table 7 below. The extent of the 20-30m buffer zones is shown Figures 3-5 in **Appendix D2**.

Table 7: Summary of the Factors That Determine the Minimum Buffer Width Requirements for Each Wetland Unit

Wetland Unit	Value / Ecological Sensitivity	Land Use Intensity	Score	Recommended Minimum Buffer
A0	3	3	**6**	**30m**
A1	2	3	**5**	**20m**
A1a	2	3	**5**	**20m**
A1b	2	3	**5**	**20m***
A1c	2	3	**5**	**20m***
A2	2	3	**5**	**20m**
A3	2	3	**5**	**20m**
A3a	2	3	**5**	**20m**
A3b	2	3	**5**	**20m**
A4	2	3	**5**	**20m***
A5	2	3	**5**	**20m**
B0	4	3	**7**	**30m**
B1	2	3	**5**	**20m**
B1a	3	3	**6**	**30m**
B1b	2	3	**5**	**20m**
B1c	2	3	**5**	**20m**
B1d	2	3	**5**	**20m**
B1e	2	3	**5**	**20m***
B2	2	3	**5**	**20m**
B3	2	3	**5**	**20m**

Wetland Unit	Value / Ecological Sensitivity	Land Use Intensity	Score	Recommended Minimum Buffer
B3a	2	3	**5**	**20m**
B4	2	3	**5**	**20m***
B5	2	3	**5**	**20m**
B6	2	3	**5**	**20m**
B6a	1	3	**4**	**20m**
B6b	1	3	**4**	**20m**
B6c	1	3	**4**	**20m**
B7	2	3	**5**	**20m**
B7a	1	3	**4**	**20m**
B8	2	3	**5**	**20m**
B8a	2	3	**5**	**20m**
B9	2	3	**5**	**20m**
B9a	1	3	**4**	**20m**
B9b	1	3	**4**	**20m**
B9c	1	3	**4**	**20m**
B9d	2	3	**5**	**20m**
B9e	2	3	**5**	**20m**
B9f	2	3	**5**	**20m**
B9g	2	3	**5**	**20m**
C0	3	3	**6**	**30m**
C1	2	3	**5**	**20m**
C2	2	3	**5**	**20m**
C3	2	3	**5**	**20m***
C4	2	3	**5**	**20m**
C5	2	3	**5**	**20m***
D0	5	3	**8**	**35m**
D1	2	3	**5**	**20m**
D2	3	3	**6**	**30m**
D3	2	3	**5**	**20m**
D4	2	3	**5**	**20m**
D5	2	3	**5**	**20m***
D6	2	3	**5**	**20m***
D7	2	4	**6**	**30m**
D8	2	3	**5**	**20m**
E	2	3	**5**	**20m***
F	2	3	**5**	**20m***
G	2	3	**5**	**20m***
H	1	4	**5**	**20m***

Furthermore, for planning purposes, the applicant has requested that those wetland units that can receive buffer encroachment without significantly compromising the integrity of the onsite wetland units be identified to inform the site development plan. In this regard, those wetland units marked with a * indicate those units that are of least value and which should be the first units to receive buffer encroachment if necessary. This does not mean that the buffers of these units can be encroached upon. Rather, where encroachment is unavoidable or undesirable for substantiated reasons, these units should be the first to receive encroachment.

11.5.2 Wetlands of the NW Quadrant and WWTW Sites

A wetland delineation and ecosystem services assessment of the North-West Quadrant and Waste-water Treatment Works (WWTW) sites was undertaken by SiVEST, dated 13 March 2012 and attached in **Appendix D2**.

The summary finding of the report stated:

Field testing of the soils across the site identified the presence of six (6) distinct wetland units, four wetland units within the north-west quadrant and two wetland units within the proposed sewerage treatment works site. With the exception of Wetland Unit I1 and swamp forest of I2, the wetlands identified had been cleared for cane cultivation and in most cases the only intact

vegetation communities present were narrow corridors of disturbed secondary wetland and riparian vegetation within the artificial drainage channels.

The majority of the sewerage treatment works infrastructure is proposed within the "Developable Area" as identified by the vegetation and wetland assessments. The 'buffer storage' for effluent irrigation is however presently sited within the disturbed secondary wetland, and it is suggested that this be shifted to a more elevated site if possible.

Wetland Units I1 and I2 were assessed as being the most valuable wetlands onsite in terms of ecosystem service provision largely due to the fact that they had received the least amount of disturbance. These systems as a unit are of intermediate importance in terms of biodiversity maintenance, surface water management and water quality enhancement.

The proposed developments stand to have some significant impacts on the wetland systems onsite during both the construction and operation phases. If the recommended mitigation measures provided in Section 8 are effectively included in the design, planning, construction and operation of the development, the negative impacts associated with the proposed development will be minimised. In addition, the propose developments provide an opportunity to formally rehabilitate, manage and protect the wetland units in perpetuity. Such interventions would improve the integrity of the wetland systems and substantially increase the level of ecosystem services provided by these systems, in particular Wetland Units I1, I2, J1 and D0. This will in turn contribute to the improvement of the water quality and flow regime of the downstream watercourses as well as local biodiversity maintenance.

11.6 Coastal Zone

Royal HaskoningDHV compiled the Coastal Impact Assessment dated November 2012 and attached in **Appendix E5**.

The beach area facing the development is wide and has a coarse grain size. Unusual monolithic rocks are seen along the shoreline and marine life is visible in the rock pools. Relic damage to the frontal dune cordon was visible on site at the time of reporting, with a degree of dune regeneration evidenced through the establishment of "hummock" dunes.

The vegetation is dune vegetation, which is an excellent condition. There is, however, some evidence of dune blowouts close to badly eroded informal access points.

Sensitive areas on site are extensive dune habitat, MPA incorporated rocky shoreline and its associated marine resources, littoral active zone, sites identified to be at risk to dynamic coastal processed and scenic and landscape values.

11.6.1 The Coastal Protection Zone

The coastal protection zone is an ongoing strip of land or adjacent land units, which starts from the high water mark and extend 100m inland in developed urban areas zoned as residential, commercial or public open space or 1,000m inland in areas that remain undeveloped or that are commonly referred to as rural areas.

The proposed development is situated partially within the default coastal protection zone.

11.6.2 Coastal Public Property

The Coastal Public Property consist of the coastal waters, the land below that waters, the seashore, Admiralty reserve, any other state land declared as coastal public property and any natural resources on or in the Coastal Public Property. *The key purpose is to prevent exclusive use of the coast by facilitating access to and sustainable use of the productive coastal resources for the benefits of all South Africans.*

State owned land is located adjacent to the property, which is either leased or managed by Umdoni Municipality and zoned as Amenity Reserve, and should be incorporated into the

Coastal Public Property. The proposed development abuts a portion of state land adjacent to Rocky Bay Resorts, which is owned by Ellingham Estate. This state land includes a portion of the existing Rocky Bay Caravan Park, which is leased to Ellingham Estate. Only residents can however access the caravan park.

11.6.3 Aliwal Shoal Marine Protected Area

Aliwal Shoal is a 1.5km wide, 5km long and 5 to 27m deep sub-tidal reef. The reef is situated approximately 5km offshore Umkomaas and is home to reef fish, tiger sharks, hammerhead sharks, Zambezi sharks, whale sharks, sea turtles, potato and brindle bass and supports a remarkable coral community.

It was declared in 2004 under Section 43 of the Marine Living Resources Act 18 of 1998 as a marine protected area and includes agreements with regard to the designation of use, formalized in a management plan. The management plan includes strict zoning of activities and the area is managed by Ezemvelo KZN Wildlife.

Stakeholders identified potential impacts on the MPA associated with the increased use and potential sea outfall. The coastal impact assessment suggests that the proposed sea outfall should not be supported (a sea outfall is not proposed). Furthermore, there should be not negative affect on the MPA through the increased recreational use of the area should effective management, compliance and enforcement of the management plan take place or continue. Increased monitoring will need to be conducted to ensure compliance with controls and will negate any negative impact on the marine environment.

11.6.4 Sea Level Risk Analysis

The proposed development is situated inland of a rocky promontory with a rocky beach overlain with a thin veneer of beach sand. The underlying beach rock platform extends north and south of the site until it reaches the Mpambanyoni Estuary in the north and the Mzimayi Estuary in the south. At the estuary mouths, the beach changes from a rocky underlain sandy veneer beach to a sandy beach with underlying rock levels located approximately 20 to 30m below sea level. The physical ground condition of the beach adjacent to the site differs significantly from those located adjacent to estuary mouths, which are far more vulnerable to sea level rise and erosion.

A number of future sea level rise scenarios were evaluated and mapped to understand the potential impacts of sea level rise. The study indicated that the site where a rocky shoreline is currently exposed is an area of low risk.

However, there exist a few caravan sites located in the northern section of the site where the small embayment allows the wave action to penetrate and erode the beach sand and that doesn't currently have an intact dune system in place. In this location the situation can be addressed by the retreat of the proposed development inland, enabling a dune buffer to be placed between the development and the sea. Along portions of the site exists a narrow green dune belt and it is recommended that this be retained as a safety buffer and to serve as a natural soft edge to assist in the reduction of salt spray and windblown sand into the development.

For added protection and peace of mind, the seaward facing row of buildings can have their foundations located onto bedrock as this will be relatively easy given the proximity of the underlying bedrock.

11.7 Flora

Vegetation Assessments of the project were undertaken by David Styles dated 26 June 2009 and 5 April 2013 and attached as **Appendices E6** and **E7** respectively. The findings of the investigations regarding the status quo of the site are discussed below.

The proposed sites are located within the 'KwaZulu-Natal Coastal Belt' Bioregion Unit (CB3). Although under sugarcane cultivation, indigenous vegetation on the property includes a wide range of types found on this part of the KZN South Coast, including:

- Grassland (includes hygrophilus grassland);
- Swamp forest of varying degrees of disturbance;
- Wetland area (reed and sedge marshes);
- Coastal forest, of both long standing and more recent origin and varying degrees of disturbance;
- Seral forest and thicket with alien plant invasion
- Seral forest;
- Dune thicket vegetation that includes species which are narrowly confined to the very close coastal littoral, or else typical of these situations;
- Floodplain and estuary (lower Mzimayi River);
- Dense *Hibiscus tileaceus*- and *Barringtonia racemosa*- dominated woodland along the Mzimayi River estuary;
- Woody vegetation comprising mainly *Eucalyptus* species, or *Eucalyptus* species and other alien tree species interpolated with more common, pioneer indigenous tree species; and
- *Casuarina equisetifolia* trees and other alien vegetation, interpolated with coastal thicket and woodland of more recent origin.

Furthermore, a Revegetation Plan and a *Cyrtanthus makenii* Restoration Plan were also composed, dated 12 August 2013, and are included as **Appendices G2.3** and **G2.4** respectively.

11.7.1 Grassland

There are a few small segments of primary grassland in the north-western corner of the main site, north and within the old and new growth coastal forest. All other grassland is secondary and extremely degraded. Some of this borders the primary grassland to the north. It contains no geophytes and almost no herbs or forbs apart from a small number of indigenous species that flourish under conditions of disturbance, as well as alien species. From a biodiversity point of view, the grassland in this area has little value and would be difficult to rehabilitate because only a few species remain. The grassland has value as it acts as faunal habitat, will ensure that corridors are maintained to connect natural areas and would buffer forest and wetland from future development. For these reasons, it is given a conservation importance of medium-low.

Areas of grassland of both primary and secondary character occur on the north-western corner of the site, straddling both banks of the Rocky Bay River, however were difficult to assess. The part of the grassland south of the R612 most proximate to farming activity is of more secondary quality, containing few forbs and a number of weeds of disturbance. However, as one proceeds south into the grassland, indigenous forbs and geophytes begin to occur more often with the added potential of rehabilitation.

The grassland is designated as:

- KZN Vegetation Type Code: FOz7
- KZN Vegetation Type Name: KwaZulu-Natal Coastal Belt Grassland
- Veld Type: Sourveld
- KZN Biome: Indian Ocean Coastal Belt
- SANBI Biome: Indian Ocean Coastal Belt
- **Conservation Status: Critically Endangered**
- Total Protected Area (ha): 3,860.6ha
- Total Protected %: 0.9%

11.7.2 Swamp Forest

There is a narrow band of Swamp Forest on the site, which is of overall good quality. It is well developed, comprising some very tall trees as well as many other smaller species typical of this forest type. On the north-western corner of the site, much of the vegetation is underlain by

wetland conditions with the occurrence of Swamp Forest. In places it is discrete, such as the narrowing arms extending east out of the main forest block.

Tree species typical of this forest type include:

- *Cassipourea gummiflua* (Large-leaved Onionwood)
- *Cyclosorus interruptus (*Fern)
- *Bridelia micrantha* (Mitzeeri)
- *Ficus sur* (Broom Cluster Fig)
- *Macaranga capensis (*Wild Poplar)
- *Phoenix reclinata* (Wild Date Palm)
- *Rauvolfia caffra* (Quinine Tree)
- *Schefflera umbellifera* (False Cabbage Tree)
- *Shirakiopsis elliptica* (Jumping-seed Tree)
- *Stenochlaena tenuifolia (*Forest Toad Tree)
- *Syzygium cordatum (*Umdoni)
- *Tabernaemontant ventricosa (*Forest Toad Tree)
- *Voacanga thouarsii* (Wild Frangipani)
- *Xymalos monospora* (Lemonwood)

Swamp forest is an endangered vegetation type and is an important biodiversity and conservation asset. It needs to be taken into good custody by buffering from development, removing alien invasive plants and allowing improvement in the quality of its ecotone. Red Listed tree found in Swamp Forest:

- *Cryptocarya latifolia* (Large-leaved Wild-quince, Declining)

11.7.3 Wetland Area

Wetland areas on the site have been transformed to sugar cane. However, there is a dam of some size with a number of floating aquatics that are no longer seen on the KwaZulu-Natal coast and several hygrophytic species (mainly sedges and some *Typha capensis*) that form a narrow fringe around it. It is likely there was much more hygrophytic vegetation in this area prior to planting of the surrounding land to sugar cane.

On the North Western site, the hygrophilous vegetation which remains is usually dominated by the alien reed *Coix lacryma-jobi*, with smaller occurrence of more robust, disturbance-resistant indigenous species such as *Ludwigia octovalis, Phragmites australis* and *Typha capensis*. There is some small persistence of other hygrophilous species on the edges of these wetlands, swamp forest and also the hygrophilous grassland, which could provide the foundation for more extensive and species-diverse recovery of wetland vegetation, provided cultivation is removed out of the wetlands, measures put in place to reinstate natural water flows, and control alien vegetation.

11.7.4 Northern Coastal Forest

A band of Northern Coastal Forest exists north of the R612. It is mostly tall, and although parts are of more recent origin with a proportion of pioneer trees, most is not and includes some more unusual species such as *Rawsonia lucida*. There is a large herbaceous diversity.

Northern Coastal Forest is also found south of the R612 and includes tall trees and has good structure. The tree species diversity is neither poor nor on the other hand remarkable and the herbaceous diversity seems rather diminished. The unusual presence of the woody clumber/small tree *Dalbergia multijuga*, although not rare or threatened, is mainly known from the Pondoland Centre of Plant Endemism extending further south into the old Transkei region of the Eastern Cape.

The main block of Coastal Forest on the site is towards the north-western corner, which can be further differentiated into areas of old-growth primary forest and that of more recent origin in

which more common pioneer species are visible and into which there is more significant infiltration by alien species.

Three small and isolated patches, surrounded by growth of *Eucalyptus grandis*, are interesting as numbers of *Podocarpus latifolius* (Real Yellowwood) trees occur within them. These trees are only occasionally found this close to the coast.

The Northern Coastal Forest is designated as:

- KZN Vegetation Type Code: CB3
- KZN Vegetation Type Name: KwaZulu-Natal Coastal Forests: Southern Moist Coastal Lowlands
- KZN Biome: Forest
- SANBI Biome: Forest
- **Conservation Status: Critically Endangered**
- Total Protected Area (ha): 250.6ha
- Total Protected %: 7.9%

Typical species within the old growth forest include:

- *Acridocarpus natalitius* (Moth-fruit)
- *Allophyllus dregeanus* (Forest False Currant)
- *Baphia racemosa* (Natal Camwood)
- *Celtis Africana* (White Stinkwood)
- *Chaetacme aristata* (Thorny Elm)
- *Cryptocarya woodii* (Cape Quince)
- *Drypetes arguta* (Water Ironplum)
- *Drypetes gerrardii* (Forest Ironplum)
- *Englerophytum natalense* (Natal Milkplum)
- *Harpephylum caffrum* (Wild Plum)
- *Mimusops obovata* (Red Milkwood)
- *Olea woodiana* (Forest Olive)
- *Strychnos gerrardii* (Black Monkey-orange)
- *Trichilia dregeana* (Forest Mahogany)
- *Vepris lanceolata* (White Ironwood)

Rare or unusual species within the old-growth forest include:

- *Chrysophyllum viridifolium* (Fluted Milkwood)
- *Cnestis polyphylla* (Itch-pod)
- *Cryptocarya latifolia* (Broad-leaved Quince)
- *Erythroxylum pictum* (Forest Coca Tree)
- *Englerodaphne ovalifolia* (Coastal Fibre-bush)

On the south-facing bank of the Mzimayi River, there is another occurrence of primary Coastal Forest, also bounded by forest and thicket of more recent origin.

Rare or unusual species of more recent origin include:

- *Aloe arborescens* (Krantz Aloe)
- *Maytenus cordata* (Water Silky Bark) (Red listed)
- *Cussonia nicholsonii* (Wedge-fruited Cabbage Tree)
- *Urera trinervis* (Climbing Nettle)

Typical species of more recent origin include:

- *Albizia adianthifolia* (Flatcrown)
- *Brachylaena discolour* (Coast Silver Oak)
- *Bridelia micrantha* (Mitzeeri)

- *Protorhus longifolia* (Red Beech)
- *Psydrax obovata* (Quar)
- *Sclerocroton integerrimum* (Duiker-berry)
- *Strelitzia nicolaii* (Wild Banana)
- *Tabernaemontana ventricosa* (Forest Toad Tree)
- *Tricalysia lanceolata* (Jackal-coffee)

11.7.5 Seral Forest and Thicket with Alien Plant Invasion

South of the R612 there is an area that comprises closed to semi-closed, very recent indigenous tree and shrub growth, with an equal or greater amount of alien vegetation, mainly *Eucalyptus grandis* (Gum) and *Psidium guajava* (Guava) trees.

11.7.6 Seral Forest

Further south of this is a taller closed canopy growth, comprising mainly indigenous tree growth of more recent origin, with low species diversity and small presence of alien species. The conservation value is rated as medium to medium-low.

11.7.7 Dune Thicket

This component on the north-western corner of the site comprises dense woody vegetation of lower stature, with a short or inconsistent closed canopy. Species composition is typical for indigenous vegetation along dunes and near-beach situations along the KwaZulu-Natal South Coast.

Common species in this thicket include:

- *Brachylaena discolour* (Coast Silver Oak)
- *Chrysanthemoides monilifera* (Bush Tick-berry)
- *Euclea natalensis* (Natal Guarri)
- *Phoenix reclinata* (Wild Date Palm)
- *Psydrax obovata* (Quar)
- *Scutia myrtina* (Cat Thorn)
- *Secamone alpine*
- *Rhoicissus digitata* (Baboon Grape)
- *Strelitzia Nicolai* (Wild Banana)

Growing with these are obligate near-beach species, which include:

- *Allophylus natalensis* (Dune False Currant)
- *Carissa macrocarpa* (Amatungulu)
- *Carpobrotus dimidiate*
- *Cynanchum obtusifolium*
- *Eugenia capensis* subsp. *capensis* (Dune Myrtle)
- *Gymnosporia arenicola (Dune Spike-thorn)*
- *Maytenus procumbens* (Dune Koko Tree)
- *Mimusops caffra* (Coastal Red Milkwood)
- *Rhus natalensis* (Natal Karree)
- *Rhus Nebulosa* (Sand Taaibos)
- *Triclysia sonderiana* (Coast Coffee)

Much of this vegetation is relatively intact, with the presence of alien plants no greater than any other representation of this vegetation type along the KZN South Coast.

11.7.8 Floodplain and Estuary

Due to the fact that river banks and floodplains comprise areas that are subject to regular disturbance, and that these systems allow for continuous travel and transportation of seeds and vegetative material, they are often invaded by alien species as is the case on this site.

Problem plants, which suppress and diminish indigenous plant diversity in this area include:

- *Arundo donax* (Spanish Reed)
- *Stenotaphrum secundatum* (Buffalo Grass)

A Red Data Listed plant growing in similar habitat along the river is *Cyrtanthus mackenii* var. *mackenii* (Ifafa Lily). Although it is known in cultivation, it is a rare plant in the wild. Approximately 10 plants were noted, which is a small number, and without intervention it is possible the species could disappear from the site.

11.7.9 Woody Vegetation

This vegetation component, in which *Eucalyptus* (Gum) trees are most evident, occupies most of the north-western site, particularly the upper stretch of the Mzimayi River and the lower part along its south bank. The extensive occurrence of *Eucalyptus grandis* trees must have some impact on water resources on the site. Where these trees occur on the river's south bank, most other indigenous plant growth is suppressed and excluded due to shading and carpeting the ground with leaves and fallen branches.

However, there is a presence amongst this growth of usually more common indigenous trees and herbs, which would likely in time transform to coastal forest if the eucalypts were destroyed.

11.7.10 *Casuarina equisetifolia* trees, other Alien Vegetation, Coastal Thicket and Woodland

At some stage over the past years, clearing evidently occurred in part of the north-western site to allow houses or infrastructure to be built. Now, most of the houses are incomplete shells that are overgrown and hidden amongst dense plant growth. The *Casuarina* trees, which probably had their origin in plantings, have spread beyond their original foundation. Some areas, cleared for construction activity that did subsequently not occur, are now quite densely occupied by alien plants, in particular *Chromolaena odorata* and *Lantana camara.* Along with the Casuarina trees and other alien vegetation, many common, pioneer indigenous trees are found, particularly *Brachylaena discolour* and *Strelitzia nicolai.*

Given the nature of the vegetation and the previous uncompleted development, this area could be developed further.

11.8 Fauna

The proposed Rorqual Estate Development includes properties which contain a diverse range of vegetation and habitat types, large sections of which are still in good condition.

As a result, there is likely a number of rare, conservation worthy and/or protected faunal species onsite that inhabit these habitats. However, the on-going edge effects on the habitat fragments onsite coupled with lack of management and buffers across the site is slowly reducing the health of these habitats and in the long term these habitats will increasingly become less viable as important faunal habitats. At this stage it is assumed that it is not necessary to identify the faunal species of conservation importance onsite provided that no development occurs within the important faunal habitats onsite, ecological linkages are maintained, buffer zones and ecotones are re-established and conservation management measures are instituted as part of the proposed development. If for any reason, encroachment is proposed within valuable and sensitive habitats a faunal assessment will have to be undertaken.

12 DESCRIPTION OF THE AFFECTED SOCIO-ECONOMIC ENVIRONMENT

12.1 Socio-Economic Characteristics

The Market and Socio-Economic Impact Assessment for the project was undertaken by Urban-Econ dated 31 May 2012 and attached as **Appendix E2**. The findings of the investigation regarding the socio-economic aspects of the area are discussed below.

12.1.1 Ugu District Municipality

The proposed Rorqual Estate is located in the Park Rynie area. Park Rynie is a small coastal town situated on the South Coast of KwaZulu-Natal. It forms part of the Umdoni Local Municipality, which is the smallest municipality in the Ugu District. From an economic perspective, there are only two municipalities in the Ugu District of economic significance. The most important is the Hibiscus Coast Municipality, which includes the important tourism areas of Margate, Ramsgate, Shelly Beach, Port Edward and Port Shepstone. The second Municipality of importance is the Umdoni Local Municipality.

The population of the Ugu District Municipality is 742,383 people (2010), accounting for 7% of the population of KZN, an increase in the population which was 667,115 people in 1995. The number of households living in the Ugu District has increased from 132,479 households in 1995 to 163,034 households in 2010. This indicates that 30,555 new households have been established in the Ugu district over a 15 year period. This indicates that the demand for housing is increasing in the municipality, as more people are moving into the area.

12.1.2 Umdoni Local Municipality

Umdoni has the second smallest population total within the district, representing only 8% of the total Ugu District population. The population has grown from 62,402 in 2000 to 76,997 in 2010. Umdoni Municipality's population growth rate is growing at 2.1%, which is more than twice the provincial average of 0.9%.

As stated previously, there are only two municipalities in the Ugu District of economic significance, the Umdoni municipality and the Hibiscus Coast Municipality. These municipalities are the economic generators in the District and all economic opportunities that can be developed in these areas are to the benefit of the whole district. However, the economic importance and potential of the municipality is only significant within the context of the extensive poverty of other municipalities in the District i.e. Vulamehlo, Umzumbe, Umuziwabantu and Ezinqoleni. These local municipalities are some of the poorest municipalities within the province and employment opportunities in these areas are severely limited with high levels of unemployment.

The Umdoni Local Municipality has the highest employment rate compared to the district and the province. Of the economically active population (15-65 years), 38% in the Umdoni Local Municipality is employed. The unemployment rate in the local municipality is 14.5% and the not economically active population (portion of the population choosing to be unemployed) is 49.6%.

Within the Umdoni Local Municipality, the wholesale and retail trade, catering and accommodation sector, which falls under the tertiary sector, is the largest employer (20.7%). The next biggest employer, also falling in the tertiary sector, is the community service, trade and finance sector (18.3%). The primary sector, which comprises agriculture, forestry and fishing, and mining and quarrying sector employs the least amount of formally employed individuals (8% and 0.6% respectively).

12.1.3 Park Rynie

The Spatial Development Framework Plan for the Umdoni Municipality and the 2011/2012 IDP Review have both recognised Park Rynie as an important industrial node within the Umdoni municipal area. Other significant towns within the Umdoni Local Municipality are the coastal

towns of Kelso, Pennington, Sezela, Bazley, Ifafa, Elysium, Mtwalume and the primary node of the Umdoni Local Municipality, Scottburgh. Scottburgh is in close proximity to Park Rynie.

Within the Umdoni Municipality, there are major coastal development opportunities with pressure for additional coastal accommodation and various forms of economic development. There is currently a need for commercial, industrial and residential development in Park Rynie which will help meet the demand and needs of the greater Umdoni area. Being located along the coast, the beach of Park Rynie forms a major tourist attraction and provides a tranquil holiday destination, as well as being in close proximity to other tourist attractions such as Croc World, golf courses and nature reserves.

In addition to this, Park Rynie is strategically positioned along the R102, R612 and the N2, which enhances its linkages to surrounding areas on both regional and national scales. The R102 provides Park Rynie with linkages to other coastal towns on the South Coast while the N2 provides national linkages to areas outside KwaZulu Natal and to other provinces in South Africa such as the Western Cape. The N2 as well as the R102 link Park Rynie to the major national economic node of Durban, which lies approximately 60 km North. Park Rynie is also connected to the rural hinterland by the R612 and forms an important road linkage to the inland town of Umzinto. This road provides an important linkage between the Umzinto/Park Rynie industrial areas. The development of the site will result in a significant increase in capital investment in Umdoni Local Municipality and Park Rynie in particular.

12.1.4 Planning Frameworks

Both the Spatial Development Framework Plan and the 2011/2012 IDP Review for the Umdoni Municipality recognise Park Rynie as an important industrial node within the municipal areas. Emphasis is also placed on the N2 which is a significant national and regional accessibility corridor linking the Municipality to other areas. There is furthermore a demand for commercial, industrial and residential development in Park Rynie, which will help with the demands and needs of the greater Umdoni area.

The following noteworthy points have been extracted from the Umdoni SDF:

- Major coastal development opportunities exist and there is pressure for additional coastal accommodation and various forms of economic development.
- The primary node of Scottburgh is close to Park Rynie.
- Development for the Scottburgh, Park Rynie, Kelso and Pennington areas
    - Short term development (0-5 years) indicates that there needs to be development east of the N2 whilst protecting natural assets (river valleys, lagoons, coastal environment), upgrading of existing development and infill development
    - Medium term development (5-10 year horizon) continued development east of the N2 whilst protecting natural assets
    - Long term development (beyond 10 year Horizon) indicates that there is potential for appropriate development of areas between Park Rynie and Kelso
- No space for industrial expansion in the Park Rynie area is available and there is a need to upgrade and expand the existing industrial area
- The existing industrial development in Park Rynie is highly accessible and visible, opportunities may exist in adjacent areas for further development.

12.1.5 Demand for Educational Facilities

The Umdoni Local Municipality SDF has indicated that an expected increase in development of the municipality in the next few years will require the provision of additional social and civic support facilities. It has also proposed potential locations of higher order facilities such as tertiary education, health centres, community halls, etc. but has not included lower order facilities such as crèches, primary and secondary school sites, etc. thus making the proposed development ideally suited to meet such needs in the future.

The municipal's SDF has indicated that the higher order facilities should be located primarily in Scottburgh, Umzinto and Pennington. Given the close proximity of Park Rynie to these 3 areas,

the proposed Rorqual Estate also presents an opportunity to integrate some of these high order facilities into its development.

12.1.6 Demand for Petrol Filling Station

There are currently 2 petrol filling stations in the Park Rynie area. There is a Caltex petrol filling station in close proximity to the proposed development site and there is a Total petrol filling station nearby.

It is not anticipated that a filling station would be required on-site until such time as the traffic base generated from the commercial, residential and hospitality sectors is established. It is suggested that the land remain set-aside, and a detailed traffic feasibility be conducted once the site in-fill has begun.

12.1.7 Demand for Private Community Hospital

The Ugu district has 3 district hospitals, a regional hospital, one specialised hospital, 38 fixed clinics (including two gateway clinics), and 15 mobile clinics with 215 visiting points. There are also ten local authority clinics in the district. Within the Umdoni area there is the G.J. Crookes District Hospital. This hospital is in very close proximity to the proposed development area in Park Rynie.

It is evident that the accessibility of the development area to existing hospitals is good. The closest private hospital to the proposed development is Kingsway Hospital in Amanzimtoti, which is found within a 50 km distance. Given the proximity of the proposed development to Kingsway Hospital, there is no immediate need within the next 5 to 15 years to include a fully integrated hospital facility within the development.

However, given the proposed settlement size, and the development of a commercial node on the site, it is suggested that medical suites would be ideally suited for the proposed commercial development. This has been accounted for in the commercial space demand section of this report.

Nonetheless, certain interested hospital groups have recently expressed desire to establish a private hospital on the site. Those hospitals that offer specialised services may particularly find a market.

12.2 Existing Infrastructure and Services

There is a municipal reservoir located onsite supplied by Umgeni Water. This reservoir currently delivers water to Park Rynie. There is also a small package treatment plant immediately inland of the railway that treats effluent from the Rocky Bay Caravan Park.

12.3 Agricultural Potential

An Agricultural Potential Assessment of the NW Quadrant and WWTW Site, was jointly undertaken by both SiVEST and Mottram and Associates, dated August 2009 and attached in **Appendix D3**.

The proposed development area (PDA) is located in the Moist Coastal Forest, Thorn and Palm Veld region of KwaZulu-Natal (KZN) and has, in terms of the Bio Resource Units (BRU) of KZN, a climate that slightly limits agricultural production.

The soils on the PDA are predominantly deep, sandy well drained and of a high agricultural potential if there were sufficient water resources available to supply a large scale irrigation scheme in order to supplement the natural rainfall. The PDA engage in good soil conservation strategies such as contour stripping and trash blankets to limit soil erosion. The soils generally have a high soil erosion hazard rating and low base status. From information gathered from the South African Sugarcane Research Institute Laboratories the fields surveyed had a pH of around 5 with low clay contents. The fields surveyed were dominated by deep Namib, Hutton

and Clovelly Forms (According to the Taxonomic System) and can be farmed with few agricultural limitations.

The climate is suitable for the production of subtropical fruits provided rainfall is supplemented with irrigation. No major river is close to the site, which could be utilized to irrigate large portions of agricultural land. The lack of water resources and infield irrigation is the largest limiting factor to all current and potential agricultural practices on the PDA. The use of municipal water is not seen as a cost effective alternative for most of the options considered.

The study concluded that Proposed Development Area (PDA) "has high potential soils which are suitable for a wide range of agricultural enterprises but the overall agricultural potential of the PDA is rated as moderate due to the lack of sufficient water resources and steep slopes. It is recommended that some type of high value agricultural is established on the undeveloped portion of Ellingham Estate, if the proposed housing development application is accepted. It is recommended that an Agricultural Management Plan is drafted for the production of high value cropping on Ellingham Estate (i.e. the remainder of the farm) utilising final effluent together with river/stream water for irrigation". The agricultural potential maps of the project site are attached as Appendix D1 in the report.

The Department of Agriculture, Forestry and Fisheries stated in their letter dated 22 October 2010 (included in **Appendix F**) that "the Department has no objection to the proposed Rorqual Estate Development on condition that the proposed development must be incorporated within the Town Planning Scheme of Umdoni Municipality and linked up to all the bulk water and other services of the Municipality".

The DAEA&RD Macro-planning recommended the following in their letter dated 4 November 2010:

- As part of the Environmental Assessment Report a full Agricultural Potential Assessment and the impact on the sugar mill associated with the relevant cane growers.
- A Needs and Desirability Assessment for such a large-scale development in this area should be very detailed.

The conclusions and recommendations of the agricultural potential assessment found:

The owners of the Ellingham Estate requested a report to evaluate the agricultural potential of the PDA, in order that it might be compared to the sustainability and viability of a housing development. The impact of a low to medium density housing development on the immediate surrounding agricultural areas would be beneficial in that:

- The value of the surrounding areas could rise, depending upon their individual potentials with respect to agriculture
- Wages and salaries should not be negatively affected, but rather stabilized
- Indirectly the market for their current produce, other than sugarcane, will expand, especially perishable crops
- Families of their current labour forces could be gainfully employed at the development, thus improving their standard of living and education
- The effluent from such a development could be distributed to the remaining portion of Ellingham Estate and utilised for high value cash crops. In this way the proposed development would actually lead to an increase in agricultural production in the area. A waste-water treatment works could be set up on the Ellingham Estate, with the necessary servitudes. It is doubtful that the current wastewater treatment works at Pennington could accommodate the sewerage and wastewater from the PDA

Of the 500ha under assessment 245ha is classified as "undevelopable" due to indigenous coastal forest, wetland areas and a 30m wetland buffer and 40m indigenous vegetation buffer (worst case scenarios). This leaves around 255ha for the proposed housing development (Figure 15 in the report) and according to the SDF this section is actually zoned for future housing (Figure 14 in the report). Due to the high potential soils of the PDA some type of high

value inclusionary agriculture is recommended as a trade-off due to the loss of productive agricultural land.

Due to the disaggregated nature of this development inclusionary high value agricultural around the housing plots would not be ideal. It is therefore recommended that irrigated high value crops, such as Macadamia and bananas are established on a suitable portion of the remaining 1,500ha of the Ellingham Estate.

In conclusion, the PDA has high potential soils which are suitable for a wide range of agricultural enterprises but the overall agricultural potential of the PDA is rated as moderate due to the lack of sufficient water resources and steep slopes. It is recommended that some type of high value agricultural is established on the undeveloped portion of Ellingham Estate, if the proposed housing development application is accepted. It is recommended that an Agricultural Management Plan is drafted for the production of high value cropping on Ellingham Estate utilising final effluent together with river/stream water for irrigation.

12.4 Traffic Impact

12.4.1 Existing Traffic Infrastructure and Conditions

As the proposed development represents a substantial increase in the local population and is in effect a new town, it is expected that the Rorqual Estate Development will generate high traffic volumes and will have a significant impact on the surrounding road network. Thus, various road network and intersection upgrades are required. The Rorqual Estate would be a phased development and the requirements per scenario have been provided in the final traffic impact assessment.

The Traffic Report stated that the existing bulk services do not meet the requirements for the full development. The completed development is proposed to generate approximately 6,156 vehicle trips during the AM peak and 768 vehicle trips during the PM peak periods.

A 2-lane road in each direction is required on the R612, as well as on the R102, only up to the intersection allowing access into area D. The intersections will have to be signalised as well.

12.4.2 Traffic Assessment

A Traffic Impact Assessment for the project was undertaken by Hatch Goba, dated October 2014 and attached in **Appendix E1**.

The Traffic Report determined that the existing bulk services do not meet the requirements for the full development. The completed development is proposed to generate approximately 6,156 vehicle trips during the AM peak and 768 vehicle trips during the PM peak periods.

A 2-lane road in each direction is required on the R612, as well as on the R102, only up to the intersection allowing access into area D. The intersections will have to be signalised as well.

A growth rate of 2% per annum over five years was used to calculate the background traffic on the surrounding road network for 2019 (Scenario 1 – Full Development) and for three years to evaluate Scenario 2 (Stand 4 Development) and Scenario 3 (Stand 5, 6 and 7 Development) in 2017.

Due to the inadequate bulk services, it was deemed appropriate to evaluate Scenario 2 and 3 in 2017 as these are the most likely to be developed by 2017.

The report contains three evaluation scenarios for the proposed development. Scenario 1 considers the full development (2019), Scenario 2 for the development of Stand 4 only (2017) and Scenario 3 the development of Stands 5, 6 and 7 (2017). Currently the bulk services supply is insufficient to cater for the full development. The current situation would therefore only be adequate for either Scenario 2 or 3 to be developed.

a. Under the existing 2014 traffic evaluation, the five key intersections operate satisfactorily at level of service (LoS) A or B during both the AM and PM peak periods.
b. Under the 2019 Scenario 1 evaluation all intersections operate satisfactorily overall at LoS A, B, or C during both the AM and PM peak periods respectively.
c. The Scenario 2 evaluation showed that the four key intersections operate satisfactorily overall at LoS A or B provided they are upgraded to signal controlled intersections.
d. The Scenario 3 evaluation showed that the four key intersections operate satisfactorily overall at LoS A or B provided they are upgraded to signal controlled intersections.

12.5 Visual Impact

A visual impact assessment was undertaken by SiVEST, dated 3 April 2014 and attached in **Appendix D4**.

The Visual Impact Assessment conducted for the proposed Rorqual Estate Development has demonstrated that the visual character within the study area varies. It includes areas with a natural uninhabited sense of place, scenic views of the ocean and rivers, distinct pastoral areas with rolling green hills and more transformed settings near the coastal towns. A number of visually sensitive receptors were identified within the study area, as the Indian Ocean has attracted several leisure based tourism facilities into the area, thus contributing to the local economy and increasing the visual sensitivity of the surrounding area.

In order to classify the visual sensitivity of the development site, a visual sensitivity analysis was carried out based on the likely visual exposure from sensitive receptor locations and visual contrast of the development with the surrounding area. The analysis revealed that most of the study area has a negligible, low or moderate visual sensitivity due to the presence dense coastal bush and rolling terrain that will obscure large portions of the development site.

The overall significance of the visual impacts as a result of the proposed mixed-use development during construction and operation was assessed according to SiVEST's impact rating matrix. The assessment revealed that the significance of the visual impacts resulting from the proposed development would be low during construction and moderate during operation. Although the visual impact of the proposed development cannot be reversed, mitigation measures were proposed to lessen the visual impact and should be implemented.

12.6 Heritage Impact

A Heritage Impact Assessment was undertaken by eThembeni Cultural Heritage, dated 30 June 2009 and attached in **Appendix E6**.

Summary of findings in terms of the KwaZulu-Natal Heritage Act 1997 Section 27(3):

a. The identification and mapping of all heritage resources in the area affected
   Indeterminate Late Iron Age ceramic sherds.

b. An assessment of the significance of such resources in terms of the heritage assessment criteria set out in regulations
   The site has low heritage significance at all levels for its scientific value.

c. An assessment of the impact of development on such heritage resources
   The site will be destroyed by the proposed development.

d. An evaluation of the impact of the development on heritage resources relative to the sustainable social and economic benefits to be derived from the development
   The benefits of the proposed development outweigh the impact on known heritage resources.

e. The results of consultation with communities affected by the proposed development and other interested parties regarding the impact of the development on heritage resources

The client has undertaken such consultation in terms of statutory requirements and retains the relevant documentation.

f. If heritage resources will be adversely affected by the proposed development, the consideration of alternatives
The Applicant should apply to Amafa for a destruction permit prior to undertaking construction activities.

g. Plans for mitigation of any adverse effects during and after completion of the proposed development

If permission is granted for development to proceed, the client is reminded that the Act requires that a developer cease all work immediately and notify Amafa should any heritage resources, as defined in the Act, be discovered during the course of development activities.

The heritage consultants recommend that this project may proceed with the proposed heritage resource mitigation and have submitted this report to Amafa aKwaZulu-Natali in fulfilment of the requirements of the KwaZulu-Natal Heritage Act. According to Section 27(4) of the Act, the report shall be considered timeously by the Council, which shall, after consultation with the person proposing the development, decide:

- whether or not the development may proceed;
- any limitations or conditions are to be applied to the development;
- what general protections in terms of this Act apply, and what formal protections may be applied to such heritage resources;
- whether compensatory action shall be required in respect of any heritage resources damaged or destroyed as a result of the development; and
- whether the appointment of specialists is required as a condition of approval of the proposal.

The client may contact Ms Wesiwe Tshabalala at Amafa's Pietermaritzburg office (telephone 033 3946 543) in due course to enquire about the Council's decision.

13 SUMMARY OF SPECIALIST STUDIES FOR SANITATION OPTION

13.1 Geohydrology for WWTW Site

A Geohydrological Assessment was undertaken by GCS (report dated 17 October 2012 and attached in **Appendix E9**).

The assessment assessed the risks associated with the disposal of this treated sewerage effluent from the plant on both groundwater and surface water, however; the report focussed on the desktop information to obtain an overview of the area of interest and the objectives were as follows:

- Desktop study and assessment of all available information.
- Analyses and review of NGDB and GRID data
- Walkover assessment, Hydro census and user survey

The effluent generated by this process is planned to be disposed to the larger farm to the west of N2.

Previous studies also show that the ambient groundwater quality in the area is generally good; with the exception of the Mzimayi River which has been reported unsatisfactory in terms of water quality by Umgeni Water (2010).

The following conclusions are based on the information obtained during the desktop study and site visit to the irrigation area:

13.1.1 Geology

The proposed site for irrigation where the sewerage effluent is to be disposed is underlain by granite of the metamorphic province. This granite ranges in terms of weathering from highly weathered on the hilltops to fresh rock at depth. Fresh granite is exposed along the Mzimayi River.

13.1.2 Hydrology

According to the previous studies done in this area, shallow groundwater seepage is not encountered in the hilltop areas; however, groundwater seepage is not uncommon along the drainage lines on the development area. The major water source found in this area is the E.J. Smith dam and the Mzimayi River, which runs through the irrigation area. A number of small streams are found in the area as well as dams and wetlands.

Mzimayi River is a major surface water source in this area, however, a number of other small streams, wetlands and dams do occur in this area where surface water abstraction takes place.

No boreholes were found from the NGDB within the irrigation area, however, a few boreholes were found from the GRIP data but these occur further away from the area of interest about 2km or more from the proposed site. These boreholes were therefore not visited.

13.1.3 Water quality

Previous studies indicate that the ambient groundwater quality is generally good with the exception of the Mzimayi River, which has been reported unsatisfactory in terms of water quality by the Umgeni water (2010).

The site visit to the irrigation area took place on the 2 November 2012 and the GCS personnel in charge of this visit were John Ngaleka (Field hydrogeologist) and Mzikayise Nkwane (Earth Scientist). Water samples were then collected from different sampling points. Field EC and pH were measured and recorded. Three water samples (MB4, Bridge 1, and Spring 1) were sent to the laboratory for further analysis of cations and anions, one sample from an identified spring (groundwater) and two from stream water. The results from the laboratory shows high Iron concentrations exceeding SANS 241-1:2011 limits. Spring 2 also shows high nitrate and manganese concentrations above SANS 241-1:2011 limits. High Iron concentration may also be as a result of laboratory errors.

13.1.4 Recommendations

Since there are no boreholes within the area, there is a necessity to drill enough boreholes in the area post-authorization to obtain:

- Enough groundwater samples for ambient groundwater quality analysis.
- Groundwater flow directions
- Underlying geology
- Type of aquifer present on-site and its thickness
- Iron concentration needs to be reconfirmed using another laboratory in the phase.

It is anticipated that at least three to four dedicated groundwater monitoring boreholes should be constructed at pre-selected sites post-authorization. Borehole locations will be determined on final irrigation programmes and plans. Geological data and hydrogeological data will also be applied to site boreholes. Boreholes will be required to measure both the shallow and deeper aquifer systems and a pair will be required next to each other.

13.2 Estuarine Water Quality and Botanical Assessment

An Estuarine Water Quality and Botanical Assessment was undertaken by Scherman Colloty & Associates (report dated December 2012 and attached in **Appendix E10**).

The following three estuaries fall within the proposed boundaries of the development: the Nkomba (located at the Happy Wanderers Holiday Resort), the Mzimayi and an unlisted estuary located at the Rocky Bay Holiday Resort).

The change in river flow and fishing pressure has been low in the Mzimayi and Nkomba estuaries according to the National Biodiversity Assessment (Van Niekerk & Turpie, 2012). The level of pollution in both estuaries is however regarded as “medium”, the loss of habitat in the Mzimayi Estuary is also regarded as “medium” and there has been a ‘high’ level of habitat loss in the Nkomba Estuary (particularly with regards to macrophytes). As a result, both estuaries have been allocated provisional Present Ecological Status scores of ‘C’, which is an Estuarine Health Index score of 61-75 and regarded as ‘moderately modified’ (DWAF, 2004).

The study provided the following recommendations:

- An intensive monitoring programme should be implemented for these three estuaries; this should include the sampling for physical and chemical parameters (including salinity, temperature, pH and dissolved oxygen), nutrients (N and P), microalgal biomass (both benthic and pelagic) and bacteria (faecal streptococcus in particular). The estuaries are located close to holiday resorts and are frequently used for full contact recreation. The density of faecal streptococci is a concern and poses a substantial risk to the health of users. In addition, once breached the water from the Rocky Bay and Mzimayi estuaries flows into a Marine Protected Area and the long-term effects should be monitored. This will be monitored on a monthly basis according to the requirements of the National Water Act, with respect to requirements of disposal of waste-water to land.

- Development near an estuary can alter the distribution and density of macrophytic vegetation, especially if there is nutrient input into the system from septic tanks, fertiliser wash (e.g. increase in littoral reed growth) and river inflow. Managers should prevent excessive nutrient inputs, the clearing of riparian zones, and infrequent or too frequent mouth breaching. Monitoring the estuary by means of aerial photographs allows an assessment of changes over time so this should be done regularly for good vegetation management. No development should take place in the estuarine functional zone. It is important that these areas be left untouched in order to maintain adequate function of the entire estuarine area.

- No sewer infrastructure should be located within the 1:100 year floodline of any aquatic system. All sewer systems should be inspected on a 6 monthly basis for leaks. The client has investigated this, and determined that it will be unavoidable to locate the sewer line in the 1:100 year floodline, however, with the possibility of the sewer lines changing from gravity fed to vacuum sewers, the risk of leaks and spills could be greatly mitigated.

13.3 Riverine Baseline Water Quality and Soil Phosphate Sorption Capacity Assessment

A baseline survey was conducted by GroundTruth (report dated April 2013 and attached in **Appendix E11**) to determine the current health/condition of the watercourses as well as to determine the potential capacity that the land under irrigation has to assimilate phosphate from the treated effluent irrigation.

Biological monitoring was conducted using aquatic macro-invertebrate and benthic diatom assessments and the bio-monitoring was augmented with physic-chemical assessments of the water quality.

The assessment was carried out at the following four sites:

- Northern-most stream flows into Turtle Bay
- Small tributary draining into Turtle Bay
- Southern-most stream draining into Submarine Bay
- Mzimayi River

The study concluded that the Mzimayi River, the main watercourse on the property, was in a good health condition. The northern-most stream has been seriously modified and the remaining two streams were in a fair condition. The water physico-chemical tests show that with the exception of soluble reactive phosphate at all sites and nitrate at sites AQS3 and AQS4, the fde determinants were within the target water quality guidelines set out by the Department of Water Affairs for aquatic ecosystems. The Mzimayi River had the highest nitrate and soluble reactive phosphate levels of all the sites at 1.05 mg N/L and 22.9 µg P/L respectively. These levels exceed the target water quality range for aquatic ecosystems and pose a minor risk of eutrophication to the system.

The sites sampled already have elevated phosphate levels, with the potential for the irrigation of treated effluent to further increase the phosphate and nitrate loads entering the river. A routine aquatic monitoring program will need to be implemented to ensure that eutrophication does not occur within the systems.

The phosphate sorption tests showed that the highly weathered soils on the estate have a high capacity to adsorb phosphate (greater than 1000 mg P/kg). A conservative estimate of the total phosphate load that the soil could assimilate was calculated at 1142 kg P. This estimate was subject to several assumptions and the volume of effluent that can be safely irrigated will depend on the concentration of phosphate in the treated effluent, the depth of the soils, the phosphate utilisation by the crops under irrigation and several other factors.

The assessment recommends that the treated effluent is irrigated on to crops (effluent quality dependant) or well vegetated areas and not to bare land. This will increase the amount of phosphate taken up by vegetation and subsequently increase the lifespan of the phosphate sorption capacity of the soils.

A regular/routine monitoring program on all four of the watercourses on the development consisting of biological and chemical sampling must be under taken on at least a quarterly basis. If impacts relating to the effluent irrigation are identified during this monitoring program, then the discharge quality of the effluent will need to be tightened or an alternative method needs to be identified and implemented for disposing the treated effluent. In addition a soil phosphate sorption capacity calculation will need to be done every 2 years to monitor for changes in the expected lifespan of the soil sorption capacity.

13.4 Engineering for Sanitation Option – WWTW Facility Design and Operation Report

A Sewage Treatment Technical Design Report was undertaken by Hatch Goba, dated 19 November 2014, and attached in **Appendix C5**. This report will be included in the waste management licence application.

A positive design application that is being proposed is for the main sewers to be vacuum sewers, as these do not leak outwards.

An Operation Plan should be required post environmental authorisation, and should include the following:

- Waste hierarchy implementation plan.
- Emergency spill contingency plan.

13.5 Agricultural Irrigation Feasibility Assessment and Design and Management Plan

An irrigation feasibility assessment and design and management plan will be undertaken post environmental authorisation, according to the following terms of reference:

- Identify agricultural land suitable to receive treated effluent.
- Calculate the irrigation demand of the suitable land.
- Identify suitable crops to be irrigated.
- Identify and design feasible irrigation systems in light of the above.
- Provide management recommendations.
- Assess the impacts of the treated effluent on the agricultural potential and yields of the remainder of the Ellingham Farm in light of the loss of agricultural land as assessed by the agricultural potential assessment.

14 MANAGEMENT PLANS

14.1 Conservation Management Plan

A conservation management plan was undertaken by Zunckel Ecological and Environmental Services, dated 6 August 2013, and attached in **Appendix G2.2**.

The purpose of the Rorqual Estate Conservation Management Plan is to retain and enhance its biodiversity, in order to share the ecological experience of the estate and its coastal environs with all. In addition, all twelve of the possible reasons listed in Chapter 3, Section 17 of the National Environmental Management: Protected Areas Act (No. 57 of 2003) are relevant and will be achieved if the estate is managed according to this management plan. These reasons as listed in the Act are as follows:

a. To protect ecologically viable areas representative of South Africa's biological diversity and its natural landscapes and seascapes;
b. To preserve the ecological integrity of those areas;
c. To conserve biodiversity in those areas;
d. To protect areas representative of all ecosystems, habitats and species naturally occurring in South Africa;
e. To protect South Africa's threatened or rare species;
f. To protect an area which is vulnerable or ecologically sensitive;
g. To assist in ensuring the sustained supply of environmental goods and services;
h. To provide for the sustainable use of natural and biological resources;
i. To create or augment destinations for nature-based tourism;
j. To manage the interrelationship between natural environmental biodiversity, human settlement and economic development;
k. Generally, to contribute to human, social, cultural, spiritual and economic development; and
l. To rehabilitate and restore degraded ecosystems and promote the recovery of endangered and vulnerable species.

The conservation management plan vision statement as agreed to by project team members who participated in the management planning meeting on 21 November 2012 is captured below.

"The Rorqual Estate will optimise regional development and co-ordinated service opportunities while securing and integrating its natural features to enhance their intrinsic value as well as their value to the development, in terms of property values and ecosystem services."

The management objectives established from the exercised are summarized as:

Management objectives relating to Institutional Arrangements

1. An institutional structure is in place that will stand accountable for the implementation of the conservation management plan.
2. The management structure of the estate has established and maintains strong linkages with relevant strategic partners.
3. All people involved with the development of the estate as well as all homeowners and residents are fully appraised of the contents of the conservation management plan and work and live in ways that are compatible with the achievement of its vision as well as demonstrate a full understanding for the value of the natural features and their management.
4. All developments on the estate are planned, developed and operated to ensure compatibility with the vision of this conservation management plan.

Management Objective Related to the Natural Features

1. The conservation integrity of all areas delineated as natural vegetation is secured through ongoing rehabilitation and management.
    a) The natural area needs to be maintained free of all invasive alien plants
    b) Buffers of 40 metres are required for indigenous vegetation components on site, and a preferred buffer of 100 metres, but not less than 60 metres, for the main block of forest and the arms of Swamp Forest, which extends out of it.
    c) All areas cultivated by sugarcane outside the development footprint (i.e. in the buffers and exclusion areas) must be re-vegetated with purpose-gathered seed mixes.
    d) The special species, *Cyrtanthus mackenii* subsp. *mackenii* (Ifafa Lily) population identified to occur on the Rorqual Estate must be protected, and populations restored in accordance with the plan developed by Styles (July 2013).
2. All fauna related to the varieties of habitats on the estate are managed to persist within the population size limitations relevant to the habitat types.
3. All of the freshwater components, including natural drainage lines (non-perennial and perennial) and wetlands on the estate, are rehabilitated and managed in order to enhance their capacity to host related indigenous species and deliver ecosystem services.
4. The integrity of the coastal zone, including the dunes, sandy and rocky shore in the inter-tidal zone, the estuaries, and the immediate off-shore area, is reinstated and maintained.

Potential impacts identified from the Coastal Impact Assessment (Royal HaskoningDHV, November 2012):

- Inappropriately located coastal settlement has the potential to suffer massive damage from dynamic, natural marine processes.
- Inappropriate coastal development has the potential to negatively impact and be a source of pollution.
- Construction activity and post-construction incursions into the dune forest environment can have negative impacts.
- Inappropriate use of the land parcel has the potential to negatively impact on its sustainability.

Recommendations from the Estuarine Assessment (Scherman Colloty & Associates, December 2012):

- An intensive monitoring programme should be implemented for the three estuaries
- Managers should prevent excessive nutrient inputs, the clearing of riparian zones, and infrequent or too frequent mouth breaching.
- No sewer infrastructure should be located within 1:100 year floodline of any aquatic system.

Some Relevant Management Principles:

- The Use of Fire as a Management Tool
- Clearing of Invasive Alien Plants

14.1.1 Recommended Action Planning Process

The process recommended to take this preliminary management planning framework forward into a comprehensive conservation management plan is as follows:

- The key individual responsible for driving / championing the development must identify relevant representatives from the development team, and together with representatives from strategic partner organisations and other stakeholders, or interested and affected parties, convene a management planning workshop.
- The services of an external independent facilitator who is familiar with and understands the requirements of a conservation management plan within the context of the estate must be procured to facilitate the workshop.
- Each of the management planning team must be provided with a copy of this management planning framework and related specialist reports with the request that they appraise themselves with the content thereof, as well as what will be expected of them in the process of deriving the comprehensive plan.
- A workshop must be scheduled where the following steps may be followed towards the compilation of the comprehensive plan:
  - Background information is presented to ensure that everyone has the same understanding as to the natural features of the estate, the basic management aspects that will be required to secure these assets and the vision and management objectives as per this framework.
  - An open discussion must be facilitated to allow for questions of clarity as well as the sharing of additional information. The facilitator will need to judge and manage this process carefully so as to not ensure that time is used efficiently and that the objective of reaching a shared understanding is achieved.
  - Information is presented on the process that is to be followed in terms of identifying and articulating the operational goals for each of the management objectives.
  - A systematic process of deriving the operational goals for each of the management objectives is then facilitated.
  - Considering that this process can take up much of the time allocated for the workshop, it is recommended that task teams be identified to populate the action planning templates.
  - Alternatively the same group may agree to reconvene with the same facilitation process to populate the templates together.

This process needs to be initiated as soon after a positive RoD has been obtained and must be completed before any development takes place on the estate.

The intended outcome of this process is a plan that provides very clear direction in terms of what needs to be done in order to achieve each of the operational goals, which will collectively ensure that each of the management objectives are achieved, which will ensure that the vision is also achieved. Every effort must be made to keep it as simple as possible and not to allow it to become too bulked up with relevant information, which can rather be referred to or included as annexures. Ancillary plans might be required to address particular aspects of management in more detail, such as the grassland rehabilitation report produced by David Styles (August 2013).

14.2 Re-vegetation Plan

A Re-vegetation Plan was undertaken by David Styles, dated 9 December 2014, and attached in **Appendix G2.3**.

Existing site conditions

Vegetation on the Rorqual Estate consists of the following components:

- Northern Coastal Forest, from degraded to primary.
- Swamp Forest, from degraded to primary.
- Eucalyptus-dominated tree growth.
- Dune Thicket

- Casuarina-dominated thicket
- Bush clumps and patches seral indigenous woody vegetation surrounded by cultivation.
- Grassland, from primary to secondary.
- A mosaic of vegetation, much secondary and alien, on a damp to wet substrate within the Mzimayi River floodplain.

There are also important wetland areas. However, these have been severely degraded by agricultural activity, including construction of agricultural drains and cultivation into them. Where not cultivated they are often extensively invaded by the alien reed *Coix lacryma-jobii.*

Vegetation on other parts of the Rorqual Estate comprises sugar cane cultivation with some gardening around dwellings.

14.2.1 Broad rehabilitation objectives

Broad rehabilitation objectives are as follows:

- Protection of indigenous vegetation components;
- Removal of alien species;
- Other management interventions to maintain and improve their plant biodiversity;
- Replacing sugar cane cultivation outside the development footprint (in the buffers and exclusion areas) with natural vegetation.

14.2.2 Specific rehabilitation objectives

The main focus of this plan is replacing sugar cane cultivation with grassland and subsequent management, with practical steps needed to reach this goal being identified. However, management of restored grassland also requires control of alien plants in proximate and interface areas of existing vegetation components.

Reasons for replacing former sugar cane cultivation with grassland are as follows:

- The other vegetation components, including forest, thickets, patches of seral woody vegetation, and now reduced areas of primary and secondary grassland were likely formerly situated within a greater area of grassland.
- It is important to maintain an open ecotone along the edges of forest and closed woody vegetation. Forest-grassland and woody vegetation-grassland ecotones support a different suite of species to the forest or closed woody vegetation interior, adding to the plant diversity of these communities.
- Ecotones are productive for wildlife and support greater faunal diversity.
- By replacing sugar cane cultivation with grassland, except where a greater proportion of reeds, sedges and hygrophytic plants would naturally have occurred (i.e. in wetland parts) this will create a more balanced and historically correct range of vegetation types and habitats.
- There are some management and security advantages to maintaining grassland buffers around areas of closed woody vegetation.

There are two rehabilitation options for grassland within the buffers, as follows:

- Rehabilitation using a commercially available seed mix.
- Rehabilitation using a purpose-harvested seed mix.

The latter option is more difficult and costly, but will provide a better ecological result.

The report then provides insight into, and practical advice on the following revegetation process:

- Preparatory work
- Commercial grass mixes
- Purpose-gathered seed mixes
- Sowing of grass cover

- Maintenance
- Control of weeds and alien plants
- Burning
- Further plantings into the grassland buffer
- Primary grassland – specific management interventions
- Alien vegetation in other vegetation components
- Livestock and large mammals
- Disturbance in the grassland rehabilitation area
- Plantings in development footprint areas
- Regulation of activities of homeowners and home occupants
- Auditing

14.3 Cyrtanthus mackenii Restoration Plan

A specific *Cyrtanthus mackenii* (Ifafa Lily) restoration plan was undertaken by David Styles, dated 24 July 2013, and attached in Appendix G2.4. Refer to attached document for findings.

14.4 Draft Wetland Rehabilitation Strategy

A draft Wetland Rehabilitation Strategy was undertaken by SiVEST, dated 15 October 2012, and is attached in **Appendix G2.1**.

14.5 Draft Open Spaces Codes of Conduct

Draft Open Spaces Codes of Conduct will be prepared and submitted post authorization, once it is better understood as to how the estate will be governed and managed (Body Corporate or Home Owner's Association), and which components of the open spaces will lie within or outside of the estate.

14.6 Engineering Studies and Plans

14.6.1 Engineering Services Study

An engineering services assessment for the project was undertaken according to the following terms of reference:

- Investigate the capacity of the existing services and infrastructure to receive the proposed development.
- Recommend all necessary upgrades and infrastructure required to service the development as well as the proposed responsibility for funding and implementing these upgrades.
- Identify measures to reduce the consumption of electricity and potable water across the development.
- Identify measures to recycle waste and storm-water generated by the development.
- Acquire confirmation of capacity letters from Eskom, Umgeni Water, Ugu Waste and Umdoni Solid Waste.
- Compile a storm-water management plan for the development as per the terms of reference provided in *Section 12.2.11* below.

A preliminary Engineering Services Report was undertaken by Hatch Goba, dated 29 September 2011, and attached in **Appendix C2**.

Furthermore, reference should be made to the Service Level Agreements, dated August 2013 and September 2014, and attached as **Appendix C9**.

14.6.2 Storm-water Management Plan

A storm-water management plan for the project was undertaken according to the following terms of reference:

- Estimate the storm-water runoff generated by the proposed development under pre- and post-development scenarios.
- Calculate the attenuation/detention capacity required to ensure that the volume and rate of post-development runoff is reduced to within 5% of the existing runoff situation before being discharged into the watercourses onsite.
- Provide recommendations regarding the design of management structures and flow routes to achieve the above requirement.
- Where feasible, incorporate the recommendations of the wetland and estuarine specialists into the design of the storm-water management system.

The Stormwater Management Plan was undertaken by Hatch Goba, dated 15 December 2014, and attached in **Appendix C5**.

15 THE PUBLIC PARTICIPATION PROCESS

Public participation is the cornerstone of any EIA. The principles of the National Environmental Management Act (NEMA) as well as the EIA Regulations (2010) govern the EIA process, including public participation. These include provision of sufficient and transparent information on an on-going basis to stakeholders to allow them to comment, and ensuring the participation of previously disadvantaged people, women and the youth. Refer to **Appendix F** for a detailed record of public participation activities.

Input into the public participation process by members of the public and stakeholders can be given at various stages of the EIA process. Registration as an I&AP can take place at any time during the process up until the final EIA report is submitted to the authorities (EDTEA). There are however specific periods in which public comments are required in order to ensure that these are captured in time for the submission of the various reports. These periods are as follows:

- Initial comment period based on the Background Information Document (BID) distribution (**30 days**) – comments must be sent to SiVEST.
- Comment period for the Draft Scoping Report (**40 days**) – comments must be sent to SiVEST.
- Comment period for the Final Scoping Report (**40 days**) – comments must be sent to the EDTEA.
- Comment period for the Draft Environmental Impact Assessment Report (EIAR) (**40 days**) – comments must be sent to SiVEST.
- Comment period for the Final Environmental Impact Assessment Report (EIAR) (**21 days**) – comments must be sent to the EDTEA.

15.1 Responsibilities of Interested & Affected Parties (I&AP's)

Members of the public who want to participate in the assessment process need to register and are referred as I&AP's. Registered I&AP's are entitled to comment, in writing, on all written submissions to the authority and to raise any issues that they believe may be significant, provided that:

- Comments are submitted within the timeframes set by the competent authority or extensions of timeframes agreed to by the applicant or Environmental Assessment Practitioner (EAP). See timeframes above.
- A copy of the comments submitted directly to the competent authority is served on the applicant or EAP.
- The I&AP discloses any direct business, financial, personal or other interest which that party may have in the approval or refusal of the application.

15.2 Steps Taken to Notify Key Stakeholders and Potential I&AP's

The following process was followed to notify potentially I&APS of the proposed development:

- Background information documents were distributed to the surrounding community within a 100m radius of the proposed site by hand delivery on the 29th October 2009.
- Background information documents were distributed to Identified stakeholders by Fax, Email and hand delivery on the 29th October 2009.
- Adverts were placed in three newspapers, one a local distribution newspaper and the others regional distributions:
  - Mercury – English version (29th October 2009).
  - Isolezwe – Zulu version (29th October 2009).
  - South Coast Herald (29th October 2009).
- 12 Site notices were placed within the vicinity of the site on the 29th October 2009.
  - 6 Zulu version
  - 6 English version
- A public meeting/open day was held on the 12th November 2009 at the Rocky Bay Conference Centre.

See **Appendix F** for proof of site notices, newspaper adverts, and the BID.

The Rorqual Estate application was originally lodged in 2009. This application has been withdrawn and resubmitted under the 2010 EIA regulations. Regarding the public participation process, notification was conducted under the 2006 EIA Regulations. As allowed for in sub-regulation 75(1), DAEA&RD confirmed that they will accept the notification as having been done in accordance with the 2010 EIA Regulations. This is because the scope of the project has not changed. However, an advert in the local press making potential I&APs aware of the availability of the Draft Scoping Report needed to be complied with the comments on the BID, and those raised at the public meeting/open day held on the 12th of November 2009 by I&APs are included in comments and response report attached as **Appendix F**.

The following Stakeholders and I&APs have provided comment on the development proposal thus far:

- WESSA
- Ezemvelo KZN Wildlife
- Illovo Sugar
- Surrounding landowners/residents
- Local Ward Councillors
- Umdoni Municipality

15.3 Summary of the Issues Raised by I&AP's During the Initial Scoping Process

The issues raised by the I&APs can be summarised into the following categories:

- Impacts on the onsite and downstream wetlands, streams and estuaries as a result of storm-water runoff and sewage generated by the development.
- Impacts on the onsite and downstream surface and groundwater quality as a result of storm-water runoff and effluent generated by the development.
- Impacts on the coastal forest.
- Minimum buffer width requirements.
- Impacts on specific species of conservation significance.
- Impacts on the two small estuaries onsite as a result of water input quantity and quality changes.
- Impacts on the quality of life of neighbouring residents.
- Need and desirability of the proposed development.
- Compatibility of high-density development with the nature of the local area and the municipal density requirements i.e. impacts on sense of place and aesthetics.

- Impacts on Illovo Sugar.
- Impacts on the Sezela sugar mill and local cane growers.
- Impact on agricultural land and potential.
- Impacts on the use of water from a pipe that drains a portion of the project site by residents in Alkins Road.
- Impacts on the Rocky Bay Caravan Park, Rocky Bay Beach and conservation area and those who live or own there.
- Impacts on the coastal zone (e.g. beaches, coastal erosion and recreational carrying capacity) and the need for a resource economics assessment to assess this impact.
- Unsustainable coastal zone planning and land use issues:
  - The proposed development represents an unsustainable land use i.e. "ribbon development".
  - The proposed development is in conflict with the principles of the Coastal Zone Management.

Please refer to the comments and response report (included in **Appendix F**) which details all the comments, and the responses to these comment, in detail.

15.4 Issues and Impacts Summary

Table 9: Summary of the issues and impacts raised by I&APs on the proposed option during Scoping and the proposed way forward to address these issues and impacts in the EIA Phase

Issues/Impacts	Raised by	Action/Way forward
1. Storm-water management:		
Storm-water runoff impacts and management	KZN Wildlife, WESSA, DWA, Cllr Edwin Baptie, Mr & Mrs Lawson	Prepare a Storm-water Management Plan to be approved by the wetland and estuarine specialists
Erosion control measures	DWA	Prepare a Storm-water Management Plan to be approved by the wetland and estuarine specialists; prepare a Construction EMPr
Explore rainwater harvesting	DWA	Prepare a Storm-water Management Plan to be approved the wetland and estuarine specialists
2. Impacts on biodiversity:		
Loss of coastal forest unacceptable	KZN Wildlife, DAFF	Conduct a Vegetation Assessment
Need to determine appropriate forest buffers – 40m to small fragments and 60m to large fragments	KZN Wildlife, DAFF	Conduct a Vegetation Assessment
Need to determine appropriate forest management	KZN Wildlife	Conduct a Vegetation Assessment
Presence of species of conservation significance	KZN Wildlife	Conduct a Vegetation Assessment
Fragmentation and connectivity impacts	KZN Wildlife	Conduct a Vegetation Assessment
Road alignment impacts on forests	DAFF	Conduct a Vegetation Assessment
Conservation management and operational impacts	KZN Wildlife, DAFF	Identify an appropriate vehicle to generate funds for conservation management; identify responsibilities for conservation management, prepare codes of conduct for conservation areas; and prepare a conservation management plan for inclusion in the Operational EMPr as a condition of the EA.

Issues/Impacts	Raised by	Action/Way forward
3. Impacts on watercourses:		
Impacts on wetlands and streams	WESSA, DWA, Mr. J. Venter	Conduct Wetland and Riverine Assessment
Need to determine appropriate wetland buffers – especially in light of high densities	WESSA	Conduct a Wetland Assessment
Water quality impacts	WESSA	Prepare a Storm-water Management Plan
Minimum buffers – 20-30m	DWA, WESSA	Conduct a Wetland Assessment
Flow regime impacts	WESSA	Prepare a Storm-water Management Plan
Service crossing impacts	WESSA	Conduct a Wetland Assessment
Wetland rehabilitation and management	KZN Wildlife, WESSA	The preparation of a Wetland Rehabilitation and Management Plan will be recommended as a condition of the EA.
Water use licenses	DWA	Apply for licenses as condition of the EA
4. Impacts on estuaries:		
Density impacts	WESSA	Conduct an Estuarine Assessment
Opportunity for the retreat of development	WESSA	Conduct an Estuarine Assessment
Storm-water and sewage impact	WESSA	Conduct an Estuarine Assessment
5. Coastal zone impacts:		
Opportunity to reinstate the dune corridor in the Admiralty Reserve at Rocky Bay	WESSA	The preparation of a Coastal Vegetation Rehabilitation Plan will be recommended as a condition of the EA.
Need for a regional coastal management plan	WESSA	Responsibility of the Umdoni Local Municipality
Ribbon development	WESSA	Ensure compatibility with existing strategic plans (e.g. SDF)
Beach capacity/recreational carrying capacity	WESSA, Mr. AJ Young	Conduct a Coastal Zone Impact Assessment
Coastal erosion risks	WESSA	Conduct a Coastal Zone Impact Assessment
6. Wastewater Management:		
Prefer Regional Treatment Works to service the development	DWA	Project engineer to liaise with the Ugu Municipality
If regional works not viable, prefer a single onsite treatment works	DWA	Engineer to prepare a WWTW Process, Design and Operation Plan for inclusion in the operational EMPr.
Package treatment plants not supported	DWA	Noted.
Opportunity to relocate Scottburgh wastewater Treatment Works to project site.	WESSA	Project engineer to liaise with the Ugu Municipality
Spill contingency plan	DWA	An operational spill contingency plan will be included in the Operational EMPr
7. Planning issues:		
Density must reflect the carry capacity of the receiving environment	WESSA	Conduct an Estuarine Assessment

Issues/Impacts	Raised by	Action/Way forward
High densities conflict with catchment management principles	WESSA	Conduct an Estuarine Assessment
High densities conflict with coastal management principles	WESSA	Conduct a Coastal Zone Impact Assessment
Ribbon development & urban sprawl	WESSA	Town planner to ensure compliance with municipal planning
Lack of bulk infrastructure and capacity of Ugu DM and Umdoni LM	WESSA	Engineer to confirm services availability and prepare an engineering services report
8. Density impacts:		
Densities too high	WESSA	Conduct a Wetland Assessment and Estuarine Assessment; Prepare a Storm-water Management Plan
Density impacts on watercourses and estuaries	WESSA	Conduct a Wetland Assessment and Estuarine Assessment
Density impacts on aesthetics	WESSA	Conduct a visual impact assessment
9. Traffic impacts:		
Increase in traffic volumes and congestion at intersections	SANRAL, SiVEST	Traffic Impact Assessment
Need for a transport management plan	SANRAL	Not the applicant's responsibility
Infrastructure upgrade requirements and phasing	SANRAL	Traffic Impact Assessment
10. Socio-economic impacts:		
Creation of jobs	SiVEST	Socio-economic impact assessment
Evaluate the economic value of coastal zone impacts – resource economics	WESSA	No action in this regard. The coastal zone impact assessment will suffice.
Impacts on Rocky Bay log cabin owners	Ms. CD Powell, Mr. AJ Young	Legal matters regarding lease agreements will be dealt with by the Ellingham Estate lawyers
Impacts on groundwater supply to Alkins Drive residents who use the water for irrigation	Mr. And Mrs. Lawson	This was investigated, and it was determined the water was being abstracted without a water use licence.
11. Agricultural land impacts:		
Cumulative loss of agricultural land	EDTEA: Macro Planning, WESSA	Agricultural Potential Assessment, Socio-economic assessment
Impact on Illovo Sugar and the Sezela Sugar Mill	EDTEA: Macro Planning	Agricultural Potential Assessment, Socio-economic assessment
12. Need and Desirability		
Question need for development	EDTEA: Macro Planning, WESSA, Cllr Edwin Baptie, Mrs. ME Huson	Market Feasibility and Socio-economic Assessment
13. Impacts in heritage resources:		
Impacts to heritage resources	SiVEST	Heritage Impact Assessment
14. Waste management:		
Solid waste management	WESSA, Cllr Edwin Baptie	Engineering Services Report
15. Flood risks:		
No development within the 1:100 year floodline	DWA	A 100 year floodline assessment/determination was completed by the Engineers
16. Alternatives		

Issues/Impacts	Raised by	Action/Way forward
Lack of land use alternatives	WESSA	Mixed-use and residential land uses are considered the only viable options to the applicant.
17. Geotechnical constraints		
Need for a detailed geotechnical investigation	DWA	Geotechnical Investigation
18. Water consumption:		
Explore water-use efficiency measures	DWA	Engineering Services Report
19. Electricity consumption:		
Explore energy-use efficiency measures	SiVEST	Detailed Engineering Services Report post-authorisation

Table 10: Summary of the issues and impacts raised by I&APs on the sanitation option, and the proposed way forward to address these issues and impacts in the EIA Phase.

Issues/Impacts	Raised by	Action/Way forward
1. Impacts on watercourses:		
Reserve determination for affected watercourses	DWAS	Conduct a Wetland Impact Assessment, Riverine Impact Assessment and Estuarine Assessment. (subject to clarity from DWAS)
2. Wastewater Management:		
If a regional works not viable, prefer a single onsite treatment works	DWAS	The following plans/studies will need to be prepared: • Geohydrological Study • WWTW Site Operation Plan • Waste Hierarchy Implementation Plan • Spill Contingency Plan • WWTW Site Plan and Facility Designs
Waste management license	DWAS	Apply for license as condition of the EA
Water use licenses for sewage disposal via irrigation	DWAS	Apply for license as condition of the EA
Sludge management	DWAS	Sludge Management Plan as part of the WWTW Operation Plan
Industrial waste	DWAS	At present no industrial development is formally proposed for the site.
Spill contingency plan	DWAS	An operational spill contingency plan will be included in the Site Operation Plan

16 ENVIRONMENTAL IMPACT ASSESSMENT METHOD

The SiVEST impact assessment method, dated 14 August 2012, is attached as **Appendix H** of this report. This method should be read before, and in conjunction with, the following impact assessment sections.

16.1 Determination of Significance of Impacts

Significance is determined through a synthesis of impact characteristics which include context and intensity of an impact. Context refers to the geographical scale (i.e. site, local, national or global) whereas intensity is defined by the severity of the impact (e.g. the magnitude of deviation from background conditions, the size of the area affected, the duration of the impact and the overall probability of occurrence).

Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The total number of points scored for each impact indicates the level of significance of the impact.

16.2 Impact Rating System Methodology

Please refer to **Appendix H** – SiVEST Environmental Rating System.

Impact assessments must take account of the nature, scale and duration of effects on the environment whether such effects are positive (beneficial) or negative (detrimental), as demonstrated in Table 6 below. Each issue / impact is usually assessed according to the project stages:

- Planning
- Construction
- Operation
- Decommissioning

Table 8: SiVEST Environmental Rating System Used to Classify Nature of Impacts

EXTENT (GEOGRAPHICAL)	
Site	The impact will only affect the site
Local/ district	Will affect the local area or district
Province/region	Will affect the entire province or region
International and National	Will affect the entire country
DURATION	
Construction period / Short term	Up to 3 years
Medium term	Up to 6 years after construction
Long term	More than 6 years after construction
PROBABILITY	
Definite	Impact will certainly occur (>75% probability of occurring)
Probable	Impact likely to occur (50 – 75% probability of occurring)
Possible	Impact may occur (25 – 50% probability of occurring)
Unlikely	Impact unlikely to occur (0 – 25% probability of occurring)
REVERSIBILITY	
Reversible	Impacts are permanent and can't be reversed by the implementation of mitigation measures
Irreversible	Impacts can be reserved though the implementation of mitigation measures
IRREPLACEABLE LOSS OF RESOURCES	
High	The impact is result in a complete loss of all resources
Medium	The impact will result in significant loss of resources
Low	The impact will result in marginal loss of resources
No Loss	The impact will not result in the loss of any resources
CUMULATIVE EFFECTS	
High	The impact would result in significant cumulative effects
Medium	The impact would result in moderate cumulative effects
Low	The impact would result in minor cumulative effects
SIGNIFICANCE RATINGS	
Significance is determined through a synthesis of impact characteristics. Significance is an indication of importance of the impact in terms of both physical (geographical) extent and time scale (duration), and therefore indicated the level of mitigation required. This describes the significance of the impact on the environmental parameter.	
High	- Province/region and medium / long term - International and National and medium / long term - Local/ District and long term - Site specific and long term
Medium	- Site specific and medium term - Local/ District and medium term - Province/region and short term/construction phase

	- International and National and short term/construction phase
Low	- Site specific and short term/construction phase - Local/ District and short term/construction phase

Within this Final EIA Report the potential impacts on the environment are identified, described and assessed in a systematic way, under two broad categories:

- Potential impacts on the biophysical environment
- Potential impacts on the socio-economic environment

Within each of these two broad categories, the various components that comprise them are listed:

- The likely potential impacts (both positive and negative), including cumulative impacts (if applicable) are described;
- Their time of occurrence during the project development cycle is identified;
- A description of the findings and recommendations of any specialist report or report on a specialised process and an indication of the appropriate mitigating measures that could be employed (where relevant).

17 ENVIRONMENTAL IMPACT ASSESSMENT OF THE PROPOSED OPTION

The following sections describe the specific impacts that may arise from the issues identified by the public, specialists and consultants to date.

The impacts identified, described and assessed below are based on the **Development Master Plan** (Plan No. J30092/L1A) prepared by GIBB dated February 2014, included in **Appendix A**.

17.1 Impacts on Biophysical Systems/Components

17.1.1 Impacts on Watercourses

17.1.1.1 Wetland Infilling & Encroachment Impacts

a. Wetland Infilling and Encroachment Impacts of the Main Rorqual Site

Development guidelines for both the residential and commercial zones will need to impose certain architectural controls, which must be monitored by the Home Owner's Association.

The layout indicates that the following Wetland Units will likely experience low-impact with building restrictions for the commercial development:

Wetland Unit	**Area**	**HGM Type**
A3a	0,80ha	Un-channelled valley bottom
B1a	0,40ha	Valley head seep
B1b	0,40ha	Valley head seep
Most of B1c	0,55ha	Un-channelled valley bottom and valley head seep
B6	0,55ha	Un-channelled valley bottom
B7	0,48ha	Channelled valley bottom
Most of Unit B8	0,47ha	Un-channelled valley bottom and valley head seep
Most of Unit B8a	0,16ha	Valley head seep
B3a	1,93ha	Un-channelled valley bottom
C3	0,89ha	Valley head seep
Most of D3	0,95ha	Un-channelled valley bottom and valley head seep
D5	1,00ha	Un-channelled valley bottom and valley head seep
E	0,94ha	Valley head seep
F	0,45ha	Valley head seep

Some of C0 (WWTW)	0,42ha	Un-channelled valley bottom
H	1,18ha	Un-channelled valley bottom
Total area:	**11,57ha**	

The layout indicates that Wetland Unit H (1.18ha) will be completely in-filled, and a portion of Wetland Unit G will be infilled for the commercial development. Please note that the exact area of Unit G to be infilled has not been calculated.

b. Impacts on Wetland Units of the North-West Quadrant and WWTW sites

The layout indicates that the following Wetland Units will likely experience low-impact with building restrictions for the commercial development:

Wetland Unit	**Area**	**HGM Type**
I1	9.27ha	Valley head seepage
I2	6,12ha	Un-channelled valley bottom
I3	1,07ha	Un-channelled valley bottom
J1	1,70ha	Un-channelled valley bottom / Valley head seep
D0	0,62ha	Un-channelled valley bottom / Valley head seep
D6	0,16ha	Un-channelled valley bottom / Valley head seep
Total area:	**18,94ha**	

It is the understanding of the author that a school is planned to be developed upslope of Wetland Units I1, I2 and J1; a possible petrol filling station adjacent to Wetland Unit I1 south of the R612; and a sewerage treatment works (STW) upslope of the Wetland Units D0 and D6.

Therefore:
- The degree of disturbance to the wetland units associated with the development is **high**;
- The extent of the impact on wetland units will be **local** because the current moderately-low level of ecosystem services supplied to the downstream systems will be lost;
- The duration of the impacts on the wetland units will be **permanent** as the wetland units will filled-in and destroyed; and
- The probability of the impact occurring is **definite**.

The significance of the loss of 1.18ha of wetland was assessed as being **medium-low** as shown in the impact summary table below (**Table 5**). In terms of acceptability, the impact level is considered **acceptable**.

Pre-mitigation impact assessment for wetland infilling (current state)

Assessment Criteria	Score	Rating
Ecosystem Goods & Services Value	2	Medium-Low
Environmental Value	**2**	
Disturbance	5	High
Extent	3	Local
Duration	5	Permanent
Probability	5	Definite
Impact Magnitude	**18**	
Significance	**36**	**Medium-Low**
Acceptability	**Acceptable**	

Mitigation measures:
The option to develop or infill wetland area and mitigate the loss through the use of wetland offsets is generally considered the last resort option in environmental planning. Before such an option is proposed, it is best practice to first consider the following mitigation hierarchy in decision-making:

1. Avoid or prevent the impact (avoidance)
2. Reduce or minimise the impact (mitigation)
3. Repair or remedy the damage caused by an impact

4. Offset or compensate for the impact or loss

In light of this, if feasible, the central portions of Wetland Unit H should be retained within the commercial development as a stormwater flow path that could contribute to stormwater attenuation and filtration. If not feasible for substantiated reasons, the measures below must be adhered to.

Although acceptable, the loss of wetlands is always a significant impact and requires compensation in the form of the regaining wetland functionality to offset the loss of wetland function. For wetland offsets, the no-net wetland loss principle is generally accepted as best practice when dealing with the issues of wetland loss. This means that wetland loss must be replaced by wetland gain so that the net wetland loss is zero. The replacement of wetlands at a ratio of 1:1 is generally regarded as being insufficient to mitigate wetland loss as wetland rehabilitation cannot reproduce pristine wetlands. Internationally, a minimum ratio of 1:1.5 is generally required to achieve 1:1 compliance on the ground. However, this minimum ratio is only considered appropriate in situations where rehabilitation has a low risk of failure, especially if the wetlands in question are degraded and of low conservation value from an ecosystem services perspective. The more valuable the wetland, the higher the offset ratio. In this case, an offset ratio of 1:3 is considered satisfactory in line with Ezemvelo KZN Wildlife's offset policy.

There are currently two approaches to the calculation of appropriate wetland area offsets: the (i) area for area approach or the (ii) hectare equivalents for hectare equivalents approach.

i. Area for Area Approach:

The area for area approach involves rehabilitating or reinstating an area of wetland equal to the wetland area being lost at the required offset ratio. If this approach were to be applied to the offsetting of the 2ha of wetland lost (not including Wetland Units 2a and 2b), 6ha of poor health wetlands of health categories D, E or F wetland would need to be rehabilitated to good healthy wetlands of A, B and C categories respectively, depending on the original state of the wetlands being lost. Thus, candidate wetlands for offsite mitigation would have to be of low health to qualify as an appropriate offset using this approach.

ii. Hectare Equivalents for Hectare Equivalents Approach:

To replace wetlands based on physical extent is often unreasonable as the extent of a wetland does not give an indication of the nature, value and health of the wetland. A useful way of expressing the realistic losses and gains in pristine (intact) wetland habitat that takes into account the present state of the wetland is to calculate the equivalent area of pristine and intact wetland lost, referred to as "hectare equivalents". Hectare equivalents are a proxy for the extent of the wetland that is intact and functional and involves rehabilitating or reinstating an area of wetland equal to the wetland hectare equivalents being lost at the required offset ratio. This approach was devised to assess the success of rehabilitation interventions in terms of functional habitat gains. The strength of this approach is that it enables the quantification of functional and intact wetland loss and gains. Thus, the hectare equivalents for hectare equivalents approach involves rehabilitating or reinstating an area of wetland equal to the wetland hectare equivalents being lost at the required offset ratio.

It is recommended that for the loss of Wetland Unit 2, the ha-equivalents approach be adopted for the calculation of the required gains in hectare equivalents that need to be achieved to offset the proposed wetland loss. The ha-equivalents approach is as follows:

Firstly, the present impact score for each of the wetland units must be converted into a health score out of 10, 10 being the highest health score.

The calculation of hectare equivalents of pristine wetland involves multiplying the health score of the wetland, on a scale of 0 to 1 (e.g. a health score of 2.8/10 = 0.28), by the area of the wetland (in hectares) to give a measure of hectare equivalents of pristine wetland. For example, if a 10 ha wetland is calculated as having an overall health score of 5 out of 10 (=0.5), the wetland in its current state would be considered to represent 5 hectare equivalents of pristine

wetland of the same type. If this same wetland were to be effectively rehabilitated so that the health score increased to 8 out of 10 (=0.8), it would then be considered to represent 8 hectare equivalents of pristine wetland. Therefore, rehabilitation has resulted in a gain of 3 hectare equivalents of pristine wetland.

It is important to note, however, that the hectare equivalents for hectare equivalents approach is only suitable for the offsetting of surface water management and water quality enhancement services and is not always suitable as an approach for calculating biodiversity offsets, particularly where important biodiversity losses are proposed. The only suitable approach for offsetting losses in biodiversity is the area for area approach at a suitable offset ratio.

Once the wetland offset requirements have been calculated for each wetland unit using either of the above approaches, candidate wetlands will need to be identified. In this regard, a wetland offset rehabilitation and management plan will need to be compiled by a suitably qualified wetland specialist to calculate the offset requirements, identify candidate offset wetlands, provide rehabilitation and management measures for the candidate wetlands, and ultimately show that the rehabilitation and management of these candidate wetlands will effectively offset the proposed loss of wetland associated with the project.

17.1.1.2 Storm-water Impacts

a. Impacts of storm-water infrastructure in wetlands during the construction phase of the Main Rorqual site

During the construction phase, the large areas of land presently under cane are going to be cleared and developed. The removal of vegetation (sugarcane) will increase surface runoff throughout the construction site as well as increase the erosion potential of the soils and the sediment loads of the runoff.

In addition, once the commercial and individual residential platforms are established, there will be erosion risks throughout the entire construction phase associated with ponding on the platform and the formation of rills and gullies down the platform embankments.

If stormwater runoff and erosion control measures are not effectively implemented during the construction phase, the exposure of the bare soils to the elements will likely lead to the erosion of the soils on site during heavy rainfall events. The result will be the formation of rills and gullies on steep slopes and embankments that will concentrate flow down-slope. The concentration of runoff down-slope within rills and gullies will increase the likelihood of the erosion and/or sedimentation within the wetlands units.

Such erosion events are likely to result in the deposition of eroded sediment into the surrounding wetland units and riparian zones. Impacts resulting from sedimentation include the covering over of the existing wetland and riparian vegetation. The smothering of the wetland plants and soils will result in the formation of a dry soil layer above the original wetland soils that will be susceptible to invasion by invasive and pioneer plants species. In addition, eroded upland seed banks will be deposited within the wetland which will likely result in the introduction of upland plant species into the wetland vegetation assemblage. The deposition of sediment within the wetlands and riparian zones can also result in the alteration of flow paths and gradients, which may lead to erosion. These impacts further act to reduce the wetland's functionality and ability to provide ecosystem services.

b. Impacts of stormwater runoff during the construction phase of the North-West Quadrant and WWTW sites

During the construction phase, large portions of the catchments of each of the wetland units will be cleared for development. The removal of vegetation will increase surface runoff throughout the construction site as well as increase the erosion potential of the soils on site. If stormwater runoff and erosion control measures are not implemented during the construction phase, the exposure of the bare soils to the elements will likely lead to the erosion of the soils on site during heavy rainfall events and the formation of rills and dongas which will concentrate flow down-

slope. The concentration of runoff down-slope within rills and dongas will increase the likelihood of the erosion and/or sedimentation of the wetlands and streams.

The negative effects of erosion and scouring on wetlands include increased concentration and canalisation of flow within the wetland, the reduction in diffuse flow and the extent of wetness within the wetland, the alteration of the vegetation communities due to decreased wetness and erosion disturbances and ultimately the reduction in the wetland's functionality and health. In addition to erosion within the wetlands, sediment plumes/fans are likely to impinge on the wetland areas if no erosion and stormwater control measures are implemented. The unnatural sedimentation of the wetland areas will disturb the vegetation of the wetland and encourage the proliferation of pioneers and alien invasive species ultimately reducing the health and functionality of the wetland.

Mitigation measures

To reduce the erosion risks on site during the construction phase, stormwater and erosion control measures must be implemented by the contractor to ensure that the erosion and sedimentation of the wetlands and streams do not occur during the construction phase. The recommended stormwater and erosion control measures include:

- Clearing activities must only be undertaken during agreed working times and permitted weather conditions. If heavy rains are expected clearing activities should be put on hold. In this regard, the contractor must be aware of weather forecasts.
- If possible, construction activities should be scheduled to minimise the duration of exposure to bare soils on site, especially steep slopes. The full length of works shall NOT be stripped of vegetation prior to commencing other activities.
- The unnecessary removal of groundcover vegetation from slopes must be prevented, especially on steep slopes. Where the buffers and/or un-cleared areas comprise sugarcane, the sugarcane should be maintained and not cleared to provide erosion protection.
- A row of silt fences and sandbags must be established along the wetland buffer edge and/or the downstream toe of the fill embankments prior to construction commencing. These silt fences and sandbags must be regularly checked and maintained and should only be removed once vegetation has successfully colonised the embankments.
- Once shaped and completed, the embankments must be topsoiled and grassed immediately with deep rooted indigenous vegetation by hydroseeding. Steep embankments should be grassed using a combination of strip sodding and hydroseeding. If re-vegetation is not practical or feasible, temporary erosion control measures must be implemented that includes the use of silt fences and fascine work at regular intervals (max. 1m) along embankment and/or bare slopes.
- Any steep of large embankments that are expected to be exposed during the 'rainy' months should either be armoured with fascine like structures/silt fences or grassed immediately with strip sods established at regular intervals (50-100cm) down the bank with hydroseeding between the strip sods.
- Where the bare surface of the platforms slope towards the edge of an embankment, silt fences and sandbags must be established along the crest of the embankment. If preferential flow routes on the sloped platform occur, these flow routes must be intercepted with a series of sandbags.
- All platforms above buffer zones must have a slight back-fall to divert runoff away from the fill embankments. Platform runoff must be diverted away from the platforms via some sort of diversion structure, preferably an open drain. This runoff must be diverted into the formal stormwater network where possible. If no formal stormwater system is possible, the diverted runoff must be diverted to a temporary detention pond or temporary outlets armoured against erosion.
- Once the roads, pathways and formal stormwater reticulation network are established, silt traps and sand bags should be used throughout the construction site to prevent eroded sediment from being washed onto the roads from un-grassed, bare/exposed areas. This applies particularly to areas where earthworks occur directly above or in the vicinity of the wetlands.
- After every rainfall event, the contractor must check the site for erosion damage and rehabilitate this damage immediately. Erosion rills and gullies must be filled-in with

appropriate material and silt fences or fascine work must be established along the gulley for additional protection until grass has re-colonised the rehabilitated area.

- It is important that all of the above-listed mitigation measures are costed for in the construction phase financial planning and budget so that the contractor and/or developer cannot give financial budget constraints as reasons for non-compliance. Proof of financial provision of these mitigation measures must be submitted to the ECO prior to construction commencing.

The impact on the wetland units is assessed as follows:

- The degree of disturbance to the wetland units will generally be **medium-low** as the wetland units are already highly impacted and modified. The impacts will be **medium** on the more intact systems like Wetland Unit D0.
- The extent of the impact on wetland units will be **local** because the erosion and sedimentation impacts will likely be experienced downstream.
- The duration of the impacts on the wetland units will be **medium-term** as the effect of the impacts are likely to be removed over time; and
- The probability of the impact occurring is **probable**, assuming poor construction practices and poor implementation of the mitigation measures prescribed in the construction phase Environmental Management Programme (EMPr).

The significance of the impact was assessed as being **low** for the medium-low value systems, **medium-low** for the medium value systems, **medium** for the medium-high systems, and **medium-high** for the high value systems, as shown in the impact summary tables below. In terms of acceptability, potential impact on the medium-high and high value systems is considered **unacceptable**.

Pre-mitigation impact assessment for construction storm-water impacts to systems of medium-low importance

Assessment Criteria	Score	Rating
Ecosystem Goods & Services Value	2	Medium-Low
Environmental Value	**2**	
Disturbance	2	Medium-Low
Extent	3	Local
Duration	3	Medium
Probability	4	Probable
Impact Magnitude	**12**	
Significance	**24**	**Low**
Acceptability	**Acceptable**	

Pre-mitigation impact assessment for construction storm-water impacts to systems of medium importance

Assessment Criteria	Score	Rating
Ecosystem Goods & Services Value	3	Medium
Environmental Value	**3**	
Disturbance	2	Medium-Low
Extent	3	Local
Duration	3	Medium
Probability	4	Probable
Impact Magnitude	**12**	
Significance	**36**	**Medium-Low**
Acceptability	**Acceptable**	

Pre-mitigation impact assessment for construction storm-water impacts to systems of medium-high importance

Assessment Criteria	Score	Rating
Ecosystem Goods & Services Value	4	Medium-High
Environmental Value	**4**	
Disturbance	3	Medium
Extent	3	Local
Duration	3	Medium
Probability	4	Probable

Assessment Criteria	Score	Rating
Impact Magnitude	**13**	
Significance	**52**	**Medium**
Acceptability	**Generally Unacceptable**	

Pre-mitigation impact assessment for construction storm-water impacts to systems of high importance

Assessment Criteria	Score	Rating
Ecosystem Goods & Services Value	5	High
Environmental Value	**5**	
Disturbance	3	Medium
Extent	3	Local
Duration	3	Medium
Probability	4	Probable
Impact Magnitude	**13**	
Significance	**65**	**Medium**
Acceptability	**Generally Unacceptable**	

Mitigation measures:

- Clearing activities must only be undertaken during agreed working times and permitted weather conditions. If heavy rains are expected, clearing activities should be put on hold. In this regard, the contractor must be aware of weather forecasts.
- Construction activities should be scheduled to minimise the duration of exposure of bare soils on site, especially on steep slopes.
- The full length of works must NOT be stripped of vegetation prior to commencing with other activities. The contractor must submit a clearing and earthworks plan to the ECO for approval prior to construction commencing. This plan must indicate how clearing and earthworks are going to progress across the site in a phased manner.
- The unnecessary removal of groundcover from slopes must be prevented, especially on steep slopes.
- Stormwater generated by the construction site must be managed and controlled by the contractor so as to ensure that surface runoff does not cause the erosion and/or sedimentation of the nearby wetland systems. In this regard, the contactor must use silt fences and sandbags to control runoff and reduce erosion across the site.
- Where necessary (i.e. large bare areas), siltation ponds should also be established to capture sediment laden runoff.
- A combination of sandbags and silt fences must be established along the edge of all bare and exposed surfaces above the wetland buffers and un-kerbed roads.
- The berms, sandbags and/or silt fences must be monitored for the duration of the construction phase and repaired immediately when damaged. The berms, sandbags and silt fences must only be removed once vegetation cover has successfully re-colonised the embankments.
- Once shaped, all exposed/bare surfaces and fill embankments must be vegetated immediately. Embankments steeper than 1:3 must be vegetated using strip sods established at regular intervals (50-100 cm) down the bank and hydro-seeding in between. Embankments with a slope less than 1:3 must be hydro-seeded and the temporary erosion control measures removed only once re-colonisation is successful. In the winter months, the newly grassed areas must be watered daily until re-colonisation is successful. During the wet months, the grassed surfaces must be monitored for erosion until re-colonisation is successful.
- If re-vegetation of exposed surfaces cannot be established immediately due to phasing issues, rows of sand bags or silt fences must be established along the contours at regular intervals to slow runoff and capture eroded soil.
- Runoff from the platforms must not be allowed to flow over the edges of the platform and down the embankments. Ponding must not be allowed to occur. In this regard, platform runoff must be diverted away from the platforms via some sort of diversion structure, preferably an open drain. This runoff must be diverted into the formal storm water network where possible. However, sediment must be removed from the runoff before being discharged into the formal system. This can be achieved by using temporary sediment capture ponds. If no formal storm water system is possible, the diverted runoff must be

diverted to a temporary detention pond or temporary outlets armoured against erosion with energy dissipation measures.

- Effort must be made to ensure that the formal storm water system including pipes, drains, channels, headwalls, ponds, storage tanks and Reno-mattresses are not silted up during the construction phase. Siltation will be minimised by ensuring that the roads and paths remain clear of sediment. Sediment on the roads from erosion or construction traffic must be cleared at the end of every day between September and March and at the end of every week between April and August. The need to clear will be minimal if the all bare slopes (sediment sources) are re-vegetated as soon as possible and adequate erosion protection and silt control applied where grassing is not feasible.
- After every rainfall event, the contractor must check the site for erosion damage and rehabilitate this damage immediately. Erosion rills and gulleys must be filled-in with appropriate material and silt fences or fascine work must be established along the gulley for additional protection until grass has re-colonised the rehabilitated area.
- It is important that all of the above-listed mitigation measures are costed for in the construction phase financial planning and budget so that the contractor and/or developer cannot give financial budget constraints as reasons for non-compliance. Proof of financial provision of these mitigation measures must be submitted to the ECO prior to construction commencing.

With the successful implementation of the above recommended mitigation, the significance of the impact on the different value systems was assessed as being **medium-low** and acceptable.

Post-mitigation impact assessment for construction storm-water impacts to systems of medium-low importance

Assessment Criteria	Score	Rating
Ecosystem Goods & Services Value	2	Medium-Low
Environmental Value	**2**	
Disturbance	1	Low
Extent	2	Surrounding Area
Duration	2	Medium-term
Probability	3	Possible
Impact Magnitude	**8**	
Significance	**16**	**Low**
Acceptability	**Acceptable**	

Post-mitigation impact assessment for construction storm-water impacts to systems of medium importance

Assessment Criteria	Score	Rating
Ecosystem Goods & Services Value	3	Medium
Environmental Value	**3**	
Disturbance	1	Low
Extent	2	Surrounding Area
Duration	2	Medium-term
Probability	3	Possible
Impact Magnitude	**8**	
Significance	**27**	**Medium-Low**
Acceptability	**Acceptable**	

Post-mitigation impact assessment for construction storm-water impacts to systems of medium-high importance

Assessment Criteria	Score	Rating
Ecosystem Goods & Services Value	4	Medium-High
Environmental Value	**4**	
Disturbance	1	Low
Extent	2	Surrounding Area
Duration	2	Medium-term
Probability	3	Possible
Impact Magnitude	**8**	
Significance	**32**	**Medium-Low**
Acceptability	**Acceptable**	

Post-mitigation impact assessment for construction storm-water impacts to systems of high importance

Assessment Criteria	Score	Rating
Ecosystem Goods & Services Value	5	High
Environmental Value	**5**	
Disturbance	1	Low
Extent	2	Surrounding Area
Duration	2	Medium-term
Probability	3	Possible
Impact Magnitude	**8**	
Significance	**40**	**Medium-Low**
Acceptability	**Acceptable But Undesirable**	

c. Impacts of storm-water infrastructure in wetlands during the operational phase of the Main Rorqual site

The commercial platforms will result in an a substantial increase in the amount of surface (stormwater) runoff generated by the development as well as an increase in the rate of flow i.e. the time that runoff takes to reach a low point. The residential components will generate less runoff but substantial amounts none the less. Cumulatively, the hardening of land for the development of the residential areas is also expected to result in a substantial increase in the amount surface runoff.

In a generic stormwater system, stormwater generated by the proposed development will be diverted from the platforms and roads into drains and underground pipes, then into attenuation structures, and ultimately discharged into the wetland buffers area via outlet headwalls with erosion protection. The exact location of the attenuation features and stormwater outlets is unknown at present but in all likelihood the outlets will be planned within the outer boundary of the wetland buffers.

This proposed generic stormwater management solution represents a substantial departure from pre-development conditions. Pre-development conditions would see rainfall intercepted by the current vegetation and/or sugarcane, a large proportion of which would enter the soil profile, especially as most of the site is relatively permeable. Only once the soil profile has reached saturation does surface runoff occur. In addition, a considerable proportion of the water that enters the soil profile is stored and/or is lost over a period ranging from weeks to months due to processes such as evaporation and evapo-transpiration. It is important to note, however, that decades of cane cultivation across the site have already resulted in the alteration of the natural infiltration and runoff rates and ultimately the flood peaks within the wetlands. Nevertheless, the alteration of the hydrological inputs to the wetland units associated with cane cultivation is considered minimal compared to that resulting from the proposed development.

The result will be that the wetland units will experience an increase in the volume of surface flow relative to subsurface flow and increased flood peaks within the wetland. These impacts on wetland hydrology will result in an increase in the velocity of surface runoff through the wetland during the wet season. This will increase the risk of erosion within the wetlands, particularly where knick-points and head-cuts are already present.

Conversely, the hardening of large areas will reduce soil infiltration across the site and ultimately reduce the subsurface flow inputs that feed the wetlands. As a result, the wetland units onsite will experience decreased water inputs during low flows, which will result in the reduction of natural soil saturation rates and plant stress and vulnerability to invasion and erosion.

Furthermore, the discharge of stormwater via point-source outlets will result in the increase of surface runoff inputs and the formation of rills and gulleys below the stormwater outlets if there are too few outlets and/or erosion protection is not sufficient. If this occurs, erosion and sedimentation will extend into the wetland over time and ultimately result in the erosion and/or sedimentation of the wetlands in a manner similar to that described for the construction phase storm water impacts mentioned above (*Section 11.2.1*).

The negative effects of erosion and scouring on wetlands include increased concentration and canalisation of flow within the wetland, the reduction in diffuse flow and the extent of wetness within the wetland. In addition to erosion within the wetlands, sediment plumes/fans are likely to impinge on the wetland areas if the erosion and stormwater control measures are inappropriate. The impacts of erosion and sedimentation of wetlands is discussed in detail above (see *Section 11.2.1*).

It is important to note, however, that many of the wetland units are already experiencing increased flodpeaks and associated erosion as a result of stormwater inputs from the N2 and the constricting effects of the N2 culverts. Thus, the impacts associated with a generic stormwater system would be slightly reduced for those systems already affected by the N2. For those not affected, the impacts will be more severe.

Another issue is the potential storm water runoff pollution impacts. The commercial platforms represent significant pollution sources for oils, hydrocarbons, sediment, dust, detergents and litter (plastic, cigarette butts etc.) and other toxicants. Thus, the commercial developments will represent a significant pollutant source to the adjacent and downstream watercourses if the runoff from the platform is not captured and then treated before it is discharged into the environment. Ultimately, the pollution of the stormwater represents a water quality risk to the downstream wetland and aquatic ecosystems and the Rocky Bay estuary both indirectly and cumulatively depending on the ability of the wetlands to assimilate and/or trap the pollutants.

In this case, the impact of a generic stormwater management system on the health of the wetland units will be **moderate** for already highly disturbed systems and **moderately-high** for the intact and functional systems. The potential impact and will reduce the current level and importance of the water quality enhancement, surface water management and biodiversity maintenance services provided by the wetland units.

d. Impacts of stormwater runoff during the operational phase of the North-West Quadrant and WWTW sites

The proposed developments will result in a substantial increase in the amount of hardened surfaces, which will in turn result in an increase in the amount of surface (stormwater) runoff generated by the development as well as an increase in the rate of flow i.e. the time that runoff takes to reach a low point. No details have been provided to the author regarding the management of stormwater onsite. However, it is assumed that the stormwater generated by the proposed development will be diverted from hardened surfaces and roads into open drains, pipes, attenuation and detention structures, and ultimately discharged into the wetland buffers area via outlet headwalls with erosion protection. The exact location of the attenuation features and stormwater outlets is unknown at the moment but in all likelihood the outlets will be planned within or in the vicinity of the outer boundary of the wetland buffers. This proposed stormwater management solution represents a substantial departure from pre-development conditions where rainfall is first intercepted by plants, a portion of the rainfall enters the soil profile and only once the soil profile has reached saturation does surface runoff occur. In addition, a considerable proportion of the water that enters the soil profile is stored and/or is lost over a period ranging from weeks to months due to processes such as evaporation and evapotranspiration.

Although there is likely to be some attenuation onsite and all outlets will have erosion protection, the amount of surface runoff inputs entering the onsite wetlands and stream channels during a storm event will still increase and the magnitude of the flood peak[1] within these systems will also increase as a result of the general increase in the rate of flow. The surface runoff inputs and the increased peak discharge will increase the risk of erosion within the wetlands and stream channels over time as the systems adjust to the modified mean and peak flows.

Furthermore, the discharge of stormwater via point-source outlets on slopes will result in the increase of surface runoff inputs and the formation of rills and gulleys below the stormwater outlets if there are too few outlets and/or erosion protection is not sufficient. If this occurs,

[1] Flood peak: The highest discharge that occurs within a watercourse following a rainfall event.

erosion and sedimentation will extend into the wetland and stream buffers over time and ultimately result in the erosion and/or sedimentation of the wetlands and streams.

The negative effects of erosion and scouring on wetlands include increased concentration and canalisation of flow within the wetland, the reduction in diffuse flow and the extent of wetness within the wetland, the alteration of the natural hydrophytic communities due to decreased wetness and erosion disturbances and ultimately the reduction in the wetland's functionality and health. In addition to erosion within the wetlands, sediment plumes/fans are likely to impinge on the wetland areas if no erosion and stormwater control measures are implemented. The unnatural sedimentation of the wetland areas will disturb the vegetation of the wetland and encourage the proliferation of pioneers and alien invasive species ultimately reducing the health and functionality of the wetland.

In addition, the hardening of large areas will reduce soil infiltration and ultimately subsurface flows that feed many of the wetlands. As a result, most of the subsurface fed wetland units onsite will experience decreased water inputs during low flows, which will result in the reduction of natural soil saturation rates. This is especially true for Wetland Units I1 and I2 that receive water inputs via subsurface flow.

Another issue is the potential stormwater runoff pollution impacts, particularly associated with the petrol filling station and sewerage treatment works. Given the current poor attitudes of KwaZulu-Natal residents towards litter and the safe disposal of pollutants, it is highly likely that the surface runoff and stormwater generated by the developments will pick up a number of urban pollutants (e.g. oils, hydrocarbons, detergents, oils etc.), rubbish and litter and the resultant discharge of these substances into the internal stormwater systems. Without appropriate mitigation, pollutants and rubbish will accumulate within the stormwater system and ultimately result in the pollution of the wetlands and streams into which the stormwater system discharges into. This, in turn, has a number of downstream water quality effects both indirect and cumulative depending on the ability of the wetlands to assimilate and/or trap the pollutants.

Mitigation measures:

Layout recommendations:

- The existing grassland outside of Wetland Unit I1, north of the R612 should be maintained so that the subsurface hydrological inputs to the wetland are not affected. At the very least, depending on the findings of the vegetation specialist, these areas should only be utilized as open spaces and/or fields associated with the school so that infiltration is maintained.
- The school fields must be located along the lowest lying slopes above the buffer zones and the actual school building located in the higher lying areas along the watershed. In effect the school fields should act as an extension of the buffer zone between Wetland Units I1 and I2, and the school buildings.

Stormwater design recommendations:

- At all development sites, stormwater should be attenuated locally at critical points through the use of tanks, ponds, swales, soakaways and/or infiltration ditches.
- The school fields should be designed to act as stormwater detention and attenuation areas where the infiltration of surface runoff is encouraged before the runoff enters the wetland buffers.
- Many smaller stormwater outlets should be favoured over a few large. The stormwater outlets must be constructed at regular intervals to spread out surface flow and avoid flow concentration. Gabion and/or concrete stilling basins should be established at all stormwater outlets to not only reduce the energy of flows but also provide some detention. Reno-mattresses should be installed below the outlet stilling basins and must be laid down to reflect the slope of the natural ground surface and designed to cope with the amount of water expected to be discharged onto the Reno-mattress.
- All stormwater generated by the petrol filling station must pass through an oil-water separator before being discharged into open spaces.

- Stormwater runoff onsite should be directed into open grass-lined channels or stone filled infiltration ditches/drains rather than into an underground piped systems or concrete V-channels. This will encourage infiltration where possible, make the potential litter pollution visible to the residents and provide some attenuation and better reduce the energy of flows through increased roughness compared to pipes.
- Grassed swales should be established wherever possible to provide additional attenuation before discharge via outlets.
- Rainwater harvesting should take place onsite and all runoff from roofs should be collected.
- Impervious areas such as roofs and parking lots should be disconnected from the formal drainage system by ensuring that runoff from these areas first has an opportunity to flow over grassed and/or permeable surfaces.
- Wherever possible the stormwater outlet structures must be located outside of the wetlands and their buffers.
- All platforms should have a slight back-fall to prevent runoff from cascading down the embankments.
- A wetland specialist must approve of the stormwater system design before the finalisation of the design prior to construction commencing.

The impact on the wetland units is assessed as follows:

- The degree of disturbance to the adjacent and downstream wetland units will be **medium**.
- The extent of the impact on wetland units will be **local** because the erosion and sedimentation impacts will likely be experienced downstream.
- The duration of the impacts on the wetland units will be **long-term** as the effect of the impacts will be present for the lifetime of the project; and
- The probability of the impact occurring is **probable**.

The significance of the impact was assessed as being medium-**low** for the medium-low and medium value systems, **medium** for the medium-high systems, and **medium-high** for the high value systems, as shown in the impact summary tables below. In terms of acceptability, potential impact on the medium-high and high value systems is considered **unacceptable**.

Pre-mitigation impact assessment for operational storm-water impacts for systems of medium-low importance

Assessment Criteria	Score	Rating
Ecosystem Goods & Services Value	2	Medium-Low
Environmental Value	**2**	
Disturbance	3	Medium
Extent	3	Local
Duration	4	Long-term
Probability	4	Probable
Impact Magnitude	**14**	
Significance	**28**	**Medium-Low**
Acceptability	**Acceptable**	

Pre-mitigation impact assessment for operational storm-water impacts for systems of medium importance

Assessment Criteria	Score	Rating
Ecosystem Goods & Services Value	3	Medium
Environmental Value	**3**	
Disturbance	3	Medium
Extent	3	Local
Duration	4	Long-term
Probability	4	Probable
Impact Magnitude	**14**	
Significance	**42**	**Medium-Low**
Acceptability	**Acceptable But Undesirable**	

Pre-mitigation impact assessment for operational storm-water impacts to systems of medium-high importance

Assessment Criteria	Score	Rating
Ecosystem Goods & Services Value	4	Medium-High
Environmental Value	**4**	
Disturbance	3	Medium
Extent	3	Local
Duration	4	Long-term
Probability	4	Probable
Impact Magnitude	**14**	
Significance	**56**	**Medium**
Acceptability	**Generally Unacceptable**	

Pre-mitigation impact assessment for operational storm-water impacts to systems of high importance

Assessment Criteria	Score	Rating
Ecosystem Goods & Services Value	5	High
Environmental Value	**5**	
Disturbance	3	Medium
Extent	3	Local
Duration	4	Long-term
Probability	4	Probable
Impact Magnitude	**14**	
Significance	**70**	**Medium-High**
Acceptability	**Unacceptable**	

Mitigation measures:

- All stormwater generated by the proposed development should be attenuated within the development footprint prior to discharge to the freshwater environment through the use of attenuation and/or detention ponds, retention areas and/or underground tanks before being discharged downstream. Unless unfeasible for substantiated technical reasons, all detention and attenuation structures must be located within the development footprint and outside of the wetland units and their buffers. In this regard, stormwater attenuation and detention should be built into the commercial and light industrial platforms and areas should be set aside within the development footprint for infiltration and attenuation/detention ponds and/or other structures. Where bulk collection points are unavoidable, bulk attenuation structures should also be installed to attenuate the bulk runoff volumes prior to discharge to the freshwater environment.
- All stormwater runoff generated by the proposed development during all rainfall events >20 year flood event that cannot be fully attenuated/detained must be conveyed through the proposed development in a controlled manner that minimises the energy of the runoff events prior to discharge to the freshwater environment. These major storm flow routes must be armoured against erosion and energy dissipation measures installed along the entire length of these major flood routes.
- All stormwater runoff onsite should be directed into open, grass-lined channels/swales and stone-filled infiltration ditches rather than into underground piped systems or concrete V-channels. These features should be well vegetated with appropriate species and stabilised by means of gabion or concrete cut off walls/check walls to prevent erosion and vertical incision. This will provide for some filtration and removal of urban pollutants (e.g. oils and hydrocarbons), provide some attenuation by increasing the time runoff takes to reach low points, and reduce the energy of storm water flows within the stormwater system through increased roughness when compared with pipes and concrete V-drains.
- Rainwater harvesting and storage should take place onsite and runoff from roofs should be collected in closed-top tanks or landscaped features for irrigation and non-potable purposes.
- With regards to the management of road stormwater runoff, water should be discharged back into the environment at regular intervals along the road by means of mitre drains or culverts to prevent the build-up of stormwater. The spacing of the culverts/mitre drains should be dependent on the ability of the receiving environment to cope with the water and not simply on the capacity of the culverts/side drains.
- With regards to outlet headwalls, the following design measures should be implemented:

- Many smaller stormwater outlets must be favoured over a few large outlets. The stormwater outlets must be constructed at regular intervals to spread out surface flow and avoid flow concentration.
- All outlets must be designed to dissipate the energy of outgoing flows to levels that present a low erosion risk. In this regard, adequately sized concrete stilling basins/sumps must be installed at all outlets and flow from these stilling basins must fall onto suitably designed gabion reno-mattresses with wing walls. The reno-mattresses must extend an appropriate distance downslope to ensure that erosion risks are minimised.
- The outlet reno-mattresses must be established to reflect the natural slope of the surface and located at the natural ground-level.
- The outlets and associated outlet protection structures should be aligned parallel to contours wherever possible to reduce the gradient of outflows.
- A level spreader, which is an outlet designed to convert concentrated runoff to sheet flow and disperse it uniformly across a slope, should also be established at all outlets to prevent erosion.
- At major flood flow route outlets, appropriate energy dissipation structures must be installed to reduce the erosion risks below the outlets to low levels. These might include sizeable stilling basins and a series of gabion weirs and Reno-mattresses.

- Measures to capture solid waste and debris entrained in stormwater entering the stormwater management system (inlet protection devices) must be incorporated into the design of the system and should include the use of either curb inlet/inlet drain grates and/or debris baskets/bags.
- In addition to inlet protection, all stormwater generated by the medium to high risk contamination urban surfaces (parking areas, light industrial platforms, commercial/retail platforms etc.) must receive basic filtering and treatment prior to discharge into the freshwater environment. The higher the watercourse pollution risk, the more stringent the basic treatment methods. Furthermore, all treatment should occur within the development footprint. Such measures include oil-water separators, grease traps and sand filter traps that will require regular maintenance by the site owners. Furthermore, a first-flush runoff treatment system must be established for the light industrial and commercial platforms to ensure that initial pulse of polluted runoff is contained and treated before being discharged to the environment.
- All stormwater outlet structures must be located outside of the wetland buffers. Where this is not feasible for substantiated technical reasons, outlet structures must be located on the upper edge of all buffers in the vicinity of the buffer boundary.
- The onsite stormwater system will need maintenance (silt and litter clearing) over time to function adequately and such maintenance should be the responsibility of the relevant body corporate and home owners associations and budgeted for.
- The use of biodegradable detergents for the washing of commercial floors, cars etc. that are discharged as stormwater mjst be enforced and written into codes of conduct of the relevant owners organisation.

With the successful implementation of the above recommended mitigation, the significance of the potential impact on the medium-low, medium and medium-high value systems was assessed as being **medium-low** and acceptable. The significance of the potential impact on the high value system (Wetland Unit D0) was assessed a being of **medium** and generally unacceptable, assuming no rehabilitation.

Post-mitigation impact assessment for operational storm-water impacts to systems of medium-low importance

Assessment Criteria	Score	Rating
Ecosystem Goods & Services Value	2	Medium-Low
Environmental Value	**2**	
Disturbance	1	Low
Extent	3	Local
Duration	4	Long-term
Probability	3	Possible
Impact Magnitude	**11**	
Significance	**22**	**Low**

Assessment Criteria	Score	Rating
Acceptability	**Acceptable**	

Post-mitigation impact assessment for operational storm-water impacts to systems of medium importance

Assessment Criteria	Score	Rating
Ecosystem Goods & Services Value	3	Medium
Environmental Value	**3**	
Disturbance	1	Low
Extent	3	Local
Duration	4	Long-term
Probability	3	Possible
Impact Magnitude	**11**	
Significance	**33**	**Medium-Low**
Acceptability	**Acceptable**	

Post-mitigation impact assessment for operational storm-water impacts to systems of medium-high importance

Assessment Criteria	Score	Rating
Ecosystem Goods & Services Value	4	Medium-High
Environmental Value	**4**	
Disturbance	1	Low
Extent	3	Local
Duration	4	Long-term
Probability	3	Possible
Impact Magnitude	**11**	
Significance	**44**	**Medium-Low**
Acceptability	**Acceptable BUT Undesirable**	

Post-mitigation impact assessment for operational storm-water impacts to systems of high importance

Assessment Criteria	Score	Rating
Ecosystem Goods & Services Value	5	High
Environmental Value	**5**	
Disturbance	1	Low
Extent	2	Surrounding Area
Duration	4	Long-term
Probability	3	Possible
Impact Magnitude	**10**	
Significance	**55**	**Medium**
Acceptability	**Generally Unacceptable**	

17.1.1.3 Sewage and Water Pipe Infrastructure Impacts

A number of wetland and stream sewer pipe crossings will be required for which the impacts are described but not assessed. The impacts should be acceptable as long as the mitigation measures provided for the construction and operational phases below are adhered to. The majority of the main sewer lines have been proposed as vacuum sewers, rather than conventional gravity sewers. The reticulation from the buildings will be conventional gravity fed sewer lines. Therefore, as a precaution, the impacts have been assessed in accordance with conventional gravity sewers.

Advantages of Vacuum Sewers:

- Requires less water to transport the excreta and faeces to the centralised treatment system
- Considerable savings in construction costs, and much shorter construction period
- Pipelines laid in shallow and narrow trenches; small diameter pipelines, flexible pipeline construction, easy to lay pipelines around obstacles
- Sewers and water mains can be laid in a common trench
- Closed systems with no leakage or smell

- No manholes along the vacuum sewers
- One central vacuum station can replace several pumping stations

Disadvantages of Vacuum Sewers:

- Needs expert design
- Needs energy to create the permanent vacuum
- Relatively high capital costs
- Recycling of nutrients and energy becomes difficult
- Unsuitability for self-help, requires skilled engineers to operate
- It is still a flushing system, which transports wastewater away, but if there is no treatment plant, and an unprofessional discharge, it can contaminate the environment.

Source: http://www.sswm.info/content/vacuum-sewers

The impacts should be acceptable as long as the mitigation measures provided for the construction and operational phases below are adhered to. In this section an assessment of conventional gravity sewers has been undertaken as a worst case scenario, however, the client has proposed a vacuum sewer system throughout.

a. Impacts of sewage infrastructure in wetlands during the construction phase of the Main Rorqual Site

Direct disturbances to the wetlands associated with the construction of the underground sewer pipes include the clearing of wetland vegetation and topsoil along the sewer line construction zone, the excavation of a trench within the wetland and the compaction of the wetland vegetation and soils by heavy vehicles involved in the excavations and the laying of the pipes. Indirect disturbances arising from the direct impacts include erosion, sedimentation and alien plant encroachment. In addition, the sewer line is also proposed to cross a number of drainage lines and stream channels that are not technically considered wetlands. These areas must also be subjected to the mitigation measures recommended for wetland crossings below.

This impact cannot be assessed at this stage due to a lack of details on the sewer crossings. However, it is assumed that the impacts of the construction of sewer pipelines across the wetland units should be **moderately-low** in the long-term provided that the contactor adheres to best environmental construction practices and the sites are rehabilitated after the completion of the construction. However, if the contactor does not adhere to best practices, the most sever impacts will likely be in the form or downstream erosion and sedimentation impacts that will disturb the hydrology and vegetation of the wetland and stream channels.

The following wetland units are proposed to be impacted upon with vacuum sewage infrastructure construction:

Wetland Unit	Area	HGM Type
A0 in 3 places	7,31ha	Channelled valley bottom
A1a	1,36ha	Un-channelled valley bottom
A2	3,17ha	Un-channelled valley bottom and valley head seep
A3a	0,80ha	Un-channelled valley bottom
B1a	0,40ha	Valley head seep
B1b	0,40ha	Valley head seep
B1c	0,55ha	Un-channelled valley bottom and valley head seep
B1d	1,2ha	Un-channelled valley bottom and valley head seep
B2	1,64ha	Channelled valley bottom and valley head seep
B3	0,54ha	Channelled valley bottom
B4	0,22ha	Valley head seep
B5	1,19ha	Un-channelled valley bottom and valley head seep
B6	0,55ha	Un-channelled valley bottom
B7	0,48ha	Channelled valley bottom
B8	0,47ha	Un-channelled valley bottom and valley head seep
B9c	0,19ha	Valley head seep

C0	13,94ha	Channelled valley bottom
C2	2,33ha	Un-channelled valley bottom
C3	0,89ha	Valley head seep
C5	0,5ha	Valley head seep
D0 in 2 places	10,28ha	Channelled valley bottom
E	0,94ha	Valley head seep
F	0,45ha	Valley head seep
H	1,18ha	Un-channelled valley bottom
Total area:	**37,04ha**	

The following wetland units are proposed to be impacted upon with sewer pumping main infrastructure construction:

Wetland Unit	**Area**	**HGM Type**
B1	0,71ha	Un-channelled valley bottom
C0	13,94ha	Channelled valley bottom
D3	0,95ha	Un-channelled valley bottom and valley head seep
D5	1,00ha	Un-channelled valley bottom and valley head seep
D7	3,56ha	Un-channelled valley bottom and valley head seep
I1	9.27ha	Valley head seepage

Mitigation measures:

Approvals:

A water use license is required to construct the wetland sewer line crossings as per Section 21 (c) and (i) of the National Water Act. This license is required prior to construction commencing.

Design and routing:

- The crossing of the Wetland Unit D0 should be and the crossing of its tributary wetlands must be minimised.
- All wetland units, stream channels and drainage lines should be crossed at right angles so that the amount of watercourse affected is minimised. The sewer lines should not run within a wetland when aligned parallel to flow.
- Incised stream crossings should be pipe-bridged to avoid the unnecessary disturbance to the stream channels and wetlands. This should apply to all wetlands, drainage lines and stream channels.
- No manholes must be located within any of the wetland, streams or drainage lines. Ideally, a 20m buffer should be established between the wetland edge and all manholes. Where this is not possible, a minimum of a 10m buffer should be established.

Site setup and construction phase:

- Construction should be undertaken between the months of April and August.
- Disturbance to the wetland soils along the pipeline route(s) should be restricted to an established construction right-of-way (ROW) corridor. The width of the ROW corridor within the wetlands should be as narrow as practically possible and should be demarcated and fenced off during the site setup phase to the satisfaction of the ECO.
- The construction ROW for trenched crossings should comprise the following:
  - a one-way running track of a maximum width of 3m,
  - a pipeline trench zone of a maximum width of 2m; and
  - an up-slope subsoil stockpile corridor of a maximum width of 1.5m.
- The construction ROW for pipe bridge crossings should comprise the following:
  - a one-way running track of a maximum width of 3 m; and
  - pipe bridge pier construction zones.
- The ROW should be established as follows:
  - Topsoil along the construction ROW must be stripped and stored outside of the wetlands in designated stockpiles areas. These turfed topsoil stockpiles must be

regularly wetted to ensure that the clayey soils remain moist. The location of these topsoil stockpiles must be agreed upon by the ECO prior to construction commencing.

- Once the ROW is established, all wetland areas outside of the demarcated ROW must be considered no-go areas. This also includes the access ROW's.
- All pipes and equipment must be stored outside of the wetland areas in a stockpile area approved by the ECO.
- Any water entering the trench must be pumped out of the trench and into a filtering system, such as a silt trap/hay-bale trap. A dewatering site must be identified in conjunction with the ECO and should be on flat ground away from the edge of the channel and preferably in a well vegetated area.
- Once the pipe is laid into the trench, the sub-soils should be reinstated in the same order they were excavated.

Figure 1: Ideal ROW for the excavation of a pipeline trench in a wetland by hand (Edwards, 2102)

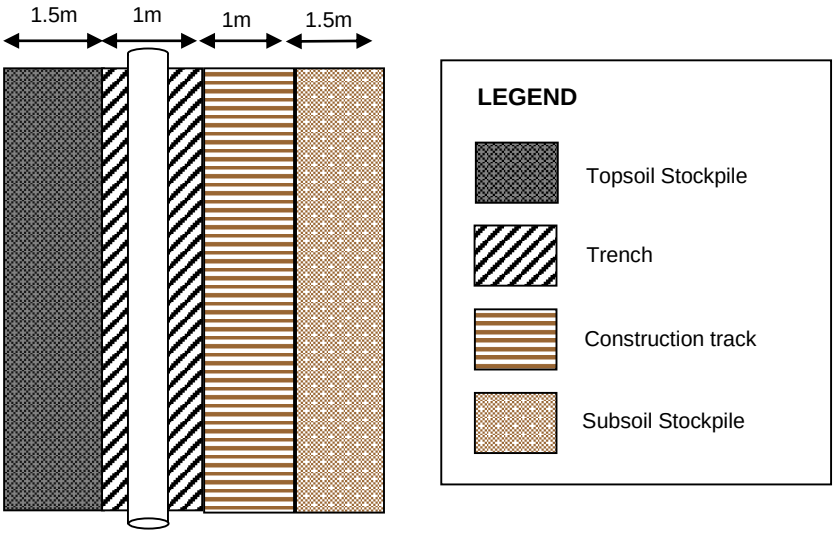
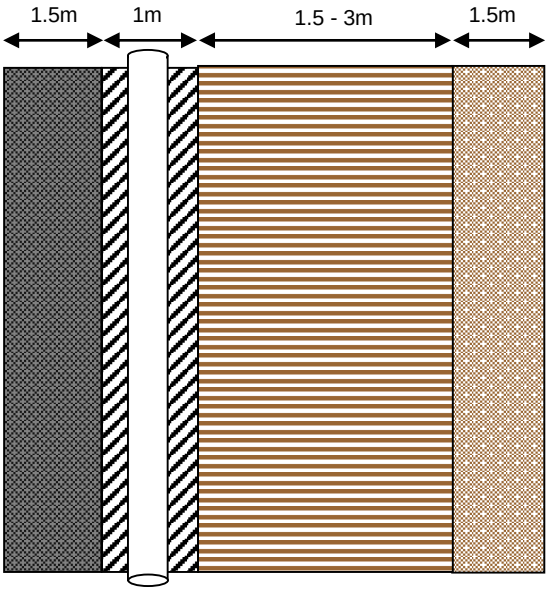


Figure 2: Ideal ROW for the excavation of a pipeline trench in a wetland using a TLB (Edwards, 2102)



Rehabilitation and monitoring:

- Once the trench has been filled-in, the running track and subsoil stockpile corridor must be removed in a systematic manner moving outwards from the wetland areas. The subsoil corridor should be moved by hand and the running track should be removed by ripping working outwards from the centre of the wetland. The running track must be ripped to a minimum depth of 30 cm and subsoil stockpile corridor to a depth of 10-20.
- Once the excavators have moved out of the ripped ROW, no heavy machinery is allowed to enter the ROW.
- Once the compacted soils are ripped, topsoil from that particular area must be reinstated within the wetland areas along the running track by hand to the satisfaction of the ECO.
- Once the topsoil has been reinstated, the bare areas must be hydro-seeded with an indigenous plant seed mix, the composition of which must be approved by the ECO.
- The disturbed area should be monitored for erosion once a month during the first wet season after construction.
- Method statements for all activities within the wetlands must be submitted to the ECO for approval prior to construction commencing.

b. Impacts on Wetland Units of the North-West Quadrant and WWTW sites

It is preferable that the crossing of wetlands by sewer and water pipes are avoided. However, the avoidance of low points like wetlands means that pump stations are going to have to be used to pump sewage upslope and away from the wetlands, which can be expensive if many pump stations are required. If the avoidance of wetlands proves to be financially or technically unfeasible, wetlands are going to have to be crossed.

Wetland pipe crossings are either underground or via a bridge. Direct disturbances to the wetlands associated with the construction of underground sewer and water pipes include the excavation of a trench within the wetland and the compaction of the wetland vegetation and soils by heavy vehicles involved in the excavations and the laying of the pipes. Indirect disturbances arising from these direct impacts include erosion, sedimentation and alien plant encroachment.

The impacts of pipe bridges on wetlands include the direct disturbance to the wetland soils and vegetation during the construction of the pipe bridge and secondary impacts of disturbance that include erosion, flow channelization, sedimentation and alien and/or pioneer plant encroachment.

Mitigation measures:

Approvals:
A water use license is required to establish the pipes within the wetland as per Section 21 (c) and (i) of the National Water Act. This license is required prior to construction commencing.

Design & routing:
- Wetland and stream sewer pipe crossings should be via pipe bridges and ideally located within already disturbed areas like existing road crossings and located across the narrowest portions of the wetland.
- Water pipes should be attached to the sewer pipe bridge and/or road crossings.
- The sewer pipe must be routed so that the wetland is crossed at right angles to the direction of flow.
- The number of pipe bridge piers within the wetland and riparian areas must be minimised.
- The span width between piers must be maximised as far as possible.
- The establishment of piers within the central lowest lying (wettest) portions of the wetland units and or the stream channels must be avoided and these areas should be spanned.

Site setup and construction phase:
- Ideally, construction should be undertaken between the months of April and August.

- The wetland and riparian zone boundaries either side of the crossing must be demarcated using shade cloth or snow fencing prior to the construction commencing.
- Disturbance to the wetland and riparian zone soils along the sewer pipe bridge crossing should be restricted to an established construction right-of-way (ROW) corridor. The ROW corridor within the wetlands and riparian zones should be as narrow as practically possible and should be demarcated and fenced off during the site setup phase to the satisfaction of the ECO.
- The construction ROW should comprise the pipe bridge pier construction zones and a narrow one-way construction track only.
- The construction track should not be established within the central lowest lying portions of the wetland and/or stream channels and banks where no piers are proposed. In this regard, the construction tracks must extend into the wetland and riparian zone from each valley side to the furthest pier construction site, thus avoiding the crossing of the central wet or channelled areas.
- Indigenous wetland and riparian vegetation and topsoil along the construction track and within the pipe bridge pier construction zones must be turfed and stored outside of the wetland. These turfed stockpiles must be regularly wetted to ensure that the wetland plants do not die out and the clayey soils remain moist. The location of these wetland and riparian vegetation/topsoil stockpile area must be agreed upon by the ECO prior to construction commencing.
- Once the construction track is turfed, Geotextile/geofabric must be laid down along the construction track within the wet areas.
- Excavated soil must not be stockpiled within the wetland or riparian zones.
- All wetland areas outside of the demarcated ROW must be considered no-go areas.
- Once the pipe bridge is completed, the construction track must be removed by hand.

Rehabilitation and monitoring:

- Compacted wetland and riparian soils along the construction track must be ripped to a depth of 20-30cm. Thereafter, the turfed topsoil and vegetation must be reinstated within the wetland and riparian areas along the construction track by hand to the satisfaction of the ECO.
- Where no indigenous vegetation is present, the compacted areas must be ripped and seeded immediately. A deep rooting indigenous plant seed mix should be used as recommended by a wetland specialist.
- The disturbed area should be monitored for erosion once a month during the first wet season after construction.
- The re-instated wetland and riparian areas must be monitored for a year post-construction by a suitably qualified wetland specialist on a bi-monthly basis. During this time, the measures to manage and control alien vegetation in the wetland rehabilitation and management plan must be applied to the re-instated ROW.
- Method statements for all activities within the wetlands and riparian zones must be submitted to the ECO for approval prior to construction commencing.

c. Impacts of sewage infrastructure in wetlands during the operational phase of the Main Rorqual Site

Once operational, the internal sewer lines represent a potential pollutant point source for the lifetime of the development, which is indefinitely. Sewer pipes often leak at joints and manhole connections when blockages create high pressures within the pipes causing sewage to be forced out of cracks and joints. In addition, manholes also overflow during pipe blockages at points below the manhole. Reasons for blockages include the flushing of foreign objects into the system by local residents, inadequate design and/or poor construction. If the sewer crossings and manholes within the vicinity of the wetlands units were to leak and/or block, then pollution in its raw form would likely enter the wetland units.

Impacts associated with the pollution of wetlands with sewage include the domination of a particular floral species as a result of the competitive advantage created by pollutants, the dieback of floral and faunal species and the resultant reduction in ecological functionality (**Coetzee, 2005**). In this case, sewage spills will likely increase the competitive advantage of

alien invasive and pioneer species. In addition, sewage pollution poses a serious water quality problem for downstream aquatic habitats and estuaries.

Due to the highly degraded nature of most of the wetland units, the impacts of sewage pollution on the health of these systems will be **moderately-low** but will further degrade the systems over the long term. Nevertheless, the most significant impact of potential surcharge events will be the cumulative, catchment-scale water quality impacts on local aquatic ecology, particularly the downstream estuaries, which is already being placed at significant risk by water quality issues that are currently in existence.

It must also be noted that the siting of sewage infrastructure within and in close proximity to watercourses is not best practice from a catchment management and water resources perspective.

Recommended mitigation measures:

Design & routing

- The crossing of the Wetland Unit D0 should be and the crossing of its tributary wetlands must be minimised.
- Unavoidable sewer and water pipe crossings should be located across the narrowest portions of the wetland units to minimise wetland disturbance.
- Where possible, the alignment of the sewer pipe crossings should be located where the wetland units have already been disturbed or proposed to be disturbed i.e. along planned road crossings.
- The sewer and water pipes must be routed so that the wetland is crossed at right angles to the direction of flow. Sewer line crossings must not be aligned parallel or near parallel to flow.
- No manholes must be established within the wetland units.
- Manholes must be located as far from the wetland edges as possible. Ideally, a minimum 20m buffer should be established between the edge of the wetland and any sewer manhole.
- If for substantiated reasons, a manhole needs to be located within the vicinity of (within 10 m of) any of the wetland units, the manhole should be elevated above (1 m) the land surface to increase storage volume during potential surcharge events and flap-gates should be installed above the wetland (at safe locations) to ensure that blockages are confined to areas outside (upstream) of the wetland.
- To reduce the risk of surcharging sewer manholes onsite and downstream, a form of gully trap should be installed at or before the connection of the various components of the retail development with the main/street line through the development. This gully trap will block foreign objects from entering the main internal line of the site and isolate blockage problems at the source.
- All future owners and employees of the retail development must be provided with a set of rules and prohibitions regarding the correct use of the toilets and kitchen sinks.
- In the case of blockages and overflowing manholes, it is the responsibility of the retail owners and employees to inform the eThekwini Municipality Sanitation Department immediately.
- If the eThekwini Municipality take a long time to respond, it is the responsibility of the owners/employees to inform the Department of Water Affairs (DWA) of the delay.
- The contractor appointed to construct the sewer line crossings must have a proven track-record with respect to sewer line construction.

d. The degeneration in the health of the wetland, riparian, estuarine units and coastline as a result of surcharging manholes in close proximity to the watercourses.

Once operational, the sewer pipe (particularly the gravity fed reticulation and manholes) pose a potential pollution risk for the lifetime of the pipe network. Manholes can overflow due to blockages at points below the manhole caused by the disposal of inappropriate objects or a lack of maintenance, and by inadequate design and/or poor construction. If any one of these

manholes were to overflow, the pollution in its raw form would enter the wetlands and riparian environments.

Impacts associated with the pollution of wetlands and riparian areas with sewage include the domination of a particular floral species as a result of the competitive advantage created by pollutants, the dieback of floral and faunal species and the resultant loss of biodiversity. In this case the wetlands on site are already disturbed and modified and as such the effects on wetland flora will be low. However, such pollution still poses a water quality problem for downstream watercourses and ultimately the river and stream systems.

- Increased risk of sewage pollution associated with surcharging manholes and leaking pipes for the lifetime of the project. Given the unlikely tendency of high income residents to introduce incompatible waste into the sewage system, the risk of sewer blockages and resultant manhole surcharges is moderately low in the long term; and
- Increased risk of sewage pollution associated with damage to the sewer pipe bridges resulting from flooding.

Pre-mitigation impact assessment the degeneration in the health of the wetland, riparian, estuarine units and coastline as a result of surcharging manholes in close proximity to the watercourses:

Assessment Criteria	Score	Rating
Ecosystem Goods & Services Value	4	Medium-High
Environmental Value	**4**	**Medium-High**
Disturbance	3	Medium
Extent	3	Local
Duration	3	Medium-term
Probability	3	Possible
Impact Magnitude	**12**	**Medium**
Significance	**48**	**Medium**
Acceptability	**Generally Unacceptable**	

Mitigation measures:

Design & routing recommendations:

- No manholes should be established within the wetland and riparian units.
- Ideally, a 20m buffer should be established between the edge of the wetland/riparian zones and any sewer manhole. Where manholes in wetland and riparian buffers are unavoidable, these manholes should be sited as far away as possible from the edge of the onsite wetlands and riparian areas.
- To reduce the risk of surcharging sewer manholes onsite, a form of gully trap should be installed at or before the connection of the individual houses and/or cluster blocks with the main/street line through the development. This gully trap will block foreign objects from entering the main internal line of the site and isolate blockage problems at the source.
- Grease traps must be installed within all commercial kitchen sinks.
- A set of rules and prohibitions regarding the correct use of the toilets and kitchen sinks must be developed for inclusion into the sale agreements for each unit.
- Fliers that educate the beneficiaries on what substances are not to be thrown down the toilet and their possible consequences for their surrounding environment and how to operate and maintain the gully and grease traps where applicable must be delivered to the new homeowners as soon as they take occupancy. These fliers must include the telephone number of the appropriate municipal department so that blockages and overflowing manholes may be reported and dealt with quickly.
- In the case of blockages and overflowing manholes, it is the responsibility of the homeowners/renters to inform the municipality immediately. This responsibility must be written into the sale agreements.
- If the municipality take a long time to respond, it is the responsibility of the homeowners to inform the Department of Water Affairs and Sanitation of the delay. The contact person at the DWA must be included on the fliers.

- The EDTEA must be notified of any sewage spills that occur onsite within 3 days of the municipality being informed of the spillage. It is the responsibility of the municipality to inform the EDTEA.
- A sewage spill detection and contingency plan must be included in the operational EMPr and it is the responsibility of the municipal waste-water department to adhered to these plans.
- A short report on the maintenance and monitoring inspections undertaken by the municipality for the sewer system must be provided to the EDTEA annually by the municipality waste-water department.

Post-mitigation impact assessment the degeneration in the health of the wetland, riparian, estuarine units and coastline as a result of surcharging manholes in close proximity to the watercourses:

Assessment Criteria	Score	Rating
Ecosystem Goods & Services Value	4	Medium-High
Environmental Value	**4**	**Medium-High**
Disturbance	3	Medium
Extent	3	Local
Duration	2	Medium-short
Probability	2	Fairly Unlikely
Impact Magnitude	**10**	**Medium-Low**
Significance	**40**	**Medium-Low**
Acceptability	**Acceptable but Undesirable**	

17.1.1.4 Road Crossing Impacts

At this stage five wetland road crossings are proposed as shown in the preliminary land uses layout plan attached as **Appendix A**. The proposed crossings occur across Wetland Units A0, A2, A3, C0 and D2.

a. Impacts of road-crossings in wetlands during the construction phase of the Main Rorqual Site

The crossings of Wetland Units A0 will occur along the current culvert crossings. Therefore, disturbance will be confined to the already disturbed corridors of the present crossings. New crossings will have to be established within Wetland Units A2, A3, C0 and D2. The crossing of units A3 and D2 will involve the establishment of a road platform across the wetland and culverts within the lowest lying and/or channelled sections. The crossing of units A2 and C0 are not true crossings and cut cross portions of the wetland but not across the width of the wetland. In these cases, the crossings will involve the establishment of a road fill platform and downslope fill embankment within the wetland.

The construction of roads within and across wetlands will result in the filling in of a portion of wetland along the road surface and fill footprint and the permanent loss of wetland. In addition, culverts will need to be installed divert surface flow through the road crossing. Where a channel is present, the culverts will have to be established within the channel. Other impacts include the compaction and clearing of areas outside of the road fill footprint during the construction phase and associated indirect impacts that includes erosion and alien plant encroachment into the wetland.

b. Impacts of road-crossings in wetlands during the construction phase of the North-West Quadrant and WWTW sites

No formal road crossings should be established within Wetlands Units I1, I2, I3 and J1. Where road crossings of Wetland Units D0 and D6 are necessary, formal road crossings should be established along existing cane road crossings.

The construction of roads within and across wetlands will result in the filling in of a portion of wetland along the road surface and fill footprint and the permanent loss of wetland. In addition, culverts will need to be installed divert surface flow through the road crossing. Where a channel

is present, the culverts will have to established within the channel. Other impacts include the compaction and clearing of areas outside of the road fill footprint during the construction phase and associated indirect impacts that includes erosion and alien plant encroachment into the wetland.

Mitigation measures:

Approvals:

A water use license is required to establish the pipes within the wetland as per Section 21 (c) and (i) of the National Water Act. This license is required prior to construction commencing.

Design & routing:

- Wetland and stream road crossings must be minimised and ideally located along existing cane road crossings.
- The road crossing must be routed so that the wetland is crossed at right angles to the direction of flow.

Site setup and construction phase:

- Construction should be undertaken between the months of April and August.
- The wetland boundaries either side of the road crossing must be demarcated using shade cloth or snow fencing prior to the construction commencing.
- Disturbance to the wetland soils along the road crossing footprint should be restricted to an established construction right-of-way (ROW) corridor. The ROW corridor within the wetland should be as narrow as practically possible and should be demarcated and fenced off during the site setup phase to the satisfaction of the ECO.
- The construction ROW should comprise the road and embankment footprint only.
- All wetland areas outside of the demarcated ROW must be considered no-go areas.

Rehabilitation and monitoring:

- Disturbed and bare soils resulting from the construction must be prepared and re-vegetated to the satisfaction of the ECO.

The impact on the wetland units is assessed as follows:

- The degree of disturbance to the adjacent and downstream wetland units will be **medium**.
- The extent of the impact on wetland units will be **local** because the erosion and sedimentation impacts will likely be experienced downstream.
- The duration of the impacts on the wetland units will be **long-term** as the effect of the impacts will be present for the lifetime of the project; and
- The probability of the impact occurring is **probable**.

The significance of the impact was assessed as being **medium-low** for the medium-low and medium value systems as shown in the impact summary tables below.

Pre-mitigation impact assessment for construction road crossing impacts for systems of medium-low importance

Assessment Criteria	Score	Rating
Ecosystem Goods & Services Value	2	Medium-Low
Environmental Value	**2**	**Medium-Low**
Disturbance	3	Medium
Extent	3	Local
Duration	4	Long-term
Probability	4	Probable
Impact Magnitude	**14**	**Medium**
Significance	**28**	**Medium-Low**
Acceptability	**Acceptable**	

Pre-mitigation impact assessment for construction road crossing impacts for systems of medium importance

Assessment Criteria	Score	Rating
Ecosystem Goods & Services Value	3	Medium
Environmental Value	**3**	**Medium**

Assessment Criteria	Score	Rating
Disturbance	3	Medium
Extent	3	Local
Duration	4	Long-term
Probability	4	Probable
Impact Magnitude	**14**	**Medium**
Significance	**42**	**Medium-Low**
Acceptability	**Acceptable BUT Undesirable**	

Mitigation measures:

Approvals:
A water use license is required to establish the pipes within the wetland as per Section 21 (c) and (i) of the National Water Act. This license is required prior to construction commencing.

Design & routing:
- Wetland and stream road crossings must be minimised and ideally located along existing cane road crossings.
- The road crossing must be routed so that the wetland is crossed at right angles to the direction of flow.

Site setup and construction phase:
- Construction should be undertaken between the months of April and August.
- The wetland boundaries either side of the road crossing must be demarcated using shade cloth or snow fencing prior to the construction commencing.
- Disturbance to the wetland soils along the road crossing footprint should be restricted to an established construction right-of-way (ROW) corridor. The ROW corridor within the wetland should be as narrow as practically possible and should be demarcated and fenced off during the site setup phase to the satisfaction of the ECO.
- The construction ROW should comprise the road and embankment footprint only.
- All wetland areas outside of the demarcated ROW must be considered no-go areas.

Rehabilitation and monitoring:
- Disturbed and bare soils resulting from the construction must be prepared and re-vegetated to the satisfaction of the ECO.

Post-mitigation impact assessment for construction road crossing impacts to systems of medium-low importance

Assessment Criteria	Score	Rating
Ecosystem Goods & Services Value	2	Medium-Low
Environmental Value	**2**	**Medium-Low**
Disturbance	1	Low
Extent	3	Local
Duration	4	Long-term
Probability	3	Possible
Impact Magnitude	**11**	**Medium**
Significance	**22**	**Low**
Acceptability	**Acceptable**	

Post-mitigation impact assessment for construction road crossing impacts to systems of medium importance

Assessment Criteria	Score	Rating
Ecosystem Goods & Services Value	3	Medium
Environmental Value	**3**	Medium
Disturbance	1	Low
Extent	3	Local
Duration	4	Long-term
Probability	3	Possible
Impact Magnitude	**11**	**Medium**
Significance	**33**	**Medium-Low**

Assessment Criteria	Score	Rating
Acceptability	**Acceptable**	

c. Impacts of road-crossings in wetlands during the operational phase of the Main Rorqual Site

Besides the permanent loss of wetland below the road fill, road crossings have a number of indirect impacts on the health of wetlands. These include:

- The concentration of wetland flow through culverts and the erosion and scouring of the wetland below the culvert(s); and
- The fragmentation of the wetland by the road, which represents a serious barrier to faunal movement along the wetland.

The impact on the wetland units is assessed as follows:

- The degree of disturbance to the adjacent and downstream wetland units will be **medium**.
- The extent of the impact on wetland units will be **local** because the erosion and sedimentation impacts will likely be experienced downstream.
- The duration of the impacts on the wetland units will be **long-term** as the effect of the impacts will be present for the lifetime of the project; and
- The probability of the impact occurring is **probable**.

Pre-mitigation impact assessment for operational road crossing impacts to systems of medium-low importance

Assessment Criteria	Score	Rating
Ecosystem Goods & Services Value	2	Medium-Low
Environmental Value	**2**	
Disturbance	1	Low
Extent	3	Local
Duration	4	Long-term
Probability	3	Possible
Impact Magnitude	**11**	**Medium**
Significance	**22**	**Low**
Acceptability	**Acceptable**	

Pre-mitigation impact assessment for operational road crossing impacts to systems of medium importance

Assessment Criteria	Score	Rating
Ecosystem Goods & Services Value	3	Medium
Environmental Value	**3**	**Medium**
Disturbance	1	Low
Extent	3	Local
Duration	4	Long-term
Probability	3	Possible
Impact Magnitude	**11**	**Medium**
Significance	**33**	**Medium-Low**
Acceptability	**Acceptable**	

Mitigation measures:

- Box culverts should be used to divert flow through the wetland and stream crossings and the box culverts must be established across the entire stream channel or seasonal wetland zone.
- If existing crossings are utilised, pipe culverts must be replaced with an adequate number of box culverts.
- Box culverts must be wide enough to not artificially constrict the limits of the 1:100 year floodline. A commitment has been provided by the engineers in this regard.
- With regards to wetland crossings only, the road fill foundation and base should include discrete permeable flow paths constructed of permeable piping or strips of multi-layered geo-fabric and geo-net.

- Erosion protection measures (e.g. Reno-mattresses) must be established below the box culverts.
- The final design for each wetland crossing must be approved by the wetland specialist prior to construction commencing.

d. Impacts of road-crossings in wetlands during the operational phase of the North-west Quadrant and WWTW Sites

Besides the permanent loss of wetland below the road fill, road crossings have a number of indirect impacts on the health of wetlands. These include:

- The concentration of wetland flow through culverts and the erosion and scouring of the wetland below the culvert(s); and
- The fragmentation of the wetland by the road, which represents a serious barrier to faunal movement along the wetland.

Mitigation measures:
- Box culverts should be used to divert flow through the wetland and stream crossings and the box culverts must be established across the entire stream channel or seasonal wetland zone.
- If existing crossings are utilised, pipe culverts must be replaced with an adequate number of box culverts.
- With regards to wetland crossings only, the road fill foundation should include discrete permeable flow paths constructed of permeable piping or strips of multi-layered geo-fabric or geo-netting, to ensure low flow seepage is maintained and that water does not dam up behind the road during heavy rainfall.
- Erosion protection measures (e.g. Reno-mattresses) must be established below the box culverts.
- The final design for each wetland crossing must be approved by the wetland specialist prior to construction commencing.

17.1.1.5 Contamination of Groundwater Impacts

a. Degeneration in the health of the wetland, riparian and estuarine areas as a result of the contamination of the groundwater and/or runoff entering the wetlands and streams during the construction phase.

Description of impact:
Groundwater and surface runoff contamination may occur during the construction phase as a result of negligence, inappropriate planning, lack of supervision and general handling errors. Pollutants include hydrocarbons i.e. diesel or hydraulic oils from construction machinery, stored fuels, bitumen based substances and cement in solution. In the event of the contamination of the groundwater and surface runoff upslope of the wetlands and streams on site, the contaminated groundwater will likely drain downslope and ends up in the wetland and riparian areas area. The degree of contamination depends on the extent of the chemical spill or cumulative effects of a number of chemical spills.

Substantial contamination of the wetlands on site can result in significant disturbances to the floral and faunal communities within the wetlands. Disturbances include the domination of a particular species as a result of the competitive advantage created by pollutants or the dieback of floral and faunal species and the resultant loss of biodiversity.

For riparian areas, the input of contaminated runoff or groundwater into the system will have a cumulative water pollution impact and contribute to the disturbance of the vegetation communities along the channels.

In this case the wetlands and riparian areas on site are already moderately disturbed and modified and as such the effects of pollution will likely be reduced. Nevertheless, pollution of the wetlands and streams will likely lead to further degradation from an ecological perspective as well as contribute cumulatively to a decreased water quality within the larger catchment, particularly the Mzimayi River and Nkomba River.

Pre-mitigation impact assessment of degeneration of health of the wetland, riparian and estuarine areas as a result of the contamination of the groundwater and/or runoff:

Assessment Criteria	Score	Rating
Ecosystem Goods & Services Value	4	Medium-High
Environmental Value	**4**	**Medium-High**
Disturbance	4	Medium-High
Extent	3	Local
Duration	4	Long-term
Probability	5	Near Definite to Definite
Impact Magnitude	**16**	**Medium-High**
Significance	**64**	**Medium-High**
Acceptability	**Generally Unacceptable**	

Mitigation measures:

- Hazardous storage and refuelling areas must be bunded prior to their use on site during the construction period. The number of bunds and their location and their construction should occur during the site setup phase.
- Mixing and/or decanting of all chemicals and hazardous substances must take place on a tray, shutter boards or on an impermeable surface and must be protected from the ingress and egress of storm-water.
- No vehicles transporting concrete, asphalt or any other bituminous product may be washed on site.
- Vehicle maintenance should not take place on site unless a specific bunded area is constructed for such a purpose.
- Ensure correct location of construction camps, equipment yards, concrete batching plants, etc. to avoid areas susceptible to soil and water contamination.
- Ensure that transport, storage, handling and disposal of hazardous substances is adequately controlled and managed. Correct emergency procedures and cleaning up operations should be implemented in the event of accidental spillage.
- Implement appropriate operation and maintenance of construction equipment to avoid petrochemical products from polluting the soil.
- A spill contingency plan for both the construction phase must be drawn up and incorporated into the EMP. This should include procedures to guide the clean-up of accidental spillages and its disposal.
- Bins should be provided to all areas that generate waste e.g. worker eating and resting areas and the camp site. General refuse and construction material refuse should not be mixed.

Post-mitigation Impact Assessment:

Assessment Criteria	Score	Rating
Ecosystem Goods & Services Value	4	Medium-High
Environmental Value	**4**	**Medium-High**
Disturbance	2	Medium-Low
Extent	3	Local
Duration	3	Medium-term
Probability	3	Possible
Impact Magnitude	**11**	**Medium-High**
Significance	**44**	**Medium-Low**
Acceptability	**Acceptable but Undesirable**	

17.1.1.6 Alien Vegetation Encroachment Impacts

a. Degeneration in the health of the wetland, riparian and estuarine areas as a result of direct construction related disturbances and alien vegetation encroachment during the construction phase.

Description of impact:

Accidental disturbance of the soils in and around the wetlands, riparian areas and buffers may lead to the clearing of wetland/riparian vegetation and/or alien invasive encroachment into the

wetlands and riparian areas. In addition, alien encroachment will occur if the construction sites are not properly rehabilitated and managed during and after construction. In this case, the wetlands and riparian zones are already impacted upon by alien encroachment and as such the disturbance impact would be medium-low. However, in light of future opportunities for rehabilitation and alien eradication, these impacts can be costly and counterproductive in the long-term.

Pre-mitigation impact assessment of degeneration in the health of the wetland, riparian and estuarine areas as a result of direct construction related disturbances and alien vegetation encroachment during the construction phase:

Assessment Criteria	Score	Rating
Ecosystem Goods & Services Value	4	Medium-High
Environmental Value	**4**	**Medium-High**
Disturbance	2	Medium-Low
Extent	3	Local
Duration	5	Permanent
Probability	5	Near Definite to Definite
Impact Magnitude	**15**	**Medium-High**
Significance	**60**	**Medium-High**
Acceptability	**Generally Unacceptable**	

Mitigation measures:

- The wetland and riparian area buffer zones must be staked out by a surveyor and fenced off using shade cloth, 'snow' fencing or similar fence material during the construction phase and considered a no-go zone for the duration of the construction phase. The buffer fencing must be established prior to construction commencing.
- Patches of alien invasive vegetation that colonise parts of the construction site in the vicinity of the buffers should be removed immediately as instructed by the Environmental Control Officer (ECO). This should be done on a continual basis.
- Any disturbance to the wetlands, riparian areas and buffers must be rehabilitated within seven days of disturbance to the satisfaction of the ECO.

Post-mitigation Impact Assessment:

Assessment Criteria	Score	Rating
Ecosystem Goods & Services Value	4	Medium-High
Environmental Value	**4**	**Medium-High**
Disturbance	2	Medium-Low
Extent	2	Surrounding Area
Duration	2	Medium-Short
Probability	3	Possible
Impact Magnitude	**9**	**Medium-Low**
Significance	**36**	**Medium-Low**
Acceptability	**Acceptable**	

17.1.1.7 Sewage Pollution Impacts

a. Impacts on Wetland Units of the North-West Quadrant and WWTW sites

It is expected that sewer pipes and manholes will be constructed along the edge of the 30m wetland buffer and possibly within the buffer and wetland where crossings are necessary. Once operational, sewer pipes, manholes and pump stations pose a potential pollution risk for the lifetime of the pipe network. Manholes overflow due to blockages at points below the manhole resulting from inappropriate use, inadequate design and/or poor construction. Similarly, pump stations and their emergency storage facilities over flow if there are failures and the municipality do not fix the problem timeously. If any one of the manholes or pump stations along the edge of the buffer, within the buffer or within the wetland were to overflow, the pollution in its raw form would enter the wetland buffer and likely the wetland itself.

Impacts associated with the pollution of wetlands with sewage include the domination of a particular floral species as a result of the competitive advantage created by pollutants, the dieback of floral and faunal species and the resultant loss of biodiversity (Coetzee, 2005). In this case, sewage spills will likely increase the competitive advantage of alien invasive and pioneer species. Such pollution poses a serious water quality problem for downstream aquatic habitats, especially the small estuaries.

Mitigation measures:

- No manholes should be established within the wetland and riparian units.
- Ideally, a minimum 20m buffer should be established between the edge of the wetland/riparian zones and any sewer manhole. Where manholes in wetland and riparian buffers are unavoidable, these manholes should be sited as far away as possible from the edge of the onsite wetlands and riparian areas.
- All proposed pump stations should have at least 24 hours emergency storage capacity (freeboard) to ensure that surcharge and overflow events are avoided. This should ensure that the municipal workers have sufficient time to address the issues before the emergency storage facility is full.
- To reduce the risk of surcharging sewer manholes onsite, a form of gully trap should be installed at or before the connection of the developments with the main/street line through the development. This gully trap will block foreign objects from entering the main internal line of the site and isolate blockage problems at the source.
- Grease traps must be installed within all kitchen sinks.
- A set of rules and prohibitions regarding the correct use of the toilets and kitchen sinks must be developed for inclusion into the sale agreements.
- In the case of blockages and overflowing manholes, it is the responsibility of the homeowners/renters to inform the Ugu Municipality immediately. This responsibility must be written into the sale agreements.
- If the Ugu Municipality take a long time to respond, it is the responsibility of the homeowners to inform the Department of Water Affairs (DWA) of the delay. The contact person at the DWA must be included on the fliers.
- The EDTEA must be notified of any sewage spills that occur onsite within 3 days of the municipality being informed of the spillage. It is the responsibility of the municipality to inform the EDTEA.

17.1.1.8 General Operational Disturbance Impacts

a. General Operational Impacts on Wetland Units of the Main Rorqual site

It is envisaged the proposed development will comprise middle to middle to upper income housing and commercial and light industrial development nodes. Likely primary impacts arising from these activities include: wetland vegetation disturbance due to informal crossings, the proliferation of exotic and alien species in gardens and in and round the industrial and commercial platforms, impeding of faunal movement corridors, light pollution, noise pollution, faunal fatalities associated with fencing, the extermination and/or hunting of fauna (e.g. frogs, chameleons, snakes and antelope), unrestricted mowing and garden expansion, and the alteration of natural faunal behaviour through feeding (e.g. monkeys and bushbuck).

Secondary impacts to wetlands arising from these primary impacts include: alien invasive plant encroachment, disturbance to light and noise sensitive wetland species and their natural populations, and the reduction in sensitive faunal population numbers.

b. General Operational Impacts on Wetland Units of the North-West Quadrant and WWTW sites

Continued disturbance and a lack of management over the lifetime of development is a problem that exists throughout South Africa where there is limited budget for the management and preservation of wetlands and often no ‘buy-in’ from local residents in terms of the conservation of important environmental systems and habitats.

As stated in Section 6.1.8 above, it is assumed that a body corporate or homeowner's association will be in place, as stated in the Draft Service Level Agreements, to manage all applicable open spaces in accordance with the requirements of the Conservation Management Plan.

Some direct impacts on wetlands arising from a lack of management and protection within open spaces onsite include the establishment of informal crossings, illegal refuse dumping, wood harvesting and vegetation clearing and trampling. These disturbances result in the disturbance of the wetland soils and plants which encourages the proliferation of alien invasive and pioneer species that are better adapted to survive in disturbed soil and moisture conditions. In addition, the extermination and/or hunting of fauna (e.g. frogs, chameleons, snakes and antelope) is a common impact where access to open spaces is unrestricted. Over time, these impacts left unattended will contribute to the gradual reduction in the current health and value of the wetlands onsite.

Mitigation measures

- Wetland Units I1 and I2 should be included as a conservation area of the school and used for educational purposes to teach and expose the learners to wetlands and forest ecosystems.
- The conservation area should be clearly demarcated for the benefit of the learners and conservation signs should be established along the conservation area boundary to inform the local residents of the wetland conservation areas, their value to society and certain prohibitions regarding the use of the wetland areas.
- Access to this conservation area must be restricted and controlled by the school. Learners should be prohibited to use cross the conservation area as a shortcut or alternative route to access the school premises.
- The portion of Wetland Unit I1 and relevant buffer zone south of the R612 should be fenced off from the road (R612) and future petrol filling station.

The impact on the wetland units is assessed as follows:

- The degree of disturbance to the wetland units will be **low** for the medium-low and medium value systems and **medium-low** for the medium-high and high value systems.
- The extent of the impact on wetland units will be **surrounding area**.
- The duration of the impacts on the wetland units will be **long-term** as the effect of the impacts will be present for the lifetime of the project; and
- The probability of the impact occurring is **possible**.

The significance of the impact was assessed as being **low** for the medium-low value systems, **medium-low** for the medium and medium-high value systems, and **medium** for the high value systems, as shown in the impact summary tables below. In terms of acceptability, potential impact on the high value systems is considered **generally unacceptable**.

Pre-mitigation impact assessment for operational disturbance impacts to systems of medium-low importance

Assessment Criteria	Score	Rating
Ecosystem Goods & Services Value	2	Medium-Low
Environmental Value	**2**	**Medium-Low**
Disturbance	1	Low
Extent	2	Surrounding Area
Duration	4	Long-term
Probability	3	Possible
Impact Magnitude	**10**	**Medium-Low**
Significance	**20**	**Low**
Acceptability	**Acceptable**	

Pre-mitigation impact assessment for operational disturbance impacts to systems of medium importance

Assessment Criteria	Score	Rating
Ecosystem Goods & Services Value	3	Medium

Assessment Criteria	Score	Rating
Environmental Value	**3**	**Medium**
Disturbance	1	Low
Extent	2	Surrounding Area
Duration	4	Long-term
Probability	3	Possible
Impact Magnitude	**10**	**Medium-Low**
Significance	**30**	**Medium-Low**
Acceptability	**Acceptable**	

Pre-mitigation impact assessment for operational disturbance impacts to systems of medium-high importance

Assessment Criteria	Score	Rating
Ecosystem Goods & Services Value	4	Medium-High
Environmental Value	**4**	**Medium-High**
Disturbance	2	Medium-Low
Extent	2	Surrounding Area
Duration	4	Long-term
Probability	3	Possible
Impact Magnitude	**11**	**Medium-Low**
Significance	**44**	**Medium-Low**
Acceptability	**Acceptable But Undesirable**	

Pre-mitigation impact assessment for operational disturbance impacts to systems of high importance

Assessment Criteria	Score	Rating
Ecosystem Goods & Services Value	5	High
Environmental Value	**5**	**High**
Disturbance	2	Medium-Low
Extent	2	Surrounding Area
Duration	4	Long-term
Probability	3	Possible
Impact Magnitude	**11**	**Medium**
Significance	**55**	**Medium**
Acceptability	**Generally Unacceptable**	

Mitigation measures:

- The conservation areas across the project must be clearly demarcated for the benefit of the homeowners and occupiers and conservation signs should be established along the edge of the conservation area boundary (wetland buffer edges) to inform the local residents of the wetland conservation areas, their value to society and certain prohibitions regarding the use of the wetland areas.
- A conservation management plan for the wetland units must be drawn up and implemented by the relevant homeowner owner associations.

With the successful implementation of the above recommended mitigation, the significance of the potential impact on all the systems was assessed as being **low** or **medium-low** and acceptable.

Post-mitigation impact assessment for operational disturbance impacts to systems of medium-low importance

Assessment Criteria	Score	Rating
Ecosystem Goods & Services Value	2	Medium-Low
Environmental Value	**2**	**Medium-Low**
Disturbance	1	Low
Extent	1	Site
Duration	4	Long-term
Probability	2	Fairly Unlikely
Impact Magnitude	**8**	**Medium-Low**
Significance	**16**	**Low**
Acceptability	**Acceptable**	

Post-mitigation impact assessment for operational disturbance impacts to systems of medium importance

Assessment Criteria	Score	Rating
Ecosystem Goods & Services Value	3	Medium
Environmental Value	**3**	**Medium**
Disturbance	1	Low
Extent	1	Site
Duration	4	Long-term
Probability	2	Fairly Unlikely
Impact Magnitude	**8**	**Medium-Low**
Significance	**33**	**Medium-Low**
Acceptability	**Acceptable**	

Post-mitigation impact assessment for operational disturbance impacts to systems of medium-high importance

Assessment Criteria	Score	Rating
Ecosystem Goods & Services Value	4	Medium-High
Environmental Value	**4**	**Medium-High**
Disturbance	1	Low
Extent	1	Site
Duration	4	Long-term
Probability	2	Fairly Unlikely
Impact Magnitude	**8**	**Medium-Low**
Significance	**32**	**Medium-Low**
Acceptability	**Acceptable**	

Post-mitigation impact assessment for operational disturbance impacts to systems of high importance

Assessment Criteria	Score	Rating
Ecosystem Goods & Services Value	5	High
Environmental Value	**5**	**High**
Disturbance	1	Low
Extent	1	Site
Duration	4	Long-term
Probability	2	Fairly Unlikely
Impact Magnitude	**8**	**Medium-Low**
Significance	**40**	**Medium-Low**
Acceptability	**Acceptable But Undesirable**	

17.1.1.9 Positive Rehabilitation Impacts

a. Positive Rehabilitation Impacts on Wetland Units of the Main Rorqual site

The proposed developments provide an opportunity to create funds for the rehabilitation and on-going management of the wetland units onsite. As the wetlands onsite are generally highly degraded as a result of cane farming practices, rehabilitation will result in substantial gains in wetland ecosystem services, particularly an improvement in the water quality and surface water management services provided to the downstream estuaries and biodiversity maintenance services.

It is envisaged that effective rehabilitation will involve the clearing of sugarcane from all the wetlands and their buffers, the plugging of the numerous artificial drainage channels within the wetlands to re-establish the natural wetness regime of the wetland soils, ongoing alien plant eradication within the wetlands and buffers to promote natural succession, and the re-vegetation of wetlands and their buffers with indigenous wetland plants where necessary. In this regard, it is recommended that a detailed wetland rehabilitation plan be compiled for the wetland units to be rehabilitated. The wetland rehabilitation and management plan should be compiled by a qualified wetland specialist to provide reasonable and feasible rehabilitation and management

measures to those responsible for the management of the wetland areas. The wetland rehabilitation plan should focus on:

- The plugging and/or infilling of artificial drainage channels within the wetland units.
- The removal of all cane haulage roads within the wetlands and buffers.
- Compilation of a wetland alien eradication and management programme that focuses on the eradication and management of alien vegetation within the wetlands and buffers as well as the re-vegetation of these areas following alien clearing if necessary.
- Identifying preferred areas within wetland units for formalised paths for recreation and education purposes; and
- Identifying preferred areas for the establishment of wetland conservation signs along the buffer edges of the wetland units to inform the residents and owners of the wetland conservation areas and their value to society.

b. Positive Rehabilitation Impacts on Wetland Units of the North-West Quadrant and WWTW sites

If these measures are implemented effectively, the positive impacts of rehabilitation on the health of the wetlands will be substantial and beneficial.

The proposed developments provide an opportunity to create funds for the rehabilitation and ongoing management of the wetland units delineated. It is envisaged that effective rehabilitation will involve the clearing of sugarcane from all the wetlands and their buffers, the plugging of the numerous artificial drainage channels within the wetlands to re-establish the natural wetness regime of the wetland soils, ongoing alien plant eradication within the wetlands and buffers to promote natural succession and the re-vegetation of wetlands and their buffers with indigenous wetland plants where necessary. In this regard, it is recommended that a detailed wetland rehabilitation plan be compiled for the wetland units to be rehabilitated. The wetland rehabilitation and management plan should be compiled by a qualified wetland specialist to provide reasonable and feasible rehabilitation and management measures to those responsible for the management of the wetland areas. The wetland rehabilitation plan should focus on:

- the removal of the cane haulage roads within Wetland Units I1, I2 and J1;
- the plugging and/or infilling of artificial drainage channels within Wetland Units I1, I2 and J1;
- the compilation of a wetland alien eradication and management programme that focuses on the eradication and management of alien vegetation within the wetlands and buffers as well as the re-vegetation of these areas following alien clearing where necessary;
- the identification of preferred areas within Wetland Units I1 and I2 for formalised paths for education purposes;
- the identification of preferred areas for the establishment of wetland conservation signs along the buffer edges of Wetland Units I1, I2 and J1 to inform the learners, residents and owners of the wetland conservation areas and their value to society; and
- the compilation of a burning regime where applicable.

If these measures are implemented effectively, the positive impacts of rehabilitation on the health of the wetlands will be substantial, particularly Wetland Units I1, I2 and J1. The removal of cane from Wetland Unit I2 and re-vegetation of the wetland and buffer will drastically reduce the current edge effects (disturbances) to the swamp forest and create natural terrestrial and wetland habitat outside of the swamp forest that will improve the integrity of the system and ultimately its biodiversity maintenance value. Similarly, the wetland habitat provided by Wetland Unit J1 would improve substantially.

Post-rehabilitation impact assessment for the systems of medium-low importance

Assessment Criteria	Score	Rating
Ecosystem Goods & Services Value	2	Medium-Low
Environmental Value	**2**	**Medium-Low**
Disturbance	4	Medium-High
Extent	3	Local
Duration	4	Long-term
Probability	4	Probable

Assessment Criteria	Score	Rating
Impact Magnitude	**+15**	**Medium-High**
Significance	**+30**	**Medium-Low**
Acceptability	**Important/Beneficial**	

Post-rehabilitation impact assessment for the systems of medium importance

Assessment Criteria	Score	Rating
Ecosystem Goods & Services Value	3	Medium
Environmental Value	**3**	**Medium**
Disturbance	4	Medium-High
Extent	3	Local
Duration	4	Long-term
Probability	4	Probable
Impact Magnitude	**+15**	**Medium-High**
Significance	**+45**	**Medium**
Acceptability	**Important/Beneficial**	

Post-rehabilitation impact assessment for the systems of medium-high importance

Assessment Criteria	Score	Rating
Ecosystem Goods & Services Value	4	Medium
Environmental Value	**4**	**Medium-High**
Disturbance	2	Medium-High
Extent	2	Local
Duration	4	Long-term
Probability	4	Probable
Impact Magnitude	**+12**	**Medium**
Significance	**+48**	**Medium**
Acceptability	**Important/Beneficial**	

Post-rehabilitation impact assessment for the systems of high importance

Assessment Criteria	Score	Rating
Ecosystem Goods & Services Value	5	High
Environmental Value	**5**	**High**
Disturbance	2	Medium-High
Extent	1	Local
Duration	4	Long-term
Probability	4	Probable
Impact Magnitude	**+11**	**Medium**
Significance	**+55**	**Medium**

17.1.2 Impacts on the Grasslands

a. Invasive alien vegetation and/or pioneers species encroachment as a result of disturbances to the grasslands and buffers during the construction and operation phases.

Description of impact:
Accidental disturbance of the soils in and around the grassland and buffer area may lead to invasive alien encroachment into the buffer areas and possibly the grassland areas if the construction sites are not properly rehabilitated and managed during and after both construction and operation.

Pre-mitigation Impact Assessment:

Assessment Criteria	Score	Rating
Ecosystem Goods & Services Value	5	High
Environmental Value	**5**	**High**
Disturbance	3	Medium
Extent	1	Site
Duration	5	Permanent
Probability	4	Probable
Impact Magnitude	**13**	**Medium**

Assessment Criteria	Score	Rating
Significance	**65**	**Medium-High**
Acceptability	**Generally Unacceptable**	

Mitigation measures:

- The grassland buffer zone must be staked out by a surveyor and fenced off using shade cloth, 'snow' fencing or similar fence material during the construction phase and considered a no-go zone for the duration of the construction phase. The buffer fencing must be established prior to construction commencing.
- Patches of invasive alien vegetation that colonise parts of the construction site in the vicinity of the grassland buffers should be removed immediately as instructed by the Environmental Control Officer (ECO). This should be done on a continual basis.
- Any disturbance to the grassland or buffer must be rehabilitated within seven days of disturbance to the satisfaction of the ECO.
- The natural area needs to be maintained in an alien free state. This requires removal of existing alien vegetation (including the copse of *Eucalyptus grandis* and many *Psidium guajava* trees), as well as any new or repeat establishment of alien vegetation, including along the edges of forest, in wetland areas and grassy buffers.
- Extant grassland and grassy buffers should be burned at least every two years, even if on a rotational basis, and fires would need to be cool enough not to burn into forest edges and cause the Swamp Forest or Northern Coastal Forest to recede. If burning does not occur, mowing should occur on a rotational and two-year cycle, to better replicate burning. For safety reasons, the latter would be more appropriate alongside a petrol station.
- Very few grassland forbs or geophytes are available commercially, and it is unlikely that such heavily transformed grassland could ever be returned to substantially primary state. However, a small number of grassland species could be obtained commercially and even this small introduction could add something to the grassland's plant diversity and productivity for wildlife (*Leonotis leonurus* is an example). This is recommended.
- It is easier to obtain and grow wetland species. By reference to wetland areas such as in the not too-distant Vernon Crookes Nature Reserve some wetland-dependent species that are likely missing from historical disturbance could be identified. It may be possible to negotiate some harvesting of seed and obtain permit approval for this through Ezemvelo KwaZulu-Natal Wildlife and grow these on a purpose basis for reintroduction. A competent specialist grower would need to be appointed to grow these plants. Some candidates are attached in Annexure D. It is not recommended that *Phragmites australis* (Common Reed) is introduced or increased in wetland areas or around the dam due to its ability to become over-dominant and exclude other wetland plant diversity.

Post-mitigation Impact Assessment:

Assessment Criteria	Score	Rating
Ecosystem Goods & Services Value	5	High
Environmental Value	**5**	**High**
Disturbance	1	Low
Extent	1	Site
Duration	5	Permanent
Probability	2	Fairly Unlikely
Impact Magnitude	**9**	**Medium-Low**
Significance	**45**	**Medium**
Acceptability	**Generally Unacceptable**	

17.1.3 Impacts on the Forest

a. Invasive alien vegetation and/or pioneers species encroachment as a result of disturbances to the forest and buffers during the construction and operation phases.

Description of impact:

Accidental disturbance of the soils in and around the forest area may lead to invasive alien encroachment into the buffer areas and possibly the coastal forest, seral forest and swamp

forest areas if the construction sites are not properly rehabilitated and managed during and after construction and during operation.

Pre-mitigation Impact Assessment:

Assessment Criteria	Score	Rating
Ecosystem Goods & Services Value	4	Medium-High
Environmental Value	**4**	**Medium-High**
Disturbance	3	Medium
Extent	1	Site
Duration	5	Permanent
Probability	3	Possible
Impact Magnitude	**12**	**Medium**
Significance	**48**	**Medium**
Acceptability	**Generally Unacceptable**	

Mitigation measures:

- The edge of the forest within and adjacent to the proposed development must be staked out by a surveyor and fenced off using shade cloth, 'snow' fencing or similar fence material during the construction phase and considered a no-go zone for the duration of the construction phase. The buffer fencing must be established prior to construction commencing.
- Patches of alien invasive vegetation that colonise parts of the construction site in the vicinity of the forest should be removed immediately as instructed by the Environmental Control Officer (ECO). This should be done on a continual basis.
- Any disturbance to the forest must be rehabilitated within seven days of disturbance to the satisfaction of the ECO.

No development should occur between the band of Northern Coastal Forest that more or less follows the north side of the R612 and the more or less parallel Swamp Forest.

The following buffers are proposed, and rationales provided.

- Buffers of up to 100 metres are recommended for Swamp Forest by Ezemvelo KwaZulu-Natal Wildlife. Due to the narrow nature of these bands, 60 metres could be supported if there was mitigation such as through a longer-term, adequately resourced management plan. A credible proposal would need to be made in this regard, for this reduction to be supported. There would however be many questions as to whether a proposed school development would be able to do this on its own.

  This buffer should not be less than 60 metres, in part because the narrowness of the band may partly be due to its contraction, as a result of being closely confined between farming activities over the years. This activity may also have prevented some merging between the swamp forest edge and the Northern Coastal Forest to the east. The larger buffer would therefore also allow some recovery to the *status quo ante*.

- Buffers on the Northern Coastal Forest of 40 metres can be supported for certain kinds of development (such as residential development with an environmental ethos and regulation of homeowner activities), particularly as it is surrounded by sugar cane or grassland of the most degraded kind. This is with a longer-term, adequately resourced management plan to manage the buffers and maintain them in alien-free state and promote development of a better ecotone.

  Unfortunately, a petrol station would be a high impact development (with frequent traffic, possible movement of people outside the footprint, and probable percolation of litter and establishment of alien species and weeds of disturbance around and beyond the footprint perimeter). It would on its own have no particular environmental ethos and as a standalone development there would be serious questions as to whether it could or would implement a management plan for the proximate forest and buffer zone over the long-term. While not in any way suggesting that a credible management plan would not be essential to mitigating impacts, given their nature, a larger buffer of 60 metres would seem better than 40 metres.

- Buffers on the most seral forest that comprises mainly pioneer species and alien vegetation could be smaller, at 20 metres.

- Buffers of 30 metres should be set in place around wetland areas to buffer hygrophytic vegetation. Given the damage caused by cane planting and destruction of biodiversity in wet to damp grassland around the dam, there would also need to be such a management plan to allow recovery in wetland areas. There is still some residue of hygrophytic species on the site and it would also be easier to source or grow hygrophytic species for reintroduction into wetland and damp grassland areas than it would be for grasses, forbs and geophytes in dryland grassland. This latter aspect should be considered. The Vernon Crookes Nature Reserve not far inland is under the management of Ezemvelo KwaZulu-Natal Wildlife. It may be possible to negotiate some harvesting of seed from wetland areas in this conservation area for propagation and planting around the dam (locally occurring *Kniphofia* species are an example).

Post-mitigation Impact Assessment:

Assessment Criteria	Score	Rating
Ecosystem Goods & Services Value	4	Medium-High
Environmental Value	**4**	**Medium-High**
Disturbance	1	Low
Extent	1	Site
Duration	5	Permanent
Probability	2	Possible
Impact Magnitude	**10**	**Medium-Low**
Significance	**40**	**Medium-Low**
Acceptability	**Acceptable but Undesirable**	

17.1.4 Impacts on Estuaries

a. Invasive alien vegetation and/or pioneers species encroachment as a result of disturbances to the estuarine habitat and its buffers during the construction and operation phases.

The *Casuarina equisetifolia* L. species were found occurring in the coastal forest vegetation. They will most likely benefit from increased nutrient availability. Like most invasive alien species could potentially become a problem along the servitudes, access roads reserves and areas used for the construction camps. Other invasive species recorded were *Solanum lycopersicum* L. (Tomato plant) and *Ricinus communis* L. These species are associated with disturbance of natural vegetation and faecal deposits. The abundance of these species will most likely increase and impact on the aesthetics of these estuaries.

In terms of the Conservation of Agricultural Resources Act (CARA) the landowner is obligated to monitoring and manage any alien plant cover.

The potential impact of the alien plants within the study area is summarised in Table 9 below.

Table 9: Potential increase alien plant growth (As provided by specialist, Scherman Colloty & Associates)

IMPACT TABLE	
Environmental Parameter	*Increase in alien plant cover*
Issue/Impact/Environmental Effect/Nature	Increase in nutrients and disturbance increases the opportunity for alien plants, that are already present along the estuarine banks to spread.
Extent	*Local (all estuaries)*
Probability	*Probable*
Reversibility	*Partly reversible*
Irreplaceable loss of resources	*Significant loss of resources*

Duration	*Long term*	
Cumulative effect	*Medium cumulative impact*	
Intensity/magnitude	*High*	
Significance Rating	*Pre-mitigation significance rating is Medium and negative. With appropriate mitigation measures, the impact is likely to be negligible.*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	3	2
Reversibility	2	2
Irreplaceable loss	3	2
Duration	3	2
Cumulative effect	3	2
Intensity/magnitude	3	2
Significance rating	- 48 (Medium negative)	- 28 (Low negative)

Mitigation measures:

- Suitable monitoring plans (water quality and plant cover changes) should be initiated by the developer, which should include the clearing and management of any alien plant species, prior to the construction phase. This should also include any areas that will be cleared for development as well as any stockpiles.

b. Increased microalgal and macroalgal growth

Nutrient enrichment from agricultural activities in the catchment is likely to lead to an accelerated expansion of *Phragmites australis*. Reed swamp has been shown to be expanding at a rate of 0.15 ha per year (Adams *et al*., 1999). In the Western Cape, Onrus Lagoon was a deep estuary until the 1940s. When the water upstream was dammed, the annual floods could no longer sweep the estuary clear of silt deposition. A combination of encroaching reeds and reduced river flow is likely to result in the extended closure of the mouths of these estuaries, salinity will decrease and the silt layers will be colonised by dense growths of *P. australis*.

Sediment and associated nutrient characteristics also determine species composition and distribution of emergent macrophyte species. Fine-textured sediments support a proportionally greater above ground biomass in *Cyperus esculentus* and *Scirpus validus* than do coarser sediments, possibly in response to greater nutrient availability associated with the fine sediments. Emergent macrophytes are effective sediment traps and the high rate of sedimentation has had serious effects in some smaller KwaZulu-Natal estuaries (Begg, 1978). Left unchecked, these macrophytes build up estuarine sediments into firmer ground thereby accelerating a succession towards coastal forest.

Table 10 below summarises the potential impacts with regard the increase in macrophyte cover, particularly reeds, should the nutrient and hydrological regime within the estuary catchments alter.

Table 10: Potential increase reedbed cover within estuaries (As provided by specialist, Scherman Colloty & Associates)

IMPACT TABLE	
Environmental Parameter	*Potential increase in reedbed cover*
Issue/Impact/Environmental Effect/Nature	Increase run-off high in nutrients will increase the macrophyte production rates, resulting in increased reedbed cover in particular. This then reduces the

	effective flows within the system, while trapping additional sediments	
Extent	*Local (all estuaries)*	
Probability	*Possible*	
Reversibility	*Partly reversible*	
Irreplaceable loss of resources	*Significant loss of resources*	
Duration	*Long term*	
Cumulative effect	*Medium cumulative impact*	
Intensity/magnitude	*High*	
Significance Rating	*Pre-mitigation significance rating is medium and negative. With appropriate mitigation measures, the impact is likely to be LOW.*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	2	2
Reversibility	2	2
Irreplaceable loss	3	2
Duration	3	3
Cumulative effect	3	3
Intensity/magnitude	3	2
Significance rating	- 45 (Medium negative)	- 28 (Low negative)

Mitigation measures

- The nutrients entering the estuaries in the river water needs to be controlled or improved if the health of these estuaries were to improve. Management options may include the more efficient use of fertilizers on agricultural and residential properties, the creation of artificial wetlands to trap excessive nutrients, the establishment of riparian buffer zones along water courses, the use of phosphorus-free detergents etc.
- No stormwater, WWTW effluent or agricultural return flows should be allowed to enter the rivers or estuaries. Suitable swales, detention ponds should be designed in such a manner to prevent any flows from reaching the aquatic systems.
- Suitable monitoring plans (water quality and plant cover changes) should be initiated by the developer.

c. Encroachment of reeds and macrophytes

Nutrient enrichment from agricultural activities in the catchment is likely to lead to an accelerated expansion of *Phragmites australis*. Reed swamp in the St Lucia estuarine system in Zululand has been shown to be expanding at a rate of 0.15 ha per year (Adams et al., 1999). In the Western Cape, Onrus Lagoon was a deep estuary until the 1940s. When the water upstream was dammed, the annual floods could no longer sweep the estuary clear of silt deposition. A combination of encroaching reeds and reduced river flow is likely to result in the extended closure of the mouths of these estuaries, salinity will decrease and the silt layers will be colonised by dense growths of *P. australis*.

Sediment and associated nutrient characteristics also determine species composition and distribution of emergent macrophyte species. Fine-textured sediments support a proportionally greater above ground biomass in *Cyperus esculentus* and *Scirpus validus* than do coarser sediments, possibly in response to greater nutrient availability associated with the fine sediments. Emergent macrophytes are effective sediment traps and the high rate of sedimentation has had serious effects in some smaller KwaZulu-Natal estuaries (Begg, 1978).

Left unchecked, these macrophytes build up estuarine sediments into firmer ground thereby accelerating a succession towards coastal forest.

Table 11 below summarises the potential impacts with regard the increase in macrophyte cover, particularly reeds, should the nutrient and hydrological regime within the estuary catchments alter.

Table 11: Potential increase reedbed cover within estuaries

IMPACT TABLE		
Environmental Parameter	*Potential increase in reedbed cover*	
Issue/Impact/Environmental Effect/Nature	Increase run-off high in nutrients will increase the macrophyte production rates, resulting in increased reedbed cover in particular. This then reduces the effective flows within the system, while trapping additional sediments	
Extent	*Local (all estuaries)*	
Probability	*Possible*	
Reversibility	*Partly reversible*	
Irreplaceable loss of resources	*Significant loss of resources*	
Duration	*Long term*	
Cumulative effect	*Medium cumulative impact*	
Intensity/magnitude	*High*	
Significance Rating	*Pre-mitigation significance rating is medium and negative. With appropriate mitigation measures, the impact is likely to be LOW.*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	2	2
Reversibility	2	2
Irreplaceable loss	3	2
Duration	3	3
Cumulative effect	3	3
Intensity/magnitude	3	2
Significance rating	- 45 (Medium negative)	- 28 (Low negative)

Mitigation measures:

- The nutrients entering the estuaries in the river water needs to be controlled or improved if the health of these estuaries were to improve. Management options may include the more efficient use of fertilizers on agricultural and residential properties, the creation of artificial wetlands to trap excessive nutrients, the establishment of riparian buffer zones along water courses, the use of phosphorus-free detergents etc.
- No stormwater, WWTW effluent or agricultural return flows should be allowed to enter the rivers or estuaries. Suitable swales, detention ponds should be designed in such a manner to prevent any flows from reaching the aquatic systems.
- Suitable monitoring plans (water quality and plant cover changes) should be initiated by the developer.

d. Bacterial contamination

The cell density of faecal coliforms and *E. coli* were generally within the water quality guidelines for recreation. However, the enterococci (Faecal Streptococci) density was high at a number of sites and pose a substantial risk to recreational users, made worse by estuaries close proximity to holiday resorts. Bacterial contamination can be the result of human or animal activity (e.g. livestock farming) but the growth of tomato plants (*S. lycopersicum*) around the fringes of the

Rocky Bay estuary indicates the presence of raw or treated sewage. The high density of Enterococci is based on a once-off sampling session so should be treated with caution; further sampling is required to confirm these results.

The potential risk would increase should the use of untreated effluent should reach the aquatic ecosystems via the sewer systems or agricultural return flows, with the potential impact being summarised in Table 12.

Table 12: Potential risk of bacterial contamination of the estuaries (As provided by specialist, Scherman Colloty & Associates)

IMPACT TABLE		
Environmental Parameter	*Potential increase bacterial growth within the estuaries*	
Issue/Impact/Environmental Effect/Nature	Untreated effluent reaching the rivers or estuaries would pose an increased risk to any users due the presence of harmful bacteria, already seen in the systems	
Extent	*Local (all estuaries)*	
Probability	*Probable*	
Reversibility	*Partly irreversible*	
Irreplaceable loss of resources	*Significant loss of resources*	
Duration	*Long term*	
Cumulative effect	*High cumulative impact*	
Intensity/magnitude	*High*	
Significance Rating	*Pre-mitigation significance rating is High and negative. With appropriate mitigation measures, the impact is likely to be Low.*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	3	3
Reversibility	2	2
Irreplaceable loss	3	2
Duration	3	2
Cumulative effect	4	3
Intensity/magnitude	3	2
Significance rating	- 51 (High negative)	- 28 (low negative)

Mitigation measures:

- Suitable monitoring plans (water quality changes) should be initiated by the developer. This should include monthly bacteriological analyses of the final effluent prior it use for irrigation as well as at one permanent site within each estuary. Should the bacteriological counts exceed any guidelines shown in this report, remedial action should be instituted and recreational use of the estuaries should be avoided until such time that the systems recover
- All sewer systems should be inspected on a 6 monthly basis for leaks
- No sewer infrastructure should be located within 1:100 year floodline of any aquatic system.

17.1.5 Impacts on the Coastal Zone

a. Impacts on the coastal zone during the construction and operation phases.

Table 13 provides an overview of the mitigation measures proposed to alleviate the potentially negative environmental impacts which may arise should the proposed development be pursued (As provided by specialist, RoyalHoskoning DHV)

Potential Negative Impacts/Hazards	**Description**	**Scale of Impact/ Hazard Without Mitigation**	**Scale of Impact/ Hazard With Mitigation**	**Proposed Mitigation Measures**
Coastal erosion/ inundation	Inappropriately located coastal settlement has the potential to suffer massive damage from dynamic, natural marine processes.	Potentially High but in reality very Low	Low	• Strict adherence to locating the proposed development behind the identified hazard zone (proposed coastal setback). • Strict maintenance of natural defences on site (i.e. the remaining vegetated dune cordon). • Beach access from the caravan park should be consolidated and limited to elevated boardwalks.
Inappropriate development & pollution	Inappropriate development & pollution	Inappropriate development & pollution	Medium	• Future development should incorporate sustainable urban drainage principles in respect to stormwater management and limit impervious surfaces. • The proposed developed should be connected to the Municipal sewerage system, failing which conservancy tanks or waste water treatment packages are recommended. Septic tanks should not be allowed. • Additional education and awareness programmes, possibly in partnership with the private sector, in respect to the prevention of littering and management of solid waste disposal in the coastal zone, should to be implemented.
Impacts on natural vegetation	Construction activity and post-construction incursions into the dune forest environment can have negative impacts.	High	Low	• Indigenous vegetation removal must be minimized. • Efforts should be made to incorporate remaining natural vegetation into proposed development design. Appropriate erosion control measures must be implemented when removing alien invasive vegetation.

Potential Negative Impacts/Hazards	Description	Scale of Impact/ Hazard Without Mitigation	Scale of Impact/ Hazard With Mitigation	Proposed Mitigation Measures
				• All efforts must be made to maintain the integrity of the continuous vegetated dune cordon – access from this proposed development should be via an elevated boardwalk or via formal access routes and not via informal dune paths.
Future land use	Inappropriate use of the land parcel has the potential to negatively impact on its sustainability.	Potentially High	Low	• Developers should endeavor to provide a sustainably managed and accessible destination for visitors and locals alike. • Access to the coast cannot be restricted and should be facilitated. • A programme for the removal of alien vegetation, to reduce the negative impact on existing indigenous vegetation, should be considered in partnership with the Working for Water Programme – especially along the rail reserve.
Cumulative impacts	Certain negative environmental impacts may be considered of low significance/scale at the local or site-specific scale, but when considered in totality with surrounding developments and activities, their significance can increase incrementally or exponentially.	Potentially High	Low	• The above potential impacts need to be considered within a context greater than that imposed by the limits of the property boundary.

17.1.6 Impacts on the Ecological Linkages

a. Ecological linkage value to successful migration of biodiversity species and their contribution to the viability and mortality of sustainable populations

Description of impact:
The development of certain infrastructural development nodes could potentially lead to natural migration pathways being severed for many species, which could adversely affect the long-term

sustainability of these populations, and a significant loss of species reliant on these systems. It is therefore essential that ecological linkages are retained to ensure the sustained supply of environmental goods and services on site.

Pre-mitigation Impact Assessment:

Assessment Criteria	Score	Rating
Ecosystem Goods & Services Value	4	Medium-High
Environmental Value	**4**	**Medium-High**
Disturbance	4	Medium-High
Extent	2	Surrounding Area
Duration	5	Permanent
Probability	4	Probable
Impact Magnitude	**15**	**Medium-High**
Significance	**60**	**Medium-High**
Acceptability	**Generally Unacceptable**	

Mitigation measures:

- The maintaining of regular ecological linkages through establishing and maintaining natural corridors of indigenous vegetation, that ensure a continuous link throughout the entire span of the development. These must connect grassland, forest, wetland and riparian habitats in a continuous fashion.
- The establishment of adequate buffers for the wetland, riparian, forest and grassland habitat types to ensure the integrity of the ecotone remains undisturbed.

Post-mitigation Impact Assessment:

Assessment Criteria	Score	Rating
Ecosystem Goods & Services Value	4	Medium-High
Environmental Value	**4**	**Medium-High**
Disturbance	1	Low
Extent	2	Surrounding Area
Duration	5	Permanent
Probability	3	Possible
Impact Magnitude	**11**	**Medium**
Significance	**44**	**Medium-Low**
Acceptability	**Acceptable But Undesirable**	

17.2 Impact Assessment of On-site Treatment of Waste Water

Hatch Goba has been investigating the wet services required by the proposed Rorqual Estate. With respect to the disposal of sewage effluent, the designs have been unable to account for the availability of municipal services within the jurisdiction of Ugu District Municipality, and as such a private Waste-water Treatment Works (WWTW) has been agreed to as the only practical solution.

Ugu District Municipality

Within the Ugu District Municipality and Umdoni Local Municipality, the existing municipal sewage infrastructure is either not available or does not have additional capacity to accept and adequately treat sewage effluent produced by each component of the development proposal. The methods of treating and disposing of effluent has been divided internally in terms of whether the waste is considered to be domestic or industrial strength.

17.2.1 Standard Operating Procedure (SOP)

A Standard Operating Procedure (SOP) is a set of written instructions that document a routine to be followed during the operational phase of an activity. The development and use of SOPs are an integral part of a successful quality system as it provides individuals with the information

to perform a job properly, and facilitates consistency in the quality and integrity of a product or end-result.

Based on the description of the type of WWTW presented below, prior to the facility being constructed a SOP will need to be compiled based on the following key themes:

- How the facility/process should be operated?
- Detail on the required standards to which the WWTW needs to achieve?
- What potential hazards could be encountered?
- What measures have been put in place to attend to each possible incident?
- What steps would be undertaken to attend to any blockages?
- What steps will be taken to attend to and remediate spillages?

17.2.2 Wastewater Treatment Works

The option of a Waste-water Treatment Works (WWTW) is the most expensive in terms of capital and operational costs, but if correctly designed and operated will produce a final effluent that can be discharged to any water course. The type of plant can be designed to suit available space, and soil conditions are generally not critical to the plant design. Other than the initial costs, the major disadvantage of a mini works is that it will need municipal and DWAS approval prior to any construction. There must also be a nominated, single body to accept full responsibility for the operation and maintenance of the plant.

The type of treatment plant proposed for the developments under consideration is the activated sludge process. This is a proven treatment technology, which uses naturally occurring bacteria in the raw sewage to breakdown organic components into inert solids and harmless gasses (nitrogen and hydrogen). This is the most flexible of the processes available, produces an effluent of excellent quality if properly designed and operated, and is relatively inexpensive in terms of capital costs, compared to most alternatives. It is also well suited to applications where nutrient removal is required.

Process Selection

The process will consist of the following:

- Head of Works with screening, degritting and flowmeter designed for an ADWF of 4,000 kl/d, constructed and installed in two stages (1&2 then 3&4). Each half of the inlet works to be designed for 90l/s.
- Activated sludge aeration reactors for a treatment capacity of 1,000 kl/d for each stage of extension.
- Chlorine dosage with contact tank, or Ultraviolet (UV) Irradiation for disinfection.
- Mechanical dewatering equipment for disposal of waste activated sludge.

Staged Design Program

1. It is proposed to design for four (4) stages of 1,000 kl/d each, giving a total design capacity of 4,000 kl/d.
2. Stages 1 and 2 will be constructed with a siamesed inlet works of nominal 2,000 kl/d capacity (90 l/s including PDWF and PWWF flows).
3. Stage 1 will comprise aerobic treatment (aeration tank) for 1,000 kl/d; settling tank capacity for 2,000 kl/d; and chlorination for the ultimate flow of 4,000 kl/d.
4. Stage 2 will consist only of a second 1,000 kl/d aeration tank.
5. Stages 3 and 4 will have a similar siamesed inlet works to Stages 1 and 2.
6. Stage 3 will comprise aerobic treatment (aeration tank) for 1 000 kl/d and settling tank capacity for 2 000 kl/d.
7. Stage 4 will consist only of the fourth (final) 1,000 kl/d aeration tank.
8. Please refer to the attached Plan No H120723-100-001 which shows the proposed works layout.

Process 1
The basic principle is that raw sewage will first enter a septic tank, where natural breakdown of BOD loads (typically 30%) will occur. The septic tank also allows for the buffering on sewer flows, which can be highly variable through the course of the day.

Process 2
The second stage is an aeration phase, where oxygen promotes the bacteriological breakdown of the organic matter. The aeration tank typically consists of an open tank fitted with surface aerators, or a closed tank with a submerged oxygen feed. The addition of oxygen to the partially treated effluent also assists in the control of foul odours.

Process 3
After aeration, phase separation takes place in a sedimentation tank. This tank allows the treated clear effluent to flow to the final disinfection stage, with the solid sludge component (which contains the active bacteria) is recycled back to the septic tank to restart the treatment process. Periodically surplus or waste sludge will need to be removed from the process, via vacuum tanker, for discharge to a licensed facility.

Process 4
The disinfection stage is designed to kill off any remaining bacteria and eColi, and typically consists of a chlorine dose using sodium hypochlorite. An alternative is to provide disinfection via a UV generator, which does not require any chemical addition.

For purely domestic effluent, there is no requirement for additional chemicals. However, for effluent from non-domestic sources (light industry & activity zones) it may be necessary to include an additional pre-treatment stage, which will involve the use of metal salts to assist in removing certain components.

Consideration has been given to utilising the treated, final effluent as an irrigation supply to adjacent agricultural croplands. The final effluent, which will be treated to 'General Standard' (as defined by DWAS guidelines), would only need to pass through a sand filter prior to being used as an irrigation supply.

17.2.3 Impacts associated with the Construction Phase

17.2.3.1 Erosion and sedimentation of wetlands and watercourses

a. *Description of impact:*

To reduce the cost of constructing the WWTW, these facilities are generally located at positions lower than the area where effluent will be received from. This enables sewage to be reticulated to these facilities by gravity. Consequently, the construction of these features are proposed near the buffers to the watercourses, and there is the potential for erosion and siltation of the wetlands and rivers during construction.

In the case of Rorqual, the proposed WWTW is situated above the development area, and sewage will instead be vacuumed upslope to the facility.

Pre-mitigation Impact Assessment:

Assessment Criteria	Score	Rating
Ecosystem Goods & Services Value	3	Medium
Conservation Status	5	Very High
Environmental Value	**4**	**Medium-High**
Disturbance	3	Medium
Extent	2	Local
Duration	4	Long
Probability	4	Probable
Impact Magnitude	**13**	**Medium**
Significance	**52**	**Medium**
Acceptability	**Generally Unacceptable**	

Mitigation measures:

To reduce the erosion risks on site during the construction phase, stormwater and erosion control measures must be implemented by the contractor to ensure that the erosion and sedimentation of the wetlands and their buffers do not occur during the construction phase. Stormwater and erosion control measures include:

- Clearing activities must only be undertaken during agreed working times and permitted weather conditions. If heavy rains are expected clearing activities should be put on hold. In this regard, the contractor must be aware of weather forecasts.
- If possible, construction activities should be scheduled to minimise the duration of exposure to bare soils on site, especially steep slopes. The full length of works shall NOT be stripped of vegetation prior to commencing other activities.
- The unnecessary removal of groundcover vegetation from slopes must be prevented, especially on steep slopes.
- Following the clearing of an area, the surfaces of all exposed slopes must be roughened to retain water and increase infiltration (especially important during the wet season).
- After earthworks are completed in an area, the embankments must be grassed immediately with deep-rooted indigenous vegetation using a combination of strip sodding and hydroseeding. If this is not practical or feasible, temporary erosion control measures must be implemented that includes the use of silt traps and fascine work at regular intervals (max. 1m) along slopes.
- Platforms should have a slight backfall and runoff should be diverted to an open drain at the toe of the cut bank. The drain must discharge into temporary detention ponds or the formal stormwater system. If the latter is proposed, then an effort must be made to ensure that silt does not enter the formal stormwater system.
- Any steep of large embankments that are expected to be exposed during the 'rainy' months should either be armoured with fascine like structures or grassed immediately with strip sods established at regular intervals (50-100cm) down the bank with hydroseeding between the strip sods.

The mitigation measures presented above will be incorporated into the Draft EMPr for the site.

Post-mitigation Impact Assessment:

Provided that the mitigation measures presented above, and the conditions of the EMPr are adhered to, the potential occurrence of significant levels of erosion is considered to be minimal.

Assessment Criteria	Score	Rating
Ecosystem Goods & Services Value	3	Medium
Conservation Status	5	Very High
Environmental Value	**4**	**Medium-High**
Disturbance	1	Low
Extent	1	Site
Duration	2	Medium-Short
Probability	3	Possible
Impact Magnitude	**7**	**Low**
Significance	**28**	**Low**
Acceptability	**Acceptable**	

17.2.4 Impacts associated with the Operational Phase

17.2.4.1 Spills

a. *Description of impact:*

During the operational phase of each WWTW, there is the potential for spills to occur. Should this take place, the spill contingency plan must be implemented to ensure that this type of incident is attended to quickly and appropriately.

It is expected that sewer pipes will be constructed along the edge of the 30m wetland buffer and possibly within the buffer and wetland where crossings are necessary. Once operational, sewer pipes, manholes and pump stations pose a potential pollution risk for the lifetime of the pipe network. Manholes overflow due to blockages at points below the manhole resulting from inappropriate use, inadequate design and/or poor construction. Similarly, pump stations and their emergency storage facilities over flow if there are failures and the municipality do not fix the problem timeously. If any one of the manholes or pump stations along the edge of the buffer, within the buffer or within the wetland were to overflow, the pollution in its raw form would enter the wetland buffer and likely the wetland itself.

Impacts associated with the pollution of wetlands with sewage include the domination of a particular floral species as a result of the competitive advantage created by pollutants, the dieback of floral and faunal species and the resultant loss of biodiversity (Coetzee, 2005). In this case, sewage spills will likely increase the competitive advantage of alien invasive and pioneer species. Such pollution poses a serious water quality problem for downstream aquatic habitats, especially the small estuaries.

Pre-mitigation Impact Assessment:

Assessment Criteria	Score	Rating
Ecosystem Goods & Services Value	4	Medium-High
Conservation Status	4	Medium-High
Environmental Value	**4**	**Medium-High**
Disturbance	3	Medium
Extent	2	Surrounding Area
Duration	2	Medium-Short
Probability	3	Possible
Impact Magnitude	**10**	**Medium**
Significance	**40**	**Medium-Low**
Acceptability	**Acceptable but undesirable**	

b. *Mitigation measures:*

- No manholes should be established within the wetland and riparian units.
- Ideally, a minimum 20m buffer should be established between the edge of the wetland/riparian zones and any sewer manhole. Where manholes in wetland and riparian buffers are unavoidable, these manholes should be sited as far away as possible from the edge of the onsite wetlands and riparian areas.
- All proposed pump stations should have at least 24 hours emergency storage capacity (freeboard) to ensure that surcharge and overflow events are avoided. This should ensure that the municipal workers have sufficient time to address the issues before the emergency storage facility is full.
- To reduce the risk of surcharging sewer manholes onsite, a form of gully trap should be installed at or before the connection of the developments with the main/street line through the development. This gully trap will block foreign objects from entering the main internal line of the site and isolate blockage problems at the source.
- Grease traps must be installed within all kitchen sinks.
- A set of rules and prohibitions regarding the correct use of the toilets and kitchen sinks must be developed for inclusion into the sale agreements.

- In the case of blockages and overflowing manholes, it is the responsibility of the homeowners/renters to inform the Estate Management and Ugu Municipality immediately. This responsibility must be written into the sale agreements.
- If the Estate Management and Ugu Municipality take a long time to respond, it is the responsibility of the homeowners to inform the Department of Water Affairs and Sanitation (DWAS) of the delay. The contact person at the DWAS must be included on the fliers.
- The EDTEA must be notified of any sewage spills that occur onsite within 3 days of the municipality being informed of the spillage. It is the responsibility of the municipality to inform the EDTEA.

A spill contingency plan will need to be drafted for each of the proposed mini works, and will need to be written to accommodate the specific design capacity, plant location and treatment philosophy. The following generic requirements must apply:

- The treatment plant will be designed as a gravity flow system, to minimize the requirement for intermediate pump stations within the sewage treatment process.
- In all instances the first stage of treatment will be a septic tank. The design volume of this tank will be such that a minimum of 24 hours retention is provided, so as to ensure sufficient buffer capacity in the event of downstream mechanical failure or short term power outages.
- The second treatment stage will be the aeration phase, which will be gravity fed from the first stage septic tank. This tank will also be designed sufficiently large to allow hydraulic retention and partial treatment in the event of mechanical or electrical failure.
- Third stage sedimentation tank (for solid / liquid phase separation) will also be gravity fed, and requires no mechanical equipment.
- Final disinfection stage will also incorporate a retention tank to allow for short-term electrical outage.
- All mechanical equipment will be provided with 100% standby capability to allow for continual treatment in the event of mechanical failure.
- High level and overflow alarms will be provided at the return sludge pump station and irrigation pump station to timeously alert the operator in the event of mechanical and/or electrical failure. The systems can be designed to automatically issue a failure alarm, via cell phone or internet, to the relevant parties.
- The treatment plants will be designed to irrigate final effluent, so a storage reservoir will be incorporated as part of the design. This could be used as an emergency storage reservoir to 'catch' any out-of-spec effluent, which may be discharged from the plant.

Post-mitigation Impact Assessment:

Assessment Criteria	Score	Rating
Ecosystem Goods & Services Value	4	Medium-High
Conservation Status	4	Medium-High
Environmental Value	**4**	**Medium-High**
Disturbance	2	Medium-low
Extent	2	Surrounding Area
Duration	1	Short-term
Probability	2	Fairly unlikely
Impact Magnitude	**7**	**Low**
Significance	**28**	**Low**
Acceptability	**Acceptable**	

17.2.4.2 Odour

a. *Description of impact:*

During the operational phase of the WWTW, there is the potential for undesirable odours to be created. The WWTW is to be located across the N3 Highway from the development nodes serviced by this facility, with the NW Quadrant site being across the R612.

Two of the residential nodes are, however, located only less than 200m away. Fortunately the prevailing wind blows in a north-easterly direction, and most odours should blow away from the estate.

Pre-mitigation Impact Assessment:

Assessment Criteria	Score	Rating
Social Value	**4**	**Medium-High**
Disturbance	2	Medium-low
Extent	3	Local
Duration	4	Medium-Short
Probability	3	Possible
Impact Magnitude	**12**	**Medium**
Significance	**48**	**Medium**
Acceptability	**Generally Unacceptable**	

Mitigation measures:

It is commonly understood that if a WWTW is maintained and operated appropriately, in accordance with an approved Standard Operating Procedure (SOP), each system is unlikely to produce undesirable odours. It is therefore recommended that the following measures are included in the SOP for the WWTW:

- The WWTW must be inspected and serviced regularly to ensure that the facility is operating appropriately.
- Air deodorisers should be incorporated into the design of these systems and should be utilised when undesirable odours are experienced.

Post-mitigation Impact Assessment:

Provided that the facility is managed and operated in line with the requirements of the SOP, and the mitigation measures presented above are implemented by the responsible party (Body Corporate, private specialist etc.) it is likely that odours will only be experienced short-term and during extenuating circumstances such as blockages or spillages.

Assessment Criteria	Score	Rating
Social Value	**4**	**Medium-High**
Disturbance	2	Medium-low
Extent	2	Local
Duration	1	Medium-Short
Probability	2	Probable
Impact Magnitude	**7**	**Low**
Significance	**28**	**Low**
Acceptability	**Acceptable**	

17.2.4.3 Impacts on Wetlands/Rivers

a. *Description of impact:*

Typically, the impacts on watercourses associated with WWTW revolve around the disposal of treated wastewater. The quantity and quality of treated effluent entering these systems has the potential to impact on their functionality. In this regard, a number of specialist studies were completed to assess whether this option is viable. However, treated effluent from the WWTW will not be discharged into the watercourses, but instead will be utilised for irrigation purposes. Therefore no impacts are envisaged and this issue has not been assessed. Please refer to **Section 17.2.4.4** below.

17.2.4.4 Disposal to Irrigation (Preferred Option)

a. *Description of impact:*

Typically, treated effluent is disposed of to the nearest watercourse, and with this method there are a number of specific environmental impacts (relating to the quality and quantity of treated effluent) that need to be assessed. A suitably qualified specialist would need to be appointed to

undertake a River, Wetland and Estuarine reserve determination to establish whether this is a feasible alternative.

Given the sensitivity of these water resources and the cost and time involved in undertaking this study, the applicant has proposed that treated effluent be utilised for irrigation purposes.

With the proposal to utilise treated effluent for irrigation purposes, there are a number of impacts that need to be assessed post authorisation, and these include:

- The quality of the effluent needs to be maintained at a high standard to prevent health implications.
- Given the fact that the treatment facility is likely to operate all day, measures need to be put in place to prevent irrigation during periods of precipitation

The plant has been designed to criteria that will produce compliance with the General Authorisation limits set by the DWAS for plants of less than 2,000 kl/d capacity.

Effluent of General Authorisation quality can be discharged to the watercourse without further treatment, although special conditions are sometimes imposed where large volumes of effluent are being discharged to a small stream or to estuarine environments.

These limits are normally applied to small plants. However, an E Coli (bacterial indicator) count of zero is sometimes applied particularly when irrigation is contemplated. This is readily achieved by a moderate increase in chlorine dosage.

The nitrate limit is achievable provided facilities to promote denitrification have been provided, as in this design.

As a further option the effluent could be irrigated (which we understand is the preferred option in this case).

The amount of land (sugar cane or similar) required for irrigation would be about 50ha per stage or about 200ha in total in order to comply with the norms currently used by DWAS.

Pre-mitigation Impact Assessment:

Assessment Criteria	Score	Rating
Ecosystem Goods & Services Value	4	Medium-High
Conservation Status	5	Very High
Environmental Value	**4**	
Disturbance	3	Medium
Extent	1	Site
Duration	4	Long
Probability	5	Definite
Impact Magnitude	**13**	**Medium**
Significance	**52**	**Medium**
Acceptability	**Generally Unacceptable**	

Mitigation measures:
The consulting engineer has proposed the following mitigation measures.

- The WWTW has been designed to comply with DWAS's General Authorisation limits for plants of less than 2,000 kl/d capacity.
- Provided that the facility is maintained by a suitably qualified specialist in line with the requirements of the SOP, the quality of the treated effluent should be maintained at an acceptable level.
- A holding reservoir will be constructed within the footprint of the WWTW site. The holding reservoir is to allow for periods of heavy and/or sustained rain when it is not possible to irrigate. Typically, an earth storage dam should be provided, with a capacity to provide a minimum of 4 day's treated effluent supply. The consulting engineer has provided a settlement pond of 900m^3.

Post-mitigation Impact Assessment:

Assessment Criteria	Score	Rating
Ecosystem Goods & Services Value	4	Medium-High
Conservation Status	5	High
Environmental Value	**4**	
Disturbance	1	Low
Extent	1	Site
Duration	3	Medium-term
Probability	3	Possible
Impact Magnitude	**8**	**Medium-Low**
Significance	**32**	**Low**
Acceptability	**Acceptable**	

17.2.4.5 Disposal to Watercourse (Alternative Option)

a. *Description of impact:*

Typically, the impacts on watercourses associated with WWTW revolve around the disposal of treated wastewater. The quantity and quality of treated effluent entering these systems has the potential to impact on their functionality. In this regard, a number of specialist studies were completed to assess whether this option is viable. However, treated effluent from the WWTW will not be discharged into the watercourses, but instead will be utilised for irrigation purposes. Therefore no impacts are envisaged.

However, although unlikely, should this occur, the impact has been assessed as follows:

Pre-mitigation Impact Assessment:

Assessment Criteria	Score	Rating
Ecosystem Goods & Services Value	4	Medium-High
Conservation Status	5	High
Environmental Value	**4**	
Disturbance	3	Medium
Extent	1	Site
Duration	4	Long
Probability	5	definite
Impact Magnitude	**13**	**Medium**
Significance	**52**	**Medium**
Acceptability	**Generally Unacceptable**	

Mitigation measures:

- Provided that the facility is maintained by a suitably qualified specialist in line with the requirements of the SOP, the quality of the treated effluent should be maintained at an acceptable level.
- A holding reservoir will be constructed within the footprint of the WWTW site. The holding reservoir is to allow for periods of heavy and/or sustained rain when it is not possible to irrigate. Typically, an earth storage dam should be provided, with a capacity to provide a minimum of 4 day's treated effluent supply. The consulting engineer has provided a settlement pond of 900m^3.

Post-mitigation Impact Assessment:

Assessment Criteria	Score	Rating
Ecosystem Goods & Services Value	4	Medium-High
Conservation Status	5	High
Environmental Value	**4**	
Disturbance	1	Low
Extent	1	Site
Duration	3	Medium-term
Probability	3	Possible
Impact Magnitude	**8**	**Medium-Low**
Significance	**32**	**Low**

Assessment Criteria	Score	Rating
Acceptability	**Acceptable**	

17.2.5 Impacts on Socio-Economic Systems/Components

For the purposes of this study, the impacts on the surrounding local residential communities, tourists to the area, and the intended beneficiaries are assessed by determining the qualitative degree of change in the quality of life, health and safety of the communities as a result of the social and economic impacts arising from the proposed mixed-use housing estate project.

17.2.5.1 Impacts on the surrounding residential populations (including beneficiaries)

a. Improvement in the quality of life of the local unemployed residents as a result of the creation of temporary jobs during the construction phase

Description of impact:
For those unemployed in the area, the creation of short-term construction jobs would improve their economic well-being for the period of construction and may lead to further employment opportunities. Economic well-being is generally regarded as an important contributor of individual quality of life, especially for those unemployed and struggling to makes ends meet. Understandably, this positive impact becomes smaller as you move up the income bracket. Notwithstanding the above, this issue is extremely complex and the scope of this study does not require that all the complexities of job creation and their effects on individual lives be fully-explained.

The exact number of jobs that will be created by the construction of the proposed development is unknown but should be relatively large as it is a substantial mixed-use development. However, it is likely that a number of jobs will be created, which will impact positively on the incomes of local residents, provided locals are given preference in the hiring of construction workers. The value of employment in South Africa is very high due to the high unemployment and poverty levels within the country.

Impact Assessment:

Assessment Criteria	Score	Rating
Social/Socio-economic Value	**4**	**Medium-High**
Contribution	4	Medium-High
Extent	5	High
Duration	5	Permanent
Probability	4	Probable
Impact Magnitude	**+18**	**High**
Significance	**+72**	**Medium-High**
Acceptability	**Very Important/Beneficial**	

b. Reduction in quality of life of the surrounding residents as a result of air pollution during the construction phase.

Description of impact:
Air pollution may occur in the vicinity of the site and the immediate surrounds during the construction phase as a result of:

- Exhaust fumes from heavy vehicles and machinery, in particular poorly serviced vehicles
- Dust from exposed surfaces and soil stockpiles picked up by wind
- Dust on haulage and access roads emitted into the air by construction vehicles
- Odours downstream of inappropriate and mismanaged chemical toilets

Pre-mitigation Impact Assessment:

Assessment Criteria	Score	Rating
Social/Socio-economic Value	**3**	**Medium**
Disturbance	3	Medium
Extent	4	Medium-High

Assessment Criteria	Score	Rating
Duration	3	Medium-term
Probability	5	Definite
Impact Magnitude	**15**	**Medium**
Significance	**45**	**Medium**
Acceptability	**Generally Unacceptable**	

Mitigation measures:

- Dust generating construction activities should be avoided during strong winds.
- Management (including storage, transport, handling and disposal) of hazardous substances that have the potential to become airborne during construction should be carefully managed.
- Un-surfaced construction roads and bare surfaces within the construction site must be regularly wetted during dry conditions. A suitable dust palliative should be applied if wetting is ineffective.
- Soil loads in transit should be kept covered or wetted.
- Stockpiles of soil should be kept covered or have suitable dust palliative applied such as water or commercial dust suppressants.
- Servicing of vehicles must occur off site to limit gaseous emissions.
- Chemical toilets should be placed on site and must be maintained on a daily basis.
- Burning of waste is forbidden.
- The maximum speed limit for construction vehicles travelling on un-surfaced construction roads within the site is 25km/hour.
- A dust complaints register must be kept within the camp site offices for the entire construction phase.

Post-mitigation Impact Assessment:

Assessment Criteria	Score	Rating
Social/Socio-economic Value	**3**	**Medium**
Disturbance	3	Medium
Extent	4	Medium-High
Duration	3	Medium-term
Probability	3	Possible
Impact Magnitude	**13**	**Medium**
Significance	**39**	**Medium-Low**
Acceptability	**Acceptable But Undesirable**	

c. Reduction in quality of life of the surrounding residents as a result of noise pollution during the construction phase.

Description of impact:

Noise generated by delivery vehicles, earth moving machinery, piling works and the workforce have the potential to impact negatively on people living and/or working along the property boundaries and in relatively close proximity to the proposed development. The negative impacts could result in an increase in stress and frustration and associated health implications.

Pre-mitigation Impact Assessment:

Assessment Criteria	Score	Rating
Social/Socio-economic Value	**4**	**Medium-High**
Disturbance	3	Medium
Extent	4	Medium-High
Duration	3	Medium-term
Probability	5	Definite
Impact Magnitude	**15**	**Medium**
Significance	**60**	**Medium-High**
Acceptability	**Generally Unacceptable**	

Mitigation measures:

- Construction activities should only take place within agreed working hours.
- Surrounding residents should be warned of particularly noisy activities by way of flyers or letters.

- A complaints register should be kept on site at all times.
- Construction staff should be provided with training regarding noise prevention and anti-social behaviour/conduct.

Post-mitigation Impact Assessment:

Assessment Criteria	Score	Rating
Social/Socio-economic Value	**4**	**Medium-High**
Disturbance	3	Medium
Extent	4	Medium-High
Duration	3	Medium-term
Probability	2	Fairly Unlikely
Impact Magnitude	**12**	**Medium**
Significance	**48**	**Medium**
Acceptability	**Generally Unacceptable**	

17.2.5.2 Impacts on the local road users and pedestrians

a. Increased danger to children and pedestrians as a result of construction vehicles travelling to and from the construction site.

The inappropriate location of temporary access points to the construction site, speeding construction vehicles on and off site, and the lack of control of access to the sight will all result in an increase in the risk of car and pedestrian accidents.

Pre-mitigation Impact Assessment:

Assessment Criteria	Score	Rating
Social/Socio-economic Value	**4**	**Medium-High**
Disturbance	3	Medium
Extent	4	Medium-High
Duration	3	Medium-term
Probability	5	Definite
Impact Magnitude	**15**	**Medium**
Significance	**60**	**Medium-High**
Acceptability	**Generally Unacceptable**	

Mitigation measures:

- The construction site must be cordoned off with shade cloth and access to the site by local residents and children prohibited. This must be enforced by the contractor.
- The construction access points to the site must occur where the operational access points are planned.
- Construction signs must be utilised to warn road users travelling along the R102 of the construction and R612 access and exit points and to slow down. If necessary, the speed limit should be reduced at these points.
- Sediment washed or deposited onto the existing roads from construction activities must be cleared from the roads at the end of very day.
- A maximum speed limit of 20km/h onsite must be enforced, the transgression of which should be penalised with a fine.

Post-mitigation Impact Assessment:

Assessment Criteria	Score	Rating
Social/Socio-economic Value	**4**	**Medium-High**
Disturbance	3	Medium
Extent	4	Medium-High
Duration	3	Medium-term
Probability	2	Fairly Unlikely
Impact Magnitude	**12**	**Medium**
Significance	**48**	**Medium**
Acceptability	**Generally Unacceptable**	

b. Degeneration in the quality of life of the local residents as a result of an increase in traffic congestion and delay times associated with heavy construction vehicles travelling to and from the site during construction phase.

Description of impact:
Traffic congestion and time delays may occur in the vicinity of the access points and associated intersections during the construction phase as a result of increase in the number of heavy vehicles using the R102, R612 and N2 Highway. In particular, the creation of the access points will likely obstruct traffic for significant periods.

Traffic congestion and time delays during peak hours are known to increase the stress and nuisance levels of regular users. In this case, the delays expected to increase slightly but be minimal.

Pre-mitigation Impact Assessment:

Assessment Criteria	Score	Rating
Social/Socio-economic Value	**4**	**Medium-High**
Disturbance	3	Medium
Extent	4	Medium-High
Duration	3	Medium-term
Probability	5	Definite
Impact Magnitude	**15**	**Medium**
Significance	**60**	**Medium-High**
Acceptability	**Generally Unacceptable**	

Mitigation measures:
The creation of access points or any other construction activities that may cause the obstruction of traffic along the roads must not occur during peak AM and PM periods.

Post-mitigation Impact Assessment:

Assessment Criteria	Score	Rating
Social/Socio-economic Value	**4**	**Medium-High**
Disturbance	3	Medium
Extent	4	Medium-High
Duration	3	Medium-term
Probability	3	Possible
Impact Magnitude	**13**	**Medium**
Significance	**52**	**Medium**
Acceptability	**Generally Unacceptable**	

c. Degeneration in the quality of life of local users as a result of an increase in traffic congestion and delay times associated with the operational phase of the project.

Description of impact:
The phased introduction of an additional 4,551 residential units, hotels, businesses, commercial space, a retirement village and educational spaces over the period of a few years to a few decades, is likely to add significant traffic congestion to an area that is positioned between a large town (Scottburgh) and a small town (Pennington). This will almost double the region's population and link two towns into an almost seamless zone of several kilometres of urban development along the coastline.

Pre-mitigation Impact Assessment:

Assessment Criteria	Score	Rating
Social/Socio-economic Value	**4**	**Medium-High**
Disturbance	3	Medium
Extent	4	Medium-High
Duration	3	Medium-term
Probability	5	Definite
Impact Magnitude	**15**	**Medium**
Significance	**60**	**Medium-High**
Acceptability	**Generally Unacceptable**	

Mitigation measures:

Construction of a 2-lane road in each direction on the R612, as well as on the R102, only up to the intersection allowing access into area D.

Signalisation of the all intersections.

Post-mitigation Impact Assessment:

Assessment Criteria	Score	Rating
Social/Socio-economic Value	**4**	**Medium-High**
Disturbance	3	Medium
Extent	4	Medium-High
Duration	3	Medium-term
Probability	3	Possible
Impact Magnitude	**13**	**Medium**
Significance	**52**	**Medium**
Acceptability	**Generally Unacceptable**	

17.2.5.3 Impacts on Agriculture

a. Loss of viable agricultural land presently under farming practices during the construction and operation phases.

Description of impact:
The decrease in sugar cane production will only account for 1.3% of total sugar cane production in the district, not affecting the viability of the sugar industry in the district significantly.

The Agricultural Potential Assessment concluded that Proposed Development Area (PDA) "has high potential soils which are suitable for a wide range of agricultural enterprises but the overall agricultural potential of the PDA is rated as moderate due to the lack of sufficient water resources and steep slopes. It is recommended that some type of high value agricultural is established on the undeveloped portion of Ellingham Estate, if the proposed housing development application is accepted.

Pre-mitigation Impact Assessment:

Assessment Criteria	Score	Rating
Agricultural Land Value	**3**	**Medium**
Disturbance	4	Medium-High
Extent	3	Medium
Duration	5	Permanent
Probability	5	Definite
Impact Magnitude	**17**	**Medium-High**
Significance	**51**	**Medium**
Acceptability	**Generally Unacceptable**	

Mitigation measures:
Some type of high value agricultural is established on the undeveloped portion of Ellingham Estate, if the proposed housing development application is accepted.

Post-mitigation Impact Assessment:

Assessment Criteria	Score	Rating
Agricultural Land Value	**3**	**Medium**
Disturbance	3	Medium
Extent	3	Medium
Duration	5	Permanent
Probability	5	Definite
Impact Magnitude	**16**	**Medium-High**
Significance	**48**	**Medium**
Acceptability	**Generally Unacceptable**	

b. Loss of harvested sugarcane tonnages and revenues for the sugar mill, supply to market and the GDP of the economy.

Description of impact:
The loss of agricultural land to urban development, including the knock-on effect of reduced cane supply to the surrounding sugar mills, is of concern.

The decrease in sugar cane production will only account for 1.3% of total sugar cane production in the district, not affecting the viability of the sugar industry in the district significantly.

The Agricultural Potential Assessment concluded that Proposed Development Area (PDA) "has high potential soils which are suitable for a wide range of agricultural enterprises but the overall agricultural potential of the PDA is rated as moderate due to the lack of sufficient water resources and steep slopes. It is recommended that some type of high value agricultural is established on the undeveloped portion of Ellingham Estate, if the proposed mixed-use development application is accepted.

Pre-mitigation Impact Assessment:

Assessment Criteria	Score	Rating
Agricultural Land Value	**3**	**Medium**
Disturbance	4	Medium-High
Extent	3	Medium
Duration	5	Permanent
Probability	5	Definite
Impact Magnitude	**17**	**High**
Significance	**51**	**Medium**
Acceptability	**Generally Unacceptable**	

Mitigation measures:
Some type of high value agricultural is established on the undeveloped portion of Ellingham Estate, if the proposed housing development application is accepted.

It is intended for the remaining sugarcane land to be irrigated using the treated effluent from the WWTW. This will supposedly intensify the productivity of this land, leading to significantly increased crop yields that will largely negate the loss of tonnages and revenues on the land that is developed.

Correspondence, dated 1 July 2010, was received from the National Department of Agriculture, Forestry and Fisheries (DAFF) confirming support for the development proposal. This information has been included in **Appendix H**.

Post-mitigation Impact Assessment:

Assessment Criteria	Score	Rating
Agricultural Land Value	**3**	**Medium**
Disturbance	2	Medium-Low
Extent	2	Medium-Low
Duration	5	Permanent
Probability	5	Definite
Impact Magnitude	**14**	**High**
Significance	**42**	**Medium-Low**
Acceptability	**Acceptable But Undesirable**	

c. Decrease of impacts of sugar cane burning (Positive Impact)

Description of impact:

There will be a change in land use away from the commercial agriculture would result in the positive impact of reduced smoke and soot levels on neighbouring communities associated with the burning of sugar cane.

Pre-mitigation Impact Assessment

Assessment Criteria	Score	Rating
Social Value	**4**	**Medium-High (+ve)**
Disturbance	3	Medium (+ve)
Extent	3	Medium
Duration	5	Permanent
Probability	3	Possible
Impact Magnitude	**14**	**Medium**
Significance	**56+**	**Medium (+ve)**
Acceptability	**Beneficial**	

Mitigation measures
The decrease in area to be actively farmed on a commercial basis will reduce the impact of smoke and soot being transferred to the neighbouring landowners. However, it must be noted that large areas of the greater farm operation, which are not proposed for development, which are located a bit further afield, will still be farmed for the foreseeable future. This aspect, including the remaining farming activities in the area indicates that the impact of burning sugar cane will be reduced to a degree, but is likely to remain.

Post-mitigation Impact Assessment

Assessment Criteria	Score	Rating
Social Value	**4**	**Medium-High (+ve)**
Disturbance	3	Medium (+ve)
Extent	3	Medium
Duration	4	Long-term
Probability	3	Possible
Impact Magnitude	**13**	**Medium**
Significance	**52+**	**Medium (+ve)**
Acceptability	**Beneficial**	

17.2.5.4 Impacts of Dust

a. *Description of impact:*

The proposed estate is located in close proximity to the Indian Ocean, and through the orientation of the land is likely to be exposed to the trade winds. With the proposal to transform the land use from agriculture to a mixed use development, there if potential for the creation of dust during periods of elevated wind velocities, especially during the construction phase.

Pre-mitigation Impact Assessment:

Assessment Criteria	Score	Rating
Social Value	**4**	**Medium-High**
Disturbance	4	Medium High
Extent	4	Medium-high
Duration	3	Medium-term
Probability	5	Definite
Impact Magnitude	**16**	**Medium-High**
Significance	**64**	**Medium-High**
Acceptability	**Generally Unacceptable**	

Mitigation measures:
The following additional dust calming techniques are recommended and will be incorporated into the Draft Construction EMPr:

- Regular dampening of the site with a water cart should be undertaken during periods of elevated wind velocities or in response to dust created by the movement of construction machinery and trucks across the site.
- Covering all soil stockpiles with hessian sheets.
- Hydro-seeding soil stockpiles likely to remain unused for an extended period of time.

Cumulative impacts of dust

Although the density of the development proposal is low, given the size of the land holdings there is the potential for construction to be undertaken on several sites in the same time period. Cumulatively, construction on a number of sites could create large amounts of dust and could negatively impact the communities located downwind. To combat this impact, the following aspects will be addressed in the Construction EMPr:

- Soil stockpile management

Dust emanating from soil stockpiles is likely to occur when wind disturbs the stockpile surface. To counter this, soil stockpile that are not in use should be covered using hessian sheets or alternatively enclosed within a shadecloth windbreak. Both of these techniques aim to reduce wind speed at the surface of the stockpile, in turn reducing the potential for dust scour and entrainment.

- Windbreaks

Windbreaks in the form of shadecloth screens should be erected along the perimeter of the site. These screens aim to reduce the creation of dust by reducing wind velocities at the surface. Porous windbreaks should be favoured over solid walls. This is because in the case of solid walls, air has nowhere to go but up and over the wall. A porous decreases the velocity of the wind and the energy available to transport dust.

Natural windbreaks, such as rows of trees, should be maintained to reduce wind velocities in flat open areas.

- Traffic management

The movement of vehicles along areas devoid of protective covering (vegetation or paving) contributes to dust in the following ways:

The draft Construction EMPr will require that the speed at which vehicles are allowed to travel through the site is reduced and monitored. Road signage and speed humps should be used in areas that fall in close proximity to neighbouring communities.

- Water carts

Dust emissions are a factor of moisture content of the soil material and the drier the material, the more friable it becomes. Water carts are typically road tanker trucks with specialised spray nozzles to release water onto the surfaces devoid of vegetation. By maintaining suitable moisture content in the soil, the potential for dust to be produced is reduced. The EMPR will require that the internal dust roads are watered regularly. Areas devoid of protective covering will also need to be dampened during periods of peak wind velocities.

- Re-vegetation through Hydro-seeding and replanting

Areas where construction activities have been completed should be revegetated as soon as possible. In other words, revegetation and landscaping should run concurrently with construction activities within each particular development node. A Draft Revegetation Plan has been compiled for the development (**Appendix G2.3**) but these activities can include hydroseeding, planting grass sods and other indigenous shrubs and trees to promote infiltration, reduce run-off and consequently reduce the potential for erosion and the creation of dust.

- Clearance planning

To prevent large areas being cleared of vegetation (sugar cane) and becoming susceptible to wind erosion and the creation of dust, each development footprint should be strategically cleared. This should involve leaving the protective vegetation cover in areas where construction activities are not required.

- Contractor management

In reducing the potential for the creation of dust, the developer, lead contractor and Environmental Control Officer (ECO) must be vigilant in managing contractors to ensure that they understand the need to follow the requirements of the EMP, especially in terms of implementing the dust suppression techniques described above.

Post-mitigation Impact Assessment:

Assessment Criteria	Score	Rating
Social Value	**5**	**Medium-High**
Disturbance	2	Low
Extent	2	Medium-low
Duration	3	Medium-term
Probability	2	Fairly Unlikely
Impact Magnitude	**9**	**Medium-Low**
Significance	**45**	**Medium-Low**
Acceptability	**Acceptable**	

17.2.5.5 Impacts of Noise

a. *Description of impact:*

The development nodes of the proposed Rorqual Estate are located in close proximity to the established towns of Park Rynie, Kelso and Pennington. Therefore, noise generated during the construction phase by delivery vehicles, earth-moving machinery, piling works and the workforce has the potential to impact negatively on people living in the vicinity of construction activities.

Pre-mitigation Impact Assessment:

Assessment Criteria	Score	Rating
Social Value	**3**	**Medium**
Disturbance	3	Medium
Extent	4	Medium-High
Duration	3	Medium-Term
Probability	4	Probable
Impact Magnitude	**14**	**Medium**
Significance	**42**	**Medium-Low**
Acceptability	**Acceptable**	

Mitigation measures:

The following measures must be implemented at this site to minimise the potential noise impacts:

- Surrounding land users must be kept informed of unusually noisy activities, which are planned.
- Noisy activities must take place during allocated construction hours only as per Section 25 of the Noise Control Regulations of the Environment Conservation Act, 1989 (Act no. 73 of 1989)
- Noisy activities must be kept to a minimum and conducted simultaneously at the start of construction if possible.
- Piling or other noisy activities must take place during normal working hours.
- The community must be notified prior to any planned activities that will be unusually noisy.

Noise from labour

- Noise from labourers must be controlled.
- The contractor must take measures to discourage labourers from loitering in the area and causing noise disturbance. Where possible labour shall be transported to and from the site by the contractor or his Sub-Contractors by the contractors won transport.

- No labour must be housed on site.

Noise from construction equipment

- Noise suppression measures must be applied to all construction equipment.
- Construction equipment must be kept in good working order and where appropriate fitted with silencers which are kept in good working order.
- Should the vehicles or equipment not be in good working order, the contractor may be instructed to remove the offending vehicle or machinery from site.

Consultation with surrounding land owners

- Should complaints regarding noise levels be received, as a result of construction activities on the site, these shall be recorded by the ECO, and if these noise levels are proven to be higher than acceptable levels, as laid down in the noise regulations of the Environment Conservation Act, then offending machinery or vehicle shall be identified and remedial measures implemented.

Post-mitigation Impact Assessment:

Assessment Criteria	Score	Rating
Social Value	**3**	**Medium**
Disturbance	2	Medium-Low
Extent	3	Medium
Duration	2	Medium-Short
Probability	3	Possible
Impact Magnitude	**10**	**Medium-Low**
Significance	**10**	**Low**
Acceptability	**Acceptable**	

17.2.5.6 Sense of Place

a. *Description of impact:*

The impact of a development proposal on "Sense of Place" is a difficult issue to investigate because it is a subjective concept explaining people's emotional relationship to a physical area. This concept is determined on an individual basis and is based on personal experience and knowledge of that space. Collectively, the common factors that 'tie' each individual to an area combine to form a community's sense of place. According to the findings of the recent Social Economic Impact Assessment for the Rorqual Estate EIR.

> *"The mid-South Coast is perceived today to be an area with a developed coastal belt and commercial agricultural zone, and an underdeveloped rural periphery. It is viewed as having a 'small town', quiet, safe and rural atmosphere with safety and security. All groups have a 'sense of place' based on these qualities and the rich environmental assets in the area, particularly the coastal environment".*

The scenic quality of the landscape is an important factor contributing to the visual character or inherent sense of place. Visual appeal is often associated with unique natural features. As such, the Indian Ocean, the Mpambanyoni River, the Mzimayi River and the Mzinto River are important natural features that would increase the scenic appeal and visual interest within the area. Views toward the ocean and across these river valleys are therefore considered valuable natural resources that are driving forces within the local economy and should be preserved. As the development site is primarily located west of the R102 it is unlikely to obstruct views toward the sea from this road. However, the development could block out views toward the sea from the N2.

Overall the visual character and 'Sense of Place' differs throughout the study area depending on the degree of transformation. The prevalence of sugar cane plantations in the broader area has changed the natural visual character to reflect a state which has been significantly transformed from its original character, but which still display a distinct pastoral sense of place. These areas are characterised by distinct light green rolling hills with a patch mosaic of darker areas where coastal bush and plantations are present. Areas with sea or river views would have

a scenic character and a natural uninhabited quality would prevail in areas of dense bush. The visual character would be more transformed within the coastal towns.

Pre-mitigation Impact Assessment:

Assessment Criteria	Score	Rating
Social Value	**4**	**Medium-High**
Disturbance	4	Medium-High
Extent	4	Medium-High
Duration	5	Permanent
Probability	4	Probable
Impact Magnitude	**17**	**High**
Significance	**68**	**Medium-High**
Acceptability	**Generally Unacceptable**	

Mitigation measures:

- Maintain building heights on the estate at a maximum of 4 storeys high.
- Maintain all buildings on the beachfront (hotels) at a maximum of 4 storeys high to not create visual obstructions and cast shadows across the coastal zone.

Post-mitigation Impact Assessment:

Assessment Criteria	Score	Rating
Social Value	**4**	**Medium-High**
Disturbance	2	Medium-Low
Extent	4	High
Duration	5	Permanent
Probability	4	Probable
Impact Magnitude	**15**	**Medium-High**
Significance	**60**	**Medium-High**
Acceptability	**Generally Unacceptable**	

Sense of place is a subjective issue and there is still the potential that certain portions of the public may still consider that any new form of large-scale development will impact negatively on the area.

17.2.5.7 Visual Impact (As provided by specialist, SiVEST)

a. Construction Phase

Table 14: Rating of visual impacts of the proposed Rorqual Estate Development during construction

IMPACT TABLE	
Environmental Parameter	Visual Impact
Issue/Impact/Environmental Effect/Nature	During construction the clearing and grading the site would create a visual scar in the landscape. Exposed bare soil would contrast with the prominently green sugarcane fields and alter the rural character of the area. Large construction vehicles and equipment may also be visible to receptors within the study area.
Extent	Large construction vehicles and bare soil could be visible from the surrounding area, particularly from motorists travelling along the N2 Freeway and R102, therefore the proposed development will affect the local area.
Probability	It is likely that construction vehicles and bare soil would be visible from some of the visually sensitive receptors and motorists travelling along the N2 and R102.
Reversibility	Visual impacts during construction could be reversed in part if mitigation measures are strictly implemented.
Irreplaceable loss of resources	In the context of the visual environment, 'resources' are defined as scenic / natural views that are almost impossible to replace. As such, visual impacts during the construction phase would not

IMPACT TABLE		
Environmental Parameter	Visual Impact	
	result in the loss of unique natural / scenic views, such as views toward the ocean.	
Duration	The visual impacts would not occur after the construction phase ends.	
Cumulative effect	Two new prospective estate developments, namely Eden Rock Forest Estate and Pennvalley Golf Estate, are located partly within the study area to the south-west of the development site. Should the construction activities of these prospective estate developments, coincide with the construction phase of the Rorqual Estate development, the visual impact on sensitive receptors would be cumulative. This is unlikely as the construction activities associated with Eden Rock Forest Estate and Pennvalley Golf Estate are likely to be complete before construction of the Rorqual Estate Development commences.	
Intensity/magnitude	Although the visual quality of the area may be altered by the construction activities, the visual character of the area would be maintain its general integrity.	
Significance Rating	**Prior to mitigation measures:** Low negative impact **After mitigation measures:** Low negative impact	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	3	2
Reversibility	2	2
Irreplaceable loss	1	1
Duration	1	1
Cumulative effect	2	2
Intensity/magnitude	2	2
Significance rating	-22 (low negative)	-20 (low negative)
Mitigation measures	▪ Carefully plan to reduce the construction period. ▪ Locate construction camp and storage areas in zones of low visibility i.e. behind dense bush or in lower lying areas. ▪ Minimise vegetation clearing and use a phased approach, only clearing vegetation when required. ▪ Areas of dense bush on the boundaries of the development site should be left intact. ▪ Rehabilitate cleared areas as soon as possible. ▪ Dust suppression techniques should be made use of. ▪ Maintain a neat construction site by removing rubble and waste materials regularly. ▪ Make use of existing gravel access roads where possible.	

** Please note in the context of the visual environment 'resources' are defined as scenic / natural views that are almost impossible to replace.*

b. Operation Phase

Table 15: Rating of visual impacts of the proposed Rorqual Estate Development during operation

IMPACT TABLE	
Environmental Parameter	Visual Impact
Issue/Impact/Environmental Effect/Nature	The proposed mixed-use development would significantly increase the urban footprint in the area, thus altering the visual character and exposing sensitive visual receptors to visual impacts. The development may be perceived as an unwelcome

IMPACT TABLE		
Environmental Parameter	Visual Impact	
	visual intrusion, particularly if located in natural areas further away from existing urban transformation, or if it blocks out sea views.	
Extent	The proposed development could be visible for a 3km radius and therefore will affect the local area.	
Probability	As indicated in **Figure 15** of the report: Zones of visual exposure, part of the study area falls within zones of high and moderate visual exposure, therefore the development would be visible from sensitive receptors and would definitely occur.	
Reversibility	The impact is unlikely to be reversed even with intense mitigation measures.	
Irreplaceable loss of resources	In the context of the visual environment, 'resources' are defined as scenic / natural views which almost impossible to replace. They include views toward the ocean or distinct green rolling hills covered in sugarcane plantation. As such, the development would result in significant loss of these resources.	
Duration	The impact will not cease and is considered to be infinite.	
Cumulative effect	As mentioned above, two new prospective estate developments, namely Eden Rock Forest Estate and Pennvalley Golf Estate, are located partly within the study area to the south-west of the development site. These prospective estate developments, in combination with the existing Selborne Golf Estate and the proposed Rorqual Estate Development could significantly alter the rustic unspoilt sense of place and rural visual character within the study area.	
Intensity/magnitude	The proposed development would alter the visual quality and character of the area by increasing the urban footprint; however the environment would continue to function in a moderately modified way.	
Significance Rating	**Prior to mitigation measures:** Medium negative impact **After mitigation measures:** Medium negative impact	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	4	4
Reversibility	3	3
Irreplaceable loss	3	2
Duration	4	4
Cumulative effect	4	3
Intensity/magnitude	2	2
Significance rating	-40 (medium negative)	-36 (medium negative)
Mitigation measures	**Layout** ▪ The zones of high visual sensitivity should be taken into consideration when undertaking the detailed designs and planning. In particular, the western facing slopes that fall within a zone of high visual sensitivity directly east of the N2 Freeway near the central parts of the study area should be precluded from the development. ▪ Slopes that are steeper than 33% (1:3) should be excluded from the development areas as positioning the dwellings or buildings on these slopes would result in terracing which would disrupt the characteristic rolling green hills and create distinct horizontal lines within the landscape. In order to access these	

IMPACT TABLE	
Environmental Parameter	Visual Impact
	buildings, roads would have to be 'cut into the slope, creating a prominent linear 'scar' that texturally contrasts with the green hillside. **Boundary** ▪ Careful consideration should be taken when designing the boundary of the estate to avoid creating a sterile edge. ▪ A discontinuous fragmented boundary or invisible fencing system should be utilised as opposed to a solid continuous wall (Gibbs D., and Saint Pol M. 2011). ▪ Indigenous trees should be planted in a scattered configuration along the boundary of the estate. **Lighting** ▪ Should street lights be required, fittings that focus the light toward the ground and prevent light spill should be utilised. ▪ Commercial buildings should not be illuminated at night. **Architecture** ▪ In order to conform with the scale of existing urban form, it is recommended that the structure heights should be limited to 2 storeys as far as possible – particularly for residential land uses. ▪ In all other land uses, no structure should exceed 4 storeys in height. ▪ Buildings should be painted with natural colours or natural materials should be used such as, face brick and stone cladding. ▪ Non-reflective materials should be utilised where possible.

17.2.5.8 Crime Impact

a. *Description of impact:*

A common concern is that incidences of crime will increase with the approval of a development proposal (in this case the Rorqual Estate), especially during the construction phase. The perception of this risk is also a subjective concept but will be assessed as part of this process.

Pre-mitigation Impact Assessment:

Assessment Criteria	Score	Rating
Social Value	**4**	**Medium-High**
Disturbance	3	Medium
Extent	2	Local
Duration	2	Short-term
Probability	3	Possible
Impact Magnitude	**10**	
Significance	**40**	**Medium-Low**
Acceptability	**Acceptable but Undesirable**	

Mitigation measures:

During the construction phase, to reduce the potential for and significance of crime as a result of the development, the following measures will be incorporated into the Draft EMPr for the Rorqual Estate:

- Access to the construction site should be strictly controlled by a security company.
- Each development node must be fenced when construction commences. This can include the erection of the boundary fence or a temporary bonnox fence to reduce the susceptibility

of construction materials to theft and the movement of construction personnel across the site.

- Where existing residential properties abut proposed development areas, the construction site must be fenced and screened to reduce the ease at which neighbouring properties can be viewed.
- Loitering and the influx of unemployed people to the area must be avoided by employing construction labour offsite and where possible, making use of members of the neighbouring communities who have the required skills.
- Labour should be transported to and from the site to discourage loitering in adjacent areas and possible increase in crime or disturbance.
- Unsocial activities such as unauthorised consumption or illegal selling of alcohol, drug utilisation or selling and prostitution on site should be banned.
- Any persons found to be engaged in such activities should receive appropriate disciplinary or criminal action taken against them.
- No labour to be housed on site.

During the operational phase, to reduce the potential for and significance of crime as a result of the development, the following measures will be incorporated into the Draft EMPr for the Rorqual Estate:

- The development nodes will be fenced to provide internal security for the residents.
- Security checkpoints will monitor the entry and exit of vehicles.

Post-mitigation Impact Assessment:

Assessment Criteria	Score	Rating
Social Value	**4**	**Medium-High**
Disturbance	1	Low
Extent	2	Local
Duration	2	Short-term
Probability	3	Possible
Impact Magnitude	**8**	
Significance	**32**	**Low**
Acceptability	**Acceptable**	

17.2.5.9 Heritage Impact

Findings were:

- Indeterminate Late Iron Age ceramic sherds were identified and mapped. It is probable that the site will be destroyed by the proposed development.
- The site was determined to have a low heritage significance at all levels for its scientific value.
- The social and economic benefits of the proposed development were determined to outweigh the impact on known heritage resources.
  The heritage consultants recommend that this project may proceed with the proposed heritage resource mitigation

Pre-mitigation Impact Assessment:

Assessment Criteria	Score	Rating
Social Value	**3**	**Medium**
Disturbance	3	Medium
Extent	3	Medium
Duration	5	Permanent
Probability	3	Possible
Impact Magnitude	**14**	**Medium**
Significance	**42**	**Medium-Low**
Acceptability	**Acceptable but Undesirable**	

Mitigation measures:

If heritage resources will be adversely affected by the proposed development, the developer should apply to Amafa for a destruction permit prior to undertaking construction activities.

Post-mitigation Impact Assessment:

Assessment Criteria	Score	Rating
Social Value	**3**	**Medium**
Disturbance	2	Medium-Low
Extent	2	Medium-Low
Duration	5	Permanent
Probability	3	Possible
Impact Magnitude	**12**	**Medium**
Significance	**36**	**Medium-Low**
Acceptability	**Acceptable**	

17.2.5.10 Provision of Educational Services

The applicant promotes the incorporation of certain types of development that will contribute to the social and economic upliftment of the area. The key components in this regard are the allocation of land for the construction of a private school.

The provision of educational facilities and services is considered to have a positive impact on the area and as such does not require assessment in the same manner as the other impacts (pre and post mitigation impact ratings).

The need and desirability of a development generally determines economic viability and the development proposal needs to address the following aspects:

- Does the development support economic growth, promote social inclusion and ensure that such growth is ecologically sustainable in the long-term.
- Financial viability must be considered within the context of justifiable economic development, measured against the social requirements of the area.
- Does the need and desirability of the proposed Rorqual Estate correlate with Umdoni Municipality's strategic spatial development planning initiatives (IDP, SDF).
- Does the development correspond with existing surrounding land uses
- Is the development provided for in terms of the infrastructure planning of the Ugu District, and Umdoni Municipalities.

To enable EDTEA to take an informed decision on the application, it is important that the applicant demonstrates the economic viability of the proposed Rorqual Estate. An Economic Assessment has been undertaken by Urban-Econ and a summary of the results have been included in **Section 8.3** above. The full specialist study has been included as **Appendix C**.

17.2.5.11 Job and Industry Creation

The two key themes emerging from the Rorqual Scoping phase relate to:

- The potential loss of jobs within the agricultural sector, and
- Positive influences associated with increased employment opportunities in the commercial nodes and ancillary services required as part of residential and holiday land use (domestic workers, cleaning staff etc.).

17.2.5.12 Loss of Employment Opportunities in the Agricultural Sector

a. *Description of impact:*

With the proposed change in land use from commercial agriculture to a mixed-use development, potentially a large percentage of staff employed in farming the areas currently under sugarcane will no longer be required and will contribute to unemployment figures in the area. However,

intensified agriculture on the rest of the farm will likely mitigate this prospective loss of employment.

b. *Pre-mitigation Impact Assessment:*

Assessment Criteria	Score	Rating
Social Value	**3**	**Medium**
Disturbance	4	Medium-High
Extent	3	Medium
Duration	5	Permanent
Probability	5	definite
Impact Magnitude	**17**	
Significance	**51**	**Medium**
Acceptability	**Generally Unacceptable**	

Mitigation measures:

- It must also be noted that there are a number of farms that will remain under agricultural practices indefinitely and therefore, an agricultural workforce will still be required. Added to this aspect, agriculture on the farm will also be phased out in time as the construction of each development node is commissioned. Therefore, the loss of employment from an agricultural perspective is likely to be minimal and over the long term.

Post-mitigation Impact Assessment:

Assessment Criteria	Score	Rating
Social Value	**3**	**Medium**
Disturbance	3	Medium
Extent	3	Medium
Duration	2	Short-term
Probability	3	Possible
Impact Magnitude	**9**	
Significance	**33**	**Low**
Acceptability	**Acceptable**	

17.2.5.13 Growth of the Tourism Sector (Positive Impact)

a. *Description of impact:*

The development of three hotels and a recreational area on the beachfront, the opportunity for growth in the present tourism industry to the region will be significant. Presently Park Rynie and Pennington offers accommodation of a camping, 2 to 3 star self-catering, and 3-star catering nature. Quality beach hotels and resorts are lacking in the region, with the nearest competition at Scottburgh and Umzumbe.

Pre-mitigation Impact Assessment:

Assessment Criteria	Score	Rating
Socio-economic Value	**3**	**Medium**
Disturbance	2	Medium-Low
Extent	4	Medium-High
Duration	5	Permanent
Probability	4	Probable
Impact Magnitude	**15**	**Medium-High**
Significance	**45**	**Medium**
Acceptability	**Important / Beneficial**	

Mitigation measures:

- The phased development of the various hospitality and tourism operations relative to market demand and marketing penetration, will go a long way to ensuring sustainable tourism

operations. This will ensure that jobs are kept and that the multiplier effect of tourism on other business sectors will be most effective.

- The correct sourcing and training of staff for the development will greatly enhance the ability of the tourism businesses performance.
- A policy of sourcing all unskilled labour from within the immediate or nearby community, and offering skills and development training to them, will ensure a more meaningful socio-economic impact on the community.
- A policy of ensuring that a corporate social responsibility program is adopted, and that sustainable tourism policies are entrenched, with further benefit the community and the environment.

Post-mitigation Impact Assessment:

Assessment Criteria	Score	Rating
Social Value	**3**	**Medium**
Disturbance	3	Medium
Extent	5	High
Duration	5	Permanent
Probability	4	Probable
Impact Magnitude	**17**	**Medium-High**
Significance	**51**	**Medium**
Acceptability	**Important / Beneficial**	

17.2.5.14 Benefits for local employment opportunities, business and industry (Positive Impact)

a. *Description of impact:*

The capital expenditure of the proposed development will lead to the direct expansion of business sales (production) by R1.1 billion at the end of 2027. There is significant potential for the proposed development to use local suppliers so as to encourage the development of local business. It is expected that the increase in direct business sales will have positive spin-off effects on the supporting businesses, for example, sub-contractors and suppliers of construction equipment and materials. A total of R2.5 billion in new business sales will be generated as a result of the indirect impact of the developments capital expenditure.

An important aspect identified is the positive impact the availability of properties zoned for commercial, service and industry purposes would have on the local economy in terms of the availability of additional employment opportunities and services.

The input-output model from the Socio-economic Impact Assessment suggests that a total of 5,483 full time employment opportunities will be created over the construction period.

Additional income generated as a result of the construction phase of the development is totalled at just over R445 million at the end of 2027. Direct wages (derived from on-site jobs) is estimated at R197 million Many of these jobs are likely to be filled by local inhabitants due to them being the closest source of labour and their skills matching the job requirements (i.e. unskilled jobs).

Pre-mitigation Impact Assessment:

Assessment Criteria	Score	Rating
Social Value	**4+**	**Medium - High**
Disturbance	3+	Medium
Extent	4	Medium-High
Duration	4+	Long-Term
Probability	4	Probable
Impact Magnitude	**15**	**Medium-High**
Significance	**60+**	**Medium-High (+ve)**
Acceptability	**Beneficial**	

Mitigation measures:

No specific mitigation measures are required. However, it is recommended that in order to further the opportunity for communities to enter the local economy the following should be considered, where possible:

- Appointment of skilled members of the community in the labour force during construction.
- Employment opportunities within the commercial zones, should be made available to members of the local communities first, before looking further afield.
- Staff training should be adopted to ensure that the development contributes to the increase in a skilled work force in the area.

Post-mitigation Impact Assessment:

Assessment Criteria	Score	Rating
Social Value	**4+**	**Medium - High**
Disturbance	3+	Medium
Extent	4	Medium-High
Duration	4+	Long-Term
Probability	4	Probable
Impact Magnitude	**15**	**Medium-High**
Significance	**60+**	**Medium-High (+ve)**
Acceptability	**Beneficial**	

17.2.5.15 Impact of increased Property Values (Positive Impact)

a. *Description of impact:*

The transformation in land use from agriculture to a mixed-use development would increase the value of the property. With this enhancement of the rates base, the value of the neighbouring properties would increase and negatively affect these landowners though increased tariffs.

The Municipal Property Rates Act (6 of 2004) is the piece of legislation that regulates the power of a municipality to value and rate immovable properties (land and buildings) located within their jurisdiction. Municipalities derive their power to levy rates from section 229(1) of the Constitution of the Republic of South Africa.

The economic impacts of the fully developed housing component (fully developed by 2027 is anticipated to cost R3.628 billion in total, which will create a significant capital injection into the local economy for the construction phase alone. While large contractors outside of the immediate catchment area will undoubtedly be involved in a project of this magnitude and type, the economic benefits will impact significantly on the area surrounding the proposed housing component.

Pre-mitigation Impact Assessment:

Assessment Criteria	Score	Rating
Social Value	**4**	**Medium-High**
Disturbance	3	Medium
Extent	3	Medium
Duration	4	Long-term
Probability	4	Probable
Impact Magnitude	**14**	**Medium**
Significance	**56+**	**Medium (+ve)**
Acceptability	**Beneficial**	

Mitigation measures:
No specific mitigation measures are required.

Post-mitigation Impact Assessment:

Assessment Criteria	Score	Rating
Social Value	**4**	**Medium-High**
Disturbance	3	Medium
Extent	3	Medium
Duration	4	Long-term
Probability	4	Probable
Impact Magnitude	**14**	**Medium**
Significance	**56+**	**Medium (+ve)**
Acceptability	**Beneficial**	

18 ENVIRONMENTAL IMPACT ASSESSMENT OF THE NO-GO OPTION

The no-go option proceeds on the assumption that the current land-use (agriculture) would continue should the development proposal be abandoned by the applicant or an environmental decision is issued by EDTEA that does not authorise the proposed Rorqual Estate.

From the environmental assessment presented above, should the status quo remain and the applicant continues with the agricultural production of sugar cane, the financial returns will continue to fall, based on the findings of the Agricultural Potential Assessment (**Appendix D3**). Furthermore, the potential opportunities for residential opportunities, employment and skills development associated with the development proposal (provision of hotels, schools and retail/office space) far outweigh the employment opportunities currently experienced on the farm itself.

A significant negative impact associated with the no-go option regards the fact that the properties will remain under agricultural activities and the areas identified for conservation purposes in this assessment process will not be rehabilitated and managed appropriately. This includes the existing ecologically sensitive areas (wetlands, riparian areas, grasslands and forests) and those that would be gained with the adoption and maintenance of buffers. Furthermore, the critically endangered and red data species still present on site will continue to be placed at risk.

18.1 Impacts on Biophysical Systems and Components

18.1.1 Impacts on the Watercourses, Estuaries, Groundwater and Aquifers

The following potential impacts on the wetland systems have been identified:

- Reduction in the water quality in all watercourses as a result of the irrigation runoff and subsurface flow entering the wetlands.
- Reduction in the water quality in watercourses, the groundwater table and aquifers as a result of farming herbicides and pesticides entering the system.
- Gradual degeneration in the health/integrity of the watercourses as a result of a lack of management and formal protection.
- Increased sedimentation of watercourses and estuaries as a result of inadequate storm-water and erosion control during the farming operation.

18.1.2 Impacts on the Terrestrial Vegetation Communities

- Direct disturbance to the vegetation communities as a result of the accidental encroachment of farm machinery and operations into the sensitive areas.
- Direct disturbance to vegetation communities as a result of inappropriate fire burning regimes or accidental fires.
- Continued uncontrolled and unmonitored encroachment of invasive alien plant species
- Gradual degeneration in the health and biodiversity value of the grassland as a result of potential disturbances associated with a lack of management.

- Gradual degeneration in the health and biodiversity value of the various forests as a result of unregulated wood harvesting and a lack of management.

18.1.3 Impacts on the Coastal Zone

- The status quo will largely remain

18.2 Impacts on Socio-economic Systems and Components

18.2.1 Impacts on the Local Economy

- The status quo will largely remain

18.2.2 Impacts on the Quality of Life of Local Residents

- The status quo will largely remain

18.2.3 Impacts on the Safety and Security of Neighbouring Residents

- The status quo will largely remain

18.2.4 Agricultural Resource Impacts

The farming operations would continue, however, the sugarcane tonnages and quality will gradually decrease over a period of decades.

18.2.5 Heritage Resource Impacts

- The status quo will largely remain

18.3 Environmental Impact Assessment

The findings and recommendations of the specialist studies will be incorporated into the planning of the proposed development where feasible and will inform the impact assessment undertaken in the EIA Report. The impact assessment method that will be used to assess the significance of the impacts in the EIA Report is attached as **Appendix H** of this report.

18.3.1 Public Participation

In terms of the public participation process stipulated in the EIA regulations (GNR 543 of 18 June 2010), Section 56(5 and 6) requires that I&AP's are afforded the opportunity to comment on both the draft and final reports produced during the environmental assessment process. In terms of the Rorqual Estate Development application, the following methodology is specified:

1. A formal comment period of forty (40) days will be allocated for key stakeholders to comment on the Draft EIA report.
2. Should correspondence be received after the allotted timeframes, this documentation will be received and forwarded to the EDTEA.
3. The EIA regulations stipulate a period of twenty-one (21) days for comment by I&AP's on the Final EIA reports. I&AP's will be provided with electronic copies of the report. The report will be made available on the SiVEST website and I&AP's will be notified of the reports availability.
4. A copy of the documentation will be made available on compact disk (CD) should the stakeholder be unable to access the information from the internet. To prevent the unsustainable use of paper, hard copies of the final reports will only be made available in exceptional circumstances.
5. I&AP's who wish to comment on the final reports will need to submit this correspondence to EDTEA within the legislated timeframes that govern this authority.

18.4 Environmental Management Program (EMPr)

A Draft Construction and Operational Environmental Management Program (EMPr) was compiled for inclusion in the EIR.

Refer to **Appendix G**

An EMPr is a detailed plan for the implementation of the mitigation measures to minimise the negative environmental impacts highlighted in the EIR. The Construction EMPr will contribute to the preparation of the contract documentation by developing clauses to which the contractor must adhere for the protection of the environment. The EMPr for this project includes a construction environmental monitoring plan specifying how the construction of the project is to be carried out.

18.4.1 Draft Construction EMPr

The construction EMPr included all those measures identified in the EIR to mitigate the negative impacts associated with the construction of the relevant development activities.

18.4.2 Draft Operational EMPr

The operational EMPr included all those measures identified in the EIR to mitigate the negative impacts associated with the operation of the relevant development activities for the duration of the project's life-cycle. In addition, plans and programmes that will be included in the Operational EMPr are:

- Conservation Management Plan
- Wetland Rehabilitation Strategy
- *Cyrtanthus mackenii* Restoration Plan
- Development Phasing Plan

18.4.3 Additional Plans associated with the Sanitation Option

If the Option for Sanitation is approved, the Operational EMPr will need to be expanded to include the following plans:

- Draft agricultural irrigation management plan with regards to the operation of the treated effluent irrigation system. This plan will be informed by an Agricultural Irrigation Feasibility Assessment and Design and Management Plan which will be undertaken post the environmental authorisation.
- Onsite Waste Water Treatment Works Operation Plan, which will include an emergency spill contingency plan and a water quality monitoring plan will be undertaken post the environmental authorisation.

19 ENVIRONMENTAL IMPACT ASSESSMENT SUMMARY

19.1 Significant Impacts before Mitigation

Table 16: Unacceptable/Beneficial impacts before mitigation

System / Component	Potential Impacts	Score	Rating	Significance Interpretation
PROPOSED OPTION				
BIOPHYSICAL IMPACTS				
Watercourses	Wetland Infilling			
	1. Wetland In-filling (current state)	36	Medium-Low	Acceptable
	Storm-water Infrastructure			
	2. Construction storm-water impacts of medium-low importance	24	Low	Acceptable
	3. Construction storm-water impacts of medium importance	36	Medium-Low	Acceptable
	4. Construction storm-water impacts of medium-high importance	52	Medium	Generally Unacceptable
	5. Construction storm-water impacts of high importance	65	Medium	Generally Unacceptable
	6. Operational storm-water impacts of medium-low importance	28	Medium-Low	Acceptable
	7. Operational storm-water impacts of medium importance	42	Medium-Low	Acceptable But Undesirable
	8. Operational storm-water impacts of medium-high importance	56	Medium	Generally Unacceptable
	9. Operational storm-water impacts of high importance	70	Medium-High	Unacceptable
	Sewage Infrastructure			
	10. Degeneration in health of wetland, riparian and estuarine units and coastline as a result of surcharging manholes in close proximity to the watercourses	48	Medium	Generally Unacceptable
	Road Crossing			
	11. Construction road crossing impacts for systems of medium-low importance	28	Medium-Low	Acceptable
	12. Construction road crossing impacts for systems of medium importance	42	Medium-Low	Acceptable But Undesirable
	13. Operational road crossing impacts to systems of medium-low importance	22	Low	Acceptable
	14. Operational road crossing impacts to systems of medium importance	33	Medium-Low	Acceptable
	Contamination of Groundwater			
	15. Degeneration of the health of the watercourses as a result of the contamination of the groundwater and/or runoff	64	Medium-High	Generally Unacceptable
	Alien Vegetation Encroachment			
	16. Degeneration of the health of the watercourses as a result of the direct construction-related disturbances and alien vegetation encroachment	60	Medium-High	Generally Unacceptable
	General Operational Disturbance			
	17. Operational disturbance impacts to systems of medium-low importance	20	Low	Acceptable
	18. Operational disturbance impacts to systems of medium importance	30	Medium-Low	Acceptable
	19. Operational disturbance impacts to systems of medium-high importance	44	Medium-Low	Acceptable But Undesirable
	20. Operational disturbance impacts to systems of high importance	55	Medium	Acceptable But Undesirable

System / Component	Potential Impacts	Score	Rating	Significance Interpretation
Grasslands	21. Invasive alien vegetation and/or pioneer species encroachment as a result of disturbances to the grassland and buffers	65	Medium-High	Generally Unacceptable
Forest	22. Invasive alien vegetation and/or pioneer species encroachment as a result of disturbances to the forest and buffers	48	Medium	Generally Unacceptable
Estuaries	23. Invasive alien vegetation and/or pioneer species encroachment as a result of estuarine habitat and its buffers	48	Medium	Generally Unacceptable
	24. Potential increase in reedbed cover within estuaries due to increased microalgal and macroalgal growth	45	Medium	Generally Unacceptable
	25. Potential increase in reedbed cover within estuaries due to encroachment of reeds and macrophytes	45	Medium	Generally Unacceptable
	26. Potential risk of bacterial contamination of the estuaries	51	Medium	Generally Unacceptable
Coastal Zone	27. Coastal erosion/inundation due to inappropriately located coastal settlement has the potential to suffer massive damage from dynamic, natural marine processes		Low	Acceptable
	28. Inappropriate development & pollution		Medium	Generally Unacceptable
	29. Impacts on natural vegetation due to construction activity and post-construction incursions into the dune forest environment		Low	Acceptable
	30. Inappropriate future use of the land parcel having the potential to negatively impact on its sustainability		Low	Acceptable
	31. Total consideration of all impacts		Low	Acceptable
Ecological Linkages	32. Ecological linkage value to successful migration of biodiversity species and their contribution to the viability and mortality of sustainable populations	60	Medium-High	Generally Unacceptable
SEWAGE & WASTE WATER TREATMENT WORKS IMPACTS				
WWTW Operation	1. Erosion and sedimentation of wetlands and watercourses	52	Medium	Generally Unacceptable
	2. Spills of wastewater	40	Medium-Low	Acceptable But Undesirable
	3. Odour emanating from WWTW	48	Medium	Generally Unacceptable
	4. Disposal of treated effluent to Irrigation (preferred)	52	Medium	Generally Unacceptable
	5. Disposal of treated effluent to Watercourses (alternative)	52	Medium	Generally Unacceptable
SOCIO-ECONOMIC IMPACTS				
Surrounding Residents	1. Improvement in the quality of life of the local unemployed residents as a result of the creation of temporary jobs	72+	Medium-High	Very Important / Beneficial
	2. Reduction in quality of life of the surrounding residents as a result of air pollution during the construction phase	45	Medium	Generally Unacceptable
Local Road Users & Pedestrians	3. Increased danger to children and pedestrians as a result of construction vehicles travelling to and from the construction site	60	Medium-High	Generally Unacceptable
	4. Degeneration in the quality of life of local users as a result of an increase in traffic congestion and delay times associated with heavy construction vehicles	60	Medium-High	Generally Unacceptable
	5. Degeneration in the quality of life of local users as a result of an increase in traffic congestion and delay times associated with the operational phase	60	Medium-High	Generally Unacceptable

System / Component	Potential Impacts	Score	Rating	Significance Interpretation
Agriculture	6. Loss of viable agricultural land presently under farming practices	51	Medium	Generally Unacceptable
	7. Loss of harvested sugar-cane tonnages and revenues for the sugar mill, supply to market and the GDP of the economy	51	Medium	Generally Unacceptable
	8. Decrease of impacts of sugar-cane burning	56+	Medium	Beneficial
Dust	9. Impacts of dust on surrounding communities and vegetation	64	Medium-High	Generally Unacceptable
Noise	10. Impacts of noise from construction operations and vehicles	42	Medium-Low	Acceptable
Sense of Place	11. Impact upon Sense of Place for residents and tourists	68	Medium-High	Generally Unacceptable
Visual	12. Visual impacts during construction phase	22	Low	Acceptable
	13. Visual impacts during operational phase	40	Medium-Low	Acceptable But Undesirable
Crime	14. Impact of crime to residents and businesses in proximity to the development	40	Medium-Low	Acceptable But Undesirable
Heritage	15. Impacts on heritage artefacts	42	Medium-Low	Acceptable But Undesirable
Education Services	16. Benefits of the provision of a private school	45+	Medium	Important / Beneficial
Jobs and Industry Creation	17. Loss of employment opportunities in the agricultural sector	51	Medium	Generally Unacceptable
	18. Growth of the Tourism Sector for job and business opportunities	45+	Medium	Important / Beneficial
	19. Benefits for local employment opportunities, business and industry growth	56+	Medium-High	Very Important / Beneficial
Property Values	20. Increase in property values to both agricultural, residential, commercial and industrial land in the region	56+	Medium	Beneficial

19.2 Significant Impacts after Mitigation (Residual Impacts)

Table 17: Unacceptable/Beneficial impacts after mitigation

System / Component	Potential Impacts	Score	Rating	Significance Interpretation
PROPOSED OPTION				
BIOPHYSICAL IMPACTS				
Watercourses	Wetland Infilling			
	33. Wetland In-filling	36	Medium-Low	Acceptable
	Storm-water Infrastructure			
	34. Construction storm-water impacts of medium-low importance	16	Low	Acceptable
	35. Construction storm-water impacts of medium importance	27	Medium-Low	Acceptable
	36. Construction storm-water impacts of medium-high importance	32	Medium-Low	Generally Unacceptable
	37. Construction storm-water impacts of high importance	40	Medium-Low	Acceptable But Undesirable
	38. Operational storm-water impacts of medium-low importance	22	Medium-Low	Acceptable
	39. Operational storm-water impacts of medium importance	33	Medium-Low	Acceptable But Undesirable
	40. Operational storm-water impacts of medium-high importance	44	Medium-Low	Generally Unacceptable
	41. Operational storm-water impacts of high importance	55	Medium	Generally Unacceptable
	Sewage Infrastructure			
	42. Degeneration in health of wetland, riparian and estuarine units and coastline as a result of surcharging manholes in close proximity to the watercourses	40	Medium-Low	Acceptable But Undesirable
	Road Crossing			
	43. Construction road crossing impacts for systems of medium-low importance	22	Medium-Low	Acceptable
	44. Construction road crossing impacts for systems of medium importance	33	Medium-Low	Acceptable
	Contamination of Groundwater			
	45. Degeneration of the health of the watercourses as a result of the contamination of the groundwater and/or runoff	44	Medium-Low	Acceptable But Undesirable
	Alien Vegetation Encroachment			
	46. Degeneration of the health of the watercourses as a result of the direct construction-related disturbances and alien vegetation encroachment	36	Medium-Low	Acceptable
	General Operational Disturbance			
	47. Operational disturbance impacts to systems of medium-low importance	16	Low	Acceptable
	48. Operational disturbance impacts to systems of medium importance	33	Medium-Low	Acceptable
	49. Operational disturbance impacts to systems of medium-high importance	32	Medium-Low	Acceptable
	50. Operational disturbance impacts to systems of high importance	40	Medium-Low	Acceptable But Undesirable
Roads & Traffic	51. Degeneration in the health of the wetland, riparian and estuarine units as a result of the disturbance during the establishment of road crossings	56	Medium	Generally Unacceptable

System / Component	Potential Impacts	Score	Rating	Significance Interpretation
	52. Degeneration in the health of the wetland, riparian and estuarine units as a result of the canalisation of flow through the road crossings	48	Medium	Generally Unacceptable
Grasslands	53. Invasive alien vegetation and/or pioneer species encroachment as a result of disturbances to the grassland and buffers	45	Medium	Generally Unacceptable
Forest	54. Invasive alien vegetation and/or pioneer species encroachment as a result of disturbances to the forest and buffers	40	Medium-Low	Acceptable But Undesirable
Estuaries	55. Invasive alien vegetation and/or pioneer species encroachment as a result of estuarine habitat and its buffers	28	Low	Acceptable
	56. Potential increase in reedbed cover within estuaries due to increased microalgal and macroalgal growth	28	Low	Acceptable
	57. Potential increase in reedbed cover within estuaries due to encroachment of reeds and macrophytes	28	Low	Acceptable
	58. Potential risk of bacterial contamination of the estuaries	28	Low	Acceptable
Coastal Zone	59. Coastal erosion/inundation due to inappropriately located coastal settlement has the potential to suffer massive damage from dynamic, natural marine processes		Low	Acceptable
	60. Inappropriate development & pollution		Medium	Generally Unacceptable
	61. Impacts on natural vegetation due to construction activity and post-construction incursions into the dune forest environment		Low	Acceptable
	62. Inappropriate future use of the land parcel having the potential to negatively impact on its sustainability		Low	Acceptable
	63. Total consideration of all impacts		Low	Acceptable
Ecological Linkages	64. Ecological linkage value to successful migration of biodiversity species and their contribution to the viability and mortality of sustainable populations	44	Medium-Low	Acceptable But Undesirable
SEWAGE & WASTE WATER TREATMENT WORKS IMPACTS				
WWTW Operation	6. Erosion and sedimentation of wetlands and watercourses	28	Low	Acceptable
	7. Spills of wastewater	28	Low	Acceptable
	8. Odour emanating from WWTW	28	Low	Acceptable
	9. Disposal of treated effluent to Irrigation (preferred)	32	Low	Acceptable
	10. Disposal of treated effluent to Watercourses (alternative)	32	Low	Acceptable
SOCIO-ECONOMIC IMPACTS				
Surrounding Residents	21. Improvement in the quality of life of the local unemployed residents as a result of the creation of temporary jobs	72+	Medium-High	Very Important / Beneficial
	22. Reduction in quality of life of the surrounding residents as a result of air pollution during the construction phase	39	Medium-Low	Acceptable But Undesirable
Local Road Users & Pedestrians	23. Increased danger to children and pedestrians as a result of construction vehicles travelling to and from the construction site	48	Medium	Generally Unacceptable
	24. Degeneration in the quality of life of local users as a result of an increase in traffic congestion and delay times associated with heavy construction vehicles	52	Medium	Generally Unacceptable
	25. Degeneration in the quality of life of local users as a result of an increase in traffic congestion and delay times associated with the operational phase	52	Medium	Generally Unacceptable

System / Component	Potential Impacts	Score	Rating	Significance Interpretation
Agriculture	26. Loss of viable agricultural land presently under farming practices	48	Medium	Generally Unacceptable
	27. Loss of harvested sugar-cane tonnages and revenues for the sugar mill, supply to market and the GDP of the economy	45	Medium-Low	Acceptable But Undesirable
	28. Decrease of impacts of sugar-cane burning	52+	Medium	Beneficial
Dust	29. Impacts of dust on surrounding communities and vegetation	45	Medium-Low	Generally Unacceptable
Noise	30. Impacts of noise from construction operations and vehicles	10	Low	Acceptable
Sense of Place	31. Impact upon Sense of Place for residents and tourists	60	Medium-High	Generally Unacceptable
Visual	32. Visual impacts during construction phase	20	Low	Acceptable
	33. Visual impacts during operational phase	36	Medium-Low	Acceptable But Undesirable
Crime	34. Impact of crime to residents and businesses in proximity to the development	32	Low	Acceptable
Heritage	35. Impacts on heritage artefacts	36	Medium-Low	Acceptable
Education Services	36. Benefits of the provision of a private school	38	Medium-Low	Important / Beneficial
Jobs and Industry Creation	37. Loss of employment opportunities in the agricultural sector	33	Low	Acceptable
	38. Growth of the Tourism Sector for job and business opportunities	33	Low	Acceptable
	39. Benefits for local employment opportunities, business and industry growth	56+	Medium	Important / Beneficial
Property Values	40. Increase in property values to both agricultural, residential, commercial and industrial land in the region	56+	Medium	Beneficial

20 CONCLUSION & RECOMMENDATIONS

It is clear from **Table 16** and **Table 17** above that the proposed mixed-use development, over a very large development site, stands to have a number of medium to medium-high significant negative impacts on the onsite and surrounding biophysical and socio-economic environments if the mitigation measures recommended and agreed to are poorly implemented or adhered to. These were assessed to be generally unacceptable.

Primary negative environmental concerns are:

- In particular the potential negative erosion, siltation and contamination impacts on downstream watercourses due to bulk infrastructural construction and operation impacts relating to storm-water, sewage and road construction are concerning.
- Further concern exists around the potential threat from direct impacts and indirect disturbances (including edge / buffer zone effects) to the highly sensitive grassland and forest ecosystems, which are critically endangered habitats.
- A general concern is the threat of invasive alien plant species encroachment into all terrestrial and aquatic environments, as well as the increase in reedbed cover with the riparian and estuarine ecosystems.

Primary wetland concerns are:

- Soil sampling of the top 50cm of the soils across the site identified the presence of a number of distinct wetland units across the site, most of which were associated with the four major north-south draining drainage lines. With the exception of Wetland Unit D0, the wetlands identified had been wholly or partly cleared for cane cultivation and in most cases the only

intact vegetation communities present were narrow corridors of disturbed secondary wetland vegetation and riparian within the artificial drainage channels.

- Most of the wetlands units were assessed as being of moderately-low importance, with the exception of **Wetland Units A0, B0, C0, D0, and D2. Wetland Unit D0 was assessed as being the most valuable wetland unit onsite in terms of ecosystem service** provision largely due to the fact that they had received the least amount of disturbance and was characterised by a corridor of intact swamp forest. The rest of the more valuable systems were generally of intermediate importance in terms of the provision of surface water management and water quality enhancement services.
- In light of these findings, the proposed development stands to have serious impacts on the moderate to highly important wetland units in their current state, both negative and positive. If the specialist recommendations provided in **Sections 9, 10 and 11** above are effectively included in the design and planning of the development, the negative impacts associated with the proposed development will be substantially minimised. Furthermore, there is an opportunity for the proposed development to include the rehabilitation of the wetlands in its planning and improve the health of the wetlands within the development sites. This will result in a significant positive impact on the health of the wetlands and ultimately on the local water resources and biodiversity. Such rehabilitation is required to offset the potential negative impacts that could occur if the mitigation measures recommended above are not strictly adhered to, which is likely. Thus, the rehabilitation is vitally important to ensure that the impacts on the wetland units are minimised and wetland health and functionality is maximised.

Wetland Conservation Management and Responsibilities

Due to the high level of uncertainty around the responsibility, management and maintenance of natural areas to be conserved within the proposed development, it is important that a detailed conservation management plan for the state is compiled that clarifies the legal zoning, funding mechanisms and legal management responsibilities. This includes the requirements to be written into all legal purchase agreements and body corporate associations.

Residual Impacts and Wetland Rehabilitation

- A detailed wetland rehabilitation plan must be made a condition of the Environmental Authorisation of the proposed development.
- At this stage, there has been no formal quantification of the residual impacts on wetland functionality associated with the proposed development. In this regard, it would be beneficial to assess the residual impact on wetland functionality as part of the preparation of the detailed wetland rehabilitation plan for the proposed development.
- It is important that the applicant consider the financial resources available for wetland rehabilitation so that the detailed plan is financially feasible.

Primary negative social and socio-economic concerns are:

- The effects on traffic congestion during the construction phase and particularly the operation phase, and the danger this poses to pedestrians, children and road-users in particular.
- The impacts of dust, noise and crime, especially on the immediately surrounding residential communities.

On the other hand, **Table 16** and **Table 17** above also show that the proposed development will have significant positive impacts.

Primary positive environmental effects are:

- The health of certain of numerous highly degraded onsite wetlands and riparian areas will be have their functionality and ecological integrity improved through the effective implementation of the interventions proposed in the Wetland Rehabilitation Strategy.
- The terrestrial vegetation communities will benefit from the implementation of the Vegetation Rehabilitation Plan and the *Cyrtanthus mackenii* (Ifafa Lily) will particularly benefit should the Restoration Plan be implemented effectively.

Primary positive social and socio-economic effects are:

- The improvement in the quality of life of local unemployed residents as a result of temporary and permanent job creation
- Increase in the potential for employment and business opportunities, and new career options in the regional economy
- The benefit of a private school in the region
- Growth in the tourism sector in the region, and stimulus of additional business opportunities through the multiplier effect of tourism
- Decrease in the effects of sugar-cane burning on local residents and businesses

Assuming that all of the mitigation measures recommended for each impact are adhered to and effectively implemented, **Table 17** indicates that all of the significant impacts on the biophysical environment can be minimised. However, it is important to note that many of the negative impacts still remain as being generally unacceptable or acceptable but undesirable, highlighting the importance of the effective implementation of the mitigation measures.

It is important that the Applicant ensures that adequate funds and resources are available to implement the recommended mitigation measures. This will ensure that each of the mitigation measures have the best chance of being implemented effectively. If funds and resources to control and manage the conservation areas cannot be found, the impacts on the watercourses, grassland, forests and the estuarine and coastal environment will be significant in the long-term.

Overall, the positive social and socio-economic impacts, and some positive biophysical impacts of the proposed development, can be considered to outweigh the potential or definite negative biophysical and social impacts associated with the proposed mixed-use project. The key to the success of this project in terms of sustainability is the success of the implementation of the mitigation measures provided and the correct phasing of the development and resultant impacts.

The Applicant will have to find creative ways of including the local communities in the conservation of the open spaces onsite and facilitating the creation of temporary conservation related jobs for the unemployed within the surrounding communities. The best solution is for the Applicant to partner with the municipalities and local government to include the management of the valuable ecosystems onsite into their Working for Wetlands, Working for Ecosystems, Working for Water and Working for Fire Programmes. The preservation of the conservation worthy ecosystems onsite will be enhanced if the project could included in the Working for Ecosystems Programme. The municipality has not yet been engaged in this regard, and it is suggested that this be initiated post authorization.

If the proposed project is authorised by the EDTEA, the following measures should be made conditions of environmental authorisation:

- All of the mitigation measures identified in this EIR must be made conditions of the authorisation.
- The management plans that have been devised be made conditions of the authorisation.
- The construction EMP must be approved by the EDTEA prior to construction commencing.
- The operational EMP must be approved by the EDTEA during the first year of construction and before any occupation of houses and businesses.

The specialist studies were conducted to address the identified impacts, and an impact assessment was conducted to ascertain the level of impact and mitigation measure which may be required. The potential positive and negative impacts associated within these studies have been evaluated and rated accordingly. The results of the specialist studies have indicated that no fatal flaws exist as a result of the proposed mixed-use development. It is therefore recommended that the proposed project be allowed to proceed provided that the recommended mitigation measures are implemented and provided the following conditions are adhered to:

An independent Environmental Control Officer (ECO) must be appointed by the Applicant to monitor the implementation of a comprehensive Environmental Management Program (EMP), which accounts for the mitigation measures identified in this report and the numerous specialist reports appended hereto. The ECO should undertake at least monthly site inspections and compile a subsequent environmental audit report, to which the Client will be held responsible.This will ensure that this large mixed-use development is constructed in an environmentally sustainable manner and according to best environmental practice. This EMP is included with this Report as **Appendix G.**

This Draft Environmental Impact Report will be made available to all registered interested and affected parties (I&AP's) for a 40-day public comment period. All comments on the Draft EIA Report must be forwarded to:

Michael Wright *Cand.Sci.Nat*.; B.Sc. (Hons) Agribusiness & Wildlife Science
Tourism Specialist and Environmental Scientist
SiVEST Environmental Division
Tel: 031 581 1537
Email: michaelw@sivest.co.za

On the completion of the 40-day public comment period, the Draft EIA Report will be finalised with comments received, and submitted to all registered interested and affected parties (I&AP's) for a 21-day public comment period. Thereafter the report together with any comments received in this time period will be submitted to the Department of Environmental Affairs (EDTEA) for acceptance and a decision.

21 REFERENCES

Adams J.B., Bate G.C. and O'Callaghan M. 1999. Primary producers: estuarine macrophytes. In: Allanson BR and Baird D (eds) Estuaries of South Africa. Cambridge University Press, Cambridge, pp91–117.

Coetzee, M. A. S. 1995. Water Pollution in South Africa: It's Impacts on Wetland Biota; In Cowan, G. I. (ed). *Wetlands of South Africa*. Department of Environmental Affairs and Tourism (DEAT), Pretoria.

Mucina, L. and Rutherford, M. C. (eds) 2006. The Vegetation of South Africa, Lesotho and Swaziland. *Strelitzia 19.* South African National Biodiversity Institute, Pretoria.

SiVEST Environmental Division
4 Pencarrow Crescent, La Lucia Ridge Office Estate,
Umhlanga Rocks. 4320
PO Box 1899, Umhlanga Rocks. 4320
South Africa

Tel + 27 31 581 1500
Fax +27 31 566 2371
Email info@sivest.co.za
www.sivest.co.za

Contact Person: Michael Wright
Tel No.: 031 581 1573
Email: michaelw@sivest.co.za