DR. COLLEEN EBERSOHN
PhD Univ. Pretoria
Cell:072 222 6013
email:ebersohn@cyberperk.co.za

MS. JANET EBERSOHN
BSc. Hons. Environmental Manageme
Cell: 082 557 7122
e-mail: janet@ecoroute.co.za

APPENDIX C: SPECIALIST STUDIES - DBAR – ERF 7614

Specialist Compliance Statement for Erf 7614, called Lelieskloof in the Knysna Local Municipality.

Terrestrial Biodiversity & Terrestrial Plant Species Report

Prepared For:	EcoRoute Environmental
Author:	Miss Bianke Fouche (MSc) Confluent Environmental Pty (Ltd) 7 St. Johns Street, Dormehls Drift, George, 6529
SACNASP:	Pr. Sci. Nat. (Botanical Science) – 141757 Cand.Sci.Nat. (Ecological Science)
Reviewer:	Dr. Jackie Dabrowski (Pr.Sci.Nat 115166)
Date:	12 August 2024
Version:	Final

DECLARATION OF SPECIALIST INDEPENDENCE

- I consider myself bound to the rules and ethics of the South African Council for Natural Scientific Professions (SACNASP);
- At the time of conducting the study and compiling this report I did not have any interest, hidden or otherwise, in the proposed development that this study has reference to, except for financial compensation for work done in a professional capacity;
- Work performed for this study was done in an objective manner. Even if this study results in views and findings that are not favourable to the client/applicant, I will not be affected in any manner by the outcome of any environmental process of which this report may form a part, other than being members of the general public;
- I declare that there are no circumstances that may compromise my objectivity in performed this specialist investigation. I do not necessarily object to or endorse any proposed developments, but aim to present facts, findings and recommendations based on relevant professional experience and scientific data;
- I do not have any influence over decisions made by the governing authorities;
- I undertake to disclose all material information in my possession that reasonably has or may have the potential of influencing any decision to be taken with respect to the application by a competent authority to such a relevant authority and the applicant;
- I have the necessary qualifications and guidance from professional experts in conducting specialist reports relevant to this application, including knowledge of the relevant Act, regulations and any guidelines that have relevance to the proposed activity;
- This document and all information contained herein is and will remain the intellectual property of Confluent Environmental. This document, in its entirety or any portion thereof, may not be altered in any manner or form, for any purpose without the specific and written consent of the specialist investigators.
- All the particulars furnished by me in this document are true and correct.

Bianke Fouche (MSc)

August 2024

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS

BPA	Biodiversity Priority Area
BSP	Biodiversity Spatial Plan
CBA	Critical Biodiversity Area
CD:NGI	Chief Directorate: National Geo-spatial Information
DFFE	Department of Forestry, Fisheries, and the Environment
EMP	Ecological Management Plan
ESA	Ecological Support Area
NEM:BA	National Environmental Management: Biodiversity Act
ONA	Other Natural Areas
PAOI	Project Area of Influence
SANBI	South African National Biodiversity Institute
SCC	Species of Conservation Concern
SDP	Site Development Plan

1. INTRODUCTION

1.1 Background

Confluent Environmental was contracted by Eco Route to undertake a specialist assessment for botanical and terrestrial sensitivity of Erf 7614, called Lelieskloof, in Knysna. The size of the Erf is ca. 5.6 ha. According to the Department of Forestry, Fisheries, and the Environment (DFFE) Screening Tool, this SSVR is required because the terrestrial plant species theme has been highlighted as having a **Low** sensitivity, and the terrestrial biodiversity has a **Very High** sensitivity. Erf 7614 is located near Kloof Street which is north of the Knysna Estuary (Fig. 1). The site is located in an urban residential area, with open space bordering the property's northern edges. Some residential erven are also built in the mid-section of the Erf, which is the reason this site has such an unusual shape (Fig. 1).

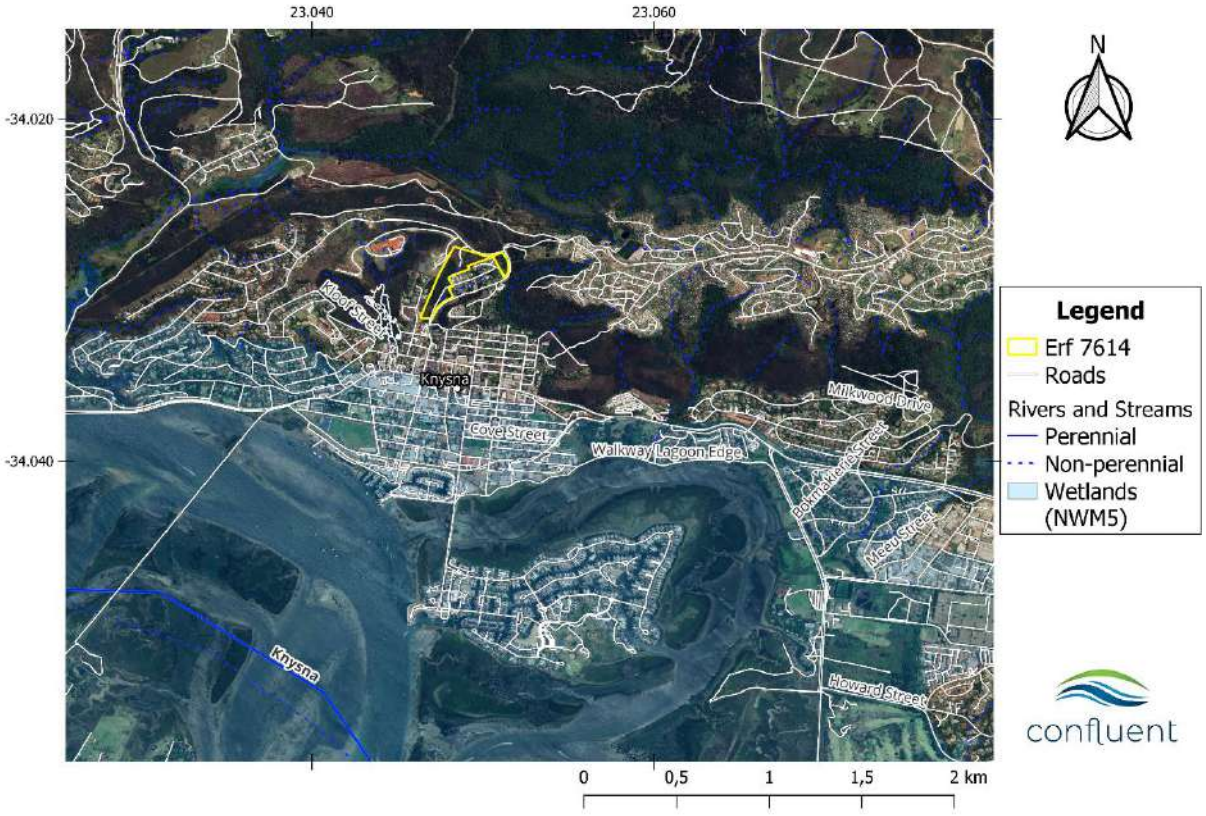


Figure 1: The general location of Erf 7614, called Lelieskloof in Knysna. Dotted blue lines illustrate non-perennial drainage lines, and the solid blue line goes through the Knysna Estuary.

1.2 Site Development Plan

The original conceptual site development plan (SDP of 2023) has divided the property into six sections (A through F), as in Fig. 2 below. The proposed development is for residential erven, and a small public open space. Areas for the proposed sections are provided in the legend of Fig 2. Since the original SDP, a revised version has been produced following the delineation of a large wetland on the site. The revision of the SDP is presented below the original layout in Fig. 2, and it is clear that there is no significant change to the extant of the development as a result of the new SDP. The revised SDP is better from an ecological perspective.

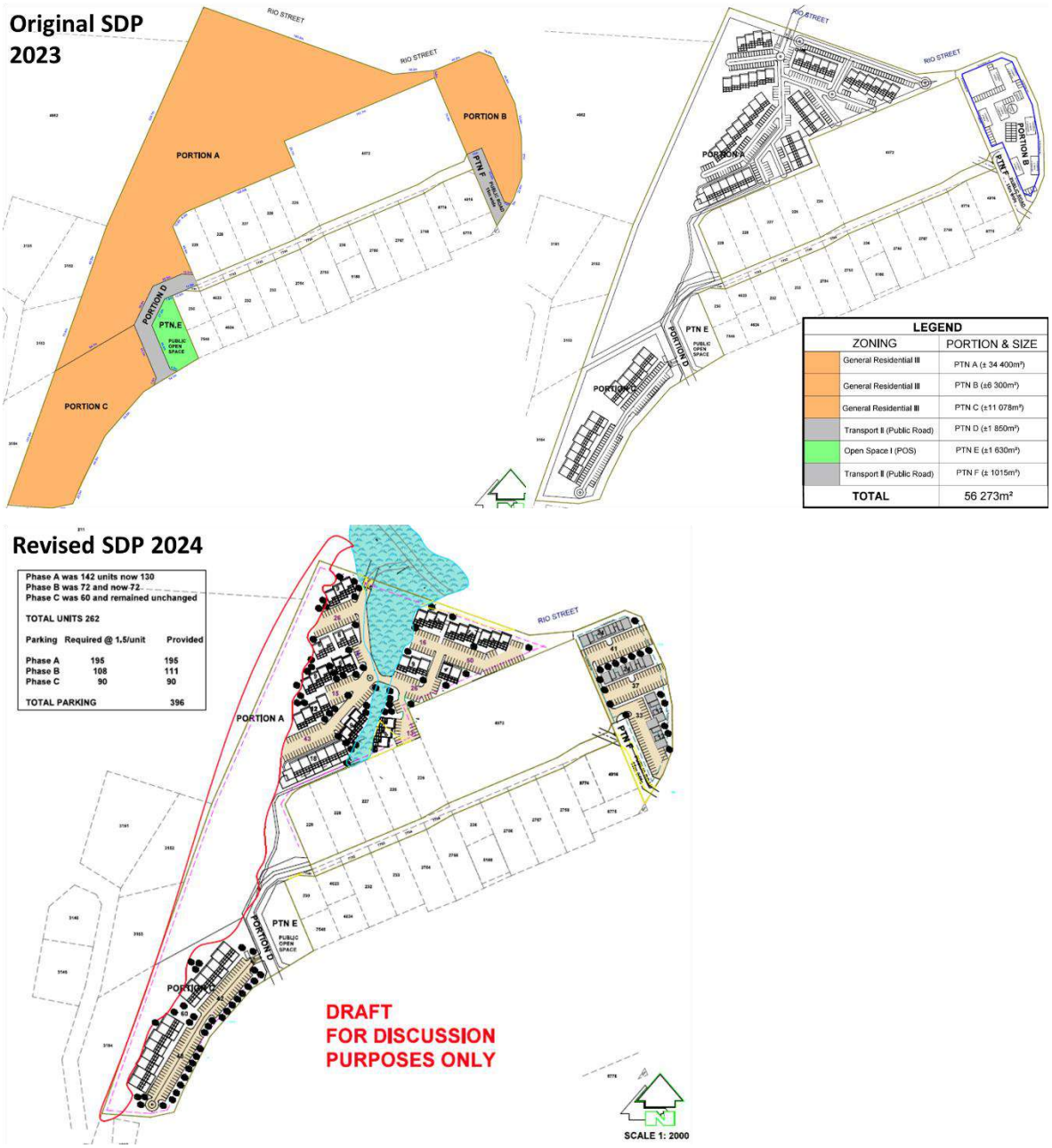


Figure 2: The original and updated site development plan for Erf 7614.

2. TERMS OF REFERENCE

This screening tool sensitivity verification report provides information on Terrestrial and Botanical diversity and sensitivity of the proposed development. The results presented are based on a desktop and field assessment, which includes a consideration of historical photographic records of the site. The assessment presented in this report follows the Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Biodiversity, and Terrestrial Plant Species themes.

This site sensitivity assessment follows the requirements of:

- The Environmental Impact Assessment Regulations, as promulgated in terms of Section 24 (5) of the National Environmental Management Act, 1998 (Act No. 107 of 1998), which includes:

    - The protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial plant species (28 July 2023). A checklist for minimum report requirements according to this theme is presented below in table 1:

Table 1: Reporting requirements as per the Terrestrial Biodiversity Protocol for a site sensitivity verification report.

No.	Site sensitivity verification (the basis of a compliance statement):	Check
4.2.1	Be applicable to the preferred site and proposed development footprint;	X
4.2.2	Confirm that the site is of "low" sensitivity for terrestrial biodiversity;	X
4.2.3.	Indicate whether or not the proposed development will have any impact on the biodiversity feature.	X
4.3.1.	The contact details of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae;	X
4.3.2.	A signed statement of independence by the specialist;	X
4.3.3.	A statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;	X
4.3.4.	A baseline profile description of biodiversity and ecosystems of the site;	X
4.3.5.	The methodology used to verify the sensitivities of the terrestrial biodiversity features on the site, including equipment and modelling used, where relevant;	X
4.3.6.	In the case of a linear activity, confirmation from the terrestrial biodiversity specialist that, in their opinion, based on the mitigation and remedial measures proposed, the land can be returned to the current state within two years of completion of the construction phase;	NA
No.	**Compliance statement:**	**Check**
4.3.7.	Where required, proposed impact management outcomes or any monitoring requirements for inclusion in the empr;	X
4.3.8	A description of the assumptions made and any uncertainties or gaps in knowledge or data; and	X
4.3.9	Any conditions to which this statement is subjected.	X
4.4	A signed copy of the compliance statement must be appended to the Basic Assessment Report or Environmental Impact Assessment Report.	Take note

    - The protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial biodiversity (20 March 2020). A checklist for minimum report requirements is presented in table 2:

Table 2: Reporting requirements as per the Terrestrial Plant Species Protocol Protocol for a site sensitivity verification report.

No.	Site sensitivity verification (the basis of a compliance statement):	Check
5.3.1	Contact details and relevant experience as well as the SACNASP registration number of the specialist preparing the compliance statement including a curriculum vitae;	X
5.3.2	A signed statement of independence by the specialist;	X
5.3.3	A statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;	X
5.3.4	A description of the methodology used to undertake the site survey and prepare the compliance statement, including equipment and modelling used where relevant;	X
5.3.6	A description of the assumptions made and any uncertainties or gaps in knowledge or data;	X
5.3.7	The mean density of observations/ number of samples sites per unit area.	X
No.	**Compliance statement:**	**Check**
5.3.5	Where required, proposed impact management actions and outcomes or any monitoring requirements for inclusion in the empr;	X
5.3.8	Any conditions to which the compliance statement is subjected.	X
NA	A signed copy of the Terrestrial Plant Species Compliance Statement must be appended to the Basic Assessment Report or the Environmental Impact Assessment Report.	Take note

- Additional guidelines for the terrestrial biodiversity theme:
    - Ecosystem Guidelines for Environmental Assessment in the Western Cape (de Villiers et al., 2016).
    - The Western Cape Biodiversity Spatial Plan Handbook and summary booklet (CapeNature, 2017; Pool-Sandvliet et al., 2017).
    - The Subtropical Thicket Ecosystem Programme Handbook: Integrating the natural environment into land-use decisions at the municipal level: towards sustainable development (Pierce & Mader, 2006).
- Additional guidelines for the terrestrial plant species theme:
    - Species Environmental Assessment Guideline: Guidelines for the implementation of the Terrestrial Flora (3c) & Terrestrial Fauna (3d) Species Protocols for environmental impact assessments in South Africa (Verburgt et al., 2020).

The assessment was undertaken by a specialist registered with the South African Council for Natural Scientific Professionals (SACNASP) with relevant expertise in the field of Botanical and/or Ecological science.

2.1 Online Screening Tool

The Department of Forestry, Fisheries, and the Environment (DFFE) screening tool report for the development footprint has identified the **terrestrial plant species theme as having a Low sensitivity**, and the **terrestrial biodiversity theme as having a Very High sensitivity**

(Fig. 3). The plant species theme was not triggered for this site (Low sensitivity rating), however, note that the Screening Tool report does not take Near Threatened plant populations into account. The terrestrial biodiversity theme sensitivity is Very High is due to the several biodiversity priority areas (BPAs) mapped on the site.

Figure 3: The screening tool generated site sensitivities for the two themes included in this report.

A Very High sensitivity rating for terrestrial biodiversity according to the screening tool is triggered for all Biodiversity Priority Areas (BPAs) and other sensitive features (Stewart et al., 2021). BPAs include the various management layers of the Western Cape Biodiversity Spatial Plan (WC BSP), as well as the other sensitive features in Table 3 below. The highlighted rows of Table 3 were triggered for the proposed development on Erf 7614.

Table 3: Sources of BPA data for the Terrestrial Biodiversity Theme sensitivity (Stewart et al., 2021)*. Only BPAs that have been triggered for Erf 7614 by the screening tool are listed here.*

Sensitivity layer	Data included and source
Red Listed Ecosystems	Any ecosystem that is listed as Vulnerable (VU), Endangered (EN), or Critically Endangered (CR) according to the "Revised National List of Ecosystems that are Threatened and in Need of Protection (NEM:BA Act no.10 of 2004, as amended in November 2022). In this case the trigger is EN Garden Route Shale Fynbos.
SAN Parks Buffer Areas	A buffer area for a National Park is defined in the February 2012 schedule on Biodiversity Policy and Strategy for South Africa's Strategy on Buffer Zones of National Parks. The buffer applicable here is the 10km wide buffer for the Garden Route National Park.
Lakes	National Lake Areas area also part of the trigger for terrestrial site sensitivity. In this case the Knysna National Lake Area applies.
Strategic Water Source Areas (SWSAs) (terrestrial)	Surface strategic water source areas, delineated by Mervyn Lotter in October 2020 with substantial input from the SWSA spatial task team as part of the SWSA spatial task team. Note that the protocol only applies to the terrestrial parts of the SWSAs.
Freshwater Ecosystem Catchments (terrestrial)	Freshwater ecosystem catchments, determined through the National Freshwater Ecosystem Priority Area (NFEPA) process.

3. METHODOLOGY

3.1 Desktop Assessment

The desktop assessment was performed using Cape Farm Mapper and QGIS version 3.28.3 “Firenze”. Plant species data was sourced from the following sources:

- The DFFE screening tool listed SCC.
- Information on plant occurrence prior to the site visit was sourced from SANBIs Botanical Research and Herbarium Management System (BRAHMS) for the Plants of Southern Africa (POSA) database.
- iNaturalist observations of the property and surrounding areas.

Ecosystem/ vegetation type data was sourced from:

- The 2018 updated South African National Vegetation Map from SANBIs Biodiversity GIS (BGIS) database, and the National Biodiversity Assessment report of 2018 (Skowno et al., 2018).
- Shapefiles for the Western Cape Biodiversity Spatial Plan (WC-BSP) i.e., information on PAs, CBAs, ESAs, and ONAs were downloaded from BGIS database (CapeNature, 2017; Pool-Sandvliet et al., 2017).
- Cape Farm Mapper for additional spatial information required for the site.
- Chief Directorate: National Geo-spatial Information (CD: NGI) Geospatial Portal and Google Earth for the acquisition of historical aerial imagery of the site.
- The conservation status of ecosystems was found in the Revised National List of Ecosystems that are Threatened and in need of protection, published under the National Environmental Management: Biodiversity Act (Act No. 10, 2004, as revised in Nov. 2022), and also using the Vegetation of South Africa, Lesotho, and Swaziland.

3.2 Field Assessment

Field work was undertaken on the 17th of January 2024. The method for identifying species was similar to a BioBlitz, also described as a “timed meander”, where the specialist especially keeps an eye out for rarer and threatened species. Some Red Listed Plant species are found more easily during a site survey than other species. This survey method is an attempt to account for the short and single survey period, where detection probability of some rare and threatened species (e.g., geophytes, small succulents, small perennials etc.) are low (Garrard et al., 2008; Wintle et al., 2012). Observations of individual species and environmental characteristics were documented using a Nikon Coolpix camera. A provisional species list and plant species accumulation curve is provided in Appendix 9.1.

3.3 Assumptions & Limitations

This assessment is subject to a few assumptions, uncertainties, and limitations, as listed below:

- Only one survey took place during the summer on the 17th of January 2024. The species list for the area is therefore limited to the findings of the one field assessment, as well as past records on iNaturalist and the Plants of Southern Africa (POSA) database for the proposed development site and its surrounding areas.
- The species list and SCC reported are not exhaustive, and more species will be added to the list should more sampling effort, and sampling in different seasons occur (Perret et al., 2023).
- Seasonal and time constraints always play a role in limiting the findings of a terrestrial specialist report. Many plant species flower seasonally and are therefore difficult / not likely to be identified outside of their flowering season.
- Some rare and threatened plant species are difficult to locate and easily overlooked in the field (e.g., geophytes, small succulents, small shrubs, and cryptic spp.). Furthermore, some species may not have been visible at all during the time of the site assessment (e.g., some geophytes, annuals, and parasitic plants).
- Environmental factors such as the prevailing fire regime, successional stage of the vegetation present, and the level of alien infestation at the site affects the species visible at the time of assessment (Cowling et al., 2010; Privett et al., 2001).
- The dense invaded sections on the site (mostly black wattles, *Acacia mearnsii*) and in the surrounding environment made it hard to gain access to some sections of the site. It is possible that focus on “bundu bashing” and getting access to some parts of the site may have caused a lapse in concentration so that an SCC could have been missed on the site.

4. RESULTS: DESKTOP ASSESSMENT

4.1 Terrestrial Biodiversity

4.1.1 Climate

Knysna is in the Garden Route along the south coast of South Africa. Temperature varies between the different seasons, with the coldest month, July, usually reaching around 17 °C during the daytime (Fig. 4). The average is about 21 °C for days in February, the hottest month. May is usually the driest month, however precipitation follows a less clear pattern when compared to the annual temperature patterns. Two seasonal peaks are usually associated with rainfall, around April and then again around October. Annual rainfall here is usually between 550 to 950mm.

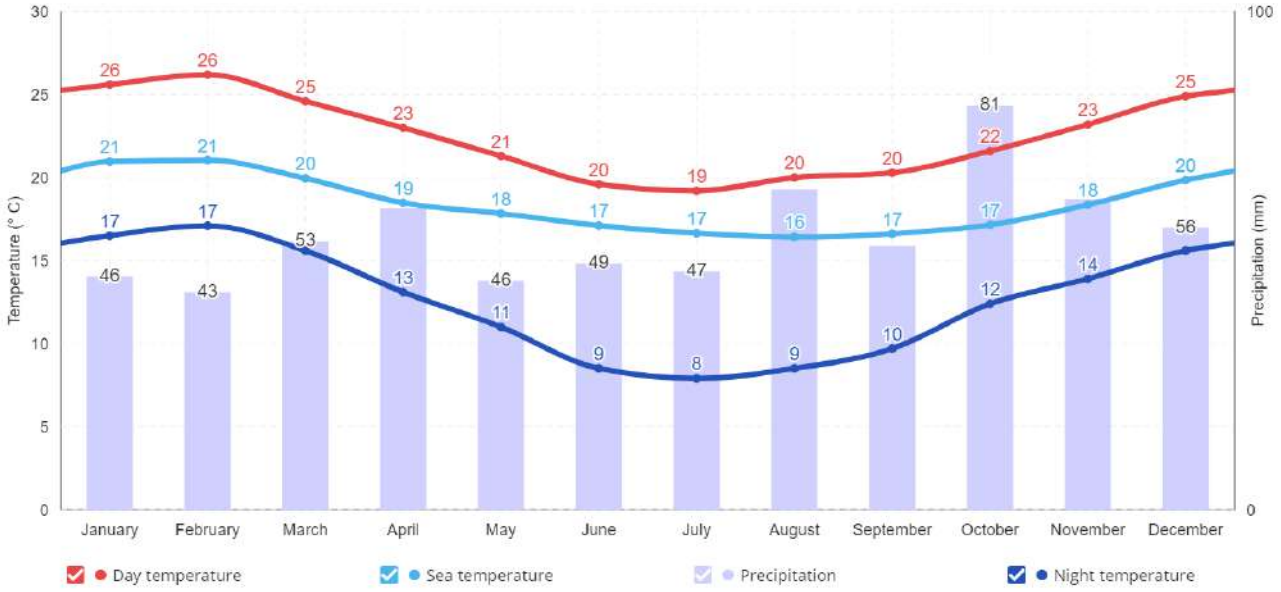


Figure 4: Climate data for Knysna, illustrating four aspects of the climate by month. This graph is sourced from Sunheron.

4.1.2 Geology and Soil

The rocks of the Knysna Basin and surrounding areas belong to the following categories (Knysna Geology article):

- Kaaimans Group – metamorphic rocks (schist, phyllite, quartzite and minor limestone)
- Cape Granite which intruded the Kaaimans rocks
- Cape Supergroup – fluvial and marine sediments (sandstone and shale)
- Table Mountain Group – mainly sandstone
- Bokkeveld Group – alternating sandstone and shale
- Uitenhage Group
- Enon – red-stained conglomerate and minor shales
- Kirkwood - sandstones
- Grahamstown Formation – remnants of the African Erosion Surface (i.e. duricrusts composed of silcrete and/or ferricrete)
- Algoa Formation – wind-blown dune fields and shallow marine sediments

According to Cape Farm Mapper (CFM) the soils of the site should have a strong textural contrast along the soil profile, and do not have a red B horizon. On CFM, the soils for the area are described as prismatocutanic and / or pedocutanic, with a high eridibility factor (0.65).

4.1.3 Vegetation Type(s)

The vegetation that is mapped for Erf 7614 according to the 2018 National Vegetation map is Garden Route Shale Fynbos (FFh 9). This vegetation type used to be listed as vulnerable (VU), but due to ongoing disturbance and habitat loss, its status has changed to endangered (EN) since November 2022. Garden Route Shale Fynbos is associated with undulating hills and moderately undulating plains (Mucina & Rutherford, 2006). The most important taxa for this vegetation type according to Mucina & Rutherford (2006) is (green entries are species confirmed on and around the site, while blue entries are when the genus was present):

Tall shrubs:

- *Leucadendron eucalyptifolium*
- *Leucospermum formosum*
- *Metalasia densa*
- P*. coronata*
- *Passerina corymbosa*
- *Protea aurea* subsp. *aurea*
- *Protea neriifolia*
- *Searsia lucida*

Low Shrubs:

- *Acmadenia alternifolia*
- *Acmadenia tetragona*
- *Anthospermum aethiopicum*
- *Cliffortia ruscifolia*
- *Elytropappus rhinocerotis*
- *Erica hispidula*
- *Helichrysum cymosum*
- *Leucadendron salignum*
- *Pelargonium cordifolium*
- *Phylica axillaris,*
- *P. pinea*
- *Psoralea monophylla,*
- *Selago corymbosa*

Herbaceous, Succulents herbs, & geophytes:

- *Crassula orbicularis*
- *Crassula roggeveldii*
- *Eriospermum vermiforme*
- *Helichrysum felinum*
- *Pteridium aquilinum*
- *Cyphia georgica* (endemic)
- *Disa newdigateae* (endemic)
- *Gladiolus roseovenosus* (endemic)

Graminoids:

- *Aristida junciformis* subsp. *galpinii*
- *Brachiaria serrata*
- *Cymbopogon marginatus*
- *Elegia juncea*
- *Eragrostis capensis,*
- *Ischyrolepis gaudichaudiana*
- *Ischyrolepis sieberi*
- *Restio triticeus*
- *Themeda triandra,*
- *Tristachya leucothrix*

The Vlok vegetation map has slightly more detail than the 2018 National vegetation map for Erf 7614 (Fig. 5), indicating that the Erf is mostly Groenvlei Coastal Forest, with a section mapped as Groot Brak River and Floodplain vegetation.

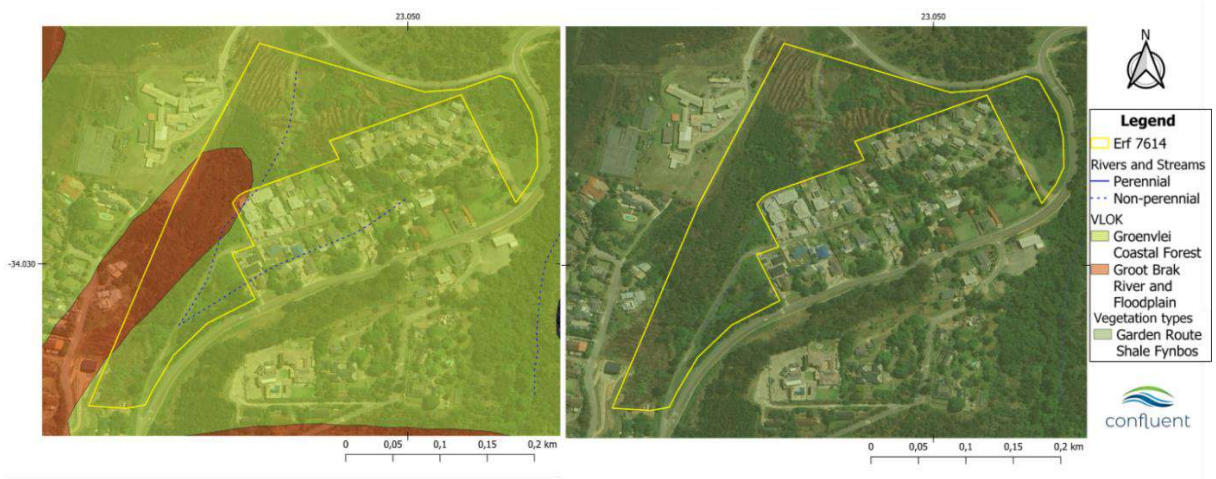


Figure 5: The mapped vegetation type according to the 2018 National Vegetation Map of South Africa (Left; Dayaram et al., 2019; Mucina & Ruthfarmord, 2006) and the Vlok vegetation map categories (Right) for Farm RE/236 and the surrounding area.

4.1.4 Western Cape Biodiversity Spatial Plan

The Biodiversity Spatial Plan for the Western Cape (WC BSP) does not include Erf 7614. Nearby, however terrestrial critical biodiversity areas (CBA1) and ecological support areas (ESA 1 & 2) are mapped (Fig. 6). Despite not being mapped on the BSP plan, the site does form part of a wider connected open landscape, albeit being heavily transformed.

Figure 6: The mapped Western Cape Biodiversity Spatial Plan (WC BSP) categories that have been mapped for Erf 7614.

4.1.5 Historical Aerial Imagery

High resolution historical imagery (Fig. 7) can be sourced upon request from the CD: NGI Geospatial portal, or from their offices in Mowbray, Cape Town. Google Earth is also a repository of more recent historical images. Over at least the last 87 years the site has been heavily disturbed. In 1936 the whole site seemed to be cleared with a road crossing over the southern corner of the site to the adjacent property. In 1968 the adjacent property to the north-west was a quarry, however parts of Erf 7614 seemed to have revegetated spontaneously – likely mostly with invasive and alien species. In 1973 four houses were present in the northern section of the site. The southern section of Erf 7614 was still cleared of vegetation with no signs of any other disturbance. The eastern portion of the Erf also had some sections cleared of vegetation

In 1989 the whole site seems to be revegetated excluding the plot with the four houses and a small section in the southeast. In 2003 a fifth structure appears in the southern section of the property. The remainder of the site relatively unchanged. In 2010 the area around the four houses had revegetated, likely with invasive vegetation. In 2013 all existing structures on the

site were demolished. In 2016 most of the property had spontaneously revegetated with a small section in the south that remained cleared. By 2020 the majority of the property was visibly taken over with invasive alien vegetation. Recently (2022), a relatively substantial attempt was made to clear the northern section of the site of the black wattle (*Acacia mearnsii*) invasion. The site visit in 2024 revealed that the cleared sections of the site have subsequently been reinvaded once more.

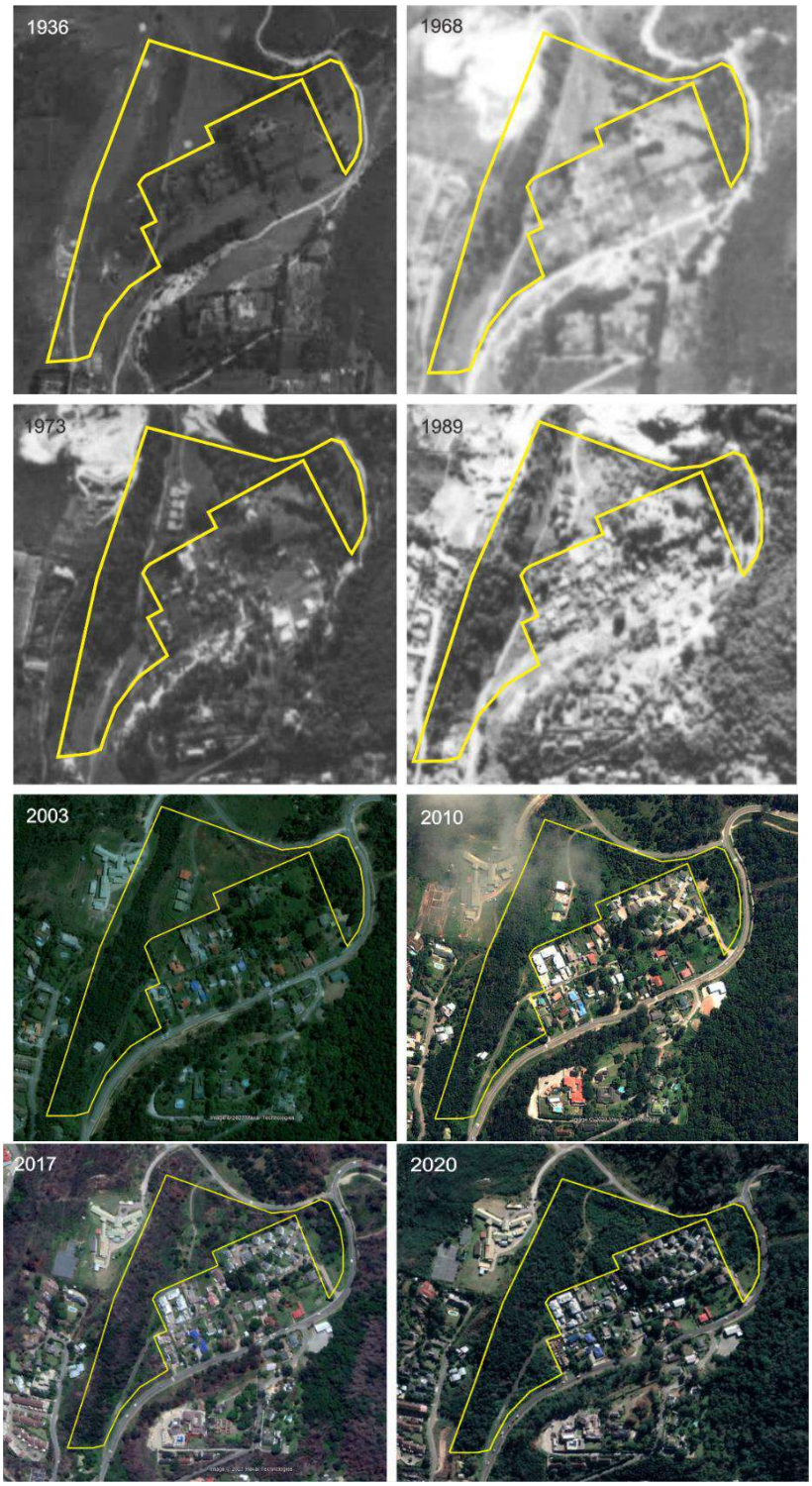


Figure 7: A series of historical imagery sourced from the CD: NGI geospatial portal (top two rows) and Google Earth (bottom two rows).

4.2 Plant Species

The plant species theme sensitivity of Medium is dependent on the presence, or likely presence, of several plant species of conservation concern (SCC). The Red List categories are discussed later in the report.

4.2.1 Species of Conservation Concern (SCC) Listed in the Screening Tool.

Several SCC have the potential to occur on the site and include the following:

- *Acmadenia alternifolia*
- *Acrolophia lunata*
- *Amauropelta knysnaensis*
- *Leucospermum glabrum*
- *Erica glandulosa fourcadei*
- *Erica glumiflora*
- *Faurea macnaughtonii*
- *Mimetes pauciflorus*
- *Muraltia knysnaensis*
- *Ocotea bullata*
- *Osteospermum pterigoideum*
- *Pterygodium cleistogamum*
- *Pterygodium newdigiteae*
- *Ruschia duthiae*
- *Selago burchellii*
- Sensitive species 419
- Sensitive species 763
- Sensitive species 1024
- Sensitive species 1081

4.2.2 Additional SCC that have been Observed Nearby on iNaturalist

- *Agathosma acutissima*
- *Brunsvigia josephonae*
- *Curtisia dentata*
- *Dioscorea mundii*
- *Gnidia chrysophylla*
- *Hermannia lavandulifolia*
- *Leucadendron conicum*
- *Oxalis pendulifolia*
- *Protea susannae*
- Sensitive species (unknown number #1)
- Sensitive species 1032

5. RESULTS: FIELD ASSESSMENT

5.1 Refined Vegetation Map & Species Observed

The majority of the site is heavily invaded by a host of alien species (Fig. 8). The bulk biomass of alien vegetation on the site is black wattles (*Acacia mearnsii*). A list of all listed and invasive species found on the site is in the species list for the site, which is provided in appendix 9.1. The vegetation map in Fig. 8 illustrates the areas where recent alien clearing efforts have taken place, although these areas have subsequently become reinvaded and have a lot of old slash material – which can smother the regrowth of indigenous plants (Fig. 9). A summary of the invasive species categories defined in NEMBA is provided in Box 1. The northern half of the site also has a very large wetland, which extends outside of Erf 7614 to the north. The water from this wetland forms a small stream which is directed under a section of the residential developments that are in the middle of Erf 7614 (Fig. 9). The stream then exits again from the residential development, and forms part of the drainage line in the south.

The entire site represents transformed vegetation, with very isolated indigenous thicket / forest vegetation observed mostly on the north-eastern portion of the site north of the overgrown lawn there (Fig. 9). This is also the only section of the site where protected tree seedlings were observed, namely one real yellowwood (*Podocarpus latifolius;* Lat: -34.028532 Lon: 23.05119) and one Outeniqua yellowwood seedling (*Afrocarpus falcatus;* Lat: -34.028217 Lon: 23.05139). One very large milkwood tree (*Sideroxylon inerme inerme*; Lat: -34.028242 Lon: 23.05104) was also observed on the site, and this tree must remain protected on the site. Apart from the protected trees, no other species of conservation concern were identified, and no Red Listed plant species were found on the site.

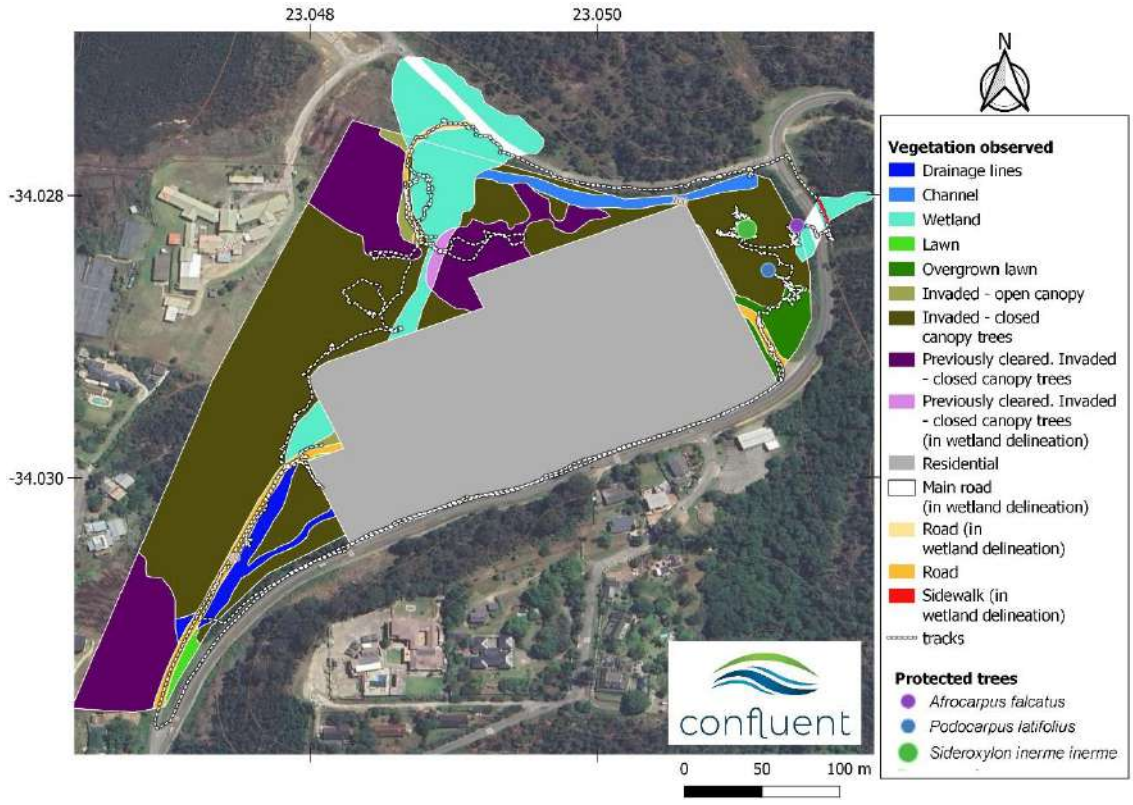


Figure 8: A revised vegetation map for Erf 7614, with the track walked and the protected trees observed indicated as dots.

Figure 9: An image illustrating the two yellowwood seedlings, large milkwood tree that were found on the site, and other landscape photos showing the state of the vegetation on Erf 7614.

BOX 1: NEMBA categories for listed invasive alien plants.

Category 1a

- Species which must be combatted or eradicated.
- Immediate steps must be taken to eradicate and combat or eradicate.
- Authorised officials must be permitted to enter properties to monitor, assist with or implement the combatting or eradication.
- If an Invasive Species Management Programme has been developed, a person must combat or eradicate the listed invasive species in accordance with such programme.

Category 1b

- Species which must be controlled.
- Property owners and organs of state must control the listed invasive species within their properties.
- If an Invasive Species Management Programme has been developed, a person must control the listed invasive species in accordance with such programme.
- Authorised officials must be permitted to enter properties to monitor, assist with or implement the control of listed species.
- Any Category 2 listed species (where permits are applicable) which fall outside of containment and control, revert to Category 1b and must be controlled.
- Any Category 3 listed species which occur within a Protected Area or Riparian (wetland) revert to Category 1b and must be controlled.
- The Minister may require any person to develop a Category 1b Control Plan for one or more Category 1b species occurring on a property.

Category 2

Any species listed under Category 2 requires a permit issued by the Department of Forestry, Fisheries and the Environment (DFFE) to carry out a restricted activity (See Permit Applications.)

- A permit is required to carry out any restricted activity.
- No person may carry out a restricted activity in respect of a Category 2 listed invasive species without a permit.
- A person in control of a Category 2 listed species must take all necessary measures to ensure that specimens of the species do not spread outside of the land or area, such as an aviary) specified in the permit.

Category 3

- Category 3 listed invasive species are subject to certain exemptions in terms of section 70(1)(a) of the NEMBA Act, which applies to the listing of alien invasive species.
- Any category 3 listed plant species that occurs in riparian areas must be considered as category 1b and the appropriate control measures instituted.

5.2 Additional SCC that may be Found

All SCC that may be present on the site have been identified using the screening tool report for the site, iNaturalist nearby observations, and the POSA database (Table 4). The current state of vegetation on the farm made it likely that numerous species were missed during the site assessment. All SCC that have been observed nearby on iNaturalist and POSA have been captured by the DFFE screening tool. The probability of occurrence that is stated in this section is a subjective assessment of SCC likelihood on the site. No SCC – apart from the yellowwood seedlings confirmed on the site – are suspected to occur on the site. The three species with a medium probability of occurrence have been spotted in transformed landscapes, and they can't be entirely ruled out on the site, although the likelihood of their occurrence is still quite low given that the search effort during the site assessment.

Table 4: All plant SCC and protected species flagged for the site and nearby surroundings, and their probability of occurrence on the site.

Species	Common name	Family	Growth form	Source	Status	Probability of occurrence
Afrocarpus falcatus	Outeniqua yellowwood	Podocarpaceae	Tree	DFFE Screening tool	Protected tree no. 16	**Confirmed** This species was found on the site
Podocarpus latifolius	Broad-leaved yellowwood	Podocarpaceae	Tree	DFFE Screening tool	Protected tree no. 18	**Confirmed** This species was found on the site.
Curtisia dentata	Assegai tree	Curtisiaceae	Tree	iNaturalist	Protected tree 570; Near Threatened A2d	**Medium** Following the precautionary principle, it is conceivable that this species might be on the site. However, this is not highly likely as the site is very transformed & invaded.
Hermannia lavandulifolia	Lavender-leaved dollrose	Malvaceae	Herbaceous perennial	iNaturalist	Vulnerable A2c	**Medium** Following the precautionary principle, it is conceivable that this species might be on the site. However, this is not highly likely as the site is very transformed & invaded.
Oxalis pendulifolia	Hangleaf sorrel	Oxalidaceae	Herbaceous perennial	iNaturalist	Near Threatened B1ab(ii,iii,iv,v)+2ab(ii,iii,iv,v)	**Medium** Following the precautionary principle, it is conceivable that this species might be on the site. However, this is not highly likely as the site is very transformed & invaded.
Acrolophia lunata	Pale Cinderella Orchid	Orchidaceae	Geophyte	DFFE Screening tool	Endangered B1ab(ii,iii,v); D	**Low** The state of the habitat & vegetation makes it unlikely that this species would be there.
Amauropelta knysnaensis	Knysna wood fern	Thelypteridaceae	Shrub fern	DFFE Screening tool	Vulnerable D2	**Low** The state of the habitat & vegetation makes it unlikely that this species would be there.
Dioscorea mundii	Cinnamon vine	Dioscoreaceae	Climbing tuberous geophyte	iNaturalist	Near Threatened B1ab(ii,iii,iv,v)	**Low** The state of the habitat & vegetation makes it unlikely that this species would be there.
Erica glandulosa subsp. fourcadei	Ridges glandular heath	Ericaceae	Shrub	DFFE Screening tool	Vulnerable B1ab(ii,iii,iv,v)	**Low** The state of the habitat & vegetation makes it unlikely that this species would be there.

Faurea macnaughtonii	Beukeboom	Proteaceae	Small tree	DFFE Screening tool	Rare	**Low** The state of the habitat & vegetation makes it unlikely that this species would be there.
Gnidia chrysophylla	Gold capesaffron	Thymelaceae	Perennial	iNaturalist	Near Threatened B1ab(i,ii,iii,iv,v)	**Low** The state of the habitat & vegetation makes it unlikely that this species would be there.
Muraltia knysnaensis	Garden Route purplegorse	Polygalaceae	Perennial	DFFE Screening tool	Endangered B1ab(ii,iii,iv,v)	**Low** The state of the habitat & vegetation makes it unlikely that this species would be there.
Ocotea bullata	Stinkwood	Lauraceae	Tree	DFFE Screening tool	Protected tree 118; Endangered A2bd	**Low** The state of the habitat & vegetation makes it unlikely that this species would be there.
Osteospermum pterigoideam	Boneseed daisies	Asteraceae	Shrub	DFFE Screening tool	Endangered B1ab(ii,iii,v)+2ab(ii,iii,v)	**Low** The state of the habitat & vegetation makes it unlikely that this species would be there.
Pterygodium cleistogamum	Blind bonnet	Orchidaceae	Geophyte	DFFE Screening tool	Vulnerable B1ab(ii,iii)	**Low** The state of the habitat & vegetation makes it unlikely that this species would be there.
Ruschia duthiae	Tentfigs	Aizoaceae	Succulent	DFFE Screening Tool	Vulnerable B1ab(ii,iii,iv,v)+2ab(ii,iii,iv,v)	**Low** The state of the habitat & vegetation makes it unlikely that this species would be there.
Selago burchellii	Garden route bitterbush	Scrophularicaceae	Herbaceous perennial	DFFE Screening tool	Vulnerable B1ab(ii,iii,iv,v)	**Low** The state of the habitat & vegetation makes it unlikely that this species would be there.
Sensitive species (unknown number #01)	-	-	-	iNaturalist	Vulnerable A2cd	**Low** The state of the habitat & vegetation makes it unlikely that this species would be there.
Sensitive species 419	-	-	-	DFFE Screening tool	Vulnerable B1ab(iii,v)+2ab(iii,v)	**Low** The state of the habitat & vegetation makes it unlikely that this species would be there.
Sensitive species 763	-	-	-	DFFE Screening tool	Vulnerable A2c	**Low** The state of the habitat & vegetation makes it unlikely that this species would be there.
Acmadenia alternifolia	Harkerville porcelainflower	Rutaceae	Dwarf shrub	DFFE Screening tool	Vulnerable B1ab(ii,iii,iv)+2ab(ii,iii,iv)"	**Very Low** Habitat not correct & too transformed
Agathosma acutissima	Buchu species	Rutaceae	Shrub	iNaturalist	Vulnerable D2	**Very Low** Habitat not correct & too transformed
Erica glumiflora	Gloomy heath	Ericaceae	Shrub	DFFE Screening Tool	Vulnerable B1ab(i,ii,iii,iv,v)	**Very Low** Habitat not correct & too transformed
Leucadendron conicum	Garden Route conebush	Proteaceae	Shrub-Tree	iNaturalist	Near Threatened A4c	**Very Low** Habitat not correct & too transformed
Leucospermum glabrum	Outeniqua pincushion	Proteaceae	Shrub	DFFE Screening tool	Endangered B1ab(iii,v)c(iv)+2ab(iii,v)c(iv); C2a(i)	**Very Low** Habitat not correct & too transformed
Mimetes pauciflorus	Treeflower pagoda	Proteaceae	Shrub	DFFE Screening tool	Vulnerable A2c+3c+4c	**Very Low** Habitat not correct & too transformed

Protea susannae	Stink-leaf Protea	Proteaceae	Shrub	iNaturalist	Near Threatened A2c+3c+4c	**Very Low** Habitat not correct & too transformed
Pterygodium newdigiteae	Bonnet species	Orchidaceae	Geophyte	DFFE Screening tool	Critically Endangered (Possibly Extinct)	**Very Low** Habitat not correct & too transformed
Sensitive species (unknown number #02)	-	-	-	iNaturalist	Vulnerable A2c; C2a(i)	**Very Low** Habitat not correct & too transformed
Sensitive species 1024	-	-	-	DFFE Screening tool	Endangered B1ab(iii,v)+2 ab(iii,v); C2a(ii)	**Very Low** Habitat not correct & too transformed
Sensitive species 1032	-	-	-	iNaturalist	Vulnerable C2a(i)	**Very Low** Habitat not correct & too transformed
Sensitive species 1081	-	-	-	DFFE Screening tool	Endangered B1ab(i,ii,iii,iv ,v)	**Very Low** Habitat not correct & too transformed

6. SITE SENSITIVITY VERIFICATION

6.1 Terrestrial Biodiversity

Erf 7614 is mostly extremely disturbed with high density and severe alien plant invasions across the site. The wetland, drainage lines, and their associated buffers on the site should be avoided (see the aquatic specialist report). Only one rather isolated section of less invaded thicket remains on the site in the north-eastern part of the Erf directly below Rio Road. No part of the site is part of the mapped BSP layers, nor does the site represent significant natural habitat. Given the findings on this report, the terrestrial biodiversity theme of the site is confirmed to have a **Low** sensitivity.

6.2 Botanical Diversity

Two protected yellowwood seedlings were found on the site (*Podocarpus latifolius* and *Afrocarpus falcatus*). Although protected, neither of these species are threatened as per the SANBI Red List. No other Red Listed plant SCC were observed or are expected to occur on the site. If an appropriate forestry license is obtained for the yellowwood seedlings, and they are retained somewhere on Erf 7614, then the development will not negatively affect the plant species on the site. The site is also very heavily invaded, and the habitats transformed. The plant species theme has a **Low** sensitivity.

7. CONCLUSION & RECOMMENDATIONS

Due to the confirmed Low sensitivity ratings for both the Terrestrial Biodiversity and Terrestrial Plant Species themes, this report serves as a compliance statement for these two themes. This report remains a compliance statement with the 2024 revision of the SDP. Should the type of development change, this compliance statement would no longer be valid, however due to the minimal change presented by the new SDP, this compliance statement is still valid. The site is heavily invaded and will require ongoing alien clearing. Some mitigation for the proposed development on Erf 7614 is listed below:

1. Alien clearing is to continue outside of the proposed development footprint in clear management blocks. All alien clearing needs to occur in a planned manner on the site as per an alien management and eradication plan.

a. Invasive species in the wetland and drainage lines on Erf 7614, like bugweed (*Solanum mauritianum*), black wattles (*Acacia mearnsii*), and canna lilies (*Canna* x *generalis* cf. *indica*), must have first priority for alien clearing efforts on the site.

b. Areas that have recently been cleared of aliens need to be prioritised as the second highest priority areas of alien clearing effort.

c. Invaded areas that are cleared outside of the proposed development area on Erf 7614 must be planted naturally occurring thicket / forest species.

2. Old & new piles of slash material may not be disposed in the wetland and drainage lines. Old slash must be disposed of responsibly and can't be left on the site.
3. All new slash material from alien clearing needs to be piled and then removed from the site and disposed of adequately or, alternatively, could be sold for firewood.
4. Trash must be cleared on the site and disposed of appropriately.
5. Any development that will affect the yellowwood seedlings found on the site will require the appropriate forestry licence to move or disturb these tree species in any way.
6. If a forestry license is obtained, then the yellowwood seedlings within the development footprint must be relocated elsewhere on Erf 7614, where they will have a reasonable likelihood of survival and chance to mature. The large Milkwood tree on the site must be avoided entirely, so that the development may only occur around the tree (see Fig. 10).

Figure 10: An example of a construction site with protected and other indigenous trees marked and sectioned off from the rest of the construction site. Each tree and box was marked, and interesting facts about the species and its ecology was provided on the construction site.

8. REFERENCES

National Environmental Management Act, 1998 (Act No. 107 of 1998): Procedures for assessment and minimum criteria for reporting on identified environmental themes when applying for environmental authorisation, Government Gazette of South Africa (2020).

CapeNature. (2017). *An overview of the Western Cape Biodiversity Spatial Plan*. https://www.capenature.co.za/wp-content/uploads/2019/10/A-Summary-Overview-of-the-Biodiversity-Spatial-Plan_web.pdf

Cowling, R. M., Knight, A. T., Privett, S. D. J., & Sharma, G. (2010). Invest in opportunity, not inventory of hotspots. In *Conservation Biology* (Vol. 24, Issue 2). https://doi.org/10.1111/j.1523-1739.2009.01342.x

Dayaram, A., Harris, L. R., Grobler, B. A., Van Der Merwe, S., Rebelo, A. G., Powrie, L. W., Vlok, J. H. J., Desmet, P. G., Qabaqaba, M., Hlahane, K. M., & Skowno, A. L. (2019). Vegetation map of South Africa, Lesotho and Swaziland 2018: A description of changes since 2006. *Bothalia*, *49*(1), a2452. https://doi.org/10.4102/ABC.V49I1.2452

de Villiers, C., Holmes, P., Rebelo, T., Helme, N., Brown, D.-E., Clark, B., Milton, S., Dean, W. R., Brownlie, S., Snaddon, K., Day, L., Ollis, D., Job, N., Dorse, C., Wood, J., Harrison, J., Palmer, G., Cadman, M., Maree, K., … Driver, A. (2016). *Ecosystem Guidelines for Environmental Assessment in the Western Cape* (M. Cadman, Ed.; 2nd ed.). Fynbos Forum.

Garrard, G. E., Bekessy, S. A., McCarthy, M. A., & Wintle, B. A. (2008). When have we looked hard enough? A novel method for setting minimum survey effort protocols for flora surveys. *Austral Ecology*, *33*(8), 986–998. https://doi.org/10.1111/J.1442-9993.2008.01869.X

Mucina, L., & Rutherford, M. C. (2006). *The Vegetation of South Africa, Lesotho and Swaziland*. Strelitzia.

NEM:BA Act, 2004 (Act no. 10 of 2004). (2022). *The Revised National List of Ecosystems that are Threatened and in Need of Protection.* www.gpwonline.co.za

Perret, J., Besnard, A., Charpentier, A., & Papuga, G. (2023). Plants stand still but hide: Imperfect and heterogeneous detection is the rule when counting plants. *Journal of Ecology*, 1–14. https://doi.org/10.1111/1365-2745.14110

Pierce, S. M., & Mader, A. D. (2006). *The Subtropical Thicket Ecosystem Programme Handbook: Integrating the natural environment into land-use decisions at the municipal level: towards sustainable development* (2nd ed.).

Pool-Sandvliet, R., Duffel-Canham, A., Pence, G., & Smart, R. (2017). *Western Cape Biodiversity Spatial Plan Handbook*.

Privett, S. D. J., Cowling, R. M., & Taylor, H. C. (2001). Thirty years of change in the fynbos vegetation of the Cape of Good Hope Nature Reserve, South Africa. *Bothalia*, *31*(1), 99–115. https://doi.org/10.4102/abc.v31i1.509

Skowno, A. L., Poole, C. J., Raimondo, D. C., Sink, K. J., van Deventer, H., van Niekerk, L., Harris, L. R., Smith-Adao, L. B., Tolley, K. A., Zengeya, T. A., Foden, W. B., Midgley, G. F., Driver, A., Adams, J. B., Adams, R., da Silva, J. M., Fizzotti, B., Jansen van Vuuren, B., Kelly, C., … Whitehead, T. O. (2018). *National Biodiversity Assessment 2018: The status of South Africa's ecosystems and biodiversity*.

Stewart, W., Bahindwa, A., Adams, A., Daniels, F., Nzimande, M., Job, N., Dabrowski, J., Ollis, D., & Palmer, R. (2021). *Environmental Assessment Guideline for Ecosystem-related aspects of the Terrestrial Biodiversity and Aquatic Biodiversity Protocols: Final Draft*.

Verburgt, L., McCleland, W., McKenzie, D., Laurence, S., Niemand, L., & Raimondo, D. (2020). *Species Environmental Assessment Guideline: Guidelines for the implementation of the Terrestrial Flora (3c) & Terrestrial Fauna (3d) Species Protocols for environmental impact assessments in South Africa.* SANBI. http://opus.sanbi.org:80/jspui/handle/20.500.12143/6922

Wintle, B. A., Walshe, T. v., Parris, K. M., & Mccarthy, M. A. (2012). Designing occupancy surveys and interpreting non-detection when observations are imperfect. *Diversity and Distributions*, *18*(4), 417–424. https://doi.org/10.1111/J.1472-4642.2011.00874.X

9. APPENDIX

9.1 Provisional Plant Species List

A species accumulation curve for all the species recorded on the site during the assessment are presented in Fig. 11. All species that were observed during the site visit are in Table 5. The site assessment species list is not exhaustive.

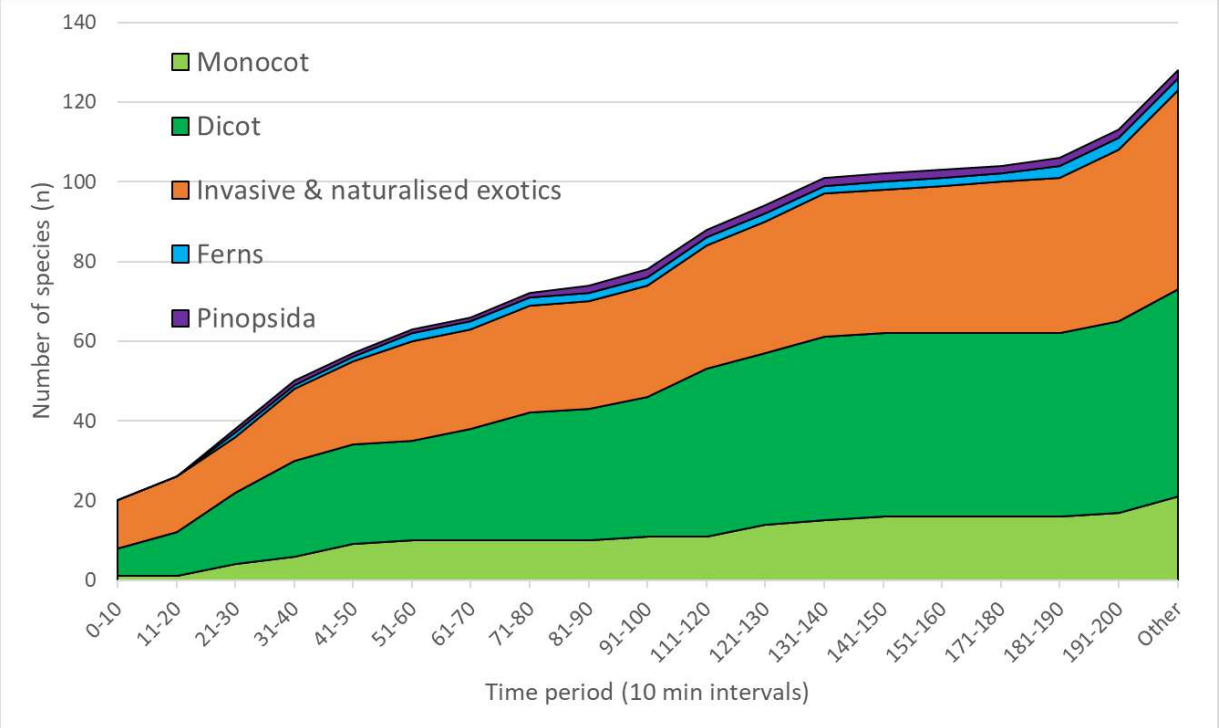


Figure 11: A plant species accumulation curve for the site assessment.

Table 5: A provisional species list made for plants found during the site assessment on Erf 7614. The orange species are naturalised exotic plants, and red rows are listed invasive species. In green are the protected tree species.

Family	Species	Common name	Information
Liliopsida (Monocots)			
Amaryllidaceae	*Agapanthus praecox*	blue lily	
Araceae	*Alocasia macrorrhizos*	giant taro	Naturalised exotic from Southeast Asia
Araceae	*Monstera deliciosa*	Swiss Cheese Plant	Naturalised exotic from Latin America
Araceae	*Zantedeschia aethiopica*	calla lily	
Asparagaceae	*Asparagus setaceus*	Common Asparagus Fern	
Asphodelaceae	*Aloe maculata*	soap aloe	
Cannaceae	*Canna x generalis cf. indica*	Garden Canna	Listed invasive plant NEMBA category 1b; CARA category 1 From South America
Commelinaceae	*Commelina benghalensis*	tropical spiderwort	
Cyperaceae	*Carex aethiopica*	True sedge species	
Cyperaceae	*Carpha glomerata*	Vlei Sedge	
Cyperaceae	*Cyperus congestus*	Purple Umbrella Sedge	
Cyperaceae	*Cyperus papyrus*	Papyrus sedge	
Cyperaceae	*Cyperus polystachyos*	Bunchy flat-sedge	
Cyperaceae	*Cyperus sp.*	flatsedges	
Cyperaceae	*Cyperus sphaerospermus*	Sedge species	
Cyperaceae	*Eleocharis limosa*	Finger Rush	
Iridaceae	*Aristea ecklonii*	Blue corn-lily	
Iridaceae	*Aristea pusilla*	Corn lily species	
Juncaceae	*Juncus effusus*	Soft Rush	
Juncaceae	*Juncus lomatophyllus*	Leafy Rush	
Juncaceae	*Juncus oxycarpus*	Lax Rush	
Poaceae	*Arundo donax*	giant reed	Listed invasive plant NEMBA category 1b; CARA category 1 From the Mediterranean
Poaceae	*Cenchrus clandestinus*	Kikuyu Grass	Listed invasive plant NEMBA category 1b; CARA category 1 From East Africa
Poaceae	*Cortaderia selloana*	Pampas Grass	Listed invasive plant NEMBA category 1b; CARA category 1 From South America
Poaceae	*Imperata cylindrica*	Cogon Grass	Naturalised exotic from Southeast Asia
Poaceae	*Setaria megaphylla*	Broadleaf Bristlegrass	Naturalised (from Southeast Africa)
Poaceae	*Stenotaphrum secundatum*	Saint Augustine grass	
Typhaceae	*Typha capensis*	Cape Bulrush	
Magnoliopsida (Dicots)			
Acanthaceae	*Thunbergia alata*	Black-eyed Susan vine	Naturalised exotic from

			East Africa
Aizoaceae	*Lampranthus multiradiatus*	Rosy Brightfig	
Amaranthaceae	*Exomis microphylla*	Brakbos	
Anacardiaceae	*Searsia chirindensis*	Red Currant-rhus	
Anacardiaceae	*Searsia lucida*	Glossy Currantrhus	
Anacardiaceae	*Searsia pyroides*	Common currant-rhus	
Anacardiaceae	*Searsia rehmanniana*	Bluntleaf Currantrhus	
Anacardiaceae	*Searsia tomentosa*	Wild currant	
Apiaceae	*Centella asiatica*	Gotu Cola	Naturalised exotic from the tropics
Apocynaceae	*Carissa bispinosa*	num-num	
Apocynaceae	*Gomphocarpus physocarpus*	balloonplant	
Apocynaceae	*Secamone alpini*	Monkey Rope	
Apocynaceae	*Vinca major*	greater periwinkle	Listed invasive plant NEMBA category 1b From the Mediterranean
Asteraceae	*Arctotheca prostrata*	Prostrate Capeweed	
Asteraceae	*Athanasia trifurcata*	Three-tooth Kanniedood	
Asteraceae	*Cineraria sp.*	Cinerarias	
Asteraceae	*Cirsium vulgare*	Bull Thistle	Listed invasive plant NEMBA category 1b; CARA category 1 From Europe, Asia, & North Africa
Asteraceae	*Delairea odorata*	Cape-ivy	
Asteraceae	*Erigeron sumatrensis*	tropical horseweed	Naturalised exotic from South America
Asteraceae	*Euryops chrysanthemoides*	Paris Daisy	
Asteraceae	*Euryops virgineus*	Virgin True-Eye	
Asteraceae	*Helichrysum cymosum*	Fume Everlasting	
Asteraceae	*Helichrysum foetidum*	Stinking Everlasting	
Asteraceae	*Helichrysum petiolare*	Licorice plant	
Asteraceae	*Helminthotheca echioides*	bristly oxtongue	Naturalised exotic from North Africa & the Mediterranean
Asteraceae	*Nidorella ivifolia*	Ivy Vleiweed	
Asteraceae	*Osteospermum moniliferum*	Bietou	
Asteraceae	*Senecio angulatus*	creeping groundsel	
Asteraceae	*Senecio ilicifolius*	Kowanna Ragwort	
Asteraceae	*Xanthium strumarium*	rough cocklebur	Listed invasive plant NEMBA category 1b; CARA category 1 From Europe & Asia
Basellaceae	*Anredera cordifolia*	Mignonette vine	Listed invasive plant NEMBA category 1b; CARA category 1 From South America
Bignoniaceae	*Tecomaria capensis*	Cape Honeysuckle	
Boraginaceae	*Wigandia urens*	fiberglass plant	Listed invasive plant NEMBA category 3 From Central America

Celastraceae	*Gymnosporia buxifolia*	Common Spikethorn	
Celastraceae	*Gymnosporia nemorosa*	White Forest Spikethorn	
Celastraceae	*Pterocelastrus tricuspidatus*	Candlewood	
Convolvulaceae	*Ipomoea cairica*	Mile-a-minute vine	Listed invasive plant NEMBA category 1b; CARA category 1 From the Tropics
Convolvulaceae	*Ipomoea indica*	oceanblue morning glory	Listed invasive plant NEMBA category 1b; CARA category 1 From the Tropics
Crassulaceae	*Crassula multicava*	Fairy Stonecrop	
Crassulaceae	*Crassula sarmentosa*	Trailing Stonecrop	
Ebenaceae	*Diospyros dichrophylla*	Poison Starapple	
Ericaceae	*Erica scabriuscula*	Grit Heath	
Euphorbiaceae	*Homalanthus populifolius*	Bleeding Heart	Listed invasive plant NEMBA category 1b From Australia
Euphorbiaceae	*Ricinus communis*	castor bean	Listed invasive plant NEMBA category 2; CARA category 2 From Tropical East Africa
Fabaceae	*Acacia mearnsii*	black wattle	Listed invasive plant NEMBA category 2; CARA category 2 From Australia
Fabaceae	*Acacia melanoxylon*	blackwood	Listed invasive plant NEMBA category 2; CARA category 2 From Australia
Fabaceae	*Lotus subbiflorus*	Hairy Bird's-foot-trefoil	Naturalised exotic from Northern Africa
Fabaceae	*Sesbania punicea*	Scarlet Sesbane	Listed invasive plant NEMBA category 1b; CARA category 1 From South America
Fabaceae	*Trifolium repens*	white clover	Naturalised exotic from Europe
Fabaceae	*Virgilia divaricata*	Gardenroute Keurboom	
Fagaceae	*Quercus robur*	English oak	Naturalised exotic from Europe
Geraniaceae	*Geranium ornithopodon*	Geranium species	
Gunneraceae	*Gunnera perpensa*	River Pumpkin	
Lamiaceae	*Coleus barbatus*	Woolly Plectranthus	
Lythraceae	*Lythrum hyssopifolia*	Hyssop Loosestrife	Listed invasive plant NEMBA category 1b From Europe
Malvaceae	*Hibiscus diversifolius*	Prickly Hibiscus	
Malvaceae	*Pavonia columella*	Pink Swampmallow	
Malvaceae	*Sida rhombifolia*	Cuban jute	Naturalised exotic from the Tropics
Meliaceae	*Melia azedarach*	Chinaberry	Listed invasive plant NEMBA cat 1b, but 3

			In urban areas. CARA category 3 From South Asia
Myrtaceae	*Eucalyptus cinerea*	Argyle apple	Naturalised exotic from Australia
Myrtaceae	*Psidium cattleyanum*	strawberry-guava	Listed invasive plant NEMBA category 1b; CARA category 3 From South America
Oleaceae	*Jasminum mesnyi*	Primrose jasmine	Naturalised exotic from Vietnam & China
Passifloraceae	*Passiflora caerulea*	Bluecrown passionflower	Listed invasive plant NEMBA category 1b; CARA category 1 From the South America
Peraceae	*Clutia pulchella*	Warty Clut	
Phytolaccaceae	*Phytolacca dioica*	Ombu	Listed invasive plant NEMBA category 3 CARA category 3 From South America
Phytolaccaceae	*Phytolacca octandra*	Inkweed	Listed invasive plant NEMBA category 1b From the Americas
Plantaginaceae	*Plantago lanceolata*	ribwort plantain	Naturalised exotic from Europe & Asia
Polygonaceae	*Persicaria decipiens*	slender knotweed	Naturalised exotic from Australia & Asia
Polygonaceae	*Persicaria madagascariensis*	Bristly Snakeroot	Naturalised exotic from Madagascar & tropical Southern Africa
Primulaceae	*Rapanea melanophloeos*	Cape beech	
Ranunculaceae	*Ranunculus multifidus*	African buttercup	
Rhamnaceae	*Scutia myrtina*	cat-thorn	
Rosaceae	*Cliffortia odorata*	No-odour Caperose	
Rosaceae	*Cliffortia strobilifera*	Cone River Caperose	
Rosaceae	*Rubus pinnatus*	South African Raspberry	
Rubiaceae	*Anthospermum aethiopicum*	Tall Flowerseed	
Rubiaceae	*Galopina circaeoides*	Galopina species	
Rutaceae	*Vepris lanceolata*	white-ironwood	
Sapindaceae	*Dodonaea viscosa*	Varnishleaf	Naturalised exotic from Australia
Sapotaceae	*Sideroxylon inerme inerme*	white milkwood	Protected tree number 579
Scrophulariaceae	*Buddleja saligna*	False Olive	
Scrophulariaceae	*Selago corymbosa*	Stiff Bitterbush	
Simaroubaceae	*Ailanthus altissima*	tree-of-heaven	Listed invasive plant NEMBA category 1b; CARA category 3 From China
Solanaceae	*Cestrum laevigatum*	inkberry	Listed invasive plant NEMBA category 1b; CARA category 1 From South America
Solanaceae	*Physalis peruviana*	Cape gooseberry	Naturalised exotic from South America

Solanaceae	*Solanum mauritianum*	bugweed	Listed invasive plant NEMBA category 1b; CARA category 1 From South America
Stilbaceae	*Halleria lucida*	African honeysuckle	
Stilbaceae	*Nuxia floribunda*	Forest Elder	
Tropaeolaceae	*Tropaeolum majus cf. speciosum*	garden nasturtium	*T. speciosum* is a listed Invasive plant (NEMBA Category 3), while *T. majus* is not listed. Both spp. from South America
Urticaceae	*Laportea peduncularis*	River Nettle	
Verbenaceae	*Lantana camara*	common lantana	Listed invasive plant NEMBA category 1b; CARA category 1 From Central & South America
Verbenaceae	*Phyla nodiflora*	turkey tangle frogfruit	Naturalised exotic from North America
Verbenaceae	*Verbena bonariensis*	purpletop vervain	Listed invasive plant NEMBA category 1b From South America
Vitaceae	*Rhoicissus tomentosa*	Common Forest Grape	
Pinopsida			
Podocarpaceae	*Afrocarpus falcatus*	Outeniqua yellowwood	Protected tree number 16
Podocarpaceae	*Podocarpus latifolius*	Real yellowwood	Protected tree number 18
Polypodiopsida			
Dennstaedtiaceae	*Pteridium aquilinum capense*	Southern Bracken	
Nephrolepidaceae	*Nephrolepis cordifolia cordifolia*	Weedy Sword Fern	Listed invasive plant NEMBA category 1b From Asia & Northern Australia
Pteridaceae	*Cheilanthes viridis*	Green Cliff Brake	
Pteridaceae	*Pteris dentata*	Toothed Brake	

Lelieskloof, Erf 7614, Knysna, Western Cape

Terrestrial Animal Species Specialist Assessment:

Site Sensitivity Verification Report and Compliance Statement

Prepared For: EcoRoute
Author: Monica Leitner (MSc)
Confluent Environmental Pty (Ltd)
7 St. Johns Street,
Dormehls Drift,
George, 6529
SACNASP: Professional Natural Scientist (Ecological Sciences), 166055

Date: March 2024
Version: Final, submitted

confluent

DECLARATION OF SPECIALIST INDEPENDENCE

- I consider myself bound to the rules and ethics of the South African Council for Natural Scientific Professions (SACNASP);
- At the time of conducting the study and compiling this report I did not have any interest, hidden or otherwise, in the proposed development that this study has reference to, except for financial compensation for work done in a professional capacity;
- Work performed for this study was done in an objective manner. Even if this study results in views and findings that are not favourable to the client/applicant, I will not be affected in any manner by the outcome of any environmental process of which this report may form a part, other than being members of the general public;
- I declare that there are no circumstances that may compromise my objectivity in performing this specialist investigation. I do not necessarily object to or endorse any proposed developments, but aim to present facts, findings and recommendations based on relevant professional experience and scientific data;
- I do not have any influence over decisions made by the governing authorities;
- I undertake to disclose all material information in my possession that reasonably has or may have the potential of influencing any decision to be taken with respect to the application by a competent authority to such a relevant authority and the applicant;
- I have the necessary qualifications and guidance from professional experts in conducting specialist reports relevant to this application, including knowledge of the relevant Act, regulations and any guidelines that have relevance to the proposed activity;
- This document and all information contained herein is and will remain the intellectual property of Confluent Environmental. This document, in its entirety or any portion thereof, may not be altered in any manner or form, for any purpose without the specific and written consent of the specialist investigators.
- All the particulars furnished by me in this document are true and correct.

Monica Leitner (MSc)

January 2024

SUMMARY OF EXPERIENCE AND ABRIDGED CV - MONICA LEITNER

Core skills

- MSc. Zoology (University of Pretoria) and 5 years of work experience (project management and field work) for ecological research projects aimed at invertebrate diversity, ecological functioning, and large mammal ecology.
- Extensive ecological and field work experience (before, during and after postgraduate degrees) across a range of environments (mesic to arid savanna, grasslands and mountain terrain, sub-Antarctic) and taxa (invertebrates, avifauna, amphibians, reptiles, small mammals and large mammals).
- Two overwintering years on Marion Island, with extensive field work as Environmental Conservation Officer and seabird monitor (2018-2019), and a marine mammal ecologist (2022-2023).

Work experience

- 2022-2023: Marine mammal field assistant on sub-Antarctic Marion Island (Marion Island Marine Mammal Programme, University of Pretoria)
- 2016-2018; 2019-2022: Project Coordinator (University of Pretoria) for international Soil Fauna in Africa consortium (funded by the United Kingdom's Royal Society and Department for International Development).
- 2019-2022: Research assistant for Marion Island Marine Mammal Programme (University of Pretoria).
- 2018-2019: Environmental Conservation Officer on sub-Antarctic Marion Island (Department of Environmental Affairs).
- 2016-2018: Research assistant for Sani Pass (Drakensburg) long term invertebrate and ecosystem monitoring project (Centre for Invasion Biology, University of Pretoria).

Qualifications

- BSc. Environmental Sciences (2011, University of Pretoria)
- BSc. Honours Zoology (*with distinction*, 2012, University of Pretoria)
- MSc. Zoology (*with distinction*, 2015, University of Pretoria)

Publications

- Trisos MO, Parr CL, Davies AB, Leitner M & February EC. 2021. Mammalian herbivore movement into drought refugia has cascading effects on savanna insect communities. Journal of Animal Ecology, https://doi.org/10.1111/1365-2656.13494
- Leitner M, Davies AB, Robertson MP, Parr CL & Van Rensburg BJ. 2020. Termite mounds create heterogeneity in invertebrate communities across a savanna rainfall gradient. Biodiversity and Conservation, 29(4), pp.1427-1441
- Leitner M, Davies AB, Parr CL, Eggleton P & Robertson MP. 2018. Woody encroachment slows decomposition and termite activity in an African savanna. Global change biology, 24(6), pp.2597-2606

SACNASP Registration Professional Natural Scientist (Ecological Sciences), 166055

References

- Dr. Michelle Thompson – Former colleague on Marion Island and University of Pretoria
  M2 Environmental Connections
  Email: ml.thompson89@gmail.com; Tel: +27 71 869 9042
- Prof. Mark Robertson – Previous employer (Soil Fauna in Africa Research Consortium)
  Department of Zoology and Entomology, University of Pretoria
  E-mail: mrobertson@zoology.up.ac.za; Tel: +27 84 718 5484

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS

CBA	Critical Biodiversity Area
DFFE	Department of Forestry, Fisheries, and the Environment
ESA	Ecological Support Area
NEMA	National Environmental Management Act
SANBI	South African National Biodiversity Institute
SCC	Species of Conservation Concern
SDP	Site Development Plan
SSVR	Site Sensitivity Verification Report
WCBSP	Western Cape Biodiversity Spatial Plan

1. INTRODUCTION

Confluent Environmental Pty (Ltd) was appointed by EcoRoute to provide Terrestrial Animal Specialist inputs for the proposed development of middle-income housing on Erf 7614, called Lelieskloof, in Knysna, Western Cape.

1.1 General Site Location

Erf 7614 is located 600m to the north of Knysna's city centre and 1.2 km north from the Knysna estuary in the Western Cape (Figure 1). The property measures 5.6 hectares in size and is surrounded by urban development to varying degrees, most notably to the south nearest to the Knysna town centre. There are however a few undeveloped areas connecting the property to green/natural areas, particularly along the northern boundary.

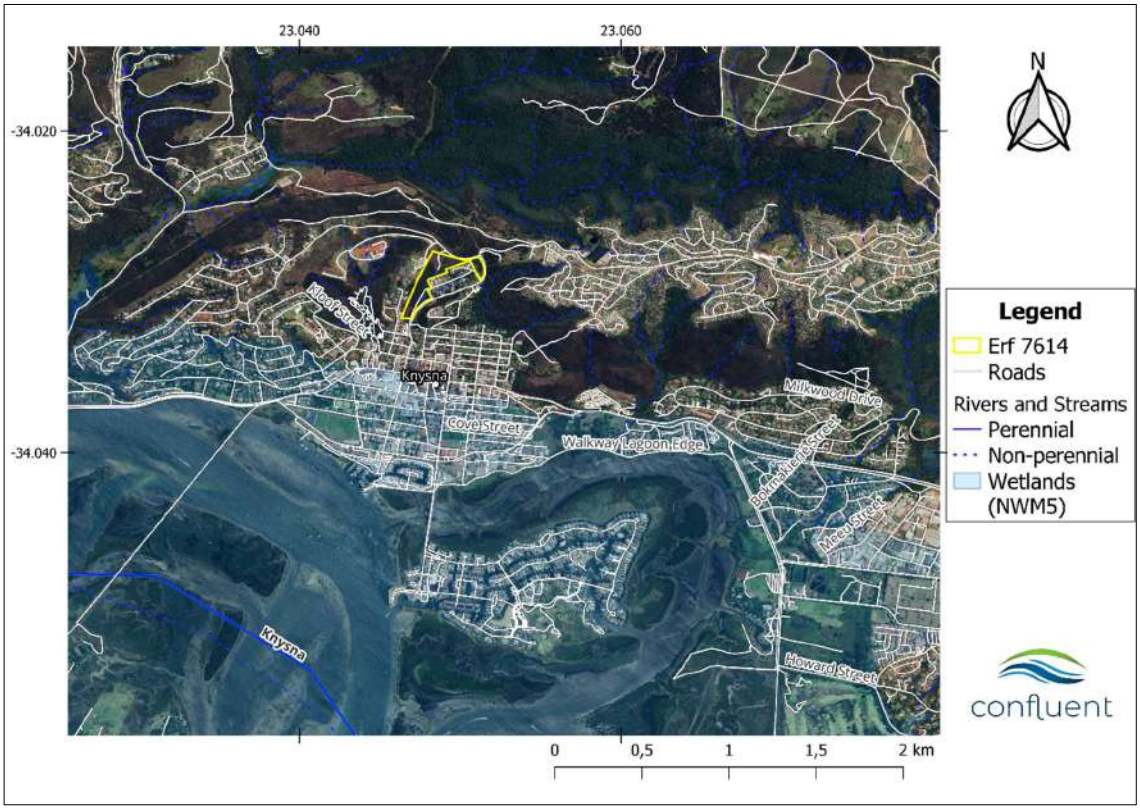


Figure 1. Erf 7614 Lelieskloof in Knysna, Western Cape.

1.2 Development Layout

The original conceptual site development plan (Figure. 2) has divided the property into six sections (A through F). The proposed development is for residential erven, and a small public open space. Areas for the proposed sections are provided in the legend of Figure 2. Since the original Site Development Plan (SDP), a revised version has been produced (Figure. 3) following the delineation of a large wetland on the site. There is no significant change to the

extent of the development because of the new SDP. The revised SDP is better from an ecological perspective.

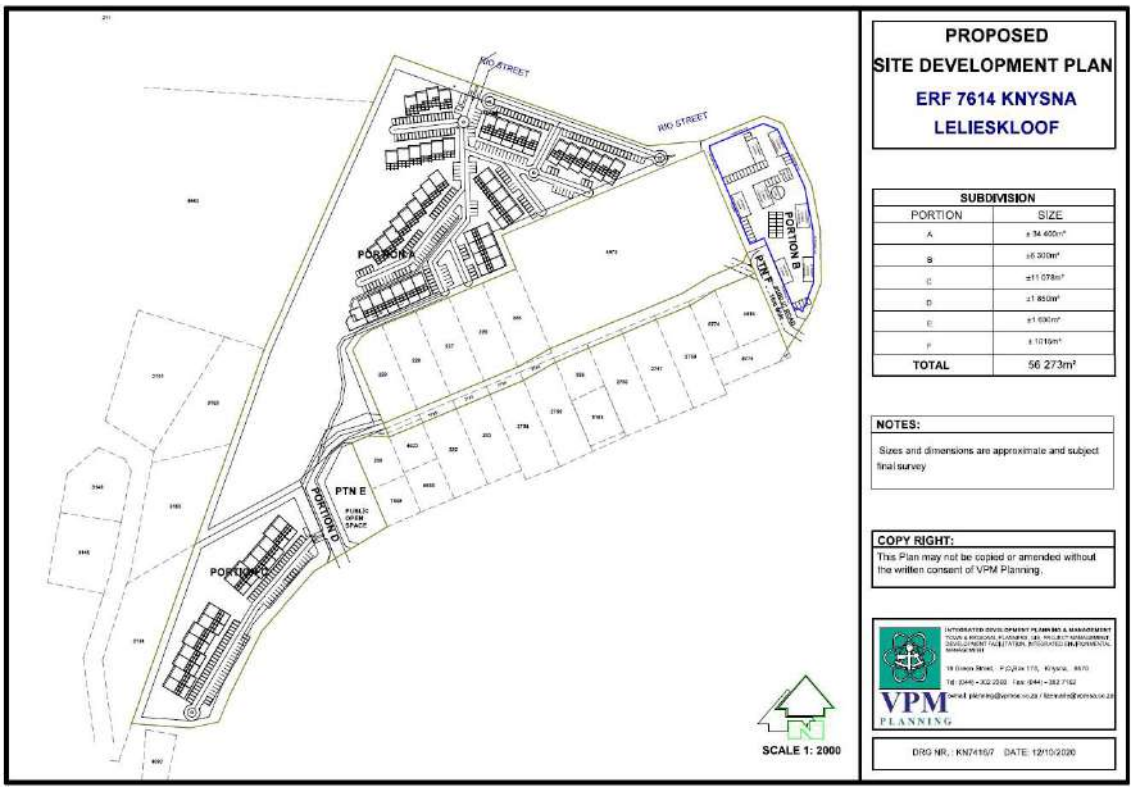


Figure 2. Original proposed site development plan for Erf 7614.

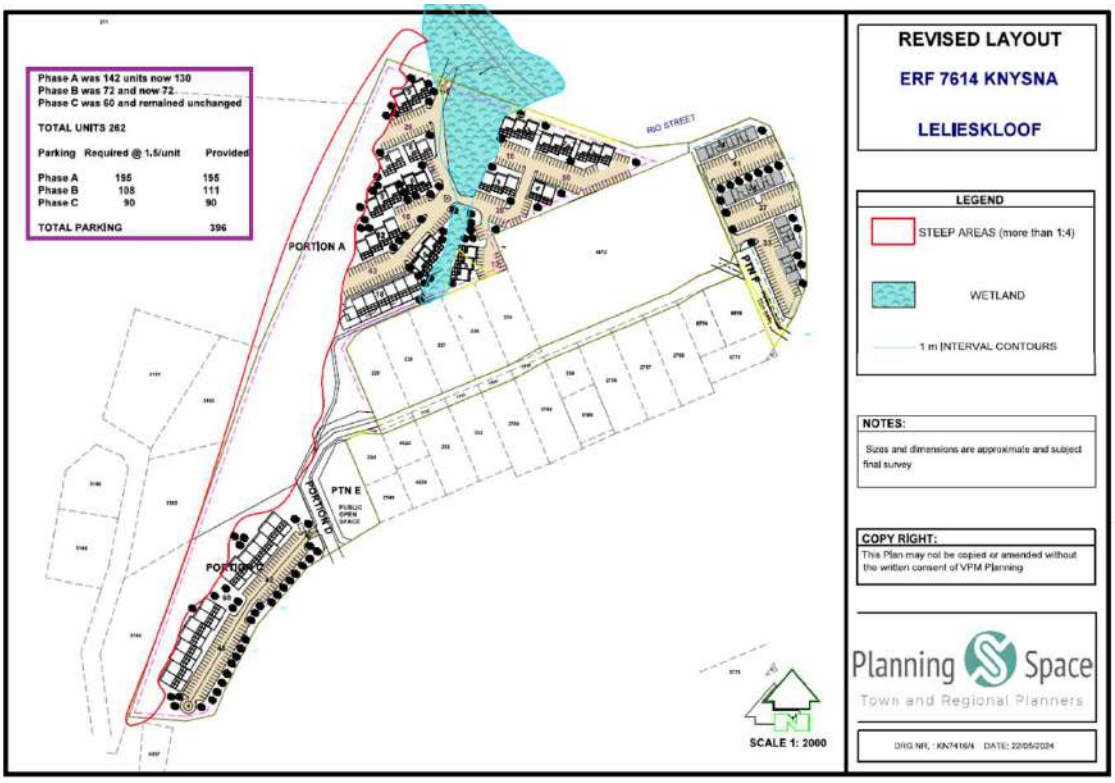


Figure 3. Revised proposed site development plan for Erf 7614. Changes from the original SDP are outlined in the purple box.

2. TERMS OF REFERENCE

2.1 Online Screening Tool

The scope of work for this report is guided by the legislative requirements of the National Environmental Management Act (NEMA; Act 107 of 1998).

The Department of Forestry, Fisheries and the Environment (DFFE) Screening Tool revealed a HIGH sensitivity for the terrestrial animal species theme across the majority of Erf 7614 as well as a few small areas highlighted as MEDIUM sensitivity (Figure 4), with several animal Species of Conservation Concern (SCC) potentially present (Table 1).

As per the Published Government Notice No. 1150 of the Government Gazette 43855 (30 October 2020):

A **HIGH** sensitivity rating for the terrestrial animal species theme indicates:

1. Confirmed habitat for SCC.

2. SCC, listed on the IUCN Red List of Threatened Species or South Africa's National Red List website as Critically Endangered, Endangered or Vulnerable, according the IUCN Red List 3.1. Categories and Criteria and under the national category of Rare.

These areas are unsuitable for development due to a very likely impact on SCC.

A **MEDIUM** sensitivity rating for the terrestrial animal species theme indicates:

1. Suspected habitat for SCC based either on historical records (prior to 2002) or being a natural area included in a habitat suitability model for this species.

2. SCC listed on the IUCN Red List of Threatened Species or South Africa's National Red List website as Critically Endangered, Endangered or Vulnerable according to the IUCN Red List 3.1. Categories and Criteria and under the national category of Rare.

Figure 4. DFFE Online Screening Tool outcome for terrestrial animal species theme. The property boundary for Erf 7614 is indicated by the blue dashed line.

Table 1. Species of Conservation Concern highlighted by the DFFE Online Screening Tool for Erf 7614.

Sensitivity	Classification	Scientific name	Common name	Red list status*
High	Avifauna	*Circus ranivorus*	Marsh Harrier	Endangered
High	Avifauna	*Circus maurus*	Black Harrier	Endangered
High	Avifauna	*Stephanoaetus coronatus*	Crowned Eagle	Vulnerable
High	Avifauna	*Bradypterus sylvaticus*	Knysna Warbler	Vulnerable
High	Avifauna	*Polemaetus bellicosus*	Martial Eagle	Endangered
High	Amphibian	*Afrixalus knysnae*	Knysna Leaf-folding Frog	Endangered
Medium	Mammal	*Chlorotalpa duthieae*	Duthie's Golden Mole	Vulnerable
Medium	Mammal	*Sensitive species 8*	-	Vulnerable

Medium	Invertebrate	*Aneuryphymus montanus*	Yellow-winged Agile Grasshopper	Vulnerable

* Red list status as per SANBI's Red List of South African Species http://speciesstatus.sanbi.org

2.2 Scope of work

The purpose of this report is to verify the site sensitivity of Erf 7614 for the terrestrial animal species theme in accordance with the protocols of Published Government Notice No. 1150, Government Gazette 43855 (30 October 2020).

The site sensitivity verification includes:

- a desktop assessment using satellite imagery
- a preliminary on-site inspection
- any other available and relevant information

Should the site sensitivity verification indicate a **LOW** sensitivity, then a Terrestrial Animal Species Compliance Statement will be issued.

Should the site sensitivity verification indicate a **HIGH** sensitivity, then a Terrestrial Animal Species Specialist Assessment must be conducted.

3. DESKTOP ASSESSMENT

3.1 Vegetation, Climate and General Habitat

Knysna in the Western Cape is situated within the Fynbos biome and experiences a temperate climate year-round (Mucina and Rutherford 2006, Rebelo, et al. 2006). The mapped vegetation type at the site is Garden Route Shale Fynbos, (FFh9; NVM, 2018), and a detailed botanical specialist assessment is available (B. Fouche, Confluent Environmental, Botanical Specialist Assessment). Average temperatures range between 28℃ and 8℃, with the hottest days experienced from January to March, peaking around 38℃, and the coldest days experienced from June-August not falling below 2℃ (Figure 5). Rain occurs throughout the year in a bimodal pattern with peaks in autumn (April) and spring (October-November) (Figure 5).

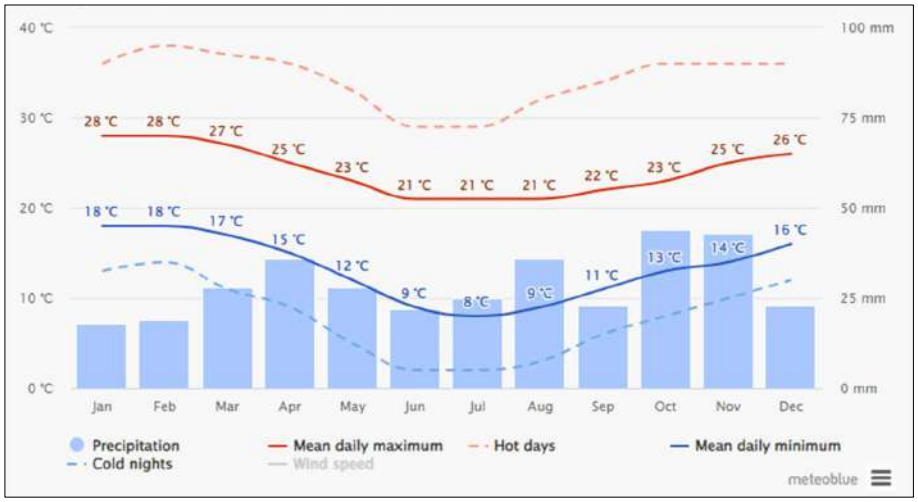


Figure 5. Summary of historical climate (modelled) for Knysna (www.meteoblue.com).

Satellite imagery from Google Earth and Cape Farm Mapper was used to assess general vegetation structure, elevational gradients and water bodies on the site (Figure 6). Most of the property consists of dense vegetation, especially along the steep slopes in the west, with a few patches having been cleared in the south and north, suggesting the presence of alien plants and recent control measures. The north-eastern section of the property has a small patch of open vegetation, likely a maintained (mowed) entrance along the access road to the residential development bordering Erf 7614. Two drainage lines are mapped, flowing in a south-westerly direction across the property.

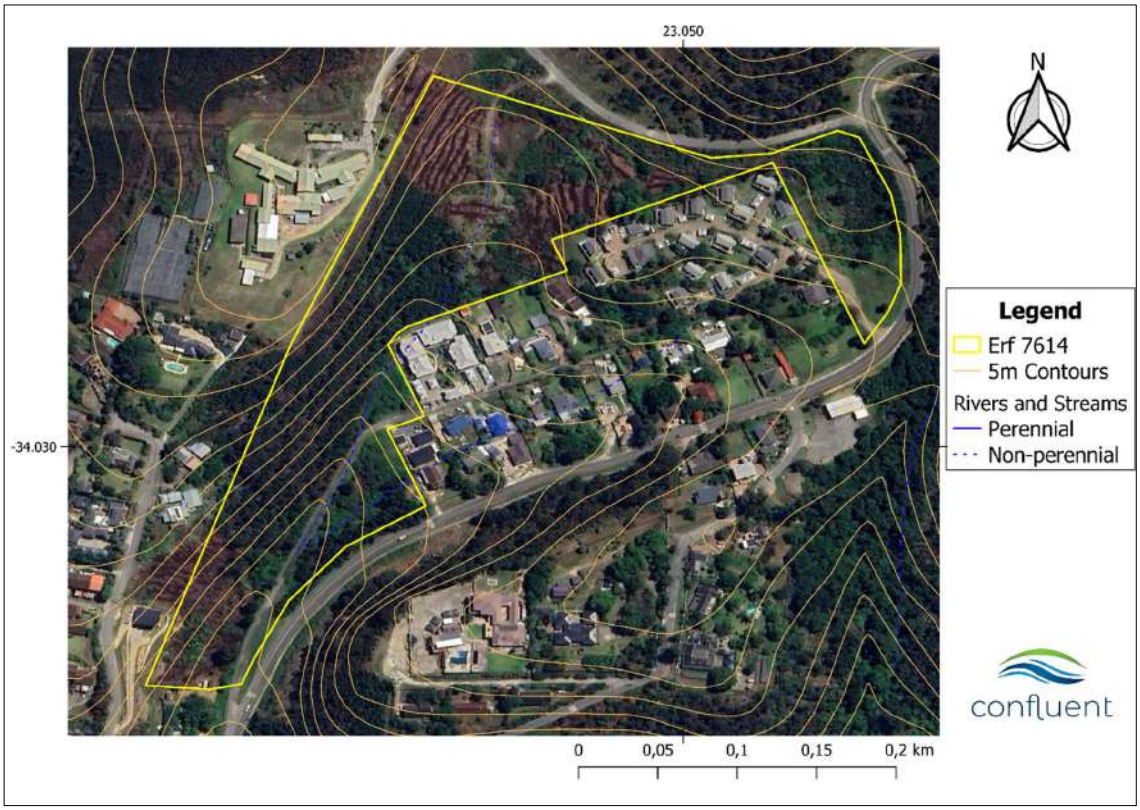


Figure 6. Satellite imagery for Erf 7614 showing topography (5m contours), vegetation structure and mapped watercourses.

3.2 Western Cape Biodiversity Spatial Plan

Additional mapping layers were applied to Erf 7614 to include wetlands (NWM5) and the Western Cape Biodiversity Spatial Plan's (CapeNature 2017) Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs) (Figure 7, Table 2). The property itself does not contain any mapped areas of concern, however, the surrounding areas are identified as CBA1, ESA1 and ESA2 due to an overlap with mapping layers for Garden Route Shale Fynbos (Endangered), Indigenous Forest Type, Rondevlei Sandplain Fynbos (Vlok variant - Critically Endangered), South Outeniqua Sandstone Fynbos (Vulnerable), Water source protection - Knysna, and Watercourse protection - South Eastern Coastal Belt.

Figure 7. Site map of Erf 7614 with layers for rivers, streams and wetlands (NWM5), and the Western Cape Biodiversity Spatial Plan's (WCBSP) Critical Biodiversity Areas (CBA1) and Ecological Support Areas (ESA1,2).

Table 2. Definitions and objectives for conservation categories identified in the Western Cape Biodiversity Spatial Plan (WCBSP) (CapeNature 2017).

WCBSP Category	Definition	Management Objective
Critical Biodiversity Area 1 (CBA 1)	Areas in a natural condition. Required to meet biodiversity targets for species, ecosystems or ecological processes and infrastructure.	Maintain in a natural or near-natural state, with no further loss of habitat. Degraded areas should be rehabilitated. Only low-

		impact, biodiversity-sensitive land uses are appropriate.
Ecological Support Area 1 (ESA 1)	Areas that are not essential for meeting biodiversity targets, but that play an important role in supporting the functioning of PAs or CBAs, and are often vital for delivering ecosystem services.	Maintain in a functional, near-natural state. Some habitat loss is acceptable, provided the underlying biodiversity objectives and ecological functioning are not compromised.
Ecological Support Area 2 (ESA 2)	Areas severely degraded or have no natural cover and ecological functioning severely impaired. Not essential for meeting biodiversity targets but support ecological functioning and delivering ecosystem services.	Restoration required to return ecological functioning. Some limited habitat loss may be acceptable. A greater range of land uses over wider areas is appropriate but ensures the underlying biodiversity objectives and ecological functioning are not compromised.

3.3 Historical Assessment of Project Area

The site appears to have been heavily disturbed over the last 87 years. In 1936 the majority of the site was cleared of vegetation and a road crosses over the southern corner to the adjacent property in the west (Figure 8).

In 1968 the adjacent property to the north-west was quarried with some activity extending into the project site. Most of the site was revegetated, likely with invasive vegetation, particularly along the steep slopes of the west and the north-eastern section, but some vegetation clearing was still taking place in the north and south of the site (Figure 8).

In 1973 four houses were present in the north of the site with an area of cleared vegetation around them. The southern area was still cleared of vegetation around the access road to the site, and the north-eastern portion seems to be marginally cleared but generally well vegetated with trees (Figure 8).

In 1989 the whole site seems to be densely vegetated, except for the northern area with the four houses and a small section in the southeastern corner of the property (Figure 8). The western steep slopes, although being mostly densely wooded, appear to have some cleared patches to the north near to the houses indicating perhaps some active management or tree thinning.

In 2003 a fifth house was constructed in the southern section of the site, and much of the vegetation was cleared in the northern section around the existing four houses, except for the steep slope along the western boundary which is more densely vegetated than before (Figure 8).

In 2010 the majority of the site became densely vegetated, most notably around the four houses which was previously cleared. An open patch is also evident in the north-east indicating a mowed/maintained patch near the access road to the houses along the eastern boundary (Figure 8).

In 2013 all five houses on the site were demolished with the northern plot still relatively clear of vegetation. The rest of the site experienced woody thickening, but otherwise unchanged (Figure 9).

In 2016 almost the entire site was revegetated, including the patch where the houses were previously in the north, with a very small part cleared in the south-eastern corner and the mowed patch in the north-east (Figure 9).

In 2017 small sections of vegetation were cleared in the south with the vegetation adjacent to the western boundary burned due to the 2017 Knysna fires (Figure 9). Fire evidence is also observed in the surrounding areas adjacent to the site.

In 2020 the entire site was heavily revegetated. The south-eastern corner and the north-eastern patch were still cleared although to a lesser extent with trees encroaching and reducing the cleared area in the north-east (Figure 9).

As seen in Figure 7 (imagery from 2022), there was a recent attempt to clear invasive vegetation in the northern part of the site.

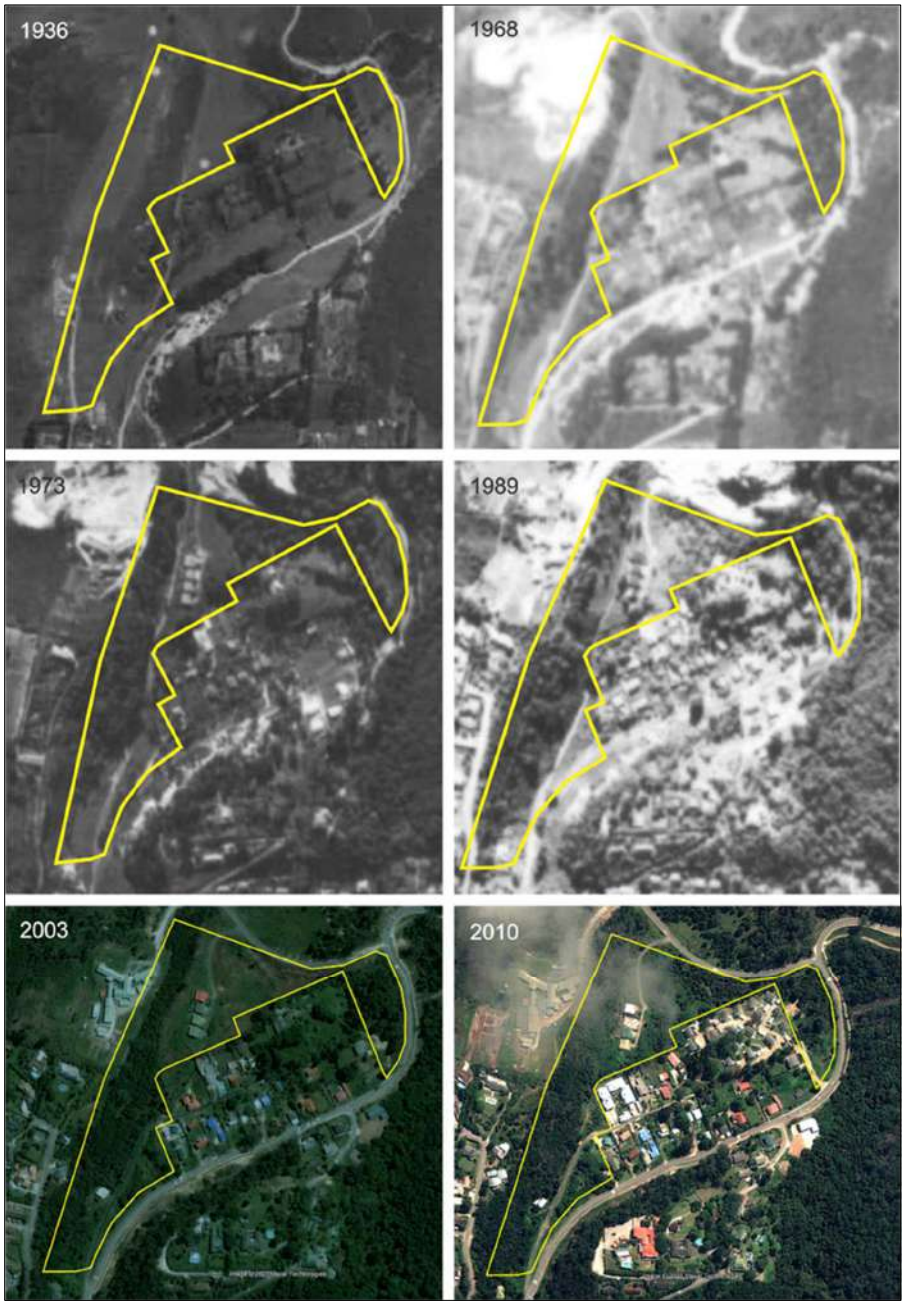


Figure 8. Historical images of Erf 7614 showing notable changes from 1936 to 2010 (CD:NGI & Google Earth imagery).

Figure 9. Historical images of Erf 7614 showing notable changes from 2013 to 2020 (CD:NGI & Google Earth imagery).

3.4 Species of Conservation Concern

In addition to the SCC highlighted by the DFFE screening tool, the following public resources were consulted to provide additional SCC for Erf 7614 and its immediate surroundings:

- iNaturalist (all taxa) within the 5km x 4km of the project area (URL for iNaturalist search area).
- Virtual Museum for herpetofauna, mammals and invertebrate taxa within the Quarter Degree Square (QDS) 3423AA: FrogMAP, ReptileMAP, MammalMAP and LepiMAP.
- South African Bird Atlas Project (SABAP2) for pentad 3400_2300.

Some species reported on the virtual museum platforms and iNaturalist were highly unlikely to occur in the project area given either completely unsuitable habitat (i.e. Cape Cormorant) or being deemed a vagrant/transient animal (i.e. Verreaux's Eagle and Blue Crane: one sighting per species over a long period of time, sighting more than a year old, sightings geographically isolated). For the purposes of this report these animals were excluded from further assessment on Erf 7614.

The combined list of SCC (from DFFE Screening Tool and public resources) possibly occurring on Erf 7614 along with their habitat, breeding and feeding requirements are listed in Table 3. The information for each SCC presented in Table 3 stems largely from the SANBI

online Red List of South African Species (http://speciesstatus.sanbi.org) in addition to a few key resources for each taxa:

- Avifauna: Roberts Birds of Southern Africa VII (Roberts, et al. 2005)
- Mammals: The Mammals of the Southern African Subregion (Skinner 2005)
- Invertebrates:
    - Field guide to the insects of South Africa (Picker, Griffiths and Weaving 2004)
    - Field guide to the butterflies of South Africa (Woodhall 2005)
- Amphibians: A complete guide to the frogs of Southern Africa (Du Preez and Carruthers 2015)
- Reptiles: A guide to the reptiles of Southern Africa (Alexander 2013)

Any information presented from different sources is cited in text.

Table 3. Summary of habitat, breeding and feeding requirements for animal SCC potentially occurring on Erf 7614.

Species	Red list status	Habitat	Breeding	Feeding
AVIFAUNA				
Circus maurus Black Harrier[1]	Endangered	-In Western Cape, mostly found in Fynbos, especially montane Fynbos and strandveld. Less common in dry restios and renosterveld. Elsewhere, occurs in dry grassland, Karoo scrub, crop fields (wheat) and grasslands (sometime >3000m elevation). -Many move from Fynbos to Karoo and grasslands during the winter, likely to follow rodent numbers (e.g. capitalise on late summer litter of Sloggett's ice rats in Free State and Lesotho). -Birds move away following fires and don't return for several years.	-Mainly monogamous but some polygamy observed. Mate fidelity is low. -Usually solitary nester and territorial, but in Western Cape some semi-colonial nesting observed with less territorial behaviour. -Nest is a small structure of grass, stems and small twigs. Usually on or just above ground, in rank marsh grasses or near Fynbos bushes and sedges (*Juncus* spp.). -Nests most often in marshes or next to small streams, but also on damp soil or dry ground. Nest areas reused in successive years (one observation of nest site used for 26 years).	-Specialist predator of mice and birds. Predominantly rodents (vlei rats, mice) eaten by birds in Fynbos areas and small birds (Common Quail) dominate diet of birds in mountain areas. Also takes reptiles, frogs, insects too lesser extent. -Sometimes caches prey. -Forages most actively on blustery days (windy and rainy), hovers 1-3m above vegetation with boyant flight. -Flashes into vegetation, hits prey hard and eats on ground. Perch hunting rare.
Circus ranivorus Marsh Harrier[1]	Endangered	- Considered a waterbird. - Roosts on taller trees around wetland edges from where it has a good vantage point.	- Breeding occurs between September and December. - Egg-laying is from August to November in South Africa.	- Dietary assessment (Simmons et al., 1991) of pellets and prey deliveries to nests includes birds, frogs, fish, eggs and micromammals (*Rhabdomys, Otomys*, and Shrews).

[1] SCC identified by DFFE Screening Tool

		- Can adapt to novel wetland habitats such as wastewater treatment works	- Nests made of grass, reed stems or sticks in reedbeds, short sedge areas or in trees along the water's edge. - The same nest is often reused by the same pair in following years.	- Hunts primarily in wetland habitats using various flight methods including soaring, hovering and low flight over wetlands and along the water's edge. - May hunt in open grasslands or pastures near wetland areas.
Polemaetus bellicosus Martial Eagle[1]	Endangered	-Savanna, Karoo shrubland, semi desert. -Can occur in open farmland with clumps of trees. -Rare in mountainous and forest areas.	- Monogamous, pair bond lasts several seasons. Solitary nester. - Nest is a substantial platform of sticks (up to 1.5m long and 3cm thick) on tall trees or pylons. - Nest tree usually tallest in vicinity, and nest placed in a large fork below the canopy. Rarely uses rocky outcrops. - 1 egg laid, incubation 48-53 days predominantly by female bird.	-Mainly small mammals like hare, jackal, small antelope, mongoose, small baboons, but also small stock animals, birds (especially gamebirds) and reptiles (especially monitor lizards). -Usually hunts on the wing by soaring high and attacking in long slanting stoop. Surprises prey by using available cover. Occasionally hunts from perch, especially at waterholes or along game trails. - Prey killed by impact or strangulation and taken to high perch to eat.
Stephanoaetus coronatus Crowned Eagle[1]	Vulnerable	-Forest (including gallery forest), dense woodlands and forested gorges in savannas and grasslands. -Also in *Eucalyptus* and Pine plantations. -Perches for long periods, resting in canopy. Sometimes soars high over territory, then descends vertically to perch. -Manoeuvres agilely through thick forest, can take off vertically from forest floor.	-Monogamous, possibly long-term pair bond. -Territorial (at least 10 km^2), solitary nester. -Tallest trees used to build large stick platform nest (sticks/branches up to 1.5m long, 3cm thick). Nest copiously lined with beachwood (*Faurea saligna*), Pine or *Eucalyptus* leaves/needles. -Nest often reused and added to in consecutive years, can reach up 2-3m diameter, 3m high. -Nest trees often at the base of cliff/ravine or at the edge of plantation. Nest trees usually	-Predominantly feeds on mammals (96% diet) and mostly on hyrax, antelope and primates. Will also take porcupine, hares, mongoose, sometimes domestic stock and domestic cats/dogs. Avian prey includes Hadeda Ibis, Egyptian geese and domestic chickens. Reptile prey mainly monitor lizards. -Most prey taken on ground, but occasionally crashes into dense foliage in pursuit. -Frequently still-hunts (stalks prey) and hunts from concealed perches frequently above waterholes in evening waiting for antelope to drink.

			White-stinkwood (*Celtis africana*), yellowwoods (*Podocarpus* spp.), Cabbage tree (*Cussonia spicata)* but also *Eucalytus* and Pine species. -Incubation 49-51 days.	-Pair sometimes hunt monkeys cooperatively. -Prey struck with downward blow of open foot, massive hind claw penetrates the skull killing instantly. -Large prey that cannot be lifted are partly eaten and dismembered on the ground and then cached in trees.
Bradypterus sylvaticus Knysna Warbler[1]	Vulnerable	- Inhabits low, dense understorey vegetation along riverbanks on the edge of forest patches and riverine woodlands -Adapted to thickets of non-native brambles (e.g. Rubus). -Disappears from areas where canopy is too thick resulting in loss of understory vegetation.	- Breeds from August and December coinciding with the greatest abundance of invertebrate species.	-Mostly on ground, creeping through dense, matted vegetation and scratches in humus -Eats mostly grasshoppers, insect larvae, spiders, slugs, worms.
MAMMALS				
Sensitive Species 8[1]	Vulnerable	- Specialised habitat requirements within a home range of approximately 0.75 ha - Strong habitat preference for dense vegetation with good undergrowth providing good cover in which to retreat. - Forest, thicket, dense coastal bush, independent of water. - Can inhabit forest edges and transitional zones. - Requires diverse plant community with variety of tree and shrub species.	- This species can breed throughout the year. - Males establish territories and exhibit aggressive behaviours towards other males and to attract females.	- Highly selective feeders, often feeding on food below troops of monkeys or frugivorous birds which drop lots of material. - Preference for fruit, but also fallen leaves, flowers and insects. Seldom actively browse. - Active in the early morning and late afternoon, foraging for around 8 hours a day within their territory.

		- Can adapt to fragmented habitat given sufficient cover and food availability. - Actively avoids open grasslands, and areas with human disturbance.		
Chlorotalpa duthieae Duthie's Golden Mole[1]	Vulnerable	- Occur in alluvial sands and sandy loams within coastal forests of the Fynbos biome. - Preference for deeper forest vegetation over fynbos, but can occur in gardens and pastures adjoining forests. - Narrow coastal band 275 km long between Wilderness and Port Elizabeth with fairly disjunct populations. - Mainly active at night.	- Little is known about breeding habits, but a female was recorded with a litter of two young in November (G. N. Bronner unpublished data) suggesting breeding occurs in summer/wetter months.	-Shallow subsurface foraging tunnels radiate outwards from nests located beneath the roots of trees. - Forages at night in tunnels and through the leaf litter. - Little is known, but diet includes earthworms.
Panthera pardus Leopard[2]	Vulnerable	- Wide habitat tolerance, but generally associated with rocky outcrops, hills, mountains and forests. - Manage to persist in areas of development provided there is adjacent cover of rocky hills or forest.	- Solitary animals with males and females holding territories and defend against same sex. - No specific breeding season but has been found to peak in unison with some ungulate prey species births in certain regions (i.e. impala in Kruger National Park). - Oestrous lasts 7 days during which male and female copulate frequently. - Gestation 106 days and cubs remain with mother for 12months	- Nocturnal, solitary hunter. - Small to medium animals, usually ungulates < 70kg (Impala, Klipspringer, Grey Rhebuck, Cape Grysbok, Duiker) but also take Baboons, Hyrax, hares, rodents, reptile, livestock or domestic cats/dogs. -Usually drags larger prey items into cover (dense shrubs) or up trees.

[2] SCC identified by MammalMAP

			after which siblings remain together for a further 2-3 months.	
Amblysomus corriae Fynbos Golden Mole[2]	Near Threatened	-Sandy soils and soft loams in Mountain Fynbos, Grassy Fynbos and Renosterveld of South West Cape. Also Afromontane forest and southern African moist savanna along the southern Cape coast. -Favours richer and wetter soils preferring forest fringes and associated fynbos. -Thrives in gardens, cultivated lands, golf courses and livestock paddocks. Can be present in exotic plantations, but at lower densities.	-Probably breeds aseasonally because pregnant females have been captured in August, May, and December. -Mean litter size is two; young are altricial and hairless at birth	-Insectivorous, mainly feeding on earthworms and insects.
TERRESTRIAL INVERTEBRATES				
Chrysoritis thysbe mithras *Brenton Sparkling Opal Butterfly*[3]	Critically Endangered	- Endemic to the Western Cape Province in South Africa, only recorded from the Still Bay area in the west, Brenton on Sea near Knysna and from Goesabos (Tsitsikamma) in the east. -Declining due to dense stands of alien plant invasions. -At Brenton on Sea on both north- and south-facing slopes at an altitude of 80 m to 120 m in disturbed areas of Knysna Sand Fynbos with a high abundance of *Osteospermum monilifera* (Bitou).	- Adults are on wing year-round with peaks in October and March.	- Larvae feed on *Chrysanthemoides incana, C. monilifera, Osteospermum polygaloides, Lebeckia plukenetiana, Aspalathus, Zygophyllum* and *Thesium* spp. -Host ant species is *Crematogaster peringueyi* ants.

[3] SCC identified by LepiMAP

		-Habitat at Stilbaai is by contrast on limestone fynbos-covered hillsides at altitudes up to 300 m.		
Orachrysops niobe Brenton Blue Butterfly[3]	Critically Endangered	Highly range-restricted endemic to the Western Cape. - Cool, moist south-facing slopes close to the sea at 90 m to 115 m altitude. -Mosaic of open and dense vegetation consisting of dune thicket, fynbos and forest.	- Adults are on wing from October to November and from February to March. There are two generations per year	--Larvae feed on the rootstock of *Indigofera erecta.* -Host ant species Camponotus baynei
Thestor brachycerus brachycerus Knysna Skolly Butterfly[3]	Critically Endangered	-Endemic, range-restricted, known only from the Knysna area in the Western Cape. -Currently restricted to two small subpopulations on the coast east of Coney Glen just above sea level. -Butterfly and its host ant both require patches of open vegetation with significant bare ground or rocks. - Inland habitat is on north-, north-east- and north-west-facing slopes covered with Knysna Sand Fynbos, originally with a warm, dry, fire-prone microclimate promoting low fynbos vegetation and patches of open sandy soil and animal paths. -Coastal habitat close to the sea to the east of Coney Glen at the Knysna Heads, with a completely different microclimate (south-facing,	-Adults are on the wing from December to January. There is one generation per year.	- Larvae have been found in the nests of the pugnacious ant, Anoplolepis custodiens, but the larval food is unknown.

		moist, sea spray) and vegetation type (Cape Seashore vegetation). -General requirements are low vegetation and a sunny, warm microclimate in midsummer, promoting good host ant populations.		
Aloeides thyra orientis Red Copper Butterfly[3]	Endangered	-Restricted range taxon endemic to the Western Cape from Witsand to Gouritsmond in the west, to the Brenton Peninsula near Knysna in the east. -Declining because of alien plant encroachment and lack of regular burning of the fynbos. -Coastal fynbos on flat sandy ground (either naturally occurring or from anthropogenic disturbances such as footpaths or unsurfaced track) between 40 m to 240 m above sea level.	- Adults are on wing from July to April with peaks in October and February. -Several generations per year through the warmer months	- Larvae feed on *Aspalathus acuminata, A. laricifolia and A. cymbiformis*. -The larvae are attended to by *Lepisiota capensis* ants.
Aneuryphymus montanus Yellow-winged Agile Grasshopper[1]	Vulnerable	- Very low area of occupancy between 100 and 1 000 km^2. Threatened by declining habitat due to invasion by aliens and habitat transformation. - Strong association with sclerophyllous fynbos vegetation on the southern slopes of the Outeniqua mountains, post-fire. - Threats to the species include habitat transformation and invasion by alien plants.	- Little is known about the reproductive habits or requirements for this species.	- Little is known about the feeding requirements of this species.

Aloeides pallida littoralis Knysna Pale Copper Butterfly[3]	Near Threatened	- Endemic taxon to the Western Cape Province. -Relatively flat terrain near the coast, coastal Fynbos	-Little known, but *Lepisiota capensis* ants are hosts for subspecies *A. p. grandis*.	-Little is known, but larval food for the subspecies A. p. pallida and A. p. jonathani feed on Aspalathus species. The larvae of subspecies A. p. grandis are fed by trophallaxis by *Lepisiota capensis* ants and feed on these ant eggs.
Ecchlorolestes nylephtha Queen Malachite Damselfly[4]	Near Threatened	-Known from streams near Storms River and in the Tsitsikamma Forest (Western Cape and Eastern Cape). -Endemic to South Africa. -Occupies a very specific microhabitat inhabits small, fern-fringed streams in the deep shade of forest.	-Little known, but the Genus typically lays eggs on tender green shoots of vegetation overhanging streams	- Little is known, but taxon is insectivorous.
HERPETOFAUNA				
Afrixalus knysnae Knysna Leaf-folding Frog[1]	Endangered	- Typically inhabit endorheic (inward draining) wetlands with shallow water (< 50cm), high clarity, and sufficient vegetation suitable for breeding. - No streaming or running water recorded at any of the sites where they've been recorded. -The frog is associated with vegetation it can use for breeding which includes indigenous and exotic species. For example, slender knotweed (*Persicaria decipiens*) and kikuyu grass (*Pennisetum clandestinum).*	- Females lay eggs on leaves which are folded and sealed by males, creating a protected environment. - Breeding occurs during warmer wetter months such as September to November (F. De Lange 2019) - Breeding takes place near deeper parts of the waterbody, but still close to the water's edge.	- The Knysna Leaf-folding Frog is an insectivorous amphibian feeding on small invertebrates found in its habitat (e.g. insects and spiders). - Foraging behaviour includes actively searching for prey on the forest/fynbos floor and in the leaf litter. - The frog uses its sticky, projectile tongue to capture and quickly ingest prey. - It is primarily active at night, relying on its vision to locate and capture prey in the darkness.

[4] SCC identified by OdonataMAP

		-It requires a habitat with diverse plant species, including shrubs, grasses, and ferns, providing shelter and breeding sites (De Lange and Du Preez 2018).		

4. FIELD ASSESSMENT

4.1 Methods

Following the Species Environmental Assessment Guidelines (SANBI 2020) and Table 3, taxa-specific sampling techniques were conducted in habitats where SCC were likely to occur (Table 4). Taxa-specific sampling was interspersed with a meander across the project area to collect additional opportunistic data for all fauna and inspect all habitat types.

All species lists for the fauna found on Erf 7614 during the site inspection have been made publicly available on various platforms recognised and recommended by the Species Environmental Assessment Guidelines.

Table 4. Sampling techniques conducted for potential SCC occurring on Erf 7614.

Taxa	Field methods	Public platform where fauna information was disseminated (data)
Avifauna	• Meander* across site for direct observations. • 5 point-counts (5-minute bird counts).	Birdlasser (species lists), iNaturalist (photos)
Mammals	• Meander* across site for direct observations, tracks, scats and signs.	iNaturalist (photos)
Amphibia	• Meander* across site for direct observations. • Active searching.	iNaturalist (photos)
Invertebrates	• Meander* across site for direct observations. • Active searching. • Sweep netting.	iNaturalist (photos)

* Meandering involved 3.8 km of walking across the site through various habitat types and key landscape features. Active observations took place for all fauna throughout this walk and was supplemented by taxa specific sampling methods in habitats deemed most suitable for SCC.

4.2 Assumptions and Limitations

- Two site visits, spaced one month apart, were conducted. Findings of this report are therefore based on animals (sightings or evidence of activity) detected during these 'snapshots' in time.
- Site visits took place during daylight hours so the likelihood of encountering nocturnal species was limited.
- The site visits coincided with summer months, which may be of consequence for some species showing seasonal variation in breeding and activity patterns. However, for the frog SCC this time falls within the breeding season and increases the likelihood of detection. Similarly, this is the optimal time of year to detect the presence of golden moles, which are generally most active in warmer and wetter conditions and their sub-surface tunneling most detectable.
- Evidence of animals in the form of tracks, scats and signs always brings with it a level of uncertainty, but best efforts were made in this regard and uncertainties are highlighted in the report.

4.3 Site Inspection Details

Site visits to Erf 7614 were conducted on 5 December 2023 and 17 January 2024, coinciding with summer at the site. The weather was overcast but warm during the December site visit, and sunny and hot during the January visit. Habitat types found on the site are shown in Figure 10, with the majority of the site heavily transformed due dense and widespread alien plant invasions (see Botanical Specialist report by B. Fouche, Confluent Environmental), and artificial drainage channels and wetland features enhanced by current stormwater infrastructure on and around the site (but see Aquatic Specialist Report by J. Dabrowski, Confluent Environmental for further clarification). An effort was made to cover the project area with the meander and to conduct taxa specific sampling techniques across a range of suitable habitats for potential SCC (Figure 11).

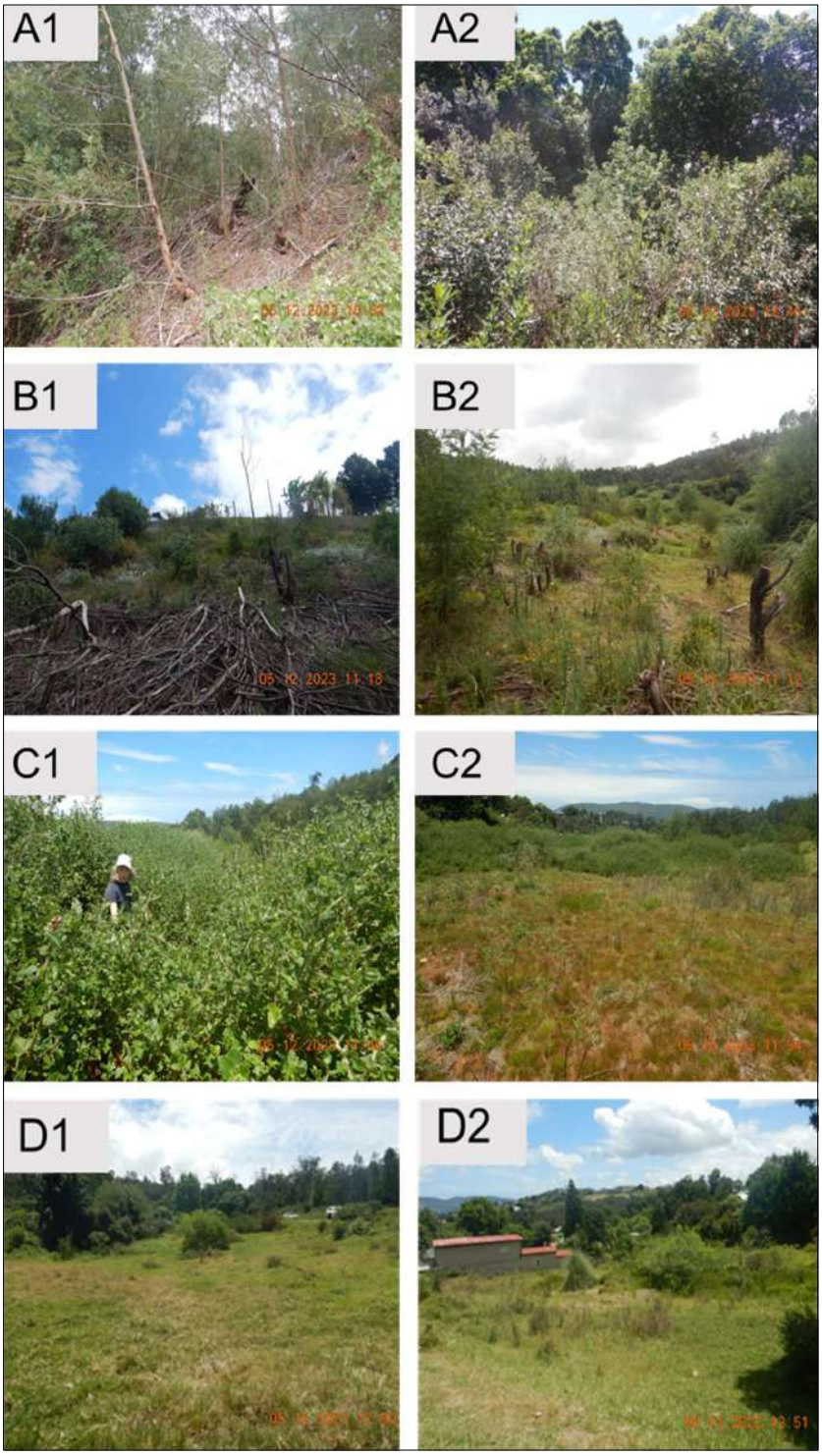


Figure 10. Main habitat types identified on Erf 7614. Alien plant invasions to varying degrees, with some past vegetation clearing evident, and a closed canopy (mostly trees) (A). Alien plant invasions to varying degrees, with some past vegetation clearing evident, and an open canopy (limited to no trees) (B). Seasonal wetland zone including some densely vegetated areas and some cleared patches (C). Artificial lawns experiencing varying degrees of maintenance and some alien plant invasions (D).

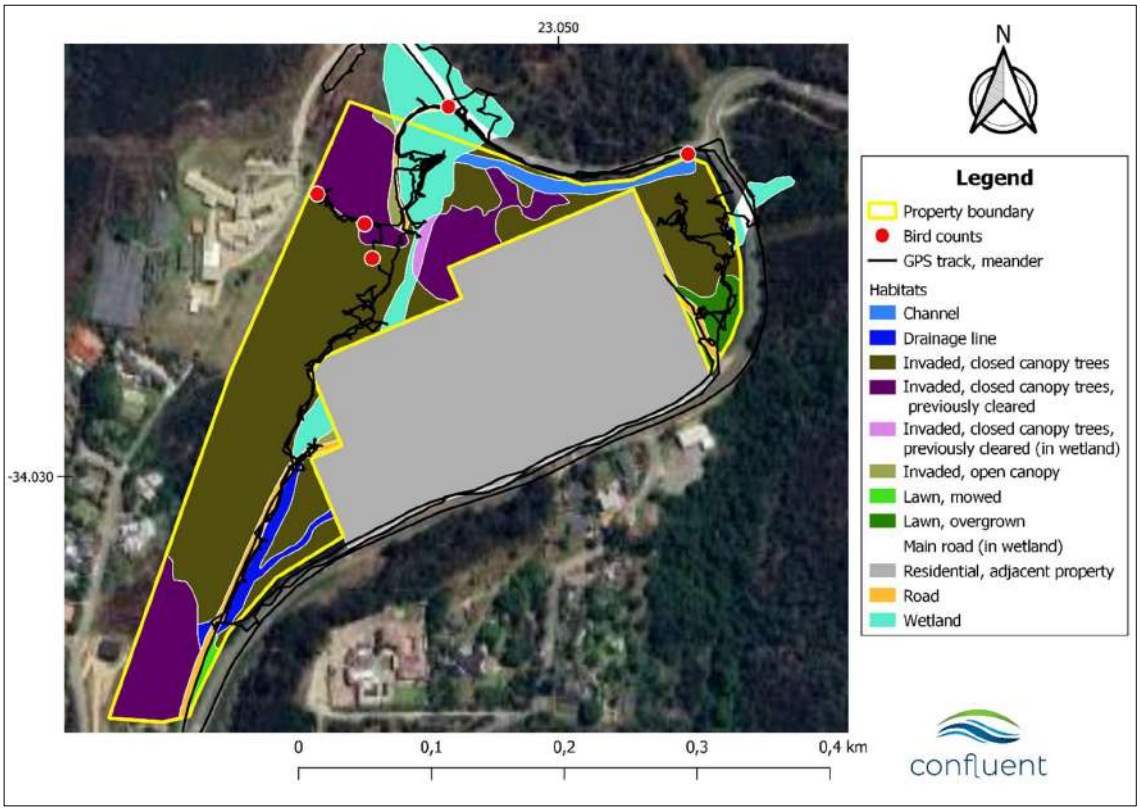


Figure 11. Habitat types, wetlands and drainage lines identified on Erf 7614, with GPS tracks depicting the meander route and waypoints indicating bird counts conducted during site visits in December 2023 and January 2024.

4.4 Results

4.4.1 Avifauna

No SCC were found on site and there was little suitable habitat for any of the SCC given the general lack of indigenous vegetation and dense stands of alien plant invasions (*A. mearnsii* and other alien species). A total of 25 bird species were encountered during the site visit (See Appendix 1, Figure 12).

Five bird counts were done across the property, in addition to opportunistic sightings noted throughout the meander and searching for nests/roosting sites. Three of the bird counts were done from vantage points to increase the chances of observing raptors soaring over the site and immediate surroundings.

Figure 12. Evidence of Helmeted Guineafowl (Numida meleagris) and a Burchell's Coucal (Centropus burchellii) seen on Erf 7614.

4.4.2 Mammals

No SCC were found during the site inspections. A small path was observed through the dense vegetation along the north-eastern boundary, however, this is appears mostly used by people and cattle (litter, shoe-prints, cow hoofprints and cow dung found) (Figure 13). This dense vegetation superficially appears as a forest patch, but is heavily invaded with alien plants, is very small in size and next to a busy road with many people walking along the edge of the property. It is therefore not functionally regarded as a forest patch and is unlikely to be utilized by wildlife given the high levels of disturbance and small habitat size providing limited shelter and foraging potential. Mole rat activity (ascribed to the abundance of mole hills within close proximity to each other) was most prevalent in the northern sections of the site (Figure 13), however, no suspected evidence of golden mole activity (sub-surface tunnelling) was observed on site. A small troop of 4-5 vervet monkeys were seen in the invaded black wattle area in the west of the site (Figure 13).

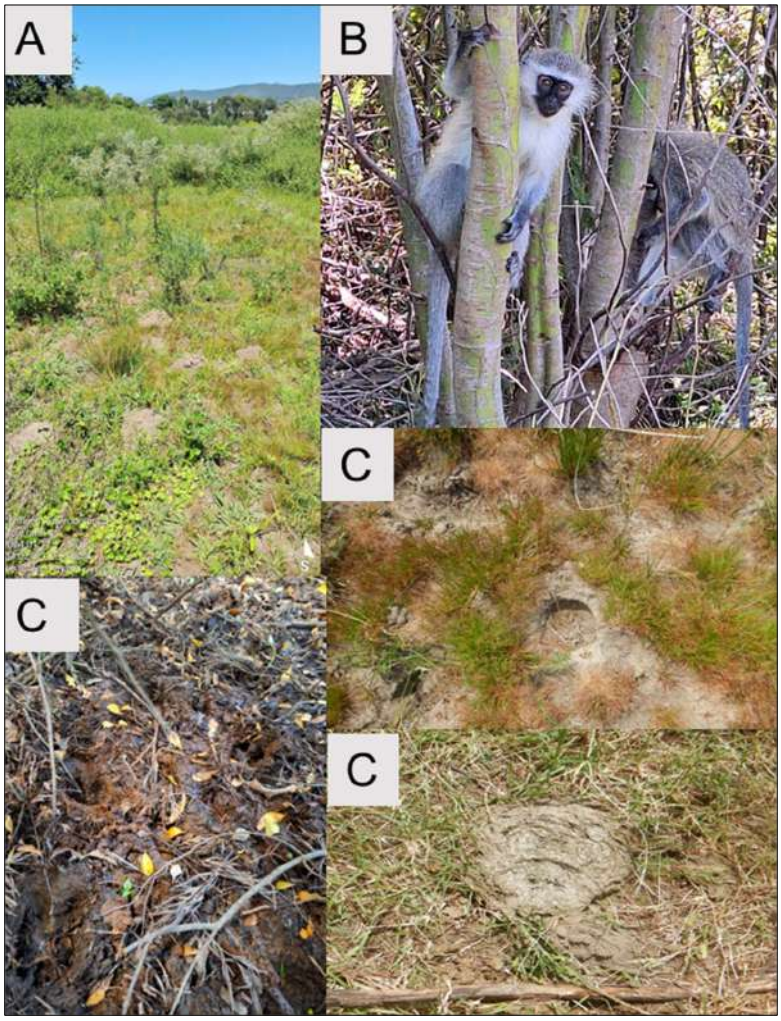


Figure 13. Multiple mole hills indicated mole rat activity (A), vervet monkeys (B), and cattle hoof prints and dung (C) found on Erf 7614 during site inspections.

4.4.3 Terrestrial Invertebrates

No SCC were found during the site inspection. The habitat is highly modified and does not represent suitable habitat for the Yellow-winged Agile Grasshopper or the butterfly SCC which largely rely on fynbos habitat. Additionally, no larval food/host plant species were found on site during the Botanical Specialist Assessment (B. Fouche, Confluent Environmental). Invertebrates from 13 Families were photographed and identified from the site (Figure 14, see also Appendix 3).

Figure 14. Invertebrates photographed on Erf 7614 during the site inspection.

4.4.4 Herpetofauna

No SCC were encountered during the site visit and no amphibians were found. There was no suitable habitat for the Knysna Leaf-folding Frog (*A. knysnae*), as the only waterbodies on site were artificial and enhanced by storm water management: small flowing streams within the drainage lines were heavily invaded with alien plants, polluted with litter and inflows of stormwater; a temporary puddle in the north of the site likely resulting from a leaking pipe (exposed pipe on one end of the puddle with evidence of recent maintenance i.e. new section/clamp seen on pipe).

4.4.5 Likelihood of Occurrence for SCC

Following the terrestrial fauna surveys and site inspection, the possible SCC for Erf 7614 were evaluated according to their likelihood of occurrence. It is always possible that a species assessed as having a low probability of occurrence can occur on the site (especially the golden moles species which are listed as having a low likelihood of detection) and therefore Table 5 should only be interpreted as a guideline.

Table 5. Likelihood of occurrence for terrestrial fauna SCC on Erf 7614.

Species	Red list status	Observed on site	Suitable habitat	Likelihood of occurrence	Reason
AVIFAUNA					
Circus maurus Black Harrier	Endangered	No	No	Low	Very limited natural Fynbos vegetation resulting in unsuitable habitat for species. High levels of human disturbance likely to deter SCC.
Circus ranivorus Marsh Harrier	Endangered	No	No	Low	No suitable habitat with site having no standing water and only a very small stream on site. High levels of human disturbance likely also to deter SCC.
Polemaetus bellicosus Martial Eagle	Endangered	No	No	Low	No suitable habitat as SCC is rare in forest and mountainous areas which surround the site. Limited presence of small mammal prey items available and high levels of human disturbance likely to deter SCC.
Stephanoaetus coronatus Crowned Eagle	Vulnerable	No	No	Low	The small remnant of dense vegetation along the north-eastern boundary presents as suitable habitat but given its very small size in addition to the high levels of human disturbance it is highly unlikely that this habitat within the property boundary is desirable for this species. Across the rest of the site there are very few perching or roosting opportunities given the lack of large trees. Limited prey availability given general lack of small-medium sized mammals.
Bradypterus sylvaticus Knysna Warbler	Vulnerable	No	No	Low	The dense vegetation along the stream area in the south-east of the site may represent marginal habitat for this species, but due to the high levels of alien plant invasion, limited understory plant growth and diversity, the general lack of tangled vegetation and the limited extent of this stream (habitat size), this is unlikely to be utilised by the SCC.
MAMMALS					
Sensitive Species 8	Vulnerable	No	No	Low	The small remnant of dense vegetation along the north-eastern boundary superficially presents as suitable habitat but given its very small size, extensive alien plant invasion, the high levels of human disturbance within and directly adjacent, and the busy road disconnecting this patch to the other green spaces to the north of the site, it is highly unlikely that this habitat is desirable or functional (limited food, shelter and connectivity) for the SCC.

Chlorotalpa duthieae Duthie's Golden Mole	Vulnerable	No	Possible	Low	Limited suitable habitat given the SCC's preference for forest habitat (not present on site) and the site being disconnected from any adjacent suitable habitats to the north by a busy road. However, this SCC can occur in open areas adjoined to forests. Despite active searching for shallow subterranean tunnels in the dense vegetation patch to the north-east, during the best time of year to increase the chances of detection (summer months (SANBI 2020)), no evidence of this SCC was found. This SCC is however listed as having a low likelihood of detection (SANBI 2020) and therefore precaution is recommended during any construction phase.
Panthera pardus Leopard	Vulnerable	No	No	Low	While there is dense vegetation on site, it is unlikely that this SCC will occur on site due the small size of the site, very limited prey items available (only domestic pets) in the vicinity, the high levels of human disturbance on and around the site and the site being surrounded by busy roads and urban development.
Amblysomus corriae Fynbos Golden Mole	Near Threatened	No	Possible	Low	Despite the site experiencing high levels of alien plant invasions, the SCC can adapt to modified landscapes. Given that the SCC favours forest fringes (not present on site and site disconnected from possible adjacent habitats by busy tar roads surrounding property) and associated fynbos (not present on site), in addition to the long-term intense disturbance experienced by the site, this habitat is likely not suitable for the SCC. Despite active searching for subterranean burrows during the best time of year to increase the chances of detection (summer months (SANBI 2020)), no evidence of this SCC was found. This SCC is however listed as having a low likelihood of detection (SANBI 2020) and therefore precaution is recommended during any construction phase.
TERRESTRIAL INVERTEBRATES					
Chrysoritis thysbe mithras Brenton Sparkling Opal Butterfly	Critically Endangered	No	No	Low	No suitable habitat. Intense alien invasion and long-standing human disturbance resulting in no natural fynbos vegetation on site.
Orachrysops niobe	Critically Endangered	No	No	Low	No suitable habitat for SCC. Intense alien invasion and long-standing human disturbance resulting in no natural mosaic fynbos or forest on site.

Brenton Blue Butterfly					
Thestor brachycerus brachycerus Knysna Skolly	Critically Endangered	No	No	Low	No suitable habitat due to intense alien invasions and human modifications leading to vegetation thickening and general lack of low vegetation structure or significant bare ground required by SCC and host ant species.
Aloeides thyra orientis Red Copper Butterfly	Endangered	No	No	Low	No suitable habitat given the lack of coastal fynbos vegetation, long-standing human disturbance and extensive alien plant invasion on site.
Aneuryphymus montanus Yellow-winged Agile Grasshopper	Vulnerable	No	No	Low	No suitable habitat given the lack of sclerophyllous fynbos vegetation, long-standing human disturbance and extensive alien plant invasion on site.
Aloeides pallida littoralis Knysna Pale Copper	Near Threatened	No	No	Low	No suitable habitat given the lack of coastal fynbos vegetation, long-standing human disturbance and extensive alien plant invasion on site.
Ecchlorolestes nylephtha Queen Malachite Damselfly	Near Threatened	No	No	Low	No suitable habitat. SCC has specific microhabitat requirements of small, fern-fringed streams in the deep shade of the forest which is not present on site.
HERPETOFAUNA					
Afrixalus knysnae Knysna Leaf-folding Frog	Endangered	No	No	Low	No suitable habitat. Only water on site were the two artificial drainage lines with small flowing streams (polluted with litter and runoff from the adjacent roads and stormwater systems) and a temporary puddle likely caused by a leaking pipe - all unfavourable conditions for SCC.

5. SITE SENSITIVITY VERIFICATION AND COMPLIANCE STATEMENT

After the site visit and fauna surveys, it is determined that the site sensitivity for the terrestrial animal theme of Erf 7614 is **LOW** in contrast to the high and medium sensitivities highlighted by the DFFE Screening tool.

Based on the information in this report during the desktop and field assessment, the following reasons support this finding:

- The property has been heavily disturbed by human activities over the last 87 years including small scale quarrying, periodic vegetation clearing, alien plant invasions and the construction and subsequent demolition of a few houses.
- The entire site has experienced long-term alien plant invasions, with high levels observed at the time of the site visit. Consequently, there is poor habitat suitability for most SCC.
- There is no suitable aquatic habitat for the Knysna Leaf-folding Frog (*A. knysnae*), Marsh Harrier (*C. ranivorus*) or Queen Malachite (*E. nylephtha*). The drainage lines and small flowing streams on the site are unlikely habitat for the Knysna Warbler (*B. sylvaticus*) given their artificial origin (high levels of stormwater input) and alien plant invasions reducing tangled vegetation structure along the banks.
- There is no suitable indigenous Fynbos vegetation for the butterfly SCC, Yellow-winged Agile Grasshopper (*A. montanus*) or Black Harrier (C. *maurus*) on site. Additionally, no larval food/host plant species for the butterfly SCC were found on site.
- The small stand of dense vegetation (superficially resembling a forest patch) along the north-eastern boundary is very limited in size and disconnected from the adjacent dense natural areas (which also experience a lot of alien plant invasions) to the north by a busy road with many people walking past. There is evidence of people walking within this dense vegetation patch (litter and a pathway) which, in addition to the vehicle traffic directly adjacent to it, is likely to deter most animals from utilizing this habitat. It is therefore not suitable habitat to support Sensitive mammal species 8, Crowned Eagle (*S. coronatus)* and Martial Eagle (*P. bellicosus*) given its small size (limited foraging and sheltering potential) and the high levels of alien plant invasion and human disturbance.
- Given that the habitat requirements for the golden mole SCC are poorly categorized and understood, the site is may contain marginally suitable habitat for the two golden mole SCC (Duthie's Golden Mole (*C. duthieae*) and the Fynbos Golden Mole (*A. corriae*)), although this was considered unlikely given the extent and intensity of alien plant invasion, limited forest-like vegetation and lack of fynbos habitat on site, and the site being surrounded by tar roads that isolate these fossorial animals from adjacent populations/areas of better habitat quality. The DFFE Screening Tool indicated suspected or modelled habitat for the SCC (Medium sensitivity in Figure 4 and Table 1), but despite the field visit taking place at the best time of the year to coincide with the highest activity levels and likelihood of detection of sub-surface tunnels, no evidence of these SCC was found. An iNaturalist search for these species showed that the nearest report of Duthie's Golden Mole (*C. duthieae*) was in Rexford (5 km south-west of site, listed in 2003) and of Fynbos Golden Mole (*A. corriae*) in Plettenberg Bay (35 km east of the site, listed in 2020). As a result of this marginal habitat suitability

(from the screening tool and site inspection), the lack of evidence observed on site (despite searching at the best time of year for detection) and the lack of nearby reports of the SCC (although this should be interpreted with caution given their low likelihood of detection), it is deemed unlikely that the golden mole SCC occur on site. However, precautionary measures should be implemented as both SCC have a low likelihood of detection (SANBI 2020).

Given the LOW sensitivity of the site, a Compliance Statement is issued for Erf 7614 in accordance with the protocols published in Gazette no.1150 (October 2020). Due to its long-standing transformed habitat, extensive alien plant invasion and its proximity to urban development the study area is of a low sensitivity for terrestrial animal species. The proposed development is unlikely to have any impact on terrestrial animal SCC, however, given the low detection probability of the two golden mole SCC (*C. duthieae* and *A. corriae*) this compliance statement is issued with the following conditions:

- An Environmental Compliance Officer is appointed to monitor for the presence of any moles prior to any vegetation clearing and during the construction phase of the proposed development.
- Should any golden moles be found or suspected to occur on site through the observation of subterranean tunnels, construction should be paused until such time that their presence and identity can be confirmed by a relevant expert.
- If either of the golden mole SCC are confirmed to occur on site (following positive identification by a relevant expert), this Compliance Statement will be revoked, and construction is to be paused until such time that a Terrestrial Animal Species Specialist Report is produced.

6. RECOMMENDATIONS

- Given the multistorey development plans (as per SDP provided), an effort should be made to prevent any possible bird collisions with infrastructure, wires or antennae with the use of anti-collision devices.
- While the property itself does not contain any conservation areas of concern, it is near CBA and ESA areas (Figure 7). Therefore, environmentally friendly practices should be adopted and prioritised to support biodiversity wherever possible. Examples of this include implementation of alien plant control measures, especially along the western slopes where no development footprint is intended (Figure 2), and to preserving some native trees and indigenous vegetation, particularly within in the dense vegetation in the north-east of the site (see next point).
- The dense habitat along the northern-eastern boundary contains many indigenous tree species. Although small in size, this patch of vegetation can provide suitable habitat and refugia for multiple animals (small mammals, reptiles, frogs, birds). Additionally, it is aesthetically pleasing and can assist in noise reduction from the adjacent busy Concordia Road. It is therefore recommended for that the indigenous vegetation not be cleared.

- General recommendation and best practice guidelines should be followed for all animal species encountered (regardless of whether they are SCC or not) during any stage of development on a site. These are summarised in Box 1 below:

BOX 1: Best practice principles for ALL fauna encountered during construction or operational phases of projects.

If any animals are seen on site, a photo or video should be taken if at all possible (to assist in identification) and all fauna encountered on site should be reported to the ECO immediately. This is particularly important when:

- An animal is harmed or compromised in any way during construction.
- Ground-dwelling animals, their nests or eggs are unearthed during earthworks (e.g. moles, tortoise eggs, terrapins/frogs estivating).
- Any animal with limited mobility is found on site (e.g. tortoises, moles, chameleons).
- Any potentially dangerous animal is encountered. This includes any potentially venomous animal (e.g. snakes, scorpions) or any medium-large animal that has become cornered in a room/enclosed area such that it cannot escape (e.g. porcupines, monkeys, baboons, antelope). It is critical in the case of snakes/scorpions to get pictures/videos to aid in identification and appropriate treatment of anyone needing medical assistance.
- Any animal that shows reluctance to escape or move away from the construction site, thereby increasing its exposure to harm or increasing the risk of injuring people on site.

The ECO should provide guidance or assistance to get all animals to safety, treating any injured animals and issuing instructions on when to continue with construction (once they are satisfied that all animals have been removed from site) or put additional mitigation measures in place to protect animals on the site from harm.

Some helpful contact details numbers for the ECO's disposal include:

For any injured animals or animals to be removed from site (domestic or wild):

A local SPCA can collect and treat most animals, and should be a first point of call for assistance. If they cannot directly assist, they will revert and notify the relevant authorities/vets. In the Garden Route please contact:

SPCA George: 044 878 1990

SPCA Mossel Bay: 044 693 0824

For any assistance with snake removals/relocations, identifications, or bite treatment:

African Snakebite Institute (all details available on www.africansnakebiteinstitute.com)

General Enquiries: +27 73 186 9176

Snakebite Emergencies: +27 82 494 2039

7. REFERENCES

Alexander, G. 2013. *A Guide to the Reptiles of Southern Africa.* Penguin Random House South Africa.

Bronner, G. 2014. *Chloroptalpa duthieae.* In Child MF, Roxburgh L, Do Linh San E, Raimondo D, Davies-Mostert HT, editors. The Red List of Mammals of South Africa, Swaziland and Lesotho. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa.

Bronner, G, and S Mynhardt. 2014. *Amblysomus corriae.* In Child MF, Roxburgh L, Do Linh San E, Raimondo D, Davies-Mostert HT, editors. The Red List of Mammals of South Africa, Swaziland and Lesotho. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa.

CapeNature. 2017. *An overview of the Western Cape Biodiversity Spatial Plan.*

De Lange, F, and L Du Preez. 2018. The tadpole of Afrixalus knysnae (Loveridge) (Anura: Hyperoliidae), with comments on reproductive biology." *Zootaxa* 4521: 121-124.

De Lange, F. 2019. *Breeding biology and ecological niche of the Knysna leaf-folding frog (Afrixalus knysnae).* North-West University (South Africa).

Du Preez, L, and V Carruthers. 2015. *A Complete Guide to the Frogs of Southern Africa.* Struik Nature.

Edge, D. 2018. *Aloeides pallida littoralis.* Southern African Lepidoptera Conservation Assessment (SALCA). Red List of South African Species. South African Biodiversity Institute. http://speciesstatus.sanbi.org/assessment/last-assessment/445/. Downloaded on 2024-01-08.

Edge, D. 2018. *Aloeides thyra orientis.* Southern African Lepidoptera Conservation Assessment (SALCA). Red List of South African Species. South African Biodiversity Institute. http://speciesstatus.sanbi.org/assessment/last-assessment/372/. Downloaded on 2024-01-08.

Edge, D. 2018. *Chrysoritis thysbe mithras.* Southern African Lepidoptera Conservation Assessment (SALCA). Red List of South African Species. South African Biodiversity Institute. http://speciesstatus.sanbi.org/assessment/last-assessment/393/. Downloaded on 2024-01-08.

Edge, D. 2018. *Orachrysops niobe.* Southern African Lepidoptera Conservation Assessment (SALCA). Red List of South African Species. South African Biodiversity Institute. http://speciesstatus.sanbi.org/assessment/last-assessment/250/. Downloaded on 2024-01-08.

Edge, D. 2018. *Thestor brachycerus brachycerus.* Southern African Lepidoptera Conservation Assessment (SALCA). Red List of South African Species. South African Biodiversity Institute. http://speciesstatus.sanbi.org/assessment/last-assessment/395/. Downloaded on 2024-01-08.

Hochkirch, A, C Bazelet, and A Danielczak. 2018. *Aneuryphymus montanus.* Red List of South African Species. South African Biodiversity Institute. http://speciesstatus.sanbi.org/assessment/last-assessment/4408/. Downloaded on 2024-01-08.

IUCN SSC Amphibian Specialist Group & South African Frog Re-assessment Group (SA-FRoG). 2016. *Afrixalus knysnae.* The IUCN Red List of Threatened Species 2016: e.T56065A77160768. https://dx.doi.org/10.2305/IUCN.UK.2016-3.RLTS.T56065A77160768.en. Accessed on 08 January 2024.

Mucina, L, and M C Rutherford. 2006. *The Vegetation of South Africa, Lesotho and Swaziland.* Strelitzia.

Picker, M, C Griffiths, and A Weaving. 2004. *Field Guide To The Insects Of South Africa.* Struik Publishers.

Rebelo, A G, C Boucher, N Helme, L Mucina, and M C Rutherford. 2006. *Fynbos biome 4. Vegetation of South Africa, Lesotho and Swaziland.*

Roberts, A, P A R Hockey, W R J Dean, and P Ryan. 2005. *Roberts Birds of Southern Africa VII.* Trustees of the J. Voelcker Bird Book Fund.

Samways, M J. 2007. *Ecchlorolestes nylephtha.* Red List of South African Species. South African Biodiversity Institute. http://speciesstatus.sanbi.org/assessment/last-assessment/1576/. Downloaded on 2024-01-08.

SANBI. 2020. *Species Environmental Assessment Guideline. Guidelines for the the implementation of the Terrestrial Fauna and Terrestrial Flora Species Protocols for environmental in impact assessments in South Africa.* South African National Biodiversity Institute, Pretoria. Version 3.1. 2022.

Skinner, J.D. & Chimimba, C.T. 2005. *The Mammals of the Southern African Subregion.* Cambridge University Press.

Swanepoel, L, W Samuel, J Power, A Snyman, I Gaigher, C Senekal, and Q Martins. 2016. *Panthera pardus.* In Child MF, Roxburgh L, Do Linh San E, Raimondo D, Davies-Mostert HT, editors. The Red List of Mammals of South Africa, Swaziland and Lesotho. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa.

Taylor, M R. 2015. *Bradypterus sylvaticus.* In: The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland. Taylor, MR, Peacock F, Wanless RW (eds). BirdLife South Africa, Johannesburg, South Africa.

Taylor, M R. 2015. *Circus maurus.* In: The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland. Taylor, MR, Peacock F, Wanless RW (eds). BirdLife South Africa, Johannesburg, South Africa.

Taylor, M R. 2015. *Circus ranivorus.* In: The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland. Taylor, MR, Peacock F, Wanless RW (eds). BirdLife South Africa, Johannesburg, South Africa.

Taylor, M R. 2015. *Polemaetus bellicosus.* In: The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland. Taylor, MR, Peacock F, Wanless RW (eds). BirdLife South Africa, Johannesburg, South Africa.

Taylor, M R. 2015. *Stephanoaetus coronatus.* In: The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland. Taylor, MR, Peacock F, Wanless RW (eds). BirdLife South Africa, Johannesburg, South Africa.

Venter, J, A Seydack, and Y Ehlers-Smith. 2016. *Philantomba monticola.* In Child MF, Roxburgh L, Do Linh San E, Raimondo D, Davies-Mostert HT, editors. The Red List of Mammals of South Africa, Swaziland and Lesotho. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa.

Woodhall, S. 2005. *Field guide to butterflies of South Africa.* New Holland Publishers (NZ) Limited.

APPENDIX 1: AVIFAUNA SPECIES OBSERVED DURING SITES VISIT TO ERF 7614

Common name	Scientific name
African Sacred Ibis	*Threskiornis aethiopicus*
Amethyst Sunbird	*Chalcomitra amethystina*
Black Saw-wing	*Psalidoprocne pristoptera*
Burchell's Coucal	*Centropus burchellii*
Cape Bulbul	*Pycnonotus capensis*
Cape Robin-Chat	*Cossypha caffra*
Cape Wagtail	*Motacilla capensis*
Cape Weaver	*Ploceus capensis*
Cape White-eye	*Zosterops virens*
Common Starling	*Sturnus vulgaris*
Common Waxbill	*Estrilda astrild*
Forest Buzzard	*Buteo trizonatus*
Green-backed Camaroptera	*Camaroptera brachyura*
Hadada Ibis	*Bostrychia hagedash*
Helmeted Guineafowl	*Numida meleagris*
Karoo Prinia	*Prinia maculosa*
Kelp Gull	*Larus dominicanus*
Klaas's Cuckoo	Chrysococcyx klaas
Red-chested Cuckoo	*Cuculus solitarius*
Red-eyed Dove	*Streptopelia semitorquata*
Red-winged Starling	*Onychognathus morio*
Sombre Greenbul	*Andropadus importunus*
Southern Fiscal	*Lanius collaris*
Speckled Mousebird	*Colius striatus*
White-rumped Swift	*Apus caffer*

APPENDIX 2: MAMMAL SPECIES OBSERVED DURING SITE VISITS TO ERF 7614

Order	Family	Common name	Scientific name
Primates	Cercopithecidae	Vervet monkey	Chlorocebus pygerythrus
Rodentia	Bathyergidae	Mole rat	-

APPENDIX 3: INVERTEBRATE SPECIES OBSERVED DURING SITE VISITS TO ERF 7614

Order	Family	Common name	Scientific name
Aranea	Salticidae	Jumping Spider	*Hyllus argyrotoxus*
Aranea	Thomisidae	Elongate Green Crab Spider	*Oxytate* sp.
Coleoptera	Scarabaeidae	Zigzag Fruit Chafer	*Anisorrhina flavomaculata*
Diplopoda (Class)	Oniscomorpha (Superorder)	Pill Millipede	-
Hemiptera	Cercopidae	Spotted Red Spittlebug	*Locris arithmetica*
Hemiptera	Scutelleridae	Ladybird Bug	*Steganocerus multipunctatus*
Hymenoptera	Formicidae	Black Cocktail Ant	*Crematogaster peringueyi*
Lepidoptera	Cheraxinae	Pearl Emperor	*Cheraxes varanes*
Lepidoptera	Lycaenidae	Common Blue	*Leptotes sp.*
Lepidoptera	Nymphalidae	Acara Acraea	*Acraea acara*
Lepidoptera	Nymphalidae	African Monarch	*Danaus chrysippus*
Lepidoptera	Nymphalidae	Painted Lady	*Vanessa cardui*
Lepidoptera	Nymphalidae	Rainforest Brown	*Cassionympha cassius*
Lepidoptera	Papilionidae	Citrus Swallowtail	*Papilio demodocus*
Lepidoptera	Papilionidae	Green-banded Swallowtail	*Papilio nireus*
Mantodea	Mantidae	Common Green Mantid	*Sphodromantis gastica*
Odonata	Libellulidae	Julia Skimmer	*Orthetrum julia*

Aquatic Biodiversity Impact Assessment

Proposed Residential Development on Erf 7614 Lelieskloof, Knysna, Western Cape.

Prepared For: EcoRoute
Author: Dr. Jackie Dabrowski
Confluent Environmental Pty (Ltd)
7 St. Johns Street,
Dormehls Drift,
George, 6529
Contact jackie@confluent.co.za

SACNASP: 115166 (Aquatic Science)
Date: March 2024
Version: Draft, pending SDP revision

confluent
aquatic consulting & research

DECLARATION OF CONSULTANTS INDEPENDANCE

I consider myself bound to the rules and ethics of the South African Council for Natural Scientific Professions (SACNASP);

• At the time of conducting the study and compiling this report I did not have any interest, hidden or otherwise, in the proposed development that this study has reference to, except for financial compensation for work done in a professional capacity;

• Work performed for this study was done in an objective manner. Even if this study results in views and findings that are not favourable to the client/applicant, I will not be affected in any manner by the outcome of any environmental process of which this report may form a part, other than being members of the general public;

• I declare that there are no circumstances that may compromise my objectivity in performing this specialist investigation. I do not necessarily object to or endorse any proposed developments, but aim to present facts, findings and recommendations based on relevant professional experience and scientific data;

• I do not have any influence over decisions made by the governing authorities;

• I undertake to disclose all material information in my possession that reasonably has or may have the potential of influencing any decision to be taken with respect to the application by a competent authority to such a relevant authority and the applicant;

• I have the necessary qualifications and guidance from professional experts in conducting specialist reports relevant to this application, including knowledge of the relevant Act, regulations and any guidelines that have relevance to the proposed activity;

• This document and all information contained herein is and will remain the intellectual property of Confluent Environmental. This document, in its entirety or any portion thereof, may not be altered in any manner or form, for any purpose without the specific and written consent of the specialist investigators.

• All the particulars furnished by me in this document are true and correct.

Jackie Dabrowski (Ph.D., Pr.Sci.Nat. *Aquatic Science*)
SACNASP Registration Number 115166
Co-director: Confluent Environmental (Pty) Ltd

Qualifications: BSc, BSc Honours (Entomology), MSc & PhD (Veterinary Science)

Expertise: > 13 years' experience working on aquatic ecosystems across South Africa, with a focus on the Southern Cape in the last 7 years. Includes research and consulting expertise, having published > 10 water-related research articles and compiled > 400 aquatic specialist reports. Research and consulting have been in a range of sectors including agriculture, urban developments, linear structures, renewable energy, conservation, and mining.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. INTRODUCTION

Confluent Environmental Pty (Ltd) was appointed by EcoRoute to provide aquatic specialist inputs for the proposed residential development on Erf 7614 Lelieskloof, Knysna, Western Cape. (Figure 1). The site is approximately 600 m North of Knysna Central and 1.2 km from the Knysna estuary.

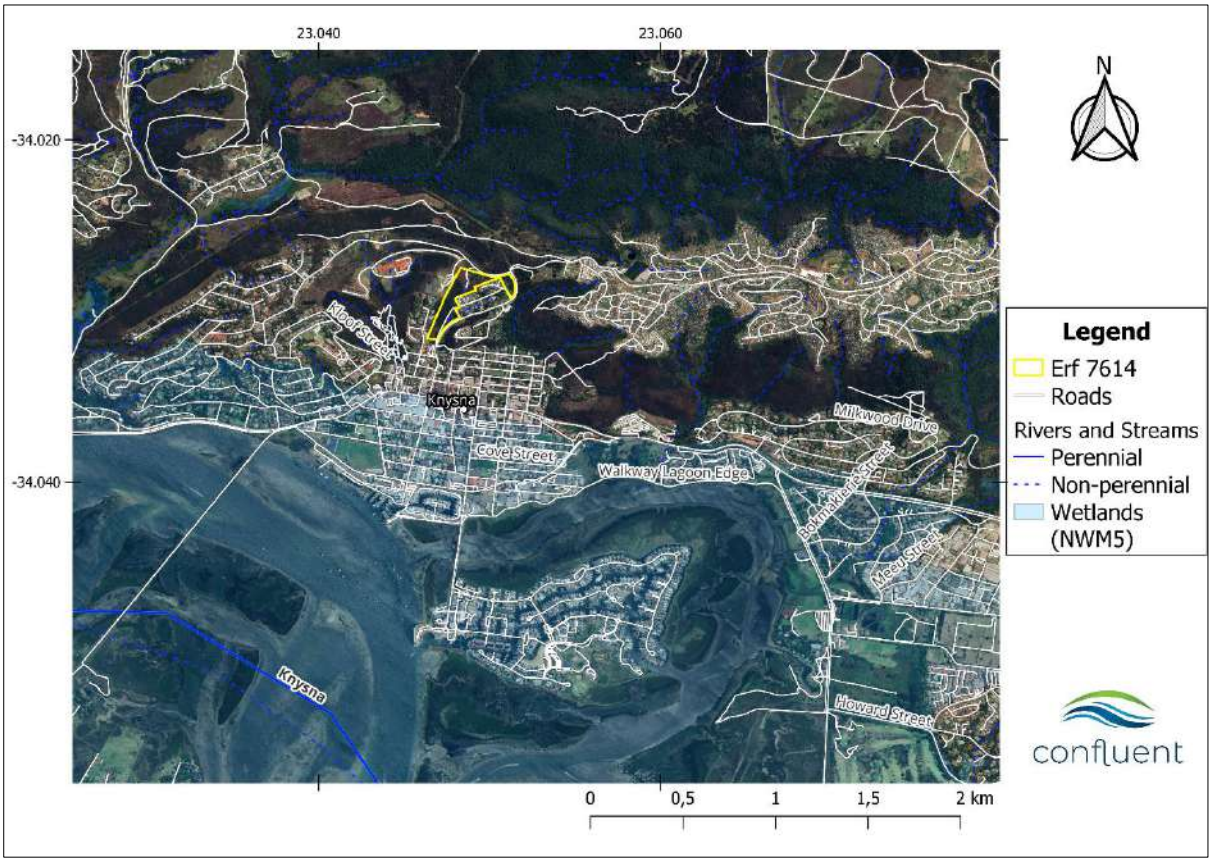


Figure 1. Erf 7614 Lelieskloof, Knysna, Western Cape.

1.1 The Proposed Development

A conceptual Site Development Plan was made available for this assessment. However, the understanding is that it may be altered based on environmental sensitivities of the site post-assessment. A description of the conceptual SDP follows. The developer proposes the development of high-density residential units, roads, and parking areas on Erf 7614 Lelieskloof, Knysna, Western Cape. The development is subdivided into six portions (A to F) with a total surface area of 5.62 ha. Portions A-C (General Residential III) will be accessed via individual access points, Portion A will be accessed via Rio Street, Portion B will be accessed via Portion F (Transport Zone II) connected to Concordia Road and Portion C will be accessed via Portion D (Transport Zone II) connected to Concordia Road. Portion E is proposed to be a public open space (Figure 2). In total, the developer proposes the development of 274 units with communal open space and parking areas, covering 60% of the property. The development will take advantage of the slope of the site allowing ground contact at two levels, hence reducing the height, and buildings higher than 3 storeys will have lift access (Figure 3).

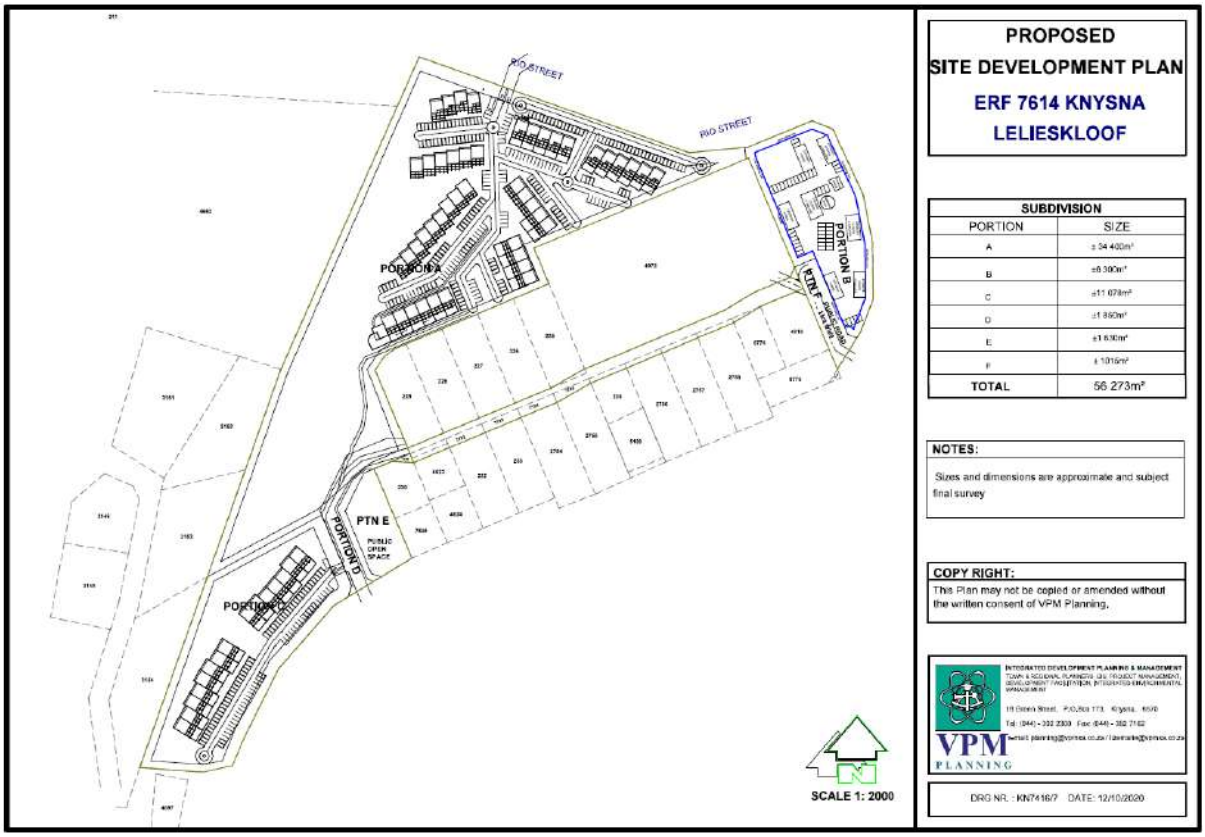


Figure 2: Conceptual Site Development Plan.

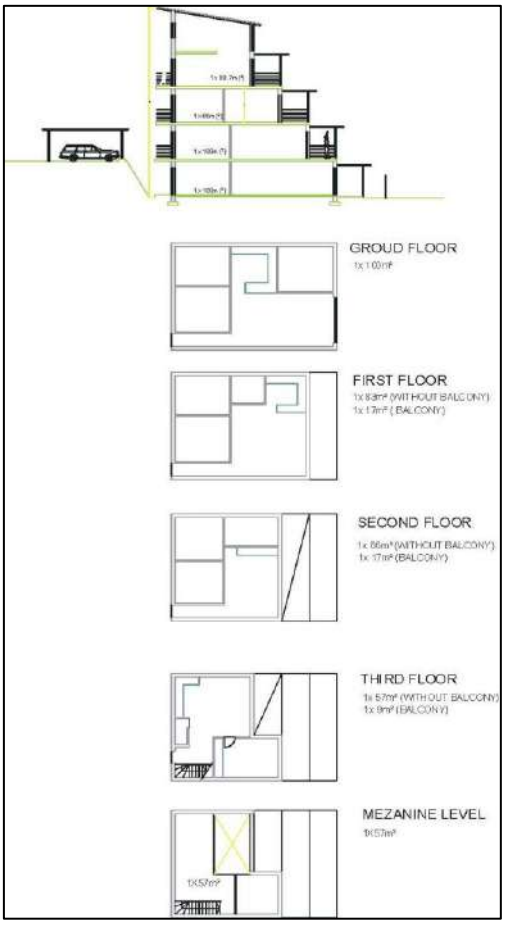


Figure 3: Proposed unit plan.

1.2 DFFE Screening Tool Results

According to the Department of Environment, Forestry and Fisheries (DFFE) screening tool, Aquatic Biodiversity at the site has a **Very High** sensitivity (Figure 4). The sensitivity features identified about the classification are:

- Freshwater Ecosystem Priority Area (FEPA) sub-catchment
- Strategic Water Source Areas (SWSA; Surface Water) Outeniqua

The scope of work for this report is guided by the legislative requirements of the National Environmental Management Act (NEMA) and the National Water Act (NWA; Act No 36 of 1998).

Figure 4. Results of the DFFE Screening Tool which indicate Very High Sensitivity of the Aquatic Biodiversity theme for Erf 7614.

1.3 Scope of work

According to the protocols specified in GN 320 (Protocol for the specialist assessment and minimum report content requirements for environmental impacts on aquatic biodiversity) of the National Environmental Management Act (NEMA; Act No. 107 of 1998), assessment and reporting requirements for aquatic biodiversity are associated with a level of environmental sensitivity identified by the national web-based environmental screening tool (screening tool). An applicant intending to undertake an activity identified in the scope of this protocol on a site identified by the screening tool as being of:

- **Very High** sensitivity for aquatic biodiversity, must submit an Aquatic Biodiversity Specialist Assessment; or
- **Low** sensitivity for aquatic biodiversity, must submit an Aquatic Biodiversity Compliance Statement.

The objectives of this assessment included the following:

- To undertake a desktop analysis and site inspection to verify the sensitivity of aquatic biodiversity as **Very High** or **Low**; and
- Compile an Aquatic Biodiversity Compliance Statement or Aquatic Biodiversity Specialist Assessment based on the site verification of the sensitivity of the site. This includes an assessment of the following:

  Interrogation of available desktop resources including:

  - DWS spatial layers (1:50 000 rivers)
  - National Freshwater Ecosystem Priority Areas (NFEPA) spatial layers (Nel *et al.,* 2011)
  - National Wetland Map 5 and Confidence Map (CSIR, 2018)
  - Western Cape Biodiversity Spatial Plan (WCBSP, 2017).

  Conduct a site visit to determine the site sensitivity:

  - Identification and classification of watercourses within and adjacent to the site according to methods detailed by Ollis *et al*. (2013);
  - Determine the watercourse Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) using an appropriate method (if watercourses are present).
  - Delineate wetland / riparian areas following methods prescribed by DWAF (2015).
  - Determine an appropriate buffer for wetland areas using the site-specific buffer tool developed by Macfarlane and Bredin (2016).

This report will also need to comply with GN4167 of 2023 of the National Water Act (NWA; Act 36 of 1998) if the proposed development will take place in the area defined as the Regulated Area. In the case of wetlands, if the development takes place within 500m of a wetland it is defined as within the Regulated Area of a watercourse. In this case, a Risk Matrix must be compiled by a SACNASP-registered aquatic scientist to determine the level of risk posed by the development to the wetland assuming full implementation of all mitigation measures. If the risk is 'Low' then the development can be Generally Authorised, but if the risk is 'Medium' or 'High' then a Water Use License Application will be required.

1.4 Assumptions and Limitations

Two site visits were conducted in December 2023 and January 2024 which is considered mid-Summer. It is possible that sensitive features such as rare or unique biota (e.g. amphibians), plants or habitats were not observed during the site visit due to relatively low rainfall and high temperatures over this period. Many plants and animals are influenced by season, time of day, flow level, or vegetation cover.

Significant areas of the site are invaded with moderate to high-density stands of black wattle (*Acacia mearnsii*). Given the presence of a wetland on the site, and the duplex soil type of the site it is not uncommon in this region that once areas invaded with wattle are cleared, wetland conditions can 'reappear' due to the reduction in abstraction of water from the vadose zone. Should the clearance of black wattle from the site result in increased wetland areas these must be further assessed by an aquatic specialist and cannot be excluded from assessment simply because they were obscured by invasive vegetation at the time of this assessment.

Any watercourse PES&EIS is limited to the watercourse areas assessed for this report and does not extend across the entire system.

Watercourse delineations and buffer determinations are site and land use specific and cannot be extrapolated beyond the area assessed in this report.

This assessment was compiled in consideration of high-density residential development as the land use. Should the proposed land use change substantially then this assessment should be revised and updated to ensure applicability. Likewise, if the SDP changes substantially from that originally assessed, then this report should be updated to consider potential impacts of any changes to aquatic ecosystems.

2. CATCHMENT CONTEXT

2.1 Catchment features

The development site (Erf 7614) is in the quaternary catchment **K50B** in the catchment of the Knysna River (Figure 5). Two non-perennial rivers or natural lines of drainage are mapped on the property flowing in a Southwest direction over the property. As the **rainfall intensity** in the area is classified as Very High and the inherent **erosion potential** of soils also as High, erosion of soils and stormwater management are factors that must be carefully considered when developing in this area, especially considering the large amounts of stormwater associated with urban developments and the fact that the development site is situated within a natural drainage line on a relatively steep gradient (*Table 1*, Figure 9 and Figure 7)

Table 1. Summary of relevant catchment features for the proposed development area.

Feature	Description
Quaternary catchment	K50B
Mean Annual Runoff	664 m^3/Ha
Mean Annual Precipitation	893.00 mm
Inherent erosion potential of soils (K-factor)	0.65, High
Rainfall intensity	Very High
Ecoregion Level II	20.02, Southeastern coastal belt
Geomorphological Zone	Not applicable
NFEPA area	Sub-quaternary reach 9117, FEPA.
Mapped Vegetation Type	FFh9: Garden Route Shale Fynbos (Endangered)
Conservation	None on site, but ESA1, 2, and CBA1 are associated with the surrounding area; WCBSP (2017).

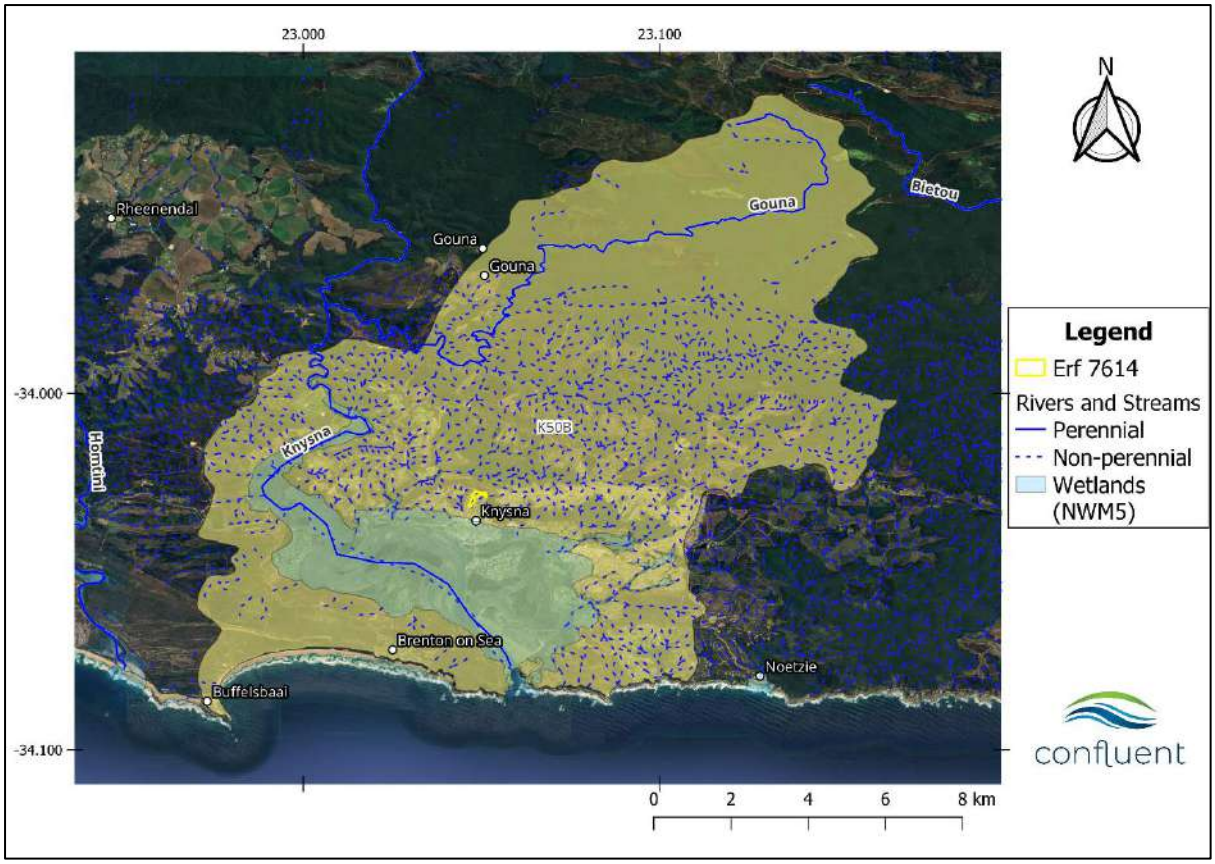


Figure 5. Location of Erf 7614 in the quaternary catchment K50B.

Rainfall occurs year-round with seasonal peaks in spring and autumn (Figure 6).

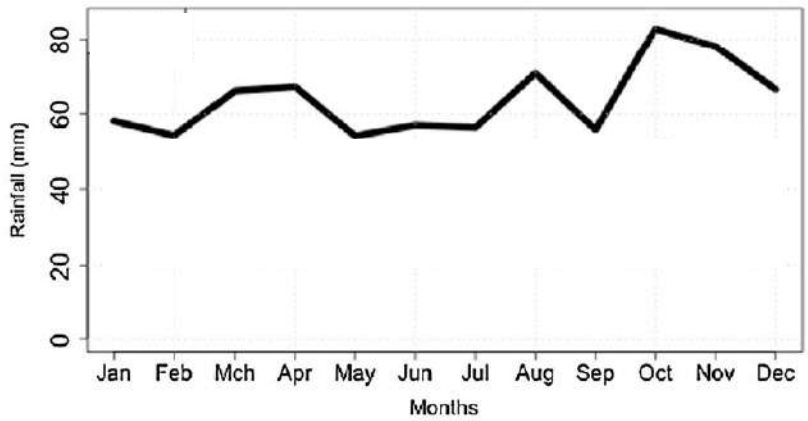


Figure 6. Area-averaged monthly rainfall for the coastal Southern Cape indicating peaks in Mar-Apr, Aug, and Oct. Data averaged between 1979 and 2011 (Engelbrecht *et al*., 2015).

The project area is located within the southeastern coastal belt (Ecoregion Level 2:20.02). The terrain is described as closed hills of moderate and high relief and moderately undulating plains. Altitude ranges between 0 – 1 300 m.a.m.s.l.

2.2 Vegetation

The vegetation type at the site is mapped as Garden Route Shale Fynbos, (FFh9; NVM, 2018). A detailed botanical specialist assessment is available for the site (Confluent Environmental, Botanical Specialist Assessment 2023). This vegetation type has been mapped as Endangered, because it is narrowly distributed with high rates of habitat loss in the past 28

years (1990-2018), placing the ecosystem type at risk of collapse (GN 47526, Revised national list of threatened ecosystems in need of protection in terms of NEM: BA, Act No. 10 of 2004). This vegetation type is primarily found on undulating hills and moderately undulating plains on the coastal forelands. The structure of this vegetation type consists of tall, dense proteoid and ericaceous fynbos in wetter areas, and graminoid fynbos (or shrubby grassland) in drier areas. Fynbos appears to be confined to flatter more extensive landscapes that are exposed to frequent. In fire-safe habitats closer to the coast have small clumps of thicket, with valley floors having scrub forests. Fairly wide belts of *Virgilia oroboides* occur on the interface between fynbos and forests (Vlok & Euston-Brown 2002).

2.3 Conservation and Catchment Management

2.3.1 Western Cape Biodiversity Spatial Plan

The Western Cape Biodiversity Spatial Plan (WCBSP; 2017) indicated that Erf 7614 does not have any mapped areas of conservation concern (Figure 7).

Figure 7. Erf 7614 in relation to mapped conservation features of the Western Cape Biodiversity Spatial Plan (2017).

2.3.2 National Freshwater Ecosystem Priority Areas

According to the National Freshwater Ecosystem Priority Atlas (NFEPA; Nel *et al*., 2011) the sub-quaternary reach (SQR 9117) is classified as a Freshwater Ecosystem Priority Areas (FEPA). This category requires that any development conducted on Erf 7614 must strive to do so with the least amount of impact on the environment to maintain the good condition (A or B ecological category) of the river catchment within which it occurs. In this case, all

watercourses on or nearby to Erf 7614 drain to the Knysna Estuary which is ranked as the number one most important estuary in South Africa. It is therefore imperative that that any impacts related to the construction or operational phase of the development be well managed to prevent negative impacts from occurring.

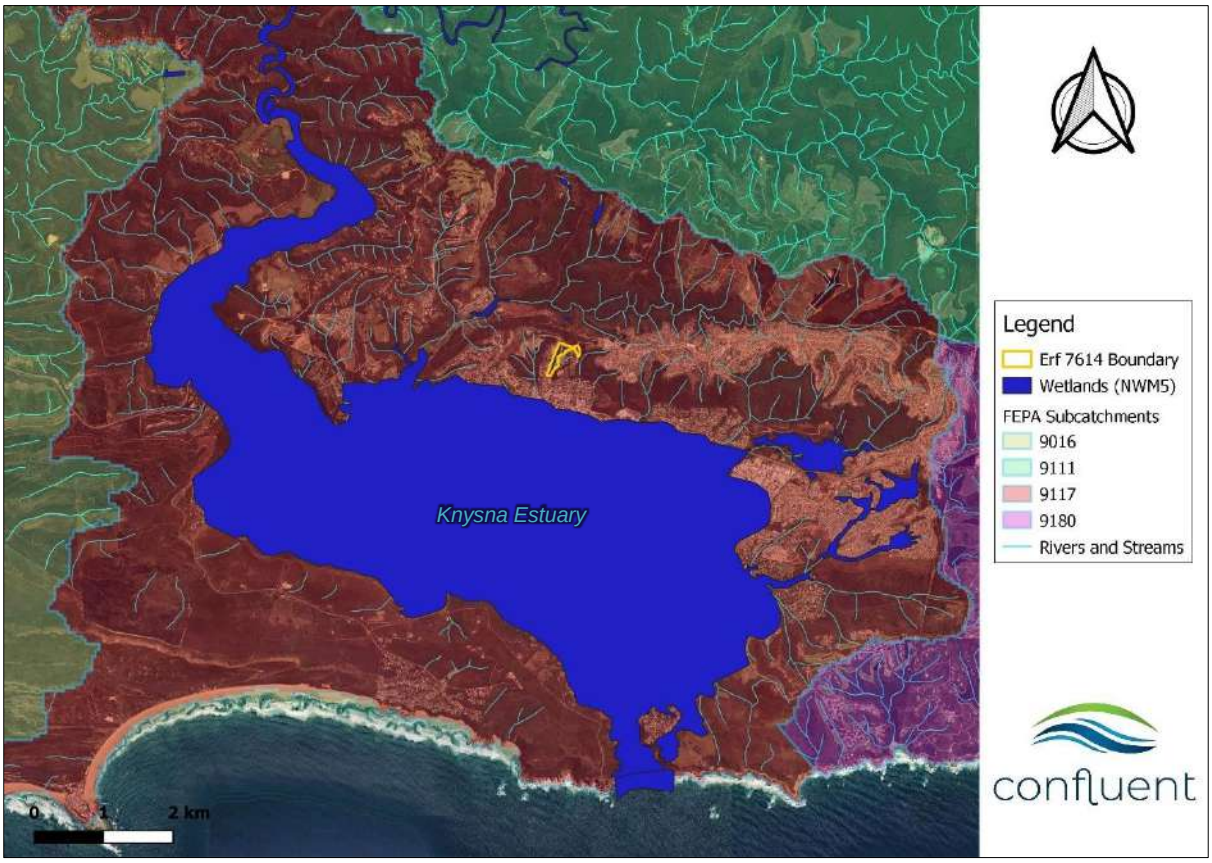


Figure 8. Location of Erf 7614 in the subquaternary catchment 9117 which drains to the Knysna Estuary.

2.3.3 Strategic Water Source Area

Erf 7614 is in the Outeniqua Strategic Water Source Area for surface water (SWSA-sw). SWSAs are defined as areas of land that supply a disproportionate (ie. Relatively large) quantity of mean annual runoff in relation to their size and are therefore considered nationally relevant (Le Maitre *et al*., 2018). A key objective in the management of SWSAs is to ensure the quantity and quality of water within and flowing from SWSAs is protected from developments that cause unacceptable and irreparable impacts.

Development of roads, parking areas and other impervious surfaces, along with wetland draining or infilling has the potential to change quantities of water in watercourses by intercepting, increasing, reducing or diverting flows from their normal path. Water quality can be impacted by flow-related alterations, particularly increased flows as this usually results in altered sediment transport causing scouring, sedimentation and increased turbidity due to suspended sediments. Especially during the construction phase. The operational phase of urban developments increase the risk of toxic hydrocarbons and other road-based pollutants as well as sewage from leaking or blocked drains or pump stations impacting on water quality.

2.4 Mapped Watercourses

Two non-perennial natural lines of drainage are mapped on the property flowing in a Southwest direction that aligns with topographical valleys (Figure 9). These drainage lines meet towards the southwest corner of the property from where they are no longer mapped. At a desktop level it appears that the southern of the two drainage lines has been completely built over, while the northern one may still be functional.

Figure 9: Location of Erf 7614 in relation to mapped watercourses.

2.5 Historical assessment

Historically the development site has been heavily disturbed during the last 87 years. In 1936 vegetation was mostly uniform across the site with some areas of more dense vegetation along the western section and a few trees planted in a row along the eastern section (Figure 10).

In 1968 the neighbouring property to the west was either quarried or mass earthworks were undertaken which extended to Erf 7164 in the northwestern corner of the site. Densification of vegetation was becoming more evident at this time and was probably the start of alien invasive vegetation (Figure 10).

In 1973 four houses were present on the site in the northern section. Bush became increasingly dense between 1973 and 1989. Construction of houses to the south of Erf 7614 progresses during this time.

In 2003 a fifth house was constructed on the southern plot and a large area of vegetation was cleared around the original four houses which was probably alien vegetation. The remainder

of the site was relatively unchanged (Figure 10). By 2010 dense vegetation had regrown around the houses and in 2013 all five houses on the site were demolished. In 2017 small sections of vegetation were cleared in portion B with the vegetation adjacent to the western boundary burned due to the 2017 Knysna fires. From then until the present the site has remained largely similar with periodic clearance and subsequent regrowth of dense alien vegetation.

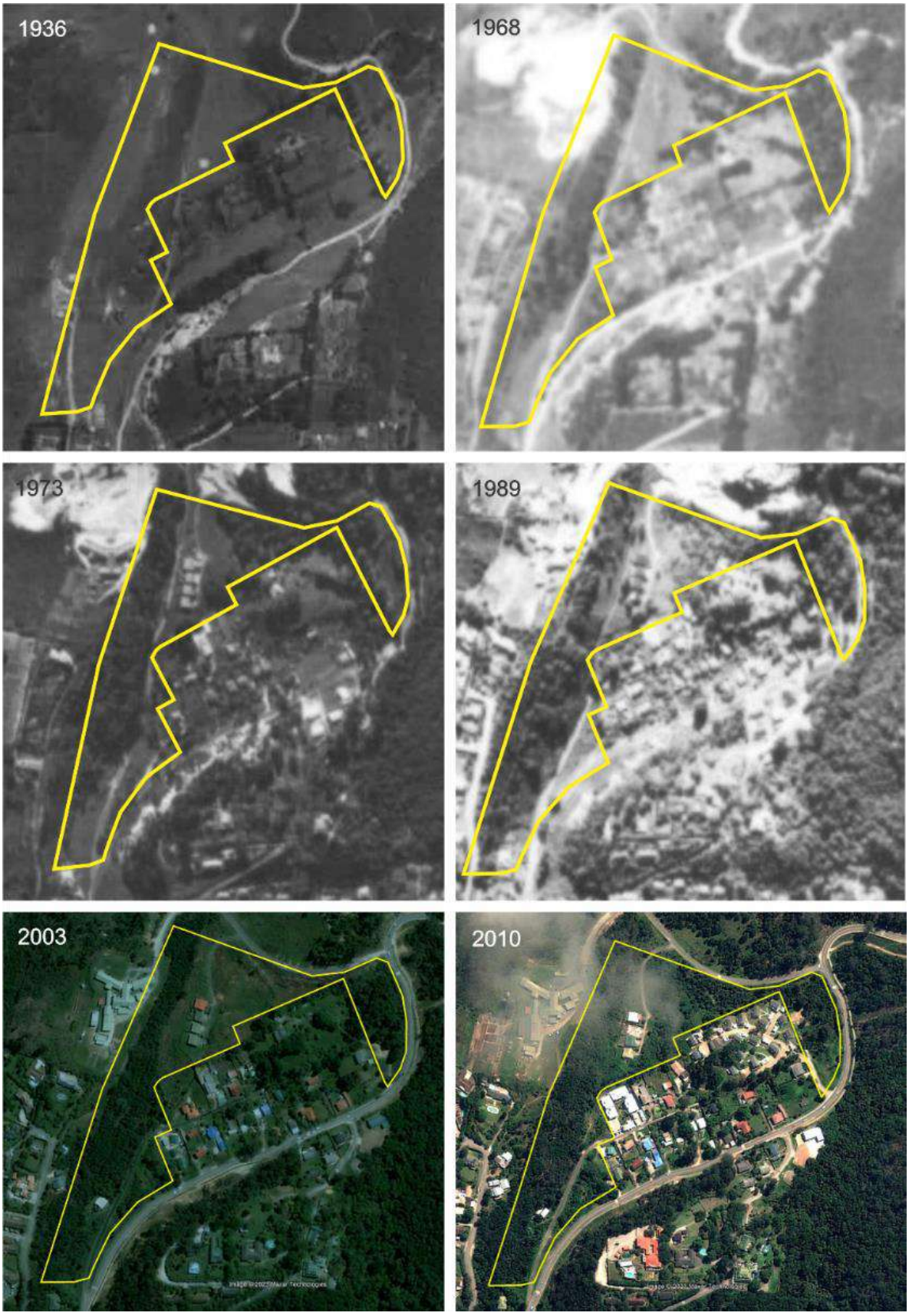


Figure 10. Historical photos showing Erf 7614 through notable changes between 1936 and 2010 (CD:NGI & Google Earth imagery).

Figure 11: Historical photos showing Erf 7614 through notable changes between 2013 and 2020 (Google Earth imagery).

3. SITE VISIT

The site was visited twice in December and January 2023. A GPS was carried throughout to track the site meander and ensure adequate coverage of the development area (Figure 12). Weather during both site visits was clear, hot and dry with moderate to low rainfall received in the weeks prior. In addition to the site itself a few adjacent areas upslope of the site were included to assess the presence / absence of wetland habitat that could be related to aquatic features observed within the property.

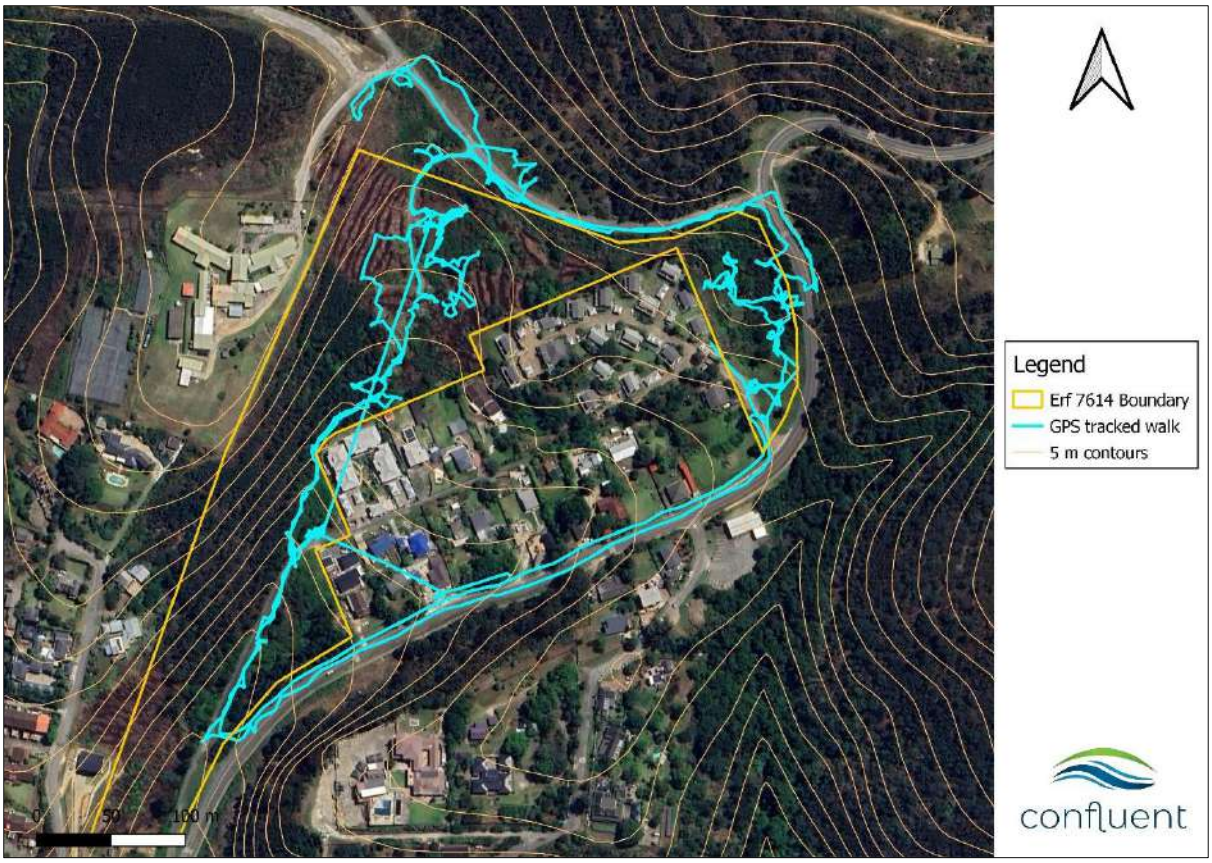


Figure 12. GPS track walked at Erf 7614 over two days of fieldwork in December 2023 and January 2024.

3.1 Site Assessment

A number of wetland features were observed during the site visit. These features have been modified to varying degrees by development adjacent to the site over several decades. Wetland areas were assessed on site as well as from the desktop perspective to determine whether they were natural or artificial features, and to accurately map them.

3.2 Wetland Delineation and Classification

Wetland delineation used typical indicators such as hydrophilic plant species, redoximorphic soil indicators and topographic position as confirmation of wetland areas (DWAF, 2005). Where wetland features were observed on the site, soil auguring and plant species identification was used to confirm observations.

3.2.1 Soils

Dominant soils in the wetland area showed mottling indicative of seasonal saturation (Figure 13). The soil has a duplex profile with a distinct clay layer approximately 30-40 cm from the surface. This layer of soil inhibits water infiltration causing periodic saturation of the A horizon leading to wetland conditions on the site.

Figure 13. Soil auger samples collected in the seasonal wetland area on Erf 7614.Soils show distinct mottling and in places were saturated with water. Soil auger samples correspond with areas of wetland vegetation growth.

3.2.2 Vegetation

Wetland plants on the site were typical seasonal wetland species from the region, and the diversity indicates a natural wetland feature (Figure 14). The wetland s dominated by a dense canopy of *Cliffortia ororata* which shelters a wide diversity of wetland plants beneath it. An area of *C. odorata* had been cleared in the wetland, revealing a wide variety of wetland plants below. Wetland plants were also observed across the road above the site where *Phragmites australis and Typha capensis* reeds were also observed among other wetland plants.

Figure 14. Wetland plant species identified from the unchanneled valley bottom wetland in the central areas of the site.

3.2.3 Watercourse Classification

Wetland classification follows methods in Ollis *et al.(*2013). The wetland is in a relatively broad valley-bottom which increases in gradient and confinement (narrows) towards the lower part of the site. A channel is evident in the lower portion of the wetland, but it is likely that this was created artificially to direct runoff into a culvert as opposed to dispersing across the site. The wetland is classified as an **unchanneled valley-bottom wetland** (Figure 15).

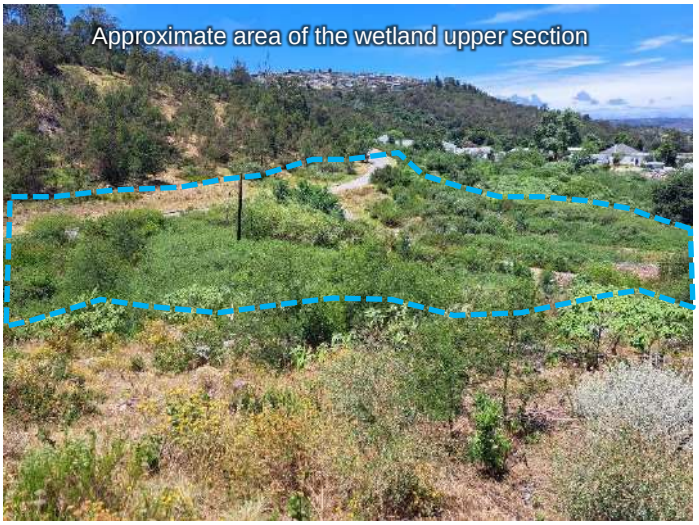


Figure 15. Unchanneled valley bottom wetland in the central area of the site.

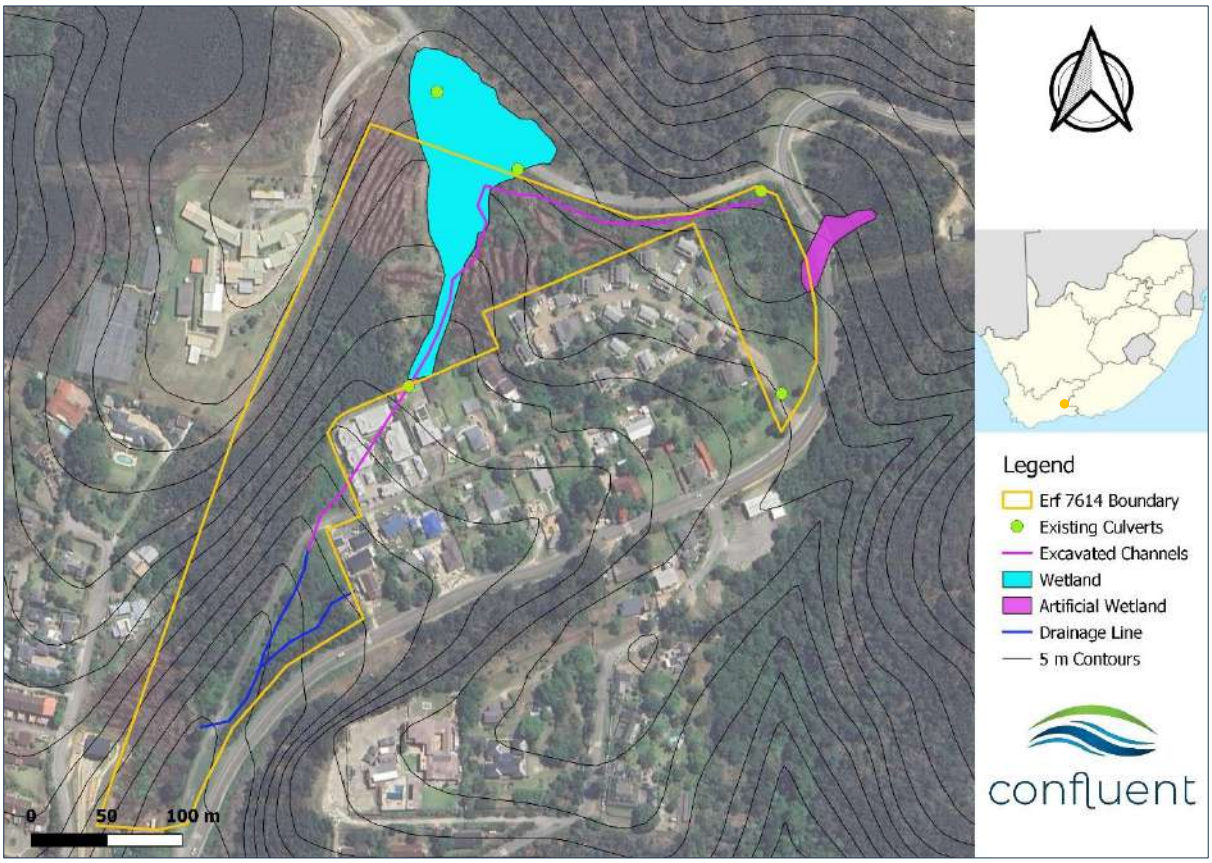


Figure 16. Delineated aquatic features on Erf 7614, Knysa in relation to 5 m contours. Culverts indicate areas where stormwater is conveyed.

3.2.4 Artificial Wetlands and Channels

A number of artificial aquatic features were identified on the site. Towards the eastern section of the site is a saturated patch of soil approximately 30-40 m^2 in extent (Figure 16). There is standing water at this site which was observed during both site visits. The diversity of wetland vegetation is very low, consisting of one species, *Zantedeschia aethiopica* (arum lilies) growing in patches below a high canopy. This wet area is downslope from the Knysna water

treatment works where sludge dams are understood to frequently overflow and seep down the slope, forming wetland-like conditions on both sides of the road. The artificial wetland at this point has very limited ecological function and can therefore be excluded from further assessment. However, it will be important to be aware of this seepage during the construction and operational phases of development as conditions at this point are currently not ideal for construction.

A drainage channel was constructed from the north-eastern culvert around the northern extent of the existing housing development, which directs stormwater into the central wetland area and around the housing development. This was presumably to mitigate any risk of flooding to the existing housing development. *Typha capensis* plants have established in the upper section of the drainage channel near the culvert, but this is reflective of stormwater discharged to the channel as opposed to reflecting wetland conditions.

The natural wetland area has an excavated channel towards the south which directs water into a piped culvert beneath 2 or 3 houses. The water daylights to the south where it is more characteristic of a drainage line and reaches a confluence with another stream. The wetland at this point is not so much artificial as significantly modified from its original state.

Figure 17. Aquatic features with limited ecological function classified as artificial on Erf 7614, Knysna.

3.2.5 Aquatic Impact Buffers

Buffers are located where the land meets a delineated watercourse, and refer to the zone where these two habitats interface. Buffer areas are linear zones adjacent to watercourses managed with the intention of protecting water resources from diffuse pollution associated with adjacent land uses. In addition, they provide habitat for wildlife within, and act as corridors for movement, feeding and breeding through fragmented landscapes. The wetland buffer areas were determined using the buffer tool developed by Macfarlane and Bredin (2016). The tool uses a wide range of site-specific environmental variables, along with anticipated land-use impacts to determine a recommended distance for the buffer.

The buffer width determined for the wetland is 15 m and for the drainage lines downstream of the housing complex is 10m (Figure 18).

This buffer accounts for a number of pre-existing impacts already affecting the wetland. Connectivity in the broader landscape has already been fragmented by the channelling and piping of water through culverts from the wetland beneath the housing complex to the south.

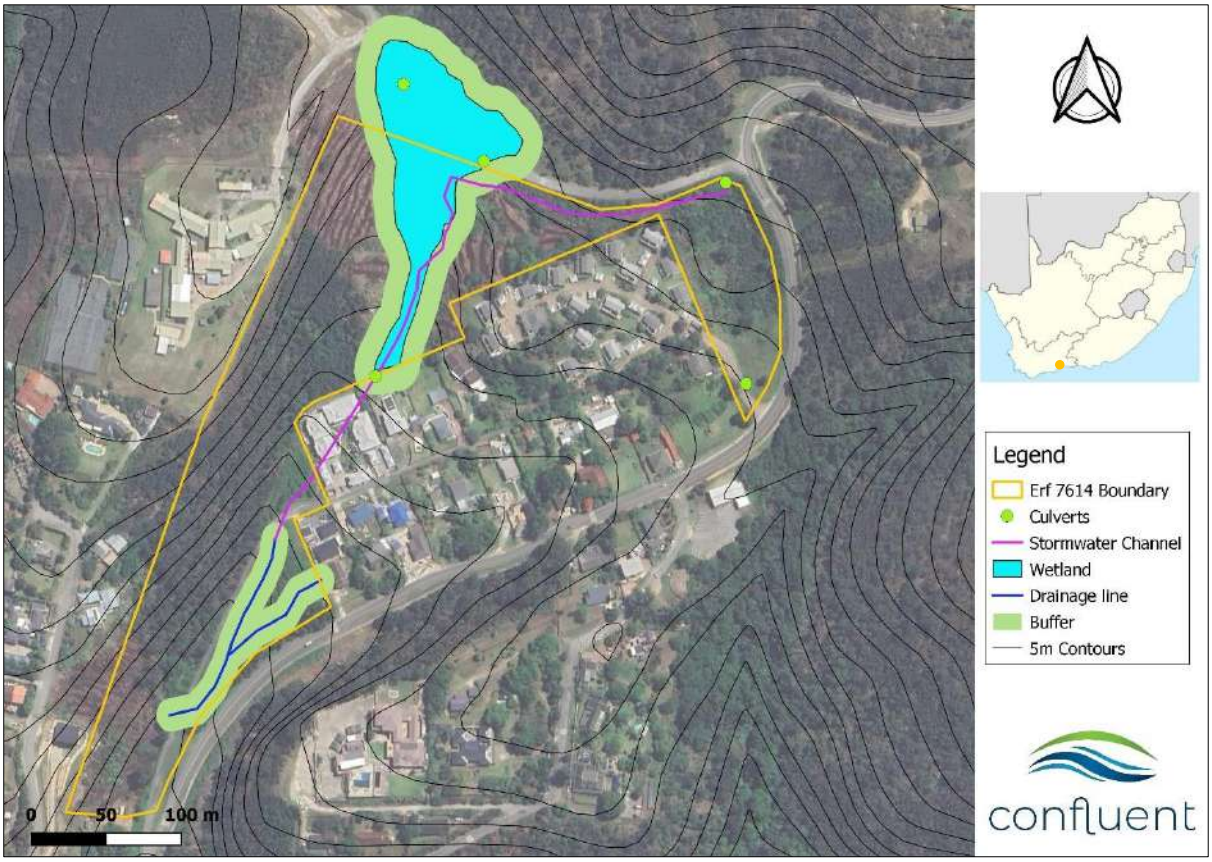


Figure 18. Delineated watercourses including a 15m wetland buffer and 10m drainage line buffer.

4. PES&EIS OF WETLAND

4.1 Present Ecological State

The PES of the wetland was determined using the updated WET-Health Version 2 method described by Macfarlane *et al.* (2020). Methods for the assessment are provided in Appendix 1. The wetland Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) were determined for the central unchanneled valley-bottom wetland. The assessment takes into account all existing impacts presently affecting the ecological state and function of the wetland. The drainage lines were included in this assessment because it is highly likely that they were an extension of the wetland prior to channelisation and high stormwater inputs which have meant these sections now function more like a stream than a wetland.

Methods used to determine the Present Ecological State (PES) of the wetland are provided in Appendix 1.

The results of the Level 2 WET-Health PES assessment determine the wetland to be in a **Moderately Modified** condition (Category C; Table 2). The Hydrology and Vegetation modules were most negatively impacted within the wetland. The combination of infilling for the existing housing development resulting in channelling the wetland through pipes under the houses and into excavated channels (drainage lines) downstream significantly affected this

area of the wetland. Downstream of the housing complex the water exits the piped culvert into a channel approximately 1.5m deep which flows parallel to the road. The most natural area of the wetland is located in the upper portion of the property where vegetation within the wetland is all indigenous and fairly diverse (Figure 14). In adjacent areas of the wetland are dense patches of alien vegetation dominated by black wattles (*Acacia mearnsii;* Figure 19). In the drainage lines below the housing complex alien vegetation includes exotic garden plants and invasive species such as sword fern (*Nephrolepis cordifolia*) and cannas (*Canna indica*). Dumping in the form of cut alien plants, garden waste, and household refuse has occurred at various points of the wetland and drainage lines (Figure 19).

The main impact affecting water quality is that a high amount of stormwater is diverted into the wetland which will likely carry high sediment loads into the wetland.

Table 2. Summarised results of the WET-Health Level 2 Assessment for the wetland on Erf 7614.

PES Assessment	Hydrology	Geomorphology	Water Quality	Vegetation
Impact Score	4,2	3,6	2,2	5,6
PES Score (%)	58%	64%	78%	44%
Ecological Category	**D**	**C**	**C**	**D**
Trajectory of change	↓	↓	→	→
Confidence (revised results)	High	High	Medium	High
Combined Impact Score	3,9			
Combined PES Score (%)	61%			
Combined Ecological Category	**C**			
Hectare Equivalents	1,2 Ha			


Dumped green waste in the wetland


Dumped rubbish in the drainage line and invasion by swortd fern

Figure 19. Photos of the wetland and drainage lines indicating impacts affecting the Present Ecological State of the wetland.

4.2 Ecological Importance and Sensitivity

The Ecological Importance and Sensitivity (EIS) was determined using methods provided in Appendix 2. The EIS was determined to be **Moderate** for the wetland on Erf 7614 (Table 3). While support for biodiversity is not anticipated to be of great importance, the wetland still plays an important hydrofunctional role, especially for the attenuation of stormwater, erosion control and sediment trapping. Furthermore, while the majority of reference vegetation has been transformed and invaded by alien plants across the remainder of the site, the wetland represents an area of predominantly indigenous vegetation representative of wetlands typical of the southern Cape.

Table 3. Summary of scores for Ecological Importance and Sensitivity of the wetland at Erf 7614, Knysna.

Ecological importance and sensitivity	Score 0-4	Motivation
Biodiversity support	**0.66**	
Presence of Red Data species	0	Not habitat for Knysna leaf-folding frog and no other Red Data species expected.
Populations of unique species	0	No populations of unique species observed or expected
Migration/feeding/breeding sites	2	Feeding and breeding for birds and small mammals, amphibians and reptiles. But limited migration due to existing fragmentation.
Landscape scale	**2**	
Protection status of wetland	2	Private land scores 3
Protection status of vegetation type	4	Garden Route Shale Fynbos (Endangered)
Regional context of the ecological integrity	1	Relatively poor, there are wetlands in much better condition with better connectivity in the region
Size and rarity of the wetland types present	1	Not a rare wetland type and not especially large
Diversity of habitat types	2	Combination of natural and artificial features increase diversity
Sensitivity of the wetland	**2**	

Sensitivity to changes in floods	3	Unchannelled valley bottom wetland most sensitive to increased flows.
Sensitivity to changes in low flows	1	Mostly seasonal wetland so not very sensitive to low flows.
Sensitivity to changes in water quality	2	Moderate sensitivity. High nutrient inputs could increase the dominance of *Typha capensis*.
Hydrofunctional Importance	**2.4**	
Flood attenuation	3	Spread and disperse surface runoff throughout wetland area (broad valley bottom)
Streamflow regulation	2	Interflow through the vadose zone maintains flow in the drainage lines
Sediment trapping	3	Dispersed flows through the wetland encourage sediment trapping
Nutrient and toxicant assimilation	2	As above, vegetations lows flows and encourages nutrient assimilation
Erosion control	3	Unchannelled flow dispersed across the wetland prevents erosion
Carbon storage	3	Extensive growth of wetland vegetation and organic inputs store carbon
Direct human benefits	**0.6**	
Water for human use	0	Not applicable
Harvestable resources	1	Minor opportunities for collection
Cultivated foods	0	Not applicable
Cultural heritage	1	Minor value
Tourism and recreation	1	Adds to sense of place in the Garden Route as a green area
Education and research	1	Minor value
ECOLOGICAL IMPORTANCE AND SENSITIVITY	**2**	**MODERATE**: Wetlands that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these systems is not usually sensitive to flow and habitat modifications. They play a small role in moderating the quantity and quality of water of major rivers.

5. IMPACT ASSESSMENT

The assessment follows the mitigation hierarchy where successive steps should only be considered when a previous step has been exhausted. Avoidance is a priority and compensation, or offsets is a last resort (Figure 20).

It is understood that the SDP referred to in this report is a conceptual layout which is likely to change based on factors including environmental sensitivities of the site. This report therefore serves to highlight the wetland and other aquatic features on site to inform subsequent revisions of the SDP. The current SDP would result in total transformation and loss of the remaining wetland area delineated on the site. According to the mitigation hierarchy it is possible and feasible to avoid and minimise the loss of this habitat by changing the layout of the development, so the wetland is preserved. It is therefore recommended that subsequent plans be developed to accommodate the wetland, drainage lines, and buffer areas stipulated in this report. This will not only protect these systems from further degradation but will reduce

risks for the development and downstream areas relating to flooding and erosion. It will also remove the requirement for offsetting wetland loss. Wetland loss is therefore not further assessed in the impact assessment as it is understood the development will be reorientated around the wetland.

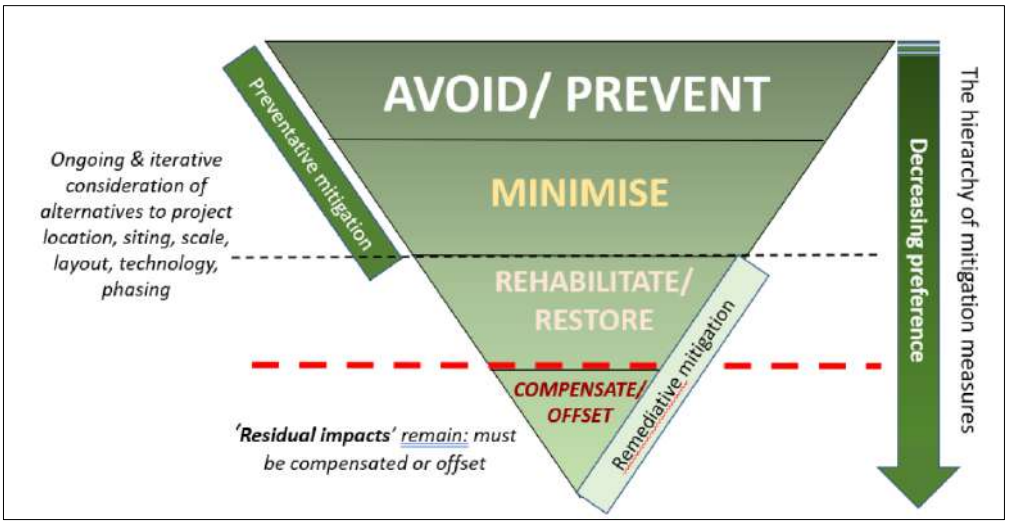


Figure 20. Mitigation hierarchy (Mitigation Hierarchy Guideline, Draft 2023).

5.1 Design and Layout Phase

5.1.1 Stormwater Management Plan

A stormwater management plan was included in the engineering services report compiled by Hofmeyr & Associates (2020) for the current SDP. The plan proposes four stormwater retention ponds at various points both on the site and off the site (Figure 21). In it, the current drainage channel north of the existing housing complex would be closed and stormwater would be rerouted north of Rio Road via a brick and concrete channel into a constructed retention dam. Remaining stormwater from the western extent of Rio Road would be channelled under the road via an existing culvert into a second retention dam. It can be seen that both these dams are located within the delineated wetland area, along with a range of other infrastructure including roads, and housing.

The construction of stormwater retention dams mimics some of the functions of a natural wetlands in terms of slowing flow, spreading surface water and controlling the release of water downstream. As there is a natural wetland in existence on the site, this feature must be preserved, and the proposed housing development reorientated around it.

It should be noted that the natural wetland extends north of Rio Road into the adjacent municipal land where one of the retention ponds has been recommended.

In principle it is feasible to enhance the amount of water retained within the wetland areas on site through the installation of retention structures which retain water for longer periods and continue to spread water without causing channel incision in the unchanneled wetland area. However, this should be considered along with other SUDS interventions as indicated in Figure 22 including source and local controls.

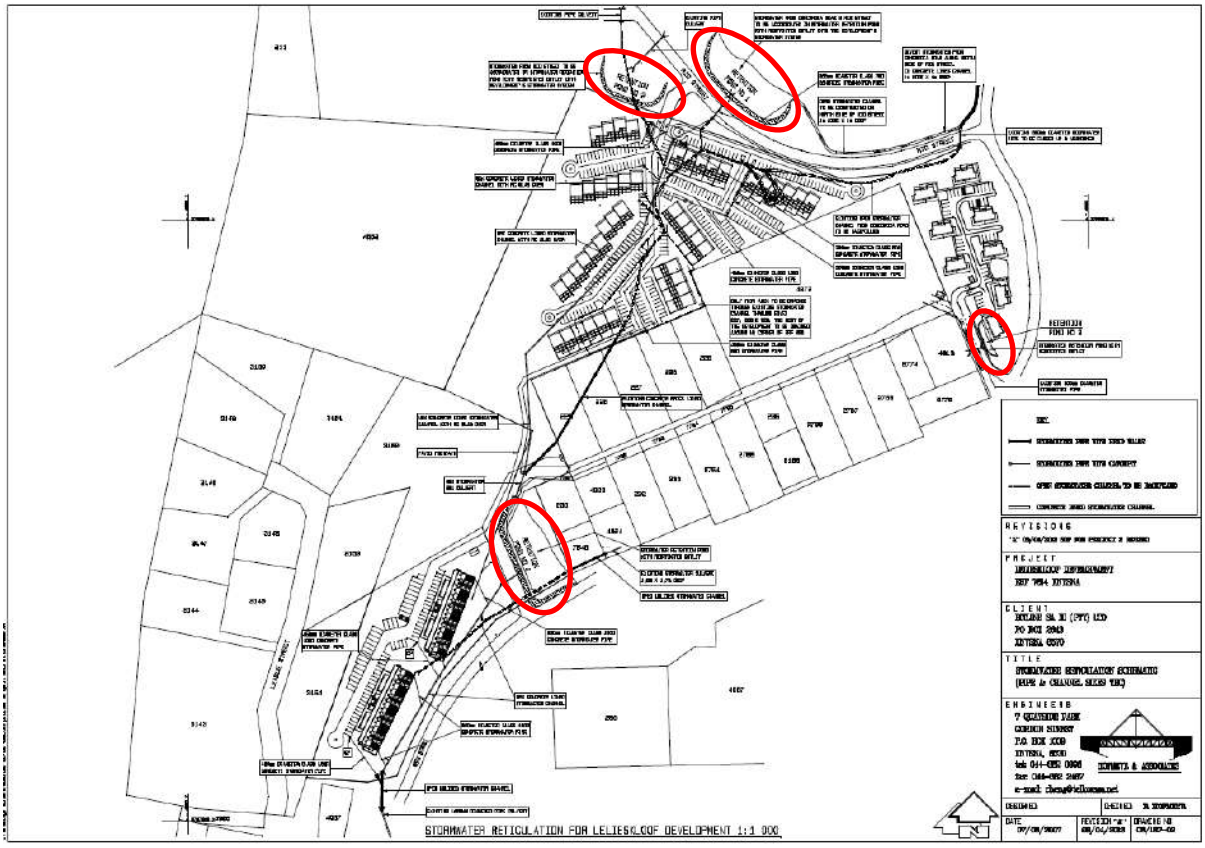


Figure 21. Stormwater reticulation plan compiled by Hofmeyr & Associates (2020). Stormwater retention ponds are shown in red.

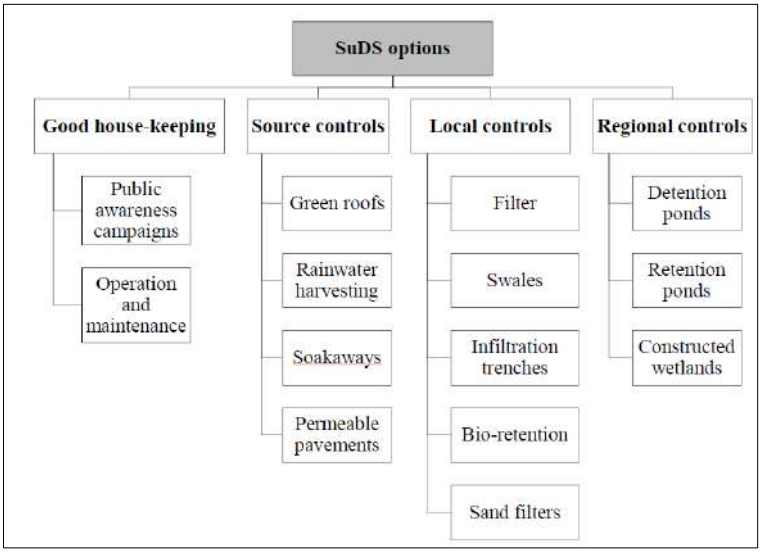


Figure 22. RSA SuDS guidelines – grouping of options (WRC, 2014)

The city of Knysna already has extensive problems in low-lying areas relating to poorly managed stormwater, much of which emanates from built up higher lying areas which create high velocity flows from impervious surfaces often channelled via conventional pipe systems into watercourses which are not able to contain excessive volumes and velocities. An excerpt

from the Guidelines for Water Sensitive Urban Design for South Africa (WRC, 2014) sums this up well:

> It is widely recognised that urban development generally results in increased runoff volumes and peak flows. Urbanisation can increase the runoff rate by 20-50% compared with natural conditions. In the extreme, the peak flow can be as much as 6.8 times that before development. This typically causes flash floods in streams and rivers and an increased number of 'bankfull' flows (SANRAL, 2007; Haubner *et al*., 2001; Brown *et al*., 2005). The SuDS philosophy of on-site treatment both promotes the retention of water on site and the reduction of runoff velocities. This reduces the costs and impacts on downstream infrastructure, e.g. bridges (ECONorthwest, 2007).

A high-density residential development on the relatively steep gradients present on Erf 7614 is likely to generate high runoff rates that will need to be effectively managed to mitigate cumulative flood risks downstream. Furthermore, *Erf 7614 represents the last significant greenfield site* in the local catchment which drains to the dense urban development of central Knysna below. Preserving the wetland on this site is all that would be left of the functional green space in this catchment.

This impact was assessed in Table 4. It is possible to reduce this impact from a *Moderate to Negligible negative impact*. There is only moderate confidence in this assessment however as it was largely qualitative and is not based on modelled pre- and post-development runoff values. These need to show a significant reduction in post-development runoff volumes which should aim to match those of pre-development runoff.

Table 4. Layout and Design Phase: Stormwater Management

Impact	**Layout and Design Phase: Channel incision in the wetland and increased downstream flood risk**			
Description of impact	**Terrestrialisation of the wetland due to channeling and cumulative flood risk to downstream infrastructure**			
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts		
Potential mitigation	**• Keep the retention dam indicated in Portion B as this is not aligned to a natural wetland and provides an excellent regional control for stormwater from this section of development. • The retention dam indicated for Portion E of the development could be constructed to function more like a wetland than the drainage line of its current state which is modified. But this area should retain a natural range of indigenous wetland plants similar to those in the wetland on Portion A to achieve this which means the entire area may not be functional as public open space as indicated in the layout. • For Portion A, a retention structure in the wetland could be considered at the lowest end of the wetland before it is channelled beneath the existing housing complex as this is currently the poorest area of habitat. • Rerouting stormwater north of Rio Road into a retention dam north of the road is not supported because this will create a channelled flow with higher volumes into the wetland on Portion A which could promote channelisation and erosion of wetland habitat. Consider an alternative method of conveying stormwater through Portion B to the retention dam on that site. • Focus efforts on source and local controls to reduce dependence on the retention dams. Ensure rainwater tanks are installed throughout. These can be plumbed into use for toilet flushing. • Use open / grass block pavers as a substitute for closed paving on walkways and parking areas to encourage better water infiltration and less runoff. • Use landscaped / garden areas as stormwater attenuation zones. Using appropriate layering these areas can function as soakaways and be placed below gutters of buildings to catch runoff before it is distributed further. • Planted trees and gardens in public areas should be lowered below hard surfaces or have 'gappy' curbs to encourage the retention and filtration of surface runoff. Some examples are provided including tree pits. • Incorporate vegetated swales with periodic check dams instead of concrete drains where runoff may occur throughout the development. • Any stormwater outlets directing runoff towards the wetland area must discharge into the buffer to a stilling basin before seeping to the wetland.**			
Assessment	**Without mitigation**		**With mitigation**	
Nature	Negative		Negative	
Duration	Permanent	Impact may be permanent, or in excess of 20 years	Short term	Impact will last between 1 and 5 years
Extent	Local	Extending across the site and to nearby settlements	Limited	Limited to the site and its immediate surroundings
Intensity	Moderate	Natural and/ or social functions and/ or processes are moderately altered	Low	Natural and/ or social functions and/ or processes are somewhat altered
Probability	Almost certain / Highly probable	It is most likely that the impact will occur	Probable	The impact has occurred here or elsewhere and could therefore occur
Confidence	High	Substantive supportive data exists to verify the assessment	Medium	Determination is based on common sense and general knowledge
Reversibility	Low	The affected environment will not be able to recover from the impact - permanently modified	Medium	The affected environment will only recover from the impact with significant intervention
Resource irreplaceability	Low	The resource is not damaged irreparably or is not scarce	Low	The resource is not damaged irreparably or is not scarce
Significance	**Moderate - negative**		**Negligible - negative**	
Comment on significance	Even with the proposed mitigation measures there is a degree of uncertainty as to whether the impact can be mitigated given the high density of the development and gradient of the site. Careful planning and modelling is required.			
Cumulative impacts	The mitigation measures are provided with the intent of minimising cumulative flood-related impacts downstream due to high density development in high-lying areas.			

5.1.2 Development Layout around Wetland

Description of the Impact

If the Site Development Plan incorporates development in the wetland a range of ecosystem services will be lost including the only remaining area of significant indigenous vegetation on the site, along with the the hydrological functions and benefits associated with the wetland.

Mitigation Objectives

Mitigation of this impact aims to preserve and enhance the indigenous vegetation and habitat in the wetland along with the hydrological functions that can protect downstream areas from flood impacts.

Mitigation Measures

Mitigation is to replan the development layout around the wetland feature including the recommended buffer area of 15m as indicated in Figure 18. The alternative development scenario of development in the wetland area to any degree would trigger the need for identification of an offset area to compensate for the wetland loss which is not recommended as it is not likely this is available within the same catchment area and is a complex (but not impossible) process.

5.2 Construction Phase

5.2.1 Site Preparation

Description of the Impact

Failure to identify sensitive features and effectively communicate with the construction team results in disturbance or destruction of aquatic features due to misinformed contractors commencing with work on site.

Mitigation Objectives

Sensitive aquatic features that are to be preserved must be clearly delineated and communicate to all personnel associated with the construction works for the full duration.

Mitigation Measures

The mitigation measures provided in Table 5 can effectively mitigate this impact from a Minor negative with no mitigation to a *Negligible negative* level provided they are fully implemented.

Table 5. Construction Phase: Site preparation for the protection of sensitive aquatic features

Project phase	**Construction**			
Impact	**Poor site preparation resulting in loss of wetland or riparian vegetation and habitat disturbance**			
Description of impact	**Vehicles, workers and materials active in the wetland, stream and buffer areas**			
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts		
Potential mitigation	**• An Environmental Control Officer (ECO) must be employed for the duration of construction to monitor implementation of mitigation measures relating to all environmental authorisations. • Pre-construction, temporary fencing must be erected along the wetland and stream buffers. Delineation of the buffer must be undertaken with the site surveyor. • Use materials that are least likely to be stolen such as wooden stakes and orange mesh construction-type fencing. • Signage indicating the wetland, stream and buffers as No-go areas for vehicles and personnel must be placed in multiple areas on fencing. • Once temporary fencing is established and before any bulk earthworks occur, all contractors must attend a site induction with the ECO and be briefed that vehicles, workers, equipment and materials may not encroach into No-Go areas around wetlands. • Any indigenous / protected trees or other vegetation to be preserved on the site should be boarded or fenced off for protection during the construction phase (Confluent Botanical Assessment). • The contractor may implement fines or the termination of contracts for encroachment into the No-Go area as any damage must be rehabilitated under guidance by an aquatic specialist.**			
Assessment	**Without mitigation**		**With mitigation**	
Nature	Negative		Negative	
Duration	Short term	Impact will last between 1 and 5 years	Immediate	Impact will self-remedy immediately
Extent	Limited	Limited to the site and its immediate surroundings	Very limited	Limited to specific isolated parts of the site
Intensity	Very high	Natural and/ or social functions and/ or processes are majorly altered	Low	Natural and/ or social functions and/ or processes are somewhat altered
Probability	Almost certain / Highly probable	It is most likely that the impact will occur	Probable	The impact has occurred here or elsewhere and could therefore occur
Confidence	High	Substantive supportive data exists to verify the assessment	High	Substantive supportive data exists to verify the assessment
Reversibility	Medium	The affected environment will only recover from the impact with significant intervention	High	The affected environment will be able to recover from the impact
Resource irreplaceability	Medium	The resource is damaged irreparably but is represented elsewhere	Low	The resource is not damaged irreparably or is not scarce
Significance	**Minor - negative**		**Negligible - negative**	
Comment on significance	The impact of unnecessarily increasing the footprint of disturbance by entering no-go areas can be mitigated to a large extent by full implementation of these mitigation measures.			
Cumulative impacts	Not applicable			

5.2.2 Management of Materials, Vehicles, Waste and Personnel

Description of the Impact

Poorly placed or managed bulk materials, refuelling areas, leaking vehicles and portable toilets can potentially pollute aquatic habitats on site and downstream, especially when combined with heavy rainfall events.

Mitigation Objectives

Significantly reduce the likelihood of any foreign materials or liquids from entering the wetland or stream during the construction period.

Mitigation Measures

Mitigation measures are provided in Table 6 which considers the mitigated impacts for this aspect as a *Negligible Negative* impact.

Table 6. Construction Phase: Poor management of materials, vehicles, waste and personnel.

Project phase	**Construction**			
Impact	**Poor management of materials, vehicles, waste and personnel**			
Description of impact	**Poorly managed materials, vehicles, personnel and waste could pollute/disturb aquatic habitat**			
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts		
Potential mitigation	**• Portable toilets to be provided at SHEQ standards of 1 per 10-15 workers. Cleaned regularly with easy access. • Workers must be provided with a designated break area including bins, clean water and toilets nearby. All located outside of the wetland and buffer areas. • The site must be kept free of litter and waste (e.g. packaging) which can be blown around. • Vervet monkeys were observed on the site making the secure and disciplined disposal of food waste a very high priority. These animals have limited options for dispersal beyond this area so care must be taken when interacting with them. • Materials must be stockpiled on level ground outside of wetland and buffer areas. Loose materials must be bunded with sandbags or similar and/or covered with a geotextile to prevent migration of material during rainfall. • No mixing of cement may take place within the wetland or buffer areas. • Vehicles must be checked daily for leaks and are not permitted on site if leaking fuel until they have been repaired. • Fuel stores and vehicle refueling areas must be located outside wetland and buffer areas on level ground. Materials for cleaning up spills must be available on site.**			
Assessment	**Without mitigation**		**With mitigation**	
Nature	Negative		Negative	
Duration	Short term	Impact will last between 1 and 5 years	Brief	Impact will not last longer than 1 year
Extent	Local	Extending across the site and to nearby settlements	Limited	Limited to the site and its immediate surroundings
Intensity	Moderate	Natural and/ or social functions and/ or processes are moderately altered	Very low	Natural and/ or social functions and/ or processes are slightly altered
Probability	Almost certain / Highly probable	It is most likely that the impact will occur	Probable	The impact has occurred here or elsewhere and could therefore occur
Confidence	High	Substantive supportive data exists to verify the assessment	High	Substantive supportive data exists to verify the assessment
Reversibility	High	The affected environment will be able to recover from the impact	High	The affected environment will be able to recover from the impact
Resource irreplaceability	Low	The resource is not damaged irreparably or is not scarce	Low	The resource is not damaged irreparably or is not scarce
Significance	**Minor - negative**		**Negligible - negative**	
Comment on significance	Risk reduction is dependent on proactive and reactive mitigation measures as contruction progresses across the site. Adaptive management is necessary along with guidance from th ECO on site.			
Cumulative impacts	Not applicable			

5.2.3 Stormwater Runoff Causing Erosion and Sedimentation

Description of the Impact

The combination of the area's high rainfall intensity, erodibility of soils, steep slopes on the site and the need for bulk earthworks will create a high-risk situation from the perspective of soil erosion from the site resulting in sedimentation and smothering of plants and stream substrates downstream. High rainfall events are common in the area and rainfall is received year-round making planning for such events an essential aspect of the construction phase.

Mitigation Objectives

The objective is to proactively plan ahead to limit and contain the amount of sediment-laden runoff that leaves the site during a storm event. As far as possible the objective is that only clear-flowing water should leave the site. In addition to the mitigation measures provided, the ECO must apply adaptive management and may apply any feasible methods to achieve these objectives as the project progresses.

Mitigation Measures

Without proactive management and mitigation, this impact is considered a Minor negative. Provided all the mitigation measures provided in Table 7 are fully implemented the impact is *Negligible*.

Table 7.Construction Phase: Stormwater runoff causing erosion and sedimentation.

Project phase	**Construction**			
Impact	**Stormwater runoff causing erosion of soil and sedimentation in aquatic habitats**			
Description of impact	**Exposed and unstable soil washing off the site into the wetland and downstream watercourses smothering habitat during high rainfall events.**			
Mitigatability	Medium	Mitigation exists and will notably reduce significance of impacts		
Potential mitigation	**• Daily and weekly site meetings must consider forecasted rainfall to avoid working during such periods, and to plan accordingly for predicted high rainfall events. Work on the site must cease altogether during rainfall. • The site office must have a store of materials suitable for rapid response to erosion control such as shade-cloth (silt-fencing), haybales (check-dams), wooden droppers, hessian fabric, and fencing wire. • All building material stores should be kept on flat areas and bunded to prevent material loss during rainfall. • Consider only commencing with bulk earthworks in one portion of the erf at a time to limit the extent of vulnerable areas to be managed. • Prior to bulk earthworks, install a continuous silt fence along the lower extent of the site to catch soil and silt. The silt fence must be inspected regularly to check for failure or areas that must be cleared to maintain function. • Monitor the site during / following periods of rainfall, and install haybale check dams at any concentrated flow paths. • Following rainfall, any sediment-laden water that must be pumped out of pools in excavated areas must not be directed to the wetland, streams or stormwater drains (as these lead to streams). A temporary haybale coffer dam can be constructed to contain water until it seeps into the ground, evaporates or slowly disperses through the haybales which act as a filter. • Monitoring of the entire area of exposed soil before, during and after rainfall is essential to ensure proactive measures can be taken preventing the runoff of sediment-laden water to aquatic systems.**			
Assessment	**Without mitigation**		**With mitigation**	
Nature	Negative		Negative	
Duration	Short term	Impact will last between 1 and 5 years	Brief	Impact will not last longer than 1 year
Extent	Local	Extending across the site and to nearby settlements	Limited	Limited to the site and its immediate surroundings
Intensity	Moderate	Natural and/ or social functions and/ or processes are moderately altered	Low	Natural and/ or social functions and/ or processes are somewhat altered
Probability	Almost certain / Highly probable	It is most likely that the impact will occur	Probable	The impact has occurred here or elsewhere and could therefore occur
Confidence	High	Substantive supportive data exists to verify the assessment	High	Substantive supportive data exists to verify the assessment
Reversibility	Medium	The affected environment will only recover from the impact with significant intervention	Medium	The affected environment will only recover from the impact with significant intervention
Resource irreplaceability	Low	The resource is not damaged irreparably or is not scarce	Medium	The resource is damaged irreparably but is represented elsewhere
Significance	**Minor - negative**		**Negligible - negative**	
Comment on significance	Risk reduction is dependent on proactive and reactive mitigation measures as contruction progresses across the site.			
Cumulative impacts	Not applicable			

5.3 Operational Phase

5.3.1 Management of Buffer and Wetland Areas within Development

Description of the Impact

The wetland could become degraded if the distinction is not clear between open space / recreation areas and the wetland area which is to be conserved and maintained in a natural state.

Mitigation Objectives

The aim is to ensure the wetland is maintained in a near natural state while the surrounding buffer provides a mixed use function which could contribute to green space within the development.

Mitigation Measures

In their mitigated state, the impacts for misplaced landscaping of the wetland and buffer areas are considered a *negligible positive* because if the current degraded buffer vegetation is improved by alien plant removal and planting of indigenous species it will be an improvement on the current state.

Table 8. Operational Phase: Landscaping of wetland and buffer areas.

Project phase	**Operation**			
Impact	**Landscaping of wetland and buffer areas**			
Description of impact	**Inappropriate mowing, planting or trimming of vegetation leading to habitat degradation**			
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts		
Potential mitigation	**• The edge of the wetland should be delineated by sinking wooden bollards (with no lighting) approximately every 50m along the wetland. This is preferable to fencing off the wetland. • Garden and maintenance staff must be informed that no maintenance (apart from removal of aliens and litter), herbicide application, or dumping of garden waste can take place in the wetland. • Mowing, weedeating, brush-cutting or trimming of the wetland vegetation is not permitted. • Buffer areas may include a number (4-5) of cleared, mowed and maintained areas for recreation (e.g. jungle gym or bird hide) linked by pathways through natural indigenous vegetation in the buffer (not the wetland). • No herbicides can be used to maintain pathways in the wetland area or buffer. • Encroachment of recreational areas into the wetland, and infilling of any sort is not permitted. • Do not plant any kikuyu grass in the buffer. If areas must be grassed, then kweek (Cynodon dactylon) or buffalo grass (Stenotaphrum secondatum) is recommended.**			
Assessment	**Without mitigation**		**With mitigation**	
Nature	Negative		Positive	
Duration	Long term	Impact will last between 10 and 15 years	Brief	Impact will not last longer than 1 year
Extent	Limited	Limited to the site and its immediate surroundings	Very limited	Limited to specific isolated parts of the site
Intensity	High	Natural and/ or social functions and/ or processes are notably altered	Low	Natural and/ or social functions and/ or processes are somewhat altered
Probability	Almost certain / Highly probable	It is most likely that the impact will occur	Probable	The impact has occurred here or elsewhere and could therefore occur
Confidence	High	Substantive supportive data exists to verify the assessment	High	Substantive supportive data exists to verify the assessment
Reversibility	Medium	The affected environment will only recover from the impact with significant intervention	High	The affected environment will be able to recover from the impact
Resource irreplaceability	Low	The resource is not damaged irreparably or is not scarce	Low	The resource is not damaged irreparably or is not scarce
Significance	**Minor - negative**		**Negligible - positive**	
Comment on significance				
Cumulative impacts	Not applicable.			

5.3.2 Alien Invasive Plants

Description of the Impact

Any bare soil surfaces cleared during construction will be rapidly colonised by alien invasive plant species given the high abundance of a wide range of invasive and exotic plants already on the site. Although large areas of currently invaded land would be transformed to built infrastructure for the development, the wetland, drainage lines and buffer zones (as well as

other open space areas) will continually be susceptible to alien infestation given the long history of alien establishment at the site.

Mitigation Objectives

Ensure the wetland, drainage lines, buffers and all open space areas are kept free of alien invasive (NEMBA-listed) plant species.

Mitigation Measures

Implementation of the mitigation measures indicated in Table 9 will ensure this impact is rated as a *Negligible Positive*. The positive is because the site is so densely established by invasive alien plants in its current state. Especially on the slopes on Portion A and Portion C.

Table 9. Operational Phase: Alien vegetation establishment

Project phase	**Operation**			
Impact	**Alien vegetation establishment**			
Description of impact	**Establishment of aliens in disturbed areas and the wetland post-construction resulting in habitat degradation**			
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts		
Potential mitigation	**• Immediately following conclusion of construction the entire site (Erf 7614) must be thoroughly inspected for remant alien plants. Small seedlings must be hand-pulled or removed with tree poppers, while bigger trees must be ring-barked or cut with a chainsaw and the stump treated with herbicide. This applies to both the wetland and buffer areas. However, herbicide cannot be used in the wetland area. • Follow-up inspections and control must take place on a 6-monthly (bi-annual) basis to ensure aliens are consistently controlled and removed from the site. This must be continued until the site can be declared 'weed-free' for the most part. For a list of alien invasive plants on the site consult the Botanical specialist report (B. Fouche, Confluent Environmental). • A significant effort should be made to revegetate any bare areas of the site with indigenous plants found in the area. Open space areas at the very least should contain plants from the area given the high rates of infestation of open spaces with alien and exotic plants in Knysna. • Under no circumstances may removed alien plants be discarded in the wetland or surrounding open space. Management must inform the landscaping / gardening team that no dumping of vegetation or discarding of waste material may happen in the wetland or buffer area.**			
Assessment	**Without mitigation**		**With mitigation**	
Nature	Negative		Positive	
Duration	Long term	Impact will last between 10 and 15 years	Brief	Impact will not last longer than 1 year
Extent	Local	Extending across the site and to nearby settlements	Limited	Limited to the site and its immediate surroundings
Intensity	High	Natural and/ or social functions and/ or processes are notably altered	Low	Natural and/ or social functions and/ or processes are somewhat altered
Probability	Almost certain / Highly probable	It is most likely that the impact will occur	Unlikely	Has not happened yet but could happen once in the lifetime of the project, therefore there is a possibility that the impact will occur
Confidence	High	Substantive supportive data exists to verify the assessment	High	Substantive supportive data exists to verify the assessment
Reversibility	High	The affected environment will be able to recover from the impact	High	The affected environment will be able to recover from the impact
Resource irreplaceability	Low	The resource is not damaged irreparably or is not scarce	Low	The resource is not damaged irreparably or is not scarce
Significance	**Moderate - negative**		**Negligible - positive**	
Comment on significance	Although a lot of the area currently covered by dense alien plants will be transformed to built infrastructure, the remaining open spaces could easily be recolonised by aliens if not consistently managed.			
Cumulative impacts	Dense alien vegetation serves as a source for seed and dispersal to adjacent areas and it is the legislated responsibility of the landowner to manage aliens on their property.			

6. RISK ASSESSMENT MATRIX

6.1 Risk Assessment Matrix

Provided potable water supply and wastewater disposal services are provided by the Knysna Municipality, the only water uses that are identified in association with the proposed housing development are Section 21 c) and i) water uses. The proposed development is taking place in the regulated area of the wetland (defined as 500m from a wetland) which requires completion of the DWS Risk Matrix to determine the level of risk associated with the proposed development. Risks are assessed in their mitigated state, and if determined to be Low, the development can be Generally Authorised, but if determined to be Medium or High a Water Use License will be required. This section is undertaken in compliance with the recently amended Section 21 c) and i) General Authorisation, GN4167 of 2023 using the revised DWS Risk Assessment Matrix (January, 2024).

The results of the Risk Matrix determined the overall risk of the development to be Medium which indicates that a Water Use License would be required (Table 10). However, the only activity which carries any medium risk is that of constructing instream stormwater retention ponds as per the current stormwater management plan. It is envisaged that this plan will be altered on the basis of feedback from this report in which case the Risk Matrix can be reassessed. It can be seen from this assessment that reduced modification to the wetland itself in terms of built infrastructure directly translates to reduced risk in the Risk Matrix.

Table 10. Risk Assessment Matrix for the proposed development on Erf 7614.

PROJECT:	Lelieskloof Wetland, Knysna		
Name of assessor:	Jackie Dabrowski (115166 Aquatic Science)		
Date of assessment:	Mar-24		
RISK ASSESSMENT MATRIX for Section 21 (c) and (i) Water Use activities (version 2.0): SUMMARY			
[ASSUMING THAT ALL PROPOSED IMPACT CONTROL MEASURES (AS STIPULATED IN PROJECT SPECS) ARE EFFECTIVELY IMPLEMENTED]			
Phase	**Activity**	**Impact**	**Risk Ratings**
PRE-CONSTRUCTION (DESIGN)	Stormwater Management Plan for current SDP places retention ponds in the wetland and will increase surface runoff volumes in the wetland.	Channelled flows causing incision and terrestrialisation	M
		Excavations in the wetland to create retention ponds could harm biota and compact soil	L
		Loss of indigenous wetland vegetation and habitat	M
CONSTRUCTION	Commencement of construction likely with bulk earthworks on the site. Poorly site preparation.	Disturbance or destruction of wetland vegetation, soils and / or habitat.	L
	Management of materials, vehicles, waste and personnel	Washoff, spillage, or flow of materials, waste, or fuel into the wetland causing polltuion	L
	Earthworks and vegetation removal creating mass eareas of exposed soil prone to erosion during high rainfall events	Sediment-laden stormwater runoff entering natural watercourses from the site.	L
		Sedimentation of wetland and drainage lines downstream	L
OPERATIONAL	Management of buffer and wetland areas within ghe development	Habitat degradation due to the wetland and / or buffer being maintained through misplaced landscaping and careless practices.	L
	Alien Invasive Plants and their management	Exposed bare areas susceptible to alien infestation	L
		Poor disposal of alien vegetation biomass discarded in the wetland smothering plants and habitat	L

7. LEGISLATIVE IMPLICATIONS

7.1 DFFE Screening Tool

The verification of a wetland on Erf 7614 confirms the Aquatic Sensitivity of the site as **Very High** in terms of the DFFE screening tool. The requirement from a reporting perspective is to compile an impact assessment report which is presented here. It is envisaged that the Site Development Plan will be updated to preserve the wetland as the alternative involves application of the mitigation hierarchy which would result in an offset requirement. The impact assessment will therefore need to be updated when a revised Site Development Plan is made available.

Protection of the wetland and the associated ecosystem services it provides is also consistent with the designation of the sub-quaternary reach as a Freshwater Ecosystem Priority Area (FEPA) and aims to sustain the provision of water quality of a high standard associated with designation of the site within the Strategic Water Source Area.

7.2 National Water Act

Based on the current Site Development Plan the outcome of the Risk Matrix is a **Medium Risk**. However, once the SDP has been revised the assessment will be updated and may present a different outcome. If the risk is maintained at Low Risk then a General Authorisation is applicable. But if maintained at Medium or High risk, then a Water Use License will be required. Reassessment will require the updated SDP as well as the engineering services report with an emphasis on the stormwater management plan.

8. CONCLUSIONS

Provided the wetland and buffer areas are implemented and preserved as far as possible on the site then the development is supported. However, the current SDP and supporting services will require revision to accommodate the wetland.

9. APPENDICES

9.1 Wetland PES Methods

The wetland area was assessed using the Level 2 WET-Health assessment tool developed by Macfarlane *et al*. (2020). The tool aims to assess the integrity of a wetland which is defined as a measure of the deviation of wetland structure and function from the wetland's natural reference condition. The reference condition is inferred from conceptual models of the selected hydrogeomorphic wetland type. The method combines an assessment of hydrological, geomorphological, water quality and vegetation health in four modules.

Data collection involved a desktop review of the extent and intensity of catchment land use impacts and was undertaken using historical and recent aerial imagery of the site (Chief Directorate: National Geo-spatial Information and satellites). Fieldwork onsite involved the identification and recording of observable impacts to the wetland at the site of relevant activities as well as at reference points upstream and downstream of the activities, and in the catchment area of the wetland. The magnitude of observed impacts to the hydrological, geomorphological and vegetation components of the wetland were calculated and combined as per the tool to provide a measure of the overall wetland condition of the wetland. Resultant

scores were then used to assign the wetland into one of six PES categories as shown in Table 11.

Table 11. Wetland Present Ecological State categories and impact descriptions.

Ecological Category	Description	PES Score
A	Unmodified, natural.	90-100%
B	Largely natural with few modifications / in good health. A small change in natural habitats and biota may have taken place but the ecosystem functions are still predominantly unchanged.	80-89%
C	Moderately modified / fair condition. Loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged.	60-79%
D	Largely modified / poor condition. A large loss of natural habitat, biota and basic ecosystem functions has occurred.	40-59%
E	Seriously modified / very poor condition. The loss of natural habitat, biota and basic ecosystem functions is extensive.	20-39%
F	Critically modified / totally transformed. Modifications have reached a critical level and the lotic system has been modified completely with an almost complete loss of natural habitat and biota.	0-19%

9.2 Ecological Importance and Sensitivity Methods

The revised method for the determination of the EIS of a wetland considers the three following ecological aspects (Rountree *et al*., 2013):

- **Ecological importance and sensitivity**
    - Biodiversity support including rare species and feeding/breeding/migration;
    - Protection status, size and rarity in the landscape context;
    - Sensitivity of the wetland to floods, droughts and water quality fluctuations.
- **Hydro-functional importance**
    - Flood attenuation;
    - Streamflow regulation;
    - Water quality enhancement through sediment trapping and nutrient assimilation;
    - Carbon storage
- **Direct human benefits**
    - Water for human use and harvestable resources;
    - Cultivated foods;
    - Cultural heritage;
    - Tourism, recreation, education and research.

Each criterion is scored between 0 and 4, and the average of each subset of scores is used to derive a score for each of the three components listed above. The highest score is used to determine the overall Importance and Sensitivity category of the wetland system (Table 12).

Table 12.Ecological importance and sensitivity categories for wetlands. Interpretation of average scores for biotic and habitat determinants.

Ecological Importance and Sensitivity Category (EIS)	Range of Median	Recommended Ecological Management Class
Very high: Wetlands that are considered ecologically important and sensitive on a national or even international level. The biodiversity of these floodplains is usually very sensitive to flow and habitat modifications. They play a major role in moderating the quantity and quality of water of major rivers.	>3 and <=4	A
High: Wetlands that are considered to be ecologically important and sensitive. The biodiversity of these floodplains may be sensitive to flow and habitat modifications. They play a role in moderating the quantity and quality of water of major rivers.	>2 and <=3	B
Moderate: Wetlands that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these floodplains is not usually sensitive to flow and habitat modifications. They play a small role in moderating the quantity and quality of water of major rivers.	>1 and <=2	C
Low/marginal: Wetlands that are not ecologically important and sensitive at any scale. The biodiversity of these floodplains is ubiquitous and not sensitive to flow and habitat modifications. They play an insignificant role in moderating the quantity and quality of water of major rivers.	>0 and <=1	D

9.3 Impact Assessment Methods

Criteria are ascribed for each predicted impact. These include the intensity (size or degree scale), which also includes the type of impact, being either a positive or negative impact; the duration (temporal scale); and the extent (spatial scale), as well as the probability (likelihood). The methodology is quantitative, whereby professional judgement is used to identify a rating for each criterion based on a seven-point scale (Table 13) and the significance is auto-generated using a spreadsheet through application of the calculations.

For each predicted impact, certain criteria are applied to establish the likely **significance** of the impact, firstly in the case of no mitigation being applied and then with the most effective mitigation measure(s) in place.

These criteria include the **intensity** *(*size or degree scale), which also includes the **nature** of impact, being either a positive or negative impact; the **duration** (temporal scale); and the **extent** (spatial scale). These numerical ratings are used in an equation whereby the **consequence** of the impact can be calculated. Consequence is calculated as follows:

Consequence = type x (intensity + duration + extent)

To calculate the significance of an impact, the **probability** (or likelihood) of that impact occurring is applied to the consequence.

Significance = consequence x probability

Depending on the numerical result, the impact would fall into a significance category as negligible, minor, moderate or major, and the type would be either positive or negative.

Table 13. Assessment criteria for the evaluation of impacts

Criteria	Numeric Rating	Category	Description
Duration	1	Immediate	Impact will self-remedy immediately
	2	Brief	Impact will not last longer than 1 year
	3	Short term	Impact will last between 1 and 5 years
	4	Medium term	Impact will last between 5 and 10 years
	5	Long term	Impact will last between 10 and 15 years
	6	On-going	Impact will last between 15 and 20 years
	7	Permanent	Impact may be permanent, or in excess of 20 years
Extent	1	Very limited	Limited to specific isolated parts of the site
	2	Limited	Limited to the site and its immediate surroundings
	3	Local	Extending across the site and to nearby settlements
	4	Municipal area	Impacts felt at a municipal level
	5	Regional	Impacts felt at a regional level
	6	National	Impacts felt at a national level
	7	International	Impacts felt at an international level
Intensity	1	Negligible	Natural and/ or social functions and/ or processes are negligibly altered
	2	Very low	Natural and/ or social functions and/ or processes are slightly altered
	3	Low	Natural and/ or social functions and/ or processes are somewhat altered
	4	Moderate	Natural and/ or social functions and/ or processes are moderately altered
	5	High	Natural and/ or social functions and/ or processes are notably altered
	6	Very high	Natural and/ or social functions and/ or processes are majorly altered
	7	Extremely high	Natural and/ or social functions and/ or processes are severely altered
Probability	1	Highly unlikely / None	Expected never to happen
	2	Rare / improbable	Conceivable, but only in extreme circumstances, and/or might occur for this project although this has rarely been known to result elsewhere
	3	Unlikely	Has not happened yet but could happen once in the lifetime of the project, therefore there is a possibility that the impact will occur
	4	Probable	Has occurred here or elsewhere and could therefore occur
	5	Likely	The impact may occur
	6	Almost certain / Highly probable	It is most likely that the impact will occur
	7	Certain / Definite	There are sound scientific reasons to expect that the impact will definitely occur

When assessing impacts, broader considerations are also considered. These include the level of confidence in the assessment rating; the reversibility of the impact; and the irreplaceability of the resource as set out in (Table 14, Table 15, & Table 16), respectively.

Table 14. Definition of confidence ratings.

Category	Description
Low	Judgement is based on intuition
Medium	Determination is based on common sense and general knowledge
High	Substantive supportive data exists to verify the assessment

Table 15. Definition of reversibility ratings.

Category	Description
Low	The affected environment will not be able to recover from the impact - permanently modified
Medium	The affected environment will only recover from the impact with significant intervention
High	The affected environmental will be able to recover from the impact

Table 16. Definition of irreplaceability ratings.

Category	Description
Low	The resource is not damaged irreparably or is not scarce
Medium	The resource is damaged irreparably but is represented elsewhere

10. REFERENCES

Council for Scientific and Industrial Research (CSIR; 2018). National Wetland Map 5 and Confidence Map [Vector] 2018. Available from the Biodiversity GIS website, downloaded on 30 September 2020.

Department of Water Affairs and Forestry (DWAF; 2005). A practical field procedure for identification and delineation of wetlands and riparian areas. Pretoria, South Africa.

Le Maitre, D.C., Walsdorff, A., Cape, L., Seyler, H., Audouin, M, Smith-Adao, L., Nel, J.A., Holland, M. and Witthüser. K. (2018). Strategic Water Source Areas: Management Framework and Implementation Guidelines for Planners and Managers. WRC Report No. TT 754/2/18, Water Research Commission, Pretoria.

Macfarlane, D.M. and Bredin, I. (2016). Site-based tool for the determination of preliminary aquatic impact buffer zone requirements. Version 1.0. Water Research Commission, Pretoria.

Macfarlane, D.M., Ollis, D.J. and Kotze, D.C. (2020). WET-Health Version 2: A refined suite of tools for assessing the present ecological state of wetland ecosystems. Water Research Commission Report No. TT 820/20.

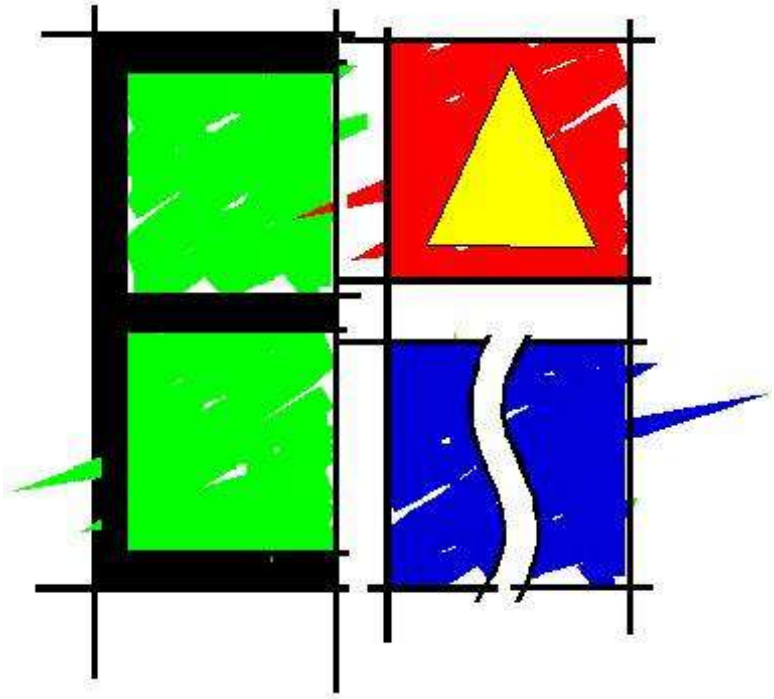
Nel, J.L., Driver, A., Strydom, W.F., Maherry, A., Peterson, C., Hill, L., Roux, D.J., Nienaber, S., van Deventer, H., Swartz, E. and Smith-Adao, L.B. (2011) Atlas of freshwater ecosystem priority

areas in South Africa: Maps to support sustainable development of water resources. Water Research Commission Report No. TT 500/11.

Ollis, D., Snaddon, K., Job, N., & Mbona, N. (2013). Classification system for wetlands and other aquatic ecosystems in South Africa. South African National Biodiversity Institute.

TRAFFIC IMPACT ASSESSMENT

FOR A PROPOSED RESIDENTIAL DEVELOPMENT ON ERF 13556, KNYSNA



January 2014

Prepared for: **Bitline SA 111 (Pty) Ltd**

Prepared by: **Engineering Advice and Services (Pty) Ltd**
(041) 5812421

Document Control Sheet

CLIENT REF: **BITLINE SA 111 (PTY) LTD**

PROJECT NAME: **PROPOSED RESIDENTIAL DEVELOPMENT ON ERF 13556, KNYSNA**

DOCUMENT TITLE: **TRAFFIC IMPACT ASSESSMENT**

DOCUMENT FILE REF: F:\1080 - 1089\1088\Reports\Rep001 - Leliekloof TIA - Version 2.docx

Version	**1**		
Compiled by	CGA Hastie Pr Tech. Eng (200070122)	January 2014	
Reviewed by			
Amendments made by			
Version	**2**		
Compiled by			
Reviewed by			
Amendments made by			
Version			
Compiled by			
Reviewed by (Director)			
Amendments made by			

DISTRIBUTION:

1) Original : Client - Mr Johan Roodt
2) Copy : Knysna Municipality
3) Copy :
4) Copy :
5) Copy : EAS File 1088

Contents

List of Tables

List of Figures

List of Annexures

1. INTRODUCTION

1.1 BACKGROUND

Engineering Advice & Services (Pty) Ltd was appointed by Bitline SA 111 (Pty) Ltd during November 2013 to conduct a traffic impact assessment for a the proposed Lelieskloof Residential development on erf 13556, Knysna situated in the Knysna Municipality.

A TIA was prepared for the development in 2007 and approved by the Knysna Municipality at the time. The initial TIA assessed a total of 220 residential units which the developer now wishes to increase to 274 units.

The Knysna Municipality has subsequently requested that the initial TIA be revised to accommodate the increase in units.

1.2 OBJECTIVES OF THE STUDY

In broad terms, the purpose of the traffic assessment is to determine the extent and nature of the traffic generated by the proposed development, to assess the impact of this traffic on the operation of the associated road network, and to devise solutions for any problems identified. The following key elements, *inter alia*, are addressed in this traffic impact assessment:

- The suitability and safety of proposals for access to and egress from the site;
- The capacity of the existing and future road network within the influence radius; and
- The road upgrading measures required to accommodate the proposed development.

In general, this report serves to satisfy the Knysna Municipality that the traffic impact of the envisaged development is within acceptable limits and that the suggested improvements conform to the standards and parameters set by this authority.

1.3 METHODOLOGY

The approach followed in conducting the traffic impact assessment was in accordance with **TMH 16 Volume 1- South African Traffic Impact and Site Assessment Manual** [(1)]. Given the extent of the proposed development (274 units), in terms of the aforementioned guidelines, the development is considered to be a large-sized development and this assessment should thus consider impact for the development (assumed to be 2015) and development plus five-year (2020) horizons.

The methodology used was as follows:

- Present traffic flow patterns were obtained and the affected intersections analysed for the development horizon (2015) before taking the proposed development into account, where after recommendations were made on the present need for road upgrading measures.

- Given the extent of the development, the expected number of trips that will be generated by the development was determined by using applicable trip generation rates as recommended by the Committee of Transport Officials (COTO).

- The distribution of the generated trips was estimated where after the generated traffic was assigned to the surrounding road network.

- Once again, the functioning of the affected intersections was analysed and recommendations made on the need for road upgrading taking cognisance of the proposed development for the development (2015) and development plus 5-year (2020) planning horizons given that more than 200 peak hour trips will be generated by the proposed development.

- The access locations were assessed in terms of geometric design standards and traffic operations to ensure that they operate at an acceptable level of service and conform to traffic safety requirements.

- By taking into account the major findings of the study, conclusions were made regarding the financial responsibilities of the affected parties for required road upgrading measures.

1.4 STUDY AREA

Based on the location of the development the study area extends to the adjacent intersections of Nelson Mandela Drive with Sisson Street, the Owens Dam Sasol and WSU Campus intersections, as it is considered that trips generated by the proposed development will approach along these roads and primarily impact on these intersections.

2. THE DEVELOPMENT AND ENVIRONS

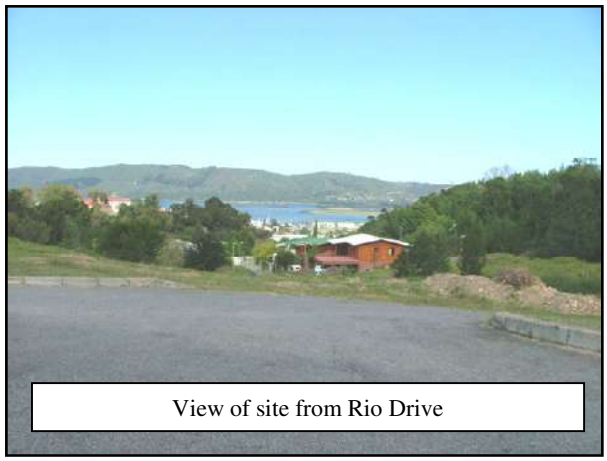
2.1 CURRENT LAND USE RIGHTS

The site, measuring approximately 5.63 ha in extent, is currently zoned for General Residential (four portions), Public Open Space and Street Zone purposes.

2.2 OVERVIEW OF DEVELOPMENT AND ENVIRONS

The proposed development is situated in Leliekloof to the north of the Knysna Central Business District and is bounded by Gray Street to the east and Rio Drive to the north. Gray Street links Knysna with the Concordia residential area north of the town centre. Rio Drive links

The proposed development comprises of three precincts as indicated on **Figure 10**. The main precinct of 142 units is situated on the northern portion of the site and is accessed from Rio Drive. The two remaining precincts are situated on the eastern corner (72 units) and southern portion (60 units) of the site and are accessed via Gray Street. The subject property is bounded by existing residential land use to the south, Concordia to the east and the prison to the west.



View of site from Rio Drive

UTSHINTSHO / AMENDMENTS			
INANI NO.	UMHLA DATE	INKCAZA DESCRIPTION	IVUNYELWE APPROVED

UMLINGANISELO WOMZOBO OHLISIWE SCALE ON REDUCED DRAWING

UMLINGANISELO SCALE: 1 : 1000

30mm KUMZOBO WANGAPHAMBILI 30mm ON ORIGINAL DRAWING

UMENZI DESIGN	CH
UMZOBI DRAWN	CP
IVUNYELWE APPROVED	CH
UMHLA DATE	JAN 2014

ENGINEERING ADVICE AND SERVICES associated with ULWAZI
73 Heugh Road, Walmer
P.O. Box 13867
Humewood
Port Elizabeth
6013
tel/fax: (041) 581 2421

IVUNYELWE APPROVED	IVUNYELWE APPROVED
INJINELI./ENG.	UMENZELWA / CLIENT
UMHLA / DATE	UMHLA / DATE

IPROJETI / PROJECT: ERF 23556, KNYSNA LELIESKLOOF APARTMENTS - TIA

UMZOBONKCAZA / DWG DESCRIPTION: LOCALITY PLAN - FIGURE 1

INANI LESIVUMELWANO CONTRACT NO.

INANI LOMZOBO DWG.NO. 1088-P-01

3. DATA COLLECTION

3.1 PEAK HOUR TRAFFIC VOLUMES

Peak hour traffic turning movement counts were conducted during typical weekday AM and PM peak periods on Tuesday 21 and Wednesday 22 January 2014 at the following intersections:

- Gray Street / Rio Drive
- Gray Street / Main Road

The detailed survey data is attached as **Annexure A** and summarised on **Figure 2** below.

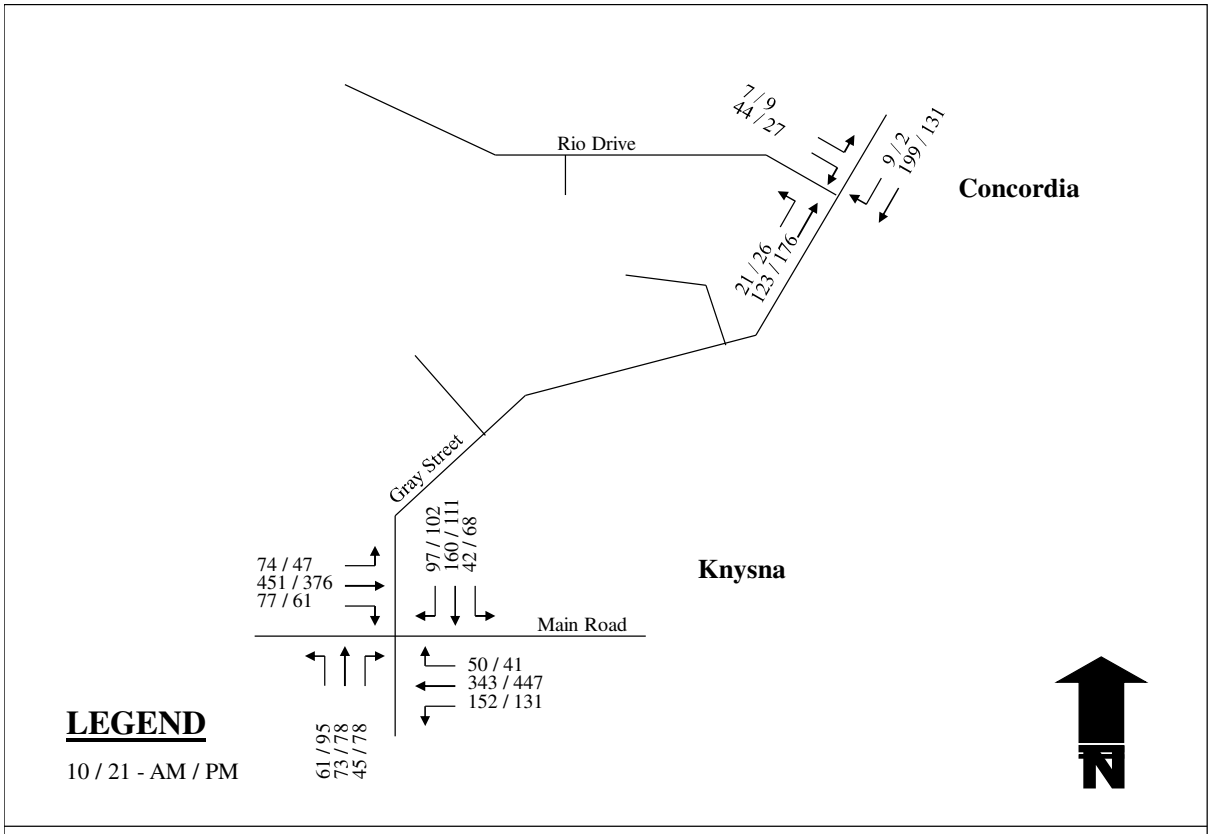


Figure 2 : Existing Peak Hour Traffic Volumes - 2014

3.2 DAILY TRAFFIC VOLUMES

As this study will also assess the impact of growth in traffic volumes to 2021, background peak hour traffic volumes will be escalated to approximate 2019 traffic volumes.

Daily traffic volumes at a permanent count station on the N2 in the vicinity of Brenton-on-Sea (Site 1203) were sourced from **SANRAL's Traffic Count Information Yearbook** [(2)]. The historical data sourced was from January 2007 to May 2011. This data was used to give an indication of the annual growth in terms of the Average Annual Daily Traffic along the N2.

The data is indicated in **Figure 3** overleaf. It is noted that there was a substantial decrease of 26.1% between 2007 and 2008. From 2008 to date the AADT has increased by 4.06% - an average of approximately 1.336% per annum.

The 30th highest hour traffic volume is however considered to be the suitable design traffic volume. As indicated on **Figure 2**, this volume, which typically occurs during peak season, increased by 8.35% (2.7% p.a.) from 1401 vehicles in 2007 to 1518 in 2010.

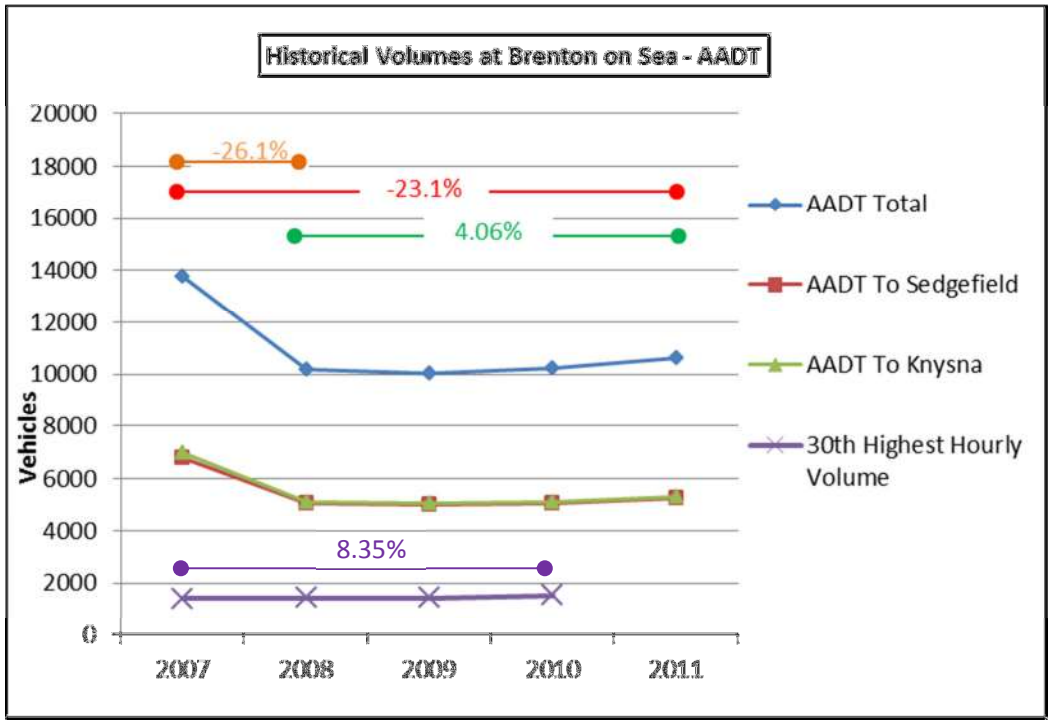


Figure 3: Historical AADT Volumes

For the purposes of this study it is proposed that the annual growth of the 30th highest hourly volumes be used to escalate observed traffic volumes. A growth rate of 3% per annum will therefore be used to project traffic volumes to 2019.

The daily traffic volumes and the growth rate calculation are attached as **Annexure B** and the escalated background peak hour traffic volumes are indicated on **Figure 4** overleaf.

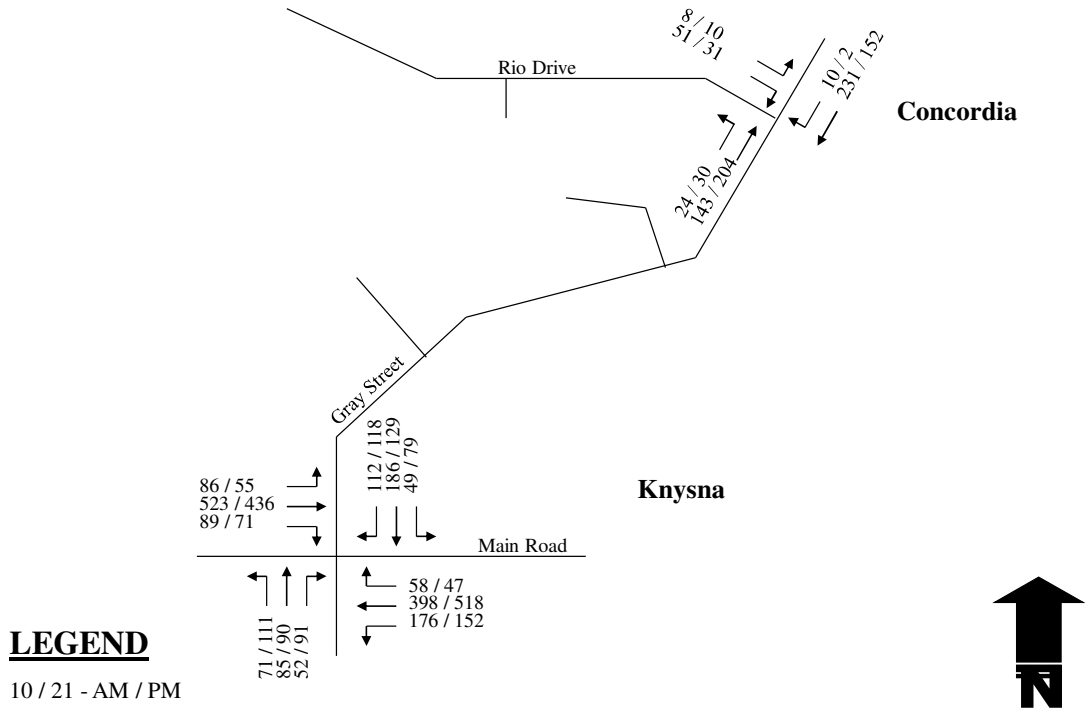


Figure 2 : Escalated Background Peak Hour Traffic Volumes - 2019

3.3 ROAD NETWORK

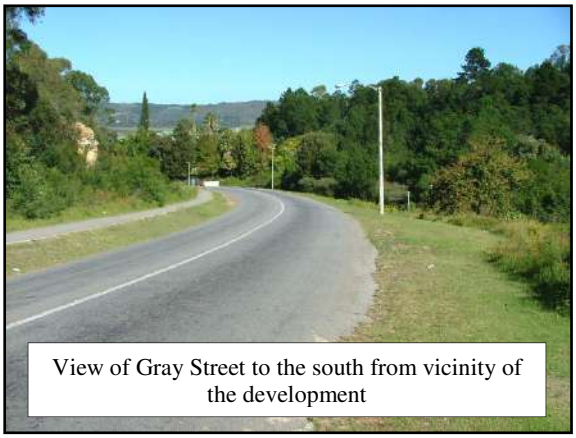
3.3.1. Existing

The primary road network can briefly be described as follows:

- **Main Road** is part of National Route 2, which passes through the Knysna Central Business District. The road comprises of a 3.7m wide traffic lane and a 2.5m wide parking lane per direction. On the east and west approaches to the Gray Street intersection, the left hand parking lane is removed to accommodate a shared left- and through-lane and an exclusive right-turn lane. The intersection is signal controlled with a 90 second cycle comprising of two main phases and a right-turn phase on Gray Street operating between 07:30 and 17:30. After 17:30 the cycle time reduces to 50 seconds and the right-turn phase is eliminated.

- **Gray Street** serves as a collector road between the CBD and the residential area immediately north of Main Road, and links to Concordia to the north. The road is 9.3m wide between Main Road and Hill Street and comprises of a single traffic lane per direction with a parking lane on either side. On the south approach to Main Road a shared left- and through-lane and an exclusive right-turn lane have been marked. The north approach to main Road comprises of one 5.1m wide traffic lane that operates as two lanes. North of Hill Street, Gray Street narrows to 6.8m in width. The posted speed limit is 40km/h, which is enforced with regular speed humps.

- **Rio Drive** is a 6m wide surfaced access road, which provides access to the prison and residential properties on the hills above Knysna.



View of Gray Street to the south from vicinity of the development

View of Rio Drive to the west

The existing road network configuration is indicated on **Figure 5** overleaf.

3.3.2. Future

The main future addition to the municipal road network is the proposed N2 Bypass /Toll Road. This road is planned to follow the ridge to the north of the CBD just above the proposed development.

As part of the **Preliminary Engineering Design Report of Alternative Routes for the Proposed Knysna N2 Toll Highway** [(3)], a possible link from the route to the CBD via Gray Street was investigated.

However this possibility was discarded because of the undesirability of bringing additional traffic into Knysna through the Gray Street / Main Road intersection and that Gray has a gradient of 10% at its upper end, in excess of the desirable 6% gradient. In addition, the Knysna High School is situated in Long Street and diverting large volumes of traffic along this route would lead to an unsafe situation

UTSHINTSHO / AMENDMENTS			
INANI NO.	UMHLA DATE	INKCAZA DESCRIPTION	IVUNYELWE APPROVED

UMLINGANISELO SCALE: N.T.S

UMLINGANISELO WOMZOBO OHLISWEYO SCALE ON REDUCED DRAWING
30mm KUMZOBO WANGAPHAMBILI
30mm ON ORIGINAL DRAWING

UMENZI DESIGN	CH
UMZOBI DRAWN	CP
IVUNYELWE APPROVED	CH
UMHLA DATE	JAN 2014

ENGINEERING ADVICE AND SERVICES associated with ULWAZI
73 Heugh Road, Walmer
P.O. Box 13987
Humewood
Port Elizabeth
6013
tel/fax: (041) 681 2421

IVUNYELWE APPROVED	IVUNYELWE APPROVED
INJINELI/ENG.	UMENZELWA / CLIENT
UMHLA / DATE	UMHLA / DATE

IPROJETI / PROJECT
ERF 23556, KNYSNA
LELIESKLOOF APARTMENTS - TIA

UMZOBONKCAZA / DWG DESCRIPTION
EXISTING ROADS - FIGURE 5

INANI LESIVUMELWANO CONTRACT NO.

INANI LOMZOBO DWG.NO.
1088-P-05

3.4 PUBLIC TRANSPORT

At present, public transport services in the form of minibus taxi modes operate along Gray Street.

3.5 NON-MOTORISED TRANSPORT

A pedestrian sidewalk is currently provided along the eastern side of Gray Street (southbound traffic lane).

Pedestrian crossing facilities are provided at the Gray Street / Rio Drive signalised intersection.

3.6 SPATIAL DEVELOPMENT FRAMEWORK PLAN

Figure 6 below is an extract of the **Knysna Municipality Spatial Development Framework** [(4)]. The SDF accommodates residential development in the area of the proposed development.

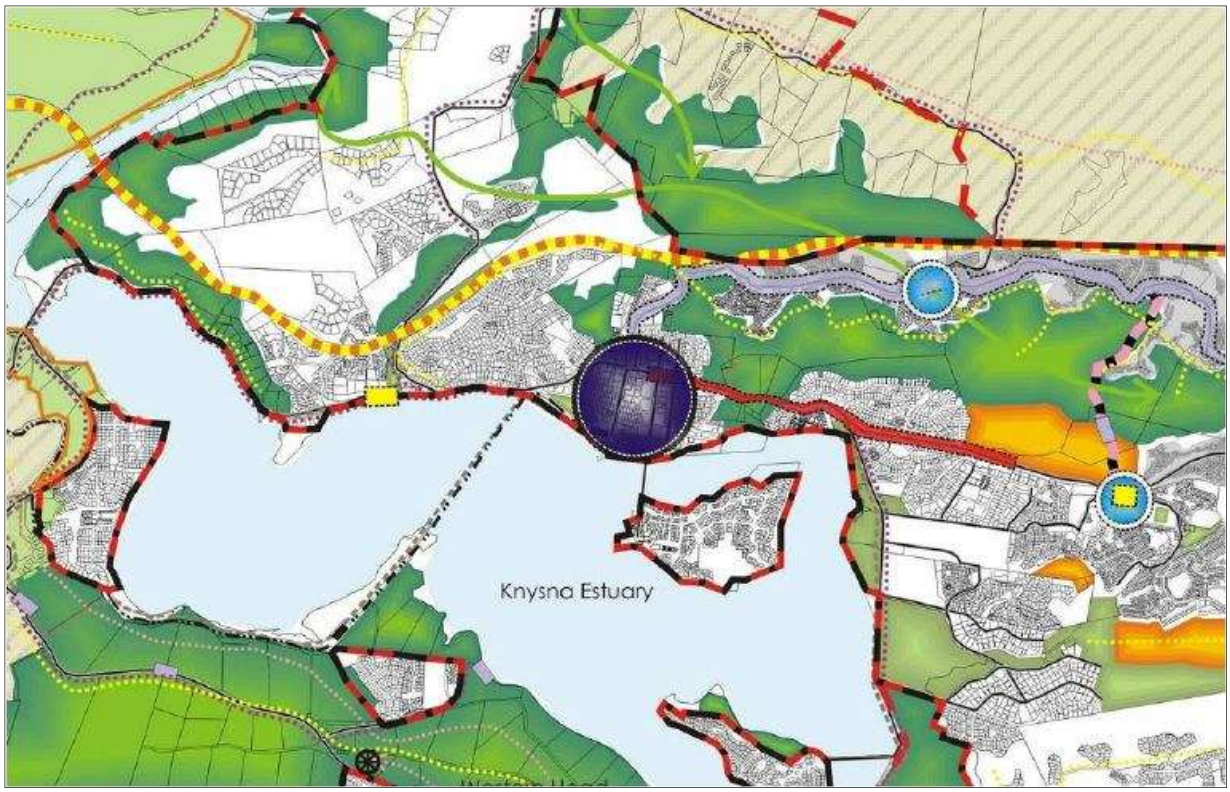


Figure 6: Extract of Spatial Development Framework

4. CAPACITY ANALYSIS – EXISTING SITUATION

Level of Service (LOS) is defined as the operating condition that may occur at an intersection when it accommodates various traffic volumes. LOS is a qualitative measure of the effect of speed, travel time, traffic interruptions, freedom to manoeuvre, safety, driving comfort and convenience, and operating costs. **LOS D** is considered an acceptable design standard. The Levels of Service applicable to intersections under various control conditions, as defined in the **Highway Capacity Manual** [5] are indicated in **Table 1** below:

Table 1: Level of Service definitions for Vehicles (Highway Capacity Manual [5] method)

Level of Service	Control delay per vehicle in seconds (d) (*including geometric delay*)	
	Signals and Roundabouts	**Stop Signs and Yield Signs**
A	$d \leq 10$	$d \leq 10$
B	$10 < d \leq 20$	$10 < d \leq 15$
C	$20 < d \leq 35$	$15 < d \leq 25$
D	$35 < d \leq 55$	$25 < d \leq 35$
E	$55 < d \leq 80$	$35 < d \leq 50$
F	$80 < d$	$50 < d$

The traffic situation was analysed in order to determine the Level of Service at which the affected intersections currently operate. The capacity analysis was undertaken using the **SIDRA INTERSECTION** [6] capacity analysis method, but applying the **Highway Capacity Manual** [5] gap acceptance criteria for unsignalised intersections where applicable. The results are shown in **Table 2** below and the detailed SIDRA output sheets attached as **Annexure C**.

Table 2: Results of Intersection Capacity Analysis – 2014 Existing

Intersection	Delay (s)		Critical Approach V/C		LOS *	
	AM	**PM**	**AM**	**PM**	**AM**	**PM**
Main Road (N2) / Gray Street	19.9	20.1	0.612	0.702	B	C
Gray Street / Rio Drive	2.4	2.0	0.114	0.113	A*	A*

* - **SIDRA INTERSECTION** [6] does not calculate intersection LOS for stop controlled intersections. The LOS indicated is sourced from the **Highway Capacity Manual** [5] (**Table 1** above).

As indicated in **Table 2** above, the surveyed intersections all operate at LOS C or better, with no problems experienced in terms of capacity.

.

5. TRIP GENERATION AND DISTRIBUTION

5.1 TRIP GENERATION

TMH 17 Volume 1 - South African Trip Data Manual [7] recommends peak hour trip generation rates of 0.85 vehicle trips per residential unit for simplex or duplex townhouse units and 0.75 for multi-level townhouse units.

However, in order to allow comparison with the initial TIA, the rate of 1.1 trips per unit will be used. Given that 274 residential units (flats) will be provided in the development, this relates to a peak hour trip generation as follows:

TGR	=	1.1 / unit * 274 units
	=	301 trips (in and out)
Split (in / out)	=	25 : 75 (AM)
		75 : 25 (PM)

The total trips generated by the proposed development are summarised in **Table 2** below:

Table 3: Summary of Generated Trips

COMPONENT	AM		PM	
	TRIPS IN	TRIPS OUT	TRIPS IN	TRIPS OUT
Residential units	75	226	226	75

5.2 TRIP DISTRIBUTION

The origins for the trip distribution for the development were determined by using the observed traffic flows at the surveyed intersections as a basis. Furthermore, given the location of the proposed development relative to employment opportunities in the Knysna area and the fact that the development is only accessible via Gray Street and Rio Drive, it is assumed that the vast majority of trips generated by the proposed development will originate from the direction of the Knysna CBD.

The following distribution has been assumed for trips generated by the development for the 2014 and 2019 development horizons:

<u>AM Peak Hour</u>

- 100 % from/to south via Gray Street, of which:
  - 35 % from/to west via Main Road
  - 15 % from/to east via Main Road
  - 50 % from/to south via Gray Street

<u>PM Peak Hour</u>

- 100 % from/to south via Gray Street, of which:
  - 26 % from/to west via Main Road
  - 16 % from/to east via Main Road
  - 58 % from/to south via Gray Street

The generated peak hour trips are indicated on **Figure 7** overleaf and the generated trips added to the weekday AM and PM peak hour volumes for the 2014 and 2019 development horizons are indicated on **Figures 8** and **9** respectively.

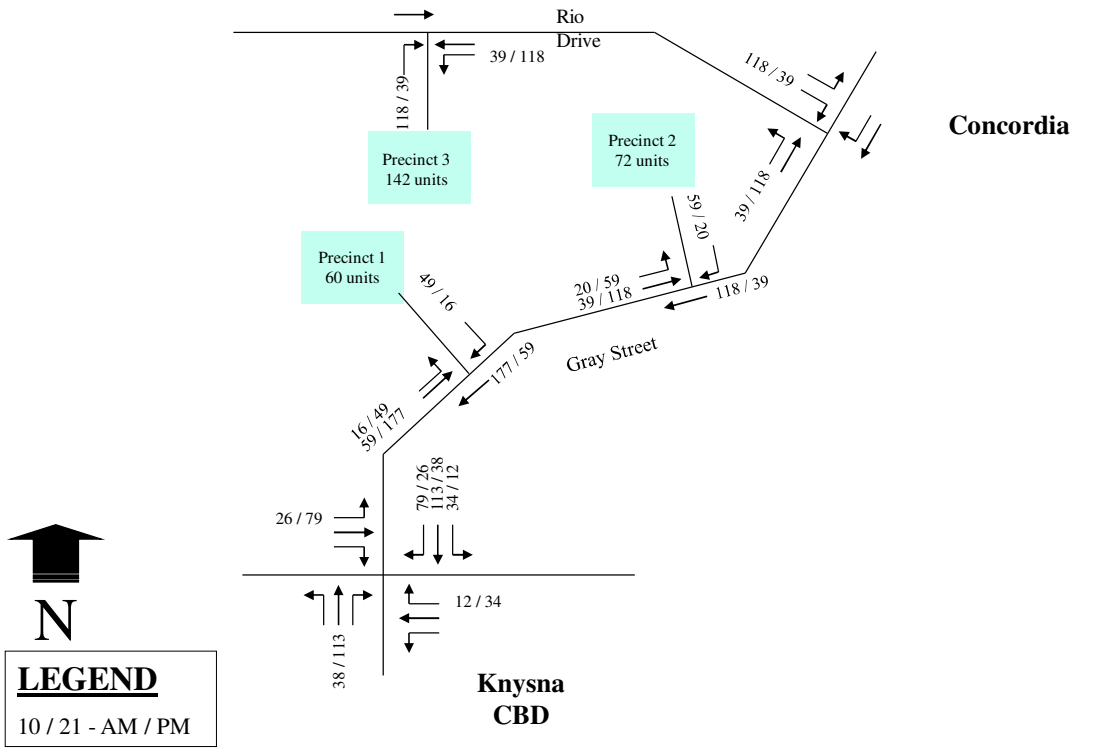


Figure 7 : Generated Peak Hour Traffic Volumes

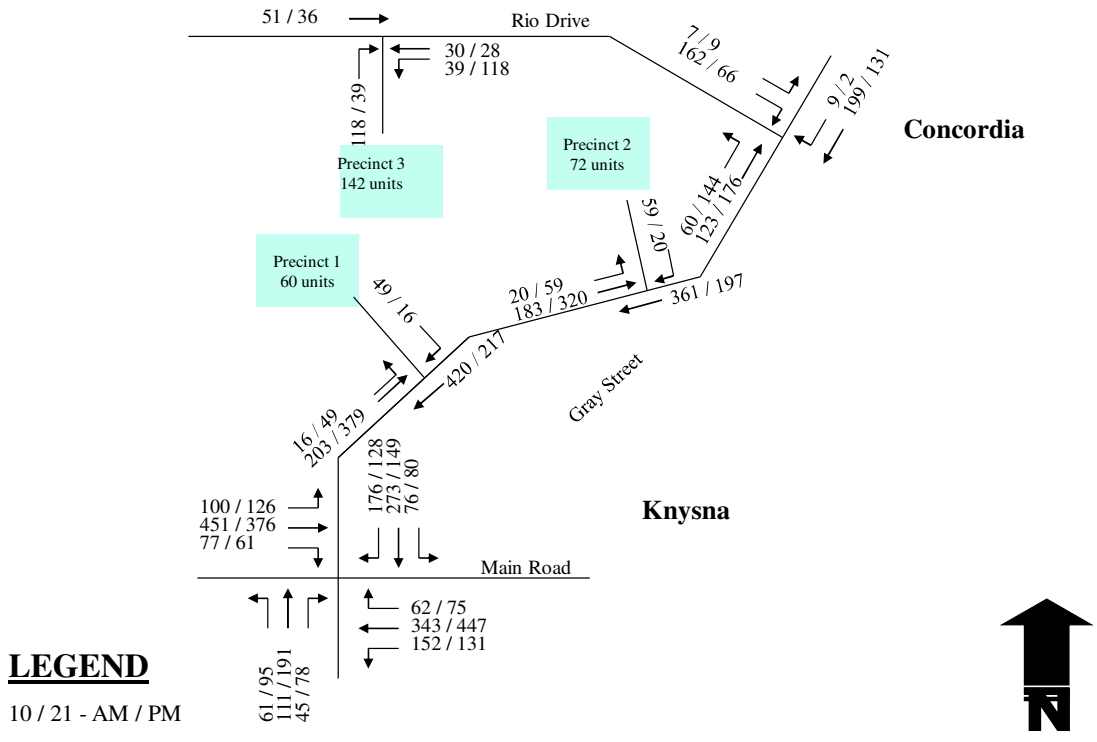


Figure 8 : Peak Hour Traffic Volumes after Development - 2014

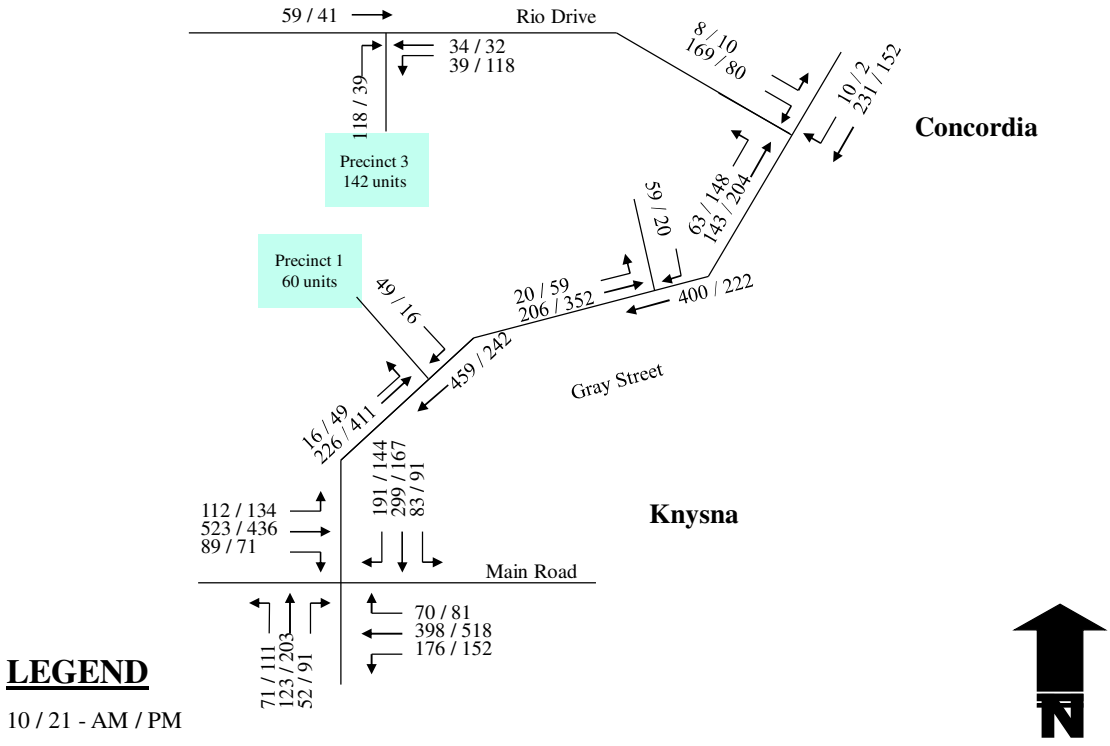


Figure 9 : Peak Hour Traffic Volumes after Development - 2019

6. PROPOSED ACCESS ARRANGEMENTS

The development comprises of three precincts, which, due to the topography are accessed via three points on Gray Street and Rio Drive. The main portion of the development is accessed from Rio Drive. The remaining two precincts are accessed from Gray Street as indicated on **Figure 6**.

Shoulder sight distance was assessed in terms of Figure 10.2 of **UTG 5: Geometric Design of Urban Collector Roads** [8]. UTG 5 indicates that a Single Unit Vehicle (e.g. a service vehicle) entering a 7.5m wide road with a design speed of 40 kph requires a minimum shoulder sight distance of 120m. The minimum required shoulder sight distance for a passenger vehicle under these operating conditions is 75m.

A visual inspection to assess the shoulder sight distances from the access points was undertaken by driving along Gray Street and Rio Drive. The result of the inspection is discussed below.

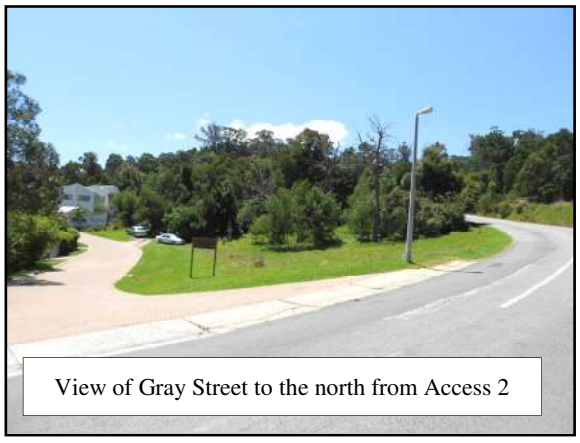
- **Gray Street (Access 1)**

  Access 1 is situated at the southern end of the proposed development serving Precinct 1. The intention is to create a new access point and close the existing road to the residential area between Gray Street and erf 7614 which intersects with Gray Street in a dangerous manner. Shoulder Sight Distance of approximately 320m to the north and 140m to the south is achieved at this proposed access point.

- **Gray Street (Access 2)**

  Access 2 is an **existing access road**, which will serve Precinct 2 of the development. It is recommended that vegetation be cleared on both approaches to this access, particularly the section towards Rio Drive such that shoulder sight distance can be improved. Should this be done, sight distances of approximately 100m to the south and 120 to the north can be achieved.

  In addition, the building line of the proposed development site should be set back and the fence line positioned (lower than the road surface) such that visibility is not hindered.



View of Gray Street to the north from Access 2

View of Gray Street to the south from Access 2

- **Rio Drive (Access 3)**

  This access point is also an **existing** one serving Precinct 3 and shoulder sight distances of approximately 120 and 130m are achieved to the east and west respectively.

7. CAPACITY ANALYSIS – AFTER DEVELOPMENT

7.1 AFTER DEVELOPMENT - 2014

The capacity analysis was undertaken using the **SIDRA Intersection** [6] capacity analysis method, but applying the **Highway Capacity Manual** [5] gap acceptance criteria for unsignalised intersections where applicable.

After adding generated traffic volumes to the background peak hour volumes, the traffic situation was analysed in order to determine the LOS at which the intersections and access points would operate after development occurs. The results are shown in **Table 4** below and the detailed SIDRA output sheets attached as **Annexure D.**

Table 4: Results of Intersection Capacity Analysis – 2014 After Development

Intersection	Delay (s)		Critical Approach V/C		LOS *	
	AM	PM	AM	PM	AM	PM
Gray Street / Main Road	20.9	21.3	0.656	0.725	C	C
Gray Street / Rio Drive	5.0	4.3	0.217	0.181	A*	A*
Gray Street / Access 1	1.8	1.4	0.136	0.116	A*	A*
Gray Street / Access 2	2.2	1.7	0.143	0.103	A*	A*
Rio Drive / Access 3	7.1	6.5	0.142	0.067	A*	A*

* - **SIDRA INTERSECTION** [6] does not calculate intersection LOS for stop controlled intersections. The LOS indicated is sourced from the **Highway Capacity Manual** [5] (**Table 1** above).

As can be seen from the results contained in **Table 4**, no problems are experienced after development at the affected intersections in terms of capacity when one considers overall intersection operation.

Table 5 below indicates the operation of Access 2 when comparing the initial development proposal of 18 units with the current increased proposal of 72 units in Precinct 2. The results indicate that there is minimal impact in terms of capacity due to the additional trips.

Table 5: Results of Intersection Capacity Analysis – 2014 After Development – Access 2

Development	Delay (s)		Critical Approach V/C		LOS *	
	AM	PM	AM	PM	AM	PM
72 units – Current Development	2.2	1.7	0.143	0.103	A*	A*
24 units – Initial Proposal	1.0	0.8	0.098	0.092	A*	A*

* - **SIDRA INTERSECTION** [6] does not calculate intersection LOS for stop controlled intersections. The LOS indicated is sourced from the **Highway Capacity Manual** [5] (**Table 1** above).

7.2 AFTER DEVELOPMENT 2019

After adding generated traffic volumes to the escalated background peak hour volumes, the traffic situation was analysed in order to determine the LOS at which the intersections and access points would operate after development occurs for the 2019 horizon. The results are shown in **Table 6** below and the detailed SIDRA output sheets attached as **Annexure E.**

Table 6: Results of Intersection Capacity Analysis – 2019 After Development

Intersection	Delay (s)		Critical Approach V/C		LOS *	
	AM	PM	AM	PM	AM	PM
Gray Street / Main Road	23.0	24.9	0.795	0.865	C	C
Gray Street / Rio Drive	4.9	4.3	0.241	0.199	A*	A*
Gray Street / Access 1	1.9	1.4	0.151	0.125	A*	A*
Gray Street / Access 2	2.2	1.7	0.159	0.112	A*	A*
Rio Drive / Access 3	6.8	6.3	0.145	0.067	A*	A*

* - **SIDRA INTERSECTION** [6] does not calculate intersection LOS for stop controlled intersections. The LOS indicated is sourced from the **Highway Capacity Manual** [5] (**Table 1** above).

As can be seen from the results contained in **Table 6**, no problems are experienced during the 2019 development horizon at the affected intersections in terms of capacity.

8. PARKING REQUIREMENTS

The parking requirement (based on **National Department of Transport** standards [9]) is 1,5 bays for a residential unit with 2 habitable rooms. Thus there is a minimum requirement of 411 parking spaces that must be provided for the development.

UTSHINTSHO / AMENDMENTS			
INANI NO.	UMHLA DATE	INKCAZA DESCRIPTION	IVUNYELWE APPROVED

UMLINGANISELO WOMZOBO OHLISWEYO SCALE ON REDUCED DRAWING

30mm KUMZOBO WANGAPHAMBILI
30mm ON ORIGINAL DRAWING

UMENZI DESIGN	CH
UMZOBI DRAWN	CP
IVUNYELWE APPROVED	CH
UMHLA DATE	JAN 2014

ENGINEERING ADVICE AND SERVICES associated with ULWAZI
73 Heugh Road, Walmer
P.O. Box 13987
Humewood
Port Elizabeth
6013
tel/fax: (041) 581 2421

IVUNYELWE APPROVED — INJINELI/ENG. — UMHLA / DATE

IVUNYELWE APPROVED — UMENZELWA / CLIENT — UMHLA / DATE

IPROJETI / PROJECT
ERF 23556, KNYSNA
LELIESKLOOF APARTMENTS - TIA

INANI LESIVUMELWANO CONTRACT NO.

UMZOBONKCAZA / DWG DESCRIPTION
PROPOSED ACCESS POINTS - FIGURE 10

INANI LOMZOBO DWG.NO.
1088-P-10

9. CONCLUSIONS

The following conclusions can be drawn from the study:

- Traffic generated by the proposed residential development has little impact on the capacity of the Main Road / Gray Street and Gray Street / Rio Drive intersections with the intersections continuing to operate at LOS C and A respectively after development for the 2014 planning horizon;
- The analysis of the intersections with growth in background traffic indicates marginal increases in delays at these intersections for the 2019 planning horizon;
- The results of the analyses also indicate that the proposed access points will operate at acceptable levels of service for both the 2014 and 2019 planning horizons, with average intersection delays ranging from 2 seconds to 7 seconds;
- The required shoulder sight distances for Single unit trucks are achievable from accesses 1 and 3;
- Sight distance of 120m to the north when exiting Access 2 is achievable provided that the building line is set back, the fence line is positioned lower than the road and the verge is kept clear of vegetation that may hinder visibility;
- Sight distance of 90m to the south when exiting Access 2 is achievable provided that the building line and fence line is set back and the verge is kept clear of vegetation
- The development of an additional 54 units in Precinct 2 has minimal impact on the operation of the access point when comparing operation of the access with only 18 units developed;
- The study therefore concludes that the impact of the proposed development on the road network is acceptable, with minimal increases in delays, and consequently no upgrading of the road network other than that required to provide access to the proposed development is required to be implemented by the developer.

10. RECOMMENDATIONS

In view of the findings of this study, it is recommended that:

- This Traffic Impact Assessment be approved by the Knysna Municipality;
- The access points to the proposed development be approved as indicated on **Figure 10**;
- The developer meets the cost of the provision of the access points to the development, including the necessary road signs and markings;
- The building line be set back, the fence line be positioned lower than the road surface and the verge on both approaches to Access 2 be kept clear of vegetation that my hinder visibility in order to achieve the required should sight distances of 120m to the north, and the maximum possible to the south (approximately 90m) with the cost thereof to be met by the developer.

11. REFERENCES

1. Joubert, Sampson, *et al*, **TMH 16 Volume 1- South African Traffic Impact and Site Assessment Manual**, COTO, August 2012.

2. *Mikros Traffic Monitoring*, **Traffic Count Information Mega Yearbook 2011**, SANRAL, 2012.

3. *Ninham Shand UWP JV,* **Preliminary Engineering Design Report of Alternative Routes for the Proposed Knysna N2 Toll Highway**, SANRAL, 2007.

4. *MCA Urban and Environmental Planners,* **Knysna Municipality Spatial Development Framework**, Knysna Municipality, 2008.

5. Transportation Research Board, **Highway Capacity Manual**, 2000.

6. Akcelik & Associates (Pty) Ltd, **SIDRA Intersection User Guide**, SIDRA Solutions, April 2013.

7. *Joubert, Sampson, et al*, **TMH 17 Volume 1- South African Trip Data Manual**, COTO, August 2012.

8. *CUTA*, **UTG 5: Geometric Design of Urban Collector Roads**, DOT, 1988.

9. *Bruinette Kruger Stoffberg Inc*, **Parking Standards (Second Edition)**, Department of Transport, November 1985.

10. *De Leuw Cather & SENA*, **SADC Road Traffic Signs Manual**, Department of Transport, June 1999.

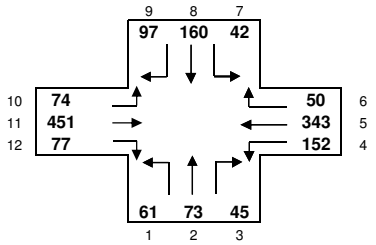
ANNEXURE A

Peak Hour Traffic Counts

Project : ERF 13556, KNYSNA - LELIESKLOOF - TIA
Intersection : GRAY STREET / MAIN ROAD
NO. 1
Day & date : 22/01/2014
Time period: 06:00 - 09:00

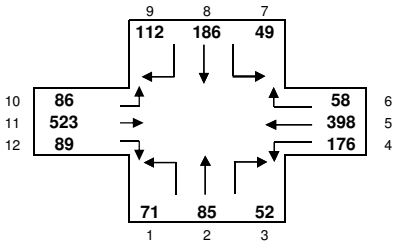
STARTING TIME	GRAY STREET Northbound				MAIN ROAD Westbound				GRAY STREET Southbound				MAIN ROAD Eastbound				INTER-SECTION	
	Left	Thru	Right	Total	Left	Thru	Right	Total	Left	Thru	Right	Total	Left	Thru	Right	Total	Total	Hour
06:00	2	4	2	8	8	26	8	42	7	7	3	17	5	27	1	33	100	
06:15	1	5	4	10	9	33	2	44	3	3	8	14	1	32	1	34	102	
06:30	5	8	3	16	14	47	12	73	5	19	15	39	7	59	4	70	198	
06:45	5	9	9	23	24	52	12	88	13	26	11	50	7	66	2	75	236	636
07:00	10	17	10	37	22	74	7	103	9	29	24	62	24	85	14	123	325	861
07:15	20	17	9	46	38	99	17	154	12	50	30	92	24	131	18	173	465	1224
07:30	13	19	15	47	45	113	17	175	13	49	22	84	15	135	27	177	483	1509
07:45	18	20	11	49	47	57	9	113	8	32	21	61	11	100	18	129	352	1625
08:00	15	15	16	46	32	86	13	131	8	24	10	42	5	107	13	125	344	1644
08:15	9	13	16	38	35	91	8	134	13	20	10	43	10	94	8	112	327	1506
08:30	16	10	13	39	30	71	7	108	8	21	21	50	11	81	16	108	305	1328
08:45	14	9	10	33	29	90	16	135	7	14	15	36	9	75	16	100	304	1280
Total	128	146	118	392	333	839	128	1300	106	294	190	590	129	992	138	1259	3541	
Peak hour	61	73	45	179	152	343	50	545	42	160	97	299	74	451	77	602	1625	
Peak 15 min				49				175				92				177	483	
PHF				0.91				0.78				0.81				0.85	0.84	

AM PEAK HOUR 2014



GRAY STREET

AM PEAK HOUR 2019



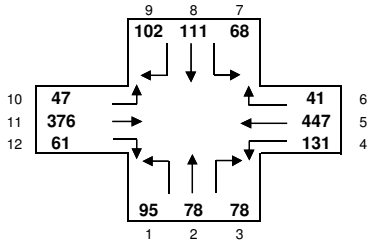
GRAY STREET

Project : ERF 13556, KNYSNA - LELIESKLOOF - TIA
Intersection : GRAY STREET / MAIN ROAD
NO. 1
Day & date : 21/01/2014
Time period: 15:00 – 18:00

STARTING TIME	GRAY STREET Northbound				MAIN ROAD Westbound				GRAY STREET Southbound				MAIN ROAD Eastbound				INTER-SECTION	
	Left	Thru	Right	Total	Left	Thru	Right	Total	Left	Thru	Right	Total	Left	Thru	Right	Total	Total	Hour
15:00	24	21	16	61	45	112	5	162	23	17	24	64	9	97	11	117	404	
15:15	24	11	21	56	26	107	12	145	9	30	17	56	12	97	15	124	381	
15:30	35	36	33	104	47	190	14	251	32	50	51	133	21	151	30	202	690	
15:45	12	10	8	31	13	38	10	61	4	14	10	28	5	31	5	41	161	1636
16:00	19	15	13	46	20	57	14	91	7	21	15	43	8	46	8	62	242	1474
16:15	24	34	18	76	30	83	6	119	6	24	18	48	14	90	12	116	359	1452
16:30	35	27	15	77	23	92	10	125	9	25	23	57	19	89	18	126	385	1147
16:45	24	25	13	62	15	86	16	117	10	30	20	60	13	75	18	106	345	1331
17:00	41	37	43	121	14	127	9	150	12	25	19	56	22	88	10	120	447	1536
17:15	26	30	27	83	15	95	11	121	5	23	14	42	13	101	13	127	373	1550
17:30	20	28	27	75	15	71	17	103	10	28	13	51	14	51	7	72	301	1466
17:45	19	24	23	66	13	64	12	89	11	19	12	42	11	80	4	95	292	1413
Total	303	298	257	858	276	1122	136	1534	138	306	236	680	161	996	151	1308	4088	
Peak hour	95	78	78	252	131	447	41	619	68	111	102	281	47	376	61	484	1636	
Peak 15 min				104				251				133				202	690	
PHF				0.61				0.62				0.53				0.60	0.59	

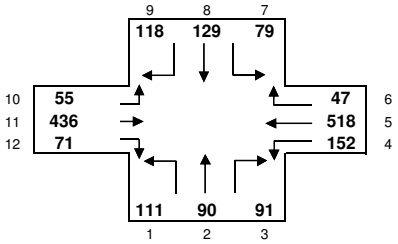
PM PEAK HOUR 2014

GRAY STREET



PM PEAK HOUR 2019

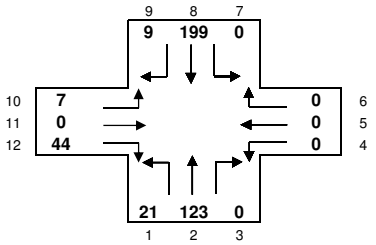
GRAY STREET



Project : ERF 13556, KNYSNA - LELIESKLOOF - TIA
Intersection : GRAY STREET / RIO DRIVE
NO 2
Day & date : 22/01/2014
Time period: 06:00 - 09:00

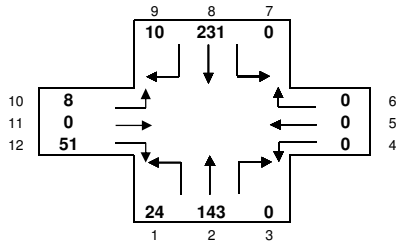
STARTING TIME	GRAY STREET Northbound				Westbound				GRAY STREET Southbound				RIO DRIVE Eastbound				INTER-SECTION	
	Left	Thru	Right	Total	Left	Thru	Right	Total	Left	Thru	Right	Total	Left	Thru	Right	Total	Total	Hour
06:00	4	13	0	17	0	0	0	0	0	25	0	25	1	0	0	1	43	
06:15	2	7	0	9	0	0	0	0	0	17	0	17	0	0	0	0	26	
06:30	4	8	0	12	0	0	0	0	0	25	5	30	0	0	2	2	44	
06:45	14	17	0	31	0	0	0	0	0	31	8	39	2	0	5	7	77	190
07:00	0	32	0	32	0	0	0	0	0	54	2	56	0	0	14	14	102	249
07:15	10	33	0	43	0	0	0	0	0	69	4	73	5	0	15	20	136	359
07:30	6	34	0	40	0	0	0	0	0	45	2	47	2	0	6	8	95	410
07:45	5	24	0	29	0	0	0	0	0	31	1	32	0	0	9	9	70	403
08:00	5	17	0	22	0	0	0	0	0	20	2	22	0	0	4	4	48	349
08:15	1	12	0	13	0	0	0	0	0	15	2	17	2	0	5	7	37	250
08:30	5	8	0	13	0	0	0	0	0	8	1	9	2	0	6	8	30	185
08:45	4	10	0	14	0	0	0	0	0	14	0	14	0	0	5	5	33	148
Total	60	215	0	275	0	0	0	0	0	354	27	381	14	0	71	85	741	
Peak hour	21	123	0	144	0	0	0	0	0	199	9	208	7	0	44	51	403	
Peak 15 min				43				0				73				20	136	
PHF				0.84				#####				0.71				0.64	0.74	

AM PEAK HOUR 2014



GRAY STREET

AM PEAK HOUR 2019



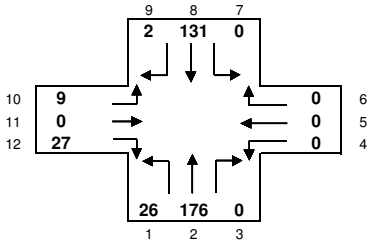
GRAY STREET

Project : ERF 13556, KNYSNA - LELIESKLOOF - TIA
Intersection : GRAY STREET / RIO DRIVE
NO 2
Day & date : 21/01/2014
Time period: 15:00 – 18:00

STARTING TIME	GRAY STREET Northbound				0 Westbound				GRAY STREET Southbound				RIO DRIVE Eastbound				INTER-SECTION	
	Left	Thru	Right	Total	Left	Thru	Right	Total	Left	Thru	Right	Total	Left	Thru	Right	Total	Total	Hour
15:00	10	20	0	30	0	0	0	0	0	27	0	27	1	0	4	5	62	
15:15	5	19	0	24	0	0	0	0	0	19	1	20	0	0	6	6	50	
15:30	5	41	0	46	0	0	0	0	0	25	3	28	5	0	20	25	99	
15:45	5	30	0	35	0	0	0	0	0	41	1	42	1	0	10	11	88	299
16:00	4	23	0	27	0	0	0	0	0	47	0	47	1	0	6	7	81	318
16:15	11	27	0	38	0	0	0	0	0	20	1	21	1	0	3	4	63	331
16:30	6	32	0	38	0	0	0	0	0	24	0	24	1	0	7	8	70	302
16:45	7	53	0	60	0	0	0	0	0	49	0	49	1	0	8	9	118	332
17:00	11	57	0	68	0	0	0	0	0	30	1	31	3	0	8	11	110	361
17:15	3	29	0	32	0	0	0	0	0	18	0	18	0	0	4	4	54	352
17:30	5	37	0	42	0	0	0	0	0	34	1	35	5	0	7	12	89	371
17:45	2	35	0	37	0	0	0	0	0	20	1	21	0	0	1	1	59	312
Total	74	403	0	477	0	0	0	0	0	354	9	363	19	0	84	103	884	
Peak hour	26	176	0	202	0	0	0	0	0	131	2	133	9	0	27	36	371	
Peak 15 min				68				0				49				12	118	
PHF				0.74				#####				0.68				0.75	0.79	

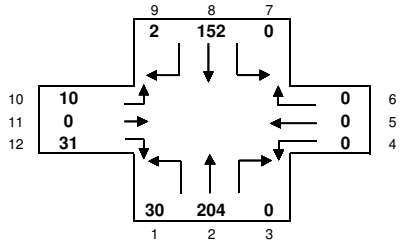
PM PEAK HOUR 2014

GRAY STREET



PM PEAK HOUR 2019

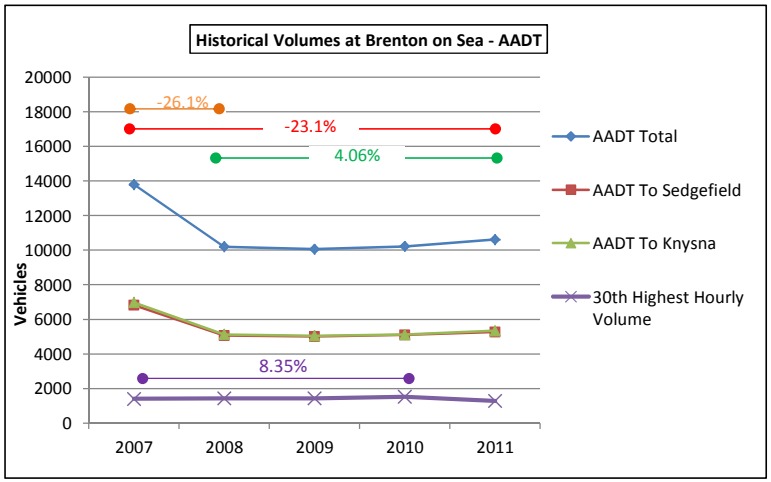
GRAY STREET

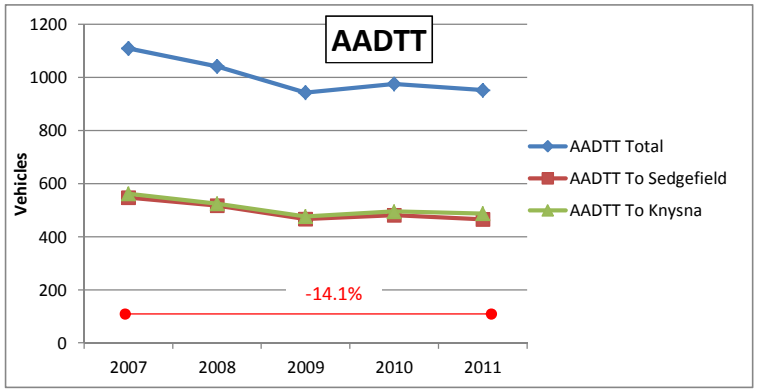


ANNEXURE B

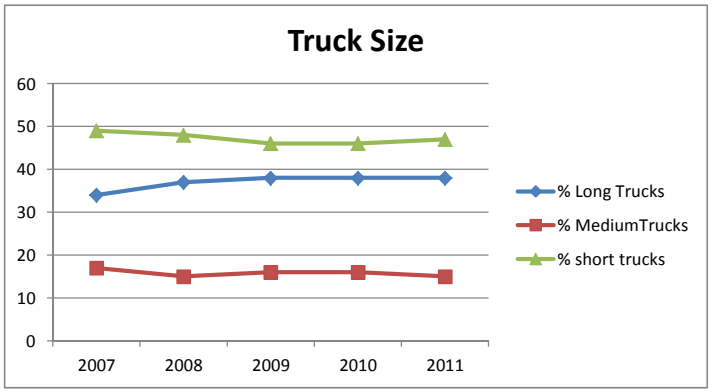
Historical 24-hr Traffic Data

	AADT Total	AADT to Sedgefie	AADT to Knysna	AADTT Total	AADTT to Sedgefiel	AADTT to Knysna	30th highe	Highest volume	Truck slit sl	Truck medi	Truck long
2007	13797	6817	6980	1109	547	562	1401	1736	49	17	34
2008	10196	5067	5130	1042	517	525	1433	1883	48	15	37
2009	10061	5011	5050	943	467	476	1432	1846	46	16	38
2010	10217	5098	5119	975	481	495	1518	1857	46	16	38
2011	10610	5269	5341	952	465	487	1289	1739	47	15	38





	Total	Per annum		Total	Per annum
AADT Growth from 2007 to 2011	-23.09922447	5.332848576	AADTT Growth from 2007 to 2011	-14.1569	3.365483
AADT Growth from 2008 to 2011	4.060415849	1.335555458			
AADT Growth from 2007 to 2008	-26.09987678		30th hour growth from 2007 to 2011	-7.99429	0.385281
			30th hour growth from 2007 to 2010	8.351178	2.709641
			30th hour growth from 2010 to 2011	-15.0856	



AADT Growth from 2008 to 2011 to Knysna	4.113060429	1.352641264
AADT Growth from 2008 to 2011 to Sedgefield	3.98657983	1.311582255

TRAFFIC HIGHLIGHTS OF SITE 1203				
1.1	Site Identifier			1203
1.2	Site Name			Brenton-on-sea New
1.3	Site Description			Between Brenton-on-Sea T/O and Knysna
1.4	Road Description	Route : N002	Road : N002 Section : 08	Distance : 22.3km
1.5	GPS Position			22 58 59.4E -34 02 10.6S
1.6	Number of Lanes			4
1.7	Station Type			Permanent
1.8	Requested Period			2007/01/01 - 2007/12/31
1.9	Length of record requested (hours)			8760
1.10	Actual First & Last Dates			2007/11/24 - 2007/12/31
1.11	Actual available data (hours)			898
1.12	Percentage data available for requested period			10.2
		To Knysna	To Sedgefield	Total
2.1	Total number of vehicles	261016	254923	515939
2.2	Average daily traffic (ADT)	6980	6817	13797
2.3	Average daily truck traffic (ADTT)	547	562	1109
2.4	Percentage of trucks	7.8	8.2	8.0
2.5	Truck split % (short:medium:long)	46 : 18 : 36	51 : 17 : 32	49 : 17 : 34
2.6	Percentage of night traffic (20:00 - 06:00)	10.2	10.6	10.4
3.1	Speed limit (km/hr)			100
3.2	Average speed (km/hr)	94.6	86.0	90.4
3.3	Average speed - light vehicles (km/hr)	96.3	88.7	92.6
3.4	Average speed - heavy vehicles (km/hr)	74.3	56.3	65.2
3.5	Average night speed (km/hr)	92.5	81.7	87.0
3.6	15th centile speed (km/hr)	81.5	71.6	73.6
3.7	85th centile speed (km/hr)	112.0	103.9	107.9
3.8	Percentage vehicles in excess of speed limit	35.3	17.8	26.7
4.1	Percentage vehicles in flows over 600 vehicles/hr	25.5	28.9	81.8
4.2	Highest volume on the road (vehicles/hr)		2007/12/27 11:00:00	1736
4.3	Highest volume in the North (vehs/hr)		2007/12/26 12:00:00	928
4.4	Highest volume in the South (vehs/hr)		2007/12/27 12:00:00	862
4.5	Highest volume in a lane (vehicles/hr)		2007/12/26 12:00:00	558
4.6	15th highest volume on the road (vehicles/hr)		2007/12/21 11:00:00	1499
4.7	15th highest volume in the North direction (vehs/hr)		2007/12/21 11:00:00	805
4.8	15th highest volume in the South direction (vehs/hr)		2007/12/26 14:00:00	734
4.9	30th highest volume on the road (vehicles/hr)		2007/12/27 13:00:00	1401
4.10	30th highest volume in the North direction (vehs/hr)		2007/12/22 10:00:00	712
4.11	30th highest volume in the South direction (vehs/hr)		2007/12/06 18:00:00	697
5.1	Percentage of vehicles less than 2s behind vehicle ahe	10.9	13.2	12.1
6.1	Total number of heavy vehicles	20460	21024	41484
6.2	Estimated average number of axles per truck	4.4	4.1	4.2
6.3	Estimated truck mass (Ton/truck)	25.1	23.5	24.3
6.4	Estimated average E80/truck	1.5	1.4	1.4
6.5	Estimated daily E80 on the road			1597
6.6	Estimated daily E80 in the North direction			812
6.7	Estimated daily E80 in the South direction			785
6.8	Estimated daily E80 in the worst North lane			747
6.9	Estimated daily E80 in the worst South lane			731
6.10	ASSUMPTION on Axles/Truck (Short:Medium:Long)			(2.0 : 5.0 : 7.0)
6.11	ASSUMPTION on Mass/Truck (Short:Medium:Long)			(10.9 : 31.5 : 39.8)
6.12	ASSUMPTION on E80s/Truck (Short:Medium:Long)			(0.6 : 2.5 : 2.1)

TRAFFIC HIGHLIGHTS OF SITE 1203				
1.1	Site Identifier			1203
1.2	Site Name			Brenton-on-sea New
1.3	Site Description			Between Brenton-on-Sea T/O and Knysna
1.4	Road Description	Route : N002	Road : N002 Section : 08	Distance : 22.3km
1.5	GPS Position			22 58 59.4E -34 02 10.6S
1.6	Number of Lanes			4
1.7	Station Type			Permanent
1.8	Requested Period			2008/01/01 - 2008/12/31
1.9	Length of record requested (hours)			8784
1.10	Actual First & Last Dates			2008/01/01 - 2008/12/31
1.11	Actual available data (hours)			8781
1.12	Percentage data available for requested period			100.0
		To Knysna	To Sedgefield	Total
2.1	Total number of vehicles	1853891	1876903	3730794
2.2	Average daily traffic (ADT)	5067	5130	10196
2.3	Average daily truck traffic (ADTT)	517	525	1042
2.4	Percentage of trucks	10.2	10.2	10.2
2.5	Truck split % (short:medium:long)	45 : 15 : 40	50 : 16 : 34	48 : 15 : 37
2.6	Percentage of night traffic (20:00 - 06:00)	9.2	9.3	9.3
3.1	Speed limit (km/hr)			100
3.2	Average speed (km/hr)	92.9	85.1	89.0
3.3	Average speed - light vehicles (km/hr)	95.1	88.5	91.8
3.4	Average speed - heavy vehicles (km/hr)	72.7	54.9	63.7
3.5	Average night speed (km/hr)	90.6	79.0	84.7
3.6	15th centile speed (km/hr)	77.7	67.8	71.6
3.7	85th centile speed (km/hr)	109.9	101.9	107.9
3.8	Percentage vehicles in excess of speed limit	31.3	17.2	24.2
4.1	Percentage vehicles in flows over 600 vehicles/hr	4.6	6.0	73.9
4.2	Highest volume on the road (vehicles/hr)		2008/12/27 12:00:00	1883
4.3	Highest volume in the North (vehs/hr)		2008/12/27 12:00:00	1060
4.4	Highest volume in the South (vehs/hr)		2008/12/27 12:00:00	823
4.5	Highest volume in a lane (vehicles/hr)		2008/12/30 12:00:00	566
4.6	15th highest volume on the road (vehicles/hr)		2008/12/27 15:00:00	1508
4.7	15th highest volume in the North direction (vehs/hr)		2008/12/23 11:00:00	800
4.8	15th highest volume in the South direction (vehs/hr)		2008/12/27 11:00:00	763
4.9	30th highest volume on the road (vehicles/hr)		2008/12/20 12:00:00	1433
4.10	30th highest volume in the North direction (vehs/hr)		2008/12/18 12:00:00	745
4.11	30th highest volume in the South direction (vehs/hr)		2008/12/29 15:00:00	732
5.1	Percentage of vehicles less than 2s behind vehicle ahea	7.6	11.2	9.5
6.1	Total number of heavy vehicles	189179	191946	381125
6.2	Estimated average number of axles per truck	4.5	4.2	4.3
6.3	Estimated truck mass (Ton/truck)	25.6	24.1	24.8
6.4	Estimated average E80/truck	1.5	1.4	1.5
6.5	Estimated daily E80 on the road			1511
6.6	Estimated daily E80 in the North direction			770
6.7	Estimated daily E80 in the South direction			741
6.8	Estimated daily E80 in the worst North lane			722
6.9	Estimated daily E80 in the worst South lane			690
6.10	ASSUMPTION on Axles/Truck (Short:Medium:Long)			(2.0 : 5.0 : 7.0)
6.11	ASSUMPTION on Mass/Truck (Short:Medium:Long)			(10.9 : 31.5 : 39.8)
6.12	ASSUMPTION on E80s/Truck (Short:Medium:Long)			(0.6 : 2.5 : 2.1)

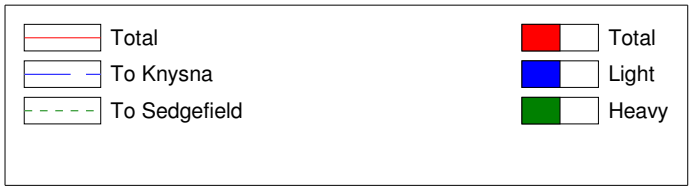
TRAFFIC HIGHLIGHTS OF SITE 1203				
1.1	Site Identifier			1203
1.2	Site Name			Brenton-on-sea New
1.3	Site Description			Between Brenton-on-Sea T/O and Knysna
1.4	Road Description	Route : N002	Road : N002 Section : 08	Distance : 22.3km
1.5	GPS Position			22 58 59.4E -34 02 10.6S
1.6	Number of Lanes			4
1.7	Station Type			Permanent
1.8	Requested Period			2009/01/01 - 2009/12/31
1.9	Length of record requested (hours)			8760
1.10	Actual First & Last Dates			2009/01/01 - 2009/12/31
1.11	Actual available data (hours)			8759
1.12	Percentage data available for requested period			100.0
		To Knysna	To Sedgefield	Total
2.1	Total number of vehicles	1828996	1843003	3671999
2.2	Average daily traffic (ADT)	5011	5050	10061
2.3	Average daily truck traffic (ADTT)	467	476	943
2.4	Percentage of trucks	9.3	9.4	9.4
2.5	Truck split % (short:medium:long)	44 : 16 : 40	48 : 17 : 35	46 : 16 : 38
2.6	Percentage of night traffic (20:00 - 06:00)	9.5	9.2	9.3
3.1	Speed limit (km/hr)			100
3.2	Average speed (km/hr)	92.7	85.4	89.0
3.3	Average speed - light vehicles (km/hr)	94.7	88.5	91.6
3.4	Average speed - heavy vehicles (km/hr)	72.6	55.4	63.9
3.5	Average night speed (km/hr)	91.5	79.5	85.5
3.6	15th centile speed (km/hr)	77.7	67.8	73.7
3.7	85th centile speed (km/hr)	109.9	103.9	107.9
3.8	Percentage vehicles in excess of speed limit	30.3	18.0	24.2
4.1	Percentage vehicles in flows over 600 vehicles/hr	5.0	5.8	72.6
4.2	Highest volume on the road (vehicles/hr)		2009/12/27 13:00:00	1846
4.3	Highest volume in the North (vehs/hr)		2009/12/27 13:00:00	1017
4.4	Highest volume in the South (vehs/hr)		2009/12/27 14:00:00	869
4.5	Highest volume in a lane (vehicles/hr)		2009/12/27 13:00:00	611
4.6	15th highest volume on the road (vehicles/hr)		2009/01/02 13:00:00	1545
4.7	15th highest volume in the North direction (vehs/hr)		2009/12/19 12:00:00	804
4.8	15th highest volume in the South direction (vehs/hr)		2009/12/29 14:00:00	755
4.9	30th highest volume on the road (vehicles/hr)		2009/01/04 12:00:00	1432
4.10	30th highest volume in the North direction (vehs/hr)		2009/12/27 16:00:00	723
4.11	30th highest volume in the South direction (vehs/hr)		2009/04/13 12:00:00	723
5.1	Percentage of vehicles less than 2s behind vehicle ahea	7.7	11.7	9.7
6.1	Total number of heavy vehicles	170393	173818	344211
6.2	Estimated average number of axles per truck	4.5	4.2	4.4
6.3	Estimated truck mass (Ton/truck)	25.8	24.4	25.1
6.4	Estimated average E80/truck	1.5	1.4	1.5
6.5	Estimated daily E80 on the road			1387
6.6	Estimated daily E80 in the North direction			701
6.7	Estimated daily E80 in the South direction			686
6.8	Estimated daily E80 in the worst North lane			659
6.9	Estimated daily E80 in the worst South lane			640
6.10	ASSUMPTION on Axles/Truck (Short:Medium:Long)			(2.0 : 5.0 : 7.0)
6.11	ASSUMPTION on Mass/Truck (Short:Medium:Long)			(10.9 : 31.5 : 39.8)
6.12	ASSUMPTION on E80s/Truck (Short:Medium:Long)			(0.6 : 2.5 : 2.1)

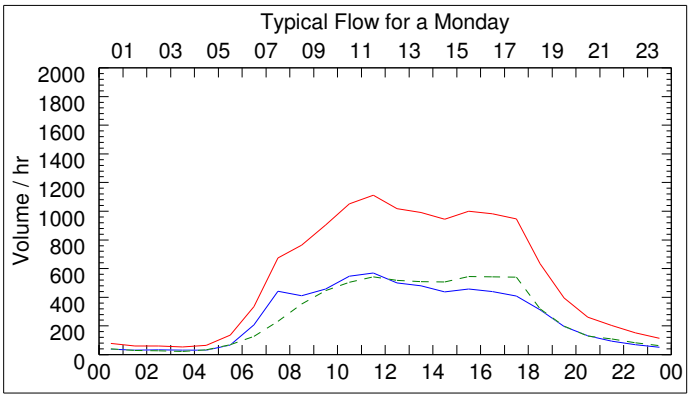
TRAFFIC HIGHLIGHTS OF SITE 1203				
1.1	Site Identifier			1203
1.2	Site Name			Brenton-on-sea New
1.3	Site Description			Between Brenton-on-Sea T/O and Knysna
1.4	Road Description	Route : N002	Road : N002 Section : 08	Distance : 22.3km
1.5	GPS Position			22 58 59.4E -34 02 10.6S
1.6	Number of Lanes			4
1.7	Station Type			Permanent
1.8	Requested Period			2010/01/01 - 2010/12/31
1.9	Length of record requested (hours)			8760
1.10	Actual First & Last Dates			2010/01/01 - 2010/12/31
1.11	Actual available data (hours)			8760
1.12	Percentage data available for requested period			100.0
		To Knysna	To Sedgefield	Total
2.1	Total number of vehicles	1860708	1868221	3728929
2.2	Average daily traffic (ADT)	5098	5119	10217
2.3	Average daily truck traffic (ADTT)	481	495	975
2.4	Percentage of trucks	9.4	9.7	9.5
2.5	Truck split % (short:medium:long)	45 : 15 : 40	49 : 16 : 35	46 : 16 : 38
2.6	Percentage of night traffic (20:00 - 06:00)	9.7	9.2	9.5
3.1	Speed limit (km/hr)			100
3.2	Average speed (km/hr)	94.0	85.8	89.9
3.3	Average speed - light vehicles (km/hr)	96.0	88.9	92.5
3.4	Average speed - heavy vehicles (km/hr)	74.2	55.9	64.9
3.5	Average night speed (km/hr)	91.5	78.9	85.4
3.6	15th centile speed (km/hr)	79.7	69.8	73.6
3.7	85th centile speed (km/hr)	109.9	103.9	107.9
3.8	Percentage vehicles in excess of speed limit	33.1	17.9	25.5
4.1	Percentage vehicles in flows over 600 vehicles/hr	5.4	6.1	74.9
4.2	Highest volume on the road (vehicles/hr)		2010/12/27 13:00:00	1857
4.3	Highest volume in the North (vehs/hr)		2010/12/27 13:00:00	992
4.4	Highest volume in the South (vehs/hr)		2010/12/30 17:00:00	886
4.5	Highest volume in a lane (vehicles/hr)		2010/12/28 12:00:00	601
4.6	15th highest volume on the road (vehicles/hr)		2010/12/23 12:00:00	1609
4.7	15th highest volume in the North direction (vehs/hr)		2010/12/27 15:00:00	834
4.8	15th highest volume in the South direction (vehs/hr)		2010/12/30 14:00:00	812
4.9	30th highest volume on the road (vehicles/hr)		2010/12/30 17:00:00	1518
4.10	30th highest volume in the North direction (vehs/hr)		2010/12/22 11:00:00	788
4.11	30th highest volume in the South direction (vehs/hr)		2010/12/28 18:00:00	767
5.1	Percentage of vehicles less than 2s behind vehicle ahea	7.7	10.2	8.9
6.1	Total number of heavy vehicles	175474	180507	355981
6.2	Estimated average number of axles per truck	4.5	4.2	4.4
6.3	Estimated truck mass (Ton/truck)	25.7	24.3	25.0
6.4	Estimated average E80/truck	1.5	1.4	1.5
6.5	Estimated daily E80 on the road			1428
6.6	Estimated daily E80 in the North direction			720
6.7	Estimated daily E80 in the South direction			708
6.8	Estimated daily E80 in the worst North lane			682
6.9	Estimated daily E80 in the worst South lane			661
6.10	ASSUMPTION on Axles/Truck (Short:Medium:Long)			(2.0 : 5.0 : 7.0)
6.11	ASSUMPTION on Mass/Truck (Short:Medium:Long)			(10.9 : 31.5 : 39.8)
6.12	ASSUMPTION on E80s/Truck (Short:Medium:Long)			(0.6 : 2.5 : 2.1)

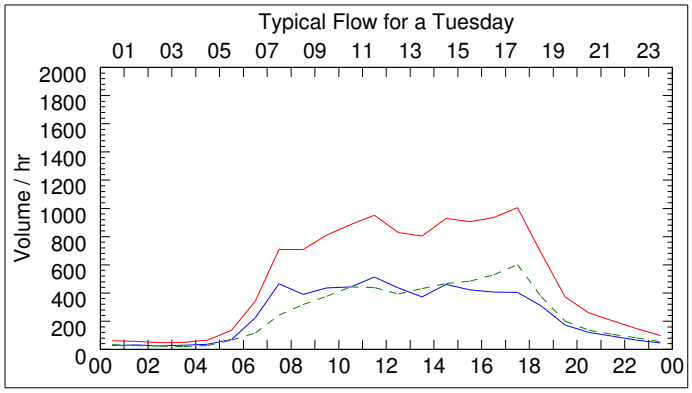
TRAFFIC HIGHLIGHTS OF SITE 1203				
1.1	Site Identifier			1203
1.2	Site Name			Brenton-on-sea New
1.3	Site Description			Between Brenton-on-Sea T/O and Knysna
1.4	Road Description	Route : N002	Road : N002 Section : 08	Distance : 22.3km
1.5	GPS Position			22 58 59.4E -34 02 10.6S
1.6	Number of Lanes			4
1.7	Station Type			Permanent
1.8	Requested Period			2011/01/01 - 2011/12/31
1.9	Length of record requested (hours)			8760
1.10	Actual First & Last Dates			2011/01/01 - 2011/05/10
1.11	Actual available data (hours)			3098
1.12	Percentage data available for requested period			35.4
		To Knysna	To Sedgefield	Total
2.1	Total number of vehicles	680057	689434	1369491
2.2	Average daily traffic (ADT)	5269	5341	10610
2.3	Average daily truck traffic (ADTT)	465	487	952
2.4	Percentage of trucks	8.8	9.1	9.0
2.5	Truck split % (short:medium:long)	44 : 15 : 41	48 : 16 : 36	47 : 15 : 38
2.6	Percentage of night traffic (20:00 - 06:00)	9.4	9.3	9.3
3.1	Speed limit (km/hr)			100
3.2	Average speed (km/hr)	91.7	85.1	88.4
3.3	Average speed - light vehicles (km/hr)	93.5	87.9	90.7
3.4	Average speed - heavy vehicles (km/hr)	73.1	57.1	64.9
3.5	Average night speed (km/hr)	90.8	78.4	84.6
3.6	15th centile speed (km/hr)	77.7	69.8	73.6
3.7	85th centile speed (km/hr)	107.9	102.0	105.9
3.8	Percentage vehicles in excess of speed limit	26.9	15.6	21.2
4.1	Percentage vehicles in flows over 600 vehicles/hr	5.7	5.9	77.2
4.2	Highest volume on the road (vehicles/hr)		2011/01/02 13:00:00	1739
4.3	Highest volume in the North (vehs/hr)		2011/01/03 12:00:00	826
4.4	Highest volume in the South (vehs/hr)		2011/01/02 13:00:00	931
4.5	Highest volume in a lane (vehicles/hr)		2011/01/02 13:00:00	562
4.6	15th highest volume on the road (vehicles/hr)		2011/01/05 13:00:00	1343
4.7	15th highest volume in the North direction (vehs/hr)		2011/01/06 13:00:00	706
4.8	15th highest volume in the South direction (vehs/hr)		2011/01/02 15:00:00	675
4.9	30th highest volume on the road (vehicles/hr)		2011/01/05 11:00:00	1289
4.10	30th highest volume in the North direction (vehs/hr)		2011/01/03 15:00:00	658
4.11	30th highest volume in the South direction (vehs/hr)		2011/05/01 12:00:00	644
5.1	Percentage of vehicles less than 2s behind vehicle ahea	8.1	9.6	8.8
6.1	Total number of heavy vehicles	60017	62881	122898
6.2	Estimated average number of axles per truck	4.5	4.3	4.4
6.3	Estimated truck mass (Ton/truck)	25.8	24.5	25.2
6.4	Estimated average E80/truck	1.5	1.4	1.5
6.5	Estimated daily E80 on the road			1399
6.6	Estimated daily E80 in the North direction			699
6.7	Estimated daily E80 in the South direction			700
6.8	Estimated daily E80 in the worst North lane			661
6.9	Estimated daily E80 in the worst South lane			653
6.10	ASSUMPTION on Axles/Truck (Short:Medium:Long)			(2.0 : 5.0 : 7.0)
6.11	ASSUMPTION on Mass/Truck (Short:Medium:Long)			(10.9 : 31.5 : 39.8)
6.12	ASSUMPTION on E80s/Truck (Short:Medium:Long)			(0.6 : 2.5 : 2.1)

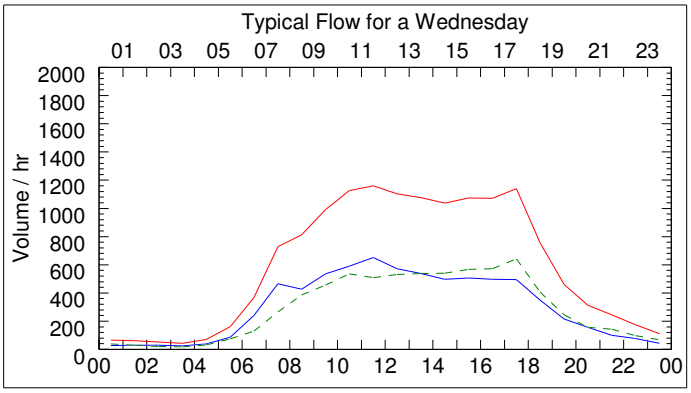
Typical Week Volume Report

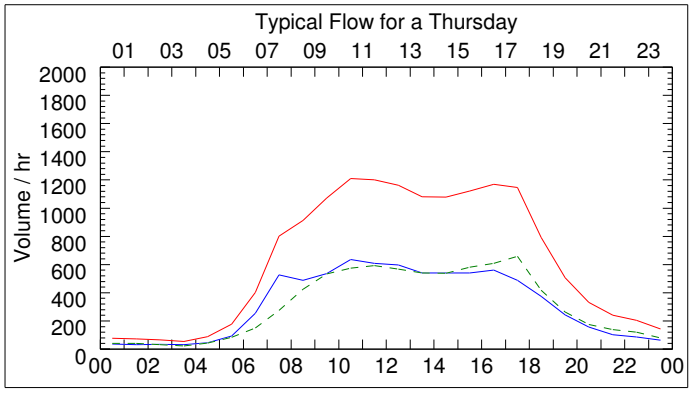
Site	: 1203 - Brenton-on-sea New
Region	: Western Cape
Actual Period	: 2007/11/24 to 2007/12/31
Classification	: RSA Ext Lgt/Hvy
Day Type	: Normal Day&Fixed Public Holiday+

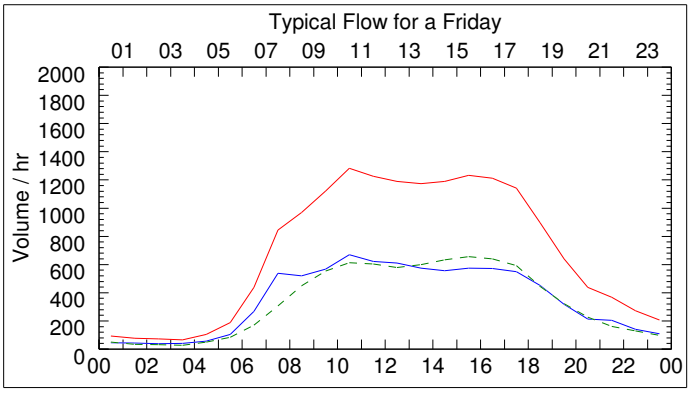


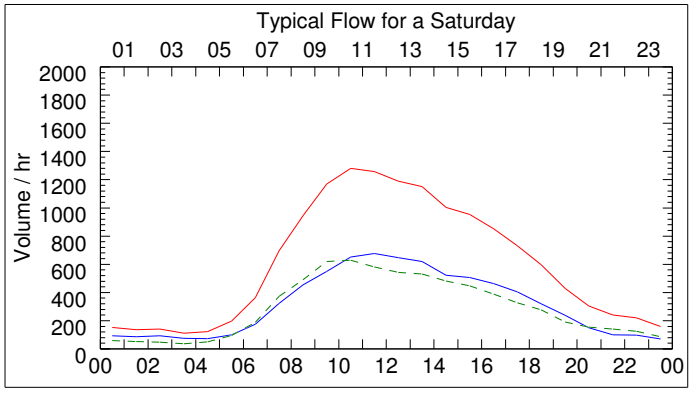


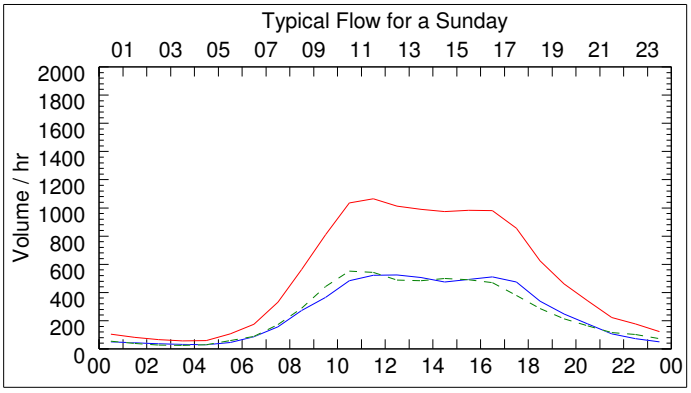


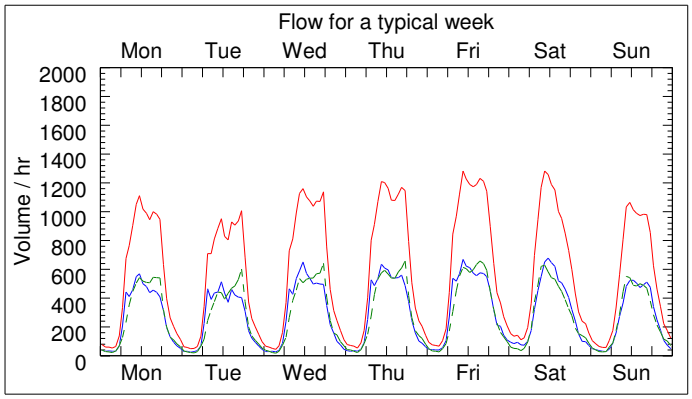


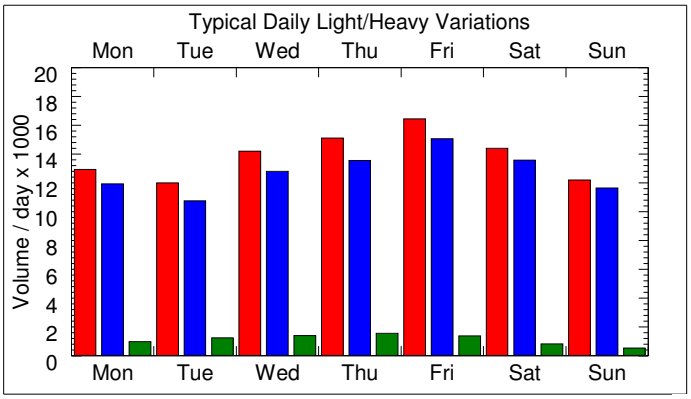






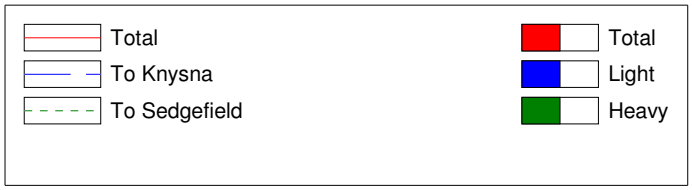


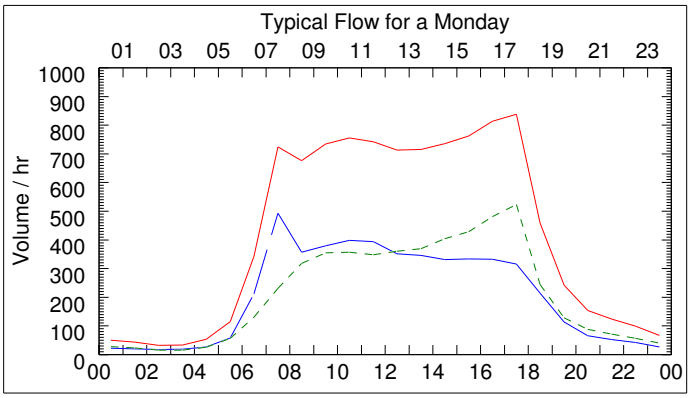


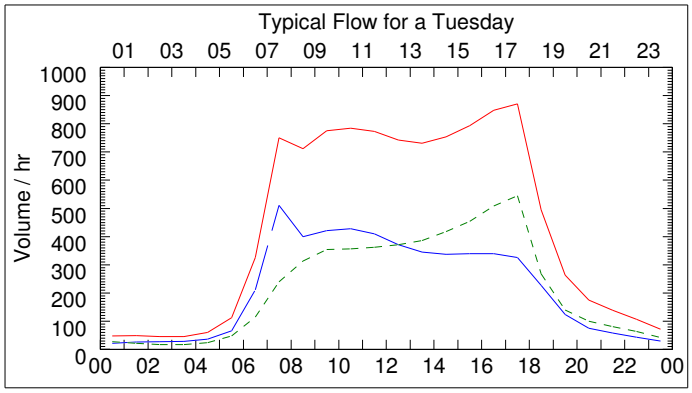


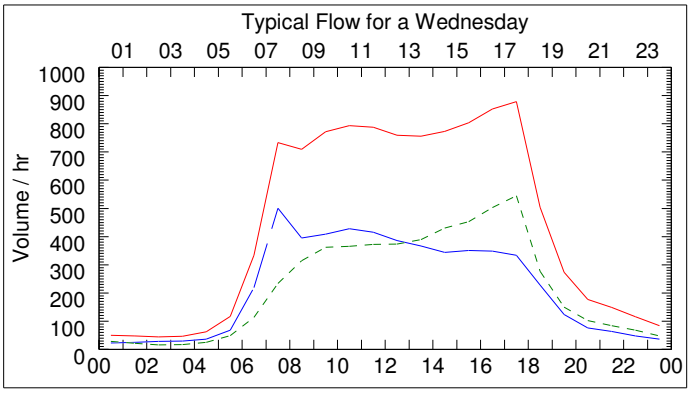
Typical Week Volume Report

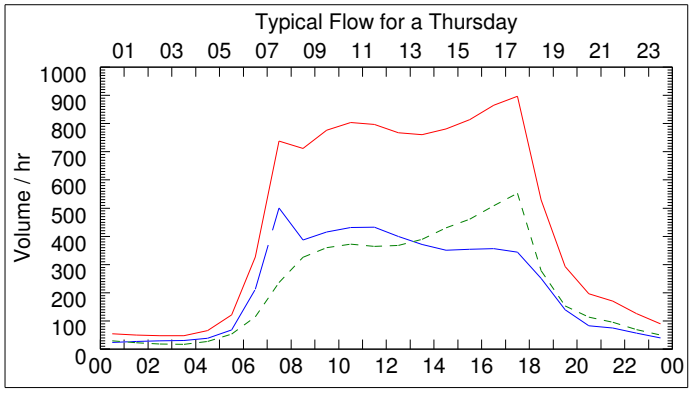
Site	: 1203 - Brenton-on-sea New
Region	: Western Cape
Actual Period	: 2008/01/01 to 2008/12/31
Classification	: RSA Ext Lgt/Hvy
Day Type	: Normal Day&Fixed Public Holiday+

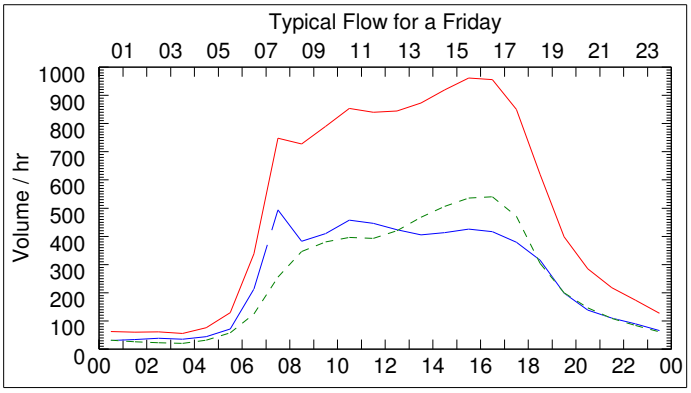


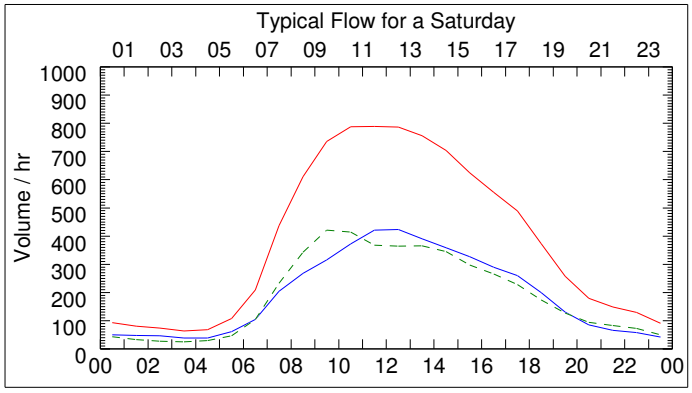


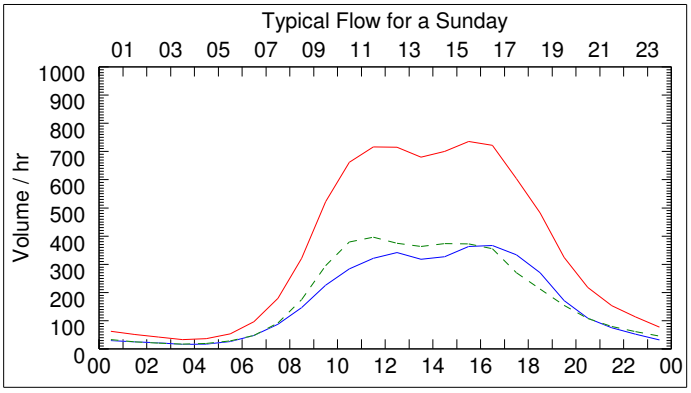


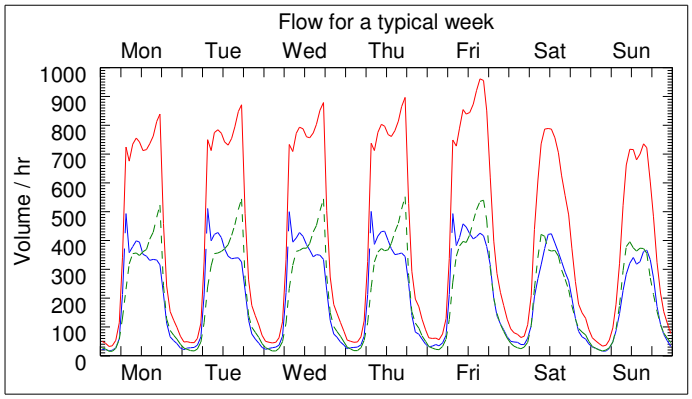


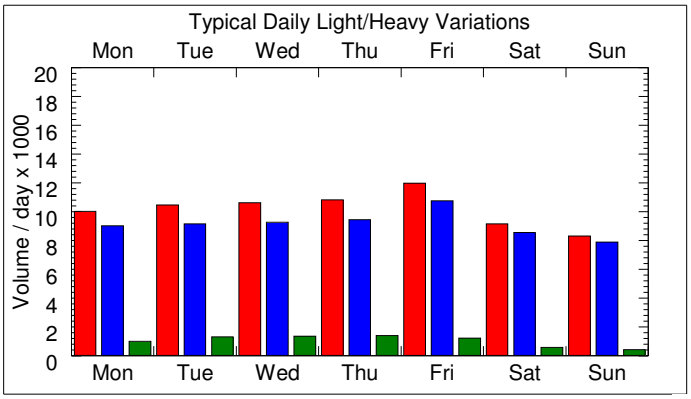






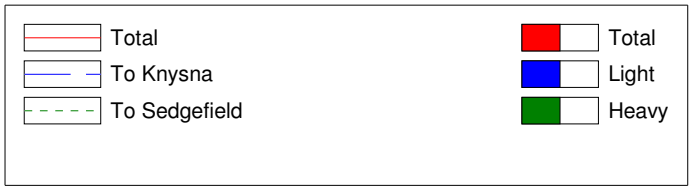


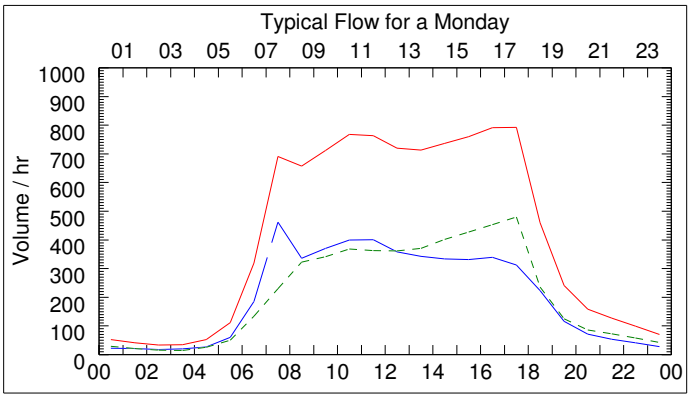


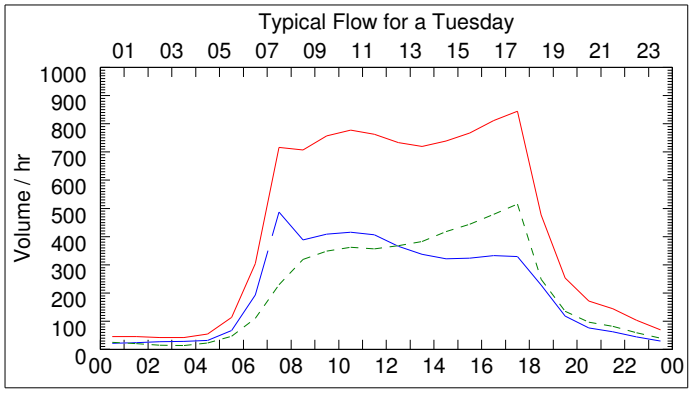


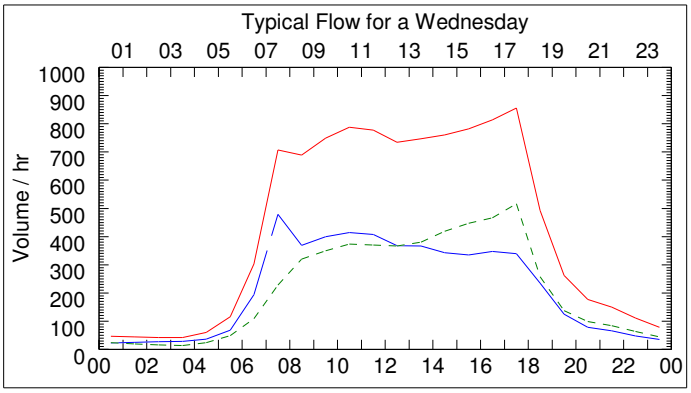
Typical Week Volume Report

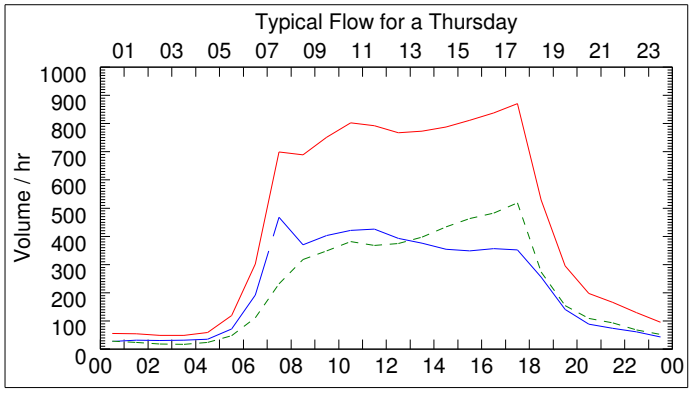
Site : 1203 - Brenton-on-sea New
Region : Western Cape
Actual Period : 2009/01/01 to 2009/12/31
Classification : RSA Ext Lgt/Hvy
Day Type : Normal Day&Fixed Public Holiday+

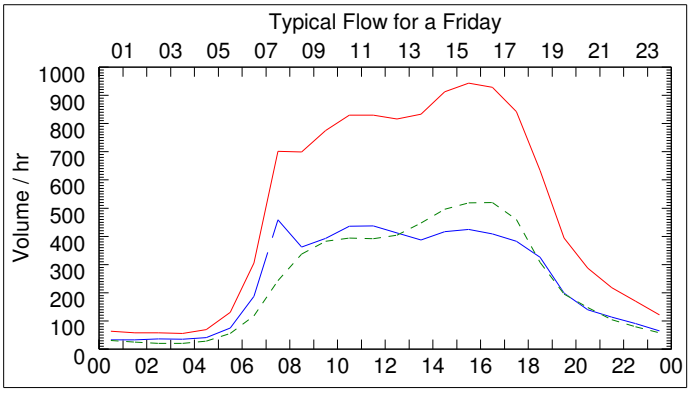


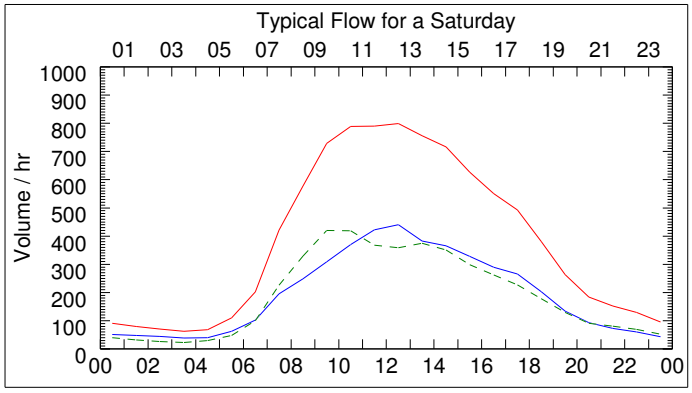


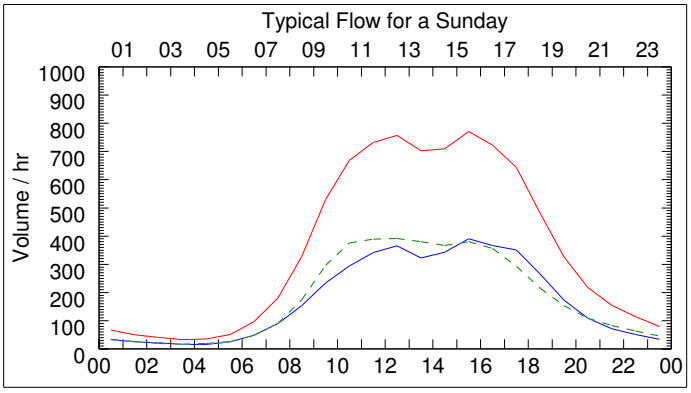


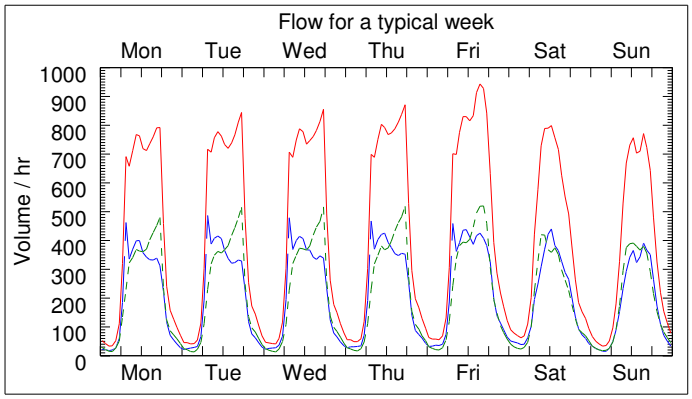


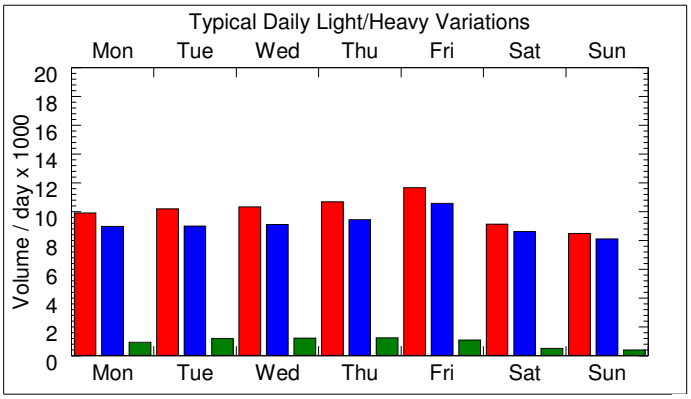






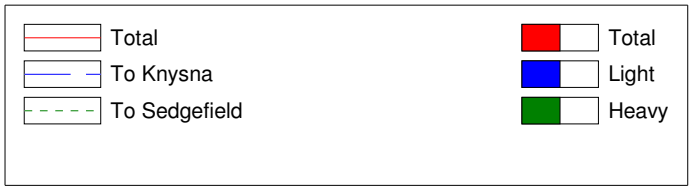


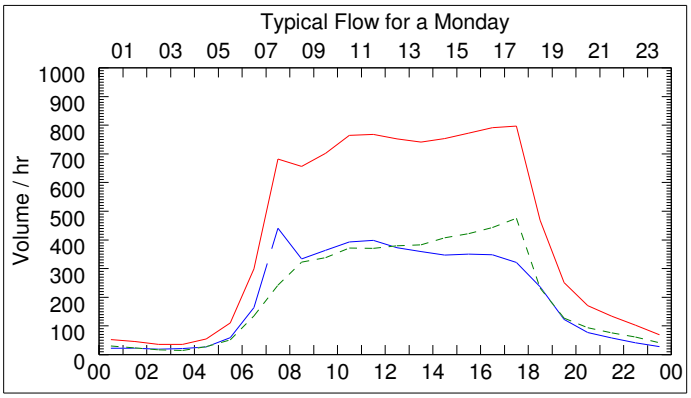


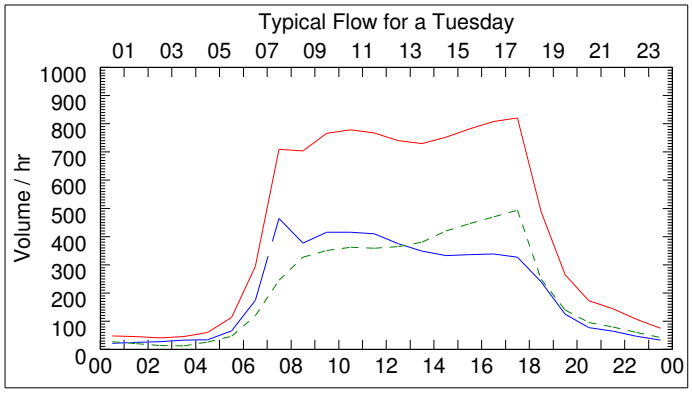


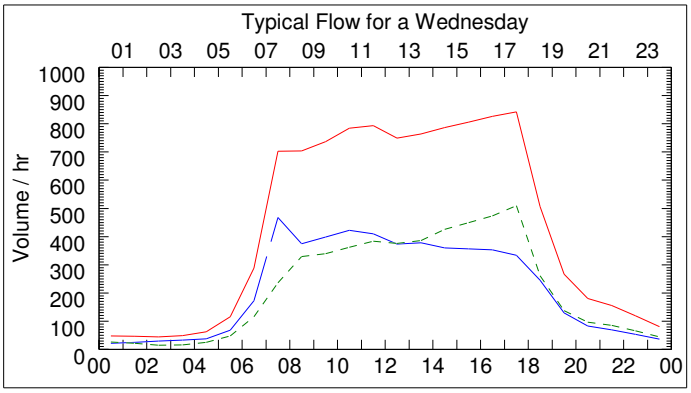
Typical Week Volume Report

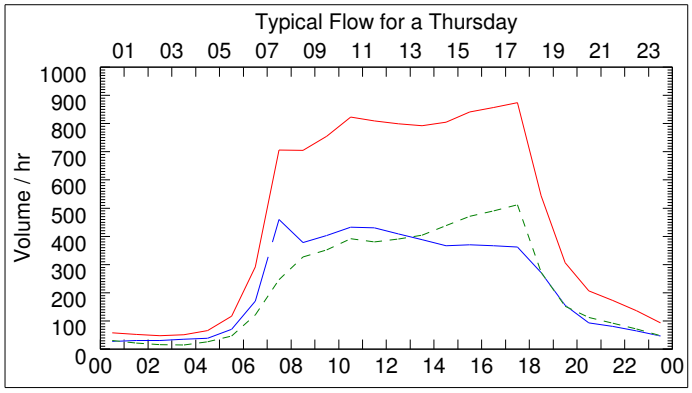
Site : 1203 - Brenton-on-sea New
Region : Western Cape
Actual Period : 2010/01/01 to 2010/12/31
Classification : RSA Ext Lgt/Hvy
Day Type : Normal Day&Fixed Public Holiday+

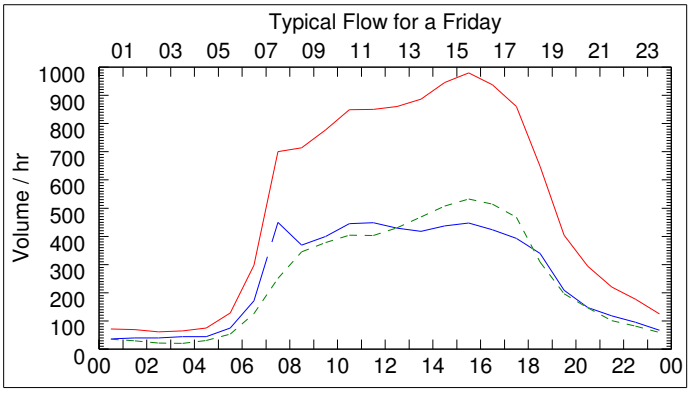


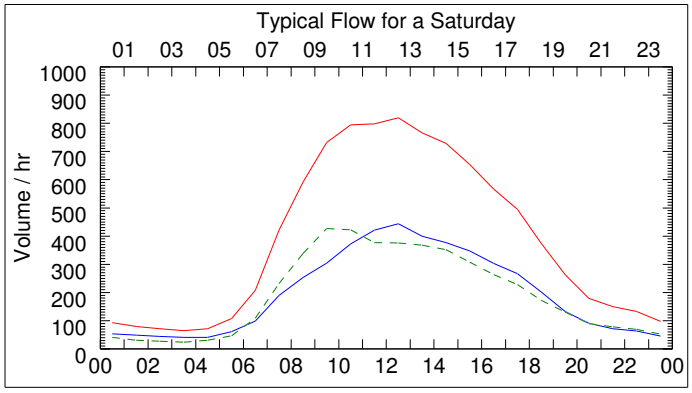


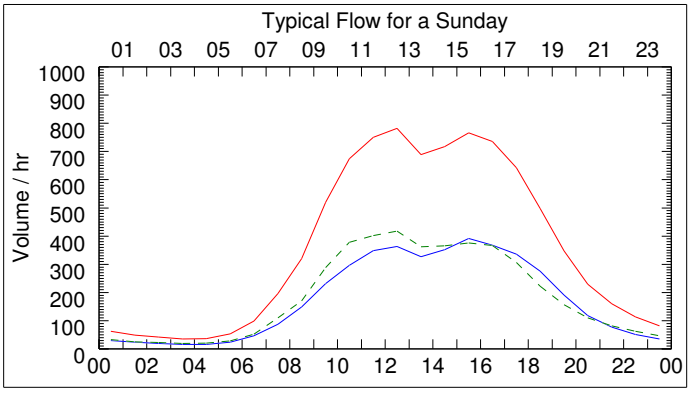


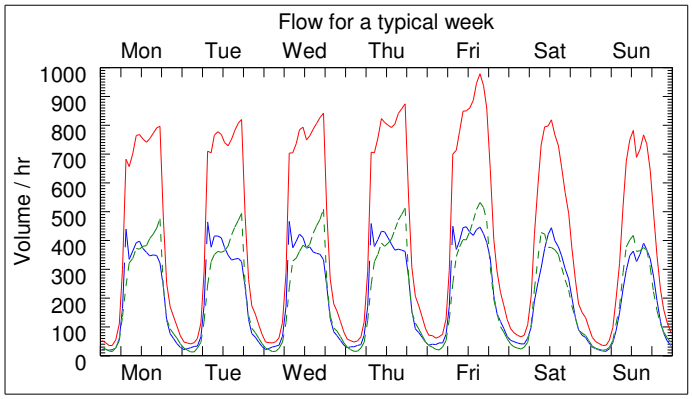


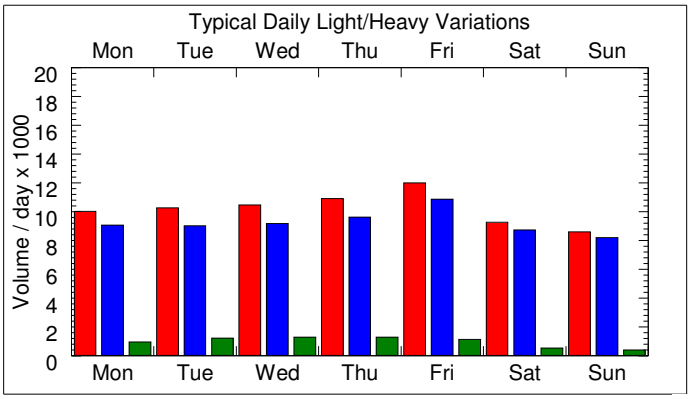






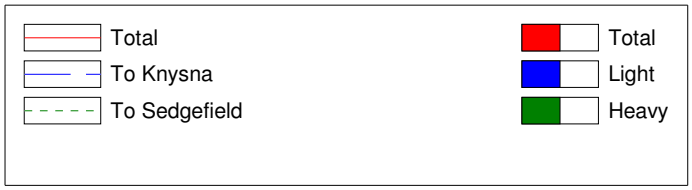


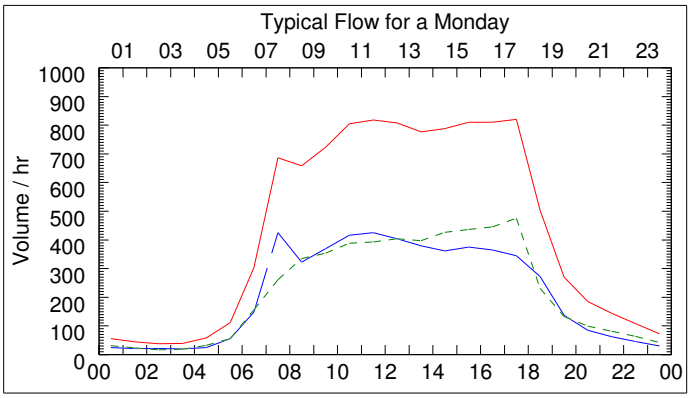


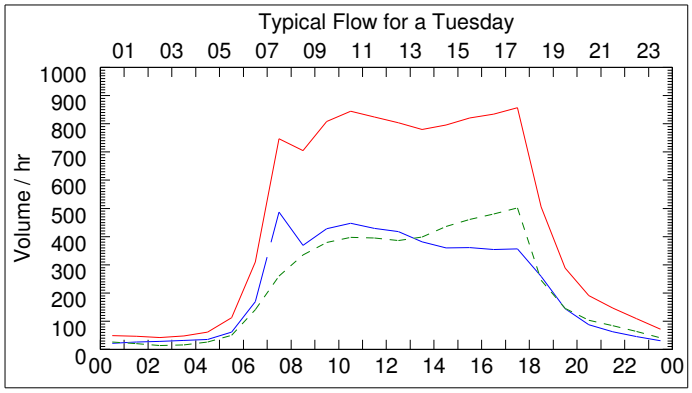


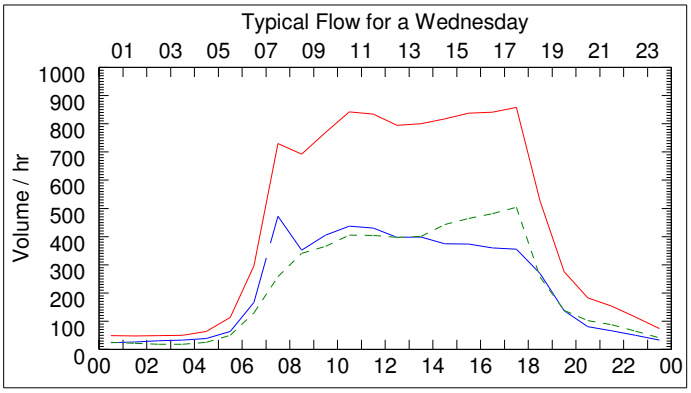
Typical Week Volume Report

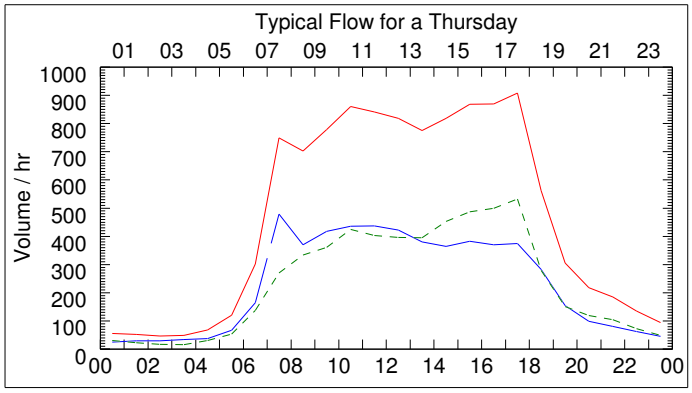
Site : 1203 - Brenton-on-sea New
Region : Western Cape
Actual Period : 2011/01/01 to 2011/05/10
Classification : RSA Ext Lgt/Hvy
Day Type : Normal Day&Fixed Public Holiday+

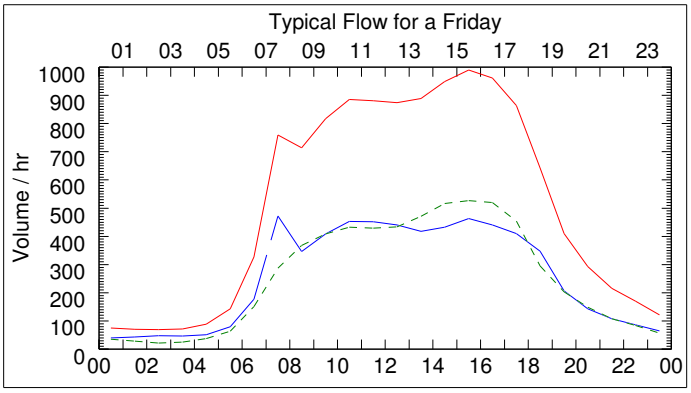


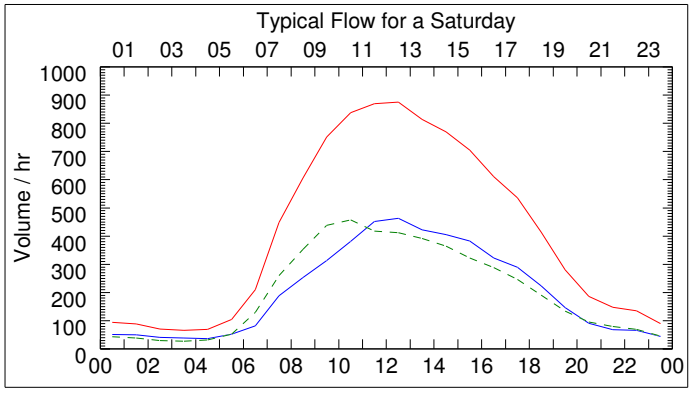


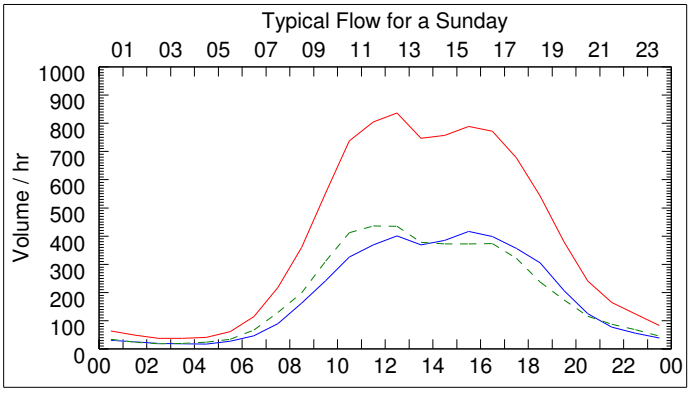


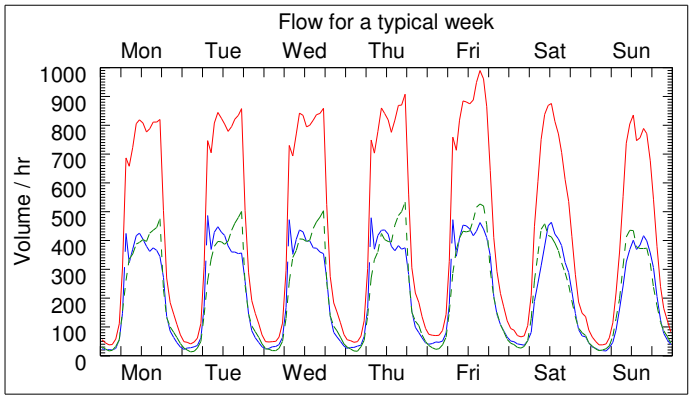


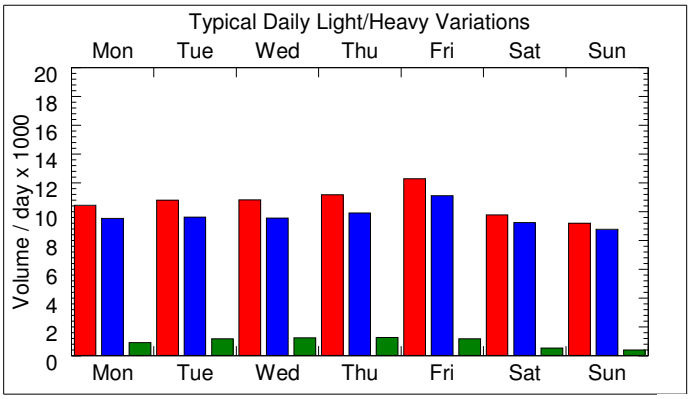












ANNEXURE C

SIDRA Output Sheets

2014 – Background Traffic Volumes
Before Development

MOVEMENT SUMMARY

Site: 2014 - 01 am nd

Proposed Residential Development on erf 23556, Knysna
01 am nd - Main Road / Gray Street
Signals - Fixed Time Cycle Time = 75 seconds (User-Given Phase Times)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Gray Street											
1	L2	64	0.0	0.185	23.9	LOS C	3.3	23.4	0.68	0.68	38.1
2	T1	77	0.0	0.185	15.7	LOS B	3.3	23.4	0.68	0.68	38.1
3	R2	47	0.0	0.111	27.3	LOS C	1.2	8.6	0.72	0.75	34.2
Approach		188	0.0	0.185	21.4	LOS C	3.3	23.4	0.69	0.69	37.1
East: Main Road											
4	L2	160	0.0	0.594	24.0	LOS C	14.0	98.1	0.78	0.75	38.4
5	T1	361	0.0	0.594	15.8	LOS B	14.0	98.1	0.78	0.75	38.4
6	R2	53	0.0	0.200	32.3	LOS C	1.6	10.9	0.81	0.76	31.7
Approach		574	0.0	0.594	19.6	LOS B	14.0	98.1	0.79	0.75	37.7
North: Gray Street											
7	L2	44	0.0	0.275	24.6	LOS C	5.3	36.9	0.71	0.65	38.6
8	T1	168	0.0	0.275	16.4	LOS B	5.3	36.9	0.71	0.65	38.6
9	R2	102	0.0	0.211	26.5	LOS C	2.6	18.5	0.73	0.77	34.6
Approach		315	0.0	0.275	20.8	LOS C	5.3	36.9	0.72	0.69	37.2
West: Main Road											
10	L2	78	0.0	0.612	24.3	LOS C	15.2	106.1	0.80	0.74	38.9
11	T1	475	0.0	0.612	16.1	LOS B	15.2	106.1	0.80	0.74	38.9
12	R2	81	0.0	0.287	32.2	LOS C	2.4	17.0	0.82	0.78	31.8
Approach		634	0.0	0.612	19.2	LOS B	15.2	106.1	0.80	0.74	37.8
All Vehicles		1711	0.0	0.612	19.9	LOS B	15.2	106.1	0.77	0.73	37.6

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	105	14.8	LOS B	0.1	0.1	0.63	0.63
P2	East Full Crossing	105	18.1	LOS B	0.2	0.2	0.70	0.70
P3	North Full Crossing	105	14.8	LOS B	0.1	0.1	0.63	0.63
P4	West Full Crossing	105	18.1	LOS B	0.2	0.2	0.70	0.70
All Pedestrians		421	16.4	LOS B			0.66	0.66

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 2014 - 01 pm nd

Proposed Residential Development on erf 23556, Knysna
01 pm nd - Main Road / Gray Street
Signals - Fixed Time Cycle Time = 75 seconds (User-Given Phase Times)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Gray Street											
1	L2	100	0.0	0.240	24.3	LOS C	4.4	31.1	0.70	0.71	37.5
2	T1	82	0.0	0.240	16.1	LOS B	4.4	31.1	0.70	0.71	37.5
3	R2	82	0.0	0.184	27.1	LOS C	2.1	15.0	0.73	0.77	34.3
Approach		264	0.0	0.240	22.6	LOS C	4.4	31.1	0.71	0.73	36.4
East: Main Road											
4	L2	138	0.0	0.702	25.1	LOS C	17.4	122.1	0.84	0.78	38.0
5	T1	471	0.0	0.702	16.9	LOS B	17.4	122.1	0.84	0.78	38.0
6	R2	43	0.0	0.129	28.4	LOS C	1.2	8.1	0.74	0.75	33.6
Approach		652	0.0	0.702	19.4	LOS B	17.4	122.1	0.83	0.78	37.6
North: Gray Street											
7	L2	72	0.0	0.246	24.3	LOS C	4.6	32.2	0.70	0.68	38.1
8	T1	117	0.0	0.246	16.2	LOS B	4.6	32.2	0.70	0.68	38.1
9	R2	107	0.0	0.238	27.5	LOS C	2.9	20.1	0.75	0.78	34.1
Approach		296	0.0	0.246	22.3	LOS C	4.6	32.2	0.72	0.72	36.5
West: Main Road											
10	L2	49	0.0	0.492	23.1	LOS C	11.3	79.2	0.74	0.68	40.0
11	T1	396	0.0	0.492	14.9	LOS B	11.3	79.2	0.74	0.68	40.0
12	R2	64	0.0	0.281	35.6	LOS D	2.1	14.4	0.86	0.77	30.2
Approach		509	0.0	0.492	18.3	LOS B	11.3	79.2	0.76	0.69	38.4
All Vehicles		1721	0.0	0.702	20.1	LOS C	17.4	122.1	0.77	0.73	37.5

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	105	14.8	LOS B	0.1	0.1	0.63	0.63
P2	East Full Crossing	105	18.1	LOS B	0.2	0.2	0.70	0.70
P3	North Full Crossing	105	14.8	LOS B	0.1	0.1	0.63	0.63
P4	West Full Crossing	105	18.1	LOS B	0.2	0.2	0.70	0.70
All Pedestrians		421	16.4	LOS B			0.66	0.66

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 2014 02 am nd

Proposed Residential Development on erf 23556, Knysna
02 am nd - Rio Drive / Gray Street
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Gray Street											
1	L2	22	0.0	0.080	8.2	LOS A	0.0	0.0	0.00	0.14	58.1
2	T1	129	0.0	0.080	0.0	LOS A	0.0	0.0	0.00	0.14	58.1
Approach		152	0.0	0.080	1.2	NA	0.0	0.0	0.00	0.14	58.1
North: Gray Street											
8	T1	209	0.0	0.114	0.5	LOS A	0.7	4.7	0.28	0.04	54.6
9	R2	9	0.0	0.114	8.9	LOS A	0.7	4.7	0.28	0.04	54.6
Approach		219	0.0	0.114	0.9	NA	0.7	4.7	0.28	0.04	54.6
West: Rio Drive											
10	L2	7	0.0	0.062	12.1	LOS B	0.2	1.4	0.33	0.91	45.6
12	R2	46	0.0	0.062	11.9	LOS B	0.2	1.4	0.33	0.91	45.6
Approach		54	0.0	0.062	12.0	LOS B	0.2	1.4	0.33	0.91	45.6
All Vehicles		424	0.0	0.114	2.4	NA	0.7	4.7	0.18	0.19	54.4

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 2014 02 pm nd

Proposed Residential Development on erf 23556, Knysna
02 pm nd - Rio Drive / Gray Street
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Gray Street											
1	L2	27	0.0	0.113	8.2	LOS A	0.0	0.0	0.00	0.13	58.3
2	T1	185	0.0	0.113	0.0	LOS A	0.0	0.0	0.00	0.13	58.3
Approach		213	0.0	0.113	1.1	NA	0.0	0.0	0.00	0.13	58.3
North: Gray Street											
8	T1	138	0.0	0.072	0.7	LOS A	0.4	3.0	0.32	0.01	54.0
9	R2	2	0.0	0.072	9.1	LOS A	0.4	3.0	0.32	0.01	54.0
Approach		140	0.0	0.072	0.8	NA	0.4	3.0	0.32	0.01	54.0
West: Rio Drive											
10	L2	9	0.0	0.041	11.9	LOS B	0.1	0.9	0.32	0.89	45.8
12	R2	28	0.0	0.041	11.7	LOS B	0.1	0.9	0.32	0.89	45.8
Approach		38	0.0	0.041	11.8	LOS B	0.1	0.9	0.32	0.89	45.8
All Vehicles		391	0.0	0.113	2.0	NA	0.4	3.0	0.15	0.16	55.3

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

ANNEXURE D

SIDRA Output Sheets

2014 After Development

MOVEMENT SUMMARY

Site: 2014 - 01 am wd

Proposed Residential Development on erf 23556, Knysna
01 am wd - Main Road / Gray Street
Signals - Fixed Time Cycle Time = 75 seconds (User-Given Phase Times)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Gray Street											
1	L2	64	0.0	0.236	24.3	LOS C	4.4	30.8	0.70	0.67	38.2
2	T1	117	0.0	0.236	16.1	LOS B	4.4	30.8	0.70	0.67	38.2
3	R2	47	0.0	0.152	31.7	LOS C	1.4	9.6	0.80	0.75	32.0
Approach		228	0.0	0.236	21.6	LOS C	4.4	30.8	0.72	0.69	36.7
East: Main Road											
4	L2	160	0.0	0.596	24.0	LOS C	14.0	98.1	0.78	0.75	38.4
5	T1	361	0.0	0.596	15.8	LOS B	14.0	98.1	0.78	0.75	38.4
6	R2	65	0.0	0.265	34.5	LOS C	2.0	14.3	0.85	0.77	30.7
Approach		586	0.0	0.596	20.1	LOS C	14.0	98.1	0.79	0.75	37.4
North: Gray Street											
7	L2	80	0.0	0.476	26.3	LOS C	10.0	70.3	0.79	0.72	37.3
8	T1	287	0.0	0.476	18.1	LOS B	10.0	70.3	0.79	0.72	37.3
9	R2	185	0.0	0.410	29.0	LOS C	5.3	37.2	0.81	0.81	33.3
Approach		553	0.0	0.476	22.9	LOS C	10.0	70.3	0.80	0.75	35.9
West: Main Road											
10	L2	105	0.0	0.656	24.7	LOS C	16.3	113.8	0.82	0.76	38.4
11	T1	475	0.0	0.656	16.5	LOS B	16.3	113.8	0.82	0.76	38.4
12	R2	81	0.0	0.287	32.2	LOS C	2.4	17.0	0.82	0.78	31.8
Approach		661	0.0	0.656	19.7	LOS B	16.3	113.8	0.82	0.76	37.5
All Vehicles		2028	0.0	0.656	20.9	LOS C	16.3	113.8	0.79	0.75	36.9

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	105	14.8	LOS B	0.1	0.1	0.63	0.63
P2	East Full Crossing	105	18.1	LOS B	0.2	0.2	0.70	0.70
P3	North Full Crossing	105	14.8	LOS B	0.1	0.1	0.63	0.63
P4	West Full Crossing	105	18.1	LOS B	0.2	0.2	0.70	0.70
All Pedestrians		421	16.4	LOS B			0.66	0.66

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 2014 - 01 pm wd

Proposed Residential Development on erf 23556, Knysna
01 pm wd - Main Road / Gray Street
Signals - Fixed Time Cycle Time = 75 seconds (User-Given Phase Times)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Gray Street											
1	L2	100	0.0	0.392	25.5	LOS C	7.9	55.2	0.76	0.72	37.4
2	T1	201	0.0	0.392	17.3	LOS B	7.9	55.2	0.76	0.72	37.4
3	R2	82	0.0	0.203	28.8	LOS C	2.2	15.7	0.76	0.77	33.4
Approach		383	0.0	0.392	21.9	LOS C	7.9	55.2	0.76	0.73	36.5
East: Main Road											
4	L2	138	0.0	0.725	25.5	LOS C	17.7	123.7	0.84	0.79	37.7
5	T1	471	0.0	0.725	17.3	LOS B	17.7	123.7	0.84	0.79	37.7
6	R2	79	0.0	0.284	32.9	LOS C	2.4	16.8	0.83	0.78	31.4
Approach		687	0.0	0.725	20.7	LOS C	17.7	123.7	0.84	0.79	36.9
North: Gray Street											
7	L2	84	0.0	0.314	24.9	LOS C	6.1	42.6	0.73	0.70	37.8
8	T1	157	0.0	0.314	16.7	LOS B	6.1	42.6	0.73	0.70	37.8
9	R2	135	0.0	0.375	31.8	LOS C	4.1	28.4	0.84	0.80	31.9
Approach		376	0.0	0.375	23.9	LOS C	6.1	42.6	0.77	0.73	35.5
West: Main Road											
10	L2	133	0.0	0.588	24.1	LOS C	14.3	99.9	0.79	0.75	38.6
11	T1	396	0.0	0.588	15.9	LOS B	14.3	99.9	0.79	0.75	38.6
12	R2	64	0.0	0.281	35.6	LOS D	2.1	14.4	0.86	0.77	30.2
Approach		593	0.0	0.588	19.9	LOS B	14.3	99.9	0.80	0.75	37.5
All Vehicles		2039	0.0	0.725	21.3	LOS C	17.7	123.7	0.80	0.75	36.7

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	105	14.8	LOS B	0.1	0.1	0.63	0.63
P2	East Full Crossing	105	18.1	LOS B	0.2	0.2	0.70	0.70
P3	North Full Crossing	105	14.8	LOS B	0.1	0.1	0.63	0.63
P4	West Full Crossing	105	18.1	LOS B	0.2	0.2	0.70	0.70
All Pedestrians		421	16.4	LOS B			0.66	0.66

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 2014 02 am wd

Proposed Residential Development on erf 23556, Knysna
02 am wd - Rio Drive / Gray Street
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Gray Street											
1	L2	63	0.0	0.103	8.2	LOS A	0.0	0.0	0.00	0.29	55.9
2	T1	129	0.0	0.103	0.0	LOS A	0.0	0.0	0.00	0.29	55.9
Approach		193	0.0	0.103	2.7	NA	0.0	0.0	0.00	0.29	55.9
North: Gray Street											
8	T1	209	0.0	0.114	0.7	LOS A	0.7	4.8	0.32	0.04	53.9
9	R2	9	0.0	0.114	9.1	LOS A	0.7	4.8	0.32	0.04	53.9
Approach		219	0.0	0.114	1.0	NA	0.7	4.8	0.32	0.04	53.9
West: Rio Drive											
10	L2	7	0.0	0.217	12.6	LOS B	0.8	5.3	0.41	0.94	45.3
12	R2	171	0.0	0.217	12.4	LOS B	0.8	5.3	0.41	0.94	45.3
Approach		178	0.0	0.217	12.4	LOS B	0.8	5.3	0.41	0.94	45.3
All Vehicles		589	0.0	0.217	5.0	NA	0.8	5.3	0.24	0.40	51.6

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 2014 02 pm wd

Proposed Residential Development on erf 23556, Knysna
02 pm wd - Rio Drive / Gray Street
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Gray Street											
1	L2	152	0.0	0.181	8.2	LOS A	0.0	0.0	0.00	0.38	54.4
2	T1	185	0.0	0.181	0.0	LOS A	0.0	0.0	0.00	0.38	54.4
Approach		337	0.0	0.181	3.7	NA	0.0	0.0	0.00	0.38	54.4
North: Gray Street											
8	T1	138	0.0	0.072	1.2	LOS A	0.5	3.3	0.42	0.01	52.6
9	R2	2	0.0	0.072	9.7	LOS A	0.5	3.3	0.42	0.01	52.6
Approach		140	0.0	0.072	1.3	NA	0.5	3.3	0.42	0.01	52.6
West: Rio Drive											
10	L2	9	0.0	0.096	12.5	LOS B	0.3	2.2	0.38	0.92	45.4
12	R2	69	0.0	0.096	12.3	LOS B	0.3	2.2	0.38	0.92	45.4
Approach		79	0.0	0.096	12.3	LOS B	0.3	2.2	0.38	0.92	45.4
All Vehicles		556	0.0	0.181	4.3	NA	0.5	3.3	0.16	0.36	52.5

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 2014 03 am wd

Proposed Residential Development on erf 23556, Knysna
03 am wd - Rio Drive / Access 3
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Access 3											
1	L2	1	0.0	0.001	10.7	LOS B	0.0	0.0	0.00	1.00	31.2
3	R2	124	0.0	0.142	11.5	LOS B	0.6	4.2	0.27	0.88	30.8
Approach		125	0.0	0.142	11.5	LOS B	0.6	4.2	0.27	0.88	30.8
East: Rio Drive											
4	L2	41	0.0	0.022	8.2	LOS A	0.0	0.0	0.00	0.67	36.0
5	T1	32	0.0	0.016	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		73	0.0	0.022	4.6	NA	0.0	0.0	0.00	0.38	43.6
West: Rio Drive											
11	T1	54	0.0	0.014	0.1	LOS A	0.1	0.6	0.08	0.02	58.3
12	R2	1	0.0	0.014	8.4	LOS A	0.1	0.6	0.16	0.04	56.5
Approach		55	0.0	0.014	0.3	NA	0.1	0.6	0.08	0.02	58.2
All Vehicles		253	0.0	0.142	7.1	NA	0.6	4.2	0.15	0.55	42.6

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 2014 03 pm wd

Proposed Residential Development on erf 23556, Knysna
03 pm wd - Rio Drive / Access 3
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Access 3											
1	L2	1	0.0	0.001	10.7	LOS B	0.0	0.0	0.00	1.00	31.2
3	R2	41	0.0	0.049	11.6	LOS B	0.2	1.3	0.28	0.87	30.7
Approach		42	0.0	0.049	11.6	LOS B	0.2	1.3	0.27	0.87	30.7
East: Rio Drive											
4	L2	124	0.0	0.067	8.2	LOS A	0.0	0.0	0.00	0.67	36.0
5	T1	29	0.0	0.015	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		154	0.0	0.067	6.6	NA	0.0	0.0	0.00	0.54	39.0
West: Rio Drive											
11	T1	38	0.0	0.010	0.3	LOS A	0.1	0.4	0.12	0.02	57.4
12	R2	1	0.0	0.010	8.7	LOS A	0.1	0.4	0.25	0.05	54.9
Approach		39	0.0	0.010	0.5	NA	0.1	0.4	0.12	0.02	57.4
All Vehicles		235	0.0	0.067	6.5	NA	0.2	1.3	0.07	0.51	42.6

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 2014 04 am wd

Proposed Residential Development on erf 23556, Knysna
04 am wd - Gray Street / Access 2
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
NorthEast: Gray Street											
25	T1	380	0.0	0.098	0.5	LOS A	0.7	4.7	0.16	0.00	56.9
26	R2	1	0.0	0.098	9.1	LOS A	0.7	4.7	0.33	0.01	54.1
Approach		381	0.0	0.098	0.5	NA	0.7	4.7	0.16	0.00	56.9
NorthWest: Access 2											
27	L2	1	0.0	0.001	11.0	LOS B	0.0	0.0	0.18	0.87	32.1
29	R2	62	0.0	0.143	17.2	LOS C	0.5	3.7	0.60	1.00	26.1
Approach		63	0.0	0.143	17.1	LOS C	0.5	3.7	0.60	1.00	26.2
SouthWest: Gray Street											
30	L2	21	0.0	0.055	8.2	LOS A	0.0	0.0	0.00	0.19	57.4
31	T1	193	0.0	0.055	0.0	LOS A	0.0	0.0	0.00	0.08	58.8
Approach		214	0.0	0.055	0.8	NA	0.0	0.0	0.00	0.09	58.7
All Vehicles		658	0.0	0.143	2.2	NA	0.7	4.7	0.15	0.13	55.2

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 2014 04 pm wd

Proposed Residential Development on erf 23556, Knysna
04 pm wd - Gray Street / Access 2
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
NorthEast: Gray Street											
25	T1	207	0.0	0.054	0.9	LOS A	0.4	2.9	0.22	0.00	55.9
26	R2	1	0.0	0.054	10.0	LOS A	0.4	2.9	0.44	0.01	52.3
Approach		208	0.0	0.054	0.9	NA	0.4	2.9	0.22	0.00	55.9
NorthWest: Access 2											
27	L2	1	0.0	0.001	11.2	LOS B	0.0	0.0	0.23	0.85	32.0
29	R2	21	0.0	0.048	16.6	LOS C	0.2	1.2	0.58	0.95	26.6
Approach		22	0.0	0.048	16.4	LOS C	0.2	1.2	0.56	0.94	26.8
SouthWest: Gray Street											
30	L2	62	0.0	0.103	8.2	LOS A	0.0	0.0	0.00	0.28	56.0
31	T1	337	0.0	0.103	0.0	LOS A	0.0	0.0	0.00	0.11	58.3
Approach		399	0.0	0.103	1.3	NA	0.0	0.0	0.00	0.14	58.0
All Vehicles		629	0.0	0.103	1.7	NA	0.4	2.9	0.09	0.12	56.4

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 2014 05 am wd

Proposed Residential Development on erf 23556, Knysna
05 am wd - Gray Street / Access 1
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
NorthEast: Gray Street											
25	T1	442	0.0	0.114	0.5	LOS A	0.8	5.7	0.17	0.00	56.7
26	R2	1	0.0	0.114	9.2	LOS A	0.8	5.7	0.34	0.00	53.8
Approach		443	0.0	0.114	0.5	NA	0.8	5.7	0.17	0.00	56.7
NorthWest: Access 1											
27	L2	1	0.0	0.001	11.1	LOS B	0.0	0.0	0.19	0.87	32.1
29	R2	52	0.0	0.136	18.6	LOS C	0.5	3.4	0.65	1.00	24.9
Approach		53	0.0	0.136	18.4	LOS C	0.5	3.4	0.64	1.00	25.1
SouthWest: Gray Street											
30	L2	17	0.0	0.059	8.2	LOS A	0.0	0.0	0.00	0.15	58.1
31	T1	214	0.0	0.059	0.0	LOS A	0.0	0.0	0.00	0.07	59.1
Approach		231	0.0	0.059	0.6	NA	0.0	0.0	0.00	0.07	59.0
All Vehicles		726	0.0	0.136	1.8	NA	0.8	5.7	0.15	0.10	55.6

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 2014 05 pm wd

Proposed Residential Development on erf 23556, Knysna
05 pm wd - Gray Street / Access 1
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
NorthEast: Gray Street											
25	T1	228	0.0	0.059	1.1	LOS A	0.5	3.4	0.23	0.00	55.6
26	R2	1	0.0	0.059	10.3	LOS B	0.5	3.4	0.47	0.01	51.8
Approach		229	0.0	0.059	1.1	NA	0.5	3.4	0.23	0.00	55.6
NorthWest: Access 1											
27	L2	1	0.0	0.001	11.4	LOS B	0.0	0.0	0.27	0.83	31.9
29	R2	17	0.0	0.044	17.9	LOS C	0.2	1.1	0.62	0.96	25.5
Approach		18	0.0	0.044	17.5	LOS C	0.2	1.1	0.60	0.95	25.8
SouthWest: Gray Street											
30	L2	52	0.0	0.116	8.2	LOS A	0.0	0.0	0.00	0.22	57.0
31	T1	399	0.0	0.116	0.0	LOS A	0.0	0.0	0.00	0.09	58.7
Approach		451	0.0	0.116	0.9	NA	0.0	0.0	0.00	0.11	58.5
All Vehicles		698	0.0	0.116	1.4	NA	0.5	3.4	0.09	0.10	56.9

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 2014 04A am wd

Proposed Residential Development on erf 23556, Knysna
04A am wd - Gray Street / Access 2
Less 48 units
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
NorthEast: Gray Street											
25	T1	380	0.0	0.098	0.4	LOS A	0.7	4.7	0.16	0.00	57.0
26	R2	1	0.0	0.098	9.0	LOS A	0.7	4.7	0.31	0.01	54.3
Approach		381	0.0	0.098	0.4	NA	0.7	4.7	0.16	0.00	57.0
NorthWest: Access 2											
27	L2	1	0.0	0.001	11.0	LOS B	0.0	0.0	0.19	0.87	32.1
29	R2	21	0.0	0.048	16.6	LOS C	0.2	1.2	0.58	0.95	26.6
Approach		22	0.0	0.048	16.4	LOS C	0.2	1.2	0.56	0.94	26.8
SouthWest: Gray Street											
30	L2	7	0.0	0.051	8.2	LOS A	0.0	0.0	0.00	0.08	59.0
31	T1	193	0.0	0.051	0.0	LOS A	0.0	0.0	0.00	0.04	59.5
Approach		200	0.0	0.051	0.3	NA	0.0	0.0	0.00	0.04	59.5
All Vehicles		603	0.0	0.098	1.0	NA	0.7	4.7	0.12	0.05	57.0

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 2014 04A pm wd

Proposed Residential Development on erf 23556, Knysna
04A pm wd - Gray Street / Access 2
Less 48 units
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
NorthEast: Gray Street											
25	T1	207	0.0	0.054	0.8	LOS A	0.4	2.8	0.21	0.00	56.1
26	R2	1	0.0	0.054	9.8	LOS A	0.4	2.8	0.42	0.01	52.6
Approach		208	0.0	0.054	0.8	NA	0.4	2.8	0.21	0.00	56.1
NorthWest: Access 2											
27	L2	1	0.0	0.001	11.3	LOS B	0.0	0.0	0.26	0.84	31.9
29	R2	7	0.0	0.016	16.1	LOS C	0.1	0.4	0.56	0.89	27.1
Approach		8	0.0	0.016	15.5	LOS C	0.1	0.4	0.52	0.88	27.6
SouthWest: Gray Street											
30	L2	21	0.0	0.092	8.2	LOS A	0.0	0.0	0.00	0.12	58.4
31	T1	337	0.0	0.092	0.0	LOS A	0.0	0.0	0.00	0.06	59.2
Approach		358	0.0	0.092	0.5	NA	0.0	0.0	0.00	0.06	59.2
All Vehicles		575	0.0	0.092	0.8	NA	0.4	2.8	0.08	0.05	57.7

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

ANNEXURE E

SIDRA Output Sheets

2019 After Development

MOVEMENT SUMMARY

Site: 2019 - 01 am wd

Proposed Residential Development on erf 23556, Knysna
01 am wd - Main Road / Gray Street
Signals - Fixed Time Cycle Time = 75 seconds (User-Given Phase Times)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Gray Street											
1	L2	75	0.0	0.267	24.5	LOS C	5.0	35.3	0.71	0.68	38.0
2	T1	129	0.0	0.267	16.3	LOS B	5.0	35.3	0.71	0.68	38.0
3	R2	55	0.0	0.190	32.9	LOS C	1.6	11.4	0.82	0.76	31.4
Approach		259	0.0	0.267	22.2	LOS C	5.0	35.3	0.73	0.70	36.4
East: Main Road											
4	L2	185	0.0	0.718	25.2	LOS C	17.4	122.0	0.84	0.79	37.5
5	T1	419	0.0	0.718	17.1	LOS B	17.4	122.0	0.84	0.79	37.5
6	R2	74	0.0	0.378	39.0	LOS D	2.5	17.7	0.92	0.78	28.8
Approach		678	0.0	0.718	21.7	LOS C	17.4	122.0	0.84	0.79	36.4
North: Gray Street											
7	L2	87	0.0	0.521	26.7	LOS C	11.2	78.7	0.81	0.74	37.0
8	T1	315	0.0	0.521	18.5	LOS B	11.2	78.7	0.81	0.74	37.0
9	R2	201	0.0	0.464	30.2	LOS C	6.0	41.9	0.84	0.81	32.7
Approach		603	0.0	0.521	23.6	LOS C	11.2	78.7	0.82	0.77	35.4
West: Main Road											
10	L2	118	0.0	0.795	28.9	LOS C	21.8	152.7	0.88	0.86	35.7
11	T1	551	0.0	0.795	20.7	LOS C	21.8	152.7	0.88	0.86	35.7
12	R2	94	0.0	0.407	36.6	LOS D	3.1	21.7	0.90	0.79	29.8
Approach		762	0.0	0.795	23.9	LOS C	21.8	152.7	0.88	0.85	34.8
All Vehicles		2302	0.0	0.795	23.0	LOS C	21.8	152.7	0.84	0.80	35.6

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	105	14.8	LOS B	0.1	0.1	0.63	0.63
P2	East Full Crossing	105	18.1	LOS B	0.2	0.2	0.70	0.70
P3	North Full Crossing	105	14.8	LOS B	0.1	0.1	0.63	0.63
P4	West Full Crossing	105	18.1	LOS B	0.2	0.2	0.70	0.70
All Pedestrians		421	16.4	LOS B			0.66	0.66

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 2019 - 01 pm wd

Proposed Residential Development on erf 23556, Knysna
01 pm wd - Main Road / Gray Street
Signals - Fixed Time Cycle Time = 75 seconds (User-Given Phase Times)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Gray Street											
1	L2	117	0.0	0.431	25.9	LOS C	8.8	61.8	0.77	0.73	37.1
2	T1	214	0.0	0.431	17.7	LOS B	8.8	61.8	0.77	0.73	37.1
3	R2	96	0.0	0.251	30.0	LOS C	2.7	19.0	0.79	0.78	32.8
Approach		426	0.0	0.431	22.7	LOS C	8.8	61.8	0.78	0.74	36.0
East: Main Road											
4	L2	160	0.0	0.865	34.9	LOS C	26.4	184.8	0.91	0.96	32.3
5	T1	545	0.0	0.865	26.7	LOS C	26.4	184.8	0.91	0.96	32.3
6	R2	85	0.0	0.365	36.2	LOS D	2.8	19.5	0.89	0.79	30.0
Approach		791	0.0	0.865	29.4	LOS C	26.4	184.8	0.90	0.94	32.0
North: Gray Street											
7	L2	96	0.0	0.354	25.2	LOS C	7.0	48.9	0.74	0.71	37.6
8	T1	176	0.0	0.354	17.0	LOS B	7.0	48.9	0.74	0.71	37.6
9	R2	152	0.0	0.449	33.3	LOS C	4.8	33.3	0.87	0.81	31.3
Approach		423	0.0	0.449	24.7	LOS C	7.0	48.9	0.79	0.74	35.0
West: Main Road											
10	L2	141	0.0	0.685	24.9	LOS C	17.1	119.7	0.83	0.78	38.0
11	T1	459	0.0	0.685	16.8	LOS B	17.1	119.7	0.83	0.78	38.0
12	R2	75	0.0	0.428	41.3	LOS D	2.7	18.6	0.94	0.78	28.0
Approach		675	0.0	0.685	21.2	LOS C	17.1	119.7	0.84	0.78	36.6
All Vehicles		2315	0.0	0.865	24.9	LOS C	26.4	184.8	0.84	0.82	34.5

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	105	14.8	LOS B	0.1	0.1	0.63	0.63
P2	East Full Crossing	105	18.1	LOS B	0.2	0.2	0.70	0.70
P3	North Full Crossing	105	14.8	LOS B	0.1	0.1	0.63	0.63
P4	West Full Crossing	105	18.1	LOS B	0.2	0.2	0.70	0.70
All Pedestrians		421	16.4	LOS B			0.66	0.66

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 2019 02 am wd

Proposed Residential Development on erf 23556, Knysna
02 am wd - Rio Drive / Gray Street
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Gray Street											
1	L2	66	0.0	0.116	8.2	LOS A	0.0	0.0	0.00	0.28	56.1
2	T1	151	0.0	0.116	0.0	LOS A	0.0	0.0	0.00	0.28	56.1
Approach		217	0.0	0.116	2.5	NA	0.0	0.0	0.00	0.28	56.1
North: Gray Street											
8	T1	243	0.0	0.132	0.8	LOS A	0.8	5.8	0.34	0.04	53.5
9	R2	11	0.0	0.132	9.2	LOS A	0.8	5.8	0.34	0.04	53.5
Approach		254	0.0	0.132	1.1	NA	0.8	5.8	0.34	0.04	53.5
West: Rio Drive											
10	L2	8	0.0	0.241	13.1	LOS B	0.8	5.9	0.44	0.96	45.0
12	R2	178	0.0	0.241	12.9	LOS B	0.8	5.9	0.44	0.96	45.0
Approach		186	0.0	0.241	12.9	LOS B	0.8	5.9	0.44	0.96	45.0
All Vehicles		657	0.0	0.241	4.9	NA	0.8	5.9	0.26	0.38	51.5

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 2019 02 pm wd

Proposed Residential Development on erf 23556, Knysna
02 pm wd - Rio Drive / Gray Street
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Gray Street											
1	L2	156	0.0	0.199	8.2	LOS A	0.0	0.0	0.00	0.36	54.8
2	T1	215	0.0	0.199	0.0	LOS A	0.0	0.0	0.00	0.36	54.8
Approach		371	0.0	0.199	3.5	NA	0.0	0.0	0.00	0.36	54.8
North: Gray Street											
8	T1	160	0.0	0.084	1.4	LOS A	0.6	4.0	0.45	0.01	52.2
9	R2	2	0.0	0.084	9.8	LOS A	0.6	4.0	0.45	0.01	52.2
Approach		162	0.0	0.084	1.5	NA	0.6	4.0	0.45	0.01	52.2
West: Rio Drive											
10	L2	11	0.0	0.122	12.9	LOS B	0.4	2.8	0.41	0.94	45.1
12	R2	84	0.0	0.122	12.6	LOS B	0.4	2.8	0.41	0.94	45.1
Approach		95	0.0	0.122	12.7	LOS B	0.4	2.8	0.41	0.94	45.1
All Vehicles		627	0.0	0.199	4.3	NA	0.6	4.0	0.18	0.36	52.4

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 2019 03 am wd

Proposed Residential Development on erf 23556, Knysna
03 am wd - Rio Drive / Access 3
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Access 3											
1	L2	1	0.0	0.001	10.7	LOS B	0.0	0.0	0.00	1.00	31.2
3	R2	124	0.0	0.145	11.6	LOS B	0.6	4.2	0.29	0.88	30.7
Approach		125	0.0	0.145	11.6	LOS B	0.6	4.2	0.28	0.88	30.7
East: Rio Drive											
4	L2	41	0.0	0.022	8.2	LOS A	0.0	0.0	0.00	0.67	36.0
5	T1	36	0.0	0.018	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		77	0.0	0.022	4.4	NA	0.0	0.0	0.00	0.36	44.3
West: Rio Drive											
11	T1	62	0.0	0.016	0.1	LOS A	0.1	0.6	0.08	0.02	58.2
12	R2	1	0.0	0.016	8.5	LOS A	0.1	0.6	0.17	0.03	56.5
Approach		63	0.0	0.016	0.3	NA	0.1	0.6	0.08	0.02	58.2
All Vehicles		265	0.0	0.145	6.8	NA	0.6	4.2	0.15	0.52	43.4

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 2019 03 pm wd

Proposed Residential Development on erf 23556, Knysna
03 pm wd - Rio Drive / Access 3
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Access 3											
1	L2	1	0.0	0.001	10.7	LOS B	0.0	0.0	0.00	1.00	31.2
3	R2	41	0.0	0.049	11.7	LOS B	0.2	1.3	0.29	0.87	30.6
Approach		42	0.0	0.049	11.7	LOS B	0.2	1.3	0.28	0.87	30.6
East: Rio Drive											
4	L2	124	0.0	0.067	8.2	LOS A	0.0	0.0	0.00	0.67	36.0
5	T1	34	0.0	0.017	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		158	0.0	0.067	6.4	NA	0.0	0.0	0.00	0.52	39.4
West: Rio Drive											
11	T1	43	0.0	0.012	0.3	LOS A	0.1	0.5	0.12	0.02	57.4
12	R2	1	0.0	0.012	8.8	LOS A	0.1	0.5	0.26	0.04	54.9
Approach		44	0.0	0.012	0.5	NA	0.1	0.5	0.13	0.02	57.4
All Vehicles		244	0.0	0.067	6.3	NA	0.2	1.3	0.07	0.49	43.3

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 2019 04 am wd

Proposed Residential Development on erf 23556, Knysna
04 am wd - Gray Street / Access 2
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
NorthEast: Gray Street											
25	T1	421	0.0	0.108	0.5	LOS A	0.8	5.4	0.17	0.00	56.7
26	R2	1	0.0	0.108	9.2	LOS A	0.8	5.4	0.35	0.00	53.7
Approach		422	0.0	0.108	0.5	NA	0.8	5.4	0.17	0.00	56.7
NorthWest: Access 2											
27	L2	1	0.0	0.001	11.0	LOS B	0.0	0.0	0.19	0.87	32.1
29	R2	62	0.0	0.159	18.4	LOS C	0.6	4.1	0.65	1.00	25.1
Approach		63	0.0	0.159	18.3	LOS C	0.6	4.1	0.64	1.00	25.2
SouthWest: Gray Street											
30	L2	21	0.0	0.061	8.2	LOS A	0.0	0.0	0.00	0.17	57.7
31	T1	217	0.0	0.061	0.0	LOS A	0.0	0.0	0.00	0.08	58.9
Approach		238	0.0	0.061	0.7	NA	0.0	0.0	0.00	0.09	58.8
All Vehicles		723	0.0	0.159	2.2	NA	0.8	5.4	0.16	0.12	55.2

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 2019 04 pm wd

Proposed Residential Development on erf 23556, Knysna
04 pm wd - Gray Street / Access 2
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
NorthEast: Gray Street											
25	T1	234	0.0	0.060	1.0	LOS A	0.5	3.5	0.23	0.00	55.7
26	R2	1	0.0	0.060	10.2	LOS B	0.5	3.5	0.46	0.01	51.9
Approach		235	0.0	0.060	1.0	NA	0.5	3.5	0.23	0.00	55.7
NorthWest: Access 2											
27	L2	1	0.0	0.001	11.3	LOS B	0.0	0.0	0.25	0.84	31.9
29	R2	21	0.0	0.053	17.6	LOS C	0.2	1.3	0.61	0.97	25.7
Approach		22	0.0	0.053	17.3	LOS C	0.2	1.3	0.60	0.96	25.9
SouthWest: Gray Street											
30	L2	62	0.0	0.112	8.2	LOS A	0.0	0.0	0.00	0.26	56.3
31	T1	371	0.0	0.112	0.0	LOS A	0.0	0.0	0.00	0.11	58.4
Approach		433	0.0	0.112	1.2	NA	0.0	0.0	0.00	0.13	58.1
All Vehicles		689	0.0	0.112	1.7	NA	0.5	3.5	0.10	0.11	56.5

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 2019 05 am wd

Proposed Residential Development on erf 23556, Knysna
05 am wd - Gray Street / Access 1
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
NorthEast: Gray Street											
25	T1	483	0.0	0.124	0.6	LOS A	0.9	6.4	0.18	0.00	56.5
26	R2	1	0.0	0.124	9.3	LOS A	0.9	6.4	0.37	0.00	53.4
Approach		484	0.0	0.124	0.6	NA	0.9	6.4	0.18	0.00	56.5
NorthWest: Access 1											
27	L2	1	0.0	0.001	11.1	LOS B	0.0	0.0	0.21	0.86	32.1
29	R2	52	0.0	0.151	20.0	LOS C	0.5	3.8	0.69	1.00	23.9
Approach		53	0.0	0.151	19.8	LOS C	0.5	3.8	0.69	1.00	24.0
SouthWest: Gray Street											
30	L2	17	0.0	0.066	8.2	LOS A	0.0	0.0	0.00	0.13	58.3
31	T1	238	0.0	0.066	0.0	LOS A	0.0	0.0	0.00	0.06	59.2
Approach		255	0.0	0.066	0.5	NA	0.0	0.0	0.00	0.07	59.1
All Vehicles		792	0.0	0.151	1.9	NA	0.9	6.4	0.16	0.09	55.6

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 2019 05 pm wd

Proposed Residential Development on erf 23556, Knysna
05 pm wd - Gray Street / Access 1
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
NorthEast: Gray Street											
25	T1	255	0.0	0.066	1.2	LOS A	0.6	4.0	0.24	0.00	55.5
26	R2	1	0.0	0.066	10.6	LOS B	0.6	4.0	0.49	0.01	51.5
Approach		256	0.0	0.066	1.2	NA	0.6	4.0	0.24	0.00	55.5
NorthWest: Access 1											
27	L2	1	0.0	0.001	11.5	LOS B	0.0	0.0	0.28	0.83	31.8
29	R2	17	0.0	0.048	19.1	LOS C	0.2	1.2	0.66	0.98	24.6
Approach		18	0.0	0.048	18.6	LOS C	0.2	1.2	0.64	0.97	24.9
SouthWest: Gray Street											
30	L2	52	0.0	0.125	8.2	LOS A	0.0	0.0	0.00	0.20	57.2
31	T1	433	0.0	0.125	0.0	LOS A	0.0	0.0	0.00	0.09	58.7
Approach		484	0.0	0.125	0.9	NA	0.0	0.0	0.00	0.10	58.6
All Vehicles		758	0.0	0.125	1.4	NA	0.6	4.0	0.10	0.09	56.9

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.