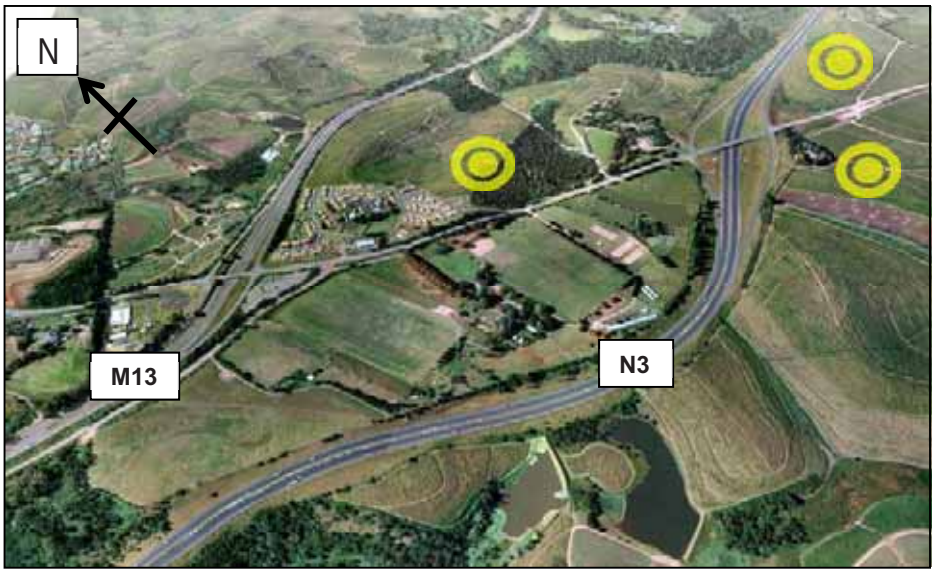
DRAFT
Environmental Impact Report
Tongaat Hulett Shongweni Centre for Retail / Mix Use Development

eThekwini Municipality
November 2013

EIA Number: DM/0003/2012



Aerial photograph illustrating the location of the three proposed sites in yellow.

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Members: K.A. Stanton (Director)

The information in this report is based on information supplied by the client, Tongaat Hulett Development. All information is given in good faith, however, no physical testing or chemical analyses were performed by Kerry Seppings Environmental Management Specialists cc during the course of this assessment.

Although every effort was made to request and obtain all pertinent information for this assessment Kerry Seppings Environmental Management Specialists cc cannot be held accountable or accept responsibility for any discrepancies in this information or for the disclosure or review of information which has not been presented to the consultant. All reports presented to the consultant for review have been referenced.

As per Regulation 32(a) of the EIA Regulations herewith (i) the expertise of the EAP to carry out an environmental impact assessment;

Expertise to Conduct Scoping and EIAs

Kerry Seppings Environmental Management Specialists cc (KSEMS) has been based in KZN since 1998. The consultancy is responsible for numerous Environmental Impact Assessments per annum and all consultants managing our EIAs have a minimum of a Master of Science degree in the Environmental Sciences. In early 2008 the business was converted to a closed corporation (cc). In the new organisation each project is reviewed by at least 3 qualified staff. The increased staff component has allowed for specialised staffing in the following areas; linear EIAs, large developments, ecological expertise, coastal and estuarine ecology, ECO provision, petrol stations, roads development and industrial development. There is also a legal expertise to complement all work done by KSEMS cc.

Integrity and Independence: Our independence in assessing environmental impacts is paramount to the EIA process. We support sustainable development and believe that as independent consultants our role is to represent the interest of the environment first and foremost and ensure an effective and efficiently conducted environmental assessment process.

Environmental Legal Knowledge:

Kerry Seppings has extensive environmental legal knowledge regarding not only the EIA process and requirements but also with regards to all other legislation at a national, provincial and local level and how these affect environmental management issues. KSEMS has compiled a number of environmental legal registers for several industries in the chemical, paint and manufacturing sector as well as for companies involved in green field developments. Kerry has also carried out several environmental legal audits and as such is conversant with a wide range of legislation relating to various aspects of industry and development.

Specialist Training:

Kerry Seppings has been extensively involved in implementing ISO 14001 Environmental management systems for a number of industries and has good industrial knowledge as well as sound ecological experience when it comes to green field development. Kerry is an ecologist by training and has experience in terrestrial and estuarine environments having obtained her honours degree working on the St Lucia estuary. She was awarded her Master of Science (cum lauded) for work done on a thesis on Environmental Management and Open Space Planning. Her continued involvement in the EIA process has resulted in her being an experienced facilitator of the public participation process and is often contracted to resolve environmental related conflict. Kerry has also been certified as an Environmental Assessment Practitioner by the EAPSA and is a GCX certified Carbon Footprint Analyst (Level 1). Kerry is also registered as a Professional Natural Scientist by the South African Council for National Scientific Professions.

Detailed CV's and proof of certifications and degrees of all KSEMS cc staff are available on request.

Major Clients and Projects:

KSEMS cc is involved with the full range of environmental assessments from a client developing a site for a single resident to some of the Nation's biggest corporations, government departments and parastatal organisations.

Key Areas of Focus Include:

Ecological system planning, hydroelectric power plant and dam construction, retail and residential developments, road and bridge development, transmission and power line installation, gas pipelines and metering stations, filling stations development, multi–use complex development, EIA and ECO work, 24G applications, carbon footprint calculations and analyses, development of rural roads, water use licensing and waste licenses and management of diverse specialist teams on major projects.

As per Regulation 31 (2) (a) of the NEMA EIA regulations herewith details of – (i) the EAP who compiled the report;

AUTHORS

This Report was prepared by *Kerry Seppings Environmental Management Specialists cc*

Kerry Seppings BSc (Hons) MSc EAPSA certified (Pr Natural Scientist) Lead Environmental Consultant & Director

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Tertiary Education:	University of Natal, Durban BSc (Hons) - Estuarine Ecology (Major), Urban Biogeography (Ecology) (Major) *MSc awarded cum laude* Environmental Management and Open Space Planning Thesis *"Developing an Open Space System for the Queensburgh Municipal Area"*
Work Experience:	1993 - 1994 Queensburgh Municipality - Unofficial Environmental Advisor for duration of MSc 1994 - 1995 IDEAS- Partner in Environmental Consultancy 1995 - 1998 Environment Branch, North and South Central Local Council- Professional Environmental Officer 1999 - present; Director Kerry Seppings Environmental Management Specialists cc.

Stephanie Williams BSc (Hons) MPhil Marine and Environmental Law Lead Environmental Scientist

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Detailed CVs and proof of certifications and degrees are available on request.

COMPILED BY: Stephanie Williams

REVIEWED BY: Kerry Stanton

EXECUTIVE SUMMARY

The Environmental Impact Assessment (EIA) has assessed three site alternatives for the development of a new regional retail centre. Tongaat Hulett Developments (THD) propose to develop this regional retail centre on their land as the primary use together with other associated, compatible and supporting land uses. All three sites are strategically located, not only locally but regionally as well. The N3 Logistics Corridor, directly adjacent to the preferred site, is the country's primary trade and logistics corridor and hence any development situated along this corridor needs to align with and support the strategic importance of the corridor and ensure land uses of a regional scale and appropriate use. After considering planning requirements (including eThekwini Municipality's spatial plans and provincial spatial growth and development strategy) as well as conducting a market-demand survey, it is apparent that there is a high need and desirability for the proposal which will be comprised of various land parcels available for purchase.

Bulk services associated with the proposed development are considered in the Environmental Impact Report and include sewer connection, electrical supply, water supply and the upgrading of relevant road intersections. A 500mm diameter steel pipeline is required to supply the proposed development with water. The pipeline will tie into the Western Aquaduct and terminate at a proposed 3.5Ml reservoir site. The total length of the pipeline is approximately 5.6km. Additional wetland, fauna and flora specialist studies were commissioned to assess the proposed pipeline route. Public Participation was also extend to notify adjacent neighbours of the proposed route.

There was no fauna of significant conservation value associated with the three site alternatives for the Retail/Mixed Use Development however the freshwater ecosystems (drainage lines, wetlands and association indigenous vegetation) were identified as the key factor to consider during the EIA process. In order to ascertain a sustainable development layout, Green Open Space has been incorporated into the layout specifically integrating the location of the drainage lines into this area designated for rehabilitation and environmental services provisions. Despite this provision, there still remains a loss of wetland area across all site alternatives, with the development of site 1 resulting in the greatest loss. THD have included a Wetland Rehabilitation Plan into the proposal to ensure that there is no net loss of wetland and that the remaining wetland system on the site is rehabilitated to a higher functioning level. A maintenance plan has been included in the Wetland Rehabilitation Plan, which will ensure long-term functioning of the wetland habitat and associated fauna. One of the main purposes of ensuring effective on-site rehabilitation is the links that all three sites have with offsite systems of high conservation value adjacent and/or further downstream. Drainage lines on sites 1 and 3 are directed into the uMhlatuzana River, which feeds the Giba Gorge Environmental Precinct. Drainage lines located within site 2 on the other hand, feed into the Wekeweke Stream, a system identified as a National Freshwater Ecosystem Priority Area (NFEPA).

Accordingly, THD are proposing to develop approximately 78 hectares of their land with an additional 28.7 hectares being allocated to Green Open Space ensuring the long-term conservation and rehabilitation of a significant wetland ecosystem. Following detailed site assessments and analysis of the site alternatives, site 2 was identified as the preferred alternative for the proposed land use. Due to the location of the preferred site, site 2, the majority of social impacts will be positive as a result of the availability of employment and increased business opportunities that will be provided by the proposed development. The marketing and socio-economic impact assessment considered the development of the proposed retail centre and found that there is expected to be a significant capital injection into the local economy during both the construction and operational phase. The Heritage Impact Assessment identified potential heritage sites that exist on the three site alternatives however, it was concluded that all archaeological sites identified by the specialist, have little historical importance.

Construction and operational activities associated with the proposed development need to be carefully managed to ensure there is no impact on these freshwater ecosystems. Implementing the proposed Wetland Rehabilitation Plan, effective stormwater management and waste management are therefore the priority areas requiring environmental consideration.

An application for environmental authorisation was submitted to the provincial Department of Agriculture and Environmental Affairs (DAEA) on the 31st January 2012. Notification of interested and affected parties (I & APs) commenced on the 06th February 2012 and the relevant adverts placed as required by the 2010 EIA regulations in terms of Chapter 5 of the National Environmental Management Act, 1998 as amended. A public meeting was held on the 22nd March 2012. The Draft Scoping Report was submitted to I & APs for review and comment on 28th May 2012. The Final Scoping Report was submitted to the DAEA along with all comments received on 07th August 2012. The DAEA approved the Scoping Report on the 02nd October 2012. After receiving all specialist reports and input on the various aspects of the proposed development, the Draft EIR was compiled and submitted to I & APs for comment on the 04 November 2013. Once all comments have been received, the Final EIR will be submitted to the DAEA for environmental authorisation.

The attached Environmental Management Programme (EMPr) should be adhered to during all phases of development: pre-construction, construction and operational. Specialist input provided during the Environmental Impact Assessment has been incorporated in the EMPr to ensure that potential impacts of the proposed development are minimized, mitigated against or prevented. Of particular importance is the incorporation of the detailed Rehabilitation Plan for site 2.

CONTENTS

APPENDICES

LIST OF FIGURES

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ACRONYMS

Arup	Arup (Pty) Ltd
BID	Background Information Document
BRG	BioResource Group
BRU	BioResource Units
DAEA	Department of Agriculture and Environmental Affairs
D'MOSS	Durban Metropolitan Open Space System
DWA	Department of Water Affairs
EAP	Environmental Assessment Practitioner
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EIR	Environmental Impact Report
ESR	Engineering Services Report
EMPr	Environmental Management Programme
GGP	Gross Geographical Product
GLA	Gross Lettable Area
DSW	Durban Solid Waste
EIS	Ecological Integrity and Sensitivity
EMPr	Environmental Management Programme
EPCPD	Environmental Planning and Climate Protection Department
EWS	eThekwini Water Services
HGM	Hydrogeomorphic
I & AP	Interested and Affected Party
LAP	Local Area Plan
LOS	Level of Service
LRI	Land Resources International
NEMA	National Environmental Management Act 107 of 1998 as amended
NFEPA	National Freshwater Ecosystem Priority Areas
PES	Present Ecological State
PGS	Present Geomorphic State
PHS	Present Hydrological State
PVS	Present Vegetation State
SABAP	South African Bird Atlas Project
SANRAL	South African National Road Agency Limited
SDP	Spatial Development Plan
SEA	Strategic Environmental Assessment
SRA	Special Rating Area
SUDS	Sustainable Urban Drainage System
SWMP	Stormwater Management Plan
TIA	Traffic Impact Assessment
THD	Tongaat Hulett Developments
Urban-Econ	Urban-Econ KZN (Pty) Ltd
WMA	Water Management Area

1.0 Introduction

1.1 Detailed Description of the Proposed Activity [Regulation 31 (2b)]

Tongaat Hulett Developments (THD) propose facilitating the construction of a new regional retail centre and other, associated, appropriate and compatible land uses in the form of logistics, light industry, business park and service. The provision of green open space has also been incorporated into the various layout options. The proposed development aims to provide a new regional retail town centre in line with eThekwini Municipality's Strategic Development Plan (SDP) for the Outer West District and the Shongweni Local Area Plan (LAP). The activity also aims at being in line with the environmental sustainability principles outlined in the Shongweni LAP by incorporating rehabilitated areas. A detailed Planning Report has been carried out by GAPP Architects and Urban Designers and is summarised in section 1.2.1 below.

Three potential sites have been identified within THD's extensive landholdings in the Ntshongweni area, south-west of Hillcrest (Figure 1). All three sites are strategically located in terms of easy access to the N3 Highway, a busy freight and logistics corridor in Southern Africa. The various land-uses proposed for the three site alternatives have been designed according to strategic contextual positioning of the sites as well as the topography/physical characteristics of each site. Market demand and socio-economic impact assessment (Appendix 2) also contributed detailing the retail potential of the study area justifying the demand for Gross Lettable Area (GLA) and proposed tenant mix. The location of the three site alternatives and associated layouts have been included in Figures 1 - 4 below.

All sites are currently under sugarcane cultivation and therefore the bulk service requirements for all three site alternatives is similar. The Engineering Services Report (ESR) is summarised below in section 3.2 with surrounding road networks requiring upgrading (assessed in the Traffic Impact Assessment summarised in section 3.2.1 of the Environmental Impact Report). The proposed development is expected to generate approximately 0.4Ml/day to 1.4Ml/day of effluent and will require approximately 1.72Ml/day of bulk water supply. In terms of electricity demands, some 29.6MW of power will be required for the ultimate development which will require a new substation being constructed in time.

The proposal includes the construction of a 5.6km water pipeline. The proposed pipeline was identified by the Engineers when determining the bulk water supply required for the proposal. After consultation with the Engineer and Applicant, the pipeline has been positioned so as to avoid watercourse crossings where possible. There are however 9 areas where the pipeline route will transect or boarder delineated watercourses. This is further discussed in section 4.0 of the EIR. The 500mm diameter steel pipeline will travel within the Applicants property apart from where is crosses underneath three major roads, namely the N3 Highway, Kassier Road and the M13.

Freshwater ecosystems located on sites alternatives 1 and 3 drain into the uMhlathuzana River system which flows into Giba Gorge, a Special Rating Area biodiversity hotspot. Freshwater ecosystems located in site 2 however drain into the Wekeweke Stream, a river identified as a National Freshwater Ecosystem Priority Areas (NFEPA) which assists in the conservation and sustainable use of South Africa's freshwater ecosystems. As mentioned above, open green spaces have been incorporated into the proposed layouts aiming to minimise the impact on the water resources however it is a priority for the proposed development to control stormwater quality and quantity to protect the freshwater ecosystems and associated species further downstream of the proposed sites. The various assessments are discussed further in section 4.2.

1.2 Description of the property on which the activity is to be undertaken and the location of the activity on the property [Regulation 31 (2c)]

The property on which the activity is to be undertaken is on the remainder of the Kirkfalls Farm No 14427 in Durban. All three site alternatives are located on land owned by the applicant. All sites are currently zoned agriculture and used for commercial sugarcane farming.

Originally, the applicants preferred location was site 1 (approximately 52 ha in extent) situated north of the N3 and south of the M13 (Figure 1 below). Since the Scoping Report and findings of the various specialist studies, site 2 has become the preferred development site location. Site 2 (approximately 82-105 ha in extent) is located on the southern side of the N3 Highway and is bounded on the east by J.B. McIntosh Drive (extension of Kassier Road). Sugarcane forms the south and west boundaries. The third site alternative, is located opposite site 2, south of the N3 and bounded on the west by J.B. McIntosh Drive. The Denny Mushroom Farm is located south of site 3 with the uMhlathuzana River, draining in a easterly direction, located on the sites eastern boundary.

It is relevant to note the location of the nearby Mushroom Factory, which gives off an unpleasant scent during production activities which reduce the demand residential units on sites 2 and 3. GAPP Architects and Urban Designers compiled a report motivating for the development of a "regional centre" which is included in Appendix 1 and summarised below.

1.2.1 Summary of Findings of Planning Specialist Report [Regulation 31 (2) (j)]

To ensure that the proposed development is appropriate for the strategic planning design for the Outer West region, GAPP Architects and Urban Designers detailed the planning aspects of the proposed Shongweni Retail/ Mixed Use Development in February 2013 (Appendix 1). The planning specialists found that the proposed sites are strategically located on the "freight and logistics corridor" in Southern Africa connecting the potential dug-out port south of Durban Harbour inland to Camperdown (i.e. the N3 highway). The proposed freight highway, reserved for road freight vehicles only, will connect with the rail system further inland and pass directly through the Ntshongweni land. The need to provide for logistics based activities in this location is therefore important for the city.

The N3 corridor will provide the backbone for trade and logistics in South Africa with the distribution of industrial nodes along this corridor reinforcing this development. Durban's economy is based, to a large extent, on port operations and businesses which extend, not only across eThekwini but also further into the Province and the rest of the country. The northern and western corridors are key to providing associated infrastructure and logistics requirements to enhance the proposed logistics investment to be made by eThekwini.

The Strategic Development Plan (SDP) for the Outer West District of eThekwini reflects the importance of the freight and logistics corridor with urban development occurring diagonally along the N3 highway. The Spatial Framework Local Area Plan (LAP) identifies the N3, M13 and Kassier Road as a "Regional Centre" with the area around this being a "Town Centre" and beyond, the "Town Centre Frame". The Tongaat Hulett proposal is to fall in line with these wider regional plans to contribute to the development of the N3 corridor. The initial phases of the Ntshongweni development are aligned to the Urban Development Line, the Municipality's urban growth management tool.

In terms of planning, the following recommendations were made:
- Site 1 should be based upon higher intensity, mixed use development
- Site 2 and 3 should be based upon lower intensity, regional related activities to maximise location adjacent to the N3 corridor. Sites 2 and 3 therefore are the preferred sites for the regional commercial centre.
- Site 2 provides the most viable option for the proposed development in terms of topography and physical attributes, proximity to the N3 and accessibility.

Site 2 provides the most viable and appropriate option for the proposed development as a result of its topographical and physical attributes, the quantum and space potential and location within the broader sub-region and region.

The layout, as shown in Figure 3 comprises of a central site potentially accommodating a regional shopping centre surrounded by sites that are large enough to serve the distribution industry associated with freight and logistics.

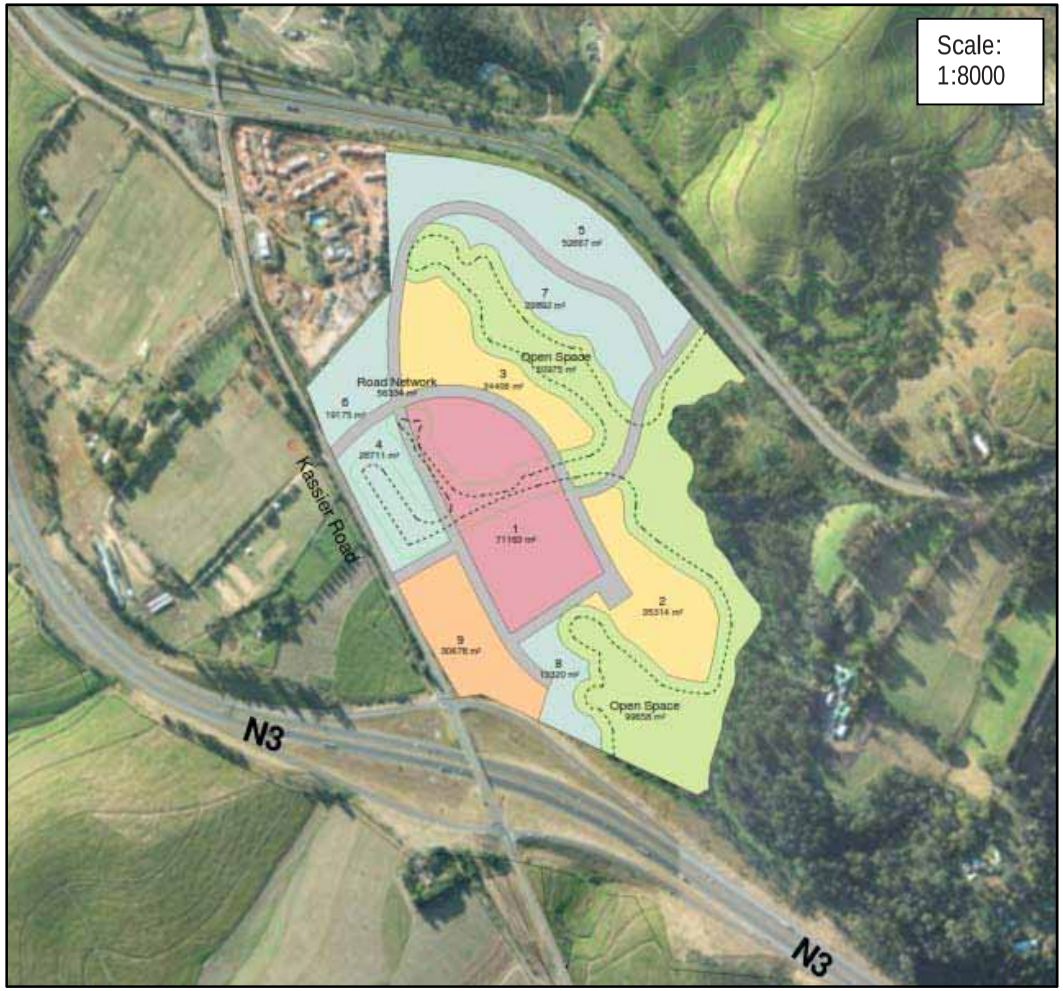
Identified environmental risk: Positive impact with the proposal being in line with national, provincial and municipal vision and strategic planning.

Figure 1: Aerial photograph showing the location of the proposed development and feasible site alternatives. All site alternatives are delineated in the red polygons with site 2 being the preferred alternative and sites 1 and 3 being the site alternatives (source: Google Maps).

1.3 Description of the Need and Desirability [Regulation 31 (2) (f)]

When considering The principles of Need and Desirability of the proposed development must be applied, as provided by the May 2009 Draft Guidelines on Need and Desirability published in the Guideline and Information Document Series of the National Environmental Management Act 107 of 1998 as amended (NEMA) Regulations by the Department of Environmental Affairs and Development Planning. "Need" refers to the type and timing of the development and "Desirability" refers to the proposed location. Urban-Econ KZN (Pty) Ltd (Urban-Econ hereafter), undertook a two phased market research and socio-economic impact assessment to ascertain whether the proposed Shongweni Retail Centre fits into eThekwini Municipality's strategic spatial plans for the Outer West region and whether there is a strong market demand for the proposed mixed land use.

Urban-Econ reviewed existing retail supply in the area to determine the market catchment area, undertook a desktop profile of Node and supporting market areas detailing a number of variables such as household size and income levels thereby identifying specific spend profiles, developed spend profiles across durable, semi-durable and non-durable goods and reviewed City interventions. Finally the specialist interpreted the household spend, market catchment figures, current transit patterns and planned nodal interventions into a potential GLA model for the site. The full Market Research and Socio-Economic Impact Assessments are provided in Appendix 2 but are summarised in the section below.



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Legend

- Tourism & Recreational
- Office
- Medium Density Res
- Green Open Space
- Road Network
- Commercial

Land Parcel Areas	
Land Usage	**Area ha**
Green Open Space	15.063319
Road Network	5.633393
	20.696712
Commercial	7.116338
Medium Density Res	6.972076
Office	14.176458
Tourism & Recreational	3.067773
	31.332645
Grand total: 12	52.029357

Figure 2: Proposed layout for the Shongweni mixed-use development for Site 1 (site alternative 1; source: GAPP Architects/ Urban Designers)

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Legend

- Office
- Business
- High Density Res
- Green Open Space
- Road Network
- Mixed Use
- Commercial

Land Parcel Areas	
Land Usage	**Area ha**
Green Open Space	11.529726
Road Network	7.364279
	18.894005
Business	18.735437
Commercial	11.158857
High Density Res	6.119757
Mixed Use	1.078527
Office	26.107079
	63.199657
Grand total: 23	82.093662

Figure 3: Proposed layout for the Shongweni mixed-use development for Site 2 (preferred site; source: GAPP Architects/ Urban Designers)

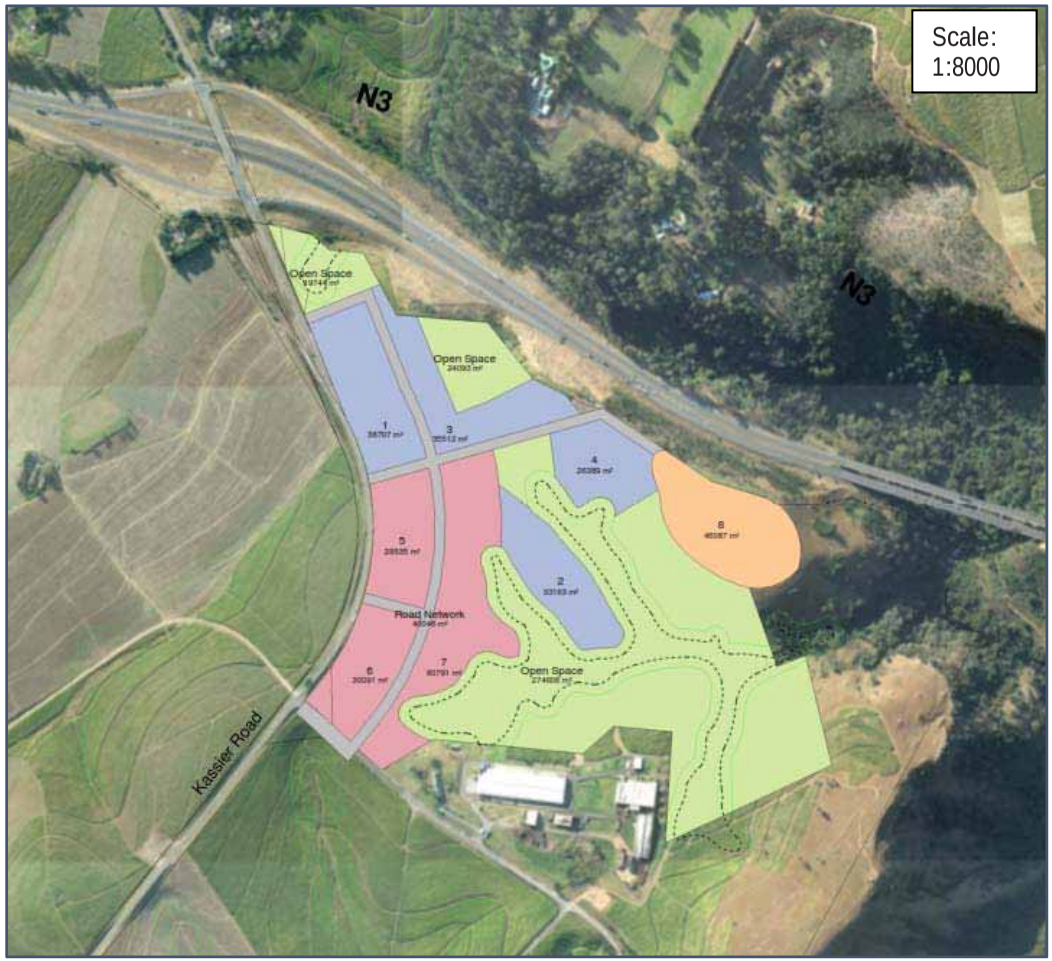


Figure 4: Proposed layout for the Shongweni mixed-use development for Site 3 (site alternative 2, source: GAPP Architects/ Urban Designers)

1.3.1 Summary of Findings of Development Economist Specialist Impact Assessment [Regulation 31 (2) (j)]

Urban-Econ's phased marketing and socio-economic impact assessment consisted of a Phase 1 Initial Market Scoping and a Phase 2 Comprehensive Market Assessment where the wider concept of a regional centre was investigated within the context of Shongweni area (both reports provided in Appendix 2).

Phase 1 of the study unpacked the existing competing supply in the area and region, determine the typical spend profiles, review of the intended local authority and major private sector development interventions and changes in the immediate area that would have an impact on commuter and foot traffic into the centre.

In terms of the regional context, the proposed retail centre is sufficiently distanced from existing regional centres such as Gateway and the Pavilion. The areas surrounding the proposed location are largely un-services offering very little retail opportunities. Apart from Hillcrest, there are no other significant mixed-use development nodes within a 10km radius increasing the demand for residential, retail and office space in this area. Existing retail-based facilities in the local context was discussed under section 2.2.2 of the initial market scoping report (Map 6 and Table 2, page 25 of the Phase 1 report in Appendix 2). There is only a small amount of retail compared to the surrounding residential areas (apart from Hillcrest). The Hillcrest Retail Corridor has the largest concentration of retail centres within a 5km radius of the proposed development however there is very little retail activity south of the N3 within a 5km radius besides for Hammersdale/Mpumalanga.

Taking into consideration retail centre classifications (outlined in Table 1 of the Phase 1 report), a small regional or regional centre would be the demand corresponding with the population dynamics in eThekwini outer-west region. Access is substantial due to the nearby relation to the N3/M13 interchange. The residential catchment within a 10km radius includes Hillcrest, Assagay, Alverstone and Summerveld (within 5km of Hillcrest retail corridor), Shongweni rural, Pinetown, Hammersdale and parts of Kloof. The market catchment area is detailed in section 3 of the Phase 1 report, which includes a nodal profile assessment on all main-place areas within a 10km radius of the proposed location.

In terms of the town planning interventions, the proposed site falls within the area allocated for development of a "mixed-use" zone in the eThekwini Spatial Development Plan (2009) for the Outer-West region (Outer-West SDP), coordinating directly with the City's future plans. Retail is to be appropriate for developing the proposed tourism/recreation corridor along Kassier Road. Proposed future residential development locations lie in close proximity to the proposed site, increasing the demand for retail activities in this area. The proposed road upgrades, described in section 3.2.1 of the EIR, will accommodate the predicted future increase in traffic created by the increase in tourism and residents in this area.

The Shongweni Local Area Plan (LAP) indicates that a "town centre" is to be situated between the two major transport roads (M13 and N3). This mixed-use centre is to be anchored by retail and supported by other land-uses. The Shongweni LAP therefore supports the proposed development, which will be in line with the urban design guidelines promoting a robust mix of activity, encouraging high density residential development to support Town Centre Core and encouraging focal, multi-use spaces within the core.

The demand model procedure, described in section 5 of the phase 1 report, determined whether a retail development is in fact viable. Urban-Econ calculated a demand GLA of approximately 60 542m^2 within the Shongweni region. The demand figure was expanded on in the Phase 2 assessment.

Phase 2 of the study included shopper and household surveys to determine retail brand, non-retail activities and support service preference, recommended GLA allocations and retail brand preferences, reviewed existing planning interventions, traffic data and modelled the retail centres impact. A consumer survey and interviews were conducted to identify any implications of the proposal. The findings of the stakeholder participation process is summarised in section 3 of the Phase 2 report.

Key findings from the interviews are listed on page 20 of the Phase 2 report and include a demand for affordable housing, the demand for office space depends on the area and whether it is upmarket, secure and safe and perceptions about the new centre and urban development in Shongweni. Interviewee's perceptions ranged from unsustainable to interest in the new shopping centre with suggestions being given for incorporation into the proposed layout.

By taking into account the findings of the survey carried out in Phase 2, the GLA was refined with the methodology outlined under section 4 of the Phase 2 report. The findings of the updated demand model noted that there will be effective demand for

49 242m^2 of retail in Shongweni by 2012, 57 450m^2 in 2015, 78 049m^2 in 2020 and 113 429m^2 in 2025. The proposed tenant mix was listed in section 4.2 of the Phase 2 report and should comprise of a mix between centres such as Liberty Midlands Mall in Pietermaritzburg and Bridge City Centre in KwaMashu.

The economic impact for the proposed development will generate new wealth in the direct area as well as the wider Outer West and eThekwini region. An input/output model was used to determine the economic impact extent using a number of economic variables. Assumptions of the model are listed in section 5.1, page 31 of the Phase 2 report. The model is essentially a set of equations which is used to determine the anticipated:

- Total employment (CAPEX phase as well as long-term sustainable employment during operation),
- Value added (i.e. Gross Geographical Product; GGP),
- Change in output (additional business turnover as a result of the introduction of an exogenous change in the economy), and
- New salaries and wages (the increase in existing salaries/wages as a result of the exogenous change).

It is expected that the total capital investment value of the proposed development during construction will be approximately R608.3 million. The economic impact of the construction phase (in terms of gross value added) will be in the region of R602 million, creating a significant capital injection into the local economy for the construction phase alone. The annual operational cost will be R60.5 million.

Total employment

3726 temporary employment opportunities will be created during the construction phase (2097 directly and 1629 indirectly). In total, 359 permanent jobs will be created during the operation phase (234 direct and 124 indirectly).

Value added

An estimated additional R602 668 564 will be generated in GGP into the eThekwini region as a result of the capital expenditure of the proposed development during construction. Of this, R249 million will be a direct injection and a further R353 million will be induced investment. The total contribution to the GGP within eThekwini during operational phase will be R68 million (R37 million in direct GVA contribution and R30 million in indirect GVA contributions).

Change in output

During construction a total of R943 million in new business sales will be generated as a result of the indirect impact of the developments capital expenditure and R752 million as a result of direct impact. The specialist expects that there will be a positive impact on local supporting businesses. In terms of new business sales during operation, a total of R139 million will be generated on an annual basis (R65 million direct and R74 million indirect).

New salaries and wages

Additional income generated as a result of the construction is almost R298 million (R131.9 million direct and R165.5 million indirect wages) leading to a significant increase in the disposable income within the region. The income that will be generated through operation of the retail centre will be R29 million (R16 million in direct wages and R12 million in indirect wages).

In order to quantify the expected socio-economic impact on the town, general public, shoppers, existing businesses, municipality, safety and security, urban environment, existing residents and traffic, an impacts rating model was undertaken (details provided in section 5.2 of the Phase 2 report in Appendix 2). It was determined that the most significant impacts will be the increase in employment and income in the region, as well as the noise and congestion that will be created with construction. Table 13 in the Phase 2 report lists the anticipated impacts and significance of all the impacts.

Urban-Econ concluded that there is sufficient effective demand to support the development of a 50,000m^2 retail centre, based on a number of conditions (public transport, new road infrastructure, bulk infrastructure etc.). In addition, the positive impacts will be a creation of new income and employment, as well as urban-renewal and convenience of shoppers. The negative impacts will be a decline in turnover for existing retailers in the outer-west area in the short-term and new noise and congestion in the long-term.

Identified environmental risk: Positive impact in that the proposal is directly in line with eThekwini's SDF for the Outer-West region as well as providing a regional centre as proposed in the Shongweni LAP. Positive impact with the injection of significant capital into the local economy during construction (R602 million), increased jobs, income and economic growth as well as a potential increase in property values of the surrounding communities. Increase in rates and utilities to the municipality is an additional positive impact. Potential increase in traffic, noise and congestion in the area, potential to decrease safety and

security with the change in built environment. Potential short-term loss in turnover of existing retail businesses in Hillcrest and Pinetown.

1.4 Purpose and Structure of this Report

The Environmental Impact Assessment (EIA) is a planning tool that assists with the assessment of social, economic and environmental impacts through independent specialist input and public participation. The role of the Environmental Assessment Practitioner (EAP) is to provide independent specialist input, manage the public participation and consolidate all relevant information culminating in the Environmental Impact Report (EIR) and Environmental Management Programme (EMPr) [Regulation 32 (2) (o)].

The purpose of the EIR is to assess environmental impact and illustrate significance according to the extent, intensity and duration, taking into account specialist input and Interested & Affected Parties (I &APs) comment. All of this is done with the intent of making recommendations to reduce or avoid the negative impacts of the proposed development. Ultimately a statement on whether or not the project should go ahead is made. Another important function of the EIR is the inclusion of an EMPr. The EMPr is a document where the findings of the EIR have been translated into measurable actions that must occur during construction and operation in order to mitigate identified environmental impacts. The EMPr is intended as a standalone, public document that becomes legally binding should the EIA be approved and the activity go ahead.

This EIR has been structured according to the requirements of the NEMA EIA 2010 regulations. Section 1.5 provides an overview of the scoping process indicating key issues identified, raised and investigated. Through each of the following sections leading up to the table of assessment of impacts in section 6.2, impacts that have been identified have been highlighted in *italics* to ensure that all impacts have been included in the table for assessment. Where specific issues for assessment have been newly identified as a result of specialist report reviews or due to further investigation, these have been added to the impacts identified in the scoping phase and are shown in the table in section 6.2 in purple.

In section 3.0 the development proposal including associated aspects such as management of stormwater, sewage, water and electricity supply as well as traffic impacts are described and discussed. Once again potential environmental risks identified in each section are listed for review and assessment in section 6.2. Section 4.0 describes the environment of the site in terms of physical, biological, social, economic and cultural characteristics. Throughout this section, potential environmental risks are identified for further assessment and rating under section 6.0. Public participation carried out during scoping is included in section 5.0 and comments raised are discussed throughout the report in the relevant sections. In section 5.4, the reader is directed to the comments and responses tables which are provided in Appendix 16.9. Section 6.0 commences with the identification and assessment of issues and impacts, identifying the underlying principles used to determine the importance of certain impacts identified and how these are rated once the mitigation measures have been taken into account. The EMPr, which is intended to function as a standalone document identifying key construction impacts and controls for mitigating these is included in Appendix 14.

Finally the report concludes by identifying assumptions gaps and uncertainties in terms of information used in the assessment (section 8.0), ending with an Environmental Impact Statement intended to summarise significant impacts (section 9.0) with the conclusion and opinion on authorisation provided in section 10.0.

1.5 Summary of Scoping Process

A Scoping Report was submitted to the KZN Department of Agriculture and Environmental Affairs (DAEA) on the 30 August 2012. The content of the Scoping Report was in line with Regulation 28 of the NEMA EIA Regulations and was accepted by the Department on the 02 October 2012. Since the Scoping Report was accepted, specialist reports have been commissioned by the applicant and reviewed by the EAP. The majority of the specialist reports are summarised in sections 3.0 and 4.0 and included in appendices to this EIR.

Below is a summary of the EIA process that has been followed to date.

EIA PROCESS

The current application is undergoing Scoping and EIA and as such the following steps have or will be followed:

An application form was submitted to the Provincial Environmental Authority (Department of Agriculture and Environmental Affairs) on the 01st February 2012.

The application has been advertised in the local newspaper (Highway Mail on the 10th February 2012) and the regional newspaper (Mercury on the 06th February 2012). Notices were place around the site on the 03rd February 2012. Notices were also handed out to neighbors within 100m of the boundary of the site. The advertised public meeting was held at the Assagay Hotel on the 22nd March 2012.

The scoping report and plan of study for EIA was produced detailing impacts to be investigated. This was made accessible to all registered I &APs and to the authorities for comment and review on the 28th May 2012.

I & APs were requested to provide comment within 30 days. All comments received were included in a final scoping report which was submitted to the DAEA for approval on the 30th August 2012.

The DAEA approved the scoping report on 02nd October 2012. All I & APs were notified of the 19th November 2012.

I&AP Input

KSEMS proceeded with the Draft EIR. This was submitted to all I&APs and authorities for review on the 04 November 2013. This report assesses the impacts identified during the scoping and investigates mitigation measures. All I & APs have a further 30 days to comment on this draft report.

I&AP Input

Please note that the comment period therefore ends on the 15th December 2013.

Current status

Once this comment period has ended, the Final EIR with all comments received will be submitted to the DAEA. The DAEA have 60 days after acknowledging receipt of the report to accept the EIR and a further 45 days to provide Environmental Authorization approving or rejecting the proposal.

1.6 Key Amendments / Clarification of Information Provided in Scoping

Since the release of the Scoping Report it has been confirmed that site 2, adjacent to the N3 on the western side of Kassier Road, is the preferred site location. Site 2 was recommended as the preferred site option by a number of the specialists, as summarised in section 4.0 below. The applicant has accordingly, proposed site 2 as the preferred site alternative.

During the Scoping phase of the EIA, many I & APs requested that open space be incorporated into the development for recreational activities such as horse riding and cycling. This concern was specifically applicable to site 1, which is no longer considered the preferred site alternative and therefore recreational activities are able to continue in this site. The provision of residential units as an associated use has fallen away with site 2 becoming the preferred site alternative (given the strategic need to support logistic type activities). Residential uses will be considered for site 1 and other portions on the land to the north of the M13 in the future.

In terms of sewage management, the Scoping Report stated that the sewer system in the uMhlatazana River catchment will be upgraded to accommodate effluent generated from this development as well as other developments in the area. Environmental authorisation was received for the Tongaat Hulett Sewer Reticulation Project which includes potentially replacing the Hillcrest Sewerage Treatment Works with a pump station, construction of a trunk sewer pipeline across the N3 and a gravity main leading to the Umhlathuzana Sewerage Treatment Works. The sewerage generated from the proposed Shongweni Retail Centre will therefore link into this new trunk sewer pipeline. For more details on the bulk service requirements and provisions please refer to section 3.2 below.

Since the Scoping Report, the Engineering Service Report has identified the need for a new pipeline to supply the proposed development with sufficient water. The bulk pipeline will tie in at the western aqueduct and terminate at a proposed new reservoir. This pipeline will be approximately 5.6km in length and 500mm in diameter. Additional public participation (see section 5.0) was therefore carried out and wetland, fauna and flora specialised commissioned to assess any potential impacts

along the proposed pipeline route. The water pipeline and associated environmental impacts are included in this EIR and are mitigated against in the attached EMPr (Appendix 14). In terms of electrical demand, completely new infrastructure will be required to meet their full load requirements. 11kV supplies will be taken from the Marian Ridge major substation to the proposed development (overhead or underground subject to the cost/benefit of the land value affected). For more details please refer to section 3.2 below.

2.0 Legislation and Guidelines Considered in Developing this Environmental Impact Report

The following sections contain a list of relevant legislation, guidelines and regulations that were consulted during the EIA process. This section aims to provide an overview of the key legal requirements that apply to the proposed Shongweni Centre for Retail/ Mixed Use Development. Legislation will be addressed in terms of its relevance to environmental protection and conservation, water use and protection, health and safety, waste management, noise management, as well as the activities requiring an impact assessment under the NEMA regulations.

2.1 Environmental Protection and Conservation

Environmental legislation provides for the effective protection and controlled use of the environment and its services. Although development is seen as key to economic growth, it has the potential to negatively impact the environment through altering biological functions and affecting fauna and flora. Table 1 provides a list of applicable legislation to the proposed centre for retail/mixed use development in terms of environmental protection and conservation.

Table 1: List of Legislation Key to Environmental Protection and Conservation

Legislation	Description
National Heritage Resources Act, 1999	The act provides protection of and management of conservation worthy places, areas and objects by heritage authorities, by means of registration and the implementation of certain protections. The Heritage Impact Assessment has confirmed that there are currently no structures older than 60 years on the preferred site 2.
Environment Conservation Act, 1989	The act empowers government authorities to prohibit any action which, in their opinion, may cause serious damage to the environment, or to instruct responsible parties to any take steps that they deem fit to remedy or rectify the situation. The Act also provides for declaration of conservation areas and protected natural environments.
Conservation of Agricultural Resources Act, 1983	The Act contains measures for the prevention of soil erosion, the development of soil conservation schemes, the protection of wetlands and associated vegetation, the utilisation and protection of the veld, the prevention of the spread of declared weeds and invader plants. During both the construction and operational phase of this development provision has been made for the protection of the remaining wetland are and removal of alien invader plants within the green open spaces.
KZN Nature Conservation Ordinance, 1983	Lists endangered and rare species of fauna and flora.
Kyoto Protocol to the United Nations Framework Convention on Climate Change	Requires developed country signatories to implement and/or further elaborate policies and measures in order to achieve quantified emission limitation and reduction commitments in order to promote sustainable development.
Bonn Convention on the Protection of Migratory Species of Wild Animals	Acknowledges the importance of the conservation migratory species and the need to take steps to prevent them from becoming endangered.
Paris Convention for the Protection of the World Cultural and	Imposes an obligation on State Parties to ensure that

Natural Heritage	effective and active measures are taken for the protection, conservation and presentation of the cultural and natural heritage situated on its territory.
National Environmental Management: Biodiversity Act, 2004	Act lists critically endangered, vulnerable and protected species and habitats.

2.2 Water Use and Protection

According to the Department of Water Affairs (DWA), water in South Africa is viewed as a national asset. In global terms, South Africa's water resources are scarce and extremely limited, and poor spatial distribution of rainfall means that the natural availability of water across the country is also highly uneven. However, provided South Africa's water resources are judiciously managed and wisely allocated and used, sufficient water of appropriate quality will be available to sustain a strong economy, high social standards and healthy aquatic ecosystems for many generations. Legislation such as the National Water Act of 1998 and the Water Act of 1956, provide regulations to govern the use, management and protection of water. Table 2 provides a list of legislation that applies to the proposed retail/mix use centre in terms of water use and protection.

Table 2: List of Legislation Key to Water Use and Protection

Legislation	Description
National Water Act, 1998	Aims to ensure that water resources are protected, used, developed, conserved, managed and controlled in a sustainable manner, for the benefit of everyone in South Africa. Section 19 includes various requirements to prevent and control water pollution. Water use is defined broadly and includes taking and storing water, activities which reduce stream flow, waste discharges and disposals, controlled activities, altering a water course and removing water from underground. Unless the water use is for basic human needs, is an existing lawful use of is permitted under general authorisation, it must be licensed.
National Water Resources Strategy, 2004	Describes how the water resources of South Africa will be protected, used, developed, conserved, managed and controlled in accordance with the requirements of the National Water Policy and the National Water Act.

2.3 Health and Safety

Health and safety is governed by the Occupational Health and Safety Act 1993. Any potential risk to the health and safety of employees and the public must be addressed. Table 3 provides a list of legislation that applies to the proposed development in terms of health and safety. The listed regulations are applicable to the construction phase of the proposed development.

Table 3: Health and Safety Regulations

Legislation	Description
Occupational Health and Safety Act, 1993	Main objective is to provide for the health and safety of persons at work, including aspects which are hazardous to health and safety.
Hazardous Chemical Substance Regulations, 1995	These regulations stipulate requirements for storage and handling of hazardous chemical substances and provide guidelines for training of staff. Any hazardous chemical substances used during construction must be identified, stored used and disposed of in accordance with this legislation.
Environmental Regulations for Workplaces, 1987	These regulations specify optimal working conditions for staff including thermal conditions, illumination requirements, requirements for ventilation, noise levels etc. and also specify requirements for housekeeping.

General Administrative Regulations, 2003	These regulations stipulate the administration of the various Occupational Health and Safety Act regulations incusing designation of health and safety committees, reporting and recording of incidents and occupational diseases.
Construction Regulations, 2003	These Regulations apply to any persons involved in construction work and are therefore applicable to the construction phase. The regulations provide guidelines for safe operation during construction.

2.4 Noise Management

There is a potential for the generation of noise during construction of the Tongaat Hulett Shongweni Centre. The Environment Conservation Act of 1989 has included a section pertaining to noise management. Table 4 lists this regulation and other by-laws which apply to the current project in terms of noise management. The potential noise generated on the site would occur during the construction phase.

Table 4: Legislation Applicable to Noise Management

Legislation	Description
Environment Conservation Act, 1989	The Act outlines general prohibitions for noise control. It is also specifies noise management during construction. Specifically section 3(i) states that no person shall use any power tool or power equipment for construction, earth drilling or demolition works, or allow it to be used, in a residential area during the following periods of time: i) Before 06:00 and after 18:00 from Monday to Saturday; and ii) at any time on any Sunday, Good Friday, Ascension Day, Day of the Covenant and Christmas Day, or any other day as may be determined by a local authority; The provisions of the regulations may not apply if any person may by means of a written application, in which the reasons are given in full, apply to the local authority concerned for exemption from any provision of these Regulations.
eThekwini Municipality by-laws (General By-laws)	The by-law outlines actions that may be viewed as a nuisance. Specifically, Section 3 states: 3.1.1 (1) A person commits an offence if in a street or public place or on premises he by act or omission causes or creates a nuisance or allows a nuisance to arise or exist in circumstances which are under his control; provided that the aforegoing shall not apply to the extent that a person acts lawfully in the exercise of a right or in the performance of a duty. 2. Without limiting the generality of the provisions of subsection (1) the following shall constitute nuisances thereunder: (a) the reproduction of noise or vibration which arises from or is caused by the operation or use of equipment or machinery;
Noise induced Hearing Loss Regulations, 2003	These regulations specify safe working conditions in environments where noise levels exceed safe levels and gives guidelines for assessment of noise, training measures, provisions of information to staff etc.
National Standards (SANS10103:2003)	Specifies the maximum ambient noise level acceptable in various land use type zones

2.5 Air Quality Management

There is a potential impact on air quality during the construction phase of the development. Monitoring air quality is governed by the Air Quality Act of 2004.

Table 5: Air Quality Management Legislation

Legislation	Description
National Environmental Management: Air Quality Act 2004	Aim is to reform the law regulating air quality in order to protect and enhance the quality of air in the South Africa.

2.6 Waste Management

During construction and operation, the production of wastes, either liquid, solid or and/or hazardous, will require that they be adequately disposed of. To regulate waste disposal and management several legislations and regulations have been formulated. Table 6 provides a list of these as well as a short description.

Table 6: Legislation for Waste Management

Legislation	Description
Environment Conservation Act, 1989	Section 31A provides that the Minister of Environmental Affairs and Tourism or the Administrator, local authority or government institution concerned may take specified action if any person performs any activity or fails to perform any activity as a result of which the environment is or may be seriously damaged. Section 20(6) of the Act states that, subject to the provisions of any other law, no person shall discard waste or dispose of it in any manner, except at a disposal site for which a permit has been issued, and in a manner or by mean of a facility or method and subject to such conditions as the Minister may prescribe. All waste generated during both the construction and operational phase of the development must be disposed of appropriately and is outlined in the EMPr.
National Environmental Management Act, 1998	Outlines principles that serves as the general framework within which environmental management and implementation plans must be formulated: "4(iv) that waste is avoided, or where it cannot be altogether avoided, minimised and reused or reduced where possible and otherwise disposed of in a responsible manner". Duty of care and remediation of environmental damage imposes an obligation on the responsible person (including an owner of land or premises, a person in control of land or premises or a person who has a right to use the land or premises) to take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment.
National Environmental Management: Waste Act, 2008	The Act imposes obligations on the holder of waste to take reasonable measures to manage waste in order to protect health and the environment by providing reasonable measures for the prevention of pollution and ecological degradation and for securing ecologically sustainable development; to provide for institutional arrangements and

	planning matters; to provide for national norms and standards for regulating the management of waste by all spheres of government; to provide for specific waste management measures; to provide for the licensing and control of waste management activities; to provide for the remediation of contaminated land; to provide for the national waste information system; to provide for compliance and enforcement; and to provide for matters connected therewith.
eThekwini Municipality by-laws (Solid Waste By-laws)	The By-law specifies the appropriate management, removal and control of solid, hazardous and industrial waste. These requirements will need to be adhered to in both the construction and operational phase of the development.

2.7 Environmental Impact Assessment

The National Environmental Management Act (107 of 1998 as amended; NEMA) requires that the potential impact on the environment, socio-economic conditions and cultural heritage of activities that require authorisation or permission by law, and which may significantly affect the environment must be considered, investigated and assessed prior to implementation. The proposed Tongaat Hulett Shongweni retail/mixed use Centre is undergoing Scoping and EIA. NEMA regulations specify which activities require environmental authorisation. The activities which apply to the current project and for which environmental authorisation is being sought are listed in Table 7.

Table 7: List of Activities Requiring Impact Assessment Identified for the Proposed Shongweni Retail/Mixed Use Centre.

Government Notice No.	Activity No(s)	Description
Government Notice No. 544 of 18th June 2010	1	The construction of facilities or infrastructure for the generation of electricity where: i. The electricity output is more than 10 megawatts but less than 20 megawatts; or ii. The output is 10 megawatts or; less but the total extent of the facility covers an area in excess of 1 hectare. The 3 site options proposed for the development have an estimated electrical demand of 16.8MVA, 29.6MVA and 10.6MVA.
Government Notice No. 545 of 18th June 2010	15	Physical alteration of undeveloped, vacant or derelict land for residential, retail, commercial, recreational, industrial or institutional use where the total area to be transformed is 20 hectares or more; except where such physical alteration takes place for: i) linear development activities; or ii) agriculture or afforrestation where activity 16 in this Schedule will apply.
Government Notice No. 544 of 18th June 2010	9	The construction of facilities or infrastructure exceeding the 1000 metres in length for the bulk transportation of water, sewage or stormwater i) with an internal diameter of 0.36 metres or more; or ii) with a peak throughput of 120 litres per second or more, Excluding where: a. such facilities or infrastructure are for bulk transportation of water, sewage or stormwater drainage inside a road reserve; or b. where such construction will occur with urban areas but further than 32 metres from a watercourse, measured from the edge of the watercourse. Infrastructure relating to stormwater control and management of sewage will be required to support the proposed development.

Government Notice No. 544 of 18th June 2010	10	The construction of facilities or infrastructure for the transmission and distribution of electricity i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts; or ii) inside urban areas or industrial complexes with a capacity of 275 kilovolts or more. Infrastructure relating to electrical distribution is required.
Government Notice No. 544 of 18th June 2010	22	The construction of a road, outside urban areas, i) with a reserve wider than 13.5 metres or, ii) where no reserve exists where the road is wider than 8 metres, or iii) for which an environmental authorisation was obtained for the route determination in terms of activity 5 in Government Notice 387 of 2006 or activity 18 in Notice 545 of 2010. Access roads will be required to service the proposed development.
Government Notice No. 544 of 18th June 2010	11	The construction of: i) canals; ii) channels; iii) bridges; iv) dams; v) weirs; vi) bulk stormwater outlet structures; vii) marinas; viii) jetties exceeding 50 square metres in size; ix) slipways exceeding 50 square metres in size; x) building exceeding 50 square metres in size; xi) infrastructure or structures covering 50 square metres or more Where such construction occurs within a watercourse or within 32 metres of a watercourse, measured from the edge of a watercourse, excluding where such construction will occur behind the development setback line. The proposed development will require the construction of infrastructure within 32 metres of a watercourse, namely the wetlands on the site.
Government Notice No. 544 of 18th June 2010	18	The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock from: i) a watercourse; ii) the sea; iii) the seashore; iv) the littoral active zone, an estuary or a distance of 100m inland of the high-water mark of the sea or an estuary, whichever distance is the greater but excluding where such infilling, depositing, dredging, excavation, removal or moving a) is for maintenance purposes undertaken in accordance with a management plan agreed to by the relevant environmental authority; b) occurs behind the development setback line. The construction phase of the development will require the infilling/ depositing of material of more than 5 cubic metres into a watercourse, namely the wetlands identified on the site.
Government Notice No. 544 of 18th June 2010	37	The expansion of facilities or infrastructure for the bulk transportation if water, sewage or stormwater where:

		a) the facility or infrastructure is expanded by more than 1000 metres in length; or b) where the throughput capacity of the facility or infrastructure will be increased by 10% or more Excluding where such expansion: i) relates to transportation of water, sewage, or stormwater within a road reserve; or ii) where such expansion will occur within urban areas but further than 32 metres from a watercourse, measured from the edge of the watercourse. The expansion of infrastructure for the bulk transportation of water, sewage and stormwater is required for this development.
Government Notice No. 544 of 18th June 2010	38	The expansion of facilities for the transmission and distribution of electricity where the expanded capacity will exceed 275 kilovolts and the development footprint will increase. The proposed development will require the expansion of existing infrastructure from the Marian Ridge major substation for the initial distribution of electricity.
Government Notice No. 544 of 18th June 2010	13	The construction of facilities or infrastructure for the storage and handling, of dangerous good, where such storage occurs in containers with a combined capacity of 80 but not exceeding 500 cubic metres. Depending on the tenant composition, there is the potential for the storage of "dangerous goods" such as oils and paints.
Government Notice No. 544 of 18th June 2010	12	The construction of facilities or infrastructure for the off-stream storage of water, including dams and reservoirs, with a combined capacity of 50 000 cubic metres or more, unless such storage falls within the ambit of activity 19 of Notice 545 of 2010.
Government Notice No. 544 of 18th June 2010	47	The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre- (i) where the existing reserve is wider than 13.5 metres; or (ii) where no reserve exists, where the existing road is wider than 8 metres excluding widening or lengthening occurring inside urban areas.
Government Notice No. 545 of 18th June 2010	18	The route determination of roads and design of associated physical infrastructure, including roads that have not yet been built for which routes have been determined before 03 July 2006 and which have not being authorized by a competent authority in terms of the Environmental Impact Assessment Regulations, 2006 or 2009, made under section 24(5) of the Act and published in Government Notice No. R.385 of 2006,- (i) it is a national road as defined in section 40 of the South African National Roads Agency Limited and National Roads Act, 1998 (Act NO.7 of 1998); (ii) it is a road administered by a provincial authority; (iii) the road reserve is wider than 30 metres; or (iv) the road will cater for more than one lane of traffic in both directions.

2.8 Mitigation of Environmental Impacts

Section 28 of NEMA places a duty of care on every person who causes, has caused or may cause pollution or degradation of the environment to take responsible measures to prevent, minimise and rectify such pollution or degradation. Such measures may include the investigation, assessment and evaluation of the impact on the environment; informing and educating employees about the environmental risk of their work and the manner in which the task must be performed to avoid causing

significant pollution or degradation of the environment; modifying or controlling any activity causing the pollution or degradations; containing or preventing the movement of pollutants or the cause of degradation; eliminating any source of the pollution or degradation; or remedying the effects of the pollution or degradation.

In terms of the Section 19 of the National Water Act of 1998, the owner of land, person in control of land or person who occupies or uses any land in which any activity or processes performed or undertaken which causes or may cause pollution a water source, must take all reasonable measures to prevent such pollution from occurring, continuing or recurring. Such measures may include modifying or controlling the act or process causing the pollution; complying with any prescribed waste standards or management practice; containing or preventing the movement of pollutant; eliminating any source of the pollution; remedying the effect of the pollution; and remedying the effect of any disturbance to the bed and banks of a water course.

2.9 Permit Requirements

Table 8 summarises the permits and authorisations that will be required for the construction of the pipeline. Agreements to cross roads and servitudes or other service providers are not provided here. Only those permits pertaining to the environmental impact assessment of the current project are included in this section.

Table 8: Permit and Authorisation Requirements

Permit/Authorisation	Description
General environmental approval	Authorisation required under regulations GNR 544 and 545 of the National Environmental Management Act 1998. In the current project, authorisation will be issued by the KZN Department of Agricultural and Environmental Affairs.
Water Use License in terms of section 39 of the National Water Act 1998	There is a wetland present on all three of the site alternatives. The majority of the wetland will be conserved as Open Space however 1.4 hectares of the wetland will be lost on site 2. Any alteration of the bed, banks or characteristics of a watercourse may require a permit from the Department of Water Affairs (DWA). A Wetland Rehabilitation Plan has been prepared whereby the wetland specialist has proposed wetland interventions that will be constructed within wetland areas on site 2 (e.g. fill in drains and reshaping of the wetland habitat). Please refer to section 6.3 of the EIR for more details.
A permit for the abstraction of water	A permit is required from the Minister of Water Affairs and Forestry for the abstraction of water from a public stream in excess of 10 000 cubic metres if this is required during construction.
Waste Management Activities in Respect of which a Waste Management License is required in accordance with section 20 of the National Environmental Management: Waste Act 2008.	Depending on the activities on site and tenant composition a waste license may be required during the operational phase of the proposed Shongweni Retail Centre.
Protected Plants	In terms of section 200 of the KZN Nature Conservation Ordinance 17 of 1974, an application may be required to be submitted to Ezemvelo KZN Wildlife regarding the "gathering" of certain specially protected species (this includes the picking, cutting or damaging of the plant species). Species are listed under Schedule 12 of the Ordinance and include the *Kniphofia* and *Cyathea dregea* species that were identified by the Vegetation specialist in the wetland on site 3. Additionally *Scadoxus puniceus* and *Eulophia streptopetala* were identified in isolated areas aling the proposed bulk water pipeline route. Species are to be avoided or a permit will need to be prior to disturbing the species.

3.0 Detailed Description of the Proposed Activity [Regulation 31 (2b)]

Section 3.0 provides a detailed description of the proposed activity in terms of services that are currently available on all three site alternatives and what will be required for the construction and operation of the proposed Shongweni Regional Centre.

Potential Environmental risks have been identified throughout the sub-sections and are included in *italics* below the descriptions. These risks have been tabulated with measures provided to mitigate the impacts in section 6.2 9 (Table 10). A comparison of all proposed alternatives is also provided in this section. The alternative comparison includes the effect that the identified alternatives may have on the environment and surrounding communities.
Tongaat Hulett is proposing to construct a town centre for retail/mixed use in Shongweni. The proposed property where the development will occur is currently owned by Tongaat Hulett with the vast majority of the land being used for sugar cane farming. The development of the town centre will be in line with the guidelines outlined in the Shongweni LAP for the Central-Eastern Precinct (Town Centre Precinct) thereby including a variety of land uses including an intensive development core and a supporting frame incorporating an open space corridor[1]. Developers, investors and tenants will purchase freehold stands within the precincts upon which they could develop retail facilities, offices or warehousing etc. for their various business activities or to lease buildings/portions of buildings that could be constructed by the developer.

Three site alternatives have been identified for further investigation for the proposed development. All three alternatives share a common general development plan however the layouts differ slightly (see Figures 2-4 for the layout alternatives). The alternatives have been fully investigated in section 3.1 below which includes a description of the topography, current features on the site and development layout. More information on the fauna, flora and freshwater ecosystems that currently exist on the sites, can be found in section 4.0 of the EIR.

The development of the site will include construction of bulk water services, sewer pipelines and associated pump station and electrical supply. The details of each of these service upgrades are outlined in more detail in section 3.1 below. Access to all three sites already exists from Kassier Road or J.B. McIntosh Drive (extension of Kassier Road) however due to the expected increase in the number of vehicles, the road network will also be upgraded. A Traffic Impact Assessment was conducted by Arup (Pty) Ltd (Arup) to anticipate the various road upgrades and improvements. A summary is provided in section 3.2 below.

Identified environmental risk for assessment: loss of agricultural land, increased pressure on existing water, sewage and electrical demands.

3.1 Description of Identified Potential Alternatives to the proposed activity, including Advantages and Disadvantages that the proposed activity or alternatives may have on the Environment and the Community that may be affected by the Activity [Regulation 31 (2) (d)]

The Western Cape Department of Environmental Affairs and Development Planning (DEA & DP) guideline[2] on alternatives has been used as a guide to the identification of feasible alternatives to the proposed activity. The NEMA EIA Regulations define alternatives as "*different means of meeting the general purpose and requirements of the activity*".

Alternatives were identified according to the following criteria:

i. Is the alternative feasible and reasonable?
ii. Does the alternative suit the general purpose of the proposed activity?
iii. Does the alternative align with the need and desirability considerations of the proposed activity?
iv. Is the alternative designed to prevent and minimise negative impacts and to maximise benefits?
v. Does the alternative compromise the integrity of the proposal?
vi. Does the alternative comply with policy and legal requirements?

The purpose of this project is to enhance the development of the Regional Town Centre in Shongweni as proposed by the local planning framework for the area. The applicant proposes to construct a commercial / mixed use town centre incorporating an open space corridor into the layout. This general purpose remains constant across the site alternatives discussed below however the layout of the retail / mixed use centre does differ to suite the location and landscape of the alternative sites. The no-go alternative is also investigated as a baseline against which all the other alternatives are measured.

Based on the above criteria, the following site alternatives have been identified for further investigation and are described below. Please note that site 2 is the preferred site alternative for the primary use proposed following detailed assessments and analysis of the site alternatives but it is anticipated that site alternatives 1 and 3 will be developed at some point in the future

[1] Iyer et al. Shongweni Local Area Plan (2010)
[2] Source: DEA&DP (2011). *Guideline on Alternatives, NEMA EIA Regulations Guideline and Information Document Series.* Western Cape Department of Environmental Affairs & Development Planning (DEA&DP).

however not for the primary uses proposed in this EIA. Separate EIA's will be required for development of these sites at the appropriate time.

3.1.1 Alternative 1: The development of the Shongweni Retail / Mixed Use Centre on Site 1

Figure 5: Aerial Map Showing the Location of Site 1. The uMhlatazana River Corridor is shown in Blue and the Green Represents the Clifton Canyon Core Conservation

The Outer West Spatial Development Plan (SDP, 2009) was developed in 2009 as a key document driving development in the Outer West eThekwini area. Since the SDP, a comprehensive Shongweni Local Area Plan (Iyer et al 2010) was prepared to ensure a clear framework for Shongweni and surrounding areas.

From a planning perspective, Site 1 is optimally located between the N3 and M13, in the area allocated for the Shongweni Regional Town Centre in the Shongweni LAP. The coordinates for the centre of the site are 29°47'49.67"S and 30°47'49.67"E. All the key structuring elements outlined in the LAP are fulfilled by site 1. These include access to the N2 and M13 interchange, Kassier Road and Cliffdale Road (Figure 5). The topographical characteristic of the land is however very steep with numerous drainage lines carrying water directly into the uMhlatazana River, which flows to Giba Gorge, a biodiversity hotspot. The existing office and staff accommodation on site have low historical value (see section 4.4 for more detail)

The site is 52.03 hectares in total with the layout incorporating 6 land uses; tourism and recreational (3.07ha), office use (14.18ha), medium density residential (6.97ha), road network (5.63ha), commercial (7.12ha) and green open space (15.06ha). 12 individual land parcel units available for purchase will be constructed. Figure 2 above indicates the proposed layout.

The green open space is located to the east of the site to create a buffer between the development and the environmentally sensitive area of the uMhlatazana River Corridor and Clifton Canyon Core. The incorporation of medium density residential units maximises the social benefits offered by the proposed development. From an environmental perspective development on this site would be a disadvantage due to the close proximity of sensitive conservation hotspots. Financially, the earthworks necessary to develop on the steep gradient of the site would also be classified as a disadvantage. A full list of the advantages and disadvantages of this site alternative are outlined below in Table 9.

Figure 6: Photograph of a section of site 1 facing north-east.

3.1.2 Alternative 2 (preferred site option): The development of the Shongweni Retail / Mixed Use Centre on Site 2

Figure 7: Aerial Map Showing the Location of Site 2. The Drainage Line is shown in Blue to the South West of the Site. The Cross shows the Location of the Mushroom Farm.

Both site alternatives 2 and 3 are not as ideally located as site 1 from a planning perspective as both sites are south of the N3, falling marginally outside the proposed area allocated for the Regional Town Centre. The co-ordinates for the centre of site 2 are 29°48'32.56"S and 30°44'38.44"E (Figure 7). With regards to the key structural elements, site 2 is directly accessible to the N2 and J.B. McIntosh Drive (an extension of Kassier Road). The topographical characteristic of the land is much flatter compared to site 1 with a wetland draining into a drainage line on the western boundary. The buildings on this site do not fall within the ambit of the KwaZulu Natal Provincial Heritage Act No 4 of 2008 however recommendations to preserve their historical influence have been included in the Heritage Impact Assessment (outlined in section 4.4 below).

The site is 106.54 hectares in total incorporating 4 land uses; business (50.53ha), commercial (17.17ha), road networks (10.19ha) and green open space (28.65ha). 27 individual land parcel units available for purchase will be constructed. The inclusion of residential is not part of the development proposal as a result of the strategic location of the N3 corridor and the fact that other, more compatible uses are required to be provided for. It is important to note the close proximity of the mushroom farm, represented by an X in Figure 7, which does not make the possibility of residential units feasible as the farm emits a powerful odour. The layout for Option A is illustrated in Figure 3 above.

In both layouts the green open space is located to minimise the potential impact that the proposed development will have on the drainage line that transverses the site in a north east - south west orientation. Layout alternative B offers a residential component however this may not be socially appealing due to odours from the neighbouring mushroom farm.

Figure 8: Photograph of a section of site 2 facing south.

3.1.3 Alternative 3: The development of the Shongweni Retail / Mixed Use Centre on Site 3

As stated above, site 3 is marginally outside the area allocated for the Shongweni Regional Town Centre, south of the N3 Highway. The co-ordinates for the centre of the site are 29°48'39.91"S and 30°45'09.81"E (Figure 9). This site is directly accessible to the N2 and J.B. McIntosh Drive (an extension of Kassier Road). The topographical characteristic of the land is flat encroaching into a diverse Sandstone Sourveld Grassland on the eastern boundary. The slope of the land allows water to drain into the uMhlatazana River Corridor flowing into the Clifton Canyon Core Open Space Asset, in the east. The labour cottages on this site do not fall within the ambit of the KwaZulu Natal Provincial Heritage Act No 4 of 2008 however recommendations to

preserve their historical influence have been included in the Heritage Impact Assessment (outlined in section 4.4 below).

Figure 9: Aerial Map Showing the Location of Site 3. The Green Represents the Diverse Grassland on the Eastern Boundary. The Cross shows the Location of the Mushroom Farm.

Site 3 is 65.88 hectares in total with the layout incorporating 5 land uses; tourism and recreational (4.61ha), business (13.38ha) road network (4.0ha), commercial (12.04ha) and green open space (31.84ha). 12 individual land parcel units available for purchase will be constructed. The layout is illustrated in Figure 5. As per Alternative A for site 2, the residential activities component is not perceived as a feasible land use due to the close proximity of the mushroom farm (marked with an X in Figure 5). The farm emits a powerful odour. Please note that the extent and shape of the site does not lend itself to the proposed development and is therefore not the preferred site alternative for this particular proposal.

The vast majority of the green open space is located at the eastern side of the site in order to minimise the potential impacts that the proposed development will have on the uMhlatazana River Corridor. The grassland has been identified as an important area to retain for floral diversity and will be incorporated into this open space area. Due to the location of the site as well as the environmental characteristics, the area available for commercial and business use is reduced, decreasing the appeal of providing a regional town centre to the Shongweni area.

Figure 10: Photograph of a section of site 3 facing south-east.

3.1.4 The no-go option: The Shongweni Retail / Mixed Use Centre will not be constructed

The no-go alternative would result in the new regional centre either not being developed or being developed in an area that has not been identified by the Shongweni LAP as being suitable for this land-use. All three sites would remain under sugar cane cultivation which is not in line with the intended use as detailed in the Shongweni LAP. Freshwater ecosystems on site would however, remain in their existing condition. There will be no reduction in the wetland size however no wetland rehabilitation would take place either. Alien invasive vegetation would remain along the riparian zones on all three site alternatives. There is no development layout for this alternative.

Table 9 below summarises the main advantages and disadvantage of each alternative discussed above thereby providing a comparative assessment.

Table 9. Advantages and disadvantages of each alternative for the development of the proposed Shongweni Retail / Mix Use Centre.

	Advantages	Disadvantages
Site Alternative 1	• Positive economic impact with the provision of potential employment and business opportunities. • The site has been identified by the Shongweni LAP and Outer West SDP as the ideal location for the new regional town centre. • The site is optimally located between the M13 and N3 Highway interchange. • The site can accommodate high density residential. • Reduce the amount of sugar cane farming in the precinct, a desired effect of the Shongweni LAP. • Stimulate investment and trading along the proposed freight corridor (i.e. N3 Highway). • Well located adjacent to the Petrol Filling Station along Kassier Road. • The market demand and socio-economic specialist expects that there will be a positive impact on local supporting businesses.	• In order to develop the site to maximise its development potential and accommodate the major regional retail centre, there would be an impact on the drainage lines and wetland system on the site. • Potential impact on the uMhlatazana River Corridor which drains into Giba Gorge, a biodiversity hotspot. • Increase in traffic. • Increase noise in the area during construction and operation. This is likely to be a nuisance to residents in the neighbouring area (i.e. Assagay Hotel located north-west of site 1). • Loss of agricultural land. • Site is steep with areas of slope failure having been identified by the Geotechnical Report (summarised in section 4.2.2 below). • High development cost due to the topography resulting in significant earthworks being required. • Site used by horse riders for out-rides and trails will be impacted. • Increase in stormwater runoff from hardened surfaces to potentially transport pollutants and excess sediment into the freshwater ecosystems on and adjacent to the site.
Site Alternative 2 (preferred)	• Positive economic impact with the provision of potential employment and business opportunities. • Improve the services in the area. • The gradient is much gentler compared to the other two sites resulting in less earthworks and more stable slopes. • No apparent open space system constraints. • There are no neighbouring residential communities that would otherwise be impacted on during construction or operational activities. • Traffic impacts during construction and operation will be lower than Site Alternative 1. • Reduce the amount of sugar cane farming in the precinct, a desired effect of the Shongweni LAP. • Stimulate investment and trading along the proposed freight corridor (i.e. N3 Highway). • The market demand and socio-economic	• Increase in traffic. • Loss of agricultural land. • Access not as good as Site Alternative 1, as the site is further from the M13. • Layout does not include a residential component due to the close proximity of the Mushroom Farm and Shongweni Landfill site (both give off an unpleasant scent) as well as the strategic location adjacent to the N3 Logistics Corridor. • Increase in stormwater runoff from hardened surfaces to potentially transport pollutants and excess sediment into the freshwater ecosystems on and adjacent to the site.

	specialist expects that there will be a positive impact on local supporting businesses.	
Site Alternative 3	• Positive economic impact with the provision of potential employment and business opportunities. • Land is not as steep as Site 1 however not as flat as site 2. • Improve the services in the area. • Traffic impacts during construction and operation will be lower than Site Alternative 1. • Reduce the amount of sugar cane farming in the precinct, a desired effect of the Shongweni LAP. • Stimulate investment and trading along the proposed freight corridor (i.e. N3 Highway). • The market demand and socio-economic specialist expects that there will be a positive impact on local supporting businesses.	• Increase in traffic. • Loss of agricultural land. • Access not as good as Site Alternative 1, as the site is further from the M13. • The layout does not include residential activities due to the close proximity of the Mushroom Farm and Shongweni Landfill site. • This site is directly adjacent to the Mushroom Farm and closest to the Shongweni Landfill site which both give off a strong scent. • Site 3 is the closest to the Clifton Canyon Core Open Space Asset and contains drainage lines adjacent to and within the site ultimately enter this biodiverse area. • Increase in stormwater runoff from hardened surfaces to potentially transport pollutants and excess sediment into the freshwater ecosystems on and adjacent to the site.
Alternative 4 (no-go)	• The existing land use would continue and thus there would be no increase in the amount of noise in the area. • There would be no significant impact on the economic conditions on site with commercial sugarcane farming continuing. • Given that the site would remain unaltered there would be no loss of open space and the environment will remain functioning as per the current state.	• The sites would remain unchanged and continue to operate as a commercial sugarcane farm, which is not a desired effect of the Shongweni LAP. • There is no requirement to upgrade the infrastructure (including the road network) on site or in the surrounding area. • The development of the regional town centre would not be fulfilled at this stage. This regional town centre forms an important link on the proposed N3 freight corridor. • From a biodiversity perspective, the monoculture (sugar cane) farming is undesired in this precinct. • Wetlands and drainage lines invaded by alien species would remain in poor functional state (i.e. no rehabilitation measures to take place). • There will be no socio-economic development benefits i.e. new jobs, business opportunities, housing, roads etc.

3.2 Bulk Services

An Engineering Services Report (ESR) was prepared by Bosch Stemele in October 2013 (Appendix 3). The report outlines the existing bulk services available on the sites, the bulk services required to serve the site options and proposals for the provisions of these services. The services discussed include water provisions, sewerage, stormwater provisions, upgrading of the road network, and solid waste management. In order to provide a more detailed investigation on certain services in the area, additional specialists were commissioned to report on their specific area of expertise. The additional specialist studies include details on the transportation opportunities (Arup), stormwater management (Bosch Stemele) and electrical services (Bosch Stemele).

The sections below are dedicated to each of the bulk services required. Findings from the specialist ESR are included in the sections and where the additional specialists have provided input, their reports have also been included in the summary and referenced.

3.2.1 Road Networks

Bosch Stemele stated in the ESR that all three proposed sites are well served by the N3 highway, which does not provide a capacity constraint. Kassier Road, the spine road for all three sites, would however require capacity upgrades if any of the proposed sites are developed. All site options would require various upgrades to the surrounding road network implemented as phasing demands. With regards to the internal road network, provisions will be made for pedestrian access and all roads will be surfaced across all three sites. The section below provides more detail on the Traffic Impact Assessment.

3.2.1.1 Summary of Specialist Findings of the Traffic Impact Assessment [Regulation 31 (2) (j)]

A Traffic Impact Assessment (TIA) for the proposed Shongweni retail/mixed use development was conducted by Arup in March 2013 (Appendix 4). The report addresses the traffic impact of the proposed development on the surrounding road networks and makes recommendations on access requirements and road network improvements to accommodate the increase in traffic. Arup have developed an AM Peak Hour SATURN Traffic Simulation Model to assess the future impact on the road network of the Shongweni development and determine upgrade requirements. There have been a number of recalibrations and validation (see Appendix E of the TIA for the Calibration and Validation report). The AM Peak Hour SATURN Traffic Simulation Model is used to in this Traffic Impact Assessment and a PM peak model has been developed as part of this TIA. Since only one site is to be developed, the TIA has assessed the road network requirements independently for each site alternative.

There are 5 main roads in the Shongweni area that are relevant to the proposed development. These include the N3, M13, R103, Kassier Road and Shongweni Road (indicated in Figure 11 below). The seven key intersections are also indicated in Figure 11 and include:

1. Kassier Road / MR 559
2. Kassier Road / N3
3. Kassier Road / Cliffdale Road
4. Kassier Road / M13 Interchange
5. Kassier Road / Alverstone Road
6. Kassier Road / R103
7. Shongweni Roaf / M13 Interchange

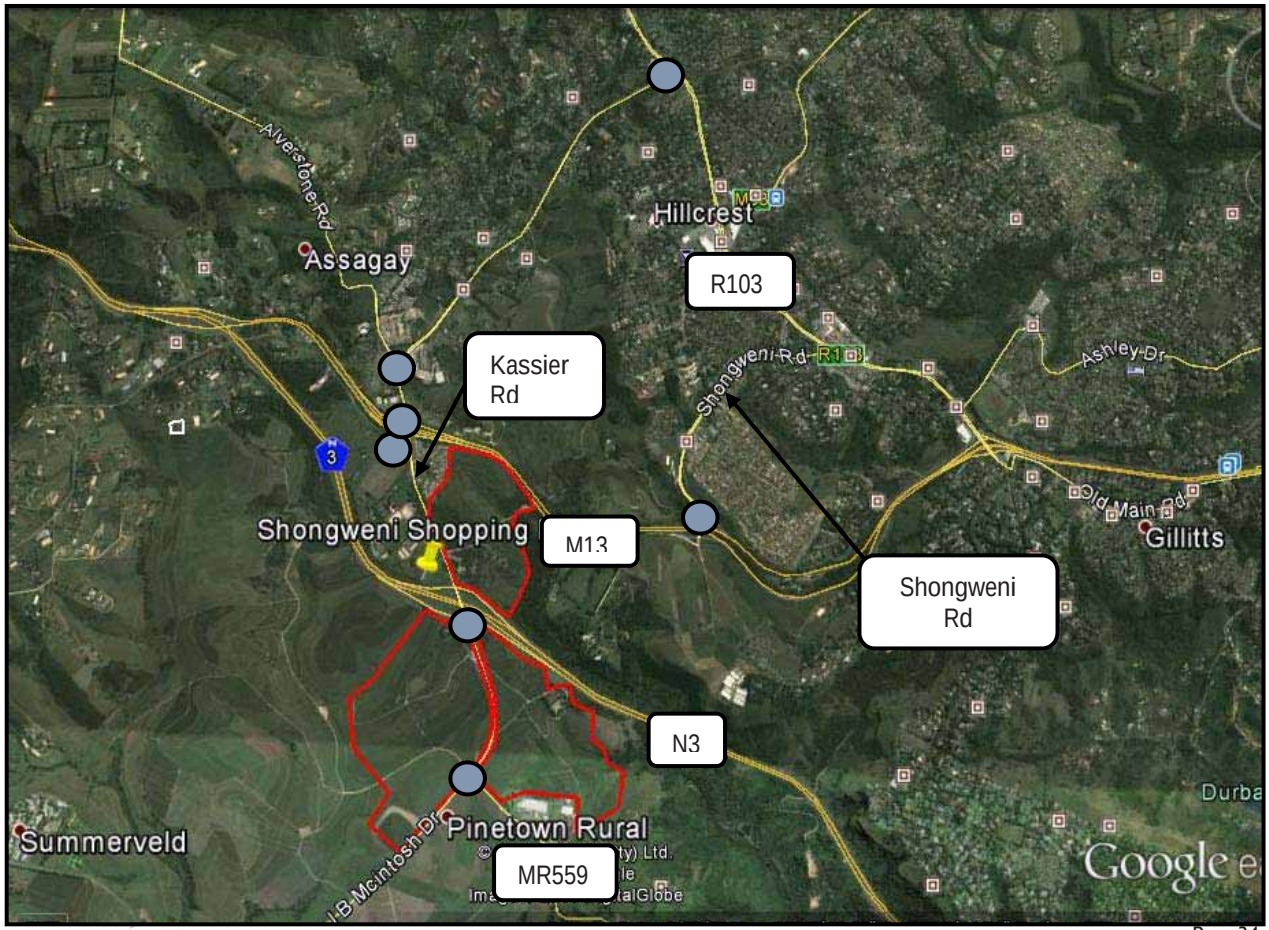


Figure 11: Aerial photograph indicating the road networks associated with the proposed site alternatives (outlined in red). Key intersections that will require upgrading or other recommended improvements are illustrated with blue circles.

The existing road networks listed above is described in section 2.0 in the TIA (Appendix 4 of the EIR). The current Level of Service (LOS) was determined for each of the intersections. The LOS provides a base against which future situations can be compared to indicating whether the intersection requires upgrading in the future (to cope with future traffic growth and/or additional traffic from the proposed development). The LOS for all intersections are currently operating at level C or less during the AM peak flows, apart from the Kassier Road / M13 Interchange which is operating at a LOS D. Those operating at a LOS C may require future upgrades to cope with the increase in traffic with a LOS D indicating that this intersection is close to capacity. For the PM peak flows, all intersections are operating at a LOS C or less.

The trip generation rates were based on those from COTO trip generation rate manual. The trip generation rates for each land use and the reductions applied are outlined in section 3.1 of the TIA. Section 3.2 describes the trip distribution calculations. These vary between the sites due to the different land use ratios etc. For all three site alternatives however, Kassier Road will be upgraded to a minimum of two lanes in each direction.

Site 1: Figure 3 in the TIA (page 18) shows the proposed layout for the key intersections, site accesses and a new link road. The proposed upgrades for the key intersections are listed in Table 6. The proposal includes the construction of a new link road from the back of site 1 connecting to Shongweni Road. SANRAL are in the process of looking at a number of interchanges on the N3 to determine upgrades for continue functionality over the next 10 years. According to SANRAL's plan (provided in Appendix D of the TIA), SANRAL has more capacity than required for the predicted traffic flows passing through the interchange at site 1.

Site 2: Two analyses were carried out for the proposed site. One trip generation rate excluded the public transport corridor which is to run along Kassier Road and the other trip generation rate was reduced by 15% to include the public transport corridor. Figure 4 in the TIA (page 20) shows the proposed layout for the key intersections without the public transport corridor and more details on the specific upgrades are listed in Table 7. Figure 5 in the TIA (page 23) shows the proposed layout for site two with the public transport corridor and Table 8 details the upgrades. Only two of the intersections see a different layout from that without public transport (Kassier Road/N3 westbound and Kassier Road / Northern access).

Site 3: Figure 6 in the TIA shows a plan of the design of the key intersections within the study area and Table 9 lists the key intersection upgrades.

A condensed list comparing the proposed interchange upgrades for all three site alternatives is provided in Table 11 of the TIA.

To accommodate the provisions for public transport in the short term, laybys would be located on Kassier Road, close to intersections. In the longer term, public transport will need to align with eThekwini's IRPTN strategy however there are currently no public transport corridors planned along Kassier Road. A sufficient road reserve is therefore recommended to ensure incorporation of public transport at a later stage if required. Linking public transport into eThekwini's planning is detailed further in section 7.0 of the TIA. The public transport interchange is to be located close to the busiest part of the development thereby reducing the trip generation rates.

Non-motorised transport (e.g. pedestrians and cyclists) has been taken into account with sidewalks within the development and on Kassier Road being a minimum of 3 metres.

The traffic specialist has stated that intersection upgrades as proposed by Arup, are in line with the current SANRAL and eThekwini Municipality plans for upgrading the NS interchange and Kassier Road. The only difference is the number of lanes required from the site access points to the M13 interchange (Arup indicates at least three lanes are required compared to the proposed two).

The traffic specialist made the following recommendations under section 9.2 of the TIA:

- Upgrade recommendations as per Table 11 for the respective site that will be constructed;
- If Site 2 is developed then in the future a loop may be required at the Kassier Road / M13 eastbound interchange in order to ease the right turn movement from the southern arm onto the M13;
- That a SCOOT system is considered for the area to help with traffic flow through the various key signalised intersections;

- Construction of a public transport interchange within the site and laybys on Kassier Road;
- In the long term ensure that the public transport aligns with the IRPTN strategy and that sufficient road reserve is maintained to provide a BRT lane if required;
- Minimum width of 3m for sidewalks, both internally and externally, to safely accommodate pedestrians and cyclists;
- Maintain a 30m road reserve along Kassier Road. In addition, all new roads intersecting with Kassier Road should also have a 30m reserve.
- Adequate road reserve splays should be provided at all intersections to accommodate future road widening or grade separations;
- The building line along Kassier Road should remain at 15m and not be relaxed in case of additional infrastructure over and above that detailed in Table 11; and
- For each phase of the development an individual TIA is carried out for that portion of land in order to update the modelling and to account for changes in travel patterns that may occur in the future.

Identified environmental risk: increase traffic/congestion and dust during construction. Positive impact with the incorporation of public transport and non-motorised transportation into the proposal.

3.2.2 Stormwater

Bosch Stemele indicated in the ESR that the stormwater control philosophy for all three sites will be to restrict post-development flows into the catchment to less than 10% of pre-development and to facilitate ingress of stormwater to replenish the wetlands in the natural drainage lines. Roadways will be provided with piped stormwater drainage and inlets designed to allow flow into the pipes when the swales reach a pre-determined capacity. Piped drainage is also required across intersections etc. Energy dissipation measures are required to be implemented where these pipes discharge into the natural watercourses. Additional attenuation facilities will be provided in the main water courses to restrict flows in larger rainfall events to encourage feeding the water into the wetlands. The section below provides more detail on the proposed Stormwater Management Plan for site 2 specifically.

3.2.2.1 Summary of Findings of Stormwater Specialist [Regulation 31 (2) (j)]

The Stormwater Management Plan (SWMP) caters specifically for Site 2 (88ha in size; Annexure C of Appendix 3). The eThekwini Municipality design guidelines and policy for the design of Stormwater Drainage and Stormwater Management Systems (May 2008) has been incorporated in this Management Plan.

The SWMP provides a guideline on holistic management of stormwater for the development of the site. It has the following purposes:

- To ensure compliance of the overall site with relevant legislation from a stormwater run-off perspective,
- To provide a practical, achievable & sustainable plan and methodology of managing stormwater run-off from site,
- To protect the health, welfare and safety of the public from damage by stormwater and floods,
- To protect against property damage from stormwater and floods,
- To prevent erosion of soil by run-off,
- To conserve the fauna and flora of the natural environment including wetland and riparian zones,
- To protect and enhance the natural water resources in the sub catchments from pollution and siltation, and
- To develop a conceptual surface water run-off management policy.

The site is undulating with slopes ranging from 6-35% and is existing sugarcane farmland. A number of small tributaries ("the Wekeweke stream") drain through the site in a southerly direction and join up with the Sterkspruit River before draining into Shongweni Dam (7km south-west of the development). The dam then drains into the uMlazi River. There are a number of wetland features associated with the tributaries.

The proposed development will "flatten" out the current steep slopes with overland slopes in the region of 0.6-3.3%. There will be an internal access road between platforms. The proposed topography will retain the drainage direction to the existing tributaries.

Section 2 of the SWMP describes management responsibilities with THD developing the overall bulk infrastructure and eThekwini Municipality being responsible for water discharged from the development. A more detailed layout and operation of

the stormwater system will need to be defined in the detail design of the development. The development is above the 1:100 year floodline.

The major risks identified are:

1. Potential flooding

Increase in impermeable surface area resulting in increased run-off. There is a risk for flooding on-site and off-site (existing access roads and wetland areas).

2. Erosion

An increase in run-off will result in increased likelihood of erosion. The south-west portion of the site is more susceptible to erosion, especially during construction, due to its steeper gradient. It is therefore recommended that run-off be routed away from direct discharge at embankments.

3. Pollution

Increased pollution risk to the existing wetlands and tributaries. The pollution could include hydrocarbons, total suspended solids and domestic waste during operation as well as general construction waste. Bio-attenuation swales and infiltration measures (permeable paving) are to be applied at the point source to reduce pollutants entering the stormwater.

4. Sedimentation

Build-up of potentially contaminated transported material in the wetlands.

5. Environmental Impacts

Improper management of stormwater on the site could negatively affect the wetland areas and tributaries currently receiving water from run-off from the property.

The stormwater system on site is to take into account:

- Minor stormwater system (low/medium rainfall events with a high occurrence interval) to address runoff from individual sites, car parks etc. Includes kerbing, gutters etc. It is proposed that the minor system on all individual sites be designed to handle a 1 in 5 year storm event.
- Major stormwater system (high rainfall events with a low occurrence interval) to address the natural streams and wetlands draining south which includes attenuation dams. It is proposed that the major stormwater system be designed to handle a 1 in 50 year storm event however cognisance is to be taken of risks by 1 in 100 year storms.

The stormwater system design is to reduce the stormwater flow to within 10% variance of the pre-development flow, prevent concentration of runoff, avoid ponding, avoid destabilisation of existing/proposed banks, ensure compliance with local authority standards, construct pollution reducing systems and ensure construction is carried out in a safe and acceptable manner. The most important design philosophy being the recharging of the natural wetlands and streams.

Run-off from individual sites be limited to within 10% of pre-development run-off for a 1:5 year storm event. The first 25mm of precipitation will be retained for infiltration and recharging of the wetlands and stream (see Annexure B dwg. 0243/192/SW006 of the SWMP attached as Annexure C of Appendix 3 of the EIR).

Stormwater Modelling parameters are outlined in section 5.4 of the SWMP and include rainfall data, design storm frequencies and run-off generation. Sustainable Urban Drainage System (SUDS) standards are to be included in the drainage system including significant infiltration measures such as soakaways (in line with eThekwini Municipality guidelines and amounts to 225m³ of storage for each hectare of hardened area) and/or permeable surfacing to intercept roof run-off. The peak run-off volumes will still be managed by the major storm systems.

Proposed attenuating measures:

- Major stormwater run-off control preventing erosion on unstable engineered banks. The specialist recommends that kerbing upstream of embankment slopes be constructed to divert flow to a stabilised channel. Energy dissipaters will also be required on the outlets from underground conduits/run-off from embankments.
- The large nature of the road reserves will not significantly contribute to run-off although runoff from the road will be directed to roadside swales for infiltration.

Catchment hydrology results and conceptual model run-off figures are included in section 5.7 of the SWMP and included in Annexure C of the report.

Recommendations:

A. Site establishment and preliminary activities

- All existing drainage systems (streams, channels) are to be maintained by the main developer in accordance with normal agricultural soil conservation practices and local authority guidelines as far as possible (except where the town planning layout makes provision for the development of land over existing drainage systems).
- Access routes to the construction site must follow existing access roads as far as possible.
- Should new access roads be required these must be constructed in a way to minimise concentrated flow run-off and pollution to the existing wetlands.
- Prior to moving onto site, the Engineer and Contractor shall inspect the existing stormwater drainage measures along these access routes and repair or construct new drainage measures to limit point source run-off, prevent erosion and allow for the natural flow of water (side drains and mitre drains; scour check walls of rocks, wooden pegs or bundled brush, constructed in long runs of side drains for the varying gradients outlined in the SWMP).
- The clearing of vegetation for the contractor's site camp is to be limited to the site camp area only.
- The creation of hardened surfaces within the site camp area is to be kept to a minimum and is to be agreed to by the Engineer prior to construction.
- Any soil or topsoil stockpiles created during site establishment are to be maintained as flat as possible, with no side slope greater than 1 in 4.
- The stockpiles are to be covered with cut brush found on site to provide wind screening and prevent soil loss.

B. Construction

- Stripping of vegetation to allow commencement of construction of the earthworks platform shall only be undertaken immediately prior to that element of construction commencing.
- Construction of the embankment shall be done in segments up to full height, before moving on to the next area, clearing vegetation, and constructing embankment, etc.
- The construction of internal stormwater piped systems are to be programmed for construction immediately on completion of the bulk earthworks for the road works.
- Any soil or topsoil stockpiles created during the construction phase is to be maintained as flat as possible, shall not exceed 6m in height.
- Materials from stockpiles are to be used as soon as is practically possible or spread and spoiled in designated areas.
- Construction vehicles must be restricted to demarcated access routes and turning areas.
- To minimize the time that an area is exposed, the stripping of vegetation is to be carried out progressively and immediately prior to commencement of construction activities in a particular area.
- Topsoiling and re-vegetation of exposed surfaces is to commence immediately after the completion of all construction activity.
- All embankments or cut slopes, unless otherwise directed by the Engineer, shall be protected by a cut off drain to prevent water from cascading down the face of the slope.
- No dumping of construction rubble or spoil is to occur in completed stormwater drains, pipes, channels or natural drainage lines (existing wetland, stream and riparian zone).
- Weekly checks are to be carried out on the site's drainage system to ensure that the water flow is unobstructed. These are to be repaired or cleared of silt if required.
- All undeveloped surfaces hardened due to construction activities are to be ripped, topsoiled and vegetated as soon as possible.

C. Maintenance guideline recommendations

- It is good practice to reserve certain months of the year before the onset of the summer rains to carry out routine maintenance work on the stormwater system. Serious problems should however receive immediate attention. Work which is of a critical nature should be done under the supervision of a professional engineer or according to his instructions.
- All kerb inlets need to be inspected and cleared of any build-up of silt, litter, vegetation or rubble that may impede the clear flow of water into the inlet. It also needs to be inspected for structural damage and repaired if necessary.
- Piped systems need to be checked in a systematic way to ensure they are clear of any obstructions and are able to flow at their full capacity. Any build-up of silt or other obstruction is to be removed by hand or by jetting.
- Swales need to be check and cleaned at regular interval. Excess vegetation and/or silt build up in swales is to be removed on a periodic basis.
- Routine inspection should be carried out every three months by a competent person appointed by the responsible body or association. The required qualification for such a person is that they shall be well acquainted with the contents of this document, should be alert and be endowed with sound judgement so that he/she will know when to call for assistance, arrange for maintenance or immediate intervention.
- The following inspection route to be followed should include the following:

i) Kerb inlets for blockages or structural damage.
ii) The full length of the main drainage swales and piped outlets (inspected for erosion, poor vegetation, silt deposition, blockages or damages to structures).
iii) The full length of the crest, toe, upstream and downstream slopes of the embankments surrounding the detention dams. These should be inspected or any signs of open cracks, sink holes or piped tunnels or poor vegetation.
iv) Inspect the inlet and outlet works from each of the detention dams, as well as the area around and downstream of the outlets, for blockages, signs of erosion, silt deposition or undercutting of structures.

- During the inspection maintenance requirements are to be noted and arrangements made to complete these works

Identified environmental risk for site 2: risk of flooding on-site and off-site due to the increase in hard surfaces, increased runoff across the site increasing erosion particularly in the south-west portion, potentially polluted stormwater and increased sedimentation entering the existing wetlands and tributaries, insufficient recharging of wetlands. Erosion on site as a result of high runoff from steep platform embankments that are currently proposed, premature or excess removal of vegetation resulting in a potential increase in sediments entering the existing wetland system to the west of site 2.

3.2.3 Sewerage

The ESR stated that full waterborne sewage reticulation will be provided for the proposed development (Appendix 3). It is anticipated that the Shongweni Retail/ Mixed Use Development will generate approximately 0.4Ml/day and 1.4Ml/day of effluent if full use is made of the proposed "bulk".

The bulk sewage proposal is based on the Hillcrest Works decommissioning and pumping/gravitating the sewer down to the Umhlatuzana Sewage Treatment Works. Associated infrastructure has been approved as part of a separate EIA (DM/0024/10), which took into account potential sewage for the proposed development. The environmental authorisation includes;

- Potentially replacing the Hillcrest Sewerage Treatment Works with a 6Ml/day pump station
- The construction of a 6Ml new pump station and rising main in order to cross the N3 to a point where it can gravitate.
- Gravity main from this point down to the existing outfall gravity main feeding the Umhlatuzana Sewerage Treatment Works.

The layout of the bulk sewers is included in Annexure D of the ESR (Appendix 3).

Not all of the sewer from the 3 developments can gravitate into the proposed outfall main or the converted pump station at the Hillcrest works therefore each site alternative will require secondary pump stations (26x25m) located at low points on the periphery of the development (location of the various pump stations indicated in drawings in Annexure E of the ESR).

Please note: The green lines in Annexure E indicate the proposed Ntshongweni rising main which will tie into the recently approved uMhlathuzana rising main/gravity main. Although the proposed bulk sewage pipelines exceed 1000 metres in length, the pipeline does not fall within 32 metres of a watercourse (please see 100 year flood lines mapped by Goba during the THD sewer reticulation EIA DM/0024/10; Appendix 5). The majority of the proposed sewerage pipeline will be constructed within the Kassier Road reserve.

The secondary pump stations and associated rising mains for site alternatives 1 and 3 may transverse minor valleys or stream lines and care will be taken to minimise the effect on these environmentally sensitive areas. Pipe bridges will be used in most cases (Annexure G of the ESR).

Identified environmental risk: proposed sewer pipelines for sites 1 and 3 disturbing minor stream lines where the pipelines traverse minor valleys.

3.2.4 Water Provision

Water supply falls under the eThekwini Water Services (EWS). There is no water supply with sufficient capacity in the development area however EWS have confirmed that a supply can be taken off the proposed and soon to be constructed Western Aquaduct (northern boundary of the proposed Assagay node; Annexure D). The applicant is currently in the process of obtaining official service confirmation from EWS, which will be attached under Appendix 6 of the Final EIR.

A 500mm diameter steel pipeline from the Western Aquaduct to the preferred ultimate reservoir site will be required (approximately 5.5km), as indicated in Figure 12 below. The greatest demand for the proposed development site options (1.72Ml/day) will require a 3.5Ml reservoir at a high point as illustrated in Annexure E in the ESR (Appendix 3 of the EIR). The reservoir location is shown in Figure 12A (29□47'42.64"S; 30□43'31.84"E). 300mm diameter bulk water supply lines will be required originating from the reservoir to the proposed site alternative. The 300mm diameter bulk water supply lines, falling under the threshold triggering environmental authorisation, are also included in the scope of works for this environmental authorisation. The physical environment associated with the pipeline route is discussed further in the following section which includes summaries of the specialist studies under taken.

Annexure G of the ESR describes the method used to cross watercourses. Where pipelines traverse minor valleys or streams, small pipe bridge structures will be the preferred method of crossing (see typical drawing in Annexure G of the ESR). Larger wetland areas/water courses will be crossed using one of two methods (depending on the topography and geotechnical conditions).

1. Bridge structure with multiple piers founded within the wetland or a suspended structure with fewer foundations within the wetland. These structures could also be used on very steep valleys and thus avoid any impact on the environmentally sensitive areas.
2. Trenching will be used over flatter wetland areas and buffers. This requires excavation. Where rock underlines the water course the pipeline would be secured to this bedrock and protected with a concrete weir type structure. Should the river crossings be within softer material then the pipeline will be encase in concrete and designed to withstand flood conditions.

The constructor will be required to produce a detailed method statement specifying the proposed construction method which will be reviewed by both the engineer and ECO prior to any work commencing in any of these environmentally sensitive areas. The engineer anticipates that trenching would be the preferred option for the majority of the crossing however this will be finalised following topographic and geotechnical surveys.

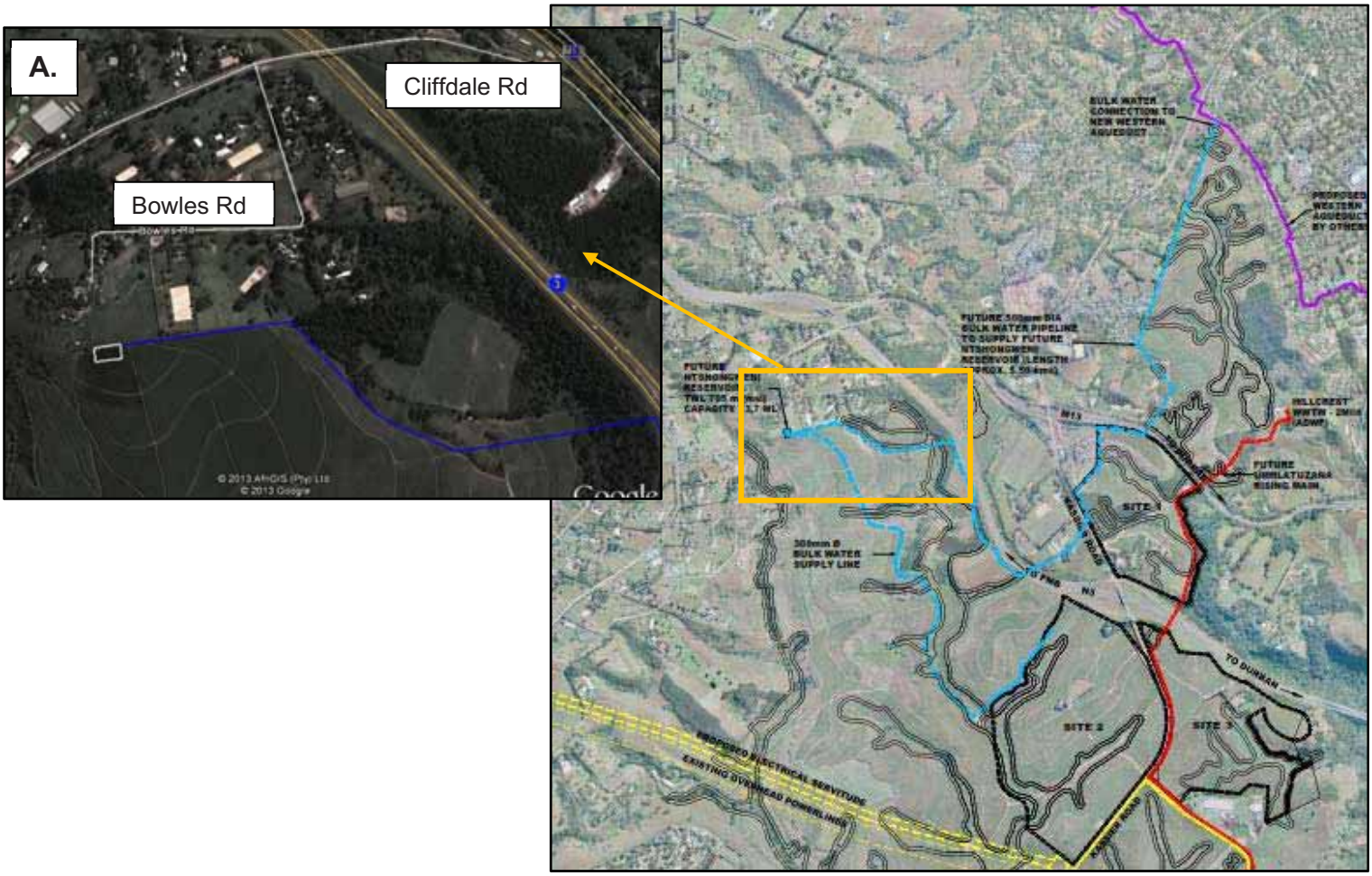


Figure 12: Proposed water pipeline route illustrated in blue above (source: Bosch Stemele, October 2013). The proposed location of the 3.5Ml reservoir is represented by the white rectangle in Figure 12A (source, Google Earth, 2013).

Water to each erf will be to municipal pressure standards and each erf will be individually metered. Reticulation will be designed to accommodate fire flow. Sustainability measures including rain-water harvesting will be implemented. Potable water will not be used for irrigation but sourced from stormwater run-off and current sugarcane irrigation raw water supply.

Identified environmental risks: Positive impact would be the sustainability measures which include rain-water harvesting and potable water not being used for irrigation.

3.2.5 Electricity Supply

Bosch Stemele stated that the Ntshongweni area is supplied with electricity from eThekwini Electricity (north and northwest area) and Eskom (south and southwest area). The 3 site options proposed for the Ntshongweni Phase 1 development have electricity demands of 16.8MVA, 29.6MVA and 10.6MVA with the total electrical load requirement in the order of 31.83MVA. All site alternatives will require new infrastructure to meet their full load requirements with one new major substation being required.

The Preliminary Services Report – Electrical conducted by Bosch Stemele in August 2013 outlines the existing electrical infrastructure and the development requirements in detail (Annexure F of Appendix 3 of the EIR and summarised below). The layout of the bulk electrical is illustrated in a drawing in Annexure D of the ESR (Appendix 3 of the EIR) and includes the proposed locations of the 90x90m 60MVA 132/11kV substations for each development alternative (indicated in yellow).

The interim electrical supply will be from two MV underground cables from Marianridge major substation and ultimately a proposed new 46m servitude for a new 132kV overhead transmission line from Eskom Gorgedale substation (south of site 2).

3.2.5.1 Summary of Findings of Electrical Specialist Services Report [Regulation 31 (2) (j)]

The report establishes the electrical load required for the proposed development, determines an effective design for supplying the electricity and includes correspondence with eThekwini Electricity, the Supply Authority. Agreement and Approval is required from eThekwini Electricity for the 11kV cabling from the Marian Ridge major substation to the development (site 2, option 2) and for the establishment of a 132kV major substation, overhead transmission lines and servitudes.

Load factors as per Annex B of NRS 069: 2004, approved by eThekwini Electricity, were used to formulate the preliminary planning criteria. The potential electrical load at the major substation/s after diversity factor applied will be approximately 31.83 MVA.

Existing & Future Electrical Infrastructure

Transmission (132/11kV): The Marian Ridge substation is 9.4km from the proposed development (site 2). It is the only substation that has 5MVA spare capacity which is required to meet the initial development requirements. One new 132/11kV, 60MVA major substation will be required adjacent to the development area for the ultimate development and surrounding region. System strengthening may also be required on the 275kV transmission line infrastructure. HV Planning have indicated that a new 275/132kV substation will be required in the future and are currently assessing a suitable site.

Transmission Line Servitudes: There are no registered servitudes within the phase 1 development. Transmission line servitudes are required outside the development area (overhead/underground). eThekwini Electricity have to liaise with Eskom for a 132kV feeder from Eskom's Gorgedale Substation (13.2km from development) to provide the feed for the new 132/11kV major at eNtshongweni.

Distribution (11kV): There is an 11kV supply in the vicinity but it is unable to support the additional load. Two 11kV supplies will therefore be taken from the Marian Ridge major substation to the development. The supply will initially feed into a distribution substation. These substations will be positioned throughout the development. From here, 11kV cable routes will be planned to run adjacent/close proximity to the proposed sites allowing sales transfers of sites to take place.

Reticulation: No electrical supply (at 400V) is currently available. For Industrial/ Business Park and offices internal electrical reticulation will be undertaken by each top structure developer to meet his requirements. The applicant will be responsible for the costs for the 11kV bulk supply to the boundary of these developments. For the residential developments, transformers and low voltage circuits will need to be positioned (cost borne by THD). Not applicable if development sold off as a multiple unit gated development or similar.

Street Lighting: Since no street lighting currently exists, provision has been made for both street lightening and public open space lighting. When street lighting standards exceed that of eThekwini Electricity, a separate service level agreement must be entered into. The specialist recommends that lighting form part of a separate report due to the aesthetic requirements of the urban architecture.

The electrical specialist is to correspond with the Supply Authority once more detailed information becomes available. A preliminary design needs to take place.

Identified environmental risk: nominal pressure on the eThekwini Municipality local major substation in the area.

3.2.6 Solid Waste

The ESR includes provisions for solid waste management (Appendix 3). The development falls within the jurisdiction of eThekwini Municipality and therefore Durban Solid Waste (DSW) will be responsible for the provision of waste collection. The nearby Bulbul Drive landfill site has adequate capacity to accept waste generated by the development. Other waste collection models could be implemented, which could include contracted waste collectors and recycling. Temporary storage of more than 100m^3 of general waste will trigger a waste license in terms of section 19 (1) of the National Environmental Management Waste Act, 2008.

Identified environmental risk: potential to increase the pressure on receiving landfills.

4.0 Description of the environment and the manner in which the physical, biological, social, economic and cultural aspects of the environment may be affected by the proposed activity [Regulation 31 (2) (d)]

The NEMA (107 of 1998) states that the "environment" is made up of:

(i) The land, water and atmosphere of the earth;
(ii) Micro-organisms, plant, and animal life;
(iii) Any part or combination of (i) and (ii) and the inter-relationships among and between them; and
(iv) The physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being.

This section aims to describe the various aspects of the environment that may be affected by the proposed development. The physical and biological characteristics of the proposed site are therefore discussed utilizing specialist reports which were commissioned to identify potential impacts that the proposed development could have on the environment as well as recommending mitigation measures to minimize or alleviate these impacts. Social, economic and cultural features within and surrounding the sites have all been identified and assessed to reach a holistic description of the environment that the proposed Shongweni retail/ mixed use development is located in.

4.1 Surrounding Land Use

All three of the sites are currently being used for commercial sugarcane farming. The historical infrastructure found on the sites is therefore associated with the production of mono-crops (i.e. labour compounds, central homesteads etc.). Kassier Road boarders all three of the proposed sites with the M13 bordering Site 1 and the N3, sites 2 and 3.

The Assagay Hotel, a residential complex is located on the north-west corner of site 1. From a visual perspective, this site alternative would have a negative impact on these residents in particular during the construction phase. Other construction impacts such as noise and dust are also likely to effect the residential complex. A petrol filing station is located next to the Assagay Hotel, adjacent to the proposed development of site 1. This site is popular with horse riders and mountain bikers who have been using the existing tracks for recreational purposes.

The Giba Gorge complex is located to the south of site 1 and 3. eThekwini Municipality's Environmental Planning and Climate Protection Department (EPCPD) and the landowners in the Giba Gorge area launched the "Giba Gorge Environmental Precinct"

in 2005. It is reportedly the first environmental Special Rating Area (SRA) in the country[3]. This area is a biodiversity hotspot which requires consideration especially during the stormwater management planning of the proposal.

Sugarcane fields boarders the east and south of site 2. In terms of land-use, there are no residents or other infrastructure that will be directly impacted on during the construction and operation of the proposed development.

Site 3 is bordered by roads on three sides with the Denny Mushroom Farm located directly south of the site. The Mushroom Farm as well as the Shongweni Landfill site (approximately 1.1km south of site 3), give off a strong scent which could impact development in the vicinity when considering a residential component in the layout. The Clifton Canyon Core Open Space which forms part of the Giba Gorge Complex, is located to the east of site 3. Similar to site 1, stormwater management planning would be essential to control the quantity and quality of water entering this system. Since there is no residential land usage adjacent to the site, site 3 is preferable from a social perspective with fewer impacts anticipated during the construction phase.

Identified environmental risks: loss of agricultural land, cumulative impact of the change in land use, improved infrastructure and services for surrounding land users, trigger for development in the Western Corridor between Pietermaritzburg and Durban.
Site 1: negative visual impact for residents in the Assagay Hotel, north-west of the development, loss of recreational activity space for local community, construction impacts likely to be greater on this site alternative.
Sites 2 and 3: proximity of mushroom farm and landfill to preclude the inclusion of a residential component into the development layouts (refer to Figures 4 and 9 above).

4.2 Physical

All three sites differ in terms of topography with site 1 comprising of a densely vegetated drainage line in the east (Figure 6 above) and a very steep, densely vegetated slope in the south-east. The freshwater ecosystem on site drains into the uMhlatuzana River (north-west to south-east direction). As stated above the site comprises of sugarcane fields and alien invasive species along the length of the drainage line. Water supplying the Giba Gorge complex, an identified biodiversity hotspot, does however originate from this tributary and it is therefore of high importance that any potential impacts that could effect this drainage lines are well mitigated against. Specific impacts have been identified by the various specialists in the sub-sections to follow with all impacts being listed in Table 10. There is infrastructure which has been identified on the site with medium local historical and social value. The cultural significance of the site is discussed further in section 4.4.

Site 2 is dominated by two north-east south-westerly trending spurs separated by a drainage line trending to the south-west. The general topography is much gentler than site 1. While the drainage lines on the proposed site may be highly disturbed, the valley bottom wetland system feeds into a larger system, which in turns feeds the Wekeweke River and Shongweni Dam. This offsite system is a healthy, well-functioning system delivering Ecological Goods and Services. As above, all possible impacts that could negative effect the downstream ecosystem quality, are to be identified and mitigated against (see Table 10 of EIR). There is infrastructure which has been identified on the site with low architectural merit. The cultural significance of the site is discussed further in section 4.4.

Site 3 is dominated by four minor hill tops situated along the N3 with steep embankments facing the freeway. The gradient becomes more gentle south of the N3 with moderately steep slopes from the west and the south. Moderately steep to steep slopes are evident sloping from the north and the east. The Sandstone Sourveld Gassland and a Scarp Forest is located along the eastern boundary of the site. The KZN Sandstone Sourveld was assessed as providing a high level of biodiversity maintenance services and therefore the proposed development should avoid impacting vegetation along the eastern boundary (the open space system has been located accordingly in the proposed layout). Similar to site 1, water drains off the site into the Giba Gorge Complex and is therefore of high importance that any potential impacts that could effect this drainage lines are well mitigated against as well.

The vast majority of the proposed bulk water pipeline traverses the Applicant's sugarcane fields however there is one area directly adjacent to a western section of the route, which has been identified as a remnant of Sandstone Sourveld (SiVest, October 2013 attached under Appendix 11. There is a huge amount of alien vegetation associated with the proposed disturbed area, which has been designed to run within existing servitudes (e.g. roads, fences etc.). No significant faunal species were identified along the proposed route during the site visit. The wetland specialist identified nine watercourse crossings (including a

[3] Seggie E. (2010) "New enviro precinct launched" *Engineering news* (http://m.engineeringnews.co.za/article/ethekwini-municipality-launches-new-environmental-precinct-2010-10-29).

20meter buffer). All watercourses crossed are the upper reaches of drainage lines apart from the uMhlatuzana River and a small wetland depression near the M13. The wetland specialist's findings as well as the fauna and flora assessments are included in the summaries below.

Potential impacts on the physical environment have been identified by various specialists (agricultural, geotechnical, wetland, vegetation, fauna and heritage). These reports are summarised in the sub-sections below and the full reports attached in Appendix 7 to 13. Mitigation measures and recommendations provided have been incorporated into the attached EMPr (Appendix 14).

4.2.1 Summary of Findings of Agricultural Specialists Assessment [Regulation 31 (2) (j)]

An assessment of the agricultural potential of Tongaat Hulett's Shongweni Estate was carried out by Mottram and Associates in 2012 (Appendix 7). Previous reports on the Estate have been referenced throughout the report, where relevant. The DAEA has been working with Tongaat Hulett and other role player in agricultural, rural and urban development to obtain an understanding between strategies to increase agriculture production whilst creating new investment opportunities along growth corridors.

Mottram and Associates carried out a basic soil survey, upon the DAEA requirements and a survey of all relevant crop species that could be cultivated on the land. A study was also made on the BioResource Units (BRU) that exist in this area. Detailed findings of the survey are included in section 3 of the report with a list of the soils found on the Shongweni Estate provided in Table 1. A description of the nine different soil forms on the Shongweni Estate is provided on pages 16-20 and include the erosion potential, infiltration rate, level of drainage and available soil water content.

The Estate falls within BRU Wb16 within the BioResource Group 3 (BRG 3.6) that is defined as Moist Coast Hinterland Ngongoni Veld. The natural vegetation consists of entirely bushed grassland. Although the Estate falls within the Shongweni Dam catchment area, it does not fall within a Controlled Area with respect to irrigation and water storage. The current water resources (two small dams and numerous small streams on the Estate), are not sufficient for irrigation of sugarcane currently being produced on the Estate.

The mean annual yield on the Shongweni Estate ranged from 31.46 to 45.42 tons per hectare per annum (t ha^{-1} $annum^{-1)}$, which the specialist stated was reasonable for dryland sugarcane in this area however there was evidence of a lack of nutrition and *Eldana* (African sugar-cane borer).

<u>Agronomic and Horticultural Crop Suitability</u>

Sugarcane:

Yields to date have varied and are on average over the last 8 years, deemed poor yields. Canesim, a sugarcane crop growth simulation model, was used to predict potential yields that might be obtained on the Estate. The yields predicted varied from 62 to 92 t ha^{-1} $annum^{-1}$. Due to the restrictions that exist on the Estate it is doubtful that such yields could be obtained let alone sustained. Currently, yields of 50 t ha can be sustained. In normal rain seasons with an average annual yield per hectare of 50 tonnes, an expected profit before CAPEX, tax, interest, etc. could be R 1 942985 or R 1 791 ha. The break-even yield potential is 45 t ha^{-1} $annum^{-1}$. Transportation to the sugar mill is a significant cost and is considered a limitation.

Bananas

Due to the lack of water for substantial irrigation, this crop is not an option.

Grasses

To produce Instant lawn would be a short to medium term enterprise and without sufficient irrigation, would not be a viable option.

Vegetable Crops

Certain vegetable crops, especially in winter months, could be grown on the Estate providing there was irrigation, secure fencing, and wind breaks. These crops are reasonably labour intensive and would provide employment to the local population. With high value crops and use of Municipal and/or borehole water vegetables could be grown especially under controlled environment conditions. There is a good market for perishable crops but water is the limiting factor.

Medicinal Plants and Trees

Limited demand outside KZN. Little cultivation currently exists due to the lack of knowledge of indigenous plant cultivation and economics of associated markets. Since medicinal plants generally grow in afforested areas, the choice on the Estate is minimal. This industry of cultivated medicinal plants is still in relative infancy and one would need to build up a stock in a nursery.

Cut flowers and potted plants, including indigenous trees

As this Estate is not situated in lower lying areas, sturdy structures would have to be erected to contend with wind conditions. This area also experiences misty conditions and high humidity, conditions that favour disease. A high level of management will be required for production, sanitation, harvesting, packing and marketing. There is potential competition in this market locally, however if selected niche products were available, this could be an option. If a licence for irrigation is not possible then use of municipal, dam or borehole water would have to be made to guarantee availability year round.

The specialist considered the cropping and land use options on the Estate together with the need for development along the N3 growth corridor. In KZN, the land used for sugarcane production has increase over the past 3 years by 17 835ha (15%) therefore the impact of the proposed development on sugarcane production is insignificant and will have little or no impact on Food Security in the region. Tongaat Hulett commenced with new sugarcane areas in 2009 with an additional 26 506ha of new sugarcane land becoming available at the end of 2015 (37% increase).

Identified environmental risk: none

4.2.2 Summary of Findings of Geotechnical Specialist [Regulation 31 (2) (j)]

The aim of the geotechnical investigation, carried out by Drennan, Maud and Partners in March 2012, was to obtain a general assessment of the geotechnical conditions of all three site alternatives. The geotechnical investigations for all three sites are included in Appendix 8 of the EIR.

The underlying geology and associated characteristics are very similar across all three site alternatives. A description of the topography of each site is given and the geotechnical results discussed. A more detailed geotechnical investigation will be required once more detail on the proposed earthworks/embankments is submitted to the Engineer. Figure 1 for all three site alternative geotechnical investigations, shows the drainage lines and potentially instable slopes. The field investigation methodology is outlined in section 2 of the reports and consisted of excavation of inspection pits, dynamic cone penetrometer tests and material sampling. Detailed laboratory results are discussed in section 4 with figures at the end of the report and values listed in Appendices 1-3 of the Geotechnical Investigation's.

Site 1: dominated by two hill tops with the northern hilltop accommodating a gated estate and the southern hilltop accommodating the sugarcane farming facilities. There are three major drainage line (south – south east from the northern hilltop; a drainage line between the two hill tops draining east and two smaller drainage suppressions draining from the southern hilltop south-east parallel to the N3 on ramp). Surface water was encountered to the south-east of the investigated area. All materials sampled were classified as G8 materials however the materials may range between G7 to G10 and are considered suitable for reuse in road and pavement works

Site 2: area dominated by two north-east, south-westerly trending spurs separated by a drainage line trending to the south-west. All materials available range from G6 to >G10 of which classifying G10 or better are considered suitable for reuse in road and pavement works. Materials not classified as G10 may be upgraded by mixing in better materials or used as backfill.

Site 3: Four minor hill tops are situated along the N2 with very steep cut embankments facing the freeway. South of the site is a spread out drainage system with moderately steep slopes from the west and the south. Moderately steep to steep slopes are present sloping down from the north and east. All materials available range from G7 to G9 and are considered suitable for reuse in road and pavement works.

The majority of all three sites is underlain by deeply weathered sedimentary bedrock of the Ordovician Natal Group Sandstone (known to weather irregularly). The depth to completely weathered, extremely soft sedimentary bedrock varies between 0.7m and 2.2m for site 1, 1.10 and 2.50m for site 2 and around 2m or in excess thereof for site 3. Where residual soils exist, they are comprised of firm/medium dense sandy clays or clayey sand and are on average 0.5 to 1.1m thick across all three sites.

Fill material is expected to be found locally close to farming facilities, structures or gravel roads. Soils within the drainage line are likely to be classified as wetland soils although the typical flora and fauna is absent due to the decades of sugarcane farming. The southern corner of site 1 is underlain by a depression filled with an accumulation of alluvial/colluvial material as well as stormwater. Recent alluvial sediments have accumulated along the drainage lines of the area with shallow bedrock exposed in the upper, steeper sections. In both sites 2 and 3, recent alluvial sediments had collected along the drainage systems with surface water evident on the eastern part of the main drainage line in both sites. The southern drainage lines also had significantly higher organic content than the others (possibly linked to neighbouring mushroom farm).

Excavatability for all site alternatives is expected to be soft through the fill materials, colluvial materials and residual soils in the upper weathered bedrock. Abnormal fill material or sandstone may reduce the trenchability locally. Excavation deeper than 1.20m must be shored at the discretion of the engineer. Perched water tables may occur where permeable sandy materials overlie less permeable clay/bedrock during high rainfall. Unweathered bedrock in site 2 may require blasting.

Evidence of slope failures were identified on the sites and indicated in red in Figure 1 of the respective geotechnical investigations (northern hilltop and a portion of the southern hilltop in site 1, should aggressive earthworks be carried out on the north to north-westerly slopes in site 2, these have the potential of slope instability issues, various steep slopes within site 3 were identified). Slopes steeper than 18□ should be excluded from the development for sites 2 and 3.

The sandy top soils/ colluvial materials and residual clayey sands are considered moderate to highly erodible to wind and water. Steep slopes in site 3 are currently mainly protected by the present vegetation. Site founding condition were considered good although should soft spots of silt and clay be encountered within foundation trenches, this should be reassessed by a competent personnel.

The specialist concluded that all three sites are stable in their existing conditions with the majority of the site being capable of development provided that work is carried out according to prescribed recommendations. During the earthworks phase, the geotechnical engineer recommended a number of slope gradients for the cut and fill embankments depending on the underlying material / location of the proposed embankment for all three sites. Pressure recommendations for carrying out shallow and deep founding are prescribed in sections 7.3. The specialist recommends that across all three sites, the overall natural drainage system should remain intact in terms of subsoil drainage as the wetland system on site is part of a wider, complex drainage system connecting to the KZN coast line. A separate wetland impact assessment has been conducted and is summarised in the following section.

Identified environmental risk:
Site 1: areas of slope failure identified along the northern hilltop and a section of the southern hilltop as indicated in Figure 1 of Appendix 8, potential for erosion to occur on cut embankments (as per specialist recommendations, all cut embankments are to be vegetated immediately after construction)
Site 2: steeper slopes in the south-west corner more vulnerable to erosion and sediment deposition into the adjacent drainage line.
Site 3: steeper slopes in the north and east of the site are more vulnerable to erosion and sediment deposition into the adjacent drainage line.

4.2.3 Summary of Findings of Wetland Specialist [Regulation 31 (2) (j)]

GroundTruth undertook a wetland study to determine the impact of the proposed development on each of the site alternative (Appendix 9). In accordance with national legislation, proposed developments should identify the extent of freshwater ecosystems onsite and avoid these systems as far as possible. However, should the destruction of freshwater ecosystems be unavoidable, appropriate impact mitigation measures must be implemented. This report includes details regarding the previous study undertaken by Land Resources International (LRI) in 2007 (LRI, 2007) that delineated the extent of the wetland habitat onsite. In addition, the riparian assessment report undertaken by GroundTruth (summarised below and included in Appendix 10) detailing the Wekeweke Stream system has been used to inform this study. If wetland habitat is impacted on, the "no-net-loss" approach may be achieved through onsite mitigation measures or offsite based on either the KZN Norms or Standards for Biodiversity Offsetting or the Draft South African National Biodiversity Institute Wetland Offset Framework.

Sites 1 and 3 fall within the U60F quaternary catchment whilst site 2 falls within the U60C quaternary catchment. Both catchments form part of the greater Mgeni catchment, a regionally important water resource. Taking into account the climate, the wetlands in sites 1 and 3 are likely to have low sensitivity to hydrological impacts with the wetlands in Site 2 having a moderate sensitivity. Under natural conditions, the vegetation types would have been KwaZulu-Natal Sandstone Sourveld (endangered) and Ngongoni Veld (vulnerable) however sugarcane is now present across the three sites.

The wetland classified the wetlands on site according to the Kotze *et al.* (2007) system, as described in section 2.5 of the wetland study (Appendix 9), with six hydrogeomorphic (HGM) unit being identified (Figure 13 below). The wetland type (unchannelled valley-bottom wetland) falls within the Sub-Escarpment Savanna bioregion which is considered "critically endangered" due to the lack of protection this vegetation unit receives. Ezemvelo KZN Wildlife makes reference to the fact that transformed systems, such as the systems within the study site, would need to be assessed taking into consideration the level of degradation.

The National Freshwater Ecosystem Priority Areas (NFEPA) assists in the conservation and sustainable use of South Africa's freshwater ecosystems. The freshwater ecosystems have been classified according to their Present Ecological State (PES) depending on their conditions. According to the available NFEPA wetlands coverage, none of the wetland HGM units onsite were classified as NFEPA wetlands however HGM unit within Site 2 drains into a NFEPA river, the Wekeweke Stream. This system is considered to be an "AB" system, which is natural or good with natural vegetation along the river system. The system should be maintained at this level. A riparian assessment was therefore undertaken on the system (see sub-section below) assessing the PES of the system and its ecological importance.

Figure 13: Aerial photograph illustrating the proposed site boundaries in blue with the wetland habitat highlighted in red. Low (yelow) and high priority (green) freshwater ecosystems are included in the figure (source: GroundTruth, Wetland Study 2013).

The study methodology to assess the wetland habitat potentially impacted upon by the proposed development is outlined in section 4 of the wetland study. This included a site visit, assessment of wetland functioning (WET-EcoServices assessment) and wetland condition/integrity (WET-Health assessment). Assumptions and limitations are listed in section 5 of the wetland assessment.

Site 1: four unchannelled valley-bottom wetland systems draining into the uMhlatuzana River. The four HGM units cover 12ha of the total 53ha site. The river and adjacent wetland habitat are heavily invaded with alien vegetation and are impacted on by the infrastructure within the catchment, the sugarcane and its associated waterways and road networks.

Site 2: two unchannelled valley-bottom wetland systems drain into the Wekeweke Stream (a NFEPA) and are approximately 6.7ha whilst the study site is approximately 160ha. Catchment extensively modified through cultivation of sugarcane. Extensive road network associated with the agricultural practices transects the wetlands and contributes to water input.

Site 3: five unchannelled valley-bottom wetland systems draining into the uMhlatuzana River. The five HGM units cover 9.5ha of the total 81ha site. As with the other sites, sugarcane farming is taking place within the catchment and wetland habitat. Additional water enters the wetland from the Denny Mushroom infrastructure resulting in the artificial expansion of the wetland habitat.

Due to the similar characteristics of the catchments and systems, the HGM units within each site were assessed as a single wetland complex in terms of ecological functioning and condition. A summary of the ecosystem services scores for each of the site is provided in Table 6.1 and a summary of the overall area weighted ecological integrity scores of the wetlands per site are provided in Table 6.2 of the wetland study (Appendix 9).

For site 1, the wetlands are supplying ecosystem services at an intermediate level with water quality enhancement and flood attenuation being the priority services provided. The effectiveness of the wetland to enhance water quality has been reduced however due to the transformation of the site for sugarcane production and the encroachment of alien vegetation. Biodiversity, provision of undisturbed wetland habitat, potential to harvestable natural resources and educational value is limited.

The wetlands within site 2, ecosystem services are supplied at moderately high level with water quality enhancement and flood attenuation being the priority services provided. As above, the effectiveness of the wetland to enhance water quality has been

reduced due to the sugarcane production. Biodiversity was recorded as high due to the abundance of natural vegetation and the NFEPA classification of the downstream system. Due to the NFEPA link, the wetland system is contributing to the provision of undisturbed wetland habitat within the landscape. Intermediate levels of service were recorded for phosphate trapping, nitrate and toxicant removal. Direct benefits and services are limited as the wetlands are located on privately-owned property.

For site 3, the wetlands are supplying ecosystem services at an intermediate level with water quality enhancement being the priority service provided. The importance of the wetland to enhance water quality is linked to the high opportunity that exists as a result of the elevated levels of pollution introduced as part of the surrounding land uses. As above for the other site alternatives, transformation of the system has reduced the effectiveness of water quality enhancement. Biodiversity, provision of undisturbed wetland habitat, potential to harvestable natural resources and educational value is limited.

In terms of the condition of the wetland ecosystems, all three sites had a Present Hydrological State (PHS) category E (change in ecosystem processes and loss of natural habitat and biota is great but some remaining natural habitat features are still recognisable), a Present Geomorphic State (PGS) category C (moderately modified with a moderate change in geomorphic processes having taken place but the system remains predominantly intact) and a Present Vegetation State (PVS) category F (vegetation composition totally or almost totally altered, and if any characteristic species still remain, their extent is very low). The historical activities at each of the sites have resulted in modifications to the systems ecological integrity.

The landscape context and the actual functional area of the wetlands versus the extent of the wetland habitat are important to consider when finalising the layout of the proposed developments. Based on the overall PES score for site 1 (level E), the 12ha of wetland habitat is considered equivalent to 3.64ha of intact wetland habitat. Based on the PES score for site 2 (level E), the 6.7ha of wetland habitat is equivalent to 2.7ha of intact wetland habitat. Based on the overall PES score for site 3 (level D), the 9.5ha of wetland habitat is considered equivalent to 3.92ha of intact wetland habitat.

Although the development layout has retained portions of the wetland habitat as open space, site 1 will see the loss of an entire HGM unit, development of site 2 will result in 1.4ha of wetland habitat lost. Development of site 3 will see the destruction of a small wetland in the north. The impacts on the wetland systems and downstream riparian habitat would have to be appropriately managed to ensure the integrity of the wetland and riparian habitats are not impaired.

The impacts on the wetland habitats within site 1 and 3 could be balanced by onsite mitigation provided that the development is carefully managed to ensure minimal impact. The development of site 2, the preferred alternative, within this system's catchment could be appropriately managed to ensure the impacts on the Wekeweke stream are negligible and there are no adverse effects downstream of the development site. The assessment of riparian habitat and fauna & flora associated with the Wekeweke stream (summarised in the section below and included in Appendix 10) highlights the importance of an appropriate buffer (32m), retention of wetland habitat functionality and mitigation of potential impacts.

The following prerequisites are required for the development of site 2:

1) Adoption and rehabilitation of a minimum 32m buffer from the boundary of the riparian habitat of the Wekeweke Stream adjacent to the site;
2) Rehabilitation of the riparian habitat adjacent and downstream of the site as discussed in the GroundTruth riparian assessment (Appendix 10);
3) Implementation, rehabilitation and management of the variable buffer zones adjacent to the wetland habitat reflected in the supplied layout; and
4) Rehabilitation of the remaining areas of wetland habitat within and directly adjacent to the site as outlined in the GroundTruth Rehabilitation Plan for site 2 (Appendix 15).

Three major mitigation measures, summarised below, were recommended by the wetland specialist and have been included in section 3N of the attached EMPr (Appendix 14).

A. Wetland Rehabilitation of remaining wetland areas within and directly adjacent to the site

- Deactivation of any drainage channels and the incised channel, promoting more frequent overtopping of the channel across the wetland habitat and where appropriate diffuse flow;
- Maximising the extent of the seasonal and permanent wetness zones within the wetland habitat;
- Eradication of alien invasive plant species within the wetland; and
- Active re-vegetation of the wetland habitat with appropriate wetland species, promoting biodiversity, emergent vegetation and nutrient uptake.

B. Buffer zones

A 32m buffer zone is recommended (subject to confirmation that specific buffers are not required for the Red Data frog species). The remaining areas of wetland habitat within and adjacent to the site should also be buffered in accordance with the variable buffer reflected in the layout. A 20m minimum buffer is recommended for the other two sites.

- Rehabilitation of the buffer zone, with the removal of alien invasive vegetation species and active replanting of indigenous plants, to ensure a DENSE, undisturbed vegetative community;
- Ideally, the establishment of indigenous vegetative cover within the buffer should take place prior to the implementation of construction activities to filter runoff before it enters the wetland habitat. If practical limitations exist, the existing vegetation should be maintained to fulfil the buffer role during the construction phases.
- Enforcement and management of the buffer zone to ensure that there is no encroachment that would reduce the efficacy of the buffer zone; and
- On-going maintenance of the buffer zone including the wetland and riparian habitats.

C. Stormwater runoff

Stormwater discharge into the freshwater ecosystem is to be managed by means of:

- Multiple discharge points that are reasonably spread out across the development adjoining the wetland habitat;
- The erosional features within the wetland habitat would need to be appropriately stabilised to ensure that no further erosion of the systems occurs, especially from water entering the erosion features from the adjacent slopes;
- Flow through the buffer zone should be via diffuse flow and concentrated flow should be avoided;
- Accompanying each discharge point should be suitable baffle structures (e.g. gabion mattresses);
- Runoff entering the buffer zone should not exceed 1.5m/sec as this is considered to reduce the pollutant removal performance of the buffer area;
- Stormwater may not be discharged directly into the Wekeweke Stream, but directed into the rehabilitated tributary wetlands;
- Outflow points incorporate a best management practice approach to trap excess suspended solids and other pollutants originating from the proposed development before entering the buffer zones. These will need to be regularly serviced and maintained to ensure adequate functioning and efficacy; and
- Promotion of infiltration as groundwater input is a key wetland driver. This includes porous pavement, grassed swales and infiltration trenches/basins within the wetland catchments.

To ensure wetland maintenance the specialist outlines management measures in section 8 of the report (derived from Ezemvelo KZN Wildlife's Biodiversity Stewardship programme guideline documents). Maintenance is to include removal of the excess plant material at regular intervals and the control of alien invasive vegetation.

- The defoliation of the wetland areas would need to be integrated into the overall plan, including the adjacent buffer zones;
- The interval for defoliation of the wetland areas should be every 2 to 3 years;
- The wetland area should be divided into two blocks, with each half being cleared alternately, leaving remnant habitat in the area for wetland dependant species;
- The implementation of burns should promote cool, patchy burns by burning when relative humidity is high and air temperatures are low, promote head fires (with the wind) rather than back burns (against the wind) and be delayed to the following year if the conditions are not favourable in terms of achieving the abovementioned criteria.
- The follow-up alien plant clearing activities to include manual activities to reduce the risk of the translocation of herbicide, frequent follow-up operations (four operations per year), control to take place indefinitely; and where necessary foliar application of herbicide to emerging coppice.

Identified environmental risk: potential increase in flooding with the reduction of wetland area which are currently attenuating water on the sites. Loss of wetland area associated with each alternative, impact on the riparian habitat, fauna & flora associated with the adjacent Wekeweke stream for site 2 and the potential for alien vegetation invasion once rehabilitation of the proposed buffer zones has been completed.

GroundTruth was further commissioned to assess the potential impact of the proposed water pipeline route in October 2013 (Appendix 9). Further comments and recommendations were provided based on a desktop review of available information (extent of wetland habitat, alignment of the pipeline, previous study undertaken by GroundTruth and experience in the area). The recommendations are based around a "no-net-loss" approach achievable through appropriate mitigation activities, removal of alien vegetation and rehabilitation.

The wetland/riparian habitat along the proposed pipeline route has been altered through historical anthropogenic disturbances (infrastructure and agricultural) thereby classed as "E" category or "seriously modified". The identified riparian habitat,

specifically the uMhlatuzana River, is also considered to be modified in the vicinity of the pipeline alignment, which coincides with an existing road crossing.

The specialist has stated that the potential impacts are predominantly related to the construction phase. Therefore, the adoption of appropriate mitigation measures within the EMPr can limit the impacts. Essentially prompt and appropriate rehabilitation of the wetland crossings is required. The following potential impacts were identified:

During construction:

- The introduction of foreign materials to the system, such as fuel, cement and other building materials;
- Compaction of the wetland soils from heavy vehicles;
- Modifications to the wetlands, river banks and beds from the trenching process;
- Trench erosion and the diversion of subsurface flow as a result of preferential flow paths having been created;
- Risk of erosion forming upstream of the trench if infilling is not adequately compacted or the longitudinal slope of the wetland system is not maintained;
- Disturbance of vegetation and the encroachment on alien invasive or ruderal/pioneer wetland plant species
- The impoundment of flows upstream of the trenches and desiccation of the systems downstream of the trenching. These conditions could continue post-development depending on how effectively the area has been rehabilitated; and
- Direct loss of portions of the wetland and riparian habitat.

The specialist noted that the crossing of the uMhlatuzana River may be problematic for heavy machinery working in the systems as the flow of the river will need to be diverted while trenching across the river and seepage from upstream damming may enter the trench during construction. As per recommendation, the EMPr has included that trenching across the uMhlatuzana River be carried out rapidly and a method statement is to be submitted prior to construction in this section.

Since the riparian habitats are dominated by alien plants, construction provides an opportunity for localised removal of alien invasive vegetation and rehabilitation with indigenous plant species. Construction activities are considered to pose a relatively low risk to the freshwater ecosystems' current integrity and functioning. Specific mitigation measures for during construction are provided on page 5 of the GroundTruth letter regarding the Bulk Water Supply Line. These measures have been incorporated into section 3.15 of the attached EMPr. Mitigation measures include crossing the watercourses to reduce erosion, alignments and rehabilitation.

During operation:

- Damage and lack of maintenance of the infrastructure impacting the water resource.

The following mitigation measures were provided by the specialist (from best-case to worst-case):

1. Buffer zones

May be difficult, considering the existing alignment of the pipeline. It is however recommended that the infrastructure be planned beyond a 20m buffer where possible (illustrated in Figure 14 below). Where this is not possible, it is recommended that the infrastructure be aligned adjacent to existing services (e.g. roads), within the freshwater ecosystems.

2. Realignment

- Where the proposed alignment of the infrastructure is parallel to flow direction, the infrastructure should be realigned outside of the identified wetland or riparian habitat
- Where the proposed infrastructure crosses the wetland or riparian habitat:
    - Crossings should be aligned with existing infrastructure (roads/ bridges etc.),
    - Infrastructure should be positioned on the downstream side of a road crossing/dams to negate potential impacts linked to headward erosion and sub-surface impoundment of flow;
    - Where the infrastructure is unable to be aligned with existing services, the crossing should be planned at a narrow section and be perpendicular to the flow direction, minimising the amount of disturbance to the freshwater ecosystem and the risks of headward erosion

3. Prevention of sub-surface flow channel and erosion

Where the pipeline is unable to avoid freshwater ecosystems, there would be a risk of erosion with the trench serving as a sub-surface flow channel, especially where a valley-bottom has a lateral slope drainage towards the main channel. The following was therefore recommended:

- "Trench-breakers", which are in-trench barriers, should be installed along the length of the trench within the wetland to deactivate the flow of water along the trench;
- These barriers to be placed at head-to-toe intervals, where the top of downstream barrier "floods" to the base of next barrier upstream. The intervals of barriers are therefore determined by the slope of the wetland down the length of the trench;
- Since work will be within the wetland, it is recommended that the barriers be constructed using 20% bentonite and in situ soil mix or impermeable geotextile liners; and
- Small-scale diversion berms should be constructed on the surface of the trench, directly downstream of the "trench-breaker" to reduce the risk of the trench becoming a preferred surface flow path.

4. Wetland rehabilitation and management

Rehabilitation of those areas of wetland habitat within the servitude would be required. The rehabilitation of the wetland habitat would include:

- Rehabilitating/enhance the wetland, promoting the effectiveness and opportunity for the system to provide benefits and services, including:
    - Eradication of alien invasive plant species within the wetland and study site,
    - Active re-vegetation of the wetland habitat with appropriate wetland species, promoting biodiversity, emergent vegetation and nutrient uptake.
    - The removal of excess vegetative material within the wetland at regular intervals (every 2-3 years depending on growth) to promote new growth and prevent the further encroachment of weedy species.

5. Riparian rehabilitation and management

Rehabilitation of the riparian habitat associated with the uMhlatuzana River is required.

- The eradication and control of alien invasive plant species,
- Active re-vegetation of the riparian habitat with appropriate riparian species, promoting biodiversity and
- The re-vegetation of the of the channel banks with appropriate indigenous woody vegetation.

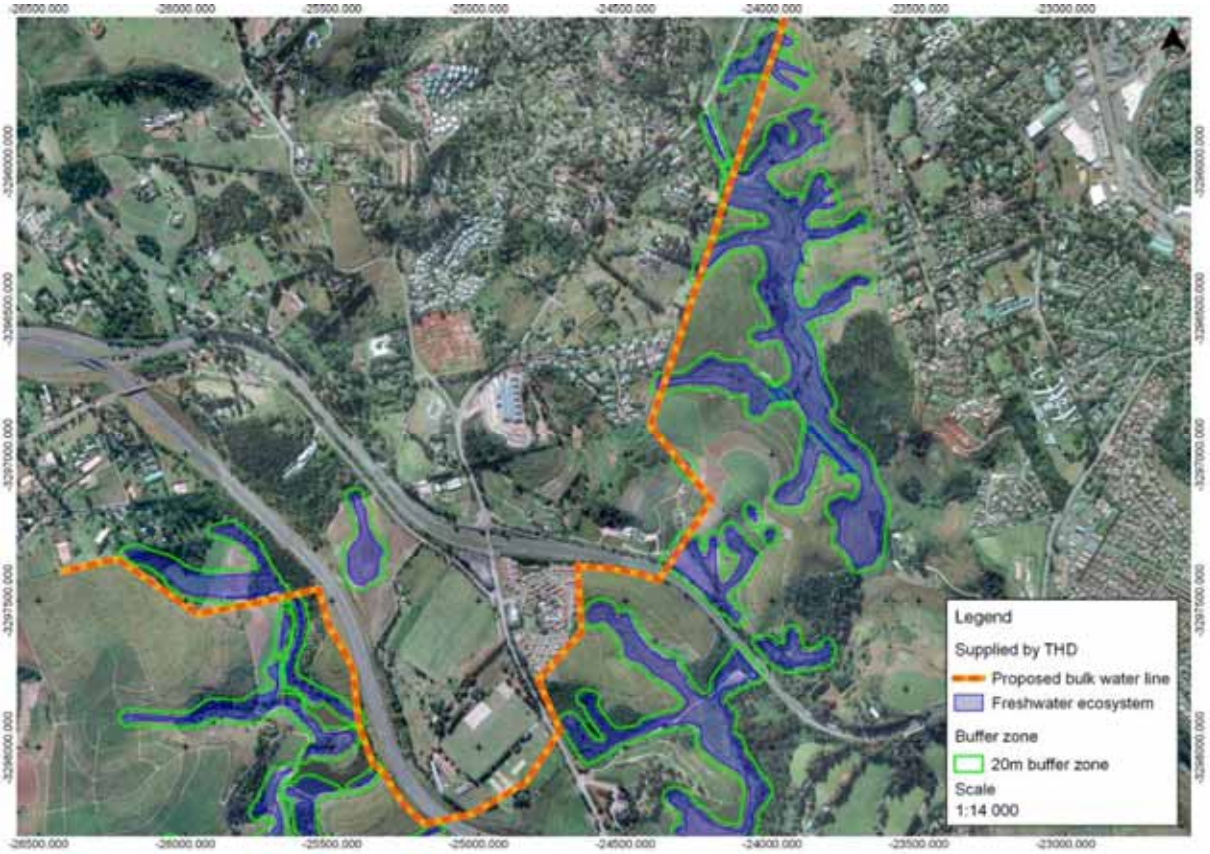


Figure 14: Aerial photograph illustrating the delineated watercourses along the pipeline route (source: GroundTruth, October

Identified environmental risks: direct impacts of pipeline causing riparian and wetland habitat destruction (includes riparian bank and bed modification and wetland hydrological impacts and alterations to flow pattern), impact on the water quality linked to construction activities and soil disturbance and impacts on water quality linked to the operational phase due to leaks and/or

damage to the infrastructure. Contamination of the systems with cement or other building materials, heavy vehicles compacting wetland soils, direct loss of portions of wetland and riparian habitat, trenching across the uMhlatuzana River encouraging seepage from the upstream dam, positive impact with the opportunity for localised alien vegetation removal and rehabilitation with indigenous species.

4.2.4 Summary of Findings of Riparian Ecosystem Assessment [Regulation 31 (2) (j)]

GroundTruth carried out a detailed assessment on the riparian ecosystems and sensitive fauna and flora associated with the Wekeweke River system which is adjacent to site 2 in August 2013 (Appendix 10). The aim of the study was to assess the present state of the riparian ecosystems and habitats in the Wekeweke River system as well as to establish whether the system supports Red Data species flagged by the NFEPA and DWA PES/Ecological Integrity and Sensitivity (EIS) database. Recommendations in terms of development constraints and opportunities are provided and appropriate buffer zones defined. The assessment consisted of a desktop study and on-site biotic data collection (further described in section 1.3 of the assessment, Appendix 10). Vegetation and frog surveys were carried out as well as aquatic biomonitoring (monitoring site located south west of the development). Assumptions and Limitations are outlined under section 4.1 of the Riparian Assessment.

The Wekeweke River catchment is located in Water Management Area (WMA) 11, secondary catchment U6. DWA recently classified this system as a category B which is "largely natural with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged". The Wekeweke system is also a NFEPA river classified as a Freshwater Ecosystem Priority Area. Riparian vegetation, terrestrial vegetation, fish and frog species potentially occurring in this area are listed in section 2 of the Riparian Assessment.

Flora

The vegetation communities that occur along the Wekeweke River system comprise of scarp forest, riverine forest, cliff face communities, grassland and wetlands. A description of where these communities were found within the Wekeweke system as well as species existing within the vegetation community was provided. A full list of all the species found in the study area is provided in Appendix 1 of the Riparian Assessment.

Aquatic ecosystems

A description of the present riparian vegetation along the Wekeweke River downstream of the proposed site indicates that the system is moderately modified. Specific Pollution Index assessed the benthic diatom community health to be "severely modified". Using the SASS5 sampling technique, it was found that downstream from the site, the system is "significantly modified". It is not likely that the Wekeweke River is important for supporting fish populations. Although not all found during the sampling, 20 species of frog are anticipated to use the study area.

Three important habitat types were identified in the study area:

1. Riverine vegetation (these areas are to remain unaffected to maintain aquatic habitat functionality and continued supply of valuable ecological and hydrological services to the landscape)
2. Wetlands (important that these areas are managed correctly and that appropriate buffer zones are properly demarcated and maintained)
3. KZN Sandstone Sourveld (endangered vegetation type. This area is a remnant of the natural vegetation should be used as a reference when designing and revegetating the proposed development area).

The following are a list of the conservation important species that exist in the vicinity of site 2:

- Population of *Gladiolus cruentus* (critically endangered) occurs downstream of the site at the waterfall. Since the species depends on spray mist it is important that normal flow volumes from the upstream catchment be maintained. Expect increase in flow volume which could improve habitat availability.
- Although no red data frog species were identified on the site there is a potential for *Afrixalus spinifrons* (near threatened), *Hemisus guttatus* (vulnerable), *A. spinifrons*, *H. guttatus* and *Hyperolius acuticeps*, to occur in the area.

The following impacts for the proposed Shongweni Regional Retail/ Commercial Development may occur:

- Habitat loss and transformation. Poor planning may result in unnecessary loss of habitat supporting biodiversity (including frog species of conservation importance).
- Increased stormwater runoff. Introduction of hard impervious surfaces increasing runoff.
- Pollution from stormwater runoff adversely affecting biota and ecosystems downstream.

Section 4.6 of the Riparian Assessment prescribes a number of recommendations to avoid and/or mitigate impacts that may arise from the proposal. These recommendations have been included in section 3N of the EMPr attached in Appendix 14. Some of the recommendations include:

- Avoidance of the riparian and wetland habitat areas where possible;
- A buffer zone of at least 32m should be adopted;
- An extended management area to be incorporated to account for the losses of the wetland habitat (represented in blue in Figure 15);
- Specific mitigation measures prescribed for the proposed sewer pump station south of the study area;
- As a conservative measure, in the case of red data frog species being present, a variable buffer (or habitat corridor) is recommended that provides for protection of important biota through enhanced terrestrial and aquatic habitat availability, functionality, and connectivity (see Figure 15 below);
- Minimal or no disturbance outside the development footprint;
- Rehabilitate areas containing solid waste and remove all waste/refuse which has accumulated on the property;
- Develop a comprehensive alien weed control programme;
- Ensure landscaping within the development comprises indigenous species appropriate to the regional vegetation;
- Controlled stormwater management;
- Monitoring of the riparian habitats, natural corridors and other open spaces during construction and operation;
- Implement a biennial or triennial fire burning regime in grassland and wetland areas;
- No reduction in hydrology of the catchment; and
- Use of chemical control is recommended for dense monotypic stands of *Pteridium aquilinum.*

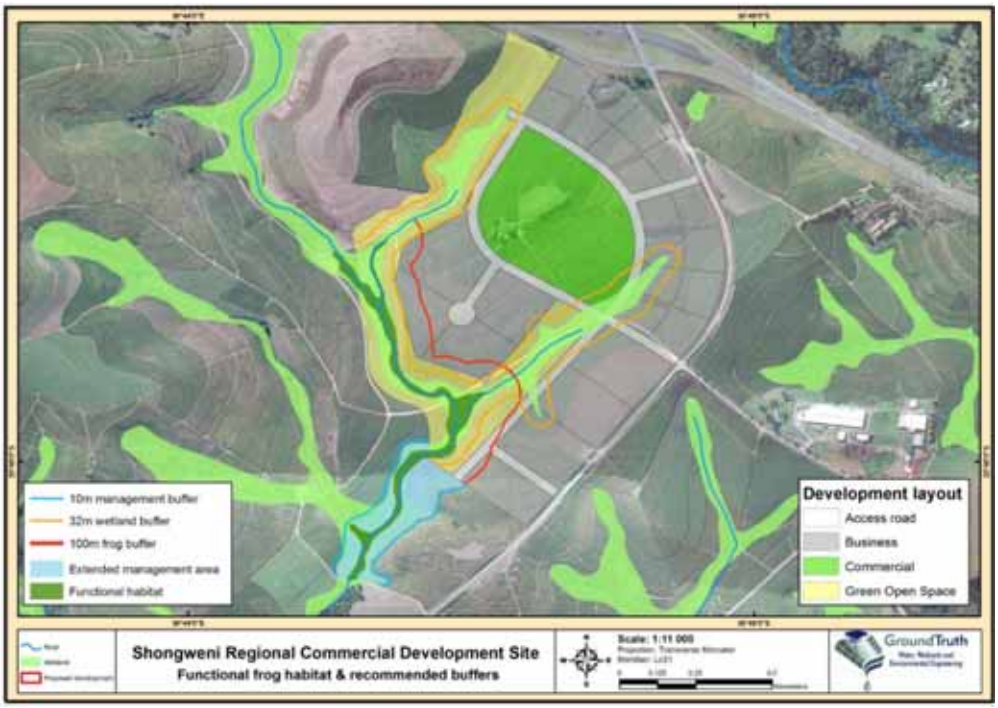


Figure 15: Map showing the present frog habitat availability with reference to various options for creating additional habitat and buffers for conservation important frog species (source: GroundTruth, Riparian Assessment, 2013).

Identified environmental risk: habitat loss and transformation currently supporting biodiversity as a result of poor planning may (including frog species of conservation importance), increased stormwater runoff, introduction of hard impervious surfaces increasing runoff, pollution from stormwater runoff adversely affecting biota and ecosystems downstream. Change in hydrology potentially impacting on the population of Gladiolus cruentus (critically endangered) occurring downstream of site 2, construction of the proposed sewer pump station south of site 2 impacting on the drainage line. Positive impact with Green Open Space being incorporated into the proposed development layout providing an improved, rehabilitated habitat refugia for flora and associated fauna.

4.3 Biological

In terms of the natural biology of the sites, all three have been largely transformed as a result of the long-term sugarcane production occurring across the sites. SiVest Environmental Division undertook detailed vegetation and fauna assessments for

the three site alternatives and concluded that the sites are heavily disturbed in terms of indigenous vegetation with the small patches of woodlot being infested with alien invasive plants. As a result of the poor quality of vegetation, the sites were found to have a low faunal conservation value.

Since the pipeline is positioned on the Applicant's land, it mainly falls within cultivated fields that are largely transformed. In areas where the pipe line is not running through sugarcane dominated areas, it is aligned next to roads and or areas considered to be unsuitable for sustainable agricultural production. Since fauna is directly dependent on the vegetation units, there were few species found within the proposed route. Vegetation and faunal assessments for the site alternatives and proposed pipeline route have been summarised below and are included in Appendices 13 and 14 of the EIR.

4.3.1 Summary of Findings of Specialist Vegetation Assessment [Regulation 31 (2) (j)]

SiVEST undertook a detailed vegetation assessment of the three proposed sites (Appendix 11). A number of databases were consulted in the process of undertaking the Desktop Analysis. These include the Ezemvelo KZN Wildlife C-Plan & SEA Database, Irreplaceability Analysis, Bio Resource Units, Environmental Potential Atlas and Mucina & Rutherford's Vegetation Assessment. A summary of the methodology utilised for each of the listed databases is provided for in detail in the report (section 3.1).The site was visited by the specialist on the 3rd and 4th of July 2012 where random sampling took place. A Conservation Importance Assessment was also carried out to identify the sites role in the preservation and maintenance of biodiversity in the local area.

The three sites were assessed individually in terms of:

1. Vegetation Communities Onsite
2. Neighbouring Areas of Conservation Value
3. Conservation Value Assessment. Please note that the conservation value for all three sites was assessed as being low due to the sugar cane cultivation. The specialist has considered ecological connectivity, ecological value scale and the current vegetation present.
4. Impacts on Floral Diversity. It is important to consider the impacts the development will have on this neighbouring community.

It is important to note that the vast majority of all three sites are dominated by sugar cane cultivations therefore the specialist focussed on areas where woody vegetation established along the last vestiges of remaining indigenous vegetation.

<u>Site 1</u>

1. In terms of the KZN Wildlife Strategic Environmental Assessment (SEA) data, there is the potential to find protected plants, invertebrates and aquatic fauna of conservation significance on this site.

2. The remaining areas of indigenous vegetation include the *Eucalyptus* wood lot, drainage line on the eastern boundary, woody vegetation along the M13 and wetland areas. A number of indigenous species were encounted however their abundances were low and considered very limited significance.

3. Eastern boundary of Site 1 is bounded by the uMhlatuzana River, a system identified in the Durban Metropolitan Open Space System (D'MOSS) as Scarp Forest. The specialist found the area to be degraded and invaded by alien species. The flood plain has been transformed to facilitate sugar cane plantation resulting in increased erosion. Since the River becomes a steep bedrock channel, it was concluded that the system would potentially be more resilient to a change in hydrology as opposed to the other two sites. The River however flows to Giba Gorge, a biodiversity hotspot. All opportunity to ensure its protection must be strongly considered. Giba Gorge is classified as a Special Rating Area under Section 22 of the Municipal Property Rates Act (No. 6 of 2004) and is bound by Section 8 of the eThekwini Municipal Rates Policy 2009/2010. Non-user Conservation Servitudes relating to Giba Gorge exist limiting the use of that portion of land to conservation-related activities.

4. Only conservation worthy community identified was the disturbed scarp forest associated with the uMhlatuzana River along the eastern boundary. The vegetation is of intermediate importance from a biodiversity conservation perspective. The biodiversity maintenance services are shown in Table 6 of the vegetation report in Appendix 11.

5. There is a small area of valuable vegetation community adjacent to the site, the disturbed D'MOSS Scarp Forest and Giba Gorge System. The impacts on the neighbouring community include increased erosion, increased storm water run-off, increased sedimentation rates of the uMhlatuzana River, currently there is a continuous open space linkage between the Upper and Lower portions of the River and the D'MOSS areas cannot be impacted on by development. The only positive impact would

be the removal of alien species which have been identified as one of the most significant threats to the Giba Gorge Environmental Precinct: Conservation Management Plan (Version 3 June 2011).

Site 2

1. In terms of SEA, no groups have been identified as potentially present on this site.

2. The only remaining natural vegetation occurs within the wetland/drainage line, which runs in a north east – south west orientation. This system merges with another system west of the site. Within the soccer field and labour housing areas only four individual indigenous species were growing.

3. The valley bottom wetland system on site feeds into a larger system, which in turns feeds the Wekeweke River and Shongweni Dam. The system offsite is a healthy, well-functioning system delivering Ecological Goods and Services.

4. No conservation worthy vegetation communities were identified however, an important wetland unit was identified within the vicinity of the western boundary of the site. It was assessed as providing an intermediate level of biodiversity. The biodiversity maintenance services are shown in Table 7 of the report in Appendix 11.

5. The hydrology of the wetland systems onsite must be maintained post-development by incorporating storm water infiltration and attenuation into the design of the development.

Site 3

1. In terms of the SEA data, there is the potential to find medicinal plants, protected plants, grasslands, invertebrates, aquatic fauna and avifauna of conservation significance on this site.

2. A recently burnt grassland area extending off the site was present, expecting to host a variety of flowering species, which were not available for sampling. Only 10 meters of this grassland area falls within site 3. A diverse herbaceous species assemblage was recorded (see section 5.1.3.1 of report in Appendix 11 for full list). Woody vegetation has also established in the grassland but is not present in the site. Site 3 also contains alien infested fallow areas and the drainage line towards the east of the site is also dominated by woody alien vegetation. An individual *Kniphofia* sp. was identified in the wetland area. This species is provincially protected under the KZN Ordinance of 1976 as amended. The garden areas and tree avenues are completely dominated by alien vegetation.

3. The Sandstone Sourveld Gassland mentioned above is extremely rare and considered to be endangered. It is currently a strong functioning and healthy system.

4. As above, the only worthy vegetation community identified was the Sandstone Sourveld Gassland within the vicinity of the site. There is also Scarp Forest located along the eastern boundary of the site. The KZN Sandstone Sourveld was assessed as providing a high level of biodiversity maintenance services. These services are shown in Table 8 of the report in Appendix 11.

5. The development could cause the fire regime to be altered as well as limit the grazing of the grassland altering the current natural regime. The grassland is currently a D'MOSS site and there is a wetland system on site.

Recommendation and Mitigation Measures

Site 2 is the preferred option from an ecological and vegetation impact perspective. The following mitigation measures are provided by the specialist:

- The control and management of alien invasive plant species is legislated by the Conservation of Agricultural Resources Act, Act 43 of 1983. It is therefore imperative that an alien management plan be implemented on Site 1 to control the alien species, most notably the *Ardisia crenata* and *Hedychium coccineum*. This will provide alien plant control benefits to the D'MOSS areas downstream, particularly the Giba Gorge Environmental Precinct.
- Similarly, all the alien vegetation that currently exists on Sites 2 and 3 should be removed and controlled.
- The wetlands on and neighbouring the site must be afforded a suitable buffer as determined by a wetland specialist.
- The wetlands within Site 2 should be rehabilitated.
- Storm water generated by the proposed development must be allowed to infiltrate back into the groundwater across the site to ensure that the wetland system downstream is not negatively impacted.
- Similarly, storm water generated by the proposed development must be effectively controlled and attenuated to ensure that the erosion and sedimentation risks associated with increased flood peaks is mitigated and/or avoided.

Assumptions, uncertainties and limitations are provided for in section 7 of the report.

In conclusion, looking at the sites in isolation, all three sites are of low biodiversity value from a floral perspective with the majority of the vegetation communities having been transformed by cultivation. It is therefore important to note how the proposed development may impact neighbouring vegetation communities of conservation value.

The reasons for concluding site 2 as the preferential option include:

- Site 2 is gentle – moderately sloping and will require the least amount of earthworks. Site 1 and 3 are characterised by moderately to steep slopes requiring the most amount of earthworks. As a result, the development of Sites 1 and 3 poses the most severe erosion and sedimentation risks.
- Sites 1 and 3 are bounded by sensitive environments that may potentially be negatively impacted upon should development proceed whereas Site 2 is not bounded by any such features. The only natural vegetation present within Site 2 is limited wetland vegetation communities that occur within the narrow wetland corridor. However, this area will, through legislation, be afforded protection.
- Site 1 forms an important linkage between the Upper and Lower uMhlatuzana River, which feeds directly into the Giba Gorge Environmental Precinct. It has been shown through rigorous research that Open Space Systems are extremely significant for the persistence of areas of conservation significance and that perturbations that may disrupt these linkages may have highly detrimental impacts on the area designated to be conserved.
- Site 3 abuts the Giba Gorge Environmental Precinct and therefore, impacts may be directly imparted on this system, which requires a buffer between itself and development.

Identified environmental risk:
Site 1: increased erosion and increased stormwater run-off due to the steep gradient of the site impacting riparian areas of the Giba Gorge Precinct, increased rate of sedimentation of the uMhlatuzana River as well as increased flood peaks and erosion in this area. Potential impact on the D'MOSS areas linking the continuous open spaces along the uMhlatuzana River and edge disturbances on the uMhlatuzana Scarp Forest. Removal of alien species is a positive impact.
Site 2: Potential for increased sedimentation, reduced base/subsurface flow and increased flood peaks and erosion on the D'MOSS wetland system on the western boundary. Potential pollution / change in hydrology of the Wekeweke River and Shongweni Dam downstream of the site.
Site 3: Edge disturbance, erosion and sedimentation increase in the biodiverse KZN Sandstone Sourveld on the sites eastern boundary (D'MOSS area). Increased erosion and sedimentation impacts on the riparian areas of the Giba Gorge Precinct. Potential removal of a Kniphofia species in the wetland area. Natural regime of the biodiverse grassland on the eastern boundary altered due to the likelihood of a change in the fire regime and limited grazing.

Similar to the Vegetation Assessment carried out for the three site alternatives summarised above, the vegetation assessment for the proposed water pipeline consulted a number of databases illustrating vegetation types that could possibly occur within the proposed pipeline route (Ezemvelo KZN Wildlife C-Plan and SEA Database, Bio Resource Units, Environmental Potential Atlas and Mucina and Rutherford's Vegetation Assessment). A field survey confirmed the vegetation and highlights areas of conservation significance and biodiversity richness.

In areas where the proposed pipeline does not run through sugar cane, it is aligned next to roads and/or areas considered to be unsuitable for sustainable agricultural production (steep slopes, along boundary fences, abandoned areas and poor soil types). The various vegetation elements are grouped and indicated in Figure 16 below. The specialist identified seven vegetation elements described below. For each vegetation element, the most common species are listed in the Rapid Assessment of the Vegetation Associated with a Proposed 500mm Bulk Water Line (Appendix 11). Photographs are also included in Appendix 2 of the Rapid Assessment of Vegetation report.

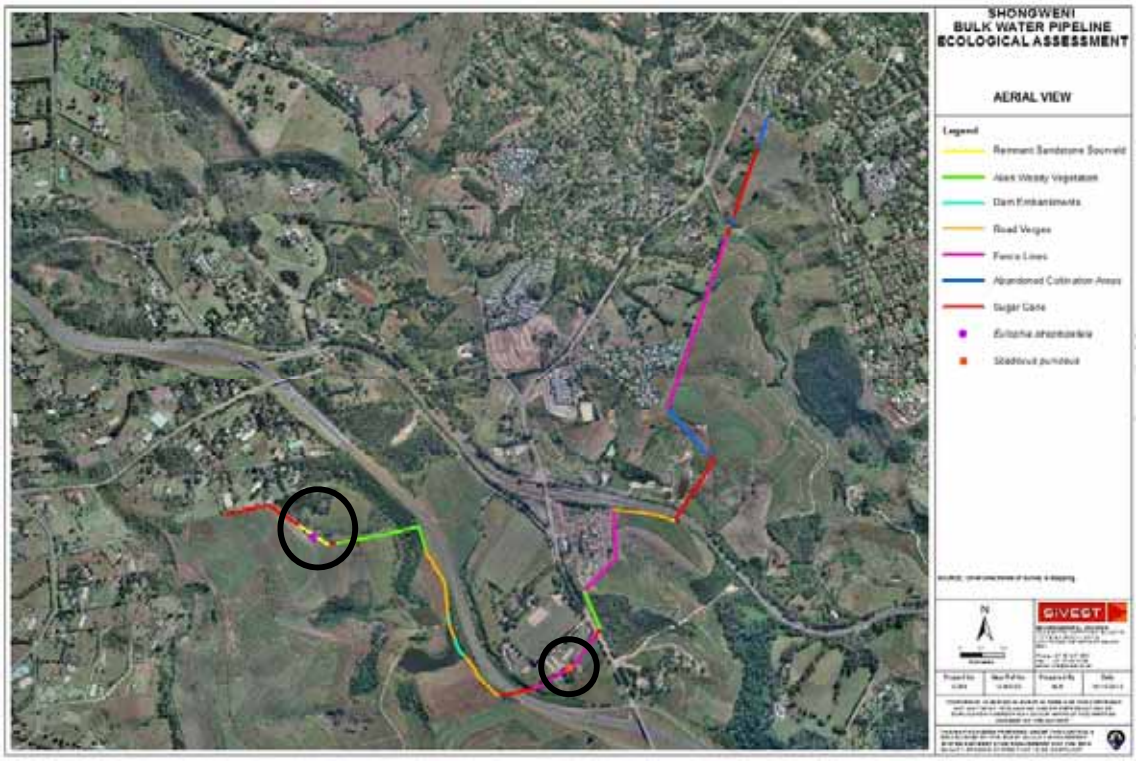


Figure 16: Map indicating the various vegetation elements along the proposed pipeline route with the Sandstone Sourveld remnant circled as well as the location of the species with conservation significance (source: SiVest, October 2013).

1. Abandoned farmlands
Abandoned due to the lack of sustainable production and has been invaded by pioneer alien species. Herbaceous indigenous species were however identified in this vegetation element and three indigenous woody species (*Burchellia bubalina*, *Ficus sur* and *Maesa lanceolata*).

2. Fence Lines
Vegetation is predominantly alien. It is not anticipated that construction will impact on any indigenous woody vegetation along the fence lines.

3. Actively Cultivated Sugar Cane Fields
Vast majority of the pipeline route.

4. Road Verges
Dominated by alien invasive species or species commonly associated with disturbance. The majority of indigenous species were encountered in the area where storm water culverts pass underneath the N3 and will potentially fall outside of the area disturbed by the pipeline. In this area specifically, removal of trees is to be avoided.

5. Dam Embankments
The dam is located directly adjacent to the N3 road embankment and is extremely transformed dominated by alien vegetation (eastern side particularly). Trees positioned in the wet area at the base are likely to be removed during construction however the overall loss and significance will be low. The large number of alien plant species removed mitigate the loss of these limited number of indigenous tree species.

6. Alien Woody Vegetation Areas
A small portion of steep land considered “waste land” comprises mostly of alien species. Large *Albizia adianthifolia* occur within this area however loss of individuals will be minimal based on the current alignment of the pipeline. A singleton of *Bridelia micrantha* and *Canthium ciliatum* were identified, however, these appeared to fall outside of the corridor that would be required to construct the water pipe line.

7. Remnant Sandstone Sourveld invaded and infested by Alien Species

Adjacent to the sugar cane lands and separated from them by a road. Assuming that the pipeline is placed within the sugarcane cordon, the route will not impact on the limited natural vegetation restricted to the steeper slopes. However, if the proposed route is located on the east of the road, a number of indigenous species will be impacted on. The specialist recommends that the pipeline be aligned on the upper slope above the cane road to alleviate the loss of the *C. sphaerocephala*. *E. streptopetala*, being an Orchid is protected under the provincial legislation and therefore would require that an application to EKZN Wildlife be submitted for its upliftment and relocation. This would apply to the *Scadoxus puniceus* individual recorded near the Shongweni Polo Club. All the indigenous species, apart from *P. urticifolia* were relict species and were simply surviving given the change in the microclimate that had been bought about by the prevalence of the alien species.

The following recommendations were provided by the specialists which will result in extremely limited loss of indigenous vegetation and a no net loss of any rare, threatened or protected plant species.

- Where possible ensure that the pipe line and associated working servitude are maintained within the current property(s) to reduce any impact on the vegetation on the other side of the fence lines,
- Where possible try and avoid the need to remove any tree species, especially indigenous species,
- An alien management plan must be in place to ensure that the construction area and pipe line servitude are maintained free of alien plant species,
- The areas which are disturbed should be rehabilitated with a standard NPA mix of grass species as the area will either be retained as a road or will abut the commercial sugarcane farming activities, therefore the merits of trying to re-establish any form of indigenous and diverse vegetation would prove fruitless.
- The up-liftment and relocation of the two provincially protected plant species will be required. Additionally a permit from EKZN Wildlife would be required to ensure compliance with the current legislation,
- In steep areas where all the vegetation has been removed there will need to be some form of berms and swales to prevent riff and gulley erosion from occurring, and
- A combination of geofabric and regrassing immediately after the construction has ceased to reduce the potential for erosion to occur and the resultant silting up of wetlands, dams and streams that are in close proximity to the construction area.

The specialist concludes that, given the current status of the vegetation that was sampled, he does not envisage that the proposed pipe line is going to create any significant environmental issues, particularly when considering the vegetation as a stand-alone biophysical characteristic. Two plant species namely, *Eulophia streptopetala* (Figure 17) *Scadoxus puniceus* (Figure 18) and will require a permit from EKZN Wildlife to have them relocated out of the working servitude into an area where they will be able to persist. A budgetary amount should be allowed for in the construction Bill of Quantities to ensure that the rehabilitation is undertaken correctly. No further assessment of the pipe line is required from a vegetation perspective and the impact that will be imparted is very low.

Figure 17: Photograph of a provincially protected Eulophia streptopetala (source: SiVest, October 2013)

***Figure 18: Photograph of Scadoxus puniceus* (Paintbrush Lily; source: www.witkoppenwildflower.co.za)**

Identified environmental risks: Large indigenous tree species such as Albizia adianthifolia and trees directly adjacent to the N3 crossing, may be removed from the proposed pipeline route, positive impact with the localised removal of alien vegetation and revegetation of indigenous species. Two provincially protected species potentially impacted on during excavation and

construction phase, namely Scadoxus puniceus and Eulophia streptopetala, potential for erosion to take place along the steep banks during the operational phase contributing to sedimentation build up in associated watercourses.

4.3.2 Summary of Findings of Specialist Fauna Assessment [Regulation 31 (2) (j)]

SiVEST undertook a detailed faunal assessment of the three proposed sites (Appendix 12). A site walkover was conducted on the 3rd July 2012 to sample vegetation units for terrestrial faunal species. The large areas of sugarcane were lacking in faunal species and were assessed in a cursory manner. Bird species that could potentially occur in the area were assessed through the South African Bird Atlas Project (SABAP) database.

Ezemvelo KZN Wildlife's C-Plan was also consulted to predict species of conservation significance in the area. The Ruby-legged Black Millipede (*Doratogonus rubipodus*), Mollusc (*Cochlitoma semidecussata*) and the Black-headed Dwarf Chameleon (*Bradypodion melanocephalum*) were predicted to be in the area however the specialist concluded that they did not occur in the development sites. Within site 1 the *Bradypodion melanocephalum* may occur in the alien infested drainage line on the eastern boundary and the highly disturbed woodlot.

Species noted within the three sites include:
Site 1:

- Strong evidence of Bushpigs (*Potamchoerus porcus*) within the woodlot.
- Evidence of antelope species within the woodlot. The species are most likely Common Duiker (*Sylvicapra grimmia*) and Bushbuck (*Tragelaphus scriptus*).
- Evidence of Grey Duiker on site.
- Vervet Monkeys (*Cercopithecus pygerythrus*).
- Most likely site to support raptor breeding due to the woodlots however no evidence was found.
- Flap-necked Chameleons (*Chamaeleo dilepis*) in woodlots.

Site 2:

- Vervet Monkeys (*Cercopithecus pygerythrus*).

Site 3:

- Evidence of antelope species within the grassland area. The species are most likely Common Duiker (*Sylvicapra grimmia*) and Bushbuck (*Tragelaphus scriptus*).
- Vervet Monkeys (*Cercopithecus pygerythrus*).
- Evidence of mongoose species.

With regards to bird species, only a few conservation significant species are likely to make use of the sites.

- Various stork species may forage on the sites.
- Various eagle species are likely to hunt on all the sites however are only likely to breed and nest on site 1.
- The Blue Crane (*Anthropoides paradiseus*) and the Grey Crowned Crane (*Balearica regulorum*) are unlikely to use the sites extensively due to the level of historical disturbance.
- The Spotted Ground-thrush (*Zoothera guttata*) may occur within the forest fragments (Giba Gorge Complex) to the east of the sites.
- The Broad-tailed Warbler (*Schoenicola brevirostris*) may occur on the sites, and is closely associated with wet areas, and rank grass, and therefore is most likely to occur in the wetland systems that traverse all three sites.
- The Bush Blackcap (*Lioptilus nigricapillus*), may use the forests to the East of the sites during the winter months.

It was concluded that site 2 is considered the best option as it has the least impact on fauna at a landscape level. Both site 1 and 3 are linked to the Giba Gorge Environmental Precinct and the associated Durban Metropolitan Open Space System. The GGEP contains a number of locally endemic and IUCN Red Listed species. The sites are however heavily disturbed and the small patches of woodlot are infested with alien invasive plants resulting in the faunal conservation value being low. The proposed development is likely to add value to the land and provide much needed funding for the improvement of the conservation significance of the sites.

The following mitigation measures have been prescribed by the specialist and apply to all three sites:

- Remove alien vegetation through proper management.

- No development should occur within the wetlands and drainage lines and development should take into account the hydrology of the wetland systems.
- Careful management of construction within the proposed development.

Should site 1 be the preference, the specialist recommends that
- The existing forest fragments within the woodlot areas are set aside.
- An extensive night-time survey be done to assess the potential presence of the Black-headed Dwarf Chameleon in the woodlot and infested drainage line. If found, specimens need to be removed and relocated to identified release sites. Release sites to be determined by Ezemvelo KZN Wildlife in conjunction with eThekwini Environmental Management Division.

Identified environmental risk:
Site 1: Potential to reduce the open space faunal links with the Giba Gorge Precinct and adjacent D'MOSS area.
Site 3: Potential to reduce the open space faunal links with the Giba Gorge Precinct and adjacent D'MOSS area.

The Faunal Assessment for the proposed bulk water pipeline determined the ecological value of the proposed bulk water pipeline route and servitude. The majority of the route is dominated by sugar cane with small remnant patches of indigenous vegetation in isolated fragments (Figure 16).

The specialist actively searched for *Doratogonus rubipodus* (Ruby-legged Black Millipede) and *Cochlitoma semidecussata* (Mollusc) which were not found within the proposed development site. Areas of alien infested woody vegetation provide an ideal vegetation mix suitable for *Bradypodion melanocephalum* (Black-headed Dwarf Chameleon) occupancy, although no specie samples were encountered. There was evidence of antelope species (Common Duiker and Bushbuck) and Vervet Monkeys. No raptor nests were identified as the proposed route lacks appropriate nesting trees. Appendix 3 of the Report includes a list of birds that have been recorded in the area surrounding the proposed pipeline. While there are a few species of conservation significance, the proposed pipeline will have no impact on them.

From a faunal perspective, the proposed pipeline corridor is degraded and currently of low conservation value. The fauna of the corridor is directly dependent on the vegetation units of the corridor (see Figure 16).

The following was therefore recommended:
- Alien clearing must be undertaken within the entire development corridor,
- The proposed pipeline route should be realigned to avoid the remnant sandstone sourveld grassland area and
- Should it be found that Black-headed Dwarf Chameleon are present, any specimens of the Black-headed Dwarf Chameleon need to be removed carefully before clearing any area for construction, and relocated to an identified release site. The release site should be identified in consultation with Ezemvelo KZN Wildlife and eThekwini Environmental Management Division.

Identified environmental risks: Excavation through alien infested sections potentially disturbing Black-headed Dwarf Chameleon habitat, potential disturbance to the remnant of sandstone sourveld grassland and a positive impact with the localised clearance of alien vegetation.

4.4 Social & Cultural

Due to the location of the preferred site, the majority of social impacts will be positive as a result of the availability of employment and business opportunities that will be provided by the proposed development. General construction activities will however impact the surrounding community in terms of road upgrades, dust and noise. The marketing and socio-economic impact assessment, summarised in section 1.3.1 above, considered the development of the proposed retail centre which found that there is expected to be a significant capital injection into the local economy for the construction and operational phase. The development of site 1 will result in significantly higher social implications, with the neighbouring residential complex bordering the site and the close proximity to other Shongweni communities (M13 interchange, Hillcrest Hospital etc.). Site 2 and 3, located south of the N3 Highway, are more secluded from the general community activities.

A Heritage Impact Assessment was conducted to identify potential heritage sites that exist on the three site alternatives (summarised below and included in Appendix 13 of the EIR). It was concluded that all archaeological sites identified by the specialist, have little historical importance.

4.4.1 Summary of Specialist Findings in Heritage Impact Assessment [Regulation 31 (2) (j)]

Dr Debbie Whelan in conjunction with eThembeni Cultural Heritage carried out a full heritage assessment of the current landholdings of the Shongweni Estate, Hillcrest District, eThekwini Municipality Outer-West (Appendix 13). The aim was to identify all archaeological structures and elements of the built environment that have heritage significance or are over the age of 60 years. While 11 archaeological/historical sites were identified, the area assessed for Tongaat Hulett extended beyond the scope of this project and therefore only the structures identified within the three site alternatives have been included in this summary. There are 7 in total that are relevant to this development.

In terms of the methodology used, an aerial survey was conducted using Google Earth and 1937 aerial photographs. Dr Whelan carried out a site inspection on 10 April 2012 visiting pre-identified areas from the aerial surveys. Further information was gathered from the Provincial Archives Repository in Pietermaritzburg as well as relevant books.

Site 1 contains four archaeologically significant sites. These include:
- Waterfall Farmhouse (currently Tongaat Hulett Headquarters; 29°48'06.66"S 30°44'51.40"E)
- Site of a Ruin by the uMhlatuzana River (29°47'55.18"S 30°45'00.30"E)
- Estate Management House 1 (29°48'03.47"S 30°44'52.30"E)
- 2x Labour Cottages (29°48'04.73"S 30°44'56.08"E)

Site 2 contains two archaeologically significant sites. These include:
- Estate Management House 2 (29°48'30.57"S 30°44'44.11"E)
- Seasonal Labour Compound (29°48'35.35"S 30°44'33.81"E)

Site 3 contains one archaeologically significant structure. This is:
- Full Time Labour Cottages (29°48'33.45"S 30°45'13.23"E)

It was concluded that all archaeological sites listed above have little historical importance however specific mitigation measures were provided for each of the individual structures.

<u>Site 1</u>
- Sections of the Waterfall Farmhouse are over the age of 60 years and has medium local historical and social value since it is associated with James McIntosh and the Durban County Wattle Syndicate. It is suggested that portions of the farmhouse and the garden be reused to retain a representation of the building of this period. The outbuildings should be demolished.
- The building by the uMhlatuzana River has been demolished therefore the only recommendation is that during bush clearing and excavation, an archaeologist is present to monitor the site.
- Similar to the Farmhouse, the Estate Management House 1 has medium local historical and social value however is of recent construction and no mitigation measures or prescribed.
- The pair of Labour Cottages were built in the 1960's and have low historical value. No mitigation measures are prescribed.

<u>Site 2</u>
- Built in the 1960s and 1970s, the Estate Management House 2 has low architectural merit. The specialist recommends possible retention of the garden.
- The Seasonal Labour Compound was constructed in the 1960s and 1970s. Even though these structures do not fall within the ambit of the KwaZulu Natal Provincial Heritage Act No 4 of 2008, labour villages are an important part of the history of KwaZulu Natal. There is opportunity for reuse of the solid, well designed buildings to record their contribution to labour history in the province. The specialist has described the cottages to have medium local and regional social value.

<u>Site 3</u>
- As above, the Full Time Labour Cottages were constructed in the 1960s and 1970s and do not fall within the ambit of the KwaZulu Natal Provincial Heritage Act No 4 of 2008. There is opportunity for reuse of the buildings to record their contribution to labour history in the province. The specialist has described the cottages to have medium local architectural value and medium local and regional social value.

Identified environmental risk: loss of historical landscape associated with mono-crop production and the McIntosh family.

Site 1: Damage to sections of the Farmhouse and the Estate Management House which were identified as having medium local historical and social value.

4.5 Specialist studies [Regulation 31 (2) (q)]

The following specialist studies were conducted:

- Ntshongweni Development Options: Engineering Services Report (Bosch Stemele (Pty) Ltd, October 2013),
- Ntshongweni Development: Stormwater Management Plan – Site 2 (Bosch Stemele (Pty) Ltd, July 2013),
- Ntshongweni Development: Preliminary Services Report - Electrical (Bosch Stemele (Pty) Ltd, August 2013)
- Tongaat Hulett Developments: Ntshongweni Saturn Model - Traffic Impact Assessment for sites 1, 2 and 3 (ARUP (Pty) Ltd, March 2013),
- Report of the Geotechnical Investigation for the Proposed Shongweni Retail Area – Precinct I, II and III (Drennan Maud Engineers, March 2013),
- Agricultural Potential of Rem of Erf 79 Assagay; Rem of Ptn 2 of Farm Botha's Halfway House No 921, Rem of Ptn 24 of Farm Summerveld No 14226, Rem of Farm Kirkfalls No 14227; Farm Shongweni No 15346 (Report 2 of 2012; ref: ck 94/23110/10/23) (Roy Mottram and Associates cc, 2013),
- Assessment and Mapping of Heritage Resources on the Shongweni Estate for Tongaat Hulett Properties (Archaic Consulting, May 2012),
- Tongaat Hulett Developments, Shongweni Retail Centre: Market Demand and Socio-Economic Impact Assessments Phase 1 Report – Initial Market Scoping (Urban Econ Development Economists KZN, July 2012),
- Tongaat Hulett Developments, Shongweni Retail Centre: Market Demand and Socio-Economic Impact Assessments Phase 2 Report – Comprehensive Market Assessment (Urban Econ Development Economists KZN, August 2012),
- Wetland Study for Tongaat Hulett Developments, Shongweni Development Sites (GroundTruth, August 2013),
- Shongweni Bulk Water Supply Line (GroundTruth, October 2013)
- Riparian Assessment Report for Tongaat Hulett Developments: Assessment of Riparian Ecosystems and Sensitive Fauna and Flora Associated with the Wekeweke River System for the Proposed Shongweni Regional Retail/Commercial Development (GroundTruth, August 2013)
- Wetland Rehabilitation Plan for Tongaat Hulett Developments, Shongweni Development: Site 2 (GroundTruth, August 2013)
- Proposed Shongweni Mixed Use Development: Faunal Assessment (SiVest, July 2012),
- Proposed Shongweni Bulk Water Pipeline: Faunal Assessment (SiVest, October 2013),
- Proposed Shongweni Mixed Use Development: Vegetation Assessment (SiVest, July 2012),
- Rapid Assessment of the Vegetation Associated with a Proposed 500mm Bulk Water Line (SiVest, October 2013) and
- Planning Report on Ntshongweni Development Proposals (GAPP Architects & Urban Designs, February 2013)

The above listed specialist studies have been summarised in the sections above however as per Regulation 31 (2) (q), copies of the reports have been provided in full in Appendices 1 through 15.

5.0 Public Participation Process [Regulation 31 (2) l and [Regulation 54, 55, 56]

(e) details of the public participation process conducted in terms of subregulation (1), including – (i) steps undertaken in accordance with the plan of study;

As per the plan of study, I &APs were given the opportunity to provide comment on the Draft Scoping Report and Draft EIR. As per regulation 28 (1) (h), the following section provides "*details of the public participation process conducted in terms of regulation 27 (a)* ".

5.1 Timeline for Public Participation

Activity	Date
Submission of Application to DAEA	1st February 2012
Notification of application to Authorities and Community groups	6th February 2012
Notification of neighbours within 100m of the site boundary	3rd February 2012
Placement of site notices	3rd February 2012
Placement of adverts in the Mercury (regional paper) and Highway Mail (community paper)	6th and 10th February

	2012
Notification of time and venue for public meeting	13th March 2012
Distribution of BID	20th March 2012
Public meeting	22nd March 2012
Distribution of meeting minutes	20th April 2012
Notification of release of scoping report	7th June 2012
Scoping report placed at Hillcrest Library and submitted to authorities	6th June 2012
40 day comment period ended	17th July 2012
Submission of final scoping report to DAEA	28th August 2012
Acknowledgement of receipt (2 weeks)	02nd October 2012
Acceptance of scoping report	02nd October 2012
Notification of release of Draft EIR	04th November 2013
Draft EIR placed at Hillcrest Library and submitted to authorities	04th November 2013
40 day comment period ended	15th December 2013
Submission of Final EIR to DAEA	x
Acknowledgement of receipt (2 weeks)	x
Assessment of EIR (60 days)	x
Compilation of EA (45 days)	x

5.2 Notification

54. (2) The person conducting a public participation process must take into account any guidelines applicable to public participation and must give notice to all potential interested and affected parties of the application which is subjected to public participation by –
(a) fixing a notice board at a place conspicuous to the public at the boundary or on the fence of –
(i) the site where the activity to which the application relates is or is to be undertaken; and
(ii) any alternative site mentioned in the application;
(4) A notice board referred to in subregulation (2) must –
(a) be of a size at least 60cm by 42cm; and
(b) display the required information in lettering and in a format as may be determined by the competent authority.

Three site notices (60cm by 42cm) in English were placed on Kassier Road at the Polo field, Engen Garage and towards the N3 on ramp, on the 3rd of February 2012. Proof of notice placement is provided in Appendix 16.1.

54. (2)(b) giving written notice to –
(i) the owner or person in control of that land if the applicant is not the owner or person in control of the land;
(ii) occupiers of the site where the activity is or is to be undertaken or to any alternative site where the activity is to be undertaken;
(iii) owners and occupiers of land adjacent to the site where the activity is or is to be undertaken or to any alternative site;
(iv) the municipal councillor of the ward in which the site or alternative site is situated and any organisation of ratepayers that represents the community in the area;
(v) the municipality which has jurisdiction in the area; and
(vi) any organ of state having jurisdiction in respect of any aspect of the activity;

Neighbours/occupiers/land owners adjacent to the property were notified by hand delivered notice (Appendix 16.1). Where possible, people were requested to sign a register indicating that they had received the notice.

All relevant authorities as well as the various community interested groups and ward councillor were notified by phone, fax and email on the 06th February 2012 (Appendix 16.1).

Background Information Documents were sent to DWA, DAEA, KZN Wildlife, eThekwini Municipality, AMAFA, WESSA, the local Rate Payers Association, the Ward Councillor and all other registered interested and affected parties on the 20th March 2012 (Appendix 16.3).

54. (2)(c) placing an advertisement in –
(i) one local newspaper; or

(ii) any official Gazette that is published specifically for the purpose of providing public notice of applications or other submissions made in terms of these Regulations; and
(d) placing an advertisement in at least one provincial newspaper or national newspaper, if the activity has or may have an impact that extends beyond the boundaries of the metropolitan or local municipality in which it is or will be undertaken: Provided that this paragraph need not be complied with if an advertisement has been placed in an official Gazette referred to in subregulation (c)(ii).

An advert was placed on the community paper, the Highway Mail on the 10th February 2012 and a regional paper, the Mercury on the 06th February 2012 (Appendix 16.4).

54. (3) A notice, notice board or advertisement referred to in subregulation (2) must –
(a) give details of the application which is subjected to public participation; and
(b) state –
(i) that the application has been or is to be submitted to the competent authority in terms of these Regulations, as the case may be;
(ii) whether basic assessment or scoping procedures are being applied to the application, in the case of an application for environmental authorisation;
(iii) the nature and location of the activity to which the application relates;
(iv) where further information on the application or activity can be obtained; and
(v) the manner in which and the person to whom representations in respect of the application may be made.

All notices, signboards and advertisements (Appendix 16.1 and 16.4) stated that the application in question is subject to scoping and EIA and that it had been submitted to DAEA. Each notice also stated the nature and location of the activity along with a brief description. The contact details for the company (phone, fax and e-mail) were provided where further information could be obtained.

54. (7) When complying with this regulation, the person conducting the public participation process must ensure that –
(a) information containing all relevant facts in respect of the application is made available to potential interested and affected parties; and
(b) participation by potential interested and affected parties is facilitated in such a manner that all potential interested and affected parties are provided with a reasonable opportunity to comment on the application.

56. (2) Before the EAP managing an application for environmental authorisation submits a report compiled in terms of these Regulations to the competent authority, the EAP must give registered interested and affected parties access to, and an opportunity to comment on the report in writing.

56. (3) Reports referred to in subregulation (2) include –
(c) scoping reports;
(d) scoping reports amended and resubmitted in terms of regulation 30 (3);
(e)specialist reports and reports on specialised processes compiled in terms of regulation 32;
(f) environmental impact assessment reports submitted in terms of regulation 31; and
(g) draft environmental management plans compiled in terms of regulation 33.

All parties who registered for the process by contacting KSEMS were provided with copies of the BID on the 20th March 2012 (Appendix 16.3). A public meeting date was set for 22nd March 2012 and registered I &APs were given details of the time and venue on the 13th March 2012 (Appendix 16.5). The meeting was held as proposed and a presentation was given. All I & APs who attended were given hard copies of the BID and copies of the presentation (Appendix 16.5). Minutes from the meeting were prepared and submitted to the I &APs on the 20th April 2012 (Appendix 16.5). I &APs were afforded the opportunity to comment on the minutes of the meeting. The draft scoping report was prepared and I &APs were notified of its availability at the Hillcrest library on the 7th June 2012 (Appendix 16.6). Hard copies of the draft scoping report and draft EIR were couriered or hand delivered to the following bodies:

Name	Authority / Group / Company
N. Leburu	DWA
W. Rozani	DAFF

A. Blackmore	EKZN Wildlife
D. Van Rensburg	eThekwini Municipal
B. Pawandiwa	AMAFA
C. Schwegmann	WESSA
P.R. Zibani	Ward councillor
R. Ryan	DoT
Hillcrest Library	Registered I & APs

I &APs were instructed that they had 40 days to comment on the draft scoping report with comment period ending on the 07th July 2012. A final scoping report including all comment received by the 17th July 2012 was submitted to the DAEA on the 28th August 2012 by courier.

The report was officially acknowledged and accepted on the 02nd October 2012.

Once the water pipeline route was confirmed, additional public participation was carried out. This included signboards being erected adjacent to the route on the 16th October 2013. Notices were hand delivered to properties neighbouring the proposed route. Proof of notification is included in Appendix 16.1. Newly registered I & APs were invited to attend a meeting which was held on the 30th October 2013 in Bowles Road (road running in close proximity to the proposed reservoir site). The attendance register is attached under Appendix 16.5 as well as meeting minutes.

The Draft EIR was prepared and I &APs were notified of its availability at the Hillcrest library on the 05 November 2013 (Appendix 16.8). Hard copies of the Draft EIR were couriered or hand delivered to the following bodies:

Name	Authority / Group / Company
N. Leburu	DWA
D. Thambu	EKZN Wildlife
W. Rozani	DAFF
D. Van Rensburg	eThekwini Municipal
P.R. Zibani	Ward councillor
R. Ryan	DoT
Hillcrest Library	Registered I & APs

DAFF had no further comments on the EIA as the proposed development does not impact on the natural forest or protected tree(s) (see Appendix 16.10 for comments on Scoping Report) however, with the inclusion of the proposed pipeline, the EAP delivered a hard copy of the EIR to DAFF.

I &APs were instructed that they had 40 days to comment on the draft EIR with comment period ending on the 15th December 2013. A Final EIR including all comment received by the 15th December 2013 will submitted to DAEA.

5.3 Register of Interested and Affected Parties [Regulation 31 (2) I (ii); 55 and 56]

55. (1) An EAP managing an application must open and maintain a register which contains the names and addresses of –
(a) all persons who, as a consequence of the public participation process conducted in respect of that application in terms of regulation 54, have submitted written comments or attended meetings with the applicant or EAP;
(b) all persons who, after completion of the public participation process referred to in paragraph (a), have requested the applicant or the EAP managing the application, in writing, for their names to be placed on the register; and
I all organs of state which have jurisdiction in respect of the activity to which the application relates.
(2) An applicant or EAP managing an application must give access to the register to any person who submits a request for access to the register in writing.

Regulation 31 (2) I ii- a list of persons, organisations and organs of state that were registered as interested and affected parties;

A register of all I &APs who registered for the project as well as the organs of state with jurisdiction in respect of the activity was maintained and is provided in Appendix 16.2.

5.4 Registered Interested and Affected Parties Entitled To Comment On Submissions (Regulation 56 & 57) Comments Of Interested And Affected Parties To Be Recorded In Reports Submitted To Competent Authority (Regulation 56) and Regulation 31

56. (1) A registered interested and affected party is entitled to comment, in writing, on all written submissions made to the competent authority by the applicant or the EAP managing an application, and to bring to the attention of the competent authority any issues which that party believes may be of significance to the consideration of the application, provided that –
(a) comments are submitted within –
(i) the timeframes that have been approved or set by the competent authority; or
(ii) any extension of a timeframe agreed to by the applicant or EAP;
(b) a copy of comments submitted directly to the competent authority is served on the applicant or EAP
(c) I the interested and affected party discloses any direct business, financial, personal or other interest which that party may have in the approval or refusal of the application.

57. (1) The EAP managing an application for environmental authorisation must ensure that the comments of interested and affected parties are recorded in reports.

Regulation 31 (2) (e) (iii) a summary of comments received from, and a summary of issues raised by registered interested and affected parties, the date of receipt of these comments and the response of the EAP to those comments; and
(iv) copies of any representations, objections and comments received from registered interested and affected parties;

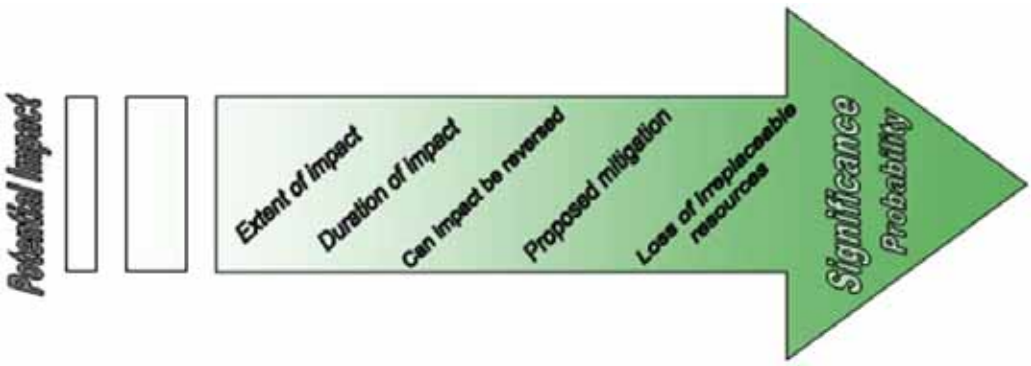
Comments received from I &APs from the draft scoping report have been summarised and included in a comments and response table in Appendix 16.9. All comments received have also been included in full in Appendix 16.9. Comments have been considered and used to establish the list of identified impacts for investigation. Comments received from the draft EIR will also be considered in the final EIR submitted to the DAEA.

6.0 Environmental Issues and Investigation of Potential Impacts

6.1 Methodology Used In Determining Significance of Potential Environmental Impacts [Regulation 32 (h)]

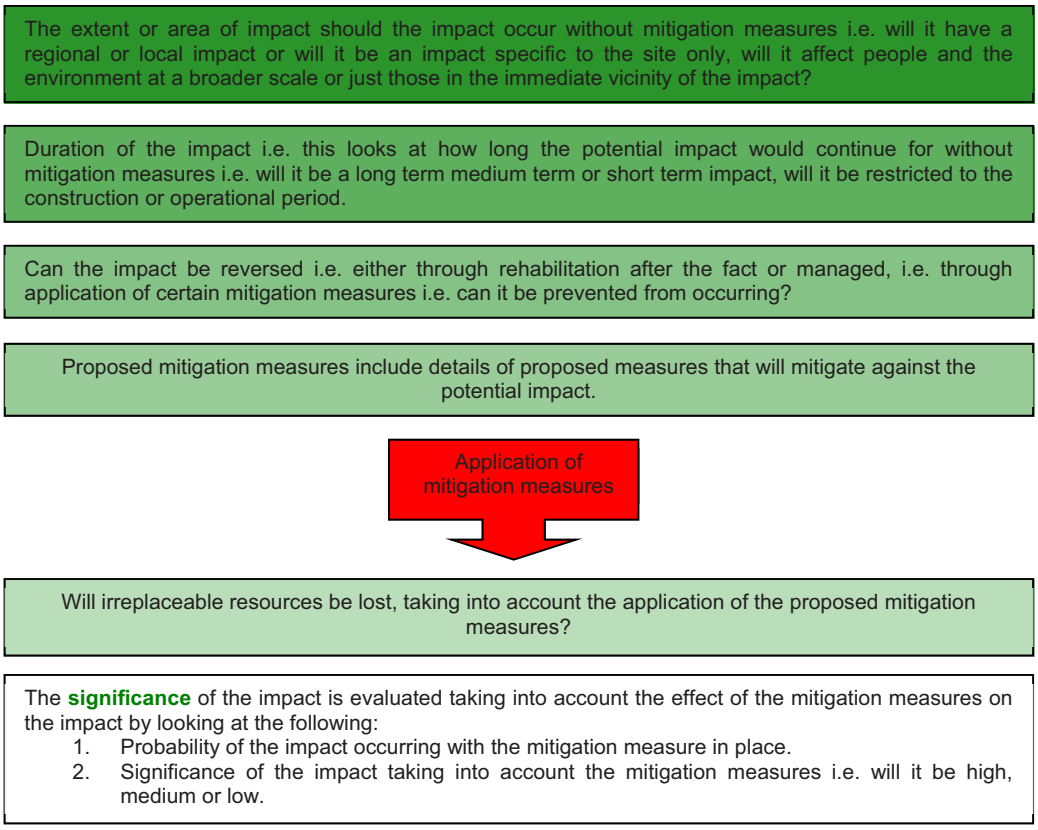
Potential impacts have been identified throughout the Scoping Report and EIR processes. Site visits have been conducted by the EAP and various specialists during which information on the surrounding environment as well as photographs of the affected areas were gathered. Specialist findings and recommendations also contributed to the identification of potential impacts. Potential impacts during construction and operation of the proposed development have been listed in the table below with mitigation measures provided. Specialist recommendations have been included in the mitigation measures where relevant. The professional judgment of the EAP based on previous EIA experience in the commercial and ecological fields has been used.

The potential impacts associated with the proposed development have been identified and rated in terms of their significance in a table, looking at the following:



As demonstrated above the significance of an impact is established using a progressive process whereby a potential impact is investigated using a number of parameters. *Potential impact* describes the potential environmental impact that might be associated with a specific aspect of the project i.e. without taking into account mitigation measures, extent of impact duration, or

intensity of the impact. All of these factors have to be considered before the significance and probability of an impact can be established.



6.2 Description Of Environmental Issues Identified, Assessment Of The Significance Of Each Issue And An Indication Of The Extent To Which The Issue Could Be Addressed By The Adoption Of Mitigation Measures [Regulation 31 (2) (h, k)]

The following impacts were identified for further investigation during the scoping phase and all potential impacts have been listed, been where these can be mitigated against. Additional potential impacts identified through the impact assessment phase and review of the specialist reports have been added and are shown in purple in the table below.

Table 10 provides an assessment of each identified potential impact, including:

(i) the nature of the impact;
(ii) the extent of the impact (i.e. spatial area that may be affected by the impact);
(iii) duration of the impact (long-term / short-term, construction / operation);
(iv) the probability of the impact occurring before and after mitigation, i.e. the likelihood of impact occurring with or without any mitigation measures in place = low/medium/high);
(v) the degree to which the impact can be reversed;
(vi) the degree to which the impact may cause irreplaceable loss of resources; and
(vii) the degree to which the impact can be mitigated, i.e. the *mitigatory potential* which has been classified as follows:

- Low (little or no mitigation measure exists to mitigate negative impacts),
- Medium (mitigation measures exists however some negative effects cannot be fully mitigated)
- High (can be fully mitigated);

The assessment into potential impacts also considered the type of impact i.e. is the impact direct or indirect; whereby the definition is as follows:

Direct Impact: Impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity, e.g. noise generated by blasting operations on the site of the activity). These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable.

Indirect Impact: Induced changes that may occur as a result of the activity. These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place as a result of the activity.

The significance of each impact after mitigation has also been evaluated according to the following criteria:

(i) Will the impact result in an alteration to the environment?
(ii) Does the level of public concern (including both norms and values) influence the impact?
(iii) Is there scientific and professional evidence against/for the impact?
(iv) Will there be environmental loss or degradation?
(v) Will the environmental impact result directly or indirectly in social change?
(vi) What is the likelihood and acceptability of the residual risk?

Based on the above criteria, *significance of the impact after mitigation* has been classified as follows:

- low (little or no residual negative impact occurs after mitigation; probability of impact occurring after mitigation is low)
- medium (residual impact is acceptable to society but has an undesirable effect – impact can be further reduced through rehabilitation / abatement measures; impact will occur to a lesser extent after mitigation)
- high (impact cannot be mitigated and will result in alteration of environment impact will definitely occur even after mitigation; potential investigation into offsets or alternative designs/proposals)
- very high (impact results in loss of irreplaceable resources even after mitigation i.e. protected areas, world heritage sites, etc.)

Table 10: Assessment of identified potentially significant impact [Regulation 31 (2) (k, l)i-vii] (impacts are relevant to all alternatives unless otherwise specified)

Nature of Impact (potential)	Direct or Indirect	Extent of Impact	Duration of Impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory Potential	Mitigation measure	Probability after mitigation	Significance after mitigation
SOIL										
Erosion of stockpiled material (stone, sand and gravel).	Direct	Local	Construction phase (short-term)	Yes, can be managed.	No	Medium	High	Material must be stocked in such a way that they cannot fall or cause injury or damage to properties or the natural environment. Stockpiles must not exceed 6m in height (as per SWMP) and must be covered if exposed to heavy wind or rain. Alternatively, low walls or berms must be constructed around the stockpiles. An Environmental Management Programme (EMPr) has been designed to manage construction activities and is attached under Appendix 14.	Low	Low
Risk of contamination to soil during concrete mixing.	Direct	Local	Construction phase (short-term)	Yes, can be prevented.	No	High	High	Cement mixing will need to take place on a hard surface or cement mixing trays will need to be used. Cement mixing will not be permitted to occur where run off can enter stormwater drains. Construction will be monitored by an Environmental Control Officer (ECO) who will ensure compliance with the construction EMPr.	Low	Low
The onsite erosion of exposed soil before rehabilitation is completed.	Direct	Local	Construction phase (short-term)	Yes, can be managed	No	Medium	High	As a general principle, contractors must limit vegetation clearing to the platform site only. The contractor must stabilise cleared areas to prevent and control erosion and/or sedimentation. Only vegetation that's needs to be removed to accommodate the development, should be removed in a phased and	Low	Low

Nature of Impact (potential)	Direct or Indirect	Extent of Impact	Duration of Impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory Potential	Mitigation measure	Probability after mitigation	Significance after mitigation
								controlled manner.		
Loss of agricultural land impacting food security.	Direct	Regional	Construction and operational phase (long-term)	Yes, can be reversed.	No	Medium	High	Mottram and Associates cc carried out the Agricultural Potetnial Report for the Shongweni Estate, where it was found to have "limited agricultural potential". Tongaat Hulett have a strategy to increase agricultural production in South Africa and food security has been incorporated into the applicant's strategies and action plans. Sugarcane production has in fact increased over the last three years and this is expected to increase even more in the future.	Low	Low
Loss of agricultural land	Direct	Regional	Construction and operational phase (long-term)	No	No	High	Low	The portion of land zoned for agriculture will be lost with the development of the site. These portions of land, currently zoned as agriculture, are however not in line with the Shongweni LAP which makes provisions for urban development and a regional centre.	High	Low
GEOTECHNICAL STABILITY										
Potentially slope failures resulting in unstable slopes during construction and operation. These slopes are also more vulnerable to erosion and sediment deposition into the adjacent drainage lines. Site 1: along the northern hilltop and a section of the southern	Direct	Local	Construction phase (short-term)	Yes, can be prevented.	No	Medium	High	The specialist concluded that all three sites are stable in their existing conditions with the majority of the site being capable of development provided that work is carried out according to prescribed recommendations. During the earthworks phase, the geotechnical engineer recommended a number of slope gradients for the cut and fill embankments depending on the underlying material / location of the	Low	Low

Nature of Impact (potential)	Direct or Indirect	Extent of Impact	Duration of Impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory Potential	Mitigation measure	Probability after mitigation	Significance after mitigation
hilltop. Site 2: steeper slopes in the south-west corner. Site 3: steeper slopes in the north and east (Geotechnical Report, 2012)								proposed embankment for all three sites. Pressure recommendations for carrying out shallow and deep founding are prescribed in sections 7.3. The specialist recommends that across all three sites, the overall natural drainage system should remain intact in terms of subsoil drainage as the wetland system on site is part of a wider, complex drainage system connecting to the KZN coast line		
Potential for erosion to occur on cut embankments (Geotechnical Report, 2012)	Direct	Local	Construction phase (short-term)	Yes, can be prevented and managed.	No	High	High	As per the geotechnical specialist's recommendations, all cut embankments are to be vegetated immediately after construction. This will aid in reducing run-off. The geotechnical specialists has stated that slopes should be less than a gradient of 1:2. Stormwater management control measures are to be implemented to prevent high run-off rates.	Medium	Low
STORMWATER										
Poor stormwater management during construction leading to erosion on and offsite. Site 2: south-west portion particularly vulnerable to erosion (Geotechnical Report, 2012).	Direct	Local	Construction and operation phase (long-term)	Yes, can be prevented.	No	High	High	The SWMP states that measures will be required to minimise the run-off especially for large storm events. Even with the bulk of overland run-off being redirected via kerbing, a certain level of erosion can be expected from precipitation on the embankments. It is recommended that these embankments be stabilised as soon as possible during the construction phase. Stormwater management is	Medium	Low

Nature of Impact (potential)	Direct or Indirect	Extent of Impact	Duration of Impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory Potential	Mitigation measure	Probability after mitigation	Significance after mitigation
								included under section 3B of the EMPr. The specialist stated that slopes are to have a gradient of less than 1:2 to prevent erosion and minimise run-off from the embankments, especially during large storm events.		
Potentially polluted stormwater run-off entering the onsite and adjacent wetland systems impacting on water quality and habitats associated with the freshwater systems.	Direct	Local with the potential to impact down stream	Construction and operational phase (long-term)	Yes, can be prevented and managed.	No	High	High	Measures to be applied to reduce pollutants include bio-attenuation swales and infiltration measures (permeable paving). These measures will be applied at the point source (individual sites and road reserves) as far as possible.	Low	Low
Risk of flooding downstream of the sites with the increase in hard surfaces resulting in increased water quantity (SWMP, 2013).	Direct	Local with the potential to impact down stream	Construction and operational phase (long-term)	Yes, can be prevented and managed.	No	High	High	One of the philosophies of the SWMP is to reduce stormwater flow to within a 10% variance of the pre-development flows using attenuating devices such as attenuation dams/structures or infiltration devices. Infiltration is to be maximised across the site with the SWMP (Annexure C of Appendix 3) being followed during design, construction and operational phases. On completion of works, a site inspection will be carried out to check compliance with the stormwater management requirements prior to the Certificate of Occupation being issued.	Low	Low
Stormwater features accumulating	Direct	Local	Construction and	Yes – can be prevented and	No	High	High	The SWMP states that no dumping of construction rubble or spoil is to	Low	Low

Nature of Impact (potential)	Direct or Indirect	Extent of Impact	Duration of Impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory Potential	Mitigation measure	Probability after mitigation	Significance after mitigation
litter/excess vegetation resulting in blockages or directing debris into the wetland/ drainage areas.			operational phase (long-term)	managed.				occur in completed stormwater drains, pipes, channels or natural drainage lines (existing wetland, stream and riparian zone). Weekly checks are to be carried out on the site's drainage system to ensure that the water flow is unobstructed. These are to be repaired or cleared of silt if required (included in section 3B of the EMPr). During operation, it will be the responsibility of the constituted Home Owners Association (or designated maintenance body) to maintain the stormwater system in a safe and responsible manner. As good practice, certain months of the year before the onset of the summer rains should be reserved to carry out routine maintenance work on the stormwater system. Routine inspections are to be carried out every three months by a competent personnel, as per specialist recommendation.		
Accumulated material on hardened surfaces transported via stormwater directly into the adjacent freshwater ecosystems resulting in a build-up of sediment /material in the wetland (SWMP, 2013)	Direct	Local	Operational phase (long-term)	Yes – can be managed.	No	High	Medium	As above, the SWMP has catered for attenuation swales and infiltration measures. Revegetation along the proposed buffer zones and Green Open Space areas will assist in reducing the transportation of sediment into the wetlands. Landscaping and re-vegetation of areas not occupied by buildings/paving shall be implemented immediately after	Low	Low

Nature of Impact (potential)	Direct or Indirect	Extent of Impact	Duration of Impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory Potential	Mitigation measure	Probability after mitigation	Significance after mitigation
								building works are complete. Stabilisation and erosion control measures should be implemented immediately if any embankments are constructed. All mitigation measures and recommendations made in the SWMP have been included in the EMPr.		
Change in Wekeweke Stream/ uMhlatuzana River input from diffuse to point source water input from stormwater infrastructure potentially increasing the risk of erosion and high volumes of water flooding the system during high rainfall events.	Direct	Local	Operational phase (long-term)	Yes – can be managed	No	High	High	The SWMP recommends that energy dissipating structures be utilised where erosion is a possibility, on the outlets from underground conduits or the run-off from the embankments. Bio-attenuation swales and infiltration measures (such as permeable paving) will be applied at the point source (individual sites and road reserves) as far as possible to reduce flow velocity draining into the different freshwater systems.	Low	Low
SURFACE WATER										
Loss of wetland area associated with each alternative as well as portions of wetland and riparian habitat associated with construction of the water pipeline.	Direct	Local	Construction and operational phase (long-term)	Yes, can be partially prevented.	No	High	Medium	To ensure that the removal of wetland area is not significant, the impacts on the wetland systems and downstream riparian habitat would have to be appropriately managed to ensure the integrity of the wetland and riparian habitats are not impaired. Within site 1 and site 3, the wetland specialist has stated that the potential impacts could be balanced by onsite mitigation provided that the development is carefully	Medium	Low

Nature of Impact (potential)	Direct or Indirect	Extent of Impact	Duration of Impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory Potential	Mitigation measure	Probability after mitigation	Significance after mitigation
								managed to ensure minimal impact. The development of site 2, could be appropriately managed to ensure the impacts on the Wekeweke stream are negligible and there are no adverse effects downstream of the development site. The specific Wetland Rehabilitation Plan for site 2 compiled by GroundTruth (Appendix 15) should be carefully adhered to which aims to ensure no-net-loss of functioning wetland area. Principles of the Rehabilitation Plan have been included in the EMPr. An extended management area is to be included into the proposal to account for the loss of wetland habitat (see Figure 15 above). This management area is located south of the proposed site. Pipeline crossing are required to be immediately rehabilitated once construction is complete. This will in fact upgrade the riparian habitat, as vegetation units are currently invaded with alien species.		
Increase in hardened surfaces reducing water infiltration and hence wetland recharge (SWMP, 2013).	Direct	Local with the potential to impact down stream.	Construction and operational phase (long-term)	Yes, can be managed	No	High	High	Currently, subsurface drainage through the perched water table recharges the wetland. The SWMP therefore recommends bio-attenuation swales and infiltration measures (e.g. permeable paving) which are to be applied at the point	Medium	Low

Nature of Impact (potential)	Direct or Indirect	Extent of Impact	Duration of Impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory Potential	Mitigation measure	Probability after mitigation	Significance after mitigation
								source to promote infiltration, reduce flow velocity and reduce pollutants from entering the wetlands decreasing functionality. The Wetland Rehabilitation Plan for site 2 (Appendix 15) includes a list of interventions such as the construction of gabion cut-off walls which is likely to reduce flow, promoting further infiltration.		
Site 2: Potential increase in pollutants and sediments entering the Shongweni Dam, downstream from the Wekeweke River (Flora Assessment, 2013).	Indirect	Local	Construction and operational phase (long-term)	Yes, can be prevented	No	Medium	High	As above, the SWMP states that there will be a variety of measures applied to reduce pollutants being carried in the stormwater (bio-attenuation swales and infiltration measures). The wetland specialist has stated that a prerequisite for developing site 2 would be the adoption and rehabilitation of a minimum 32m buffer from the boundary of the riparian habitat of the Wekeweke Stream adjacent to the site. Rehabilitation of the riparian habitat adjacent and downstream of the site, as discussed in the GroundTruth Riparian Assessment (Appendix 10), is to commence with the implementation, rehabilitation and management of the variable buffer zones adjacent to the wetland habitat. The GroundTruth Rehabilitation Plan (Appendix 15) for site 2 is to be followed when rehabilitating the remaining wetland areas within and directly adjacent to	Low	Low

Nature of Impact (potential)	Direct or Indirect	Extent of Impact	Duration of Impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory Potential	Mitigation measure	Probability after mitigation	Significance after mitigation
								site 2.		
Site 2: construction of the proposed sewer pump station south of site 2 impacting on the drainage line (Riparian Assessment, 2013).	Direct	Local	Construction and operational phase (long-term)	Yes, can be managed.	No	Medium	High	Although the footprint of the pump station (26m x 26m) is negligible, GroundTruth recommends that appropriate mitigation measures are in place in case of power / operational failures: - The pump station must be constructed on contour, - A designated bund area must be constructed below or directly adjacent to the sewer pump station to capture accidental spills/leaks, - The pump station should include a backup generator and - Emergency procedures should be in place to manage pump station failures and spills/leaks with immediate effect.	Low	Low
Proposed sewer pipelines disturbing minor stream lines where the pipelines traverse minor valleys (site 1 and site 3).	Direct	Local	Construction and operational phase (long-term)	Yes, can be prevented.	No	Medium	High	After consulting the uMhlatuzana Catchment map (provided in Appendix 5), there are unlikely to be any perennial stream lines crossed. The ESR (Appendix 3) states that in most instances the use of pipe bridges will be preferred as shown in Annexure G of the ESR.	Medium	Low
Poor waste management potentially resulting in leachate formation infiltrating into the soil and groundwater.	Direct	Local	Construction phase (short-term)	Yes, can be prevented.	No	Medium	High	The waste management area should be located on an impermeable surface to prevent leachate from coming into direct contact with the soil. Waste Management is outlined in section 3F of the attached EMPr.	Low	Low
Spillages of hazardous	Direct	Local	Construction	Yes, can be	No	High	High	"Hazardous materials" in this impact	Low	Medium

Nature of Impact (potential)	Direct or Indirect	Extent of Impact	Duration of Impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory Potential	Mitigation measure	Probability after mitigation	Significance after mitigation
material, leaking storage facilities and fittings and poor sewerage facilities potentially contaminating water resources.			phase (short-term)	managed and prevented.				refers to materials that could potentially be on site during construction. For example oils and herbicides are classified as "hazardous". As described above, efficient and effective waste management is included in the EMPr however a designated hazardous store will be set up which must be located within a bunded area on a hardened surface and under cover. Toilets on site are to be monitored regularly to ensure that no leaks or overflow is permitted. Safe-disposal slips are to be retained on site for auditing purposes in the site environmental file.		
Degradation of the proposed Green Open Space areas and/or drainage lines from deposition of construction sediment and rubble.	Direct	Local	Construction phase (short-term)	Yes, can be prevented.	No	High	High	It is recommended that the areas designated as Green Open Space in the layouts be avoided where possible. No stockpiling or dumping of construction material should occur within or directly adjacent to the Green Open Space or drainage lines. If this is unavoidable, the area disturbed must be rehabilitated as soon as possible and all materials removed from the area, No dumping of construction rubble or spoil is to occur in completed stormwater drains, pipes, channels or natural drainage lines. Weekly checks are to be carried out during construction. These are to be repaired or cleared of silt if required.	Low	Low

Nature of Impact (potential)	Direct or Indirect	Extent of Impact	Duration of Impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory Potential	Mitigation measure	Probability after mitigation	Significance after mitigation
During construction of the pipeline, there is potential for sedimentation and foreign materials to enter the freshwater ecosystem such as fuel, cement and other building materials reducing the water quality (GroundTruth, October 2013).	Direct	Local	Construction phase (short-term)	Yes, can be prevented.	No	High	High	A Method Statement is to be submitted to the Engineer and ECO detailing the construction method including stockpiling and waste management of workers constructing the pipeline route. Cement mixing is not to take place within the watercourse itself or directly adjacent to it. This is to be tightly monitored by the ECO. Alternatively, if a spill occurs or cement mixing does take place, the affected area is to be rehabilitated immediately to the satisfaction of the ECO. Soil excavated from the trench is to be placed on the upslope side of the trench, minimizing the risk of excess sediment entering the downstream areas of the freshwater ecosystems.	Low	Low
Compaction of the wetland soils by heavy vehicles accesses areas requiring excavation during the pipeline construction building materials (GroundTruth, October 2013).	Direct	Local	Construction phase (short-term)	Yes, can be prevented.	No	High	High	Vehicles are to use existing roads where possible. The working servitude across the systems must be as narrow as practically possible. i.e. machinery must utilise the same route through the systems at all times so as to avoid unnecessary disturbance.	Low	Low
Potential modification of wetlands, river banks and beds from the trenching process building materials (GroundTruth, October 2013).	Direct	Local	Construction phase (short-term)	Yes, can be prevented.	No	High	High	The pipeline is to be located beyond a 20m buffer where possible, however if this cannot be achieved, the pipeline is to be aligned adjacent to existing services such as roads within the freshwater ecosystem. Where	Medium	Low

Nature of Impact (potential)	Direct or Indirect	Extent of Impact	Duration of Impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory Potential	Mitigation measure	Probability after mitigation	Significance after mitigation
								infrastructure cannot be aligned adjacent to existing services, the crossings should be planned at a narrow section and be perpendicular to the flow direction, minimising the amount of disturbance to the freshwater ecosystem and the risks of headward erosion.		
Trench erosion and the diversion of subsurface flow as a result of preferential flow paths having been created (GroundTruth, October 2013).	Direct	Local	Construction and Operational phase (long-term)	Yes, can be prevented.	No	High	High	In order to prevent sub-surface channel flow and erosion, the wetland specialist recommends that: - "Trench-breakers", which are in-trench barriers, should be installed along the length of the trench within the wetland to deactivate the flow of water along the trench; - These barriers to be placed at head-to-toe intervals, where the top of downstream barrier "floods" to the base of next barrier upstream. The intervals of barriers are therefore determined by the slope of the wetland down the length of the trench; - Since work will be within the wetland, it is recommended that the barriers be constructed using 20% bentonite and in situ soil mix or impermeable geotextile liners; and - Small-scale diversion berms should be constructed on the surface of the trench, directly downstream of the "trench-breaker" to reduce the risk of the trench becoming a preferred surface flow	Medium	Low

Nature of Impact (potential)	Direct or Indirect	Extent of Impact	Duration of Impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory Potential	Mitigation measure	Probability after mitigation	Significance after mitigation
								path. Additionally, infrastructure is to be positioned on the downstream side of a road crossing/ dam to reduce headward erosion and sub-surface impoundment of flow.		
Risk of erosion forming upstream of the trench if infilling is not adequately compacted or the longitudinal slope of the wetland system is not maintained (GroundTruth, October 2013).	Direct	Local	Operational phase (long-term)	Yes, can be prevented.	No	High	High	The risk of erosion will be greatly reduced with effective rehabilitation measures. The watercourse crossings are to be rehabilitated to ensure that no barriers exist within the stream so that the in-stream habitat is similar to the natural situation. This should be done as soon as possible after the pipeline construction activities have ceased, to the ECO's satisfaction. The pipeline alignment is to be rehabilitated, with the wetland and riparian habitat at the crossing points being restored to near-natural conditions. In addition, areas where disturbance adjacent to these ecosystems has occurred should also be rehabilitated. This should be done as soon as possible after the pipeline construction activities have ceased, to the ECO's satisfaction. In riparian areas, backfilling should occur as soon as possible, compact if possible and reshape river to original levels.	Medium	Low
Potential impoundment	Direct	Local	Construction	Yes, can be	No	Medium	High	Infrastructure is to be positioned on	Medium	Low

Nature of Impact (potential)	Direct or Indirect	Extent of Impact	Duration of Impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory Potential	Mitigation measure	Probability after mitigation	Significance after mitigation
of flow upstream of the trenches and desiccation of the systems downstream of the trenching. (GroundTruth, October 2013).			and Operational phase (long-term)	prevented.				the downstream side of a road crossing/ dam to reduce headward erosion and sub-surface impoundment of flow. Effective rehabilitation is to take place along the disturbed area. This is done by eradicating alien invasive plant species, actively re-vegetating the disturbed area with appropriate wetland species and removing excess vegetative material within the wetland at regular intervals promoting new growth.		
Difficulty associated with trenching in the uMhlatuzana River during pipeline excavation (GroundTruth, October 2013).	Direct	Local	Construction phase (long-term)	Yes, can be managed and prevented.	No	High	Medium	The Contractor is to submit a detailed method statement to the Engineer and ECO prior to trenching in the uMhlatuzana River. The Method Statement is to ensure that trenching across this system occurs rapidly to reduce any potential impacts.	Medium	Low
FLORA										
Risk of alien vegetation invasive with the proposed disturbance resulting in displacement of indigenous species.	Indirect	Local	Construction and operation phase (long-term)	Yes, can be managed.	No	High	High	The wetland specialist has recommended that the rehabilitation of the buffer zones between site development and the drainage lines is to include the removal of alien invasive vegetation species and active replanting of indigenous plants, to ensure a DENSE, undisturbed vegetative community. This will reduce the likelihood of alien vegetation invasion however a maintenance plan is also included in the Rehabilitation Plan for site 2 (Appendix 15). This involves the	Medium	Low

Nature of Impact (potential)	Direct or Indirect	Extent of Impact	Duration of Impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory Potential	Mitigation measure	Probability after mitigation	Significance after mitigation
								intermittent removal of excess plant material and control of alien species (to continue during operational phase). It is also a recommendation within the Riparian Assessment, that a comprehensive alien weed control programme be implemented be developed.		
Excess removal of vegetation resulting in a potential increase in sediments entering the existing wetland system (SWMP, 2013).	Direct	Local	Construction phase (short-term)	Yes, can be prevented.	No	High	High	The SWMP states that the stripping of vegetation to allow commencement of construction of the earthworks platform shall only be undertaken immediately prior to that element of construction commencing with topsoiling and re-vegetation of exposed surfaces to commence immediately after the completion of all construction activity. Precautionary measures are to be incorporated into the stormwater infrastructure to attenuate the water allowing sediments to settle and encourage infiltration. The incorporation of the buffer area surrounding the drainage lines will assist in preventing high amounts of sediments being washed into the wetlands.	Medium	Low
Site 1: high stormwater runoff impacting on the riparian zone and edge disturbance on the uMhlatuzana Scarp Forest of the Giba Gorge Precinct (Vegetation	Direct	Local with potential to impact down stream	Operational phase (long-term)	Yes, can be prevented.	No	High	High	The ESR states that for all three sites, the stormwater control philosophy will be to restrict post-development flows into the catchment to less than 110% of that occurring pre-development and to facilitate ingress of stormwater into the ground to replenish the	Medium	Low

Nature of Impact (potential)	Direct or Indirect	Extent of Impact	Duration of Impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory Potential	Mitigation measure	Probability after mitigation	Significance after mitigation
Assessment, 2012).								wetlands in the natural drainage lines on site. Additional attenuation features will be required in the main water courses to restrict the flows in larger rainfall events encouraging efficient water feeding in to the wetlands. Since the SWMP attached in Annexure C of Appendix 3 is specific to site 2, a detailed SWMP will be required should site 1 be developed. Prescribed buffer zones and the location of the Green Open Space within the development footprint will assist in reducing the water runoff into the riparian and scarp forest areas.		
Site 2: potential erosion of the D'MOSS wetland system on the western boundary (Vegetation Assessment, 2012).	Direct	Local with potential to impact down stream	Operational phase (long-term)	Yes, can be prevented.	No	Medium	High	The vegetation specialist stated that the potential for erosion of the wetland system can be mitigated against provided that the "hydrology of the wetland systems onsite be maintained post-development by incorporating storm water infiltration and attenuation into the design of the development". The SWMP for site 2, recommends these attenuation and infiltration measures ensuring post-development flows are less than 110% of pre-development flows. Erosion is to be monitored and prevented throughout the site as per the requirements in section 3K of the EMPr.	Low	Low
Site 3: edge disturbance	Direct	Local with	Operational	Yes, can be	No	Medium	High	Similar to site 1, the stormwater	Low	Low

Nature of Impact (potential)	Direct or Indirect	Extent of Impact	Duration of Impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory Potential	Mitigation measure	Probability after mitigation	Significance after mitigation
(increase in erosion and sedimentation) of the biodiverse KZN Sandstone Sourveld and the riparian zone of the Giba Gorge Precinct on the sites eastern boundary (Vegetation Assessment, 2012).		potential to impact down stream	phase (long-term)	prevented.				control philosophy will be to restrict post-development flows into the catchment to less than 110% of that occurring pre-development and to facilitate ingress of stormwater into the ground to replenish the wetlands in the natural drainage lines on site. Additional attenuation features will be required in the main water courses to restrict the flows in larger rainfall events encouraging efficient water feeding in to the wetlands. Since the SWMP attached in Annexure C of Appendix 3 is specific to site 2, a detailed SWMP will be required should site 3 be developed. Prescribed buffer zones and the location of the Green Open Space within the development footprint will assist in reducing the water runoff into the Sandstone Sourveld.		
Site 3: potential removal of a *Kniphofia and Cyathea dregea* species in the wetland area Vegetation Assessment, 2012).	Direct	Local with potential to impact down stream	Operational phase (long-term)	Yes, can be prevented.	No	Medium	Low	While the majority of HGM units are incorporated in the Green Open Space land parcel, there will be a loss of an entire wetland HGM unit in the north-west corner of site 3. It is therefore likely that any protected species found in this north-west wetland will be lost to the development. If site 3 is developed, the applicant is to apply for a permit with Ezemvelo KZN Wildlife for the removal/relocation of these protected species in terms of the KZN Ordinance of 1976 as	Medium	Medium

Nature of Impact (potential)	Direct or Indirect	Extent of Impact	Duration of Impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory Potential	Mitigation measure	Probability after mitigation	Significance after mitigation
								amended.		
Site 3: natural regime of the biodiverse grassland on the eastern boundary altered due to the likelihood of the change in the fire regime and limited grazing (Vegetation Assessment, 2012).	Indirect	Local	Operational phase (long-term)	Potential for the impact to be prevented.	No	High	Low	The natural regime currently existing at the grassland will not continue, even with the inclusion of the Green Open Space land parcels. It is highly unlikely that burning will be approved due to the safety precautions however it has been recommended as a condition of the environmental authorisation that should site 3 be developed, a fire regime is to be considered for incorporation into the site specific Rehabilitation Plan (see section 10 of the EIR).	High	High
Site 2: a change in hydrology potentially impacting on the population of *Gladiolus cruentus* (critically endangered) occurring downstream of site 2 (Riparian Assessment, 2013).	Indirect	Local	Operational phase (long-term)	Yes, can be managed.	No	High	High	The species depends on spray mist from the waterfall downstream. It is therefore important that normal flow volumes from the upstream catchment be maintained. It is anticipated that there will be an increase in flow volume which could improve habitat availability.	Medium	Low
Disturbance of vegetation and the encroachment of alien invasive or ruderal/pioneer wetland plant species during construction of the proposed pipeline (GroundTruth, October 2013).	Direct	Local	Construction phase (short-term)	Yes, can be managed.	No	High	High	Alien clearing must be undertaken within the entire development corridor and an alien management plan put in place to ensure that the construction area and pipeline servitude are maintained free of alien plant species.	Medium	Low
Potential impact on *Bradypodion*	Direct	Regional	Construction phase (short-	Yes, can be prevented.	No	Low	Medium	While no Chameleons were found during the site survey, the specialist	Low	Low

Nature of Impact (potential)	Direct or Indirect	Extent of Impact	Duration of Impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory Potential	Mitigation measure	Probability after mitigation	Significance after mitigation
melanocephalum (Black-headed Dwarf Chameleon) found within alien infested woody vegetation along the pipeline route (SiVest, October 2013).			term)					recommends that should a specimen be found during construction, the specie needs to be removed carefully before construction continues. The specie needs to be relocated to an identified release site. The release site should be identified in consultation with Ezemvelo KZN Wildlife and eThekwini Environmental Management Division.		
Potential disturbance to the remnant of sandstone sourveld grassland located in the western section of the pipeline route (SiVest, October 2013).	Direct	Local	Construction phase (short-term)	Yes, can be prevented.	No	High	High	The remnant of sandstone sourveld is indicated in yellow on Figure 16 above. The pipeline is to be placed within the sugarcane cordon and not impact the limited natural vegetation which is restricted to the steeper slopes. Workers are to be trained and educated on the location of these species prior to work commencing. No stockpiling is to occurring in this remnant. The contractor is to be aware that *Eulophia streptopetala* occurs in this area and must not be disturbed.	Low	Low
Potential disturbance / removal of indigenous species in the vicinity of the storm water culvert which passes underneath the N3 (SiVest, October 2013).	Direct	Local	Construction phase (short-term)	Yes, can be prevented.	No	Medium	High	The Contractor is to avoid the removal of tree species in this area.	Low	Low
Overall loss of indigenous species	Direct	Local	Construction phase (short-	Yes, can be managed.	No	High	Medium	The loss of individual tree species will be minimal based on the current	Medium	Low

Nature of Impact (potential)	Direct or Indirect	Extent of Impact	Duration of Impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory Potential	Mitigation measure	Probability after mitigation	Significance after mitigation
which fall within the pipeline route (SiVest, October 2013).			term)					alignment however the vegetation specialist has stated that a large amount of alien vegetation will be removed during the construction process which will mitigate the loss of the limited number of indigenous tree species (page 7 of the Rapid Vegetation Assessment). The two provincially protected species found along the pipeline route are not to be disturbed. Alternatively, a permit is to be obtained from KZN Wildlife prior to construction.		
Potential damage/ removal of the provincially protected *Scadoxus puniceus* and *Eulophia streptopetala species* located within/adjacent to the proposed pipeline route (SiVest, October 2013).	Direct	Local	Construction phase (short-term)	Yes, can be prevented.	No	High	High	The vegetation specialist has stated that the species appear to fall outside of the proposed pipeline route and therefore the Contractors are to avoid these species. Pictures have been provided in the EMPr and the personnel working on the pipeline are to be educated on the location of these species.	Low	Medium
Loss of the individual *C. sphaerocephala,* a large old indigenous tree located on the western end of the pipeline (SiVest, October 2013).	Direct	Local	Construction phase (short-term)	Yes, can be prevented.	No	High	High	The specialist recommends that the pipeline be aligned on the upper slope above the cane road to alleviate the loss of the *C. sphaerocephala.*	Low	Low
Proposed pipeline route impacting on vegetation within adjacent properties (SiVest, October 2013).	Direct	Local	Construction phase (short-term)	Yes, can be prevented.	No	Low	High	Where possible, the contractor is to ensure that the pipeline and associated working servitude are maintained within the current property(s) to reduce any impact on the vegetation on the other side of	Low	Low

Nature of Impact (potential)	Direct or Indirect	Extent of Impact	Duration of Impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory Potential	Mitigation measure	Probability after mitigation	Significance after mitigation
								the fence lines.		
Removal of soils in steeper areas along the pipeline route resulting in erosion (SiVest, October 2013).	Direct	Local	Construction and Operational phase (long-term)	Yes, can be prevented and managed.	No	Medium	High	The areas which are disturbed should be rehabilitated with a standard NPA mix of grass species. In steep areas where all the vegetation has been removed berms and swales are to be incorporated into the layout to prevent riff and gulley erosion from occurring. The vegetation specialist recommends that a combination of geofabric and regrassing is to occur immediately after construction has ceased to reduce the potential for erosion to occur and the resultant silting up of wetlands, dams and streams that are in close proximity to the construction area.	Low	Low
Positive impact with the removal of existing alien invasive vegetation.	Direct	Local	Construction and operational phase (long-term)	The Rehabilitation Plan as well as the recommendations in the Riparian Assessment state that there be intermittent removal of excess plant material and control of alien species (to continue during operational phase) and that a comprehensive alien weed control programme be implemented before development. Alien vegetation will also be removed locally from the pipeline route and disturbed area. An alien management plan is to be put in place to ensure the construction area and pipeline servitude are maintained free of alien species. The areas which are disturbed should be rehabilitated with a standard NPA mix of grass species as the area will either be retained as a road or will abut the commercial sugarcane farming activities, therefore the merits of trying to re-establish any form of indigenous and diverse vegetation would prove fruitless.							
FAUNA										
Site 1 and site 3 have the potential to reduce the open space faunal links with the Giba Gorge Precinct and adjacent D'MOSS area (Fauna Assessment, 2012)	Direct	Regional	Operational phase (long-term)	Yes, can be prevented.	No	High	High	The applicant has taken into consideration the faunal links by positioning the Green Open Space directly adjacent to the D'MOSS areas/ Giba Gorge Precinct in both development layouts for sites 1 and 3. Once rehabilitated and revegetated, this will form a buffer between the development and the	Medium	Low

Nature of Impact (potential)	Direct or Indirect	Extent of Impact	Duration of Impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory Potential	Mitigation measure	Probability after mitigation	Significance after mitigation
								faunal habitat maintaining the corridor.		
Site 2: Poor planning may result in unnecessary loss of habitat supporting biodiversity (including frog species of conservation importance; Riparian Assessment, 2013).	Direct	Regional	Operational phase (long-term)	Yes, can be prevented.	Yes	High	High	Although no red data species were identified on the site there is potential for a variety of near threatened and vulnerable. The Riparian Assessment concluded that a buffer 32m zone is required to be incorporated into the layout to preserve and protect the riparian areas of the Wekeweke River and associated wetland habitat. A 100m frog buffer was further proposed however the specialist notes that a portion of the development footprint falls within this 100m buffer (Figure 15). A variable buffer or "habitat corridor" is therefore recommended to provide sufficient protection of the potentially conservation important biota. The developments proposed Green Open Space was considered by the riparian specialist as an adequate offset to the loss of 3.9 hectares from the recommended 100m frog buffer. The Green Open Space furthermore provides additional terrestrial and aquatic habitat for frogs.	Medium	Low
Green Open Space being incorporated into the proposed development layout providing an improved, rehabilitated habitat	Direct	Regional	Operational phase (long-term)	The freshwater ecosystems on the sites are currently degraded and are not being maintained due to the current land use however it will be part of the proposed development plans to rehabilitate the ecosystems and remove the alien invasive vegetation. By removing the alien species, indigenous species will be encouraged to grown and it is likely that faunal species associated with this vegetation, will populate the proposed Green Open Space.						

Nature of Impact (potential)	Direct or Indirect	Extent of Impact	Duration of Impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory Potential	Mitigation measure	Probability after mitigation	Significance after mitigation
refugia for flora and associated fauna.										
SENSITIVE ENVIRONMENTAL AREAS										
Degradation of environmentally sensitive areas neighbouring the sites: Site 1: uMhlatuzana River situated to the south-east. Site 2: Wekeweke River situated to the south-west. Site 3: uMhlatuzana River situated to the east.	Direct	Regional	Construction and operational phase (long-term)	Yes, can be prevented and managed.	Potentially, yes	High	High	During construction, stormwater and waste management will be high priority (sections 3B and 3F in the attached EMPr). Workers on site are to be educated on the location and function of the Green Open Space areas as well as the neighbouring environmentally sensitive areas (depending on which site alternative is developed). These adjacent sites should be clearly demarcated to prevent workers from entering the area. During operation, stormwater is to be controlled and maintained according to the site specific SWMP. Litter should not be disposed of within or adjacent to the environmentally sensitive areas. The Rehabilitation Plan for site 2 has included a maintenance schedule for within the wetland and buffer zone. Should site alternatives 1 or 3 be developed, the Rehabilitation Plan is to include mitigation measures to ensure that the adjacent areas are not degraded.	Medium	Low
Encroachment into the wetland buffer zone, thereby reducing protection of the	Direct	Regional	Construction phase (short-term)	Yes, can be prevented.	No	High	High	As stated above, the wetland buffer zone is to be demarcated prior to the commencement of construction activities and workers to be	Low	Low

Nature of Impact (potential)	Direct or Indirect	Extent of Impact	Duration of Impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory Potential	Mitigation measure	Probability after mitigation	Significance after mitigation
drainage line and riparian habitat.								educated on the location and function of the buffer zones. Waste management and stockpile areas in particular are not to encroach into the wetland buffer zone (included in the EMPr). Any construction related impacts are to be rectified prior to the Contractor vacating the site (this could include rehabilitation measures).		
Potential for workers during the construction phase to interfere with the area within the layout designated as Green Open Space.	Direct	Local	Construction phase (short-term)	Yes, can be prevented and/or managed	No	High	High	The area designated for Green Open Space is to be clearly demarcated so all workers on site are aware of these areas. Workers are to be informed on the conservational significance of the area (included in toolbox talks as per section 3L of the EMPr).	Low	Low
Opportunity to rehabilitate and improve the condition of the wetland systems on the sites.	Direct	Local	Operational phase (long-term)	A Rehabilitation Plan has been prepared for the preferred site alternative which aims at achieving the objective of "no-net-loss" through detailed rehabilitation planning. The Rehabilitation Plan includes the remove of alien invasive vegetation, wetland interventions to enhance the functionality as well as monitoring for the long-term stability of the interventions. The Rehabilitation Plan is summarised below the table and included in Appendix 15 of the EIR.						
WASTE										
Improper storage of hazardous waste i.e. used oils from vehicles; old cement bags etc. resulting in possible contamination to the surrounding environment.	Direct	Local	Construction phase (short-term)	Yes, can be prevented.	No	High	High	Hazardous waste must be stored on a hard surface within a bunded area and must not be allowed to enter stormwater drains and the surrounding environment. Waste must be disposed of regularly by a reputable contractor. Hazardous waste such as oils, contaminated rags etc. must be disposed of at a hazardous class landfill. Safe disposal certificates must be provided and retained in the site	Low	Low

Nature of Impact (potential)	Direct or Indirect	Extent of Impact	Duration of Impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory Potential	Mitigation measure	Probability after mitigation	Significance after mitigation
								environmental file for audit purposes (waste management included in section 3F of the EMPr).		
Potential for improper storage and disposal of waste materials generated during construction resulting in possible contamination to the surrounding environment.	Direct	Local	Construction phase (short-term)	Yes, can be prevented.	No	High	High	Waste must be stored in the bins within the waste collection area in the construction camp and must not be allowed to blow around the site or be placed in piles adjacent the skips / bins. Separate waste bins for each of the waste streams generated must be provided. The waste containers must be appropriate to the waste type contained therein and where necessary should be lined and covered. Waste must not be allowed to accumulate on site but should be disposed of regularly by a reputable contractor and must be disposed of at an appropriate landfill site.	Low	Low
Littering around the site.	Direct	Local	Construction phase (short-term)	Yes, can be managed.	No	High	High	Littering will not be permitted on the site and general housekeeping will be enforced. Construction will be monitored by an ECO who will manage compliance with the construction EMPr (Appendix 14).	Low	Low
Litter and solid waste accumulating on site due to delay in servicing by Durban Solid Waste (DSW).	Direct	Local	Construction phase (short-term)	Yes, can be prevented and managed.	No	High	Medium	Solid waste will be stored on the site where it will be collected by a private operator or eThekwini Municipality. During construction, a waste management area is required to ensure that all waste types are contained and effectively managed. Safe disposal slips should be retained on site for audit purposes.	Low	Low

Nature of Impact (potential)	Direct or Indirect	Extent of Impact	Duration of Impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory Potential	Mitigation measure	Probability after mitigation	Significance after mitigation
								Section 3F of the EMPr outlines waste management. Large amounts of solid general waste (>100m3) should not be allowed to accumulate on site.		
Improper disposal of rubble i.e. burying or neglecting building rubble resulting in direct mechanical damage to surrounding vegetation and untidiness of the site.	Direct	Local	Construction phase (short-term)	Yes, can be prevented.	No	Low	High	All excess material and rubble not being utilized on the site must be removed and disposed of at an approved, designated landfill. A safe disposal certificate must be obtained and retained in the sites environmental file.	Low	Low
Potential for construction waste to be disposed of at incorrect landfill resulting in contamination at the landfill site.	Indirect	Local	Construction phase (short-term)	Yes, can be prevented.	No	Medium	High	Recycling should be undertaken where possible to limit waste added to the landfill site. Waste to be sent to registered landfills and safe disposal certificates must be retained for hazardous waste.	Low	Low
Nominal increase in pressure on local landfill.	Direct	Local	Construction phase (short-term)	Yes, can be managed.	No	Low	Medium	Solid waste will be collected by eThekwini Municipality for disposal or a private operator depending on the type and quantity of waste. The ESR states that the nearby DSW Bulbul Drive landfill site has adequate air-space (capacity) to accept waste generated from the development. The ESR also states that other waste collection models could be implemented, which could include 'contracted out' collection, facilities for waste separation for recycling etc. (section 7 in Appendix 3 of EIR).	Low	Low
HAZARDOUS CHEMICALS / FUELS										
Bulk storage of	Direct	Local	Construction	Yes, can be	No	High	High	Cement mixing will need to take	Low	Low

Nature of Impact (potential)	Direct or Indirect	Extent of Impact	Duration of Impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory Potential	Mitigation measure	Probability after mitigation	Significance after mitigation
dangerous fuels i.e. spillage of diesel during construction potentially contaminating groundwater and surrounding environment.			phase (short-term)	prevented.				place on a hard surface or cement mixing trays will need to be used. If the creation of a permanent bunded area is not feasible, these materials must be stored on drip trays capable of holding at least 110% of the spilled volume. Any construction equipment that could leak oil must be placed on a drip tray. All equipment must be in good working order to reduce the likelihood of oil leaks occurring. Any re-fuelling of equipment must occur on a hardened surface, within a designated re-fuelling area where any spills can be contained. A designated hazardous store will be set up which must be located within a bunded area on a hardened surface and under cover. Construction will be monitored by an ECO who will manage compliance with the construction EMPr.		
Risk of spills from construction equipment (oils, fuels etc.) contaminating soil and stormwater.	Direct	Local	Construction phase (short-term)	Yes, can be prevented.	No	High	High	As mentioned above, a designated re-fuelling area is required to contain spills, cement mixing is to take place on a hardened surface and a designated hazardous store will be set up within a bunded area capable of holding at least 110% of the spilled volume.	Low	Low
Improper storage of hazardous waste i.e. used oils from vehicles, old cement bags,	Direct	Local	Construction phase (short-term)	Yes, can be managed.	No	Medium	High	A separate bin dedicated to the storage of hazardous waste will be required. The bin should be clearly labelled as such and frequently	Low	Low

Nature of Impact (potential)	Direct or Indirect	Extent of Impact	Duration of Impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory Potential	Mitigation measure	Probability after mitigation	Significance after mitigation
contaminated soil etc.								emptied with the contents being disposed of at a registered hazardous landfill site. Safe disposal records are required to be kept on site for audit purposes. The hazardous storage area will be monitored according to the EMPr by an independent ECO.		
NOISE										
Site 1: Noise generated during construction disturbing surrounding residents (e.g. Assagay Hotel).	Direct	Local	Construction phase (short-term)	Yes, can be managed	No	Medium	High	Excessive noise must be controlled on site. Workers will be trained regarding noise on site and construction hours will be kept to working hours (07h00 to 17h00). All precautions must be taken to ensure that noise generation is kept to a minimum should site 1 be developed as the preferred alternative. If excessive noise is expected during certain stages of the construction, neighbouring residents must be notified prior to the event. The EMPr has been designed to manage construction activities and is attached under Appendix 14.	Low	Low
Potential for the reservoir to be noisy impacting on residential neighbours.	Direct	Local	Operational phase (long-term)	Yes, can be prevented	No	Low	High	The majority of the water feed would be gravity and therefore there is no need for pumps.	Low	Low
AIR QUALITY										
Emissions generated from construction vehicles	Direct	Local	Construction phase (short-term)	Yes, can be managed.	No	Medium	Low	The only emissions that will be generated will be from construction vehicles which are expected to be minimal and are not expected to significantly affect the surrounding	Medium	Low

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								communities or the environment. Air emissions should be monitored daily by the onsite ECO and a complaints register available to surrounding communities.		
Dust generated from construction vehicles and other on-site activities Site 1: impacting workers on-site as well as the neighbouring residential complex during construction. Site 2: impacting workers on-site. Site 3: Dust generated from construction vehicles and other on-site activities impacting workers on-site as well as the Denny Mushroom Farm, adjacent to the site.	Direct	Local	Construction phase (short-term)	Yes, can be managed.	No	High	Medium	Dust control measures (the use of water cart/ truck) must be used to wet exposed soil thereby maintaining low dust levels. The dust levels must be kept below the required SANS Standards to ensure minimal impact on the surrounding community and environment. The ECO should monitor the dust levels daily. Drivers and workers on the site should be educated with regards to the air pollution on site. A complaints register is to be maintained recording any air quality/dust complaints.	Low	Low
RESOURCE USE & CONSERVATION										
Sourcing of raw materials i.e.: (gravel, stone, sand, cement and water) from unsustainable sources resulting in illegal sand winning and mining operations causing significant environmental damage.	Indirect	Potential to be regional	Construction phase (short-term)	Yes, can be prevented.	Yes, potential loss of irreplaceable soil and water resources.	Medium	High	Materials are to be sourced on site where possible and rubble from demolished infrastructure utilised as fill material. All sourced materials must be obtained from a registered and sustainable source and all delivery notes and slips must be made available to the ECO e.g. mined material such as stone must only be obtained from permitted quarries.	Low	Medium

Nature of Impact (potential)	Direct or Indirect	Extent of Impact	Duration of Impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory Potential	Mitigation measure	Probability after mitigation	Significance after mitigation
TRAFFIC										
Increase in traffic disruptions on surrounding access roads during construction.	Direct	Local	Construction phase (short-term)	Yes, can be managed.	No	High	High	Points man in attendance to control traffic where road disruption is most likely. Alert traffic department if road closure is required, conduct road closures during off peak hours and place notices of intent in advance. Construction vehicles to comply with the speed limits.	Medium	Medium
Potential impact of increased traffic on pedestrian safety.	Indirect	Local	Construction and operational phase (long-term)	Yes, can be managed.	No	Medium	Medium	The traffic specialist recommended that the minimum width of the proposed new sidewalks be 3meters to safely accommodate pedestrians and cyclists. Initially, a sufficient road reserve is required to ensure the incorporation of public transport provisions at a later stage.	Medium	Medium
Increase in the volume of traffic on the roads during the operation of the proposed development resulting in congestion.	Direct	Local	Operational phase (long-term)	Yes, can be prevented.	No	High	High	The Traffic Impact Assessment has identified intersections/ roads requiring upgrades and/or signalised. Once the upgrades are complete, the road network should cope with the calculated predicted traffic flows.	Low	Low
Nuisance impact on surrounding residents with the upgrading of nearby roads.	Direct	Local	Construction phase (short-term)	Yes, can be managed.	No	High	Medium	Keep points man in attendance to control traffic where road disruption is most likely. Alert traffic department if road closure is required, conduct road closures during off peak hours and place notices of intent in advance.	Medium	Low
Positive impact with the incorporation of public transport and non-motorised transportation into the proposal.	Direct	Local	Operational phase (long-term)	The Traffic Impact Assessment has stated that there will be the construction of a public transport interchange within the site and laybys on Kassier Road. In the long term, the road upgrades will ensure that the public transport aligns with the IRPTN strategy and that sufficient road reserve is maintained to provide a BRT lane if required. There will be a minimum width of 3m for sidewalks, both internally and externally, to safely accommodate pedestrians and cyclists.						

Nature of Impact (potential)	Direct or Indirect	Extent of Impact	Duration of Impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory Potential	Mitigation measure	Probability after mitigation	Significance after mitigation
INFRASTRUCTURE & SERVICES										
Damage to existing services (electricity, water and sewer pipeline traversing site).	Direct	Local	Construction phase (short-term)	Yes, can be prevented.	No	High	High	As a result of the existing long-term land use, there are not many services found in the proposed sites however, this impact can be fully mitigated against by identifying services prior to construction and avoiding damage to existing services. Alternatively, if service disruption is unavoidable, the parties affected must be notified in advance.	Low	Medium
Increased pressure on existing bulk water services in the Western area.	Direct	Local	Operational phase (long-term)	Yes, can be managed.	No	High	High	The bulk water supply for the proposed development will originate from the proposed and soon to be constructed Western Aquaduct. eThekwini Water and Sanitation have confirmed that a supply may be taken off the Western Aquaduct to serve the greater development (proof of capacity confirmation to be attached under Appendix 6 of the Final EIR once obtained).	Low	Low
Nominal pressure on the eThekwini Municipality's local substation (Marian Ridge Major substation to obtain developments initial load).	Indirect	Local	Operational phase (long-term)	Yes, can be managed.	No	High	High	Bosch Stemele, as the electrical engineers are to be in correspondence with the Supply Authority, eThekwini Municipality, to ensure that there is sufficient capacity available (proof of capacity confirmation to be attached under Appendix 6 of the Final EIR once obtained). In the long term, the proposed development will require the construction of a new major substation (Electrical Services Report, Annexure F of Appendix 3	Low	Low

Nature of Impact (potential)	Direct or Indirect	Extent of Impact	Duration of Impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory Potential	Mitigation measure	Probability after mitigation	Significance after mitigation
								of EIR).		
Potential for the existing wastewater treatment works not having sufficient capacity to treat sewage from the upgrade.	Direct	Local	Operational phase (long-term)	Yes, can be managed.	No	Low	High	The Tongaat Hulett Sewer Reticulation Project obtained environmental authorisation for the construction of bulk sewerage facilities in the area (EIA DM/0024/10). This assessment took into consideration existing and potential sewer generation for the proposed Shongweni retail/ mixed-use development. There is therefore sufficient capacity at the uMhlatuzana Sewage Treatment Works.	Low	Low
Over densification of the Shongweni area and change in sense of place currently associated with the existing land-use.	Indirect	Regional	Operational phase (long-term)	No	No	Low	Low	While there will be a loss of open space, the continuation of agricultural activities is not in line with the city's need for growth and development. GAPP Architects and Urban Designers, have stated the proposed development is aligned to the Urban Development Line, the Municipality's urban growth management tool. There will therefore be an unmitigated change in the sense of place currently associated with the site.	Low	Low
Positive impact for meeting housing and basic service needs, access to employment opportunities	Direct	Regional	Operational phase (long-term)	Findings from interviews conducted in the local area, undertaken as part of the Marketing and Socio-Economic Impact Assessment identified the demand for affordable housing, the demand for safe, secure, upmarket office space and retail brand preferences (which are likely to be incorporated into the tenant considerations).						
VISUAL										
Site 1: Loss of visual aesthetics for the neighbouring residential	Direct	Local	Construction and operational	No	No	High	Low	There will be a loss of open space associated with the sugarcane and this will change the visual	High	Medium

Nature of Impact (potential)	Direct or Indirect	Extent of Impact	Duration of Impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory Potential	Mitigation measure	Probability after mitigation	Significance after mitigation
complex (the Assagay Hotel), currently associated with the sugarcane farming.			phase (long-term)					aesthetics for the neighbouring residential complex. In particular, construction activities.		
Reservoir having a negative visual impact on the immediately adjacent neighbours.	Direct	Local	Operational phase (long-term)	Yes, can be partially managed.	No	High	Medium	The EAP has recommended that as part of the post construction phase, the area disturbed by the pipeline and reservoir be rehabilitated back to its current state. The reservoir is to be located as far underground as practically possible. Trees and shrubs are to be incorporated into the final design as far as practically possible.		
SOCIO-ECONOMIC										
Unauthorised access to property.	Indirect	Local	Construction phase (short-term)	Yes, can be prevented.	No	Medium	High	The applicants are the landowners and thereby will authorize access to the property. The entire site should however be fenced so ensure workers do not cross boundary lines particularly where the development footprint runs adjacent to residential communities.	Low	Low
Potential for an associated increase in crime due to the influx of workers into the area.	Direct	Local	Construction phase (short-term)	Yes, can be managed to an extent.	No	High	High	As mentioned above, the entire site should be fenced to prevent workers from accessing adjacent properties. Security personnel on site should be strategically positioned at exit and entry points as well as paying attention to the neighbouring residential communities in the event that site 1 is developed. The EAP further recommends that security personnel patrol the	Low	Medium

Nature of Impact (potential)	Direct or Indirect	Extent of Impact	Duration of Impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory Potential	Mitigation measure	Probability after mitigation	Significance after mitigation
								pipeline route where it runs adjacent to neighbouring properties during the construction phase.		
Site 1: removal of recreational land that has been available to the local community for horse riding, mountain biking etc.	Direct	Local	Construction and operational phase (long-term)	Yes, can be prevented.	No	High	Low	Just over 3 hectares of land has been allocated for "Recreational and Tourism" however the tracks and trails originally on site 1 will no longer exist on the site. The preferred site alternative is however site 2.	High	Low
Potential temporary and permanent employment for skilled and unskilled members of the local community during the construction and operational phases (Market Research and Socio-Eco Impact Assessment, 2012).	Direct	Regional	Construction and operational phase (long-term)	3726 temporary employment opportunities will be created during the construction phase (2097 directly and 1629 indirectly) and 359 permanent jobs will be created during the operation phase (234 direct and 124 indirectly).						
Shongweni Regional Centre stimulating trade and investment along the intended freight highway (the N3; Planning Report, 2013).	Direct	Regional	Construction and operational phase (long-term)	The planning specialist states that the sites sit strategically within what is by far the most dominant freight and logistics corridor in Southern Africa. In anticipation of the proposed dug-out Port, a proposed freight highway along the N3 highway, is intended to pass directly through the THD landholdings in Shongweni.						
CULTURAL										
Potential unearthing and damage to items of cultural or historical significance.	Direct	Local	Construction phase (short-term)	Yes, can be prevented.	No	Low	High	A Heritage Impact Assessment was conducted is included in Appendix 13. During the construction phase, should any culturally significance artifacts be discovered, construction is to cease immediately and the heritage authority contacted (AMAFA).	Low	Low
Loss of historical	Direct	Local	Construction	No	No	Low	Low	The heritage specialist has stated	Low	Low

Nature of Impact (potential)	Direct or Indirect	Extent of Impact	Duration of Impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory Potential	Mitigation measure	Probability after mitigation	Significance after mitigation
landscape associated with mono-crop production and the McIntosh family.			and operational phase (long-term)					that there is little remnant on the property of any archaeological value given the extent and period over which the land has been disturbed. Even with the association with the McIntoshes (started the Durban County Wattle Syndicate), the farmhouse on site 2 has "medium historical and social value". The specialist recommends that were possible, established gardens should be retained.		
Site 1: Unintentional damage to sections of the Farmhouse and the Estate Management House during construction which were identified as having medium local historical and social value.	Direct	Local	Construction phase (short-term)	Yes, can be prevented.	Yes	High	High	Should site 1 be developed, the applicant is to lodge an application with AMAFA for the demolition, alteration or alteration to a structure which is over 60 years old. Care should be taken when relocating the infrastructure to ensure that no damage is caused.	Low	Low
HEALTH & SAFETY										
Speeding construction vehicles resulting in safety issues for surrounding residents.	Direct	Local	Construction phase (short-term)	Yes, can be prevented.	No	High	High	Speeding will be prohibited.	Low	Low
Lack of toilet facilities during construction resulting in unsanitary conditions.	Direct	Local	Construction phase (short-term)	Yes, can be prevented.	No	High	High	Adequate toilet facilities will be provided for all staff members as standard construction practice. The provision of toilets is included in the attached EMPr requirements.	Low	Low
Improper disposal of toilet waste from chemical toilets resulting in contamination of the surrounding	Direct	Local	Construction phase (short-term)	Yes, can be prevented.	No	High	High	The chemical toilets to be provided must be from a registered company and all sewage must be disposed of at an appropriate facility. Safe disposal certificates must be kept	Low	Low

Nature of Impact (potential)	Direct or Indirect	Extent of Impact	Duration of Impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory Potential	Mitigation measure	Probability after mitigation	Significance after mitigation
environment.								on record in the site environmental file.		
IMPACTS OF THE NO-GO OPTION										
Lack of improved service provision in the area.	Direct	Local	Long-term	-	No	-	-	Electrical, bulk water and sewerage infrastructure improvements associated with the proposed development will not be constructed.	-	-
No additional opportunities for employment in the area.	Direct	Local	Long-term	-	No	-	-	The opportunity to provide employment associated with the construction and operation of the proposed development, will be lost.	-	-
Lost opportunity to rehabilitate the freshwater ecosystem currently existing on the sites.	Direct	Regional	Long-term	-	No	-	-	Freshwater ecosystems will remain in their current state invaded by alien vegetation but will also not be effected by the change in hydrology/ waste management that may impact the system during construction and operation of the proposed development.	-	-
Risk of further alien invasive encroachment taking over indigenous fauna and flora within the sensitive areas.	Direct	Regional	Long-term	-	No	-	-	As above, the wetland systems on all three sites are invaded by alien vegetation. The proposed development will see the incorporation of an alien invasive control plan to be continued throughout the operation of the Shongweni retail/ mixed use development.	-	-
No net loss in wetland area and Green Open Space currently associated with the sugarcane fields.	Direct	Regional	Long-term	-	No	-	-	Positive impact with the current size and open space corridors being maintained across the sites.	-	-
Loss of development opportunity for a	Direct	Regional	Long-term	-	No	-	-	The land currently zoned as agricultural, no longer falls within	-	-

Nature of Impact (potential)	Direct or Indirect	Extent of Impact	Duration of Impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory Potential	Mitigation measure	Probability after mitigation	Significance after mitigation
proposed Shongweni Regional Centre, an important link on the N3 freight corridor.								the Shongweni LAP. The development of a strategic regional centre for this area will be postponed.		
Recreational activities will continue to be available to the local community (site 1).	Direct	Local	Long-term	-	No	-	-	Positive impact with the local community continuing to utilise site 1 for horse riding, mountain biking etc.	-	-

From the above impacts table, it is evident that the freshwater ecosystems on the site and their associated fauna and flora links are the most important environmental component to consider during the EIA. The drainage lines identified on all three of the site alternatives are associated with significant conservation habitats further downstream of the proposed site. Sites 1 and 3 drain into the uMhlatuzana River which provides water to Giba Gorge, where a significant number of rare and threatened plant species exist. The Giba Gorge Precinct is a registered Protected Area within the eThekwini Municipality. The drainage lines within site 2, also provide water to an important freshwater ecosystem, the Wekeweke Stream which ultimately drains into Shongweni Dam. This stream has been identified as a NFEPA.

Due to the current land use, all three sites have are heavily disturbed in terms of indigenous vegetation with the small patches of woodlot being infested with alien invasive plants. Due to the poor quality of vegetation, the sites have a low faunal conservation value. Although the proposed development will result in the loss of open green space currently provided by the sugarcane fields, the fauna and flora specialist has stated that it is likely to add value to the land and provide much needed funding for the improvement of the conservation significance of the sites. Green Open Space has been incorporated into all four of the layout alternatives and have been positioned to take into account the location of the drainage lines and freshwater ecosystems of the sites. The Green Open Space as well as the proposed 32m buffer, are the main mitigatory measures that are in place to reduce the impact of the proposed development on the freshwater ecosystems.

According to the findings of the wetland specialist, the proposed development of site 1 will result in a loss of one HGM unit, development on the preferred site 2 will result in the loss of 1.4 hectares of wetland and development on site 3 resulting in the loss of a wetland system in the north-west corner. It is apparent that site 2 is the preferred environmental alternative and therefore the applicant commissioned GroundTruth to carry out an extensive Wetland Rehabilitation Plan for site 2 which aims to achieve “no-net-loss” through detailed rehabilitation planning and interventions (included in Appendix 15 and summarised in section 6.3 below).

Provided that the Rehabilitation Plan, SWMP and EMPr measures are strictly followed during site establishment, construction and operation, it is likely that all identified impacts as listed in Table 10 above, can be effectively mitigated against and managed. On-going maintenance and monitoring of the stormwater infrastructure, Green Open Space and extended management area (as illustrated in Figure 15) are vital for achieving a sustainable environmental development.

The proposed pipeline route is to avoid the two provincially protected plants and remnant of Sandstone Sourveld. No faunal species will be impacted on during operation however the contractor and workers are to be aware of the Black-headed Dwarf Chameleon. The chameleon and both plant species are illustrated in the EMPr and should be included in initial toolbox talks. The wetland specialist has stated that although freshwater ecosystems are crossed, there is an opportunity for rehabilitation of currently modified wetland habitats. Provided that method statements are submitted to the Engineer and ECO prior to construction activities taking place, the watercourses should not be significantly impacted on by the proposed pipeline route.

The major positive impacts that require noting are the provision of opportunities for employment during construction and operation of the Shongweni retail/ mixed use development as well as the alignment with local, regional and national strategic plans for the Outer West area.

6.3 Summary of Findings of Wetland Rehabilitation Plan [Regulation 31 (2) (j)]

The Wetland Rehabilitation Plan for site 2 (Appendix 15) includes an assessment of the wetland systems within the post-development landscape and aims to achieve “no-net-loss” through detailed rehabilitation planning. The Rehabilitation Plan was undertaken in accordance with the general process adopted by the national Working for Wetlands programme and in accordance with the approach outlined in WET-RehabPlan (Kotze et al., 2009). 5.06ha of wetland habitat will remain within the post-development landscape. The rehabilitation plan assumes that appropriate attenuation facilities have been incorporated into the post-development layout, as proposed by the stormwater specialist.

Section 4 of the Rehabilitation Plan describes the methodology used which includes an assessment of wetland functionality and condition/integrity for current (carried out in the wetland study, summarised above) and post-development scenarios. A Rehabilitation Plan was compiled to achieve desired levels of functioning and integrity within the wetland habitat and specific maintenance and management requirements included. Alien invasive plant clearing techniques have been recommended to include in the follow-up operation of these areas. Assumptions and Limitations are listed in section 5 of the Rehabilitation Plan.

Wetland Ecological Functioning

Current state: Moderately High level with water quality enhancement and biodiversity maintenance being the priority services provided.
Post-development: Moderately High level with the wetland continuing to enhance water quality however more effectively. The level of integrity relating to biodiversity is anticipated to improve as the system will comprise of indigenous wetland vegetation in comparison to sugarcane or alien vegetation. The improved biodiversity will result in improved wetland habitat, important when considering the nature of the NFEPA classification of the Wekeweke Stream.

Wetland Ecological Integrity
Current state: extensive modification associated with agricultural activities. The PES category for HGM Unit 1 in terms of Hydrology was a category E, geomorphology C and Vegetation E. For HGM Unit 2, the PES category for hydrology was at a level E, B for geomorphology and F for vegetation.
Post-development: Categories anticipated to improve as a result of the rehabilitation. The PES category for HGM Unit 1 in terms of Hydrology remained a category E, geomorphology decreased to level D and Vegetation improved to a category D. For HGM Unit 2, the PES category for hydrology improved to a level C, decreased to a level C for geomorphology and increased significantly to a level C for vegetation.

Overall Ecosystem Integrity
The post-development scenario, with the adoption of mitigation activities, includes both positive and negative impacts. The system's geomorphic integrity is reduced due to the infilling and deactivation of portions of the wetland, but the overall integrity is marginally improved by the improvements in the hydrological and vegetation components, relating to the anticipated rehabilitation of the remaining wetland habitat. The current equivalent of intact wetland for HGM Unit 1 is 1.62ha with the post-development scenario considered to be equivalent to 1.86ha. An overall PES Category E was achieved for HGM Unit 1 in its current state with a post-development category of D being anticipated. For HGM Unit 2, the current equivalent of intact wetland is 1.08ha with the post-development scenario considered to be equivalent to 2ha. An overall PES Category C was achieved for HGM Unit 2 in its current state with a post-development category of C being anticipated.

The Wetland Rehabilitation Plan is outlined in section 7 of the report. It includes identification of the wetland problems with the agricultural activities being the key biophysical driver and details the rehabilitation aims and objectives.

The aim of the rehabilitation is to offset the impacts of the potential development, enhancing the functioning and integrity of the remaining freshwater ecosystems within the development site.

The wetland rehabilitation strategy is detailed in section 7.3 of the Rehabilitation Plan and is to include interventions, re-vegetation and planting, alien invasive plant control and timing. Specific recommendations are prescribed under each of these headings. It has been recommended as a condition for authorisation (section 10 of the EIR) that the Wetland Rehabilitation Plan be strictly followed and therefore all recommendations have not been listed in this summary. Earthworks will be required for the proposed interventions in both HGM Units. These earthworks include backfilling drain and/or channel, deactivation of agricultural road network and the incorporation of sediment fences and/or "bio-jute". Numerous structural intervention types have been recommended including concrete weirs and gabion cut-off walls. Following alien plant clearing and earthworks activities, re-vegetation of the wetland habitat would be required. Details of the re-vegetation and eradication of alien invasive species is provided in sections 7.4.3 and 7.4.4 of the Rehabilitation Plan.

Implementation order of the proposed rehabilitation interventions is critical. The following sequences is therefore recommended for both HGM Units:
Phase 1 (earthworks)
- Fill in drains;
- Fill in channel (HGM Unit 2);
- Deactivate road network within the wetlands and buffer zones;
- Re-shape wetland habitat; and
- Placement of sediment fences and / or bio-jute (if required).

Phase 2 (construction of gabion cut-off walls)
Phase 3 (construction of concrete weirs)
Phase 4 (eradication of alien vegetation)
Phase 5 (re-vegetation of freshwater ecosystems)

A wetland rehabilitation monitoring framework was developed (section 8 of the Rehabilitation Plan) in accordance with the principles outlined in WET-RehabEvaluate (Cowden & Kotze, 2009), with specific monitoring being recommended for the anticipated outputs and outcomes of the project. The monitoring includes the collection of baseline and routine monitoring

information to enable the evaluation of the rehabilitation effectiveness three years (two growing seasons) after completion of the rehabilitation activities. The monitoring is to include the assessment of the structural interventions, site photographs and wetland assessments to evaluate the wetland rehabilitation effectiveness.

To ensure wetland maintenance the specialist outlines further management measures in section 9 of the Rehabilitation Plan. These measures have been summarised above and include the removal of the excess plant material at regular intervals and the control of alien invasive vegetation. The specialist further recommends that due to the rapid re-growth of species such as *Lantana camara*, at least four follow up operations should be planned for during the first two years after the initial clearing (during the spring and summer months).

6.4 Draft Environmental Management Programme [Regulation 31 (2) (p) and 33]

An Environmental Management Programme (EMPr) in accordance with Regulation 33 has been compiled and is included in Appendix 14. The objective of the EMPr is to provide measures to mitigate and manage construction, operation and decommissioning activities in order to minimise potential negative impacts on the surrounding environment. The EMPr serves as a standalone document required to be kept on site during construction phase. It typically forms the basis for monitoring compliance with the Environmental Authorisation during the construction and operational phase.

An independent Environmental Control Officer (ECO) will be required to ensure that the applicant as well as the contractor on the site comply with the requirements of the EMPr. Frequent audits will be conducted and submitted to the DAEA. Due to the magnitude of the proposed development as well as the requirement for frequent monitoring, the EAP proposes that weekly audits be carried out during construction and post-construction phase until rehabilitation of the site is complete.

6.5 Determination and Assessment of Cumulative impacts [Regulation 32 (2) (l) (i)]

The NEMA EIA regulations define cumulative impact as follows:

> *"the impact of an activity that in itself may not be significant but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area"*

The DEA guideline on the assessment of alternatives and impacts identifies two types of cumulative impacts:

(1) Additive cumulative impact, i.e. where the identified potential impact adds to the impact which is caused by other similar impacts; or
(2) Interactive cumulative impact, i.e. where a cumulative impact is caused by different impacts that combine to form a new kind of impact. Interactive impacts can be further classified:
    a. Counterveiling: the net adverse cumulative impact is less than the sum of the individual impacts; or
    b. Synergistic: the net adverse cumulative impact is greater than the sum of the individual impacts.

Table 11 provides an assessment of potential cumulative impacts that may arise from the development proposal:

Table 11: Assessment of potential cumulative impacts for the proposed development of the Shongweni retail/ mixed use development

Nature of Impact (potential)	Extent of Impact	Duration of Impact	Type of Cumulative Impact	Mitigatory Potential	Mitigation measure	Probability after mitigation	Significance after mitigation
The proposed development will place added pressure on services in the area, namely electricity, water and sanitation.	Local and potential regional impact if services are impacted	Operational phase (long-term)	Additive	High	The Engineering Services Report (Appendix 3) indicates that eThekwini Municipality have the capacity to handle the sewerage with the upgrade of the uMhlatuzana Sewage Treatment Works and associated pipework. The proposed development will tie into the authorised sewer pipeline (EIA DM/0024/10). This assessment took into consideration potential sewerage generation for the proposed Shongweni retail/ mixed-use development. There is therefore sufficient capacity at the uMhlatuzana Sewage Treatment Works. In the long term, the proposed development will require the construction of a new major substation as stated in the Electrical Report (Annexure F of Appendix 3) however Marian Ridge Major substation will supply the initial load requirements. Eskom's Gorgedale Substation is to provide the feed for the new 132/11kV major substation for the proposed development (eThekwini Municipality liaising with Eskom regarding the transmission lines. The Electrical Engineers is in correspondence with the Supply Authority, eThekwini Municipality, to ensure that there is sufficient capacity available (proof of capacity confirmation to be attached under Appendix 6 of the Final EIR once obtained by applicant). eThekwini Water and Sanitation have confirmed that a supply may be taken off the soon to be constructed Western Aquaduct to serve the greater development (proof of capacity confirmation to be attached under Appendix 6 of the Final EIR once obtained by applicant). In the long-term, the proposed development will facilitate the construction of new, more appropriate infrastructure into the area and therefore this is a major positive impact.	Low	Low
Increase in traffic volumes on the surrounding road networks causing congestion and additive safety risks.	Local	Operational phase (long-term)	Additive	High	A Traffic Impact Assessment was carried out to anticipate the increase in traffic and identify the roads and intersections which would be significantly affected. The TIA is summarised above in	Medium	Low

Nature of Impact (potential)	Extent of Impact	Duration of Impact	Type of Cumulative Impact	Mitigatory Potential	Mitigation measure	Probability after mitigation	Significance after mitigation
					section 3.2.1.1 with seven key intersections being identified. The traffic engineer has recommended a number of road upgrades which will improve the road network reducing future traffic problems (Table 11 in the TIA, Appendix 4 of EIR). Additionally, the preferred site alternative, is well located adjacent to the national highway, which will provide direct access to the development and reduce the amount of vehicles utilising the surrounding residential roads/intersections. With regards to pedestrian safety, the traffic specialist recommended that the minimum width of the proposed new sidewalks be 3meters to safely accommodate pedestrians and cyclists. Initially, a sufficient road reserve is required to ensure the incorporation of public transport provisions at a later stage.		
Cumulative change in land-use with the loss of agricultural land in Kwa-Zulu Natal.	Local	Operational phase (long-term)	Interactive, synergistic	Medium	The agricultural report states that the DAEA has been working with Tongaat Hulett and other role player in agricultural, rural and urban development to obtain an understanding between strategies to increase agriculture production whilst creating new investment opportunities along growth corridors. The specialist considered the cropping and land use options on the Estate together with the need for development along the N3 growth corridor and concluded that the impact of the proposed development on sugarcane production is insignificant and will have little or no impact on food security in the region. In fact, the land used for sugarcane production in KZN has increased by 15% over the past 3 years. The development of site 1, will however have a greater impact regarding the change in land-use due to the close proximity of the residential complex and the Assagay community utilising the M13 intersection.	Medium	Low

Based on Table 11, there are relatively few cumulative impacts resulting from the development of the Shongweni retail/mixed use development. All cumulative impacts identified above can be sufficiently mitigated against with the upgrading of services in the area (including electrical, water, sanitation and road networks). This is in fact a major positive with the proposed development facilitating the construction of services in the area. The agricultural specialist has confirmed that the change in land-use from agricultural to commercial, will not impact on food security for the region. Furthermore, the specialist indicated that the current water resources (two small dams and numerous small streams on the Estate), are not

sufficient for irrigation of sugarcane currently being produced on the Estate. The strategic location of the site along the N3 freight and logistics corridor, supports the development proposal.

7.0 Comparative assessment of all alternatives identified during the environmental impact assessment process including the advantages and disadvantages that the proposed activity may have on the environment and the community that may be affected by the activity [Regulation 31 (2) (i) and (g)]

As discussed in section 3.1 above, the applicant identified three site alternatives within Tongaat Hulett's Shongweni Estate. Site 1 (Alternative 1), located on a portion of land between the M13 and N3, site 2 (Alternative 2) located south of the N3 to the west of J.B McIntosh Drive and site 3 (Alternative 3) located south of thee N3 to the east of J.B McIntosh Drive. Taking into consideration the findings and recommendations of the various environmental specialists as well as the general topography of the land, site 2 has been indicated as the preferred alternative throughout the EIR.

Please note that information used in the comparison tables in this section are for the long-term operational phase of the proposed development. Section 6 above includes all potential impacts (construction and operational) and proposed mitigation measures. It was concluded that the majority of the construction related impacts could be fully mitigated or avoided utilising the attached EMPr (Appendix 14) and GroundTruth's Wetland Rehabilitation Plan (Appendix 15).

Table 12: No Go Option vs Alternatives
Advantages and disadvantages are clearly labelled. If not stated as being an advantage or disadvantage, the point can be interpreted as both depending on one's point of view.

	ENVIRONMENTAL SERVICES / BIOLOGICAL	SURROUNDING COMMUNITIES/ BUSINESS (SOCIAL)	ECONOMIC FEASIBILITY & OPPORTUNITY
Alternative 1: Development of site 1	• Greatest amount of wetland loss post development compared to the other two sites (disadvantage). • Site is steep with areas of slope failure having been identified by the Geotechnical specialist (disadvantage). • Potential impact on the uMhlatazana River Corridor which drains into Giba Gorge, a biodiversity hotspot (disadvantage). • Loss of agricultural land. • Increase in stormwater runoff from hardened surfaces to potentially transport pollutants and excess sediment into the freshwater ecosystems on and adjacent to the site (disadvantage). • Opportunity to rehabilitate 15 hectares of green open space which includes the heavily infested scarp forest on the sites eastern boundary (advantage).	• The site has been identified by the Shongweni LAP and Outer West SDP as the ideal location for the new regional town centre (advantage). • The site is optimally located between the M13 and N3 Highway interchange (advantage). • The site can accommodate high density residential satisfying demand and guidelines in the Shongweni LAP (advantage). • Reduce the amount of sugar cane farming in the precinct, a desired effect of the Shongweni LAP (advantage). • Well located adjacent to the Petrol Filling Station along Kassier Road (advantage). • Change in aesthetics from agricultural to commercial impacting the adjacent residential complex (disadvantage). • The market demand and socio-economic specialist expects that there will be a positive impact on local supporting businesses. • Increase in vehicles requiring access to the development via the M13 interchange potentially impacting surrounding community (disadvantage). • Increased noise in the area. This is likely to be a nuisance to residents in the neighbouring	• Provision of temporary and permanent employment and business opportunities (advantage) • Stimulate investment and trading along the proposed freight corridor (i.e. N3 Highway; advantage). • High development cost due to the steep topography resulting in significant earthworks being required (disadvantage).

	ENVIRONMENTAL SERVICES / BIOLOGICAL	SURROUNDING COMMUNITIES/ BUSINESS (SOCIAL)	ECONOMIC FEASIBILITY & OPPORTUNITY
		area (i.e. Assagay Hotel; disadvantage). • Loss of recreational activities currently existing on site 1 (disadvantage). • Road upgrades will impact on the surrounding communities during construction (dust, noise and road delays) as well as during operation (improvement to the flow of traffic, pedestrian and public transport provisions).	
Alternative 2: Development of site 2 (preferred).	• Gentle gradient resulting in less earthworks and more stable slopes (advantage). • Loss of agricultural land. • Wetland Rehabilitation Plan providing an opportunity to rehabilitate 5.06 hectares of wetland habitat which will remain on the site post development (advantage). • Loss of 1.4 hectares of wetland system (disadvantage). • Increase in stormwater runoff from hardened surfaces to potentially transport pollutants and excess sediment into the freshwater ecosystems on and adjacent to the site (disadvantage). • Layout incorporates the existing drainage lines into the development footprint as part of the Green Open Space land-use component (advantage). • Increase in velocity, potentially expanding the habitat availability for the population of *Gladiolus cruentus* (critically endangered) occurring downstream of the site (advantage).	• Extend thereby improving the services in the area (advantage). • No neighbouring residential complexes directly adjacent to the site (advantage). • Direct access onto the N3 will potentially result in less vehicles accessing the proposed development via the M13 interchange (advantage). • Reduce the amount of sugar cane farming in the precinct, a desired effect of the Shongweni LAP (advantage). • The market demand and socio-economic specialist expects that there will be a positive impact on local supporting businesses (advantage). • Road upgrades will impact on the surrounding communities during construction (dust, noise and road delays) as well as during operation (improvement to the flow of traffic, pedestrian and public transport provisions). • Layout supports the guidelines for the Shongweni LAP (positive).	• Provision of temporary and permanent employment and business opportunities (advantage) • Stimulate investment and trading along the proposed freight corridor (i.e. N3 Highway; advantage).
Alternative 3: Development of site 3	• Loss of agricultural land. • Increase in stormwater runoff from hardened surfaces to potentially transport pollutants and excess sediment into the freshwater ecosystems on and adjacent to the site (disadvantage). • Loss of • Upstream from the Clifton Canyon Core Open Space Asset and contains drainage lines	• Extend thereby improving the services in the area (advantage). • No neighbouring residential complexes directly adjacent to the site (advantage). • Direct access onto the N3 will potentially result in less vehicles accessing the proposed development via the M13 interchange (advantage). • Direct access onto the N3 will potentially result in less vehicles	• Provision of temporary and permanent employment and business opportunities (advantage) • The layout does not include a residential component as per the guidelines for the Shongweni LAP (disadvantage). • Stimulate investment and trading along the proposed freight corridor (i.e. N3 Highway; advantage).

	ENVIRONMENTAL SERVICES / BIOLOGICAL	SURROUNDING COMMUNITIES/ BUSINESS (SOCIAL)	ECONOMIC FEASIBILITY & OPPORTUNITY
	adjacent to and within the site ultimately enter this biodiverse area. • Increase in stormwater runoff from hardened surfaces to potentially transport pollutants and excess sediment into the freshwater ecosystems on and adjacent to the site (disadvantage).	accessing the proposed development via the M13 interchange (advantage). • Reduce the amount of sugar cane farming in the precinct, a desired effect of the Shongweni LAP (advantage). • The market demand and socio-economic specialist expects that there will be a positive impact on local supporting businesses (advantage). • Located directly adjacent to the Mushroom Farm and closest to the Shongweni Landfill site which both give off a strong scent (disadvantage). • Road upgrades will impact on the surrounding communities during construction (dust, noise and road delays) as well as during operation (improvement to the flow of traffic, pedestrian and public transport provisions).	
No Go	• Given that the site would remain unaltered there would be no loss of open space and the environment will remain functioning as per the current state (advantage). • There will be no additional pollutants entering the downstream ecosystems, which may result from the proposed development of not managed correctly (advantage). • Wetlands and drainage lines invaded by alien species would remain in poor functional state (i.e. no rehabilitation measures to take place; advantage). • There will be no net loss in the amount of wetland area on the Shongweni Estate (advantage). • From a biodiversity perspective, the monoculture (sugar cane) farming is undesired in this precinct (disadvantage).	• The existing land use would continue and thus there would be no increase in the amount of noise in the area (advantage). • The sites would remain unchanged and continue to operate as a commercial sugarcane farm, which is not a desired effect of the Shongweni LAP (disadvantage). • There is no requirement to upgrade the infrastructure (including the road network) on site or in the surrounding area (disadvantage). • The development of the regional town centre would not be fulfilled at this stage. This regional town centre forms an important link on the proposed N3 freight corridor (disadvantage). • There will be no socio-economic development benefits i.e. new jobs, business opportunities, housing, roads etc. (disadvantage).	• There would be no significant impact on the economic conditions on site with commercial sugarcane farming continuing.

7.1 Rating of the identified potential alternatives according to how the proposed activity may impact the environment and the community that may be affected by the activity [Regulation 31 (2) (g)]

Each identified alternative was reviewed by a matrix system using the following criteria:

a) Which alternative is more suitable from an environmental services / biological perspective at least in terms of the site itself?
b) Which alternative is more feasible from the perspective of the environmental services / biological perspective from a regional perspective?
c) Which alternative is more suitable from the perspective of the surrounding communities / businesses in terms of services or benefits they may receive?
d) Which alternative is more suitable from the perspective of the surrounding communities / businesses in terms of impacts i.e. traffic, that may affect them?
e) Which alternative is more economically feasible and also more viable for the developer?

In selecting the criteria for the matrix, the impacts and benefits from an environmental, social and economic perspective, as listed in Table 12 above, have all been considered with a view to ensuring that no aspect is unfairly weighted. As in Table 12 above, layout options A and B for the preferred site alternative were included in rating of "Alternative 2", as the development footprint is similar in nature.

Table 13: Rating of alternatives
Key: 0 = not viable (or may cause impact); 1 = less viable (or impact can be mitigated); 2 = most viable (or no impact caused);

	No Go	Alternative 1	Alternative 2	Alternative 3
Environmental Services / Biological – on site	1	1	2	1
Environmental Services / Biological – regional	2	1	1	1
Surrounding Communities / Businesses – services / benefits / positive impacts	1	0	2	2
Economic Feasibility & Viability for the developer	0	1	2	2

Alternative 2 was rated the highest in terms of the on-site provision of environmental service. This was a result of the information current provided to the EAP regarding the proposed rehabilitation measures that are to take place prior to, during and after construction. Existing land-use on the sites results in alien vegetation invasion within the drainage lines, increase nutrient input and high sedimentation rates during periods when the land is left uncultivated. These factors have resulted the no go option receiving a level 1 rating for the environmental services on site. Alternative 1 and 3, at this stage of the process remain at a level 1 until a site specific rehabilitation plan has been put in place. It is likely that the environmental services will however be improved on the sites with rehabilitation measures in place, similar to those proposed for site 2.

The impact that the current land use is having on regional environmental service provision, will not change if the sites are left undeveloped and therefore a rating of level 2 (no impact caused) was allocated to the no go option. There is a possibility that the increase in stormwater runoff may carry pollutants/sediments into the catchments adjacent to the sites if not managed tightly during operation. For sites 1 and 3, freshwater ecosystems drain into the uMhlatuzana River flowing through the Giba Gorge Precinct. Site 2 drains into the Wekeweke stream, a river identified as national importance. Mitigation measures have however been provided for the identified potential impacts and therefore all three site alternatives have achieved level 1 ratings.

Alternative 1 received the lowest rating from a social perspective as there will be a significant impact on the neighbouring residential complex during construction as well as the operational phase (including an increase in traffic). Recreational activities, currently existing on the site would be lost with the development of site 1. There are less employment and business opportunities available to the community with the existing land-use and therefore the no go option was rated at a level 1. Alternatives 2 and 3 are anticipated to result in a greater number of positive impacts socially and therefore have the highest ratings. The positive impacts include employment, business opportunities and fulfilling trading demand but the location of the two alternatives is also preferable from a social perspective as there are no residents and fewer businesses neighbouring the sites.

It will be less feasible, economically, for the developer to develop site 1 due to the extensive earthworks required. It is therefore "less viable" than alternatives 2 and 3. The No Go option has the lowest rating as the current water resources are not sufficient for irrigation of sugarcane currently being produced on the Estate and the calculated profit is also low according to the

agriculture specialist's findings. Additionally, transportation of sugarcane to the mill is costly. Alternative 2 and 3 have therefore been rated as being the most economically feasible and viable for the applicant.

8.0 Assumptions, uncertainties and gaps in knowledge [Regulation 31 (2) (m)]

The EAP is satisfied that sufficient information has been made available to allow for assessment of this proposal. The opinion of the EAP is based on the number of specialist studies listed in section 4.7 of the EIR. The fact that the activity as proposed is in line with strategic development proposals for the area has been considered by the EAP.

9.0 Environmental impact statement with summary of key findings and comparative assessment of the positive and negative implications of the proposed activity and identified alternatives [Regulation 31 (2) (o) i-ii]

Tongaat Hulett Developments (THD) propose facilitating the construction of a new regional retail centre and other, associated, appropriate and compatible land uses in the form of logistics, light industry, business park and service. The provision of green open space has also been incorporated into the various layout options. The proposed development aims to provide a new regional retail town centre in line with eThekwini Municipality's Strategic Development Plan (SDP) for the Outer West District and the Shongweni Local Area Plan (LAP). The activity also aims at being in line with the environmental sustainability principles outlined in the Shongweni LAP by incorporating rehabilitated areas.

There was no fauna of significant conservation value associated with the three site alternatives including the pipeline route. The freshwater ecosystems (drainage lines, wetlands and association indigenous vegetation) were however identified as the key factor to consider during the EIA process. After consultations with the wetland specialist's, the applicant has integrated "Green Open Space" into the development layout specifically incorporating the location of the drainage lines into this area designated for rehabilitation and environmental services provisions. The Applicant therefore proposes a major new sustainable development that will provide an opportunity for long-term conservation and maintenance of a currently degraded wetland (and associated vegetation and fauna). From a sustainability perspective, it is important to note that there are massive local and regional socio-economic benefits.

Despite the provision of open space into the layout, there still remains a loss of wetland area across all site alternatives, with the development of site 1 resulting in the greatest loss. To ensure that the wetland loss is compensated for, THD have included a Wetland Rehabilitation Plan into the proposal to ensure that the remaining wetland system is rehabilitated to a higher functioning level and expand the wetland system westward of site 2. A long-term maintenance plan has been included in the Wetland Rehabilitation Plan (Appendix 15). Although the Wetland Rehabilitation Plan is specifically designed for site 2, the plan will be amended in the event that authorisation is given for the development of sites 1 or 3.

One of the main purposes of ensuring effective on-site rehabilitation is the links that all three sites have with systems of high conservation value adjacent and/or further downstream. The Giba Gorge Environmental Precinct aims to protect biodiversity of the area, KZN sandstone sourveld grasslands, as well as scarp forest, which have been classified as endangered and vulnerable, respectively[4]. Drainage lines on sites 1 and 3 are directed into the uMhlatuzan River, which feeds the Giba Gorge Environmental Precinct. Drainage lines located within site 2 on the other hand, feed into the Wekeweke Stream, a system identified as a NFEPA. This freshwater ecosystem has therefore been identified as an important for conserving South Africa's inland water biodiversity. Construction and operational activities associated with the proposed development therefore need to be carefully managed to ensure there is no impact on these freshwater ecosystems. Implementing the proposed Wetland Rehabilitation Plan on site 2, effective stormwater management and waste management are therefore the top areas requiring environmental consideration.

Where the proposed pipeline traverses sections of freshwater systems (including the 20m buffer), method statements are to be submitted to the Engineer and ECO to ensure there is no increase in sedimentation of the watercourse, construction waste does not enter the watercourse, erosion control features are incorporated into the design and effective rehabilitation (including maintenance) is in place for the operation of the pipeline. The wetland specialist has stated that the freshwater ecosystems along the length of the proposed route have already been modified with the construction activities posing a relatively low risk to the freshwater ecosystems current integrity and functioning. The pipeline route is to avoid the remnant of Sanstone Sourveld as well as the *Scadoxus puniceus* and *Eulophia streptopetala* species, which are protected under provincial legislation. The localised removal of alien species and rehabilitation along the proposed route will be a positive impact. The proposed pipeline

[4] Note 2

link from the Western Aquaduct is advantageous facilitating the construction of new, appropriate infrastructure for the Shongweni area

Provided that all mitigation measures, included in the EMPr, are adhered to the EAP is confident that the pipeline will not significantly impact on any vegetation units or faunal species.

10.0 Reasoned opinion on authorisation and conditions for authorisation [Regulation 31 (2) (n)]

When deciding whether the activity should or should not be authorised, the EAP has evaluated and considered all identified impacts as listed in Table 10 as well as the cumulative impacts listed in Table 11. The EAP has included specialist recommendations and prescribed mitigation measures into the EMPr. Provided that the applicant and contractors adhere to the specifically designed EMPr (Appendix 14), the EAP is of the opinion that environmental authorisation should be granted for the construction and operation of the Shongweni Retail/Mixed Use Development on site 2 as illustrated in Figure 1 and Figure 3. Provided that the rehabilitation of the wetland system takes place, as proposed in the Wetland Rehabilitation Plan (Appendix 15), the Green Open Space is an effective method for the long-term conservation of an integral wetland system in the Shongweni area. The pipeline and reservoir are required to supply the proposed development with water. Provided that measures outlined in the EMPr are adhered to and audited on a regular basis, the EAP is of the opinion that the pipeline route as illustrated in Appendix D of the ESR (Appendix 3) be granted environmental authorisation.

Taking into account the above mentioned factors, a number of conditions for environmental authorisation have been prescribed by the EAP. The conditions below have been developed based on the fact that site 2 is the preferred option:

1. The applicant must ensure that mitigation measures and controls specified in the EMPr attached are adhered to during all phases of the development (pre-construction, construction and operational). All phases are to be monitored by an independent ECO who should ensure compliance with the EMPr.
2. Environmental audits during construction should be conducted on a weekly basis by an independent ECO in addition to a pre-construction and post-construction audit (PCA).

<u>Pre-construction</u>

3. Should site 1 or 3 be approved, an assessment of the wetland habitats and their associated buffer zones must be reviewed prior to the development of the sites.
4. Should site 3 be developed, the wetland rehabilitation plan is to consider a burn regime to mimic the existing natural regime continuing the functionality of the adjacent grassland ecosystem.
5. Should site 1 or 3 be approved a detailed Stormwater Management Plan is to be submitted to ensure effective stormwater control and management.
6. Existing services (i.e. electricity lines, water pipeline etc.) are to be identified prior to construction.
7. As recommended by the geotechnical specialist, a more detailed geotechnical investigation is required once more detail on the proposed earthworks/embankments is submitted to the Engineer.

<u>Construction</u>

8. The entire construction site is to be fenced off.
9. Prior to construction, the contractor and staff are to attend an environmental awareness training course presented by the independent ECO. The environmental awareness training should include the following aspects:
    a. Basic awareness and training of key environmental features of the work site (including the location and importance of the Wekeweke Stream),
    b. Understanding the importance of, and reasons why, the environment must be protected,
    c. Ways to minimise environmental impacts, and
    d. Requirements of the Environmental Authorisation and EMPr.
    e. Location of the significant sensitive vegetation along the pipeline route including plant identification
10. A board with contact details for complaints should be placed at the entrance to the site. The board is to include emergency contact numbers.
11. Adequate toilet facilities are to be provided for all staff members as standard construction practice. The chemical toilets must be from a registered company and all sewage must be disposed of at an appropriate facility. Safe disposal certificates must be kept on record during construction.
12. The toilets are not to be situated in close proximity or adjacent to the areas that have been identified as “Green Open Space” in the development layouts.

13. Alien vegetation within the construction site must be cleared to ensure that invasion of disturbed areas does not occur, in particular vegetation within the "Green Open Space" component.
14. Alien vegetation along the area disturbed by the pipeline and reservoir is to be removed and an alien management plan implemented post-construction.
15. Cement mixing must take place on a hard surface or on cement mixing trays. Cement mixing will not be permitted where run-off can enter the wetland system. In addition, cement and fuels must be stored within bunded and hard surfaced areas. If the creation of a permanent bunded area is not feasible, these materials are to be stored on drip trays capable of holding at least 110% of the spilled volume.
16. When sourcing raw materials such as sand and stone, company details and proof of registration must be available on site for auditing purposes. This should prove that the contractor is obtaining materials from a permitted site.
17. Littering must not be permitted on the site and general housekeeping must be enforced.
18. Waste must be stored in the bins within the waste management area in the construction camp and must not be allowed to blow around the site or to be placed in piles adjacent to the receptacles and must be disposed of at an appropriate landfill site.
19. If there is any hazardous waste, it must be stored on a hard surface within a bunded area and must not be allowed to enter a watercourse and the surrounding environment.
20. Waste recycling should be undertaken where possible to limit waste added to the landfill site.
21. A spill response procedure must be designed by the contractor to manage spills during construction. Suitable spill kits must be available in the event and staff must be aware of the spill response procedure.
22. In the event of a Heritage resource or artefact being uncovered during construction, activities around the site must cease immediately and AMAFA must be contacted to investigate the finding.
23. Normal construction hours must be adhered to unless prior permission has been obtained.
24. The wetting of dust sources should occur when necessary (without excessive wetting), to reduce dust at source.
25. The Wetland Rehabilitation Plan compiled for Tongaat Hulett Developments Shongweni Development: Site 2 by GroundTruth (August 2013; reference: GTW280-200813-01) is to be strictly adhered to.
26. A minimum buffer of 32 metres from the boundary of the riparian habitat of the Wekeweke Stream adjacent to the site is to be adoption, rehabilitation and maintained
27. Rehabilitation of the riparian habitat adjacent and downstream of the site as discussed in the GroundTruth riparian assessment (Appendix 10);
28. Implementation, rehabilitation and management of the variable buffer zones adjacent to the wetland habitat reflected in the supplied layout
29. Rehabilitation of the remaining areas of wetland habitat within and directly adjacent to the site as outlined in the GroundTruth Rehabilitation Plan for site 2 (Appendix 15).
30. A permit is required to be obtained from Ezemvelo KZN Wildlife should the *Scadoxus puniceus* and *Eulophia streptopetala* species need to be removed or relocated.

11.0 References

DEA & DP 'Guideline on Alternatives, NEMA EIA Regulations Guideline and Information Document Series. Western Cape Department of Environmental Affairs & Development Planning' (2011).

eThekwini Municipality: Outer West Spatial Development Plan (2009).

IYER et al. 'Shongweni LAP: a framework for sustainable urban development final document' (2010, http://www.iyer.co.za/portfolio/shongweni-local-area-plan/)

MOTTRAM and Associates cc Agricultural Potential Rem of Erf 79 Assagay; Rem of Ptn 2 of Farm Botha's Halfway House No 921, Rem of Ptn 24 of Farm Summerveld No 14226, Rem of Farm Kirkfalls No 14227; Farm Shongweni No 15346 (Report 2 of 2012; ref: ck 94/23110/10/23).

SEGGIE E. (2010) "New enviro precinct launched" *Engineering news* (http://m.engineeringnews.co.za/article/ethekwini-municipality-launches-new-environmental-precinct-2010-10-29).

APPENDIX 1:

PLANNING REPORT ON THE NTSHONGWENI DEVELOPMENT PROPOSAL (GAPP ARCHITECTS & URBAN DESIGNS)

PLANNING REPORT ON NTSHONGWENI DEVELOPMENT PROPOSALS

Prepared for

TONGAAT HULETT DEVELOPMENTS

by

GAPP Architects & Urban Designers

February 2013

The landholding

Tongaat Hulett Developments (THD) have very extensive landholdings in the Ntsongweni area, south-west of Hillcrest in the Outer West District of the Ethekwini Metro. As shown in Figures 1 and 2, the N3 Highway and the M13 traverse the combined landholdings in an east-west direction and Kassier Road forms the predominant road north-south from Hillcrest down into the Ntshongweni Valley.

Figure 1: The significant THD Ntshongweni landholding is focused around the N3/M13/Kassier Rd. junction south-west of Hillcrest.

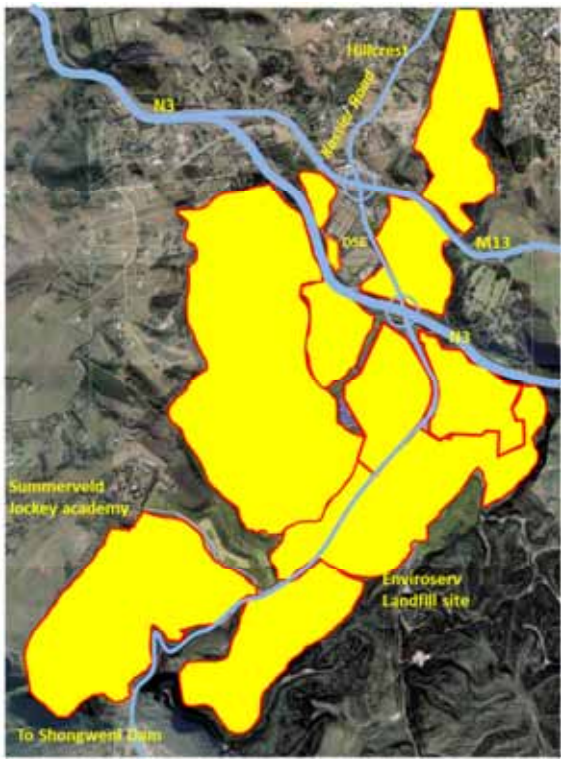


Figure 2: The landholding extends north-south from the southern extensions of Hillcrest to the Shongweni Dam and east-west from the regional landfill site to Summerveld.

To a large extent, the landholdings are contiguous and are primarily south of the N3 Highway. The topography is very undulating and becomes extremely steep approaching the Ntshongweni Valley in which the Shongweni Dam is a prominent feature, offering important regional recreational opportunities into the future.

The western portions of the landholding, south of the N3, are contiguous with Summerveld and the Summerveld Race track and Jockey Academy.

East of the landholding south of the N3, the large scale regional landfill sites that serve for general urban refuse disposal and for specialist medical waste disposal.

Between the N3 and the M13 highways, various portions of the landholding abut the Durban Shongweni Club, a focal point of the equestrian character that typifies this sector of Ethekwini. Within this area, a portion of the landholding is contiguous with the Assagay Hotel.

North of the M13 highway, an embryonic urban node is emerging with various small-scale commercial developments now bolstered by the recent completion of the Hillcrest Private Hospital.

East of the hospital, a significant portion of the overall landholding stretches northwards through the Assegay Valley, stretching to the southern extensions of Hillcrest.

The landholding in a national, provincial and metropolitan strategic context

As indicated in **Figure 3**, the THD Ntshongweni landholding sits strategically within what is by far the most dominant freight and logistics corridor in Southern Africa. For this reason, it is believed that much of the landholding could have potential allied to this.

This view is enhanced by a planned dedicated freight highway now proposed to connect from the new dug-out port south of Durban Harbour inland as far as Cato Ridge and Camperdown.

Figure 3: The Ntshongweni landholding is located in the busiest freight and logistics corridor of Southern Africa.

The intention of this highway, reserved for road freight vehicles alone, is to bypass the very slow, winding section of the Durban-Johannesburg railway line and connect the new dug-out harbour to the rail system further inland. This would have the added effect of decongesting back-of-port logistics by removing freight and logistics further inland.

As noted in **Figure 4**, this proposed freight highway is intended to pass directly through the THD landholdings in Ntshongweni.

At this time there are however a number of options and alternatives being considered for the movement of freight out of the Port of Durban as part of the SIP2 process.

Figure 4: The proposed freight highway is intended to link through the Ntsongweni landholding from the back-of-port inland to Cato Ridge and Camperdown.

These include the use of a dedicated freight highway parallel to the N3, the upgrading of the N3 itself, a freight route to the south of the city and/or upgrade of the rail infrastructure.

Whichever option is ultimately chosen it is clear that Ntshongweni is strategically located along this national priority corridor in close proximity to the Port and to Cato Ridge. The need to provide for logistics based activities in this strategic location is therefore important for the city.

In a Kwazulu-Natal provincial context, too, **Figures 3** and **4** emphasise the importance of the strategic position occupied by the Ntshongweni landholding. As a port, Richards Bay holds a particular specialisation at a national level and also connects to the Gauteng City Region as a freight and logistics corridor independently of the N3 corridor. There is also, of course, a powerful logistic connection between Durban, Dube Trade Port and Richards Bay.

Nevertheless, the backbone of this network, both at a national and provincial level, is to focus on the N3 corridor as South Africa's premier strategic infrastructure development project. Within this context, it is also noted that, as the corridor widens further inland, all key components of the infrastructure constituting this corridor narrow considerably from Ladysmith through Pietermaritzburg, Camperdown, Cato Ridge, Ntshongweni and Pinetown to Durban. The distribution of industrial nodes within the sector entering Ethekwini reinforces this.

It is critical for the city of Durban to ensure that it enforces and enhances its regional position as being the major gateway into Africa. Durban's economy is based, to a large extent, on the port and its associated operations and businesses which extend, not only across the eThekwini Municipality but also further into the Province and to the rest of the country.

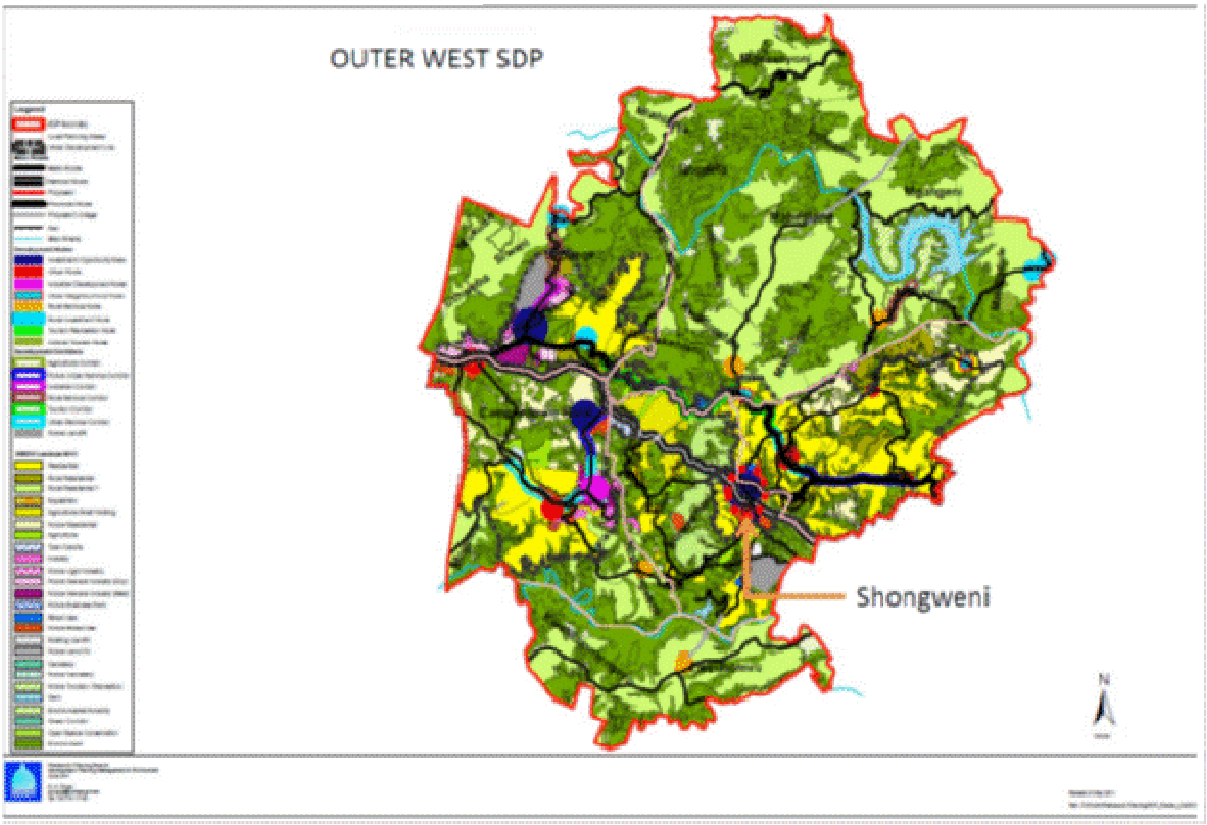
The planned port expansions are vital in regard to preserving and increasing Durban's economic role in the region as they will increase the container handling capacity from the current 2.9 million TEUs per annum to 4 million TEUs per annum in the short term and then ultimately to over 20 million TEUs per annum.

It is therefore important that all the allied and associated infrastructure and logistics requirements are adequately planned and provided for in order to ensure the maximum return on this investment and to ensure that such returns are invested and utilised within the municipality as opposed to further afield.

The northern and western corridors are key in this regard and the opportunities that they offer within the broader freight, logistics and business value chains must be enabled to be unlocked.

Ntshongweni's location within the western corridor and directly surrounding the N3 and Kassier Road Interchange is therefore important and has to be viewed in the above context. The landholding's role does therefore lead to a number of responsibilities including regional commercial centre, mixed use and residential area and logistics and industrial node.

Figure 5 – Outer West SDP



The Strategic Development Plan (SDP) for the Outer West District of the Ethekwini Metro largely reflects the prominence of the Pietermaritzburg-Durban development axis with the consolidation of urban development diagonally through the district following the N3 highway. The remainder of the district remains predominantly low-intensity usage, agriculture and natural reserve.

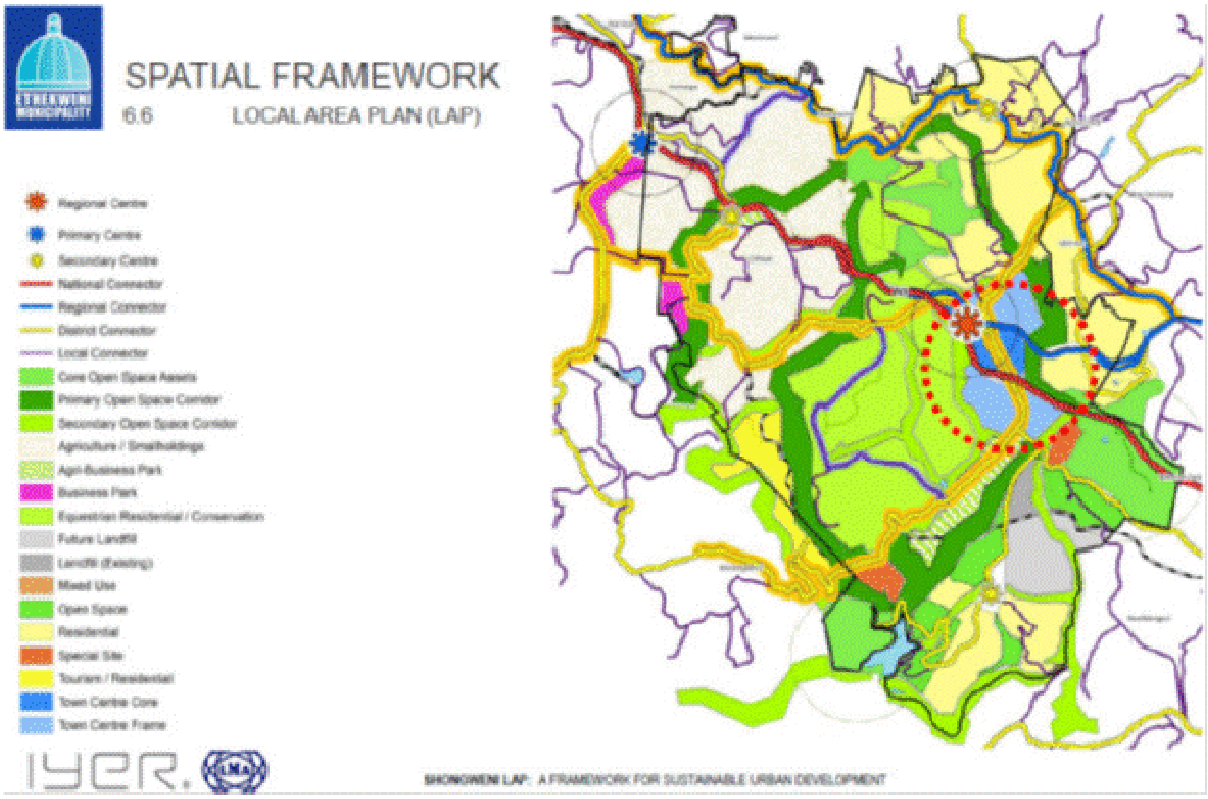


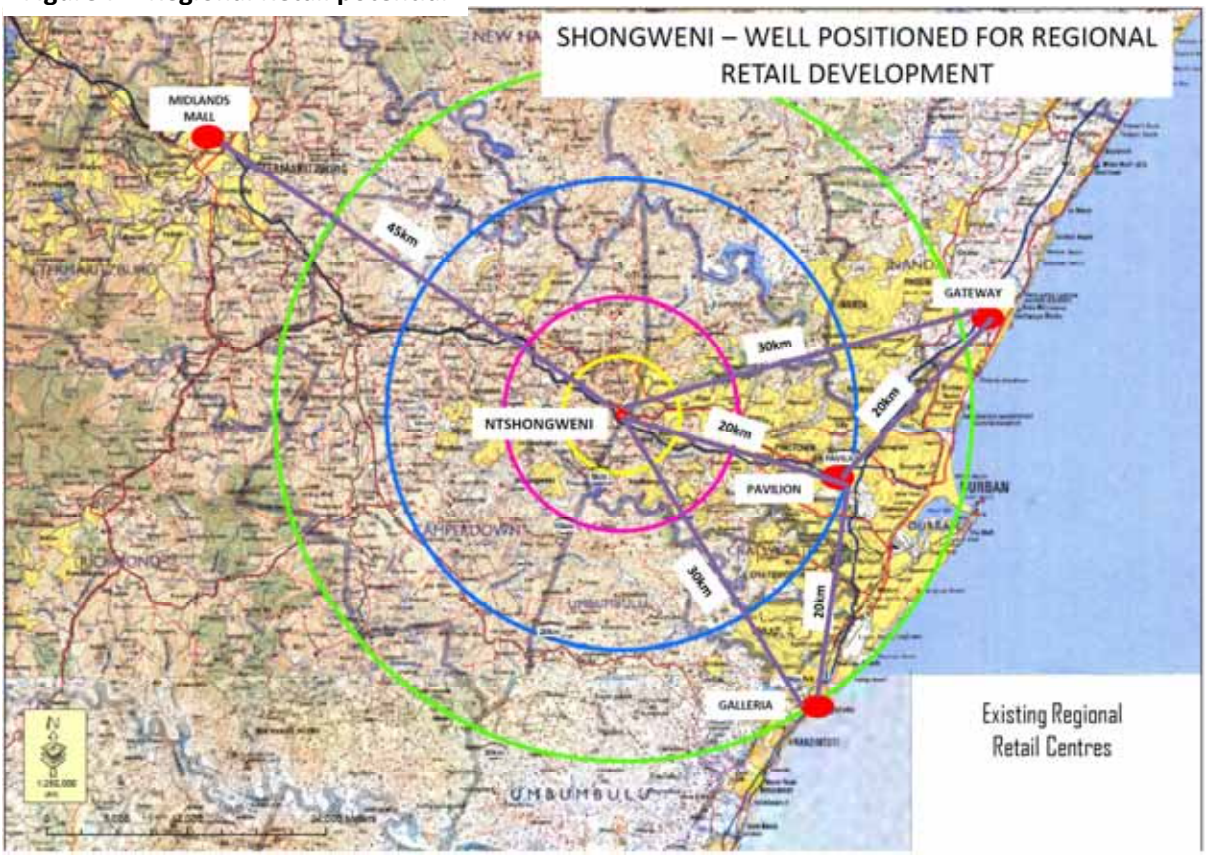
Figure 6 – Shongweni LAP

Based on this consolidation of urban development within the N3 Corridor, as far as it influences the Outer West District, the Spatial Framework Local Area Plan (LAP) notes the general zone defined by the expanded junction of the N3, the M13 and Kassier Road as a "Regional Centre". The expanded area around this is noted as "Town Centre" and, further beyond this, "Town Centre Frame".

The majority of land available within the areas so designated, together with smaller landholdings such as the Durban Shongweni Club and the Farmers' Market area, coincides with the THD Ntshongweni landholding.

It is essential, therefore, that the THD landholding be carefully planned to tie in with these wider regional plans and make the necessary contributions to the consolidation of the greater N3 corridor strategic intentions.

Figure 7 – Regional Retail potential



As noted in **Figure 7,** the spatial patterning of super-regional shopping centres including Gateway at Umhlanga Ridge, The Pavilion at Westway, The Galleria at Umbogentwini and The Midlands Mall in Pietermaritzburg, indicate that the basis of a new town centre at Ntshongweni as proposed in the LAP could certainly be a further regional shopping centre of substance.

The patterning of nodes set out in the figure is again telling in respect of how urban consolidation focuses within the N3 Corridor and in the corridors north and south of Durban. The Ntshongweni area is a naturally-occurring node in a maturing urban region, hence the policy support it enjoys in the LAP.

It is also noted that the initial phases of the Ntshongweni development are aligned to the Urban Development Line, the Municipality's urban growth management tool.

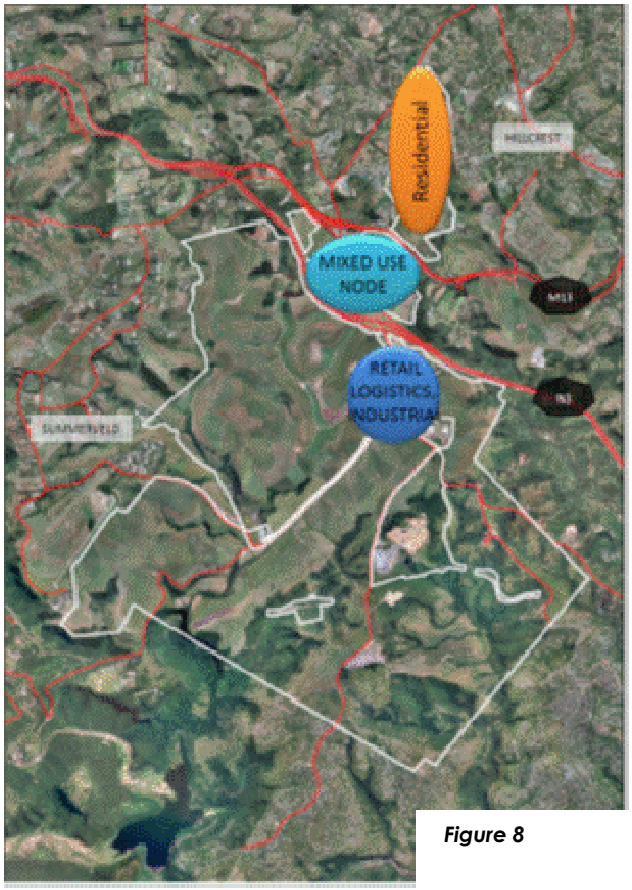


Figure 8

Within the overall context of its landholding, THD, in keeping with the LAP, propose a development strategy focusing on a mixed-use node within the junction of the N3, M13 and Kassier Road as noted in **Figure 8**.

Although THD own much of the land within this node, by far the prominent and flattest site for potential future development is that used by the DSC as an equestrian and polo centre.

Much of the future and potential within this prospective node itself is therefore dependent on whether the DSC site becomes available for re-development. THD has already had extensive discussions with the DSC but the consistent view seems to be that the club is unlikely to move in the short to medium term.

In light of this, the emerging picture of the landholding's potential strategic regional role within the national logistics corridor and the strong demand in the market for logistics, light, service industries and business parks there is an opportunity for an initial development phase south of the N3 and focused on Kassier Road for logistics and industrial purposes. Within this initial phase, THD has also made provision for a regional shopping centre on a prominent site relative to the highway and on relatively flat land which will be relatively easy to develop.

Having established a nascent node through these retailing, logistic, commercial and light service industrial uses, a more consolidated mixed-use node may develop in future on/around the DSC site and the wider area within the expanded highway junction. This node would be suitable for further retailing, higher-intensity offices, higher density residential, office parks and business parks.

The landholding north of the M13 and east of Kassier Road within the Assagay Valley is seen as being most suitable for residential purposes making provision for lower and medium density housing options.

With this series of core activity nodes collectively defining a wider node around the expanded N3/M13/Kassier Road junction, **Figure 9** below sets out an indication of an expanded development framework into the long term for the overall landholding. It is purely indicative of possibilities but does, in principle, establish the on-going commitment to establishing a series of projects, each of an enduring quality, that successively ensures that the overall landholding goes to best-purpose uses within a sustainable urban structure.

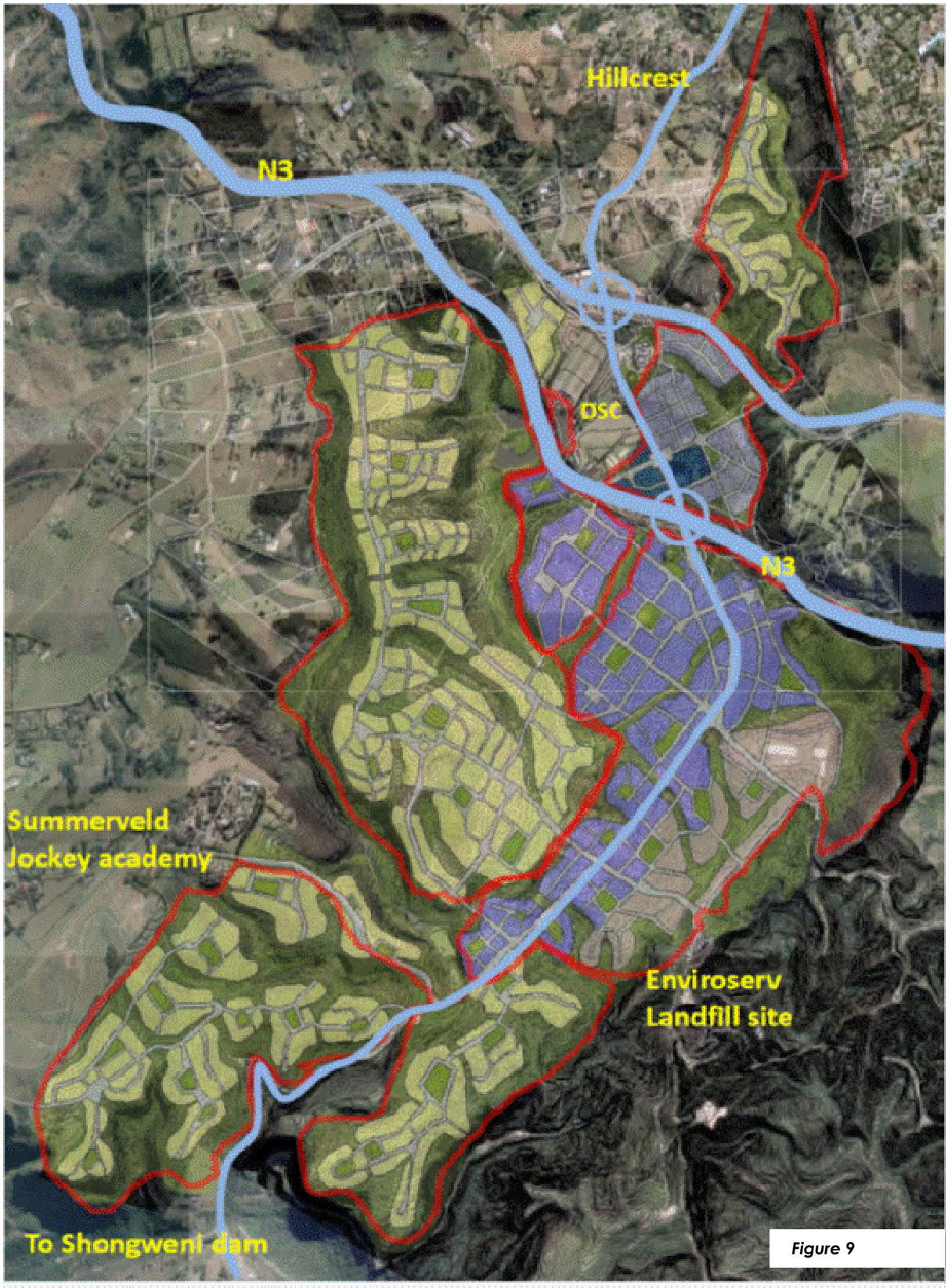
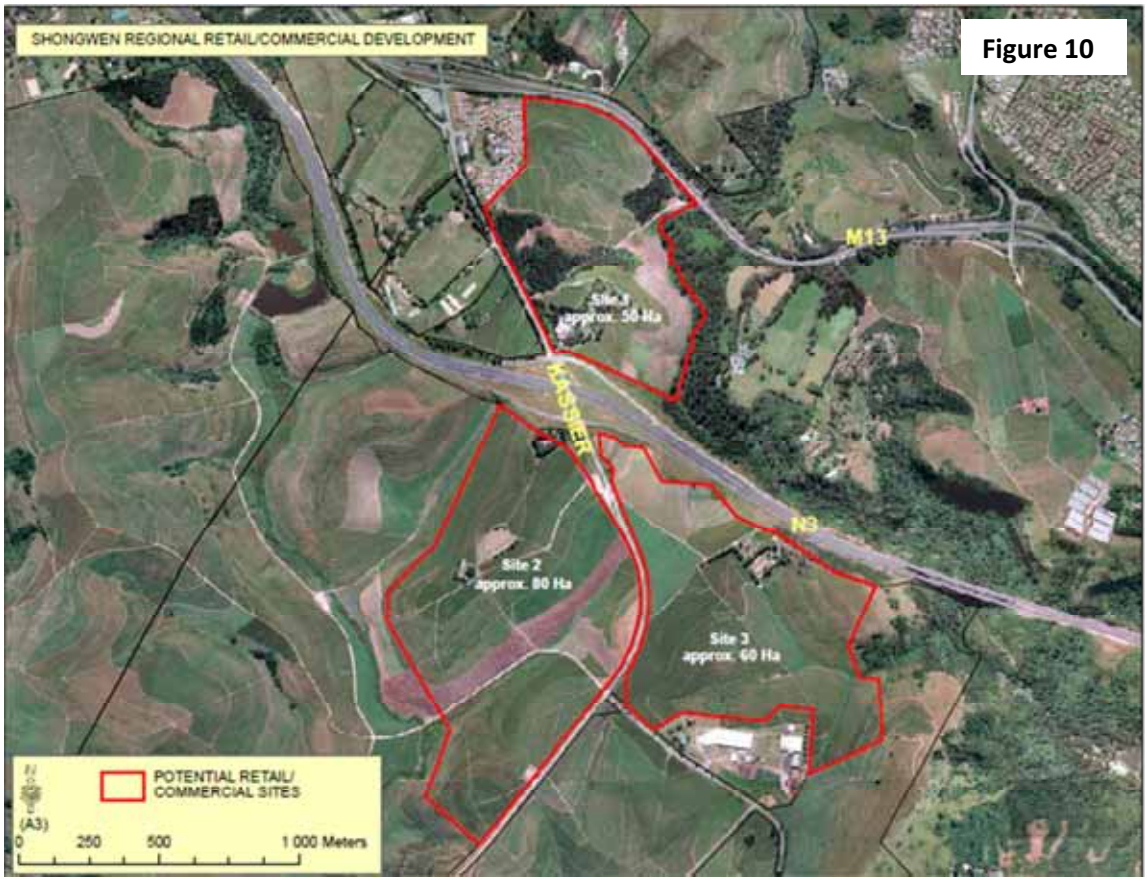


Figure 9

The above, indicative development framework for the overall THD landholding was prepared prior to planning information becoming available in 2012 regarding Metro Council planning dealing with the proposed dedicated freight road highway noted earlier in the section dealing with the N3 Corridor. This highway is planned to run from the back-of-port area of the proposed dug-out port south of the existing Durban Harbour heading inland to Cato Ridge and Camperdown.

Site and Development Alternatives

The EIA process has identified three site alternatives to be considered and assessed for a regional retail centre and associated activities and uses. The 3 site alternatives are indicated in **Figure 10** below.



Each site needs to be assessed in terms of the context described above in this report. This includes the broader sub-region's strategic location along the national N3 freight and logistics corridor, the subregion's role and positioning within the eThekwini Municipality as described in the Outer West Spatial Development Plan as well as within the more local context as provided for in the Shongweni Local Area Plan. All of these elements are discussed above and lead towards the following conclusion:-

- The area between the 2 major roads (M13 and N3) (Site 1) should be based upon higher intensity, mixed use development
- The area south of the N3 highway (Sites 2 and 3) should be based upon lower intensity, regional related activities to maximise location adjacent to the N3 corridor

This therefore offers Sites 2 and 3 as being preferable for a regional commercial centre.

This is further backed up by the following facts:-

- Physically and topographically Site 1 is severely constrained for the purpose of a large-scale regional retail centre development
- The wetland and ecological reports point towards the fact that Site 1 is the most vulnerable given the adjacent Umhlatuzane stream and habitat on the boundary as well as the existing wetland systems on the site which would be directly impacted upon.
- Sites 2 and 3 have more favourable topographical attributes but Site 3 has more wetland systems which reduce the available or potential area for an appropriate sized development and associated uses and activities.
- Site 2 provides the most appropriate and viable option for the development as proposed – in terms of topographical and physical attributes, proximity to the N3 and accessibility.

From a layout land use perspective, **Annexures 1, 2** and **3** indicate the layouts and uses for each of the 3 site alternatives based upon a mixed use proposal around a regional retail centre and provide the following the potential bulks.

Site 1 (50 hectares in extent) – 270 000m^2 of bulk floor area including retail, offices, residential and limited conference/hotel

Site 2 (80 hectares in extent) **Option 1** - 440 000m^2 of bulk floor area including retail, offices, business and residential

Site 3 – (65 hectares in extent) – 210 000 m^2 of bulk floor area including retail and business and limited conference/hotel

Again, referring to the strategic contextual positioning of the sites and based upon the above recommendation that Site 2 is the most suitable site locationally and physically, an alternative land use and layout option is proposed as indicated in **Annexure 4**.

Site 2 (80 hectares in extent) **Option 2** – 420 000m^2 including retail and business/logistics/distribution and industrial opportunities

In this option, residential use has been excluded as has pure office use. This is based upon the need to provide opportunities for more business/logistics and light/service industrial opportunities in line with the N3 corridor's national and local importance and imperatives. Such an option would be in direct support of the city's strategic plans in terms of port expansion as well as economic development and employment creation opportunities.

Site 2, Option 2 is therefore the recommended option from a planning perspective.

On this basis, the site now under application is laid out as indicated in the following **Figure 11**. Effectively, the layout comprises a central site, roughly 17ha in area, which could accommodate a regional shopping centre surrounded by sites that are large enough to serve the distribution industry associated with the freight and logistics sector. A schedule of rights is attached, indicating the land use allocations, their respective land areas, the floor areas proposed and the resultant floor area, or bulk, envisaged. At a FAR of 0.6 (which is a usual intensity for business parks and freight operations, approximately 300 000m² of bulk is allocated for these purposes. An additional 120 000m² of bulk is envisaged for various commercial purposes on the large site capable of accommodating a super-regional shopping centre.

A regional retailing facility supported by logistics and distribution activities

Figure 11

Legend

- Business
- Green Open Space
- Road Network
- Commercial

Complete Land Parcel Schedule

Land Usage	Area	Area ha	% of Development	FAR	Bulk
Business	505253 m²	50.525278	59.35	0.6	303152 m²
	505253 m²	50.525278	59.35		303152 m²
Commercial	171740 m²	17.17399	20.17	0.7	120218 m²
	171740 m²	17.17399	20.17		120218 m²
Green Open Space	286504 m²	28.650424	33.65		0 m²
	286504 m²	28.650424	33.65		0 m²
Road Network	101938 m²	10.193816	11.97		0 m²
	101938 m²	10.193816	11.97		0 m²
Grand total: 27	1065435 m²	106.543508	125.15		423370 m²

Building heights will be around the 4 Storey level in general although provision will be made for specific operational/functional requirements. These details will be confirmed and finalised in the Planning and Development Act application that will follow the EIA process.

It is noted that, in line with other THD developments, a Design Review Panel will be constituted which will manage the design process ahead of the formal municipal approval process. This will be based on a Building Design guideline which will be similar to that developed for the RiverHorse Valley Business Estate.

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ANNEXURE 1 – SITE 1 DEVELOPMENT ALTERNATIVE

ANNEXURE 2 – SITE 2 DEVELOPMENT ALTERNATIVE – OPTION 1

ANNEXURE 3 – SITE 3 DEVELOPMENT ALTERNATIVE

ANNEXURE 4 – SITE 2 DEVELOPMENT ALTERNATIVE - OPTION 2

APPENDIX 2:

TONGAAT HULETT DEVELOPMENTS, SHONGWENI RETAIL CENTRE: MARKET DEMAND AND SOCIO-ECONOMIC IMPACT ASSESSMENTS PHASE 1 & 2 REPORT (URBAN ECON DEVELOPMENT ECONOMISTS KZN)

TONGAAT HULETT DEVELOPMENTS

SHONGWENI RETAIL CENTRE

MARKET DEMAND AND SOCIO-ECONOMIC IMPACT ASSESSMENT

PHASE 1 REPORT – INITIAL MARKET SCOPING

DRAFT 2

JULY 2012

Tongaat Hulett DEVELOPMENTS

URBAN-ECON DEVELOPMENT ECONOMISTS KZN

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SECTION 1: INTRODUCTION & BACKGROUND

1.1: PURPOSE AND BACKGROUND OF THE STUDY

The eThekwini Municipality have been proactive in undertaking and completing key strategic spatial plans for the Outer West region, including a Spatial Development Plan (SDP) and a Local Area Plan (LAP). Both of these plans indicate that the Shongweni region is earmarked as a future sub-metropolitan mixed-use node consisting of various activity nodes ranging from low to high density. Following the adoption of these plans, Tongaat-Hulett have reviewed its landholdings in Shongweni, and based on the key elements presented within these plans together with strong market demand, have commenced an application for a mixed use development centred around a regional retail centre. In part therefore, the City's spatial planning clearly demonstrates the need and desirability for such development within the region.

Urban-Econ have been appointed to undertaken the study, of which the purpose is to undertake a retail market assessment and socio-economic impact assessment for the proposed Shongweni Retail Centre. The size and exact location of the proposed retail centre has not yet been determined, however the wider concept of a regional centre will be investigated within the context of Shongweni area.

1.2: APPROACH AND METHODOLOGY

The study comprises of two key phases, an **Initial Market Scoping** and a **Comprehensive Market Assessment.**

Phase 1: Initial Market scoping

The first phase of the study of the retail potential of the study area; unpacking the existing competing supply in the area and region; the typical spend profiles as reflected in the quantitative datasets (available down to the spend category, but not brand level) as well as a review of the intended local authority and major private sector development interventions and changes in the immediate area that would have an impact on commuter and foot traffic into the centre.

Phase 2: Comprehensive Market Assessment

The second phase of the study includes shopper and household surveys that would assist in determining retail brand preferences; non-retail activities and support services within the centre. These will be packaged into specific GLA allocations and brand preference recommendations. In addition, the review of existing detailed planning interventions, traffic data as well as the modeling of the proposed retail centre's impact will be undertaken. This will provide for a detailed socio-economic impact assessment of the centre to support the market assessment.

This report deals with Phase 1 only – the Initial Market Scoping

In respect to undertaking a market assessment, the principles of Need and Desirably must be applied, as provided by the May 2009 Draft Guidelines on Need and Desirability published in the Guideline and Information Document Series of the NEMA Environmental Impact Assessment Regulations by the Department of Environmental Affairs and Development Planning. This states that

the concept of need and desirability can be explained in terms of the general meaning of its two components:

- Need refers to the type and timing of the development, and
- Desirability refers to the place or location of the proposed development

In this regard, the methodology that is followed in this report is as follows:

1. Review of existing retail supply in the area in order to determine market catchment area (including source markets);

2. Desktop profile of Node and the supporting market area, detailing household size, density, socio-economic profile, dependency ratios as well as income levels to identify specific spend profiles;

3. Develop spend profile across durable, semi-durable and non-durable goods;

4. Review intended City interventions (ETA, EDU and Special Projects are the identified key departments for initial engagement), private sector interventions, and changes in the immediate precinct that would have an impact on commuter and foot traffic into the centre;

5. Interpret the household spend and market catchment figures as well as the current transit patterns and planned nodal interventions into a potential GLA model for the site

1.3: REPORT OUTLINE

The report follows the following structure:

Section 2 presents a market profile which includes an assessment of the site's characteristics (location, accessibility, and visibility), a spatial overview, and an assessment of the shopping centre classifications. This is used to set the scene for a market delimitation of the proposed development.

Section 3 undertakes a market delineation which includes the general catchment areas, as well as a nodal profile for the areas expected to support the proposed development. This includes detailing household size and density, providing a socio-economic profile of the supporting market area, identifying the dependency ratios, as well as household income levels and a household expenditure profile.

Section 4 provides a demand and supply analysis. This includes an assessment of both the supply and demand side factors that have potential to impact on the supporting market area. The report will assess current City policy, strategy and interventions, as well as private sector develop plans that will have an impact on the supporting market area, as well as proposed developments and interventions being driven by the private sector. This is supplemented by research to identify the most recent interventions that are expected to impact on the demand and supply characteristics of the wider outer-west region of eThekwini.

Section 5 presents an interpretation of all the household spend data, market catchment figures, transient transport patterns and interventions identified in the subsequent sections in order to develop the potential GLA for the proposed sites. This will give an initial indication of the potential demand for such a retail development based on existing desktop information.

Section 6 concludes the report by providing a brief summary of the findings of the report.

SECTION 2: MARKET PROFILE

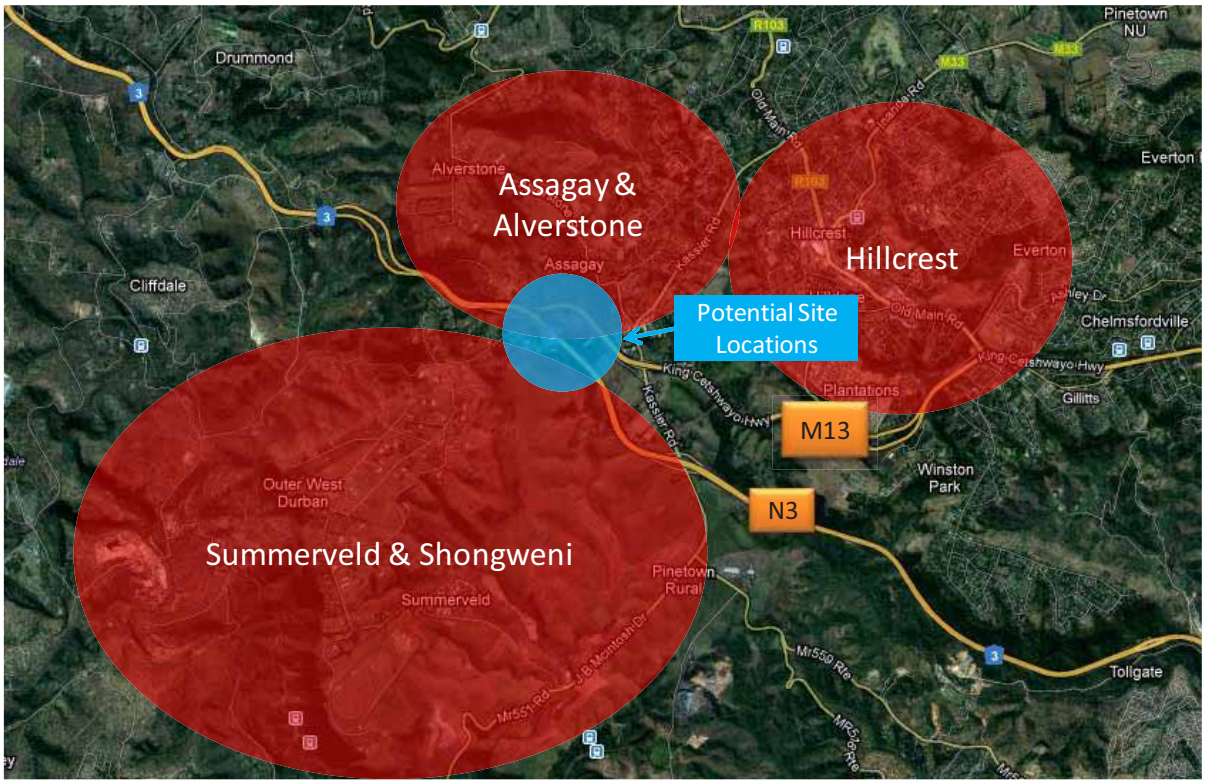
2.1: REGIONAL CHARACTERISTICS

2.1.1: LOCATION

The exact location of the proposed centre has not yet been determined. However, this is immaterial at this stage as the proposed location is on/around the N3/Kassier Road interchange or between the M13 and N3 regional transport network. This initial assessment therefore does not go into specific detail regarding site location, but rather undertakes an analysis of the regional potential for such a retail development within the Shongweni area based on these proposed locations.

The map below displays the potential location for the proposed retail development in the wider context, and displays the main access routes as well as directly surrounding residential areas of Hillcrest, Assagay, Alverstone, Shongweni, and Summerveld.

Map 1: The site in relation to main access routes and residential areas



Source: Urban-Econ adapted from Google Maps (2012)

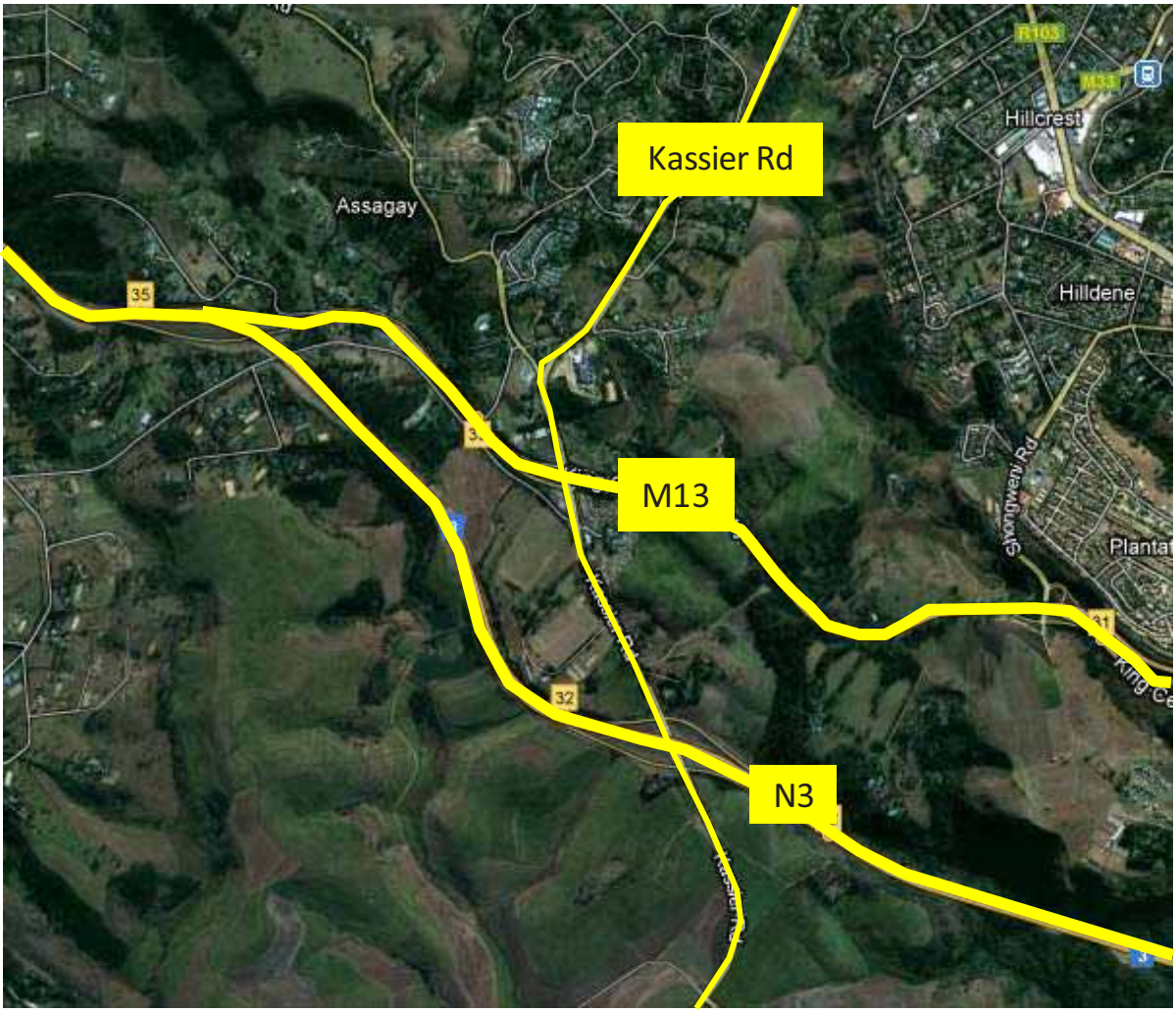
Shongweni is one of a number of residential areas in the outer reaches of KwaZulu-Natal's Upper Highway region (or eThekwini's Outer West planning area). These residential areas run in a corridor west of the boom town of Hillcrest. Assagay and, on the plateau above it, the agricultural community of Alverstone, lie on Kassier Road that links Hillcrest and the M13. Across the M13, lie the horsy hot spots of Shongweni and, further west, Summerveld, home of horse-racing in KwaZulu-Natal and the only jockey academy in South Africa.

The location of the proposed retail development lies in-between the abovementioned residential areas, around the N3 and M13 interchange.

2.1.2: ACCESSIBILITY AND VISIBILITY

In terms of regional accessibility, the proposed location of the development is around the N3/M13 interchange. This area is highly accessible from both the N3 and M13, providing good access to the various residential nodes situated around this interchange. Kassier Road joins the N3 to the M13, thereby linking Hillcrest and other northern suburbs to the N3 in the south and the greater Shongweni area. These roads experience high traffic volumes, and this provides an advantage to the proposed development. The map below displays the main access routes to the site.

Map 2: Main access routes linking the proposed location



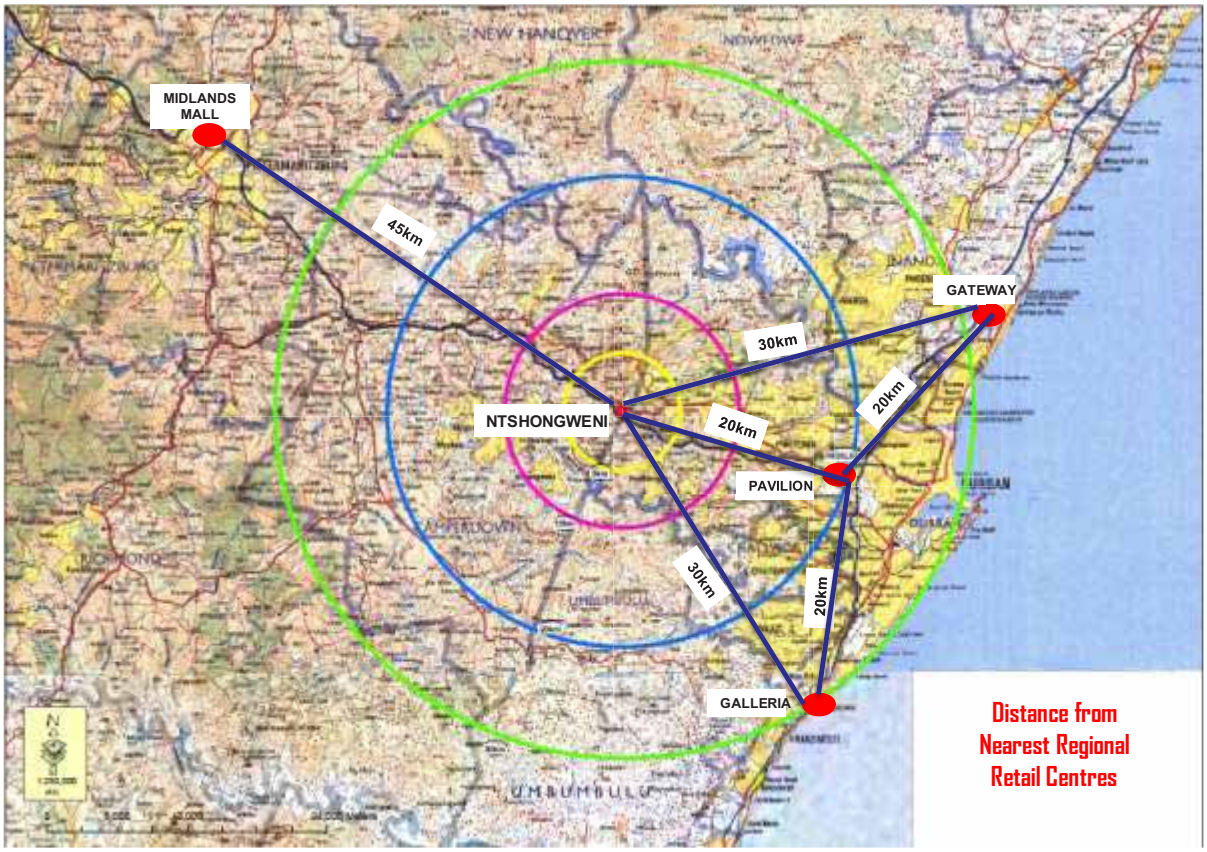
Source: Urban-Econ adapted from Google Maps (2012)

The location of the proposed development around the M13/N3 interchange provides good visibility from both the west and east and along both the M13 and N3. Some additional signage would however be required to enhance visibility.

2.2: SPATIAL OVERVIEW

2.2.1: REGIONAL CONTEXT

Given the nature of the proposed regional centre, it is important to review the development in the wider regional context. The map below provides an indication of the distance between the proposed development's location and existing regional shopping centres.



Source: Tongaat Hulett Developments (2012)

Shongweni lies closest to the Pavilion Shopping Centre (20km away), and is equidistant from both the Galleria and Gateway (30km) to the north and south of the Durban city centre. Liberty Midlands Malls is approximately 45km north-west of Shongweni. According to standard retail classifications and planning guidelines, a small regional or regional shopping centre has an average radius of between 5 – 8 kilometres, or a travelling distance of between 10 – 16 minutes. In this regard, the regional positioning of the proposed Shongweni retail centre is sufficiently distanced from existing regional centres within the wider eThekwini and KwaZulu-Natal region. Additionally, the areas surrounding the proposed location are largely un-serviced and contain very little retail offerings.

In terms of general development nodes, the area of Shongweni lies approximately 14km from the core of the Pinetown CBD as well as the Hammersdale town, and 19km from Cato Ridge. There are no significant mixed-use development nodes within a 10km radius besides Hillcrest, which is fairly well serviced in term of retail, residential and office property. It is anticipated that retail, residential and office space within the Hillcrest area will have a substantial impact on the demand for the proposed mixed-use development due to the significant increase in supply over the past decade.

2.2.2: LOCAL CONTEXT

Within the local context, there are various commercial land-uses surrounding the proposed location. All of the land-uses besides the Summerveld Racing Establishment lie north of the N3, leaving the southern side of the N3 towards Shongweni rural and Summerveld largely un-serviced. The map below displays the main commercial-land uses surrounding the proposed development's location.

Map 3: Main commercial land-uses surrounding the site

Source: Urban-Econ adapted from Google Maps (2012)

There are a number of equestrian facilities comprising horse racing tracks and polo fields situated directly between the M13 and N3. The Summerveld Racing Establishment is situated approximately 4km south-west of polo fields.

Most of the land situated south of the N3 is sugar-cane and is owned by Tongaat-Hulett Developments. There is also a large plot of sugar-cane land east of the Private Hospital site between Kassier Road and Hillcrest.

In terms of retail land-uses, there is currently only a limited amount of retail within the general location of the proposed development. At the intersection of the M13 and Kassier Road there are a

number of retail-based facilities (Mushroom Farm node) such as The Mushroom Shop, AC Smith Equestrian Supplies, Simple Spaces, Garden Decor Zone (Nursery), SA Sandstone & Slate, Equerry Hay Barn, and Mink & Manure. Approximately 500m south of this retail node along Kassier Road is an Engen garage with a small retail convenience centre. Just north of the Mushroom Farm node is the Shongweni Farmers and Craft Market which operates on Saturday mornings and attracts a sizeable number of visitors.

The only other substantial commercial activities within the wider area are the retail and office properties situated along the Hillcrest Old Main Road, approximately 5km from the proposed location. There is a cluster of retail at the northern end of Hillcrest where the Old Main Road meets the M33. There are also other retail facilities that run from this cluster in the north, south along the Old Main Road towards the Heritage Market, creating a strip of retail that follows the Old Main Road corridor for approximately 1.5km.

A substantial land-use within the location is the recently developed Hillcrest Private Hospital. The growing demand for property within the Hillcrest, Assagay and Shongweni areas has pushed up the demand for a private hospital. It is expected that the hospital will increase the vehicular traffic along Kassier Road, which will create extra demand for retail, office and potential residential property within the wider Shongweni/Assagay region.

Directly adjacent to the new Hillcrest Private Hospital across Kassier Road is a retirement village development called Hillcrest Country Retirement Estate which is currently being developed. Although this development has not yet been completed, it is expected that this will increase the population of the area and subsequently the market catchment potential for the proposed development.

In summary, there are a wide range of land-uses that surround the Shongweni node, with the majority of space occupied by residential estates, farms, small-holdings, and single-stand properties. There is only a small amount of retail the surrounding residential areas (besides Hillcrest), which indicates that the area is generally underserviced in this regard. The Hillcrest area however has seen significant investment into both retail and office property over the past decade, and the demand and supply characteristics of this corridor must be investigated further to ensure that there is sufficient demand to support additional retail within a 10km radius of the Hillcrest corridor.

2.3: RETAIL CLASSIFICATION

Before undertaking a delineation of the market, it is important to understand the characteristics of a regional centre. The proposed development will be anchored by retail space, but supported by other commercial, residential or even industrial land-uses should there be sufficient demand to support such land-uses. However, as the centre is predominately anchored by retail, the classification of a small regional, regional, and super regional centre will be assessed below.

The table on the following page displays the classifications for small regional, regional and super regional centres. Before investigating these classifications, it is important to remember the following existing regional centre sizes:

- Gateway - 158,319 m^2
- The Pavilion - 119,900 m^2

- Galleria - 84,536 m^2
- Liberty Midlands Mall - 52,850 m^2

Table 1: Regional Retail Centre Classification

Type of Centre	Size of centre (m^2)	Trade area	Access Requirements	No. of households	Population	Socio-economic groups	Average Radius (km)	Median Travel time (minutes)	Main tenants
Small regional	±25 000-±50 000 75-150 stores	Specific sub-region of city (can be large self contained community (i.e. Chatsworth)	Major suburban arterial road linking to a provincial highway	17 800-35 700	62 500-125 000	All LSM 4-10	5,0	10-16	• large supermarket • 1 or 2 large clothing anchors • Strong national tenant comparison goods component • boutiques • restaurants • entertainment • services
Regional centre	±50 000-±100 000 150-250 stores	Large region of city/or whole city	Major arterial road usually a Provincial main road linking to a National road.	28 600 – 57 150	100 000 - 200 000	All LSM 4-10	8,0	14-20	• large supermarket/ hyper • 2 or more large clothing • small clothing and boutiques • entertainment restaurants • services • convenience
Super regional centre	>100 000 More than 250 stores	Large region in city and surrounding areas/Tourists	Major arterial road usually a Provincial main road, linking to a National road.	57 150- 114 300	200 000-400 000	Above average LSM 5-10	10+	16-28	• as at regional but more emphasis on entertainment and variety

Source: Dirk Prinsloo (2006; 10-11: South African Shopping Centre Classification Standards for South African Council of Shopping Centres)

The typical size of a **small regional centre** is between 25,000 – 50,000 square metres, and generally services a specific sub-city region. This would typically accommodate between 75 – 150 stores. The number of households that are required to support such a centre is between 17,800 – 35,700 or between 62,500 – 125,000 people, and this relates to all LSM groupings of 4 - 10. The average radius is approximately 5km with a 10 – 16 minute travel time. Such a centre requires accessibility from off a major suburban arterial road linked to a provincial road.

A **regional centre** is generally between 50,000 - 100,000 square metres, servicing either a large region within a city of a whole city. This would typically accommodate more than 250 stores. Regional centres require road access from a major arterial usually being a provincial road linked to a national road. The number of households required to support such a centre is between 286,000 – 571,150 households or 100,000 – 200,000 people, and relates to all LSM groupings of 4 - 10. The average radius or catchment of a regional centre is about 8km or a 14 - 20 minutes travel time. In terms of these classifications, both the Liberty Midlands Mall and Galleria are regional centres. With regards to the Midlands Malls this can be substantiated given that the mall is located on the N3 and supports the entire city of Pietermaritzburg which has an approximate population estimate of between 350,000 – 500,00 people.

The size of a **super regional centre** is over 100,000 square metres and services a large region in a city and surrounding areas. This would typically accommodate between 75 – 150 stores. As with a regional centre, a super regional requires access from off a major arterial, usually being a provincial road linked to a national road. The household population required to support such a centre is between 57,150 – 114,300 households or between 200,000 – 400,000 people, with an above average LSM rating of 5 -10. Super regional centres generally have catchment of over 10km within a 16 - 28 minute travel time. Both Gateway and The Pavilion are classified as super regional centres. Both these centres service a large area. In the case of the Pavilion, the Westville and Pinetown areas fall within the catchment area, as well as the wider Durban central areas. Gateway services Mt Edgecombe, Umhlanga, Durban North, and even draws people from the Durban central areas.

The implications of the above assessment of shopping centre classifications on the proposed development are as follows:

- The catchment population for any centre development from a small regional to a super regional centre is between 17,800 – 57,150 households or a population of 62,500 – 400,000. Based on a comprehensive understanding of the eThekwini outer-west region and the population dynamics, it is expected that a small regional, or at the most, a regional centre, could be accommodated. This will be substantiated within the following section.

- The proposed development will require access from at least a main arterial such as a provincial road, but preferably linked to a national road. Given the proposed location of the planned developed around the M13/N3 interchange, it is expected that access is substantial.

- The LSM range within the region varies from very low to high, and therefore the shopping centre concept and composition (to be dealt with in the following phase) will be crucial in ensuring that the wider population can be attracted to such a facility.

- The residential catchment within a 5km radius is limited to Hillcrest, Assagay, Alverstone and Summerveld – areas which are largely serviced by the Hillcrest retail corridor. Up to a 10km

radius, the catchment includes Shongweni rural, Pinetown, Hammersdale, and even parts of Kloof.

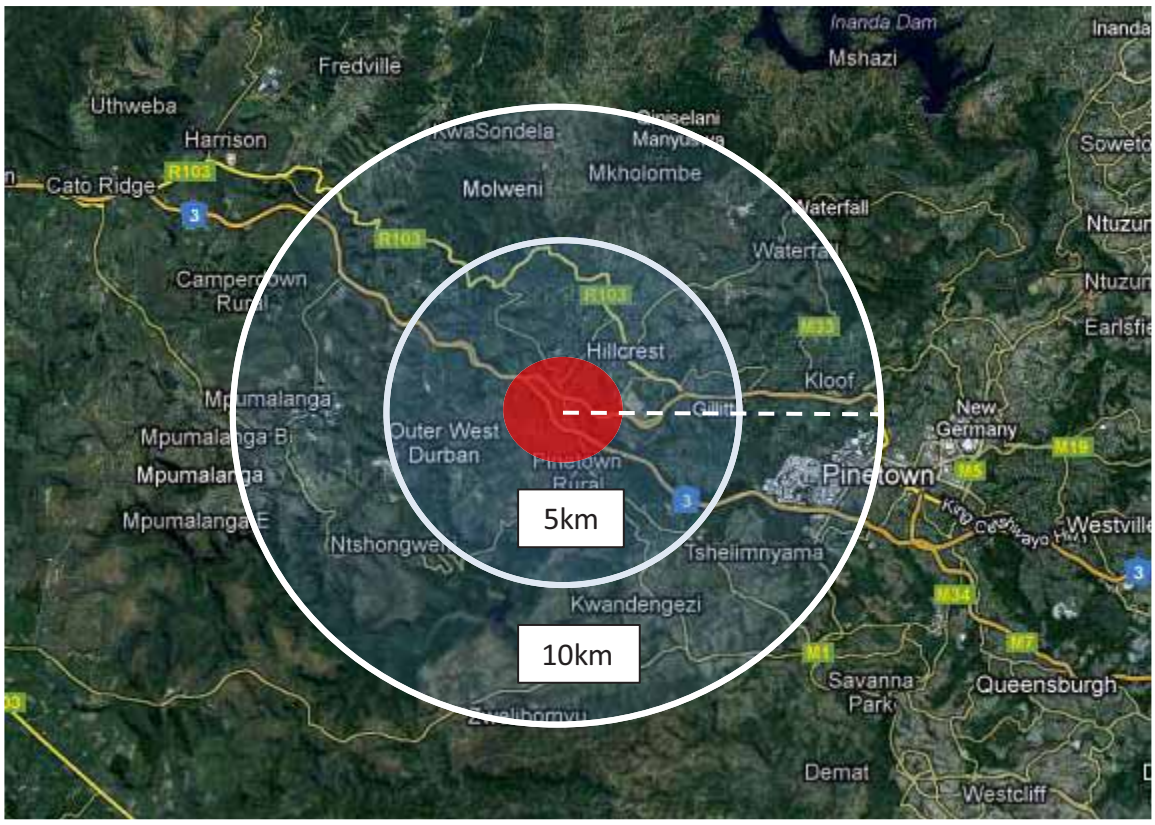
SECTION 3: MARKET DELINEATION

In order to further develop the proposed retail centre concept, a delineation of the market catchment areas will be required. As the exact size and location of the centre has not yet been determined, the market delineation will focus on identifying the key residential areas that surround the proposed location of the centre, providing analysis of the population and household characteristics of these areas, and developing a market catchment area that can be supported based on the basic retail classifications above.

3.1: POTENTIAL MARKET CATCHMENT AREA

In order to determine potential market catchment area, the Stats SA 'main-place' map will be utilised as this allows for a direct correlation with the available statistics. However, a general market catchment must first be determined. The map below displays the areas that are expected to fall within the market catchment of the proposed regional centre, based on the retail classification guideline of between 5 – 10km radiuses for a small to super regional centre.

Map 4: Market Catchment Areas based on a general 5km and 10km radiuses



Source: Urban-Econ adapted from Google Maps (2012)

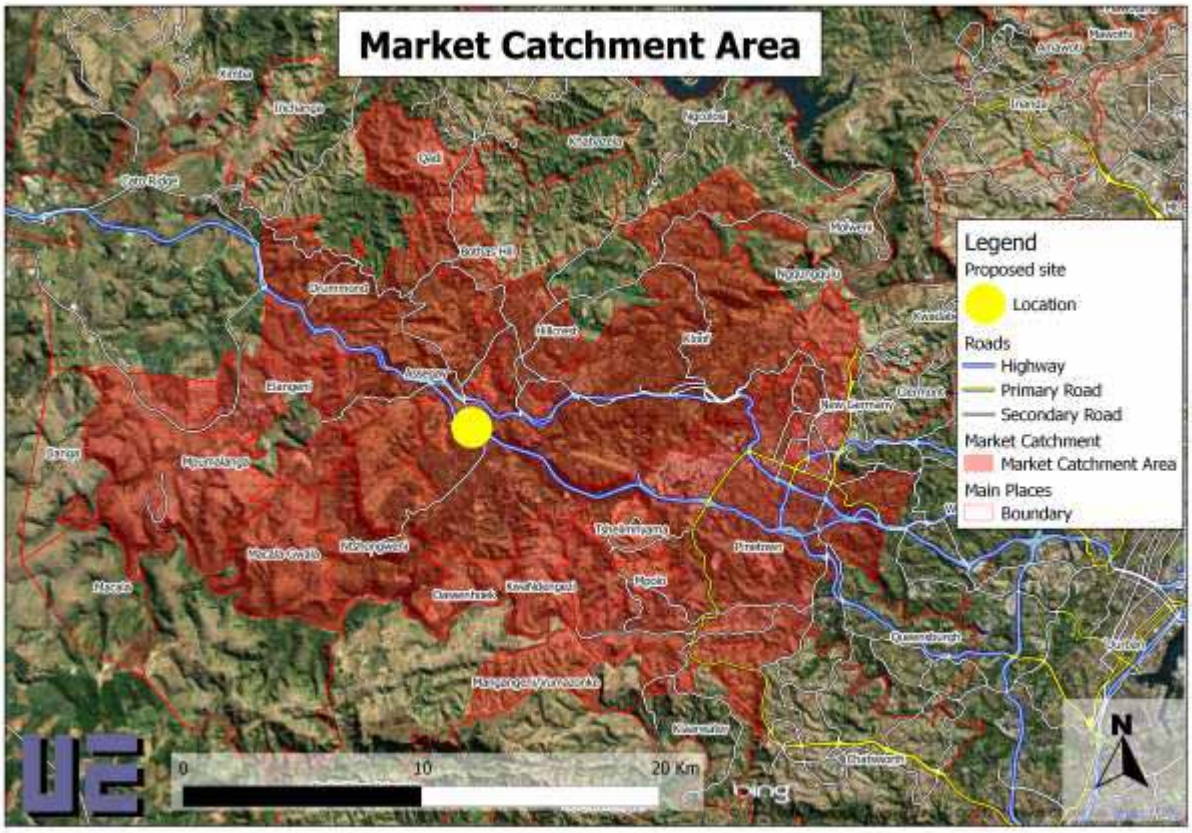
From the above map it is clear that within a 5km radius, the areas of Hillcrest, Assagay, Alverstone and Summerveld are included. Most of these communities consist of residential and equestrian

estates, farms, small-holdings, and single-stand properties. Within Alverstone, Shongweni, Summersveld and Assagay, the majority of properties are smallholdings or farms used either for agricultural purposes or by horse-owners. Within Hillcrest, properties are generally single-stand or estate properties. Although the characteristics of these communities differ, they are generally home to middle-high income earning households who fall within the Living Standards Measure (LSM) 6 – 10.

Within a 10km radius, this is extended to include Mpumalanga, Hillcrest, Shongweni rural, Botha's Hill, Drummond, Pinetown, New Germany, Kloof, Hammersdale, and the rural settlements to the south of the N3, namely KwaNdengezi, Dassenhoek, Magangeni, Elangeni, Tshelimnyama, and Mpolo, which are townships largely consisting of households in the lower income bracket.

In order to extract the relevant up-to-date information required to undertake a nodal profile, the above market delineation must be correlated with the main-places as per Stats SA demarcation. The map below displays the main-places that will be used for statistical purposes during the Nodal Profile, and to extract data about the income and expenditure patterns of these areas. The main-places identified either fall directly within a 10km radius or are un-serviced and have road linkages to the M13/N3 are and proposed location.

Map 5: Main-places impacting on the market delineation



Source: Urban-Econ based on Stats SA Main-Place Demarcations and Bing Satellite Imagery (2012)

A few areas have been omitted as the main place name is associated with various locations, some of which fall farm outside of the 10km radius. This will ensure that no additional households are counted which fall far outside of the potential market catchment of the development. The area

directly surrounding the site falls under the 'eThekwini' main-place and is therefore also omitted as this will include households for the entire Durban central region. This area is largely the sugar cane plot to the south of the N3, which contains very little residential activity, and therefore can be omitted with certainty.

SECTION 3.2: NODAL PROFILE

Information on the above main-places were extracted from the Quantec database and assessed in order to develop a nodal profile for the impacted residential areas that fall within the potential market catchment of the proposed development.

3.1: HOUSEHOLD SIZE AND DENSITY

The table below displays the population breakdown of the eThekwini main-places that fall within the potential market catchment area of the proposed development.

Population and Households (2012)	Population total	Households total	Population density (People per Sqr Km)	Household density (Households per Sqr Km)
Assagay	3 546	1 112	104	33
Bothas Hill	2 281	805	309	109
Dassenhoek Part 1	10 672	2 084	1 869	365
Dassenhoek Part 2	26 607	11 750	4 946	2 184
Drummond	2 168	605	132	37
Elangeni	3 008	730	332	81
Hillcrest	5 846	2 111	583	211
Kloof	40 514	14 267	634	223
KwaNdengezi	37 325	7 520	4 666	940
Mangangeni/Vumazonke	4 083	1 289	486	153
Mpolo	8 922	2 267	4 623	1 175
Mpumalanga	123 373	31 307	3 217	816
New Germany	15 079	4 844	1 650	530
Ntshongweni	798	210	58	15
Pinetown	115 956	34 771	1 612	483
Qadi	9 222	1 934	531	111
Tshelimnyama	19 962	7 260	5 469	1 989
Total	429 362	124 866		

The total number of people within the potential catchment area is 429,362 with the number of households totalling 124,866. The most populated areas are Mpumalanga with 123,373 people and Pinetown with 115,956. However, given the amount of retail that exists within the Pinetown region and the close proximity to the Pavilion Shopping Centre, as well as the proposed shopping centre within Hammersdale, it is expected that the catchment of both these areas will be modest.

The most densely populated areas are Tshelimnyama (5469 people/sqr km), Dassenhoek Part 2 (4946 people/sqr km), KwaNdengezi (4666 people/sqr km), and Mpolo (4623 people/sqr km), all of which are largely un-serviced in terms of retail.

3.2: POPULATION GROUP AND AGE

A brief socio-economic assessment is undertaken in order to identify the characteristics of the potential catchment populations. The table below displays the racial distribution.

Households (2012)	African	Coloured	Asian	White
Assagay	61%	2%	7%	30%
Bothas Hill	60%	0%	6%	34%
Dassenhoek Part 1	100%	0%	0%	0%
Dassenhoek Part 2	100%	0%	0%	0%
Drummond	23%	3%	13%	61%
Elangeni	87%	3%	3%	7%
Hillcrest	9%	0%	1%	90%
Kloof	41%	1%	10%	49%
KwaNdengezi	99%	0%	1%	0%
Mangangeni/Vumazonke	100%	0%	0%	0%
Mpolo	99%	1%	0%	0%
Mpumalanga	100%	0%	0%	0%
New Germany	44%	2%	5%	49%
Ntshongweni	81%	0%	1%	17%
Pinetown	64%	4%	9%	24%
Qadi	100%	0%	0%	0%
Tshelimnyama	100%	0%	0%	0%

Six of the areas consist of only African persons (Dassenhoek Part 1 & 2, Mangangeni, Mpumalanga, Qadi, and Tsdlimnyama), all of which are largely rural settlements. Hillcrest has the highest percentage of White persons (90%), followed by Drummond (61%), New Germany and Kloof (49%), Bothas Hill (34%) and Assagay (30%). Drummond, Kloof, Pinetown and Assagay all have the largest contribution of Asians (includes Indians) with 13%, 10%, 9% and 7% respectively.

The table below displays the age distribution of the catchment populations.

Population Age Breakdown (2012)	Assagay	Bothas Hill	Dassenhoek Part 2	Drummond	Elangeni	Hillcrest	Kloof	KwaNdengezi	Mangangeni/Vumazonke	Mpolo	Mpumalanga	New Germany	Ntshongweni	Pinetown	Qadi	Tshelimnyama	Dassenhoek Part 1
00-04 Year(s)	5%	5%	9%	6%	10%	5%	7%	9%	11%	9%	9%	7%	3%	8%	9%	10%	10%
05-09 Year(s)	3%	5%	8%	6%	8%	5%	6%	9%	11%	9%	10%	6%	2%	7%	10%	8%	11%
10-14 Year(s)	3%	6%	7%	5%	7%	4%	6%	9%	12%	8%	9%	6%	21%	8%	10%	8%	10%
15-19 Year(s)	6%	12%	9%	4%	10%	4%	6%	10%	13%	9%	10%	7%	34%	8%	11%	8%	11%
20-24 Year(s)	10%	7%	12%	7%	12%	4%	7%	13%	12%	12%	12%	9%	9%	10%	12%	12%	12%
25-29 Year(s)	15%	8%	16%	8%	13%	6%	8%	13%	11%	14%	13%	11%	4%	12%	13%	15%	12%

Population Age Breakdown (2012)	Assagay	Bothas Hill	Dassenhoek Part 2	Drummond	Elangeni	Hillcrest	Kloof	KwaNdengezi	Mangangeni/Vumazonke	Mpolo	Mpumalanga	New Germany	Ntshongweni	Pinetown	Qadi	Tshelimnyama	Dassenhoek Part 1
30-34 Year(s)	14%	8%	12%	10%	11%	7%	8%	11%	7%	13%	10%	10%	4%	11%	9%	14%	11%
35-39 Year(s)	12%	7%	8%	9%	8%	6%	9%	8%	6%	10%	8%	8%	3%	9%	7%	9%	7%
40-44 Year(s)	8%	7%	5%	7%	5%	8%	8%	5%	4%	5%	5%	8%	2%	7%	4%	5%	4%
45-49 Year(s)	5%	7%	4%	6%	6%	7%	7%	4%	4%	3%	4%	6%	4%	5%	4%	4%	3%
50-54 Year(s)	7%	7%	3%	9%	3%	8%	7%	3%	3%	3%	4%	6%	4%	5%	3%	3%	3%
55-59 Year(s)	4%	5%	2%	7%	3%	7%	6%	2%	1%	2%	3%	4%	3%	4%	3%	2%	2%
60-64 Year(s)	4%	5%	2%	5%	2%	8%	5%	2%	2%	1%	2%	4%	3%	3%	2%	1%	2%
65-69 Year(s)	3%	5%	1%	5%	1%	8%	4%	1%	1%	1%	1%	3%	2%	2%	1%	1%	1%
70-74 Year(s)	2%	4%	1%	2%	0%	5%	3%	1%	1%	1%	1%	2%	0%	1%	1%	0%	1%
75-79 Year(s)	1%	1%	0%	2%	0%	3%	2%	0%	0%	0%	0%	1%	0%	1%	0%	0%	0%
80+ Year(s)	1%	1%	0%	1%	0%	5%	2%	0%	0%	0%	0%	2%	0%	1%	0%	0%	0%

The average percentage contribution of people below the age of 20 (the child population) is 33%. The most youthful areas are Ntshongweni, which has a remarkably high number of people below the age of 20 at 61%, Mangangeni (47%), and Dassenhoek Part 1 (41%). The average percentage contribution of people between the ages of 20 and 60 years old (the adult population) is 58%. Assegay and Drummond fall well above this average with 74% and 64% of their population being adult; whereas youthful areas fall well below the average (such as Ntshongweni at 34%). Only 8% of the total population in the catchment area are between the ages of 60 and 80 years old. The particularly aged areas include Bothas Hill (16%), Drummond (15%) and Hillcrest (29%).

3.3: EMPLOYMENT

The following table shows the unemployment rate, and labour participation rate for each of the areas.

Unemployment and Labour Participation Rate (2012)	Unemployment Rate (%)	Labour Participation (%)
Assagay	4.6	68.7
Bothas Hill	2.2	59.2
Dassenhoek Part 1	32.9	48.9
Dassenhoek Part 2	31.8	45.4
Drummond	4.6	76.6
Elangeni	14.8	59.3
Hillcrest	1.1	73.9
Kloof	2.6	73.8

Unemployment and Labour Participation Rate (2012)	Unemployment Rate (%)	Labour Participation (%)
KwaNdengezi	30.9	42.4
Mangangeni/Vumazonke	57.7	28.0
Mpolo	32.3	50.3
Mpumalanga	35.5	41.0
New Germany	3.3	77.2
Ntshongweni	5.3	69.7
Pinetown	13.2	57.2
Qadi	24.8	49.8
Tshelimnyama	26.3	53.6

The unemployment rate describes the number of people in the labour force who are looking for work. The labour force does not include those that are not economically active (such as housewives and students). The highest rate of unemployment is 57.7% in Mangangeni/Vumazonke. This area also has the lowest labour force participation rate at 28% which means that only 28% of the total working age population is actively seeking work or employed. Conversely it shows that 72% of the working age population is not economically active (chooses not to work). Mpumalanga, Mpolo and Dassenhoek (parts 1 and 2) also have high unemployment rates (greater than 30%). The lowest unemployment rates and highest labour force participation rates are being experienced in Ntshongweni, New Germany, Kloof, Hillcrest, Drummond, Bothas Hill and Assegay.

The following table describes the number of people employed in formal businesses and the number of people employed in informal businesses.

Formal and Informal Employment (2012)	Employed (Formal)	Employed (Informal)
Assegay	1482	352
Bothas Hill	739	188
Dassenhoek Part 1	1512	415
Dassenhoek Part 2	4215	1295
Drummond	907	249
Elangeni	742	253
Hillcrest	2253	533
Kloof	16251	3774
KwaNdengezi	5805	1301
Mangangeni/Vumazonke	211	57
Mpolo	1516	424
Mpumalanga	15802	4524
New Germany	6437	1324
Ntshongweni	267	84
Pinetown	31528	7475
Qadi	1613	450
Tshelimnyama	3749	1023

The split between formal and informal employment is fairly standard across the area with around 80% of people being employed in the formal sector and 20% employed in the informal sector.

3.4: HOUSEHOLD INCOME AND EXPENDITURE

The following table gives the total annual household income and expenditure for each of the areas in Rand millions.

Income and Expenditure in Rands Million (2012)	Current Income	Remuneration	Unearned Income	Final Consumption Expenditure
Assegay	R 231.8	75%	25%	R 219.20
Bothas Hill	R 107.6	78%	22%	R 104.4
Dassenhoek Part 1	R 357.3	68%	32%	R 334.5
Dassenhoek Part 2	R 700.8	64%	36%	R 677.82
Drummond	R 121.4	77%	23%	R 114.5
Elangeni	R 122.7	71%	29%	R 115.1
Hillcrest	R 461.5	76%	24%	R 415.0
Kloof	R 2 999.0	78%	22%	R 2 747.7
KwaNdengezi	R 993.1	66%	34%	R 959.9
Mangangeni/Vumazonke	R 46.7	63%	37%	R 41.9
Mpolo	R 325.7	63%	37%	R 304.8
Mpumalanga	R 2 797.8	66%	34%	R 2 566.1
New Germany	R 1 220.7	76%	24%	R 1 142.2
Ntshongweni	R 11.0	79%	21%	R 12.7
Pinetown	R 5 878.8	75%	25%	R 5 557.7
Qadi	R 232.7	66%	34%	R 206.9
Tshelimnyama	R 1 083.4	68%	32%	R 968.6

The area with the highest income is Pinetown with R5.8billion income per year and R5.5 billion expenditure per year. The lowest income areas are Ntshongweni and Mangangeni/Vumazonke with R11 million and R46 million income respectively. Between 63% and 78% of all income is remuneration. The highest proportion of unearned income is being earned in Mpolo (37%), Mangangeni (37%) and Dassenhoek Part 2 (36%).

The following table describes on which goods category income is spent in each of the areas.

Percentage of total Expenditure (2012)	Durable	Semi-Durable	Non-Durable	Services
Assagay	7%	6%	30%	56%
Bothas Hill	7%	6%	32%	55%
Dassenhoek Part 1	6%	8%	33%	53%
Dassenhoek Part 2	8%	11%	51%	30%
Drummond	7%	6%	33%	54%
Elangeni	7%	8%	36%	49%
Hillcrest	8%	6%	30%	57%
Kloof	7%	6%	31%	55%
KwaNdengezi	10%	12%	41%	36%
Mangangeni/Vumazonke	6%	10%	53%	31%
Mpolo	7%	10%	52%	32%
Mpumalanga	8%	11%	49%	32%
New Germany	7%	7%	35%	50%
Ntshongweni	6%	6%	34%	55%
Pinetown	7%	7%	35%	51%
Qadi	9%	11%	45%	36%
Tshelimnyama	6%	8%	33%	53%

The majority of income is spent on services (47%), with 38% being spent on Non-Durable goods, and 8% being spent on both semi-durable and durable goods each. However, Dassenhoek Part 2, KwaNdengezi, Mangangeni, Mpolo, Mpumalanga and Qadi do not follow this spending profile as all these areas spend the majority of their income on non-durable goods.

The following table gives a breakdown of the expenditure on durable goods.

Break down of Durable Goods (2012)	Furniture, household appliances, etc	Personal transport equipment	Recreational and entertainment goods	Other durable goods
Assagay	11%	50%	31%	8%
Dassenhoek Part 2	22%	60%	10%	8%
Hillcrest	10%	66%	17%	7%
Kloof	11%	52%	28%	9%
KwaNdengezi	22%	59%	11%	7%
Mpumalanga	24%	57%	10%	9%
Ntshongweni	8%	51%	35%	6%
Pinetown	14%	54%	24%	8%
Tshelimnyama	22%	47%	20%	11%
Dassenhoek Part 1	20%	51%	18%	10%
Bothas Hill	11%	54%	28%	8%
Drummond	12%	55%	24%	8%
Elangeni	21%	49%	21%	9%
Mangangeni/Vumazonke	25%	52%	12%	11%
Mpolo	25%	52%	12%	11%
Qadi	26%	52%	12%	10%
New Germany	17%	51%	23%	9%

Only 8% of all expenditure is spent on durable goods. This category includes luxury items such as cars, tvs, furniture etc. 54% of expenditure on durable goods is spent on personal transport equipment, 20% is spent on recreation and entertainment goods, 17% is spent on furniture and household appliances, and 9% is spent on other.

The following table gives a breakdown of expenditure on semi-durable goods.

Breakdown of Semi-Durable Goods (2012)	Clothing and footwear	Household textiles, furnishings, glassware, etc	Motor car tyres, parts and accessories	Recreational and entertainment goods	Miscellaneous goods
Assegay	41%	11%	17%	15%	16%
Dassenhoek Part 2	64%	16%	15%	4%	1%
Hillcrest	31%	11%	26%	19%	14%
Kloof	39%	12%	21%	17%	12%
KwaNdengezi	62%	16%	15%	4%	3%
Mpumalanga	62%	17%	16%	4%	1%
Ntshongweni	26%	7%	17%	19%	31%
Pinetown	45%	13%	18%	13%	11%
Tshelimnyama	58%	17%	11%	9%	6%
Dassenhoek Part 1	59%	16%	11%	9%	6%
Bothas Hill	36%	11%	21%	18%	14%
Drummond	37%	11%	21%	17%	14%
Elangeni	56%	15%	13%	9%	7%
Mangangeni/Vumazonke	66%	16%	14%	3%	1%
Mpolo	65%	16%	15%	4%	1%
Qadi	61%	17%	15%	5%	2%
New Germany	47%	14%	17%	13%	9%

Only 8% of all expenditure is spent on semi-durable goods. The majority of expenditure (52%) is on clothing and footwear, 17% is spent on motor parts, 15% on households textiles etc, 10% on recreational and entertainment goods, and 7% on other. A higher proportion of income is spent on

clothing and footwear in the informal settlement areas with Mangangeni, for example, spending 66% of all semi-durable expenditure on clothing and footwear.

The following table describes expenditure on non-durable goods.

Breakdown of Non-Durable Goods (2012)	Food, beverages and tobacco	Household fuel and power	Household consumer goods	Medical and pharmaceutical products	Petroleum products	Recreational and entertainment goods
Assagay	67%	4%	11%	10%	8%	3%
Bothas Hill	69%	3%	10%	9%	9%	3%
Dassenhoek Part 1	72%	4%	10%	7%	8%	2%
Dassenhoek Part 2	65%	15%	10%	1%	9%	1%
Drummond	70%	4%	10%	9%	8%	3%
Elangeni	67%	8%	11%	5%	8%	2%
Hillcrest	66%	3%	10%	11%	10%	4%
Kloof	66%	3%	9%	12%	10%	3%
KwaNdengezi	62%	12%	11%	3%	13%	2%
Mangangeni/Vumazonke	68%	13%	11%	1%	6%	1%
Mpolo	68%	13%	11%	1%	6%	1%
Mpumalanga	67%	12%	10%	2%	9%	1%
New Germany	69%	5%	10%	7%	9%	3%
Ntshongweni	70%	6%	9%	7%	8%	3%
Pinetown	68%	5%	10%	7%	9%	3%
Qadi	65%	11%	10%	3%	10%	1%
Tshelimnyama	71%	5%	10%	8%	7%	2%

The proportion of expenditure on non-durable goods for the whole catchment area is 38%. This proportion is highest for informal settlements that often spend the majority of their income on this category. The vast majority of expenditure in this category is spent on food, beverages and tobacco (62% - 72%). Between 7% and 11% is spent on household consumer goods and petrol products each. A larger proportion of expenditure (12%) is spent on household fuel and power in informal settlements, and a larger proportion is spent on medical costs (10%) in Kloof, Hillcrest and Assagay which is likely due to the ageing population in these areas.

The following table describes expenditure on services.

Breakdown of Services (2012)	Rent	Household services, including domestic servants	Medical services	Transport and communication services	Recreational, entertainment and educational services	Miscellaneous services
Assagay	35%	5%	14%	21%	7%	18%
Bothas Hill	38%	5%	13%	21%	6%	16%
Dassenhoek Part 1	39%	7%	10%	16%	6%	22%
Dassenhoek Part 2	22%	8%	16%	19%	14%	20%
Drummond	38%	5%	13%	20%	7%	16%
Elangeni	38%	6%	12%	19%	8%	16%
Hillcrest	32%	5%	14%	21%	7%	21%
Kloof	36%	5%	13%	20%	6%	19%
KwaNdengezi	15%	6%	16%	23%	16%	24%
Mangangeni/Vumazonke	29%	10%	14%	16%	12%	19%

Breakdown of Services (2012)	Rent	Household services, including domestic servants	Medical services	Transport and communication services	Recreational, entertainment and educational services	Miscellaneous services
Mpolo	28%	9%	14%	17%	12%	20%
Mpumalanga	23%	8%	14%	19%	13%	23%
New Germany	36%	6%	13%	21%	7%	18%
Ntshongweni	43%	5%	12%	23%	6%	12%
Pinetown	35%	5%	14%	21%	8%	18%
Qadi	21%	7%	15%	19%	13%	25%
Tshelimnyama	40%	7%	10%	16%	6%	21%

47% of all spending in the catchment area is spent on services. 33% of this is spent on rent, 20% on transport and communication and 19% on other. Only 6% is spent on household services including domestic servants.

The spending profile implies that the majority of spending in the catchment area is spent on rent, transport and communication, clothing and footwear and non-durable food products. This is standard for the province.

3.5: IMPLICATIONS FOR THE STUDY

- The most populated areas are Mpumalanga with 123,373 people and Pinetown with 115,956. However, given the amount of retail that exists within the Pinetown region and the close proximity to the Pavilion Shopping Centre, as well as the proposed shopping centre within Hammersdale, it is expected that the catchment of both these areas will be modest.

- The majority (over 60%) of the population in the catchment areas are between the ages of 20 and 65 which means that there is buying power in these areas. Ntshongweni, however, has a very youthful population with 61% being under the age of 20 years old.

- The lowest unemployment rates and highest labour force participation rates are being experienced in Ntshongweni, New Germany, Kloof, Hillcrest, Drummond, Bothas Hill and Assegay which means there is good buying power in these areas as most people are working and earning an income.

- The area with the highest income is Pinetown with R5.8billion income per year and R5.5 billion expenditure per year. The lowest income areas are Ntshongweni and Mangangeni/Vumazonke with R11 million and R46 million income respectively.

- The majority of income is spent on services (47%), with 38% being spent on Non-Durable goods, and 8% being spent on both semi-durable and durable goods each. However, Dassenhoek Part 2, KwaNdengezi, Mangangeni, Mpolo, Mpumalanga and Qadi do not follow this spending profile as all these areas spend the majority of their income on non-durable goods.

- The spending profile implies that the majority of spending in the catchment area is spent on rent, transport and communication, clothing and footwear and non-durable food products. This is standard for the province.

SECTION 4: RETAIL POTENTIAL ASSESSMENT

4.1: INTRODUCTION

There are a number of factors which determine the potential market share that the proposed development could capture, including transport patterns, the socio-economic profile of the feeding communities, the supply of existing retail, planned developments, and accessibility and visibility.

These supply and demand side factors are briefly assessed within this section before moving onto and effective demand analysis.

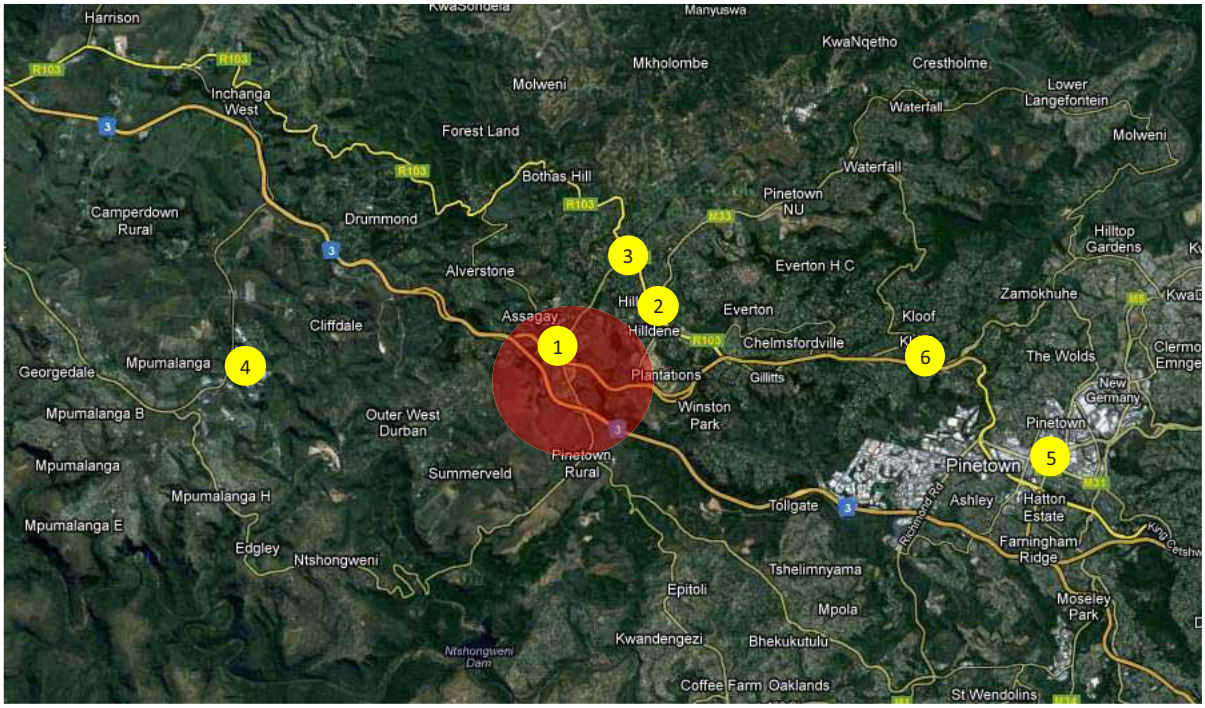
4.2: MARKET SUPPLY ANALYSIS

In terms of retail supply, many of the main-places that fall within the potential market catchment area are largely un-serviced. The more rurally located areas such as Mpolo, KwaNdengezi, Ntshongweni and Elangeni contain very little or even no formal retail activity. Kloof, Bothas Hill, and Assagay are largely serviced by the Hillcrest retail corridor which contains a number of larger retail centres, while Pinetown is fairly well serviced with a few retail centres.

In order to present a clear picture regarding the supply of retail space in the wider Outer-West region, and assessment of existing retail space in the region was undertaken. This section presents the findings of the assessment.

The map on the following page displays the existing retail activities identified during an analysis of existing retail, and the table following that displays the details relating to each retail facility.

Map 6: Location of existing retail in the wider context



Source: Urban-Econ mapping based on Google Maps (2012)

Table 2: Existing retail facilities

Map Ref	Description	Some retail facilities offered
1	Assagay Retail Node	Engen Convenience Store, The Mushroom Shop, AC Smith Equestrian Supplies, Simple Spaces, Garden Decor Zone (Nursery), SA Sandstone & Slate, Equerry Hay Barn, Mink & Manure, and Farmers Market
2	Hillcrest Retail Corridor (3 distinct retail nodes)	Christians Village, Hillcrest Corner, The Colony, Richdens Village Centre, Service Station
		Hillgate Shopping Centre, Hillcrest Centre
		Hillcrest Heritage Market, Mr Price Sport, 8 on Old Main, Lillies Quarter, Bailey Centre
3	Various Retail Stores	Sherwell Cupboard Systems, BEDS, Aluka Rugs, eDrive, The Plastic Shop
4	Hammersdale/ Mpumalanga Retail	Boxer Cash and Carry Store, Retail Market, Hammersdale Hyper, Sipha Mandla, Magaba Supermarket, Dunbar Centre
5	Pinetown Retail	Various retail stores along the Old Main Road, Pinecrest Centre, Pinewalk Centre
6	Kloof retail	Various retail stores along the Old Main Road and M13 such as Kloof Village Mall and Field Shopping Centre

Source: Urban-Econ (2012)

The Assagay Retail Node consists of various single-stand retail stores. Retail stores in the location of the proposed development are located at the Mushroom Farm site, and include facilities such as The Mushroom Shop, AC Smith Equestrian Supplies, Simple Spaces, Garden Decor Zone (Nursery), SA Sandstone & Slate, Equerry Hay Barn and Mink & Manure.

The Hillcrest Retail corridor has the largest concentration of retail centres within a 5km radius of the proposed development. These various retail centres form a corridor along the Hillcrest Old Main Road, from the Heritage Market in the south-east, to Richden's Village Centre in the north-west.

There is a large number of retail stores located within the various retail centres along this corridor, and this reduces the wider catchment area of the proposed development, as the entire community of Hillcrest (and surrounding areas) would use this corridor for the majority of their shopping requirements.

A small retail node along the Bothas Hill old main road, including shops such as Sherwell Cupboard Systems, BEDS, Aluka Rugs, eDrive, and the Plastic Shop. These are however small convenience-type retail stores and would not impact on the catchment area of the proposed development.

Retail within the Hammersdale/Mpumalanga area is currently limited to the Boxer Cash and Carry, and a few smaller shopping centres or supermarkets such as the Hammerdale Hyper, Sipha Mandla, Magaba Supermakret and Dunbar centre. Hammerdale Junction is a new 19,000m^2 retail centre proposed for the area, with construction anticipated for April 2012 through to April 2013. The centre will have a mix of both national and local retailers such as Pick 'n Pay, Super Spar, Mr Price and others.

The Pinetown area is the other large significant retail corridor besides Hillcrest. The entire Old Main Road is lined with various retail stores, mostly in the form of vehicle showrooms, but also consisting of fast-food and small convenience supermarkets/shops. The largest significant retail node contains the Pinecrest and Pinewalk Centres, which have a range of national and local retailers.

The Kloof area is also fairly well serviced in terms of retail with various nodes present along the M13 as well as Kloof Old Main Road. The two most prominent nodes are the Field Shopping Centre on Old Main Road and Kloof Village Mall on Village Road.

In conclusion, although there are a large amount of retail facilities within the Hillcrest and Pinetown corridors. However, very little retail activity exists south of the N3 within a 5km radius of the proposed location besides in Hammerdale/Mpumalanga. Although many residents from un-serviced out-lying areas do their shopping within the Hillcrest and Pinetown retail corridor, there is still scope for retail centre to be located at the proposed location. The report will now move onto an assessment of the town planning interventions that are expected to have an impact on the proposed development.

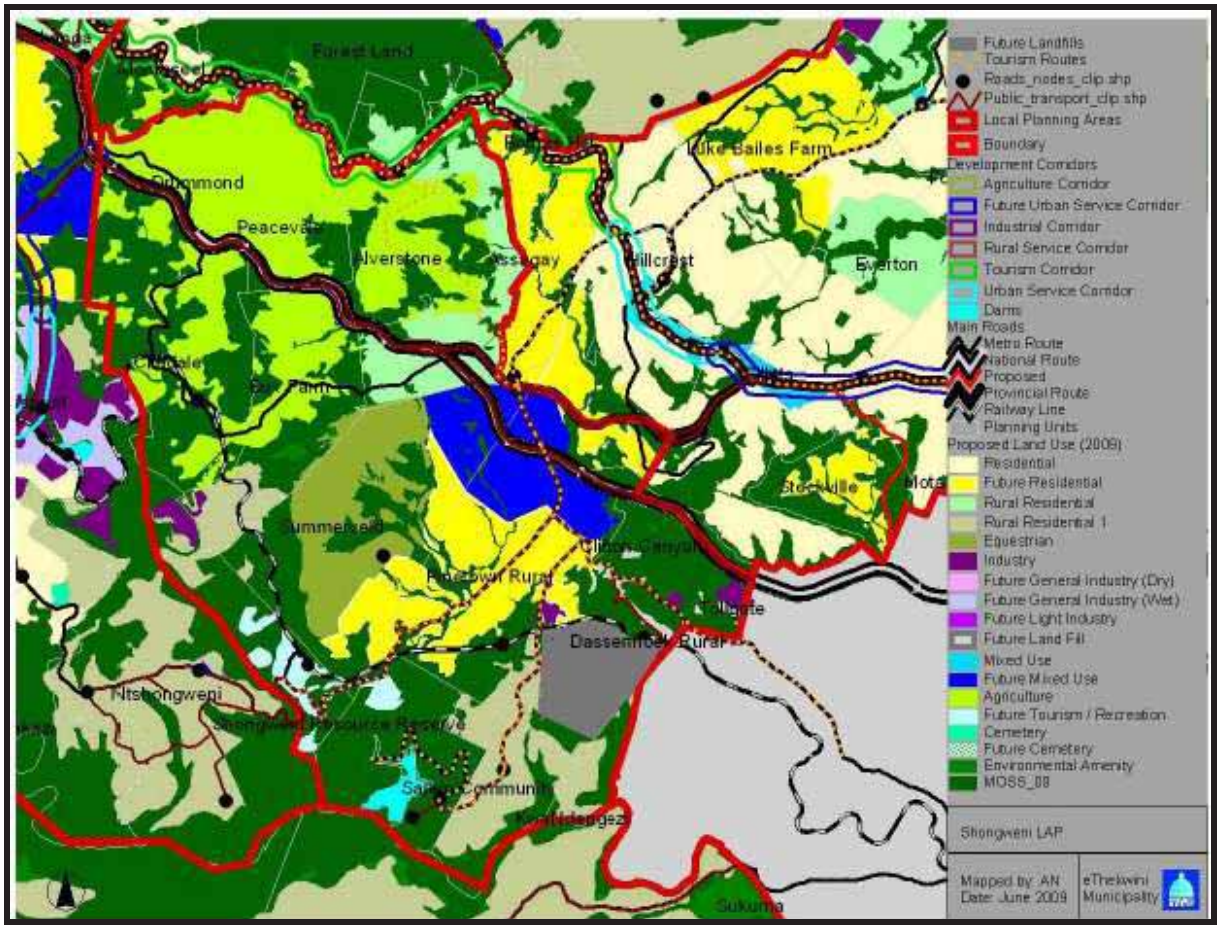
4.3: MARKET DEMAND ANALYSIS

This section will undertake an assessment of the demand for the proposed retail development area. This includes identifying any development plans of the City for the area, other planned developments, and collecting data on the surrounding population and traffic patterns.

4.3.1: LOCAL PLANNING PRIORITIES

The eThekwini Spatial Development Plan (2009) for the Outer-West region breaks this region down into six sub-regions, of which the Shongweni region is important for the purpose of this study. The Map below displays the Shongweni sub-region and land-uses

Map 7: Current and proposed land-uses for the Shongweni sub-region as per the Outer-West SDP



Source: eThekwini Outer-West Spatial Development Plans (2009)

The area in which the proposed site resides coincides with the City's plan to develop this area into a mixed use zone, noted by the blue area on the map. This area allocation dedicated to Future Mixed Use includes the plans for retail, residential, and office development. Thus, the area where the purposed site lies coordinates directly with the City's plans for a Future Mixed Use area. Additionally, the other components of a mixed use development outside of retail development, residential and office developments, will draw in additional consumer demand to support a retail centre.

The spine running from the site, north towards the Hillcrest Old Main Road in a corridor along Kassier Road has been identified as a future tourism/recreation corridor. This needs to be considered when deciding on the type of retail to be installed within the proposed development site. Increased traffic into the site catchment area due to tourism/recreation development will add to the potential volume of retail demand. If appropriate retail is constructed, a retail centre within the proposed site has great potential to draw in potential consumers in transit to or from their tourist or recreational activities.

Additionally, the areas shown in yellow that run from the M13, north towards the Hillcrest Old Main Road, and south of the N3 highway have been identified as future residential locations. This will too have an impact on the proposed development. With two large areas directly south and directly north of the site area dedicated by the City to residential development, there will be a large increase in demand for retail products once the residential area has been constructed. This is particularly important in the southern area for planned residential development, because no substantial retail

exists here. The northern area allocated to future residential development is in close access to the Hillcrest Retail facilities. However, the new site will have potential to draw a percentage of these customers due to the site location and the resulting market catchment area. Existing secondary roads are placed such that these future residential areas will connect to the proposed retail development site.

The Outer-West SDP displays the role of the Shongweni sub-region as:

- National equestrian centre;
- Low density rural and suburban residential expansion;
- Sub metropolitan commercial/service expansion;
- Environmental asset consolidation and protection.

Within the greater market catchment area, these four roles of the Shongweni sub-region noted above have the potential to bring in new consumers and increase the demand for a retail centre around the proposed location. A national equestrian centre will bring tourist and recreational traffic into the area. The benefits of said traffic are mentioned above. Residential expansion will also increase the demand for retail facilities in the area.

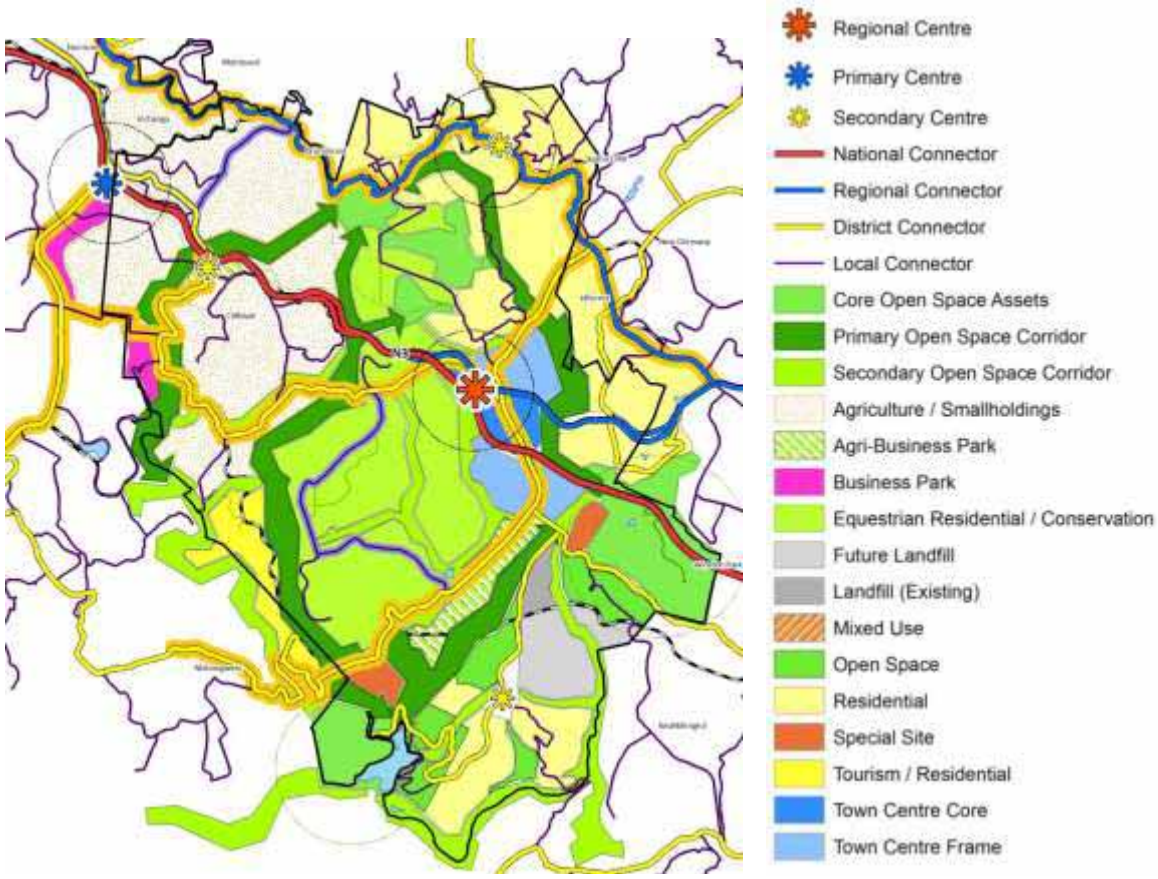
Importantly, Shongweni also has been identified as a Key Investment Opportunity Node, potentially accommodating new industrial development. Additionally, the SDP identifies the need for the establishment of Kassier Road as a movement spine liking the western suburbs to Shongweni, while also noting that better connectivity is needed between Kassier Road and Inanda Road. In this regard, the SDP suggests the development of a link road between Inanda and the inner-west to provide an alternative exit for the western suburbs.

A number of additional opportunities have also been identified. One such opportunity that is stated in the SDP is the development of the land between the M13 and N3, which has the potential to accommodate a range of activities such as mixed-use commercial, light and service industry, and office and business parks in the long-run. Once established, these activities will increase the volume of traffic on Shongweni's road network.

With regard to the above mentioned initiatives in the Outer-West region, especially in the Shongweni sub-region, there is expected to be some substantial development within this node, and this will have an impact on the proposed retail development. The influx of light/service industry and other mixed-use development between the site and the N2 will increase the vehicular traffic in the area, which will enhance the potential of the proposed retail development. The proposed Inanda Link Road will substantially increase the amount of vehicular traffic and too enhance the potential of the proposed development. However, new mixed-use development will include an element of retail, and this could compete directly with the proposed retail development.

There are also plans to upgrade Kassier Road into a two-lane, dual-carriageway road. This, along with the plans to link Kassier Road directly into Inanda by by-passing Hillcrest, will ensure that there will be a substantial increase in vehicular traffic passing the proposed location, which increases the catchment potential of the proposed development. Similarly, more road linkages and a better supported transportation infrastructure will increase accessibility to the proposed location.

The Shongweni Local Area Plan spatial framework is presented below:



Source: Shongweni Local Area Plan (2011)

The entire central region (around the M13 and N3 interchange) is earmarked as the town centre core and frame. This comprises a regional centre situated between these two major transport roads. In addition, the LAP recognises that this regional centre "would represent the highest order of centre within the study area and has the potential to serve as a mixed use Town Centre catering for the broader sub-region". This substantiates the future need for as mixed-use centre anchored by retail, and supported by other land-uses.

The LAP also provides a future land-use response for each of the precincts identified, of which the Town Centre Precinct is one. The most relevant land-use reposes are for this precinct are intensive development of the core (Retail/ Office) as well as a Supporting frame consisting a Commercial/ Mixed use zone which includes a residential component. In addition, the following have been noted as urban design guidelines:

- Promote a robust mix of activity;
- Encourage high density residential development to support Town Centre Core;
- Encourage a focal, multi use spaces within the core;

This again supports the proposed Tongaat-Hulett plans for a retail centre supported by other land-uses such as retail and office development.

SECTION 5: EFFECTIVE DEMAND MODEL

The demand model produces an output in the form of an effective demand figure, or, the potential size of retail in that particular area that can be supported by the surrounding populations (in terms of metres squared). This determines whether the retail development is in fact viable.

As mentioned earlier, the primary method for determining a potential GLA for the retail centre is by using the surrounding households expenditure patterns and the potential catchment of these households.

The analysis will follow a conservative approach to ensure that demand is not overestimated. To do this, the analysis will ignore residents that live outside of the primary catchment areas, who might also travel past the site to reach amenities such as schools, tourist facilities, the farmers market, and the future hospital, as well as to access the M13 and N3.

5.1: DEMAND BASED ON HOUSEHOLD EXPENDITURE PATTERNS

In order to accurately calculate the effective demand for the proposed centre, an average household income and expenditure was first calculated, and assumptions were made with regards to the potential catchment area of each main-place. The assumptions with regards to potential catchment for each main place are displayed in the table below:

Main-Place	Potential Catchment Percentage	Justification
Assagay	40%	Largely serviced by Hillcrest
Bothas Hill	20%	Largely serviced by Hillcrest
Dassenhoek Part 1	45%	Largely un-serviced; Direct road access to proposed location
Dassenhoek Part 2	45%	Largely un-serviced; Direct road access to proposed location
Drummond	45%	Partially serviced by Hillcrest
Elangeni	35%	Partially serviced by Mpumalanga/Hammersdale
Hillcrest	10%	Well serviced within Hillcrest
Kloof	10%	Serviced within Kloof; Partially serviced by Hillcrest and Pinetown
KwaNdengezi	45%	Largely un-serviced; Direct road access to proposed location
Mangangeni/Vumazonke	35%	Largely un-serviced; Direct road access to proposed location
Mpolo	45%	Largely un-serviced; Direct road access to proposed location
Mpumalanga	20%	Fairly well serviced within Mpumalanga/Hammersdale
New Germany	10%	Direst linkage to the Pinetown node
Ntshongweni	80%	Largely un-serviced; Direct road access to proposed location
Pinetown	10%	Well serviced from within the Pinetown node
Qadi	35%	Largely un-serviced; Road access to the M13
Tshelimnyama	45%	Largely un-serviced; Direct road access to proposed location

Based in these assumptions, a market demand model was developed using the average annual household income for each sub-place, the potential market catchment displayed above, as well as the average trading density of a regional centre of approximately R21,287/m^2.

The table below displays the result of the demand model:

Table 3: Results of the demand model based on household expenditure patterns

Main-Place	Total H/H Disposable Income 2012	Expenditure % of Income	Total expenditure by households	Retail % of expenditure	Expenditure on Retail items	Potential catchment	Potential expenditure catchment	Average Trading Density (R/square metre)	Effective Demand (square metre)
Assegay	R 214 834 013	94%	R 202 965 431	37%	R 74 986 129	40%	R 29 994 451	21 287	1 409
Bothas Hill	R 97 570 387	97%	R 94 589 691	37%	R 35 334 547	20%	R 7 066 909	21 287	332
Dassenhoek Part 1	R 325 319 739	94%	R 304 567 829	41%	R 124 389 410	45%	R 55 975 234	21 287	2 630
Dassenhoek Part 2	R 652 577 882	29%	R 191 781 371	59%	R 113 405 937	45%	R 51 032 672	21 287	2 397
Drummond	R 114 503 797	94%	R 107 992 129	38%	R 41 480 717	45%	R 18 666 323	21 287	877
Elangeni	R 114 694 607	94%	R 107 643 323	44%	R 47 531 057	35%	R 16 635 870	21 287	782
Hillcrest	R 416 778 956	90%	R 374 824 443	34%	R 126 818 170	10%	R 12 681 817	21 287	596
Kloof	R 2 743 440 597	92%	R 2 513 512 819	37%	R 917 537 037	10%	R 91 753 704	21 287	4 310
KwaNdengezi	R 856 083 049	97%	R 827 532 664	51%	R 421 713 164	45%	R 189 770 924	21 287	8 915
Mangangeni/Vumazonke	R 44 473 871	90%	R 39 911 660	61%	R 24 387 400	35%	R 8 535 590	21 287	401
Mpolo	R 310 132 993	94%	R 290 253 332	60%	R 174 720 813	45%	R 78 624 366	21 287	3 694
Mpumalanga	R 2 587 070 303	92%	R 2 372 741 737	57%	R 1 359 914 700	20%	R 271 982 940	21 287	12 777
New Germany	R 1 177 197 108	94%	R 1 101 509 836	42%	R 458 627 238	10%	R 45 862 724	21 287	2 154
Ntshongweni	R 10 328 192	116%	R 11 968 388	39%	R 4 636 367	80%	R 3 709 094	21 287	174
Pinetown	R 5 303 547 181	95%	R 5 013 849 672	41%	R 2 040 399 442	10%	R 204 039 944	21 287	9 585
Qadi	R 211 349 529	89%	R 187 954 762	54%	R 101 130 255	35%	R 35 395 589	21 287	1 663
Tshelimnyama	R 1 010 171 924	89%	R 903 125 007	41%	R 371 166 527	45%	R 167 024 937	21 287	7 846
									60 542

Source: Urban-Econ calculations based in Quantec Data (2012)

The total disposable household income for each main-place was extracted from the Quantec database and was multiplied by the percentage of income used for expenditure by households to arrive at a total annual expenditure figure. This was then multiplied by the percentage spent by each main-place on retail items to arrive at a figure for retail expenditure for each main-place. This includes:

Non-durable goods:

- Food, beverages and tobacco; household consumer goods; medical and pharmaceutical products; and recreational and entertainment goods;

Semi-durable goods:

- Clothing & footwear, household textiles & furnishings, medical & pharmaceutical goods, and recreational & entertainment goods;

Durable goods:

- Furniture & household appliances, and recreational & entertainment goods.

The potential catchment percentages identified earlier were then applied for each main-place based on the characteristics of each main-place. The result is the total potential expenditure catchment figure for each main-place. This figure is then divided by the average trading density for a regional centre of R21,287 per square metre. This produces a GLA for each of the main places. Adding these together provides a total potential **GLA of 60,542 m^2.**

Therefore, it is clear that there is an effective demand figure of approximately **60,542** m^2 within the Shongweni region. This figure is however determined using assumptions about the expected market catchment areas, and assumes that all these households would prefer a retail centre within Shongweni over the area in which they reside. This is effectively the demand that would be available within the Shongweni node, should a centre be developed along with all the relevant and required facilities and infrastructure, including sufficient road linkages, pedestrian bridges and taxi facilities.

The demand model developed within the second phase will take all survey information into account, as well as existing and future retail developments in the area, in order to provide a more accurate assessment of retail demand within the wider Shongweni region.

SECTION 6: CONCLUSION

The location of the proposed convenience retail centre development is well positioned in terms of both accessibility and visibility, being position around the M13 and N3 interchange. The intersections between Kassier Road, the M13, and the N3 all experience high traffic volumes, and this ensures that there is sufficient passing traffic to support such a development over and above the large residential populations that reside within the potential market catchment area.

After undertaking a demand model based on existing information and date, it is clear that there is effective demand within the potential market catchment areas of approximately 60,542 m^2. This is

the total effective demand that exists within the potential catchment areas, based on a number of assumptions about retail trends, and based on the assumption that such a centre developed in the area has all the relevant and required infrastructure such as road linkages, pedestrian bridges and taxi facilities.

This initial assessment provided an investigation into the proposed development of a retail centre within the wider Shongweni area. In order to more accurately determine the potential for such as retail centre, and specifically what retail offerings could be provided, the second phase of the study will incorporate shopper and household surveys that would assist in determining retail brand preferences; non-retail activities and support services within the centre. These will be packaged into specific GLA allocations and brand preference recommendations. In addition, the review of existing detailed planning interventions, traffic data as well as the modeling of the proposed retail centre's impact will be undertaken. This will provide for a detailed socio-economic impact assessment of the centre to support the market assessment. The demand for other land-uses such as light-industry, residential and office space will also be incorporated into the second phase to understand the dynamics behind these property types within the wider Shongweni region.

TONGAAT HULETT DEVELOPMENTS

SHONGWENI RETAIL CENTRE

MARKET DEMAND AND SOCIO-ECONOMIC IMPACT ASSESSMENT

PHASE 2 REPORT – COMPREHENSIVE MARKET ASSESSMENT

AUGUST 2012

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TABLE OF CONTENTS

SECTION 1: INTRODUCTION & BACKGROUND

1.1: PURPOSE AND BACKGROUND OF THE STUDY

Tongaat Hulett Developments (THD) have identified the potential for development of a regional centre within Shongweni, based on the future growth potential of the Shongweni region. Urban-Econ have been appointed to undertaken the study, of which the purpose is to undertake a retail market assessment and socio-economic impact assessment for the proposed Shongweni Retail Centre. The size and exact location of the proposed retail centre has not yet been determined, however the wider concept of a regional centre will be investigated within the context of Shongweni area.

The proposed development can be classified as a mixed-use development. It is proposed that the development will be anchored by retail, and supported by residential and office space should the demand be sufficient to support such activities.

1.2: APPROACH AND METHODOLOGY

The study comprises of two key phases, an **Initial Market Scoping** and a **Comprehensive Market Assessment.**

Phase 1: Initial Market scoping

The first phase of the study includes a brief assessment of the retail potential of the study area; unpacking the existing competing supply in the area and region; the typical spend profiles as reflected in the quantitative datasets (available down to the spend category, but not brand level) as well as a review of the intended local authority and major private sector development interventions and changes in the immediate area that would have an impact on commuter and foot traffic into the centre.

Phase 2: Comprehensive Market Assessment

The second phase of the study includes shopper and household surveys that would assist in determining retail brand preferences; non-retail activities and support services within the centre. These will be packaged into specific GLA allocations and brand preference recommendations. In addition, the review of existing detailed planning interventions, traffic data as well as the modelling of the proposed retail centre's impact will be undertaken. This will provide for a detailed socio-economic impact assessment of the centre to support the market assessment.

This report deals with Phase 2 only – the Comprehensive Market Assessment Report

In this regard, the methodology that is followed in this report is as follows:

- Development and roll out of a consumer survey measuring detailed market trends;
- Analysis of the consumer survey findings at to understand the local buying preference and patterns;

- Detailed interviews with local business, education facilities as well as government offices in close proximity to the site;
- Development of retail market segmentation for the proposed development in terms of LSM and spend profile as per the survey;
- Review of the current supply side retail factors and current retail spend patterns in the catchment area;
- Review traffic data and interception rates (regional centre);
- Model the retail demand for the proposed centre utilising the inputs from the consumer surveys and interviews to provide GLA (Gross Leasable Area) recommendations per category;
- Identify potential tenant mix per category and services mix for the retail centre;
- Develop future demand scenarios for the centre;
- Model the Socio-Economic Impact of the centre on the local and regional economy and the affected community.

1.3: REPORT OUTLINE

The report follows the following structure:

Section 2 presents a summary of the key findings from the Phase 1 report;

Section 3 reviews the results of the consumer survey and interviews conducted, and provides implications for the proposed retail centre based on these results. This includes a retail market segmentation and the spend profile as per the survey results;

Section 4 undertakes a market demand model with recommendations for GLA per product category and the proposed tenant mix (goods and services), including future scenario development;

Section 5 provides a socio-economic impact assessment for the proposed centre to determine the impact on the local and regional economy;

Section 6 concludes the report by providing a brief summary of the findings of the report.

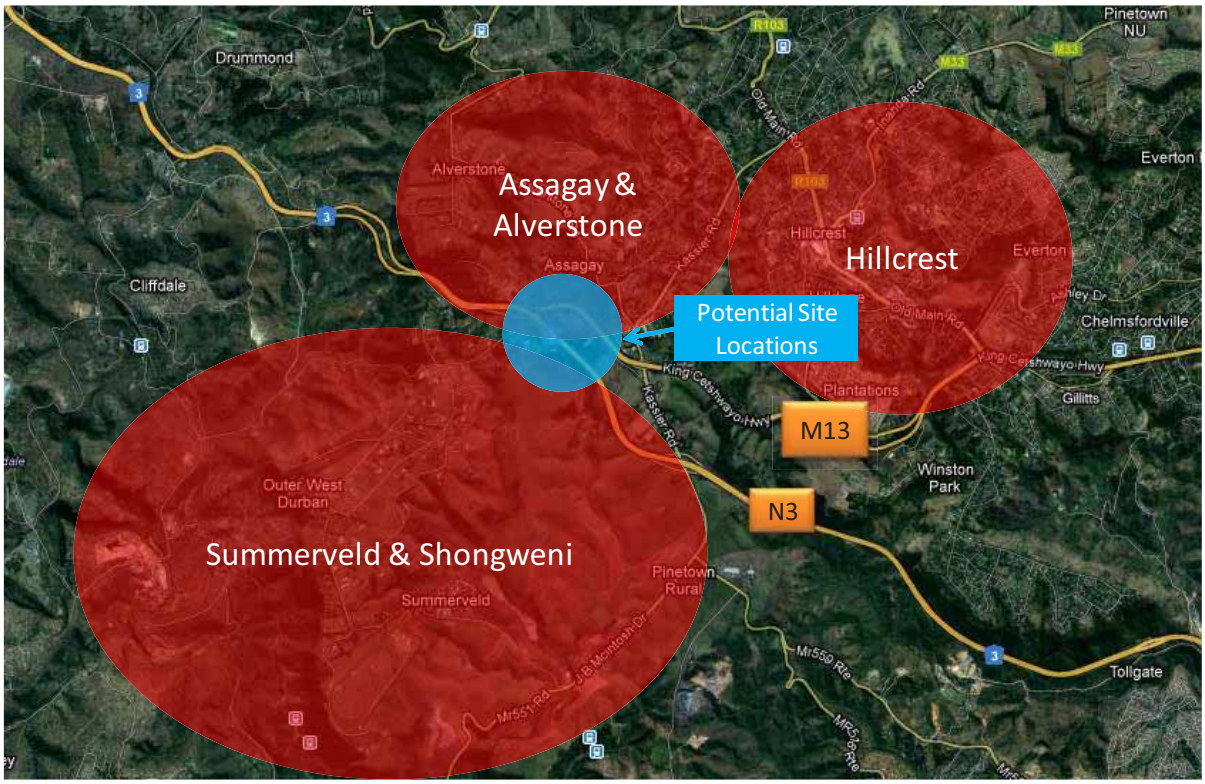
SECTION 2: SUMMARY OF THE INITIAL SCOPING REPORT

An initial scoping report was developed as Phase 1 of the study. The purpose of this phase was to undertake a basic desktop assessment of the proposed development in order to provide an understanding of the socio-economic characteristics and spending patterns of the surrounding population and to undertake a basic demand model.

2.1: LOCATION

The map below displays the potential location for the proposed retail development in the wider context, and displays the main access routes as well as directly surrounding residential areas of Hillcrest, Assagay, Alverstone, Shongweni, and Summerveld.

Map 1: The site in relation to main access routes and residential areas



Source: Urban-Econ adapted from Google Maps (2012)

The proposed location of the retail centre development is well positioned in terms of both accessibility and visibility, being position around the M13 and N3 interchange. The intersections between Kassier Road, the M13, and the N3 all experience high traffic volumes, and this ensures that there is sufficient passing traffic to support such a development over and above the large residential populations that reside within the potential market catchment area.

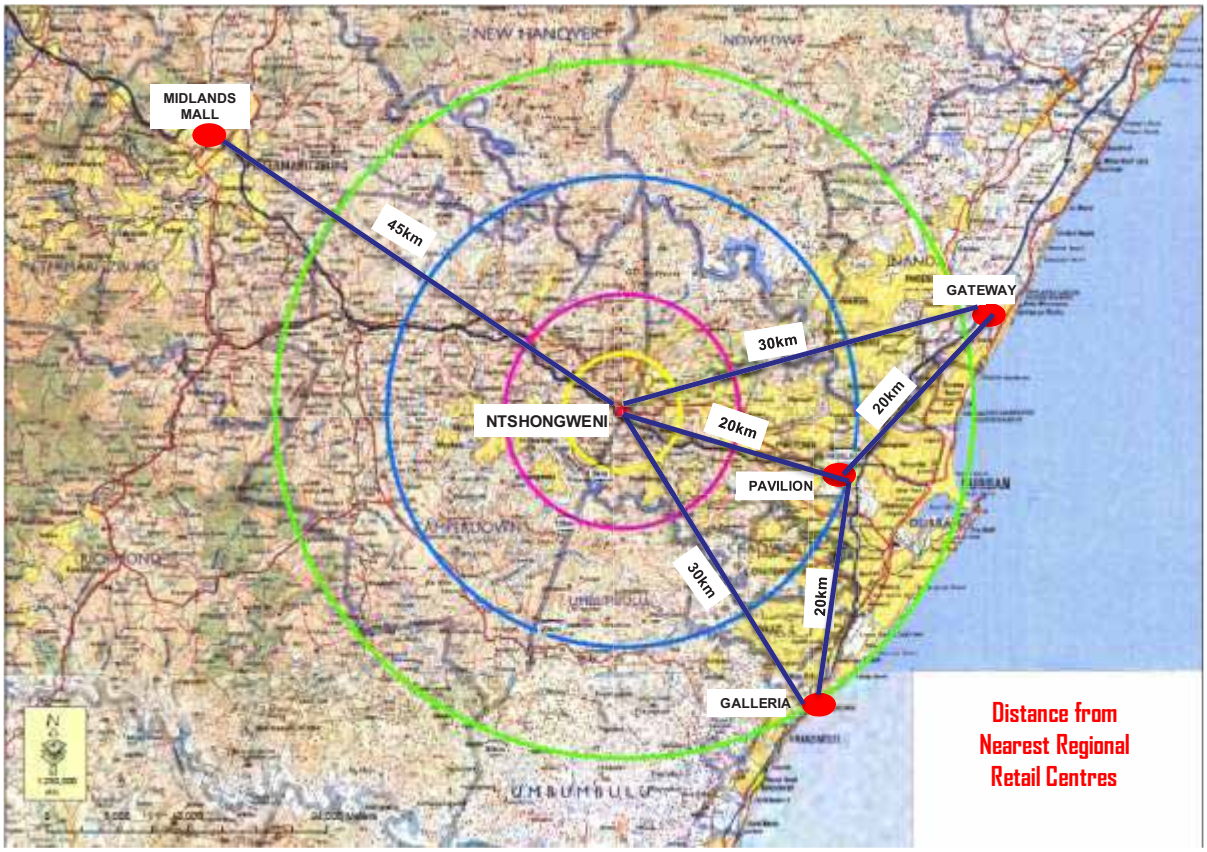
In terms of regional accessibility, the proposed location of the development is around the N3/M13 interchange. This area is highly accessible from both the N3 and M13, providing good access to the various residential nodes situated around this interchange. Kassier Road joins the N3 to the M13, thereby linking Hillcrest and other northern suburbs to the N3 in the south and the greater

Shongweni area. These roads experience high traffic volumes, and this provides an advantage to the proposed development.

2.2: REGIONAL CONTEXT

The map below provides an indication of the distance between the proposed development's location and existing regional shopping centres.

Map 2: Shongweni in the Regional Context



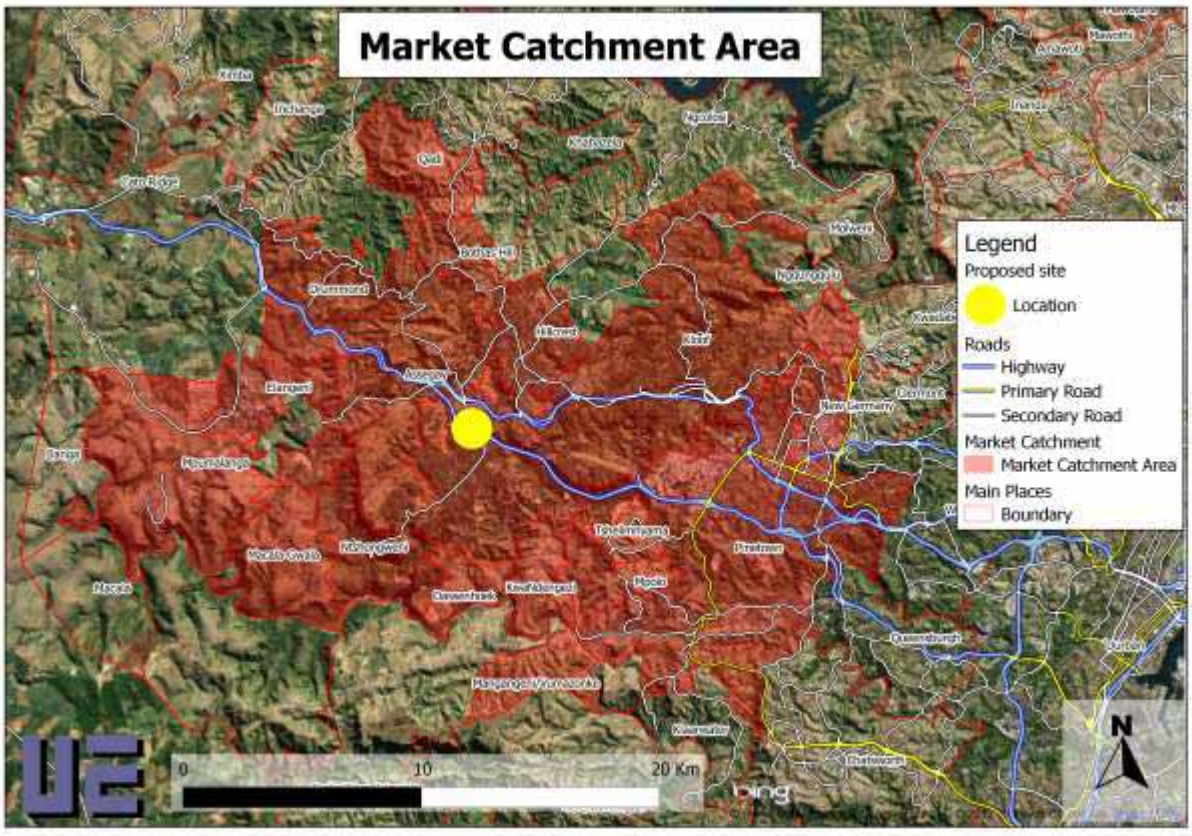
Source: Tongaat Hulett Developments (2012)

Shongweni lies closest to the Pavilion Shopping Centre (20km away), and is equidistant from both the Galleria and Gateway (30km) to the north and south of the Durban city centre. Liberty Midlands Malls is approximately 45km north-west of Shongweni. According to standard retail classifications and planning guidelines, a small regional or regional shopping centre has an average radius of between 5 – 8 kilometres, or a travelling distance of between 10 – 16 minutes. In this regard, the regional positioning of the proposed Shongweni retail centre is sufficiently distanced from existing regional centres within the wider eThekwini and KwaZulu-Natal region. Additionally, the areas surrounding the proposed location are largely un-serviced and contain very little retail offerings.

2.3: MARKET DELINEATION

A market delineation was undertaken in order to identify the areas that would typically fall within the market catchment area of such a development based on a 10km radius common to regional centres.

Map 3: Main-places impacting on the market delineation



Source: Urban-Econ based on Stats SA Main-Place Demarcations and Bing Satellite Imagery (2012)

The areas of Hillcrest, Assagay, Alverstone and Summerveld are included within a 5km radius. Most of these communities consist of residential and equestrian estates, farms, small-holdings, and single-stand properties. Within Alverstone, Shongweni, Summersveld and Assagay, the majority of properties are smallholdings or farms used either for agricultural purposes or by horse-owners. Within Hillcrest, properties are generally single-stand or estate properties. Although the characteristics of these communities differ, they are generally home to middle-high income earning households who fall within the Living Standards Measure (LSM) 6 – 10.

Within a 10km radius, this is extended to include Mpumalanga, Hillcrest, Shongweni rural, Botha's Hill, Drummond, Pinetown, New Germany, Kloof, Hammersdale, and the rural settlements to the south of the N3, namely KwaNdengezi, Dassenhoek, Magangeni, Elangeni, Tshelimnyama, and Mpolo, which are townships largely consisting of households in the lower income bracket.

2.4: MARKET SUPPLY ANALYSIS

In terms of retail supply, many of the main-places that fall within the potential market catchment area are largely un-serviced. The more rurally located areas such as Mpolo, KwaNdengezi, Ntshongweni and Elangeni contain very little or even no formal retail activity. Kloof, Bothas Hill, and Assagay are largely serviced by the Hillcrest retail corridor which contains a number of larger retail centres, while Pinetown is fairly well serviced with a few retail centres.

Table 1: Existing retail facilities

Map Ref	Description	Some retail facilities offered
1	Assagay Retail Node	Engen Convenience Store, The Mushroom Shop, AC Smith Equestrian Supplies, Simple Spaces, Garden Decor Zone (Nursery), SA Sandstone & Slate, Equerry Hay Barn, Mink & Manure, and Farmers Market
2	Hillcrest Retail Corridor (3 distinct retail nodes)	Christians Village, Hillcrest Corner, The Colony, Richdens Village Centre, Service Station
		Hillgate Shopping Centre, Hillcrest Centre
		Hillcrest Heritage Market, Mr Price Sport, 8 on Old Main, Lillies Quarter, Bailey Centre
3	Various Retail Stores	Sherwell Cupboard Systems, BEDS, Aluka Rugs, eDrive, The Plastic Shop
4	Hammersdale/ Mpumalanga Retail	Boxer Cash and Carry Store, Retail Market, Hammersdale Hyper, Sipha Mandla, Magaba Supermarket, Dunbar Centre
5	Pinetown Retail	Various retail stores along the Old Main Road, Pinecrest Centre, Pinewalk Centre
6	Kloof retail	Various retail stores along the Old Main Road and M13 such as Kloof Village Mall and Field Shopping Centre

Source: Urban-Econ (2012)

Although there are a large number of retail facilities within the Hillcrest and Pinetown corridors, very little retail activity exists south of the N3 within a 5km radius of the proposed location besides in Hammerdale/Mpumalanga. Although many residents from un-serviced out-lying areas do their shopping within the Hillcrest and Pinetown retail corridor, there is still scope for retail centre to be located at the proposed location.

2.5: LOCAL PLANNING PRIORITIES

The City has developed and adopted a Spatial Development Plan (SDP) Outer-West Region and Local Area Plan for the Shongweni area. Within both the plans, the Shongweni node has been identieid as a future mixed-use node. This area allocation dedicated to Future Mixed Use includes the plans for retail, residential, and office development. Thus, the area where the purposed site lies coordinates directly with the City's plans for a Future Mixed Use area. Additionally, the other components of a mixed use development outside of retail development, residential and office developments will draw in additional consumer demand to support a retail centre.

Within the LAP specifically, the entire central region of Shongweni (around the M13 and N3 interchange) is earmarked as the town centre core and frame. This comprises a regional centre situated between these two major transport roads. In addition, the LAP recognises that this regional centre "would represent the highest order of centre within the study area and has the potential to serve as a mixed use Town Centre catering for the broader sub-region". This substantiates the future need for as mixed-use centre anchored by retail, and supported by other land-uses.

The spine running from the site, north towards the Hillcrest Old Main Road in a corridor along Kassier Road has been identified as a future tourism/recreation corridor. This needs to be considered when deciding on the type of retail to be installed within the proposed development site. Increased traffic into the site catchment area due to tourism/recreation development will add to the potential volume of retail demand. If appropriate retail is constructed, a retail centre within the

proposed site has great potential to draw in potential consumers in transit to or from their tourist or recreational activities.

Additionally, the belt runs from the M13 north towards the Hillcrest Old Main Road, and south of the N3 highway have been identified as future residential locations. This will too have an impact on the proposed development. With two large areas directly south and directly north of the site area dedicated by the City to residential development, there will be a large increase in demand for retail products once the residential area has been constructed. This is particularly important in the southern area for planned residential development, because no substantial retail exists here.

2.6: EFFECTIVE DEMAND MODEL

The demand model produces an output in the form of an effective demand figure, or, the potential size of retail in that particular area that can be supported by the surrounding populations (in terms of metres squared). This determines whether the retail development is in fact viable, based on various assumptions. After running a desktop demand model based on current desktop information, it is clear that there is sufficient effective demand currently (approximately 60,542m^2) to support retail at the proposed site.

This however is based on the assumption that a percentage of the surrounding populations are in fact willing to change their shopping patterns to shop within the Shongweni Node. This also assumes that there are sufficient road linkages developed to support an increase in traffic and to create linkages with areas such as Dassenhoek that currently have limited access to the area. In addition, it assumes that there are public transport facilities at the site which will allow those travelling by taxi or bus to easily access the site, as well as pedestrian bridges linking the surround communities.

This model therefore needs to be scrutinised further to ensure that that the assumptions are in fact accurate enough to produce a demand figure that is reliable. This report will utilise the surveys that were undertaken to determine shopper preference and patterns in order to make adjustments to the demand model with the objective of producing a more accurate demand figure.

SECTION 3: FINDINGS OF THE STAKEHOLDER PARTICIPATION PROCESS

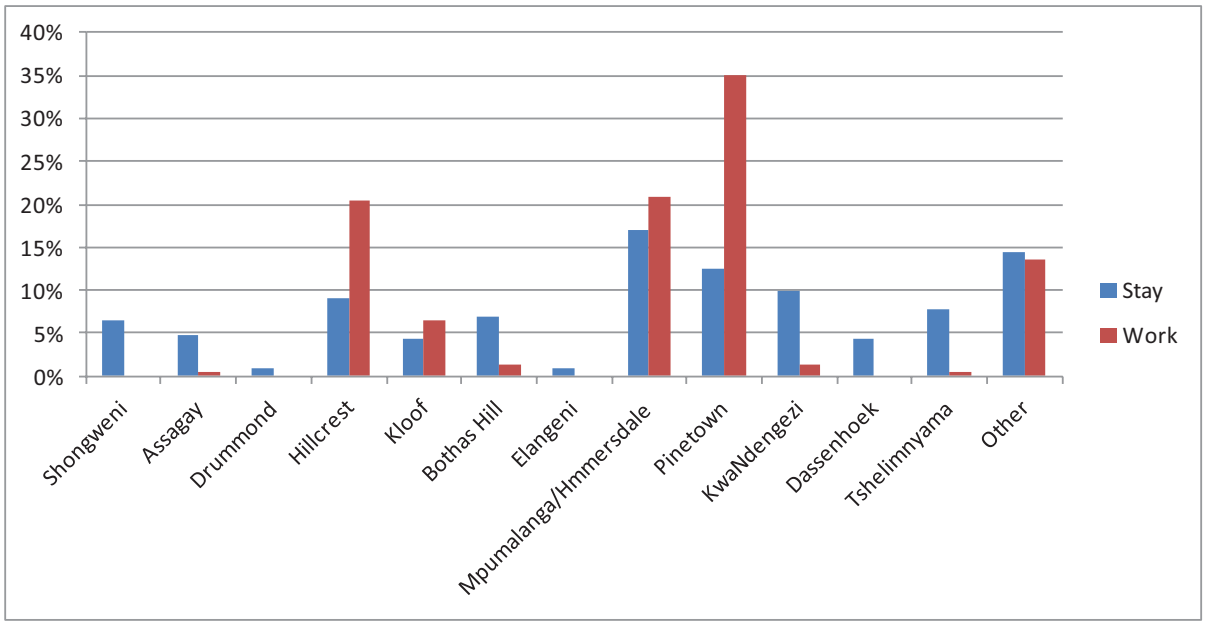
Section 3 reviews the results of the consumer survey and interviews conducted, and provides implications for the proposed retail centre based on these results. This includes a retail market segmentation and the spend profile as per the survey results;

3.1: CONSUMER SURVEY

Consumer surveys were undertaken in Hillcrest, Pinetown and Hammersdale as these are the three most significant retail nodes that people within the catchment area travel to for shopping purposes. A total of 230 questionnaires were undertaken, with 84 being done in Hillcrest, 100 in Pinetown, and 46 in Hammersdale. This section provides and assessment of the key findings of the surveys. Questionnaires were undertaken in taxi ranks, parking lots of retail centres, as well is within main retail corridors in the areas identified above. The objective was to receive a variety of inputs from people within varying income categories within the retail nodes for various reasons. This was expected to provide a broad understanding of the varying demographics that fall within the market catchment areas identified in the initial scoping report.

3.1.1: ORIENTATION

The graph below displays the place of residence and place of work of the survey population.



17% of the sampled population lived in Mpumalanga/Hammersdale, while 13% were from Pinetown, 10% from KwaNdengezi, 9% from Hillcrest, and 7% from Shongweni. 14% are from other areas which include Claremont, Durban, Ntshanga, and KwaNyuswa. In terms of population distribution, the survey has managed to sufficiently capture the various market catchment areas that are expected to be attracted to the proposed regional centre.

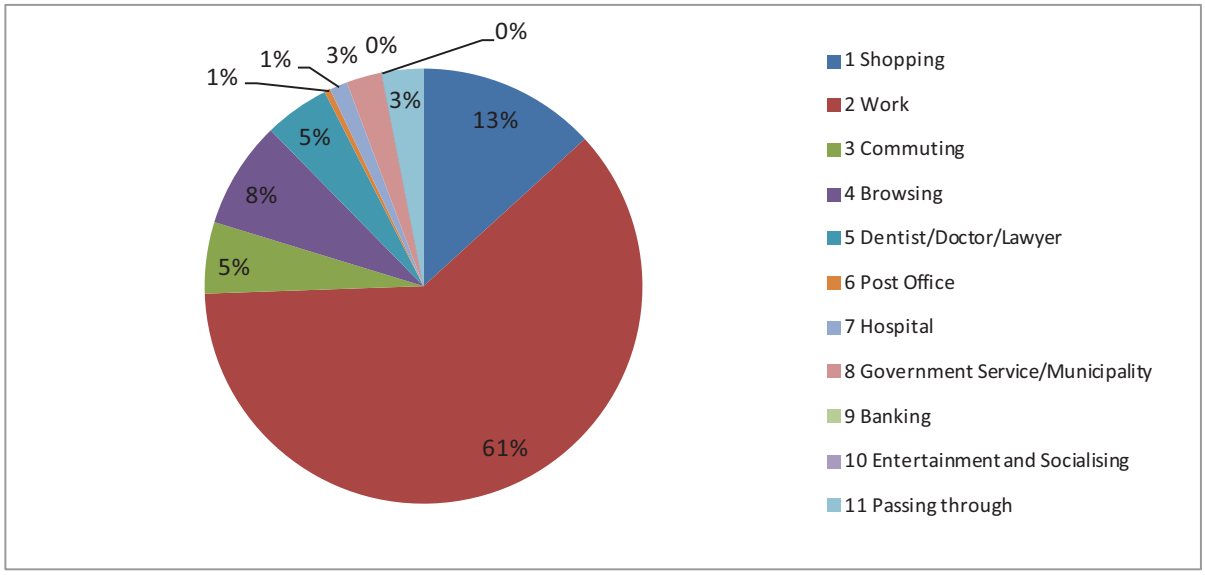
In terms of place of work, most people questioned work in Pinetown (35%), while 21% worked in Hammersdale and Hillcrest respectively, 7% in Kloof, and 14% on other areas (largely in Durban, but also a number were unemployed). No one questioned worked in Shongweni.

The graph below displays the age breakdown of the sample population.

Age	Male	Female
18 – 24	3.5%	4.3%
25-55	36.1%	41.7%
56- 64	5.2%	8.7%
65+	0.0%	0.4%

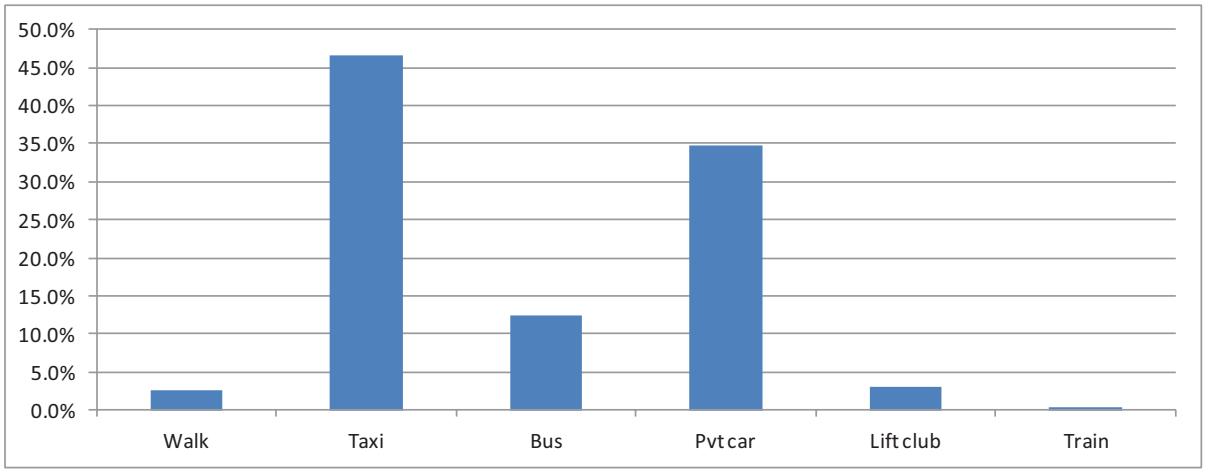
The clear majority of the sample population (almost 78%) fall within the 25 – 55 year age group, with 41.7% of these persons being female. About 14% are within the 56 – 64 year age group, while almost 8% were between the ages of 18 – 24 years old.

The sample population was asked the reasons for being within the area in which the survey was being undertaken. The graph below displays the key reasons for being in the survey area, and a breakdown of this per survey area.



Interestingly enough, although a large number of questionnaires were undertaken at retail facilities, over 60% of respondents were actually in the area for work purposes. Only 13% of respondents were in the survey area for shopping purposes. 5% of people were on the survey area due to commuting between areas, while 8% were browsing, and another 5% were visiting dentists/doctors/lawyers.

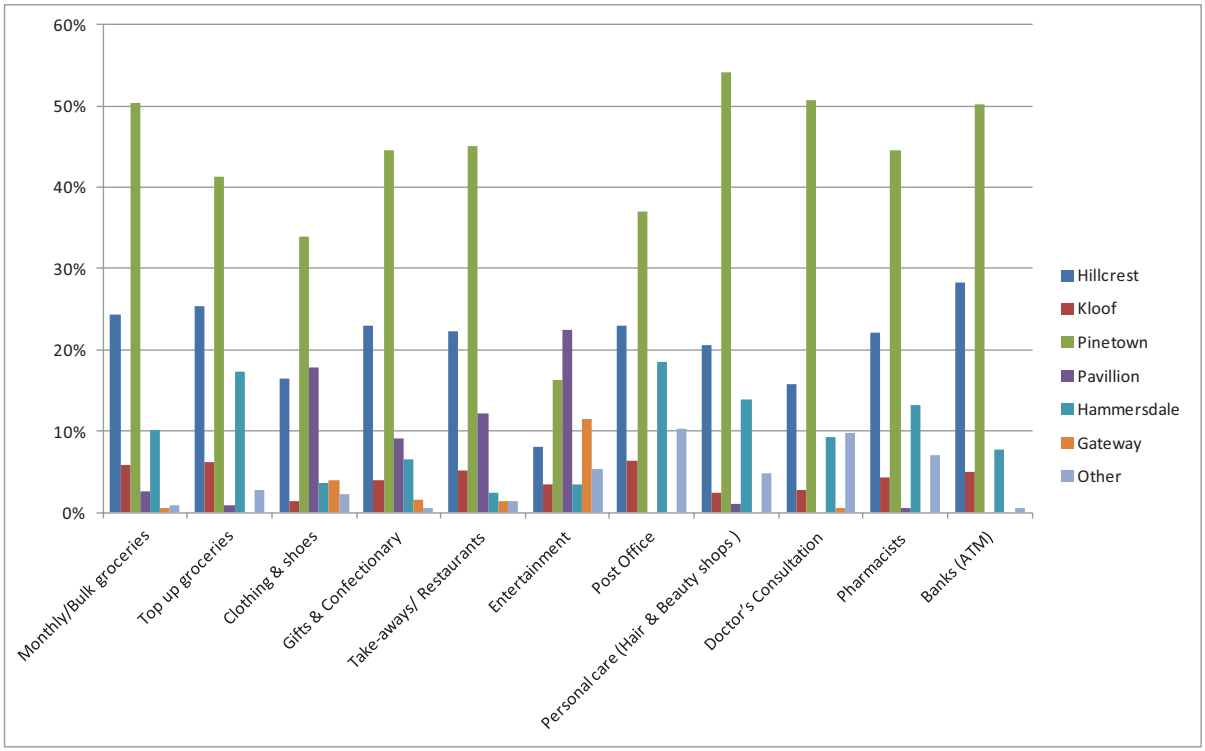
Respondents were then asked what mode of transport they used to arrive at the survey area. The graph below displays the results. 46.7% of respondents used a taxi to arrive at the survey location, while almost 35% used a private vehicle to access the survey location. 12.3% used the bus to arrive at the survey location. This is a very favourable split given the varying population dynamics that exist between middle-high income areas that directly surround Shongweni such as Assagay and Hillcrest, and more low-middle income areas with linkages to Shongweni such as KwaNdengezi and Drummond. 2.6% of the persons walked to the survey area while 3.1% used a lift club.



3.1.2: SHOPPING PATTERNS

Questions were asked on the current shopping patterns of the survey population in order to provide insight into where shopping is currently done, the preferred products and value of brands, and the time and frequency of the shopping outings.

Respondents were firstly asked where they do various types of shopping, ranging from monthly/bulk groceries to take-aways, to doctor's consultations. The results are displayed in the graph below.



From the graph it is clear that a large amount of shopping in all categories is undertaken in Pinetown. This consists of people who reside not only in Pinetown, but also Shongweni, Botha's Hill, Drummond, KwaNdengezi, Dassenhoek, Elangeni and even Mpumalanga. This indicates that a large number of people are travelling from areas that pass through or are directly linked to Shongweni to access retail in Shongweni, which gives an initial indication that such a facility would be favourable.

Half of respondents did their monthly bulk shopping in Pinetown, while a quarter did their monthly bulk shopping in Hillcrest. This does indicate that a large portion of the catchment population in the outer-west area use the Pinetown and Hillcrest nodes to do their monthly or bulk shopping. 10% use Hammersdale (although these people were all from Hammersdale), while only 5% said they use the Durban CBD and almost 1% said Midlands Mall.

With regard to top-up groceries, 41% of the respondents to these in Pinetown, while 25% do these in Hillcrest. 17% do top-up groceries in Hammersdale, while 6% do these in Kloof and the Durban CBD respectively. For clothing and shoes, again the largest category falls within Pinetown (34%) although the rest are more widely distributed between other areas. 21% of respondents travel to the Durban CDB, while 18% visit the Pavilion and 17% Hillcrest. 4% stated Gateway, while 2% stated other and indicated the Midlands Mall in Pietermaritzburg. This shows that regional centres are more in demand when it comes to items such as clothing rather than grocery shopping, which is preferred in locations where people work or live.

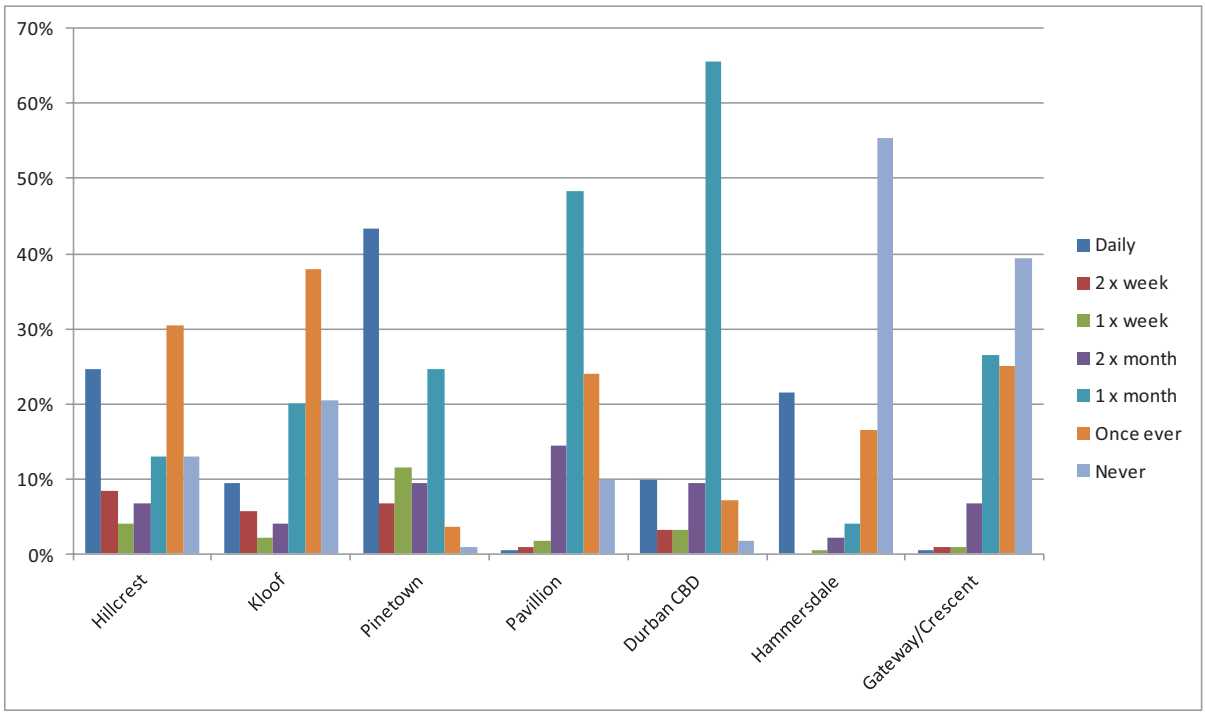
45% of respondents use Pinetown for gift and confectionary shopping, while 23% do this in Hillcrest, 11% in Durban, and 9% at Pavilion. With regards to take-aways, the pattern is similar with 45% visiting Pinetown, 22% visiting Hillcrest, and 12% visiting the Pavilion and the Durban CBD respectively. In terms of entertainment, the pattern changes significantly with most people visiting the Durban CBD, (30%) for entertainment, 22% to the Pavilion, 16% to Pinetown. 11.5% said Gateway and other places respectively, including the Wild Cost, Midlands Mall, or not undertaking any entertainment activities.

In terms of post office usage, 37% said they would visit Pinetown, 23% would visit Hillcrest, and 18% used the Hammersdale Post Office. For personal care items, 54% said they would visit Pinetown, 21% said Hillcrest, 14% said Hammersdale, and 9% to the Durban CBD. For doctors consultations, 51% said they would visit doctors in Pinetown, 16% said Hillcrest, 11% in the Durban CBD and 9% in Hammersdale. 10% said they visited doctors in Botha's Hill, Pietermaritzburg or Westville. In terms of pharmacists, just over 44% of respondents used Pinetown; about 22% visited Hillcrest, 13% went to Hammersdale, and almost 9% went to the Durban CBD. About 7% said 'other' and visited Pietermaritzburg and Cato Ridge. In terms of banks, respondents largely visited Pinetown (50%), 28% visited Hillcrest, 8% visited to the Durban CBD and Hammersdale respectively, and 5% visited Kloof.

In terms of an average shopping time, respondents noted that they spent an average of 187 minutes shopping, which equates to just over three hours. Respondents were then asked how often they visit the following areas for shopping purposes. The results are displayed in the graph below.

Hillcrest is visited daily by 25% of the sample population, twice a week by 8% of the sample population and once a month by 13% of the sample population. About 30% said they have only ever gone there once for shopping purposes. Within Kloof, shopping is less frequent amongst the sample population, with on 9% stating they visit Kloof daily, while 20% say they visit once a month, 38% once ever and 21% say they never shop there. Within Pinetown, shopping patterns are more frequent, with 43% stating they shop there daily, 12% noting they shop there once a week, and 25% shopping there once a month.

With regards to the Pavilion, 14% said they shop there twice a month, 48% said once a month, 24% said they shopped there only once ever, and 10% said they never shopped there. 10% of respondents said they shopped in the Durban CDB on a daily basis, while 66% said they only shop there once a month. 21% said they shopped in Hammersdale daily, while 55% said they never shopped there. 26% of respondents said they only shopped at Gateway once a month, 25% said they shipped at Gateway only once ever, and 39% said they never shopped there before.



The sample population was then asked what brands they prefer in terms of the purpose categories, and how much they spend on each of the brands per month. The table below displays the breakdown in terms of preferred brands and the average monthly expenditure on each category.

Category	Preferred Brands	Average Monthly Expenditure
Monthly/Bulk groceries	Pick 'n Pay (22%), Checkers (18%), Boxer (14%), Spar (12%), Cambridge (9%), Other (Shoprite, Woolworths, Checkout)	R 1 269
Top up groceries	Shoprite (39%), Boxer (18%), Pick 'n pay (18%), Checkers (14%), Spar (13%)	R 305
Clothing & shoes	Truworths (13%), Edgars (12%), Mr Price (11%), Jet (7%), China shops (4%), Other (Identify, Foschini, Legit, Urban)	R 535
Gifts & Confectionary	CNA (22%), Woolworths (11%), Game (11%), @ Home (10%), Mr Price (10%), Other (the Hub, Shoprite)	R 181
Take-aways/ Restaurants	KFC (18%), Nando's (18%), Spur (17%), McDonlad's (10%), Others (Steers, Wimpy, Hungry Lion, Debonairs, Mug and Bean	R 185

Entertainment	Cinema (24%), Casino (8%), Gateway (5%), Other (Beach, Bridge City, Art Galleries, Ice Rink, uShaka, Football)	R 344
Bottle store	Liberty Liquors (39%), Tops (25%), Shoprite (13%), Cambridge (12%), Other (local stores)	R 395
Personal care (Hair & Beauty shops etc.)	Clicks (24%), Discom (11%), Manhattans (7%), Other (Checky Hair, Shoprite, OK, Glen salon, Local salons, Just on, Home)	R 191
Doctor's Consultation	GP's, Local clinics, Dermatologists, etc	R 361
Pharmacists	Dischem (27%), Link (20%), Sparksport (18%), Clicks(10%), other (Alpha pharmacy, Health 4 All)	R 121
Butchery	Bluff Meats (30%), Chester (14%), Jwayelani & Cambridge (11%), Royal and Boxer (11%), other (Shoprite, Spar, Dirk's)	R 459
Total Average Monthly Expenditure		**R 4 345**

The preferred mostly/bulk grocery brand is Pick 'n Pay with Checkers close behind. On average, households spend close to R1300 per month on bulk groceries. In terms of top-up groceries, Shoprite (39%) is a clear leader with Boxer and Pick 'n Pay following behind with 18% each. Households spend on average R305 per month on top-up shopping.

With regards to clothing and shoes, the preferred brands are Truworths, Edgars and Mr Price with an average of R535 being spent by households on clothing and shoes per month. Households spend on average R180 per month on gifts and confectionary, with CNA leading this category, followed by Woolworths and Game, @ Home and Mr Price. Households also spend an average of R185 per month on fast-food and restaurants, with KFC, Nando's and Spur being the leading fast-food outlets.

For entertainment, households note that cinemas are the primary activity, followed by the casino, Gateway centre, and other activities such as the beach. Households spend an average of R344 per month on entertainment. The average monthly household expenditure on alcohol is close to R400, with Liberty Liquors leading the brand preference, followed by Tops and then Shoprite.

In terms of personal care, respondents prefer Clicks and Discom, and spend on average R191 per month on personal care items. Households spend R360 on average per month on doctor's consultations, and primarily use GPs and local clinics. With regards to pharmacies, respondents prefer Dischem, Links and Sparksport Pharmacies, and spend R120 on average per month. Finally with regards to butcheries, respondents note that they spend on average R460 per month at butcheries. The preferred brand is Bluff Meat Supply, followed by Chester, Jwalelani & Cambridge, as well as Royal and Boxer.

The total average household expenditure of the sample population is therefore R4345. The breakdown of this expenditure into specific purchase category is displayed in the table below:

Category	Percentage Contribution to retail expenditure
Monthly/Bulk groceries	29%
Top up groceries	7%
Clothing & shoes	12%

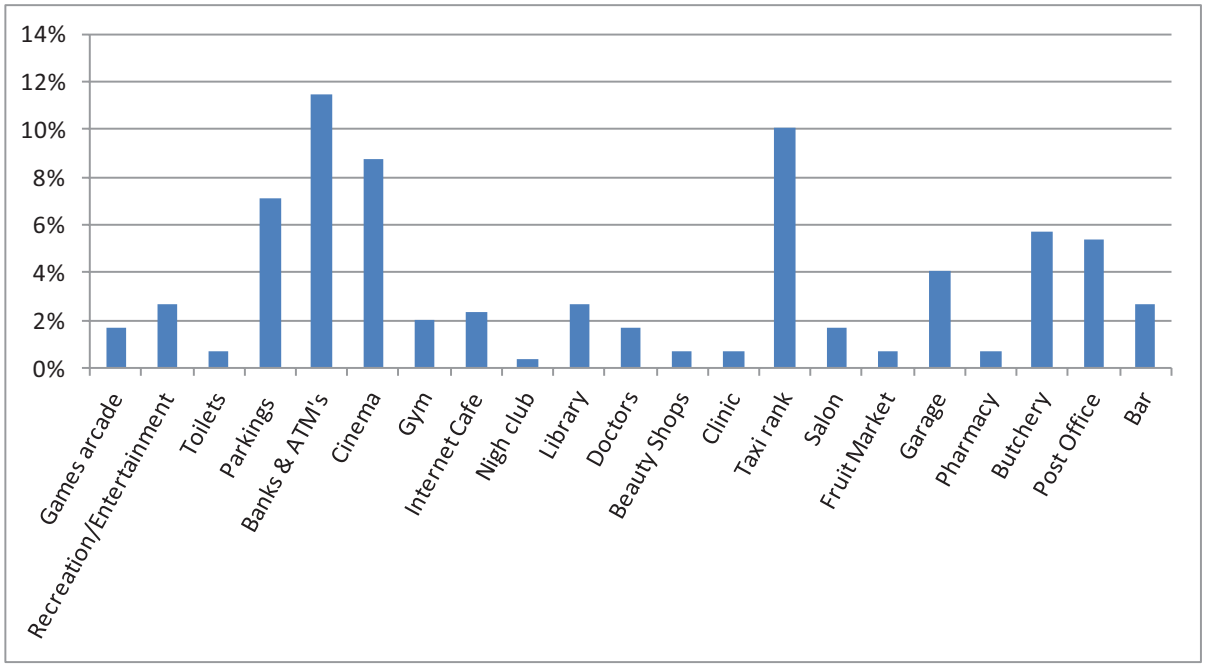
Gifts & Confectionary	4%
Take-aways/ Restaurants	4%
Entertainment	8%
Bottle store	9%
Personal care (Hair & Beauty shops etc.)	4%
Doctor's Consultation	8%
Pharmacists	3%
Butchery	11%

In terms of a category breakdown, the largest purchase category was monthly/bulk groceries, followed by clothing & shoes, and butcheries. Bottle stores contributed 9%, with doctors consultations at 8% and top-up groceries at 7%. This provides an initial indication of how the tenant mix can be structured.

3.1.3: SHOPPER PERCEPTIONS

This portion of the survey seeks to determine the perceptions of shoppers towards the proposed development and motivating factors, its facilities, and expected frequency of visits. Respondents were asked if they feel that there is a need for a new shopping centre in Shongweni. 81% of respondents felt that the proposed development was required, while the other 19% felt that it was unnecessary.

The types of facilities that respondents felt they would they would to see at the proposed development are displayed below.



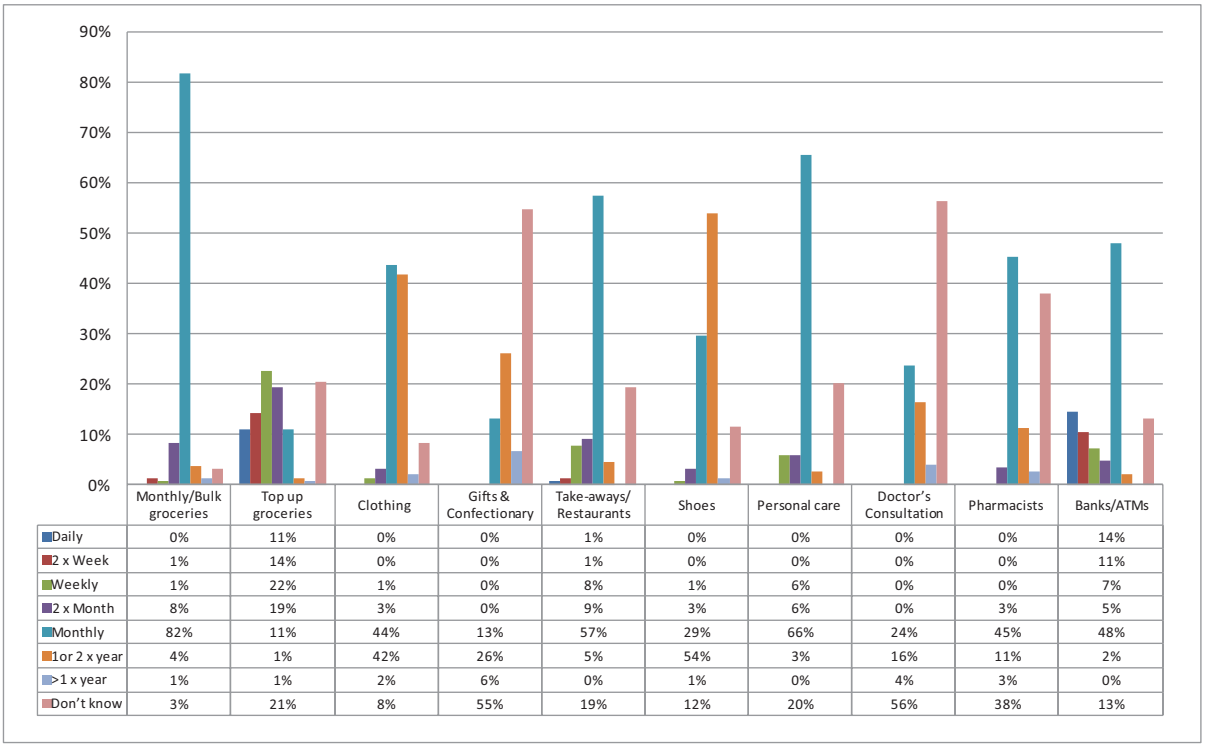
The facilities or activities that are most requested by potential centre visitors are banks/ATMs, a Taxi Rank, a cinema, parking, a butchery, post office, and garage. Following this was recreational/entertainment facilities and a games arcade (which if added with cinemas is the most highly demanded focus), as well as a library, bar, internet cafe and gym. Other facilities include doctor's rooms, salon/s, a pharmacy, beauty shops, a clinic, toilets, a fruit market and night club.

Respondents were then asked if they would shop at the new centre should it be developed. 71% said they would shop there, while the other 29% said that they would not. The reasons for the 'yes' and 'no' responses are displayed below.

If yes, why?		If no, why?	
Close	75%	Too far	39%
Convenient	8%	Inconvenient	8%
Insufficient Centres	13%	Existing centres are sufficient	39%
Next to transport	2%	Not convenient for transport	6%
Other	3%	Other	8%

Most respondents (75%) that said they would shop at the proposed centre stated the reason as being 'close'. Only 13% believe there are insufficient centre. At the same time, 39% of those who said they would not shop that the proposed centre said so due to there being sufficient existing centres, with the same amount of people stating that it's too far.

Respondents were then asked how often they would us the proposed centre to access various types of retail categories. The table below displays the results.



	Monthly/Bulk groceries	Top up groceries	Clothing	Gifts & Confectionary	Take-aways/ Restaurants	Shoes	Personal care	Doctor's Consultation	Pharmacists	Banks/ATMs
Daily	0%	11%	0%	0%	1%	0%	0%	0%	0%	14%
2 x Week	1%	14%	0%	0%	1%	0%	0%	0%	0%	11%
Weekly	1%	22%	1%	0%	8%	1%	6%	0%	0%	7%
2 x Month	8%	19%	3%	0%	9%	3%	6%	0%	3%	5%
Monthly	82%	11%	44%	13%	57%	29%	66%	24%	45%	48%
1or 2 x year	4%	1%	42%	26%	5%	54%	3%	16%	11%	2%
>1 x year	1%	1%	2%	6%	0%	1%	0%	4%	3%	0%
Don't know	3%	21%	8%	55%	19%	12%	20%	56%	38%	13%

Not surprising, very few people said they would visit the centre on a daily basis for any products or services besides top-up groceries (11%) and banks/ATMs (14%), as these products do not require daily visits. 82% of respondents would visit the centre on a monthly basis for bulk groceries.

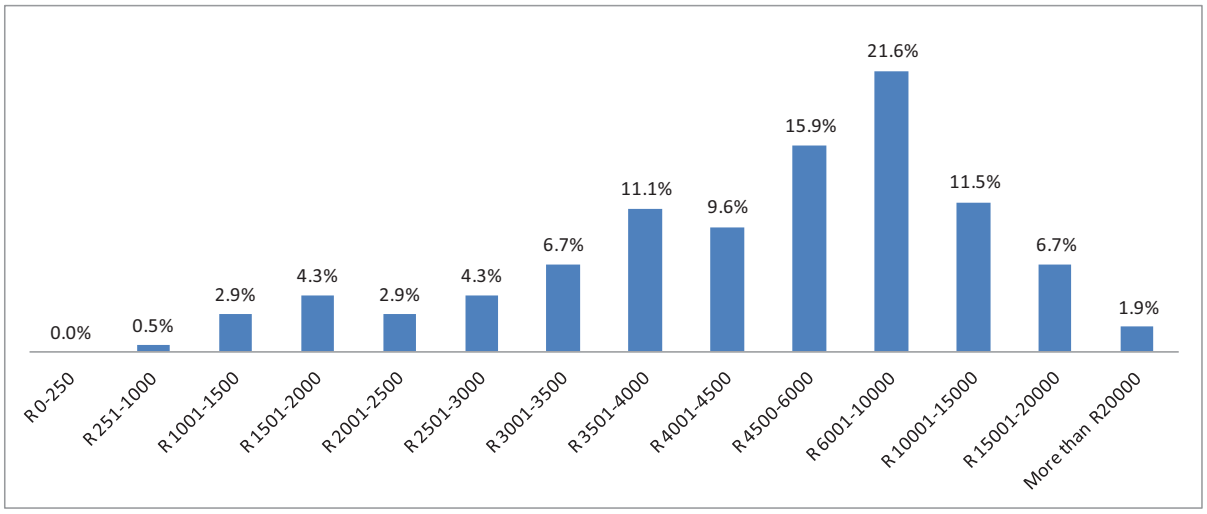
14% of respondents said they would visit the proposed centre twice a week for top-up groceries, 22% said weekly, 19% twice a month, and 11% said monthly. Therefore, almost 50% of respondents would visit the centre at least once a week. In terms of clothing, 44% of respondents would shop at the proposed centre monthly, while another 42% said they would shop there once or twice a year for clothing.

The majority (55%) of respondents said they don't know if they would ship at the proposed centre of gifts and confectionary, with just over a quarter saying they would shop there once or twice a year. Over 65% of respondents said they would use the centre to buy fast-food or use restaurants more than once a month, while 19% said they do not know how often they would visit the centre. In terms of shoes, almost 30% said they would shop at the proposed centre monthly for shoes, while 54% said they would visit once or twice a year for shoes.

66% of respondents said they would visit the proposed centre on a monthly basis for personal care items, while 56% said they don't know if they would visit the centre for doctor's consultations. However, around 40% said they would visit documents at the centre more than once a year, including 24% who said monthly. 45% of respondents would visit the centre on a monthly basis for a pharmacy while another 11% said once or twice a year. 14% of respondents would visit the centre daily for banks, 11% twice a week, and 7% weekly. Therefore around a third of respondents would visits the centre at least once a week for banking.

3.1.4: MONTHLY HOUSEHOLD INCOME

Finally, respondents were asked what their total monthly household income was in order to evaluate the expected spending power of the catchment population. The graph below displays the findings.



Over 55% of respondents have an average household income over R4500 per month, translating into an average annual household income of R54,000 per annum. Less than 20% of the sample population have an average monthly household income of R10,000 or more. This indicates that the sample population cover the lower to middle income population.

Based in the distribution, a total average monthly household income was calculated to be R6909, which translates to into an total average annual household income of R82,911. This figure will be sued to assist in refining the demand model in the following sections.

3.2: INTERVIEWS AND DISCUSSIONS

A number is interviews and discussions were undertaken with key stakeholders in the area, including commercial and residential estate agents and leasing agents from various retail centres in the surrounding areas such as Pinetown, Hillcrest, and Westville. This section provides a summary of the key findings from these discussions.

- There is demand for affordable housing as it is difficult to enter the property market in the outer-west with the current residential offerings, particularly modern affordable housing and middle-income gated communities within the R 500 000- R 600 000 range;
- There are vacancies within the current residential letting stock;
- There are vacancies in the retail property market, and there is very little demand for additional retail space due to the current economic climate;
- There is an over-supply of office-park space, with demand focused around the band between Hillcrest and Kloof;
- The demand for office space depends on an area and conditions, and whether it is an upmarket, secure, and safe area;
- There is demand for industrial space within the 5000 – 15,000 square metre range;

Perception about the new centre and urban development in Shongweni

- Most interviewees felt that the proposed retail centre will not work currently due to the lack of residential densities that exist around the proposed Shongweni urban development area. However, many feel that in a few years when a sufficient number of new residential developments have occurred in that area, that new demand will be generated;
- Other interviewees feel that the centre will not be sustainable as most of the major retailers area already fully represented in the outer-west area, mainly in Hillcrest;
- It was mentioned that double storey, 2-bedroom type properties must be considered as part of the proposed Shongweni Urban Centre;
- Certain interviewees feel that a new retail centre will work if supported by a proper taxi rank and linked to existing transport routes;
- Other developments that should be considered is a petrol station and A-grade office park component.
- There was a perception that the new centre will have an impact on existing retailers initially, but after a period of time things will settle down;
- There seems to be interest in a new retail centre as far as community is concerned. A major concern relates to traffic jams and congestion.

- Entertainment facilities are lacking in the entire outer-west region, including a cinema, parks and recreational activities for the youth, and these elements should be considered and incorporated into the proposed development;
- The proposed new development must look to integrate sustainably into the existing natural environment, and include open spaces and parks;
- There is a need to include other facilities such as old age homes.

SECTION 4: MARKET DEMAND MODEL

Section 4 undertakes a revised market demand model with recommendations for GLA per product category and the proposed tenant mix (goods and services), including future scenario development;

4.1: GROSS LETTABLE AREA (GLA)

As mentioned in the summary of the situational analysis report in Section 2, an initial demand model was undertaken based on desktop information and base assumptions. This produced an effective demand figure of 60,542m^2 for retail in the Shongweni node. However, this did not take into account the findings of the survey, which provided insight into the shopping patterns of the surround catchment populations. This section provides a refined demand model based in some input from the survey findings.

In order to refine the demand model, the perception towards the proposed shopping centre was compared with the existing 'potential catchment' in order to revise the catchment based on these perceptions. Within certain areas, the potential catchment was raised as a large majority if questionnaire respondents stated they would visit the centre, while in other cases the catchment was reduced due to a lack of willingness to change shopping patterns.

Although an average retail expenditure figure was calculated as 63% of total expenditure from the survey findings, the percentage of expenditure used for retail purposes was left unchanged as this is a historic trend and more accurately reflects the total amount of expenditure on retail items per catchment area. Due to the fact that this retail expenditure figure was higher than the historic retail expenditure trend for all areas, it is assumed that the retail expenditure provided by households was ambitious and perhaps less is actually spent on the various retail items than provided. Regardless, this retail expenditure figure will provide an indication of the breakdown in retail expenditure for the following section.

The tables on the following three pages provide an updated retail demand model for the Shongweni area for 2012, 2015, 2020 and 2025. Expenditure was escalated at the historic growth rate from 2000 – 2011, while the trading density was escalated at an average inflation rate of 6%.

The findings of the updated demand model note that:

- There is effective demand for approximately 49,242m^2 of retail in Shongweni in 2012;
- There is effective demand for approximately 57,450m^2 of retail in Shongweni in 2015;
- There is effective demand for approximately 78,049m^2 of retail in Shongweni in 2020;
- There is effective demand for approximately 113,429m^2 of retail in Shongweni in 2025.

This suggests that there is currently excess demand for retail within the node, and based on historic growth trends, this demand continues to grow to over 100,000m^2 in 13 years time.

Table 2: Effective Demand (2012)

Main-Place	Total H/H Disposable Income 2012	Expenditure % of Income	Total expenditure by households	Retail % of expenditure	Expenditure on Retail items	Potential catchment	Potential expenditure catchment	Average Trading Density (R/square metre)	Effective Demand (square metre)
Assegay	R 214 834 013	94%	R 202 965 431	37%	R 74 986 129	40%	R 29 994 451	21 287	1 409
Bothas Hill	R 97 570 387	97%	R 94 589 691	37%	R 35 334 547	20%	R 7 066 909	21 287	332
Dassenhoek Part 1	R 325 319 739	94%	R 304 567 829	41%	R 124 389 410	45%	R 55 975 234	21 287	2 630
Dassenhoek Part 2	R 652 577 882	29%	R 191 781 371	59%	R 113 405 937	45%	R 51 032 672	21 287	2 397
Drummond	R 114 503 797	94%	R 107 992 129	38%	R 41 480 717	35%	R 14 518 251	21 287	682
Elangeni	R 114 694 607	94%	R 107 643 323	44%	R 47 531 057	35%	R 16 635 870	21 287	782
Hillcrest	R 416 778 956	90%	R 374 824 443	34%	R 126 818 170	10%	R 12 681 817	21 287	596
Kloof	R 2 743 440 597	92%	R 2 513 512 819	37%	R 917 537 037	5%	R 45 876 852	21 287	2 155
KwaNdengezi	R 856 083 049	97%	R 827 532 664	51%	R 421 713 164	45%	R 189 770 924	21 287	8 915
Mangangeni/Vumazonke	R 44 473 871	90%	R 39 911 660	61%	R 24 387 400	45%	R 10 974 330	21 287	516
Mpolo	R 310 132 993	94%	R 290 253 332	60%	R 174 720 813	45%	R 78 624 366	21 287	3 694
Mpumalanga	R 2 587 070 303	92%	R 2 372 741 737	57%	R 1 359 914 700	15%	R 203 987 205	21 287	9 583
New Germany	R 1 177 197 108	94%	R 1 101 509 836	42%	R 458 627 238	5%	R 22 931 362	21 287	1 077
Ntshongweni	R 10 328 192	116%	R 11 968 388	39%	R 4 636 367	80%	R 3 709 094	21 287	174
Pinetown	R 5 303 547 181	95%	R 5 013 849 672	41%	R 2 040 399 442	5%	R 102 019 972	21 287	4 793
Qadi	R 211 349 529	89%	R 187 954 762	54%	R 101 130 255	35%	R 35 395 589	21 287	1 663
Tshelimnyama	R 1 010 171 924	89%	R 903 125 007	41%	R 371 166 527	45%	R 167 024 937	21 287	7 846
									49 242

Table 3: Effective Demand (2015)

Main-Place	Total H/H Disposable Income 2015	Expenditure % of Income	Total expenditure by households	Retail % of expenditure	Expenditure on Retail items	Potential catchment	Potential expenditure catchment	Average Trading Density (R/square metre)	Effective Demand (square metre)
Assegay	R 299 470 609	94%	R 282 926 247	37%	R 104 527 869	40%	R 41 811 148	25 353	1 649
Bothas Hill	R 125 166 924	97%	R 121 343 175	37%	R 45 328 472	20%	R 9 065 694	25 353	358
Dassenhoek Part 1	R 577 719 967	94%	R 540 867 630	41%	R 220 897 281	45%	R 99 403 776	25 353	3 921
Dassenhoek Part 2	R 788 927 430	29%	R 231 852 149	59%	R 137 100 961	45%	R 61 695 432	25 353	2 433
Drummond	R 159 156 453	94%	R 150 105 452	38%	R 57 656 811	35%	R 20 179 884	25 353	796
Elangeni	R 159 293 895	94%	R 149 500 700	44%	R 66 013 628	35%	R 23 104 770	25 353	911
Hillcrest	R 583 205 419	90%	R 524 497 802	34%	R 177 458 682	10%	R 17 745 868	25 353	700
Kloof	R 3 958 860 194	92%	R 3 627 068 090	37%	R 1 324 031 166	5%	R 66 201 558	25 353	2 611
KwaNdengezi	R 1 019 031 306	97%	R 985 046 594	51%	R 501 982 742	45%	R 225 892 234	25 353	8 910
Mangangeni/Vumazonke	R 59 592 685	90%	R 53 479 559	61%	R 32 677 854	45%	R 14 705 034	25 353	580
Mpolo	R 413 929 638	94%	R 387 396 566	60%	R 233 197 126	45%	R 104 938 707	25 353	4 139
Mpumalanga	R 3 323 274 011	92%	R 3 047 953 872	57%	R 1 746 906 210	15%	R 262 035 932	25 353	10 335
New Germany	R 1 710 947 218	94%	R 1 600 942 762	42%	R 666 572 311	5%	R 33 328 616	25 353	1 315
Ntshongweni	R 12 222 173	116%	R 14 163 148	39%	R 5 486 583	80%	R 4 389 266	25 353	173
Pinetown	R 6 852 778 877	95%	R 6 478 457 145	41%	R 2 636 425 343	5%	R 131 821 267	25 353	5 199
Qadi	R 275 676 360	89%	R 245 161 108	54%	R 131 910 494	35%	R 46 168 673	25 353	1 821
Tshelimnyama	R 1 778 388 711	89%	R 1 589 934 623	41%	R 653 431 705	45%	R 294 044 267	25 353	11 598
									57 450

Table 4: Effective Demand (2020)

Main-Place	Total H/H Disposable Income 2020	Expenditure % of Income	Total expenditure by households	Retail % of expenditure	Expenditure on Retail items	Potential catchment	Potential expenditure catchment	Average Trading Density (R/square metre)	Effective Demand (square metre)
Assegay	R 520 922 138	94%	R 492 143 606	37%	R 181 823 790	40%	R 72 729 516	33 928	2 144
Bothas Hill	R 189 572 569	97%	R 183 781 280	37%	R 68 652 601	20%	R 13 730 520	33 928	405
Dassenhoek Part 1	R 1 504 511 979	94%	R 1 408 540 253	41%	R 575 265 915	45%	R 258 869 662	33 928	7 630
Dassenhoek Part 2	R 1 082 376 199	29%	R 318 091 674	59%	R 188 096 916	45%	R 84 643 612	33 928	2 495
Drummond	R 275 527 442	94%	R 259 858 589	38%	R 99 813 946	35%	R 34 934 881	33 928	1 030
Elangeni	R 275 397 094	94%	R 258 466 016	44%	R 114 128 425	35%	R 39 944 949	33 928	1 177
Hillcrest	R 1 020 973 566	90%	R 918 198 587	34%	R 310 663 477	10%	R 31 066 348	33 928	916
Kloof	R 7 295 042 704	92%	R 6 683 645 118	37%	R 2 439 809 295	5%	R 121 990 465	33 928	3 596
KwaNdengezi	R 1 362 407 126	97%	R 1 316 970 824	51%	R 671 132 340	45%	R 302 009 553	33 928	8 901
Mangangeni/Vumazonke	R 97 052 412	90%	R 87 096 598	61%	R 53 219 023	45%	R 23 948 560	33 928	706
Mpolo	R 669 716 159	94%	R 626 787 059	60%	R 377 300 559	45%	R 169 785 252	33 928	5 004
Mpumalanga	R 5 044 630 390	92%	R 4 626 702 668	57%	R 2 651 751 294	15%	R 397 762 694	33 928	11 724
New Germany	R 3 190 673 173	94%	R 2 985 530 511	42%	R 1 243 062 537	5%	R 62 153 127	33 928	1 832
Ntshongweni	R 16 181 619	116%	R 18 751 384	39%	R 7 263 994	80%	R 5 811 196	33 928	171
Pinetown	R 10 504 301 724	95%	R 9 930 521 584	41%	R 4 041 252 136	5%	R 202 062 607	33 928	5 956
Qadi	R 429 269 398	89%	R 381 752 579	54%	R 205 404 403	35%	R 71 891 541	33 928	2 119
Tshelimnyama	R 4 564 701 239	89%	R 4 080 984 375	41%	R 1 677 203 916	45%	R 754 741 762	33 928	22 245
									78 049

Table 5: Effective Demand (2025)

Main-Place	Total H/H Disposable Income 2025	Expenditure % of Income	Total expenditure by households	Retail % of expenditure	Expenditure on Retail items	Potential catchment	Potential expenditure catchment	Average Trading Density (R/square metre)	Effective Demand (square metre)
Assegay	R 906 131 905	94%	R 856 072 320	37%	R 316 278 240	40%	R 126 511 296	45 404	2 786
Bothas Hill	R 287 118 657	97%	R 278 347 413	37%	R 103 978 347	20%	R 20 795 669	45 404	458
Dassenhoek Part 1	R 3 918 085 618	94%	R 3 668 153 782	41%	R 1 498 121 077	45%	R 674 154 485	45 404	14 848
Dassenhoek Part 2	R 1 484 975 918	29%	R 436 408 780	59%	R 258 061 284	45%	R 116 127 578	45 404	2 558
Drummond	R 476 985 820	94%	R 449 860 316	38%	R 172 795 264	35%	R 60 478 342	45 404	1 332
Elangeni	R 476 123 453	94%	R 446 851 963	44%	R 197 312 248	35%	R 69 059 287	45 404	1 521
Hillcrest	R 1 787 341 115	90%	R 1 607 420 741	34%	R 543 855 026	10%	R 54 385 503	45 404	1 198
Kloof	R 13 442 669 213	92%	R 12 316 039 002	37%	R 4 495 868 034	5%	R 224 793 402	45 404	4 951
KwaNdengezi	R 1 821 487 885	97%	R 1 760 741 231	51%	R 897 279 090	45%	R 403 775 590	45 404	8 893
Mangangeni/Vumazonke	R 158 059 173	90%	R 141 845 174	61%	R 86 672 290	45%	R 39 002 531	45 404	859
Mpolo	R 1 083 565 160	94%	R 1 014 108 157	60%	R 610 452 257	45%	R 274 703 516	45 404	6 050
Mpumalanga	R 7 657 597 807	92%	R 7 023 196 044	57%	R 4 025 279 023	15%	R 603 791 853	45 404	13 298
New Germany	R 5 950 151 582	94%	R 5 567 589 701	42%	R 2 318 134 802	5%	R 115 906 740	45 404	2 553
Ntshongweni	R 21 423 751	116%	R 24 826 007	39%	R 9 617 209	80%	R 7 693 767	45 404	169
Pinetown	R 16 101 548 975	95%	R 15 222 028 445	41%	R 6 194 644 908	5%	R 309 732 245	45 404	6 822
Qadi	R 668 436 772	89%	R 594 445 965	54%	R 319 845 432	35%	R 111 945 901	45 404	2 466
Tshelimnyama	R 11 716 503 408	89%	R 10 474 917 161	41%	R 4 304 983 914	45%	R 1 937 242 761	45 404	42 667
									113 429

4.2: PROPOSED TENANT MIX

In terms of comparison, a first phase of the proposed retail centre of approximately 50,000m^2 would compare to the Liberty Midlands Mall which currently sits around 52,850m^2, expanding over time to a similar size to that of the Pavilion which is 119,000m^2. In addition, based on the outcome of the surveys, the proposed tenant mix of the Shongweni retail centre would be a mix between centre's such as Liberty Midlands Mall in Pietermaritzburg and Bridge City Centre in KwaMashu.

Anchor Tenant		
Brand/Name	Recommended Size (m2)	Cumulative Total Size (m2)
FMCG anchor - Pick 'n Pay/Shoprite Checkers	3000	3000
FMCG anchor - Superspar	3000	6000
Speciality Grocer	1000	7000
National clothing brand anchor - Edgars/Truworths	2000	9000
National clothing brand anchor - Edgars/Truworths	2000	11000
National clothing brand anchor - Mr Price/Jetmart	2000	13000
Other Food & Beverage Stores		
Brand/Name	Recommended Size (m2)	Cumulative Total Size (m2)
Woolworths Food	800	13800
Butchery - Independent	400	14200
Bakery/Baked Goods - Bread Ahead/Cinnabon	200	14400
Spice Emporium/Gorima's/Spice World	100	14500
Liberty Liquors/Pick 'n Pay Liquors/Tops	300	14800
Fast Food, Restaurants and Cafes		
Brand/Name	Recommended Size (m2)	Cumulative Total Size (m2)
KFC	300	15100
Chicken Licken	100	15200
Nandos	300	15500
Steers/Wimpy	300	15800
Spur	400	16200
MacDonald's	100	16300
Debonairs/Scooters	100	16400
Pannarottis/Pizza Hut	300	16700
Ninos/Mimos	200	16900
Fishaways/Ocean Basket	200	17100
King Pie/Pie City	50	17150
Coffee Shop/Home-brand store	100	17250
Cosmic Candy/Sweets from Heaven	80	17330
Milky Lane/Mozart	50	17380
Urban Juice/Juicy Lucy	50	17430
Pantsula Bites	150	17580
Mug & Bean/Gloria Jeans	200	17780
Biltong Store	50	17830
Pub - Keg/Independent	200	18030
Clothing, Shoes and Accessories		
Brand/Name	Recommended Size (m2)	Cumulative Total Size (m2)
Nationals department stores - Jetmart/The Hub	1500	19530
Nationals department stores - Woolworths	1500	21030
Smaller nationals -Foshini	1200	22230
Smaller nationals -Identity	500	22730
Smaller nationals -Legit	500	23230
Smaller nationals - Markhams	500	23730

Smaller nationals - Uzzi	400	24130
Smaller nationals - Miladys	600	24730
Smaller nationals - PnP Clothing	400	25130
Jay Jays	300	25030
Pep/Jam	450	25480
Ooh La La/Bedazzle/Accessorise	200	25680
Temptations	100	25780
Shoe City/Rage/Payless Shoes	400	26180
Converse	200	26380
Froggie/Green Cross	200	26580
Spec Savers	100	26680
Optician	100	26780
Jewellery and Leather Accessories		
Brand/Name	Recommended Size (m2)	Cumulative Total Size (m2)
2 x Jewellery stores - NWJ/American Swiss/Independent	400	27180
Watch store - Swatch/Watches Unlimited	100	27280
2 x Luggage stores - The Coachman/Independent	300	27580
Pharmaceutical/Health/Beauty		
Brand/Name	Recommended Size (m2)	Cumulative Total Size (m2)
Dis-chem/Link Pharmacy	500	28080
Clicks	500	28580
Hair Salon	200	28780
Beauty Parlour	200	28980
The Body Shop	200	29180
Fragrance Boutique	150	29330
Cheeky Hair	150	29480
Banks/ATM's		
Brand/Name	Recommended Size (m2)	Cumulative Total Size (m2)
ABSA	400	29880
FNB	400	30280
Nedbank	400	30680
Standard Bank	400	31080
ATM x 4	80	31160
Foreign Exchange	100	31260
Household Furnishings & Accessories		
Brand/Name	Recommended Size (m2)	Cumulative Total Size (m2)
Savells/Furniture City	1600	32860
Boutique Linens - Independent	100	32960
Boutique Cookware - Independent	80	33040
Joshua Doore/Pep Home	1600	34640
Sheet Street/Best Bedding/@home	300	34940
Boardman's	400	35340
Cellular & Electronics		
Brand/Name	Recommended Size (m2)	Cumulative Total Size (m2)
Telkom and 8ta	120	35460
Vodacom	120	35580
MTN	120	35700
Cell C	120	35820
Glocell/Independent Cellular Store	60	35880
Giddy's Electrical Express/independent electronics store	200	36080
PC Zone/Incredible connection	500	36580
Govan Mani	300	36880
PC Game Store	100	36980
Music, Books & Stationary		
Brand/Name	Recommended Size (m2)	Cumulative Total Size (m2)

Musica/Look and Listen	200	37180
CNA/Independent stationers	200	37380
Cardies	80	37460
Exclusive Books/Great Books	300	37760
Pen & Art	150	37910
Music Instrument Store	200	38110
Other Specialised Retail		
Brand/Name	Recommended Size (m2)	Cumulative Total Size (m2)
Baby Store	200	38310
Toy Store - Toys R Us/Reggies	350	38660
Sports Store - Sports Scene/Mr Price Sport/Total Sports/Sportsman Warehouse	300	38960
Pet Store	150	39110
2 x Billabong/Rip Curl/ Quicksilver/Lizzard	500	39610
Game	2500	42110
Cape Union Mart/Due South	200	42310
Hardware store in parking/roof top area - Build-it/Builders Warehouse	2000	44310
Services		
Brand/Name	Recommended Size (m2)	Cumulative Total Size (m2)
Internet Café	100	44410
Post Office/Postnet	150	44560
Photo and Copy Shop	100	44660
Video/DVD rental	80	44740
4 x Doctors Rooms (GP, Dentist, Optometrist)	600	45340
Gym	1000	46340
Cinema	2000	48340
Travel agent - Flight Centre/Pentravel/Independent	200	48540
Other entertainment (arcade; ten-pin bowling; go-carting)	1000	49540
Kiosks/Trading Barrows		
Brand/Name	Recommended Size (m2)	Cumulative Total Size (m2)
Key cutting	30	49570
Shoe repair	30	49600
2 x Jewellery kiosks	60	49660
Cosmetics kiosk	30	49690
4 x other kiosks (Verimark products, cleaning products, cellphone accessories)	80	**49770**

SECTION 5: IMPACT ASSESSMENT

Section 5 provides a socio-economic impact assessment for the proposed centre to determine the impact on the local and regional economy;

5.1: QUANTIFYING THE ECONOMIC IMPACT

The proposed retail development will have a significant economic impact on the area directly surround the proposed site as well as the wider outer-west and eThekwini region. Both the capital injection and the operational cost will create a multiplier impact which will generate new wealth, jobs and contribute positively to the local economy. There are a number of economic variables which have to be measured to determine the extent to which the local economy has been impacted on due to this exogenous change. These will be determined through a high level input/output modelling exercise based on assumed construction costs per gross developed area of specific land-use – specifically the following will be determined through the application of Urban-Econ's Adjusted KZN Input/Output Model™ to assess the economic impact of the proposed project.

INPUT-OUTPUT MODEL

In order to quantify the economic impact of the proposed Shongweni retail centre, an input/output model is used. The model contains information on inter-sector relations, including tables that describe, for each sector included in the model, the amount of input the sector requires from other sectors to produce one unit of output. It is thus a set of equations describing the relationships that link the output of one industry with all other industries in an economy.

These models are able to estimate impacts within each industry in the model and thereby provide much more information than simple total economic impacts on income, output, and employment. Using, for example, new investment or operational expense data, multipliers are calculated to estimate different impacts of development investment and its ripple effects through the economy. Measures of input also take into account imports and exports to and from the specific geographic area.

The anticipated economic impacts are described below:

- **Total employment**, this reflects the number of additional jobs created by economic growth. This reflects the number of jobs created during CAPEX phase as well as long term sustainable employment generated through operation of the estate. In addition, the shift in jobs from agriculture to other sectors.
- **Value Added**, the equivalent to Gross Domestic Product or, in this case, Gross Geographic Product - GGP) is a broader economic measure of the full income effect.
- **Change in Output** (new business sales), this equates to additional business turnover as a result of the introduction of an exogenous change in the economy.
- **New salaries and wages**, This measures the increase in existing salaries and wages as a result of the exogenous change in the economy

CAPEX IMPACT MODELLING

The socio-economic impact during the construction phase is shown for each of the following associated CAPEX costs. The associated costs tabulated below include cost of super structure and cost of top structure.

ASSUMPTIONS OF THE MODEL

A number of assumptions where used to derive an estimated cost of the proposed development. These costs were assumed using building cost data from the 2012 Property and Construction Handbook by Davis Langdon and allocated sizes per zoning regulation. These rates (per m² excluding VAT) include the cost of appropriate building services, e.g. air-conditioning, electrical, etc., but exclude costs of site infrastructure development, parking, any future escalation, loss of interest, professional fees and Value Added Tax (VAT). Office rates exclude parking and include appropriate tenant allowances incorporating carpets, wallpaper, louvre drapes, partitions, lighting, air-conditioning and electrical reticulation.

The following assumptions are therefore made for purposes of this calculation:

- For the purpose of this study, the potential supporting commercial (office), residential and light-industrial land-uses are excluded from the CAPEX calculation as the retail component is considered the key component of the proposed development;

- It is assumed that the retail development would have a 50% coverage on site. An average construction cost of R 8 200/m^2 will be used for purposes of the proposed development, based on the parameters provided by the Davis Langton guide of R7400 – R9000 per square metre for a regional centre of between 50,000m^2 – and 100,000m^2;

- A land servicing cost of R2500 per square metre is used as average development cost above excludes the development of infrastructure, and it can be assumed that this will be covered by the developer;

- It is assumed that for every 100m² of retail space, 4 parking bays are allocated. Structured parking at R 3375 /m² (excl. VAT) based on the parameters of between R2950 – R3800 per square metre of structured parking.

In terms of economic impacts, the table below displays the capital investment that is expected for the proposed Shongweni retail development. It is estimated that the total capital investment value of the proposed development will be approximately R 608.3 million as shown in the grand total below.

Table 6: Expected Capital Investment Value of the Proposed Shongweni Retail Development

	Value	Unit
Retail centre Size	49242	m2
Coverage	50	%
Site Size	73863	m2
Average Land Servicing Cost	2500	Rand/m2
Average building cost per square metre	8200	Rand/m2
Land Servicing Capital Cost	R 184 657 500	
Retail Centre Capital Cost	R 403 784 400	
Parking required	4	per 100m2
Parking bays required	1970	bays
Average size per bay	3	m2
Total bay size required	5909	m2
Parking development cost	R 3 375	R per m2
Total capital cost of parking	R 19 943 010	

Total cost of entire retail development	**R 608 384 910**

Given a capital investment value of R 608 million, it is possible to calculate the contribution of the proposed development towards GGP, employment, new business sales, and income using the provincial multiplier table. The economic multipliers for the construction industry are displayed below:

Table 7: Economic Multiplier for the Construction Industry

	NEW BUSINESS SALES MULTIPLIER PER R1 SPENT			GROSS VALUE ADDED MULTIPLIERS PER R1 SPENT			INCOME MULTIPLIERS PER R1 SPENT			EMPLOYMENT MULTIPLIERS PER R1000000 SPENT		
SECTOR DESCRIPTION	Total	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect
Construction	2.78817898	1.237056543	1.551122437	0.990604	0.409365	0.581239	0.488991	0.216822	0.272169	6.1244606	3.446931	2.67753

Using the capital expenditure for the proposed retail centre and entering this into the input/output model, yielded results for the following categories:

- Changes in Gross Value Added;
- Changes in Business Sales;
- Changes in Income;
- Changes in Employment

The results of the multiplier model are summarised in the table below.

Table 8: Results of the multiplier model

	Total	Direct	Indirect
New business sales	R 1 696 286 018	R 752 606 534	R 943 679 484
Gross value added	R 602 668 564	R 249 051 300	R 353 617 264
Income multipliers	R 297 494 672	R 131 911 096	R 165 583 576
Employment multipliers	3 726	2 097	1 629

The economic impact of the construction phase (in terms of gross value added) of the proposed Shongweni retail centre will be in the region of R602 million, and will create a significant capital injection into the local economy for the construction phase alone.

There are additional and sustained economic benefits that are expected to arise from this development. The direct and indirect economic benefits arising from the initial capital expenditure in the construction phase will be short-term in nature. It is important to note that the total impacts for each of the categories span the entire lifespan of the construction phase and may not be generated immediately, but as increments as and when construction takes place.

IMPACT ON GROSS VALUE ADDED

The capital expenditure phase for the proposed development will impact on the gross geographic product of the region. The results for gross value-added or Gross Geographic Product (GGP) from the input-output model are presented in the table above.

In total, an estimated additional R602 668 564 will be generated in gross value added or GGP into the eThekwini region as a result of the capital expenditure of the proposed development. Of this, R249 million will be a direct injection and a further R353 million will be induced investment.

	Total	Direct	Indirect
Gross Value Added	R 602 668 564	R 249 051 300	R 353 617 264

IMPACT ON NEW BUSINESS SALES

As a result of the increased economic activity that will result from the proposed development, there will be an increase in business sales in the region. The capital expenditure of the proposed Shongweni retail development will lead to the expansion of business sales (direct and indirect production) by R1,696 billion by the end of the construction phase. There is significant potential for the proposed development to use local suppliers so as to encourage the development of local business. It is expected that the increase in direct business sales will have positive spin-off effects on the supporting businesses, for example, sub-contractors and suppliers of construction equipment and materials. A total of R943 million in new business sales will be generated as a result of the indirect impact of the developments capital expenditure and R752 million as a result of direct impact.

	Total	Direct	Indirect
New Business Sales	R 1 696 286 018	R 752 606 534	R 943 679 484

IMPACT ON EMPLOYMENT AND JOB CREATION

The proposed retail development is expected to have a positive impact on both direct and indirect employment creation. Firstly, in the initial construction phase, which occurs in the short-term, and secondly, in the operational phase, which has a long-term impact. The impact on employment from the input-output model suggests that a total of 3726 temporary employment opportunities will be created as a result of the proposed development at the end of construction of the entire development. Of this amount, 2097 will be created directly and 1629 indirectly. When calculating

employment figures in the input-output model, the model converts total man hours into jobs or employment opportunities. However, it must be noted that the construction period of the development will require a number of contractors to complete the development. It is estimated that a number of contractors may be required, each with a compliment of staff and sub-contractors / suppliers required to do the work.

	Total	Direct	Indirect
Employment Multipliers	3 726	2 097	1 629

IMPACT ON INCOME

The capital expenditure phase of the proposed development will impact positively on the income generated within the region, and as displayed in the table below, additional income generated as a result of the construction phase of the development is almost R298 million. Direct wages (derived from on-site jobs) is estimated at R131,9 million and indirect wages are R 165,5 million. This will significantly increase the disposable income within the region.

	Total	Direct	Indirect
Income Multipliers	R 297 494 672	R 131 911 096	R 165 583 576

OPEX (LONG TERM SUSTAINABILITY)

The operating expenditure will result in both direct and indirect economic benefits that will be long-term in nature as oppose to temporary jobs created throughout the construction phase. In terms of operational impact, given the lack of an exact operational cost of the development, an assumption is made that the operational cost will be 15% of the capital cost of the retail development (actual building structure excluding parking and infrastructure development costs). Therefore, the annual operational cost will be R60,5 million. The multiplier table used to calculate the operational cost of the retail centre is displayed below:

	NEW BUSINESS SALES MULTIPLIER PER R1 SPENT			GROSS VALUE ADDED MULTIPLIERS PER R1 SPENT			INCOME MULTIPLIERS PER R1 SPENT			EMPLOYMENT MULTIPLIERS PER R1000000 SPENT		
SECTOR DESCRIPTION	Total	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect
Trade, catering & accommodation	2.311321164	1.079578496	1.231742668	1.125977	0.618525	0.507451	0.484725	0.279744	0.204982	5.9226621	3.868801	2.053861

Entering this operational cost into the model produces the following results:

	Total	Direct	Indirect
New business sales	R 139 991 314	R 65 387 543	R 74 603 771
Gross value added	R 68 197 783	R 37 462 640	R 30 735 143
Income multipliers	R 29 358 679	R 16 943 423	R 12 415 256
Employment multipliers	359	234	124

In terms of new business sales, a total of R139 million will be generated on a annual basis through the operations of the centre, with R65 million being direct and R74 million being indirect. The total contribution to the gross value added within eThekwini will be R68 million, with R37 million in direct GVA contribution and R30 million in indirect GVA contributions. The income that will be generated through operation of the retail centre will be R29 million, with R16 million in direct wages and R12 million in indirect wages. In total, 359 permanent jobs will be created, with 234 being direct and 124 being indirectly created.

5.2: SOCIO-ECONOMIC IMPACT

A number of socio-economic impacts are expected as a result of the construction and operation of a regional retail centre in the Shongweni area. The specific areas which will be impacted on have been identified below:

- Impact on the town and general public
- Impact on the shoppers
- Impact on existing businesses (competitors)
- Impact on the municipality
- Impact on safety and security
- Impact on the urban environment
- Impact on existing residents
- Impact on traffic

In order to quantify the impacts within each of these impact areas, an impact rating model is undertaken which provides an assessment of each impact in terms of its, direction (positive or negative), extent, intensity, duration, and probability if the impact occurring. The first step involves arriving at a consequence score. This is done by totalling the score for the extent, duration and intensity of the impact. The table below displays the rating system.

Table 9: Consequence Score Rating

Rating	Definition of rating	Score
A. Extent - The area over which the impact will be experienced		
None		0
Area	Confined to the study area or part thereof (Outer-West)	1
Local	The local area (eThekwini)	2
Region	The wider region (KZN)	3
B. Intensity - the magnitude of the impact in relation to the sensitivity of the receiving environment		
None		0
Low	Natural and/or social functions and processes are negligibly altered	1
Medium	Natural and/or social functions and processes continue albeit in a modified way	2
High	Natural and/or social functions and processes are severely altered	3
C. Duration - the time frame for which the impact will be experienced		
None		0
Short-term	Up to 2 years	1
Medium-term	2 to 15 years	2
Long-term	More than 15 years	3

Each consequence score elates to a consequence rating, which is displayed in the following table.

Table 10: Consequence Rating

Combined Score (A+B+C)	0-2	3-4	5	6	7	8-9
Consequence Rating	**Not**	**Very low**	**Low**	**Medium**	**High**	**Very High**

	significant					

Once a consequence rating has been assigning to each impact, a probability rating needs to be applied to each impact. This represent the expected probability of each impact occurring. The table below displays the breakdown for each probability rating.

Table 11: Probability Rating

Probability of the impact (likelihood of the impact occurring)	
Improbable	< 40% chance of occurring
Probable	40% - 70% chance of occurring
Highly Probable	> 70% - 90% chance of occurring
Definite	> 90% chance of occurring

Given that each impact now has been assigned a consequence rating and a probability rating, the significance of each impact can be calculated. The table below displays the significance rating system used to arrive at the significance of each impact.

Table 12: Significance Rating

Significance Rating	**Consequence Score**	**&**	**Probability of impact occurring**
Insignificant	Very Low	&	Improbable
	Very Low	&	Probable
Very Low	Very Low	&	Highly Probable
	Very Low	&	Definite
	Low	&	Improbable
	Low	&	Probable
Low	Low	&	Highly Probable
	Low	&	Definite
	Medium	&	Improbable
	Medium	&	Probable
Medium	Medium	&	Highly Probable
	Medium	&	Definite
	High	&	Improbable
	High	&	Probable
High	High	&	Highly Probable
	High	&	Definite
	Very High	&	Improbable
	Very High	&	Probable
Very High	Very High	&	Highly Probable
	Very High	&	Definite

The table on the following page displays the results of the impact assessment model.

Table 13: Anticipated Impacts and Significance

Socio-Economic Impacts		Direction of impact	Extent of impact		Intensity of impact		Duration of impact			Consequence Score	Consequence Rating	Probability of impact		Significance of impact
Impact on the town and general public	Employment	+	Local area	2	Medium	2	L-term	3		7	High	Highly Probable		High
	Income	+	Local area	2	Medium	2	L-term	3		7	High	Highly Probable		High
	Economic growth	+	Local area	2	Medium	1	L-term	3		7	High	Probable		Medium
Impact on the shoppers	Convenience	+	Study area	1	Medium	2	L-term	3		6	Medium	Highly probable		Medium
	Shopping patterns	+	Local area	2	Medium	2	L-term	3		7	High	Probable		Medium
Impact on existing businesses	Competition	-	Local area	2	Medium	2	S-term	1		5	Low	Highly Probable		Low
	Customers/turnover	-	Local area	2	Medium	2	S-term	1		5	Low	Probable		Very Low
Impact on the municipality	Service provision	-	Study area	1	Low	1	L-term	3		5	Low	Definite		Low
	Increase in Rates and Utilities	+	Local area	2	Low	1	L-term	3		6	Medium	Definite		Medium
Impact on safety and security	Crime	-	Study area	1	Low	1	L-term	3		5	Low	Probable		Very Low
	Road safety	-	Study area	1	Medium	2	L-term	3		6	Medium	Highly Probable		Medium
Impact on the urban environment	Urban renewal	+	Study area	1	High	3	L-term	3		7	High	Probable		Medium
	Aesthetic quality	+	Study area	1	Medium	2	L-term	3		6	Medium	Probable		Low
Impact on existing residents	Noise & congestion	-	Study area	1	High	3	L-term	3		7	High	Highly probable		High
	Property values	+	Study area	1	Medium	2	M-term	2		5	Low	Highly Probable		Low
Impact on traffic	Increased traffic & congestion	-	Study area	1	Medium	2	L-term	3		6	Medium	Highly probable		Medium

In general, the development of the proposed regional retail centre will have numerous impacts on surrounding communities and businesses, both positive and negative. The actual construction phase will attract more vehicles to the area, create dust and noise, and increase congestion. This is a short-term impact and is typically less significant than the medium and long-term impacts. The establishment of the centre in the medium and long term on the other hand creates a new built environment within the Shongweni node. This is expected to change the aesthetics of the area, increase the amount of traffic, noise and congestion, and possibly decrease safety and security in the area.

In addition, retail within the surround nodes of Hillcrest and Pinetown might experience some short-term loss in turnover. However, in the medium to long term, this impact will be mitigated by the expected change in retail type (Hillcrest retail is expected to adjust by become more niche and convenience retail) and the increase in persons to the area, and therefore this impact is not very significant in the long-run.

However, the more positive impacts are increased convenience to shoppers and residents, new jobs, income and economic growth, increased property values of the surround communities, as well as an increase in rates and utilities to the municipality.

The most significant positive impacts of the proposed development are the increase in employment and income within the eThekwini municipality. The monetary impact of this has been calculated in the section prior to this, but it is important to again note that the proposed development will have an impact on employment and income within the area.

The most negative impact is that of noise and congestion. Development of a regional centre is certain to increase the activity within the Shongweni node in the medium-long run, which will lead to a rise in noise and congestion. Development of the centre itself will have a short-term impact on noise and congestion.

SECTION 6: CONCLUSION

Section 6 concludes the report by providing a brief summary of the findings of the report. The first section provides a background to the project, the approach and methodology and the report outline. This is followed by a summary of the phase 1 report titled "Initial Scoping Report". This provides a brief recap on the location and spatial dynamics of the proposed development, the regional context, a market delineation, market supply analysis, the local planning priorities of the municipality, and the effective demand model.

The outcomes of the initial demand model show an estimated effective demand of approximately 60,542m^2 in 2012. This however is based on the assumption that a percentage of the surrounding populations are in fact willing to change their shopping patterns to shop within the Shongweni Node. This also assumes that there are sufficient road linkages developed to support an increase in traffic and to create linkages with areas such as Dassenhoek that currently have limited access to the area. In addition, it assumes that there are public transport facilities at the site which will allow those travelling by taxi or bus to easily access the site, as well as pedestrian bridges linking the surround communities. The model is refined later in section 4 of the report.

Section 3 provided the findings of the consultation process. This included an analysis of the consumer survey which was undertaken. A total of 230 questionnaire were completed in the key retail nodes of Hillcrest, Pinetown and Hammersdale, and the results were relatively positive, with just over 80% of respondents feeling that the proposed retail centre development is required, and again over 70% noting that they would shop there should it be developed. A number of interviews and discussions were undertaken with leasing agents and real estate agents, and the results of these were also included within section 3.

Section 4 then moved onto development of a refined market demand model. Based on the findings from the shopper surveys, the potential market catchment figures were revised. In addition, the effective demand was projected up until 2025 to determine the long-term potential demand for such a development. The key outcomes of this model were:

- There is effective demand for approximately 49,242m^2 of retail in Shongweni in 2012;
- There is effective demand for approximately 57,450m^2 of retail in Shongweni in 2015;
- There is effective demand for approximately 78,049m^2 of retail in Shongweni in 2020;
- There is effective demand for approximately 113,429m^2 of retail in Shongweni in 2025.

This suggests that there is currently excess demand for retail within the node, and based on historic growth trends, this demand continues to grow to over 100,000m^2 in 13 years time. This warrants development of a small regional centre of around 50,000m^2 growing to up to 100,000m^2 by 2025. A proposed tenant mix was then as presented for the first phase (up to 50,000m^2). The detailed tenant mix can be viewed in section 4.2.

Section 5 then presented an impact assessment for the proposed development, which was broken into the economic impacts, as well as the socio-economic impacts. In terms of economic impact, the

capital expenditure on construction of the retail component of the proposed development is expected to have the following impact on the local economy (short-term):

	Total	Direct	Indirect
New business sales	R 1 696 286 018	R 752 606 534	R 943 679 484
Gross value added	R 602 668 564	R 249 051 300	R 353 617 264
Income multipliers	R 297 494 672	R 131 911 096	R 165 583 576
Employment multipliers	3 726	2 097	1 629

In terms of the operation of the retail centre component, the following table displays the long-term, permanent impact of the proposed development.

	Total	Direct	Indirect
New business sales	R 139 991 314	R 65 387 543	R 74 603 771
Gross value added	R 68 197 783	R 37 462 640	R 30 735 143
Income multipliers	R 29 358 679	R 16 943 423	R 12 415 256
Employment multipliers	359	234	124

With regards to socio-economic impacts, the following key impact area were identified and rated:

- Impact on the town and general public
- Impact on the shoppers
- Impact on existing businesses (competitors)
- Impact on the municipality
- Impact on safety and security
- Impact on the urban environment
- Impact on existing residents
- Impact on traffic

It was determined that the most significant impacts will be the increase in employment and income in the region, as well as the noise and congestion that will be created with establishment of retail centre and associated supporting land-uses.

In summary, there is sufficient effective demand to support the development of a 50,000m^2 retail centre, based on a number of conditions (public transport, new road infrastructure, bulk infrastructure, etc). In addition, the positive impacts will be a creation of new income and employment, as well as urban-renewal and convenience of shoppers. The negative impacts will be a decline in turnover for existing retailers in the outer-west area in the short-term and new noise and congestion in the long-term.

APPENDIX 3:

NTSHONGWENI DEVELOPMENT OPTIONS: ENGINEERING SERVICES REPORT (BOSCH STEMELE (PTY) LTD)

BOSCH STEMELE

CONTRACT NO. 243/192 OCTOBER 2013

Tongaat Hulett DEVELOPMENTS

NTSHONGWENI DEVELOPMENT OPTIONS

ENGINEERING SERVICES REPORT REVISION 3

Tongaat Hulett DEVELOPMENTS

NTSHONGWENI DEVELOPMENT OPTIONS ENGINEERING SERVICES REPORT REVISION 3

PROJECT No. : 243/192	**DATE**: October 2013
CONSULTING ENGINEERS: Bosch Stemele (Pty) Ltd PO Box 2009 Durban 4000 Tel : +27 31 535-6000 Fax : +27 31 535-6011	**COMMISSIONED BY**: Tongaat Hulett Developments (Pty) Ltd 305 Umhlanga Rocks Drive La Lucia 4051 Tel : +27 31 560-1900 Fax : +27 31 560-1998
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DISCIPLINE: **ENGINEERING SERVICES REPORT**	

BOSCH STEMELE
• Consulting Engineers • Project Managers

QUALITY VERIFICATION

This report has been prepared under the control of the Bosch Stemele Quality Management System which meets the requirements of ISO 9001:2008 as independently certified by international auditors (Certificate No. 20705704/1)

Verification	Capacity	Name	Signature	Date
Checked by:	Lead Engineer	**P G Tooley**		2013/10/22
Reviewed by:	Project Manager/Director	**C P Kroeger**		22/10/13
Accepted by:	Client Authorised Representative	**R Wilkinson**		
Accepted by:	Client Authorised Representative			

NTSHONGWENI DEVELOPMENT OPTIONS

ENGINEERING SERVICES REPORT

REVISION 3

INDEX

NTSHONGWENI DEVELOPMENT OPTIONS

ENGINEERING SERVICES REPORT

REVISION 3

1. INTRODUCTION

The Ntshongweni development area contains 3 separate sites under consideration for development. All are currently under sugarcane cultivation, and the terrain for all 3 sites is moderate.

This report outlines the existing bulk services available in the area, the bulk services requirements to serve the three site options, and proposals for the provision of the services to the development.

In most aspects the bulk services requirements are similar for the 3 site options, and where requirements are different, these will be highlighted.

2. SITE OPTIONS

The three different site options are shown on drawing 243/192/032 Rev 1 in Annexure A, and are as follows.

2.1. Site 1

This site option is situated between the M13 and the N3, with Kassier Road as its western boundary.

The site measures approximately 50ha.

The proposed development will comprise commercial, industrial, and residential opportunities. This option is expected to yield the following total floor areas (bulk) when completed.

- 121 158m^2 commercial
- 75 649m^2 industrial
- 523 residential opportunities

2.2. Site 2

This option is situated at the north western corner of the Assagay/Shongweni Interchange on the N3, and is bounded by the N3 to the east and Kassier Road to the south.

The site measures approximately 88ha.

The proposed development will comprise commercial and industrial opportunities. The development is expected to yield the following total floor areas (bulk) when completed.

- 128 805m^2 commercial
- 301 468m^2 industrial

2.3. Site 3

The third site option is situated to the south of N3, with Kassier Road as its western boundary.

The site measures approximately 61ha.

The proposed development will comprise commercial, industrial, and residential opportunities. This option is expected to yield the following total floor areas (bulk) when completed.

- 123 812m^2 logistics/industrial
- 23 043m^2 tourism

3. ROADS

3.1. Bulk Roads

The sites are all well served on a primary level by the N3 freeway adjacent to the development. The N3 does not provide a capacity constraint.

The major secondary route adjacent to the all the areas is Kassier Road, which effectively forms the spine road from which all 3 sites would obtain direct access.

The capacity upgrade requirements are sourced from the traffic impact assessment undertaken by Arup (*and in particular reference is made to the 'Traffic Impact Assessments for Sites 1, 2, and 3 dated 18 March 2013).*

All site options would require upgrades to the road network, which is detailed in the Tables in Annexure B. Upgrades would include various elements of the following:

- Upgrading of the N3 interchange, including the overhead structure and the ramps (currently at very preliminary planning by SANRAL).
- Upgrading of the M13 interchange, including the overhead structure and the ramps (currently at planning and design stage by KZN Dept. of Transport).

- Doubling up of Kassier Road northwest of the M13 to 4 lanes as part of current eThekwini proposals.
- Widening of Kassier Road to up to 4 through lanes plus turning lanes from the N3 to the M13.
- Widening of Kassier Rd to 4 lanes from the south of the N3 interchange.
- Phased signalisation of intersections as traffic volumes dictate

The road upgrades can be implemented as phasing demands.

3.2. Internal Roads

The internal roads will be of very similar standard for all 3 site options.

They will be either single carriageway or dual carriageway roads as determined by the TIA. All roads will be surfaced, and will make provision for pedestrian access in the form of surfaced sidewalks.

4. STORMWATER

All the sites have well defined drainage paths. All sites would undergo significant earthworks platforming to provide the site sizes necessary for commercial/retail developments and industrial logistics developments.

For all 3 sites, the stormwater control philosophy will be to restrict post development flows into the catchment to less than 110% of that occurring pre-development (cane cultivation), and to facilitate ingress of stormwater into the ground to replenish the wetlands in the natural drainage lines.

In order to achieve this, the application of sustainable urban drainage systems (SUDS) principles will be actively applied.

All purchasers and developers of individual erven will, in terms of sales agreements, be required to implement on-erf stormwater attenuation to attenuate the first 25mm of each rainfall event, and to restrict run-off for 1:5 year storms to 110% of pre-development levels. This is to be achieved by a combination of on-site attenuation tanks for roof run-off, permeable paving to parking areas, and unpaved areas, etc.

Excess stormwater run-off from greater storms will be accommodated in either the roadway drainage or by piping to the natural watercourses and discharging via energy dissipating outlets.

Run-off from the roadways (as well as excess stormwater from the sites where applicable) will be accommodated in roadside drainage swales on situated on either side of the road. The swales will be sized to accommodate a minimum of a 1:2 year storm, and these will increase times of concentration of stormwater flow and encourage infiltration. These swales will however be limited to where road gradients are less than 5% to prevent scour.

To cater for greater storm events, roadways will also be provided with piped stormwater drainage with inlets designed only to allow flow into the pipes when the swales reach a pre-determined capacity.

Piped drainage will also be required across intersections, etc. Energy dissipation measures will be implemented where these pipes discharge into the natural watercourses.

Additional attenuation facilities will be provided in the main water courses to restrict the flows in larger rainfall events. These will be designed to encourage feeding water into the wetlands.

A detailed Stormwater Management Plan has been concluded for the preferred, proposed site 2 and is attached as Annexure C.

5. SANITATION

The Ntshongweni development will be provided with full waterborne sewage reticulation. This development options will generate between approximately 0.4Mℓ/day and 1.4Mℓ/day of effluent if full use is made of the proposed 'bulk'.

The only current sewage treatment facility in the area is the Hillcrest Works, which is currently at capacity. eThekwini Water and Sanitation is opposed to increasing the capacity of the works.

The bulk sewage proposal necessary for all 3 site options is therefore based on the current proposal of decommissioning the Hillcrest works and pumping/gravitating all the sewer down the Umhlatuzana valley to the Umhlatuzana Sewage Treatment Works.

The infrastructure required is based on the report prepared by Goba for the EIA for the pumpstation and pumping/outfall main. The Record of Decision approving this pipeline has recently been received.

Their assessment took account of existing and potential sewer generation for the Hillcrest area as well as the sewer generated by this Ntshongweni development, and the infrastructure encompasses the following:

- Replace the Hillcrest Sewerage Treatment Works with a 6Mℓ/day pumpstation

- A rising main from the pumpstation across the N3 to a point where it can gravitate

- A gravity main from this point down to the existing outfall gravity main feeding the Umhlatuzana Sewerage Treatment Works. This gravity main will require 3 No. river crossings.

The capacity of the sewerage treatment works can be upgraded to deal with the sewer outflows.

The layout of the bulk sewers is illustrated on drawing 243/192/031 Rev 3 in Annexure D.

The sewer generated from the Ntshongweni development will therefore link into this new outfall main.

Not all of the sewer from the 3 development options can gravitate into the proposed outfall main or the converted pumpstation at the Hillcrest works. Each site option will require secondary pumpstations located at low points on the periphery of the development.

The positioning of the various pumpstations and rising mains drawings for each of Sites 1, 2, and 3 are illustrated on drawings 243/192/033 Rev 2, 243/192/034 Rev 3, and 243/192/035 Rev 2 respectively, which are contained in Annexure E.

It is anticipated that certain pipelines may traverse minor valleys or stream lines and care will be taken to minimise the effect on these environmentally sensitive area. In most instances the use of pipe bridges will be preferred as shown in Annexure G (243/192/036).

6. WATER

The water supply in the development area falls under the authority of eThekwini Water Services (EWS).

6.1. Bulk Water Supply

There is no water supply of sufficient capacity to the development area.

However the proposed and soon to be constructed Western Aquaduct will pass on the northern boundary of the proposed Assagay node. eThekwini Water and Sanitation have confirmed that a supply may be taken off the Western Aquaduct to serve the greater development area.

The potential ultimate water demand for the greater development area will require the construction of a 500mm diameter steel pipeline from the Western Aquaduct to the preferred ultimate reservoir site, a distance of approximately 5,6km.

6.2. Reservoirs and Supply Mains

The reservoir will be positioned so as to be able to be the future supply reservoir node to developments in the area.

The calculated greatest demand for the Ntshongweni development site options (1.72Mℓ/day) will require the construction of a 3.5Mℓ reservoir at a high point near to the boundary of the development. However eThekwini have proposed a 13,7Mℓ reservoir to service the great Ntshongweni region.

The 3,5Mℓ reservoir would be the first of a series of reservoirs constructed in modules as the demand for the greater requires. The supply pipeline to the reservoir will however be required from the outset.

The layout of the bulk water is illustrated on drawing 243/192/031 Rev 3 in Annexure C and typical wetland buffer crossings in Annexure G.

The positioning of the supply lines to each of Sites 1, 2, and 3 are illustrated on drawings 243/192/033, 243/192/034, and 243/192/035 respectively, which are contained in Annexure E.

6.3. Reticulation

Water to each erf will be to municipal pressure standards and each erf will be individually metered.

The reticulation will be designed to accommodate fire flows. Any additional requirements for individual erven over and above 'Red Book' standards will have to be provided by the developer of the individual erf (e.g. booster connections, on site tanks, etc.).

Sustainability measures including rain-water harvesting will be implemented. Potable water will not be used for irrigation. This will be sourced from contained stormwater run-off, and be complemented by supplies from the current sugarcane irrigation raw water supply.

7. ELECTRICITY

The greater Ntshongweni area is supplied with electricity from two service providers, i.e. eThekwini Electricity and Eskom. The south and southwest area of Ntshongweni is supplied by Eskom and the north, northeast area is supplied by eThekwini Electricity. It must be noted that the areas of supply between Eskom and eThekwini Electricity do not follow the geographical boundary of the greater eThekwini Municipality. A copy of the Preliminary Services Report – Electrical, Revision 06, dated August 2013 is attached in Annexure F.

7.1. Existing

The existing electrical infrastructure is divided into the categories shown below.

7.1.1. 132/11kV Sub-Transmission Lines & Servitudes

Both 275kV and 88kV transmission lines exist in close proximity to Shongweni. The 88kV line is dedicated to Transnet's traction substations.

An existing 132kV overhead line linking Klaarwater to Hillcrest runs in a northerly direction past the eastern boundary of Shongweni (4 – 5km). There is a registered servitude for this line as well as the 275kV and 88kV lines highlighted above.

The Hillcrest major substation is located in relative close proximity to Ntshongweni. There is currently no spare capacity to meet development needs.

The Marian Ridge major substation is located 9.4km from the proposed Ntshongweni development. Discussions held with eThekwini Electricity in May 2013 indicated that it is the only substation in the vicinity that has some spare capacity to meet the needs of the initial development requirements.

7.1.2. Distribution (11kV)

There is electrical supply at 11kV available within the vicinity of proposed development area. However it cannot support the demand of the development.

7.1.3. Reticulation

No electrical supply (at 400V) is available within the boundaries of this project.

7.2. Development Requirements

The 3 site options proposed for the Ntshongweni Phase 1 development have electricity demands of 16.8MVA, of 29.6MVA and 10.6MVA. In formulating the load, good engineering practice and load factors as per Annex B of NRS 069: 2004 are used which are approved by eThekwini Electricity. The system will be designed to cater for the failure of any single MV cable, i.e. electrical load can be transferred via switching in the event of a fault occurring.

All of the site development options will require completely new infrastructure to meet their full load requirements.

The proposed future electrical infrastructure is covered under the headings below.

7.2.1. Sub-Transmission Major Substations (275/132 kV)

If all the proposed bulks are achieved, one new 132/11kV, 60MVA major substations will be required to be installed adjacent to the development area.

System strengthening may also be required on the 275kV transmission line infrastructure. eThekwini are presently assessing the need for a 275/132kV substation in the area and a suitable site will need to be determined.

7.2.2. 132kV Sub-Transmission Lines & Servitudes

Transmission line servitudes are required outside the development area. This may be overhead or underground subject to the cost/benefit of the land value affected. eThekwini Electricity have to liaise with Eskom for a 132kV feeder from Eskom's Georgedale Substation (13.2km from the development) to provide the feed for the new 132/11kV major at Ntshongweni.

7.2.3. Distribution (11kV)

At present the Marian Ridge substation has approximately 5MVA spare capacity to assist in meeting the initial demands of the development.

Two 11kV supplies will be taken from the Marian Ridge major substation to the development. This supply will initially feed in to a distribution substation. Distribution substations will be planned and positioned in key locations throughout the development. From here 11kV cable routes will be planned to run adjacent or be in close proximity to each proposed site allowing sales transfers of sites to take place.

The layout of the bulk electrical is illustrated on drawing 243/192/031 Rev 2 in Annexure D.

The positioning of the transmission lines from the major switching points and substations for each of Sites 1, 2, and 3 are illustrated on drawings 243/192/033, 243/192/034, and 243/192/035 respectively, which are contained in Annexure E.

7.2.4. Reticulation

In most instances the internal electrical reticulation will be undertaken by each top structure developer to meet his specific requirements. The developer will supply a 11kV bulk supply to the boundary of these developments.

7.2.5. Street Lighting

Provision is to be made for both street lighting as well as public open space lighting. It is recommended that lighting form part of a separate report due to the aesthetic requirements of the urban architecture.

8. SOLID WASTE

The development falls within the jurisdiction of eThekwini Municipality, and therefore Durban Solid Waste (DSW) will be responsible for provision of waste collection.

The nearby DSW Bulbul Drive landfill site has adequate air-space (capacity) to accept waste generated from the development.

Other waste collection models could be implemented, which could include 'contracted out' collection, facilities for waste separation for recycling, etc.

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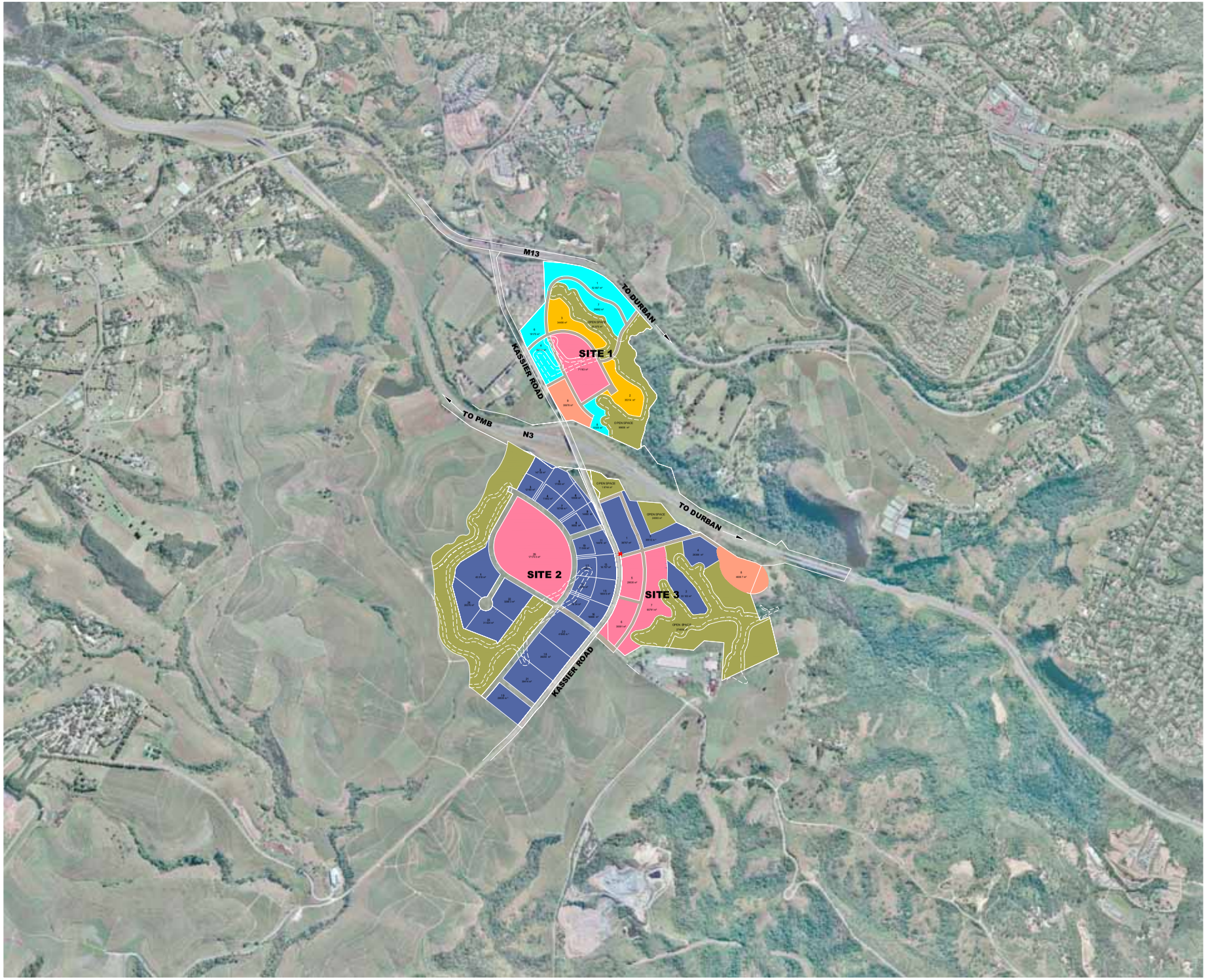
ANNEXURE A

SITE OPTIONS
DRG. 243/192/032 REV 1



LANDUSE LEGEND

- COMMERCIAL
- OFFICE
- RESIDENTIAL
- TOURISM / RECREATION
- OPEN SPACE
- BUSINESS
- WETLANDS & BUFFER

CONTOUR INTERVALS = 2.5m

0m 100m 200m 300m

SCALE

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ANNEXURE B

UPGRADES TO ROAD NETWORK TABLE

Table 11: Summary of Proposed Upgrades for the Key Intersections for each Site

Intersection	Site 1	Site 2	Site 3
Kassier Road/MR559	No upgrades required	Intersection signalised North arm upgraded to three lanes West arm single lane left turn slip South arm flare added for right turners	Intersection signalised North arm upgraded to three lanes South arm flare added for right turners West arm upgraded to three lanes
Kassier Road/N3 westbound	Upgraded to signal control	Intersection signalised North arm upgraded to three lanes and a flare for right turners East arm single lane left turn slip added South arm upgraded to four lanes	Intersection signalised North arm upgraded to three lanes East arm flare added for left turners South arm upgraded to four lanes
Kassier Road/N3 eastbound	Intersection signalised North arm upgraded to two lanes South arm flare added for right turners West arm upgraded to two lanes	Intersection signalised North arm upgraded to three lanes South arm upgraded to four lanes West arm upgraded to two lanes	Intersection signalised North arm increased to four lanes South arm upgraded to four lanes with a right turn flare West arm upgraded to two lanes with a right turn flare
Kassier Road/Cliffdale Road	Intersection signalised North arm upgraded to three lanes East arm upgraded to two lanes South arm upgraded to three lanes and a flare for the left turners West arm upgraded to two lanes and a flare for the right turners	Intersection signalised North arm upgraded to four lanes No upgrades to east arm South arm upgraded to three lanes and a flare for right turners West arm no upgrades	Intersection signalised North arm upgraded to three lanes with a flare for right turners South arm upgraded to three lanes with left turn flare West arm upgraded to two lanes
Kassier Road/M13 westbound	North arm upgraded to two lanes and a flare for the right turners East arm upgraded to one lane and a flare for the right turners with the left turners having a slip road South arm upgraded to three lanes	North arm upgraded to three lanes and a flare for right turners East arm upgraded to two lanes and a single lane left turn slip South arm upgraded to three lanes	North arm flare added for right turners East arm left turn flare added South arm upgraded to three lanes
Kassier Road/M13 eastbound	North arm upgraded to two lanes South arm upgraded to two lanes with a flare for right turners West arm upgraded to	North arm upgraded to three lanes South arm upgraded to three lanes and a flare for right turners West arm no upgrades	North arm upgraded to four lanes South arm upgraded to four lanes West arm existing right turn flare converted to

	two lanes		full lane for combined through and right turners
Kassier Road/Alverstone Road	North arm remains as per existing layout East arm upgraded with a flare for the right turners South arm upgraded to include a flare for right turners West arm upgraded to two lanes and a flare for right turners	North arm upgraded to three lanes and a flare for right turners East arm no upgrades South arm a flare for right turners added West arm no upgrades	South arm upgraded to three lanes East arm left turn flare added
Kassier Road/R103	East arm two lane left turn slip added South arm upgraded to three lanes West arm upgraded to include a flare for the right turners	East arm single lane left turn slip added South arm upgraded to three lanes West arm no upgrades	East arm dedicated right turn lane added South arm added dedicated lane for right turners West arm existing through lane converted to dedicated right turn
Shongweni Road/M13 westbound	Intersection has been signalised North arm slip road for right turners has been removed and upgraded to two lanes and a flare for the right turners East arm has been upgraded to two lanes South arm has been upgraded to two lanes	Intersection signalised	No upgrades required
Shongweni Road/M13 eastbound	Intersection has been signalised No other changes have taken place	Intersection signalised	Intersection signalised
Site 1 Southern Access	Intersection signalised North arm two lanes with a one lane left turn slip East arm three lanes and a flare for the right turners South arm three lanes		
Site 1 Northern Access	North arm two lanes East arm two lanes South arm two lanes and a flare for the right turners		
Site 2 Southern Access		Intersection signalised North arm flare added for right turners	

Site 2 Northern Access		Intersection signalised North arm upgraded to four lanes South arm upgraded to two lanes West arm single lane with a two lane left turn slip	
Site 3 Northern Access			Intersection signalised North arm two lanes and a two lane left turn slip East arm three lanes and a flare for the left turners South arm two lanes and a flare for the right turners
Miscellaneous	**New link road between the site and Shongweni Road connecting south of the M13.**	**Loop for the M13eastbound on-ramp maybe required in the future**	

ANNEXURE C

STORMWATER MANAGEMENT PLAN

NTSHONGWENI DEVELOPMENT

STORMWATER MANAGEMENT PLAN – SITE 2

---

1. INTRODUCTION

1.1. Description of the Development

The Ntshongweni development site is situated on both sides of the N3 Highway next to the Kassier Road interchange within the jurisdiction of the eThekwini Municipality (see Annexure A). The proposed development consists of 3 development sites with Site 1 being north-west of the N3/Kassier Road interchange, Site 2 being southwest of the above interchange and Site 3 being south-east of the interchange.

The overall development will cater for industrial, commercial and residential use and is approximately 199ha in size.

This Stormwater Management Plan (SWMP) caters specifically for Site 2 (88ha in size).

1.2. The purpose of this Stormwater Management Plan

The purpose of this document is to provide a guideline policy for the holistic management of stormwater for the development of the site.

This SWMP has the following purposes:

- To ensure compliance of the overall site with relevant legislation from a stormwater run-off perspective,
- To provide a practical, achievable & sustainable plan and methodology of managing stormwater run-off from site,
- To protect the health, welfare and safety of the public from damage by stormwater and floods,
- To protect against property damage from stormwater and floods,
- To prevent erosion of soil by run-off,
- To conserve the fauna and flora of the natural environment including wetland and riparian zones,
- To protect and enhance the natural water resources in the sub catchments from pollution and siltation, and
- To develop a conceptual surface water run-off management policy.

1.3. Current Use & Topographical Features of the Site

The Site 2 development will take place on existing sugarcane farmland. Two farm dwellings are situated in the central and northern portion of the site, with a soccerfield more or less in the centre of Site 2.

The area is undulating with slopes ranging from between 6% up to 35% on the steeper sections.

A number of small tributaries, collectively known as the Wekeweke stream drains through the site in a southernly direction and joins up with the Sterkspruit River before draining to the Shongweni Dam, approximately 7km south-west of the development. Outflow from the dam drains to the uMlazi River towards the KwaZulu Natal coast. A number of wetland features are also encountered in these tributaries (see drawings in Annexure B).

1.4. Geological Features

The geotechnical report by Drennan, Maud & Partners dated March 2012 provides a detailed assessment of ground conditions on site. Accordingly the site is overlain by residual sandy clays and clayey sands of depths ranging from 0.5 to 2.5m. Deeply weathered bedrock is expected to be encountered between depths of less than 1m up to deeper than 3m.

The shallow bedrock encountered on certain trial holes could indicate potential for a perched water table at certain places.

1.5. Proposed Use

The proposed development will “flatten” out the current steep grades and make provision for a number of platforms with overland slopes in the region of 0.6% to 3.3%. The proposed platforms will be linked by internal access roadways between platforms. The proposed topography of the development will retain in general the drainage direction to the existing tributaries.

1.6. Legal Requirements

The management of stormwater on site is governed by two main acts:

- National Water Act (36 of 1998) which deals with pollution control and the protection of existing watercourses, and

- National Environmental Management Act (107 of 1998) which deals with compliance and duty of care and remediation to the existing environment.

This SWMP includes recommendations for compliance to the applicable legislation.

1.7. Local Authority Requirements

The eThekwini Municipality design guidelines and policy for the design of Stormwater Drainage and Stormwater Management Systems (May 2008) has been incorporated in this Management Plan.

2. Management Responsibilities

2.1. On-Site Stormwater Management

The overall development's bulk infrastructure will be developed by Tongaat Hulett Developments.

Once the services infrastructure are provided, a management association will be formed to manage stormwater facilities falling outside the individual properties.

This management association will also have an overseeing function for stormwater management on the individual properties since the discharge quantity/quality will influence stormwater management further downstream within the overall development.

Overall responsibility for water discharging from the development and draining from the tributaries to Shongweni Dam will be for the local municipality, in this case the eThekwini Municipality.

3. Exclusions

The following are excluded from the SWMP:

- The SWMP provided a holistic overview of stormwater management on site. A more detailed layout and operation of the stormwater system will need to be defined in the detail design of the development,
- This SWMP excludes the delineation of wetland and river areas, and
- The determination of floodlines is excluded from this SWMP. The development proposal is situated above the indicative 1:100 year floodlines as obtained from the Ethekwini Municipality. For reference previously determined floodlines obtained from the eThekwini Municipality are indicated on the drawings in Annexure B.

4. Major Identified Risks

The major risks applicable to this development are as follows.

4.1. Potential flooding

The development of the area will result in increased "hardening" of the area (i.e. increased impermeable surface areas). This will result in increased overland run-off that will have to be catered for. Potential risks include flooding of on-site facilities (proposed commercial, industrial & residential facilities etc.) but also off-site (existing access roads and wetland areas).

4.2. Erosion

An increase in run-off will result in the increased likelihood of erosion. The south-west portion of the development is steep (> 12%) and increased run-off coupled with the reshaping of the area, especially during the construction stage, could increase the likelyhood of erosion. To reduce erosion it is recommended that run-off be routed away from direct discharge at embankments.

4.3. Pollution

The development of the area to commercial, industrial and residential activities will increase the risk of pollution, especially to the existing wetlands and tributaries. Primary anticipated increased pollution includes hydrocarbons from vehicles, total suspended solids (TSS) from the industrial portion of the development and domestic waste from the residential portion of the development.

In addition pollution from construction materials for the proposed development and associated facilities is also a potential risk.

4.4. Sedimentation

Accumulated material on hardened surfaced which is transported to the existing wetlands during storm events can lead to a build-up of transported material in the wetlands. This material normally contains the bulk of the pollutants.

4.5. Environmental Impacts

The wetland areas and tributaries receives water from the existing property predominantly via overland run-off. It is expected that some subsurface drainage through the perched water table between the bedrock and the more clayey sands is expected. Improper management of stormwater on site could negatively affect these areas by insufficient recharging of the wetlands.

5. DESIGN PHILOSOPHY & CONCEPT HYDROLOGY MODEL

5.1. Stormwater System

The stormwater system for the proposed development must take cognisance of the impacts of both the minor and major stormwater system in terms of run-off, potential flooding, the impact on the existing wetlands, stormwater attenuation etc.).

The minor stormwater system will consist of all measures to address run-off from individual sites and road reserves, buildings and car lots to the major stormwater system for minor storm events. This includes kerbing, gutters, conduits, channels, swales, infiltration systems etc. The minor system normally deals with low/medium rainfall events with high occurrence intervals (normally up to a one in 2 or 5-year interval) which are likely to cause a level of nuisance to users if not controlled. For this development it is proposed that the minor system on all individual sites be designed to handle a 1 in 5-year storm event.

The major stormwater system will consist of the natural streams and wetlands draining south. It also includes attenuation dams and other structures to control stormwater run-off. The major system also controls run-off for high rainfall events with low occurrence intervals (usually 1 in 10 years or longer as in this case) with a high risk of flooding.

For this development it is proposed that the major system be designed to handle a 1 in 50-year storm event. Cognisance is to be taken though of risks by storms of a higher magnitude (i.e. 1 in 100-year).

As such the design philosophy for the minor and major stormwater system should allow for the following:

- Reduce stormwater flow to within a 10% variance of the pre-development flows using attenuating devices such as attenuation dams/structures or infiltration devices,
- Prevent the concentration of stormwater run-off at any point where erosion is a possibility. This will be prevalent near areas with high impermeably (roof structures, large surfaced areas) and embankments.
- Avoid ponding on site, especially near building structures,
- Avoid destabilisation of existing and proposed embankments,
- Ensure compliance to local authority standards,
- Construction of pollution reducing systems, and
- Ensure that the construction of stormwater control systems is executed in a safe and acceptable manner.

In addition the design philosophy should cater for other environmental factors that are potentially impacting on the surrounding habitat. The most important being the recharging of the natural wetlands and streams.

5.2. Conceptual Stormwater System Management for individual sites

The extent of proposed platforming on the site makes it more suitable to manage minor storm events on the individual site platforms instead of discharging directly to the wetlands and streams. Cognisance of recharging of the natural streams is to be taken into account as well.

As such it is proposed that:

- Run-off from individual sites be limited to within 10% of the pre-development run-off for a 1:5-year storm event,
- Allowance is to be made to retain the first 25mm of precipitation for any storm event on the individual sites for infiltration and recharging of the wetlands and stream. Retainment can be done via various approved attenuation devices (storage tanks, permeable paving, swales, irrigation ponds etc., see Annexure B dwg. 0243/192/SW006).

Run-off in excess of the 1 in 2-year predevelopment are to be routed to the existing streams and retained to pre-development levels via attenuation devices (attenuation ponds, buffer dams etc.).

5.3. Pollution Control

Section 4.3 deals with potential pollutant impact by the proposed development. Measures to be applied to reduce pollutants include bio-attenuation swales and infiltration measures (permeable paving). These measures will be applied at the point source (individual sites and road reserves) as far as possible.

5.4. Concept Stormwater Modelling Parameters

5.4.1. *Rainfall Data*

The following SAWS rainfall station data in the vicinity of the development were utilised:

Table 1: SAWS Rainfall Station Data

Station Name	Station No.	Records (Yrs)	MAP (WRC) (mm)	Altitude (m msl)
Shongweni	0240381_W	75	705	315
Municipal Centre - Shongweni	0240381_A	66	705	315
Intake	0240564_W	69	926	693
Bothas Hill	0240404_W	48	833	640
Inchanga (SAR)	0240284_W	70	787	700
Municipal Kloof	0240587_A	31	1037	488
Avg.			832	

The following average depth-duration-frequency rainfall data from the above stations were used for the development:

Table 2: Adopted Depth Duration Frequency Rainfall Data

Stations	See above				
MAP (avg)	832mm				
Rainfall	1-Day Design Rainfall (mm)				
Duration (Days)	2	5	20	50	100
1	70	102	164	221	276

5.4.2. *Design Storm Frequencies*

The following design storm frequency is to be used:

i) Minor stormwater system: 1 in 5 year frequency (the proposed development is predominantly industrial and commercial in use and a smaller design return period is not advisable as it will lead to more periodic nuisance flooding).

ii) Minor stormwater system – roadside swales: 1 in 5 year frequency

iii) Minor stormwater system – infiltration/storage systems – 25mm/24hr

iv) Major stormwater system/pollution control: 1 in 10 & 50 year frequency. Building floor levels to be above the 1:100 year flood level. Cognisance is to be taken of risks for a 1:100 year flood event.

5.4.3. *Run-off generation*

The SCS Formula was used to calculate run-off. Run-off was calculated using the Autodesk Storm and Sanitary Sewer Analysis Package that utilises the EPA SWMM analysis engine.

Parameters used are as follows:

Table 3: SWMM modelling parameters

Hydrology Method	SWMM
Distribution Curve	SA SCS Type 2
Link Routing	Kinematic Wave
Pre-development Weighted SCS Curve No.	Various
Post-development Weighted SCS Curve No.	Various
Conduit Manning's roughness factor	0.015
Stream Manning's roughness factor	0.032 (streambanks 0.040)

The SCS curve numbers adopted for the development are based on the SCS Urban Hydrology for Small watersheds, 2nd Ed. June 1986, SCS Curve Number Table for various land uses.

The adopted values was based on a Hydrological Soil Group C/D based on the extensive coverage of sandy clays and clayey sands and a relatively high bedrock level in certain places.

Category C/D soils typically have a moderately high to high stormflow potential with a slow rate of infiltration. Similarly engineered fills are likely to exhibit similar hydrological soil groupings or slightly worse, group D. This however will not effect the "green areas", where "light friable materials" are likely to be 300 to 500mm in depth and will have a much better soil grading, group B or better.

Soils permeability is thus considered restricted with an infiltration rate between 3 and 6mm/h and a permeability rate of 3.8mm/hr or less.

The adopted SCS CN for the pre-development scenario is as follows:

- Sugarcane, planted on contour, partial cover - 80

The adopted SCS CN for the post-development scenario is as follows:

- Roof areas – 98,
- Impermeable traffic surfaces – 98
- Permeable traffic surfaces (permeable paving) - 50
- Soft landscaping (incl. open areas in road reserves) – 80
- Undeveloped areas – 80 (as for pre-development)

For the purpose of this SWMP it is assumed that 60% of the coverage will be hard surfaces (roofs) with 30% parking and 10% soft landscaping for the post-development run-off. Once the development proposals are finalised further adjustments can be made to fine tune expected run-off figures.

5.5. Development of a Sustainable Urban Drainage System (SUDS)

One of the key approaches of this development is to attempt to "mimic" the natural hydrological cycle of the pre-development scenario as much as possible, as well as to prevent the wash-off of urban pollutants to the existing watercourses. In this regard it is proposed to provide a drainage system complying with acceptable "sustainable urban drainage systems" (SUDS) standards. The proposed measures include the following:

5.5.1. *Infiltration measures (permeable surfacing, soakaways)*

Due to the presence of bedrock relatively close to the surface and the reshaping of the platforms (in cut) it can be expected that infiltration will be dramatically reduced.

To ensure maximisation of groundwater recharging, it is recommended that infiltration measures be constructed on the platformed sites. The eThekwini Municipality guidelines for soakaways for 1m³ of storage per 40m² of hardened land is sufficient to allow the infiltrating of up to 25mm precipitation in the platformed areas. Based on a conceptual 60% hardening to roof structures, 30% paving and the remainder soft landscaping, this equates to 225m³ of storage for each hectare of hardened area (roof and paving areas).

The interception of 25mm of run-off is not adequate to handle a 1:2 year storm event (expected run-off is 70mm in 24-hours) but will be sufficient to cater for the infiltration for the majority of the minor storm events.

It is recommended that interception of roof run-off be retained within the paving areas via permeable paving. Assuming a 30% voids ratio in stone this would equate to a 250mm stone layer thickness on a permeable paving area. Note that the above won't reduce peak run-off volumes which would still have to be managed by the major storm system.

Based on the relatively low expected permeability of the in-situ soils, the permeable surfaces will have to be drained with small diameter conduits to the minor stormwater system (see Annexure B, dwgs. 0243/192/SW007 & 008).

5.6. Proposed Attenuating Measures

For the attenuating of stormwater run-off to predevelopment flow, a dual approach is to be considered.

5.6.1. *Major Stormwater Run-off Control*

Where embankments are constructed on engineering fill, careful consideration will have to be applied to prevent erosion on unstable banks. In this regard it is recommended that kerbing upstream of embankment slopes be constructed to divert flow away to an underground conduit or stabilised channel to the existing major stormwater system. Energy dissipaters will be required where further erosion is a possibility, on the outlets from underground conduits or the run-off from the embankments.

5.6.2. *Roadways*

Due to the large open nature of the development, the road reserves form a relatively small portion of the total area and thus do not contribute significantly to run-off.

Although roadways will be impermeable surfaces, run-off will be directed to roadside swales for infiltration.

5.7. Catchment Hydrology Results

Annexure C contains a tabulated summary of expected run-off flows for the pre-development scenario. The expected pre-development flows for the various subcatchments are indicated on dwg. 0243/192/SW003 (Annexure B). Due to the extensive reshaping and change in delineation of the proposed development to form the individual platforms, a direct comparison of subcatchments run-off for the pre- and post-development scenarios for individual subcatchments is not possible.

The anticipated run-off for the 1:2, 1:5, 1:50 & 1:100 year storm events for the post-development subcatchments is shown on dwg. 0243/192/SW005 (also see Annexures D & E).

5.7.1. *Conceptual model run-off*

The expected pre- and post-development run-off draining the site at the convergence of the tributaries at Junction (node) J-54 (see dwgs. 0243/192/SW002-005) is as follows:

Table 4: Expected peak run-off for different return intervals (J-54)

Return Period	Pre-development Run-off	Post-development Run-off excl. infiltration measures	Post-development Run-off with infiltration measures
1:2	3.60	6.33	3.65
1:5	9.54	12.80	9.35
1:50	39.13	43.62	37.18
1:100	55.49	60.29	53.34

From the model results in Annexure D and Table 4 the post-development run-off with infiltration measures stays within the 10% variance for pre-development flow **without the need for attenuation dams**.

The following reasons can be attributed to this:

- The nature of the existing soils on site (clayey sands/sandy clays) is of a poorly draining material. With the proposed development and site "hardening', the increase in run-off is less than normally expected.

- The existing steep slopes that will be cut back to form flatter platforms will result in slower catchment response times and thus reduced peak run-offs,

- The rerouting of run-off from certain cathments site over a longer flowpath (as in the case with subcatchments B12 & B13) also results in slower catchment response times, and

- On site infiltration measures are acting as attenuation facilities for the development.

Without infiltration measures, attenuation dams will be required to limit flows to pre-development run-off. The anticipated volume of storage required is approximately 9, 600m³. To limit the depth of attenuation dams to less than 4,0m it is proposed that the storage requirement be split up in 3 or more dams. Drawing 0243/192/SW006 contains a conceptual layout and positioning of proposed attenuation dams (see Annexure E for the model results).

5.8. Wetlands Recharging

From the model results in Annexure C the pre-development infiltration potential (that could potentially recharge the existing wetlands) for a minor storm is in the region of 62, 900m³ for a 1:2 year storm event which reduces to 52, 400m³ for the post-development scenario with infiltration (see Annexure D).

With the further inclusion of swales it is expected that the infiltration would be within the 10% variance for pre-development flow.

The infiltration volume without consideration for permeable paving is 33 500m³ for a 1:2 year storm event or 53% of the pre-development infiltration (see Annexure E).

From the above the requirement to recharge the existing wetlands can be adequately met using infiltration measures such as permeable paving as a medium to "mimic" the natural environment.

5.9. Special Considerations

5.9.1. *General Embankment protection*

The proposed platform embankments are in general at a slope of 1:2 according to the latest layout. This is considered too steep to prevent erosion and measures will be required to minimise run-off to the embankments, especially for large storm events.

Even with the bulk of overland run-off being redirected via kerbing, a certain level of erosion can be expected from precipitation on the embankments. It is recommended that these embankments be stabilised as soon as possible during the construction phase.

6. SITE ESTABLISHMENT AND PRELIMINARY ACTIVITIES

The following general conditions must be adhered to and maintained during the site establishment and preliminary activities of the project.

6.1. Existing Stormwater Systems

All existing drainage systems (streams, channels) are to be maintained by the main developer in accordance with normal agricultural soil conservation practices and local authority guidelines as far as possible (except where the town planning layout makes provision for the development of land over existing drainage systems).

6.2. Access Routes

Access routes to the construction site must follow the existing access roads as far as possible. Should new access roads be required these must be constructed in a way to minimise concentrated flow run-off and pollution to the existing wetlands.

6.3. Existing stormwater systems

Prior to moving onto site, the Engineer and Contractor shall inspect the existing stormwater drainage measures along these access routes and repair or construct new drainage measures to limit point source run-off, prevent erosion and allow for the natural flow of water.

The drainage measures shall include:

i) Side drains and mitre drains.

ii) Scour check walls of rocks, wooden pegs or bundled brush, constructed in long runs of side drains for the following gradients:

Gradient of Drain	Scour Check Spacing
Less than 4%	Not required
5%	20 m
8%	10 m
10%	5 m

6.4. Contractors Site Camp

The clearing of vegetation for the contractor's site camp is to be limited to the site camp area only.

The creation of hardened surfaces within the site camp area is to be kept to a minimum and is to be agreed to by the Engineer prior to construction.

Any soil or topsoil stockpiles created during site establishment are to be maintained as flat as possible, with no side slope greater than 1 in 4. The stockpiles are to be covered with cut brush found on site to provide wind screening and prevent soil loss.

7. CONSTRUCTION STAGE ACTIVITIES

7.1. Programming

Stripping of vegetation to allow commencement of construction of the earthworks platform shall only be undertaken immediately prior to that element of construction commencing.

Construction of the embankment shall be done in segments up to full height, before moving on to the next area, clearing vegetation, and constructing embankment, etc.

The construction of internal stormwater piped systems are to be programmed for construction immediately on completion of the bulk earthworks for the road works.

7.2. Stockpiles

Any soil or topsoil stockpiles created during the construction phase is to be maintained as flat as possible, shall not exceed 6m in height.

Materials from stockpiles are to be used as soon as is practically possible or spread and spoiled in designated areas.

7.3. Haulage and Temporary Access Roads on Site

Construction vehicles must be restricted to demarcated access routes and turning areas.

7.4. Exposed Surfaces

To minimize the time that an area is exposed, the stripping of vegetation is to be carried out progressively and immediately prior to commencement of construction activities in a particular area.

Topsoiling and re-vegetation of exposed surfaces is to commence immediately after the completion of all construction activity.

All embankments or cut slopes, unless otherwise directed by the Engineer, shall be protected by a cut off drain to prevent water from cascading down the face of the slope.

7.5. Stormwater Systems

No dumping of construction rubble or spoil is to occur in completed stormwater drains, pipes, channels or natural drainage lines (existing wetland, stream and riparian zone).

Weekly checks are to be carried out on the site's drainage system to ensure that the water flow is unobstructed. These are to be repaired or cleared of silt if required.

7.6. Contract Completion

All undeveloped surfaces hardened due to construction activities are to be ripped, topsoiled and vegetated as soon as possible.

8. MAINTENANCE

Following the completion of the works and the handover of the development, it will be the responsibility of the constituted Home Owners Association (or designated maintenance body) to maintain the stormwater system in a safe and responsible manner.

The following provides a guideline for the general maintenance of the system and an overview of routine inspections required.

8.1. General Maintenance

It is good practice to reserve certain months of the year before the onset of the summer rains to carry out routine maintenance work on the stormwater system. Serious problems should however receive immediate attention. Work which is of a critical nature should be done under the supervision of a professional engineer or according to his instructions.

8.1.1. *Kerb Inlets*

All kerb inlets need to be inspected and cleared of any build up of silt, litter, vegetation or rubble that may impede the clear flow of water into the inlet. It also needs to be inspected for structural damage and repaired if necessary.

8.1.2. *Piped Systems*

Piped systems need to be checked in a systematic way to ensure they are clear of any obstructions and are able to flow at their full capacity. Any build up of silt or other obstruction is to be removed by hand or by jetting.

8.1.3. *Swales*

Swales need to be check and cleaned at regular interval. Excess vegetation and/or silt build up in swales is to be removed on a periodic basis.

8.2. Routine Inspections

Routine inspection should be carried out every three months by a competent person appointed by the responsible body or association. The required qualification for such a person is that they shall be well acquainted with the contents of this document, should be alert and be endowed with sound judgement so that he/she will know when to call for assistance, arrange for maintenance or immediate intervention.

The inspection route to be followed should include the following:

i) Kerb inlets for blockages or structural damage.

ii) The full length of the main drainage swales and piped outlets. These should be inspected for erosion, poor vegetation, silt deposition, blockages or damages to structures.

iii) The full length of the crest, toe, upstream and downstream slopes of the embankments surrounding the detention dams. These should be inspected or any signs of open cracks, sink holes or piped tunnels or poor vegetation.

iv) Inspect the inlet and outlet works from each of the detention dams, as well as the area around and downstream of the outlets, for blockages, signs of erosion, silt deposition or undercutting of structures.

During the inspection maintenance requirements are to be noted and arrangements made to complete these works

Prepared by L Streicher
Bosch Stemele (Pty) Ltd

NTSHONGWENI DEVELOPMENT

STORMWATER MANAGEMENT PLAN – SITE 2

I N D E X

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ANNEXURE A: LOCALITY PLAN

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ANNEXURE C: PRE-DEVELOPMENT RUN-OFF DATA

ANNEXURE D: POST-DEVELOPMENT RUN-OFF DATA (WITH INFILTRATION MEASURES)

ANNEXURE E: POST-DEVELOPMENT RUN-OFF DATA (EXCLUDING INFILTRATION MEASURES)

NTSHONGWENI DEVELOPMENT

STORMWATER MANAGEMENT PLAN – SITE 2

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SYNOPSIS: Ntshongweni Development Stormwater Management Plan Site 2	
FUNCTION: Civil Engineering	

BOSCH STEMELE

QUALITY VERIFICATION

This report has been prepared under the controls established by a quality management system that meets the requirements of ISO9001: 2008 which has been independently certified by DEKRA Certificate under certificate number 20705704

ISO 9001:2008 CERTIFIED

Verification	Capacity	Name	Signature	Date
Checked by:	Lead Engineer	**A Knox**		
Reviewed by:	Project Manager	**P Tooley**		
Authorised by:	Director	**C Kroeger**		
Accepted by:	Client Authorised Representative	**R Wilkinson**		

CONTRACT No. 243/192 JULY 2013

NTSHONGWENI DEVELOPMENT

STORMWATER MANAGEMENT PLAN – SITE 2

ANNEXURE A

LOCALITY PLAN

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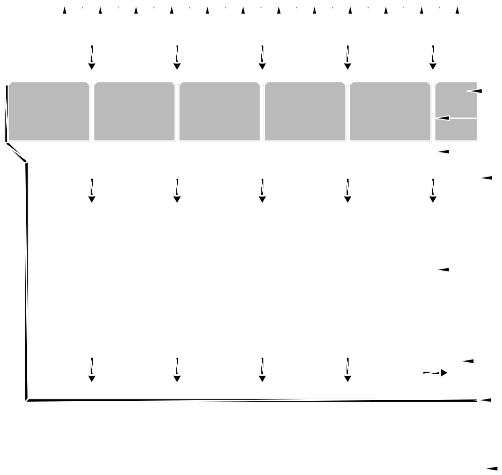
ANNEXURE B

DRAWINGS & TYPICAL DETAILS



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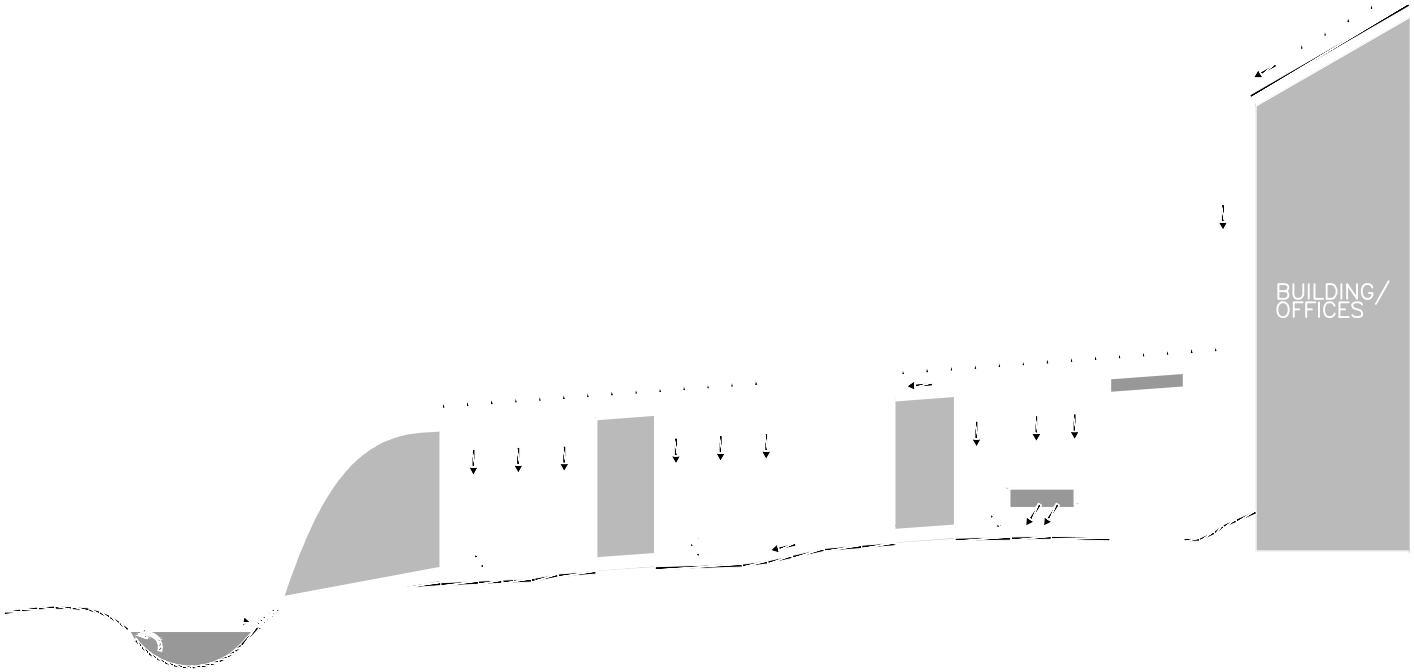

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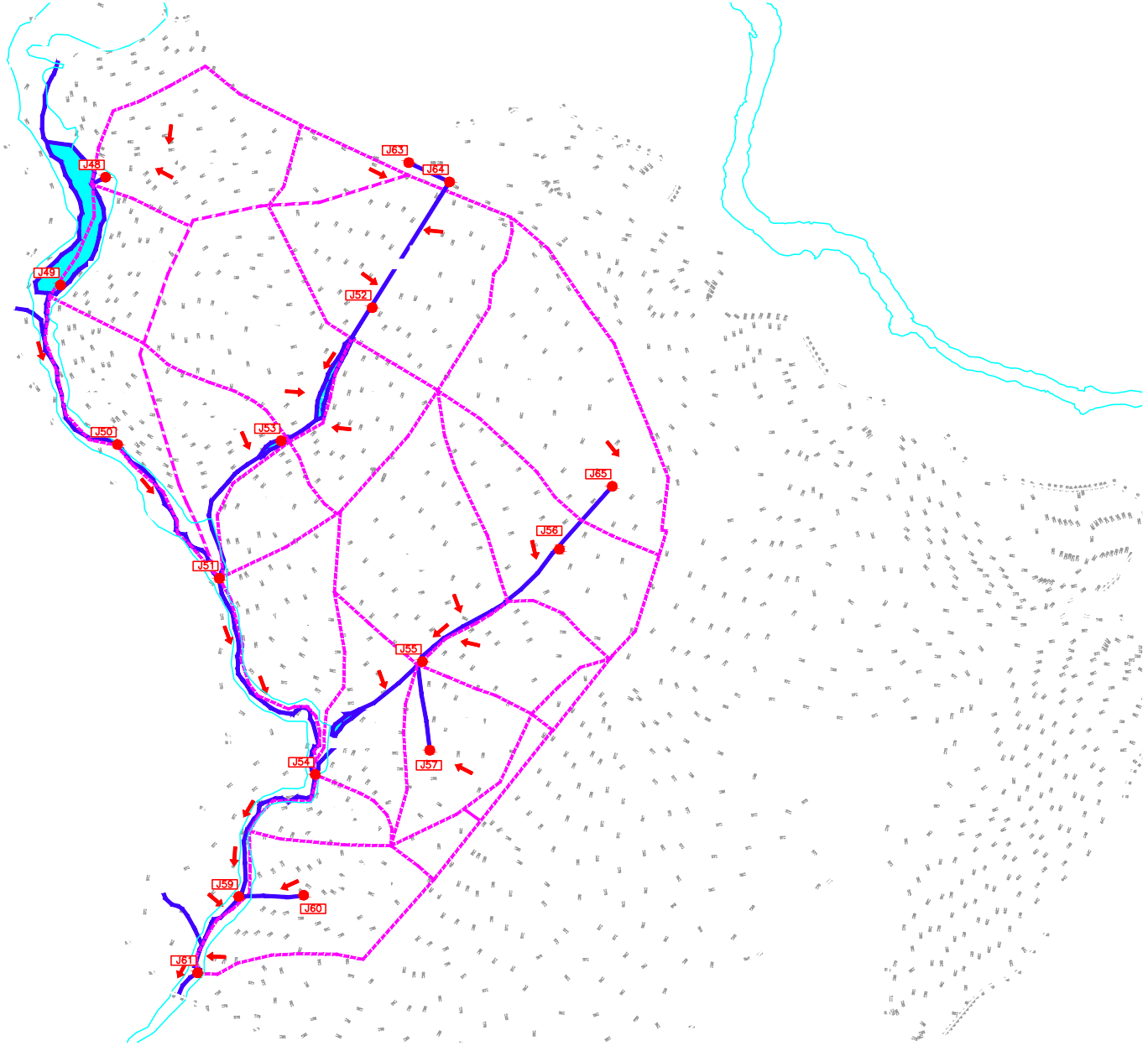

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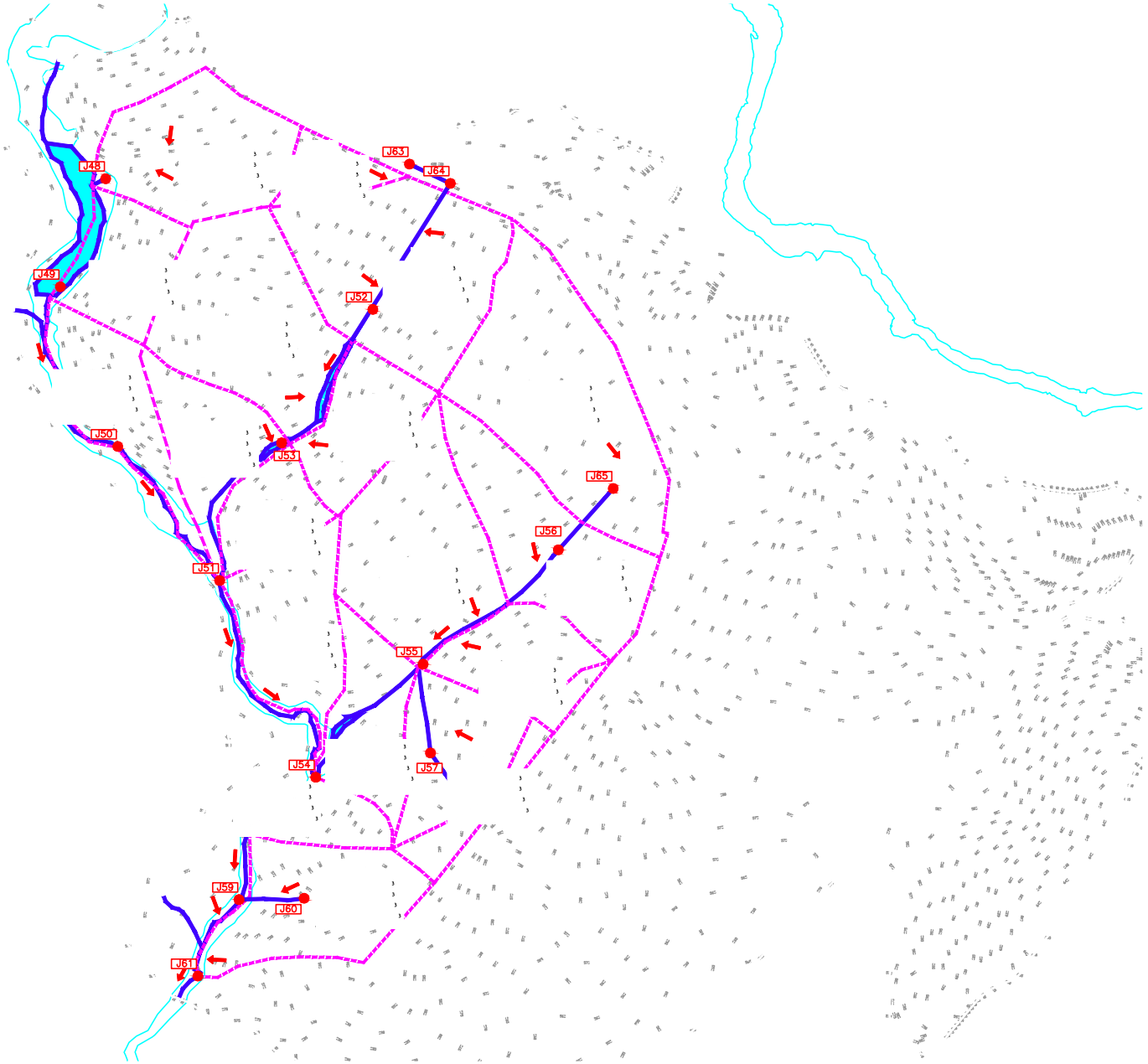

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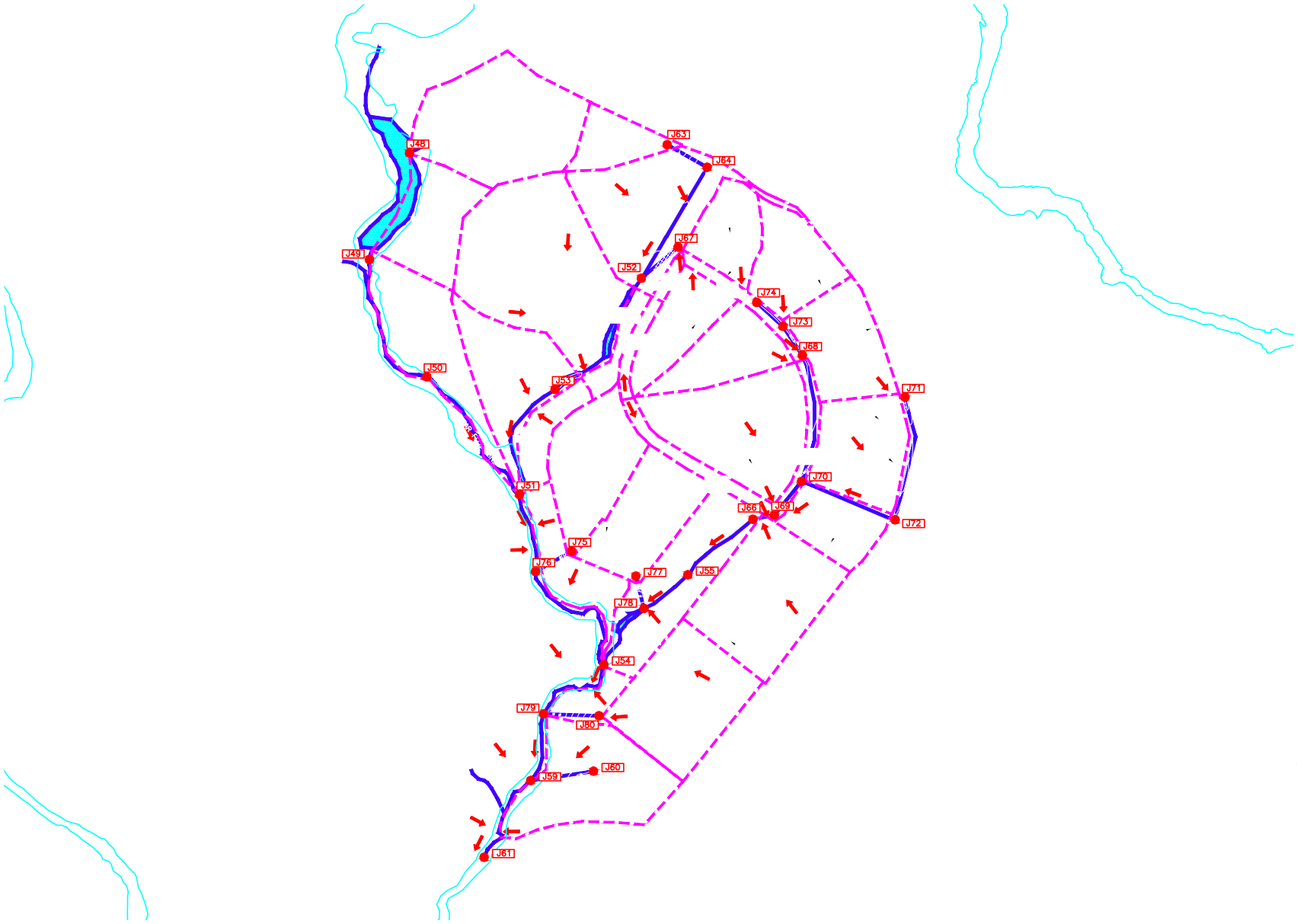

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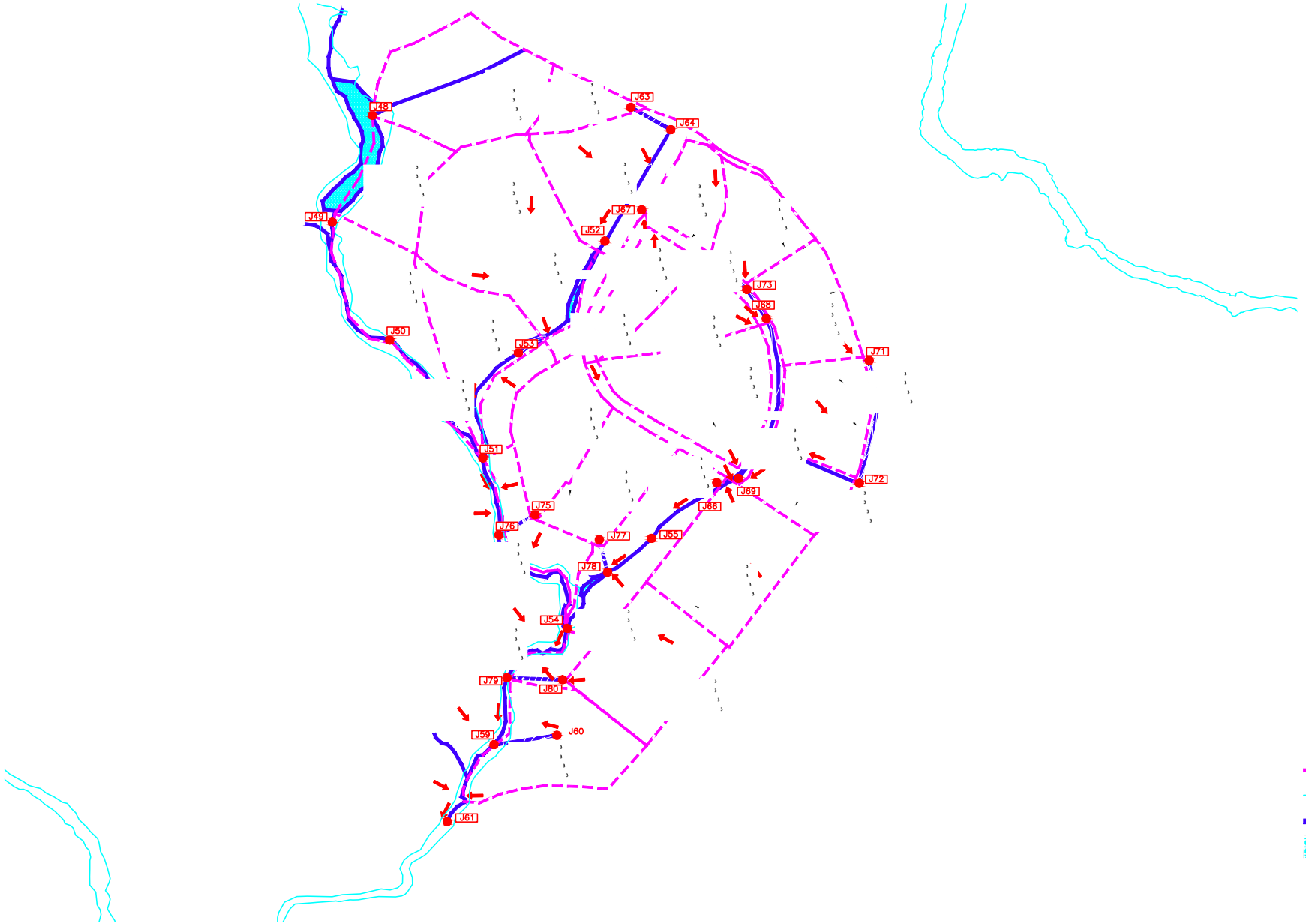
BLOCK 2, GROUND FLOOR, GREEN ACRES OFFICE PARK
2nd AVENUE, NEWTON PARK, PORT ELIZABETH, 6045, RSA
TELEPHONE: (041) 363 0598 TELEFAX: (041) 363 7646
E-mail: bspe@boschstemele.co.za
www.boschstemele.co.za



J72

BOSCH STEMELE (PTY) LTD.
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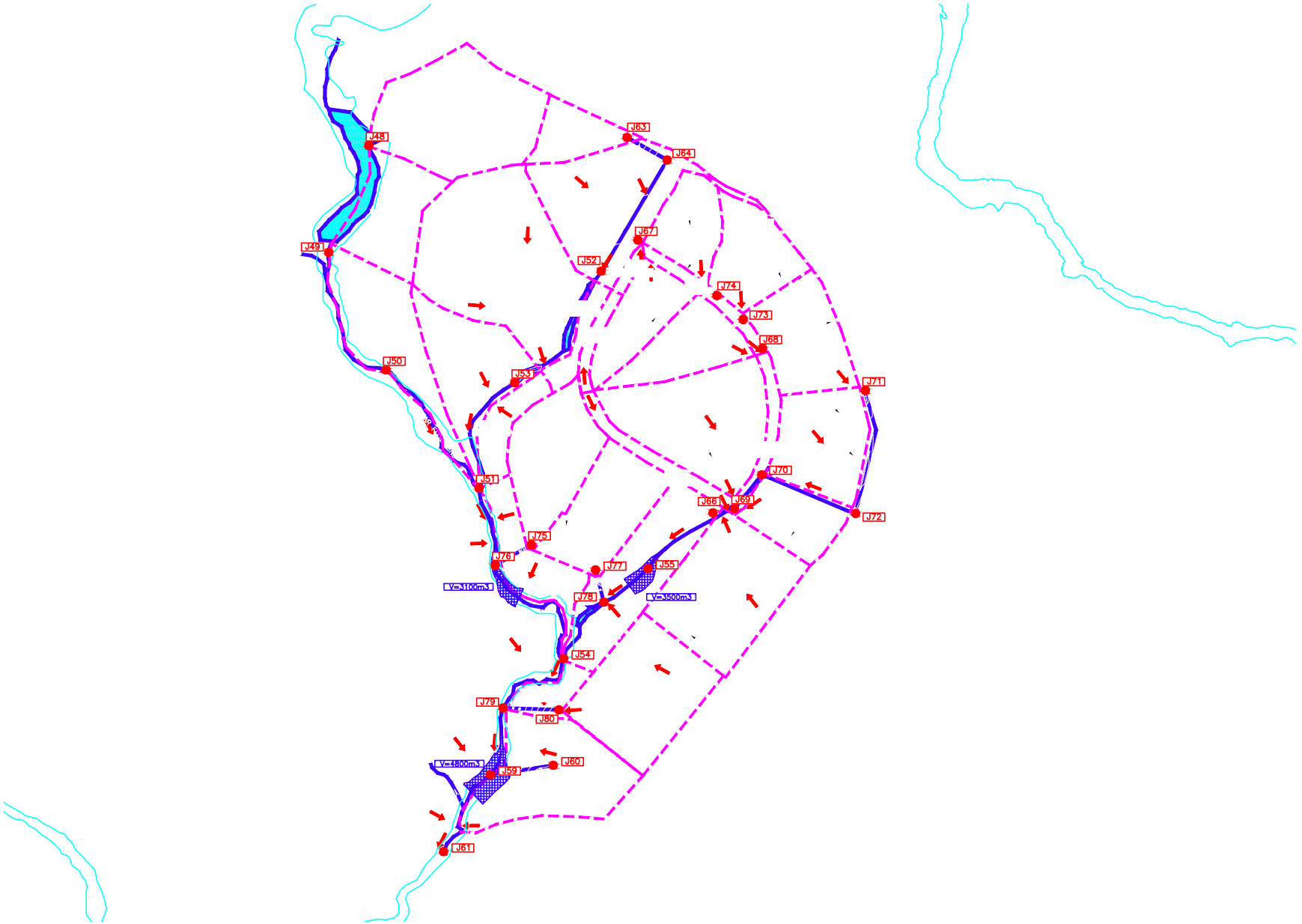

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ANNEXURE C

PRE-DEVELOPMENT RUN-OFF DATA

Ntshongweni Development Site 2 SWMP: **1-2 year storm - Pre-development junction flow**

SN	Element ID	X Coordinate	Y Coordinate	Invert Elevation	Ground/Rim (Max) Elevation	Ground/Rim (Max) Offset	Initial Water Elevation	Initial Water Depth	Surcharge Elevation	Surcharge Depth	Ponded Area	Minimum Pipe Cover	Peak Inflow	Peak Lateral Inflow	Maximum HGL Elevation Attained	Maximum HGL Depth Attained	Maximum Surcharge Depth Attained	Minimum Freeboard Attained	Average HGL Elevation Attained	Average HGL Depth Attained	Time of Maximum HGL Occurrence	Time of Peak Flooding Occurrence	Total Flooded Volume	Total Time Flooded
				(m)	(m)	(m)	(m)	(m)	(m)	(m)	(m²)	(m)	(cms)	(cms)	(m)	(m)	(m)	(m)	(m)	(m)	(days hh:mm)	(days hh:mm)	(ha-mm)	(minutes)
1	Jun-48	1305,17	1434,25	585,50	591,50	6,00	585,50	0,00	591,50	0,00	0,00	4,00	0,57	0,57	585,54	0,04	0,00	5,96	585,51	0,01	0 12:22	0 00:00	0,00	0,00
2	Jun-49	1209,63	1190,07	583,00	589,00	6,00	583,00	0,00	589,00	0,00	0,00	4,00	0,77	0,44	583,13	0,13	0,00	5,87	583,03	0,03	0 12:51	0 00:00	0,00	0,00
3	Jun-50	1358,53	863,14	578,00	584,00	6,00	578,00	0,00	584,00	0,00	0,00	4,00	0,62	0,57	578,16	0,16	0,00	5,84	578,04	0,04	0 12:43	0 00:00	0,00	0,00
4	Jun-51	1583,92	570,24	573,00	579,00	6,00	573,00	0,00	579,00	0,00	0,00	1,00	2,01	0,71	573,49	0,49	0,00	7,51	573,11	0,11	0 12:50	0 00:00	0,00	0,00
5	Jun-52	1906,22	1144,07	588,20	594,20	6,00	588,20	0,00	594,20	0,00	0,00	2,00	0,63	0,50	588,25	0,05	0,00	5,95	588,21	0,01	0 12:33	0 00:00	0,00	0,00
6	Jun-53	1692,81	848,99	580,30	586,30	6,00	580,30	0,00	586,30	0,00	0,00	1,00	1,35	0,93	580,52	0,22	0,00	7,78	580,35	0,05	0 12:41	0 00:00	0,00	0,00
7	Jun-54	1791,89	142,32	566,00	572,00	6,00	566,00	0,00	572,00	0,00	0,00	0,00	3,60	1,01	566,65	0,65	0,00	5,35	566,15	0,15	0 12:51	0 00:00	0,00	0,00
8	Jun-55	2002,04	365,54	576,00	582,00	6,00	576,00	0,00	582,00	0,00	0,00	1,00	1,46	0,30	576,12	0,12	0,00	5,88	576,03	0,03	0 12:48	0 00:00	0,00	0,00
9	Jun-56	2298,21	607,26	581,00	587,00	6,00	581,00	0,00	587,00	0,00	0,00	3,00	1,00	0,36	581,06	0,06	0,00	5,94	581,01	0,01	0 12:32	0 00:00	0,00	0,00
10	Jun-57	2044,51	193,50	587,50	593,50	6,00	587,50	0,00	593,50	0,00	0,00	1,00	0,28	0,28	587,52	0,02	0,00	5,98	587,50	0,00	0 12:18	0 00:00	0,00	0,00
11	Jun-59	1627,47	-124,45	561,00	567,00	6,00	561,00	0,00	567,00	0,00	0,00	0,00	3,85	0,00	561,62	0,62	0,00	5,38	561,15	0,15	0 12:54	0 00:00	0,00	0,00
12	Jun-60	1765,76	-130,98	571,00	577,00	6,00	571,00	0,00	577,00	0,00	0,00	1,00	0,47	0,47	571,09	0,09	0,00	5,91	571,01	0,01	0 12:13	0 00:00	0,00	0,00
13	Jun-61	1509,88	-316,09	559,00	565,00	6,00	559,00	0,00	565,00	0,00	0,00	1,00	3,84	0,00	559,35	0,35	0,00	5,65	559,07	0,07	0 12:55	0 00:00	0,00	0,00
14	Jun-63	1972,06	1458,12	606,00	612,00	6,00	606,00	0,00	612,00	0,00	0,00	5,00	0,16	0,16	606,03	0,03	0,00	5,97	606,00	0,00	0 12:12	0 00:00	0,00	0,00
15	Jun-64	2061,49	1415,89	595,00	601,00	6,00	595,00	0,00	601,00	0,00	0,00	2,00	0,16	0,00	595,02	0,02	0,00	5,98	595,00	0,00	0 12:22	0 00:00	0,00	0,00
16	Jun-65	2417,35	749,27	585,00	591,00	6,00	585,00	0,00	591,00	0,00	0,00	3,00	0,64	0,64	585,04	0,04	0,00	5,96	585,01	0,01	0 12:14	0 00:00	0,00	0,00
17	Jun-66	1798,09	200,74	566,80	572,80	6,00	566,80	0,00	572,80	0,00	0,00	2,00	1,90	0,00	567,29	0,49	0,00	5,51	566,91	0,11	0 12:54	0 00:00	0,00	0,00
18	Jun-67	1823,71	186,48	567,80	573,80	6,00	567,80	0,00	573,80	0,00	0,00	3,00	1,30	0,00	567,92	0,12	0,00	5,88	567,83	0,03	0 12:50	0 00:00	0,00	0,00

Ntshongweni Development Site 2 SWMP: **1-5 year storm - Pre-development junction flow**

SN	Element ID	X Coordinate	Y Coordinate	Invert Elevation	Ground/Rim (Max) Elevation	Ground/Rim (Max) Offset	Initial Water Elevation	Initial Water Depth	Surcharge Elevation	Surcharge Depth	Ponded Area	Minimum Pipe Cover	Peak Inflow	Peak Lateral Inflow	Maximum HGL Elevation Attained	Maximum HGL Depth Attained	Maximum Surcharge Depth Attained	Minimum Freeboard Attained	Average HGL Elevation Attained	Average HGL Depth Attained	Time of Maximum HGL Occurrence	Time of Peak Flooding Occurrence	Total Flooded Volume	Total Time Flooded
				(m)	(m)	(m)	(m)	(m)	(m)	(m)	(m²)	(m)	(cms)	(cms)	(m)	(m)	(m)	(m)	(m)	(m)	(days hh:mm)	(days hh:mm)	(ha-mm)	(minutes)
1	Jun-48	1305,17	1434,25	585,50	591,50	6,00	585,50	0,00	591,50	0,00	0,00	4,00	1,41	1,41	585,57	0,07	0,00	5,93	585,51	0,01	0 12:15	0 00:00	0,00	0,00
2	Jun-49	1209,63	1190,07	583,00	589,00	6,00	583,00	0,00	589,00	0,00	0,00	4,00	1,96	0,92	583,23	0,23	0,00	5,77	583,04	0,04	0 12:31	0 00:00	0,00	0,00
3	Jun-50	1358,53	863,14	578,00	584,00	6,00	578,00	0,00	584,00	0,00	0,00	4,00	1,61	1,26	578,27	0,27	0,00	5,73	578,05	0,05	0 12:27	0 00:00	0,00	0,00
4	Jun-51	1583,92	570,24	573,00	579,00	6,00	573,00	0,00	579,00	0,00	0,00	1,00	5,57	1,65	573,79	0,79	0,00	7,21	573,15	0,15	0 12:33	0 00:00	0,00	0,00
5	Jun-52	1906,22	1144,07	588,20	594,20	6,00	588,20	0,00	594,20	0,00	0,00	2,00	1,64	1,32	588,29	0,09	0,00	5,91	588,21	0,01	0 12:21	0 00:00	0,00	0,00
6	Jun-53	1692,81	848,99	580,30	586,30	6,00	580,30	0,00	586,30	0,00	0,00	1,00	3,55	2,38	580,66	0,36	0,00	7,64	580,36	0,06	0 12:25	0 00:00	0,00	0,00
7	Jun-54	1791,89	142,32	566,00	572,00	6,00	566,00	0,00	572,00	0,00	0,00	0,00	9,54	2,44	567,02	1,02	0,00	4,98	566,21	0,21	0 12:34	0 00:00	0,00	0,00
8	Jun-55	2002,04	365,54	576,00	582,00	6,00	576,00	0,00	582,00	0,00	0,00	1,00	3,87	0,82	576,22	0,22	0,00	5,78	576,04	0,04	0 12:31	0 00:00	0,00	0,00
9	Jun-56	2298,21	607,26	581,00	587,00	6,00	581,00	0,00	587,00	0,00	0,00	3,00	2,60	0,94	581,10	0,10	0,00	5,90	581,01	0,01	0 12:21	0 00:00	0,00	0,00
10	Jun-57	2044,51	193,50	587,50	593,50	6,00	587,50	0,00	593,50	0,00	0,00	1,00	0,73	0,73	587,54	0,04	0,00	5,96	587,51	0,01	0 12:12	0 00:00	0,00	0,00
11	Jun-59	1627,47	-124,45	561,00	567,00	6,00	561,00	0,00	567,00	0,00	0,00	0,00	10,16	0,00	561,97	0,97	0,00	5,03	561,20	0,20	0 12:37	0 00:00	0,00	0,00
12	Jun-60	1765,76	-130,98	571,00	577,00	6,00	571,00	0,00	577,00	0,00	0,00	1,00	1,19	1,19	571,15	0,15	0,00	5,85	571,02	0,02	0 12:10	0 00:00	0,00	0,00
13	Jun-61	1509,88	-316,09	559,00	565,00	6,00	559,00	0,00	565,00	0,00	0,00	1,00	10,11	0,00	559,59	0,59	0,00	5,41	559,10	0,10	0 12:38	0 00:00	0,00	0,00
14	Jun-63	1972,06	1458,12	606,00	612,00	6,00	606,00	0,00	612,00	0,00	0,00	5,00	0,38	0,38	606,06	0,06	0,00	5,94	606,01	0,01	0 12:10	0 00:00	0,00	0,00
15	Jun-64	2061,49	1415,89	595,00	601,00	6,00	595,00	0,00	601,00	0,00	0,00	2,00	0,38	0,00	595,04	0,04	0,00	5,96	595,00	0,00	0 12:15	0 00:00	0,00	0,00
16	Jun-65	2417,35	749,27	585,00	591,00	6,00	585,00	0,00	591,00	0,00	0,00	3,00	1,67	1,67	585,07	0,07	0,00	5,93	585,01	0,01	0 12:15	0 00:00	0,00	0,00
17	Jun-66	1798,09	200,74	566,80	572,80	6,00	566,80	0,00	572,80	0,00	0,00	2,00	5,06	0,00	567,59	0,79	0,00	5,21	566,95	0,15	0 12:37	0 00:00	0,00	0,00
18	Jun-67	1823,71	186,48	567,80	573,80	6,00	567,80	0,00	573,80	0,00	0,00	3,00	3,49	0,00	568,02	0,22	0,00	5,78	567,84	0,04	0 12:32	0 00:00	0,00	0,00

Ntshongweni Development Site 2 SWMP: **1-50 year storm - Pre-development junction flow**

SN	Element ID	X Coordinate	Y Coordinate	Invert Elevation	Ground/Rim (Max) Elevation	Ground/Rim (Max) Offset	Initial Water Elevation	Initial Water Depth	Surcharge Elevation	Surcharge Depth	Ponded Area	Minimum Pipe Cover	Peak Inflow	Peak Lateral Inflow	Maximum HGL Elevation Attained	Maximum HGL Depth Attained	Maximum Surcharge Depth Attained	Minimum Freeboard Attained	Average HGL Elevation Attained	Average HGL Depth Attained	Time of Maximum HGL Occurrence	Time of Peak Flooding Occurrence	Total Flooded Volume	Total Time Flooded
				(m)	(m)	(m)	(m)	(m)	(m)	(m)	(m²)	(m)	(cms)	(cms)	(m)	(m)	(m)	(m)	(m)	(m)	(days hh:mm)	(days hh:mm)	(ha-mm)	(minutes)
1	Jun-48	1305,17	1434,25	585,50	591,50	6,00	585,50	0,00	591,50	0,00	0,00	4,00	4,96	4,96	585,65	0,15	0,00	5,85	585,52	0,02	0 12:11	0 00:00	0,00	0,00
2	Jun-49	1209,63	1190,07	583,00	589,00	6,00	583,00	0,00	589,00	0,00	0,00	4,00	7,13	3,00	583,48	0,48	0,00	5,52	583,08	0,08	0 12:18	0 00:00	0,00	0,00
3	Jun-50	1358,53	863,14	578,00	584,00	6,00	578,00	0,00	584,00	0,00	0,00	4,00	7,27	4,00	578,55	0,55	0,00	5,45	578,09	0,09	0 12:17	0 00:00	0,00	0,00
4	Jun-51	1583,92	570,24	573,00	579,00	6,00	573,00	0,00	579,00	0,00	0,00	1,00	23,45	5,32	574,50	1,50	0,00	6,50	573,27	0,27	0 12:21	0 00:00	0,00	0,00
5	Jun-52	1906,22	1144,07	588,20	594,20	6,00	588,20	0,00	594,20	0,00	0,00	2,00	6,58	5,42	588,41	0,21	0,00	5,79	588,23	0,03	0 12:14	0 00:00	0,00	0,00
6	Jun-53	1692,81	848,99	580,30	586,30	6,00	580,30	0,00	586,30	0,00	0,00	1,00	14,15	8,83	580,99	0,69	0,00	7,31	580,42	0,12	0 12:15	0 00:00	0,00	0,00
7	Jun-54	1791,89	142,32	566,00	572,00	6,00	566,00	0,00	572,00	0,00	0,00	0,00	39,13	8,32	567,85	1,85	0,00	4,15	566,37	0,37	0 12:23	0 00:00	0,00	0,00
8	Jun-55	2002,04	365,54	576,00	582,00	6,00	576,00	0,00	582,00	0,00	0,00	1,00	16,13	3,80	576,50	0,50	0,00	5,50	576,07	0,07	0 12:19	0 00:00	0,00	0,00
9	Jun-56	2298,21	607,26	581,00	587,00	6,00	581,00	0,00	587,00	0,00	0,00	3,00	10,45	3,87	581,24	0,24	0,00	5,76	581,03	0,03	0 12:14	0 00:00	0,00	0,00
10	Jun-57	2044,51	193,50	587,50	593,50	6,00	587,50	0,00	593,50	0,00	0,00	1,00	2,81	2,81	587,60	0,10	0,00	5,90	587,51	0,01	0 12:10	0 00:00	0,00	0,00
11	Jun-59	1627,47	-124,45	561,00	567,00	6,00	561,00	0,00	567,00	0,00	0,00	0,00	41,42	0,00	562,77	1,77	0,00	4,23	561,36	0,36	0 12:25	0 00:00	0,00	0,00
12	Jun-60	1765,76	-130,98	571,00	577,00	6,00	571,00	0,00	577,00	0,00	0,00	1,00	4,36	4,36	571,32	0,32	0,00	5,68	571,04	0,04	0 12:10	0 00:00	0,00	0,00
13	Jun-61	1509,88	-316,09	559,00	565,00	6,00	559,00	0,00	565,00	0,00	0,00	1,00	41,14	0,00	560,26	1,26	0,00	4,74	559,20	0,20	0 12:26	0 00:00	0,00	0,00
14	Jun-63	1972,06	1458,12	606,00	612,00	6,00	606,00	0,00	612,00	0,00	0,00	5,00	1,29	1,29	606,12	0,12	0,00	5,88	606,01	0,01	0 12:10	0 00:00	0,00	0,00
15	Jun-64	2061,49	1415,89	595,00	601,00	6,00	595,00	0,00	601,00	0,00	0,00	2,00	1,30	0,00	595,08	0,08	0,00	5,92	595,01	0,01	0 12:11	0 00:00	0,00	0,00
16	Jun-65	2417,35	749,27	585,00	591,00	6,00	585,00	0,00	591,00	0,00	0,00	3,00	6,74	6,74	585,16	0,16	0,00	5,84	585,02	0,02	0 12:10	0 00:00	0,00	0,00
17	Jun-66	1798,09	200,74	566,80	572,80	6,00	566,80	0,00	572,80	0,00	0,00	2,00	20,97	0,00	568,38	1,58	0,00	4,42	567,07	0,27	0 12:24	0 00:00	0,00	0,00
18	Jun-67	1823,71	186,48	567,80	573,80	6,00	567,80	0,00	573,80	0,00	0,00	3,00	14,87	0,00	568,29	0,49	0,00	5,51	567,87	0,07	0 12:20	0 00:00	0,00	0,00

Ntshongweni Development Site 2 SWMP: **1-100 year storm - Pre-development junction flow**

SN	Element ID	X Coordinate	Y Coordinate	Invert Elevation	Ground/Rim (Max) Elevation	Ground/Rim (Max) Offset	Initial Water Elevation	Initial Water Depth	Surcharge Elevation	Surcharge Depth	Ponded Area	Minimum Pipe Cover	Peak Inflow	Peak Lateral Inflow	Maximum HGL Elevation Attained	Maximum HGL Depth Attained	Maximum Surcharge Depth Attained	Minimum Freeboard Attained	Average HGL Elevation Attained	Average HGL Depth Attained	Time of Maximum HGL Occurrence	Time of Peak Flooding Occurrence	Total Flooded Volume	Total Time Flooded
				(m)	(m)	(m)	(m)	(m)	(m)	(m)	(m^2)	(m)	(cms)	(cms)	(m)	(m)	(m)	(m)	(m)	(m)	(days hh:mm)	(days hh:mm)	(ha-mm)	(minutes)
1	Jun-48	1305,17	1434,25	585,50	591,50	6,00	585,50	0,00	591,50	0,00	0,00	4,00	6,72	6,72	585,68	0,18	0,00	5,82	585,52	0,02	0 12:11	0 00:00	0,00	0,00
2	Jun-49	1209,63	1190,07	583,00	589,00	6,00	583,00	0,00	589,00	0,00	0,00	4,00	9,73	4,08	583,57	0,57	0,00	5,43	583,10	0,10	0 12:16	0 00:00	0,00	0,00
3	Jun-50	1358,53	863,14	578,00	584,00	6,00	578,00	0,00	584,00	0,00	0,00	4,00	10,45	5,48	578,64	0,64	0,00	5,36	578,12	0,12	0 12:16	0 00:00	0,00	0,00
4	Jun-51	1583,92	570,24	573,00	579,00	6,00	573,00	0,00	579,00	0,00	0,00	1,00	33,26	7,28	574,73	1,73	0,00	6,27	573,34	0,34	0 12:19	0 00:00	0,00	0,00
5	Jun-52	1906,22	1144,07	588,20	594,20	6,00	588,20	0,00	594,20	0,00	0,00	2,00	9,25	7,61	588,45	0,25	0,00	5,75	588,23	0,03	0 12:13	0 00:00	0,00	0,00
6	Jun-53	1692,81	848,99	580,30	586,30	6,00	580,30	0,00	586,30	0,00	0,00	1,00	19,93	12,12	581,10	0,80	0,00	7,20	580,45	0,15	0 12:14	0 00:00	0,00	0,00
7	Jun-54	1791,89	142,32	566,00	572,00	6,00	566,00	0,00	572,00	0,00	0,00	0,00	55,49	11,22	568,12	2,12	0,00	3,88	566,46	0,46	0 12:20	0 00:00	0,00	0,00
8	Jun-55	2002,04	365,54	576,00	582,00	6,00	576,00	0,00	582,00	0,00	0,00	1,00	22,88	5,47	576,61	0,61	0,00	5,39	576,10	0,10	0 12:17	0 00:00	0,00	0,00
9	Jun-56	2298,21	607,26	581,00	587,00	6,00	581,00	0,00	587,00	0,00	0,00	3,00	14,65	5,44	581,29	0,29	0,00	5,71	581,04	0,04	0 12:13	0 00:00	0,00	0,00
10	Jun-57	2044,51	193,50	587,50	593,50	6,00	587,50	0,00	593,50	0,00	0,00	1,00	3,89	3,89	587,62	0,12	0,00	5,88	587,51	0,01	0 12:10	0 00:00	0,00	0,00
11	Jun-59	1627,47	-124,45	561,00	567,00	6,00	561,00	0,00	567,00	0,00	0,00	0,00	58,77	0,00	562,98	1,98	0,00	4,02	561,44	0,44	0 12:22	0 00:00	0,00	0,00
12	Jun-60	1765,76	-130,98	571,00	577,00	6,00	571,00	0,00	577,00	0,00	0,00	1,00	5,97	5,97	571,38	0,38	0,00	5,62	571,05	0,05	0 12:10	0 00:00	0,00	0,00
13	Jun-61	1509,88	-316,09	559,00	565,00	6,00	559,00	0,00	565,00	0,00	0,00	1,00	58,29	0,00	560,45	1,45	0,00	4,55	559,25	0,25	0 12:23	0 00:00	0,00	0,00
14	Jun-63	1972,06	1458,12	606,00	612,00	6,00	606,00	0,00	612,00	0,00	0,00	5,00	1,73	1,73	606,14	0,14	0,00	5,86	606,01	0,01	0 12:10	0 00:00	0,00	0,00
15	Jun-64	2061,49	1415,89	595,00	601,00	6,00	595,00	0,00	601,00	0,00	0,00	2,00	1,74	0,00	595,09	0,09	0,00	5,91	595,01	0,01	0 12:11	0 00:00	0,00	0,00
16	Jun-65	2417,35	749,27	585,00	591,00	6,00	585,00	0,00	591,00	0,00	0,00	3,00	9,42	9,42	585,20	0,20	0,00	5,80	585,03	0,03	0 12:10	0 00:00	0,00	0,00
17	Jun-66	1798,09	200,74	566,80	572,80	6,00	566,80	0,00	572,80	0,00	0,00	2,00	29,68	0,00	568,65	1,85	0,00	4,15	567,14	0,34	0 12:22	0 00:00	0,00	0,00
18	Jun-67	1823,71	186,48	567,80	573,80	6,00	567,80	0,00	573,80	0,00	0,00	3,00	21,19	0,00	568,40	0,60	0,00	5,40	567,89	0,09	0 12:18	0 00:00	0,00	0,00

ANNEXURE D

POST-DEVELOPMENT RUN-OFF DATA (WITH INFILTRATION MEASURES)

Ntshongweni Development Site 2 storm - Post-development subbasin flow (with infiltration measures)

SN	Element ID	Area	Drainage Node ID	Weighted Curve Number	Conductivity	Drying Time	Average Slope	Equivalent Width	Impervious Area	Impervious Area No Depression	Impervious Area Depression Depth	Impervious Area Manning's Roughness	Pervious Area Depression Depth	Pervious Area Manning's Roughness	Curb & Gutter Length	Rain Gage ID	Total Precipitation	Total Runon	Total Evaporation	Total Infiltration	Total Runoff	Peak Runoff	Time of Concentration	Vol Infiltration
		(ha)			(mm/hr)	(days)	(%)	(m)	(%)	(%)	(mm)		(mm)		(m)		(mm)	(mm)	(mm)	(mm)	(mm)	(cms)	days hh:mm:ss	m³
1	B1	8,81	Jun-52	80,00	0,1500	7,00	12,3000	293,57	0,00	0,00	2,0000	0,0320	5,0000	0,1000	0,00	1:2YR	70,53	0,00	0,0000	33,4150	30,91	0,49	0 01:05:35	2944
2	B10	3,46	Jun-74	81,80	0,1500	7,00	4,0000	122,36	0,00	0,00	2,0000	0,0150	5,0000	0,1000	0,00	1:2YR	70,53	0,00	0,0000	31,3740	32,42	0,16	0 01:28:40	1086
3	B11	4,46	Jun-73	81,80	0,1500	7,00	2,0000	148,12	0,00	0,00	2,0000	0,0150	5,0000	0,1000	0,00	1:2YR	70,53	0,00	0,0000	31,3740	31,86	0,16	0 01:53:21	1399
4	B12	5,32	Jun-71	81,80	0,1500	7,00	1,6000	285,55	0,00	0,00	2,0000	0,0150	5,0000	0,1000	0,00	1:2YR	70,53	0,00	0,0000	31,3740	32,37	0,24	0 01:30:55	1669
5	B13	5,76	Jun-70	81,80	0,1500	7,00	0,5800	222,88	0,00	0,00	2,0000	0,0150	5,0000	0,1000	0,00	1:2YR	70,53	0,00	0,0000	31,3740	30,96	0,15	0 02:29:52	1807
6	B14	3,62	Jun-69	81,80	0,1500	7,00	2,5000	237,47	0,00	25,00	2,0000	0,0150	5,0000	0,1000	0,00	1:2YR	70,53	0,00	0,0000	31,3740	32,82	0,21	0 01:10:31	1136
7	B15A	3,80	Jun-67	81,80	0,1500	7,00	1,0000	107,42	0,00	0,00	2,0000	0,0150	5,0000	0,1000	0,00	1:2YR	70,53	0,00	0,0000	31,3740	30,86	0,09	0 02:33:46	1192
8	B15B	4,17	Jun-68	81,80	0,1500	7,00	1,0000	110,10	0,00	0,00	2,0000	0,0150	5,0000	0,1000	0,00	1:2YR	70,53	0,00	0,0000	31,3740	30,69	0,10	0 02:40:17	1308
9	B16	9,07	Jun-69	81,80	0,1500	7,00	3,0000	275,78	0,00	0,00	2,0000	0,0150	5,0000	0,1000	0,00	1:2YR	70,53	0,00	0,0000	31,3740	32,03	0,34	0 01:45:49	2846
10	B17	1,27	Jun-68	89,00	0,1500	7,00	1,0000	30,77	0,00	0,00	2,0000	0,0150	5,0000	0,1000	0,00	1:2YR	70,53	0,00	0,0000	21,7240	39,87	0,04	0 02:48:48	276
11	B18	1,21	Jun-69	89,00	0,1500	7,00	3,0000	32,14	0,00	0,00	2,0000	0,0150	5,0000	0,1000	0,00	1:2YR	70,53	0,00	0,0000	21,7240	41,31	0,07	0 01:54:44	263
12	B19	1,35	Jun-67	89,00	0,1500	7,00	1,0000	36,13	0,00	0,00	2,0000	0,0150	5,0000	0,1000	0,00	1:2YR	70,53	0,00	0,0000	21,7240	40,15	0,05	0 02:38:58	293
13	B2	14,23	Jun-53	80,00	0,1500	7,00	8,7600	332,41	0,00	0,00	2,0000	0,0320	5,0000	0,1000	0,00	1:2YR	70,53	0,00	0,0000	33,4150	30,38	0,57	0 01:29:53	4755
14	B20	1,56	Jun-66	89,00	0,1500	7,00	3,0000	33,68	0,00	0,00	2,0000	0,0150	5,0000	0,1000	0,00	1:2YR	70,53	0,00	0,0000	21,7240	40,93	0,07	0 02:09:59	339
15	B21	6,34	Jun-75	81,80	0,1500	7,00	4,0000	153,55	0,00	25,00	2,0000	0,0150	5,0000	0,1000	0,00	1:2YR	70,53	0,00	0,0000	31,3740	31,90	0,23	0 01:51:19	1989
16	B22	5,84	Jun-77	81,80	0,1500	7,00	4,0000	167,70	0,00	25,00	2,0000	0,0150	5,0000	0,1000	0,00	1:2YR	70,53	0,00	0,0000	31,3740	32,15	0,23	0 01:40:27	1832
17	B23	9,16	Jun-66	81,80	0,1500	7,00	3,0000	333,50	0,00	25,00	2,0000	0,0150	5,0000	0,1000	0,00	1:2YR	70,53	0,00	0,0000	31,3740	32,28	0,39	0 01:35:01	2874
18	B24	8,28	Jun-80	81,80	0,1500	7,00	3,0000	317,61	0,00	25,00	2,0000	0,0150	5,0000	0,1000	0,00	1:2YR	70,53	0,00	0,0000	31,3740	32,34	0,37	0 01:32:02	2598
19	B25	4,80	Jun-49	80,00	0,1500	7,00	22,5900	289,19	0,00	0,00	2,0000	0,0320	5,0000	0,1000	0,00	1:2YR	70,53	0,00	0,0000	33,4150	31,49	0,44	0 00:38:19	1604
20	B26	6,94	Jun-50	80,00	0,1500	7,00	20,6900	287,28	0,00	0,00	2,0000	0,0320	5,0000	0,1000	0,00	1:2YR	70,53	0,00	0,0000	33,4150	31,26	0,52	0 00:49:16	2319
21	B3	6,41	Jun-51	80,00	0,1500	7,00	13,1700	177,83	0,00	0,00	2,0000	0,0320	5,0000	0,1000	0,00	1:2YR	70,53	0,00	0,0000	33,4150	30,78	0,33	0 01:11:44	2142
22	B4	1,30	Jun-53	80,00	0,1500	7,00	2,5900	44,89	0,00	0,00	2,0000	0,0320	5,0000	0,1000	0,00	1:2YR	70,53	0,00	0,0000	33,4150	30,11	0,05	0 01:42:15	434
23	B5	2,15	Jun-51	80,00	0,1500	7,00	1,6400	70,28	0,00	0,00	2,0000	0,0320	5,0000	0,1000	0,00	1:2YR	70,53	0,00	0,0000	33,4150	29,67	0,06	0 02:01:22	718
24	B6	3,76	Jun-76	80,00	0,1500	7,00	1,1500	86,85	0,00	0,00	2,0000	0,0320	5,0000	0,1000	0,00	1:2YR	70,53	0,00	0,0000	33,4150	28,56	0,08	0 02:46:25	1256
25	B7	7,15	Jun-54	80,00	0,1500	7,00	4,7200	135,17	0,00	25,00	2,0000	0,0320	5,0000	0,1000	0,00	1:2YR	70,53	0,00	0,0000	33,4150	29,64	0,20	0 02:02:49	2389
26	B8	1,51	Jun-79	80,00	0,1500	7,00	36,2400	273,65	0,00	0,00	2,0000	0,0320	5,0000	0,1000	0,00	1:2YR	70,53	0,00	0,0000	33,4150	31,96	0,20	0 00:17:10	505
27	B9	8,43	Jun-59	80,00	0,1500	7,00	10,3000	245,64	0,00	0,00	2,0000	0,0320	5,0000	0,1000	0,00	1:2YR	70,53	0,00	0,0000	33,4150	30,71	0,41	0 01:14:58	2817
28	SC1	10,47	Jun-48	80,00	0,1500	7,00	5,6800	247,90	0,00	0,00	2,0000	0,0320	5,0000	0,1000	0,00	1:2YR	70,53	0,00	0,0000	33,4150	30,13	0,37	0 01:41:31	3499
29	SC2	2,47	Jun-63	80,00	0,1500	7,00	7,8800	111,31	0,00	0,00	2,0000	0,0320	5,0000	0,1000	0,00	1:2YR	70,53	0,00	0,0000	33,4150	30,97	0,15	0 01:02:34	825
																						Vol Infiltration =		49114

Ntshongweni Development Site 2 storm - Post-development subbasin flow (with infiltration measures)

SN	Element ID	Area	Drainage Node ID	Weighted Curve Number	Conductivity	Drying Time	Average Slope	Equivalent Width	Impervious Area	Impervious Area No Depression	Impervious Area Depression Depth	Impervious Area Manning's Roughness	Pervious Area Depression Depth	Pervious Area Manning's Roughness	Curb & Gutter Length	Rain Gage ID	Total Precipitation	Total Runon	Total Evaporation	Total Infiltration	Total Runoff	Peak Runoff	Time of Concentration	Vol Infiltration
		(ha)			(mm/hr)	(days)	(%)	(m)	(%)	(%)	(mm)		(mm)		(m)		(mm)	(mm)	(mm)	(mm)	(mm)	(cms)	days hh:mm:ss	m³
1	B1	8,81	Jun-52	80,00	0,1500	7,00	12,3000	293,57	0,00	0,00	2,0000	0,0320	5,0000	0,1000	0,00	1:5YR	102,77	0,00	0,0000	39,2490	56,96	1,18	0 00:56:25	3458
2	B10	3,46	Jun-74	81,80	0,1500	7,00	4,0000	122,36	0,00	0,00	2,0000	0,0150	5,0000	0,1000	0,00	1:5YR	102,77	0,00	0,0000	36,4620	59,07	0,38	0 01:16:16	1262
3	B11	4,46	Jun-73	81,80	0,1500	7,00	2,0000	148,12	0,00	0,00	2,0000	0,0150	5,0000	0,1000	0,00	1:5YR	102,77	0,00	0,0000	36,4620	58,35	0,38	0 01:37:29	1626
4	B12	5,32	Jun-71	81,80	0,1500	7,00	1,6000	285,55	0,00	0,00	2,0000	0,0150	5,0000	0,1000	0,00	1:5YR	102,77	0,00	0,0000	36,4620	59,00	0,57	0 01:18:12	1940
5	B13	5,76	Jun-70	81,80	0,1500	7,00	0,5800	222,88	0,00	0,00	2,0000	0,0150	5,0000	0,1000	0,00	1:5YR	102,77	0,00	0,0000	36,4620	57,23	0,37	0 02:08:54	2100
6	B14	3,62	Jun-69	81,80	0,1500	7,00	2,5000	237,47	0,00	25,00	2,0000	0,0150	5,0000	0,1000	0,00	1:5YR	102,77	0,00	0,0000	36,4620	59,59	0,49	0 01:00:39	1320
7	B15A	3,80	Jun-67	81,80	0,1500	7,00	1,0000	107,42	0,00	0,00	2,0000	0,0150	5,0000	0,1000	0,00	1:5YR	102,77	0,00	0,0000	36,4620	57,10	0,24	0 02:12:16	1386
8	B15B	4,17	Jun-68	81,80	0,1500	7,00	1,0000	110,10	0,00	0,00	2,0000	0,0150	5,0000	0,1000	0,00	1:5YR	102,77	0,00	0,0000	36,4620	56,89	0,25	0 02:17:52	1520
9	B16	9,07	Jun-69	81,80	0,1500	7,00	3,0000	275,78	0,00	0,00	2,0000	0,0150	5,0000	0,1000	0,00	1:5YR	102,77	0,00	0,0000	36,4620	58,57	0,83	0 01:31:01	3307
10	B17	1,27	Jun-68	89,00	0,1500	7,00	1,0000	30,77	0,00	0,00	2,0000	0,0150	5,0000	0,1000	0,00	1:5YR	102,77	0,00	0,0000	24,0470	68,83	0,10	0 02:25:11	305
11	B18	1,21	Jun-69	89,00	0,1500	7,00	3,0000	32,14	0,00	0,00	2,0000	0,0150	5,0000	0,1000	0,00	1:5YR	102,77	0,00	0,0000	24,0470	70,59	0,14	0 01:38:41	291
12	B19	1,35	Jun-67	89,00	0,1500	7,00	1,0000	36,13	0,00	0,00	2,0000	0,0150	5,0000	0,1000	0,00	1:5YR	102,77	0,00	0,0000	24,0470	69,16	0,11	0 02:16:44	325
13	B2	14,23	Jun-53	80,00	0,1500	7,00	8,7600	332,41	0,00	0,00	2,0000	0,0320	5,0000	0,1000	0,00	1:5YR	102,77	0,00	0,0000	39,2490	56,28	1,43	0 01:17:19	5585
14	B20	1,56	Jun-66	89,00	0,1500	7,00	3,0000	33,68	0,00	0,00	2,0000	0,0150	5,0000	0,1000	0,00	1:5YR	102,77	0,00	0,0000	24,0470	70,11	0,16	0 01:51:48	375
15	B21	6,34	Jun-75	81,80	0,1500	7,00	4,0000	153,55	0,00	25,00	2,0000	0,0150	5,0000	0,1000	0,00	1:5YR	102,77	0,00	0,0000	36,4620	58,41	0,56	0 01:35:45	2312
16	B22	5,84	Jun-77	81,80	0,1500	7,00	4,0000	167,70	0,00	25,00	2,0000	0,0150	5,0000	0,1000	0,00	1:5YR	102,77	0,00	0,0000	36,4620	58,73	0,56	0 01:26:24	2129
17	B23	9,16	Jun-66	81,80	0,1500	7,00	3,0000	333,50	0,00	25,00	2,0000	0,0150	5,0000	0,1000	0,00	1:5YR	102,77	0,00	0,0000	36,4620	58,89	0,94	0 01:21:44	3340
18	B24	8,28	Jun-80	81,80	0,1500	7,00	3,0000	317,61	0,00	25,00	2,0000	0,0150	5,0000	0,1000	0,00	1:5YR	102,77	0,00	0,0000	36,4620	58,97	0,87	0 01:19:10	3019
19	B25	4,80	Jun-49	80,00	0,1500	7,00	22,5900	289,19	0,00	0,00	2,0000	0,0320	5,0000	0,1000	0,00	1:5YR	102,77	0,00	0,0000	39,2490	57,74	0,89	0 00:32:57	1884
20	B26	6,94	Jun-50	80,00	0,1500	7,00	20,6900	287,28	0,00	0,00	2,0000	0,0320	5,0000	0,1000	0,00	1:5YR	102,77	0,00	0,0000	39,2490	57,42	1,13	0 00:42:22	2724
21	B3	6,41	Jun-51	80,00	0,1500	7,00	13,1700	177,83	0,00	0,00	2,0000	0,0320	5,0000	0,1000	0,00	1:5YR	102,77	0,00	0,0000	39,2490	56,79	0,79	0 01:01:42	2516
22	B4	1,30	Jun-53	80,00	0,1500	7,00	2,5900	44,89	0,00	0,00	2,0000	0,0320	5,0000	0,1000	0,00	1:5YR	102,77	0,00	0,0000	39,2490	55,92	0,11	0 01:27:57	510
23	B5	2,15	Jun-51	80,00	0,1500	7,00	1,6400	70,28	0,00	0,00	2,0000	0,0320	5,0000	0,1000	0,00	1:5YR	102,77	0,00	0,0000	39,2490	55,36	0,16	0 01:44:23	844
24	B6	3,76	Jun-76	80,00	0,1500	7,00	1,1500	86,85	0,00	0,00	2,0000	0,0320	5,0000	0,1000	0,00	1:5YR	102,77	0,00	0,0000	39,2490	53,96	0,20	0 02:23:08	1476
25	B7	7,15	Jun-54	80,00	0,1500	7,00	4,7200	135,17	0,00	25,00	2,0000	0,0320	5,0000	0,1000	0,00	1:5YR	102,77	0,00	0,0000	39,2490	55,32	0,53	0 01:45:39	2806
26	B8	1,51	Jun-79	80,00	0,1500	7,00	36,2400	273,65	0,00	0,00	2,0000	0,0320	5,0000	0,1000	0,00	1:5YR	102,77	0,00	0,0000	39,2490	58,36	0,38	0 00:14:46	593
27	B9	8,43	Jun-59	80,00	0,1500	7,00	10,3000	245,64	0,00	0,00	2,0000	0,0320	5,0000	0,1000	0,00	1:5YR	102,77	0,00	0,0000	39,2490	56,70	1,01	0 01:04:29	3309
28	SC1	10,47	Jun-48	80,00	0,1500	7,00	24,0000	247,90	0,00	0,00	2,0000	0,0320	5,0000	0,1000	0,00	1:5YR	102,77	0,00	0,0000	39,2490	56,95	1,39	0 00:56:40	4109
29	SC2	2,47	Jun-63	80,00	0,1500	7,00	7,8800	111,31	0,00	0,00	2,0000	0,0320	5,0000	0,1000	0,00	1:5YR	102,77	0,00	0,0000	39,2490	57,05	0,34	0 00:53:49	969
																						Vol Infiltration =		57340

Ntshongweni Development Site 2 - Post-development subbasin flow (with infiltration measures)

SN	Element ID	Area	Drainage Node ID	Weighted Curve Number	Conductivity	Drying Time	Average Slope	Equivalent Width	Impervious Area	Impervious Area No Depression	Impervious Area Depression Depth	Impervious Area Manning's Roughness	Pervious Area Depression Depth	Pervious Area Manning's Roughness	Curb & Gutter Length	Rain Gage ID	Total Precipitation	Total Runon	Total Evaporation	Total Infiltration	Total Runoff	Peak Runoff	Time of Concentration	Vol Infiltration
		(ha)			(mm/hr)	(days)	(%)	(m)	(%)	(%)	(mm)		(mm)		(m)		(mm)	(mm)	(mm)	(mm)	(mm)	(cms)	days hh:mm:ss	m³
1	B1	8,81	Jun-52	80,00	0,1500	7,00	12,3000	293,57	0,00	0,00	2,0000	0,0320	5,0000	0,1000	0,00	1:50YR	222,67	0,00	0,0000	49,4090	165,87	4,16	0 00:41:24	4353
2	B10	3,46	Jun-74	81,80	0,1500	7,00	4,0000	122,36	0,00	0,00	2,0000	0,0150	5,0000	0,1000	0,00	1:50YR	222,67	0,00	0,0000	45,0740	169,07	1,42	0 00:55:58	1560
3	B11	4,46	Jun-73	81,80	0,1500	7,00	2,0000	148,12	0,00	0,00	2,0000	0,0150	5,0000	0,1000	0,00	1:50YR	222,67	0,00	0,0000	45,0740	167,87	1,54	0 01:11:32	2010
4	B12	5,32	Jun-71	81,80	0,1500	7,00	1,6000	285,55	0,00	0,00	2,0000	0,0150	5,0000	0,1000	0,00	1:50YR	222,67	0,00	0,0000	45,0740	168,96	2,15	0 00:57:23	2398
5	B13	5,76	Jun-70	81,80	0,1500	7,00	0,5800	222,88	0,00	0,00	2,0000	0,0150	5,0000	0,1000	0,00	1:50YR	222,67	0,00	0,0000	45,0740	166,08	1,56	0 01:34:36	2596
6	B14	3,62	Jun-69	81,80	0,1500	7,00	2,5000	237,47	0,00	25,00	2,0000	0,0150	5,0000	0,1000	0,00	1:50YR	222,67	0,00	0,0000	45,0740	169,96	1,70	0 00:44:30	1632
7	B15A	3,80	Jun-67	81,80	0,1500	7,00	1,0000	107,42	0,00	0,00	2,0000	0,0150	5,0000	0,1000	0,00	1:50YR	222,67	0,00	0,0000	45,0740	165,89	1,01	0 01:37:03	1713
8	B15B	4,17	Jun-68	81,80	0,1500	7,00	1,0000	110,10	0,00	0,00	2,0000	0,0150	5,0000	0,1000	0,00	1:50YR	222,67	0,00	0,0000	45,0740	165,56	1,06	0 01:41:10	1880
9	B16	9,07	Jun-69	81,80	0,1500	7,00	3,0000	275,78	0,00	0,00	2,0000	0,0150	5,0000	0,1000	0,00	1:50YR	222,67	0,00	0,0000	45,0740	168,24	3,30	0 01:06:48	4088
10	B17	1,27	Jun-68	89,00	0,1500	7,00	1,0000	30,77	0,00	0,00	2,0000	0,0150	5,0000	0,1000	0,00	1:50YR	222,67	0,00	0,0000	27,5140	182,59	0,35	0 01:46:33	349
11	B18	1,21	Jun-69	89,00	0,1500	7,00	3,0000	32,14	0,00	0,00	2,0000	0,0150	5,0000	0,1000	0,00	1:50YR	222,67	0,00	0,0000	27,5140	185,30	0,46	0 01:12:25	333
12	B19	1,35	Jun-67	89,00	0,1500	7,00	1,0000	36,13	0,00	0,00	2,0000	0,0150	5,0000	0,1000	0,00	1:50YR	222,67	0,00	0,0000	27,5140	183,09	0,39	0 01:40:21	371
13	B2	14,23	Jun-53	80,00	0,1500	7,00	8,7600	332,41	0,00	0,00	2,0000	0,0320	5,0000	0,1000	0,00	1:50YR	222,67	0,00	0,0000	49,4090	164,69	5,63	0 00:56:44	7031
14	B20	1,56	Jun-66	89,00	0,1500	7,00	3,0000	33,68	0,00	0,00	2,0000	0,0150	5,0000	0,1000	0,00	1:50YR	222,67	0,00	0,0000	27,5140	184,55	0,54	0 01:22:03	429
15	B21	6,34	Jun-75	81,80	0,1500	7,00	4,0000	153,55	0,00	25,00	2,0000	0,0150	5,0000	0,1000	0,00	1:50YR	222,67	0,00	0,0000	45,0740	167,97	2,22	0 01:10:16	2858
16	B22	5,84	Jun-77	81,80	0,1500	7,00	4,0000	167,70	0,00	25,00	2,0000	0,0150	5,0000	0,1000	0,00	1:50YR	222,67	0,00	0,0000	45,0740	168,50	2,20	0 01:03:24	2632
17	B23	9,16	Jun-66	81,80	0,1500	7,00	3,0000	333,50	0,00	25,00	2,0000	0,0150	5,0000	0,1000	0,00	1:50YR	222,67	0,00	0,0000	45,0740	168,76	3,60	0 00:59:59	4129
18	B24	8,28	Jun-80	81,80	0,1500	7,00	3,0000	317,61	0,00	25,00	2,0000	0,0150	5,0000	0,1000	0,00	1:50YR	222,67	0,00	0,0000	45,0740	168,91	3,32	0 00:58:05	3732
19	B25	4,80	Jun-49	80,00	0,1500	7,00	22,5900	289,19	0,00	0,00	2,0000	0,0320	5,0000	0,1000	0,00	1:50YR	222,67	0,00	0,0000	49,4090	167,25	2,81	0 00:24:11	2372
20	B26	6,94	Jun-50	80,00	0,1500	7,00	20,6900	287,28	0,00	0,00	2,0000	0,0320	5,0000	0,1000	0,00	1:50YR	222,67	0,00	0,0000	49,4090	166,69	3,64	0 00:31:06	3429
21	B3	6,41	Jun-51	80,00	0,1500	7,00	13,1700	177,83	0,00	0,00	2,0000	0,0320	5,0000	0,1000	0,00	1:50YR	222,67	0,00	0,0000	49,4090	165,57	2,90	0 00:45:17	3167
22	B4	1,30	Jun-53	80,00	0,1500	7,00	2,5900	44,89	0,00	0,00	2,0000	0,0320	5,0000	0,1000	0,00	1:50YR	222,67	0,00	0,0000	49,4090	164,09	0,47	0 01:04:32	642
23	B5	2,15	Jun-51	80,00	0,1500	7,00	1,6400	70,28	0,00	0,00	2,0000	0,0320	5,0000	0,1000	0,00	1:50YR	222,67	0,00	0,0000	49,4090	163,17	0,68	0 01:16:36	1062
24	B6	3,76	Jun-76	80,00	0,1500	7,00	1,1500	86,85	0,00	0,00	2,0000	0,0320	5,0000	0,1000	0,00	1:50YR	222,67	0,00	0,0000	49,4090	160,95	0,89	0 01:45:03	1858
25	B7	7,15	Jun-54	80,00	0,1500	7,00	4,7200	135,17	0,00	25,00	2,0000	0,0320	5,0000	0,1000	0,00	1:50YR	222,67	0,00	0,0000	49,4090	163,09	2,24	0 01:17:32	3533
26	B8	1,51	Jun-79	80,00	0,1500	7,00	36,2400	273,65	0,00	0,00	2,0000	0,0320	5,0000	0,1000	0,00	1:50YR	222,67	0,00	0,0000	49,4090	168,12	1,15	0 00:10:50	746
27	B9	8,43	Jun-59	80,00	0,1500	7,00	10,3000	245,64	0,00	0,00	2,0000	0,0320	5,0000	0,1000	0,00	1:50YR	222,67	0,00	0,0000	49,4090	165,41	3,72	0 00:47:19	4165
28	SC1	10,47	Jun-48	80,00	0,1500	7,00	24,0000	247,90	0,00	0,00	2,0000	0,0320	5,0000	0,1000	0,00	1:50YR	222,67	0,00	0,0000	49,4090	165,86	4,94	0 00:41:35	5173
29	SC2	2,47	Jun-63	80,00	0,1500	7,00	7,8800	111,31	0,00	0,00	2,0000	0,0320	5,0000	0,1000	0,00	1:50YR	222,67	0,00	0,0000	49,4090	166,02	1,19	0 00:39:30	1220
																							Vol Infiltration =	71462

Ntshongweni Development Site 2 - Post-development subbasin flow (with infiltration measures)

SN	Element ID	Area	Drainage Node ID	Weighted Curve Number	Conductivity	Drying Time	Average Slope	Equivalent Width	Impervious Area	Impervious Area No Depression	Impervious Area Depression Depth	Impervious Area Manning's Roughness	Pervious Area Depression Depth	Pervious Area Manning's Roughness	Curb & Gutter Length	Rain Gage ID	Total Precipitation	Total Runon	Total Evaporation	Total Infiltration	Total Runoff	Peak Runoff	Time of Concentration	Vol Infiltration
		(ha)			(mm/hr)	(days)	(%)	(m)	(%)	(%)	(mm)		(mm)		(m)		(mm)	(mm)	(mm)	(mm)	(mm)	(cms)	days hh:mm:ss	m³
1	B1	8,81	Jun-52	80,00	0,1500	7,00	12,3000	293,57	0,00	0,00	2,0000	0,0320	5,0000	0,1000	0,00	1:100YR	278,08	0,00	0,0000	51,6950	218,75	5,65	0 00:37:52	4554
2	B10	3,46	Jun-74	81,80	0,1500	7,00	4,0000	122,36	0,00	0,00	2,0000	0,0150	5,0000	0,1000	0,00	1:100YR	278,08	0,00	0,0000	46,9680	222,16	1,96	0 00:51:12	1625
3	B11	4,46	Jun-73	81,80	0,1500	7,00	2,0000	148,12	0,00	0,00	2,0000	0,0150	5,0000	0,1000	0,00	1:100YR	278,08	0,00	0,0000	46,9680	220,77	2,16	0 01:05:27	2095
4	B12	5,32	Jun-71	81,80	0,1500	7,00	1,6000	285,55	0,00	0,00	2,0000	0,0150	5,0000	0,1000	0,00	1:100YR	278,08	0,00	0,0000	46,9680	222,03	2,97	0 00:52:30	2499
5	B13	5,76	Jun-70	81,80	0,1500	7,00	0,5800	222,88	0,00	0,00	2,0000	0,0150	5,0000	0,1000	0,00	1:100YR	278,08	0,00	0,0000	46,9680	218,72	2,23	0 01:26:33	2705
6	B14	3,62	Jun-69	81,80	0,1500	7,00	2,5000	237,47	0,00	25,00	2,0000	0,0150	5,0000	0,1000	0,00	1:100YR	278,08	0,00	0,0000	46,9680	223,19	2,30	0 00:40:43	1700
7	B15A	3,80	Jun-67	81,80	0,1500	7,00	1,0000	107,42	0,00	0,00	2,0000	0,0150	5,0000	0,1000	0,00	1:100YR	278,08	0,00	0,0000	46,9680	218,50	1,44	0 01:28:48	1785
8	B15B	4,17	Jun-68	81,80	0,1500	7,00	1,0000	110,10	0,00	0,00	2,0000	0,0150	5,0000	0,1000	0,00	1:100YR	278,08	0,00	0,0000	46,9680	218,13	1,53	0 01:32:33	1959
9	B16	9,07	Jun-69	81,80	0,1500	7,00	3,0000	275,78	0,00	0,00	2,0000	0,0150	5,0000	0,1000	0,00	1:100YR	278,08	0,00	0,0000	46,9680	221,19	4,60	0 01:01:07	4260
10	B17	1,27	Jun-68	89,00	0,1500	7,00	1,0000	30,77	0,00	0,00	2,0000	0,0150	5,0000	0,1000	0,00	1:100YR	278,08	0,00	0,0000	28,2090	236,32	0,49	0 01:37:29	358
11	B18	1,21	Jun-69	89,00	0,1500	7,00	3,0000	32,14	0,00	0,00	2,0000	0,0150	5,0000	0,1000	0,00	1:100YR	278,08	0,00	0,0000	28,2090	239,41	0,63	0 01:06:16	341
12	B19	1,35	Jun-67	89,00	0,1500	7,00	1,0000	36,13	0,00	0,00	2,0000	0,0150	5,0000	0,1000	0,00	1:100YR	278,08	0,00	0,0000	28,2090	236,89	0,54	0 01:31:48	381
13	B2	14,23	Jun-53	80,00	0,1500	7,00	8,7600	332,41	0,00	0,00	2,0000	0,0320	5,0000	0,1000	0,00	1:100YR	278,08	0,00	0,0000	51,6950	217,37	7,83	0 00:51:54	7356
14	B20	1,56	Jun-66	89,00	0,1500	7,00	3,0000	33,68	0,00	0,00	2,0000	0,0150	5,0000	0,1000	0,00	1:100YR	278,08	0,00	0,0000	28,2090	238,54	0,74	0 01:15:04	440
15	B21	6,34	Jun-75	81,80	0,1500	7,00	4,0000	153,55	0,00	25,00	2,0000	0,0150	5,0000	0,1000	0,00	1:100YR	278,08	0,00	0,0000	46,9680	220,88	3,11	0 01:04:17	2978
16	B22	5,84	Jun-77	81,80	0,1500	7,00	4,0000	167,70	0,00	25,00	2,0000	0,0150	5,0000	0,1000	0,00	1:100YR	278,08	0,00	0,0000	46,9680	221,49	3,07	0 00:58:00	2743
17	B23	9,16	Jun-66	81,80	0,1500	7,00	3,0000	333,50	0,00	25,00	2,0000	0,0150	5,0000	0,1000	0,00	1:100YR	278,08	0,00	0,0000	46,9680	221,80	4,99	0 00:54:52	4302
18	B24	8,28	Jun-80	81,80	0,1500	7,00	3,0000	317,61	0,00	25,00	2,0000	0,0150	5,0000	0,1000	0,00	1:100YR	278,08	0,00	0,0000	46,9680	221,97	4,59	0 00:53:09	3889
19	B25	4,80	Jun-49	80,00	0,1500	7,00	32,0000	328,00	0,00	0,00	2,0000	0,0320	5,0000	0,1000	0,00	1:100YR	278,08	0,00	0,0000	51,6950	220,71	4,16	0 00:18:28	2481
20	B26	6,94	Jun-50	80,00	0,1500	7,00	35,0000	340,00	0,00	0,00	2,0000	0,0320	5,0000	0,1000	0,00	1:100YR	278,08	0,00	0,0000	51,6950	220,37	5,59	0 00:21:57	3588
21	B3	6,41	Jun-51	80,00	0,1500	7,00	13,1700	177,83	0,00	0,00	2,0000	0,0320	5,0000	0,1000	0,00	1:100YR	278,08	0,00	0,0000	51,6950	218,40	3,96	0 00:41:26	3314
22	B4	1,30	Jun-53	80,00	0,1500	7,00	2,5900	44,89	0,00	0,00	2,0000	0,0320	5,0000	0,1000	0,00	1:100YR	278,08	0,00	0,0000	51,6950	216,68	0,66	0 00:59:03	672
23	B5	2,15	Jun-51	80,00	0,1500	7,00	1,6400	70,28	0,00	0,00	2,0000	0,0320	5,0000	0,1000	0,00	1:100YR	278,08	0,00	0,0000	51,6950	215,61	0,96	0 01:10:05	1111
24	B6	3,76	Jun-76	80,00	0,1500	7,00	1,1500	86,85	0,00	0,00	2,0000	0,0320	5,0000	0,1000	0,00	1:100YR	278,08	0,00	0,0000	51,6950	213,07	1,29	0 01:36:06	1944
25	B7	7,15	Jun-54	80,00	0,1500	7,00	4,7200	135,17	0,00	25,00	2,0000	0,0320	5,0000	0,1000	0,00	1:100YR	278,08	0,00	0,0000	51,6950	215,53	3,18	0 01:10:56	3696
26	B8	1,51	Jun-79	80,00	0,1500	7,00	36,2400	273,65	0,00	0,00	2,0000	0,0320	5,0000	0,1000	0,00	1:100YR	278,08	0,00	0,0000	51,6950	221,24	1,51	0 00:09:55	781
27	B9	8,43	Jun-59	80,00	0,1500	7,00	10,3000	245,64	0,00	0,00	2,0000	0,0320	5,0000	0,1000	0,00	1:100YR	278,08	0,00	0,0000	51,6950	218,21	5,10	0 00:43:18	4358
28	SC1	10,47	Jun-48	80,00	0,1500	7,00	24,0000	247,90	0,00	0,00	2,0000	0,0320	5,0000	0,1000	0,00	1:100YR	278,08	0,00	0,0000	51,6950	218,74	6,70	0 00:38:03	5412
29	SC2	2,47	Jun-63	80,00	0,1500	7,00	7,8800	111,31	0,00	0,00	2,0000	0,0320	5,0000	0,1000	0,00	1:100YR	278,08	0,00	0,0000	51,6950	218,93	1,61	0 00:36:08	1277
																							Vol Infiltration =	74604

ANNEXURE E

POST-DEVELOPMENT RUN-OFF DATA (EXCLUDING INFILTRATION MEASURES)

Ntshongweni Development Site 2 SWMP:

SN	Element ID	X Coordinate	Y Coordinate	Invert Elevation	Ground/Rim (Max) Elevation	Ground/Rim (Max) Offset	Initial Water Elevation	Initial Water Depth	Surcharge Elevation	Surcharge Depth	Ponded Area	Minimum Pipe Cover	Peak Inflow	Peak Lateral Inflow	Maximum HGL Elevation Attained	Maximum HGL Depth Attained	Maximum Surcharge Depth Attained	Minimum Freeboard Attained	Average HGL Elevation Attained	Average HGL Depth Attained	Time of Maximum HGL Occurrence	Time of Peak Flooding Occurrence	Total Flooded Volume	Total Time Flooded
				(m)	(m)	(m)	(m)	(m)	(m)	(m)	(m^2)	(m)	(cms)	(cms)	(m)	(m)	(m)	(m)	(m)	(m)	(days hh:mm)	(days hh:mm)	(ha-mm)	(minutes)
1	Jun-48	1305,17	1434,25	585,50	591,50	6,00	585,50	0,00	591,50	0,00	0,00	4,00	0,36	0,36	585,53	0,03	0,00	5,97	585,51	0,01	0 12:18	0 00:00	0,00	0,00
2	Jun-49	1209,63	1190,07	583,00	589,00	6,00	583,00	0,00	589,00	0,00	0,00	4,00	0,48	0,40	583,16	0,16	0,00	5,84	583,03	0,03	0 12:27	0 00:00	0,00	0,00
3	Jun-50	1358,53	863,14	578,00	584,00	6,00	578,00	0,00	584,00	0,00	0,00	4,00	0,79	0,49	578,19	0,19	0,00	5,81	578,04	0,04	0 12:18	0 00:00	0,00	0,00
4	Jun-51	1583,92	570,24	573,00	579,00	6,00	573,00	0,00	579,00	0,00	0,00	1,00	2,39	0,37	573,56	0,56	0,00	7,44	573,10	0,10	0 12:28	0 00:00	0,00	0,00
5	Jun-52	1906,22	1144,07	588,20	594,20	6,00	588,20	0,00	594,20	0,00	0,00	2,00	0,79	0,48	588,26	0,06	0,00	5,94	588,21	0,01	0 12:18	0 00:00	0,00	0,00
6	Jun-53	1692,81	848,99	580,30	586,30	6,00	580,30	0,00	586,30	0,00	0,00	1,00	1,32	0,59	580,53	0,23	0,00	7,77	580,34	0,04	0 12:25	0 00:00	0,00	0,00
7	Jun-54	1791,89	142,32	566,00	572,00	6,00	566,00	0,00	572,00	0,00	0,00	0,00	3,40	0,20	566,63	0,63	0,00	5,37	566,17	0,17	0 12:24	0 00:00	0,00	0,00
8	Jun-55	2002,04	365,54	576,00	582,00	6,00	576,00	0,00	582,00	0,00	0,00	3,00	3,83	0,00	576,23	0,23	0,00	5,77	576,04	0,04	0 12:18	0 00:00	0,00	0,00
9	Jun-59	1627,47	-124,45	561,00	567,00	6,00	561,00	0,00	567,00	0,00	0,00	0,00	4,48	0,39	561,69	0,69	0,00	5,31	561,18	0,18	0 12:22	0 00:00	0,00	0,00
10	Jun-60	1765,76	-130,98	571,00	577,00	6,00	571,00	0,00	577,00	0,00	0,00	1,00	0,00	0,00	571,00	0,00	0,00	6,00	571,00	0,00	0 00:00	0 00:00	0,00	0,00
11	Jun-61	1509,88	-316,09	559,00	565,00	6,00	559,00	0,00	565,00	0,00	0,00	1,00	4,46	0,00	565,00	6,00	0,00	0,00	559,31	0,31	0 12:19	0 12:25	80,23	45,00
12	Jun-63	1972,06	1458,12	606,00	612,00	6,00	606,00	0,00	612,00	0,00	0,00	5,00	0,14	0,14	606,03	0,03	0,00	5,97	606,00	0,00	0 12:12	0 00:00	0,00	0,00
13	Jun-64	2061,49	1415,89	595,00	601,00	6,00	595,00	0,00	601,00	0,00	0,00	2,00	0,14	0,00	595,03	0,03	0,00	5,97	595,00	0,00	0 12:13	0 00:00	0,00	0,00
14	Jun-66	2189,80	521,83	582,50	588,50	6,00	582,50	0,00	588,50	0,00	0,00	3,00	3,85	0,92	582,61	0,11	0,00	5,89	582,52	0,02	0 12:14	0 00:00	0,00	0,00
15	Jun-67	1991,63	1182,38	602,50	608,50	6,00	602,50	0,00	608,50	0,00	0,00	5,00	0,27	0,27	602,53	0,03	0,00	5,97	602,51	0,01	0 12:18	0 00:00	0,00	0,00
16	Jun-68	2302,77	921,73	601,50	603,50	2,00	601,50	0,00	603,50	0,00	0,00	0,50	0,95	0,28	601,91	0,41	0,00	1,59	601,58	0,08	0 12:13	0 00:00	0,00	0,00
17	Jun-69	2232,04	511,99	590,00	596,00	6,00	590,00	0,00	596,00	0,00	0,00	4,50	2,97	1,24	590,37	0,37	0,00	5,63	590,07	0,07	0 12:16	0 00:00	0,00	0,00
18	Jun-70	2306,87	617,82	596,00	598,00	2,00	596,00	0,00	598,00	0,00	0,00	0,00	1,79	0,34	596,37	0,37	0,00	2,63	596,07	0,07	0 12:16	0 00:00	0,00	0,00
19	Jun-71	2540,07	825,38	598,00	600,00	2,00	598,00	0,00	600,00	0,00	0,00	0,50	0,51	0,51	598,39	0,39	0,00	1,61	598,07	0,07	0 12:12	0 00:00	0,00	0,00
20	Jun-72	2525,19	527,12	597,00	599,00	2,00	597,00	0,00	599,00	0,00	0,00	0,00	0,50	0,00	597,38	0,38	0,00	2,62	597,07	0,07	0 12:14	0 00:00	0,00	0,00
21	Jun-73	2246,53	1010,76	602,00	604,00	2,00	602,00	0,00	604,00	0,00	0,00	0,50	0,69	0,35	602,41	0,41	0,00	1,59	602,08	0,08	0 12:12	0 00:00	0,00	0,00
22	Jun-74	2155,77	1083,02	602,50	604,50	2,00	602,50	0,00	604,50	0,00	0,00	0,50	0,34	0,34	602,79	0,29	0,00	1,71	602,55	0,05	0 12:12	0 00:00	0,00	0,00
23	Jun-75	1717,40	422,44	592,50	598,50	6,00	592,50	0,00	598,50	0,00	0,00	5,00	0,51	0,51	592,55	0,05	0,00	5,95	592,51	0,01	0 12:12	0 00:00	0,00	0,00
24	Jun-76	1630,15	372,21	570,50	576,50	6,00	570,50	0,00	576,50	0,00	0,00	2,00	2,87	0,07	571,11	0,61	0,00	5,39	570,62	0,12	0 12:28	0 00:00	0,00	0,00
25	Jun-77	1882,70	358,89	591,00	597,00	6,00	591,00	0,00	597,00	0,00	0,00	5,00	0,51	0,51	591,05	0,05	0,00	5,95	591,01	0,01	0 12:12	0 00:00	0,00	0,00
26	Jun-78	1908,70	294,55	572,30	578,30	6,00	572,30	0,00	578,30	0,00	0,00	3,00	4,31	0,00	572,55	0,25	0,00	5,75	572,34	0,04	0 12:24	0 00:00	0,00	0,00
27	Jun-79	1642,20	21,41	563,00	569,00	6,00	563,00	0,00	569,00	0,00	0,00	0,00	4,12	0,21	563,69	0,69	0,00	5,31	563,18	0,18	0 12:21	0 00:00	0,00	0,00
28	Jun-80	1791,03	14,96	587,00	593,00	6,00	587,00	0,00	593,00	0,00	0,00	5,00	0,79	0,79	587,06	0,06	0,00	5,94	587,01	0,01	0 12:12	0 00:00	0,00	0,00
29	Jun-83	1798,23	200,61	566,80	572,80	6,00	566,80	0,00	572,80	0,00	0,00	2,00	2,87	0,00	572,80	6,00	0,00	0,00	567,10	0,30	0 12:17	0 12:31	168,93	49,00
30	Jun-84	1823,51	186,61	567,80	573,80	6,00	567,80	0,00	573,80	0,00	0,00	3,00	4,30	0,00	573,80	6,00	0,00	0,00	568,21	0,41	0 12:05	0 12:19	708,43	91,00
																							957,59	

Ntshongweni Development Site 2 SWMP:

SN	Element ID	X Coordinate	Y Coordinate	Invert Elevation	Ground/Rim (Max) Elevation	Ground/Rim (Max) Offset	Initial Water Elevation	Initial Water Depth	Surcharge Elevation	Surcharge Depth	Ponded Area	Minimum Pipe Cover	Peak Inflow	Peak Lateral Inflow	Maximum HGL Elevation Attained	Maximum HGL Depth Attained	Maximum Surcharge Depth Attained	Minimum Freeboard Attained	Average HGL Elevation Attained	Average HGL Depth Attained	Time of Maximum HGL Occurrence	Time of Peak Flooding Occurrence	Total Flooded Volume	Total Time Flooded
				(m)	(m)	(m)	(m)	(m)	(m)	(m)	(m^2)	(m)	(cms)	(cms)	(m)	(m)	(m)	(m)	(m)	(m)	(days hh:mm)	(days hh:mm)	(ha-mm)	(minutes)
1	Jun-48	1305,17	1434,25	585,50	591,50	6,00	585,50	0,00	591,50	0,00	0,00	4,00	0,93	0,93	585,56	0,06	0,00	5,94	585,51	0,01	0 12:15	0 00:00	0,00	0,00
2	Jun-49	1209,63	1190,07	583,00	589,00	6,00	583,00	0,00	589,00	0,00	0,00	4,00	1,27	0,89	583,25	0,25	0,00	5,75	583,04	0,04	0 12:18	0 00:00	0,00	0,00
3	Jun-50	1358,53	863,14	578,00	584,00	6,00	578,00	0,00	584,00	0,00	0,00	4,00	1,93	1,13	578,30	0,30	0,00	5,70	578,05	0,05	0 12:17	0 00:00	0,00	0,00
4	Jun-51	1583,92	570,24	573,00	579,00	6,00	573,00	0,00	579,00	0,00	0,00	1,00	5,84	0,95	573,85	0,85	0,00	7,15	573,14	0,14	0 12:20	0 00:00	0,00	0,00
5	Jun-52	1906,22	1144,07	588,20	594,20	6,00	588,20	0,00	594,20	0,00	0,00	2,00	1,82	1,18	588,30	0,10	0,00	5,90	588,21	0,01	0 12:14	0 00:00	0,00	0,00
6	Jun-53	1692,81	848,99	580,30	586,30	6,00	580,30	0,00	586,30	0,00	0,00	1,00	3,18	1,54	580,67	0,37	0,00	7,63	580,36	0,06	0 12:17	0 00:00	0,00	0,00
7	Jun-54	1791,89	142,32	566,00	572,00	6,00	566,00	0,00	572,00	0,00	0,00	0,00	9,07	0,53	566,98	0,98	0,00	5,02	566,24	0,24	0 12:15	0 00:00	0,00	0,00
8	Jun-55	2002,04	365,54	576,00	582,00	6,00	576,00	0,00	582,00	0,00	0,00	3,00	6,95	0,00	576,32	0,32	0,00	5,68	576,05	0,05	0 12:15	0 00:00	0,00	0,00
9	Jun-59	1627,47	-124,45	561,00	567,00	6,00	561,00	0,00	567,00	0,00	0,00	0,00	11,26	1,01	562,05	1,05	0,00	4,95	561,25	0,25	0 12:18	0 00:00	0,00	0,00
10	Jun-60	1765,76	-130,98	571,00	577,00	6,00	571,00	0,00	577,00	0,00	0,00	1,00	0,00	0,00	571,00	0,00	0,00	6,00	571,00	0,00	0 00:00	0 00:00	0,00	0,00
11	Jun-61	1509,88	-316,09	559,00	565,00	6,00	559,00	0,00	565,00	0,00	0,00	1,00	11,21	0,00	565,00	6,00	0,00	0,00	559,29	0,29	0 12:16	0 12:20	91,28	27,00
12	Jun-63	1972,06	1458,12	606,00	612,00	6,00	606,00	0,00	612,00	0,00	0,00	5,00	0,34	0,34	606,05	0,05	0,00	5,95	606,01	0,01	0 12:10	0 00:00	0,00	0,00
13	Jun-64	2061,49	1415,89	595,00	601,00	6,00	595,00	0,00	601,00	0,00	0,00	2,00	0,34	0,00	595,05	0,05	0,00	5,95	595,01	0,01	0 12:10	0 00:00	0,00	0,00
14	Jun-66	2189,80	521,83	582,50	588,50	6,00	582,50	0,00	588,50	0,00	0,00	3,00	7,00	1,67	582,66	0,16	0,00	5,84	582,52	0,02	0 12:12	0 00:00	0,00	0,00
15	Jun-67	1991,63	1182,38	602,50	608,50	6,00	602,50	0,00	608,50	0,00	0,00	5,00	0,52	0,52	602,55	0,05	0,00	5,95	602,51	0,01	0 12:15	0 00:00	0,00	0,00
16	Jun-68	2302,77	921,73	601,50	603,50	2,00	601,50	0,00	603,50	0,00	0,00	0,50	1,75	0,53	602,05	0,55	0,00	1,45	601,60	0,10	0 12:11	0 00:00	0,00	0,00
17	Jun-69	2232,04	511,99	590,00	596,00	6,00	590,00	0,00	596,00	0,00	0,00	4,50	5,39	2,26	590,51	0,51	0,00	5,49	590,10	0,10	0 12:14	0 00:00	0,00	0,00
18	Jun-70	2306,87	617,82	596,00	598,00	2,00	596,00	0,00	598,00	0,00	0,00	0,00	3,26	0,64	596,51	0,51	0,00	2,49	596,10	0,10	0 12:14	0 00:00	0,00	0,00
19	Jun-71	2540,07	825,38	598,00	600,00	2,00	598,00	0,00	600,00	0,00	0,00	0,50	0,91	0,91	598,52	0,52	0,00	1,48	598,09	0,09	0 12:10	0 00:00	0,00	0,00
20	Jun-72	2525,19	527,12	597,00	599,00	2,00	597,00	0,00	599,00	0,00	0,00	0,00	0,89	0,00	597,52	0,52	0,00	2,48	597,09	0,09	0 12:12	0 00:00	0,00	0,00
21	Jun-73	2246,53	1010,76	602,00	604,00	2,00	602,00	0,00	604,00	0,00	0,00	0,50	1,23	0,64	602,55	0,55	0,00	1,45	602,10	0,10	0 12:11	0 00:00	0,00	0,00
22	Jun-74	2155,77	1083,02	602,50	604,50	2,00	602,50	0,00	604,50	0,00	0,00	0,50	0,61	0,61	602,89	0,39	0,00	1,61	602,57	0,07	0 12:10	0 00:00	0,00	0,00
23	Jun-75	1717,40	422,44	592,50	598,50	6,00	592,50	0,00	598,50	0,00	0,00	5,00	0,92	0,92	592,56	0,06	0,00	5,94	592,51	0,01	0 12:10	0 00:00	0,00	0,00
24	Jun-76	1630,15	372,21	570,50	576,50	6,00	570,50	0,00	576,50	0,00	0,00	2,00	6,81	0,20	571,41	0,91	0,00	5,09	570,66	0,16	0 12:23	0 00:00	0,00	0,00
25	Jun-77	1882,70	358,89	591,00	597,00	6,00	591,00	0,00	597,00	0,00	0,00	5,00	0,93	0,93	591,07	0,07	0,00	5,93	591,01	0,01	0 12:10	0 00:00	0,00	0,00
26	Jun-78	1908,70	294,55	572,30	578,30	6,00	572,30	0,00	578,30	0,00	0,00	3,00	7,81	0,00	572,65	0,35	0,00	5,65	572,35	0,05	0 12:15	0 00:00	0,00	0,00
27	Jun-79	1642,20	21,41	563,00	569,00	6,00	563,00	0,00	569,00	0,00	0,00	0,00	10,41	0,38	564,05	1,05	0,00	4,95	563,25	0,25	0 12:17	0 00:00	0,00	0,00
28	Jun-80	1791,03	14,96	587,00	593,00	6,00	587,00	0,00	593,00	0,00	0,00	5,00	1,41	1,41	587,09	0,09	0,00	5,91	587,01	0,01	0 12:10	0 00:00	0,00	0,00
29	Jun-83	1798,23	200,61	566,80	572,80	6,00	566,80	0,00	572,80	0,00	0,00	2,00	6,80	0,00	572,80	6,00	0,00	0,00	567,06	0,26	0 12:14	0 12:23	180,66	28,00
30	Jun-84	1823,51	186,61	567,80	573,80	6,00	567,80	0,00	573,80	0,00	0,00	3,00	7,80	0,00	573,80	6,00	0,00	0,00	568,04	0,24	0 12:06	0 12:16	630,79	49,00
																							902,73	

Ntshongweni Development Site 2 SWMP:

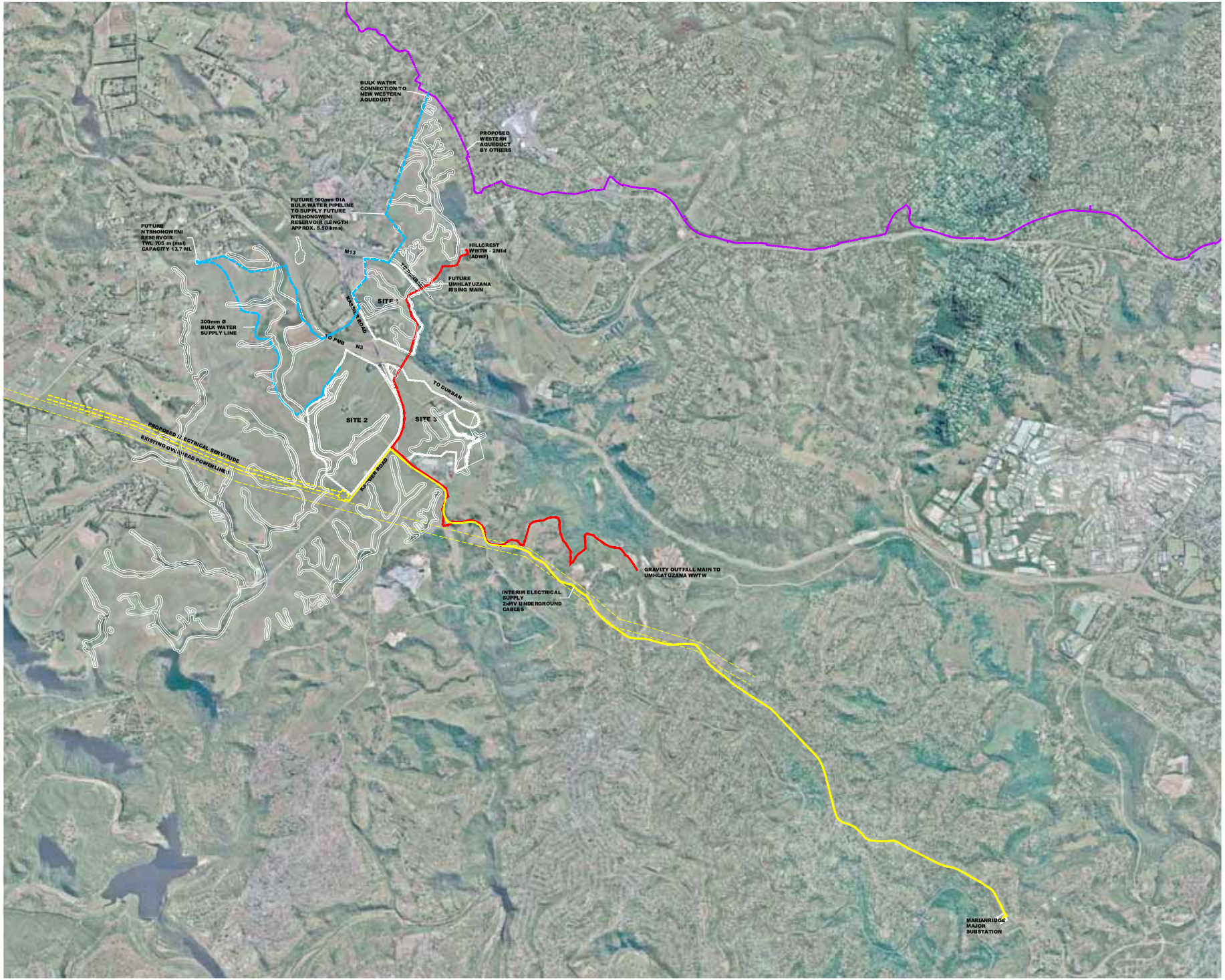
SN	Element ID	X Coordinate	Y Coordinate	Invert Elevation	Ground/Rim (Max) Elevation	Ground/Rim (Max) Offset	Initial Water Elevation	Initial Water Depth	Surcharge Elevation	Surcharge Depth	Ponded Area	Minimum Pipe Cover	Peak Inflow	Peak Lateral Inflow	Maximum HGL Elevation Attained	Maximum HGL Depth Attained	Maximum Surcharge Depth Attained	Minimum Freeboard Attained	Average HGL Elevation Attained	Average HGL Depth Attained	Time of Maximum HGL Occurrence	Time of Peak Flooding Occurrence	Total Flooded Volume	Total Time Flooded
				(m)	(m)	(m)	(m)	(m)	(m)	(m)	(m²)	(m)	(cms)	(cms)	(m)	(m)	(m)	(m)	(m)	(m)	(days hh:mm)	(days hh:mm)	(ha-mm)	(minutes)
1	Jun-48	1305,17	1434,25	585,50	591,50	6,00	585,50	0,00	591,50	0,00	0,00	4,00	3,80	3,80	585,63	0,13	0,00	5,87	585,52	0,02	0 12:10	0 00:00	0,00	0,00
2	Jun-49	1209,63	1190,07	583,00	589,00	6,00	583,00	0,00	589,00	0,00	0,00	4,00	5,35	2,81	583,50	0,50	0,00	5,50	583,08	0,08	0 12:12	0 00:00	0,00	0,00
3	Jun-50	1358,53	863,14	578,00	584,00	6,00	578,00	0,00	584,00	0,00	0,00	4,00	7,76	3,64	578,58	0,58	0,00	5,42	578,09	0,09	0 12:13	0 00:00	0,00	0,00
4	Jun-51	1583,92	570,24	573,00	579,00	6,00	573,00	0,00	579,00	0,00	0,00	1,00	22,33	3,58	574,56	1,56	0,00	6,44	573,27	0,27	0 12:15	0 00:00	0,00	0,00
5	Jun-52	1906,22	1144,07	588,20	594,20	6,00	588,20	0,00	594,20	0,00	0,00	2,00	6,62	4,16	588,42	0,22	0,00	5,78	588,23	0,03	0 12:10	0 00:00	0,00	0,00
6	Jun-53	1692,81	848,99	580,30	586,30	6,00	580,30	0,00	586,30	0,00	0,00	1,00	11,97	6,10	580,96	0,66	0,00	7,34	580,41	0,11	0 12:12	0 00:00	0,00	0,00
7	Jun-54	1791,89	142,32	566,00	572,00	6,00	566,00	0,00	572,00	0,00	0,00	0,00	37,99	2,24	567,80	1,80	0,00	4,20	566,41	0,41	0 12:13	0 00:00	0,00	0,00
8	Jun-55	2002,04	365,54	576,00	582,00	6,00	576,00	0,00	582,00	0,00	0,00	3,00	19,90	0,00	576,58	0,58	0,00	5,42	576,09	0,09	0 12:12	0 00:00	0,00	0,00
9	Jun-59	1627,47	-124,45	561,00	567,00	6,00	561,00	0,00	567,00	0,00	0,00	0,00	44,75	3,72	562,85	1,85	0,00	4,15	561,42	0,42	0 12:15	0 00:00	0,00	0,00
10	Jun-60	1765,76	-130,98	571,00	577,00	6,00	571,00	0,00	577,00	0,00	0,00	1,00	0,00	0,00	571,00	0,00	0,00	6,00	571,00	0,00	0 00:00	0 00:00	0,00	0,00
11	Jun-61	1509,88	-316,09	559,00	565,00	6,00	559,00	0,00	565,00	0,00	0,00	1,00	44,44	0,00	565,00	6,00	0,00	0,00	559,39	0,39	0 12:13	0 12:17	178,54	16,00
12	Jun-63	1972,06	1458,12	606,00	612,00	6,00	606,00	0,00	612,00	0,00	0,00	5,00	1,19	1,19	606,10	0,10	0,00	5,90	606,01	0,01	0 12:10	0 00:00	0,00	0,00
13	Jun-64	2061,49	1415,89	595,00	601,00	6,00	595,00	0,00	601,00	0,00	0,00	2,00	1,19	0,00	595,10	0,10	0,00	5,90	595,01	0,01	0 12:10	0 00:00	0,00	0,00
14	Jun-66	2189,80	521,83	582,50	588,50	6,00	582,50	0,00	588,50	0,00	0,00	3,00	20,03	4,78	582,79	0,29	0,00	5,71	582,54	0,04	0 12:10	0 00:00	0,00	0,00
15	Jun-67	1991,63	1182,38	602,50	608,50	6,00	602,50	0,00	608,50	0,00	0,00	5,00	1,62	1,62	602,60	0,10	0,00	5,90	602,52	0,02	0 12:10	0 00:00	0,00	0,00
16	Jun-68	2302,77	921,73	601,50	603,50	2,00	601,50	0,00	603,50	0,00	0,00	0,50	5,11	1,65	602,53	1,03	0,00	0,97	601,66	0,16	0 12:10	0 00:00	0,00	0,00
17	Jun-69	2232,04	511,99	590,00	596,00	6,00	590,00	0,00	596,00	0,00	0,00	4,50	15,37	6,33	590,94	0,94	0,00	5,06	590,16	0,16	0 12:12	0 00:00	0,00	0,00
18	Jun-70	2306,87	617,82	596,00	598,00	2,00	596,00	0,00	598,00	0,00	0,00	0,00	9,39	1,90	596,94	0,94	0,00	2,06	596,16	0,16	0 12:12	0 00:00	0,00	0,00
19	Jun-71	2540,07	825,38	598,00	600,00	2,00	598,00	0,00	600,00	0,00	0,00	0,50	2,53	2,53	598,95	0,95	0,00	1,05	598,15	0,15	0 12:10	0 00:00	0,00	0,00
20	Jun-72	2525,19	527,12	597,00	599,00	2,00	597,00	0,00	599,00	0,00	0,00	0,00	2,47	0,00	597,93	0,93	0,00	2,07	597,15	0,15	0 12:11	0 00:00	0,00	0,00
21	Jun-73	2246,53	1010,76	602,00	604,00	2,00	602,00	0,00	604,00	0,00	0,00	0,50	3,47	1,83	603,04	1,04	0,00	0,96	602,16	0,16	0 12:10	0 00:00	0,00	0,00
22	Jun-74	2155,77	1083,02	602,50	604,50	2,00	602,50	0,00	604,50	0,00	0,00	0,50	1,67	1,67	603,17	0,67	0,00	1,33	602,61	0,11	0 12:10	0 00:00	0,00	0,00
23	Jun-75	1717,40	422,44	592,50	598,50	6,00	592,50	0,00	598,50	0,00	0,00	5,00	2,64	2,64	592,62	0,12	0,00	5,88	592,52	0,02	0 12:10	0 00:00	0,00	0,00
24	Jun-76	1630,15	372,21	570,50	576,50	6,00	570,50	0,00	576,50	0,00	0,00	2,00	25,48	0,89	572,13	1,63	0,00	4,37	570,79	0,29	0 12:15	0 00:00	0,00	0,00
25	Jun-77	1882,70	358,89	591,00	597,00	6,00	591,00	0,00	597,00	0,00	0,00	5,00	2,61	2,61	591,13	0,13	0,00	5,87	591,02	0,02	0 12:10	0 00:00	0,00	0,00
26	Jun-78	1908,70	294,55	572,30	578,30	6,00	572,30	0,00	578,30	0,00	0,00	3,00	22,30	0,00	572,92	0,62	0,00	5,38	572,39	0,09	0 12:12	0 00:00	0,00	0,00
27	Jun-79	1642,20	21,41	563,00	569,00	6,00	563,00	0,00	569,00	0,00	0,00	0,00	41,75	1,15	564,85	1,85	0,00	4,15	563,42	0,42	0 12:14	0 00:00	0,00	0,00
28	Jun-80	1791,03	14,96	587,00	593,00	6,00	587,00	0,00	593,00	0,00	0,00	5,00	3,90	3,90	587,17	0,17	0,00	5,83	587,02	0,02	0 12:10	0 00:00	0,00	0,00
29	Jun-83	1798,23	200,61	566,80	572,80	6,00	566,80	0,00	572,80	0,00	0,00	2,00	25,40	0,00	572,80	6,00	0,00	0,00	567,14	0,34	0 12:12	0 12:17	236,97	14,00
30	Jun-84	1823,51	186,61	567,80	573,80	6,00	567,80	0,00	573,80	0,00	0,00	3,00	22,28	0,00	573,80	6,00	0,00	0,00	567,97	0,17	0 12:07	0 12:13	524,73	21,00
																							940,24	

Ntshongweni Development Site 2 SWMP:

SN	Element ID	X Coordinate	Y Coordinate	Invert Elevation	Ground/Rim (Max) Elevation	Ground/Rim (Max) Offset	Initial Water Elevation	Initial Water Depth	Surcharge Elevation	Surcharge Depth	Ponded Area	Minimum Pipe Cover	Peak Inflow	Peak Lateral Inflow	Maximum HGL Elevation Attained	Maximum HGL Depth Attained	Maximum Surcharge Depth Attained	Minimum Freeboard Attained	Average HGL Elevation Attained	Average HGL Depth Attained	Time of Maximum HGL Occurrence	Time of Peak Flooding Occurrence	Total Flooded Volume	Total Time Flooded
				(m)	(m)	(m)	(m)	(m)	(m)	(m)	(m²)	(m)	(cms)	(cms)	(m)	(m)	(m)	(m)	(m)	(m)	(days hh:mm)	(days hh:mm)	(ha-mm)	(minutes)
1	Jun-48	1305,17	1434,25	585,50	591,50	6,00	585,50	0,00	591,50	0,00	0,00	4,00	5,34	5,34	585,66	0,16	0,00	5,84	585,52	0,02	0 12:10	0 00:00	0,00	0,00
2	Jun-49	1209,63	1190,07	583,00	589,00	6,00	583,00	0,00	589,00	0,00	0,00	4,00	7,55	3,85	583,58	0,58	0,00	5,42	583,09	0,09	0 12:11	0 00:00	0,00	0,00
3	Jun-50	1358,53	863,14	578,00	584,00	6,00	578,00	0,00	584,00	0,00	0,00	4,00	10,88	4,89	578,68	0,68	0,00	5,32	578,11	0,11	0 12:12	0 00:00	0,00	0,00
4	Jun-51	1583,92	570,24	573,00	579,00	6,00	573,00	0,00	579,00	0,00	0,00	1,00	31,15	4,93	574,79	1,79	0,00	6,21	573,32	0,32	0 12:13	0 00:00	0,00	0,00
5	Jun-52	1906,22	1144,07	588,20	594,20	6,00	588,20	0,00	594,20	0,00	0,00	2,00	9,12	5,65	588,46	0,26	0,00	5,74	588,23	0,03	0 12:10	0 00:00	0,00	0,00
6	Jun-53	1692,81	848,99	580,30	586,30	6,00	580,30	0,00	586,30	0,00	0,00	1,00	16,66	8,49	581,06	0,76	0,00	7,24	580,43	0,13	0 12:11	0 00:00	0,00	0,00
7	Jun-54	1791,89	142,32	566,00	572,00	6,00	566,00	0,00	572,00	0,00	0,00	0,00	66,77	3,18	568,21	2,21	0,00	3,79	566,47	0,47	0 12:14	0 00:00	0,00	0,00
8	Jun-55	2002,04	365,54	576,00	582,00	6,00	576,00	0,00	582,00	0,00	0,00	3,00	26,50	0,00	576,68	0,68	0,00	5,32	576,10	0,10	0 12:12	0 00:00	0,00	0,00
9	Jun-59	1627,47	-124,45	561,00	567,00	6,00	561,00	0,00	567,00	0,00	0,00	0,00	74,94	5,10	563,26	2,26	0,00	3,74	561,48	0,48	0 12:16	0 00:00	0,00	0,00
10	Jun-60	1765,76	-130,98	571,00	577,00	6,00	571,00	0,00	577,00	0,00	0,00	1,00	0,00	0,00	571,00	0,00	0,00	6,00	571,00	0,00	0 00:00	0 00:00	0,00	0,00
11	Jun-61	1509,88	-316,09	559,00	565,00	6,00	559,00	0,00	565,00	0,00	0,00	1,00	74,68	0,00	561,02	2,02	0,00	3,98	559,40	0,40	0 12:17	0 00:00	0,00	0,00
12	Jun-63	1972,06	1458,12	606,00	612,00	6,00	606,00	0,00	612,00	0,00	0,00	5,00	1,61	1,61	606,12	0,12	0,00	5,88	606,01	0,01	0 12:10	0 00:00	0,00	0,00
13	Jun-64	2061,49	1415,89	595,00	601,00	6,00	595,00	0,00	601,00	0,00	0,00	2,00	1,61	0,00	595,12	0,12	0,00	5,88	595,01	0,01	0 12:10	0 00:00	0,00	0,00
14	Jun-66	2189,80	521,83	582,50	588,50	6,00	582,50	0,00	588,50	0,00	0,00	3,00	26,70	6,34	582,84	0,34	0,00	5,66	582,55	0,05	0 12:10	0 00:00	0,00	0,00
15	Jun-67	1991,63	1182,38	602,50	608,50	6,00	602,50	0,00	608,50	0,00	0,00	5,00	2,21	2,21	602,62	0,12	0,00	5,88	602,52	0,02	0 12:10	0 00:00	0,00	0,00
16	Jun-68	2302,77	921,73	601,50	603,50	2,00	601,50	0,00	603,50	0,00	0,00	0,50	6,83	2,25	602,63	1,13	0,00	0,87	601,68	0,18	0 12:10	0 00:00	0,00	0,00
17	Jun-69	2232,04	511,99	590,00	596,00	6,00	590,00	0,00	596,00	0,00	0,00	4,50	20,45	8,37	591,17	1,17	0,00	4,83	590,19	0,19	0 12:12	0 00:00	0,00	0,00
18	Jun-70	2306,87	617,82	596,00	598,00	2,00	596,00	0,00	598,00	0,00	0,00	0,00	12,53	2,57	597,17	1,17	0,00	1,83	596,19	0,19	0 12:11	0 00:00	0,00	0,00
19	Jun-71	2540,07	825,38	598,00	600,00	2,00	598,00	0,00	600,00	0,00	0,00	0,50	3,33	3,33	599,17	1,17	0,00	0,83	598,17	0,17	0 12:10	0 00:00	0,00	0,00
20	Jun-72	2525,19	527,12	597,00	599,00	2,00	597,00	0,00	599,00	0,00	0,00	0,00	3,27	0,00	598,15	1,15	0,00	1,85	597,17	0,17	0 12:11	0 00:00	0,00	0,00
21	Jun-73	2246,53	1010,76	602,00	604,00	2,00	602,00	0,00	604,00	0,00	0,00	0,50	4,61	2,44	603,14	1,14	0,00	0,86	602,13	0,13	0 12:10	0 00:00	0,00	0,00
22	Jun-74	2155,77	1083,02	602,50	604,50	2,00	602,50	0,00	604,50	0,00	0,00	0,50	2,19	2,19	603,29	0,79	0,00	1,21	602,63	0,13	0 12:10	0 00:00	0,00	0,00
23	Jun-75	1717,40	422,44	592,50	598,50	6,00	592,50	0,00	598,50	0,00	0,00	5,00	3,52	3,52	592,64	0,14	0,00	5,86	592,52	0,02	0 12:10	0 00:00	0,00	0,00
24	Jun-76	1630,15	372,21	570,50	576,50	6,00	570,50	0,00	576,50	0,00	0,00	2,00	35,46	1,29	572,36	1,86	0,00	4,14	570,84	0,34	0 12:14	0 00:00	0,00	0,00
25	Jun-77	1882,70	358,89	591,00	597,00	6,00	591,00	0,00	597,00	0,00	0,00	5,00	3,45	3,45	591,15	0,15	0,00	5,85	591,02	0,02	0 12:10	0 00:00	0,00	0,00
26	Jun-78	1908,70	294,55	572,30	578,30	6,00	572,30	0,00	578,30	0,00	0,00	3,00	29,69	0,00	573,03	0,73	0,00	5,27	572,41	0,11	0 12:12	0 00:00	0,00	0,00
27	Jun-79	1642,20	21,41	563,00	569,00	6,00	563,00	0,00	569,00	0,00	0,00	0,00	71,25	1,51	565,26	2,26	0,00	3,74	563,48	0,48	0 12:15	0 00:00	0,00	0,00
28	Jun-80	1791,03	14,96	587,00	593,00	6,00	587,00	0,00	593,00	0,00	0,00	5,00	5,14	5,14	587,20	0,20	0,00	5,80	587,03	0,03	0 12:10	0 00:00	0,00	0,00
29	Jun-83	1798,23	200,61	566,80	572,80	6,00	566,80	0,00	572,80	0,00	0,00	2,00	35,34	0,00	568,67	1,87	0,00	4,13	567,15	0,35	0 12:16	0 00:00	0,00	0,00
30	Jun-84	1823,51	186,61	567,80	573,80	6,00	567,80	0,00	573,80	0,00	0,00	3,00	29,66	0,00	568,53	0,73	0,00	5,27	567,91	0,11	0 12:12	0 00:00	0,00	0,00
																							0,00	

ANNEXURE D

BULK SERVICES
DRG. 243/192/031 REV 3



BULK SERVICES LEGEND

CONTOUR INTERVALS = 2.5m

0m 100m 200m 300m

SCALE

LAYOUT PLAN

SCALE 1 : 20 000

BOSCH STEMELE (PTY) LTD.
P.O.BOX 2009, DURBAN, 4000.
1 HOLWOOD PARK, 5 CANEGATE ROAD,
LA LUCIA RIDGE OFFICE ESTATE,
KWAZULU-NATAL, RSA
TELEPHONE: (031) 535 6000
TELEFAX: (031) 535 6011
E-mail: bskzn@boschstemele.co.za
www.boschstemele.co.za
REGIONAL OFFICES IN:
CAPE TOWN • EAST LONDON • PORT ELIZABETH • JOHANNESBURG

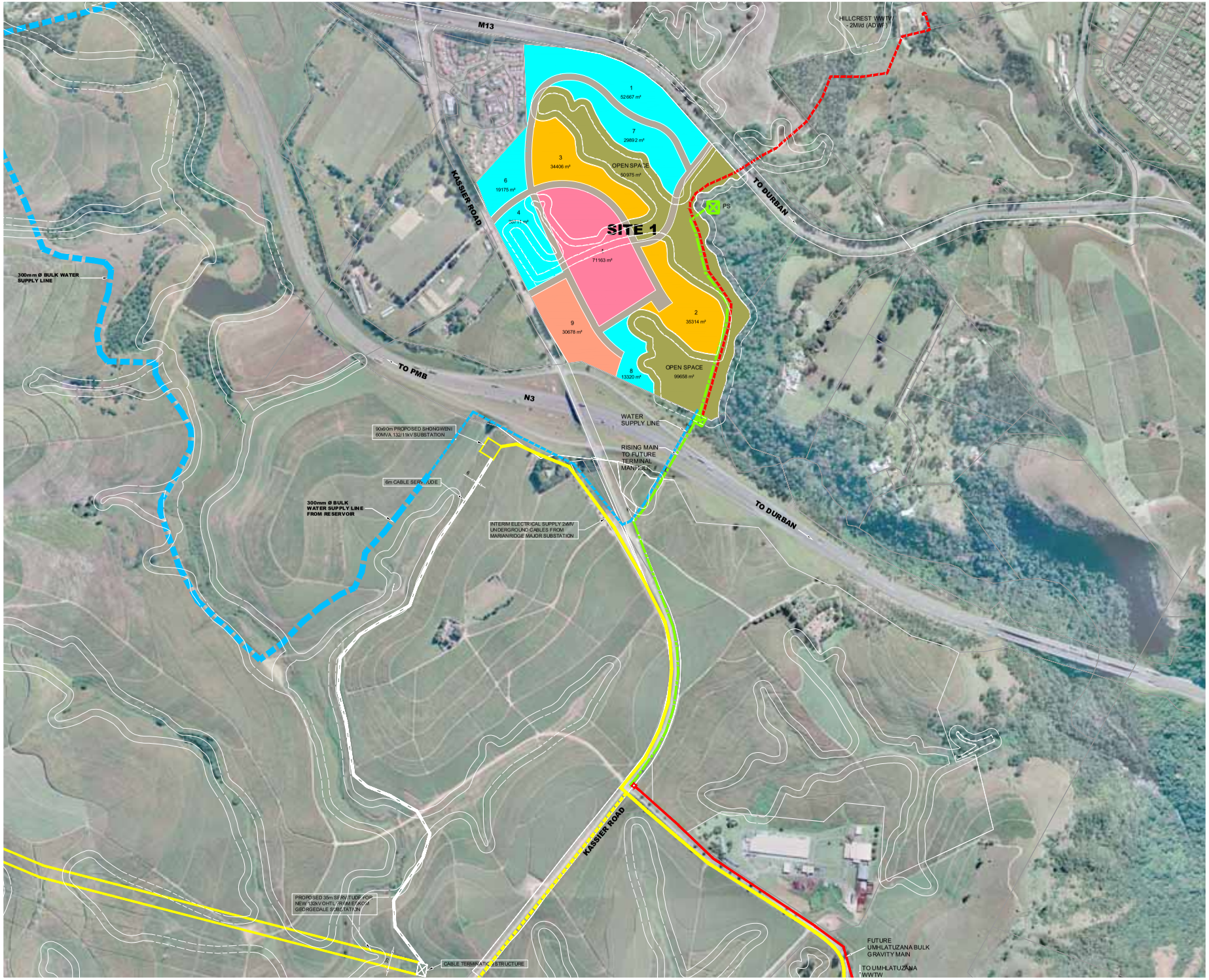
ANNEXURE E

BULK SERVICES

SITE 1 DRG. 243/192/033 REV 2

SITE 2 DRG. 243/192/034 REV 3

SITE 3 DRG. 243/192/035 REV 2



BOSCH STEMELE (PTY) LTD.
P.O.BOX 2009, DURBAN, 4000.
1 HOLWOOD PARK, SCANEGATE ROAD,
LA LUCIA RIDGE OFFICE ESTATE,
KWAZULU-NATAL, RSA
TELEPHONE: (031) 535 6000
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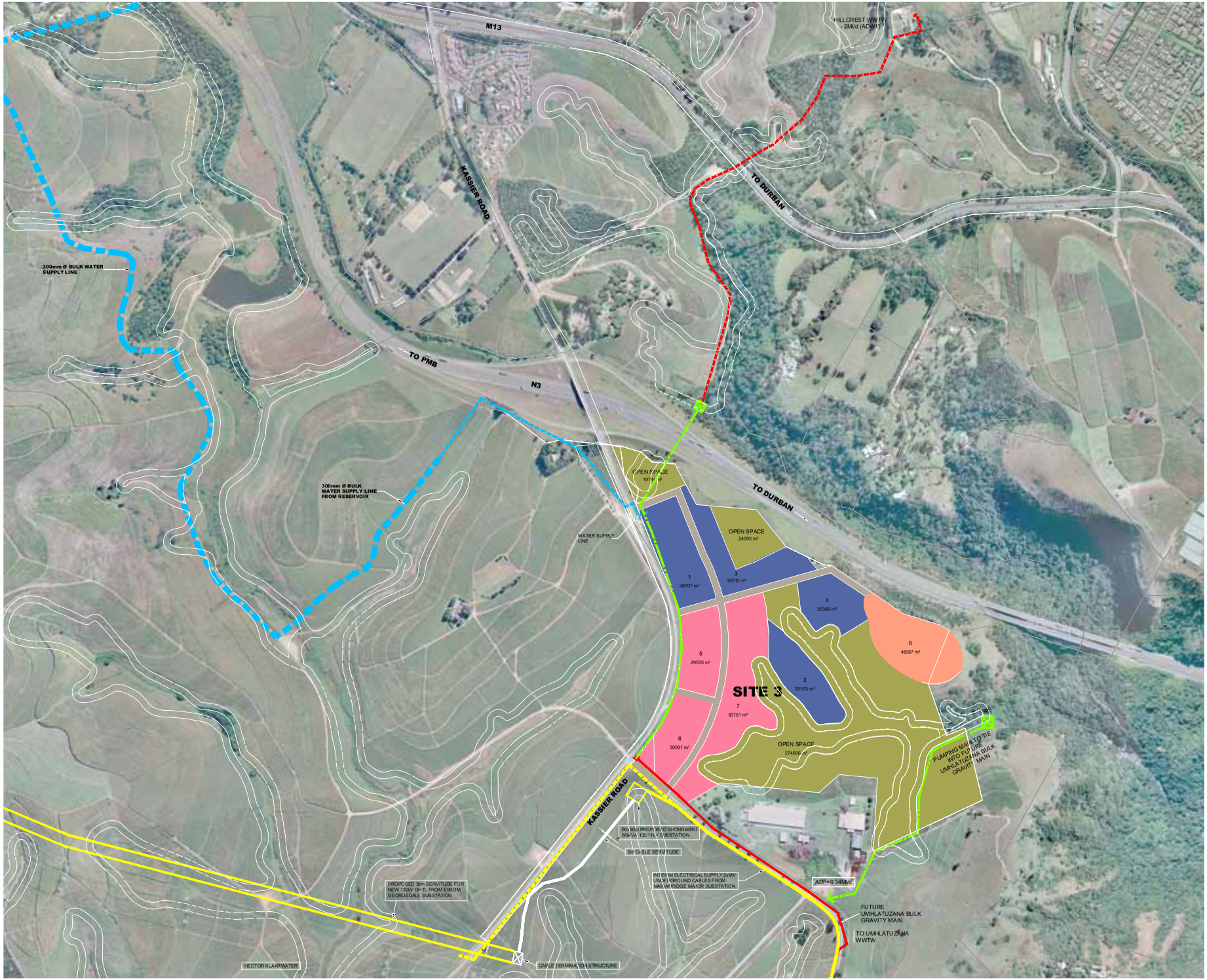

LANDUSE LEGEND

- COMMERCIAL
- OFFICE
- RESIDENTIAL
- TOURISM / RECREATION
- OPEN SPACE
- BUSINESS
- WETLANDS & BUFFER

CONTOUR INTERVALS = 2.5m

0m 100m 200m 300m

SCALE

BOSCH STEMELE (PTY) LTD.
P.O.BOX 2009, DURBAN, 4000.
1 HOLWOOD PARK, SCANEGATE ROAD,
LA LUCIA RIDGE OFFICE ESTATE,
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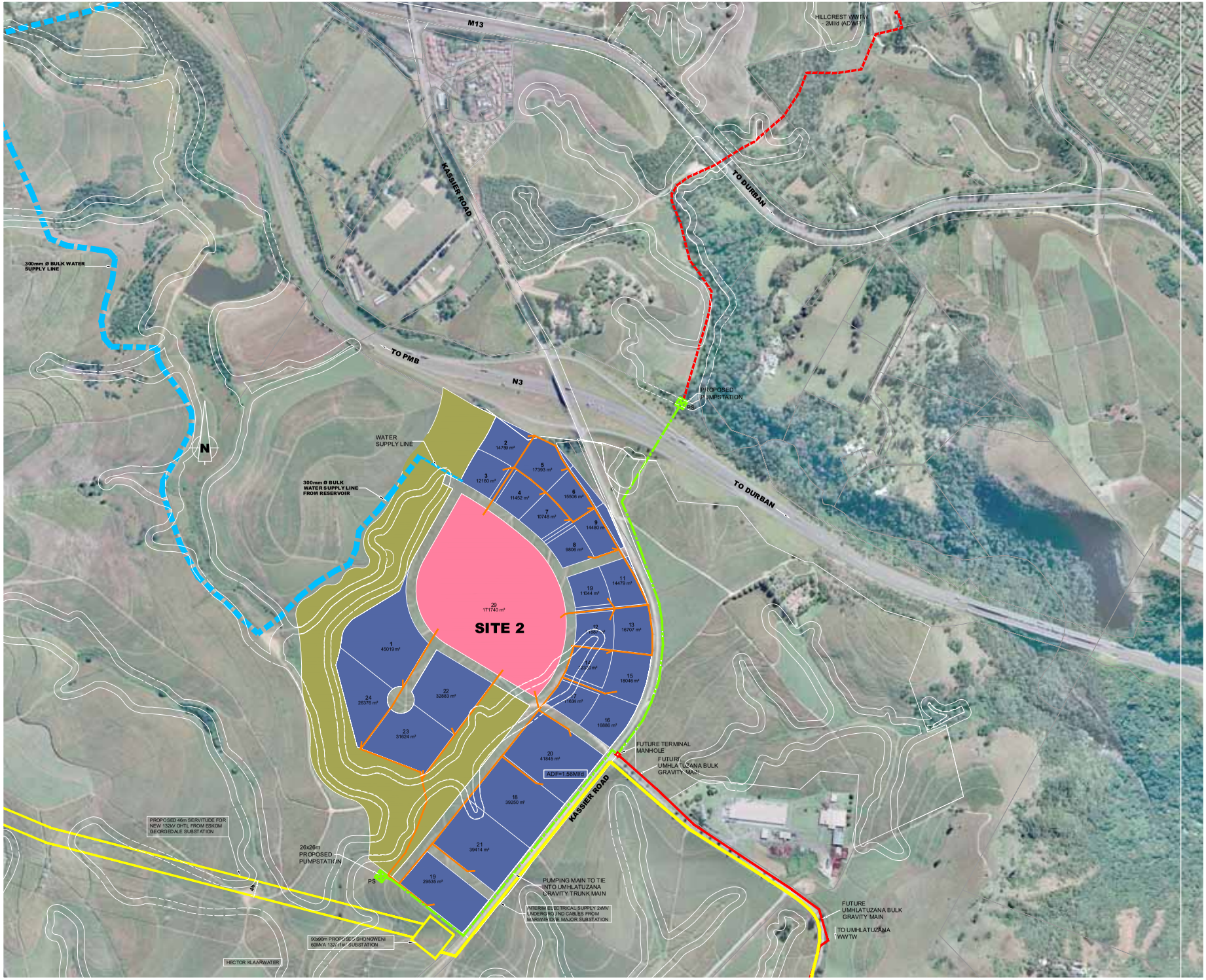

BOSCH STEMELE (PTY) LTD.
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ANNEXURE F

PROVISIONAL SERVICES REPORT: ELECTRICAL REV 6

BOSCH PROJECTS

eNtshongweni Development

Preliminary Services Report Electrical Revision 06

August 2013

Tongaat Hulett DEVELOPMENTS

eNtshongweni Development
Preliminary Services Report - Electrical

August 2013 – Rev 06

Bosch Projects Ref.: 243/208/1040

1 Holwood Park • 5 Canegate Road • La Lucia Ridge Office Estate • Durban

PO Box 2009 • Durban 4000 • KwaZulu-Natal • South Africa

Telephone: +27 (0)31 535 6000 • Facsimile: +27 (0)31 535 6011

Internet: http://www.boschProjects.co.za

E-mail: Sunderlalls@boschprojects.co.za

Contact Persons:	**Mobile ph:**
Derick Serfontein	+27 83 447 0656
Sudesh Sunderlall	+27 83 283 1397

TABLE OF CONTENTS

1. EXECUTIVE SUMMARY

This report is a summary of the electrical load requirements of the proposed eNtshongweni Phase 1 Development (site 2 option 2) to be undertaken by Tongaat Hulett Developments (THD). The report identifies the Supply Authority as eThekwini Electricity and the Marian Ridge Major substation from which the development will obtain its initial load requirements.

Based on the bulk and usage information, it is estimated that the total electrical load requirement is in the order of 31.83MVA. One new major substation will be required for the ultimate development.

2. INTRODUCTION

This report deals specifically with the proposed eNtshongweni Phase 1 Development which lies west of Durban. The development will consist of industrial business park and commercial. Bosch Projects (BP) has been appointed to compile a preliminary services report for the electrical infrastructure

The terms of reference include the following activities:

- To establish the projected electrical loads for this development.
- To determine the optimum and most cost effective design to supply the projected electrical loading, which includes:

    - To obtain agreement and approval from e'Thekwini Electricity's planning department with regard to the 11kV cabling from the Marian Ridge major substation to cater for the Site 2 Option 2 proposal.
    - To obtain agreement and approval from e'Thekwini Electricity's high voltage planning department with regard to the 132kV major substations, overhead transmission lines and servitudes.

3. ELECTRICAL INFRASTRUCTURE (EXISTING)

The proposed eNtshongweni Phase 1 development is within the e'Thekwini Electricity area of supply.

The electrical infrastructure is divided into the following categories shown below:

3.1 Transmission (132/11 kV)

The Marian Ridge major substation is located 9.4km from the proposed eNtshongweni development however it is the only substation in the vicinity that has 5MVA spare capacity to meet the needs of the initial development requirements.

3.2 Transmission Line Servitudes

There are no registered servitudes within the phase 1 development.

3.3 Distribution (11kV)

There is an 11kV supply in the vicinity of the development but is unable to support the additional load of the new development.

3.4 Reticulation

No electrical supply (at 400V) is available within the boundaries of the project.

3.5 Street Lighting

No street lighting currently exists within the boundaries of the project.

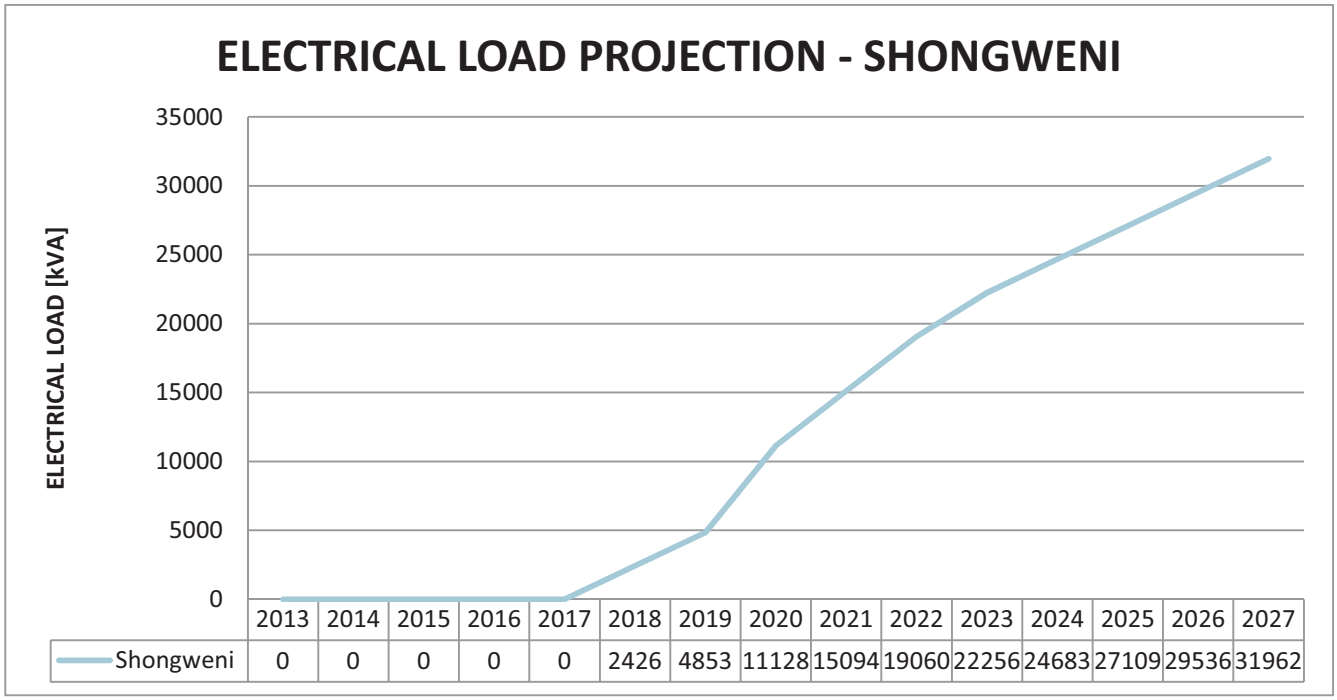
4. PROPOSED DEVELOPMENT REQUIREMENTS

The preliminary planning criteria are based on the following information:

USE	Commercial Bulk Area [m²]	Business Park Area [m²]	VA/m²	kVA
Retail	120,218		80	9,617
Industrial Business Park		303,152	100	30,152
TOTAL	**120,218**	**303,152**		**39,769**

The potential electrical load at the major substation/s after diversity factor applied will be in the order of 31.83 MVA.

In formulating the preliminary planning criteria we have used good engineering practice and load factors as per Annex B of NRS 069: 2004 which are approved by e'Thekweni Electricity. The system will be designed to cater for the failure of any single MV cable, i.e. electrical load can be transferred via switching in the event of a fault occurring.



5. FUTURE ELECTRICAL INFRASTRUCTURE REQUIREMENTS

The proposed electrical infrastructure is covered under the headings below:

5.1 Transmission (275/132 kV)

If all the proposed bulks are achieved, one new 132/11kV, 60MVA major substation will be required to be installed within or adjacent to the development area.

System strengthening may also be required on the 275kV transmission line infrastructure. HV Planning have indicated that a new 275/132kV substation will be required in the future.

5.2 Transmission Line Servitudes

Transmission line servitudes are required outside the development area. This may be overhead or underground subject to the cost/benefit of the land value affected. e'Thekwini Electricity have to liaise with Eskom for a 132kV feeder from Eskom's Georgedale Substation (13.2km from the development) to provide the feed for the new 132/11kV major at eNtshongweni.

5.3 Distribution (11kV)

Two 11kV supplies will be taken from the Marian Ridge major substation to the development. This supply will initially feed in to a distribution substation. Distribution substations will be planned and positioned in key locations throughout the development. From here 11kV cable routes will be planned to run adjacent or be in close proximity to each proposed site allowing sales transfers of sites to take place.

5.4 Reticulation (400V)

In most instances the internal electrical reticulation of the Industrial/ Business Park and offices (i.e. within the property/erf) will be undertaken by each top structure developer to meet his specific requirements. Tongaat Hulett Developments will be responsible for the costs for the 11kV bulk supply to the boundary of these developments.

Reticulation for residential developments will however include the positioning

of transformers and low voltage circuits that will be reticulated to the boundaries of the residential properties, the cost thereof will also be borne by Tongaat Hulett Development. This will not be applicable if a development is sold off as a multiple unit gated development or similar.

5.5 Street Lighting

Provision is made for both street lighting as well as public open space lighting. It is recommended that lighting form part of a separate report due to the aesthetic requirements of the urban architecture. When street lighting standards exceed that of e'Thekweni Electricity, a separate service level agreement must be entered into. The additional cost are amortised over 20 years and its cost is for the Developers account.

5.6 FINAL COMMENTS

As detailed information becomes available, co-ordination meetings with the Supply Authority shall take place to ensure that the development milestones are achieved.

6. ACTION ITEMS

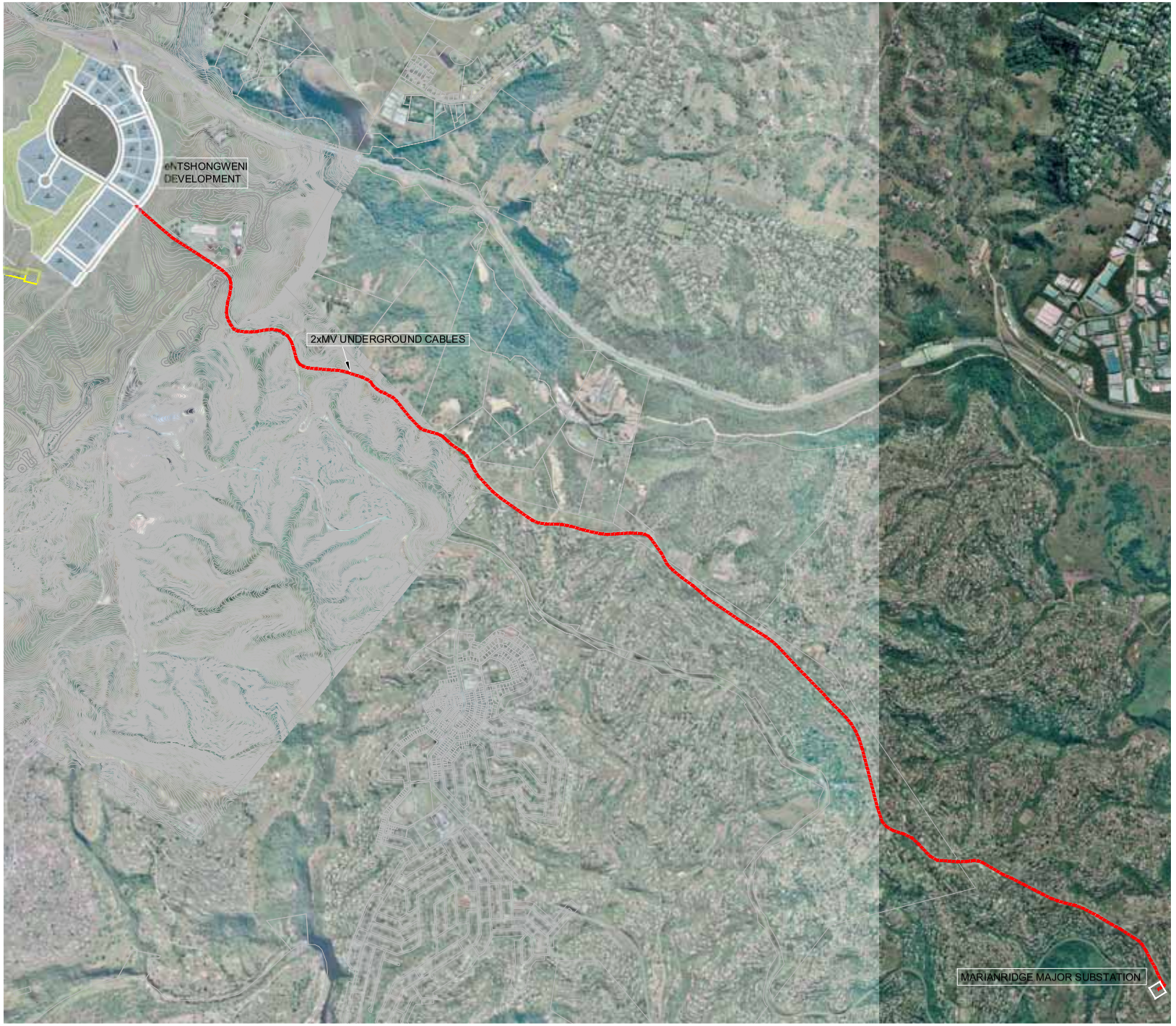
The following actions are required going forward.

- Preliminary design needs to take place.

APPENDICES

- **Appendix A – Interim MV Feed**
- **Appendix B – Proposed new 132/11kV Major Substation**

APPENDIX A



REV.	BY	DESCRIPTION	DATE	APPR'D
01	S.L.	ISSUED FOR CLIENT APPROVAL	01/03/13	
1	S.L.	FOR INTERNAL REVIEW	01/03/13	

DRG. No. REFERENCE DRAWING

NOTE:
THE CLIENT IS RESPONSIBLE FOR ENSURING COMPLIANCE TO ANY LOCAL HEALTH AND SAFETY LAWS AND REGULATIONS

IF IN DOUBT, ASK !

THIS DRAWING WAS PREPARED USING A QUALITY MANAGEMENT SYSTEM CERTIFIED BY DEKRA

Quality Management ISO 9001:2008 Voluntary participation in regular monitoring DEKRA Certification DEKRA certified

1 HOLWOOD PARK
5 CANEGATE ROAD
LA LUCIA RIDGE OFFICE ESTATE
DURBAN, SOUTH AFRICA, 4320

TEL: +27 (0)31 535 6000
FAX: +27 (0)31 535 6010
e-mail: mail@boschprojects.co.za
website: www.boschprojects.co.za

DESIGNED	S.S.	DRAWN	S.L.
CHECKED	S.S.	PROCESS ENGINEER	N/A
CIVIL ENGINEER	N/A	STRUCTURAL ENGINEER	N/A
INSTRUMENT ENGINEER	N/A	ELECTRICAL ENGINEER	S.S.
MECHANICAL ENGINEER	N/A	CO-ORDINATION ENGINEER	N/A

APPROVED S.S. PROJECT MANAGER K.N. DRAWING OFFICE MANAGER

TONGAAT HULETT DEVELOPMENTS

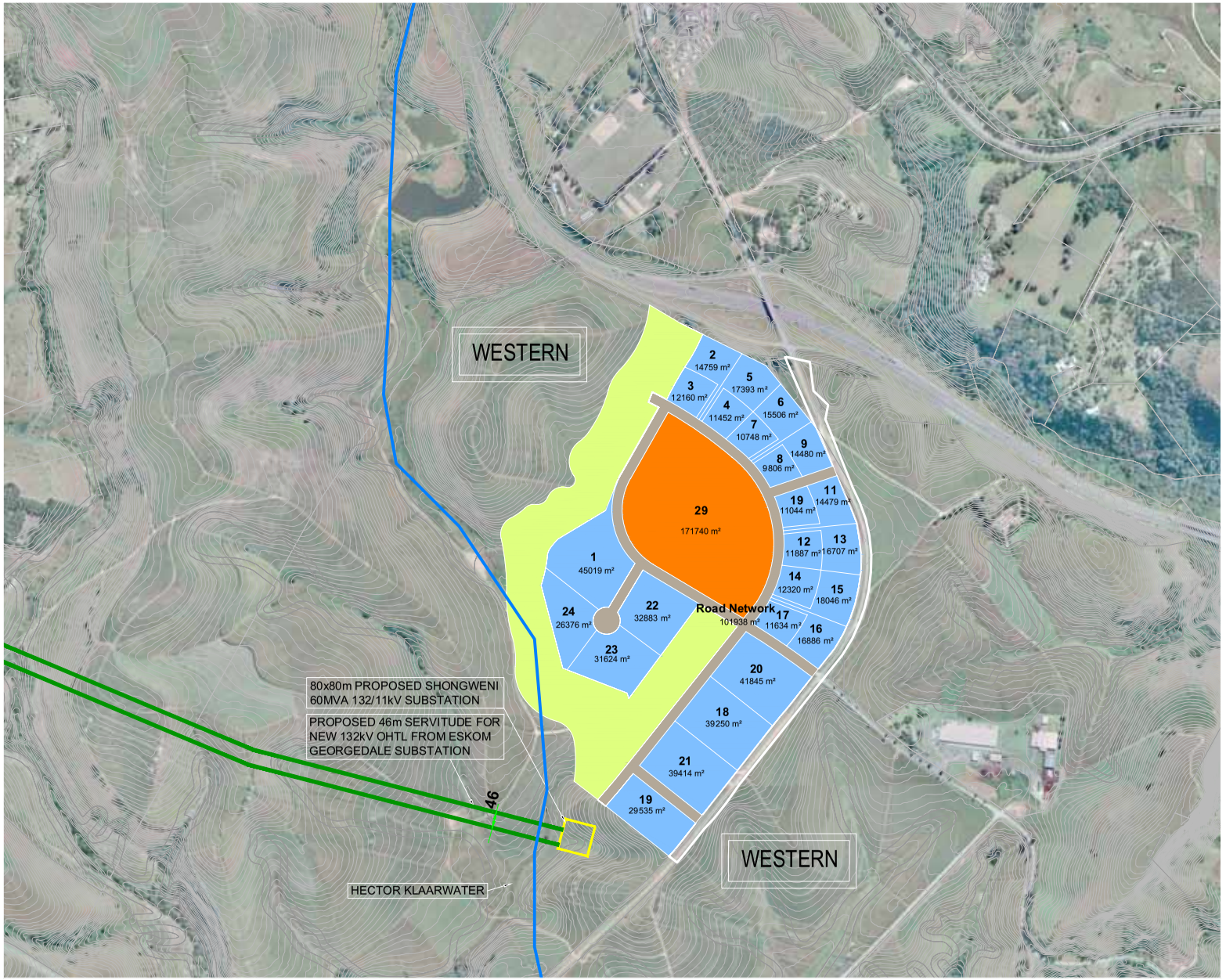
eNTSHONGWENI DEVELOPMENT

PROPOSED MV CABLE ROUTE FROM MARIANRIDGE MAJOR SUBSTATION

SCALE NTS DATE 01/03/13

DRAWING NUMBER 243/208/3016 A2 REVISION 01

APPENDIX B



Legend

- Proposed 46m OHTL Servitude
- Denotes eThekwini Electricity Supply Area Boundary
- Business
- Green Open Space
- Road Network
- Commercial

REV.	BY	DESCRIPTION	DATE	APPR'D
02	T.B.	ETHEKWINI AREA SUPPLY BOUNDARY ADDED	06/03/13	
01	S.L.	ISSUED FOR CLIENT APPROVAL	01/03/13	
1	T.B.	FOR INTERNAL REVIEW	13/02/13	

DRG. No. REFERENCE DRAWING

NOTE:
THE CLIENT IS RESPONSIBLE FOR ENSURING COMPLIANCE TO ANY LOCAL HEALTH AND SAFETY LAWS AND REGULATIONS

IF IN DOUBT, ASK !

THIS DRAWING WAS PREPARED USING A QUALITY MANAGEMENT SYSTEM CERTIFIED BY DEKRA

Quality Management ISO 9001:2008 Voluntary participation in regular monitoring DEKRA Certification DEKRA certified

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TONGAAT HULETT DEVELOPMENTS

eNTSHONGWENI DEVELOPMENT

PROPOSED BULK ELECTRICITY SUPPLY SITE 2 OPTION 2

SCALE NTS DATE 13/02/13

DRAWING NUMBER **243/208/3010** A2 REVISION 02

ANNEXURE G

WETLAND BUFFER PIPE CROSSING

ANNEXURE G : WETLAND BUFFER PIPE CROSSING

It is anticipated that certain sewer and bulk water supply pipelines may traverse valley lines which could contain various wetland areas and care will be taken to minimise the e ect on these environmentally sensitive areas. Where these crossin s traverse minor valleys or stream lines then small pipe brid e structures will be pre erred as shown on the attached typical drawin 243/192/036.

The proposed 500mm diameter eThekwini bulk water supply line to the proposed reservoir (Annexure C: 243/192/031 Rev 3) planned to service the reater Ntshon weni re ion will traverse throu h lar er wetland areas and water courses, or these crossin where are two typical options which will relate to either the topo raphy and/or the eotechnical conditions. The choice o crossin will be determined durin detailed desi n and in addition to the topo raphy and eotechnical conditions, will be overned by the sensitivity o each o the e ected wetlands. The two options are:-

1. Brid e Structure

   The detailed review o each crossin will determine whether a brid e structure with multiple piers ounded within the wetland area or a suspended structure with ewer oundations within the wetland is used. The suspended structure could either be a cable stayed brid e or a lattice steel structure on piers which would be desi ned to carry the proposed pipeline over lar er spans. These structures could also be used on very steep valleys and thus avoid any impact on the environmentally sensitive areas.

2. Trenchin

   For crossin s over latter wetland areas and bu ers trenchin would be the pre erred option, It would re uire excavatin throu h the bu er areas and water course to allow or the placement o the pipeline. The depth o the trenchin would be determined by detail eotechnical investi ations however reat care would be taken in limitin the width o the trench and work area or construction vehicles. Where rock underlines the water course the pipeline would be secured to this bedrock and protected with a concrete weir type structure. Should the river crossin s be within so ter material then the pipeline will be encase in concrete and desi ned to withstand lood conditions.

Independent o the type o crossin detailed, the constructor will be re uired to produce a detailed method statement speci yin the proposed construction which will be reviewed by both the en ineer and environmental control o icer prior to any work commencin in any o these environmentally sensitive areas.

On the eThekwini Bulk Water Supply pipeline ive valley lines / wetland crossin reater than 30m have been identi ied and it is anticipated that trenchin would be the pre erred option or the ma ority o these crossin however this will be inalised ollowin topo raphic and eotechnical surveys. In addition to these there are our environmentally sensitive bu er areas throu h which trenchin will traverse and the construction methods used will be restricted by the Approved Environmental Mana ement Plan.

The ollowin table re lects the expected type o crossin or each o the proposed crossin s:

Crossin	Width 1	Width 2	Width 3	Pre erred Crossin method
Crossin A	28m	29m	n/a	Trenchin
Crossin A 2 (Umhlatuzana)	85m	90m	30m	Brid e Structure
Crossin B	46m	98m	n/a	Brid e Structure
Crossin C	Bu er			Trenchin
Crossin D	Bu er			Trenchin
Crossin E	Bu er			Trenchin
Crossin F	75m	18m	n/a	Brid e Structure
Crossin G	30m	n/a	n/a	Brid e Structure
Crossin H	Bu er			Trenchin

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APPENDIX 4:

TONGAAT HULETT DEVELOPMENTS: NTSHONGWENI SATURN MODEL - TRAFFIC IMPACT ASSESSMENT FOR SITES 1, 2 AND 3 (ARUP (PTY) LTD)

Tongaat Hulett Developments

Ntshongweni Saturn Model

Traffic Impact Assessment for Sites 1, 2 and 3

Rep/TIA Sites 1, 2 and 3/D1

Issue | 18 March 2013

Job number 224459

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		Signature			
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Contents

Tables

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Appendices

1 Introduction

In 2007 Arup Pty (Ltd) were appointed by Tongaat Hulett Developments to develop an AM Peak Hour SATURN Traffic Simulation Model to assess the future impact on the road network of the Shongweni development and determine the upgrades required in order to accommodate the development.

Since then a Local Area Plan has been developed for the Shongweni area and Tongaat Hulett have undertaken a number of revisions in their plan. In 2012 Tongaat Hulett appointed Arup to update the model to a base year of 2012 and to assess the impact of the revised land use plan on the road network.

Following on from this assessment, Arup were asked to produce a Traffic Impact Assessment for the development of Sites 1, 2 and 3. It should be noted that only **one** of these sites will be developed so each site is assessed on its own.

The decision was taken to use the updated SATURN model to assess the impact of these sites; therefore a PM peak model was developed as part of the assessment.

1.1 Site Location

As stated above, there are three sites that Tongaat are looking at developing and these are all located in close proximity to the N3 and M13.

- Site one is between the N3 and M13 and east of Kassier Road;
- Site two is located to the south of the N3 and west of Kassier Road; and
- Site three is located between the N3 and MR559 and east of Kassier Road.

The location of each of these sites can be seen in **Figure 1**.

1.2 Development Details

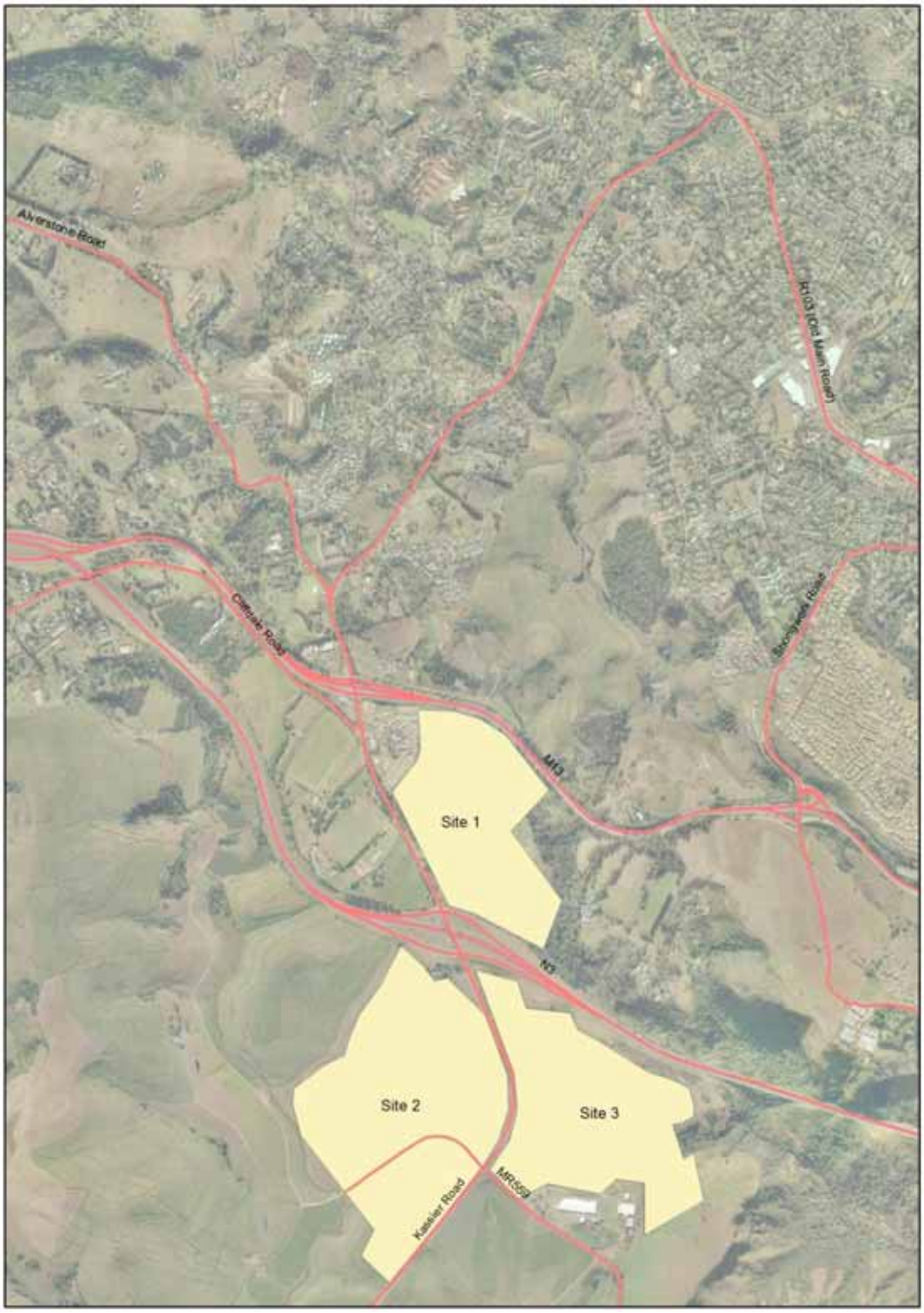
The details of the development planned for each site can be seen in **Table 1**.

Table 1: Development Details for Each Site

Land Use	Area (GLA m^2)		
	Site One	Site Two	Site Three
Tourism and Recreation – Hotel	15,339		23,044
Office	85,059		
Medium density residential	41,832		
Commercial / Retail	128,093	128,805	120,417
Business		303,152	
Logistics/Industrial			66,886
Total	270,323	431,957	210,347

It should be noted that for the tourism and recreation the development is expected to be a 200 bedroom hotel and for the medium density residential 523 units have been used. Detailed layouts of each site can be found in Appendix A.

Figure 1: Location of Each Site



1.3 Approach

It is important to note that at the present moment in time Tongaat only plan to develop one of the sites assessed in this Traffic Impact Assessment and as such each is assessed independently of each other.

The approach to undertake the assessment is to run the model with the existing road network and to allow the model to undertake an assignment. Within this base model all new intersections are modelled as priority. From this first assignment it is possible to determine the main routes to and from the development and thus the amount of traffic that passes through these key intersections.

2 Status Quo

2.1 Existing Road Network

For the road network in the Shongweni area there are five major roads, of which three run in an east-west direction. The five major roads are as follows:

- The N3;
- The M13;
- The R103;
- Kassier Road; and
- Kassier Road

Along with these five roads, there are a number of minor roads off Kassier Road heading towards various developments and towards Shongweni dam and outlying areas.

2.1.1 N3

The N3 is a freeway running in an east-west direction linking Durban with Gauteng and beyond. At the point that the N3 passes through the site it consists of three lanes per direction with a 120km/h speed limit in place.

The nearest interchange to the sites is the Shongweni interchange itself.

The N3 at this point is a toll road with the toll booths being located to the east of the site at Mariannhill.

2.1.2 M13

The M13 is an east-west running freeway located to the north of the N3. For its entire length the M13 runs a parallel course to that of the N3 and provides an alternative route to the tolled N3. It links the Durban CBD and Pinetown CBD with the western suburbs of Durban.

At the point at which the M13 passes the site the road is a two lane dual carriageway with a speed limit of 100km/h.

2.1.3 R103

The R103 is a single carriageway two lane road and is classified as a Class 3 rural main road. The R103 runs in an-east-west direction and provides a non-freeway alternative to travelling between Durban and the Outer West area and beyond. The speed limit on the R103 is 80km/h, but in places this is not possible due to the alignment of the road.

2.1.4 Kassier Road

Kassier Road is a north-south running road, the only one within the area, and effectively links the Hillcrest and Shongweni with each other and with the N3,

M13 and the R103. Based on the COTO classification the road is classed as a Class 3 rural main road.

Kassier Road is a single lane single carriageway with localised widening at the N3 and M13 interchanges and at other key intersections along the route. The speed limit for the road is 80km/h.

2.1.5 Shongweni Road

Shongweni Road is a north south running road that crosses the M13 and provides a link between the R103 (Hillcrest) and the M13. South of the M13, Shongweni Road becomes a dirt track.

North of the M13 interchange Shongweni Road is a single carriageway two lane road with localised widening at intersections in order to accommodate right turn refuges.

2.2 Key Intersections

There are a number of key intersections along the route and these are as below, and can be seen in **Figure 2**, along with the SATURN layouts:

1. Kassier Road/MR559
2. Kassier Road/N3 interchange;
3. Kassier Road/Cliffdale Road;
4. Kassier Road/M13 Interchange;
5. Kassier Road/Alverstone Road;
6. Kassier Road/R103; and
7. Shongweni Road/M13 Interchange.

2.2.1 Kassier Road/MR559

This intersection is located to the south of the N3 and is a four arm intersection with the minor arms being stop controlled. The western arm of the intersection is a gravel road heading into the current sugar cane fields and as such traffic volumes on this arm will be low.

2.2.2 Kassier Road/N3 Interchange

This interchange consists of two intersections, one for the westbound on and off-ramps and the other for the eastbound on and off-ramps. Both of these are currently operating as priority controlled intersections with a right turn refuge in the middle.

2.2.3 Kassier Road/Cliffdale Road

This is a staggered right left intersection in close proximity to the Kassier Road/M13 interchange approximately 150m to the north. This currently operates as a priority controlled intersection with the eastern arm providing access to a development and the west arm being Cliffdale Road.

A right turn refuge is currently provided on Kassier Road.

2.2.4 Kassier Road/M13 Interchange

This interchange has recently been upgraded from priority control to signal control to ease congestion at this intersection. For this interchange there is no localised widening due to the width of the bridge over the M13.

2.2.5 Kassier Road/Alverstone Road

This intersection is located to the north of the M13 and effectively consists of two parts. For those travelling northbound on Kassier Road and wishing to take Alverstone Road they are able to take a slip road onto Alverstone Road and thus avoid the actual intersection itself. For all other movements, traffic has to pass through the intersection.

For the main intersection right turn refuges are provided.

2.2.6 Kassier Road/R103

This intersection is operating as a signal controlled T-intersection.

For the eastern arm of the R103 it consists of one straight ahead and one straight ahead and left turn lane, and for the western arm it consists of two straight ahead lanes and a right turn refuge. For Kassier Road it consists of one right turn lane and a short left turn lane.

2.2.7 Shongweni Road/M13 Interchange

Since the original model was developed in 2007 this interchange has been upgraded as the original model had no westbound off-ramp.

The eastbound off-ramp is a loop design, while the other on and off ramps are of a normal straight design. Currently this interchange is priority controlled with left turn slips for the eastbound on and off ramps while there is a right turn slip for the westbound on ramp.

2.2.8 Intersection Analysis

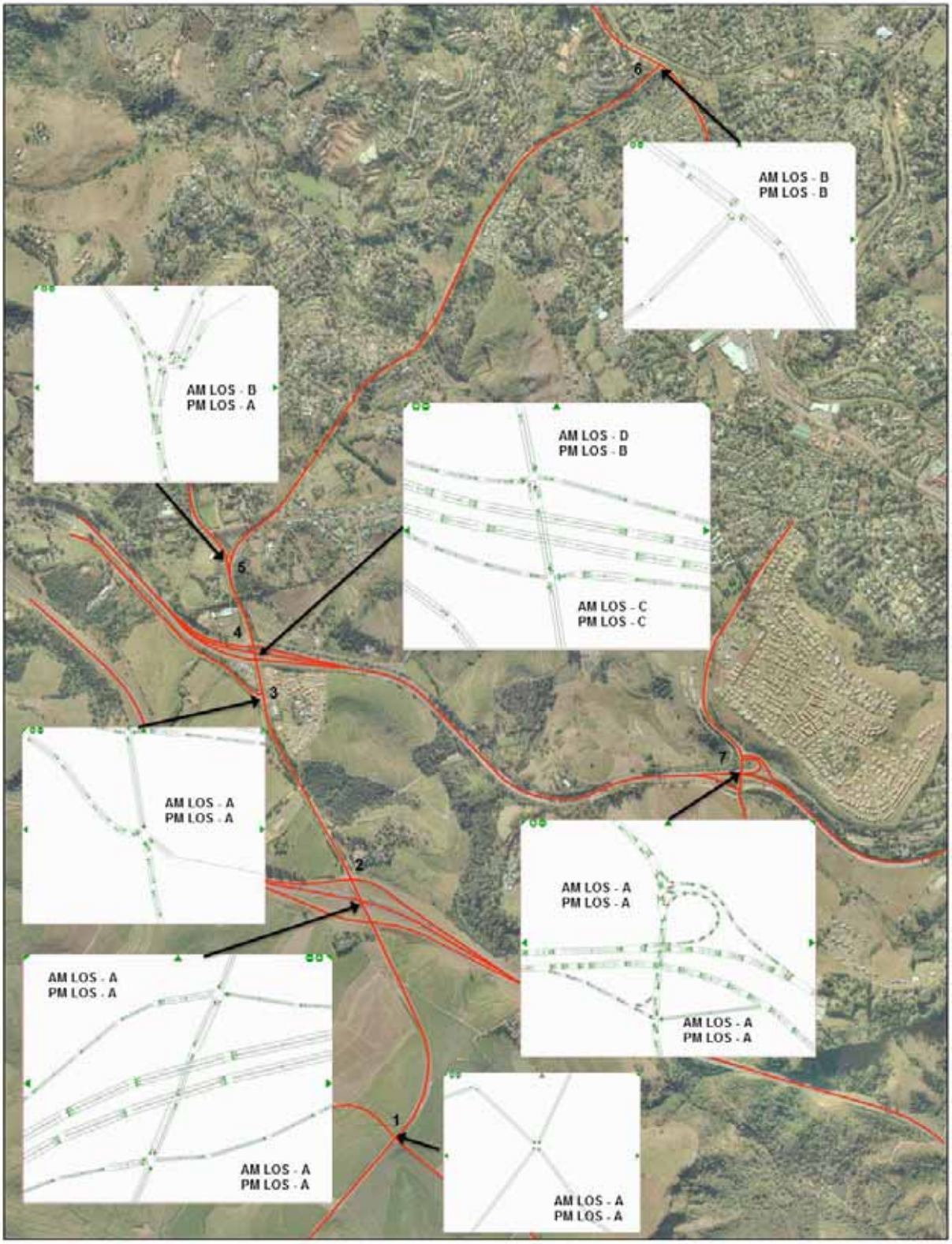
As part of the assessment the intersections are assessed with the base 2012 AM and PM traffic flows to determine the Level of Service that they are currently operating at. This provides a base against which the future situation can be compared and indicates whether intersections are going to require upgrades in order to cope with the future traffic flows, let alone additional traffic from the development.

The results for the AM peak show that all intersections, except for the Kassier Road/M13 eastbound intersection all operate with a LOS C or less which is acceptable, but those operating at C may require upgrades in the future to cope with the background increase in traffic. The Kassier Road/M13 eastbound intersection operates at a LOS D indicating that it is close to capacity. For this intersection it is likely that upgrades will be required in order to cope with the increase in the background traffic.

For the PM peak the results show that overall all intersections are operating with a LOS of C or less. This indicates that all intersections are operating satisfactorily with the base 2012 traffic flows. It maybe that those intersections that are operating at a LOS of C may require upgrades in order to cope with the additional traffic as a result of the increase in traffic due to general growth.

Appendix C contains the results of the analysis for the key intersections with the base 2012 traffic volumes.

Figure 2: Existing Intersection Layouts from the SATURN Model



3 Traffic Demand

As stated in Section 1, the three sites are to be analysed separately as the developer plans to develop only one of these three sites at the present moment in time.

3.1 Trip Generation Rates

The trip generation rates for the developments are based on those from the COTO trip generation rate manual as it is felt that these are more realistic for a number of reasons:

- The surveys used are more recent than the 1992 SATGRM;
- The number of sites surveyed is greater;
- The variety of sites surveyed is greater;
- The new trip rates take into account public transport, low car ownership etc and provide figures for reducing the trip rates if any of these apply.

Table 2 below shows the trip rates for each land use and the reductions applied to each one with the final trip rate applied. Appendix B provides a table showing the number of trips generated using the trip generation rates from the SATGRM.

Table 2: Trip Rates and Adjustment Factors for the Proposed Land Uses

Land Use	Trip Rate	Adjustment Factors				
		Size adjustment factor	Mixed-use	Low vehicle ownership	Very low vehicle ownership	Transit nodes or corridors
Offices	2.1	1	20%	NA	NA	NA
Apartments and Flats	0.65	1	15%	NA	NA	NA
Hotel	0.5	1	20%	NA	NA	NA
Retail (site 1)	0.6	1.16	10%	NA	NA	NA
Business Centre	1.5	1	15%	NA	NA	NA
Retail (site 3)	0.6	1.33	10%	NA	NA	NA

Using the Table above it becomes possible to calculate the total number of trips generated by each land use, then to apply the adjustment factors to provide the final number of trips generated by each land use. **Table 3**,

Table 4 and **Table 5** show the trips generated for each site.

Table 3: Adjusted Trip Rates for Site 1

Land Use	Area/No. of units	Total		In:Out Split		Revised trips after Adjustment					
		AM	PM	AM	PM	AM			PM		
						In	Out	Total	In	Out	Total
Offices	85,059	1786	1786	85:15	20:80	1214	214	1428	214	1214	1428
Flats	523	340	340	25:75	70:30	72	217	289	202	87	289
Hotel	200	100	100	60:40	55:45	48	32	80	44	36	80
Retail	128,093	769	4355	65:35	50:50	521	281	802	2273	2273	4545
Total		2995	6581			1855	744	2599	2733	3610	6342

Table 4: Adjusted Trip Rates for Site 2

Land Use	Area/No. of units	Total		In:Out Split		Revised trips after Adjustment					
		AM	PM	AM	PM	AM			PM		
						In	Out	Total	In	Out	Total
Business Park	303,152	4547	4547	85:15	20:80	3285	580	3865	773	3092	3865
Retail	128,805	773	4379	65:35	50:50	524	282	806	2284	2284	4567
Total		5320	8926			3809	862	4671	3057	5376	8432

Table 5: Adjusted Trip Rates for Site 3

Land Use	Area/No. of units	Total		In:Out Split		Revised trips after Adjustment					
		AM	PM	AM	PM	AM			PM		
						In	Out	Total	In	Out	Total
Hotel	200	100	100	60:40	55:45	48	32	80	44	36	80
Business Park	66,887	1003	1003	85:15	20:80	725	128	853	171	682	853
Retail	120,417	723	4094	65:35	50:50	558	300	858	2432	2431	4863
Total		1826	5197			1331	460	1791	2647	3149	5796

For Site 2, a scenario was run with a 15% reduction in trips due to a public transport corridor being in-situ. This was carried out to determine the road upgrades that would be required if a public transport corridor was in place on Kassier Road.

3.2 Trip Distribution

For this analysis the trip distribution is concerned with distributing the trips to and from each land use between the various zones of the model. The distribution has been based on existing traffic counts and residential spatial patterns.

The trip distribution has a small proportion of trips originating and arriving at internal traffic zones, but due to the low residential component of the area, the majority of the trips originate and arrive at external traffic zones. These external zones represent Durban to the east, Cato Ridge to the west and the Hillcrest area to the north of Shongweni.

4 Analysis of Site 1

As stated in Section 1.3 the initial run of the model was carried out with the existing road network in order to provide an initial traffic assignment and an indication as to of the number of vehicles passing through each intersection and thus the layout of the intersection required.

As can be expected, considering the traffic generated by the development, upgrades are required to the intersections within the road network due to the amount of traffic on the network. Kassier Road has been upgraded to a minimum of two lanes in each direction, with the major intersections being upgraded to signal controlled.

It should be noted that for a small number of intersections they will remain as priority controlled as the number of vehicles on the minor roads do not justify the cost of upgrading to signal controlled.

One of the road network scenarios tested included a new road from the back of the site connecting to Shongweni Road south of the M13 interchange. The advantage of constructing this link is that it provides an alternative route for those travelling between Kassier Road and Shongweni Road. This new link will be based on two existing dirt roads, the first runs from the Shongweni Road, south of the M13 interchagne, to provide access to a two farms in the area and the second runs from Kassier Road towards the M13. The second road will be diverted into the site and will no longer intersect with Kassier Road. Both roads will be upgraded to surfaced roads and a new section will be constructed that links the two sections together.

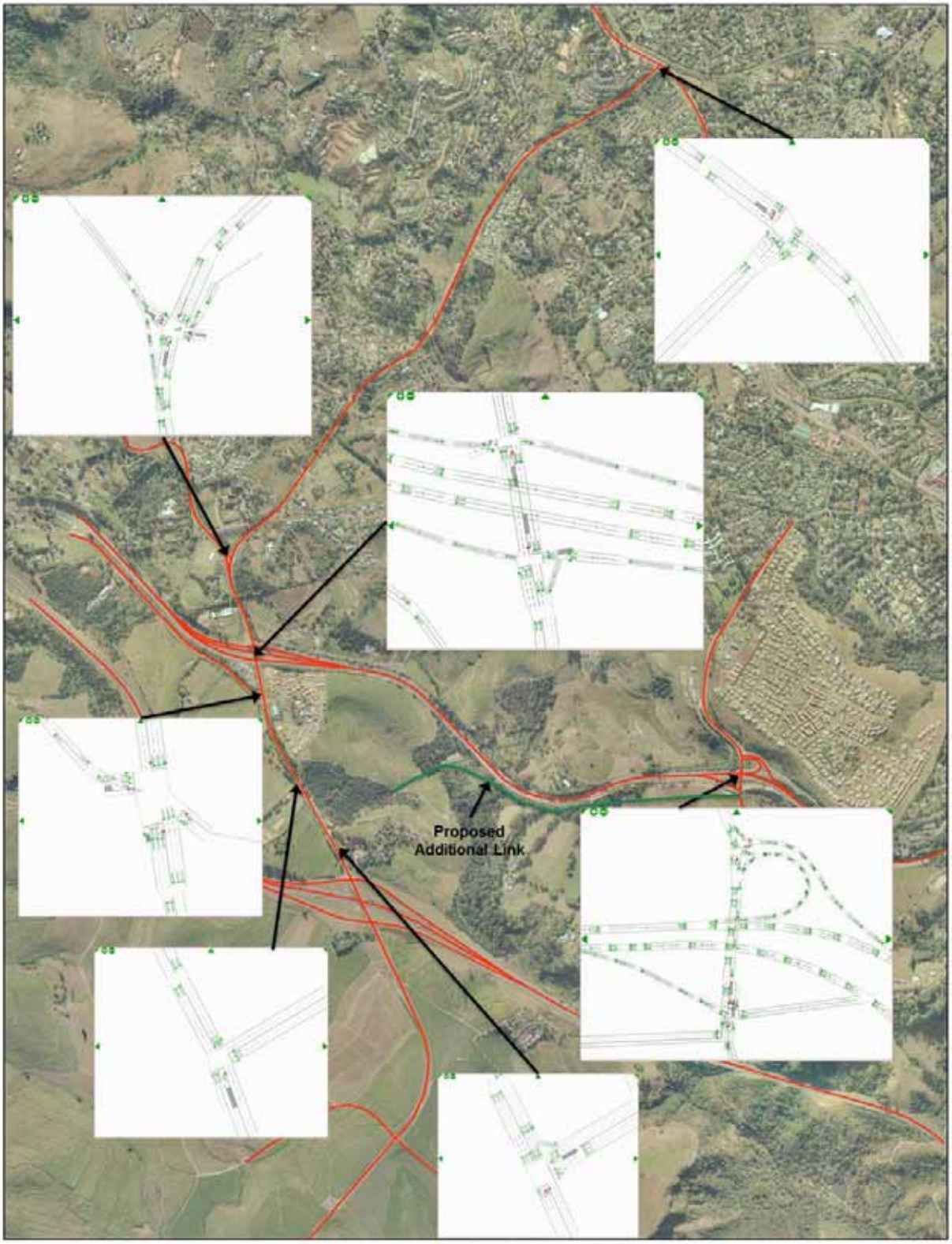
If this new access road is included then the resultant intersections are of a size and design that should be accommodated within the road reserve. With this link road in place the designs of the intersections are such that they all operate with a Level of Service of less than C. Appendix C contains the complete table of results for the final model.

Figure 3 shows the proposed layouts for the key intersections, site accesses and the new link road.

SANRAL are currently looking at a number of interchanges on the N3 to determine the upgrades that required in order to continue to function over the next 10 years. A plan showing SANRAL's interim plan has been provided for our knowledge and can be seen in Appendix D.

By comparing the plan from SANRAL and the design from the SATURN model it can be seen that the SANRAL plan has more capacity than required for the predicted traffic flows passing through the interchange from Site 1.

Figure 3: Proposed Intersection Layouts for the Key Intersections for Site 1 from the SATURN Model



As well as the general upgrades indicated some of the key intersections required additional upgrades in order to operate with a satisfactory Level of Service (LOS). The additional upgrades required are listed in **Table 6** below.

Table 6: Proposed Upgrades for the Key Intersection for Site 1

Intersection	Upgrade
Kassier Road/MR559	No upgrades required
Kassier Road/N3 westbound	Upgraded to signal control
Kassier Road/N3 eastbound	Intersection signalised North arm upgraded to two lanes South arm flare added for right turners West arm upgraded to two lanes
Kassier Road/Cliffdale Road	Intersection signalised North arm upgraded to three lanes East arm upgraded to two lanes South arm upgraded to three lanes and a flare for the left turners West arm upgraded to two lanes and a flare for the right turners
Kassier Road/M13 westbound	North arm upgraded to two lanes and a flare for the right turners East arm upgraded to one lane and a flare for the right turners with the left turners having a slip road South arm upgraded to three lanes
Kassier Road/M13 eastbound	North arm upgraded to two lanes South arm upgraded to two lanes with a flare for right turners West arm upgraded to two lanes
Kassier Road/Alverstone Road	North arm remains as per existing layout East arm upgraded with a flare for the right turners South arm upgraded to include a flare for right turners West arm upgraded to two lanes and a flare for right turners
Kassier Road/R103	East arm two lane left turn slip added South arm upgraded to three lanes West arm upgraded to include a flare for the right turners
Shongweni Road/M13 westbound	Intersection has been signalised North arm slip road for right turners has been removed and upgraded to two lanes and a flare for the right turners East arm has been upgraded to two lanes South arm has been upgraded to two lanes
Shongweni Road/M13 eastbound	Intersection has been signalised No other changes have taken place
Kassier Road/Southern access	Intersection signalised

	North arm two lanes with a one lane left turn slip East arm three lanes and a flare for the right turners South arm three lanes
Kassier Road/Northern access	North arm two lanes East arm two lanes South arm two lanes and a flare for the right turners

5 Analysis of Site 2

5.1 No Public Transport Corridor

Due to the large amount of traffic generated by the proposed development in addition to the anticipated growth in background traffic, certain upgrades to the road network will be required in order to maintain acceptable LOSs throughout.

The most significantly affected element is Kassier Road, which has been upgraded to a minimum of two lanes in each direction. Furthermore, a number of intersections along Kassier Road and a few on Shongweni Road have been signalised due to the relatively large number of vehicles expected on their minor approaches.

Other upgrades to the road network include left turn slip lanes and the widening of certain links and intersection approaches (especially within the vicinity of the development). The effected upgrades imply that the network operates at LOS C or better. Appendix C contains the complete table of results for the final model.

Figure 4 shows a plan showing the design of the key intersections within the study area and more specific details with regards to the intersection upgrades are listed in **Table 7** below.

SANRAL are currently looking at a number of interchanges on the N3 to determine the upgrades that required in order to continue to function over the next 10 years. A plan showing SANRAL's interim plan has been provided for our knowledge.

By comparing the plan from SANRAL with that from the SATURN model it can be seen that there are some differences and that some additional capacity will be require don Kassier Road over the N3 in order to accommodate the predicted traffic from the development.

Figure 4: Proposed Intersection Layouts for the Key Intersections for Site 2 from the SATURN Model

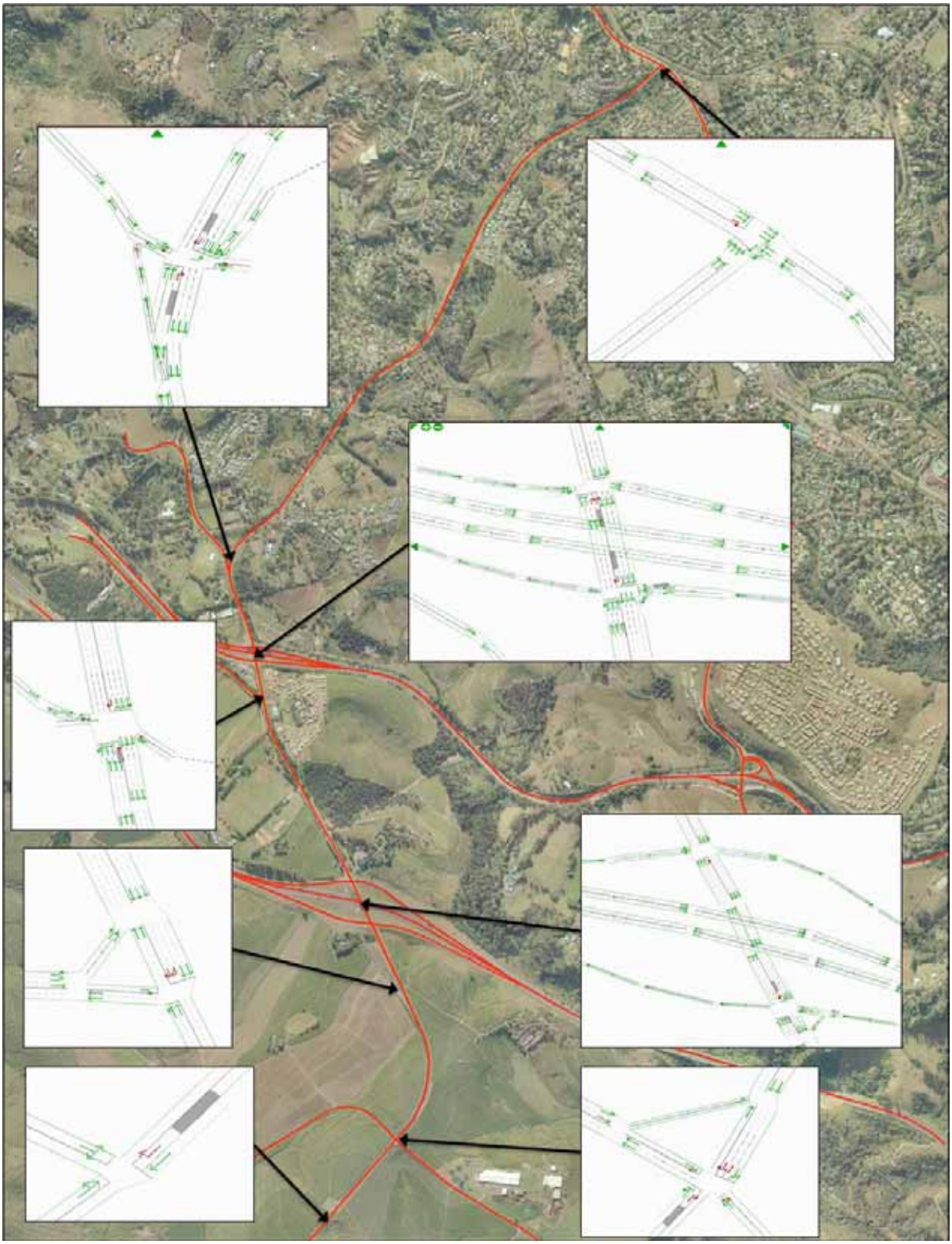


Table 7: Proposed Upgrades for the Key Intersection for Site 2

Intersection	Upgrade
Kassier Road/MR559	Intersection signalised North arm upgraded to three lanes East arm no changes South arm flare added for right turners West arm single lane left turn slip
Kassier Road/N3 westbound	Intersection signalised North arm upgraded to three lanes and a flare for right turners East arm single lane left turn slip added and two lanes South arm upgraded to four lanes
Kassier Road/N3 eastbound	Intersection signalised North arm upgraded to three lanes South arm upgraded to four lanes West arm upgraded to two lanes
Kassier Road/Cliffdale Road	Intersection signalised North arm upgraded to four lanes No upgrades to east arm South arm upgraded to three lanes and a flare for right turners West arm no upgrades
Kassier Road/M13 westbound	North arm upgraded to three lanes and a flare for right turners East arm upgraded to two lanes and a single lane left turn slip South arm upgraded to three lanes
Kassier Road/M13 eastbound	North arm upgraded to three lanes South arm upgraded to three lanes and a flare for right turners West arm no upgrades
Kassier Road/Alverstone Road	North arm upgraded to three lanes and a flare for right turners East arm no upgrades South arm a flare for right turners added West arm no upgrades
Kassier Road/R103	East arm single lane left turn slip added South arm upgraded to three lanes West arm no upgrades
Shongweni Road/M13 westbound	Intersection signalised
Shongweni Road/M13 eastbound	Intersection signalised
Kassier Road/Southern access	Intersection signalised North arm flare added for right turners
Kassier Road/Northern access	Intersection signalised North arm upgraded to four lanes

	South arm upgraded to two lanes West arm single lane with a two lane left turn slip

5.2 With Public Transport Corridor

With this scenario the trip generation rate was reduced by 15% to account for a public transport corridor running along Kassier Road. The expected impact of this would be to remove a proportion of cars from the road and that these would then be replaced by a lower number of buses. The lower number of vehicles travelling through the network means that the upgrades and layouts of the intersections should be smaller than with the full trip rate.

As per the no public transport scenario all intersections are operating at a LOS of D or less for both the AM and PM peak.

Plans of the intersections from the SATURN model can be found in **Figure 5** and more details on the upgrades can be found in **Table 8**.

Figure 5: Proposed Intersection Layouts for the Key Intersections for Site 2, with Public Transport, from the SATURN Model

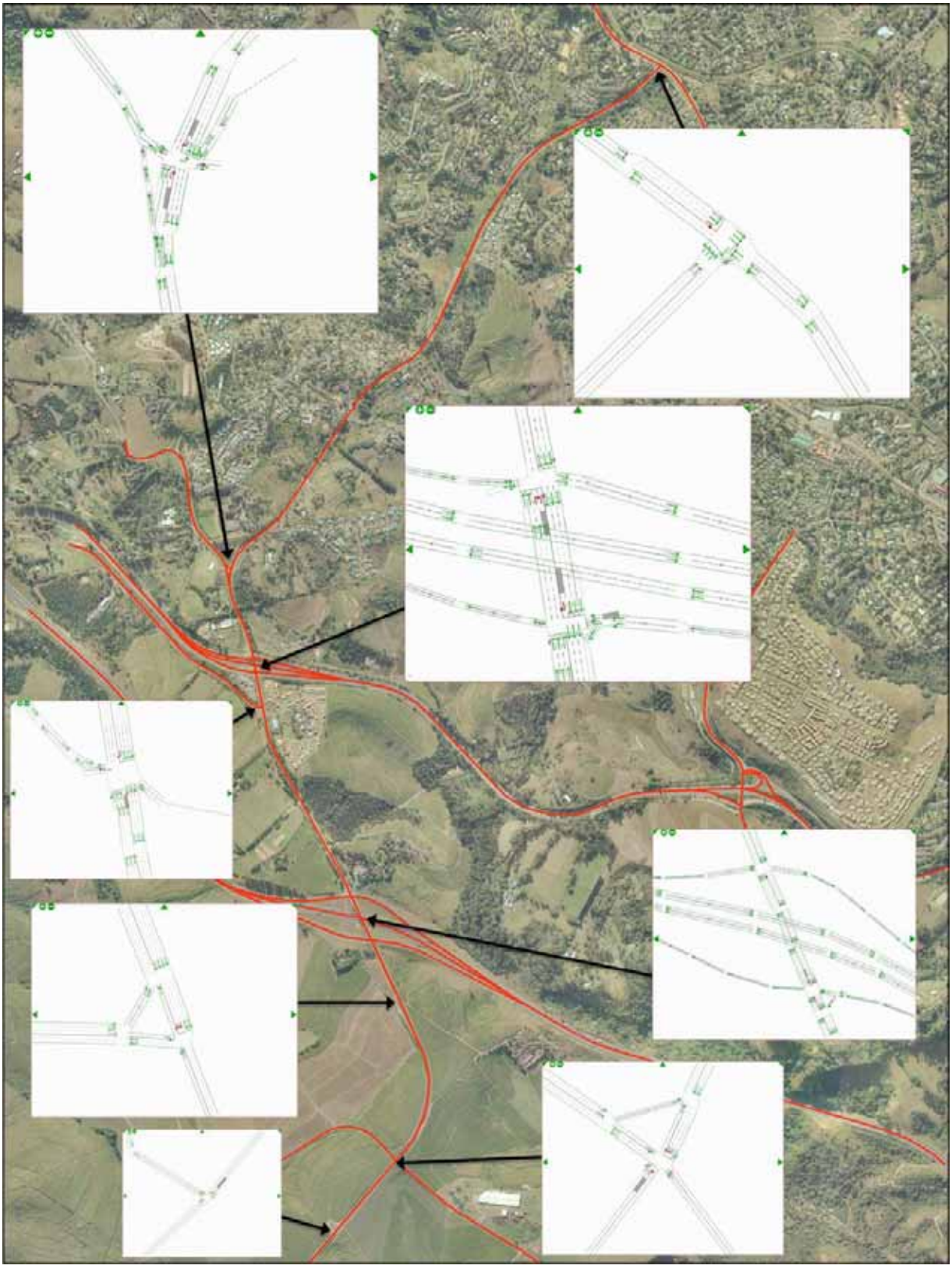


Table 8: Proposed Upgrades for the Key Intersections for Site 2 with Public Transport

Intersection	Upgrade
Kassier Road/MR559	Intersection signalised North arm upgraded to three lanes East arm no changes South arm flare added for right turners West arm single lane left turn slip
Kassier Road/N3 westbound	Intersection signalised North arm upgraded to three lanes and a flare for right turners East arm single lane left turn slip added and two lanes South arm upgraded to three lanes
Kassier Road/N3 eastbound	Intersection signalised North arm upgraded to three lanes South arm upgraded to four lanes West arm upgraded to two lanes
Kassier Road/Cliffdale Road	Intersection signalised North arm upgraded to four lanes No upgrades to east arm South arm upgraded to three lanes and a flare for right turners West arm no upgrades
Kassier Road/M13 westbound	North arm upgraded to three lanes and a flare for right turners East arm upgraded to two lanes and a single lane left turn slip South arm upgraded to three lanes
Kassier Road/M13 eastbound	North arm upgraded to three lanes South arm upgraded to three lanes and a flare for right turners West arm no upgrades
Kassier Road/Alverstone Road	North arm upgraded to three lanes and a flare for right turners East arm no upgrades South arm a flare for right turners added West arm no upgrades
Kassier Road/R103	East arm single lane left turn slip added South arm upgraded to three lanes West arm no upgrades
Shongweni Road/M13 westbound	Intersection signalised
Shongweni Road/M13 eastbound	Intersection signalised
Kassier Road/Southern access	Intersection signalised North arm flare added for right turners
Kassier Road/Northern access	Intersection signalised

	North arm upgraded to four lanes South arm no upgrades West arm single lane with a single lane left turn slip

6 Analysis of Site 3

As can be expected, considering the traffic generated by the proposed development, upgrades are required to the intersections within the road network due to the amount of traffic on the network. Kassier Road has been upgraded to a minimum of two lanes in each direction, with the key intersections being upgraded to signal controlled. The proposed upgrades to all the key intersections can be seen in **Table 9** below.

Both the northern and southern access to the proposed development off Kassier Road will require signalisation.

Figure 6 shows a plan showing the design of the key intersections within the study area.

SANRAL are currently looking at a number of interchanges on the N3 to determine the upgrades that required in order to continue to function over the next 10 years. A plan showing SANRAL's interim plan has been provided for our knowledge.

By comparing the plan from SANRAL with that from the SATURN model it can be seen that there are some differences and that some additional capacity will be required on Kassier Road over the N3 in order to accommodate the predicted traffic from the development.

Figure 6: Proposed Intersection Layouts for the Key Intersections for Site 3 from the SATURN Model

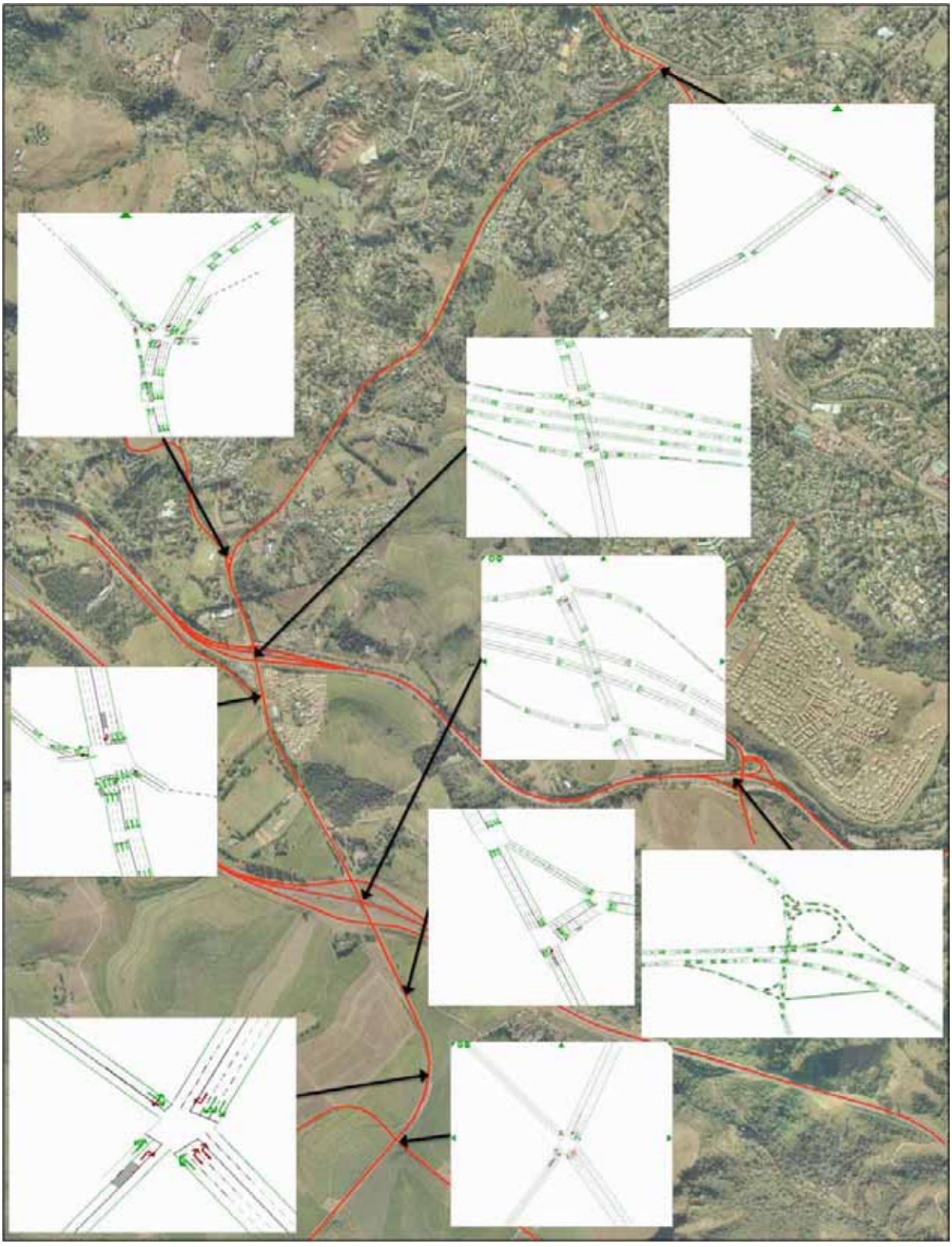


Table 9: Proposed Upgrades for the Key Intersection for Site 3

Intersection	Upgrade
Kassier Road/MR559	Intersection signalised North arm upgraded to three lanes South arm flare added for right turners West arm upgraded to three lanes
Kassier Road/N3 westbound	Intersection signalised North arm upgraded to three lanes East arm flare added for left turners South arm upgraded to four lanes
Kassier Road/N3 eastbound	Intersection signalised North arm increased to four lanes South arm upgraded to four lanes with a right turn flare West arm upgraded to two lanes with a right turn flare
Kassier Road/Cliffdale Road	Intersection signalised North arm upgraded to three lanes with a flare for right turners South arm upgraded to three lanes with left turn flare West arm upgraded to two lanes
Kassier Road/M13 westbound	North arm flare added for right turners East arm left turn flare added South arm upgraded to three lanes
Kassier Road/M13 eastbound	North arm upgraded to four lanes South arm upgraded to four lanes West arm existing right turn flare converted to full lane for combined through and right turners
Kassier Road/Alverstone Road	South arm upgraded to three lanes East arm left turn flare added
Kassier Road/R103	East arm dedicated right turn lane added South arm added dedicated lane for right turners West arm existing through lane converted to dedicated right turn
Shongweni Road/M13 westbound	No upgrades required
Shongweni Road/M13 eastbound	Intersection signalised
Kassier Road/northern access	Intersection signalised North arm two lanes and a two lane left turn slip East arm three lanes and a flare for the left turners South arm two lanes and a flare for the right turners

7 Public Transport

For public transport two strategies are required, these being short term and long term.

For the short term it is envisioned that a public transport interchange will be constructed and that this will be located close of the busiest point in each of the developments. Considering the developments, the best location for the public transport interchange would be in close proximity to the shopping centre as these attract the most trips. As well as the interchange, laybys would be located on Kassier Road close to intersections.

In the longer term the public transport will need to align with eThekwini's IRPTN strategy. Although there are currently no IRPTN corridors planned along Kassier Road, a sufficient road reserve will be recommended in order to ensure there is sufficient land available for a BRT corridor if required in the future.

An inspection of the IRPTN Wall to Wall plan indicates that the closest trunk corridor passing the site is the Corridor 7 from Hammarsdale to Pinetown and onwards to Chatsworth. In this regard, one of three strategies could be implemented:

- The trunk 7 corridor be deviated to pass through the Shongweni Area
- Feeder services link the Shongweni Area with Corridor 7
- A new trunk corridor or complimentary corridor is created linking the Shongweni Area with the IRPTN network

8 Non-Motorised Transport

It is envisioned that in the future Non-Motorised Transport will play a significant part in future transport modes for the area. This is partly due to the significant amount of development potential that this area has and it is more efficient to design these facilities from the outset than try to retrofit them later on.

It is envisioned that the sidewalks within the development and on Kassier Road will be a minimum width of three metres in order to provide adequate width to safely accommodate both pedestrians and cyclists.

The sidewalks on Kassier Road are included in the NMT infrastructure works as the route to and from the site needs to be considered for necessary upgrades. If this is not upgraded then no matter how safe the network within the site is, limited trips will be made by these modes as the route to and from the site will not be perceived as safe.

In order to ensure that people can use NMT modes to travel to and from the site it is recommended that Kassier Road has pavements of a minimum width of three metres in order to safely accommodate cyclists and pedestrians.

9 Conclusion and Recommendations

9.1 Conclusion

Arup were appointed by Tongaat Hulett to undertake a Traffic Impact Assessment using the SATURN model previously prepared by Arup. This TIA would look at the impact that development of one of three sites would have on the road network and the upgrades required in order to accommodate the development traffic. **It should be noted that at this present moment in time only one of the three sites will be developed.**

The SATURN model, originally developed as part of a previous study undertaken for Tongaat Hulett looking at the impact of development in the area, was updated using 2012 counts to develop a new base matrix and to update the road network. A base matrix was also developed for the PM peak as the idea is to use the model for the TIA. As a result of updating the base matrix, the model had to be recalibrated and validated. This was carried out successfully and a copy of the Calibration and Validation report can be found in Appendix E.

As stated above; three different sites were assessed in this TIA and these are as below:

- Site 1 located between the N3 and M13;
- Site 2 located to the south of the N3 on the west side of Kassier Road; and
- Site 3 located between the N3 and the MR559 on the east side of Kassier Road.

Table 10 shows the trips generated for each site for the AM and PM peak.

Table 10: Summary of Trips Generated for each Site

Site	AM Peak			PM Peak		
	In	Out	Total	In	Out	Total
Site 1	1856	744	2600	2805	3538	6343
Site 2	3809	862	4671	3057	5376	7319
Site 3	1331	460	1791	2646	3150	5796

With the number of trips generated by each of these sites, it can be seen that road upgrades will be required in order to accommodate the additional number of vehicles generated by any of these sites.

The results from the modelling show that Kassier Road needs to be upgraded to a minimum of two lanes per direction north of the M13 and that key intersections need to be upgraded to be signal operated. Intersections within the vicinity of the development and the N3 and M13 interchanges need additional upgrades to the two lanes and signalisation.

The exact upgrades required for each intersection for each site can be found in **Table 11**.

Table 11: Summary of Proposed Upgrades for the Key Intersections for each Site

Intersection	Site 1	Site 2	Site 3
Kassier Road/MR559	No upgrades required	Intersection signalised North arm upgraded to three lanes West arm single lane left turn slip South arm flare added for right turners	Intersection signalised North arm upgraded to three lanes South arm flare added for right turners West arm upgraded to three lanes
Kassier Road/N3 westbound	Upgraded to signal control	Intersection signalised North arm upgraded to three lanes and a flare for right turners East arm single lane left turn slip added South arm upgraded to four lanes	Intersection signalised North arm upgraded to three lanes East arm flare added for left turners South arm upgraded to four lanes
Kassier Road/N3 eastbound	Intersection signalised North arm upgraded to two lanes South arm flare added for right turners West arm upgraded to two lanes	Intersection signalised North arm upgraded to three lanes South arm upgraded to four lanes West arm upgraded to two lanes	Intersection signalised North arm increased to four lanes South arm upgraded to four lanes with a right turn flare West arm upgraded to two lanes with a right turn flare
Kassier Road/Cliffdale Road	Intersection signalised North arm upgraded to three lanes East arm upgraded to two lanes South arm upgraded to three lanes and a flare for the left turners West arm upgraded to two lanes and a flare for the right turners	Intersection signalised North arm upgraded to four lanes No upgrades to east arm South arm upgraded to three lanes and a flare for right turners West arm no upgrades	Intersection signalised North arm upgraded to three lanes with a flare for right turners South arm upgraded to three lanes with left turn flare West arm upgraded to two lanes
Kassier Road/M13 westbound	North arm upgraded to two lanes and a flare for the right turners East arm upgraded to one lane and a flare for the right turners with the left turners having a slip road South arm upgraded to three lanes	North arm upgraded to three lanes and a flare for right turners East arm upgraded to two lanes and a single lane left turn slip South arm upgraded to three lanes	North arm flare added for right turners East arm left turn flare added South arm upgraded to three lanes
Kassier Road/M13 eastbound	North arm upgraded to two lanes South arm upgraded to two lanes with a flare for right turners West arm upgraded to	North arm upgraded to three lanes South arm upgraded to three lanes and a flare for right turners West arm no upgrades	North arm upgraded to four lanes South arm upgraded to four lanes West arm existing right turn flare converted to

	two lanes		full lane for combined through and right turners
Kassier Road/Alverstone Road	North arm remains as per existing layout East arm upgraded with a flare for the right turners South arm upgraded to include a flare for right turners West arm upgraded to two lanes and a flare for right turners	North arm upgraded to three lanes and a flare for right turners East arm no upgrades South arm a flare for right turners added West arm no upgrades	South arm upgraded to three lanes East arm left turn flare added
Kassier Road/R103	East arm two lane left turn slip added South arm upgraded to three lanes West arm upgraded to include a flare for the right turners	East arm single lane left turn slip added South arm upgraded to three lanes West arm no upgrades	East arm dedicated right turn lane added South arm added dedicated lane for right turners West arm existing through lane converted to dedicated right turn
Shongweni Road/M13 westbound	Intersection has been signalised North arm slip road for right turners has been removed and upgraded to two lanes and a flare for the right turners East arm has been upgraded to two lanes South arm has been upgraded to two lanes	Intersection signalised	No upgrades required
Shongweni Road/M13 eastbound	Intersection has been signalised No other changes have taken place	Intersection signalised	Intersection signalised
Site 1 Southern Access	Intersection signalised North arm two lanes with a one lane left turn slip East arm three lanes and a flare for the right turners South arm three lanes		
Site 1 Northern Access	North arm two lanes East arm two lanes South arm two lanes and a flare for the right turners		
Site 2 Southern Access		Intersection signalised North arm flare added for right turners	

Site 2 Northern Access		Intersection signalised North arm upgraded to four lanes South arm upgraded to two lanes West arm single lane with a two lane left turn slip	
Site 3 Northern Access			Intersection signalised North arm two lanes and a two lane left turn slip East arm three lanes and a flare for the left turners South arm two lanes and a flare for the right turners
Miscellaneous	**New link road between the site and Shongweni Road connecting south of the M13.**	**Loop for the M13eastbound on-ramp maybe required in the future**	

Currently SANRAL and eThekwini Municipality have plans for upgrading the N3 interchange and Kassier Road. Based on preliminary drawings we have for these changes the upgrades proposed for these sites align with those from SANRAL and eThekwini municipality. Based on these drawings the proposed upgrades for these sites are broadly in line with those required for any of these sites. The only difference is in the number of lanes required from the site access points to the M13 interchange as the modelling indicates at least three lanes, but the preliminary drawings show two lanes.

For Site 2 a scenario was run whereby the trips generated were reduced by 15% to account for a public transport corridor on Kassier Road. The outcome of this was to reduce the number of trips to the site as more visitors/employees will travel by public transport than private vehicle. Without the public transport reduction factor the maximum number of trips for site 2 was 8432 in the PM peak and with the public transport factor taken into account the PM peak trips was 6221. With this reduced number of trips it would be expected that there would be a change in the layout of the key intersections, but an analysis of the model shows that only two of the intersections see a different layout from that without public transport. The two intersections and upgrades required are listed below:

- Kassier Road/N3 westbound – Southern arm upgraded to three rather than four lanes; and
- Kassier Road/Northern access – Southern arm no upgrades and west arm has a single lane left turn slip rather than the two lanes required with no public transport.

As well as upgrades to the road network consideration needs to be given to public transport and Non-Motorised Transport modes.

For public transport it is recommended that a public transport interchange is constructed for each site and that this be located close to the busiest part of the development. In most cases this will be in close proximity to the commercial node of the development. It is also recommended that public transport laybys are located on Kassier Road in close proximity to key intersections. In the long term the public transport needs to be aligned with the IRPTN strategy for the municipality. Although there are currently no public transport corridors planned for Kassier Road a sufficient road reserve is recommended to ensure there is the ability to include a BRT corridor if desired at a later stage. Based on the current strategy the closest trunk corridor passing the site is Corridor 7 from Hammarsdale to Pinetown and then onwards to Chatsworth. Three possible strategies could be implemented to align with the current strategy and these being:

- The Trunk Corridor 7 is deviated to pass through the Shongweni area;
- Feeder services linking Shongweni with Corridor 7; and
- A new trunk corridor or complimentary corridor linking the Shongweni area with the IRPTN network.

With regards to the NMT it the sidewalks within the site would be a minimum of three metres wide to ensure that they are sufficiently wide enough to accommodate pedestrians and cyclists safely.

9.2 Recommendations

Following on from the modelling the following recommendations are made:

- Upgrades as per **Table 11** above for the respective Site that will be constructed;
- That if Site 2 is developed then in the future a loop maybe required at the Kassier Road/M13 eastbound interchange in order to ease the right turn movement from the southern arm onto the M13;
- That a SCOOT system is considered for the area to help with traffic flow through the various key signalised intersections;
- Construction of a public transport interchange within the site and laybys on Kassier Road;
- In the long term ensure that the public transport aligns with the IRPTN strategy and that sufficient road reserve is maintained to provide a BRT lane if required;
- Minimum width of 3m for sidewalks, both internally and externally, to safely accommodate pedestrians and cyclists;
- Maintain a 30m road reserve along Kassier Road. In addition, all new roads intersecting with Kassier Road should also have a 30m reserve.
- Adequate road reserve splays should be provided at all intersections to accommodate future road widening or grade separations;
- That the building line along Kassier Road should remain at 15m and not be relaxed in case of additional infrastructure over and above that detailed in **Table 11**; and

- That for each phase, of which ever site is developed, an individual TIA is carried out for that portion of land in order to update the modelling and to account for changes in travel patterns that may occur in the future.

Appendix A

Trips Generated using the South African Trip Generation Rate Manual

Site 1

Land Use	Area/No. of units	Trip Rate	In/Out Split (%)	AM Peak Trips			PM Peak Trips		
				In	Out	Total	In	Out	Total
Offices	85,059	2.3	85/15	1663	293	1956	293	1663	1956
Residential	823	1.1	75/25	431	144	575	144	431	575
Retail	128,093	4.12	50/50				2637	2637	5274
Hotel	200	0.7	55/45	77	63	140	63	77	140
Total				2171	500	2671	3137	4808	7945

Site 2

Land Use	Area/No. of units	Trip Rate	In/Out Split (%)	AM Peak Trips			PM Peak Trips		
				In	Out	Total	In	Out	Total
Business Centre	303,152	2.3	85/15	5927	1046	6972	1046	5927	6973
Retail	128,805	4.11	50/50				2647	2647	5294
Total				5927	1046	6972	3693	8574	12,266

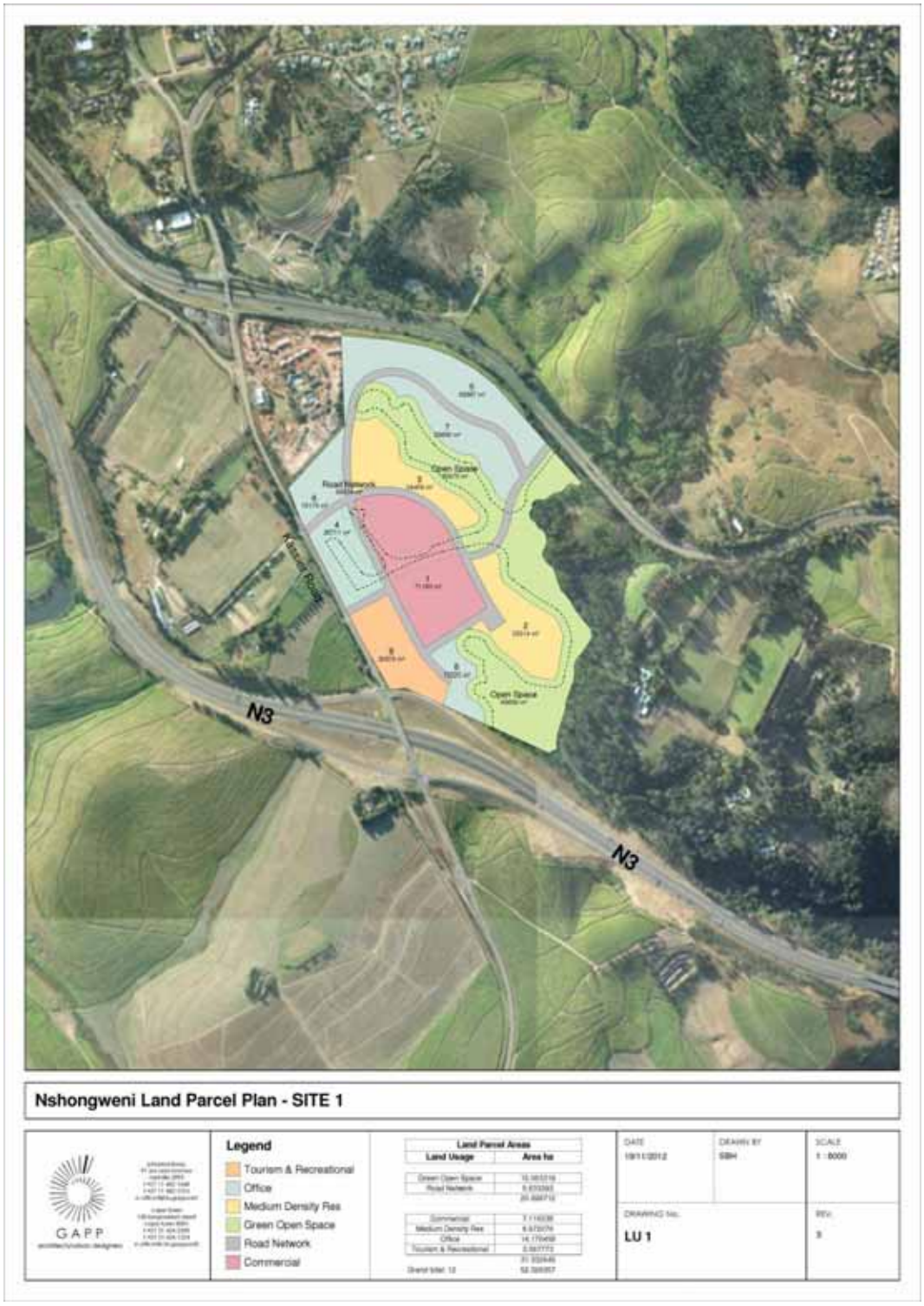
Site 3

Land Use	Area/No. of units	Trip Rate	In/Out Split (%)	AM Peak Trips			PM Peak Trips		
				In	Out	Total	In	Out	Total
Business Centre	66,887	2.3	85/15	1308	231	1539	231	1308	1539
Retail	120,417	4.21	50/50				2532	2532	5064
Hotel	200	0.7		77	63	140	63	77	140
Total				1385	294	1679	2826	3917	6743

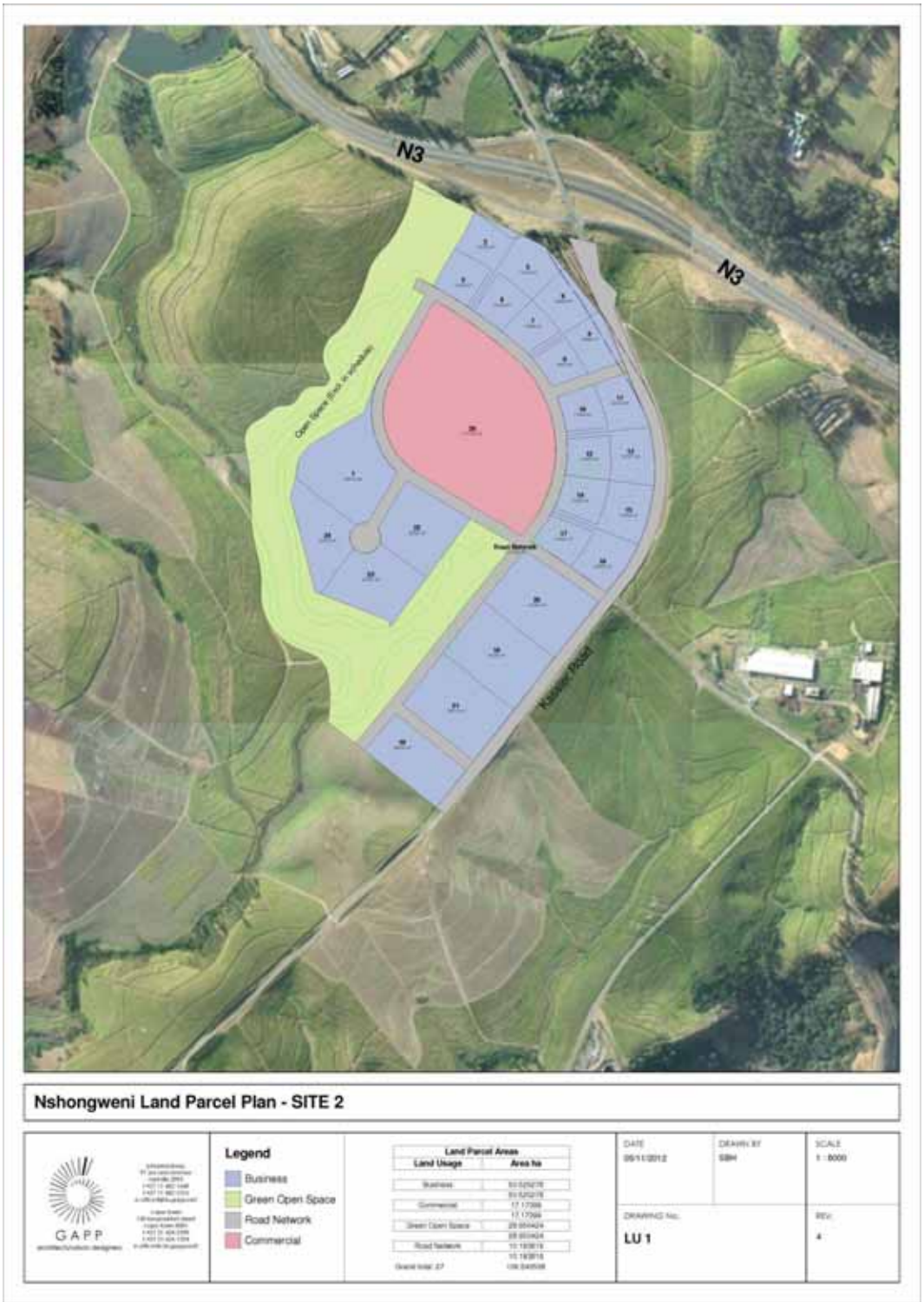
Appendix B

Site Plans for the Individual Sites

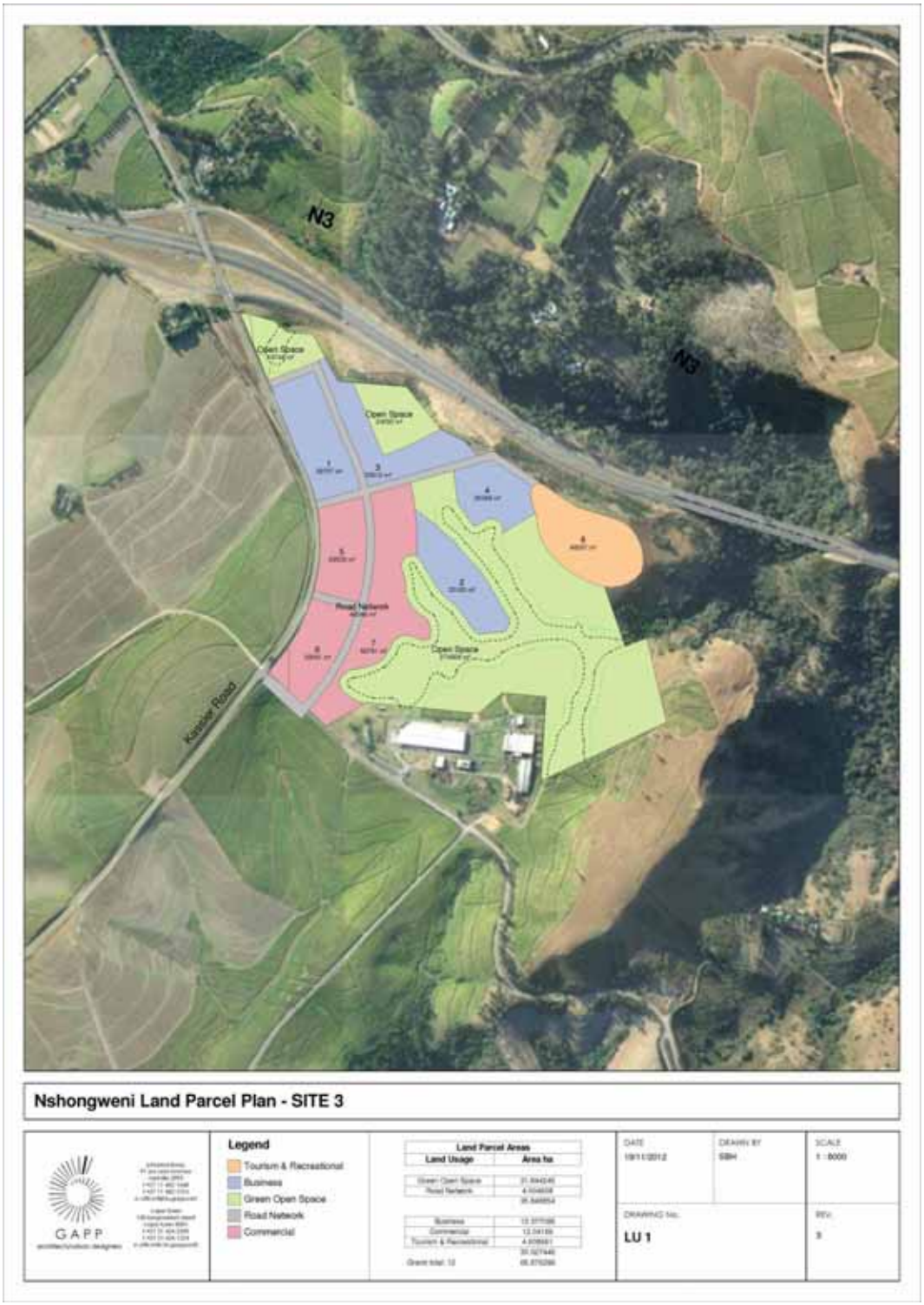
B1 Site 1 Site Plan



B2 Site 2 Site Plan



B2.1 Site 3 Site Plan



Appendix C

Key Intersection Analysis Results

C1 Base 2012 Key Intersection Analysis Results

C1.1 AM Peak

A node	B node	C node	Ref	Intersection Name	Approach	Movement	Turn					Approach					Intersection		
							Volume	Delay	V/C	Capacity	LOS	Volume	Delay	V/C	Capacity	LOS	Delay	V/C	LOS
1382	1369	1385	1382-1369-1385	Kassner Road/MR559	Kassner Road	Left	193	0.00	11.29	1599.22	A								
1382	1369	1310	1382-1369-1310	Kassner Road/MR559	Kassner Road	Thru	155	0.00	6.46	1516.67	A	360	0.03	6.87	4363	A			
1382	1369	1337	1382-1369-1337	Kassner Road/MR559	Kassner Road	Right	3	3.33	0.19	1247.06	A								
1385	1369	1310	1385-1369-1310	Kassner Road/MR559	MR559	Left	17	3.58	1.95	879.68	A								
1385	1369	1337	1385-1369-1337	Kassner Road/MR559	MR559	Thru	0	4.18	0.03	745.74	A	383	4.13	14.81	2736	A			
1390	1369	1382	1385-1369-1382	Kassner Road/MR559	MR559	Right	366	4.16	32.94	1110.60	A								
1310	1369	1337	1310-1369-1337	Kassner Road/MR559	J B Mcintosh Drive	Left	0	0.00	0.01	1595.92	A						2.08	5.35	A
1310	1369	1382	1310-1369-1382	Kassner Road/MR559	J B Mcintosh Drive	Thru	92	0.00	5.42	1687.29	A	100	0.34	2.30	4364	A			
1310	1369	1385	1310-1369-1385	Kassner Road/MR559	J B Mcintosh Drive	Right	8	4.04	0.78	1073.06	A								
1337	1369	1382	1337-1369-1382	Kassner Road/MR559	Access	Left	2	4.67	33.92	2100.00	A								
1337	1369	1385	1337-1369-1385	Kassner Road/MR559	Access	Thru	0	7.43	0.24	683.33	A	2	4.99	0.06	3232	A			
1337	1369	1310	1337-1369-1310	Kassner Road/MR559	Access	Right	0	4.25	0.06	448.29	A								
1339	1344	1349	1339-1344-1349	Kassner Road/N3 westbound	Kassner Road (north)	Thru	277	0.00	14.35	1900.00	A	279	0.03	10.35	2693	A			
1339	1344	1332	1339-1344-1332	Kassner Road/N3 westbound	Kassner Road (north)	Right	2	1.61	0.16	893.48	A								
1353	1344	1349	1353-1344-1349	Kassner Road/N3 westbound	N3 westbound off-slip	Left	27	3.83	1.19	1428.11	A	189	0.05	0.44	2230	A	1.24	11.48	A
1353	1344	1339	1353-1344-1339	Kassner Road/N3 westbound	N3 westbound off-slip	Right	166	4.36	26.00	810.01	A								
1349	1344	1339	1349-1344-1339	Kassner Road/N3 westbound	Kassner Road (south)	Thru	364	0.00	21.36	1705.25	A	409	0.00	14.61	3141	A			
1349	1344	1332	1349-1344-1332	Kassner Road/N3 westbound	Kassner Road (south)	Left	95	0.00	6.53	1435.74	A								
1319	1328	1342	1319-1328-1342	Kassner Road/N3 eastbound	Kassner Road (north)	Left	596	0.00	33.84	1604.75	A								
1319	1328	1335	1319-1328-1335	Kassner Road/N3 eastbound	Kassner Road (north)	Thru	214	0.00	15.53	1257.02	A	810	0.00	28.30	2862	A			
1335	1328	1319	1335-1328-1319	Kassner Road/N3 eastbound	Kassner Road (south)	Thru	351	0.00	20.06	1900.00	A								
1335	1328	1342	1335-1328-1342	Kassner Road/N3 eastbound	Kassner Road (south)	Right	199	9.51	29.26	578.45	A	530	3.04	22.30	2378	A	1.47	20.05	A
1305	1328	1319	1305-1328-1319	Kassner Road/N3 eastbound	N3 eastbound off-slip	Left	5	4.46	9.47	1089.47	A								
1305	1328	1335	1305-1328-1335	Kassner Road/N3 eastbound	N3 eastbound off-slip	Right	64	6.73	9.21	700.23	A	70	6.56	3.89	1790	A			
1250	1255	1262	1250-1255-1262	Kassner Road/Cliffdale Road	Kassner Road (north)	Left	57	0.00	5.47	939.58	A								
1250	1255	1258	1250-1255-1258	Kassner Road/Cliffdale Road	Kassner Road (north)	Thru	774	0.00	44.14	1596.19	A	932	0.64	29.72	3136	A			
1249	1255	1250	1249-1255-1250	Kassner Road/Cliffdale Road	Kassner Road (north)	Right	101	5.81	15.10	606.34	A								
1262	1255	1258	1262-1255-1258	Kassner Road/Cliffdale Road	Access	Left	16	17.57	5.19	239.31	B								
1262	1255	1249	1262-1255-1249	Kassner Road/Cliffdale Road	Access	Thru	3	25.10	0.12	118.09	C	68	22.67	13.06	522	C			
1262	1255	1250	1262-1255-1250	Kassner Road/Cliffdale Road	Access	Right	53	24.34	32.35	164.67	C						2.29	18.12	A
1258	1255	1249	1258-1255-1249	Kassner Road/Cliffdale Road	Kassner Road (south)	Left	7	0.00	0.49	1403.76	A								
1258	1255	1250	1258-1255-1250	Kassner Road/Cliffdale Road	Kassner Road (south)	Thru	348	0.00	20.12	1739.64	A	368	0.28	10.98	3626	A			
1258	1255	1262	1258-1255-1262	Kassner Road/Cliffdale Road	Kassner Road (south)	Right	10	9.74	2.10	483.67	A								
1249	1255	1250	1249-1255-1250	Cliffdale Road	Cliffdale Road	Left	139	6.09	18.80	737.92	A								
1249	1255	1262	1249-1255-1262	Cliffdale Road	Cliffdale Road	Thru	9	17.07	0.10	190.45	B	164	7.88	14.17	1157	A			
1249	1255	1258	1249-1255-1258	Cliffdale Road	Cliffdale Road	Right	25	15.93	10.95	228.30	B								
1246	1250	1255	1246-1250-1255	Kassner Road/M13 westbound	Kassner Road (north)	Thru	656	17.90	96.91	676.08	B								
1246	1250	1240	1246-1250-1240	Kassner Road/M13 westbound	Kassner Road (north)	Right	179	32.74	88.48	181.17	C	877	20.93	108.07	811	C			
1257	1250	1255	1257-1250-1255	Kassner Road/M13 westbound	M13 westbound off-slip	Left	234	15.42	64.36	792.87	B								
1257	1250	1246	1257-1250-1246	Kassner Road/M13 westbound	M13 westbound off-slip	Right	259	32.74	88.48	181.17	C	533	25.12	84.70	974	C	26.55	67.45	C
1250	1250	1240	1255-1250-1240	Kassner Road/M13 westbound	Kassner Road (south)	Left	30	15.41	9.59	312.57	B								
1255	1250	1246	1255-1250-1246	Kassner Road/M13 westbound	Kassner Road (south)	Thru	519	15.42	64.36	792.87	B	549	15.42	48.87	1105	B			
1239	1243	1253	1239-1243-1253	Kassner Road/M13 eastbound	Kassner Road (north)	Left	425	60.80	109.62	388.37	E								
1239	1243	1246	1239-1243-1246	Kassner Road/M13 eastbound	Kassner Road (north)	Thru	840	60.80	109.62	730.63	E	1265	60.80	114.98	1100	E			
1246	1243	1239	1246-1243-1239	Kassner Road/M13 eastbound	Kassner Road (south)	Thru	571	4.32	35.39	1613.33	A								
1246	1243	1263	1246-1243-1263	Kassner Road/M13 eastbound	Kassner Road (south)	Right	238	39.35	65.28	364.44	D	809	14.62	46.89	1978	B	41.74	62.30	D
1237	1243	1239	1237-1243-1239	Kassner Road/M13 eastbound	M13 eastbound off-slip	Left	175	31.52	48.06	364.47	C								
1237	1243	1246	1237-1243-1246	Kassner Road/M13 eastbound	M13 eastbound off-slip	Right	37	31.51	16.22	225.93	C	212	31.52	35.88	590	C			
1230	1218	1222	1230-1218-1222	Kassner Road/Alverstone Road	Kassner Road (north)	Left	54	3.86	3.98	1288.00	A								
1230	1218	1212	1230-1218-1212	Kassner Road/Alverstone Road	Kassner Road (north)	Thru	1055	8.49	77.79	1288.00	A	1153	8.06	35.44	3256	A			
1230	1218	1204	1230-1218-1204	Kassner Road/Alverstone Road	Kassner Road (north)	Right	45	5.00	5.12	894.93	A								
1222	1218	1212	1222-1218-1212	Kassner Road/Alverstone Road	Hospital Access	Left	74	37.58	48.19	166.79	D								
1222	1218	1204	1222-1218-1204	Kassner Road/Alverstone Road	Hospital Access	Thru	1	37.58	2.71	51.03	D	91	38.13	24.16	377	D			
1222	1218	1230	1222-1218-1230	Kassner Road/Alverstone Road	Hospital Access	Right	16	41.15	8.35	169.00	D						12.15	34.61	B
1212	1218	1204	1212-1218-1204	Kassner Road/Alverstone Road	Kassner Road (south)	Left	82	5.81	11.33	726.26	A								
1212	1218	1230	1212-1218-1230	Kassner Road/Alverstone Road	Kassner Road (south)	Thru	554	5.81	46.23	1197.72	A	745	8.25	31.77	2346	A			
1212	1218	1222	1212-1218-1222	Kassner Road/Alverstone Road	Kassner Road (south)	Right	109	22.49	25.88	421.49	C								
1204	1218	1230	1204-1218-1230	Kassner Road/Alverstone Road	Kassner Road/Alverstone Road	Left	37	37.55	49.94	74.50	D								
1204	1218	1222	1204-1218-1222	Kassner Road/Alverstone Road	Kassner Road/Alverstone Road	Thru	4	37.55	49.94	8.78	D	170	43.09	64.50	263	D			
1204	1218	1212	1204-1218-1212	Kassner Road/Alverstone Road	Kassner Road/Alverstone Road	Right	128	44.87	71.31	180.09	D								
1475	1479	1481	1475-1479-1481	Kassner Road/R103	R103 (west)	Thru	726	3.68	28.23	2571.43	A								
1475	1479	1471	1475-1479-1471	Kassner Road/R103	R103 (west)	Right	456	20.04	61.79	738.14	C	1182	9.93	35.72	3310	A			
1481	1479	1471	1481-1479-1471	Kassner Road/R103	R103 (east)	Left	421	14.91	57.70	729.67	B								
1481	1479	1475	1481-1479-1475	Kassner Road/R103	R103 (east)	Thru	556	14.91	47.29	1173.24	B	977	14.91	51.35	1903	B	14.04	41.64	B
1471	1479	1475	1471-1479-1475	Kassner Road/R103	Kassner Road	Left	235	13.94	29.83	771.43	B								
1471	1479	1481	1471-1479-1481	Kassner Road/R103	Kassner Road	Right	279	29.20	62.16	437.14	C	514	21.82	42.57	1209	C			
1523	1521	1520	1523-1521-1520	Shongweni Road/M13 Westbound	Shongweni Road (north)	Thru	1	0	0	1800	A								
1524	1521	1514	1524-1523-1514	Shongweni Road/M13 Westbound	Shongweni Road (north)	Right	364	5	21	1706	A	365	4.77	12.56	2908	A			
1520	1521	1567	1520-1521-1567	Shongweni Road/M13 Westbound	M13 westbound off-slip	Left	0	3	0	1233	A								
1567	1521	1523	1567-1521-1523	Shongweni Road/M13 Westbound	M13 westbound off-slip	Right	317	3	18	1797	A	317	3.00	12.47	3031	A	3.94	7.17	A
1520	1521	1516	1520-1521-1516	Shongweni Road/M13 Westbound	Shongweni Road (south)	Left	1	0	0	1800	A								
1520	1521	1523	1520-1521-1523	Shongweni Road/M13 Westbound	Shongweni Road (south)	Thru	0	0	0	1799	A	1	0.00	0.03	3599	A			
1533	1643	1548	1533-1643-1548	Shongweni Road/M13 Eastbound	Shongweni Road (north)	left	437	3	23	1900	A								
1525	1530	1532	1525-1530-1532	Shongweni Road/M13 Eastbound	Shongweni Road (north)	Thru	364	0	20	1800	A	801	1.64	21.66	3700	A			
1534	1532	1528	1534-1532-1528	Shongweni Road/M13 Eastbound	M13 eastbound off-slip	Left	1	4	0	1354	A								
1548	1530	1525	1548-1530-1525	Shongweni Road/M13 Eastbound	M13 eastbound off-slip	Right	291	8	29	665	A	202	7.64	10.00	2018	A	2.16	15.46	A
1532	1530	1525	1532-1530-1525	Shongweni Road/M13 Eastbound	Shongweni Road (south)	Thru	317	0	18	1800	A								
1532	1530	1543	1532-1530-1543	Shongweni Road/M13 Eastbound	Shongweni Road (south)	Right	0	5	0	1023	A	317	0.00	11.25	2823	A			

C1.2 PM Peak

A node	B node	C node	Ref	Intersection Name	Approach	Movement	Turn					Approach					Intersection		
							Volume	Delay	V/C	Capacity	LOS	Volume	Delay	V/C	Capacity	LOS	Delay	V/C	LOS
1382	1369	1380	1382-1369-1380	Kassner Road/MR559	Kassner Road	Left	349	0.00	21.79	1602.84	A								
1382	1369	1310	1382-1369-1310	Kassner Road/MR559	Kassner Road	Thru	94	0.00	5.96	1347.36	A	446	0.02	10.94	4078	A			
1382	1369	1337	1382-1369-1337	Kassner Road/MR559	Kassner Road	Right	3	3.30	0.27	1127.82	A								
1385	1359	1310	1385-1359-1310	Kassner Road/MR559	MR559	Left	4	3.39	0.34	1157.86	A								
1385	1359	1337	1385-1359-1337	Kassner Road/MR559	MR559	Thru	0	3.83	0.00	1012.93	A	138	3.83	4.17	3312	A			
1385	1359	1382	1385-1359-1382	Kassner Road/MR559	MR559	Right	134	3.84	11.77	1143.74	A						0.94	4.61	A
1310	1359	1337	1310-1359-1337	Kassner Road/MR559	J B Mcintosh Drive	Left	0	0.00	0.01	1598.71	A								
1310	1359	1382	1310-1359-1382	Kassner Road/MR559	J B Mcintosh Drive	Thru	76	0.00	4.55	1674.79	A	89	0.72	2.17	4099	A			
1310	1359	1385	1310-1359-1385	Kassner Road/MR559	J B Mcintosh Drive	Right	13	5.05	1.55	825.19	A								
1337	1359	1382	1337-1359-1382	Kassner Road/MR559	Access	Left	9	3.81	6.32	2100.00	A								
1337	1359	1385	1337-1359-1385	Kassner Road/MR559	Access	Thru	1	8.32	1.94	815.97	A	9	4.22	0.29	3318	A			
1337	1359	1310	1337-1359-1310	Kassner Road/MR559	Access	Right	8	4.12	0.21	402.30	A								
1339	1344	1349	1339-1344-1349	Kassner Road/N3 westbound	Kassner Road (north)	Thru	362	0.00	21.20	1899.00	A								
1339	1344	1332	1339-1344-1332	Kassner Road/N3 westbound	Kassner Road (north)	Right	18	3.77	1.41	1266.17	A	400	0.17	12.88	3106	A			
1353	1344	1349	1353-1344-1349	Kassner Road/N3 westbound	N3 westbound off-slip	Left	84	4.48	5.16	1158.89	A								
1353	1344	1339	1353-1344-1339	Kassner Road/N3 westbound	N3 westbound off-slip	Right	324	8.90	38.61	839.02	A	369	6.58	19.44	1898	A	2.57	11.87	A
1349	1344	1339	1349-1344-1339	Kassner Road/N3 westbound	Kassner Road (south)	Thru	202	0.00	11.32	1783.00	A								
1349	1344	1332	1349-1344-1332	Kassner Road/N3 westbound	Kassner Road (south)	Left	17	0.00	1.06	1598.10	A	219	0.00	6.47	3381	A			
1319	1328	1342	1319-1328-1342	Kassner Road/N3 eastbound	Kassner Road (north)	Left	106	0.00	7.18	1472.91	A								
1319	1328	1335	1319-1328-1335	Kassner Road/N3 eastbound	Kassner Road (north)	Thru	327	0.00	19.31	1694.32	A	433	0.00	13.66	3167	A			
1335	1328	1319	1335-1328-1319	Kassner Road/N3 eastbound	Kassner Road (south)	Thru	459	0.00	27.72	1900.00	A								
1335	1328	1342	1335-1328-1342	Kassner Road/N3 eastbound	Kassner Road (south)	Right	27	4.91	2.87	941.94	A	526	0.25	19.18	2742	A	0.76	14.29	A
1305	1328	1319	1305-1328-1319	Kassner Road/N3 eastbound	N3 eastbound off-slip	Left	6	5.62	0.79	807.16	A								
1305	1328	1335	1305-1328-1335	Kassner Road/N3 eastbound	N3 eastbound off-slip	Right	73	8.54	13.48	541.75	A	79	8.33	0.83	1358	A			
1258	1255	1262	1258-1255-1262	Kassner Road/Cliffdale Road	Kassner Road (north)	Left	7	0.00	0.75	987.94	A								
1258	1255	1256	1258-1255-1256	Kassner Road/Cliffdale Road	Kassner Road (north)	Thru	426	0.00	30.30	1406.79	A	606	2.19	20.18	3001	A			
1258	1255	1249	1258-1255-1249	Kassner Road/Cliffdale Road	Kassner Road (north)	Right	172	7.40	28.33	606.34	A								
1262	1255	1258	1262-1255-1258	Kassner Road/Cliffdale Road	Access	Left	1	6.61	3.13	584.97	A								
1262	1255	1249	1262-1255-1249	Kassner Road/Cliffdale Road	Access	Thru	9	10.75	0.02	161.26	B	11	10.65	1.29	869	B			
1262	1255	1256	1262-1255-1256	Kassner Road/Cliffdale Road	Access	Right	10	19.79	5.79	167.82	B						2.00	14.46	A
1258	1256	1249	1258-1255-1249	Kassner Road/Cliffdale Road	Kassner Road (south)	Left	27	0.00	2.05	1319.58	A								
1258	1256	1255	1258-1255-1256	Kassner Road/Cliffdale Road	Kassner Road (south)	Thru	477	0.00	26.96	1769.70	A	506	0.01	13.38	3782	A			
1258	1256	1262	1258-1255-1262	Kassner Road/Cliffdale Road	Kassner Road (south)	Right	1	5.49	0.20	693.08	A								
1249	1255	1258	1249-1255-1258	Cliffdale Road	Cliffdale Road	Left	139	6.68	20.69	663.18	A								
1249	1255	1262	1249-1255-1262	Cliffdale Road	Cliffdale Road	Thru	9	13.94	0.81	228.47	B	148	7.11	13.04	1133	A			
1249	1255	1256	1249-1255-1256	Cliffdale Road	Cliffdale Road	Right	9	13.67	3.77	240.88	B								
1246	1250	1258	1246-1250-1258	Kassner Road/M13 westbound	Kassner Road (north)	Thru	306	15.91	65.25	468.58	B								
1246	1250	1240	1246-1250-1240	Kassner Road/M13 westbound	Kassner Road (north)	Right	109	35.45	60.10	181.51	D	415	21.05	63.61	650	C			
1257	1250	1251	1257-1250-1251	Kassner Road/M13 westbound	M13 westbound off-slip	Left	300	19.29	86.32	683.74	B	625	27.69	72.24	865	C	22.88	71.55	C
1257	1250	1246	1257-1250-1246	Kassner Road/M13 westbound	M13 westbound off-slip	Right	325	35.45	60.10	181.51	D								
1255	1250	1240	1255-1250-1240	Kassner Road/M13 westbound	Kassner Road (south)	Left	36	19.29	27.93	129.62	B	526	19.29	77.00	814	B			
1255	1250	1246	1255-1250-1246	Kassner Road/M13 westbound	Kassner Road (south)	Thru	190	19.29	86.32	683.74	B								
1239	1243	1253	1239-1243-1253	Kassner Road/M13 eastbound	Kassner Road (north)	Left	147	10.15	20.91	703.00	B								
1239	1243	1246	1239-1243-1246	Kassner Road/M13 eastbound	Kassner Road (north)	Thru	377	10.16	48.41	933.00	B	524	10.16	32.03	1636	B			
1246	1243	1239	1246-1243-1239	Kassner Road/M13 eastbound	Kassner Road (south)	Thru	757	4.36	43.79	1637.79	A	915	5.81	37.53	2438	A	10.72	36.14	B
1246	1243	1253	1246-1243-1253	Kassner Road/M13 eastbound	Kassner Road (south)	Right	158	10.15	24.71	800.52	B								
1237	1243	1239	1237-1243-1239	Kassner Road/M13 eastbound	M13 eastbound off-slip	Left	188	32.68	16.66	342.18	C	226	32.69	42.37	534	C			
1237	1243	1246	1237-1243-1246	Kassner Road/M13 eastbound	M13 eastbound off-slip	Right	38	32.68	19.73	191.64	C								
1230	1218	1222	1230-1218-1222	Kassner Road/Alverstone Road	Kassner Road (north)	Left	18	8.06	1.23	1140.00	A								
1230	1218	1212	1230-1218-1212	Kassner Road/Alverstone Road	Kassner Road (north)	Thru	373	5.69	32.68	1140.00	A	423	5.22	14.36	2946	A			
1230	1218	1204	1230-1218-1204	Kassner Road/Alverstone Road	Kassner Road (north)	Right	36	7.55	5.41	665.26	A								
1222	1218	1212	1222-1218-1212	Kassner Road/Alverstone Road	Hospital Access	Left	80	25.89	63.47	126.35	C								
1222	1218	1204	1222-1218-1204	Kassner Road/Alverstone Road	Hospital Access	Thru	9	28.03	9.00	34.14	C	116	26.27	44.09	264	C			
1222	1218	1230	1222-1218-1230	Kassner Road/Alverstone Road	Hospital Access	Right	36	27.20	35.91	103.21	C								
1212	1218	1204	1212-1218-1204	Kassner Road/Alverstone Road	Kassner Road (south)	Left	34	7.17	8.74	388.93	A								
1212	1218	1230	1212-1218-1230	Kassner Road/Alverstone Road	Kassner Road (south)	Thru	754	7.17	68.16	1106.28	A	820	6.98	32.32	2536	A			
1212	1218	1222	1212-1218-1222	Kassner Road/Alverstone Road	Kassner Road (south)	Right	32	2.31	3.06	1043.86	A								
1204	1218	1230	1204-1218-1230	Kassner Road/Alverstone Road	Kassner Road/Alverstone Road	Left	18	24.79	27.55	65.58	C								
1204	1218	1222	1204-1218-1222	Kassner Road/Alverstone Road	Kassner Road/Alverstone Road	Thru	1	24.79	27.55	3.63	C	81	28.29	28.87	289	C			
1204	1218	1212	1204-1218-1212	Kassner Road/Alverstone Road	Kassner Road/Alverstone Road	Right	62	29.36	28.23	220.09	C								
1475	1479	1481	1475-1479-1481	Kassner Road/R103	R103 (west)	Thru	497	7.22	15.83	2571.43	A								
1475	1479	1471	1475-1479-1471	Kassner Road/R103	R103 (west)	Right	166	18.11	21.76	672.31	B	663	7.26	17.06	3044	A			
1481	1479	1471	1481-1479-1471	Kassner Road/R103	R103 (east)	Left	462	17.08	76.49	603.42	B								
1481	1479	1475	1481-1479-1475	Kassner Road/R103	R103 (east)	Thru	849	17.08	74.96	1132.72	B	1311	17.08	75.49	1736	B	19.39	42.58	B
1471	1479	1475	1471-1479-1475	Kassner Road/R103	Kassner Road	Left	322	13.52	41.69	771.43	B								
1471	1479	1481	1471-1479-1481	Kassner Road/R103	Kassner Road	Right	449	44.99	102.78	437.14	D	771	32.03	63.79	1209	C			
1523	1521	1520	1523-1521-1520	Shongweni Road/M13 Westbound	Shongweni Road (north)	Thru	5	0	0	1800	A								
1524	1523	1514	1524-1523-1514	Shongweni Road/M13 Westbound	Shongweni Road (north)	Right	191	7	25	719	A	196	6.64	7.36	2519	A			
1567	1521	1520	1567-1521-1520	Shongweni Road/M13 Westbound	M13 westbound off-slip	Left	3	3	0	1031	A								
1567	1521	1523	1567-1521-1523	Shongweni Road/M13 Westbound	M13 westbound off-slip	Right	546	3	31	1770	A	549	3.64	19.60	2802	A	3.92	8.32	A
1520	1521	1515	1520-1521-1515	Shongweni Road/M13 Westbound	Shongweni Road (south)	Left	1	0	0	1795	A								
1526	1521	1523	1526-1521-1523	Shongweni Road/M13 Westbound	Shongweni Road (south)	Thru	5	0	0	1799	A	6	0.00	0.18	3594	A			
1533	1543	1548	1533-1543-1548	Shongweni Road/M13 Eastbound	Shongweni Road (north)	left	173	7	9	1896	A								
1526	1530	1532	1526-1530-1532	Shongweni Road/M13 Eastbound	Shongweni Road (north)	Thru	182	0	10	1800	A	353	1.46	9.61	3696	A			
1534	1532	1528	1534-1532-1528	Shongweni Road/M13 Eastbound	M13 eastbound off-slip	Left	4	3	0	1619	A								
1540	1530	1526	1540-1530-1526	Shongweni Road/M13 Eastbound	M13 eastbound off-slip	Right	224	9	38	585	A	229	9.14	10.35	2204	A	2.31	12.59	A
1532	1530	1525	1532-1530-1525	Shongweni Road/M13 Eastbound	Shongweni Road (south)	Thru	548	0	30	1900	A								
1532	1530	1543	1532-1530-1543	Shongweni Road/M13 Eastbound	Shongweni Road (south)	Right	5	4	0	1379	A	551	0.03	17.35	3179	A			