

TITLE: **TRAFFIC IMPACT ASSESSMENT STUDY IN SUPPORT OF THE PROPOSED TOWNSHIP DEVELOPMENT ON THE GREATER SEVILLE EXTENSION 1 TOWNSHIP LAYOUT PLAN SITUATED ON A PORTION OF THE REMAINDER OF PORTION 2 AND THE REMAINDER OF PORTION 3 OF THE FARM SEVILLE 224 KU**

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1. INTRODUCTION

1.1 Terms of Reference

Real Development Planning Company appointed **Lumka Civil Developments** on the 16 August 2022 for the compilation of Traffic Analysis Report for the proposed traffic impact assessment study in support of the proposed township development on the Seville extension 1 township situated on a portion of the Farm Seville 224KU in Bushbuckridge Local Municipality.

1.2 Background

Lumka Civil Developments Projects was appointed to conduct a Traffic Impact Assessment (TIA) for the proposed development in accordance with the Manual of Traffic Impact Studies Technical Methods for Highways published by the South African Roads Agency Limited, TMH16 and TMH17.

These manuals set the guidelines for carrying out a traffic impact investigations as a result of proposed developments. In terms of the guidelines, a fully-fledged traffic impact analysis is required to be carried out if more than 50 vehicle trips per hour will be generated by any development.

This should include conducting vehicle count surveys, conflicting turning movement analysis, and intersection performance analysis and road safety assessment if applicable. Measures such as level of service, delay, and volume or capacity ratio can be used to quantify the performance of an intersection or a roadway facility as a result of the proposed development. Further, the report assesses the impact of the township establishment on the existing provincial roads, particularly D4419

1.3 Site Location

The Proposed site is Situated 55.4 km North East on Bushbuckridge town to wards Nyeleti game reserve using Road D4419 on Portion Farm Seville 224KU (Road D4419 and D4418 Junction between Hluvukani within the Ehlanzeni district, in the Mpumalanga Province.

Table 1: Locality Map

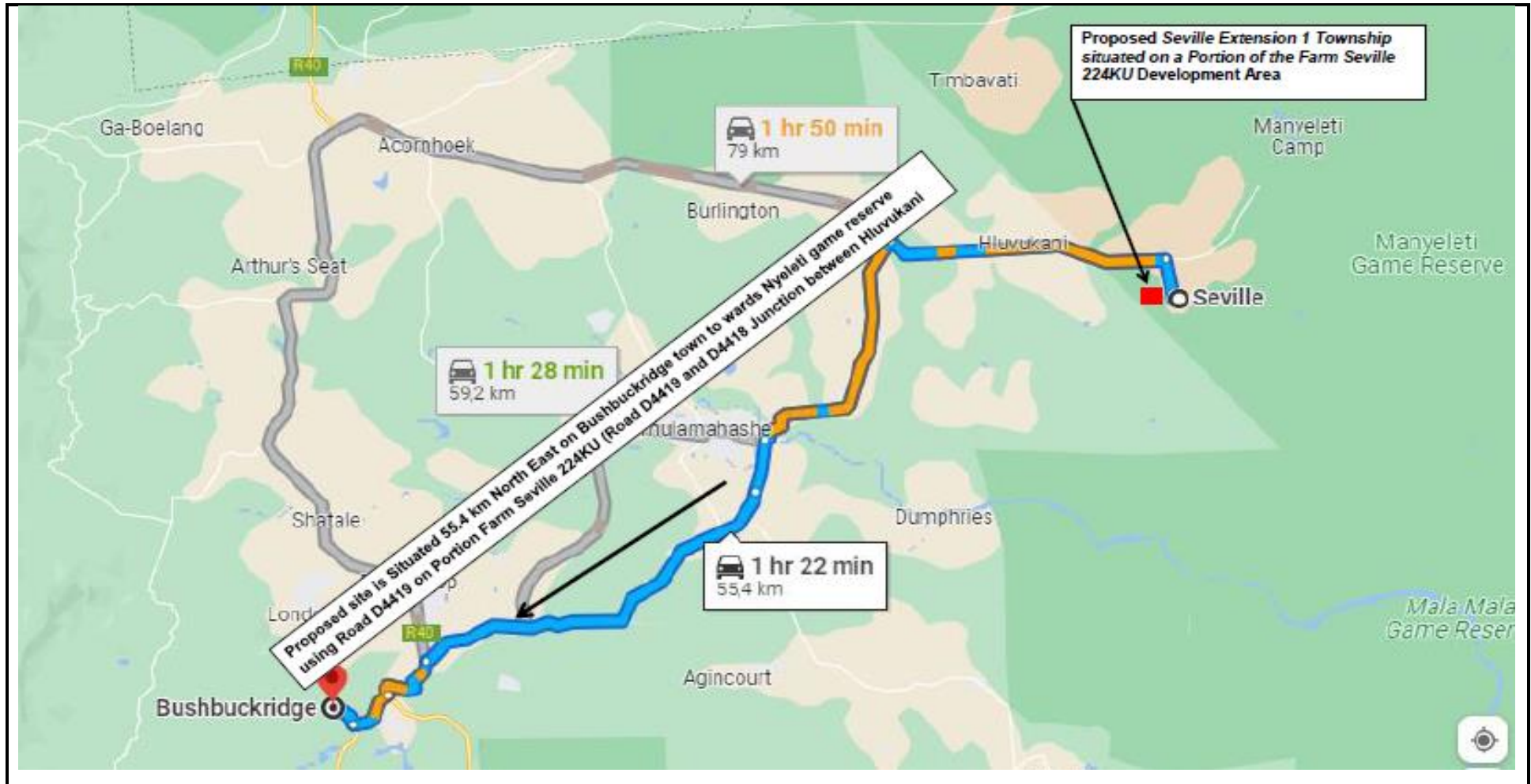


Table 2: Site Map



1.4 Climate

The Seville lies on 411m above sea level the climate is warm and temperate in Kildare. In winter, there is much less rainfall than in summer. The climate here is classified as Cwa by the Köppen-Geiger system. The average annual temperature is 21.1 °C in Seville. About 740 mm | 29.1 inch of precipitation falls annually.

The driest month is August, with 11 mm of rainfall. Most precipitation falls in January, with an average of 126 mm

The difference in precipitation between the driest month and the wettest month is 115 mm the average temperatures vary during the year by 8.7 °C

	January	February	March	April	May	June	July	August	September	October	November	December
Avg. Temperature (°C)	24.9	24.5	23.7	21.2	18.7	16.2	16.3	18.1	20.6	21.6	22.9	24.1
Min. Temperature (°C)	19.3	19.1	18	15.2	11.5	8.5	8.6	10.5	13.4	15.4	17.2	18.5
Max. Temperature (°C)	30.6	30	29.4	27.3	25.9	23.9	24	25.7	27.8	27.9	28.7	29.7
Avg. Temperature (°F)	76.8	76.1	74.7	70.2	65.7	61.2	61.3	64.6	69.1	70.9	73.2	75.4
Min. Temperature (°F)	66.7	66.4	64.4	59.4	52.7	47.3	47.5	50.9	56.1	59.7	63.0	65.3
Max. Temperature (°F)	87.1	86.0	84.9	81.1	78.6	75.0	75.2	78.3	82.0	82.2	83.7	85.5
Precipitation / Rainfall (mm)	126	124	81	55	21	12	12	11	23	56	103	

1.5 Demographics

Geographical

Seville A is located in Bushbuckridge local municipality, within the province of Mpumalanga. (GPS coordinates: 24.6691 S, 31.4166 E) in the Mpumalanga province of South Africa.

Historical

Bushbuckridge Local Municipality is one of the five constituents of Ehlanzeni District Municipality in Mpumalanga, and is bounded by Kruger National Park in the east and Mbombela in the South. It also forms part of the Kruger to Canyon Biosphere. The Municipal area provides a link to Limpopo Province and can therefore be called the gateway to the major tourism attraction points in Mpumalanga and the eastern part of the Limpopo Province. Bushbuckridge Local Municipality consists of 135 settlements and is divided into 34 wards.

According to Census 2011, the Bushbuckridge Local Municipality has a total population of 541248, of which 99,5% are black African, with the other population groups making up the remaining 0,5%.

Of those aged 20 years and older, 4,0% have completed primary school, 32,2% have some secondary education, 25,7% have completed matric, 7,4% have some form of higher education and 18,7% of those aged 20 years and older have no form of schooling.

Living Condition

There are 134 197 households in the municipality, with an average household size of 4,0 persons per household. 11,9% of households have access to piped water inside dwelling/institution and 29,5% have water in their yard. One in five households (21,0%) do not have access to piped water. With a growth factor of 0.79%

Economy

More than half (52,1%) of the 128 862 economically active (employed or unemployed but looking for work) people in the municipality are unemployed.

Almost two-thirds (64,6%) of the 71 272 economically active youth (15 – 34 years) in the area are unemployed.

2. INTRODUCTION SCOPE OF THE ASSESSMENT

2.1 General

The Traffic Impact Assessment is conducted according to TMH 16 and 17 and in terms of this manuals, Lumka Civil Developments is fully responsible for the Traffic Impact and Site Traffic Assessments. This responsibility, however, is restricted to the assessments described in TMH 16 and TMH17 and Lumka Civil Developments shall not be responsible for undertaking any assessments that would normally form part of the master planning of the Municipality (as described in TMH16).

The assessments that were undertaken by Lumka Civil Developments are as follows:

- Traffic Impact Assessment, requiring the assessment to assess the traffic impact of a proposed change in land-use rights.
- Site Traffic Assessment which entails the assessment of transportation facilities and site accesses proposed in a Site Development Plan or during Township Establishment.

2.2 Objectives of the Traffic Impact Assessment

Traffic Impact Assessments (TIA) is required to determine the traffic impact of a land development proposal and whether such development can be accommodated by the transportation system. Transportation and land development are inescapably related and Traffic Impact Assessments are required to ensure that the impact of land development can be accommodated by the transportation system.

An inadequate transportation system will lead to congestion and result in deterioration of traffic safety, as well as a diminished quality of life and a reduced economic viability of development.

The purpose of traffic assessments is to support sustainable development by protecting the overall integrity of the transportation system for the benefit of all users. Neither public nor private interests are served if transportation systems are needlessly degraded due to poor development planning and control. An efficient, reliable and safe transportation system will in fact unlock and enhance land development potential.

The specific objectives of a Traffic Impact Assessment for Proposed proposed Township on the Seville Extension 1 Township situated on a Portion of the Farm Seville 224KU in Bushbuckridge Local Municipality under Ehlanzeni District Municipality, Mpumalanga Province. 150 IS were to determine:

- The local impact of a proposed change in land use on the road and transportation system surrounding the development.
- To evaluate the combined impacts not only of the proposed development, but also other likely nearby developments.

- Whether it is possible to accommodate the proposed change in land use, with or without the implementation of mitigation measures.
 - The mitigation measures and improvements that may be required to accommodate the proposed change.

2.3 Legal Framework

Integrated Development Plan

The Constitution of the Republic of South Africa empowers a Municipality to government, on its own initiative, the local government affairs of its community, subject to national and provincial legislation.

According to the constitution, the Municipality has executive authority in respect of, and has the right to administer, inter alia; the local government matters listed in Part B of Schedule 4 and Part B of Schedule 5, which includes municipal roads.

The Municipality also has the right to exercise any power concerning a matter reasonably necessary for, or incidental to, the effective performance of its functions. In terms of Section 152(1) of the Constitution, the objects of local government include, inter alia, to ensure provision of services to communities in a sustainable manner and to promote social and economic development.

Section 153 emphasises that in its budgeting and planning processes, the Municipality must give priority to the basic needs of the community and to promote social and economic development of the community. Municipal development planning in South Africa is regulated by the Municipal Systems Act (Act No 32 of 2000). This act requires the preparation and adoption of Integrated Development Plans.

2.4 Assessment Methodology

The assessment methodology entailed the baseline assessment, traffic demand estimation, traffic impact assessment and recommended mitigation measures and associated costs. The baseline assessment included the identification of the following:

- Background study: proposed Township Seville Extension 1 Township Situated on a Portion of the Farm Seville 224KU In Bushbuckridge Local under Ehlanzeni District Municipality, Mpumalanga Province;
 - Identification of affected external roads
 - The investigation and assessment of the status quo of internal and external road networks
 - Existing traffic volumes
 - Capacity analysis of the existing affected access roads and intersections.

Traffic demand estimation entailed the adoption of a methodology for estimating traffic demand as a combination of "traffic growth" and "build-up" methods. The future traffic demand is estimated by applying a growth rate to existing traffic counts and by accumulating the trip generation of other expected developments, including those that have been approved but not yet fully implemented.

The potential impacts of the upgrade of the township establishment were identified and assessed as presented in Section 7 followed by conclusion and recommendations in mitigating the impact of traffic.

2.5 Approach

The approach followed in the execution of this study is described in this section

- The Critical Peak Hours Were Analysed - Design Period - (Average Daily Traffic Demand)
- The Study Period for the Development Base Year (existing situation) is 2022
- The manual traffic counts were also conducted by Lumka Civil Developments.
- A site visit was undertaken on Wednesday the 24th August 2022 and Friday the 26th August 2022 at the identified sites to view road transport access routes and access implications for the project, in relation to the background traffic and anticipated traffic for the development of the proposed Township on the Seville Extension 1 Township Situated on a Portion of the Farm Seville 224KU In Bushbuckridge Local under Ehlanzeni District Municipality, Mpumalanga Province.
- Traffic counts were undertaken at identified Junction during the above site visits, for the AM and PM peak hours, and at the proposed site junction Situated on Portion Farm Seville 224KU (Road D4419 and D4418 Junction between Hluvukani and Nyeleti) 24° 39' 09.50" S : 31° 24' 41.32" E: during the AM peak hour

3. TRAFFIC ACCESSMENT METHODOLOGY

3.1 Site Accessibility

The subsection below elaborate on the following:

- a) Existing roadway system
- b) Traffic flows
- c) Public transport
- d) Traffic safety.

3.2 Manual Traffic counts

The purpose of the manual traffic counts is to determine the pattern of turning movements, as well as the splits between the following various modes of transport for specific time intervals:

- a) Heavy vehicles
- b) Light vehicles
- c) Taxis
- d) Buses.

Traffic counts were conducted on Wednesday 24th August 2022 and Friday 26th August 2022 at proposed site junction Situated on Portion Farm Seville 224KU (Road D4419 and D4418 Junction between Hluvukani and Nyeleti) 24° 39' 09.50" S : 31° 24' 41.32" E: **See Appendix B**

3.3 Manual Traffic counts

The proposed Township on the Seville Extension 1 Township Situated on a Portion of the Farm Seville 224KU In Bushbuckridge Local under Ehlanzeni District Municipality, Mpumalanga Province. The count was done on the proposed site junction Situated on Portion Farm Seville 224KU (Road D4419 and D4418 Junction between Hluvukani and Nyeleti) 24° 39' 09.50" S: 31° 24' 41.32" E:

Detailed information about these manual traffic surveys includes the following:

- a) 12-hour traffic counts per movement, per intersection
- b) The existing distributing of vehicle per type of mode, per intersection.

The traffic counts are in chapter 5 of this report to make the various calculations.

3.4 Public Transport

The following information about public transport is relevant:

- a) There are relatively a lot of public transport movements in the vicinity of the proposed development.
- b) People from surrounding villages use public transport to their work place and school, there for the Township development.

3.5 Traffic Safety

The D4418 enters the Southern outskirts of Seville, where it reaches a junction with the D4419 Road.

No formal accident statistics information was found for Road D4419 and D4418

4. AREA CONDITION ASSESSMENT

The existing Junction Seville extension (Road D4419/D4418 Junction) is no safe, as it's currently in use by the local motorist coming from other existing parts of Seville Village and the surrounding villages. The condition of the road is very bad with server potholes

The existing access is sufficient to accommodate Delivery Trucks and Freight trucks passing on both lanes at the same time.

Table 3: Site Photos

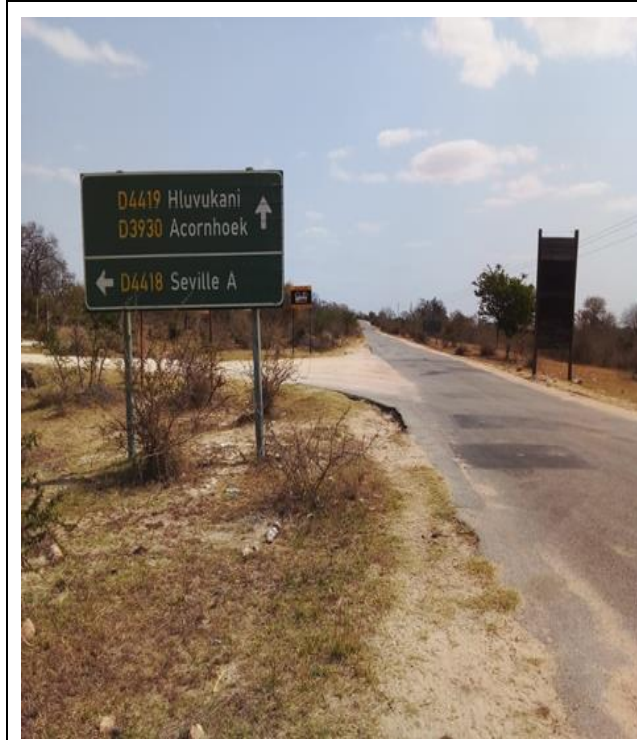


Photo 1: Site junction Situated on Portion Farm Seville 224KU (Road D4419 and D4418 Junction)



Photo 2: High Volume of Light Vehicle passing the area



Photo 3 : Road D332D4418 in to Seville Village



Photo 4: Road D4419 between Hluvukani and Nyeleti

Table 4: Proposed Development Area



Table 5: Development Land use Legend

DESCRIPTION	LAND USE	NO. OF ERF	AREA (H)	% OF AREA	NOTATION
RESIDENTIAL 1	DWELLING UNITS	477	21.55	31.36	
BUSINESS 1	SHOPS/ RETAILS	13	8.56	12.45	
INSTITUTIONAL	PLACE OF WORSHIP	2	0.19	0.27	
EDUCATIONAL	CRECHE	2	0.23	0.33	
P. OPEN SPACE	OPEN SPACE	3	27.68	40.28	
ROAD PURPOSES	PROPOSED ROADS	*	10.51	15.31	
TOTAL		497	68.71	100%	

5. TRAFFIC COUNT ANALYSIS AND PROJECTIONS

5.1 Current Transport Usage

During Site visit the following was observed:

- By far the largest use of transport is private vehicles, Trucks and Freight Trucks
- No **Motorcycles** were seen for entire duration of the traffic survey in this area.
- Buses were observed using Road D4419 for residents going to work and school linked to the residential areas around the proposed site.
- This could change with the finalisation and development of the proposed Township on Portion Farm Seville 224KU in Bushbuck Ridge Local Municipality within Ehlanzeni District Municipality, Mpumalanga Province. Upgrading of the alternative access road in this report.
- **Truck traffic** is particularly significant and travels mainly from Hlulekani towards Nyeleti passing Seville Township.
- **Truck traffic** is particularly significant and travels mainly from the D4419 provincial route
- A moderate portion of freight transport has moved from rail to road transport (e.g. mining and forestry related freight transport).

5.2 Traffic Counts

Two methods were applied in the analysis of this project.

- a) Consultation with the South African Roads Agency Limited Traffic counts on proposed site junction Situated on Portion Farm Seville 224KU (Road D4419 and D4418 Junction between Hluvukani and Nyeleti) 24° 39' 09.50" S: 31° 24' 41.32" E: was done by the Consultant.
- b) A two days traffic count (Wednesday & Friday) survey was conducted by Lumka Civil Developments Technicians with the help of local Labourers

5.3 Vehicle Classification

The average vehicle classification during the survey period was 61% light vehicles, 20% taxi's, 10% buses, and 7% heavy vehicles.

The development and formalization of the proposed Simile Extension will mostly include light vehicles and mini-bus taxis. Although some of the heavy vehicles may also use the Access.

5.4 Traffic Growth within the Study Area

It is expected that the increase in traffic should be significant during the early morning (6:00-08:00) and early evening (17:00-18:00) and the traffic count will therefore done over a 12 hr period.

6. ROADS AND TRAFFIC VOLUMES IN THE SURROUNDING AREA

6.1 Description of Road Infrastructure

a) Road (D4419 and D4418 Junction between Hluvukani and Nyeleti) 24° 39' 09.50" S: 31° 24' 41.32" E:

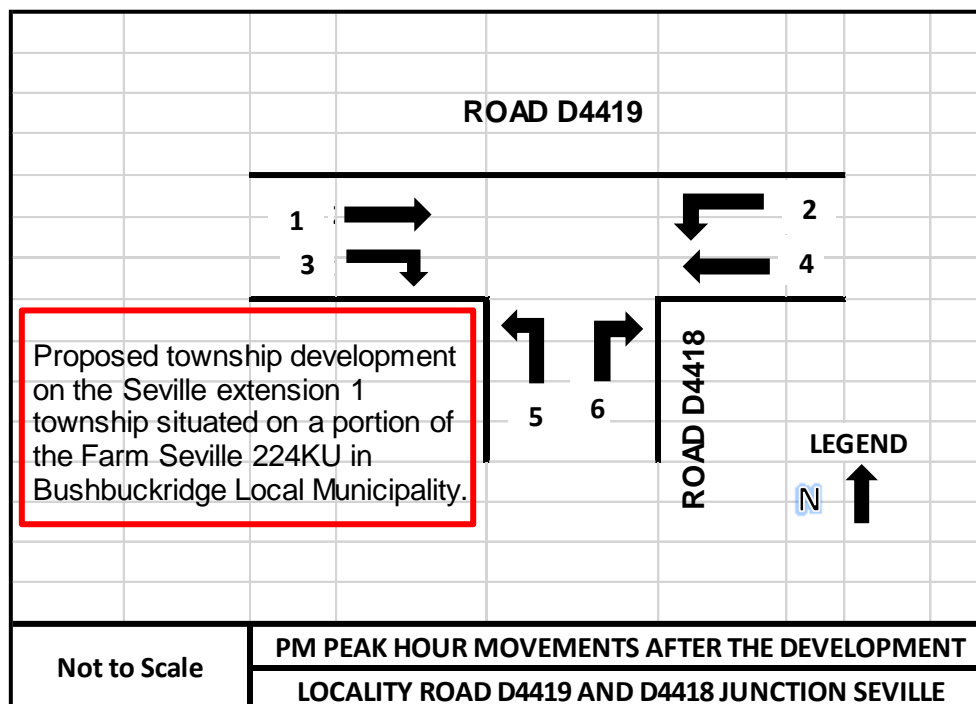
Detailed information about these manual traffic surveys includes the following:

- a) 12-hour traffic counts per movement, per intersection.
- b) The existing distributing of vehicle per type of mode, per intersection.

The major road in the vicinity of the study area is the Road D4419 between Hluvukani and Nyeleti. This section of the D4419 carries Moderate traffic volumes, but has a high percentage of light vehicles (Over 61%)

Heavy vehicles counted but generally some 7%, based on annual traffic count data. The heavy vehicles comprise mainly freight trucks and buses.

Table 6: Turning Movement



6.2 Public Transport

The following information about public transport is relevant:

- c) There are relatively a lot of public transport movements in the vicinity of the proposed development.
- d) People from surrounding villages use public transport to their work place and school therefore it is important to make the access formal and safe.

6.3 Road Accident

No formal accident statistics information was found for Road D4419 and D4418 Junction between Hluvukani and Nyeleti

7. TRAFFIC DEMAND ESTIMATION

7.1 Traffic Demand Estimation

7.1.1 General Methodology for Estimating Traffic

General Methodology for estimating traffic demand described in this appendix is a combination of "traffic growth" and "build-up" methods. The future traffic demand is estimated by applying a growth rate to existing traffic counts and by accumulating the trip generation of the expected township developments.

7.1.2 Traffic Growth Rate

Traffic growth appropriate growth rates must be used for the estimation of future background traffic. Growth rates are only applied to traffic counts and not to the trip generation rates of developments since such rates are determined for fully occupied developments. Typical growth rates are provided in the Trip Data Manual. For the Simile Extension township establishment, a moderate annual growth rate of 4% would be used.

Trip Generation Trip generation fundamentally consists of four types of trips:

- (a) Primary trips, - new trips on the total road network. This is in contrast with the other types of trips that are already on the road network, although they could be new on segments of the road network.
- (b) Pass-by trips, - these are trips attracted from roads directly adjacent to a development and from which direct access is provided to the development. These trips are made as intermediate stops on the on the way from an origin to a primary destination without route diversion. Pass-by trips are not new trips on the road network, but are trips turning in and out of accesses to the development. The trips should therefore not be deducted from the trip generation of the development – it is only the trip distribution that is affected.
- (c) Diverted trips – are the attracted trips from roads in the vicinity of the generator but which require a diversion to another road to gain access to the development. Diverted trips add traffic to streets adjacent to a site, but may not add traffic to other roads in the road network. The trips are similar to pass-by trips, except that they have to deviate to other roads to obtain access to the site. Diverted trips well tend to return to their original route and continue to their original destinations after visiting the development.
- (d) Transferred trips, are those that are already present on the road network and which are visiting similar developments near to the proposed development and which has the potential of transferring or switching their destination to the proposed development. These trips are different from pass-by and diverted trips in that trips are wholly transferred from one development to another The trip generation and other traffic characteristics of a development depend not only on the type of development but also on its size and for this project, the Single Dwelling Units would be used as provided in the township layout plan designed

8. TRAFFIC VOLUME DATA

8.1 Annual Average Daily Traffic (AADT) From Mpumalanga Public works, Roads and Transport

Lumka Civil Developments requested traffic count information from Mpumalanga Public works, Roads and Transport. The information obtained was to be used a guideline and also verification purposes. No Information was found to date

9. TRAFFIC ANALYSIS

9.1 Traffic Analysis Using Actual Site 2020 Information

Traffic counts were used to determine the traffic demand pass the site. Traffic growth allows for the expected increase in traffic due to undeveloped land in the area. A two day traffic count (Wednesday & Friday) survey was conducted by Lumka Civil Development will be conducted by Lumka Civil Development Technicians. Detail of the traffic count is provided in **Appendix C**

The Following is **Cumulative E80s/DIR** conducted on **26th August 2022**

Table 7: Cumulative E80s/DIR

CUMULATIVE E80/DIR													
SECTION	DIR	ADT	LV	MB-T	MB	B	HV	ADE	Growth (%)	CUMULATIVE E80/DIR @ various yrs			
										5	10	15	20
Proposed site junction Situated on Portion Farm Seville 224KU (Road D4419 and D4418 Junction between Hluvukani and Nyeleti) 24° 39' 09.50" S : 31° 24' 41.32" E	Incoming	730	380	174	16	122	39	326	4	671 201	1 487 820	2 481 362	3 690 157
									6	711 993	1 664 801	2 939 873	4 646 206
Proposed site junction Situated on Portion Farm Seville 224KU (Road D4419 and D4418 Junction between Hluvukani and Nyeleti) 24° 39' 09.50" S : 31° 24' 41.32" E	Outgoing	362	253	46	10	24	28	120	4	247 390	548 379	914 577	1 360 113
									6	262 426	613 610	1 083 575	1 712 493
Total Average		546	317	110	13	73	34	223		459296	1018099	1697969	2525135

The Following is **Average Cumulative E80s/DIR** conducted on **24th August 2022 and 26th August 2022**

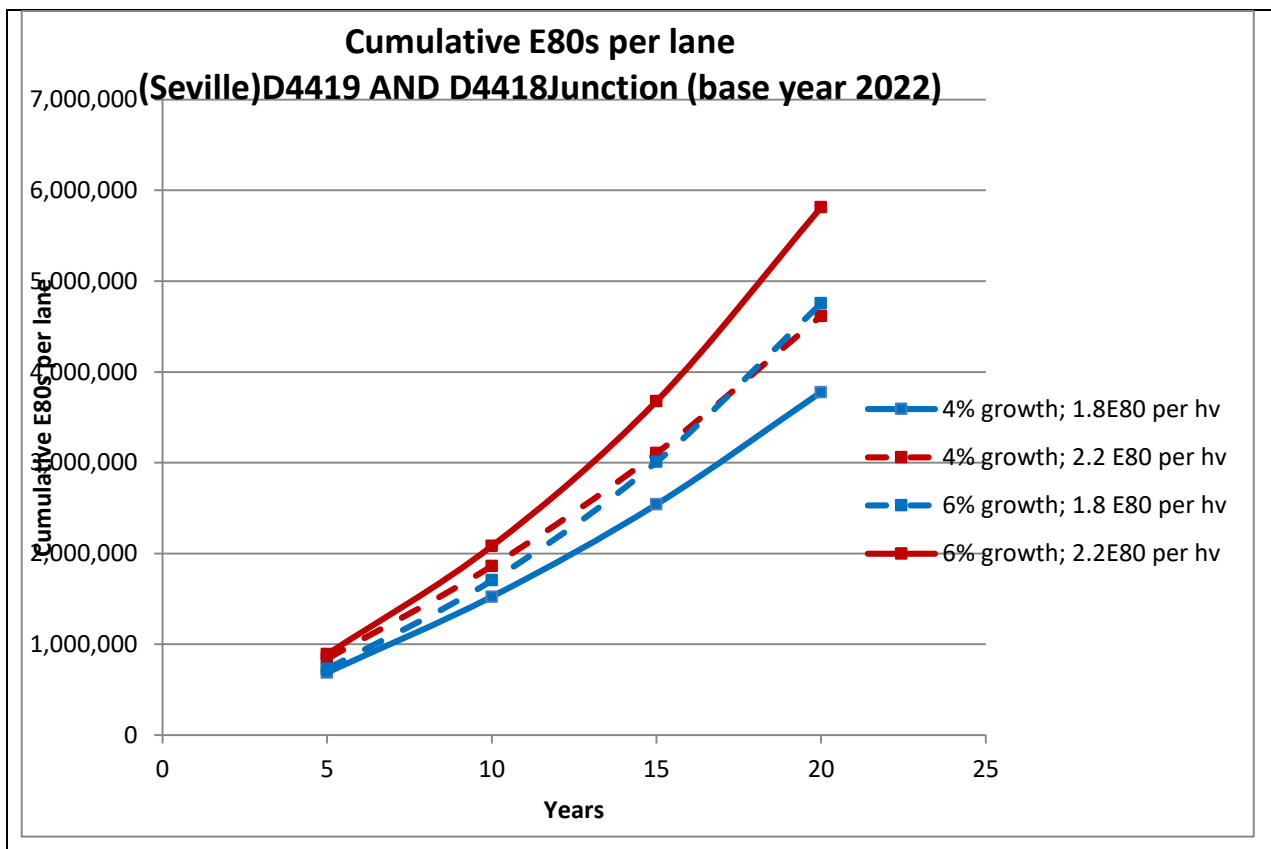
Cumulative E80s over Design Period.

CUMULATIVE E80/DIR												
SECTION	DIR	ADT	LV	MB-T	B	HV	ADE	Growth (%)	CUMULATIVE E80/DIR @ various yrs			
									5	10	15	20
Proposed site junction Situated on Portion Farm Seville 224KU (Road D4419 and D4418 Junction between Hluvukani and Nyeleti) 24° 39' 09.50" S : 31° 24' 41.32" E:	Incoming	1246	696	296	147	80	482	4	991 708	2 198 273	3 666 244	5 452 255
								6	1 051 979	2 459 765	4 343 700	6 864 829
Proposed site junction Situated on Portion Farm Seville 224KU (Road D4419 and D4418 Junction between Hluvukani and Nyeleti) 24° 39' 09.50" S : 31° 24' 41.32" E:	Outgoing	657	464	79	41	56	224	4	461 062	1 022 014	1 704 499	2 534 845
								6	489 083	1 143 586	2 019 459	3 191 575
Total Average		952	580	187	94	68	353		726385,20	1610143,86	2685371,40	3993550,10

Traffic count data for the year 2022 was obtained from Manual traffic counting done by Lumka Civil Developments on the roundabout of road R35 next to Proposed site junction Situated on Portion Farm Seville 224KU (Road D4419 and D4418 Junction between Hluvukani and Nyeleti) 24° 39' 09.50" S : 31° 24' 41.32" E in Bushbuck Ridge Local Municipality, under Ehlanzeni District Municipality, Mpumalanga Province.: information indicates that the Annual Average Daily Traffic (AADT) for this section in 2022 was 1903 vehicles per day. The Annual Average Daily Truck Traffic (AADTT) was 350 vehicles per day which is about 7% of AADT.

The traffic count data was projected to the initial design year, 2022, using a 4 % annual growth rate. Thereafter, cumulative E80s were determined over a 20 years design period. In order to determine the sensitivity of the cumulative E80s over the design period to design inputs, growth rates of 4 % and 10 % as well as E80s per heavy vehicle of 1.8 and 2.2 were used and results are tabulated in Table 1 below. The analysis indicates that this road section will have cumulative E80s per lane over a 20 year design period ranging from 0.72 to 4.98 million.

Table 8: Cumulative E80s per Lane (base year 2022)



9.2 Average Annual Daily Traffic Demand (AADT)

12-Hour Weekday Traffic Demand

The current traffic demand is shown in Table 1 as about 16 000 vehicles during a 12-hour period on a weekday (Friday).

Average Weekday Traffic Demand (AWDT)

A conversion factor of 1.25 is appropriate to convert 12-hour Friday traffic counts to AWDT traffic counts - based on typical traffic patterns in urban areas along major roads.

Average Annual Daily Traffic Demand (AADT)

Since the expected monthly or annual fuel sales is based on factored daily trips, it is common practice to use a number of average trading days per month which is less than the calendar average of 30.5 days. In this instance – based on the prevailing traffic characteristics - it is recommended to use 25 average trip days per month.

The affected Road is D4419

The township establishment is expected to generate 3025 vehicles per day in both directions combined and characterised by the following:

- The week peak AM and PM generated would be 6048 combined in and out. A directional split assumed is 85:15 and 15:85 in the determination of the worst-case scenario to evaluate intersections capacity and propose mitigation measures
- From the site investigations, the morning peak hour at the intersections are 7:00 to 8:00 except for D4419/D4418 which occurs between 6:00 to 7:00 am. The afternoon peak hour observed was between 5:00 to 6:00pm.

9.3 Proposed Alternative Access Road

The establishment of the township would affect the following major roads:

- Proposed Alternative Access 1 (S 24° 39' 11.66";E 31° 24' 09.17")

The affected internal access roads are D4419:

The township establishment is expected to generate 1903 vehicles per day in both directions combined and characterised by the following:

- The week peak AM and PM generated would be 2019 combined in and out. A directional split assumed is 85:15 and 15:85 in the determination of the worst-case scenario to evaluate intersections capacity and propose mitigation measures
- From the site investigations, the morning peak hour at the intersections are 7:00 to 8:00 except for D4419 and D4418 which occurs between 6:00 to 7:00 am. The afternoon peak hour observed was between 5:00 to 6:00pm.

10. PROPOSED ACCESS DESIGN

10.1 Pavement Design

The pavement design was done according to Draft TRH4:1996 “Structural Design of Flexible Pavements for Interurban and Rural Roads”.

The following inputs were considered in the design:

- A Structural Design period of 20 years
- ES 10 (3 to 10 million cumulative 80 kN axles per lane)
- Road Category B
- Moderate climatic region.

A structural design period of 20 years was considered most appropriate as this is expected to provide a more optimal life cycle strategy when considering initial construction costs and long term maintenance costs.

Design subgrade CBR:

No geotechnical test was done the existing road to expose the layers in the existing gravel shoulder. A general assumption was used base on the existing geological information of the area. However, descriptions of the assumed profile indicator that the material within the depth of the subbase and selected layers is silty clayey gravel. It is expected that these materials will be of at least G7 quality and will therefore be suitable for use as selected layers.

Table 9: Proposed Pavement Design

Surfacing	45 mm	Continuously graded asphalt (medium) with rolled in chipping.
Base	150 mm	G1 Crushed stone base compacted to 88% Apparent Relative Density, imported material
Upper-Subbase	150 mm	Stabilised natural gravel (C4), Min. UCS of 0.75 MPa at 100% Mod. AASHTO, min. ITS of 200 kPa at 100 Mod. AASHTO, compacted to 97% Mod. AASHTO, Imported material
Lower-Subbase	150 mm	Stabilised natural gravel (C4), Min. UCS of 0.75 MPa at 100% Mod. AASHTO, min. ITS of 200 kPa at 100 Mod. AASHTO, compacted to 96% Mod. AASHTO, Imported material.
Upper selected	150 mm	Natural Gravel (G7), Compacted to 95% Mod. AASHTO density, min. CBR of 15% at density specified for the layer, Max. PI of 12 or 3GM +10, Imported Material.
Lower selected	150 mm	Natural Gravel (G9), Compacted to 93% Mod. AASHTO density, min. CBR of 7% at density specified for the layer, Max. PI of 12 or 3GM +10, Imported or In-situ material.
Roadbed preparation / fill	-	Roadbed or fill (G10), Compacted to 93% Mod. AASHTO density, min. CBR of 3% at density specified for the layer, Max. PI of 12 or 3GM +10, In-situ or Imported material.

10.2 Junction

The road have two additional 7.4m lane surfaced wide, with two lanes each being 3.7m; this will serve as turning lane. 15m Radius Bell mouth will be sufficient with associated slip way into the village. See Appendix E

11. ROAD SAFETY AND ROAD SIGNS

11.1 Road safety and Road Signs

The area lacks information, directional and warning signs in mainly areas. A special budget is required to upgrade and install signage in most of the area.

From a traffic safety point of view it would be advisable to provide the following:

- a) It is extremely important to provide the necessary signboards to ensure that the proposed new facilities would function optimally.

12. CONCLUSIONS AND RECOMMENDATIONS

Conclusion The proposed township establishment will adversely impact the level of service of existing intersections owned by the South African Roads Agency and Two additional intersections under the jurisdiction of Mpumalanga Department of Public works, Roads and Transport. Recommended Access Road be upgraded and signal timing are provided in the recommendations below together with the expected Level of Service at an annual growth rate of 2%.

Recommendations on the intersection will require an upgrade from an existing give way yield control to a signalised control in order to provide enough capacity for the proposed trips generated by the township. The proposed layout is shown in Table: 8. It is expected that the PM Level of Service on Identified locations intersection would be based on average delay on each lane for a signal timing in

It is recommended that the application be approved as per recommendation of this report and the geometrical specification of the Mpumalanga Department of Public works, Roads and Transport. and the Ehlanzeni district Municipality, subjected to the provision of the required road reserve as indicated on the attachment.

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**APPENDIX A
LOCALITY MAP**

APPENDIX B TRAFFIC COUNTS

**APPENDIX C
TRAFFIC ANALYSIS
CALCULATIONS**