TRAFFIC IMPACT ASSESSMENT
PART OF AN ENVIRONMENTAL IMPACT ASSESSMENT FOR THE KEBRAFIELD ROODEPOORT COLLIERY IN THE PULLEN'S HOPE AREA

20 March 2014

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DECLARATION

I certify that this TRAFFIC IMPACT ASSESSMENT: PART OF AN ENVIRONMENTAL IMPACT ASSESSMENT FOR THE KEBRAFIELD ROODEPOORT COLLIERY IN THE PULLEN'S HOPE AREA was prepared by me and I have experience and training in the field of traffic and transportation engineering.

Signed: ……

DATE: 20 MARCH 2014

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ECSA Registration Number: 970277

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TRAFFIC IMPACT ASSESSMENT
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1. BACKGROUND

This study was conducted by Corli Havenga Transportation Engineers as part of the Environmental Impact Assessment conducted by Eco Elementun Environmental and Project Management for the development of the Kebrafield Roodepoort Colliery near Pullen's Hope in Mpumalanga Province.

This will be an opencast mine located on a portion of Portion 17 of the Farm Roodepoort 151-IS.

2. METHODOLOGY

This basis of this report is in accordance with the Manual for Traffic Impact Studies [(1)]. The threshold value where no traffic impact study is required is 50 peak hour trips or where more than 75 peak hour trips are added to critical movements. Two peak hours occur during a normal weekday, a morning peak hour that occurs between 06:00 and 08:00 and an afternoon peak hour that occurs between 16:00 and 18:00.

It is important to note that this report deals with peak traffic hours on a normal weekday and that references made to traffic volumes generally refer to these periods.

3. SITE LOCATION AND ACCESSIBILTY

The proposed opencast mine is located on Portion 17 of the Farm Roodepoort 151 IS near Pullen's Hope in Mpumalanga Province as depicted in Figure 1. The road network and route numbers used in this report are depicted in the extract from the Mpumalanga Roads Department Road Network Plan presented as Figure 2.

Access to the mine can be obtained from the N11, Pullen's Hope/Hendrina Power Station intersection, via Road D2274 as depicted in the photos below.

N11 towards Middelburg

N11 towards Hendrina

Road D2274 towards Pullen's Hope

Typical sections along Road D2274 are depicted in the photos below.

Typical section along Road D2274

Typical section along Road D2274

Typical section along Road D2274 in Pullen's Hope

Typical section along Road D2274 in Pullen's Hope

Typical section along Road D2274 east of Road D2539 towards Pullen's Hope

Typical section along Road D2274 east of and towards Road D2539

Road D2274 is used up to the intersection with Road D2539, and then Road D2539 is taken towards the mine. The intersection of Road D2274 and Road D2539 is depicted in the photos below.

Road D2274 at intersection with Road D2539 towards Pullen's Hope

Road D2274 at intersection with Road D2539 towards Broodsnyersplaas

Road D2539 to the mine is a gravel road as depicted in the photos below.

Road D2539 towards the mine (at the intersection with Road D2274)

Typical section along Road D2539
(±1,1km from intersection with Road D2274)

Typical section along Road D2539
(± 2,1km from intersection with Road D2274

Typical section along Road D2539
(± 3,1km from intersection with Road D2274

Road D2539 on the mine site

Road D2539 north of the mine site

The section of Road D2539 across the mine area needs to be relocated to mine the area beneath the existing road.

4. MINING OPERATION

This application only deals with the opencast mine on approximately 60ha of Portion 17 which is 410ha in size. The farm and mining footprint are depicted in Figure 3. The intention is to mine 800000 tons of coal over a period of 3 years taking mine closure and rehabilitation into account.

At this stage we do not know where the coal will be delivered to and will, for the purposes of this report, take the coal truck trips to the N11 and distribute 50% of the trips towards Middelburg and 50% of the trips towards Hendrina.

Mine to operate 24 hours per day, seven days per week

Three shifts per day on the mine:

Shift change times:	06:00 to 14:00
	14:00 to 22:00
	22:00 to 06:00
Admin, normal office hours Monday to Friday:	07:30 to 16:00

The product will all be transported by road and we assume at this stage that 30-ton trucks will be used.

5. EXISTING TRAFFIC DEMAND

We conducted classified turning movement counts at three major intersections in the vicinity of the mine on Thursday 27 February 2014. The counts were done between 06:00 and 18:00. The weekday peak traffic hours as defined in the Manual for Traffic Impact Studies were as follows:

Morning peak hour (a.m.):	06:45 – 07:45
Afternoon peak hour (a.m.):	16:00 – 17:00

The existing weekday morning and afternoon peak hour traffic demand is depicted in Figure 4. During the morning peak hour the traffic flow towards Hendrina Power Station causes a queue from the entrance to the Power Station all along the access road and Road D2274 as depicted in the photo below.

Road D2274 in Pullen's Hope towards Hendrina Power Station

This is only a morning peak hour occurrence.

Operations at the mine will take place throughout the day and during the off-peak periods when traffic flow is normally significantly lower than during the peak traffic hours. To quantify this we will include the total 12-hour traffic flow for each movement including the truck trips during this period as depicted in Figure 5.

The truck trips vary significantly between the various points along Road D2274. The total 12-hour trips as well as the 12-hour truck trips in both directions at four points along Road D2274 as well as the N11 are summarised below:

Road D2274:

Point A:	4026 vehicles of which 362 are truck trips
Point B:	2672 vehicles of which 97 are truck trips
Point C:	2883 vehicles of which 99 are truck trips
Point D:	346 vehicles of which 41 are truck trips

N11:

Point N11(S)	3987 vehicles of which 379 are truck trips
Point N11(N)	5769 vehicles of which 605 are truck trips

Trucks comprise a significant part of the 12-hour traffic flow and this mining operation will add additional trucks.

6. TRIP GENERATION

The mine is not a land use for which trip generation figures are available in the "SA Trip Data Manual" [(2)]. From a trip generation point of view, the mine's peak trip generation occurs around shift change times and before and after the admin office hours. The trip generation will therefore be based on employment figures and operational information provided to us for this project. For the purposes of this report we will use the following information:

<u>Operational phase</u>

<u>Staff:</u>

Approximately 100 working in 1 shift per day between 07:00- 15:00
Normal weekday operation

In order to quantify the potential peak trip generation, we will make the following assumptions in terms of staff transport to and from the mine:

65% company transport (bus or mini-bus)
Mini-bus capacity 25-seaters
35% private vehicle (occupancy 1,5 per vehicle)

Product:

Production 800 000 tons. If we assume the initial construction phase and mine closure and rehabilitation, mining could take place over a two-year period.
Product to be transported by road to the N11 and from there we have no information on where the product will be delivered.

We assume that 30-ton trucks will be used.

General trips:

The mine will generate trips throughout the day, with the period during normal office hours generating, for instance, visitors, maintenance, general delivery etc. trips. This is difficult to quantify and we normally use the equivalent of the trip generation of the two peak traffic hours for this purpose. We normally allow for around 5% of these trips to occur during the peak periods of the admin trips. For the purposes of this report this is estimated at around 50 trips. This includes trucks that will deliver supplies to the mine.

The expected weekday morning peak hour trip generation is depicted in Table 1.

Transport	Directional split	Total trips	Trips in	Trips out
Morning peak hour				
Staff bus	100:0	3	3	0
Own transport	100:0	23	23	0
Trucks (product)	50:50	14	7	7
General trips	65:35	3	2	1
Total trips			**35**	**8**

Table 1: Expected weekday morning peak hour trip generation

The expected weekday afternoon peak hour trip generation is depicted in Table 2.

Transport	Directional split	Total trips	Trips in	Trips out
Afternoon peak hour				
Staff bus	0:100	2	0	3
Own transport	0:100	23	0	23
Trucks (product)	50:50	14	7	7
General trips	35:65	3	1	2
Total trips			**8**	**35**

Table 2: Expected weekday afternoon peak hour trip generation

In terms of potential trip generation this mine is a significant trip generator. If we summarize the peak hour trip generation at the various times during a normal weekday, the mine can generate the number of trips as depicted in Table 3.

	Trips in	Trips out
Morning peak hour	35	8
General trips	22	22
Product	42	42
Afternoon peak hour	8	35
Total trips (24 hour)	**107**	**107**

Table 3: Expected daily trip generation for the mine

Construction phase:

The construction phase's trip generation will be significantly lower than that of the opencast mine once it is in production. The construction phase will be over a relatively short period and we will therefore only evaluate the traffic impact during the operational phase.

The closure and rehabilitation period is expected to have a significantly lower trip generation due to the fact that at that stage none of the product trips are made and the actual construction period (for the rehabilitation) extends over a relatively short period of time.

The operational phase will be the worst case scenario from a trip generation and traffic impact point of view.

7. TRIP DISTRIBUTION AND BACKGROUND TRAFFIC GROWTH

The main traffic flow is from the Middelburg and Hendrina areas from where labour can be employed and where personnel can reside. This does not exclude other areas, but the same access routes will be used.

The expected peak hour trip assignment for the operational phase is depicted in Figure 6.

We applied a 3% per annum background traffic growth rate.

8. DESIGN SCENARIOS

In terms of the Manual for Traffic Impact Studies[(1)], intersections where more than 75 peak hour trips are added to the critical movements must be analysed to determine the impact of the additional traffic on the operating conditions of the intersections. In this instance this is not expected at any of the major intersections. We will however include the analyses of the two major intersections on the route to quantify the current and future operating conditions of these intersections.

We will assume that mining will commence in a year's time and be completed two years later. The following design scenarios were adopted for the purposes of this study:

- Scenario 1: 2014 - existing a.m. and p.m. peak hour traffic demand (Figure 4).
- Scenario 2: 2017– expected a.m. and p.m. peak hour traffic demand with a 3% per annum background traffic growth and the expected traffic demand from the mine (Figure 7).

9. EXISTING AND FUTURE OPERATING CONDITIONS OF INTERSECTIONS

The aaSidra 5.1 software package[(3)] was used to simulate the current and future operating conditions of the nearest intersections to the mine.

The operation of priority-controlled intersections is acceptable when the following conditions are met for each individual turning movement:

Period	Maximum Volume/Capacity	Minimum Level of service (TRB 2004)
Normal 15-minute peak	85%	D

Table 4: Performance measures for priority-controlled intersections

The results of the capacity analyses for each intersection are presented below.

The following parameters were used to evaluate the capacity analyses as depicted in the tables below:

Volume/capacity ratio: v/c
Level of service: LOS
Average delay: Delay
Queue length: 95 percentile queue lengths

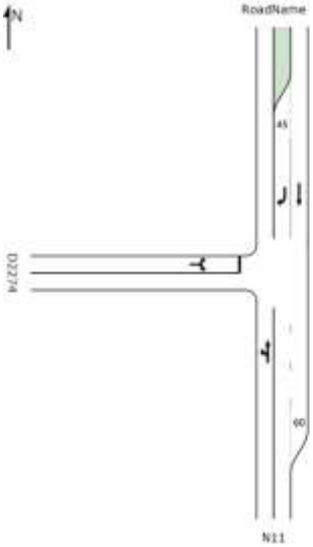
9.1 Intersection: N11 and D2274

Scenario 1: Intersection layout

Operating conditions:							
Weekday (a.m.)				Weekday (p.m.)			
V/C	LOS	Delay	Queue length	V/C	LOS	Delay	Queue length
0.34	A-B	8.3	5.4	0.42	A-B	8.2	7.5

The approaches to the intersection operate at acceptable levels of service during both peak hours.

Scenario 2: Intersection layout



Operating conditions:							
Weekday (a.m.)				Weekday (p.m.)			
V/C	LOS	Delay	Queue length	V/C	LOS	Delay	Queue length
0.40	A-C	8.9	7.8	0.53	A-B	9.1	12.9

The approaches to the intersection continue to operate at acceptable levels of service during both peak hours.

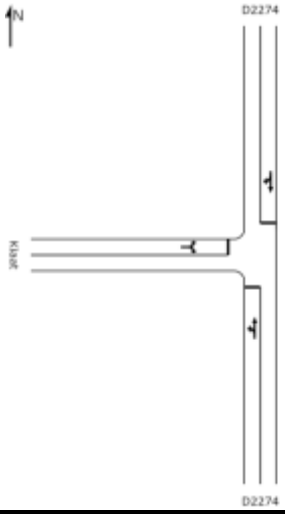
9.2 Intersection: Road D2274 and Kiaat Street

Scenario 1: Intersection layout

Operating conditions:							
Weekday (a.m.)				Weekday (p.m.)			
V/C	LOS	Delay	Queue length	V/C	LOS	Delay	Queue length
0.26	C	20.8	4.2	0.54	C	24.5	12.2

The approaches to the intersection operate at acceptable levels of service during both peak hours.

Scenario 2: Intersection layout



Operating conditions:							
Weekday (a.m.)				Weekday (p.m.)			
V/C	LOS	Delay	Queue length	V/C	LOS	Delay	Queue length
0.32	C	21.2	5.3	0.62	D	26.1	16.2

The approaches to the intersection operate at acceptable levels of service during both peak hours.

10. PUBLIC TRANSPORT

The mine will provide transport for staff and we do not expect external public transport to be used in this instance.

11. RE-ALIGNMENT OF ROAD D2539 AND THE ACCESS

Road D2539 needs to be re-aligned in order to mine the area which the existing road crosses. The proposed re-alignment is depicted in Figure 8. The re-alignment will be more or less between the two points indicated in the photos below.

Start of re-alignment on southern side of mine
(±S 26^0 00,35" E 29^0 34,49")

End of realignment on northern side of mine
(±S 26^0 00,06" E 29^0 34,42")

The realignment needs to take into account the existing pylons of the power line depicted in the photo below.

Re-alignment to run between the pylons

The re-alignment in Drawing No 002 depicts a concept and does not indicate any geometric design standard for the road. A separate re-alignment proposal will be submitted to the Mpumalanga Road Department for comment.

Access to the mine will be via this re-aligned section of Road D2539 as depicted in Plan No Kebra01, which forms part of the re-alignment application.

The applicant will have to do the detail design and submit this for approval to the Mpumalanga Roads Department. The cost of the design and construction of this re-alignment will be for the applicant's account.

12. MITIGATION MEASURES

The following is proposed for this mine development:

12.1 Intersection Road D2539 and Road D2274

No road upgrades are proposed for this mine at this stage. Road D2539 is a gravel road tying in with a surfaced road. The road edges at the tie-in point will be eroded with the traffic from the mine and a bell mouth as depicted in Figure 8 is proposed to prevent this.

12.2 Road D2539

The road from Road D2274 to the mine including the re-aligned section should be constructed to accommodate the expected traffic demand from the mine. The mine is expected to operate for a maximum of three years and a well-constructed and maintained gravel road to accommodate the high truck volumes with dust suppression should be adequate.

Road D2539 should be left in a good condition when the mining operation is completed.

13. CONCLUSION AND RECOMMENDATION

This study was conducted by Corli Havenga Transportation Engineers as part of the Environmental Impact Assessment conducted by Eco Elementun Environmental and Project Management for the development of the Kebrafield Roodepoort Colliery near Pullen's Hope in Mpumalanga Province.

The proposed opencast mine is located on Portion 17 of the Farm Roodepoort 151 IS near Pullen's Hope in Mpumalanga Province Access to the mine can be obtained from the N11, Pullen's Hope/Hendrina Power Station intersection via Road D2274. Road D2274 is used up to the intersection with Road D2539, and then Road D2539 is taken towards the mine.

The mine is not a land use for which trip generation figures are available in the "SA Trip Data Manual"[2]. From a trip generation point of view, the mine's peak trip generation occurs around shift change times and before and after the admin office hours. The trip generation will therefore be based on employment figures and operational information provided to us for this project.

The expected weekday morning peak hour trip generation is 43 trips with 35 trips towards the mine and 8 trips from the mine during the morning peak hour. The expected weekday afternoon peak hour trip generation is also 43 trips with 8 trips towards the mine and 35 trips from the mine during the morning peak hour.

In terms of potential trip generation, this mine is a significant trip generator. If we summarize the peak hour trip generation at the various times during a normal weekday, the mine can generate the number of trips as depicted in Table 3.

	Trips in	Trips out
Morning peak hour	35	8
General trips	22	22
Product	42	42
Afternoon peak hour	8	35
Total trips (24 hour)	**107**	**107**

Table 3: Expected daily trip generation for the mine

The construction phase's trip generation will be significantly lower than that of the opencast mine once it is in production. The construction phase will be over a relatively short period and we will therefore only evaluate the traffic impact during the operational phase.

The closure and rehabilitation period is expected to have a significantly lower trip generation due to the fact that no product trips will be on the road network, and the actual construction period (of the rehabilitation) will extend over a relatively short period of time. The operational phase will be the worst case scenario from a trip generation and traffic impact point of view.

In terms of the Manual for Traffic Impact Studies[1], intersections where more than 75 peak hour trips are added to the critical movements must be analysed to determine the impact of the additional traffic on the operating conditions of the intersections. In this instance this is not expected at any of the major intersections. We did however include analyses of the two major intersections on the route to quantify the current and future operating conditions of these intersections.

Intersection N11 and Road D2274

The approaches to the intersection currently operate at acceptable levels of service during both peak traffic hours and will continue to do so with the additional traffic from the mine.

Intersection Road D2274 and Road 2539

The approaches to the intersection currently operate at acceptable levels of service during both peak traffic hours and will continue to do so with the additional traffic from the mine.

Road D2539 needs to be realigned in order to mine the area which the existing road crosses. A separate re-alignment proposal will be submitted to the Mpumalanga Roads Department for comment. Access to the mine will be located on this re-aligned section of Road D2539

The proposed mine development can be supported from a traffic flow point of view. In order to support the expected traffic demand from the mine it is further recommended that:

13.1 The mine obtains access off Road D2539 approximately 3km from the intersection with Road D2274.

13.2 The section of Road 2539 is re-aligned as depicted in Plan No Kebra01 subject to approval from the Mpumalanga Roads Department.

13.3 The following road and intersection upgrades are implemented:

13.3.1 Road D2539

The gravel road is upgraded and maintained to accommodate the high truck volumes with dust suppression for the 3-year application period.

Road D2539 should be left in a good condition when the mining operation is completed.

13.3.2 Intersection: Road D2274 and Road D2539

The implementation of a bell mouth as depicted in Figure 8 is proposed to prevent damage to the edges of Road D2274.

13.4 All the road upgrades on the Provincial roads and the access road to be designed and approved by the relevant provincial roads department.

14. REFERENCES

(1) Manual for Traffic Impact Studies. PR 93/635 Department of Transport, 1995.
(2) COTO THM 17 Volume 1 South African Trip Data Manual, September 2012.
(3) ARRB Transport Research Ltd, aaSIDRA 5.1, Akcelik & Associates Pty Ltd, Greythorn, Victoria, Australia.