

# MEMORANDUM

# TRAFFIC IMPACT ASSESSMENT

## PROPOSED MANGANESE MINING OPERATION ON PORTION 1 OF THE FARM LEHATING 741 NEAR HOTAZEL, NORTHERN CAPE PROVINCE



**JULY 2013**

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## INTRODUCTION

Siyazi Transportation Services Gauteng (Pty) Ltd was appointed by SLR Consulting (Africa) (Pty) Ltd during February 2012 to conduct a Traffic Impact Assessment (TIA) for the proposed manganese mining operation situated on portion 1 of the Farm Lehating 741 near the town of Hotazel, Northern Cape Province.

Access from and to the proposed mining development will be obtained from Road R380 via an access corridor that will cross Portion 2 of the Farm Wessels 227. In broad terms, the proposed mining operation will comprise the following:

- a) An underground mine
- b) Processing plant
- c) Topsoil dump
- d) Tailings dam
- e) Stock yard
- f) Weigh bridge
- g) Administrative office
- h) Relevant support infrastructure.

**Figure A-1** of **Appendix A** provides a graphical presentation of the locality of the proposed mining development in relation to other activities including the location of the proposed access intersection under investigation while **Figure A-2** of **Appendix A** provides a graphical presentation of the proposed access corridor. **Figure A-3** provides the concept site layout as provided by TWP Projects (Pty) Ltd. **Table 1.1** contains a summary of the extent of the proposed mining development for the respective phases:

- a) Construction
- b) Operational
- c) Decommissioning
- d) Closure.

**TABLE 1.1: SUMMARY OF THE EXTENT OF THE PROPOSED DEVELOPMENT FOR THE RESPECTIVE PHASES**

DESCRIPTION	PHASE				
	CONSTRUCTION		OPERATIONAL		CLOSURE
Production (tonnes of manganese product per month)	Not relevant.		500 000 sale tonnes per annum 41 667 sale tonnes per month		Not relevant. (All activities on the site, although limited, are planned to be completed and the mining company will leave the site)
Duration	± 36 Months		Minimum 16 years		Part of decommissioning phase
Relevant time frame	September 2014 to September 2017		October 2017 to October 2033		October 2033 to April 2034
Number of construction workers	±1000 at peak of construction		Not relevant		Less than Construction Phase
Assumed maximum % of construction workers transport that will occur during the AM or PM peaks respectively	100%		Not relevant		Not relevant
Location from where workers are expected to come	Kuruman, Hotazel, Kathu (All south of proposed mining development)	100%	Kuruman, Hotazel, Kathu (All south of proposed mining development)	100%	Not relevant
Number of dayshift workers	Not relevant		±66 per day		Not relevant
Number of shift workers (2 shifts per day)	Not relevant		±198 per day (99 per shift)		Not relevant
Number of shift workers (3 shifts per day)	Not relevant		±33 per day (11 per shift)		Not relevant

**TABLE 1.1: SUMMARY OF THE EXTENT OF THE PROPOSED DEVELOPMENT FOR THE RESPECTIVE PHASES**

DESCRIPTION	PHASE			
	CONSTRUCTION	OPERATIONAL	DECOMMISSIONING	CLOSURE
Expected number of heavy vehicles delivering consumables per day	4	9	Limited, occasionally	Limited, occasionally
Assumed maximum % of heavy vehicles during AM or PM peak respectively	20%	20%	Limited, occasionally	Limited, occasionally
Heavy vehicle distribution	See <b>Figure B-2</b> of <b>Appendix B</b>	See <b>Figure B-2</b> of <b>Appendix B</b>	Same as for Operational Phase	Same as for Operational Phase
Heavy vehicles per day transporting manganese product (30 ton trucks)	Not relevant	46	Not relevant	Not relevant
Abnormal vehicles delivering large components related to the proposed mining development	Once-off events	Once-off events	Once-off events	Once-off events
Access road	Access from Road R380	Same as for Construction Phase	Same as for Construction Phase	Same as for Construction Phase
Calculated number of vehicle trips to be generated per AM or PM peak hours	81 (See <b>Table 3.4</b> )	105 (See <b>Tables 3.5 and 3.6</b> )	Less than Construction and Operational Phases	Less than Construction and Operational Phases

Source: Metago Project Team, assumptions and calculations.

The purpose of this study is to undertake an assessment of the implications of the traffic that would be generated at the proposed mining development:

- a) The impact that the change in land use would have on road and transport related infrastructure
- b) Whether it is possible to accommodate the proposed mining development within acceptable norms
- c) The mitigating measures required to accommodate the proposed mining development within acceptable norms.

The Northern Cape Department of Transport, Roads & Public Works (NCTRP) is the relevant road authority related to the adjacent road network to the proposed development.

The following sections of the memorandum elaborate on the:

- a) Section 2: Findings and Recommendations
- b) Section 3: Detailed Information Related to Findings and Recommendations.

# FINDINGS AND RECOMMENDATIONS

*Based on a site inspection of the existing road network adjacent to the site under investigation, traffic surveys, calculations and reference to the relevant traffic impact assessment guideline documents, the following findings and recommendations were made:*

## 2.1 FINDINGS

The following are discussed in terms of the findings:

- a) Traffic impact during the respective phases
- b) Site accessibility
- c) Broader road network.

### 2.1.1 TRAFFIC IMPACT DURING THE RESPECTIVE PHASES

The capacity calculations for the traffic impact assessment were conducted for the years 2013 and 2023 respectively. The last mentioned time frame is in line with traffic engineering guidelines and practice and determined by the expected number of vehicle trips that could potentially be generated during any specific peak hour by a specific development. However, the expected lifespan of the proposed Lehating Manganese Mine will be at least until 2033. It is therefore required that the proposed Lehating Manganese Mine should evaluate the relevant intersection and road section on a regular basis as part of the risk and safety management process.

Furthermore, owing to the type and nature of the proposed mining activities, it is expected that the proposed activities will have a manageable impact on traffic during the construction, operational, decommissioning and closure phases, provided that road infrastructure improvements are implemented as indicated in **Table 2.1** and **Figure 2.1** to mitigate the impact of the proposed land development area.

### 2.1.2 SITE ACCESSIBILITY

Proper, safe and reliable access would be needed to the proposed mining development should access be provided at the intersection of road R380 and the proposed access road (Point A) during all relevant phases.

This could be achieved at the location as indicated by **Figure A-1** of **Appendix A**, which would provide the sight distances required for the proposed access intersection.

The coordinates for the proposed point of access are as follow:

Latitude: S 27° 3'2.28"  
Longitude: E 22°51'4.22"

## 2.2 RECOMMENDATIONS

The following are discussed in terms of the recommendations:

- a) Need for improvements (mitigation measures)
- b) Institutional arrangements

### 2.2.1 NEED FOR IMPROVEMENTS (MITIGATION MEASURES)

At this stage no improvements would be required on the relevant roads network. It is recommended that the following mitigation measures should be implemented for the current situation in terms of safety:

- a) In terms of workers and visitors, a dedicated loading and off-loading area should be provided on the property of the proposed mining development;
- b) Proper lighting and road signs should be provided at the proposed access intersection to ensure visibility during night time and sufficient information to road users; and
- c) It is recommended that the speed limit of 90 km/h should be reduced to at least 60 km/h at the proposed access intersection, which would result in a safer intersection.

Should Road R380 be tarred in the future, the following improvements are recommended:

- a) The improvements as indicated by **Table 2.1** should be provided at Point A (proposed intersection of Road R380 and the proposed access road) should Road R380 be tarred in the future.
- b) The layout as indicated by **Figure 2.1** should be provided at Point A (proposed intersection of Road R380 and the proposed access road) should Road R380 be tarred in the future.

The traffic impact assessment does not comment on pavement layer attributes in terms of the relevant road section. The last mentioned needs to be based on recommendations to be made by pavement design specialist.

### 2.2.1 INSTITUTIONAL ARRANGEMENTS

The following recommendations are made in terms of the detailed design phase for the proposed project:

- a) Detailed investigations should be conducted in conjunction with the relevant road authority in terms of the existing quality and potential life span of the existing road surface layers of the roads where consumables, manganese products and workers will be transported (Road R380).
- b) A road maintenance plan needs to be prepared in conjunction with the relevant road authority on public roads where trucks will operate (R380) in order to ensure that consumables, manganese product and workers can be transported at all times

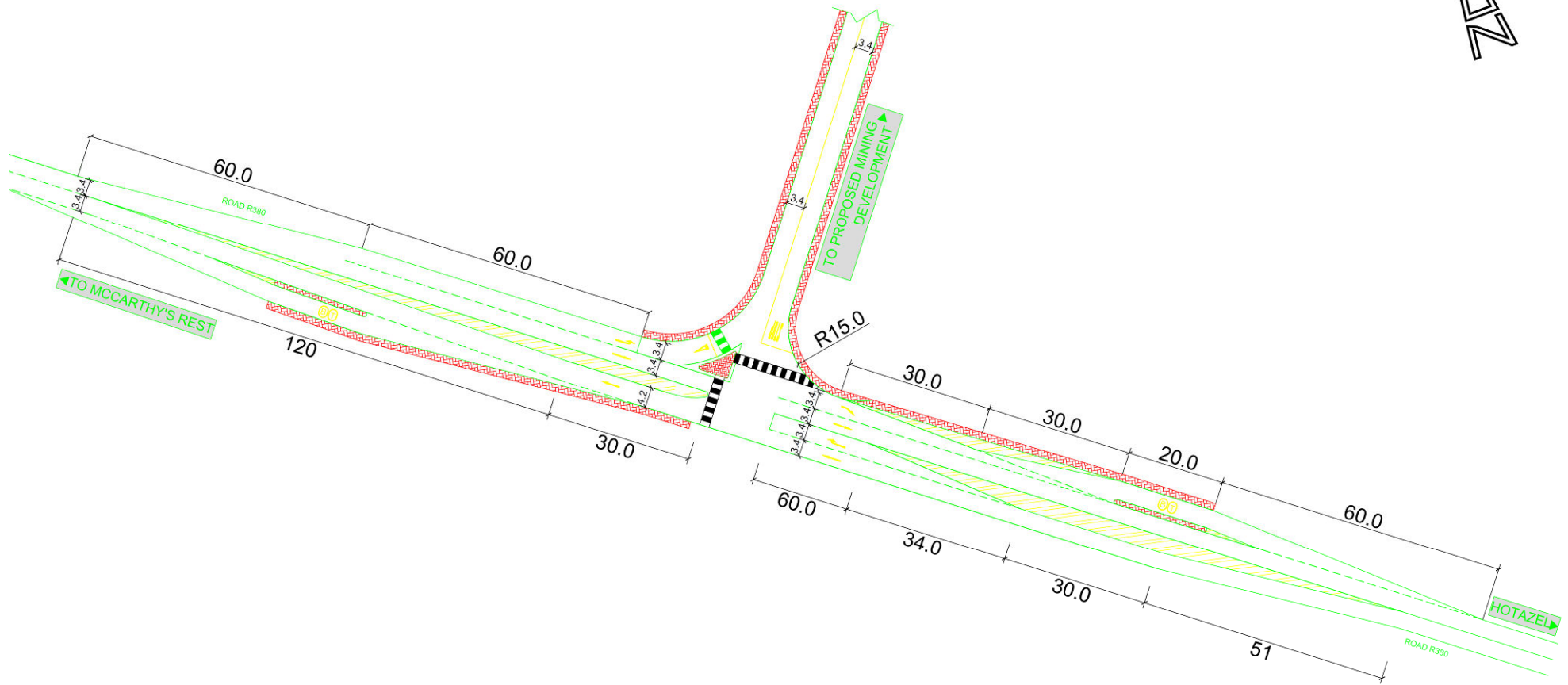
In conclusion, it is recommended that the Northern Cape Department of Transport, Roads & Public Works should approve the Traffic Impact Assessment based on the recommendations of this report.

**TABLE 2.1: RECOMMENDED ROAD NETWORK IMPROVEMENTS AT THE PROPOSED ACCESS INTERSECTION SHOULD ROAD R380 BE TARRED IN THE FUTURE**

POINT	INTERSECTION	APPROACH	IMPROVEMENTS RECOMMENDED															GEOMETRY DETERMINED BY MEANS OF SIDRA	
			Approach Traffic Control				Extra Lanes Required (m)						Improvements Only Required from a Road Safety Perspective	Reflective Studs required at intersection	Road Markings Required	Road Signs Required	Public Transport Loading & Off-Loading		Pedestrian Walkways
			Free-Flow	Stop	Roundabout	Traffic Light System	Left Turn Taper	Left Turn Deceleration Lane	Acceleration Lane	Acceleration Lane in Middle of Road	Dedicated Right Turn Lane	Number of Extra Through Lanes							
OPERATIONAL PHASE																			
A	Road R380 / proposed access road	Northern (R380)	Yes	-	-	-	-	Yes, 60m	-	-	-	-	Yes	Yes	Yes	Yes	Yes	-	(Refer to <b>Figure 2.1</b> )
		Eastern (Proposed Access)	-	Yes	-	-	-	-	-	-	-	-	Yes		Yes	Yes	-	-	
		Southern (R380)	Yes	-	-	-	-	-	Yes, 30m	-	Yes, 60m	-	Yes		Yes	Yes	Yes	-	

**Note:** Improvements should only be provided should Road R380 be tarred

DRAWING NOT TO SCALE



**Legend:**



Pedestrian walkway.

**Notes**

1. Typical Layout Should the Design Speed be 60km/h
2. Final Position to be Determined as Part of Detail Design.

**FIGURE 2.1: RECOMMENDED LAYOUT OF THE PROPOSED ACCESS INTERSECTION OF ROAD R380 AND THE PROPOSED ACCESS ROAD SHOULD ROAD R380 BE TARRED IN THE FUTURE (POINT A)**

## Section 3

# DETAILED INFORMATION RELATED TO FINDINGS AND RECOMMENDATIONS

The purpose of **Section 3** is to provide the detailed information related to the findings and recommendations:

- a) The *status quo* of the land use, as well as the road characteristics
- b) The future land use, as well as the road characteristics
- c) The current and future levels of service at the relevant intersection that would provide access to the proposed mining development
- d) Other traffic-related issues.

The following subsections elaborate on the above mentioned.

### 3.1 STATUS QUO OF LAND USE, AS WELL AS ROAD CHARACTERISTICS

The following information is discussed in terms of the *status quo* of the existing land use and road characteristics:

- a) Existing land use information
- b) Existing road characteristics
- c) Traffic counts conducted as a basis for making traffic calculations.

#### 3.1.1 EXISTING LAND USE INFORMATION

The relevant property of the proposed mining development is currently zoned as Agricultural. For the purpose of this TIA, the following assumptions are made:


- a) That the anticipated average rate of growth will be included as background traffic for the respective road sections
- b) That the absorption rate by all other types of completed developments will maintain the same status for the next ten years.

### 3.1.2 EXISTING ROAD CHARACTERISTICS AND MODAL DISTRIBUTION

The following are relevant as part of this section:

- a) **Table 3.1** provides information concerning the relevant road sections under investigation and includes the following:
  - i) Relevant road section
  - ii) Picture of road section
  - iii) Existing class of road
  - iv) Proposed class of road
  - v) Road reserves widths
  - vi) Lane widths
  - vii) Median widths
  - viii) Type of pavement
  - ix) Anticipated traffic growth per annum
  - x) Road authority.
- b) **Table 3.2** provides a copy of the “TYPICAL ROAD CHARACTERISTICS AND ACCESS MANAGEMENT REQUIREMENTS” as provided by the *National Guidelines for Road Access Management in South Africa*. The relevant table is only provided for reference purposes.

**TABLE 3.1: SUMMARY OF ROAD CHARACTERISTICS**

RELEVANT ROAD SECTION	PICTURE OF ROAD SECTION	ASSUMED EXISTING CLASS OF ROAD			POSSIBLE FUTURE CLASS OF ROAD			Road Authority	Road Reserve (M)	Number of Lanes	Lane Width	Type Of Surface	Median	Anticipated Traffic Growth Per Annum Over 10 Years	Speed Limit
<u>Road Section 1</u> Road R380  Road link between Kuruman, Hotazel, Black Rock and McCarthy's Rest		<u>Primary Function:</u> Mobility (Vehicle priority, through route)			<u>Proposed Function:</u> Mobility (Vehicle priority, through route)			NCDTRP	30m	One lane per direction	3.5m wide	Gravel	None.	2%	90 km/h
		Class	Class No.	Route No.	Class	Class No.	Route No.								
		Minor Arterial	3	R	Minor Arterial	3	R								
		<u>Description:</u> Minor provincial road (Rural)			<u>Description:</u> Minor provincial road (Rural)										
		Access spacing: > 800m			Access spacing: > 800m										

**TABLE 3.2: TYPICAL ROAD CHARACTERISTICS AND ACCESS MANAGEMENT REQUIREMENTS  
(NATIONAL GUIDELINES OF ACCESS MANAGEMENT)**

Primary Function	Class (Table 3.2)	Class no.	Route no.	Description	Mobility			Access				Design				Traffic		Public Facilities	
					Through traffic component	Travel distance	Travel speed km/h	Access to property	Parking	Inter-section control	Access spacing	Typical cross section	Road reserve width	Distance between km	% of Built km (urban)	% of Travel km	ADT	Public trans-port stops	Pedestrian footways
Mobility (vehicle priority, through route)	Principal arterial	1	N/R	Freeway rural	exclusively	>40 km	120	not allowed	no	inter-change	>2.4 km	4 lane freeway	60-80 m	-			>25 000	no	no
			N	non-freeway National road mainly rural	exclusively	>40 km	100-120	not allowed	no	priority	>1.6 km	2 lane highway with surfaced shoulder	60 m	-		33%	>10 000	yes at inter-sections	no
			N/R/M	Freeway/ motorway urban	exclusively	>10 km	80-120	not allowed	no	Inter-change	1,6-2,4 km	4/8 lane freeway	45-70 m	4,0-12,0	3%		50 000-120 000	no	no
	Major arterial	2	R	major provincial road rural	predom-inant	>20 km	80-120	not allowed	no	priority	>1,6 km	2 lane with surfaced shoulder lane divided	50-60 m	-		17%	<10 000	yes at inter-sections	no
			R/M	major arterial metropolitan	predom-inant	5-20 km	80-90	not allowed	no	co-ordinated traffic signal	800 m ± 10%	4/6 lane divided	40-60 m	1,5-4,0	3%		20 000-50 000	yes at inter-sections	restricted or separated
	Minor arterial	3	R	Minor provincial road rural	predom-inant	>20 km	80-100	not allowed	no	priority	>800 m	2 lane gravel shoulder	30-50 m	-		24%	<10 000	yes at inter-sections	some-limit conflict
			M	Minor arterial urban	major	3-10 km	70-80	generally not allowed	no	co-ordinated traffic signal	600 m ± 20%	4 lane divided or undivided	25-40 m	0.8-1,5	5%	24%	10 000-40 000	yes at inter-sections	some-limit conflict
Activity and access	Activity arterial/spine		A	Activity arterial	minor	<2km (if continuous) 3-4 km if destination	50-60	limited	limited, preference to public transport stops	traffic signals round-about or priority	inter-sections 200-500m, property Access from side and back	4 lane divided	25-40 m	-	1%	3%	15 000-25 000	yes at inter-sections	yes
	Activity street	4	N/a	collector non-residential, CBD street commercial industrial street	discourage	0,5-3 km	40-50	all property	yes	traffic signal, priority or round-about	inter-sections 200-300m combine individual accesses ± 40 m	4 lane undivided one-way in CBDs	20-30 m	-	9%	6%	5 000-15 000	yes anywhere	yes
	Residential street	5	N/a	residential, collector	discourage	0,5-2 km	40-50	small developments	yes on street	priority or round-about	-	2 lane undivided 10,5 m wide	20-25 m	-	12%	10%	<5 000	yes anywhere	yes
			N/a	Local street	prevent	<0,5-1 m	30-40	individual houses	yes on verge	priority of mini-circle	-	2 lane mountable kerbs	12-15 m	N/a	67%	7%	<1 000	not bus routes	not normally
	Non-motorized	6	N/a	pedestrian/ cycleway	ban	<1 km	80m/ minute	as required	no	pedestrian signal	500 m maximum	Block paving	6 m	-				no, unless busway	yes

### 3.1.3 TRAFFIC COUNTS AS BASIS FOR MAKING TRAFFIC CALCULATIONS

In order to gain a better understanding of the existing traffic patterns and movements adjacent to the proposed development, 12-hour manual traffic counts were conducted at the relevant section of Road R380 where the proposed mining development proposes to gain access.

It is standard traffic engineering practice to conduct 12-hour manual traffic counts at all intersections that could potentially be affected by a proposed development, as close as possible to a month-end Friday when traffic movement is expected to be at its highest. From the 12-hour manual traffic counts, the AM and PM peak hours are determined respectively, and used for any further calculations.

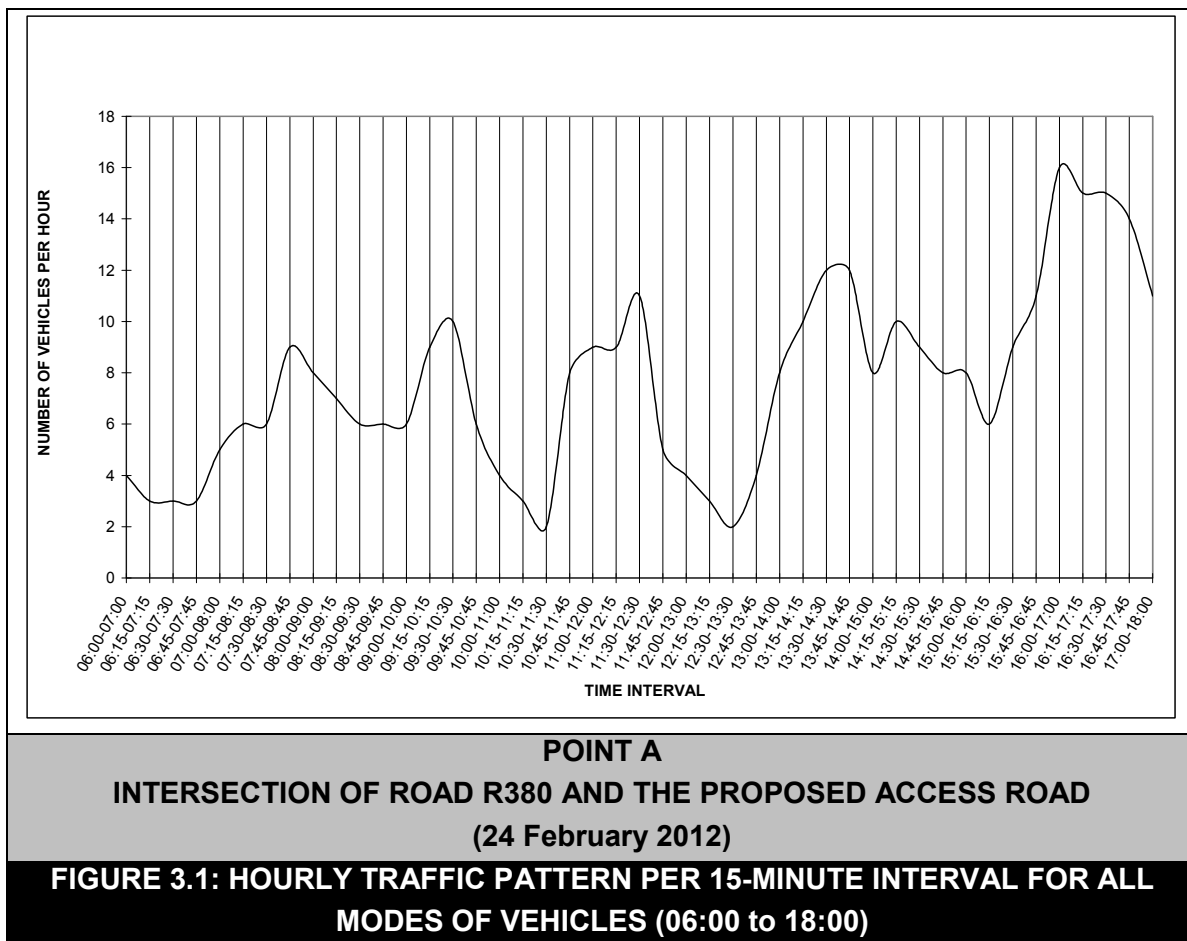
Traffic counts at the relevant proposed access intersection on Road R380 was available from counts conducted on Friday 24 February 2012 and was consequently used as part of this report. The last mentioned traffic counts were deemed acceptable to use due to the locality of the proposed mining development, the low anticipated growth in traffic volumes per annum and the low volume of traffic as determined from the relevant traffic counts.

The combined hourly totals of all the vehicle types for the traffic survey conducted on Friday 24 February 2012 between 06:00 and 18:00 is indicated in **Table A-1** of **Appendix A** of this report. The description of the relevant vehicle movements at the proposed access intersection appears in **Figure A-4** of **Appendix A**.

The respective peak-hour flows for the traffic count at the relevant intersection were identified as indicated in **Table 3.3** below.

TABLE 3.3: PEAK HOUR PERIODS AT THE RELEVANT INTERSECTION					
POINT	INTERSECTION	AM PEAK	NUMBER OF VEHICLES	PM PEAK	NUMBER OF VEHICLES
A	Road R380 and the proposed access road	07:45 – 08:45	9	16:00 – 17:00	16

**Figure 3.1** indicates the hourly traffic pattern, per 15-minute interval, for all modes of vehicles at the relevant intersection between 06:00 and 18:00 on Friday 24 February 2012.



### 3.2 DETERMINATION OF FUTURE LAND USE AND ROAD CHARACTERISTICS

The following are relevant:

- Land use information, including possible future developments in the area
- Information about the expected future modal distribution
- Determination of the vehicle trips expected to be generated by the proposed mining development
- Determination of the vehicle trips to be generated by the proposed mining development at the relevant intersection.

The subsections below elaborate on the above mentioned future land use and road characteristics.

#### 3.2.1 LAND USE INFORMATION, INCLUDING POSSIBLE FUTURE DEVELOPMENTS IN THE AREA

The proposed mining development will entail the development of an underground mine, including various support infrastructure and an administrative office. There are no known future developments in the direct vicinity of the proposed mining development.

### 3.2.2 INFORMATION ABOUT THE EXPECTED FUTURE MODAL DISTRIBUTION

**Figures B-2 and B-3 of Appendix B** indicate, in percentages, the expected trips distribution, respectively, of heavy and light vehicles for the AM and PM peak periods for the relevant scenarios of the operational phase.

### 3.2.3 DETERMINATION OF VEHICLE TRIPS EXPECTED TO BE GENERATED BY THE PROPOSED DEVELOPMENT

**Tables 3.4 to 3.6** indicate the trip generation rates, the number of vehicle trips which are expected to be generated by the proposed mining development and the distribution of the vehicle trips to and from the respective areas of the proposed mining development respectively for the construction and operational phases. The trip generation rates are based on the *South African Trip Generation Rates*, Second Edition, 1995, and assumptions made based on experience where information was not available.

**Note:** For the operational phase, there will be three mining teams, of which two teams will work per day in two shifts. Thus **Tables 3.5 and 3.6** indicate the number of mining workers active during the peak periods as 33%. The same will be applicable to the plant workers, with four teams, two teams working per day in two shifts, thus only 25% of workers active during the peaks.

**TABLE 3.4: TRIP GENERATION RATES, EXPECTED NUMBER OF VEHICLE TRIPS TO BE GENERATED BY THE PROPOSED MINING ACTIVITIES AND THE DISTRIBUTION OF VEHICLE TRIPS (CONSTRUCTION PHASE)**

Item	Component	Num Workers per Day	% Workers Active during Peak Hour	Num Workers Active per Peak Hour		Num Trucks per Day	% Trucks Active during Peak Hour	Num Trucks Active during Peak Hour		Assumed Ave. Num Persons per Veh	Comments		Trip Generation Calculations for Peak Hour						Final Trip Information for Traffic Engineering Calculations				
													If Inward Movemen t is Relevant Value = 1	Num Veh Trips for Inwards Direction	If Outward Movemen t is Relevant Value = 1	Num Veh Trips for Outwards Direction	Total Num Veh Trips Generated during Peak Hour (In & Out)	Calculated Trip Generation Rate per Person / Veh during Peak Hour		Trip Dist. %		Trip Generatio n	
																				In	Out	In	Out
AM Peak Hour																							
1.	Construction workers (using own transport)	50	100%	50						1.2	Trips per worker (1.2 persons per vehicle)		1	42	0	0	42	0.83		100 %	0%	42	0
2.	Construction workers (transported via 50 seater buses)	950	100%	950						50.0	50 persons per bus (bus deliver workers and leave site empty)		1	19	1	19	38	0.04		50%	50%	19	19
3.	Heavy vehicles delivering consumables					4	20%	1		1.0	20% of delivery vehicles expected during peak periods		1	1	1	1	2	2.00		50%	50%	1	1
TOTAL																	81				61	20	
PM Peak Hour																							
1.	Construction workers (using own transport)	50	100%	50						1.2	Trips per worker (1.2 persons per vehicle)		0	0	1	42	42	0.83		0%	100 %	0	42
2.	Construction workers (transported via 50 seater buses)	950	100%	950						50.0	50 persons per bus (bus deliver workers and leave site empty)		1	19	1	19	38	0.04		50%	50%	19	19
3.	Heavy vehicles delivering consumables					4	20%	1		1.0	20% of delivery vehicles expected during peak periods		1	1	1	1	2	2.00		50%	50%	1	1
TOTAL																	81				20	61	

**TABLE 3.5: TRIP GENERATION RATES, EXPECTED NUMBER OF VEHICLE TRIPS TO BE GENERATED BY THE PROPOSED MINING ACTIVITIES AND THE DISTRIBUTION OF VEHICLE TRIPS (AM) (OPERATIONAL PHASE)**

Item	Component	Num Workers per Day	% Workers Active during Peak Hour	Num Workers Active per Peak Hour		Num Trucks Per Day	% Trucks Active during Peak Hour	Num Trucks Active during Peak Hour		Assume d Ave. Num Persons per Veh	Comments		Trip Generation Calculations for Peak Hour						Final Trip Information for Traffic Engineering Calculations								
													If Inward Movemen t is Relevant Value = 1	Num Veh Trips for Inwards Directio n	If Outward Movemen t is Relevant Value = 1	Num Veh Trips for Outwards Direction	Total Num Veh Trips Generated during Peak Hour (In & Out)	Calculated Trip Generation Rate per Person / Veh during Peak Hour	Trip Dist. %		Trip Generation						
																			In	Out	In	Out					
AM Peak Hour																											
MINING																											
1.	Health, safety, environment and community staff (using own transport) DAY SHIFT	1	100%	1						1.2	Trips per worker (1.2 persons per vehicle)		1	1	0	0	1	0.83		100%	0%	1	0				
2.	Surface mining staff (using own transport) DAY SHIFT	9	100%	9						1.2	Trips per worker (1.2 persons per vehicle)		1	8	1	8	16	1.80		50%	50%	8	8				
3.	Surface mining staff (using own transport) TWO SHIFTS PER DAY	6	33%	2						1.2	Trips per worker (1.2 persons per vehicle) day shift in, night shift out		1	2	1	2	4	2.00		50%	50%	2	2				
4.	Surface mining staff (using contracted transport) TWO SHIFTS PER DAY	12	33%	4						15.0	Trips per worker (15 persons per vehicle) day shift in, night shift out		1	1	1	1	2	0.13		50%	50%	1	1				
5.	Underground mining staff (using own transport) DAY SHIFT	2	100%	2						1.2	Trips per worker (1.2 persons per vehicle)		1	2	0	0	2	0.83		100%	0%	2	0				
6.	Underground mining staff (using own transport) TWO SHIFTS PER DAY	15	33%	5						1.2	Trips per worker (1.2 persons per vehicle) night shift in, day shift out		1	4	1	4	8	1.67		50%	50%	4	4				
7.	Underground mining staff (using contracted transport) DAY SHIFT	3	100%	3						15.0	Trips per worker (15 persons per vehicle)		1	0.20	1	0.20	0.40	0.13		50%	50%	0.20	0.20				
8.	Underground mining staff (using contracted transport) TWO SHIFTS PER DAY	132	33%	44						15.0	Trips per worker (15 persons per vehicle) day shift in, night shift out		1	3	1	3	6	0.13		50%	50%	3	3				
TOTAL FOR MINING (AM)																	40									22	18
PROCESS PLANT																											
9.	Health, safety, environment and community staff (using own transport) DAY SHIFT	1	100%	1						1.2	Trips per worker (1.2 persons per vehicle)		1	1	0	0	1	0.83		100%	0%	1	0				
10	Process plant workers (using own transport) DAY SHIFT	5	100%	5						1.2	Trips per worker (1.2 persons per vehicle)		1	4	0	0	4	0.83		100%	0%	4	0				
11	Process plant workers (using contracted transport) DAY SHIFT	9	100%	9						15.0	Trips per worker (15 persons per vehicle)		1	1	1	1	1	0.13		50%	50%	1	1				
12	Process plant workers (using own transport) TWO SHIFTS PER DAY	4	25%	1						1.2	Trips per worker (1.2 persons per vehicle) night shift in, day shift out		1	1	1	1	2	1.67		100%	0%	2	0				
13.	Process plant workers (using contracted transport) TWO SHIFTS PER DAY	28	25%	7						15.0	Trips per worker (15 persons per vehicle) day shift in, night shift out		1	0.47	1	0.47	1	0.13		50%	50%	0.47	0.47				
TOTAL FOR PROCESS PLANT (AM)																	9									8	1

**TABLE 3.5: TRIP GENERATION RATES, EXPECTED NUMBER OF VEHICLE TRIPS TO BE GENERATED BY THE PROPOSED MINING ACTIVITIES AND THE DISTRIBUTION OF VEHICLE TRIPS (AM) (OPERATIONAL PHASE) CONTINUE**

Item	Component	Num Workers per Day	% Workers Active during Peak Hour	Num Workers Active per Peak Hour		Num Trucks Per Day	% Trucks Active during Peak Hour	Num Trucks Active during Peak Hour		Assume d Ave. Num Persons per Veh	Comments		Trip Generation Calculations for Peak Hour						Final Trip Information for Traffic Engineering Calculations											
													If Inward Movemen t is Relevant Value = 1	Num Veh Trips for Inwards Directio n	If Outward Movemen t is Relevant Value = 1	Num Veh Trips for Outwards Direction	Total Num Veh Trips Generated during Peak Hour (In & Out)	Calculated Trip Generation Rate per Person / Veh during Peak Hour	Trip Dist. %		Trip Generation									
																			In	Out	In	Out								
OTHER STAFF (MANAGEMENT, ADMIN, HR, HSEC, ENGINEERING etc.)																														
14.	Other staff (using own transport) DAY SHIFT	32	100%	32						1.2	Trips per worker (1.2 persons per vehicle)		1	27	0	0	27	0.83		100%	0%	27	0							
15.	Other Staff (using contracted transport) DAY SHIFT	4	100%	4						15.0	Trips per worker (15 persons per vehicle)		1	1	1	1	2	0.13		50%	50%	0.27	0.27							
16.	Other Staff (using own transport) THREE SHIFTS PER DAY	15	33%	5						1.2	trips per worker (1.2 persons per vehicle)		1	4	1	4	8	1.67		50%	50%	4	4							
17.	Other Staff (using contracted transport) THREE SHIFTS PER DAY	18	33%	6						15.0	Trips per worker (15 persons per vehicle)		1	0.40	1	0.40	0.80	0.13		50%	50%	0.40	0.40							
18.	Heavy vehicles exporting processed product					46	20%	9		1.0	20% of export vehicles expected during peak periods		1	9	1	9	18	2.00		50%	50%	9	9							
19.	Heavy vehicles delivering consumables					9	20%	2		1.0	20% of delivery vehicles expected during peak periods		1	2	1	2	4	2.00		50%	50%	2	2							
TOTAL FOR OTHER STAFF (AM)																	58												43	15
TOTAL FOR AM PEAK PERIOD																	107												73	34

**TABLE 3.6: TRIP GENERATION RATES, EXPECTED NUMBER OF VEHICLE TRIPS TO BE GENERATED BY THE PROPOSED MINING ACTIVITIES AND THE DISTRIBUTION OF VEHICLE TRIPS (PM) (OPERATIONAL PHASE)**

Item	Component	Num Workers per Day	% Workers Active during Peak Hour	Num Workers Active per Peak Hour		Num Trucks Per Day	% Trucks Active during Peak Hour	Num Trucks Active during Peak Hour		Assume d Ave. Num Persons per Veh	Comments		Trip Generation Calculations for Peak Hour						Final Trip Information for Traffic Engineering Calculations									
													If Inward Movemen t is Relevant Value = 1	Num Veh Trips for Inwards Directio n	If Outward Movemen t is Relevant Value = 1	Num Veh Trips for Outwards Direction	Total Num Veh Trips Generated during Peak Hour (In & Out)	Calculated Trip Generation Rate per Person / Veh during Peak Hour	Trip Dist. %		Trip Generation							
																			In	Out	In	Out						
PM Peak Hour																												
MINING																												
1.	Health, safety, environment and community staff (using own transport) DAY SHIFT	1	100%	1						1.2	Trips per worker (1.2 persons per vehicle)		0	0	1	1	1	0.83		0%	100%	0	1					
2.	Surface mining staff (using own transport) DAY SHIFT	9	100%	9						1.2	Trips per worker (1.2 persons per vehicle)		1	8	1	8	16	1.80		50%	50%	8	8					
3.	Surface mining staff (using own transport) TWO SHIFTS PER DAY	6	33%	2						1.2	Trips per worker (1.2 persons per vehicle) day shift in, night shift out		1	2	1	2	4	2.00		50%	50%	2	2					
4.	Surface mining staff (using contracted transport) TWO SHIFTS PER DAY	12	33%	4						15.0	Trips per worker (15 persons per vehicle) day shift in, night shift out		1	1	1	1	2	0.13		50%	50%	1	1					
5.	Underground mining staff (using own transport) DAY SHIFT	2	100%	2						1.2	Trips per worker (1.2 persons per vehicle)		0	0	1	2	2	0.83		0%	100%	0	2					
6.	Underground mining staff (using own transport) TWO SHIFTS PER DAY	15	33%	5						1.2	Trips per worker (1.2 persons per vehicle) night shift in, day shift out		1	4	1	4	8	1.67		50%	50%	4	4					
7.	Underground mining staff (using contracted transport) DAY SHIFT	3	100%	3						15.0	Trips per worker (15 persons per vehicle)		1	0.20	1	0.20	0.40	0.13		50%	50%	0.20	0.20					
8.	Underground mining staff (using contracted transport) TWO SHIFTS PER DAY	132	33%	44						15.0	Trips per worker (15 persons per vehicle) day shift in, night shift out		1	3	1	3	6	0.13		50%	50%	3	3					
TOTAL FOR MINING (PM)														40												18	22	
PROCESS PLANT																												
9.	Health, safety, environment and community staff (using own transport) DAY SHIFT	1	100%	1						1.2	Trips per worker (1.2 persons per vehicle)		0	0	1	1	1	0.83		0%	100%	0	1					
10	Process plant workers (using own transport) DAY SHIFT	5	100%	5						1.2	Trips per worker (1.2 persons per vehicle)		1	4	0	0	4	0.83		0%	100%	0	4					
11	Process plant workers (using contracted transport) DAY SHIFT	9	100%	9						15.0	Trips per worker (15 persons per vehicle)		1	1	1	1	1	0.13		50%	50%	1	1					
12	Process plant workers (using own transport) TWO SHIFTS PER DAY	4	25%	1						1.2	Trips per worker (1.2 persons per vehicle) night shift in, day shift out		1	1	1	1	2	1.67		0%	100%	0	2					
13.	Process plant workers (using contracted transport) TWO SHIFTS PER DAY	28	25%	7						15.0	Trips per worker (15 persons per vehicle) day shift in, night shift out		1	0.47	1	0.47	1	0.13		50%	50%	0.47	0.47					
TOTAL FOR PROCESS PLANT (PM)														9													1	8

**TABLE 3.6: TRIP GENERATION RATES, EXPECTED NUMBER OF VEHICLE TRIPS TO BE GENERATED BY THE PROPOSED MINING ACTIVITIES AND THE DISTRIBUTION OF VEHICLE TRIPS (PM) (OPERATIONAL PHASE) CONTINUE**

Item	Component	Num Workers per Day	% Workers Active during Peak Hour	Num Workers Active per Peak Hour		Num Trucks Per Day	% Trucks Active during Peak Hour	Num Trucks Active during Peak Hour		Assume d Ave. Num Persons per Veh	Comments		Trip Generation Calculations for Peak Hour						Final Trip Information for Traffic Engineering Calculations									
													If Inward Movement is Relevant Value = 1	Num Veh Trips for Inwards Direction	If Outward Movement is Relevant Value = 1	Num Veh Trips for Outwards Direction	Total Num Veh Trips Generated during Peak Hour (In & Out)	Calculated Trip Generation Rate per Person / Veh during Peak Hour	Trip Dist. %		Trip Generation							
																			In	Out	In	Out						
OTHER STAFF (MANAGEMENT, ADMIN, HR, HSEC, ENGINEERING etc.)																												
14.	Other staff (using own transport) DAY SHIFT	32	100%	32						1.2	Trips per worker (1.2 persons per vehicle)		0	0	1	27	27	0.83		0%	100%	0	27					
15.	Other staff (using contracted transport) DAY SHIFT	4	100%	4						15.0	Trips per worker (15 persons per vehicle)		1	1	1	1	2	0.13		50%	50%	1	1					
16.	Other staff (using own transport) THREE SHIFTS PER DAY	15	33%	5						1.2	Trips per worker (1.2 persons per vehicle)		1	4	1	4	8	1.67		50%	50%	4	4					
17.	Other staff (using contracted transport) THREE SHIFTS PER DAY	18	33%	6						15.0	Trips per worker (15 persons per vehicle)		1	0.40	1	0.40	0.80	0.13		50%	50%	0.40	0.40					
18.	Heavy vehicles exporting processed product					46	20%	9		1.0	20% of export vehicles expected during peak periods		1	9	1	9	18	2.00		50%	50%	9	9					
19.	Heavy vehicles delivering consumables					9	20%	2		1.0	20% of delivery vehicles expected during peak periods		1	2	1	2	4	2.00		50%	50%	2	2					
TOTAL FOR OTHER STAFF (PM)																	60									17	43	
TOTAL FOR AM PEAK PERIOD																	105										36	69

### 3.2.4 DETERMINATION OF THE TOTAL TRAFFIC EXPECTED TO BE GENERATED AT THE RELEVANT INTERSECTION

The detailed traffic-related investigation was conducted for the Operational Phase, since it is the worst case scenario. The following figures are relevant:

- a) **Figure B-1:** Base year, 2013, peak hour traffic without the proposed mining development (Scenario 1)
- b) **Figure B-2:** Projected trip distribution for the proposed mining development (heavy vehicles)
- c) **Figure B-3:** Projected trip distribution for the proposed mining development (light vehicles)
- d) **Figure B-4:** Projected vehicle trips generated by the proposed mining development
- e) **Figure B-5:** Base year, 2013, peak hour traffic with the proposed mining development (Scenario 2)
- f) **Figure B-6:** Projected 2023 peak hour traffic without the proposed mining development (Scenario 3)
- g) **Figure B-7:** Projected 2023 peak hour traffic with the proposed mining development (Scenario 4)

### 3.3 DETERMINATION OF THE LEVELS OF SERVICE AT THE RELEVANT INTERSECTIONS

The “**SIDRA Intersection**” software was used as an aid for the design and evaluation of the relevant intersection. The following intersection was evaluated for levels of service:

- a) Point A: Intersection of Road R380 and the proposed access intersection.

In **Appendix C, Tables C-1 to C-4** indicates the levels of service and the degree of saturation calculated for the relevant intersection for the various scenarios:

- a) **Table C-1:** Levels of service for various approaches for the year 2013, without the proposed mining development (Scenario 1)
- b) **Table C-2:** Levels of service for various approaches for the year 2013, with the proposed mining development (Scenario 2)
- c) **Table C-3:** Levels of service for various approaches for the year 2023, without the proposed mining development (Scenario 3)
- d) **Table C-4:** Levels of service for various approaches for the year 2023, with the proposed mining development (Scenario 4).

From **Tables C-1 to C-4** it is possible to note:

- a) That no additional infrastructure is required from a traffic capacity point of view at the relevant proposed intersection.
- b) That the relevant proposed intersection will operate at acceptable levels of services for the relevant time frame that this report was prepared for.

**See Figure 2.1** for more detailed information concerning specific proposed intersection layout should Road R380 be tarred in the future, which would be based on road safety requirements.

**Table 3.7** provides a summary of the available road reserve capacity on the various road sections of the roads that had been investigated. The assumed free-flow capacity of individual lanes is relevant provided that related intersections have reserve capacity available.

<b>TABLE 3.7: AVAILABLE RESERVE CAPACITY FOR RELEVANT ROAD SECTION</b>										
<b>Intersecti on</b>	<b>Direction of Road Section</b>	<b>Capacity per Lane</b>	<b>Actual Number of Vehicles per Lane</b>				<b>Reserve Capacity Available per Lane</b>			
			<b>2013</b>		<b>2023</b>		<b>2013</b>		<b>2023</b>	
			<b>AM</b>	<b>PM</b>	<b>AM</b>	<b>PM</b>	<b>AM</b>	<b>PM</b>	<b>AM</b>	<b>PM</b>
Road R380 and the proposed access road (Point A)	North (R380)	700	2	13	3	17	698	687	697	683
	East (Proposed Access)	400	N/a	N/a	N/a	N/a	N/a	N/a	N/a	N/a
	South (R380)	700	42	73	44	74	658	627	656	626

### 3.4 OTHER TRAFFIC-RELATED ISSUES

**Table 3.8** provides a summary of the following:

- Access related issues for access to Road R380 from and to the proposed mining development
- Road safety
- Available sight distances
- Non-motorised transport
- Public transport.

TABLE 3.8: SUMMARY OF OTHER TRAFFIC RELATED ISSUES

Item	Description of Element	General Comments	Specific Issues	Actions Required
1.	<b>ACCESS RELATED ISSUES</b>			
1.1	<b>Intersection spacing</b>	a) There are no other accesses located near the proposed location of the proposed access intersection	a) None	a) None
1.2	<b>Proposed access road from Road R380</b>	<p>a) Access will be provided via an access corridor which would cross Portion 2 of the Farm Wessels 227. Refer to <b>Figures A-1</b> and <b>A-2</b> of <b>Appendix A</b> for a graphical presentation of the locality of the proposed access road and access corridor.</p> <p>b) Safe and reliable access could be provided from Road R380. See <b>Figures A-1</b> and <b>A-2</b> of <b>Appendix A</b> for the proposed location of the proposed access road.</p> <p>c) Currently Road R380 is a gravel road that is in a good condition. At this point in time, no standards are available for the design of an access on a gravel road. The following guidelines should provide a safe and proper access intersection:</p> <p>i) The wide gravel road surface will allow for vehicles passing the proposed access to safely pass stationary vehicles waiting to turn right into the proposed development</p> <p>Refer to <b>Figure 2.1</b> for proposed intersection layout should Road R380 be tarred in the future.</p>	a) None	a) None

TABLE 3.8: SUMMARY OF OTHER TRAFFIC RELATED ISSUES

2. ROAD SAFETY ISSUES				
2.1	<b>General Road Safety</b>	<p>The following are typical elements related to the road network, which cause road safety problems in rural areas and which need to be addressed on a continuous basis:</p> <ul style="list-style-type: none"> <li>a) Intersection layout, with specific reference to the lack of dedicated right turn lanes, where there is heavy vehicle movement</li> <li>b) Insufficient public transport facilities</li> <li>c) Insufficient lighting at intersections</li> <li>d) Fencing to control animal movement</li> <li>e) Lack of provision and quality of road signs</li> <li>f) Improper road safety training for workers as well as adjacent community /ies</li> <li>g) Dust generated from moving vehicles</li> <li>h) Speed limits</li> </ul>	<ul style="list-style-type: none"> <li>a) Intersection layout.</li> <li>b) Dust generated from moving vehicles along Road R380 which momentarily limit visibility of following vehicles that could result in unsafe overtaking.</li> <li>c) Lighting at the proposed intersection</li> <li>d) Existing speed limit of 90 km/h in the vicinity of the proposed access.</li> </ul>	<ul style="list-style-type: none"> <li>a) In general the report was compiled so as to address the road safety issues as far as practically possible.</li> <li>b) Refer to point 1.2 b above for recommended access layout while Road R380 remains a gravel surfaced road.</li> <li>c) See <b>Table 2.1 and Figure 2.1</b> for the recommended layout of the proposed access intersection should Road R380 be tarred in the future.</li> <li>d) Collaborate with relevant Roads Authority to set up a road maintenance plan to maintain the relevant road network on which heavy vehicle movement is anticipated.</li> <li>e) Provide proper lighting at the proposed access intersection which would ensure good visibility during night time.</li> <li>f) Provide proper road and information signs for the relevant proposed intersection.</li> <li>g) It is recommended to reduce the speed limit of 90 km/h to 60 km/h at the access point to ensure a safer environment at the proposed access intersection.</li> <li>h) Provide mine workers with training on road safety with specific reference to overtaking and visibility issues when following other vehicles on the gravel section of Road R380. The following is recommended: <ul style="list-style-type: none"> <li>i) Keep a good following distance to ensure visibility</li> <li>ii) Do not overtake vehicles when limited visibility as there might be oncoming traffic, donkey carts or stationary vehicles.</li> </ul> </li> </ul>
3. AVAILABLE SIGHT DISTANCES				
3.1	<b>Available Sight Distances</b>	<ul style="list-style-type: none"> <li>a) During the site visit it was determined visually that the available sight distances at the proposed access intersection could be achieved.</li> <li>b) The required sight distance for a single unit and trailer type of vehicle is 380 metres for a speed of 60 km/h.</li> <li>c) <b>Table 3.8</b> provides a summary of the sight distance calculations.</li> </ul>	<ul style="list-style-type: none"> <li>a) None</li> </ul>	<ul style="list-style-type: none"> <li>a) None</li> </ul>
4. NON-MOTORISED TRANSPORT				
4.1	<b>Non-Motorised Transport</b>	<ul style="list-style-type: none"> <li>a) There are currently a low volume of non-motorised transport movements in the vicinity of the section of Road R380 and the proposed access road.</li> <li>b) No pedestrian movement were observed in the vicinity of the proposed mining development</li> </ul>	<ul style="list-style-type: none"> <li>a) Locals make use of donkey carts on Road R380.</li> </ul>	<ul style="list-style-type: none"> <li>a) Mining workers and contractors should be made aware of the possibility of encountering donkey carts and be provided with road safety training.</li> </ul>

**TABLE 3.8: SUMMARY OF OTHER TRAFFIC RELATED ISSUES**

5.	PUBLIC TRANSPORT			
5.1	Public Transport	a) Currently there is limited public transport available in the vicinity of the proposed mining development, and it is thus anticipated that workers will make use of contracted taxis.	a) Workers will preferably make use of minibus taxis to get to the proposed mining development.	a) It is recommended that a dedicated loading and off-loading area should be provided for public transport close to the operational area of the mine where workers can be loaded and off-loaded in a safe environment as part of the construction and operational phases.

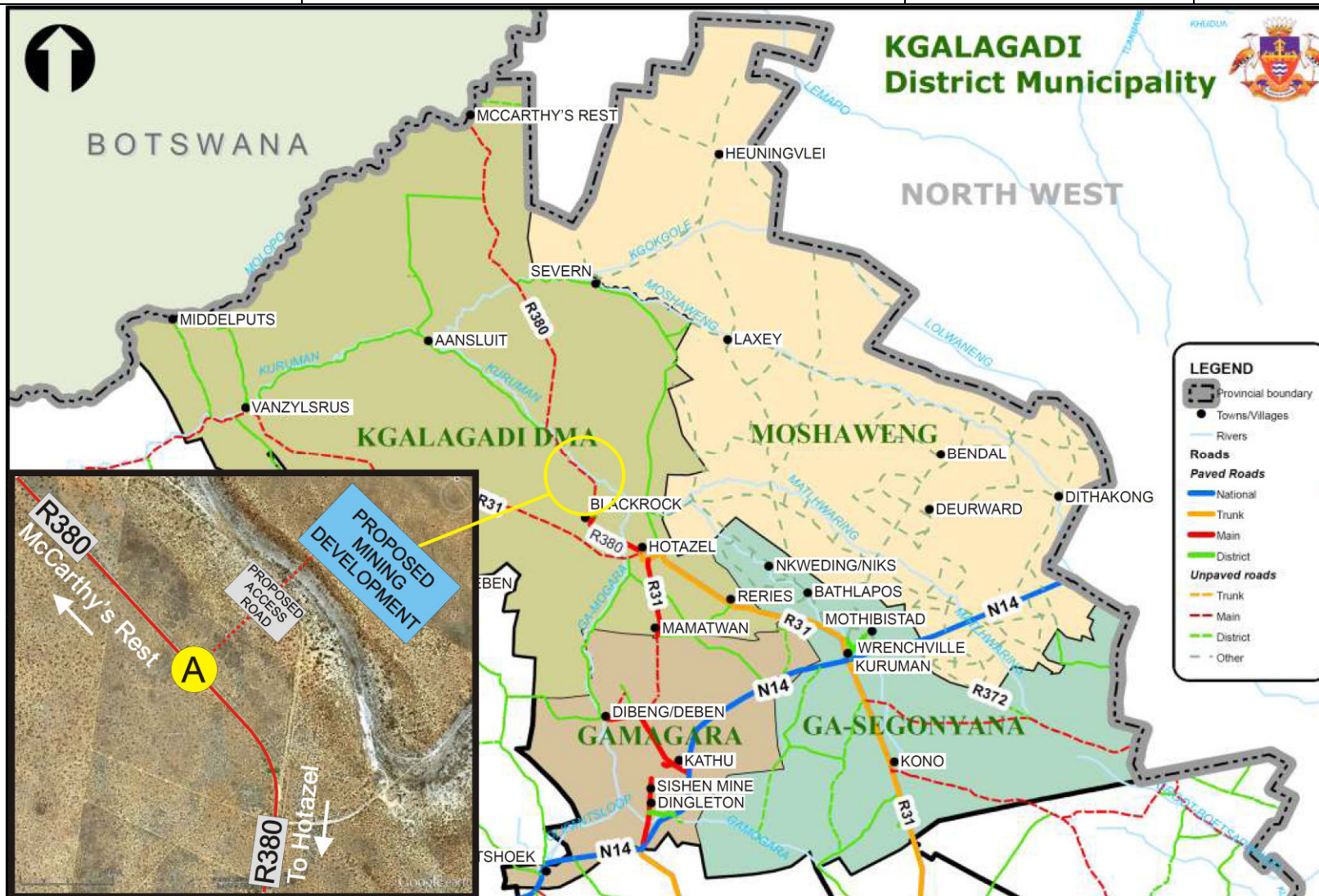
**TABLE 3.9: SUMMARY OF SIGHT DISTANCE CALCULATIONS (60 km/h)**

Date	04 JULY 2013						
Type of Development	Mining						
Recommended vehicle	Single Unit & trailer						
DESCRIPTION	NORTHERN SIDE OF INTERSECTION			SOUTHERN SIDE OF INTERSECTION			COMMENTS
Available sight distance horizontal	+500m			500m			None.
Available sight distance vertical	+500m			500m			None.
Gradient of road section	N/a			N/a			None.
Design Speed	60 km/h			60 km/h			None.
Picture of relevant approach							None.
Type of Vehicle	Passenger Car	Single Unit	Single Unit & Trailer	Passenger Car	Single Unit	Single Unit & Trailer	
1) Required, Intersection sight distance (m). Based on SANRAL Geometric Design Guidelines. Road Access Management in South Africa. (Table 7.4) (Same as minimum required Gap Acceptance Distance)	120m	180m	225m	120m	180m	225m	None.
	Pass	Pass	Pass	Pass	Pass	Pass	
2) Required, Stopping sight distances (m) (Depend on Gradient (Based on SANRAL Geometric Design Guidelines. (Table 3.5 and Figure 3.2)	90m	90m	90m	90m	90m	90m	None.
	Pass	Pass	Pass	Pass	Pass	Pass	
3) Minimum required gap acceptance sight distance (m) (Based on the National Guidelines for Road Access Management in South Africa. (Table 7.4))	120m	180m	225m	120m	180m	225m	None.
	Pass	Pass	Pass	Pass	Pass	Pass	

## **APPENDIX A**

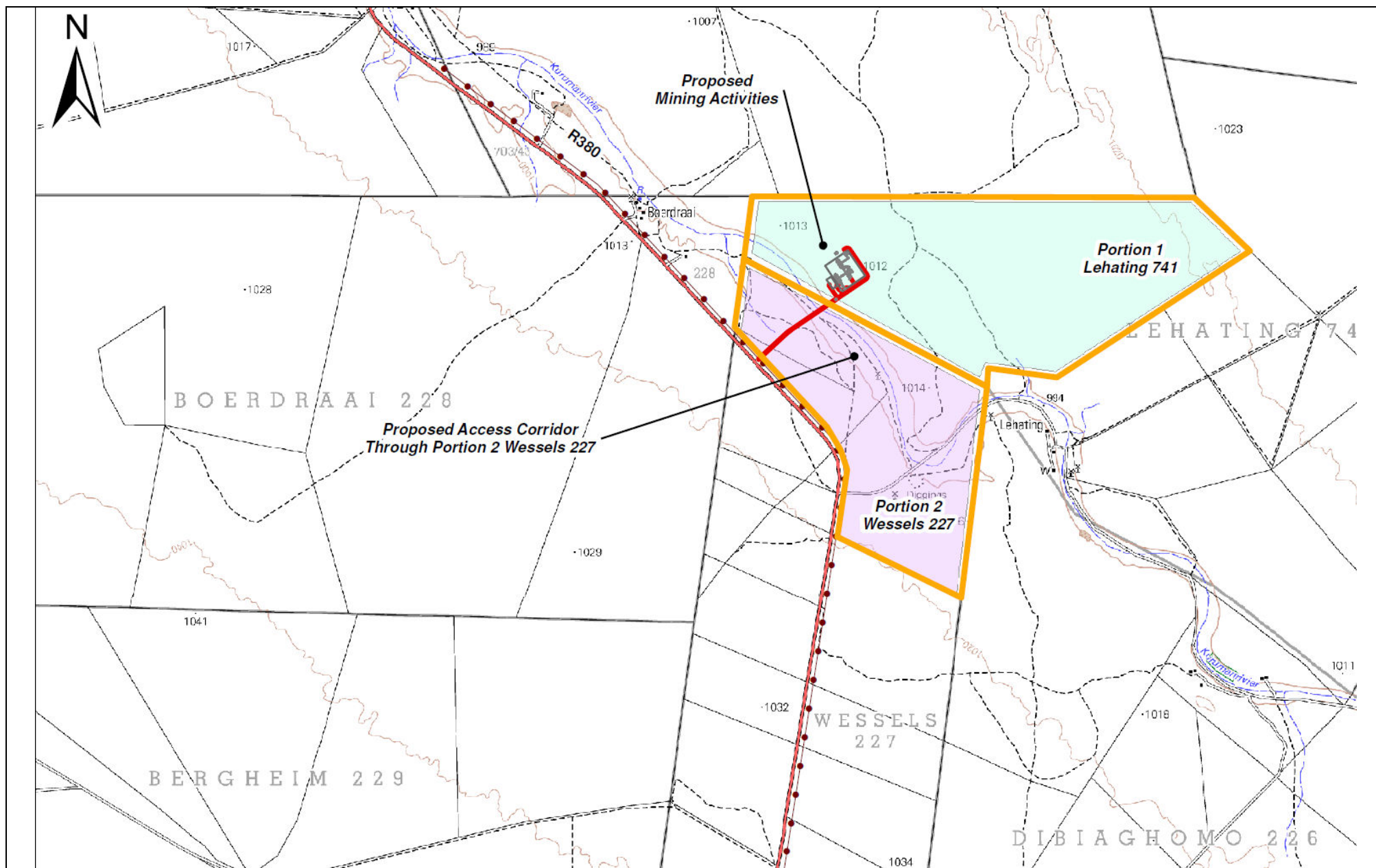
### INFORMATION RELATED TO STATUS QUO

POINT	INTERSECTION STATUS	INTERSECTION	GPS CO-ORDINATES	
			LATITUDE	LONGITUDE
A	Proposed	Road R380 and the proposed access road	S 27° 3'2.28"	E 22°51'4.22"

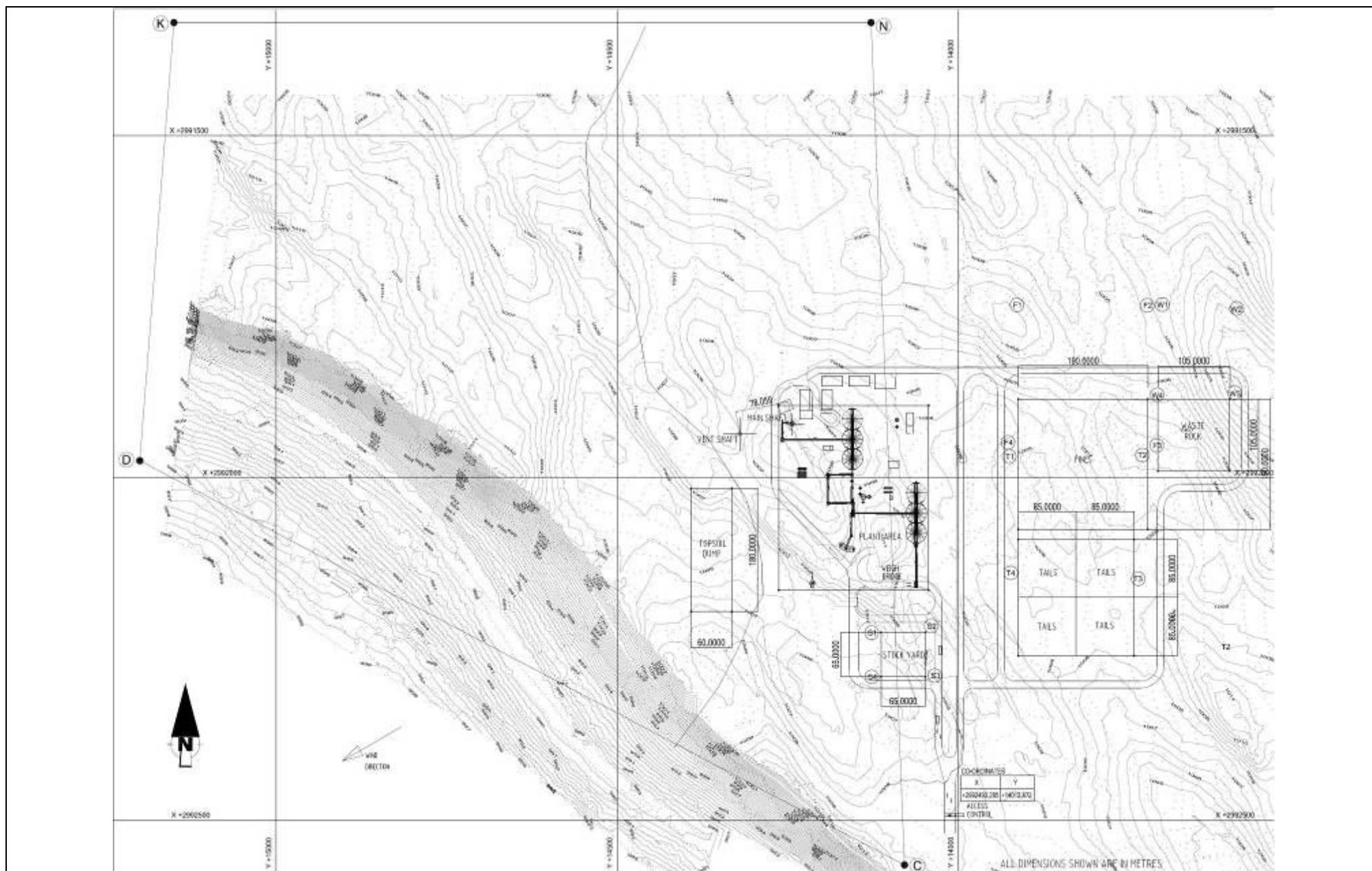


**FIGURE A-1: LOCALITY OF PROPOSED MINING DEVELOPMENT AND PROPOSED ACCESS INTERSECTION**

Map source: Kgalagadi District Municipality

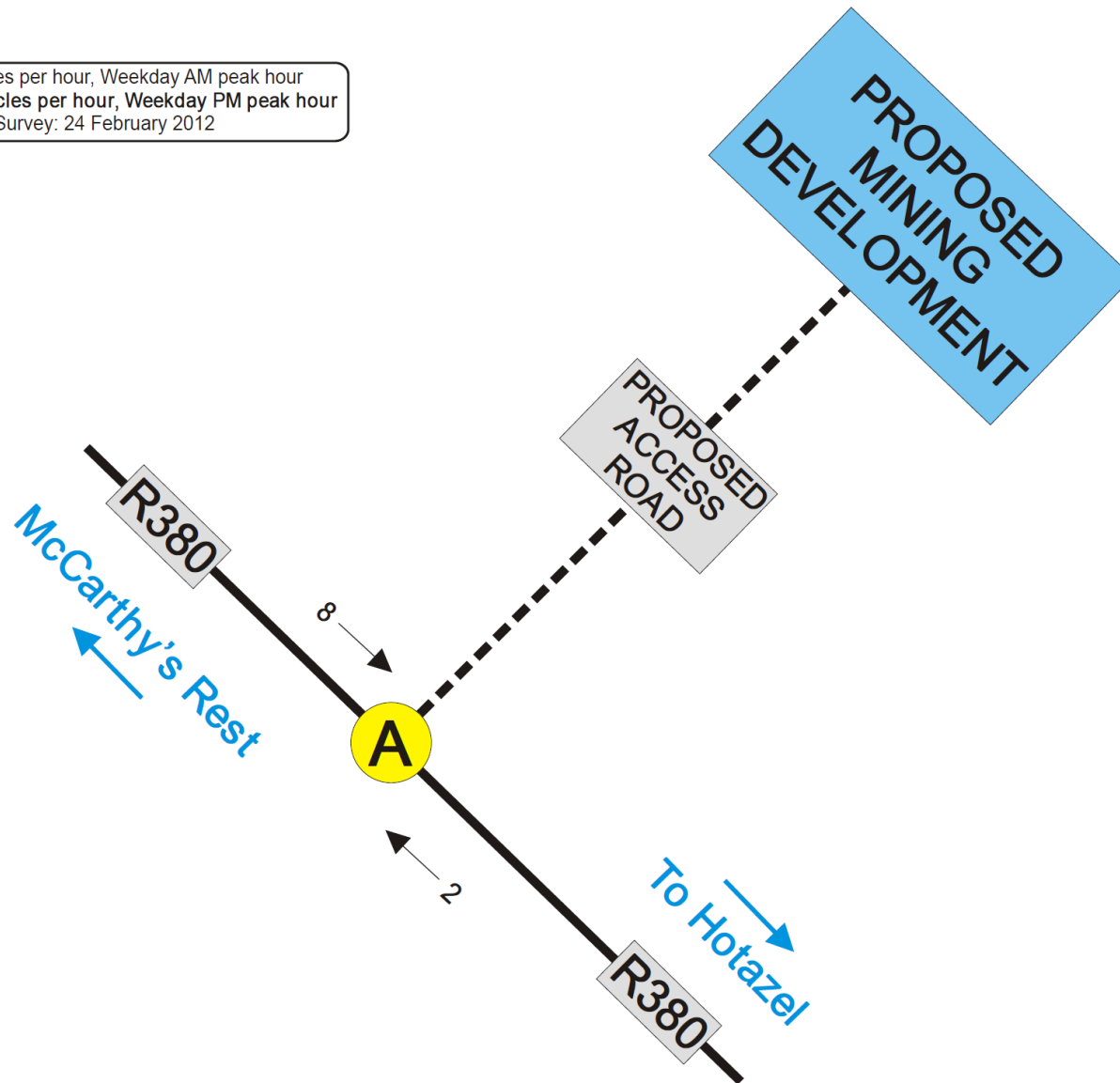


**FIGURE A-2: GRAPHICAL PRESENTATION OF PROPOSED ACCESS CORRIDOR**



**FIGURE A-3: CONCEPT SITE LAYOUT**

5 Vehicles per hour, Weekday AM peak hour  
(5) Vehicles per hour, Weekday PM peak hour  
Date of Survey: 24 February 2012



Schematic

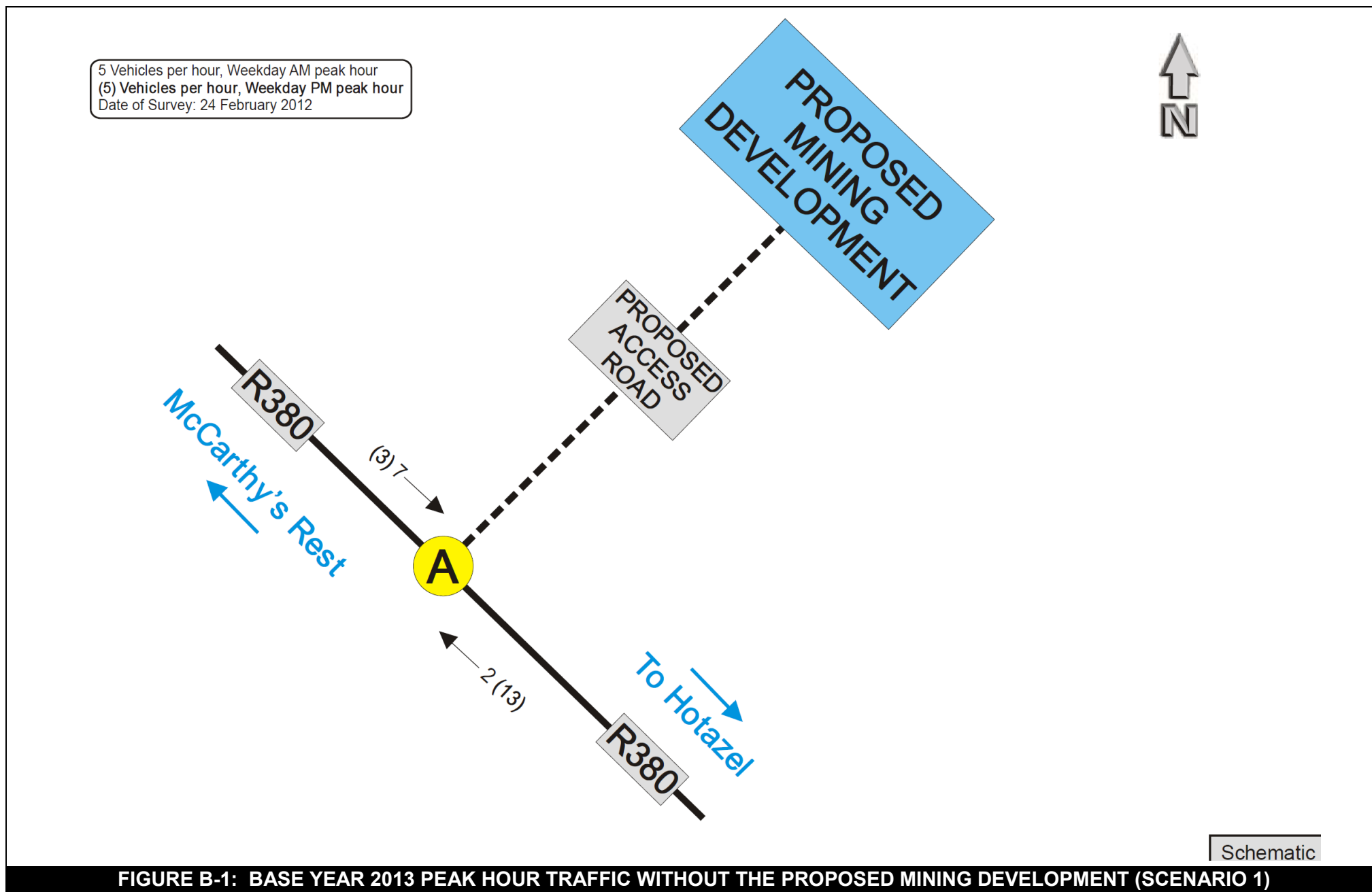
FIGURE A-4: RELEVANT MOVEMENTS TO TRAFFIC COUNTS

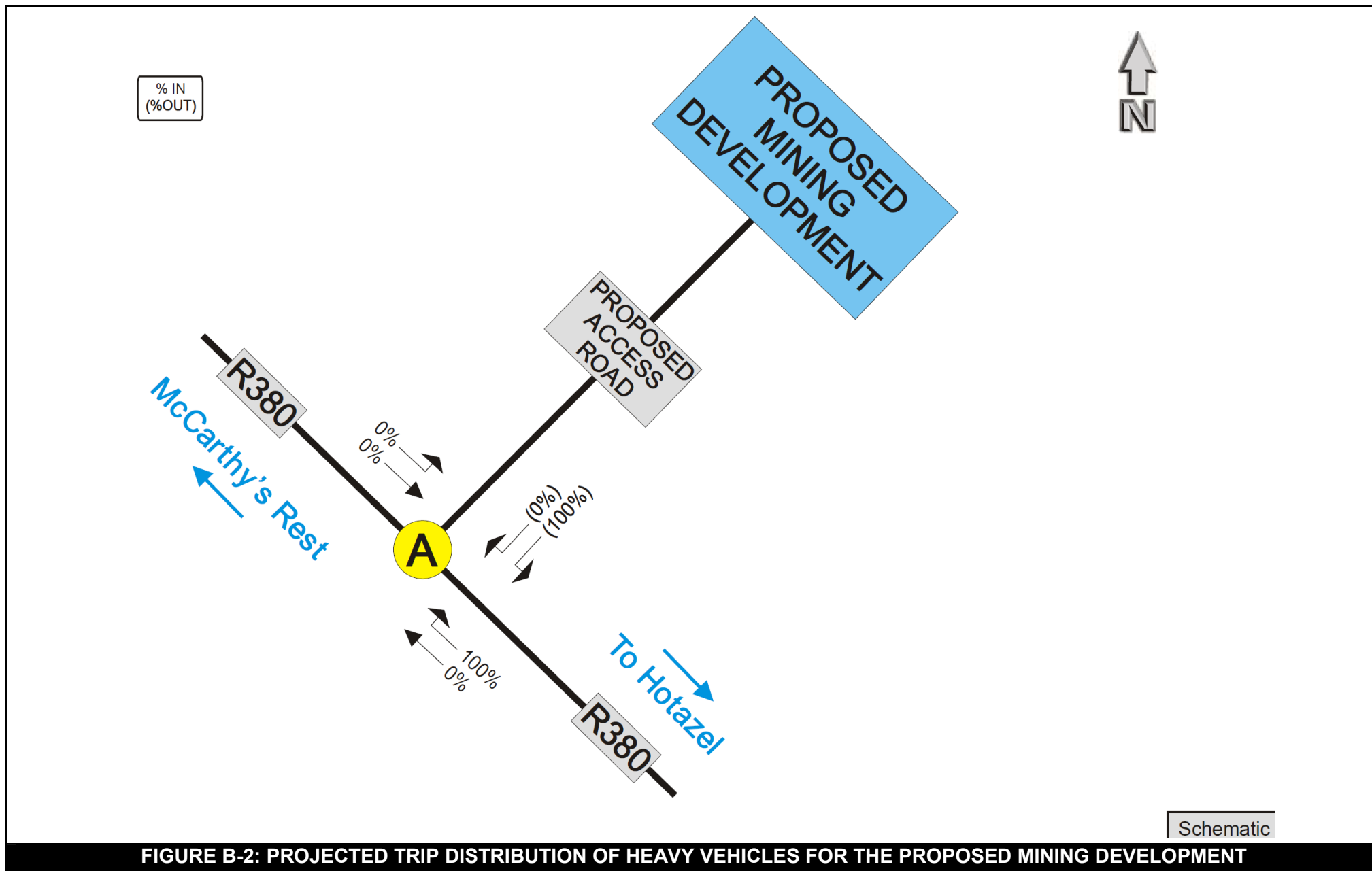
**TABLE A-1: HOURLY TRAFFIC COUNTS FOR ALL VEHICLES SIMULTANEOUSLY AT THE  
INTERSECTION OF ROAD R380 AND THE PROPOSED ACCESS INTERSECTION  
POINT A (24<sup>th</sup> OF FEBRUARY 2012)**

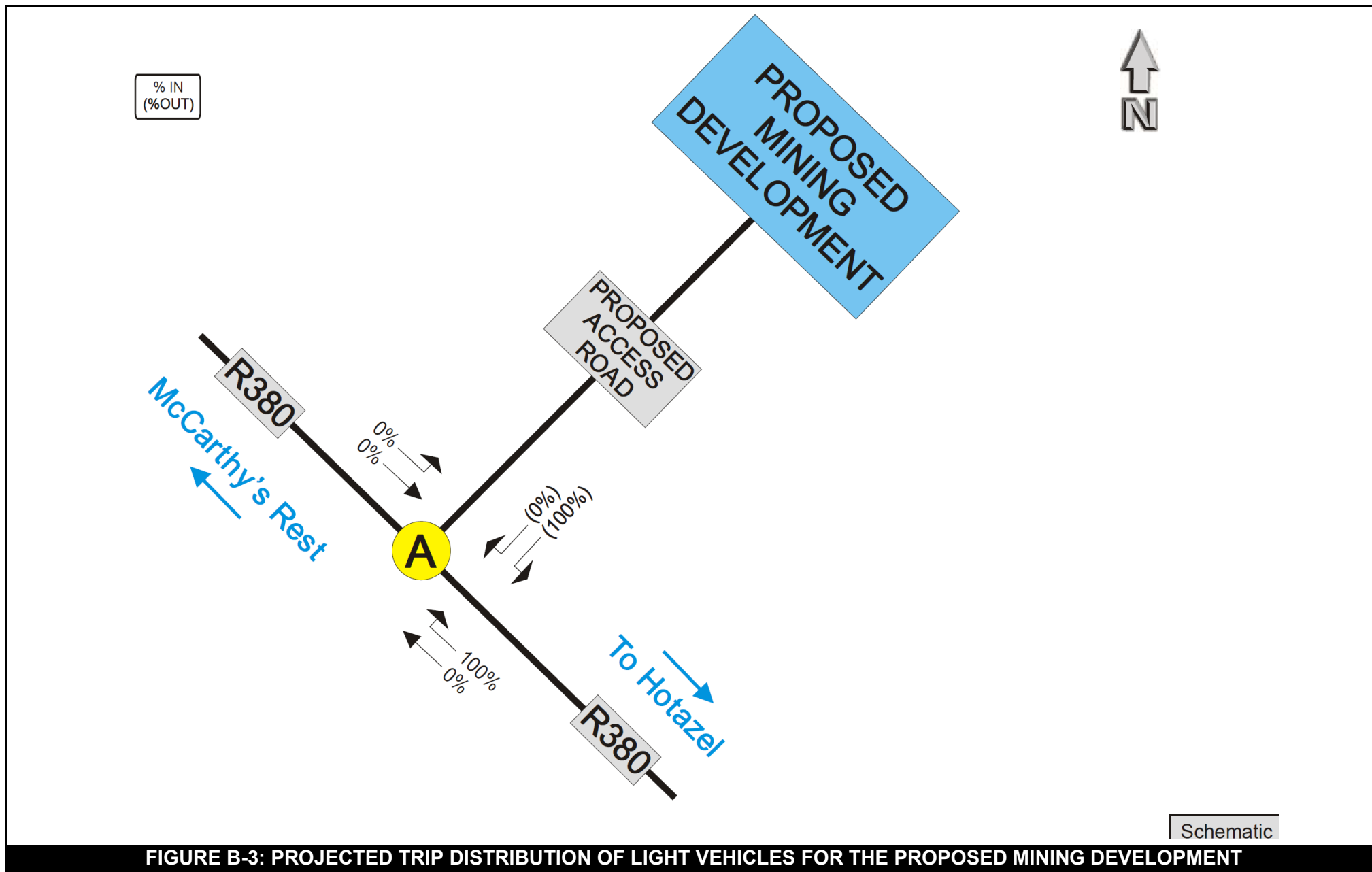
TIME INTERVALS	MOVEMENTS		
	2	8	TOTAL
06:00-07:00	0	4	4
06:15-07:15	0	3	3
06:30-07:30	0	3	3
06:45-07:45	0	3	3
07:00-08:00	0	5	5
07:15-08:15	1	5	6
07:30-08:30	1	5	6
07:45-08:45	2	7	9
08:00-09:00	3	5	8
08:15-09:15	2	5	7
08:30-09:30	2	4	6
08:45-09:45	3	3	6
09:00-10:00	3	3	6
09:15-10:15	5	4	9
09:30-10:30	5	5	10
09:45-10:45	3	3	6
10:00-11:00	2	2	4
10:15-11:15	0	3	3
10:30-11:30	0	2	2
10:45-11:45	2	6	8
11:00-12:00	2	7	9
11:15-12:15	3	6	9
11:30-12:30	3	8	11
11:45-12:45	1	4	5
12:00-13:00	1	3	4
12:15-13:15	1	2	3
12:30-13:30	1	1	2
12:45-13:45	2	2	4
13:00-14:00	6	2	8
13:15-14:15	8	2	10
13:30-14:30	10	2	12
13:45-14:45	11	1	12
14:00-15:00	7	1	8
14:15-15:15	8	2	10
14:30-15:30	8	1	9
14:45-15:45	7	1	8
15:00-16:00	7	1	8
15:15-16:15	6	0	6
15:30-16:30	8	1	9
15:45-16:45	9	2	11
16:00-17:00	13	3	16
16:15-17:15	11	4	15
16:30-17:30	10	5	15
16:45-17:45	10	4	14
17:00-18:00	8	3	11

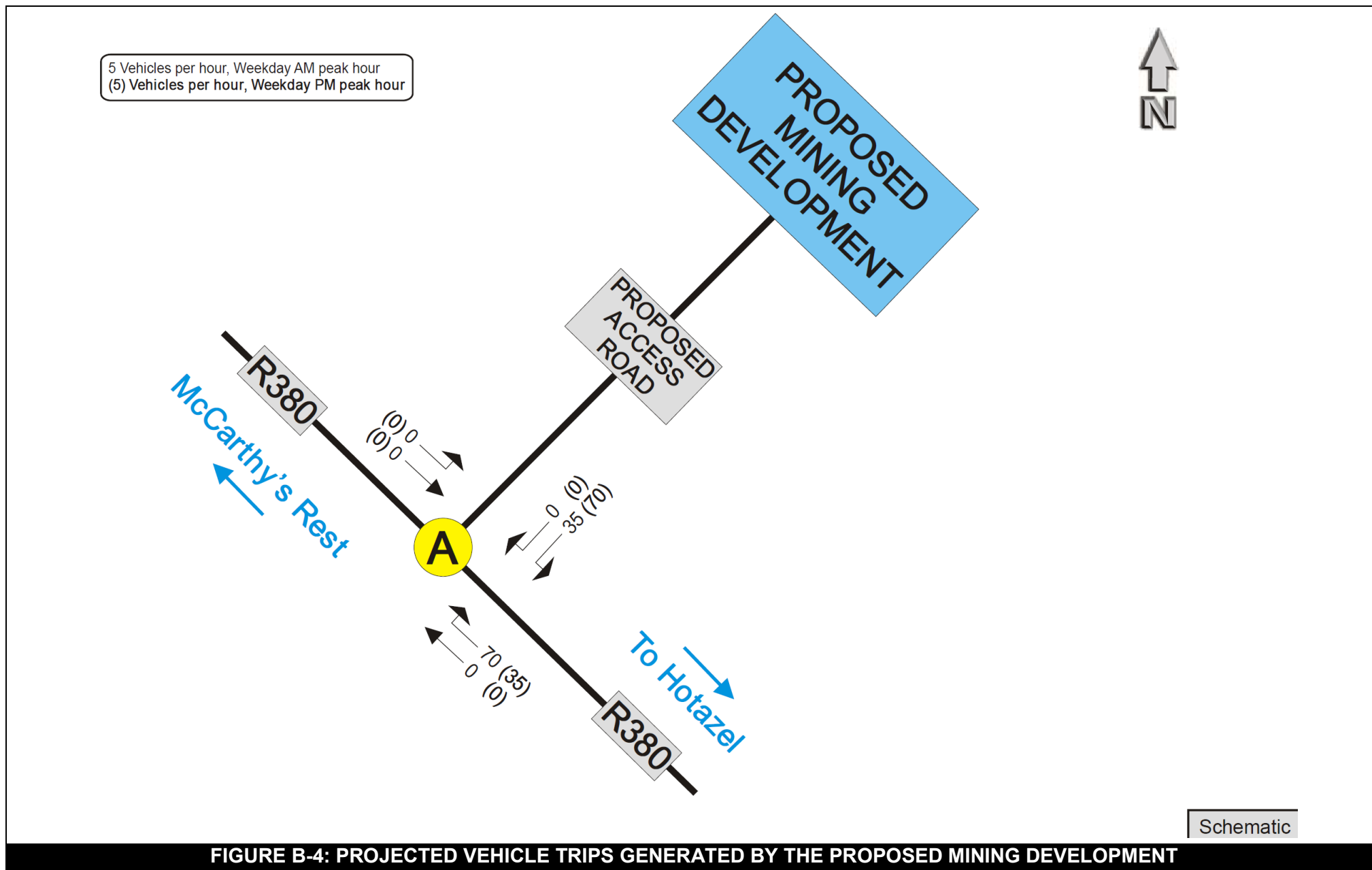
## **APPENDIX B**

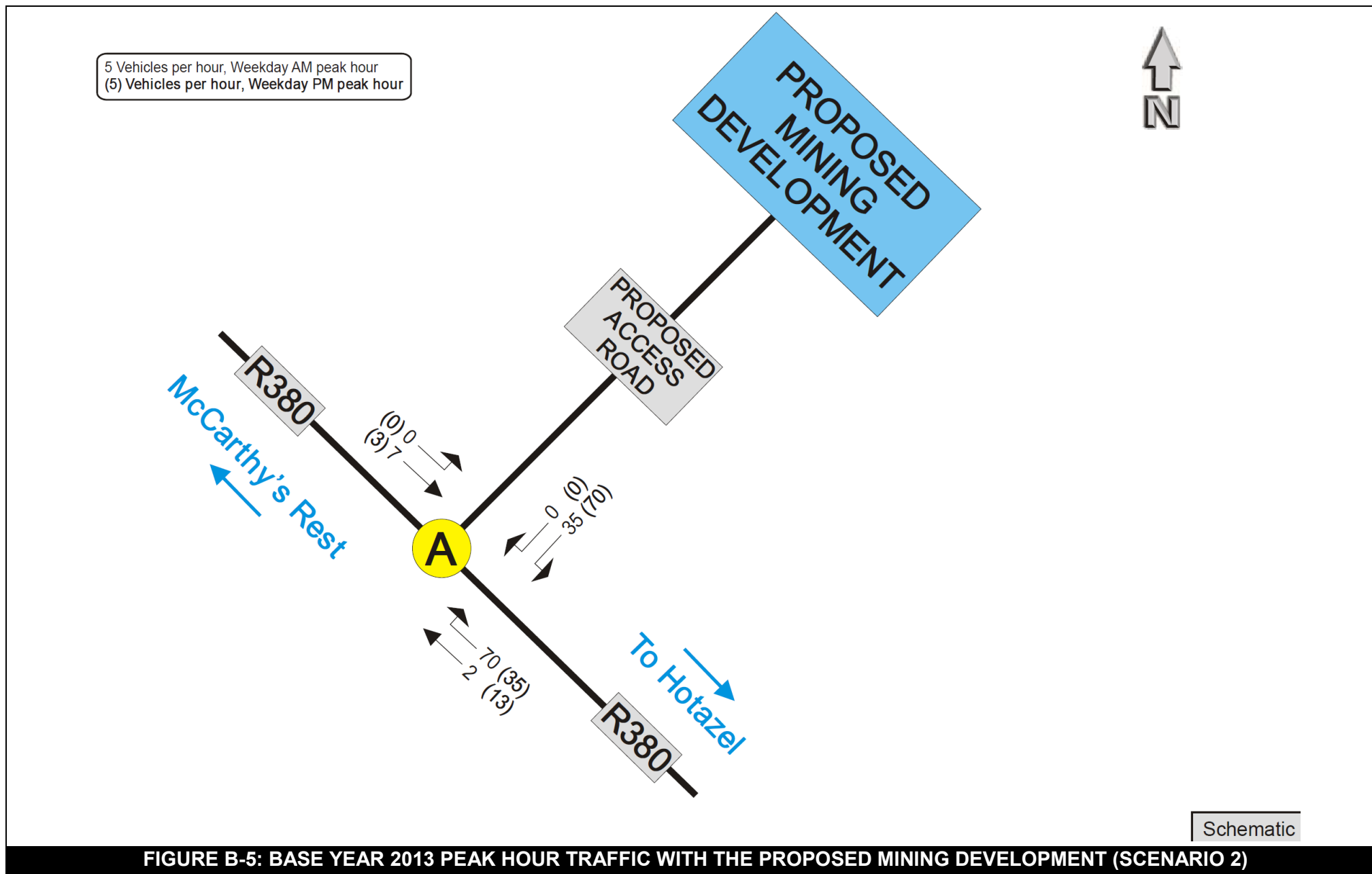
### TRIP INFORMATION RELATED TO THE PROPOSED DEVELOPMENT

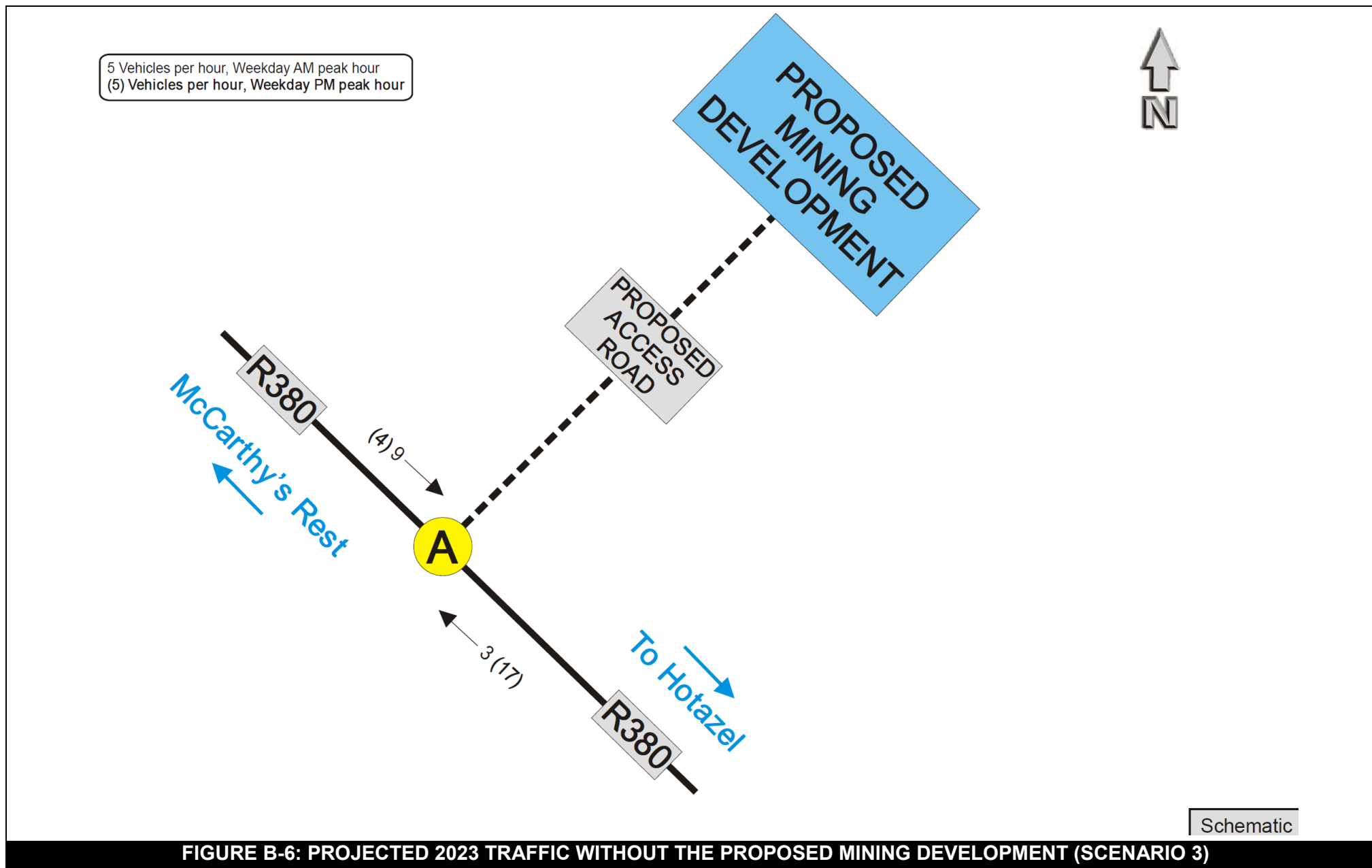


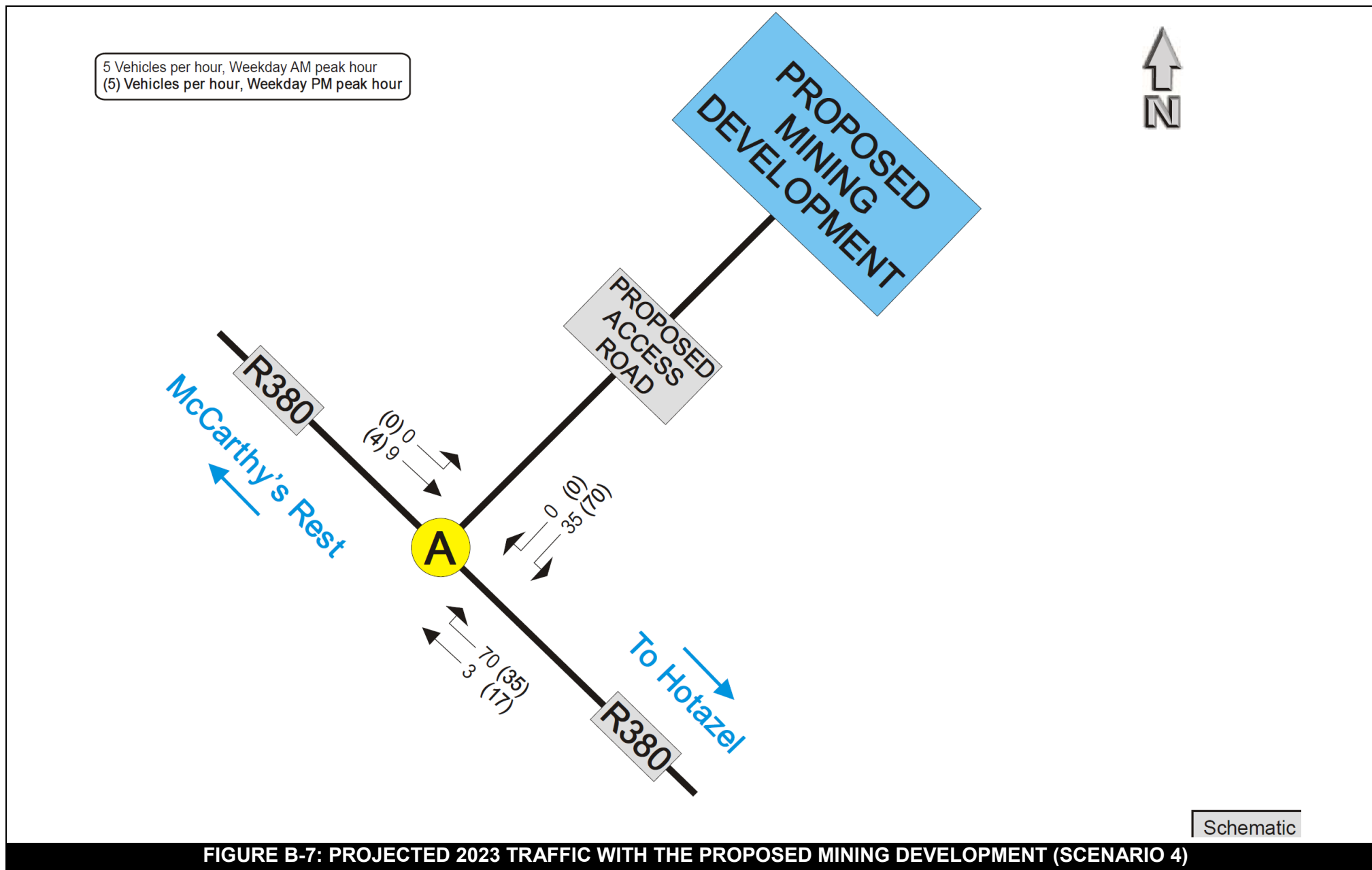












## **APPENDIX C**

### SIDRA CALCULATION RESULTS

**TABLE C-1: LEVELS OF SERVICE FOR VARIOUS APPROACHES FOR THE YEAR 2013  
WITHOUT THE PROPOSED MINING DEVELOPMENT (SCENARIO 1)**

<b><i>Point A: INTERSECTION OF ROAD R380 AND THE PROPOSED ACCESS ROAD</i></b>						
<b><i>Type of intersection control: Free-flow on Road R380</i></b>						
Intersection does not exist for this scenario						

**TABLE C-2: LEVELS OF SERVICE FOR VARIOUS APPROACHES FOR THE YEAR 2013  
WITH THE PROPOSED MINING DEVELOPMENT (SCENARIO 2)**

<b><i>Point A: INTERSECTION OF ROAD R380 AND THE PROPOSED ACCESS ROAD</i></b>						
<b><i>Type of intersection control: Free-flow on Road R380</i></b>						
APPROACH	FRIDAY (AM)			FRIDAY (PM)		
	Delay	Level of Service	Degree of Saturation	Delay	Level of Service	Degree of Saturation
North (R380)	1.0	A	0.004	2.0	A	0.002
East (Proposed access)	10.7	C	0.032	10.7	C	0.063
South (R380)	8.2	B	0.053	6.2	B	0.033
<b>Intersection</b>	<b>8.5</b>	<b>B</b>	<b>0.053</b>	<b>8.6</b>	<b>B</b>	<b>0.063</b>

**TABLE C-3: LEVELS OF SERVICE FOR VARIOUS APPROACHES FOR THE YEAR 2023  
WITHOUT THE PROPOSED MINING DEVELOPMENT (SCENARIO 3)**

<b><i>Point A: INTERSECTION OF ROAD R380 AND THE PROPOSED ACCESS ROAD</i></b>						
<b><i>Type of intersection control: Free-flow on Road R380</i></b>						
Intersection does not exist for this scenario						

**TABLE C-4: LEVELS OF SERVICE FOR VARIOUS APPROACHES FOR THE YEAR 2023  
WITH THE PROPOSED MINING DEVELOPMENT (SCENARIO 4)**

<b><i>Point A: INTERSECTION OF ROAD R380 AND THE PROPOSED ACCESS ROAD</i></b>						
<b><i>Type of intersection control: Free-flow on Road R380</i></b>						
APPROACH	FRIDAY (AM)			FRIDAY (PM)		
	Delay	Level of Service	Degree of Saturation	Delay	Level of Service	Degree of Saturation
North (R380)	0.8	A	0.005	1.6	A	0.003
East (Proposed access)	10.7	C	0.032	10.7	C	0.063
South (R380)	8.1	B	0.053	5.7	B	0.035
<b>Intersection</b>	<b>8.3</b>	<b>B</b>	<b>0.053</b>	<b>8.3</b>	<b>B</b>	<b>0.063</b>

## **APPENDIX D**

### LEVEL OF SERVICE CRITERIA

TABLE D-1: LEVEL OF SERVICE CRITERIA FOR UNSIGNALISED INTERSECTIONS		
LEVEL OF SERVICE	AVERAGE TOTAL DELAY (SEC/VEH)	PERFORMANCE EVALUATION
A	$\leq 5$	Excellent
B	$> 5$ and $\leq 10$	Very Good
C	$>10$ and $\leq 20$	Good
D	$>20$ and $\leq 30$	Average
E	$>30$ and $\leq 45$	Poor
F	$>45$	Fail

TABLE D-2: LEVEL OF SERVICE CRITERIA FOR SIGNALISED INTERSECTIONS		
LEVEL OF SERVICE	AVERAGE TOTAL DELAY (SEC/VEH)	PERFORMANCE EVALUATION
A	$\leq 5$	Excellent
B	$> 5$ and $\leq 15$	Very Good
C	$> 15$ and $\leq 25$	Good
D	$> 25$ and $\leq 40$	Average
E	$> 40$ and $\leq 60$	Poor
F	$> 60$	Fail

Level of Service criteria obtained from *The Highway Capacity Manual (Special Report 2009)*