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Memo

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CC	Rob Dol (Colliers Project Leaders), Allan Lockie (Industre Property Rua Ltd)
From	Cameron Inder
Date	2 May 2024
Job No.	148440.01
Job name	SL1 – Fast Track Consenting Process Application
Subject	**SL1 Transportation and Access Summary (including Stage 1)**

1. Introduction

This memorandum provides a high-level overview of an indicative transport network and access arrangement for servicing the proposed SL1 residential and industrial growth area bordering the southwest end of Hamilton.

The potential development yield of SL1 is around 8,700 new houses and 64 net hectares of new industrial land.

The extent of SL1 is shown in Figure 1.

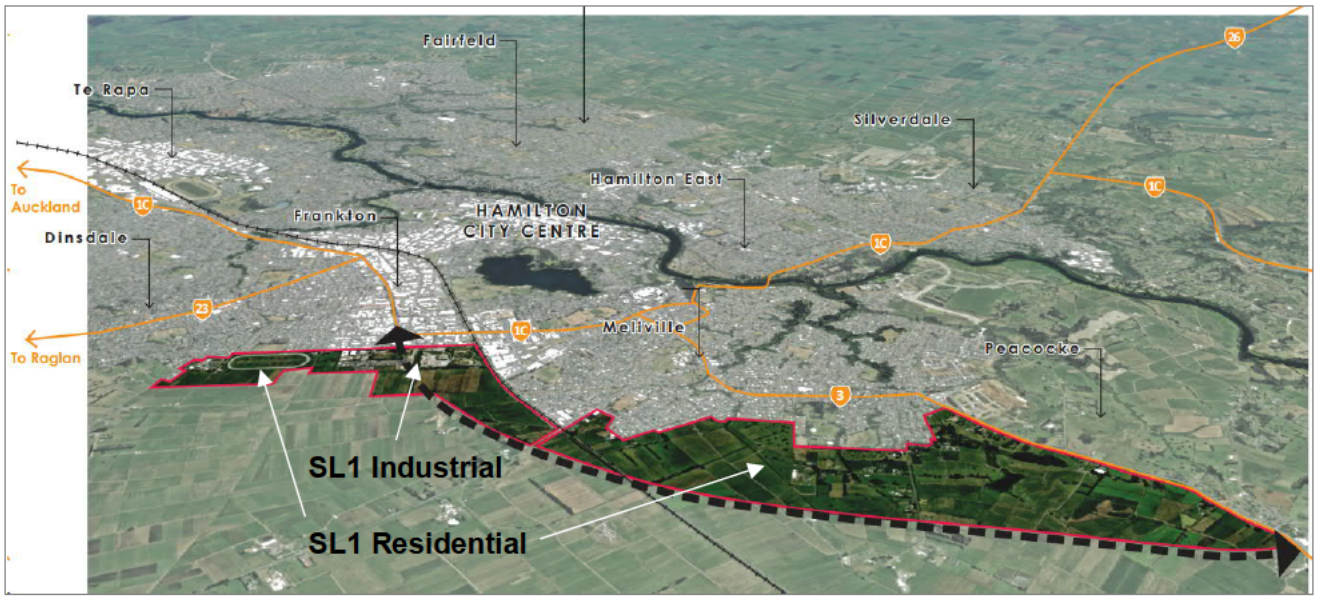

Figure 1: SL1 General Overview

The memo firstly describes the high-level strategic transport considerations influencing the SL1 concept transport network, followed by an overview of the infrastructure triggers to sustainably integrate the development with both the present and future land transport network in Hamilton.

It then provides greater detail concerning the proposed Stage 1 development comprising up to 1100 new dwellings and 46 ha of new industrial land, and the expected transport effects and infrastructure provisions to address those effects.

The strategic high-level considerations that influence the ultimate form of the SL1 transport network are:

- The existing transport network; capacity and connectivity constraints and opportunities.
- The draft GPS (2024) on Transport
- Hamilton Southern Links Arterial Network (HSL)
- Potential development yield and future travel mode share (private car v PT and active mode travel)
- Integration with the Waikato Metro-Spatial Plan key moves for the future Rapid Transit Network (RTN).
- Walking and Cycling network connectivity and integration with existing infrastructure

2. Existing Transport Network; Constraints and Opportunities

SL1 is essentially two distinct areas from a transportation access point of view due to the North Island Main Trunk Rail line (NIMTR) and the Hamilton Southern Links designation (HSL) through the areas.

The two areas are referred herein as the Northern and Southern Blocks.

SL1 South Block has connections to the existing transport network comprising primarily of residential streets servicing the existing neighbourhoods of Deanwell and Glenview that then connect to Collins Road (a Collector Road in Hamilton District Plan) and/or Ohaupo Road (Major Arterial Transport Corridor and State Highway 3).

The transport network adjacent to SL1 North Block comprises the residential streets of Karen Cresent and Higgins Road, and industrial streets of Wickham Street, and Higgins Road. These connect to the primary network of Tuhikaramea Road (minor arterial), Kahikatea Drive Extension (Collector Road) and Kahikatea Drive and Greenwood street (major arterial and SH1c).

The current average daily traffic volumes (from the Mobile Road website) for these roads are:

- Ohaupo Road (north of Colins Road); approximately 30,000 vpd, 9% HCV
- Ohaupo Road (near Saxbys Road); 27,700 vpd, 9% Heavy Commercial Vehicles (HCV)
- Ohaupo Road (near Houchens Road); 16,200 vpd, 9.9% HCV
- Collins Road near level crossing; 3,800 vpd, 5.4% HCV
- Collins Road near Ohaupo Road; 7,850 vpd, 3% HCV
- Kahikatea Drive Extension; 5020 vpd, 3% HCV
- Kahikatea Drive; 29,450 vpd, 8.2% HCV
- Greenwood Street; 25,833 vpd, 8.2% HCV
- Tuhikaramea Road; 8,200 vpd, 3% HCV

SL1 Northern Block Network Constraints

Figure 2 shows the Northern Block and proposed transport connections to existing and future road corridors.

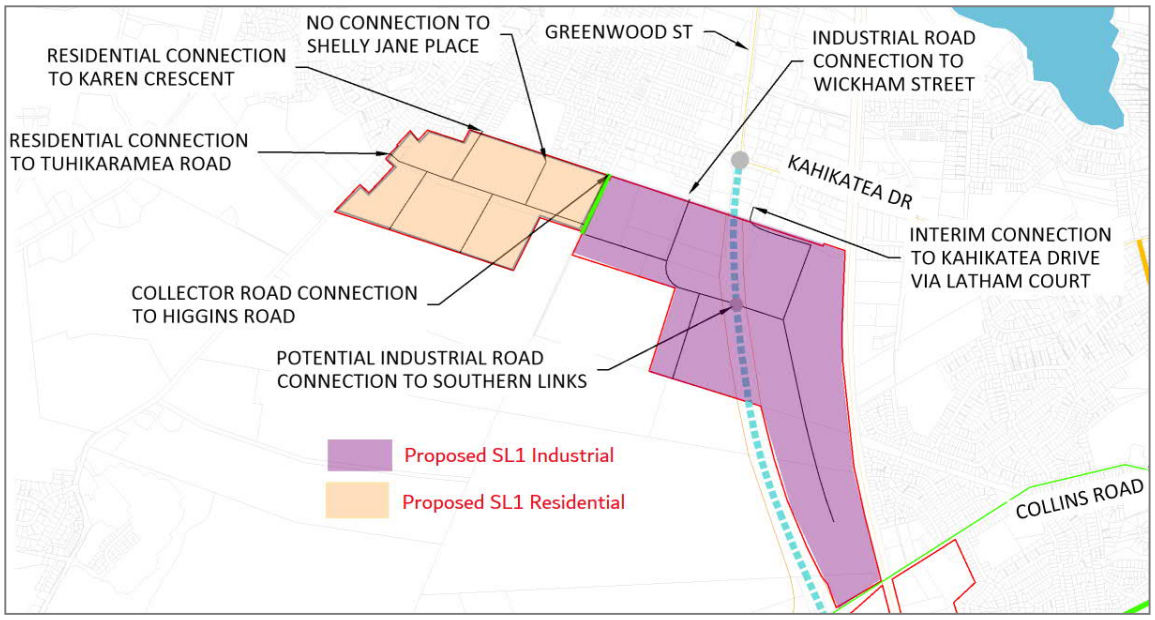

Figure 2: SL1 North Block

HCC advised during our initial discussions on SL1 that a direct connection from the proposed SL1 Industrial area to Kahikatea Drive would not be supported (as a long-term solution) given the access challenges that exist because of the high traffic volumes. For this reason, HCC also advised that they have had initial discussions with NZTA about allowing a connection from the future HSL corridor to the identified SL1 industrial area to avoid it becoming land-locked by the HSL designation. The approximate location of a new connection (indicatively a roundabout as shown in Figure 2) is approximately 600 m from the future HSL / Kahikatea Drive / Greenwood Street roundabout.

The primary existing network constraint for SL1 North Block accessibility is Kahikatea Drive / Greenwood Street intersection. This intersection is a Give Way controlled 'Tee' junction but is to be replaced with a large urban 4-arm roundabout as part of the HSL project.

Our high-level transport modelling for SL1 indicates that it is likely this roundabout will be needed to enable development of the SL1 Northern Block if development precedes HSL construction.

SL1 Southern Block Network Constraints

Figure 3 shows the Southern Block and proposed transport connections to existing and future road corridors.

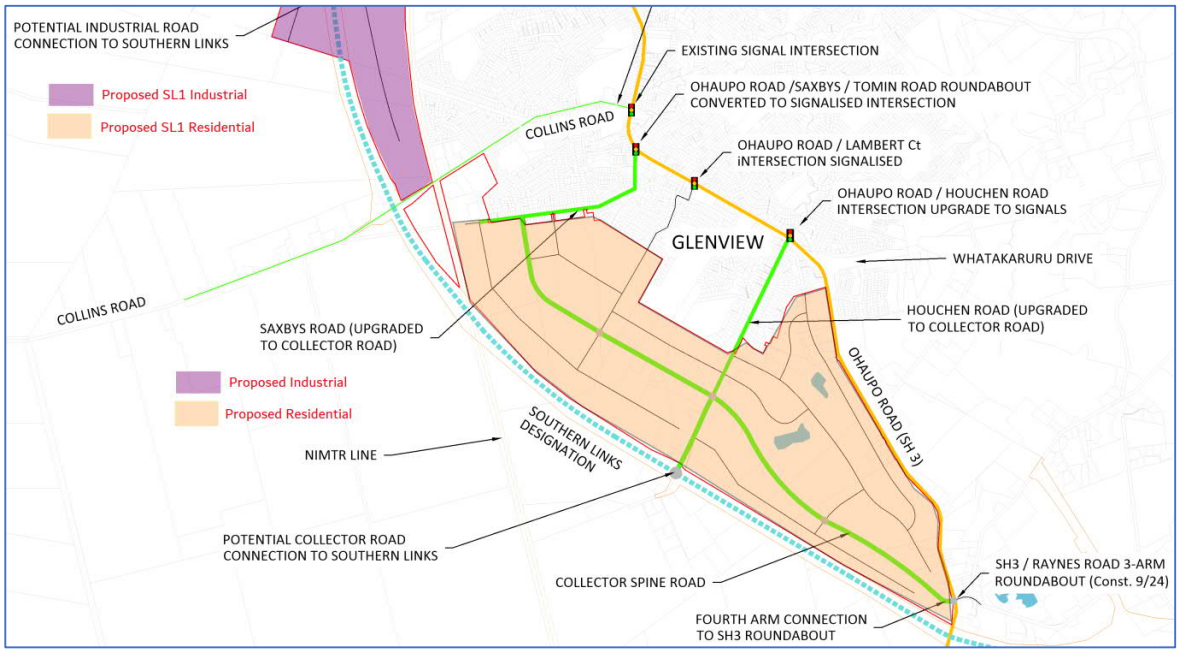

Figure 3: SL1 South Block

Ohaupo Road is a major arterial corridor and State Highway 3, with its primary function being for the movement of people and freight locally and as an inter-regional and strategically critical connection between Hamilton and New Plymouth. It also connects the nearby towns of Ohaupo, Te Awamutu and Otorohanga to Hamilton, and as a result carries a significant volume of commuter traffic in the AM and PM peaks.

Locally, Ohaupo Road is also a primary transport corridor connecting the residential suburbs of Glenview, Melville and Deanwell, (and the future Peacocke) to central Hamilton. It is also one of two primary routes connecting the city with Hamilton Airport and Titanium Business Park.

A primary purpose of the HSL project between Ohaupo Road and Kahikatea Drive is to enable residential growth in the southern areas of Hamilton by reliving pressure on Ohaupo Road and improving network resilience for freight and public transport.

Current network constraints on Ohaupo Road that impact accessibility for new trips from SL1 include:

- Ohaupo Road / Collins Rd signal intersection
- Ohaupo Road / Saxby's Road roundabout
- Ohaupo Road / Lambert Court intersection
- Ohaupo / Houchens Road intersection.

Each of these intersections will require upgrades to improve accessibility and reliability for Public Transport to adequately serve the travel demand from SL1.

Ohaupo Road / Houchens Road intersection is currently a Stop controlled 'Tee' junction, but the Houchens Road Plan Change requires that this be upgraded to a signalised intersection to support the 140-160 lot rural lifestyle development. That plan change area is now included in SL1 for future medium density residential, so it is reasonable to expect that a similar form of upgrade of the intersection is required to support SL1.

The HSL designation borders the southwest edge of SL1 South Block. The designation presently has no direct access to Glenview other than a half-diamond grade separated intersection with Collins Road. However, this location has limited accessibility to Glenview and the wider Hamilton network other than through the congested intersection of Ohaupo Road / Collins Road. Complicating accessibility matters is the existence of the Collins Road / North Island Main Trunk Railway level crossing adjacent to the planned HSL half-diamond interchange.

However, we have identified potential solutions to improve access for SL1 South Block and Deanwell and Glenview areas. This includes:

- Promoting a new roundabout connection direct to HSL from Houchens Road (no connection presently exists in the HSL designation), and
- Connecting the proposed Spine Road at its south end to the new SH3 / Raynes Road roundabout that is being constructed by NZTA as a safety project in 2024.

Additionally, SL1 creates an opportunity for the function of the HSL link between SH3 and Kahikatea Drive to be reconsidered, to better support significant residential growth than the present designation allows. This section of HSL could be reimagined as an integrated spine road through the South Block to convey freight, with shared PT and freight lanes in both directions, while providing an urban arterial function through SL1 South Block rather than its current single purpose residential bypass-function around the southwestern side of Hamilton.

Each of the above are concepts that are yet to be fully discussed with NZTA, but we consider that this substantial growth opportunity (SL1) for Hamilton's housing and employment justifies a credible review of the form and function of this specific section of HSL.

This memo outlines the high-level desk top infrastructure assessments to date to identify what and when certain transport infrastructure would be required to support all of SL1. It will require much greater levels of testing and evaluation with scenario runs in the Waikato Regional Transport Model if SL1 is to be rezoned and brought into the Hamilton City boundary as a preferred emerging growth area.

3. Hamilton Southern Links Arterial Network (HSL) and the draft GPS on Transport

High-level network capacity testing outlined in the following sections identifies that a high mode-shift to Public Transport and walking and cycling together with the addition of the HSL project are the primary infrastructure requirements for unlocking the SL1 growth area.

The NZ Government released its' new draft GPS for Transport on 6 March 2024 for consultation. It contains the new Government's four strategic priorities for transport in New Zealand, as follows:

- Economic Growth and Productivity
- Increased maintenance and resilience
- Safety
- Value for money.

In addition, the draft GPS identifies that Roads of National Significance will again be a high priority for delivery, and this specifically includes Hamilton Southern Links as a "road to unlock housing growth".

The Roads of National Significance include:

Whangarei to Auckland, with the following stages prioritised:

- Alternative to Brynderwyns
- Whangarei to Port Marsden
- Warkworth to Wellsford.

Tauranga to Auckland, with the following stages prioritised:

- Cambridge to Piaere
- Tauriko West State Highway 29.

Auckland roads:

- Mill Road
- the East West Link.

Roads to unlock housing growth:

- Hamilton Southern Links
- Petone to Grenada Link Road and the Cross Valley Link

Although still a draft, the GPS signals the intent and delivery of HSL roads is to support housing growth in Hamilton, which directly relates to SL1 as a major residential growth opportunity. The industrial land component within SL1 not only supports the GPS priority, 'economic growth and prosperity' but also contributes to reducing the current and projected industrial land shortfall in Hamilton.

4. Indicative Development Staging

The size of SL1 means the development is likely to occur in stages over a 25-30 year period. Indicative stage sequencing is shown below based on the need to connect and integrate with existing transport infrastructure (as well as three-waters infrastructure).

SL1 North Block indicative staging

SL1 South Block indicative staging

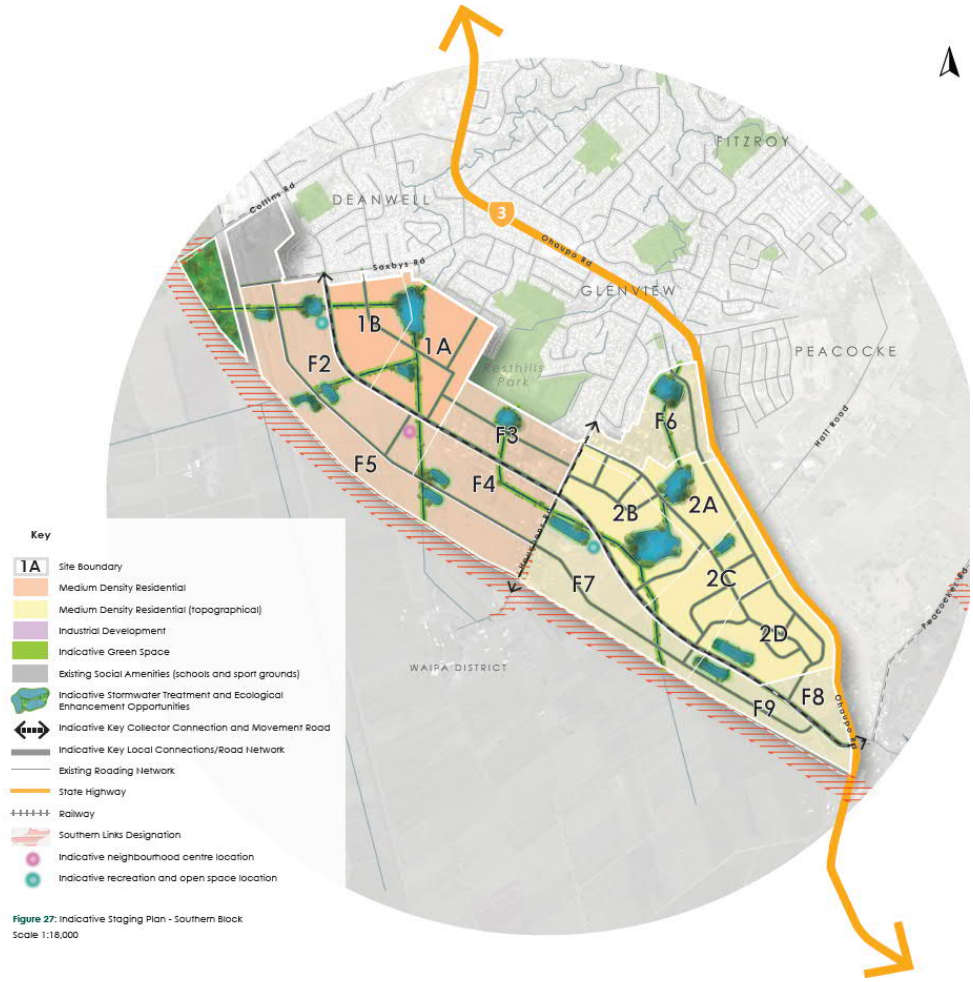

Figure 27: Indicative Staging Plan - Southern Block
Scale 1:18,000

5. SL1 Yield Potential and Overall Trip Generation

Figure 4 outlines the potential development yield of SL1 in its entirety, along with high-level trip generation calculations for the residential and industrial activities. The calculation of peak hour trips for residential areas is based on a typical weekday peak hour rate of 0.75 trips/dwelling for medium-density residential[1]. Similarly, for industrial activities the representative trip rate of 20.4 trips/net hectare is adopted for commuter peak hours.

Travel Mode	Assume	Census 2018 Glenview
PT	30%	3.0%
Active Modes	10%	6.2%
Private Veh Pass.	6%	5.1%
Private Veh Driver	40%	75.2%
Work at Home	12.5%	8.9%
Other	1.5%	1.6%

	Stage	Gross Area (ha)	Density (sqm)	Development Percentage	Ha	Peak Hr Trip Generation	Public Transport	Active Modes	Private Veh Passenger	Private Veh Driver
Industrial	IA	43	1000-2500sqm	65%	28	572	172	57	34	229
	IB	37	1000-2500sqm	65%	24	488	146	49	29	195
Future Industrial	F1	24	1000-2500sqm	65%	16	322	97	32	19	129
Industrial Total					**68**	**1381**	**414**	**138**	**83**	**553**

	Stage	Gross Area (ha)	Density (sqm)	Development Percentage	Estimated Yield	Peak Hr Trip Generation	Public Transport	Active Modes	Private Veh Passenger	Private Veh Driver
Residential	1A	28	250	60%	490	367.5	110	37	22	147
	1B	20	250	60%	540	405	122	41	24	162
	2A	20	400	50%	250	187.5	56	19	11	75
	2B	29	400	50%	350	262.5	79	26	16	105
	2C	24	400	50%	300	225	68	23	14	90
	2D	25	400	50%	300	225	68	23	14	90
	3A	24	200	65%	760	570	171	57	34	228
	3B	21	200	65%	670	502.5	151	50	30	201
	Sub-total				3660	2745	824	275	165	1098
Future Residential	F2	29	200	60%	870	652.5	196	65	39	261
	F5	40	200	60%	1190	892.5	268	89	54	357
	F3	22	175	60%	760	570	171	57	34	228
	F4	22	200	60%	660	495	149	50	30	198
	F6	20	400	50%	250	187.5	56	19	11	75
	F7	32	200	60%	970	727.5	218	73	44	291
	F9	18	400	60%	260	195	59	20	12	78
	F8	9	400	60%	140	105	32	11	6	42
	Sub-total				5100	3825	1148	383	230	1530
Residential Total					**8760**	**6570**	**1971**	**657**	**394.2**	**2628**

Figure 4

Travel mode splits reference the 2018 Census data for Glenview but are then adjusted to reflect aspirational travel behaviour change toward greater use of PT (30% mode share), walking and cycling (10% mode share) and working from home over the next 30+. This timeframe aligns with HCC and the Waikato Regional Council's planned "Rapid Transit Future" for Hamilton, as detailed in the Waikato Metro Spatial Plan.

The overarching outcome of the high-level trip generation calculation is that private vehicle trips are still expected to be the predominant transport mode. However, it is significantly reduced from 75% in 2018 to approximately 40% of all peak hour trips in 30 years' time. This is an aspirational mode-shift from car dependence during commuter peaks, but it is supported by the proposed medium-density residential in SL1 (restricted car parking and garaging) and aligns with the "transformational" shift to PT enabled by the Rapid Transit Network key moves envisaged in the Waikato Metro Spatial Plan (refer to Section 6 for further information).

On this basis with 40% private car mode share, the residential component of SL1 can be expected to add around 2,500 - 3000 new vehicle trips to the network in the commuter peaks, and roughly 550 new vehicle trips to and from the North Block Industrial area.

[1] Refer to Appendix A for trip generation supporting information

As mentioned, the North and South Blocks have very separate traffic loading points on the network. This helps to reduce the concentration of new traffic on Ohaupo Road, identified earlier as a capacity constraint (pre-HSL).

6. Public Transport

6.1 Waikato Metro Spatial Plan

The Waikato Metro Spatial Plan (MSP) identifies "Short list Option C"[2] as the recommended programme to "support a radical transport shift and support the transformative move to a Rapid Transit Network future" in Hamilton.

The MSP illustrates the Rapid Transit Network[3] (RTN) components of this programme as follows:

Figure 5

[2] Waikato Metro Spatial Plan Programme Business Case report. Revision D, Section 6.2.2
[3] Waikato Metro Spatial Plan Executive Summary report. Revision C, Figure 1-8

RTN 4 is one of four key Rapid Transit routes across Hamilton. It will service Waikato Hospital and Glenview West, with potential to be extended in the long-term to Te Awamutu. Glenview West is immediately adjacent to the SL1 South Block residential area. So_SL1 is highly accessible to Hamilton's "transformative" RTN network.

The MSP describes RT4 (and RT3) as a service supporting Light Rail Transit or Bus Rapid Transit on RT1 and RT2 routes, by way of bus priority[4]. This suggests RT4 is not envisaged as a BRT or LRT service itself but a frequent bus service on a route with bus priority measures including bus lanes and signal priority at intersections. The diagram suggests the route may use the Ohaupo Road corridor although that is not determined in the MSP business case report.

The use of the Ohaupo Road corridor by RT4 will require significant modifications to existing road infrastructure and space allocation, including bus priority upgrades at the key intersections identified earlier as network constraints.

One of the key requirements for BRT or LRT to be viable is sufficient medium to high-density residential population surrounding the transit route. The MSP states[5]

"The routes designated as RT3 and RT4 will deal to increased density of existing neighbourhoods and aligns with the existing and proposed community facilities. Although these routes may not ultimately be able to achieve the demand for a full BRT – they are key routes that will require early investigation and investment to
deliver bus lanes and bus priority for service functions and reliability.

The above refers to existing neighbourhoods potentially not being dense enough to achieve the demand for full BRT. It should be noted that the addition of circa 7900 new homes near RTN4 corridor would likely change this sentiment and potentially propel RTN4 to be viable as a full BRT corridor.

The MSP also identifies a recommended timeframe to implement the programme as shown below[6]. This indicates RTN4 coming online from Year 20 onwards (year 1 is 2025). While not ideal for supporting rapid growth of new homes in SL1, the timeframe could potentially be accelerated with contributions from new development such as SL1 instead of investing in upgrades to road capacity for vehicles.

Recommended Programme | Accelerated Staging and Performance

		YEARS 1 - 3	YEARS 3 - 10	YEARS 10 - 15	YEARS 15 – 20	YEARS 20 – 50+
Infrastructure and operations	PT Operations Span, frequency, vehicle type	Bus service 19 hour (12 hours peak) Peak: 15 min Off-peak: 20 min	Bus service+ priority 19 hour (12 hours peak) Peak: 10 min Off-peak: 15 min	BRT (RT1) 24 hour (19 hours peak) Peak: 5 min Off-peak: 15 min	BRT (RT1, RT2) 24 hour (19 hours peak) Peak: 5 min Off-peak: 15 min	BRT (RT1, 2, 3, 4) 24 hour (19 hours peak) Peak: 3 - 5 min Off-peak: 10 min
	Infrastructure Bus Priority BRT					
PT Performance	Patronage (AM peak/direction/hour) • Airport to Hamilton • Te Awa to Hamilton • Hamilton to Ruakura	-	930 650 1400	1450 1000 2150	1650 1150 2500	2250 1550 3350
	PT Travel Time (savings compared with general traffic) • Airport to Hamilton • Hamilton to Ruakura	23 min 19 min	22 min (-1 min) 10 min (-9 min)	22 min (-3 min) 10 min (-13 min)	22 min (-6 min) 10 min (-17 min)	22 min (-10 min) 10 min (-22 min)
	PT Reliability	Low	Medium	High	High	High
Micro-mobility	Micro-mobility network	Early implementation	10% of cycle network • Biking and micro-mobility 10 year programme • Develop city centre traffic circulation plan and low traffic neighbourhoods • Facilitate safe and easy active mode access to stations	40% of cycle network • Extend cross city connections to more peripheral centres and growth cells – Rotofuna, Dinsdale, Rotokauri, Peacocke and R2. • Begin to fill out network with build-out of cross city connections, community links and local links. • Improve Te Awa River Ride cycle path to Ngāruawāhia and Cambridge.	70% of cycle network • Active mode network in town centres and growth cells • Continue build-out of cross city connections, community links and local links	100% of cycle network • Complete build-out of cross city connections, community links and local links
Cost	Cost – CAPEX (per year)	146 million	138 million	162 million	62 million	5 million
	Existing LTP maintained (per year)	110 million	110 million	8 million	8 million	5 million
	Cost – OPEX (per year)	24 million	27 million	35 million	38 million	66 million

Figure 6

[4] Waikato Metro Spatial Plan Programme Business Case report. Revision D, Section 5.13
[5] Waikato Metro Spatial Plan Programme Business Case report. Revision D, Section 6.2.2
[6] Waikato Metro Spatial Plan Programme Business Case report. Revision D, Figure 6-9

6.2 Integration with Existing Public Transport in the Short Term.

Existing Public Transport services operate near each of the SL1 Blocks, as illustrated below:

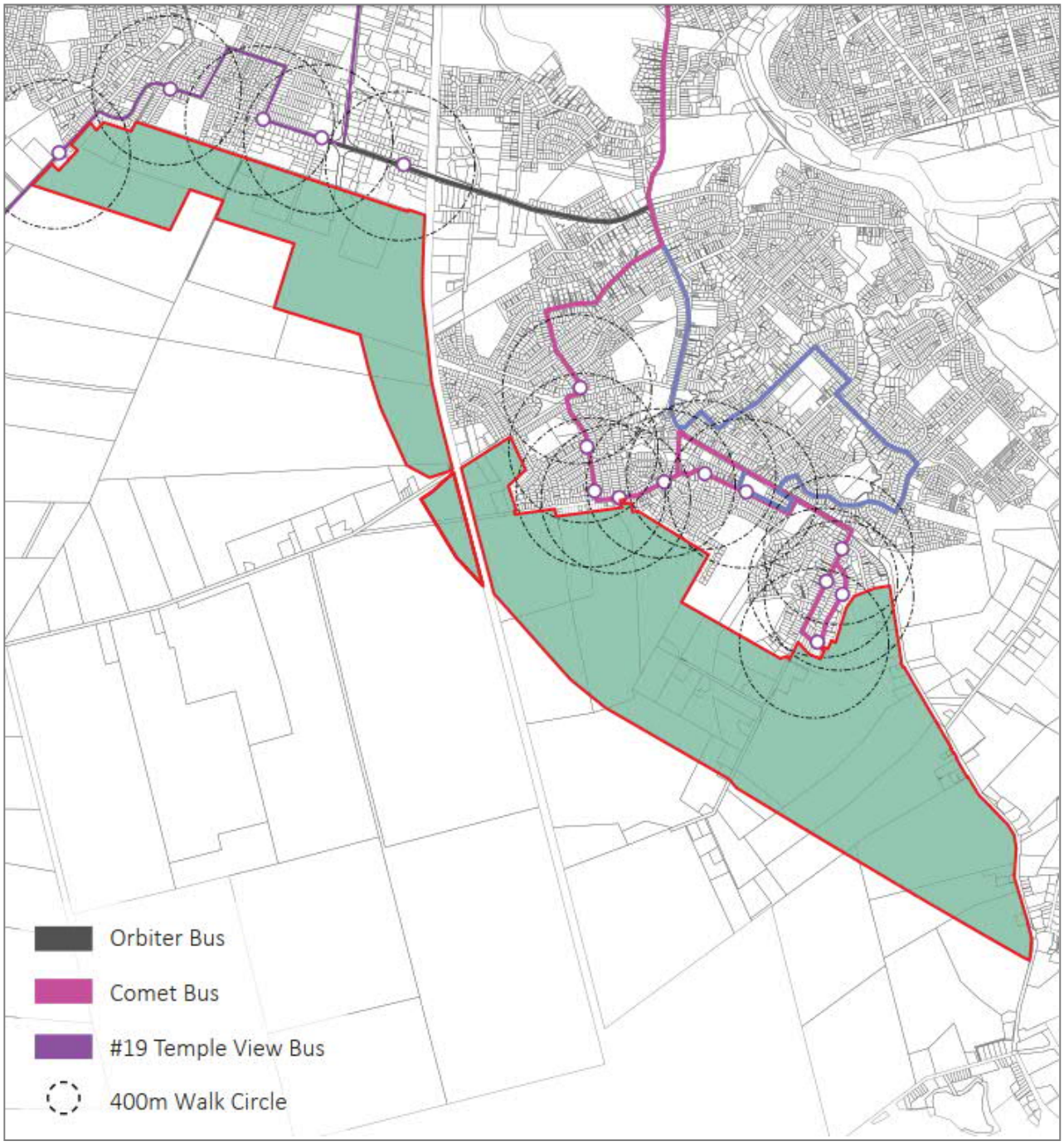

Figure 7

SL1 could be serviced by PT in the short term via the Commet Bus and first and last mile use of cycling or micro-mobility (e-scooters etc) to reach existing stops on Saxbys Road and Houchens Road.

There also appears to be potential to extend the existing PT services into SL1 as it develops. A possible PT network using the SL1 spine road with stop spacings of 400m is shown below in Figure 8.

Figure 8: Potential Integration of SL1 Public Transport

The following typical x-section illustrates how a 30m wide spine road through SL1 could operate as a Collector Road with bus lanes for PT and integration with active modes for first and last mile connectivity.

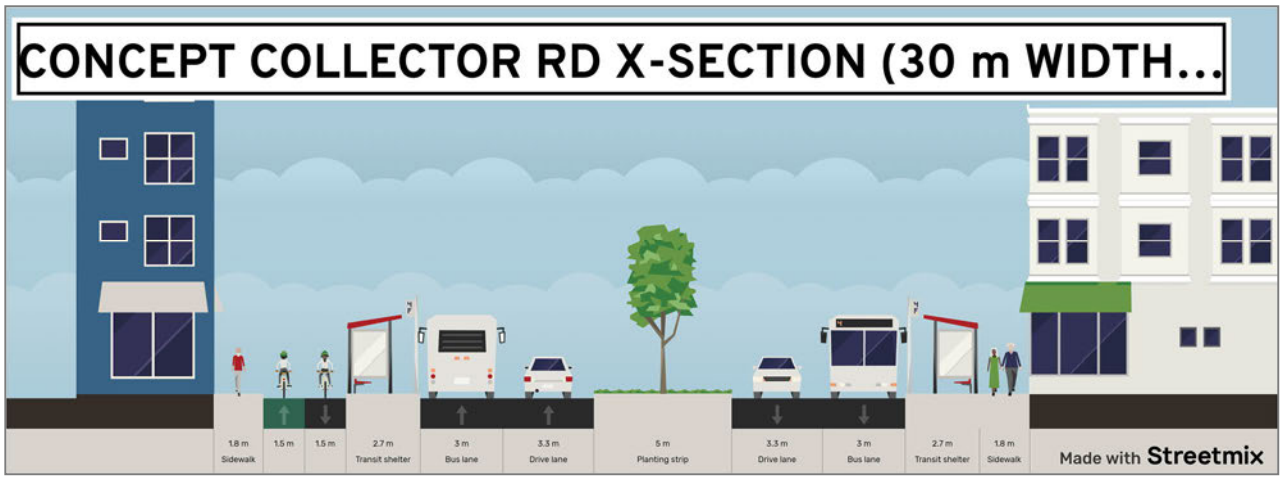

Figure 9

7. Walking and Cycling Network and Connectivity

SL1 is well situated for connecting to and extending the existing walking and cycling network in Hamilton.

The proposed spine road through SL1 provides an opportunity for a bi-directional cycle way path along the full length (Refer to Figure 8 x-section), connecting to the existing off-road shared walking and cycling path that starts in the CBD at Tristram Street and extends to Collins Road via the Western Rail Trail and Gallagher Drive.

Figure 10 shows an indicative walking and cycling network through SL1 taking advantage off-road paths wherever possible and connecting to the existing off-road shared walking and cycling paths and bike lanes.

Local Roads would like to be constructed to facilitate slow vehicle speeds and promote walking, e-scootering and cycling for short trips.

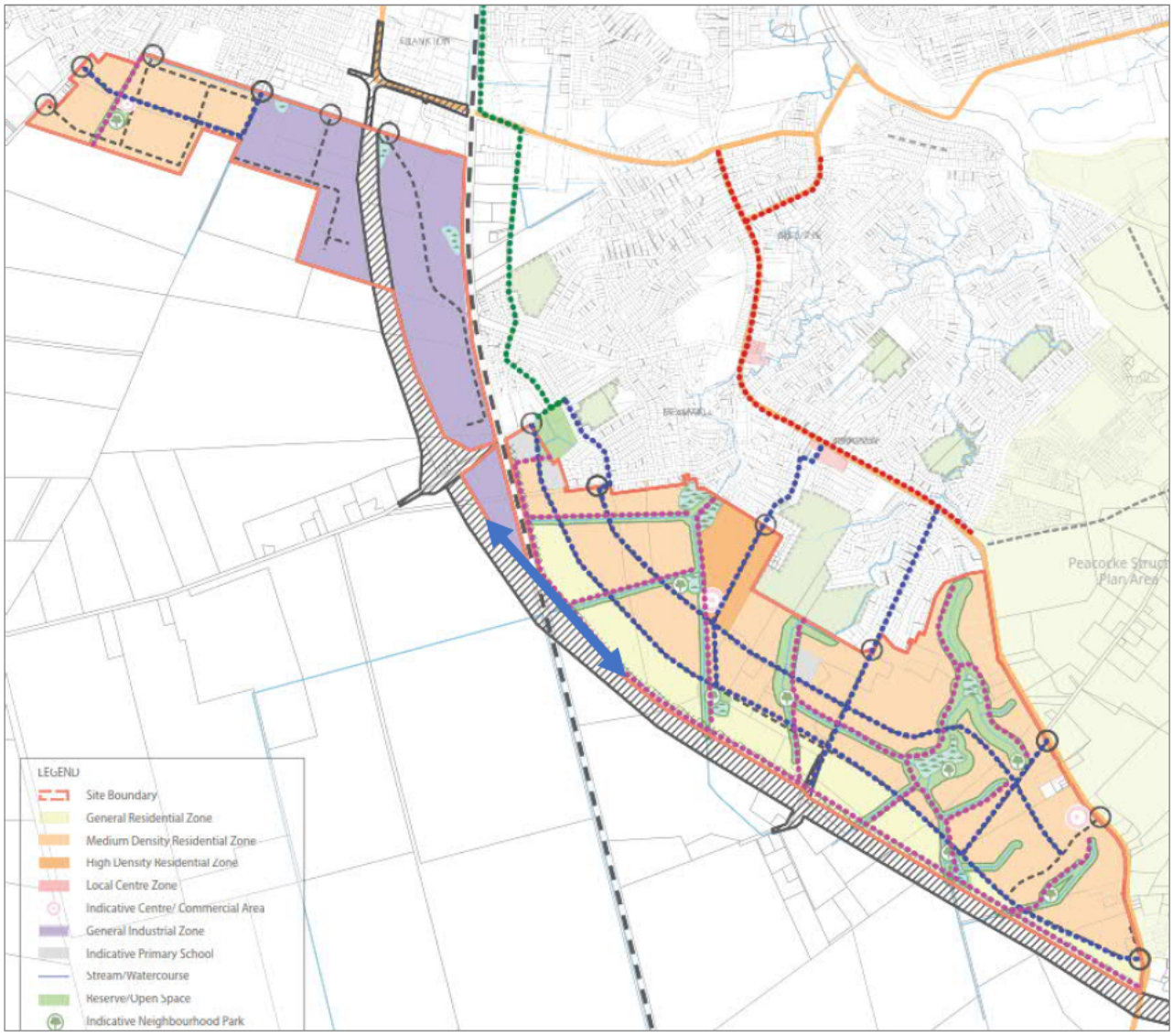

Figure 10: Potential SL1 Walking and Cycling Connectivity

The blue arrow in Figure 10 illustrates the potential to connect to a Walking and Cycling path alongside the HSL arterial to provide a safe grade-separated crossing for cycling and walking across the NIMTR.

8. Stage 1 Transport Infrastructure Assessment

High-level capacity assessments for SL1 Stage 1 have been carried out with baseline volume input from the WRTM developed in 2022 for the Northern Precinct Airport Business Zone plan change at Hamilton Airport. Two WRTM model versions were refined by BBO for that plan change; 2031 without HSL, and 2031 with HSL. These are the most accurate models currently available in terms of the future traffic volume predictions for Ohaupo Road as they take account of the latest Peacocke development land-use predictions and road infrastructure (currently under construction) and the zoned by not developed employment land around the airport. Both are committed developments that will add to the future traffic volumes at intersections on Ohaupo Road that carry traffic from the SL1 development.

2031 is 7 years from now, which generally aligns with the timeframe anticipated for developing the residential and industrial areas in SL1 Stage 1.

For clarification, no WRTM scenarios have been run with the proposed SL1 development. This will be undertaken as part of the detailed transport assessment if SL1 is accepted in the Fast Track consenting process.

8.1 Stage 1 Proposal

Figures 11 and Figure 12 illustrate the proposed Stage 1 residential and industrial development areas (South Block and North Block respectively) adjacent and accessible to existing Hamilton City road infrastructure.

Stage 1 Residential

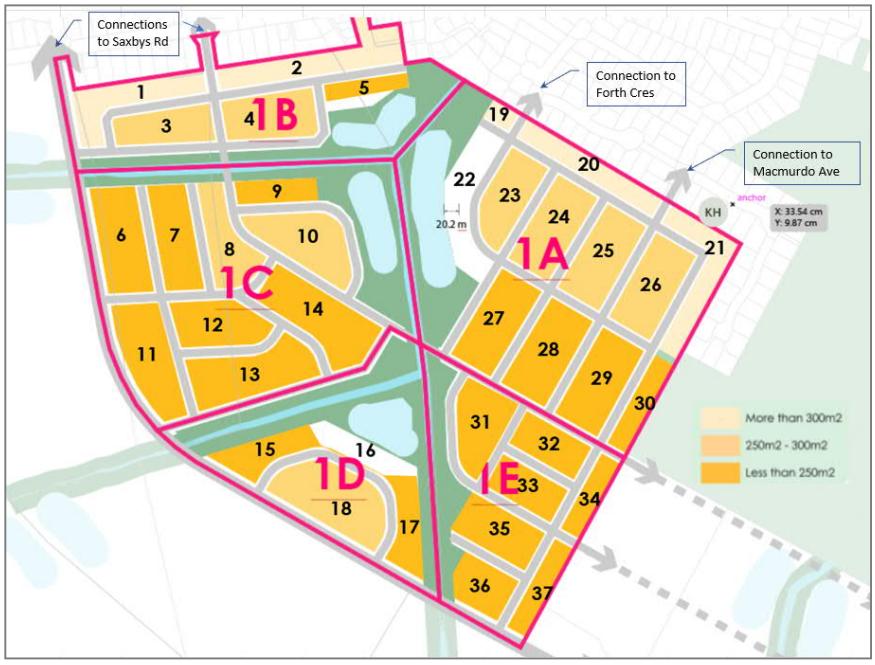

Figure 11: SL1 Stage 1 Residential

Indicatively, Stage 1 residential would be developed in the general order of the sub-stages 1A to 1E.

The concept plan incorporates a mix of medium residential densities with lot sizes ranging from 150 to 300 sq.m with 16.8 m wide residential streets consistent with the Peacocke Structure Plan residential roads. This results in the following residential yield figures and approximate volume of trips generated per peak hour (based 0.75 trips/ medium density dwelling).

Stage 1 Residential Sub-Stages	Number of Dwellings	Peak Hour Trip Generation
1A	310	233
1B	117	88
1C	330	248
1D	94	71
1E	180	135
Total	1031	775

Stage 1 Industrial

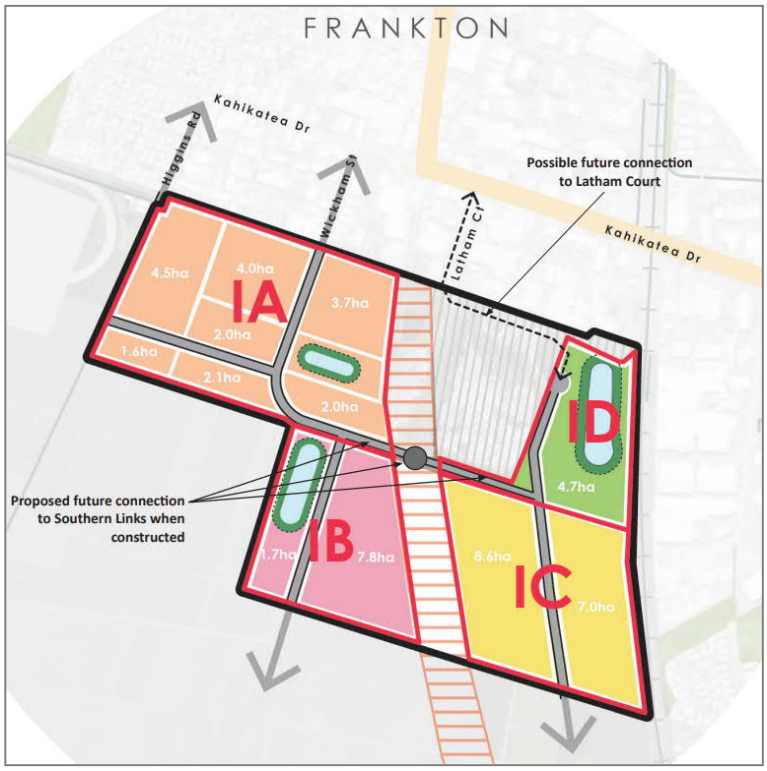

Figure 12: SL1 Stage 1 Industrial

Indicatively, Stage 1 industrial is expected to develop in the following order of sub-stages to align with necessary road and intersection infrastructure improvements. This results in the following approximate number of trips generated by industry per peak hour (based 20.8 trips/net hectare).

Stage 1 Industrial Sub-Stages	Net Developable Hectare	Peak Hour Trip Generation
IA	13.9	290
IB	11.8	245
ID	4.7	100
IC	15.6	325
Total	46.0	960

BBO calculated the Stage 1 vehicle trip component for the residential and industrial areas and manually assigned the trips to the respective adjacent road networks using a spreadsheet model and the 2031 WRTM (without HSL) baseline flows. SIDRA Intersection models were then developed to test the performance of the critical intersections and identify any potential infrastructure upgrades needed.

SIDRA Intersection modelling has been conducted to test the amount of Stage 1 residential and industrial development that could be accommodated on the existing road network with modest infrastructure upgrades (ie intersection upgrades but not Hamilton Southern Links arterial).

8.2 Stage 1 Residential Transport Effects and Infrastructure Requirements

As illustrated in Figure 11, Stage 1 Residential consists of five sub-stages accessing three existing roads: Saxbys Road, Forth Crescent and Macmurdo Avenue.

The location of stormwater tributaries and basins in Stage 1 influence the internal road pattern such that sub-stages 1A and 1E are likely to connect to the existing transport network via Macmurdo Avenue and Forth Crescent. These are residential streets that connect to/from Ohaupo Road via the intersection with Lambert Court. Sub-stages 1B, 1C and 1 D are expected to access the network via Saxbys Road and the Ohaupo Road/Saxbys Road roundabout.

As stated in Section 2, the primary network constraints on Ohaupo Road that impacts accessibility for the SL1 South Block are:

- Ohaupo Road / Collins Rd signal intersection
- Ohaupo Road / Saxby's Road roundabout
- Ohaupo Road / Lambert Court intersection
- Ohaupo / Houchens Road intersection.

Figure 13 illustrates these intersections in context with Stage 1 residential area and the five sub-stages.

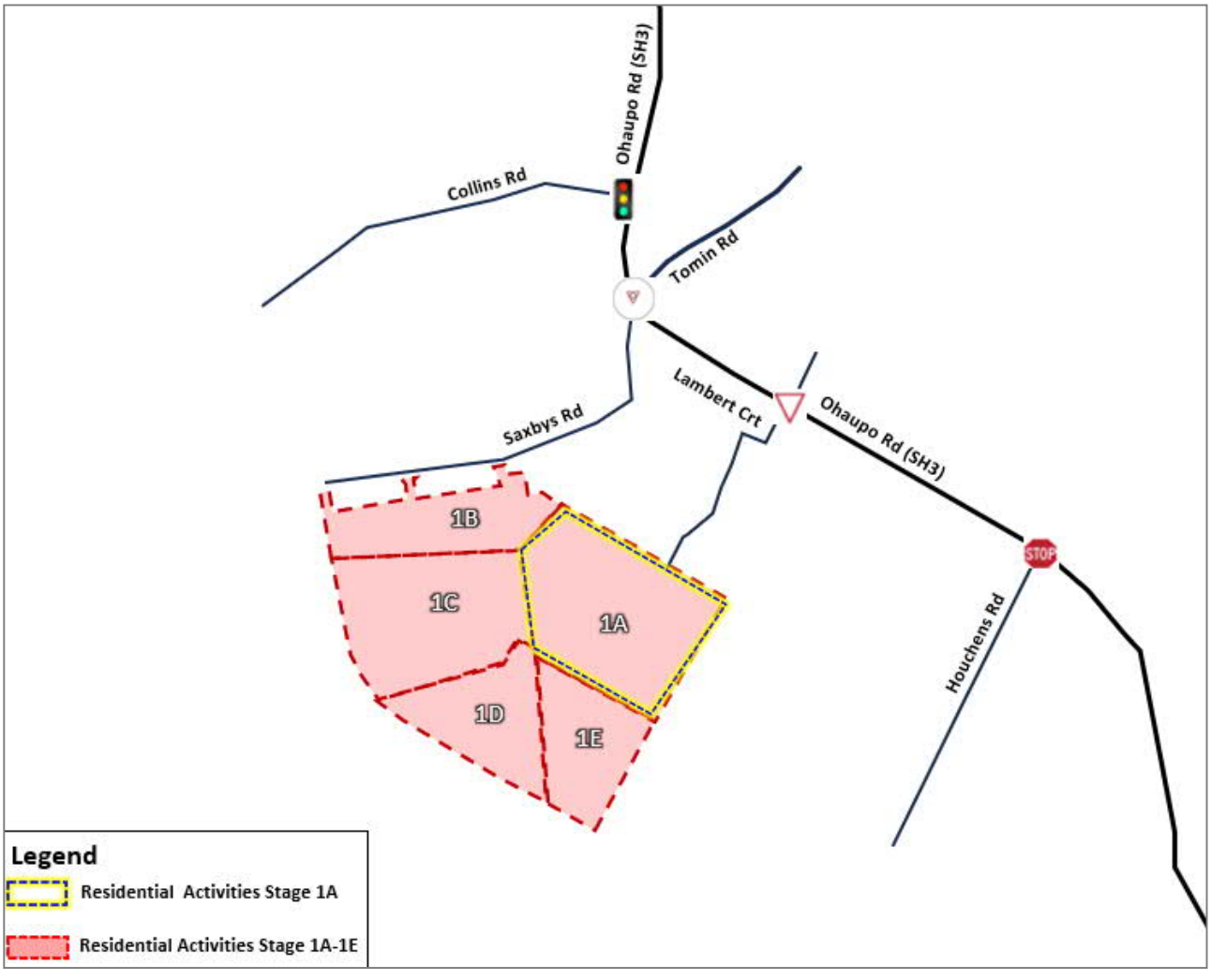

Figure 13: Stage 1 Residential and affected Ohaupo Road intersections.

Ohaupo Road / Lambert Court intersection

This is presently a four-arm priority-controlled junction as shown in Figure 14.

Figure 14: Existing Ohaupo Road / Lambert Court intersection

SIDRA modelling (Attachment 1) shows that by 2031 the intersection in its current form without any SL1 development traffic is expected to operate poorly (demand flow exceeds capacity) in the AM and PM peaks for the right turn out of Lambert Crt. High delays and long queues may lead to safety issues as drivers accept smaller gaps to cross / merge into Ohaupo Road traffic.

This shows the intersection will need to be upgraded before any Stage 1 traffic can be added to it. The form of upgrade is likely to involve signalising the intersection to enable future Bus priority to be added and signals also improve safety and connectivity for pedestrians and cyclists through the provision of at-grade signal crossings over Ohaupo Road.

Ohaupo Road / Houchens Road intersection

This intersection is south of Stage 1 area. Stage 1 traffic has no direct access to Houchens Road and only a small amount of Stage 1 traffic will pass through the intersection on Ohaupo Road. The intersection is presently a three-arm stop-controlled Tee junction as shown in Figure 15. It is expected that an upgrade of this intersection to a signalised form will be triggered when Stage 2 of SL1 accesses direct to Houchens Road.

Figure 15: Existing Ohaupo Road / Houchens Road intersection

Ohaupo Road / Saxbys Road roundabout

This is presently a four-arm roundabout as shown in Figure 16.

Figure 16: Existing Ohaupo Road / Saxbys Road Roundabout

SIDRA modelling in Attachment 1 shows that by 2031, the intersection in its current form without any SL1 development traffic is expected to operate well with an overall LoS A in the AM and PM peaks. The single worst movement operates at LoS D (southbound Ohaupo Road right turn).

Ohaupo Road / Collins Road Intersection

This is presently a three-arm signalised intersection as shown in Figure 17.

Figure 17: Existing Ohaupo Road / Collins Road Signal Intersection

SIDRA model results for 2031 show that the intersection in its current form without any SL1 development traffic is expected to operate satisfactorily at an overall LoS C in the AM and PM peaks.

Sub-stage 1A is expected to be the first residential development, yielding approximately 310 dwellings and generating 230 trips/peak hour for which 67% (155 trips/hour) are assumed to be private vehicle trips[7]. This reflects greater PT mode-share (10%) and active mode share (6.2%) by 2031, which we consider to be supported by the SL1 development as a comprehensive medium-density, low car-dependency design.

Sub-stage 1A accesses Ohaupo Road through Macmurdo Avenue, Forth Crescent and Lambert Court. It is recommended as part of the development work that upgrades to these streets are undertaken to improve the connectivity and attractiveness for walking and cycling from sub-stage 1A to Glenview shopping precinct and the recently completed bus stops on Ohaupo Road.

Vehicle traffic generated by sub-stage 1A is expected to favour a northerly distribution to/from Hamilton via Ohaupo Road, and a lesser volume south via Ohaupo Road toward the Airport and its employment hub and Te Awamutu. As mentioned above, the intersection of Ohaupo Road / Lambert court requires upgrading to a signalised intersection to accommodate any new traffic from SL1.

The following Table 1 summarises the performance of the key intersections for the 2031 Baseline (no Stage 1 development) and the 2031 Baseline + Stage 1A residential scenarios.

Table No: 1

SL1 Residential - Intersection Performance Comparison: Baseline vs Baseline + Sub-stage 1A						
Intersection Name	AM Peak Hour			PM Peak Hour		
	Av. Delay (s/veh)	95th percentile Queue (m)	LOS	Av. Delay (s/veh)	95th percentile Queue (m)	LOS
2031 Baseline (without SL1 residential development traffic)						
Ohaupo Rd / Collins Rd	23.3	183	C	21.0	192	C
Ohaupo Rd / Saxbys Rd / Tomin Rd	5.8	54	A	6.1	160	A
Ohaupo Rd / Lambert Crt / Access Rd (Existing intersection form)	>80	389	F	53.7	220	F
2031 Baseline + Sub-Stage 1A residential development traffic						
Ohaupo Rd / Collins Rd	48.7	308	D	64.2	>400	E
Ohaupo Rd / Saxbys Rd / Tomin Rd	5.9	58.9	A	6.5	182	A
Ohaupo Rd / Lambert Crt /Access Rd (Traffic Signals)	23.2	166	C	22.9	220	C

The above results comparison demonstrates:

- Collins Road signal intersection performance deteriorates from LoS C to LoS D in the AM and LoS E in the PM. Queues on Ohaupo Road also significantly increase, beyond 400m in length.

[7] Refer to Appendix A for Stage 1 mode split explanations and assumptions.

- Saxbys Road roundabout is expected to continue operating at a high level of service with Stage 1A traffic added via Ohaupo Road approaches. No improvement work is needed for effects mitigation.
- Lambert Crt intersection signal upgrade provides a significant performance improvement over the 2031 baseline conditions (LoS F to LoS C). The resulting queues on Ohaupo Road remain long but are less than the baseline queue length in the AM peak. Delays are significantly reduced.

Figure 18 shows the concept signal intersection upgrade required at the Ohaupo Road / Lambert Crt intersection to accommodate Stage 1A traffic.

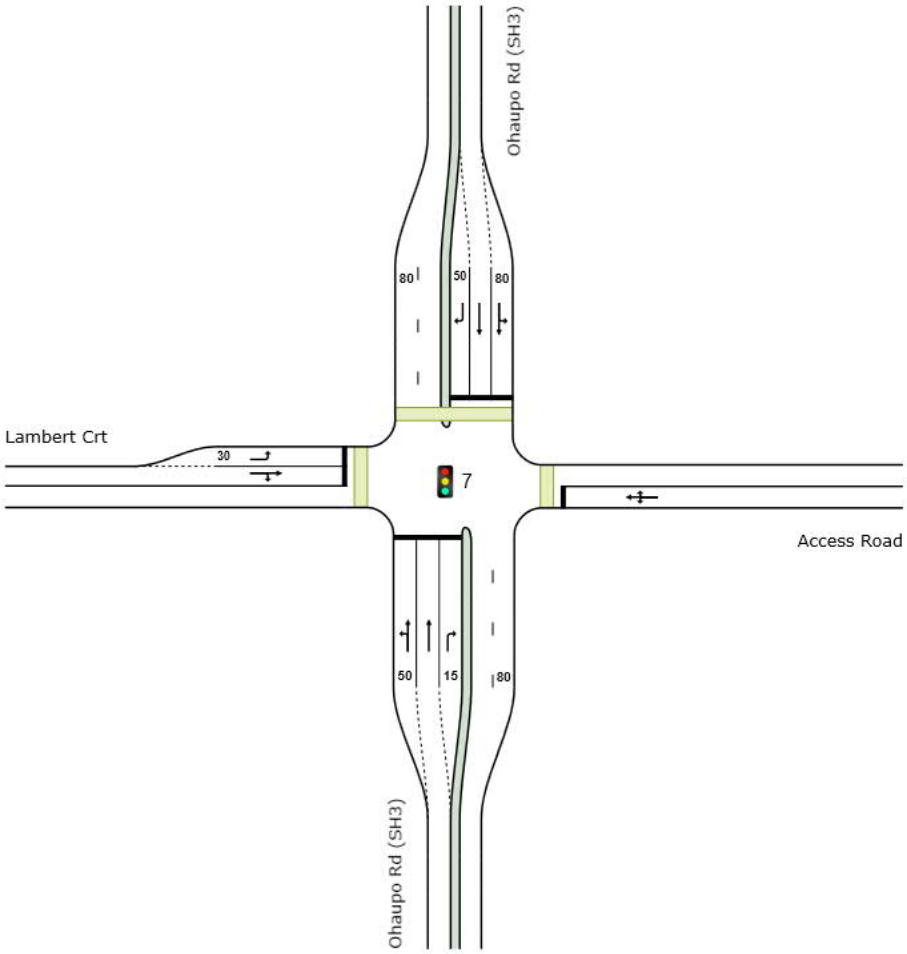

Figure 18: Ohaupo Road / Lambert Court / Access Lane Concept Intersection Upgrade.

The deterioration in performance for the Ohaupo Rd / Collins Road intersection indicates the need to improve capacity to accommodate Stage 1A traffic. However, increasing the intersection's capacity is not straight-forward due to the highly constrained road reserve width preventing the addition of new lanes through the intersection (refer to Figure 17).

Furthermore, Ohaupo Road is already a four-lane divided carriageway through the intersection and includes a fifth lane on the north side of the intersection for a dedicated right turn into Collins Road. The constrained width also makes the addition of bus lanes challenging to improve public transport accessibility unless a general traffic lane in each direction is taken solely for buses. This would cause unsustainable congestion on the network. Similarly, the width of Collins Road near the intersection is also constrained making it difficult to improve public transport or improve walking and cycling facilities without requiring private land.

For these reasons, it is proposed instead that the development of SL1 addresses its transport effects at the Ohaupo Road / Collins Road intersection through financial contribution and/or infrastructure improvements

that advance the viability and timing of the future RT4 line identified in the MSP to serve Glenview West. The viability and timing of the RT4 network through Glenview is vital for enabling the overall development of SL1.

Further to the above Stage 1A assessment, we have conducted further intersection modelling for the total Stage 1 residential area (ie Sub-stages 1A – 1E inclusive) to identify any likely additional impacts on the key Ohaupo Road intersections. As noted previously, sub-stages 1B, 1C and 1 D are assumed to access the network via Saxbys Road and the Ohaupo Road/Saxbys Road roundabout while 1A and 1E access via Ohaupo Road/Lambert Court upgraded intersection.

Table 2 compares the performance results of the three intersections with sub-stage 1A traffic and the completed Stage 1 development traffic. Attachment 1 contains the detailed trip generation, and mode split calculations together with the detailed SIDRA modelling results.

The performance results for the Ohaupo Road / Saxbys Road roundabout identified the need for a further infrastructure improvement involving extension of the dual southbound exit lanes on Ohaupo Road, from the roundabout to Ohaupo Road / Lambert Court intersection; a distance of 385 m.

Table No: 2

SL1 Residential - Intersection Performance Comparison: Baseline + Sub-Stage 1A v Total Stage 1						
Intersection	AM Peak Hour			PM Peak Hour		
	Av. Delay (s/veh)	95th percentile Queue (m)	LOS	Av. Delay (s/veh)	95th percentile Queue (m)	LOS
2031 Baseline + Sub-Stage 1A residential development traffic						
Ohaupo Rd / Collins Rd	47.1	297	D	63	416	E
Ohaupo Rd / Saxbys Rd / Tomin Rd	5.9	57	A	6.4	175	A
Ohaupo Rd / Lambert Court /Access Rd (Traffic Signal)	23.2	166	C	22.9	219	C
2031 Baseline + Stage 1 (sub-stages 1A,1B,1C,1D,1E) residential development traffic						
Ohaupo / Collins Rd	>80.0	>400	F	>80.0	>400	F
Ohaupo / Saxbys Rd / Tomin Rd	7.8	87.3	A	57.2	>400	E
Ohaupo / Saxbys Rd / Tomin Rd (Added southbound exit lane to Lambert Court intersection)	7.8	87.3	A	25.7	244	C
Ohaupo / Lambert Court /Access Rd (Traffic Signals)	26.6	188	C	25.7	244	C

These results demonstrate:

- The Saxbys Road roundabout can function well with all Stage 1 residential traffic added provided the Ohaupo Road southbound dual exit lanes are extended 385m to the Lambert Crt signal intersection.
- Collins Road signal intersection performance deteriorates further as expected. Ongoing investment in public transport is the appropriate response to improve the "people per hour" throughput capacity instead of vehicles per hour.
- Lambert Crt intersection signal upgrade with Stage 1 traffic continues to perform better than the 2031 baseline intersection due to the signal upgrade. The resulting queues on Ohaupo Road are only 20m, or three car lengths (approximately) longer than the Stage 1A queues.

Figure 19 illustrates the required extension of the Ohaupo Road dual exit lanes from the Saxbys Rd roundabout.

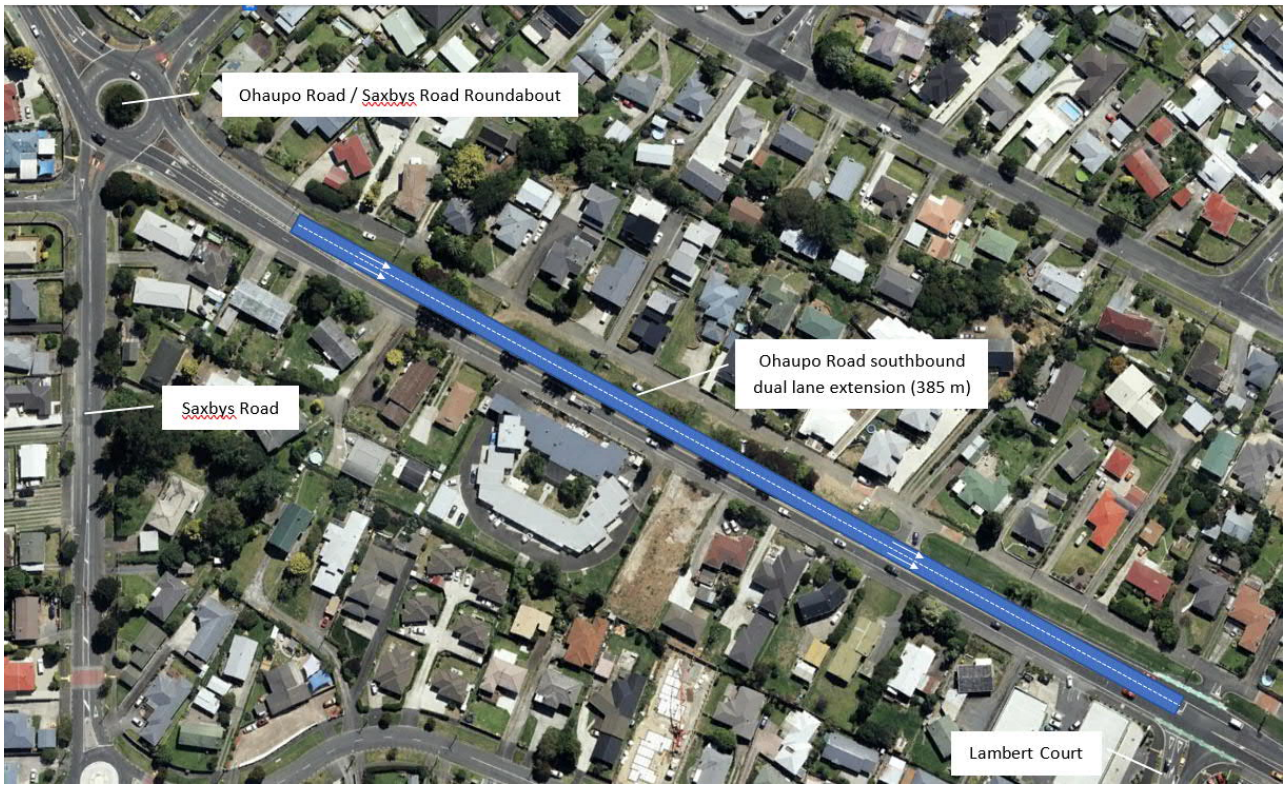

Figure 19: Ohaupo Road Southbound Dual Lane Upgrade Location and Extent

8.3 Stage 1 Industrial Transport Effects and Infrastructure Requirements

As illustrated in Figure 12, Stage 1 Industrial consists of four sub-stages accessing two existing roads; Higgins Road and Wickham Street, and one future road; the HSL arterial.

The location of the HSL designation and the uncertainty around construction timing means sub-stages IA and 1B will be developed before IC and ID, as a connection to the existing transport network via Wickham Street and Higgins Road is possible.

Sub-stages IC and ID are severed from IA and IB by the HSL designation. Access to these areas is proposed via a direct connection to HSL, which is supported by HCC but not confirmed by NZTA at this time. An interim connection across the designation is also proposed in the period before HSL is constructed, which NZTA's agreement is also required. Without these two approvals from NZTA areas IC and ID are effectively land-locked as a road connection through to Latham Court requires third party land. We understand HCC is not in favour of this alternative access option either due to safety concerns at the intersection of Latham Court / Kahikatea Drive.

Kahikatea Drive / Greenwood Street intersection is the primary network constraint that is critical for access to the Stage 1 Industrial area, so is the focus of the study herein.

While two other intersections (Higgins Road/Kahikatea Drive and Wickham Street/Kahikatea Drive) will also be predominant access points for Stage 1 traffic, the SIDRA modelling results for these two intersections (in Attachment 1) show no adverse effects are expected at either intersection with all of Stage 1 industrial traffic added.

Figure 20 illustrates the three intersections and the network context adjacent to the Stage 1 Industrial area.

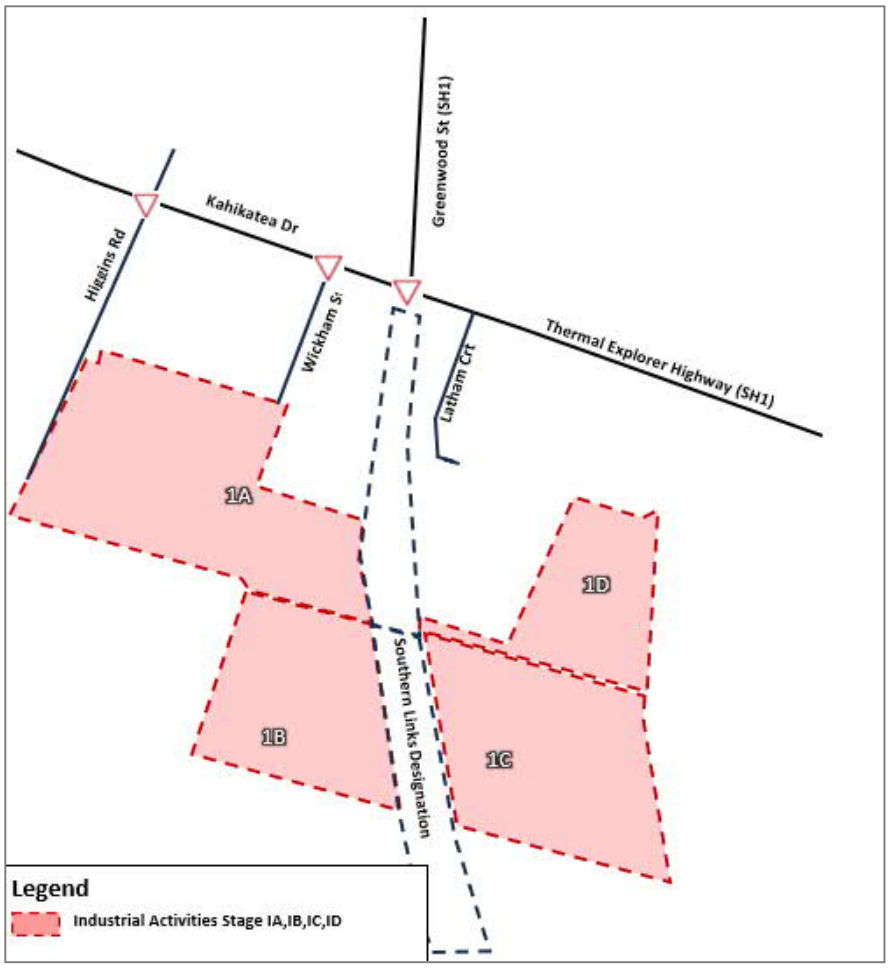

Figure 20: Stage 1 Industrial – Existing Road Network Context.

Kahikatea Drive / Greenwood Street intersection

This intersection is presently a three-arm priority-controlled junction as shown in Figure 21.

Figure 21: Existing Kahikatea Drive / Greenwood Street Intersection.

SIDRA model results for the 2031 baseline (refer to Table 3 below, and further details in Attachment 1) show that the existing intersection operates very poorly for the right turn out of Kahikatea Drive west, with long delays corresponding to LoS F in the AM and PM peaks. Note, this is without any Stage 1 industrial traffic added.

Long delays are already observed daily for this movement in the AM and PM peak periods. Adding more traffic to the intersection only raises the safety risk for all road users as drivers feel pressure to accept small and unsuitable gaps to cross or merge into the main opposing traffic flow on Kahikatea Drive. Drivers on the main road alignment also feel they should let side-road traffic in, which causes flow breakdown on Kahikatea Drive and increases the risk of nose-tail crashes.

This demonstrates that the Kahikatea Drive / Greenwood Street intersection requires a capacity and safety upgrade before any further traffic can be safely added to it.

The HSL project involves upgrading this intersection to a four-arm dual circulating lane roundabout in future, to connect the new arterial to Greenwood Street and Kahikatea Drive.

Ideally, the form of intersection upgrade to support SL1 Stage 1 industrial development should be consistent with the ultimate HSL roundabout form, to avoid significant sacrificial infrastructure costs in future. A similar form of intersection for the interim period may also facilitate a potential cost-share arrangement with NZTA for the intersection before the HSL arterial is constructed. Therefore, we recommend the intersection is upgraded to a three-arm roundabout that the Southern Links project can upgrade as needed for connecting the HSL arterial as the fourth arm.

Figure 22 illustrates the recommended roundabout layout to support Stage 1 Industrial development.

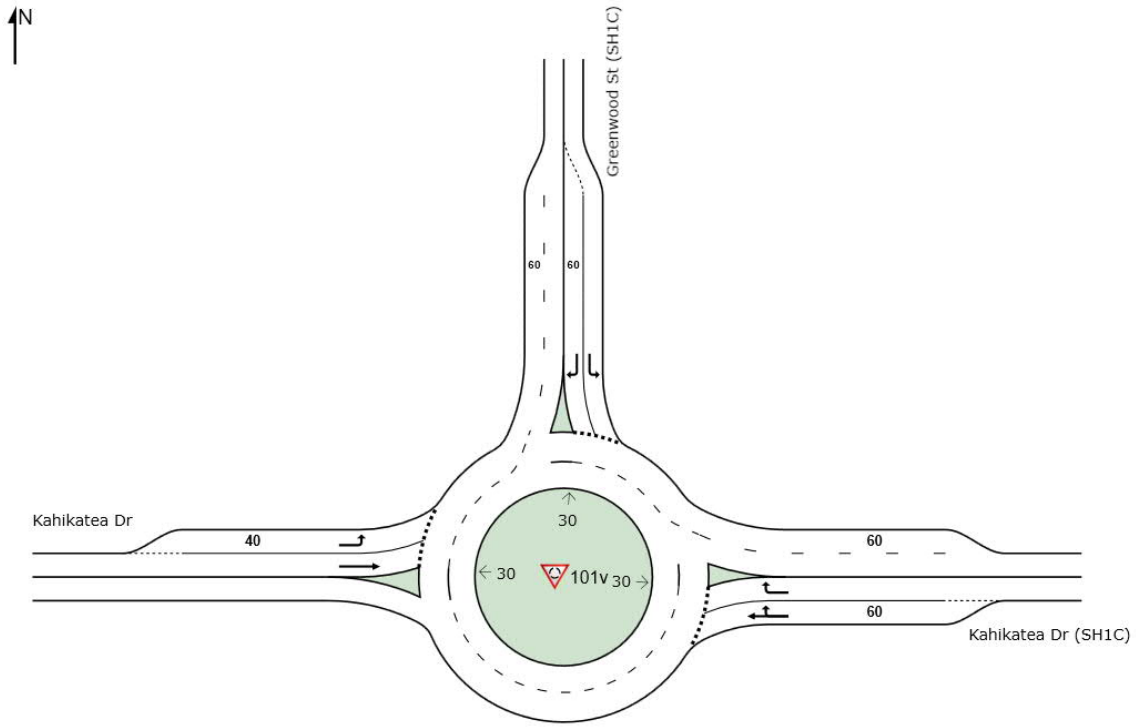

Figure 22: Kahikatea Drive / Greenwood Street Roundabout Upgrade.

The performance of the three-arm roundabout proposal has been tested on the basis that all Stage 1 industrial traffic (sub-stages IA-IE) accesses through it. This is a worst-case scenario and assumes that NZTA will allow a link road to be built across the HSL designation as an interim local road connection before HSL is constructed to enable sub-stages IC and ID access via Higgins Road and Wickham Street. Figure 23 illustrates.

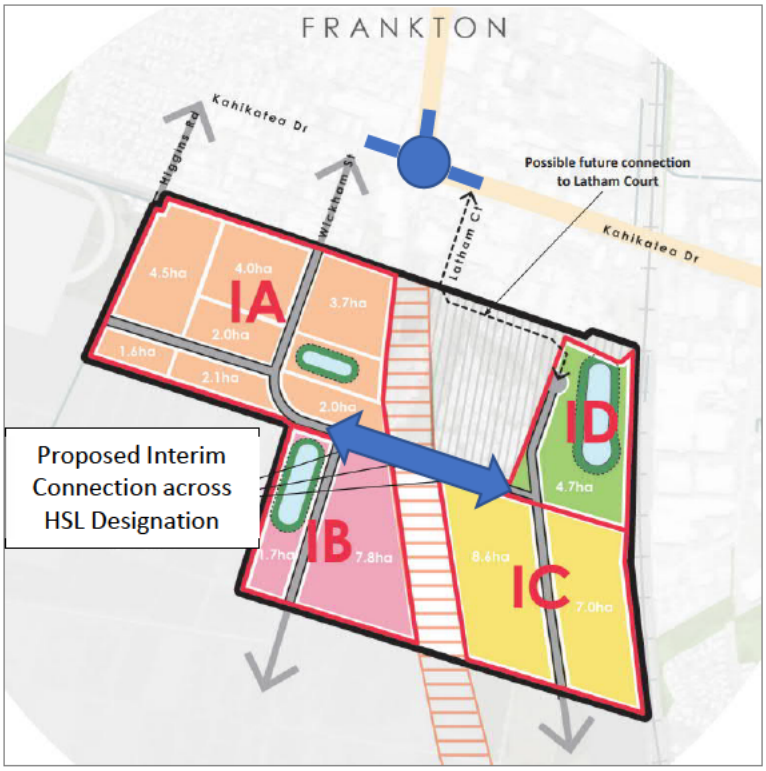

Figure 23: Stage 1 Industrial – Proposed Interim Internal Road across HSL Designation

The combined sub-stages IA - IE yield approximately 46 ha of net developable industrial land and is expected to generate approximately 640 vehicle trips/peak hour[8] in 2031.

Peak hour vehicle trips were manually assigned to Higgins Road and Wickham Street 2031 baseline volumes (using a similar spreadsheet model to Stage 1 residential) based on a 15%:85% split respectively, that reflects the indicative internal road layout and the areas of land convenient to both access points. Traffic then distributes to Kahikatea Drive and the wider road network in accordance with the 2031 WRTM baseline traffic distribution patterns.

Table 3 compares the performance results for the Kahikatea Drive/Greenwood Street intersection for the 2031 Baseline (no Stage 1 industry) and the 2031 Baseline + Stage 1 industry scenarios.

Attachment 1 contains further detailed SIDRA model results.

Table No: 3

SL1 Industrial - Intersection Performance Comparison: Baseline vs Baseline + Stage 1						
Intersection	AM Peak Hour			PM Peak Hour		
	Av Delay (s/veh)	95th percentile Queue (m)	LOS	Av Delay (s/veh)	95th percentile Queue (m)	LOS
2031 Baseline (without SL1 Industrial development traffic)						
Higgins Rd /Kahikatea Dr	3.9	5.3	A	4.2	7.4	A
Wickham St /Kahikatea Dr	1.3	0.7	A	1.9	2.5	A

[8] Refer to Attachment A for Stage 1 trip generation and mode split assumptions.

SL1 Industrial - Intersection Performance Comparison: Baseline vs Baseline + Stage 1						
Intersection	AM Peak Hour			PM Peak Hour		
	Av Delay (s/veh)	95th percentile Queue (m)	LOS	Av Delay (s/veh)	95th percentile Queue (m)	LOS
Greenwood St /Kahikatea Dr (existing intersection format)	>80	152	F	>80.0	>400	F
2031 Baseline + Sub-Stage IA, IB Industrial development traffic						
Higgins Rd /Kahikatea Dr	4.0	7.0	A	4.3	8.3	A
Wickham St /Kahikatea Dr	3.2	3.8	A	3.3	7.6	A
Greenwood St /Kahikatea Dr (3-arm Roundabout)	5.8	48.2	A	6.9	64.5	A
2031 Baseline + Stage 1 (sub-stages IA, IB, IC, ID) Industrial development traffic						
Higgins Rd /Kahikatea Dr	4.0	8.8	A	4.3	9.2	A
Wickham St /Kahikatea Dr	4.5	8.3	A	6.3	41.7	A
Greenwood St /Kahikatea Dr (3-arm Roundabout)	7.6	78.8	A	8.9	105	A

The modelling results demonstrate:

- The Higgins Rd /Kahikatea Dr intersection and Wickham St /Kahikatea Dr intersection will continue to operate well, at LoS A, with the full Stage 1 Industrial traffic accessing through these two intersections.
- The Greenwood St/Kahikatea Dr intersection functions very well, at LoS A with Stage 1 Industrial traffic and the intersection upgraded to a three-arm roundabout in accordance with the design in Figure 22.
- No further infrastructure improvements are required to support the development of Stage 1 industrial.

9. SL1 Transport Infrastructure and Timing Summary

The following transport infrastructure improvements have been identified to support the development of SL1 Stage 1 residential and industrial components.

Stage 1 Residential			
#	Infrastructure Timing	Infrastructure Item	Infrastructure Requirement
1	Before Sub-Stage 1A traffic adds to Ohaupo Rd	Ohaupo / Collins Rd intersection	Financial contribution to Public Transport serving Glenview and Deanwell. (Contribution equivalent to providing suitable capacity for sub-stage 1A at the intersection if physical capacity increases were possible)
		Ohaupo Road / Lambert Court intersection	Upgrade existing priority-controlled intersection to a 4-arm signalised intersection.
		Macmurdo Ave, MacDonald Road and Lambert Court	Upgrade Macmurdo Ave, MacDonald Road and Lambert Court to include an off-street bi-directional cycle path and safer pedestrian crossing facilities for SL1 residents to access Glenview retail precinct.
2	Before Sub-stages 1B, 1C or 1D traffic accesses Saxbys Road	Ohaupo Road	Widen and extend Ohaupo Road southbound dual exit lanes from Saxbys Rd roundabout approximately 385 m to the signalised Ohaupo Road / Lambert Court intersection.
		Ohaupo / Collins Rd intersection	Further financial contribution to Public Transport serving Glenview and Deanwell. (Contribution equivalent to providing suitable capacity for sub-stages 1B-1E at the intersection if physical capacity increases were possible)
		Saxbys Road	Upgrade Saxbys Road to Collector Road standard, rationalising roadside parking and providing an off-street bi-directional cycle path connecting to Ohaupo Road cycling facilities and the Spine Road bi-directional cycle path.
Stage 1 Industrial			
3	Before any Industrial traffic adds to Higgins Road, Wickham Street or Kahikatea Drive	Kahikatea Drive / Greenwood St intersection	Upgrade the existing intersection to a 3-arm dual circulating lane roundabout, including provision for safe walking and cycling connectivity.

The following additional transport infrastructure improvements are likely to be necessary to support further development of SL1 residential and industrial areas beyond Stage 1.

Future Residential Stages			
A	Before any further residential stages in the South Block add traffic to Ohaupo Road	Saxbys / Ohaupo roundabout	Replace roundabout with a 4-arm signalised intersection with satisfactory traffic capacity, safe walking and cycling facilities and bus-priority measures included.
		Houchens Rd / Ohaupo Road	Upgrade to a signalised intersection.
		Ohaupo Road	Widen Ohaupo Road to 4 lanes between Saxbys Road and Whatukooruru Drive roundabout. Consider allocating widened area to bus lanes and bus priority at intersection should be investigated and discussed with HCC and WRC. Include an off-street bi-directional cycle path in the berm.
		Houchens Road	Upgrade Houchens Road to a Collector Road, rationalising street-side parking and providing an off-street bi-directional cycle path connecting to Ohaupo Road cycling facilities.
		SL1 spine road	Requires completion of relevant stages of the spine road to connect development stages to either Saxbys Road or Houchens Road (the Collector Roads).
		RTN4 Public Transport	Investment in RTN4 infrastructure to increase patronage toward 30% mode share in 20 years peak periods.
		Southern Links	Southern Links western corridor to provide capacity relief on Ohaupo Road.
		Connection to Southern Links	Collector Rd connection from Houchens Road to Southern Links including roundabout intersection on Southern Links
B	Before Residential Stages 3A or 3B generate traffic	Tuhikaramea Road	Upgrade the Tuhikaramea Road intersections with Kahikatea Drive and Gibson Road to a pair of co-ordinated signalised intersections, with bus priority and walking and cycling infrastructure.
Future Industrial Stages			
C	For Stage F1	Southern Links	New roundabout intersection on Southern Links arterial

10. Conclusion

SL1 Stage 1 yield of up to 1100 new dwellings and 46 net hectare of Industrial land is a significant development undertaking requiring some transport infrastructure upgrades and contributions to future public transport (the Rapid Transit Network) to support it.

The comprehensive design of the medium density residential development proposed in Stage 1 will contribute positively toward greater use of public transport for commuter trips, and walking and cycling provided meaningful investment in infrastructure for these non-car modes is part of any consent for Stage 1.

Further SL1 development stages beyond Stage 1 will require a significant uptake of alternative travel modes for transport to be sustainable. SL1 is perfectly positioned for future residents to access the proposed Rapid Transit Network identified in the Waikato Metro Spatial Plan. It is not unrealistic to expect 30% PT mode share achieved by residents in SL1 in 20 years' time if high quality, connected and frequent PT infrastructure exists alongside the housing density as proposed in SL1.

In addition, significant investment in walking and cycling path infrastructure is needed to support medium and high-density living to make it easy for day-to-day errands to be undertaken without a car. The density proposed for SL1 residential will yield around 8,700 new dwellings making it impractical to provide space for two car parks or garaging for every household. Therefore, easy access to high quality, safe and connected walking, cycling paths and public transport are critical components for sustainable transport for the SL1 growth area.

Bloxam Burnett & Olliver

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Attachment A – Trip Generation and Modelling report

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Memo

To	Cameron Inder
From	Thato Mariti
Date	1 May 2024
Job No.	148440.01
Job name	SL1 Fast Track Application
Subject	**SL1 – Stage 1 Development Trip Generation and Infrastructure Assessment**

1. Trip Generation – Residential Activities

The predicted trip generation for the proposed residential dwelling units has been estimated using the trip rate data provided in the following widely adopted trip generation manuals and related publications and shown in Table No: 1 **Error! Reference source not found.**below:

- NZ Transport Agency research report 453: Trips and parking related to land use (November 2011);
- RTA Guide to Traffic Generating Developments (Version 2.2, October 2002), and
- Institute of Transportation Engineers (ITE) Trip Generation Manual (7th Edition)

Table No: 1

Trip Generation Rate - Published Data					
Land Use Activity		Published Trip Rate Data			
Residential Dwelling	Code	Land Use Categories	Daily	Peak Hour	Directional Distribution In/Out (%) - ITE Manual
NZ Transport Agency research report 453	7.2.1	Inner Suburban	9.5 per dwelling unit	1.1per dwelling unit	-
RTA Guide	3.3.1	Dwelling Houses	9.0 per dwelling unit	0.85 per dwelling	-
RTA Guide	Table 3.7	Medium Density	6.5 per dwelling unit	0.65 per dwelling	-
ITE Trip Manual	210	Single Detached housing	9.57 per dwelling unit	AM: 0.77 per dwelling PM: 1.02 per dwelling	*Weekday: 50%/50%* *AM: 26%/76%* *PM:64%/36%*
ITE Trip Manual	231	Single Detached housing	-	AM: 0.54 per dwelling PM: 0.52 per dwelling	*AM: 18%/82%* *PM:55%/45%*

Table No: 1 above provides a summary of the predicted trip generation for the proposed indoor entertainment land use based on trip data for typical activities associated with the proposed residential land use. Trip generation rates for single dwelling units and medium density residential land use could be found in the RR453, RTA Guide and ITE manuals. The land use activities are described as follows in the respective manuals:

- ***R453*** *Inner Suburban average rates*
- ***RTA Medium Density*** *are a medium density residential flat building is a building containing at least 2 but less than 20 dwellings. This includes villas, town houses, flats, semi-detached houses, terrace or row houses and other medium density developments. This does not include aged or disabled persons' housing.*
- ***RTA Dwelling House*** *rates are based on surveys conducted in areas where new residential subdivisions are being built. Public transport accessibility in such areas is often limited. Traffic generation rates in inner metropolitan areas where public transport is more accessible could be lower.*
- ***ITE Single Family Detached Housing (210)*** *includes all single family detached homes on individual lots.*
- ***ITE Single Family Detached Housing (231)*** *are low rise residential condominiums/townhouse are units located in buildings that have one to two levels (floors).*

The RTA medium density and dwelling houses were considered more applicable to the proposed residential development. However, the dwelling houses were considered high as the area is well provided for in terms of public transport active modes infrastructure. Therefore, an average rate between the medium density and dwelling house trip rates were considered more applicable to the subject site.

Thus, a daily trip generation rate of 7.75/dwelling, and peak hour trip rate of 0.75/dwelling were considered appropriate for this assessment.

1.1 Trip Generation – Residential Activities (Sub-stages 1A to 1E)

Table No: 2 provides the estimated trip generation for stage 1A and stage 1A to stage 1E on the site, based on the adopted daily and peak hour trip rate figures provided in **Error! Reference source not found.** above.

Table No: 2

Expected Trip Generation						
Stage	Land Use Activity	Estimated Yield	Trip Rate		Estimated Trip Generation	
			Daily Rate	Peak Hour Rate	Daily Trips	Peak Hour Trips
Sub-stage 1A	Residential dwellings	310 dwelling units	7.75 trips/ dwelling	0.75 trips/ dwelling	**2,403**	**233**
Total Stage 1 (1A,1B,1C,1D,1E)	Residential dwellings	1,100 dwelling units	7.75 trips/ dwelling	0.75 trips/ dwelling	**8,525**	**825**

1.2 Estimated Travel Mode Share

According to 2018 census data on the Stats NZ website:

- Approximately 3.0% of residents in (Glenview which adjacent to the site) statistical area use public transport (bus) to travel to work, 3% either walk or jog and 3.2% cycle to work,
- Approximately 64% drive a private vehicle to work while 12% drive a company car and 6% are passengers, and
- 8.9% work from home and 1% was listed as other.

With the ongoing and planned improvements for public transport and active mode infrastructure, it is anticipated that the mode share for walking, cycling and public transport trips will increase over time. We consider it a reasonable assumption to increase the combined mode share from 9% to approximately 16% of the total trip generation in 2031 Baseline and working from home increases to 11%.

Table No: 3 provides an estimate of the anticipated demand for public transport, walking and cycling for the weekday commuter peak periods. As shown in Table No: 3 it is anticipated that the proposed Stage 1A residential development would generate approximately 240 commuter trips per day and 149 walking and cycling trips per day.

Table No: 3

Estimated 2031 Mode Share					
Transport Mode	Assumed Mode Share 2031	Net Predicted Trips Sub-Stage 1A		Net Predicted Trips – Total Stage 1	
		Daily Trips (tpd)	Peak Hour Trips (tph)	Daily Trips (tpd)	Peak Hour Trips (tph)
Car (Driver)	66.7%	1,602	155	5,686	550
Car (Passenger)	5.1%	123	12	435	42
Public Transport	10.0%	240	23	853	83
Walking & Cycling	6.2%	149	14	529	51
Working from Home	11.0%	264	26	938	91
Other	1.0%	24	2	85	8
Total		**2,403**	**233**	**8,525**	**825**

1.3 Trip Distribution

Directional distribution data provided in the ITE Trip Generation Manual was used to estimate the number of daily and peak trips (inbound and outbound). The inbound and output trip split for the proposed residential development is provided in **Appendix B**. Table No: 4 below provides a summary of the number of inbound and outbound trips for the respective analysis periods.

Table No: 4

Directional Distribution – Peak Hour Vehicle Trips – Sub-Stage 1A					
Daily Trip Generation (vpd)		AM Peak Trip Generation (vph)		PM Peak Trip Generation (vph)	
IN	OUT	IN	OUT	IN	OUT
801	801	40	115	99	56
Directional Distribution – Peak Hour Vehicle Trips – Total Stage 1 (Sub-Stages 1A,1B,1C,1D,1E)					
Daily Trip Generation (vpd)		AM Peak Trip Generation (vph)		PM Peak Trip Generation (vph)	
IN	OUT	IN	OUT	IN	OUT
2,843	2,843	143	407	352	198

2. Capacity Assessment – Residential Activities

This section discusses the performance analysis of the nearby intersections for 2031 WRTM baseline traffic with 310 residential units of Sub-stage 1A only and again with the 1,100 residential units for the total Stage 1 residential development.

The capacity assessment results are summarised in the following sections in terms of Level of Service (LOS) with full SIDRA outputs provided in Appendix B. LOS is a standard measure for intersection performance and is based on the average delay experienced by drivers in each lane, by arm. In general, LOS levels A to C are considered acceptable, LOS D to E are considered permissible where reasonable improvements cannot be made. LOS F is generally considered to be an unsatisfactory level of service. Delay thresholds in seconds of delay for LOS A to F are given in Table No: 5 below.

Table No: 5

Sidra Level of Service Definitions			
Level of Service	Average Delay per Vehicle in seconds		
	Unsignalized Intersections	Roundabout Intersections	Signalized Intersections
A	d ≤ 10	d ≤ 10	d ≤ 10
B	10 < d ≤ 15	10 < d ≤ 20	10 < d ≤ 20
C	15 < d ≤ 25	20 < d ≤ 35	20 < d ≤ 35
D	25 < d ≤ 35	35 < d ≤ 50	35 < d ≤ 55
E	35 < d ≤ 50	50 < d ≤ 70	55 < d ≤ 80
F	50 < d	70 < d	80 < d

Table No: 6 to below summarises the capacity analysis results for the four intersections, while the SIDRA Intersection summaries are provided in Appendix B. The performance assessment is based on the existing intersection configuration and the turning volume figures provided in **Appendix A.**

As shown in Table No: 6, the intersection of Ohaupo Road with Lambert Court is expected to perform at LOS F, during the AM and PM peak periods for the 2031 baseline (i.e. without SL1 traffic added). This is an unacceptable performance level indicating severe congestion and queues.

However, the intersection is expected to operate well at LOS C with the upgrade to a signalised intersection format. This requires additional lanes on Ohaupo Road for at least 80m either side of the intersection. Refer to **Appendix C** for Sidra modelling degree of saturation movement displays.

Table No: 6

SL1 Residential - Intersection Performance Comparison: Baseline vs Baseline + Stage 1						
Intersection	AM Peak Hour			PM Peak Hour		
	Av. Delay (s/veh)	95th percentile Queue (m)	LOS	Av. Delay (s/veh)	95th percentile Queue (m)	LOS
2031 Baseline (without Stage 1 residential development traffic)						
Ohaupo / Collins Rd	23.3	183	C	21.0	192	C
Ohaupo / Saxbys Rd / Tomin Rd	5.8	54	A	6.1	160	A
Ohaupo / Lambert Court / Access Rd (Existing intersection form)	>80	389	F	53.7	220	F
2031 Baseline + Sub-Stage 1A residential development traffic						
Ohaupo / Collins Rd	48.7	308	D	64.2	>400	E
Ohaupo / Saxbys Rd / Tomin Rd	5.9	58.9	A	6.5	182	A
Ohaupo / Lambert Court /Access Rd (Traffic Signals)	23.2	166	C	22.9	220	C
2031 Baseline + Stage 1 (sub-stages 1A,1B,1C,1D,1E) residential development traffic						
Ohaupo / Collins Rd	>80.0	>400	F	>80.0	>400	F
Ohaupo / Saxbys Rd / Tomin Rd	7.8	87.3	A	57.2	>400	E
Ohaupo / Saxbys Rd / Tomin Rd (Added southbound exit lane to Lambert Court intersection)	7.8	87.3	A	25.7	244	C
Ohaupo / Lambert Court /Access Rd (Traffic Signals)	26.6	188	C	25.7	244	C

3. Trip Generation – Industrial Activities

The predicted trip generation for the proposed industrial land use has been estimated using the generation manual and related research material (i.e. previous ITAs) shown in Table No: 1 **Error! Reference source not found.**below:

- Hamilton Airport Central and Southern Development Precincts ITA prepared by BBO 2018; and
- Ohinewai Rezoning and Structure Plan ITA prepared by BBO and dated May 2020.

Table No: 7

Estimated Trip Generation – Industrial Activities				
Stage	Land Use Activity	Developable Area (ha)	Estimated Trip Generation	
			Peak Hour Trip Rate / developable hectare	Total Peak Hour Trips
Stage IA, IB	Industrial	25.7	20.9	537 trips per hour
Stage IA, IB, IC, ID	Industrial	46.0	20.9	961 trips per hour

3.1 Estimated Travel Mode Share

Table No: 8 provides an estimate of the anticipated demand for public transport, walking and cycling for the weekday commuter peak periods. As shown in Table No: 8 it is anticipated that the proposed Stage IA to ID Industrial development would generate approximately 97 commuter trips per hour and 59 walking and cycling trips per hour.

Table No: 8

Estimated 2031 Mode Share					
Transport Mode	Assumed Mode Share 2031	Peak Hour Trips			
		Stage IA	Stage IB	Stage IC	Stage ID
Car (Driver)	66.7%	194	164	217	66
Car (Passenger)	5.1%	15	13	17	5
Public Transport	10.0%	29	25	33	10
Walking & Cycling	6.2%				
18	15	20	6	36	11
Other	1.0%	3	2	3	1
Total		**291**	**247**	**326**	**98**

3.2 Vehicle Trip Distribution

Directional distribution data provided in the ITE Trip Generation Manual was used to estimate the peak trips (inbound and outbound). The inbound and output trip split for the proposed industrial development is provided in **Appendix B**. Table No: 9 below provides a summary of the number of inbound and outbound trips for the respective analysis periods.

Table No: 9

Directional Distribution – Peak Hour Vehicle Trips - Stage IA, ID			
AM Peak Trip Generation (vph)		PM Peak Trip Generation (vph)	
IN	OUT	IN	OUT
312	47	104	254

Directional Distribution – Peak Hour Vehicle Trips - Stage IA, IB, IC, ID			
AM Peak Trip Generation (vph)		PM Peak Trip Generation (vph)	
IN	OUT	IN	OUT
558	83	186	455

4. Capacity Assessment – Industrial Activities

This section discusses the performance analysis of the nearby intersections for 2031 WRTM baseline traffic, first with stage IA&IB of the industrial activities and then with stages IA, IB, IC & ID.

Table No: 10 below summarises the capacity analysis results for the four intersections, while the Sidra Intersection summaries are provided in Appendix B. The 2031 baseline performance assessment uses the existing stop-controlled intersection configuration, while the Stage 1 scenarios reflect the performance of the three-arm roundabout intersection upgrade.

As shown in Table No: 10, the stop-controlled intersection of Kahikatea Drive/Greenwood Street is expected to perform at unacceptable LOS F, during the AM and PM peak periods for the 2031 baseline (i.e. without the traffic associated with the proposed development) assessment scenario.

The upgraded intersection is expected to operate well with LOS A during both AM and PM peak hours with Stage 1 traffic added. Appendix C contains the Sidra modelling degree of saturation movement displays.

Table No: 10

SL1 Industrial - Intersection Performance Comparison: Baseline vs Baseline + Stage 1						
Intersection	AM Peak Hour			PM Peak Hour		
	Av Delay (s/veh)	95th percentile Queue (m)	LOS	Av Delay (s/veh)	95th percentile Queue (m)	LOS
2031 Baseline (without SL1 Industrial development traffic)						
Higgins Rd /Kahikatea Dr	3.9	5.3	A	4.2	7.4	A
Wickham St /Kahikatea Dr	1.3	0.7	A	1.9	2.5	A
Greenwood St /Kahikatea Dr (existing intersection format)	21.6	152	F	>50.0	>200	F
2031 Baseline + Sub-Stage IA, IB Industrial development traffic						
Higgins Rd /Kahikatea Dr	4.0	7.0	A	4.3	8.3	A
Wickham St /Kahikatea Dr	3.2	3.8	A	3.3	7.6	A
Greenwood St /Kahikatea Dr (3-arm Roundabout)	5.8	48.2	A	6.9	64.5	A
2031 Baseline + Stage 1 (sub-stages IA, IB, IC, ID) Industrial development traffic						
Higgins Rd /Kahikatea Dr	4.0	8.8	A	4.3	9.2	A
Wickham St /Kahikatea Dr	4.5	8.3	A	6.3	41.7	A
Greenwood St /Kahikatea Dr (3-arm Roundabout)	7.6	78.8	A	8.9	105	A

Yours sincerely
Bloxam Burnett & Olliver

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Transportation Engineer
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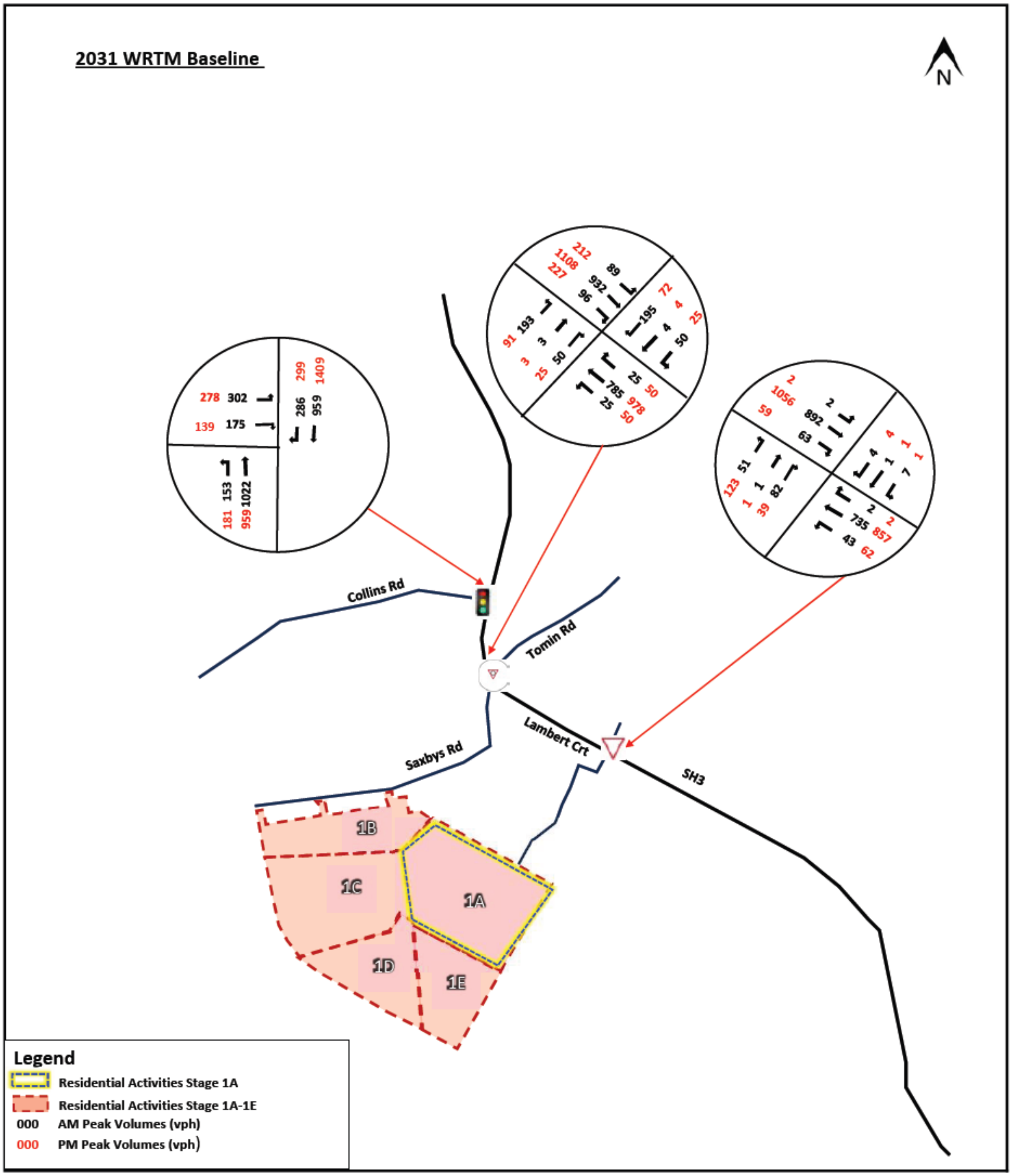
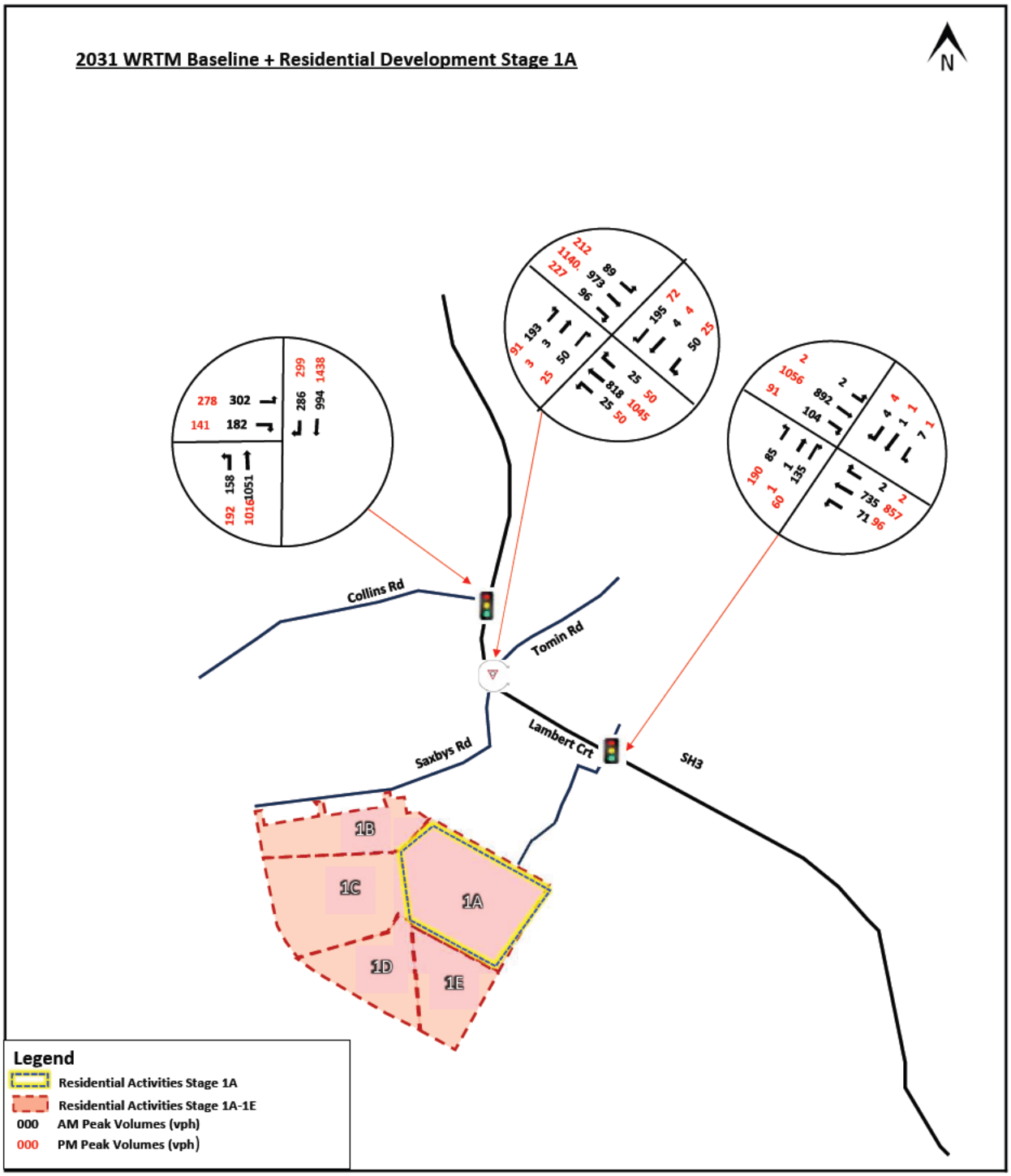
C:\12ds\data\10.7.120.14\148440.01 - SL1 Fast Track Consenting_5474\10 Traffic\Project Template\02 Reports and memos\SL1 Trip Gen and Sidra Memo.docx

Appendix A – 2031 WRTM Baseline Traffic Volumes

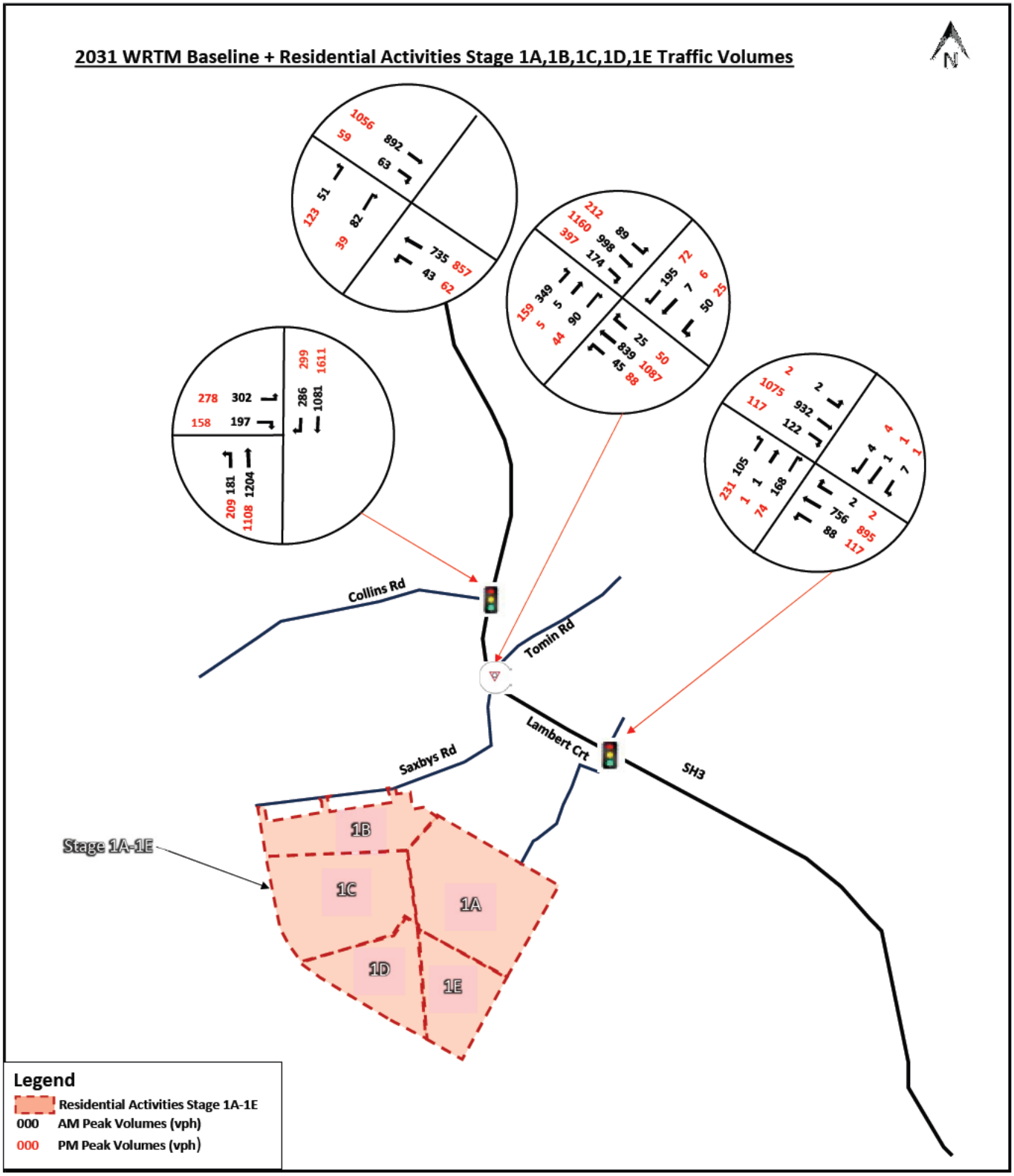


2031 WRTM Baseline
N
Collins Rd
Tomin Rd
Saxbys Rd
Lambert Crt
SH3
1A
1B
1C
1D
1E
Legend
Residential Activities Stage 1A
Residential Activities Stage 1A-1E
000 AM Peak Volumes (vph)
000 PM Peak Volumes (vph)

2031 WRTM Baseline + Residential Development Stage 1A



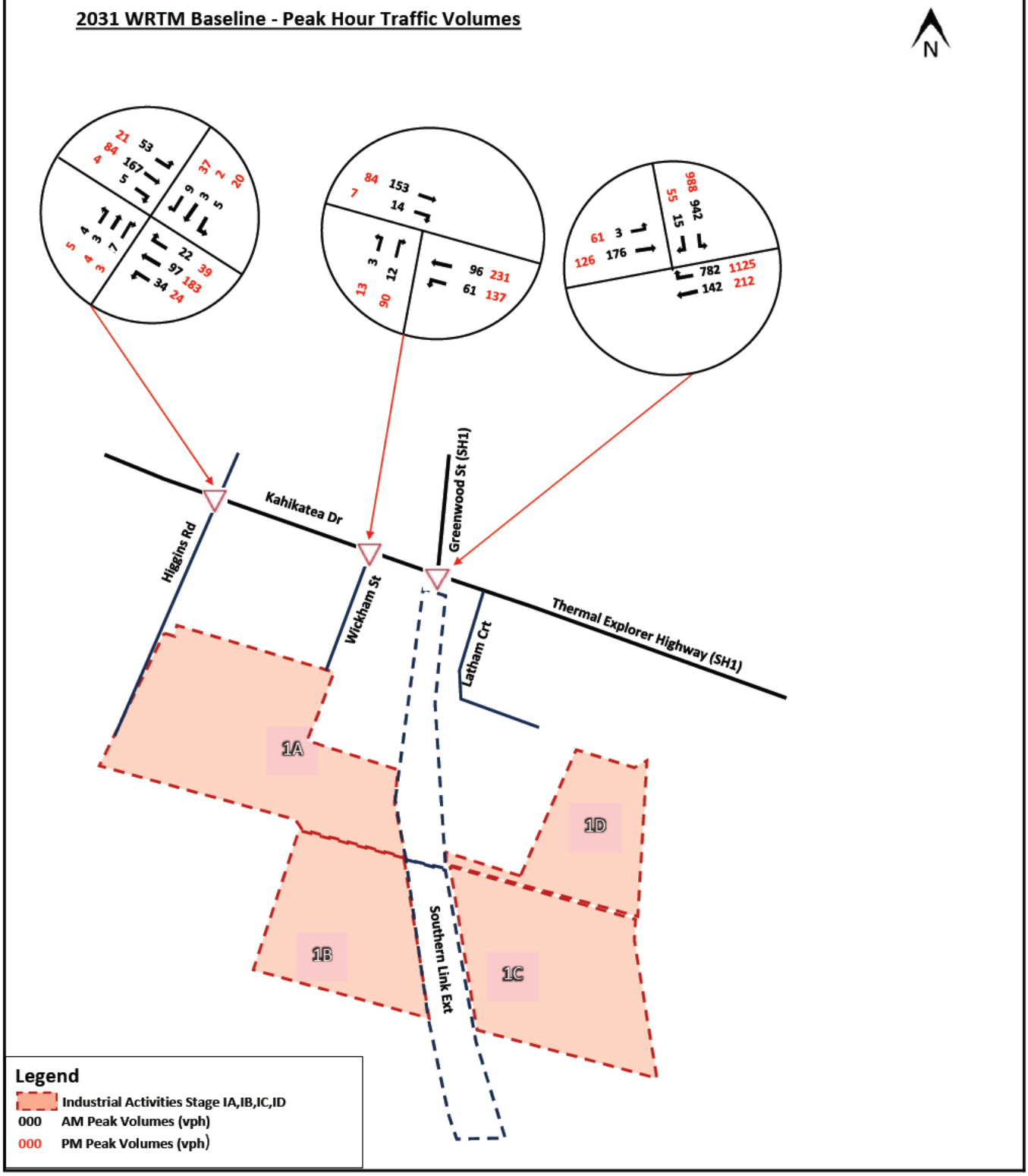
2031 WRTM Baseline + Residential Activities Stage 1A,1B,1C,1D,1E Traffic Volumes



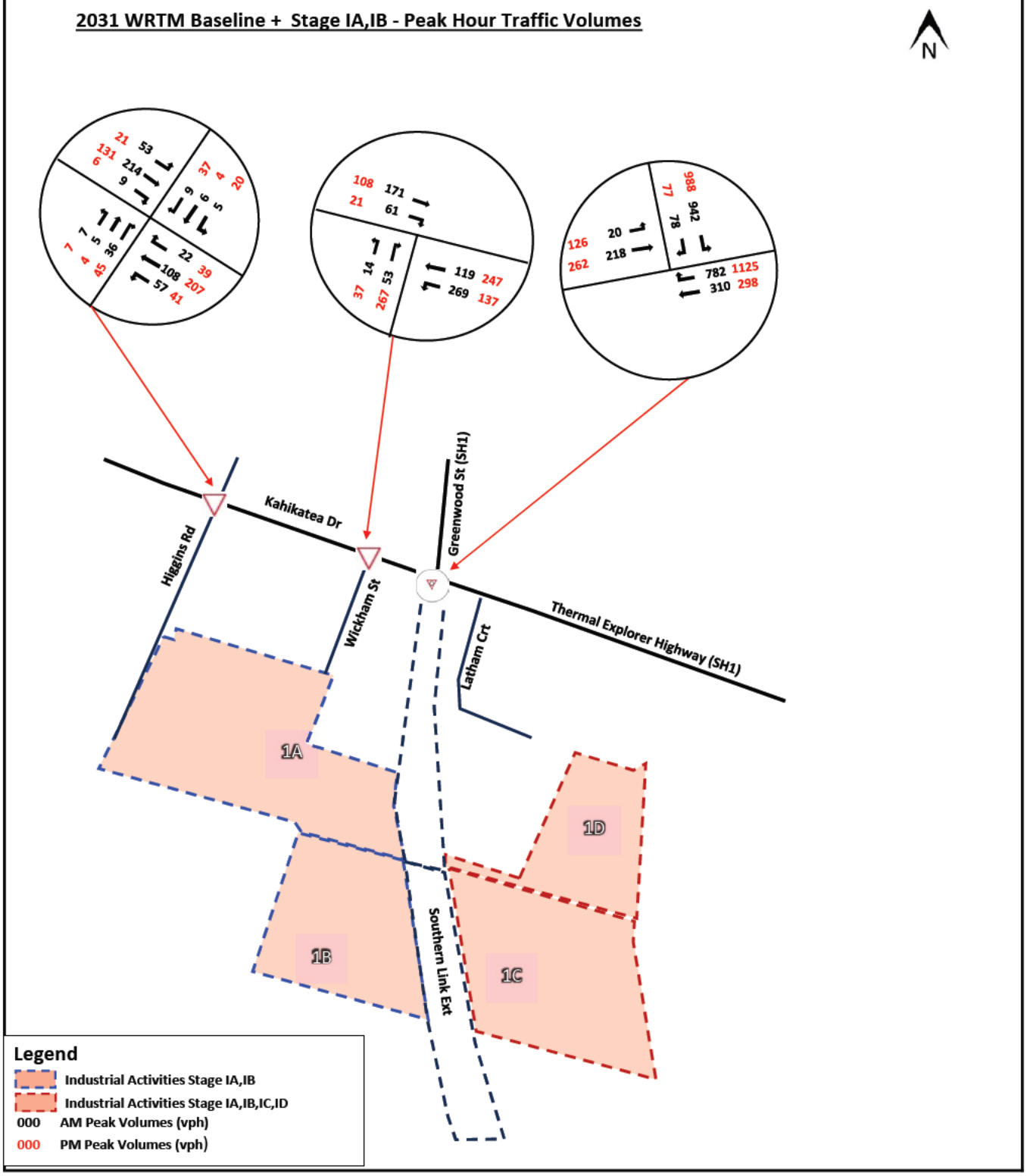
Legend

- Residential Activities Stage 1A-1E
- 000 AM Peak Volumes (vph)
- 000 PM Peak Volumes (vph)

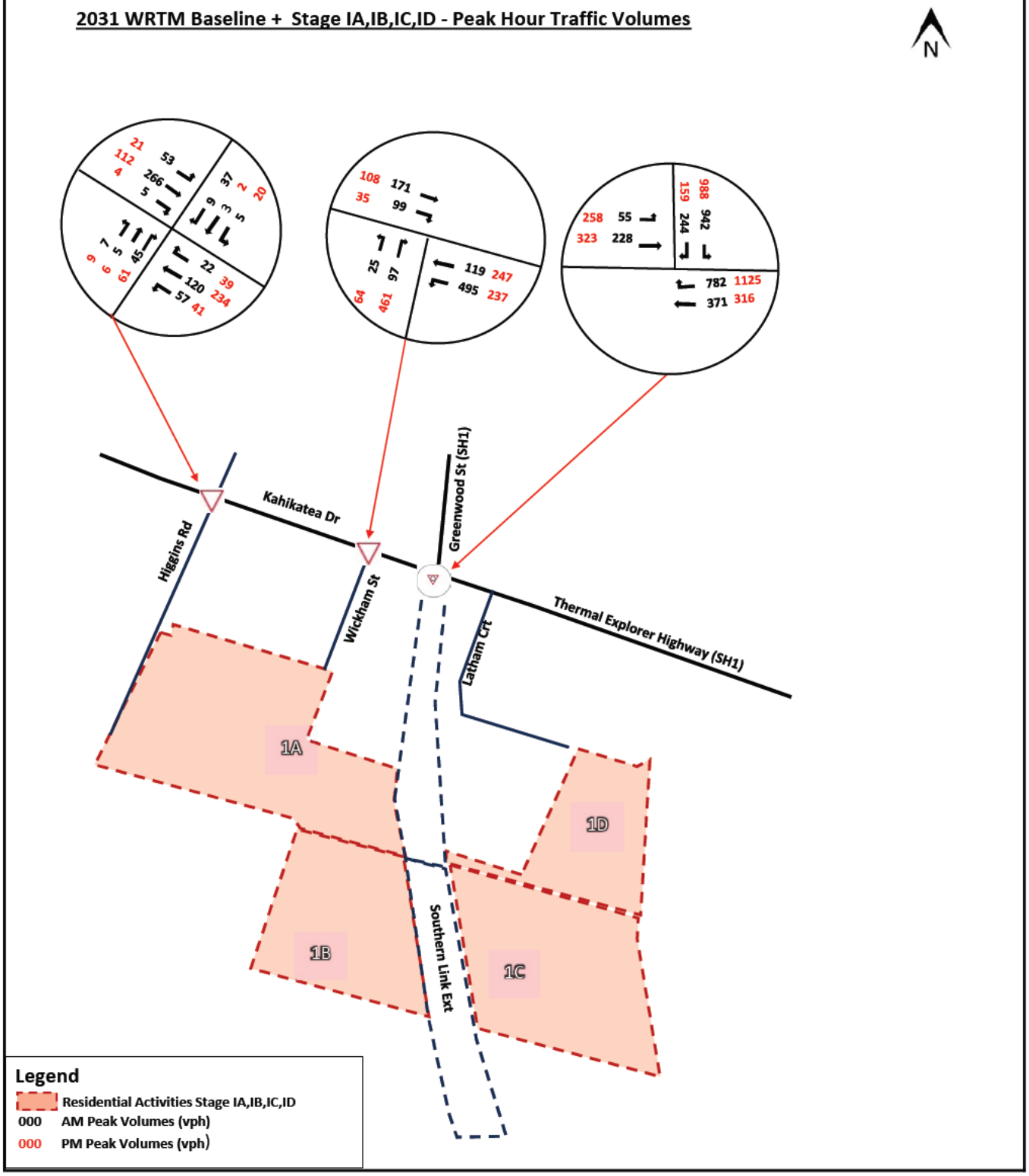
2031 WRTM Baseline - Peak Hour Traffic Volumes



2031 WRTM Baseline + Stage IA,IB - Peak Hour Traffic Volumes

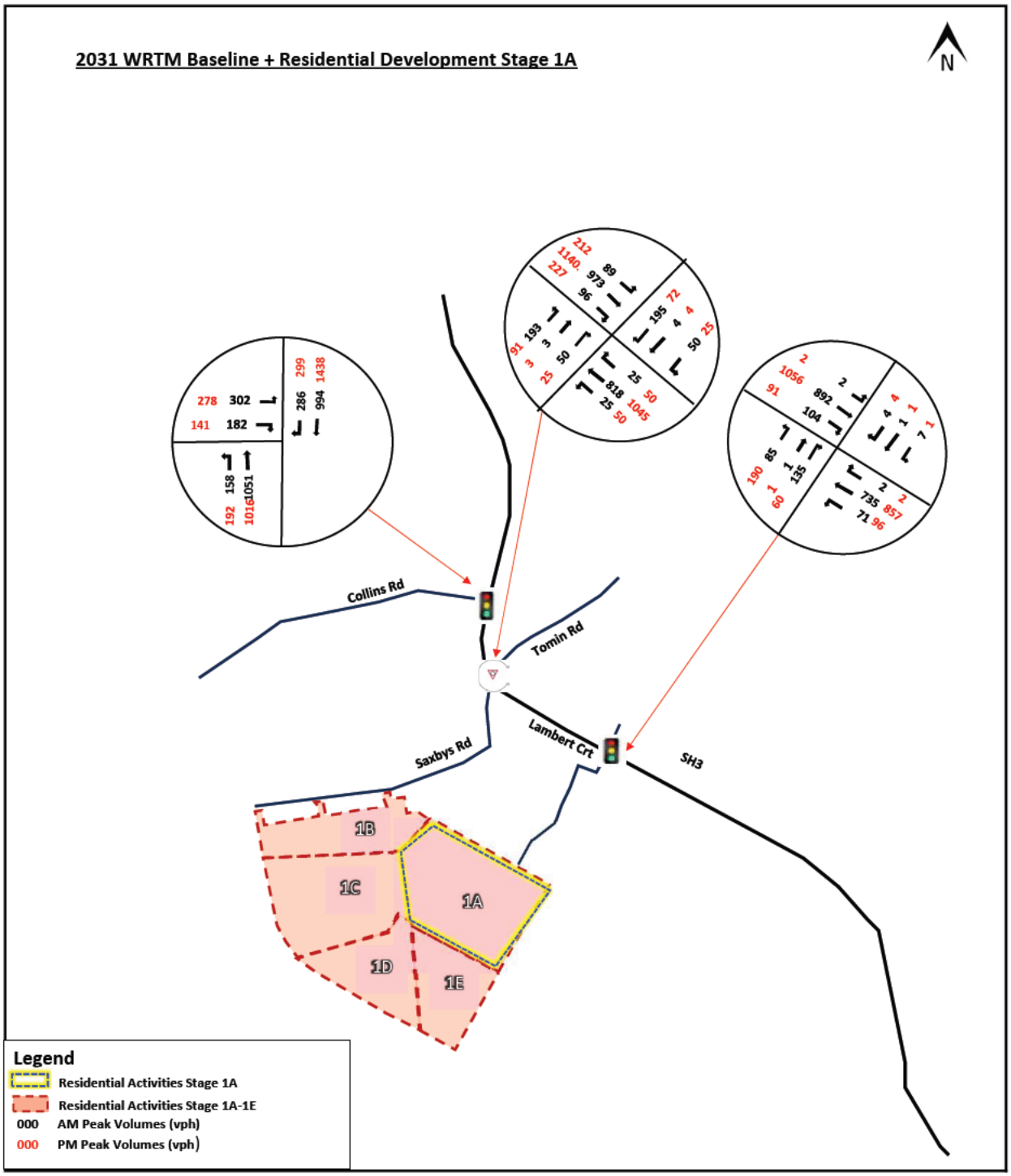


2031 WRTM Baseline + Stage IA,IB,IC,ID - Peak Hour Traffic Volumes

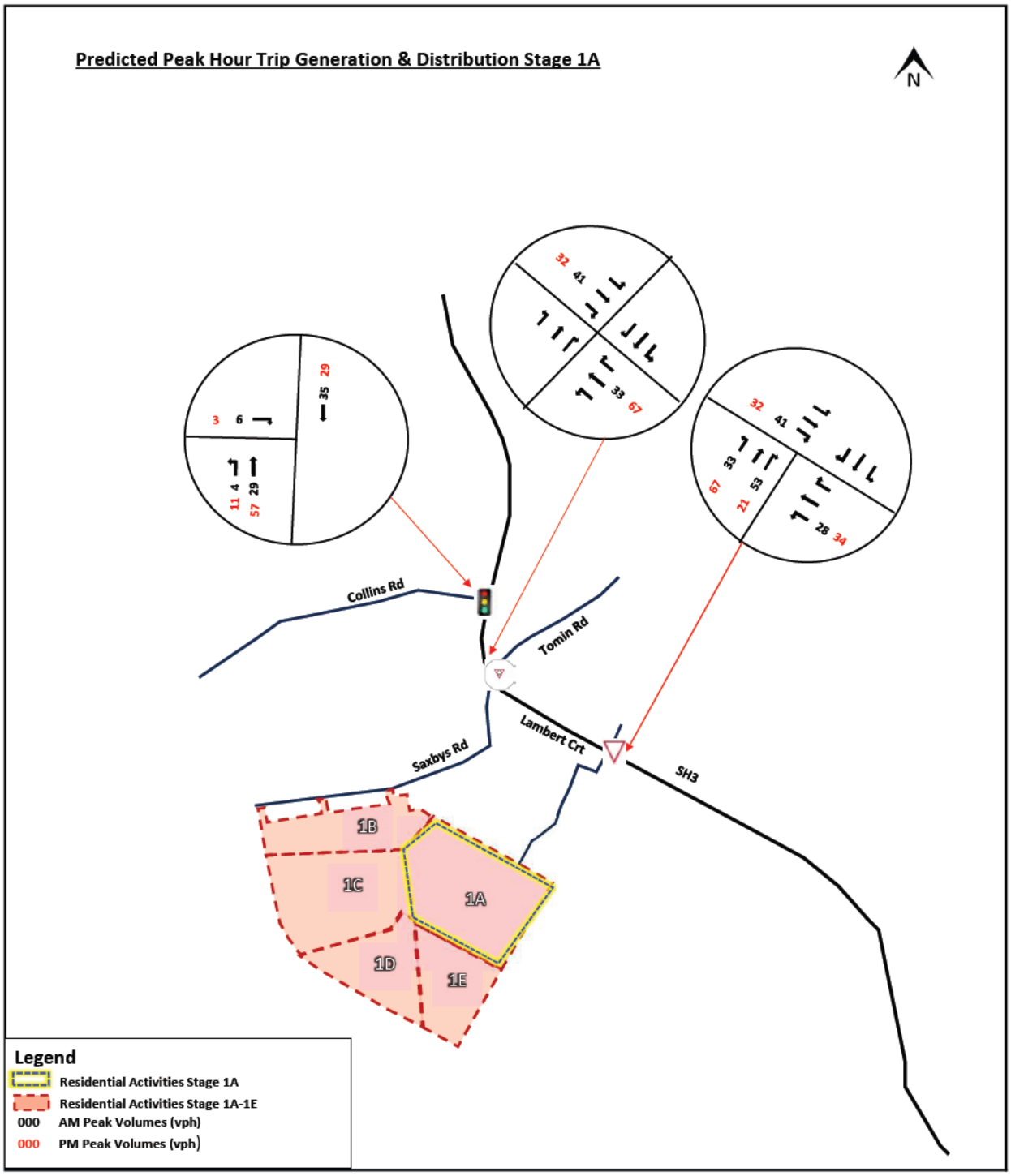


Appendix B –Expected Trip Distribution

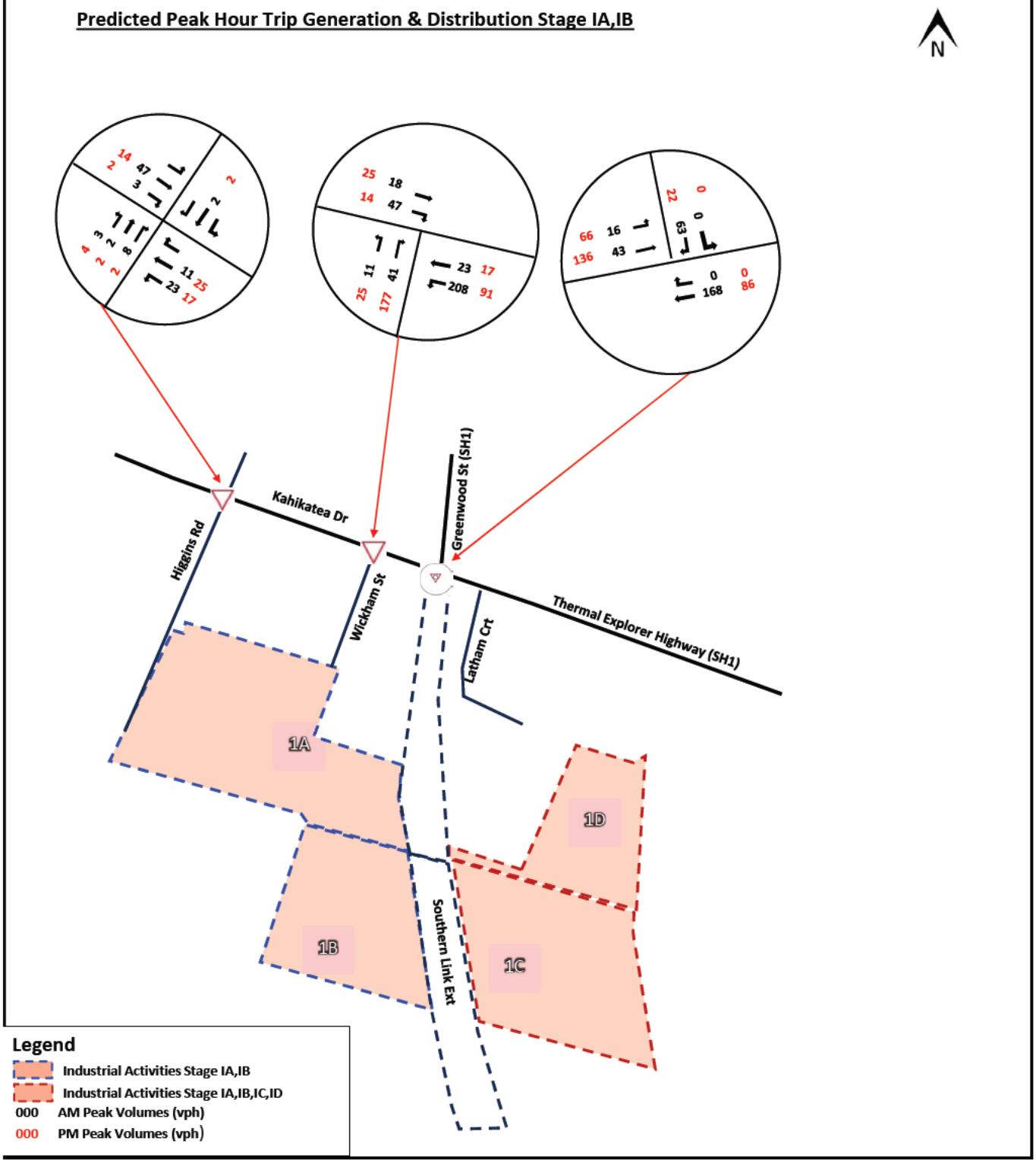
2031 WRTM Baseline + Residential Development Stage 1A



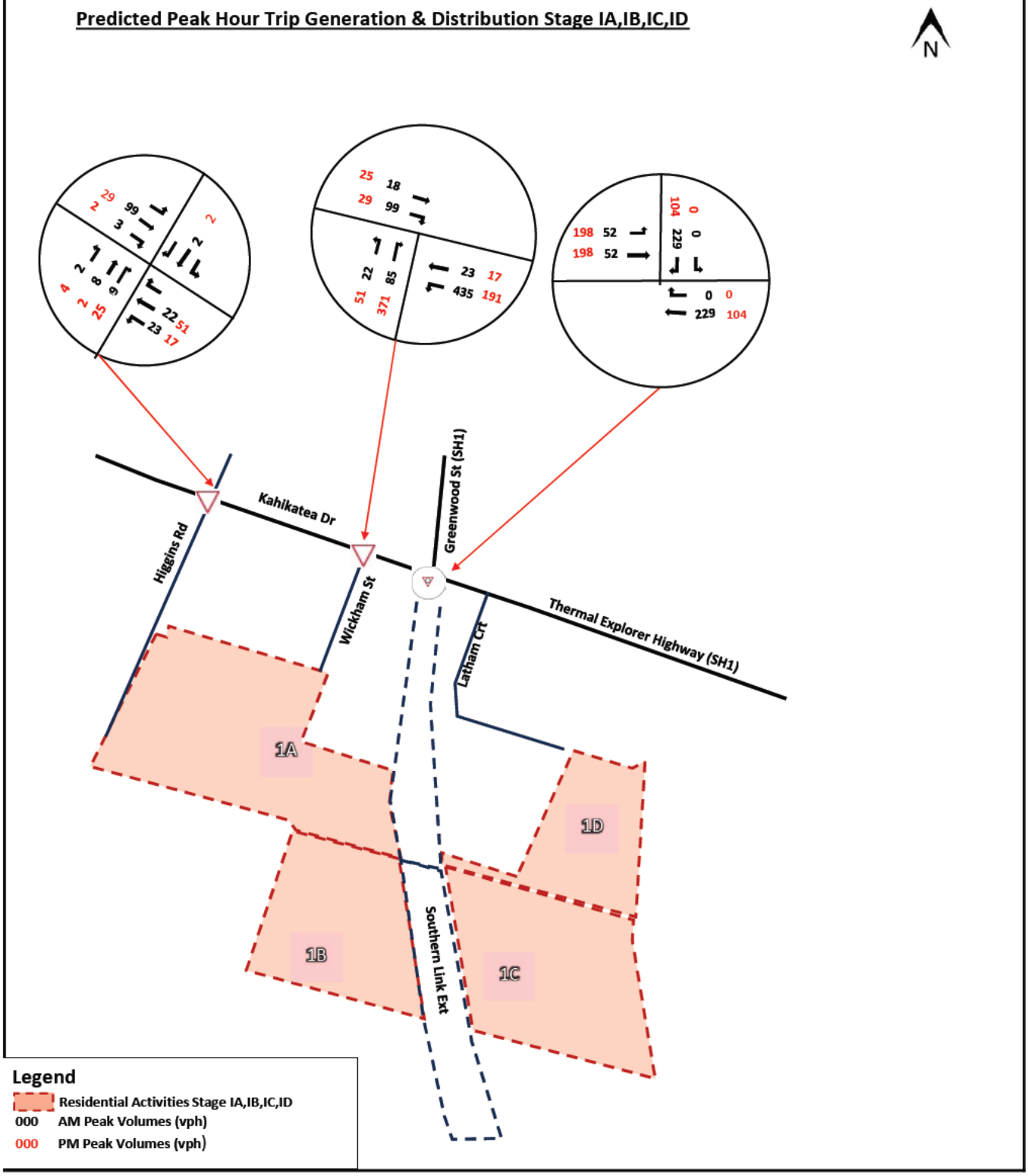
Predicted Peak Hour Trip Generation & Distribution Stage 1A



Predicted Peak Hour Trip Generation & Distribution Stage IA,IB

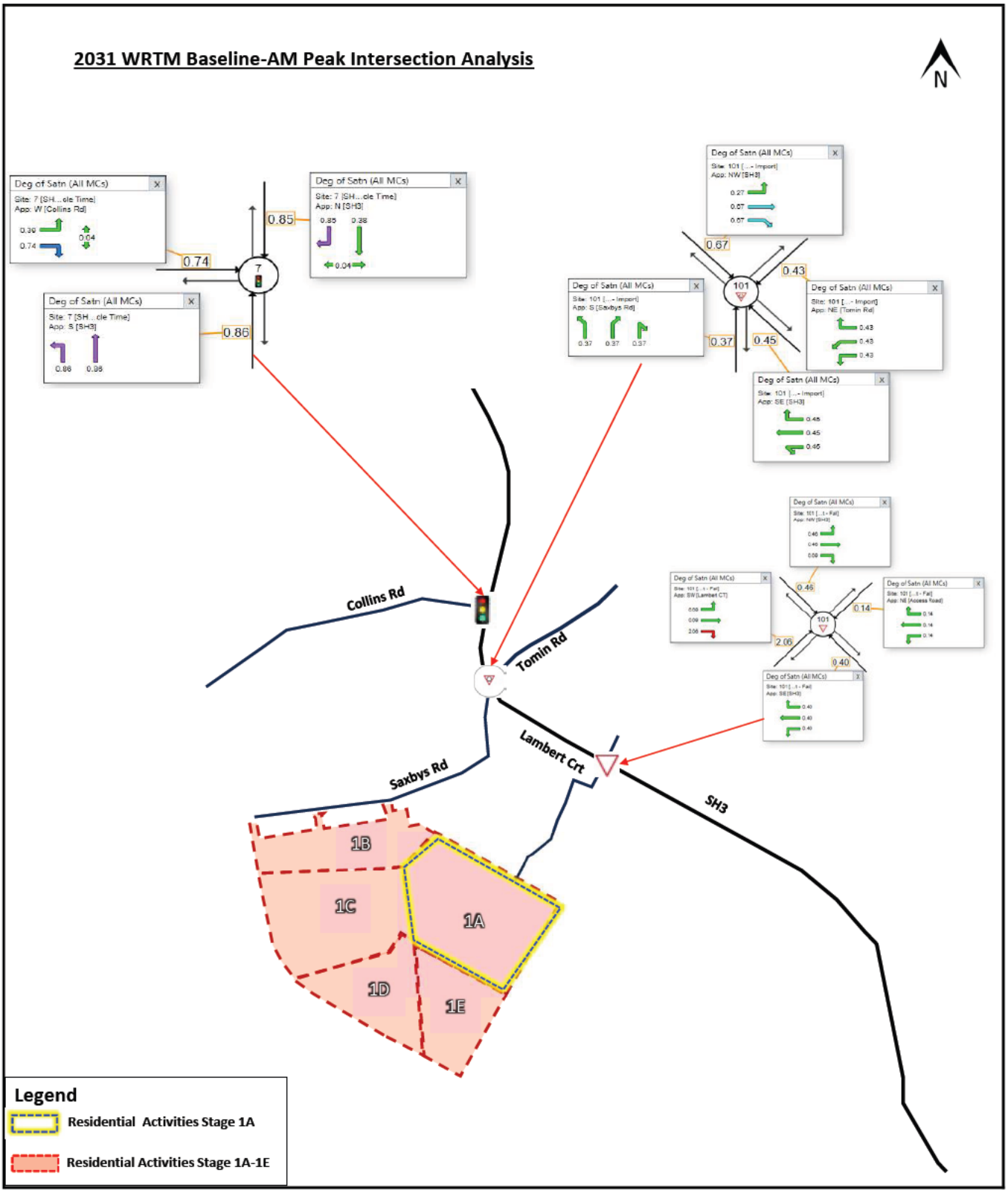


Predicted Peak Hour Trip Generation & Distribution Stage IA,IB,IC,ID

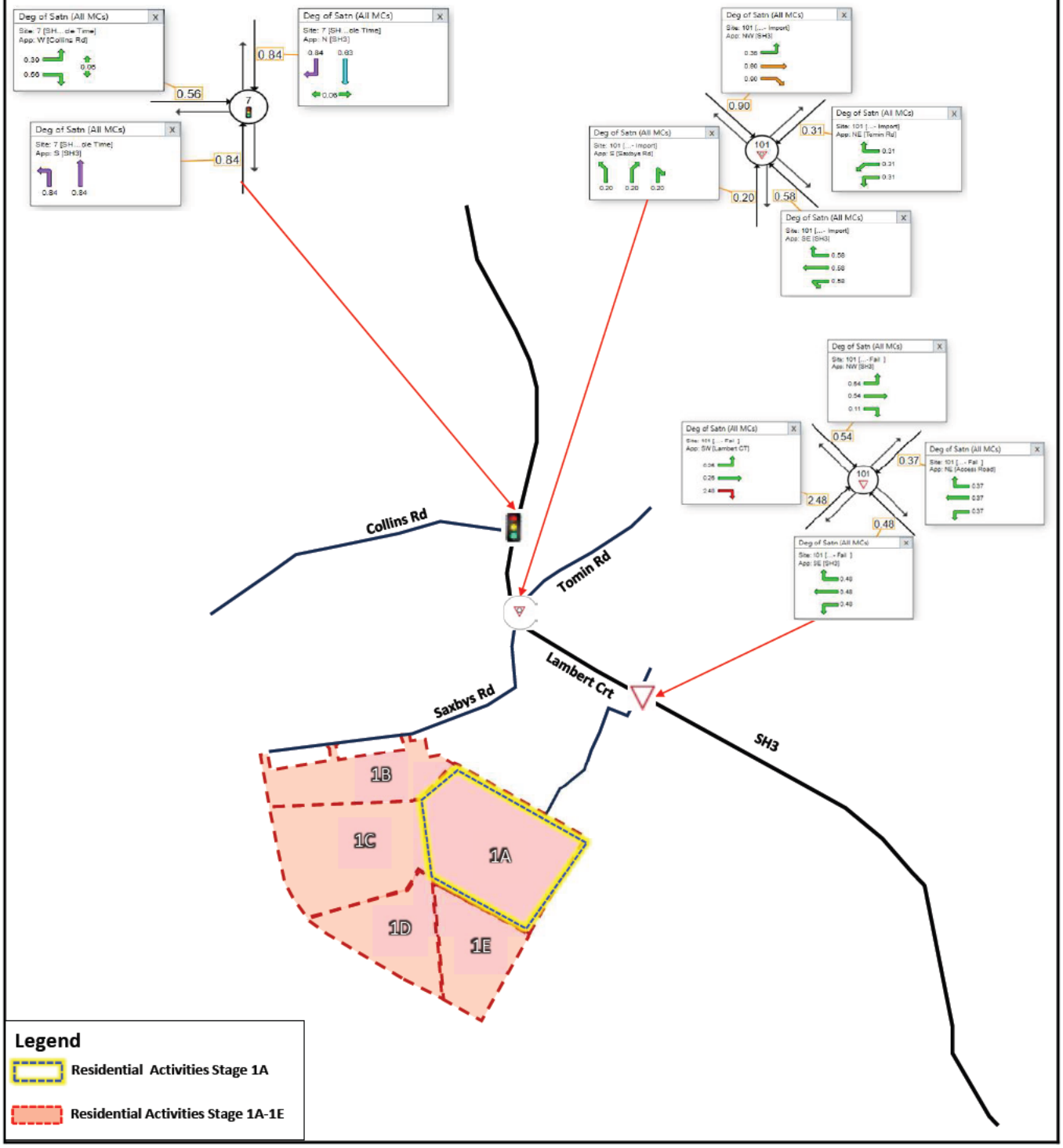


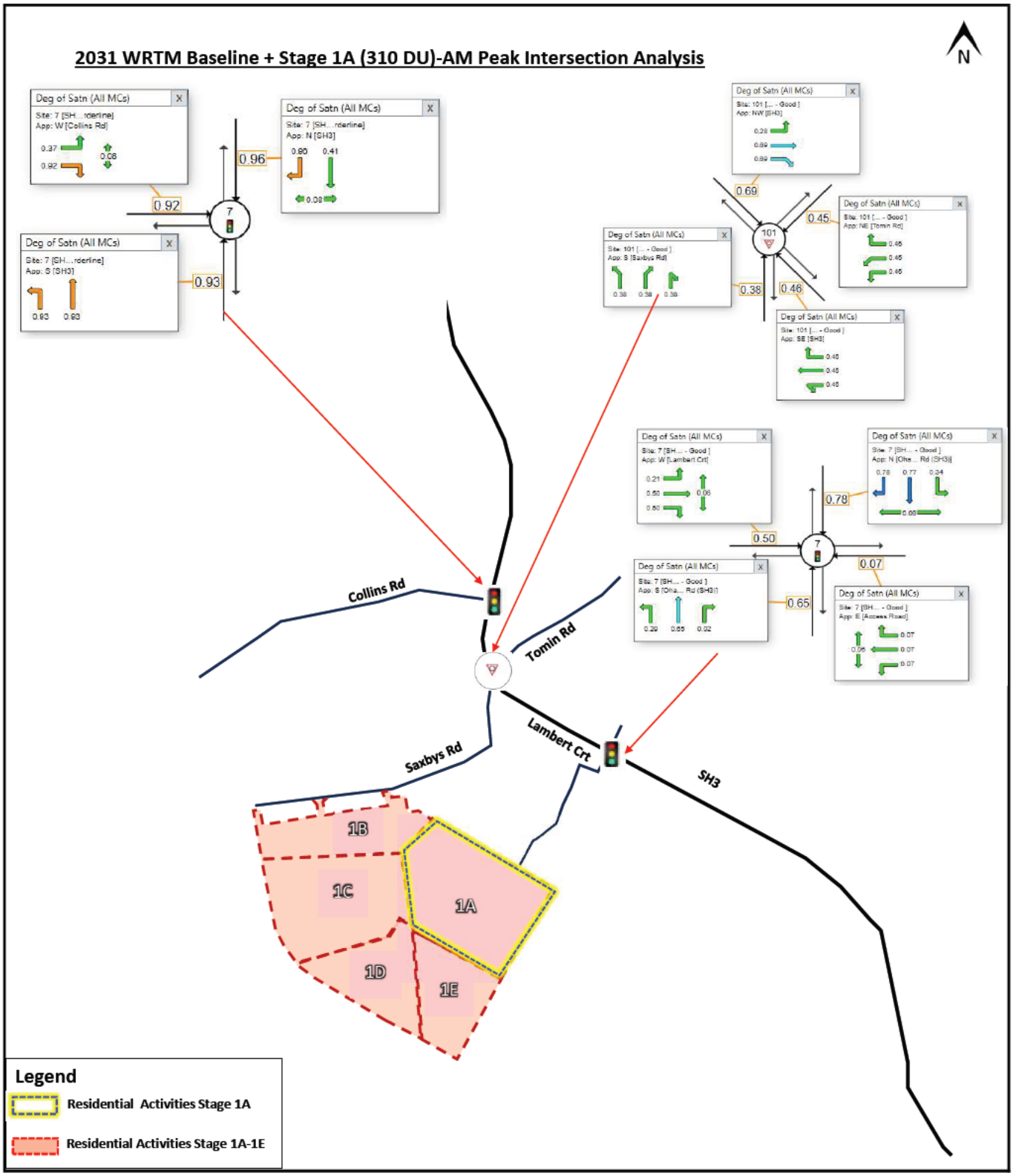
Appendix C – Sidra Modelling

2031 WRTM Baseline-AM Peak Intersection Analysis

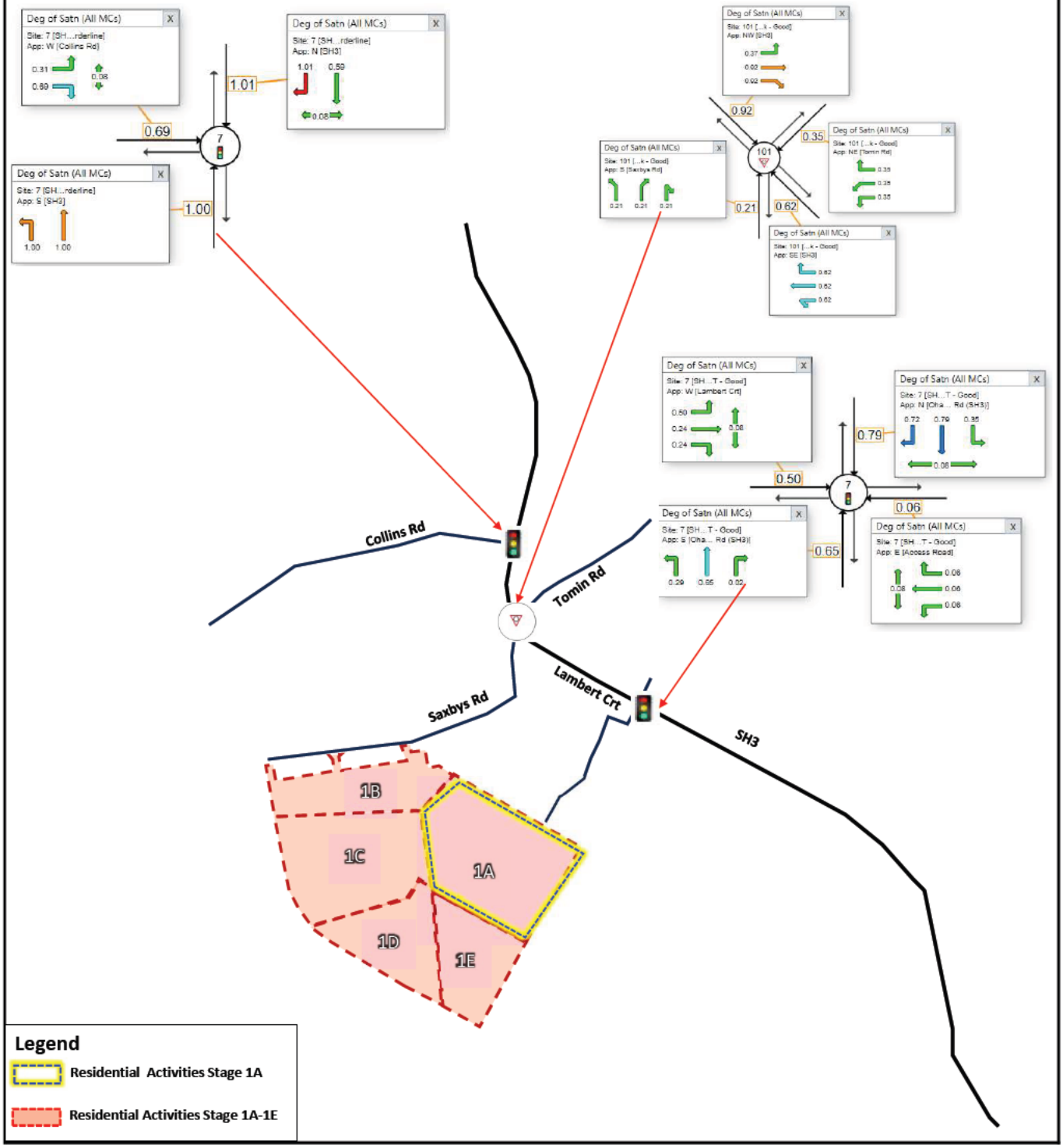


2031 WRTM Baseline-PM Peak Intersection Analysis

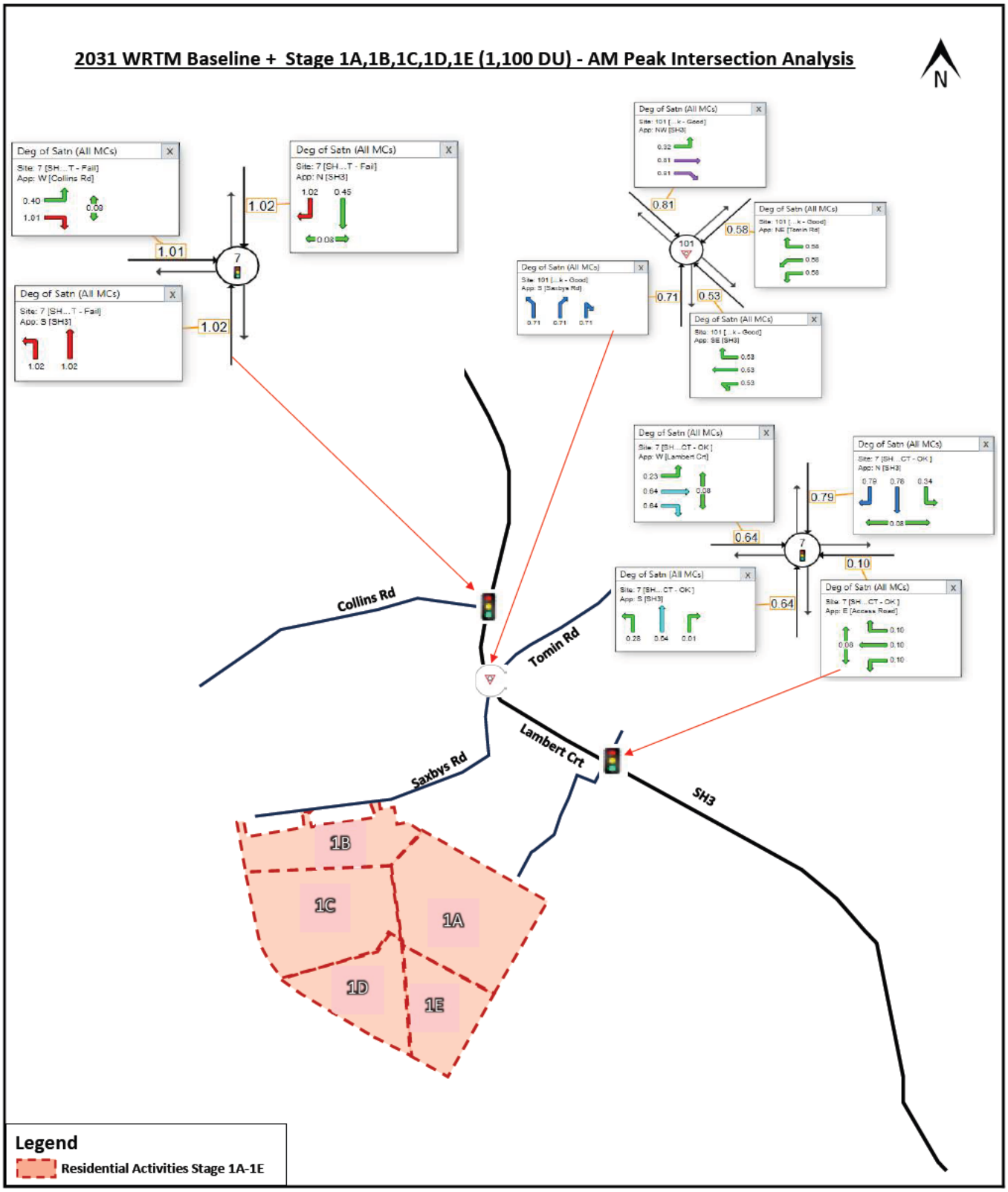



2031 WRTM Baseline + Stage 1A (310 DU)-AM Peak Intersection Analysis
N
Deg of Satn (All MCs)
0.92
0.96
0.93
0.69
0.45
0.38
0.46
0.50
0.78
0.07
0.65
Collins Rd
Tomin Rd
Saxbys Rd
Lambert Crt
SH3
1A
1B
1C
1D
1E
Legend
Residential Activities Stage 1A
Residential Activities Stage 1A-1E

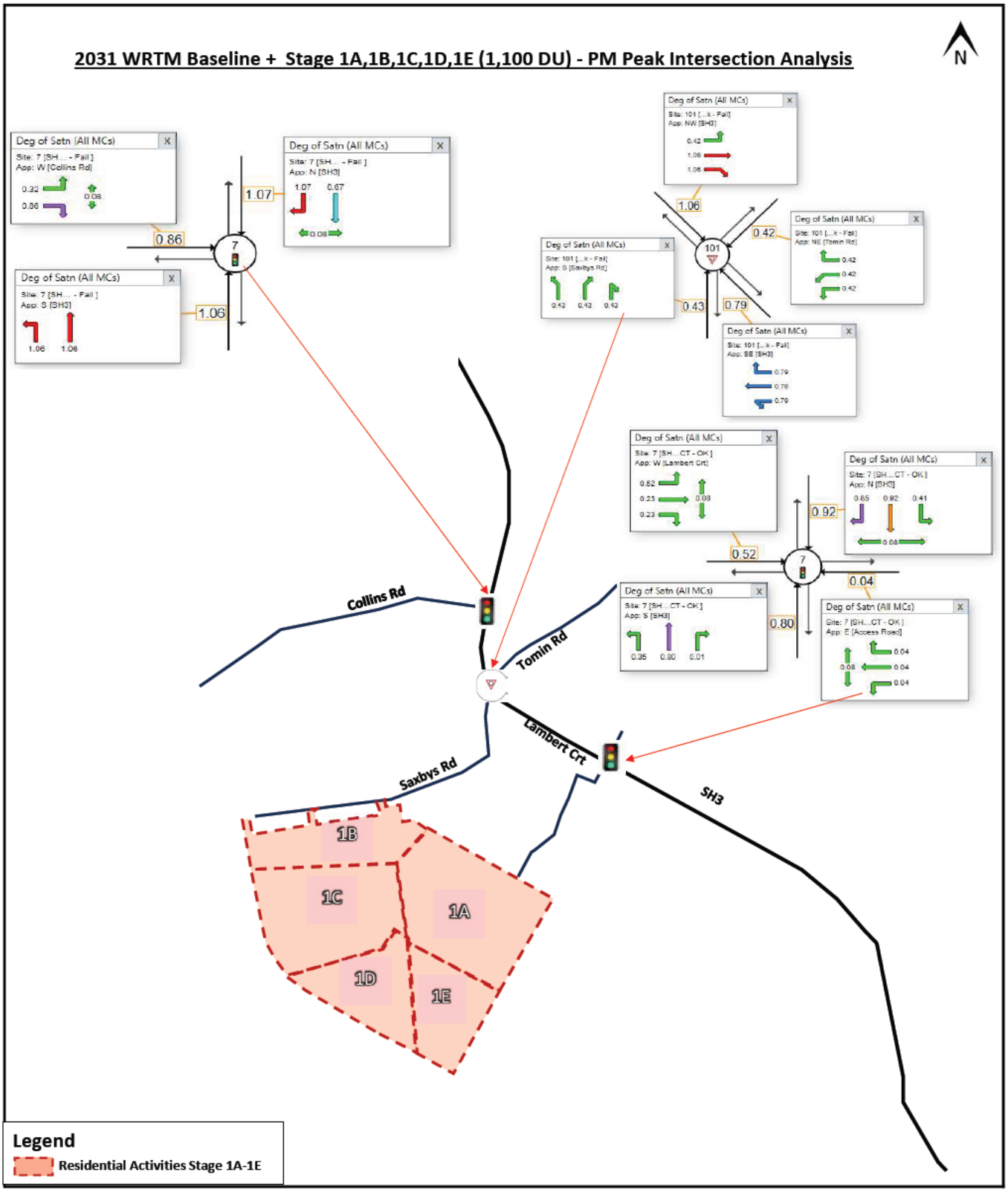
2031 WRTM Baseline + Stage 1A (310 DU)-PM Peak Intersection Analysis

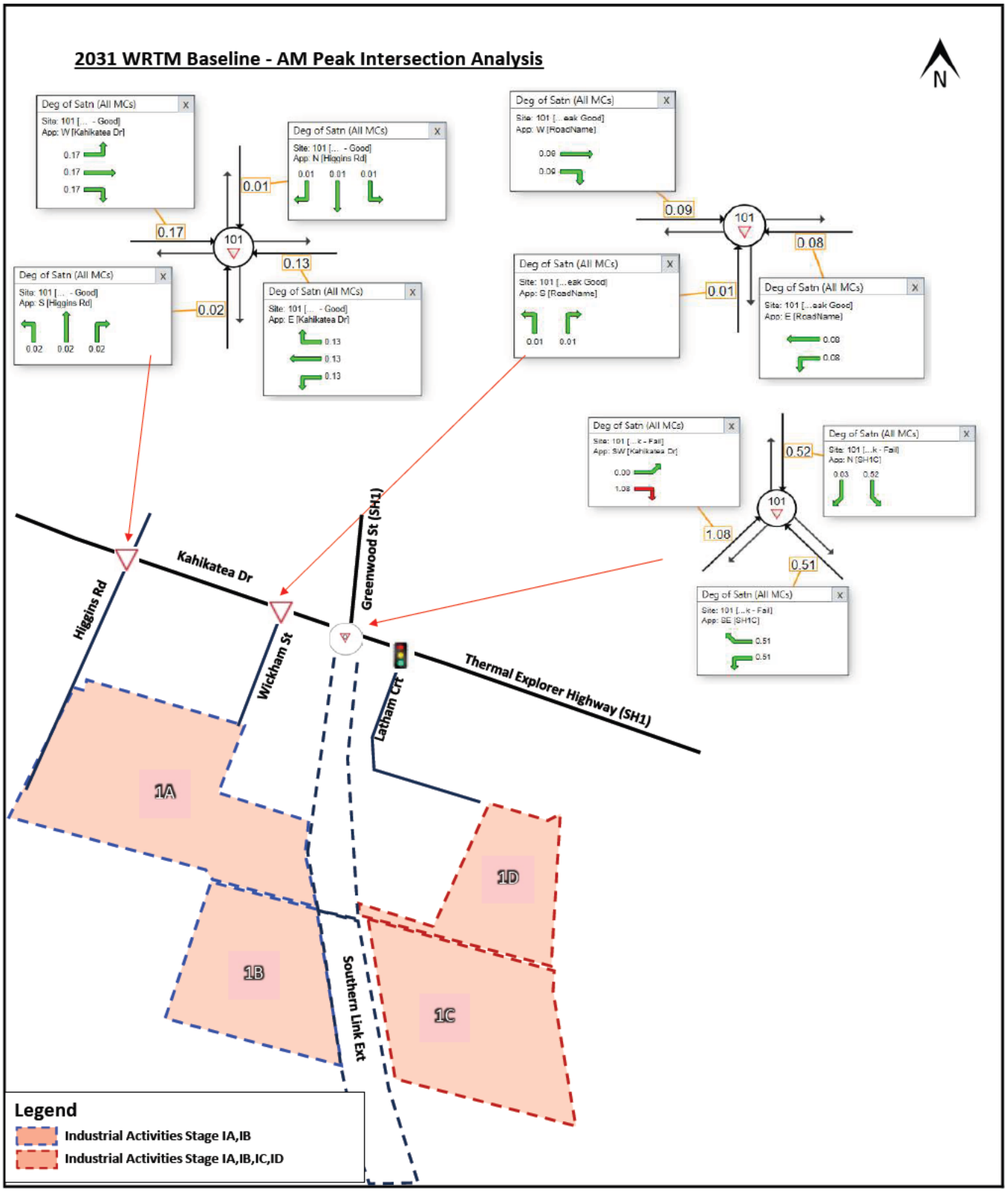


2031 WRTM Baseline + Stage 1A,1B,1C,1D,1E (1,100 DU) - AM Peak Intersection Analysis



2031 WRTM Baseline + Stage 1A,1B,1C,1D,1E (1,100 DU) - PM Peak Intersection Analysis




2031 WRTM Baseline - AM Peak Intersection Analysis
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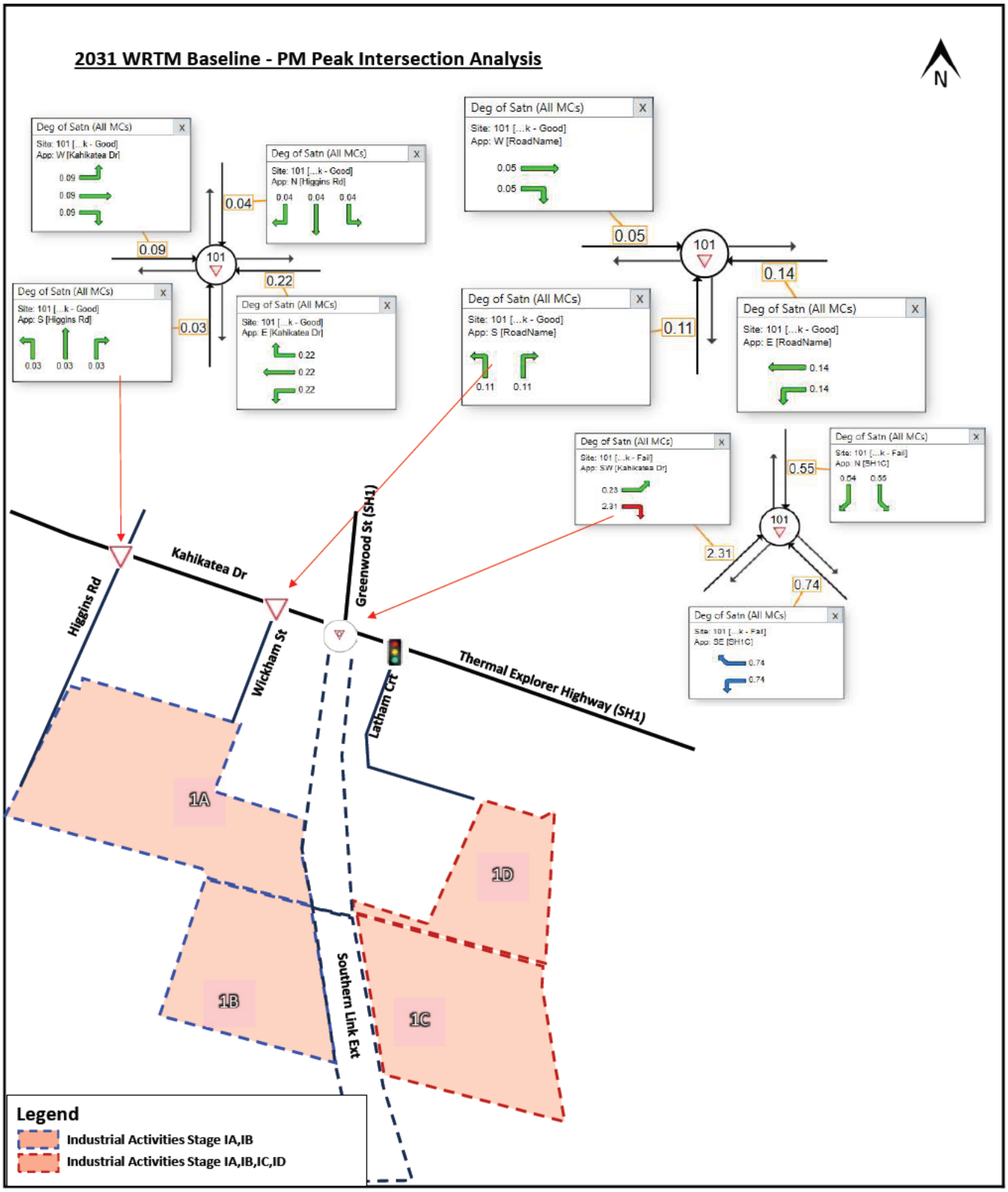
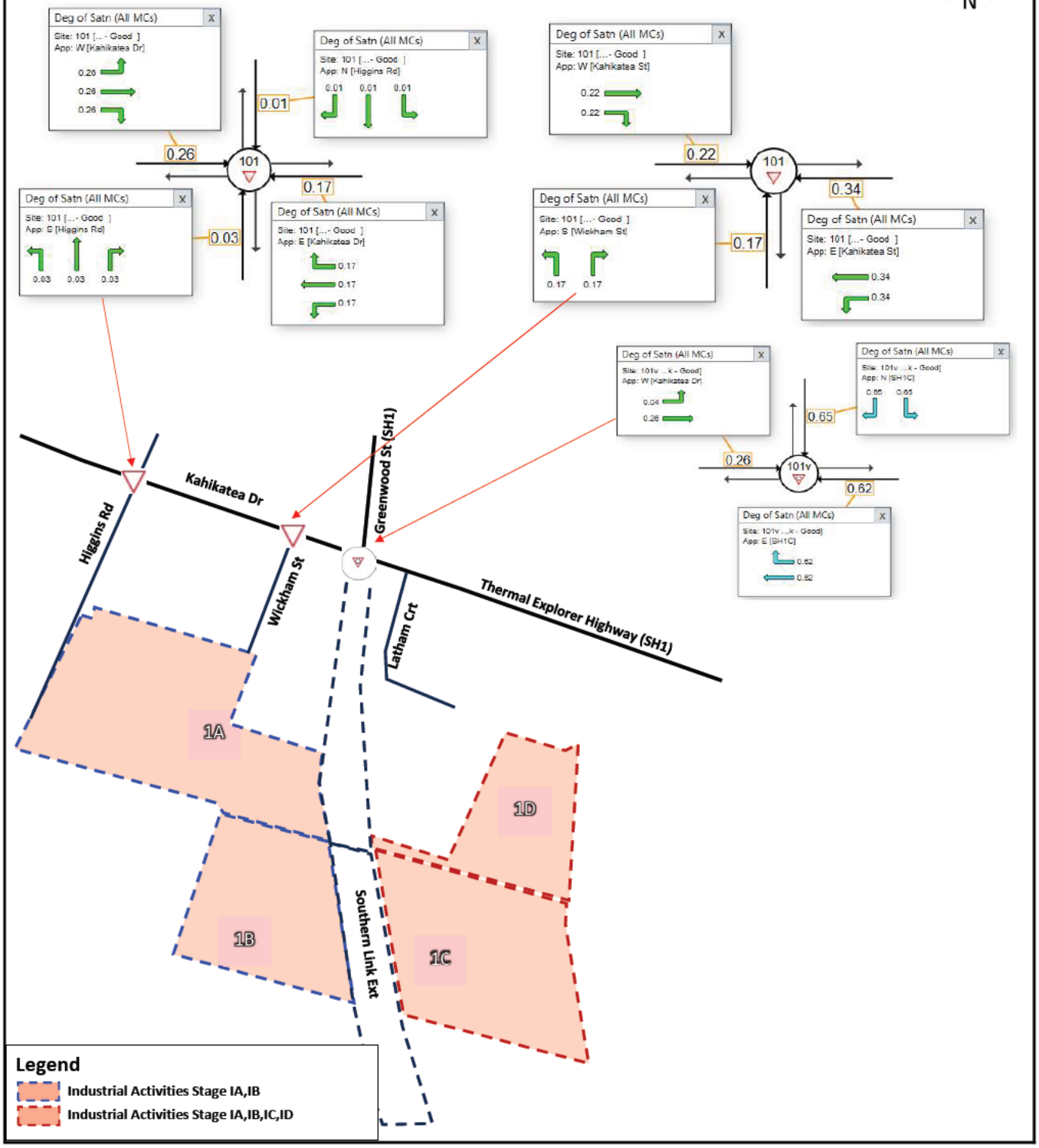
Deg of Satn (All MCs)
Site: 101 [... - Good]
App: W [Kahikatea Dr]
0.17
0.17
0.17
Deg of Satn (All MCs)
Site: 101 [... - Good]
App: N [Higgins Rd]
0.01 0.01 0.01
0.01
0.17
101
0.13
Deg of Satn (All MCs)
Site: 101 [... - Good]
App: S [Higgins Rd]
0.02 0.02 0.02
0.02
Deg of Satn (All MCs)
Site: 101 [... - Good]
App: E [Kahikatea Dr]
0.13
0.13
0.13
Deg of Satn (All MCs)
Site: 101 [...eak Good]
App: W [RoadName]
0.09
0.09
0.09
101
0.08
Deg of Satn (All MCs)
Site: 101 [...eak Good]
App: S [RoadName]
0.01 0.01
0.01
Deg of Satn (All MCs)
Site: 101 [...eak Good]
App: E [RoadName]
0.08
0.08
Deg of Satn (All MCs)
Site: 101 [...k - Fail]
App: SW [Kahikatea Dr]
0.00
1.08
1.08
0.52
101
Deg of Satn (All MCs)
Site: 101 [...k - Fail]
App: N [SH1C]
0.03 0.52
0.51
Deg of Satn (All MCs)
Site: 101 [...k - Fail]
App: SE [SH1C]
0.51
0.51
Kahikatea Dr
Higgins Rd
Wickham St
Greenwood St (SH1)
Latham Crt
Thermal Explorer Highway (SH1)
1A
1B
1C
1D
Southern Link Ext
Legend
Industrial Activities Stage IA,IB
Industrial Activities Stage IA,IB,IC,ID

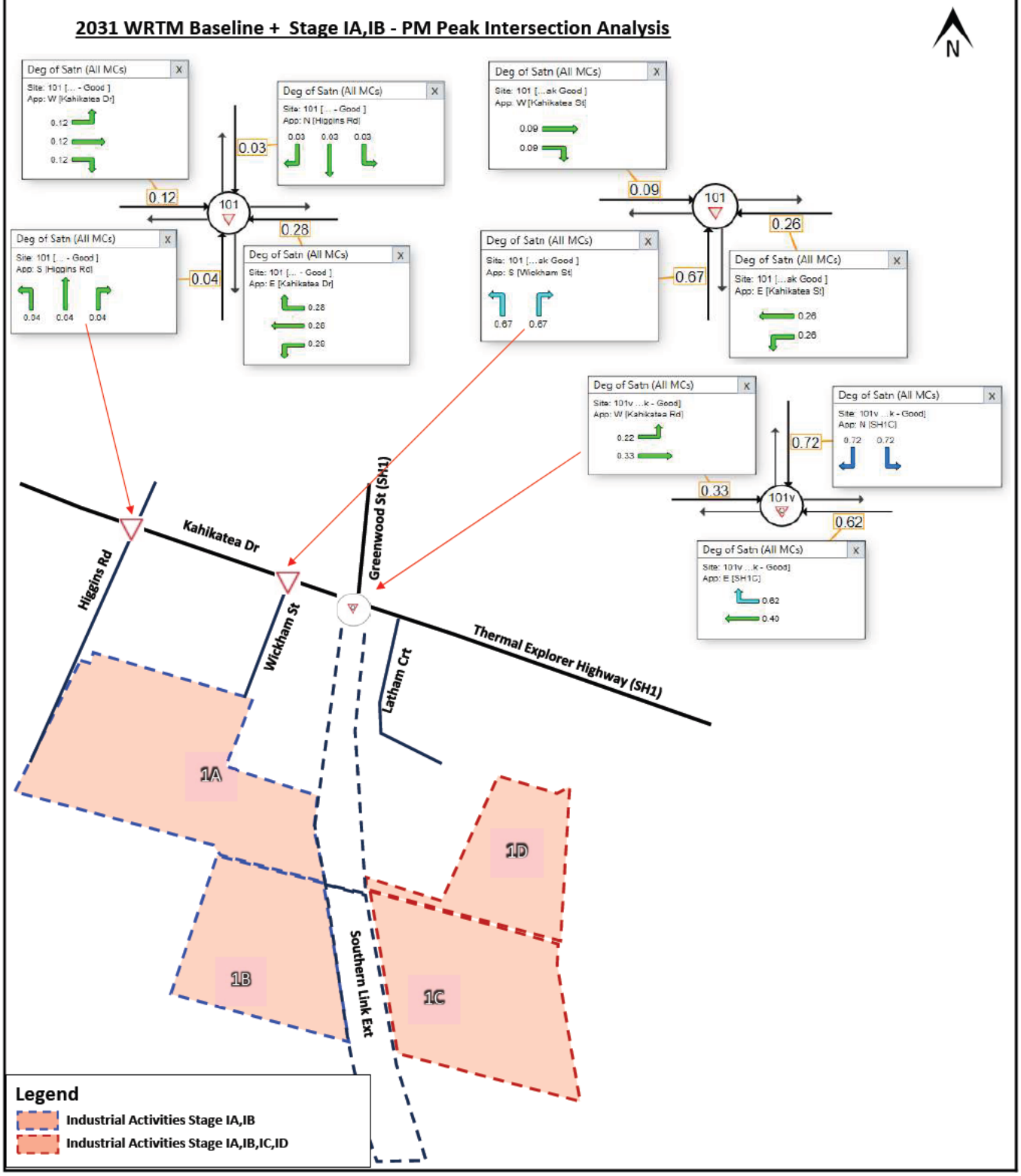
2031 WRTM Baseline - PM Peak Intersection Analysis



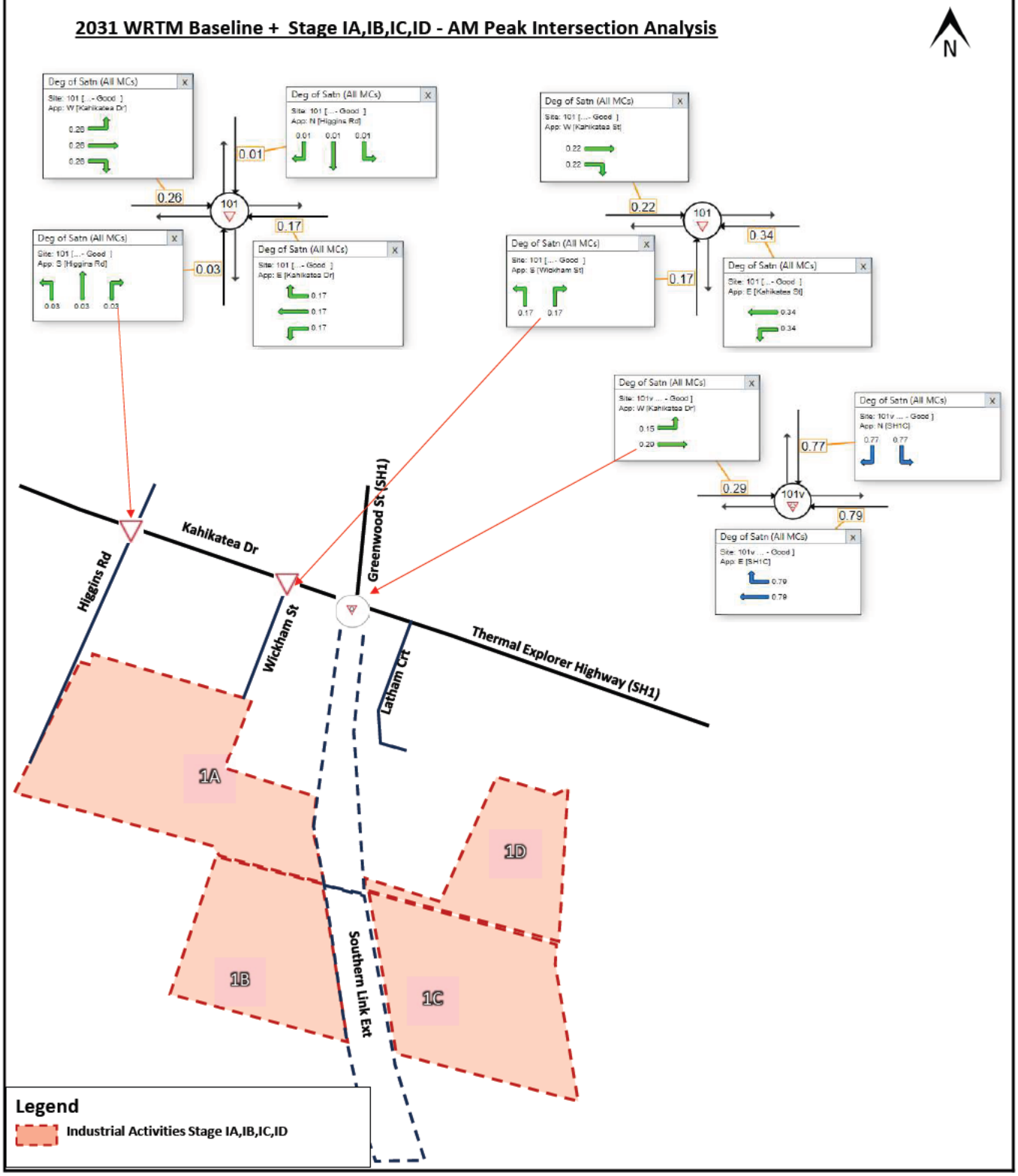
2031 WRTM Baseline + Stage IA,IB - AM Peak Intersection Analysis

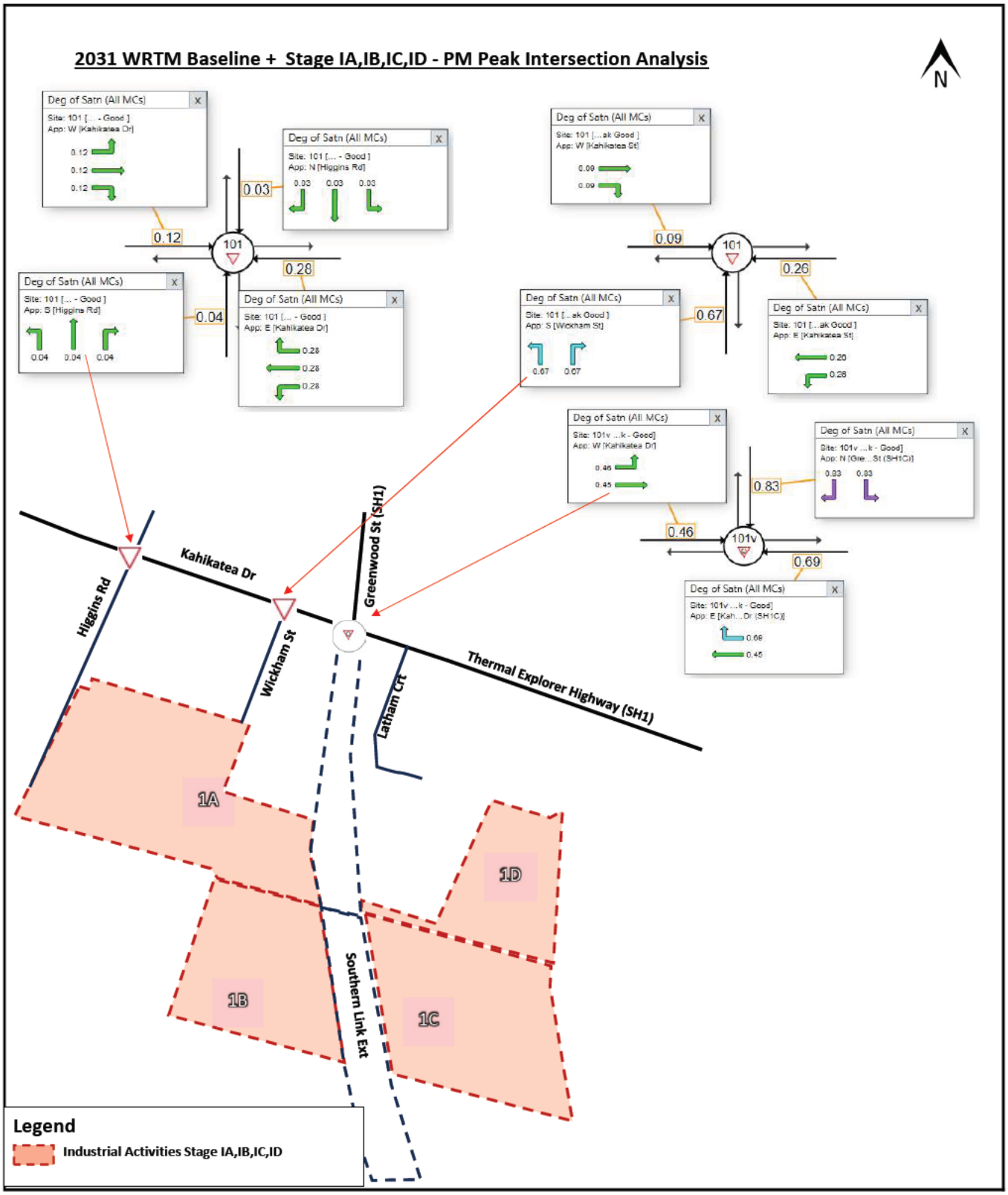


2031 WRTM Baseline + Stage IA,IB - PM Peak Intersection Analysis



2031 WRTM Baseline + Stage IA,IB,IC,ID - AM Peak Intersection Analysis




2031 WRTM Baseline + Stage IA,IB,IC,ID - PM Peak Intersection Analysis
N
Deg of Satn (All MCs)
Site: 101 [... - Good]
App: W [Kahikatea Dr]
0.12
0.12
0.12
Deg of Satn (All MCs)
Site: 101 [... - Good]
App: N [Higgins Rd]
0.03
0.03
0.03
0.03
0.12
101
0.28
Deg of Satn (All MCs)
Site: 101 [... - Good]
App: S [Higgins Rd]
0.04
0.04
0.04
0.04
Deg of Satn (All MCs)
Site: 101 [... - Good]
App: E [Kahikatea Dr]
0.28
0.28
0.28
Deg of Satn (All MCs)
Site: 101 [...ak Good]
App: W [Kahikatea St]
0.09
0.09
0.09
101
0.26
Deg of Satn (All MCs)
Site: 101 [...ak Good]
App: S [Wickham St]
0.67
0.67
0.67
Deg of Satn (All MCs)
Site: 101 [...ak Good]
App: E [Kahikatea St]
0.26
0.26
Deg of Satn (All MCs)
Site: 101v ...k - Good]
App: W [Kahikatea Dr]
0.46
0.46
0.83
Deg of Satn (All MCs)
Site: 101v ...k - Good]
App: N [Gre...St (SH1C)]
0.83
0.83
101v
0.69
Deg of Satn (All MCs)
Site: 101v ...k - Good]
App: E [Kah...Dr (SH1C)]
0.69
0.46
Higgins Rd
Kahikatea Dr
Greenwood St (SH1)
Wickham St
Latham Crt
Thermal Explorer Highway (SH1)
1A
1B
1C
1D
Southern Link Ext
Legend
Industrial Activities Stage IA,IB,IC,ID