Huia Replacement WTP Transport Assessment

Prepared for Watercare Services Limited
Prepared by CH2M Beca Ltd

10 July 2019

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Contents

Appendices

Revision History

Revision Nº	Prepared By	Description	Date
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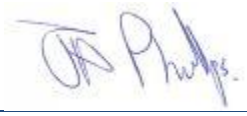
Reviewed by	**Joe Phillips**		09/07/2019
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on behalf of	CH2M Beca Ltd		

Executive Summary

This Transport Assessment Report has been undertaken by CH2M Beca Ltd (Beca) for Watercare Services Ltd (Watercare) to consider the potential transport effects arising from the enabling works, construction and operation for the replacement Huia Water Treatment Plant (WTP) and the associated proposed reservoirs, referred to as the 'Project'.

The Project sits on three adjacent sites along Woodlands Park Road which is located west of Titirangi, just north east of Waima, surrounded by the Waitakere Ranges. The three sites consist of the following:

- Proposed WTP – adjacent to the existing Huia WTP site on the corner of Woodlands Park Road and Manuka Road
- Proposed Reservoir 1 – located on a new site north of the existing WTP
- Proposed Reservoir 2 – located on the existing WTP site (once existing WTP decommissioned).

This report addresses the transport effects relating to the regional consents for the Project (the replacement WTP and Reservoirs enabling works and bulk earthworks), as well as the Outline Plan of Works for the Project (construction and operation of the replacement WTP and Reservoirs).

The site accesses are from Woodlands Park Road and the potential heavy vehicle routes used to access the Project during the enabling and construction works have been assessed with consideration to the transport conditions. The assessment of the transport conditions has considered the predicted traffic movements, together with land use and transport environments, to determine the potential effects and impacts of the enabling and construction works on the transport network.

The expected heavy truck and staff vehicles generated due to the proposed enabling works and construction activities has been assessed based on the indicative methodology and programme provided to Beca by ALTA. The effects of the generated heavy vehicles and staff vehicles during construction has been assessed by considering the combined impact of the total vehicle movements for both the replacement WTP and proposed reservoirs, as provided in the indicative construction programme produced by ALTA.

The development of that programme included consideration of methods to reduce the daily number of heavy vehicles and staff vehicles, whilst balancing this against the effects of a longer programme duration. The assessment is based on a combination of rigid heavy vehicles, articulated and truck and trailers with limited over size heavy vehicles. From the indicative construction programme, the anticipated percentages of rigid vehicles is forecast at 28%, semi-articulated heavy vehicles (including truck and trailers) account for 70% and plant equipment (including over dimensional heavies) approximately 2% of the total heavy vehicles.

Existing traffic volumes for roads surrounding the site have been surveyed. The Average Daily Traffic (ADT) volume on Woodlands Park Road is 5,135 vehicles, with 3% heavy vehicles, which is around 154 heavy vehicles per day. The existing daily traffic volume on Scenic Drive (just south of the Titirangi Roundabout) is 7,325 vehicles, 4% of which is heavy vehicles, which is 293 heavy vehicles per day. Heavy vehicles include buses, rigid trucks and articulated trucks (including truck and trailers), as well as any occasional over-dimensional vehicles.

The predicted traffic demand assessed is considered to provide a reasonable assessment of the predicted effects, given it primarily considers the highest traffic demands anticipated in the busiest 11 months of the overall programme. In the remaining months, the predicted traffic demands will generally be lower (albeit with some peaks) and there will be several periods of little or no heavy vehicle movements, which equates to 76% of the overall programme.

The expected highest heavy truck movements, based on the current indicative construction programme and an indicative 7 hour working day, are as follows:

- The busiest truck movements are generated during 11 busiest months with a total of 88 to 118 heavy vehicle movements per day for the combined sites, equating to total heavy vehicle movements ranging up to around 13 to 17 per hour across the indicative working day
- The average truck movements across the periods of the programme when heavy truck movements occur is a total of approximately 37 heavy vehicle movements per day, which equates to up to around eight heavy vehicle movements per hour
- Anticipated staff movements are expected to reach a maximum of 130 light vehicle movements spread across the whole day with most occurring outside the weekday peak periods, due to the anticipated start and finish times on the Project site.

An alternative site at the Parau landfill, which could accommodate the excavated earthwork volumes, has also been identified and assessed in this report. It is considered that the route would only be suitable for rigid heavy vehicles, rather than truck and trailer heavy vehicles. As a result, there would be an increase in the predicted number of heavy vehicle movements required to use this route, when compared with the number of vehicles required to remove this material along other potential heavy truck routes via Titirangi Road or Atkinson/ Kaurilands Roads. However, the use of this route would spread heavy vehicle movements across the potential routes, meaning there would be less heavy vehicle movements along the Titirangi Road and/or Atkinson/ Kaurilands Roads routes. It is considered the route to the alternative site can accommodate the increase of approximately 13 rigid heavy vehicle movements per hour during the busiest earthworks period. Whilst the effects on this route could be managed by continuing to operate some truck and trailer units for cut material on the Titirangi Road and Atkinson/Woodlands Park Roads route, if the Parau site is used, it is considered that the adverse effects of using this route are overall balanced by the reduced adverse effects on the other routes.

The traffic assessment identifies that the existing road network, including the Titirangi roundabout, will generally have sufficient capacity to cater for the proposed heavy and staff vehicle movements generated by the proposed construction and operational activities. However, there is the potential for adverse safety and efficiency impacts on the road network due to the increase in heavy vehicles at certain times (such as during the school pick-up/drop-off and in the busier traffic periods through Titirangi village) requiring mitigating measures in order to reduce these adverse effects.

The assessment has therefore identified the following mitigation to minimise the adverse impacts on nearby schools, local and town centres, public transport services, and recreational users that will be implemented through the provision of a Construction Traffic Management Plan (CTMP), which will be a condition of the consent:

- In developing the construction methodology, balance the daily number of heavy truck movements and the implications on the extension of the programme, that will prolong the duration of the potential and actual adverse effects
- Preventing or limiting, where practicable, heavy truck movements on the adjacent road network during the busiest periods of construction in the weekday morning and afternoon peak periods around school pick-up/drop-off time and general commuter peak periods, as well as during the Saturday mid-day peak period
- Heavy truck routing via the identified haul route options using a combination of Woodlands Park Road and Scenic Drive, together with; Titirangi Road, Golf Road, Godley Road, Atkinson Road, Kaurilands Road and Glendale Road, which will address the operational and safety effects of the predicted hourly heavy truck movements on the identified truck routes at certain times of day or days of the week

- Heavy truck routing to the existing Parau landfill site via Woodlands Park Road and Huia Road for the disposal of a large proportion, if not all, of the cut material with associated mitigation, including managing truck movements around school pick-up/drop-off times
- Localised road widening along the northern side of Woodlands Park Road to provide new kerb and channel between Scenic Drive and the Project sites
- Site-specific traffic management, temporary speed limit reductions, temporary bus stop relocations and pedestrian management measures along Woodlands Park Road in the vicinity of the Project sites, up to and including the Scenic Drive intersection, as well as at the Parau landfill site access off Huia Road
- On-street staff parking restrictions, on-site parking / loading management, together with a staff travel management plan, including details of staff shuttle bus scheduling and identification of a suitable pickup/drop-off location at the 'staging' site
- Provision of a 'staging' site (location to be confirmed, likely in New Lynn area) to store materials, provide parking, bus/shuttle pickup and act as a partial assembly location to have greater flexibility and reliability of site truck and light vehicle movements
- For over-dimensional plant/equipment movements and 'Wide Loads' identification of appropriate scheduling of these movements, such as overnight or on weekends.

It is therefore considered that the proposed CTMP will satisfactorily manage the potential adverse effects of the enabling and construction works for the replacement WTP and proposed reservoirs providing for the safe and efficient operation of the local transport network. A draft CTMP is appended with this report. The conditions of consent will provide for the further development and approval of the CTMP by the Council (including Auckland Transport), prior to the enabling works and construction commencing. It is considered that the CTMP will be usefully guided by the following objectives, in terms of implementing identified measures and management procedures to mitigate the predicted effects:

- Manage the number of construction traffic movements on the transport network
- Provide for the safety of everyone at all times
- Ensure of maintenance of access at all times to / from properties
- Minimise disruption from construction traffic on the travelling public and road users along the identified sections of the construction routes
- Seek to avoid full road closures and minimise any partial or managed closures
- Manage integration with other construction projects and Auckland Transport projects
- Provide for prior engagement with relevant stakeholders, when public access, particularly to properties, will be affected by construction traffic
- Provide a mechanism for addressing queries and responding to complaints (incl. through a Community Liaison Group (CLG) or similar).

It is considered that any transport effects generated by the operation of the Project, when completed, will be generally similar to those of the existing WTP and largely not discernible. The width of the proposed WTP site access will have an adverse effect on pedestrians using the footpath on the southern side of Woodlands Park Road, which is considered to be acceptable. As such, there is considered to be no mitigation required. It is understood that Watercare is in separate discussions with Auckland Transport to explore the opportunity for improvements to the existing Woodlands Park Road / Scenic Drive intersection.

On this basis, it is therefore considered that the Project can be undertaken with effects on the safe operation of the transport network that are minor or less and are overall acceptable. As such, it is considered there are no transport related reasons to prevent the approval of the replacement WTP and proposed reservoirs consent applications.

1 Introduction

1.1 Background

This Transport Assessment Report (TAR) has been prepared by CH2M Beca Ltd (Beca) on behalf of Watercare Services Ltd (Watercare) to consider the proposal for the enabling works, construction and operation for the replacement Huia Water Treatment Plant (WTP) and the associated proposed reservoirs (also referred to as 'the Project'). The Project sites are located in Titirangi off Woodlands Park Road.

This report assesses the transport effects of the Project, including the following activities, which are anticipated and the associated heavy truck and staff vehicle movements:

Early Works

- Site Establishment for Reservoir 1

Replacement WTP

- Enabling Works & Bulk Earthworks
- Construction
- Commissioning
- Operation

Proposed Reservoir 1

- Enabling Works & Bulk Earthworks
- Construction
- Commissioning
- Operation

Proposed Reservoir 2

- Site Establishment
- Decommissioning of Existing WTP
- Demolition of Existing Structure
- Reservoir 2 – Ground Improvements
- Construction - Reservoirs 2
- Commissioning
- Operation

The extent of this assessment covers Woodlands Park Road, which provides direct site access to the replacement WTP and proposed reservoirs, as well as the potential routes identified for heavy vehicles during the construction and operational periods of the Project.

This report addresses the transport effects relating to the regional consents for the Project (the replacement WTP and Reservoirs enabling works and bulk earthworks, plus the construction and operation of the Reservoirs), as well as the Outline Plan of Works for the Project (construction and operation of the replacement WTP and Reservoirs).

The purpose of the assessment is to identify the actual and potential transport effects (both positive and adverse) of the proposed development, as well as recommend measures to avoid, remedy or mitigate any

adverse effects of the construction and operational activities for the replacement WTP and proposed reservoirs.

1.2 Location

The replacement Huia WTP site (shown in **Figure 1-1**) is located on land owned by Watercare and is designated in the Auckland Unitary Plan (AUP) for 'Water supply purposes – water treatment plants and associated structures' (designation reference 9324 – Huia and Nihotupu Water Treatment Plants). The project spans three sites owned by Watercare which have a total site area of approximately 145,700 m^2. The site on which the proposed replacement Huia WTP is located has an area of approximately 42,000 m^2, the proposed Reservoir 1 site has an area of approximately 63,600 m^2, and the existing WTP site (on which Reservoir 2 is proposed) has an area of approximately 40,100 m^2.

The three sites consist of the following:

- Proposed WTP – adjacent to the existing Huia WTP site on the corner of Woodlands Park Road and Manuka Road
- Proposed Reservoir 1 – located on a new site north of the existing WTP
- Proposed Reservoir 2 – located on the existing WTP site (the existing WTP to be decommissioned).

The project site is located approximately 1 km from Titirangi Village and approximately 1.5 km north of the closest reach of the Manukau Harbour. The project site is predominately surrounded by residential (large lot) zones in all directions other than to the south east of the proposed WTP site, which adjoins land zoned "Open Space – Conservation" and designated by Auckland Council (the Council) for Regional Park purposes. There are five residential sites adjoining the proposed WTP southern boundary. There are also an additional eleven properties located on the ridge above the proposed reservoir site.

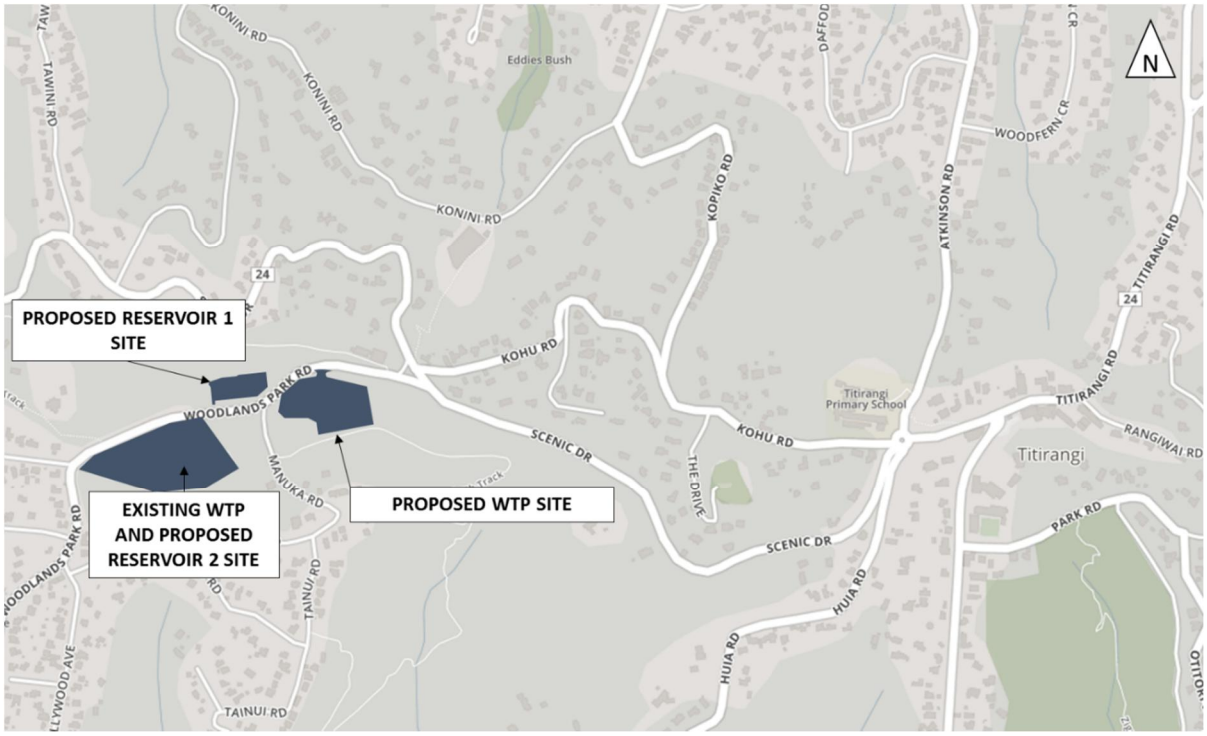


Figure 1-1: Proposed Development Sites

The replacement WTP site slopes away from the Woodlands Park Road to the south with gullies located at the southern boundary running north to south. The eastern extent of this site features steep slopes, which slope up towards Scenic Drive.

The Reservoir 1 site on the northern site of Woodlands Park Road is relatively hummocky with a knoll located in the southwestern corner of the site and a small gulley feature which runs through the middle of the site. Extremely steep slopes are present along the northern boundary beneath and above Exhibition Drive. Located on the western side of the reservoirs is a permanent section of Armstrong Gully stream.

Both the WTP and Reservoir 1 site are almost completely vegetated in native bush. The sites are identified as part of an extensive Significant Ecological Area (SEA_T_5539) in the Auckland Unitary Plan (AUP) that essentially extends throughout the entire Waitakere Ranges area.

Proposed Reservoir 2 will be constructed on the existing WTP site, once it is decommissioned.

Figure 1-2 indicates the land use in the wider site area, mainly residential. As shown in **Figure 1-2**, the replacement WTP site is located directly adjacent to the existing Huia WTP, west of Manuka Road. The proposed Reservoir 1 site is located opposite the existing Huia WTP on Woodlands Park Road. The existing Huia WTP will be retained and remain operational throughout the proposed development, and Reservoir 2 will be constructed on this site after the existing WTP has been decommissioned.

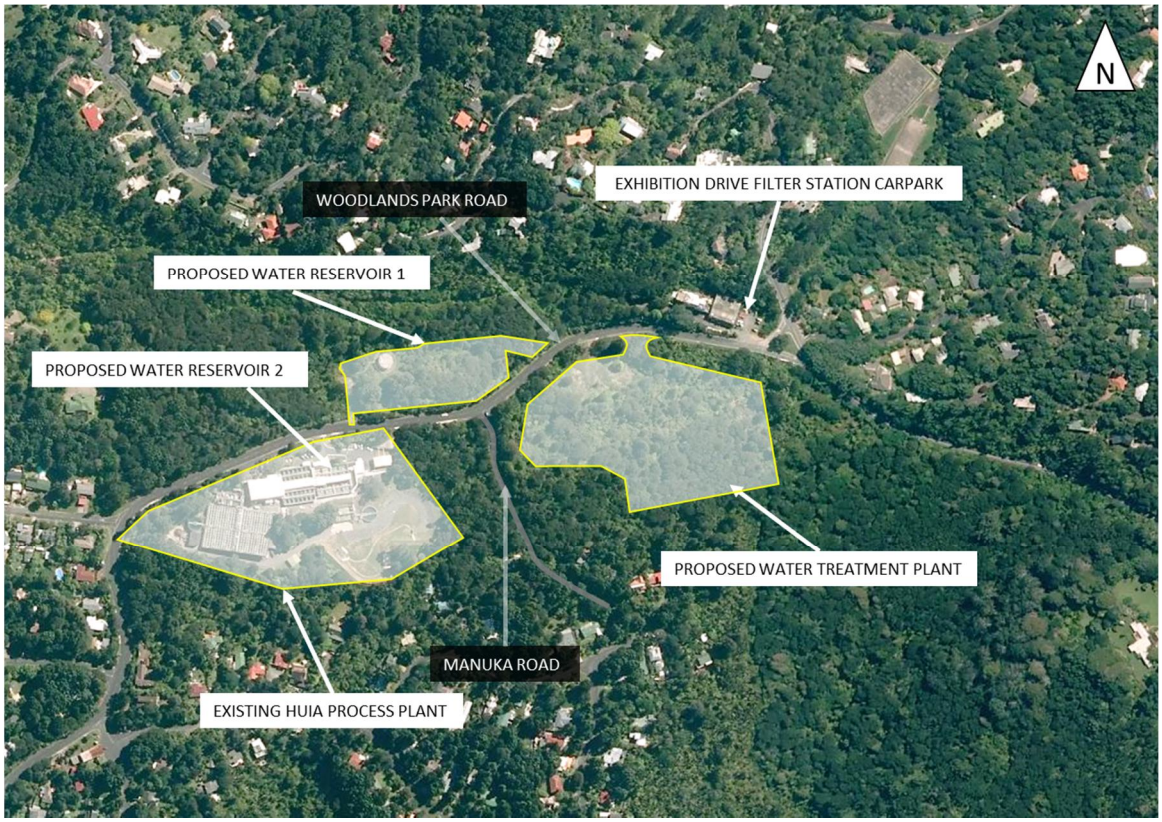


Figure 1-2: Aerial Image Identifying the General Locations of the Replacement WTP and Proposed Reservoirs

This TAR is based on the bulk and location plans that have been developed for the replacement WTP and proposed reservoirs, which are included in the *"Huia Replacement WTP Assessment of Environmental Effects* (AEE) *Report prepared by Tonkin and Taylor Ltd* (T&T)*"*. These plans have also been used (by ALTA) to estimate the amount of construction traffic generated by the enabling and construction works for both the replacement WTP and proposed reservoirs. This is discussed further in **Section 3**.

The bulk and location plans also illustrate indicative site access locations, which are intended to be used for the construction works and subsequent operational phase that are assessed in **Section 4** of this report. Information relating to the site layout, including on-site manoeuvring and layover for heavy vehicles and staff parking during the enabling works, bulk earthworks and construction is addressed in the ALTA Indicative Construction Methodology (dated 6 May 2019) which is included as an appendix in AEE **(**prepared by T&T**)**.

1.3 Report Structure

The report is structured as follows and has been prepared on the basis of initial liaison with Auckland Council, Council's transport consultant and Auckland Transport:

- Section 2: Transport and Land Use Environment
- Section 3: Proposed Development
- Section 4: Assessment of Transport Effects
- Section 5: Recommended Transport Mitigation
- Section 6: Summary and Conclusion.

2 Transport and Land Use Environment

2.1 Local Road Network

The road network surrounding the replacement WTP and proposed reservoirs sites, as well as providing access to the wider network is shown in **Figure 2-1**. The figure also illustrates Woodlands Park Road, which provides direct access to the sites.

The likely heavy vehicle (also referred to as HCV (Heavy Commercial Vehicle)) routes to be used as part of the development are also identified. Although these are within a wider area away from the site they form part of the assessment. The determination of the likely heavy vehicle traffic routes and their assessment is detailed in **Section 3.2** of this report. In addition to Woodlands Park Road, the roads that may be affected by the Project and its associated heavy vehicle routes include:

- Woodlands Park Road
- Scenic Drive
- Titirangi Road
- Atkinson Road
- Kaurilands Road
- Glendale Road
- West Coast Road
- Golf Road
- Godley Road
- Portage Road

Figure 2-1: Surrounding Transport Network and Potential Vehicle Routes for the Project

Site visits have been conducted on several occasions between May 2018 and April 2019 to understand the current land use and transport environment and road geometry, as well as the operation of the surrounding road network. These have covered different days of the week and times of day.

A summary of the transport environment along the key roads is provided in **Table 2-1** in relation to the routes illustrated in **Figure 2-1**. The key roads relating to the route to the Parau landfill site are addressed in **Section 4.1.6** of this report.

Table 2-1: Road Network Description

Road Name and Description	Road Image
Woodlands Park Road • Collector Road • Road layout – One lane each direction – Approx. 3.2m wide lanes – Formal footpath 1.3m wide (southern side only) – 50km/h • Road condition – Paved, good condition, limited shoulder • Dense vegetation and embankment on northern side • Existing WTP will be operational during the enabling/construction works period • Access to Exhibition Drive carpark close to Scenic Drive intersection.	
Scenic Drive • Arterial Road • Road layout – One lane each direction – Approx. 3.5m wide lanes – Formal footpath on southern side only – 50km/h • Road condition – Recent repaving and localised widening by Auckland Transport – Good condition, no shoulder • Low number of property driveways (seven in 1 km) • Dense vegetation and embankment on northern side with occasional property access.	

Titirangi Road (Village Section Only)

- Arterial Road
- Road layout
  - One lane each direction
  - Approx. 3 to 3.5m wide lanes with adjacent on-street parking and hatched median in places
  - Formal footpaths, generally both sides of the road
  - Several pedestrian crossings, including one signalised crossing and one zebra crossing
  - 50km/h
- Road condition
  - Good condition, no shoulder
- Dense vegetation and embankment on northern side on western side of village.

Titirangi Road (East of Village)

- Arterial Road
- Road layout
  - One lane each direction
  - Approx. 3.5m wide lanes
  - Formal footpath mainly on both sides of the road
  - 50km/h
- Road condition
  - Good condition, no shoulder
- Sections of on-street parking with generally low to intermittent use
- Residential for most part with regular property driveways.

Atkinson Road

- Arterial Road
- Road layout
  - One lane each direction
  - Approx. 4.2m wide lanes
  - Formal footpath on northern side nearer Titirangi and both sides for the majority of the road
  - 50km/h
- Road condition
  - Good condition, no shoulder
- Sections of on-street parking on both sides of road with more frequent use around schools at peak times
- Several schools along the route
- Residential for most part with regular property driveways.

Kaurilands Road

- Arterial Road
- Road layout
  - One lane each direction
  - Approx. 4.8m wide lanes
  - Formal footpath on both sides
  - 50km/h
- Road condition
  - Good condition, No shoulder
  - Large sections of on-street parking on both sides of road
- Sections of on-street parking on both sides of road with more frequent use around schools at peak times
- Several schools and kindergartens along the route
- Residential for most part with regular property driveways.

Glendale Road

- Arterial Road
- Road layout
  - One lane each direction
  - Approx. 4.5m wide lanes
  - Formal footpath on both sides
  - 50km/h
- Road condition
  - Good condition, limited shoulder
- Residential arterial route towards West Coast Road with some recreational activities located along the route
- Sections of on-street parking on both sides of road with more frequent use close to activities such sports grounds / shops
- Residential for most part with regular property driveways.

West Coast Road

- Arterial Road
- Road layout
  - Two lanes each direction for the majority through Glendale local centre
  - Approx. 3m wide lanes
  - Formal footpath on both sides
  - 50km/h
- Road condition
  - Good condition, kerb and channel
- Mixed use arterial route with combination of retail, commercial and residential activities along the route
- Sections of on-street parking on both sides of road with more frequent use close to Glen Eden local centre
- Some property driveways.

Golf Road

- Collector Road
- Road layout
  - One lane each direction
  - Approx. 4.5 to 5m wide lanes
  - Formal footpath on one side
  - 50km/h
- Road condition
  - Good condition, limited shoulder
- Sections of on-street parking on both sides of road, generally low to intermittent use
- Residential collector towards Portage Road
- Residential for most part with regular property driveways.

Godley Road

- Arterial Road
- Road layout
  - One lane each direction
  - Approx. 4 to 5m wide lanes
  - Formal footpath on both sides
  - 50km/h
- Road condition
  - Good condition, limited shoulder
- Sections of on-street parking on both sides of road with more frequent use around schools at peak times, plus close to Green Bay local centre
- Otherwise, residential for most part with regular property driveways.

Portage Road

- Arterial Road
- Road layout
  - One lane each direction
  - Approx. 4.5 to 5m wide lanes
  - Formal footpath and on-road cycle lanes on both sides
  - 50km/h
- Road condition
  - Good condition, limited shoulder
- Sections of on-street parking on both sides of road, generally low to intermittent use, but busier closer to New Lynn
- Mix of residential and industrial (closer to New Lynn) activities with regular property driveways.

2.2 Regional Freight Network

Within Auckland, freight moves primarily on the State Highways, motorways, and the arterial road network. The Auckland Regional Land Transport Plan (RLTP) 2018-28 identifies the regional freight network that is used for these movement types.

Figure 2-2 below shows the freight network for Auckland in relation to the site location. From the Auckland RLTP freight network, Rata Street and West Coast Road have been identified as the closest parts of the freight network, which can be accessed via the routes outlined in **Figure 2-1**.

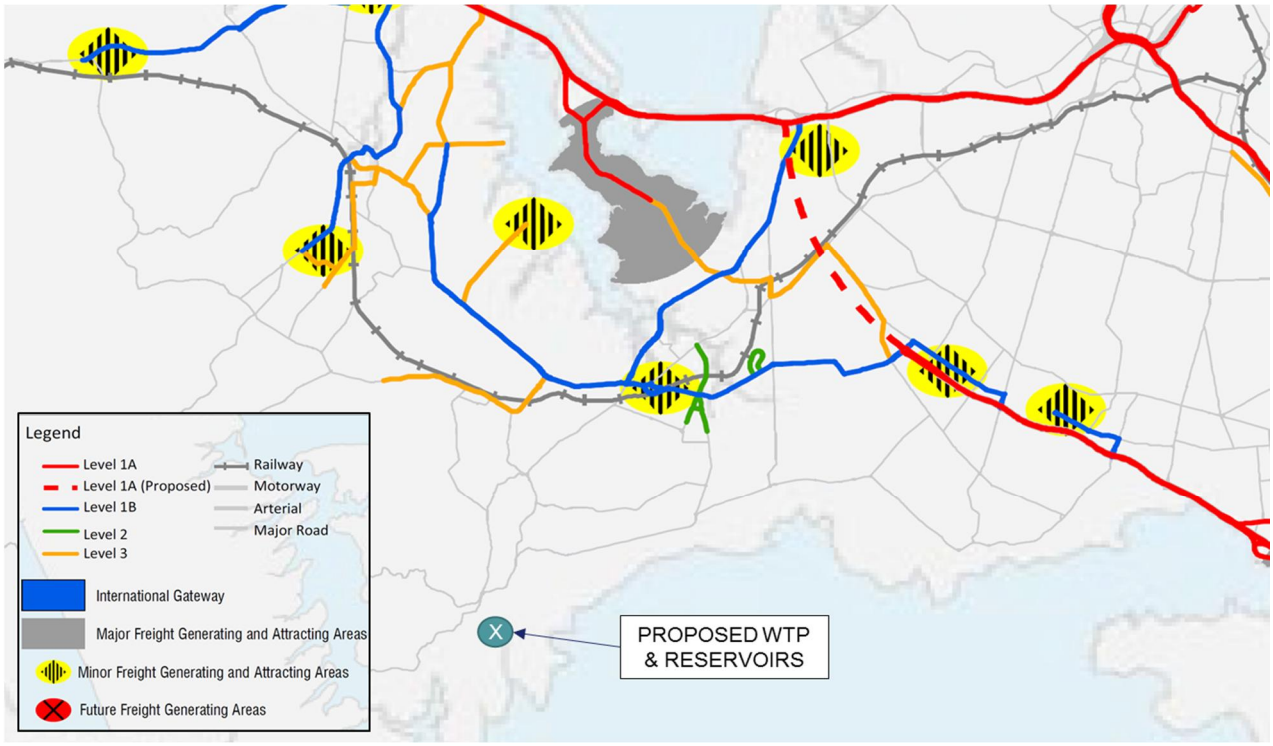


Figure 2-2: Auckland RLTP 2018-2028 Regional Freight Network

2.3 Over Dimension Vehicle Routes

The NZ Transport Agency provides maps identifying the over dimension vehicles routes within Auckland, freight moves primarily on the State Highways, motorways, and the arterial road network. **Figure 2-3** below shows the over dimension vehicle routes closest to the Project site.

The closest over dimensional vehicle routes to the site are along Great North Road and Rata Street, as well as parts of Golf road and Godley Road connecting with Rata Street and Kinross Street, which can be accessed via the routes outlined in **Figure 2-1**.

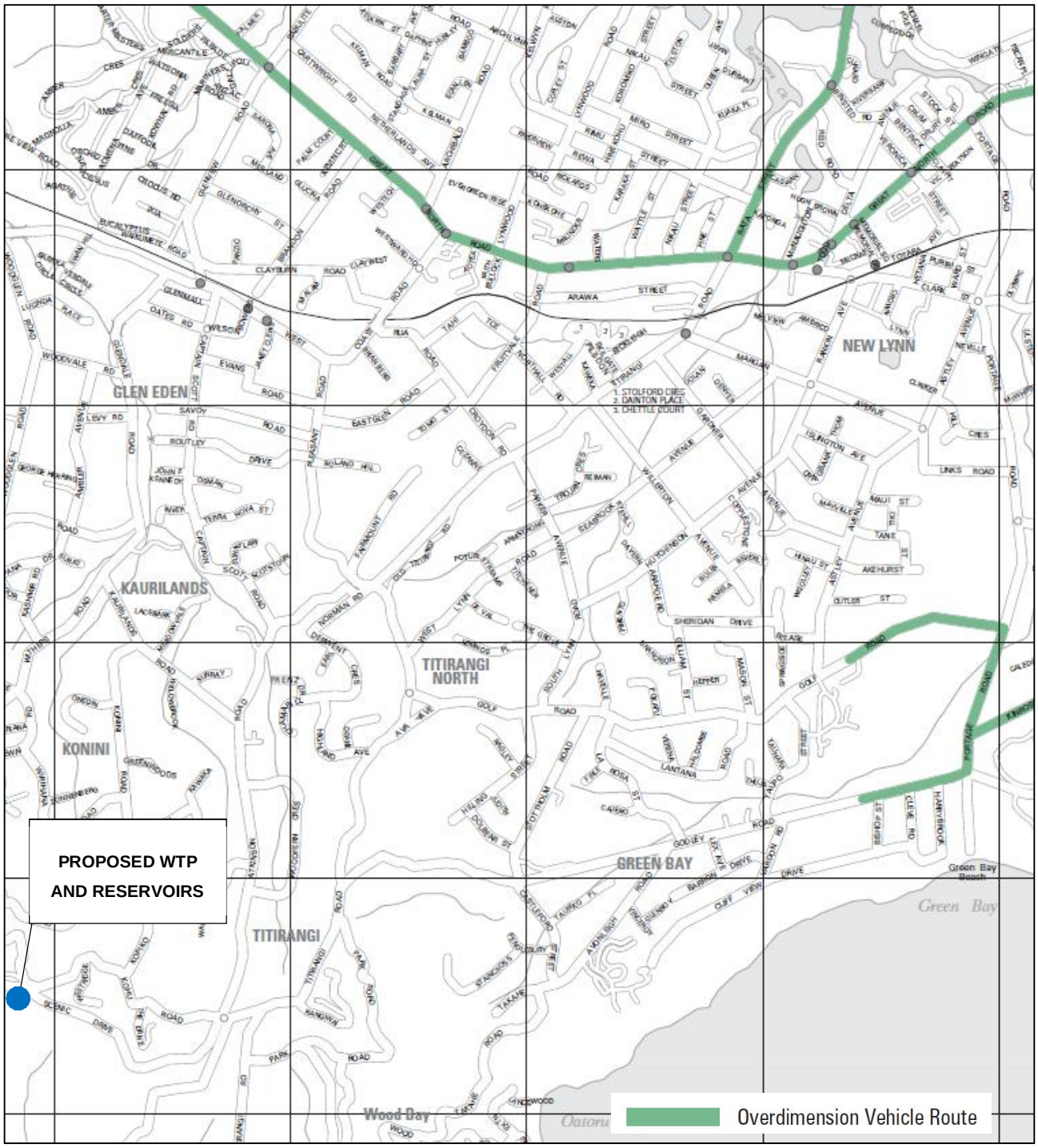


Figure 2-3: Over Dimension Vehicle Routes

2.4 Crash Data

2.4.1 Adjacent to Project Site

The crash history of roads adjacent to the Project has been extracted for a ten-year period from January 2009 to December 2018 (inclusive) and has been summarised in this section. The data has been obtained from NZTA Crash Analysis System (CAS) software. The crash study extent is shown in **Figure 2-4** below. Further detail of the crash data is available, is required.

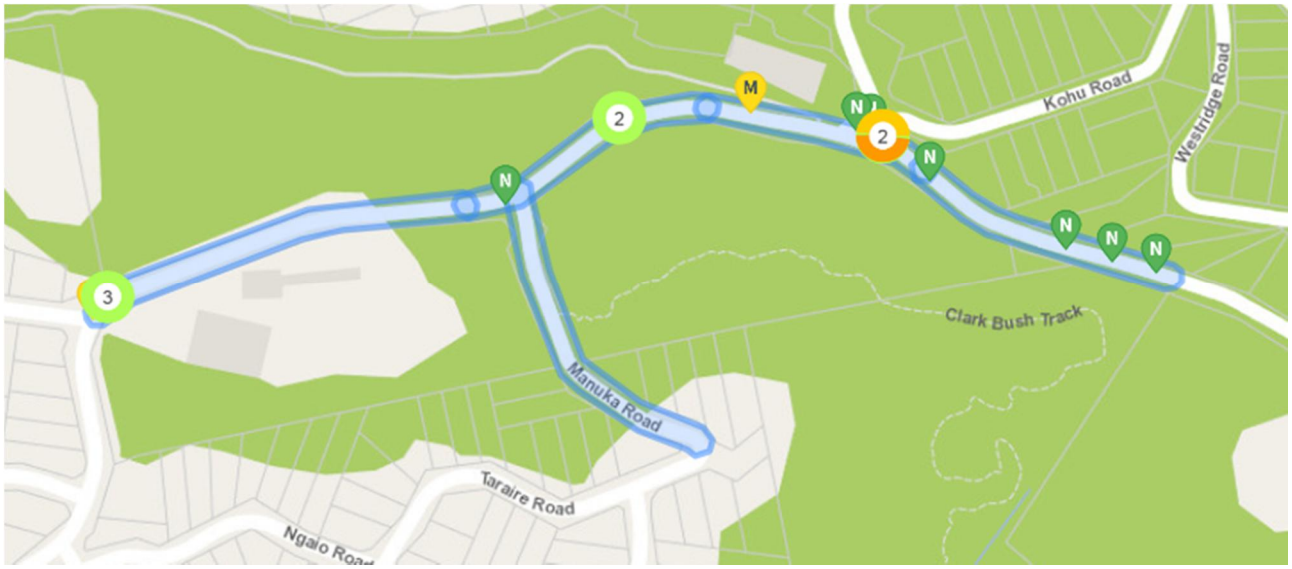


Figure 2-4: Crash Study Extent (NZTA Crash Analysis System)

The crash data along Scenic Drive and Woodlands Park Road (including the intersection of Scenic Drive and Woodlands Park Road) in the vicinity of the site is summarised below:

- Over a period of 10 years (2009-2018) 23 crashes were recorded
  - One of these 23 crashes was a serious crash which occurred nine years ago, in 2010
  - Two crashes were minor crashes that occurred ten years ago, in 2009, and one other minor crash occurred in 2012
  - All other crashes were non-injury crashes
- The serious crash in 2010 involved a cyclist travelling northbound on Scenic Drive, which was sideswiped by a car turning left heading southbound onto Scenic Drive
- One of the minor crashes involved a motorcyclist at the Woodlands Park Road and Scenic Drive intersection, where a vehicle failed to notice the motorcyclist travelling westbound when merging
- The second minor crash occurred on Woodlands Park Road, 100m west of the Scenic Drive intersection. This involved an eastbound vehicle which rear-ended another vehicle that was stopped/moving slowly on Woodlands Park Road
- The third minor crash occurred at the Woodlands Park Road and Waima Crescent intersection. This involved a vehicle that lost control at the horizontal curve, while travelling southbound on Woodlands Park Road
- The majority of the non-injury crashes occurred at the Woodlands Park Road and Waima Crescent intersection, or the Woodlands Park Road and Scenic Drive intersection (the latter discussed below)
- Seven of the non-injury crashes were loss of control crashes.

From the crash data which includes a 50m radius surrounding the Woodlands Park Road and Scenic Drive intersection, is summarised below (this includes some duplication of CAS data from the previous section):

- Total of 13 crashes recorded over a 10 year period:
  - No fatal crashes
  - One serious crash, which occurred almost ten years ago, in 2010
  - One minor crash
  - 11 non-injury crashes.

Of the total of thirteen crashes, three crashes occurred at night (outside the likely proposed construction works period), whilst eight crashes involved vehicles crossing or merging at the Woodlands Park Road and Scenic Drive intersection. This suggests that the existing layout could be a contributing factor to the reported crashes. However, existing traffic movements at this intersection associated with the existing WTP are a negligible proportion of total daily traffic movements along both Woodlands Park Road and Scenic Drive.

2.4.2 Key Truck Routes

The crash history of roads along the key truck routes for the Project (refer to **Section 4.1.1**) has also been extracted for a ten-year period from January 2009 to December 2018 (inclusive) and has been summarised in this section. The data has been obtained from NZTA CAS software.

The crash study extent is shown in **Figure 2-5**. This considers the key truck routes between the Project site and main regional freight network (refer to **Figure 2-2**), i.e. through to Great North Road at the intersections with West Coast Road and Titirangi Road. Further detail of the crash data is available, if required.

Figure 2-5: Key Truck Routes – Crash Analysis

The crash data for the routes is summarised below, focussing on recorded crashes involving trucks:

- Over a period of 10 years (2009-2018) 54 crashes involving heavy vehicles were recorded:
  - There were no fatal crashes recorded
  - One crash was of a serious nature, which occurred in 2015
    - The 2015 event involved the heavy vehicle colliding with a pedestrian on a footpath, on Rua Road.
  - Eight crashes were minor crashes, of which four occurring along West Coast Road
  - All other crashes were non-injury crashes.
  - There were two non-injury crashes along the Parau route on Woodlands Park Road, both occurring in 2011.

The crash analysis relating to trucks on these routes did not identify any specific locations with crash issues or any recurring crash causation patterns along the routes.

2.5 Posted Speed Limits and Speed Survey Data

The road network adjacent to the Project has a posted speed limit of 50km/h. **Figure 2-6** illustrates the posted speed limits of these roads, as well as identifying roads that have a 30km/h posted speed limit (Kohu Road). Some of the school zones have a posted speed limit of 40km/h. These are mainly concentrated around the Titirangi roundabout and the school locations.

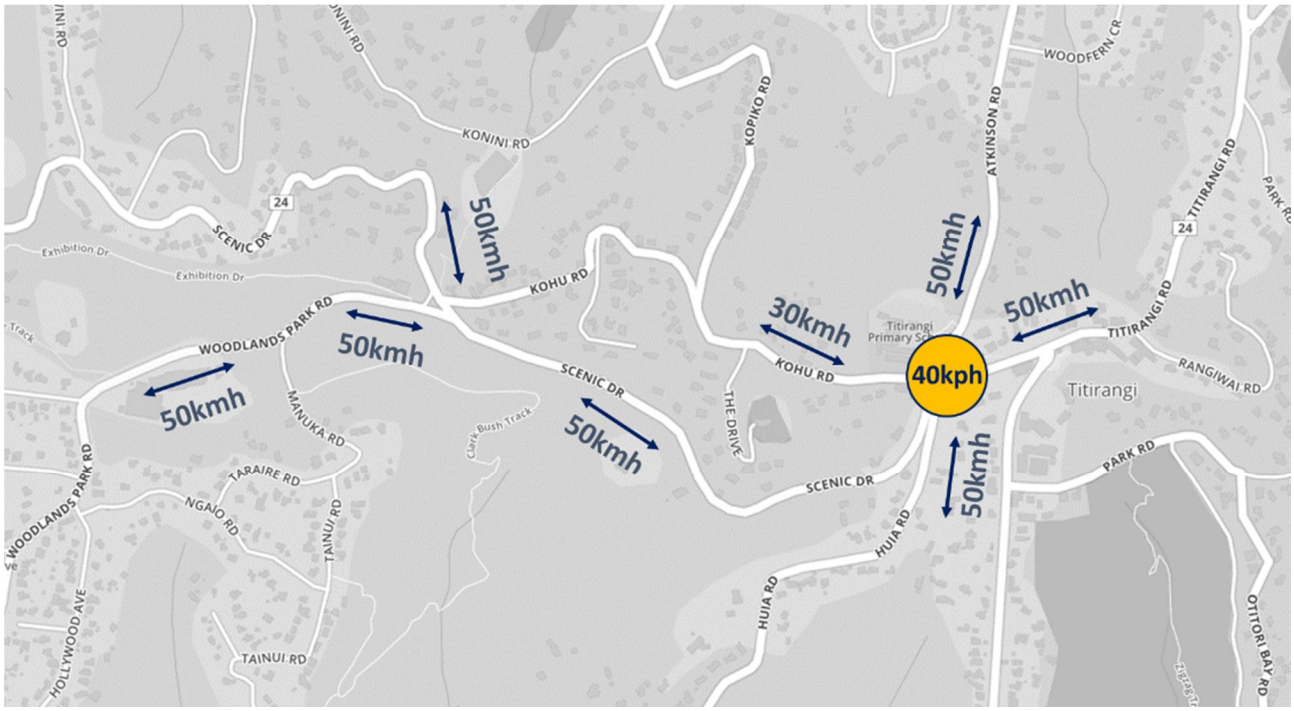


Figure 2-6: Posted Speed Limits

Traffic counts and speed surveys were conducted along Woodlands Park Road, Scenic Drive, Kohu Road, Atkinson Road and Titirangi Road for a seven day period ranging from 13 February 2018 to 19 February 2018. The locations of the traffic counts and speed surveys are shown in **Figure 2-7** below. The surveys were focussed on those roads surrounding the Project site and did not include the wider network.

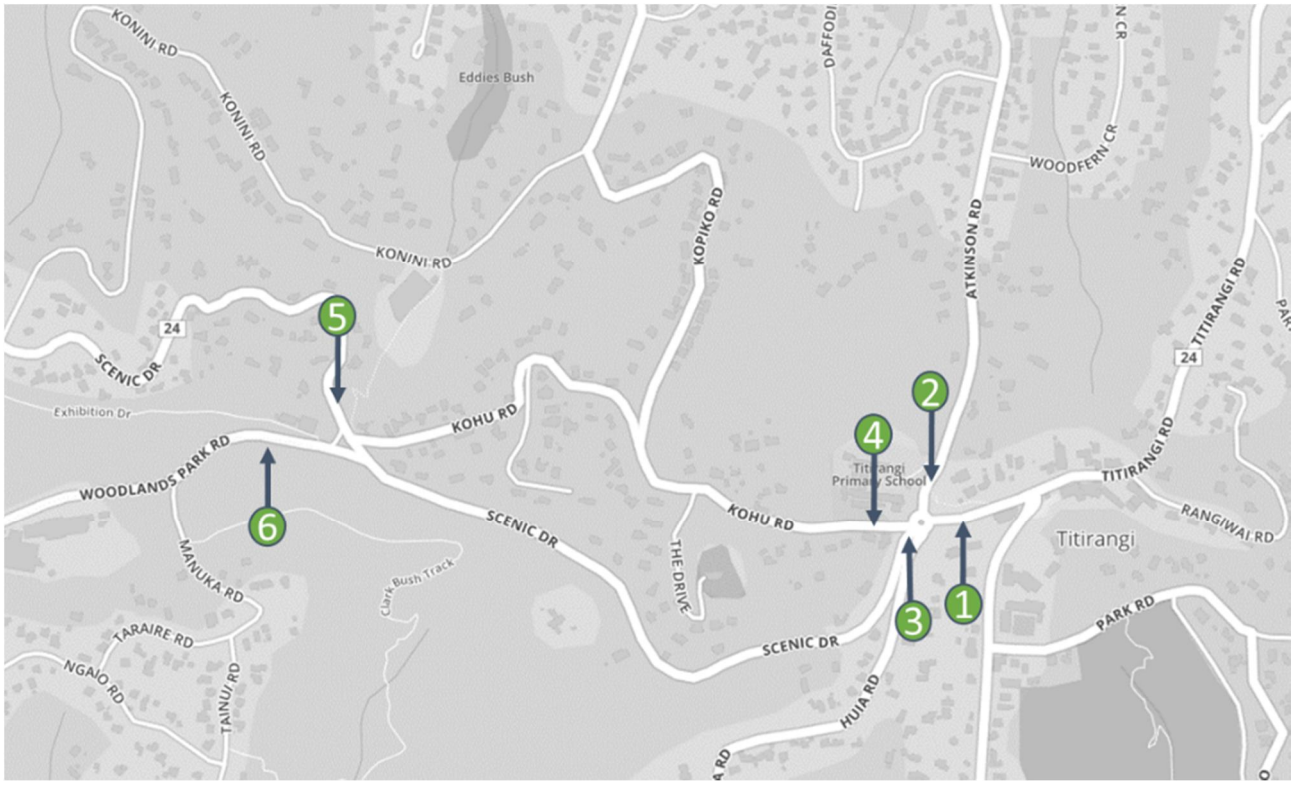


Figure 2-7: Traffic Count and Speed Survey Locations

The speed survey data was collected to understand the current speed environment (85th percentile operating speeds) on the surrounding road network. The surveys also inform the review of any safety issues on the local road network. **Table 2-2** shows the recorded speeds from the surveys.

Table 2-2: Surveyed Average Weekly Speeds

Count Number	Road Name	Posted Speed (Km/h)	Weekly Average Speed	
			Northbound (Km/h)	Southbound (Km/h)
1	**Titirangi Rd** (13/02/18-19/02/18)	50	32	34
2	**Atkinson Rd** (13/02/18-19/02/18)	50 (School zone variable speed 40km/h outside Titirangi Primary and Kaurilands Schools)	32	31
4	**Kohu Rd** (13/02/18-19/02/18)	30	19	20
5	**Scenic Drive** (13/02/18-19/02/18)	50	51	55
6	**Woodlands Park Rd** (13/02/18-19/02/18)	50	55	56

The recorded average weekly speeds for Titirangi Road and Atkinson Road are significantly lower than the posted speed limit. This is likely due to the tube counts being located near the roundabout where speeds approaching an intersection are lower. During the weekday morning (AM) and evening (PM) peak periods, the 40km/h school zone restriction likely contributed to the lower than 50kph speed recorded. The lower speeds are unlikely to be due to the reduced speed required by the traffic management plans that were in place for the Auckland Transport Scenic Drive Rehab project that began on Monday (18 February 2018), as this was the last day of the speed survey, and works were overnight.

The average weekly speeds recorded for Scenic Drive, both near the Titirangi roundabout and Woodlands Park Road, are very similar to the posted speed limit. The Rehab Works along Scenic Drive started on the last day of the speed survey (Monday 19 February 2018). The average speed on this day (Sunday 18 February 2018) was 1km/h less than the average on the previous day (Saturday 17 February 2018).

The average weekly speeds recorded for Woodlands Park Road for the northbound traffic are very similar to the posted speed limit, while the southbound traffic was observed at about 5km/h higher than the posted speed, noting this direction is on a slightly downhill grade.

2.6 Traffic Data

2.6.1 Traffic Survey Data

Existing traffic volumes were obtained by undertaking a seven day traffic survey on roads surrounding the site. The locations of the counts are shown in **Figure 2-7** and have been numbered for easy reference in **Table 2-3**. The surveys were conducted during the week of 13 to 19 February 2018. Supplementary traffic data has also been appended to this report in **Appendix A**.

Table 2-3: Traffic Data

Count Number	Road Name	5 Day Average (both directions)			
		ADT	HCV%	AM Peak	PM Peak
1	Titirangi Road	18,131	5%	1,439	1,497
2	Atkinson Road	7,954	5%	830	701
3	Scenic Drive	7,325	4%	509	650
4	Kohu Road	122	2%	12	10
6	Woodlands Park Road	5,135	3%	445	458

Note: Scenic Drive location was approaching the Titirangi Roundabout

It should be noted that, the heavy vehicle percentage includes different types of heavy vehicles (such as buses, truck and trailers and rigid trucks). According to the traffic count data, there are roughly 154 heavy vehicle movements on Woodlands Park Road per day, albeit this is currently identified mainly as buses and rigid trucks with a small number of truck and trailers.

Traffic volume data for roads further away from the site (such as Golf Road, Godley Road, Portage Road, Glendale Road and Kaurilands Road are outlined in **Table 2-4** and was obtained from the Auckland Transport Traffic Count data.

Table 2-4: Auckland Transport Traffic Data

Road Name	5 Day Average (both directions)			
	ADT	HCV%	AM Peak	PM Peak
Kaurilands Road (2015)	7,531	2%	1,112	971
Glendale Road (2016)	12,265	3%	1,067	1,240
Golf Road (2015)	11,735	4%	1,338	1,344
Godley Road (2015)	13,415	3%	1,231	1,630
Portage Road (2015)	10,064	4%	815	1,615

From the above tables and the data collected (refer to **Appendix A**), it has been identified that:

- All roads have a heavy vehicle percentage ranging from 2% to 5%. The higher ADT on Golf Road, Godley Road, Portage Road, Glendale Road and Titirangi Road, means there is a higher number of heavy vehicles than the other roads
- Golf Road and Godley Road have lower morning (AM) peak traffic counts than Titirangi Road
- Portage Road and Godley Road have higher afternoon (PM) peak than Titirangi Road
- Kaurilands Road and Glendale Road have lower AM peak and lower PM peak traffic (both ways) than Titirangi Road
- Weekday and weekend ADT were relatively similar on Golf Road, Godley Road, Portage Road and Titirangi Road. Whereas, Kaurilands Road and Glendale Road generally have less traffic on the weekends compared to weekdays
- During the Scenic Drive Rehabilitation project, which began on the second to last day of the surveyed week in 2018, there was a small increase in the heavy vehicle percentage on Scenic Drive from around 3% to 5%.

2.6.2 Residual Road Capacity

Table 2-5 identifies the theoretical 'residual' road capacity based on the existing traffic data (detailed above). The 'residual' capacity identifies the potential spare capacity of the surrounding road network, which has been used to consider any potential adverse effects of the Project.

The theoretical road capacity (vehicles per hour per lane) is based on Austroads Part 3 and is influenced by road type and side friction from accesses and other activity. It should be noted that the road capacity for Titirangi Road in the village section would be lower than the majority of the road section, due to the interaction with the existing signalised pedestrian crossing, on-street parking and vehicle driveways. This has been discussed further in **Section 4.1.3**.

Based on the volumes in **Table 2-5**, it is considered that the surrounding road network in closer proximity to the site generally has substantial residual capacity on a daily basis during the AM and PM peak period with the exception of the busy weekday commuter peak periods through Titirangi village, which are primarily affected by the signalised pedestrian crossing facility. It is noted that in off-peak periods (outside the AM and PM peak periods) there would be greater residual capacity to that identified below.

Table 2-5: Existing Traffic Demand and Residual Road Capacity (Highest Peak Hour)

Road Name	Woodlands Park Road	Titirangi Road	Atkinson Road	Scenic Drive	Kaurilands Road*	Glendale Road*
Highest Peak Hour	PM	PM	AM	PM	AM	PM
Highest Peak Hour Volume (both directions)	458	1,492	829	650	1,215*	1,132*
Peak Hour Volume Northbound	144	933	469	437	-	-
Peak Hour Volume Southbound	314	559	360	213	-	-
Road capacity per direction (vehicle/hour/lane)	900	1,200	900	900	1,800	1,800
Residual Capacity Northbound	**84%**	**22%**	**48%**	**51%**	**32%**	**37%**
Residual Capacity Southbound	**65%**	**53%**	**60%**	**76%**		

** Observed 2015/16 traffic volumes adjusted by 3% per annum to provide a 2018 traffic demand.*

2.6.3 Existing Site Traffic

The replacement Reservoir 1 site is undeveloped land owned by Watercare and therefore does not currently generate any vehicle movements.

The existing Huia WTP, adjacent to the proposed WTP generates up to 1 to 2 heavy vehicle movements a day, but not every day, which include activities such as sludge removal /chemical deliveries. A small amount of staff vehicle movements (approximately around 10 staff) occur during the typical weekday peak periods. These traffic movements are negligible in terms of the overall existing traffic movements on the existing surrounding road network.

Generally, staff movements occur in the AM and PM general traffic peaks, with some off-peak movements also likely. Heavy vehicle movements are scheduled deliveries but occur randomly throughout the day as per the WTP operational demands. Both staff and heavy vehicles make use of Woodlands Park Road, Scenic Drive and Titirangi Road, as the main routes.

Parking on site includes approximately 20 staff/visitor carparks and two main loading/offloading areas with separate entrances for heavy vehicles. The current off-road parking supply is adequate for both staff and heavy vehicles.

2.7 Schools and School Bus Services

2.7.1 Schools

Several schools are located along the potential heavy vehicle routes that need to be considered in relation to the potential adverse effects of heavy vehicles. **Figure 2-8** below illustrates the locations of the schools near these heavy vehicle routes.

School traffic is unlikely to significantly affect the areas immediately adjacent to the Project site on Woodlands Park Road, albeit it is used as a route to schools. However, Atkinson Road, Kaurilands Road and Godley Road experience peak school traffic in the vicinity of the schools, particularly associated with on-street parking, that would interact with heavy vehicle traffic associated with the Project.

Based on available information and observations, the majority of school weekday morning traffic movements generally occur around 8:30am through to 9am with the majority of the traffic travelling southbound on Kaurilands Road including in both directions on Godley Road and the northern end of Atkinson Road. In the afternoon, the majority of school traffic peaks around 2.30pm through to 3pm with traffic travelling both directions on Godley Road and Kaurilands Road including the majority of the traffic travelling northbound on Atkinson Road.

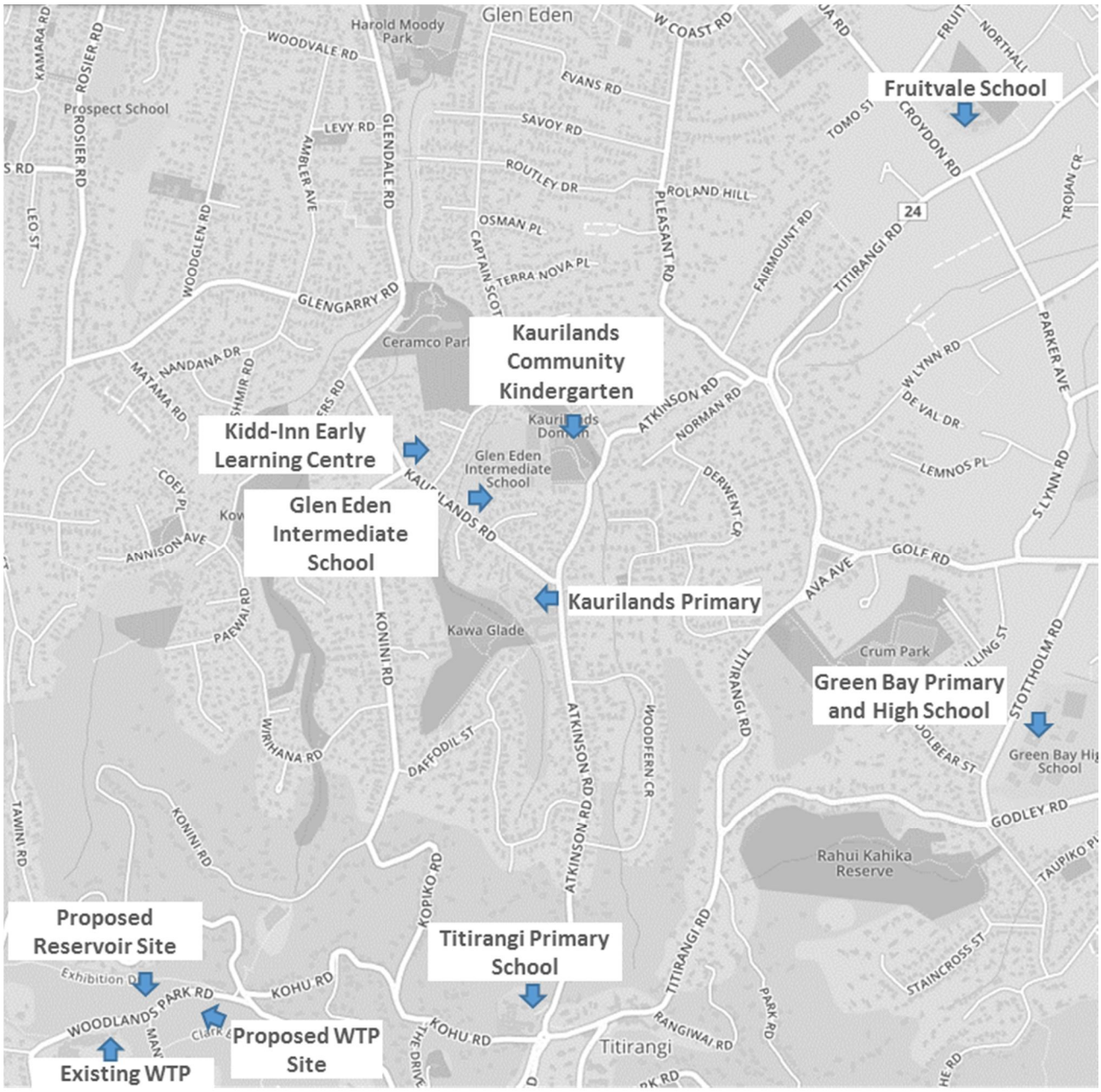


Figure 2-8: Schools near Potential Heavy Truck Routes

2.8 Public Transport

2.8.1 Scheduled Bus Services

There are scheduled bus routes along Woodlands Park Road and other roads as shown in **Figure 2-9** below. The services on these routes include “Express” bus services in the weekday morning and afternoon peak periods on the majority of the bus routes. These buses connect south Titirangi to New Lynn and Glen Eden train stations. There are no “express” buses on Glendale Road, Godley Road and Golf Road.

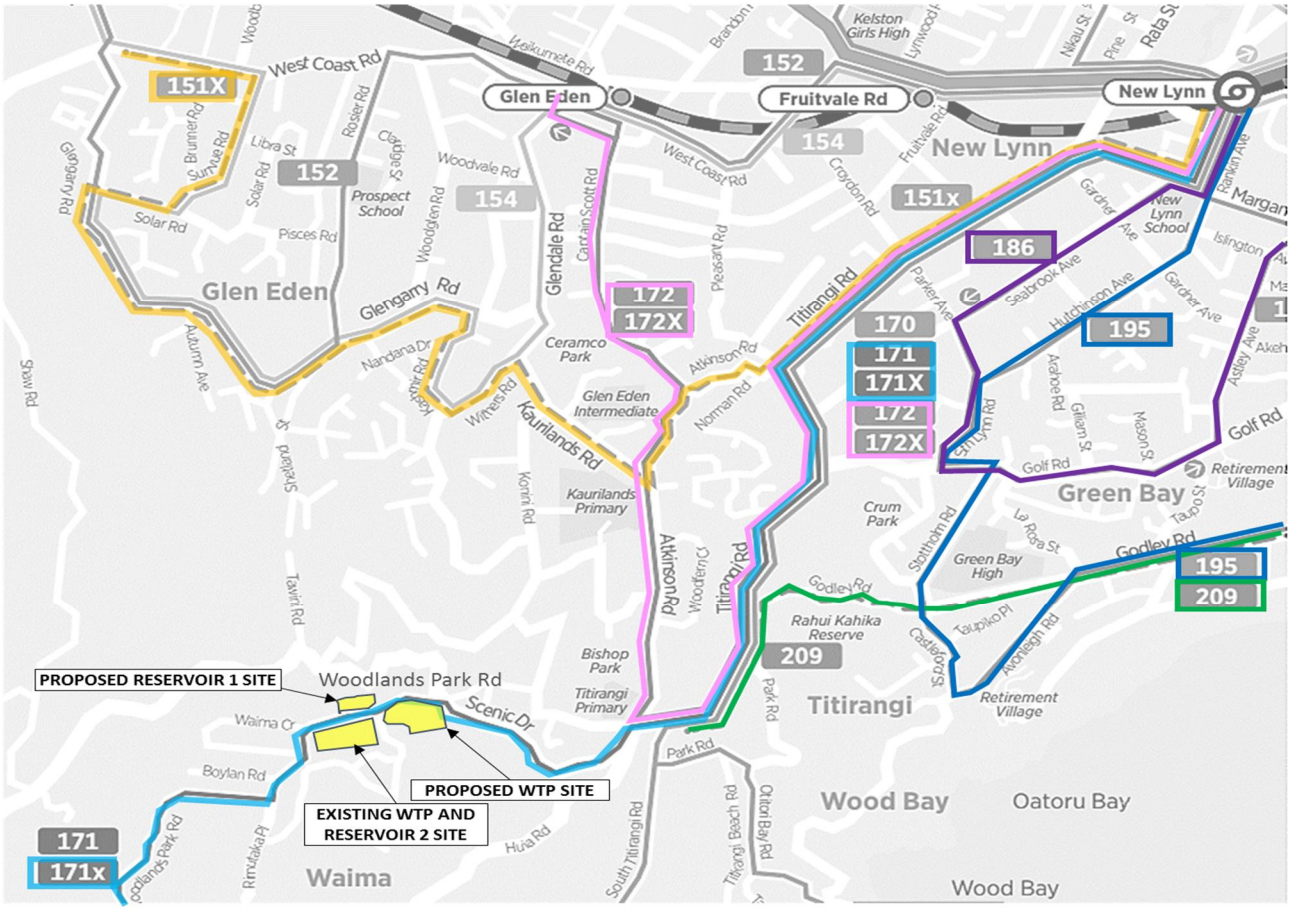


Figure 2-9: Bus Routes on the Potential Heavy Truck Routes

2.8.2 Bus Stops

Figure 2-10 shows the bus stops located near the proposed access locations along Woodlands Park Road for the existing WTP, proposed WTP and proposed reservoir site.

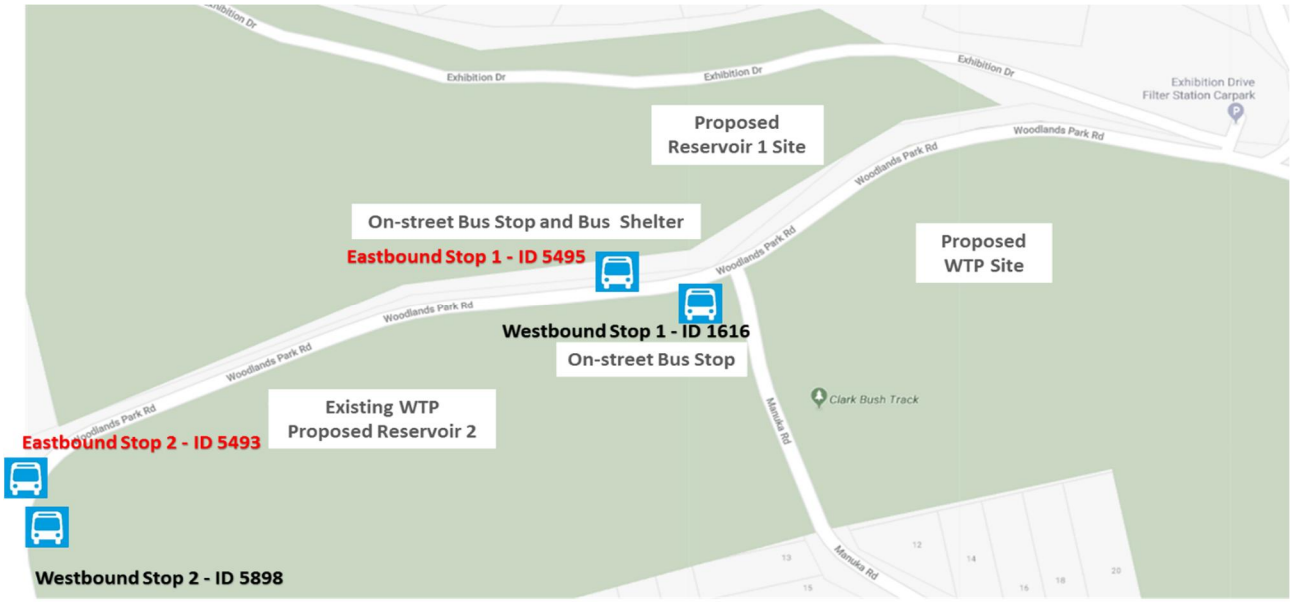


Figure 2-10: Bus Stops on Woodlands Park Road

Auckland Transport HOP data (for February/March 2019) has been collected to understand the current patronage for the stops shown in **Figure 2-8**. The key information for the bus stops, including both public and school services, is summarised below:

- Total patronage for the week – 1,808 users
  - Westbound – 1,050 users (58%)
  - Eastbound – 758 users (42%)
- Stops 5493 and 5898, furthest away from the Project site, are the main stops used with 85% (1,539) of all the patronage
- Westbound stops are mainly used for "tag off" (alighting) trips – 1,039 users (99%) out of 1,050 – again with the vast majority of trips at stop 5898, further from the Project site, as below
  - Stop 1616 – 180
  - Stop 5898 – 859 (83%)
- Eastbound stops are mainly used for "tag-on" (boarding) trips – 733 users (97%) out of 758 – again with the vast majority of trips at stop 5493, further from the Project site, as below
  - Stop 5495 – 53
  - Stop 5493 – 680 (93%)
- Low usage of stops nearest sites, particularly the stop 5495 on the north side of Woodlands Park Road
- Stop 5495 is little used by school kids, children tend to alight at westbound stop in the afternoon, when returning home.

2.8.3 School Bus Services

There are five school bus services that run along the key routes identified. The majority of the school buses run along Woodlands Park Road, Atkinson Road and Godley Road. The school buses serve Titirangi Primary School, Kaurilands Primary and Glen Eden Intermediate and run between 7.30am to 8.30am and from 3pm to 4pm on weekdays.

2.9 Pedestrian and Cycling Facilities

Woodlands Park Road has a single footpath located adjacent to the proposed WTP site with a narrow unpaved shoulder not suitable for on-road cycling on the eastbound traffic lane.

Figure 2-11 below shows the footpath adjacent to the WTP site which is approximately 1.3m wide with no berm adjacent to the footpath. **Figure 2-12** below also shows the existing bus stops adjacent to the eastbound lane, which have no formal footpath, only a narrow shoulder and a bus shelter. These bus stops currently cater for the school bus services and other scheduled bus services.

Figure 2-11: Pedestrian Facilities on Woodlands Park Road (Southbound)

Figure 2-12: Woodlands Park Rd (Northbound) cross section showing locations of bus stops

2.9.1 Recreational Users

During site visits, cyclists and pedestrians have been observed using the footpath and riding on road along Woodlands Park Road. This is the only footpath on this road and is located adjacent to the westbound traffic lane. There is no footpath adjacent to the northern kerb and a narrow unpaved shoulder.

These recreational users are generally observed to be using Woodlands Park Road to access the Exhibition Drive track located at the corner of Scenic Drive and Woodlands Park Road, but some will potentially be walking to/from Titirangi along Scenic Drive, including some school children.

2.10 Parking

Woodlands Park Road is a two lane carriageway with 3.2m wide lanes with a minimal unpaved shoulder along the northern kerb and a formal footpath 1.3m wide (southern side only). On-street parking is permitted, however, observations during the site visits indicate that there is no demand in the section between Waima Crescent and the Scenic Drive intersections. In the instance that a vehicle is parked parallel on the street, vehicles would need to cross the road painted centreline to pass the parked vehicle.

Manuka Road is a two lane carriageway with 2.75m wide lanes with no shoulder. Similar to Woodlands Park Road, on-street parking is permitted, and observations also indicated that there is no demand. Likewise, in the instance that a vehicle is parked parallel on the street, vehicles would need to cross the road centreline to pass the parked vehicle.

3 Proposed Development

3.1 Overview

Watercare is responsible for the bulk and retail supply of potable water and for the collection, treatment and disposal of wastewater to around 1.5 million people in Auckland. Watercare is a Council Controlled Organisation (CCO), wholly owned by the Council.

The Huia WTP is the third largest water treatment plant in Auckland and is a crucial component of Auckland's water supply network, treating approximately 20% of Auckland's water. The aging asset requires replacement due to the structural integrity of the buildings but also to improve the current water treatment process to efficiently and effectively treat the raw water supplied from the Waitakere Ranges. Watercare therefore proposes to construct a new WTP to replace the aging Huia WTP. As part of this project Watercare is also proposing to construct two treated water reservoirs (50ML total capacity) to increase treated water storage within the western supply zone.

This report has been prepared to assess the traffic and transportation effects of the proposed works and to accompany the regional resource consent application and Outline Plan of Works in relation to the proposed construction and operational activities for the replacement WTP and associated proposed reservoirs.

3.2 Proposed Development

The replacement WTP will be constructed on the corner of Manuka Road and Woodlands Park Road directly across from the existing Huia WTP site. The replacement WTP will have a treatment capacity of 140 mega-litres per day (MLD). A new 25ML treated water reservoir will be located on the northern side of Woodlands Park Road (Reservoir 1), with another 25ML reservoir (Reservoir 2) subsequently constructed on the existing Huia WTP site once the existing plant has been decommissioned. The proposed works also includes construction of the North Harbour 2 watermain (NH2) valve chamber and tunnelling reception shaft within the Reservoir 1 site. Refer to the AEE prepared by T&T for further details on the proposed development and the the proposed site layout plans.

The access and internal roads have been designed in order to accommodate the operational requirements of the replacement WTP and the reservoirs. On-site parking and loading bays have also been determined based on the operational requirements of the Project sites. Assessment of the site access and internal layout for the operational phase is detailed in **Sections 4.2**, which relates solely to the Outline Plan of Works application.

3.3 Construction Methodology Overview

This section summarises the construction methodology for the Project and the more detailed ALTA Indicative Construction Methodology (dated 6 May 2019), which is included as an appendix in the AEE (prepared by T&T).

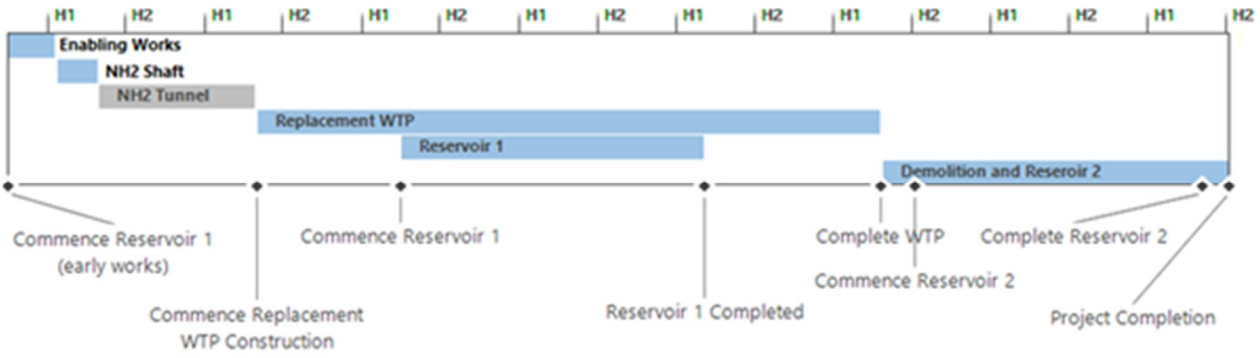
This assessment is based off the bulk and location plans that have been developed for both the replacement WTP and proposed reservoirs sites, included in the AEE prepared by T&T. These plans have also been used by ALTA to estimate the amount of construction traffic generated by the proposed works, detailed in **Section 3.4**.

The indicative construction methodology and programme has been developed through an iterative process, looking for opportunities to reduce heavy vehicle and staff movements. The development of that programme included consideration of methods to reduce the daily number of heavy vehicles and staff vehicles, whilst balancing this against the effects of a longer programme duration. Given the interdependencies between some activities, reducing daily trucks further than considered in this assessment was identified by ALTA to result in a substantial increase in the enabling / construction works programme for the Project.

The indicative programme provided by ALTA and used in this report has been identified to provide an appropriate balance between vehicle movements and construction programme period. The indicative programme (as per the attached AEE appendix) has been used for the assessment in this report, which has an overall duration of approximately 8 years, including several periods with much lower or no activities on the project site (such as between construction phases, as described further below. The working periods specified in the ALTA report to determine potential daily traffic demands, which are then used in this assessment, are based around ALTA's initial view working periods.

At a conceptual level (refer to **Table 3-1**), the works programme comprises 6 months early works on the Reservoir 1 site (site clearance and construction of the NH2 shaft), followed by a year's pause in the project works while the NH2 tunnelling is underway. Enabling works and earthworks would then be undertaken on the WTP site (approximately 1 year), followed by construction works on the WTP and Reservoir 1 sites (approximately 2 years). Reservoir 2 is expected to be constructed a few years later, once the existing plant has been decommissioned and demolished.

Table 3-1: High-level Indicative Construction Programme for the WTP and Reservoirs



Note: Taken from Indicative ALTA Construction Methodology Report, May 2019

It should be noted that there are breaks in activity during some of the construction phases identified above, i.e. there would not be continuous works during those phases. These breaks include 12 months between early works/NH2 shaft and the start of the replacement WTP as well as 6 months between the commissioning of Reservoir 1 and decommissioning of the existing WTP and construction of Reservoir 2.

A draft Construction Traffic Management Plan (CTMP) is included as **Appendix E**, which provides a framework for the measures that are considered necessary to manage and mitigate the predicted construction effects. The appropriate working days and hours would be managed through the CTMP, which will need to be approved by the Council, including Auckland Transport.

The indicative construction methodology provided by ALTA also shows that some activities occur concurrently (refer to the attached AEE appendix) and includes the following key assumptions:

- Vehicle movements and operational durations are based on achieving approximately 75% productive working to take account of lost days for inclement weather, particularly in the winter
- Enabling/construction activities will be conducted during the day time and no night time construction works.

3.4 Predicted Traffic Generation

As mentioned, the construction programme has been based on achieving a balance between reducing daily heavy truck and staff movements and the overall programme period. This section details the predicted light and heavy vehicle traffic generated with the proposed construction programme. Refer to **Appendix B** for a summary of the heavy vehicle movements across the programme.

3.4.1 Light Vehicles and On-site Parking Demand

Due to the adjacent road environment on Woodlands Park Road, on-street parking would not be safe for construction vehicles and staff traffic. Due to this, the on-site parking has been assessed and rationalised to provide any construction parking on the Project sites, with the exception of a shuttle bus that would transport the remainder of workers to the sites. The location of the shuttle bus interchange (likely to be at 'staging' site, potentially in the New Lynn area) has not yet been determined and will be clarified, once a contractor is appointed, through the completion of the CTMP.

It is assumed that approximately 80% of staff will arrive in the morning and 80% leave in the afternoon, albeit with the proposed site hours, this would generally be outside the network peak periods. On this basis, the construction staff (light) vehicles forecast has been estimated as per **Table 3-2**.

The maximum on-site parking at any one time would include 50 carparks distributed between both the WTP and reservoir/s sites. On this basis, it has been estimated that approximately 90 construction staff will need to make use of the shuttle bus, which means that this will result in a total of approximately 30 movements per day (15 movements in each direction). Further details of the shuttle bus and movements will be outlined in the CTMP, as this is developed by the contractor, once the 'staging' site and staff details are confirmed.

Table 3-2: Anticipated Staff Vehicle Movements per Activity per Day

Activity/Group	Number of People	Number of vehicles parked on sites	Movements per day (both directions)
On-site Staff	30	20	40
WTP Trades	40	20	40
Reservoir Trades	20	10	20
Shuttle Bus	90	0	30
Total	**180**	**50**	**130**

3.4.2 Early Works, NH2 Shaft and Tunnelling

Figure 3-1 below shows the anticipated heavy vehicle for the Early Works and **Figure 3-2** below shows the anticipated heavy vehicles for the NH2 Shaft and Tunnelling. Both tasks are of a relatively short duration, not lasting more than a few months. The NH2 shaft and tunnelling has some associated earthworks movements.

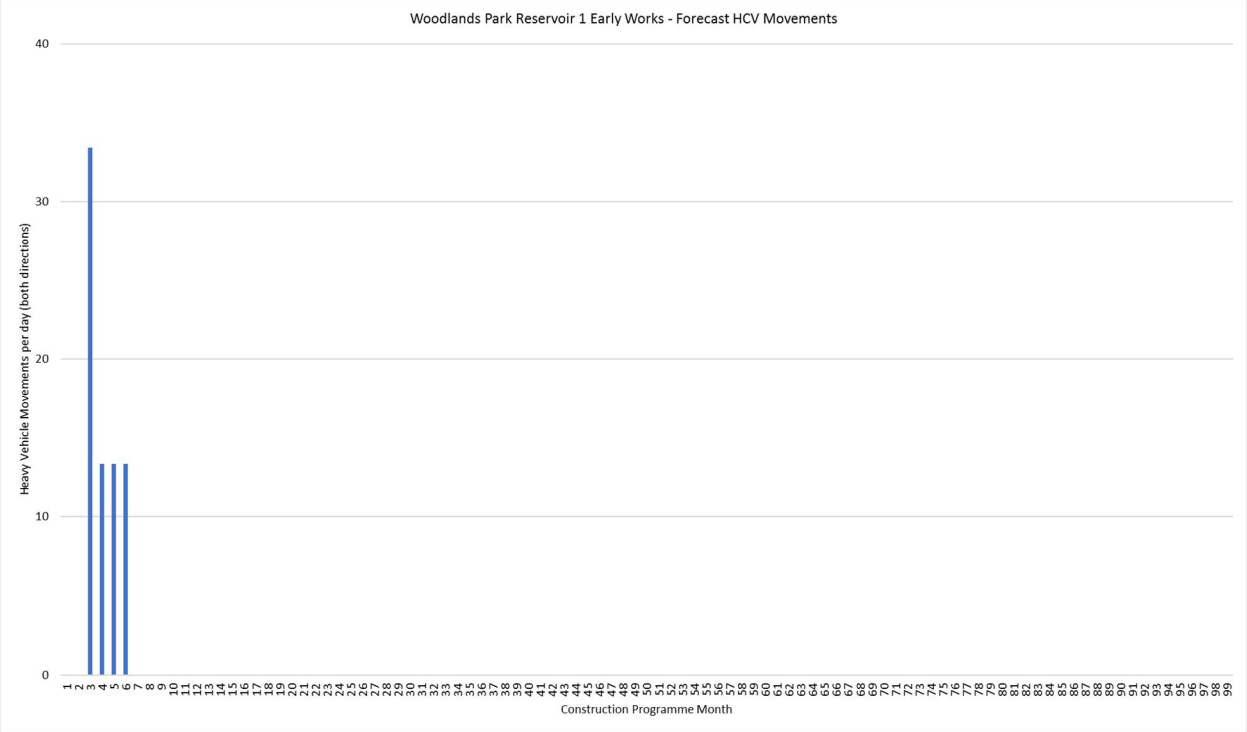


Figure 3-1: Anticipated Daily Heavy Vehicle Movements for the Early Works

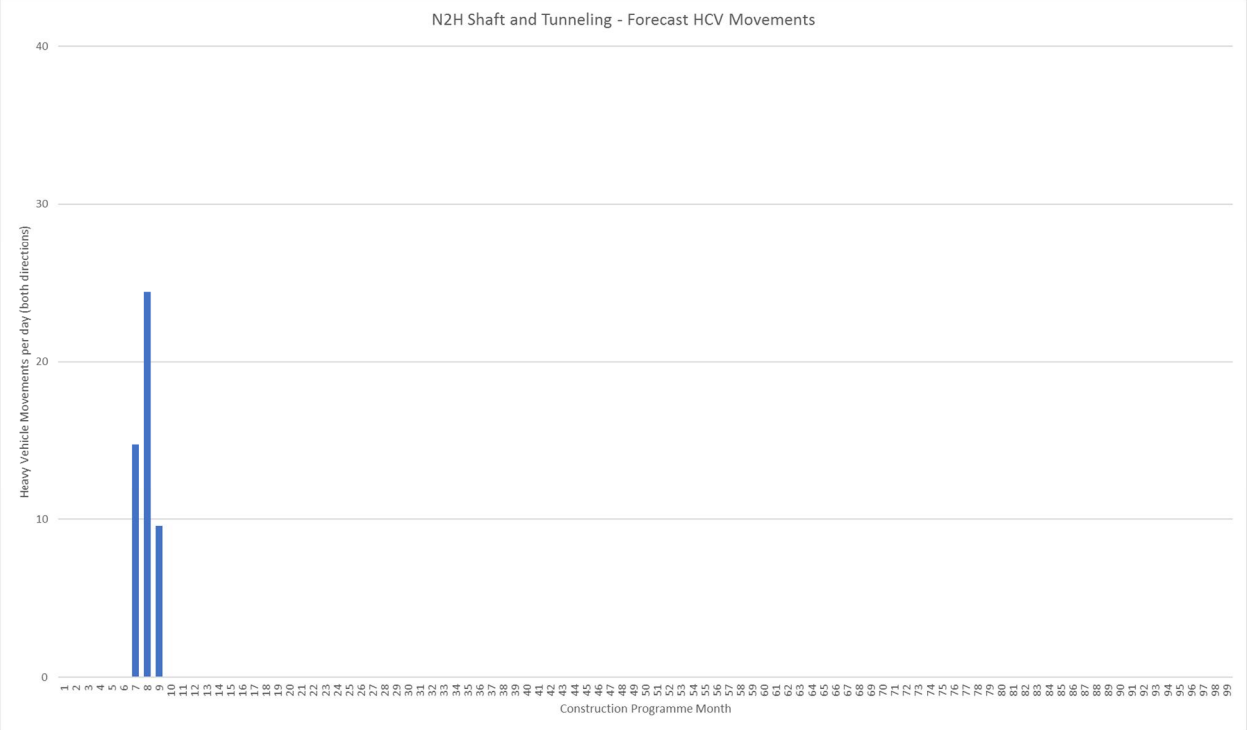


Figure 3-2: Anticipated Daily Heavy Vehicle Movements for the NH2 Shaft and Tunnelling

The following key points are highlighted:

- Reservoir 1 Early Works
  - Around 13 to 33 total heavy vehicle movements per day

- NH2 Shaft & Tunnelling
  - Around 15 to 24 total heavy vehicle movements per day

3.4.3 Replacement WTP Site

Figure 3-3 shows the anticipated heavy vehicle per activity for the replacement WTP site works.

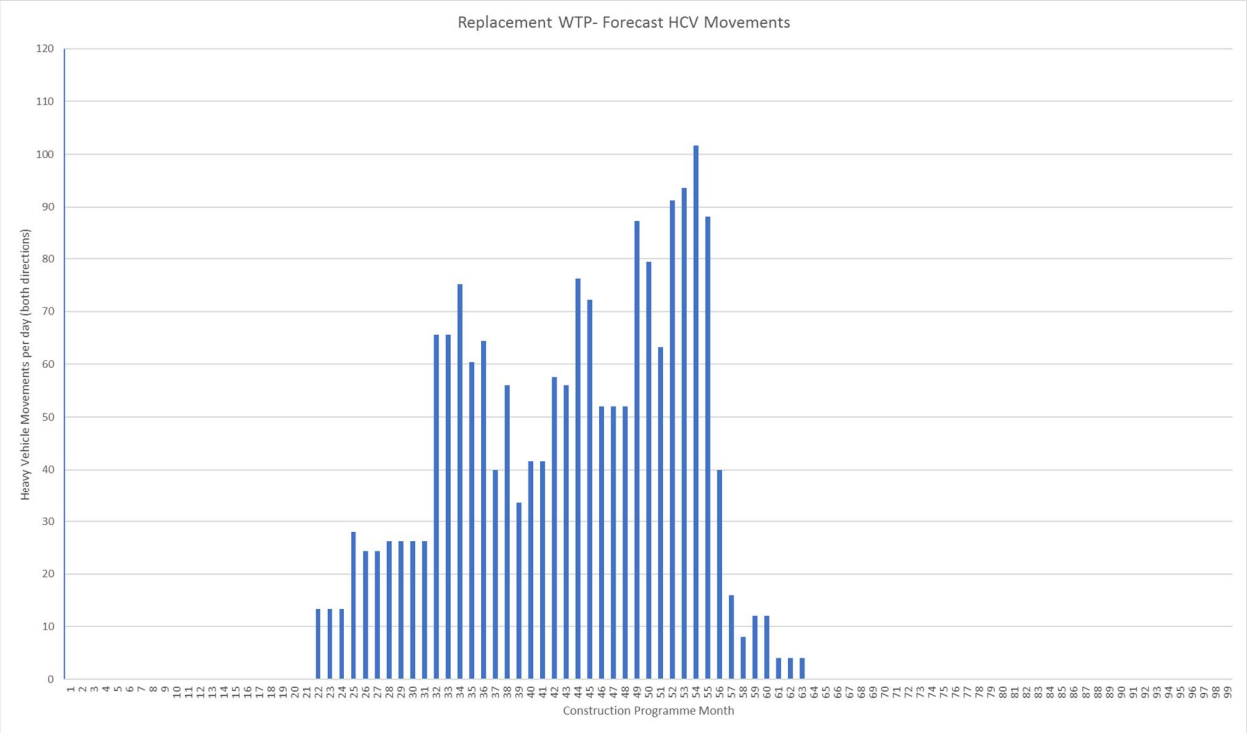


Figure 3-3: Anticipated Daily Heavy Vehicle Movements for the Replacement WTP Site

The following key points are highlighted:

- The highest heavy vehicle movements are generated during months 49 to 55, with an anticipated total of around 63 to 102 daily heavy vehicle movements
  - The total hourly heavy vehicle movements would be up to 9 to 15 per hour
- Anticipated staff movements for the WTP are expected to reach a maximum total of 105 light vehicle movements spread across the whole day (including shuttle bus movements) with most occurring outside the weekday peak periods.

3.4.4 Woodlands Park Reservoir 1 Site

Figure 3-4 below shows the anticipated heavy vehicles at the proposed Reservoir 1 site.

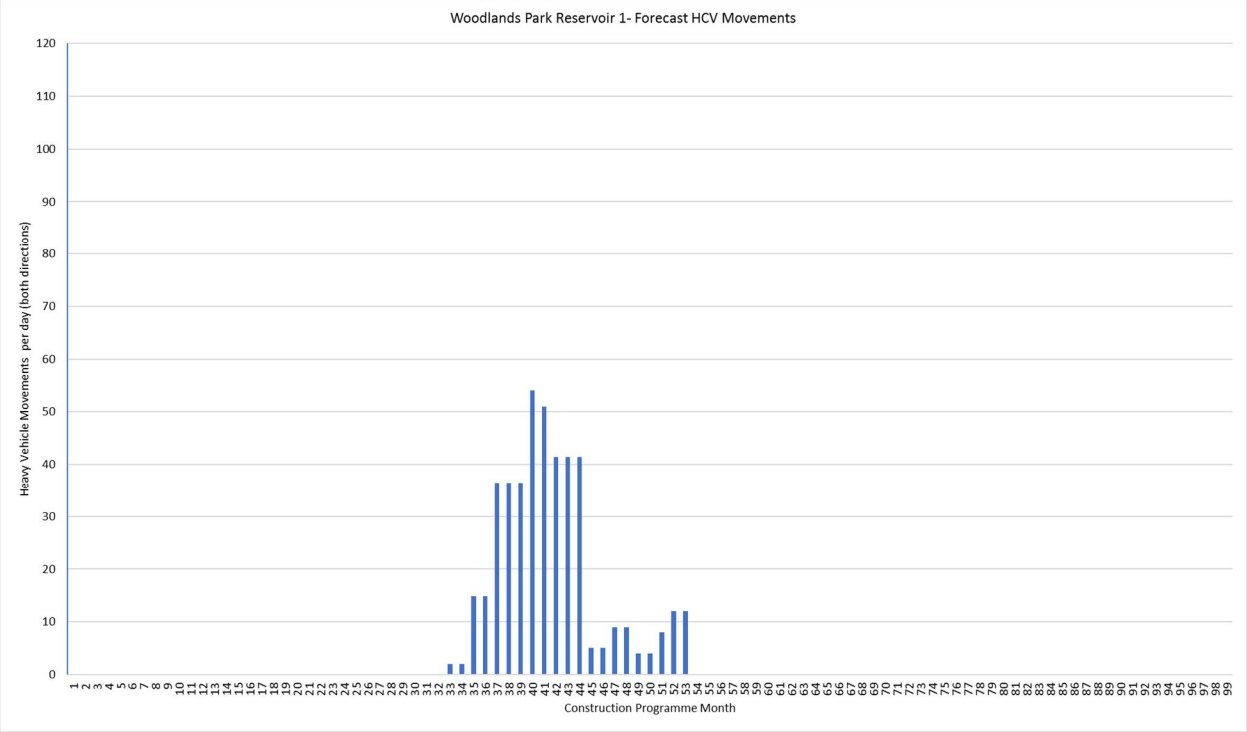


Figure 3-4: Anticipated Daily Heavy Vehicle Movements for the Reservoir 1 Site on Woodlands Park Site

The following key points are highlighted:

- The highest truck movements are generated during months 40 to 41, with an anticipated total of around 51 to 54 daily heavy vehicle movements
  - The total hourly heavy vehicle movements would be up to around 7 to 8 per hour
- Anticipated staff movements for the reservoir are expected to reach a maximum total of 45 light vehicle movements (including shuttle bus movements) spread across the whole day with most occurring outside the weekday peak periods.

3.4.5 Existing WTP Reservoir 2 Site

Figure 3-5 below shows the anticipated heavy vehicle and staff vehicle movements for the proposed Reservoir 2 site.

The following key points are highlighted:

- The highest truck movements are generated during months 74 to 75, with an anticipated total of 24 daily heavy vehicle movements
  - The total hourly heavy vehicle movements would be up to around 3 per hour
- Anticipated staff movements for the reservoir are expected to reach a maximum total of 45 light vehicle movements (including shuttle bus movements) spread across the whole day with most occurring outside the weekday peak periods.

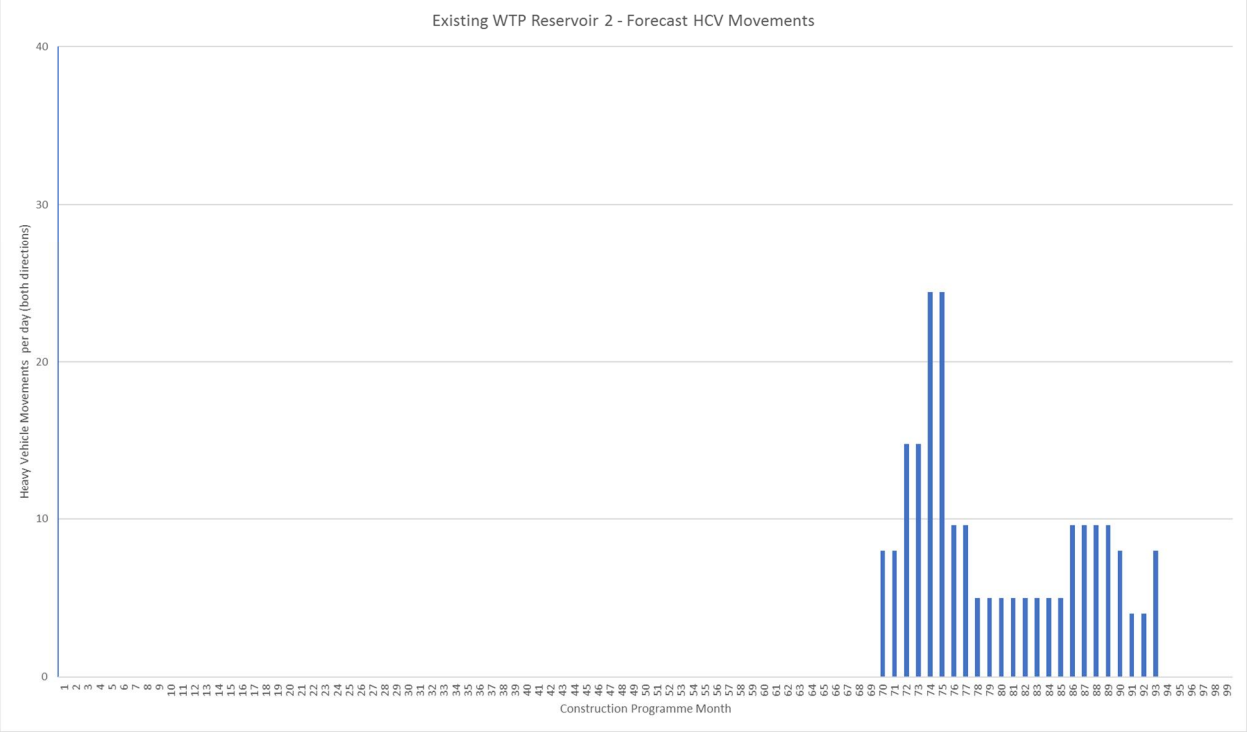


Figure 3-5: Anticipated Daily Heavy Vehicle Movements for the Reservoir 2 on Existing WTP Site

3.4.6 Overall Traffic Demands

A high-level summary of the total anticipated construction traffic demand for the combination of above activities is illustrated in **Figure 3-6** to **Figure 3-8**. A more detailed version of this information is included in **Appendix B**.

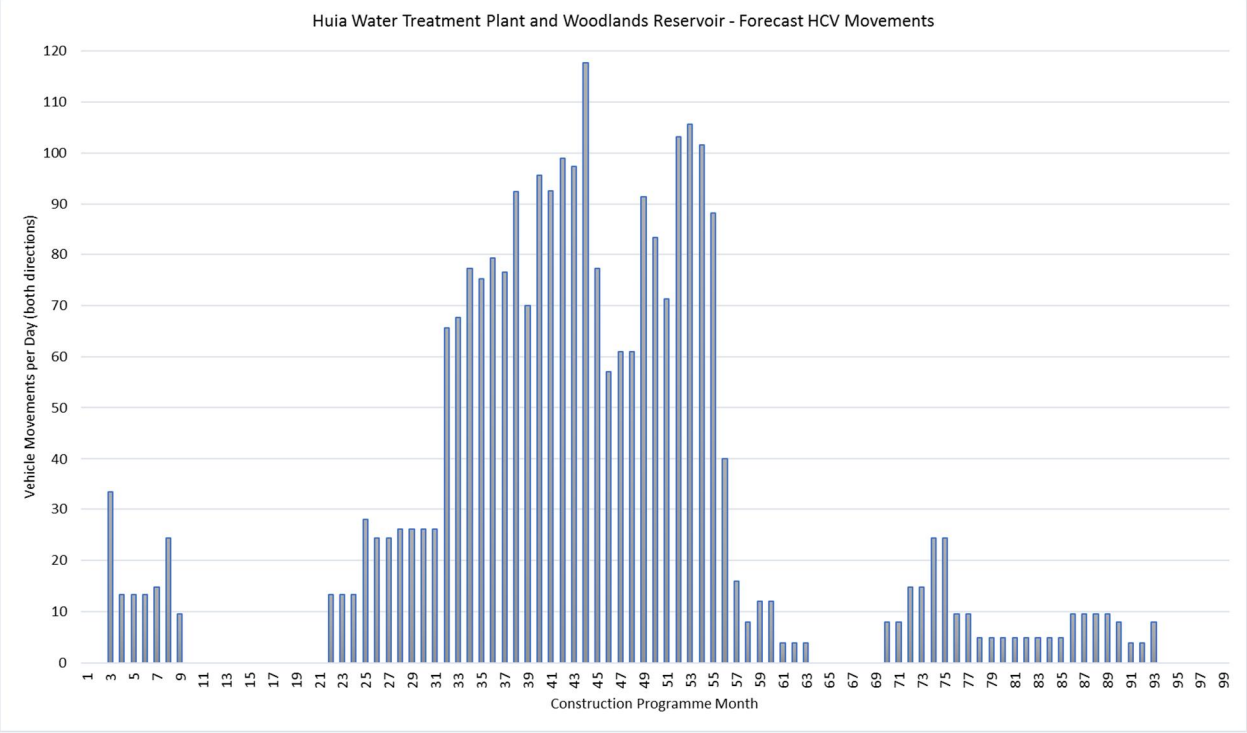


Figure 3-6: Anticipated Overall Daily Heavy Vehicle Movements during Construction Period

Figure 3-7 illustrates the summary for the overall heavy vehicle movements during the construction period with the different periods of heavy truck movements separately highlighted by the predicted range of daily heavy truck movements, between the quietest to the busiest periods of activity.

From **Figure 3-6** and **Figure 3-7**, it can be seen that there are several activities that are anticipated to be undertaken concurrently and it is expected that heavy vehicle movements would peak during this period. The busiest period of heavy vehicle movements has been estimated to last for approximately 11 months (shown in blue), albeit this period includes a couple of drops in traffic demand for three periods (totalling seven months) across this busiest period. This busiest period is approximately 11% of the total duration of the enabling and construction works.

There are also several extended periods with little or no anticipated heavy vehicle movements (26 months) and less than 42 heavy vehicle movements per day (49 months), that represent a total of approximately 75 months (76%) of the overall programme, as shown below.

The following is also noted in relation to **Figure 3-7**:

- The highest total truck movements are generated during months 38, 40 to 44, 49 and 52 to 55 (11 months in total). In these months there is anticipated to be a total of 88 to 118 heavy vehicle movements per day (shown in blue), of which semi-articulated trucks (including truck and trailers) represent a total of 44 to 87 daily heavy vehicle movements. Overall ,this equates to total hourly heavy vehicle movements of up to around 13 to 17 per hour
- The average truck movements across the whole programme is approximately 37 trucks per day, when considering only the months during which heavy vehicle movements are expected to occur (74 months of the programme). This equates to a total of up to around eight vehicle movements per hour
- Anticipated staff movements are expected to reach a maximum of 130 light vehicle movements (including shuttle bus) spread across the whole day with most occurring outside the weekday peak periods, due to the anticipated start and finish times on the Project site.

The total heavy vehicles movements are a combination of rigid heavy vehicles, semi articulated trucks (including truck and trailers) and a limited number over size heavy vehicles, the latter for transporting plant and large components.

Figure 3-8 illustrates the heavy vehicle split between rigid, articulated and over dimensional heavy vehicles across the programme. Across the whole programme, of the overall number of heavy vehicle movements, the approximate proportion by each heavy vehicle category are:

- 28% rigid heavy vehicles
- 70% articulated heavy vehicles
- 2% oversize heavy vehicles.

Figure 3-8 illustrates the majority of heavy vehicles are semi-articulated vehicles, including truck and trailer units, but shows that that the semi-articulated heavy vehicle movements are not active for the entire construction programme. In several periods, there are relatively little or no semi-articulated vehicle movements.

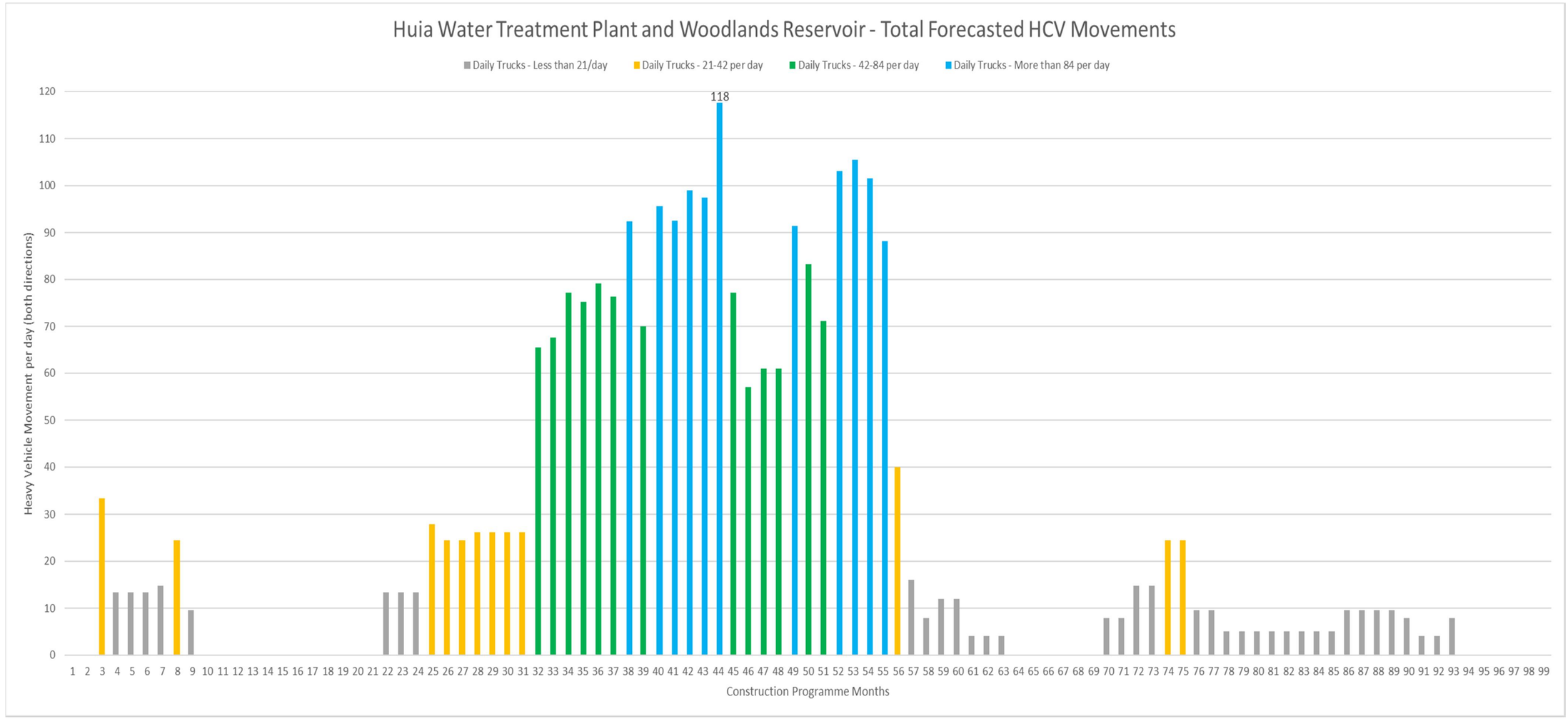


Figure 3-7: Summary of Anticipated Overall Daily Heavy Vehicle Movements across Programme

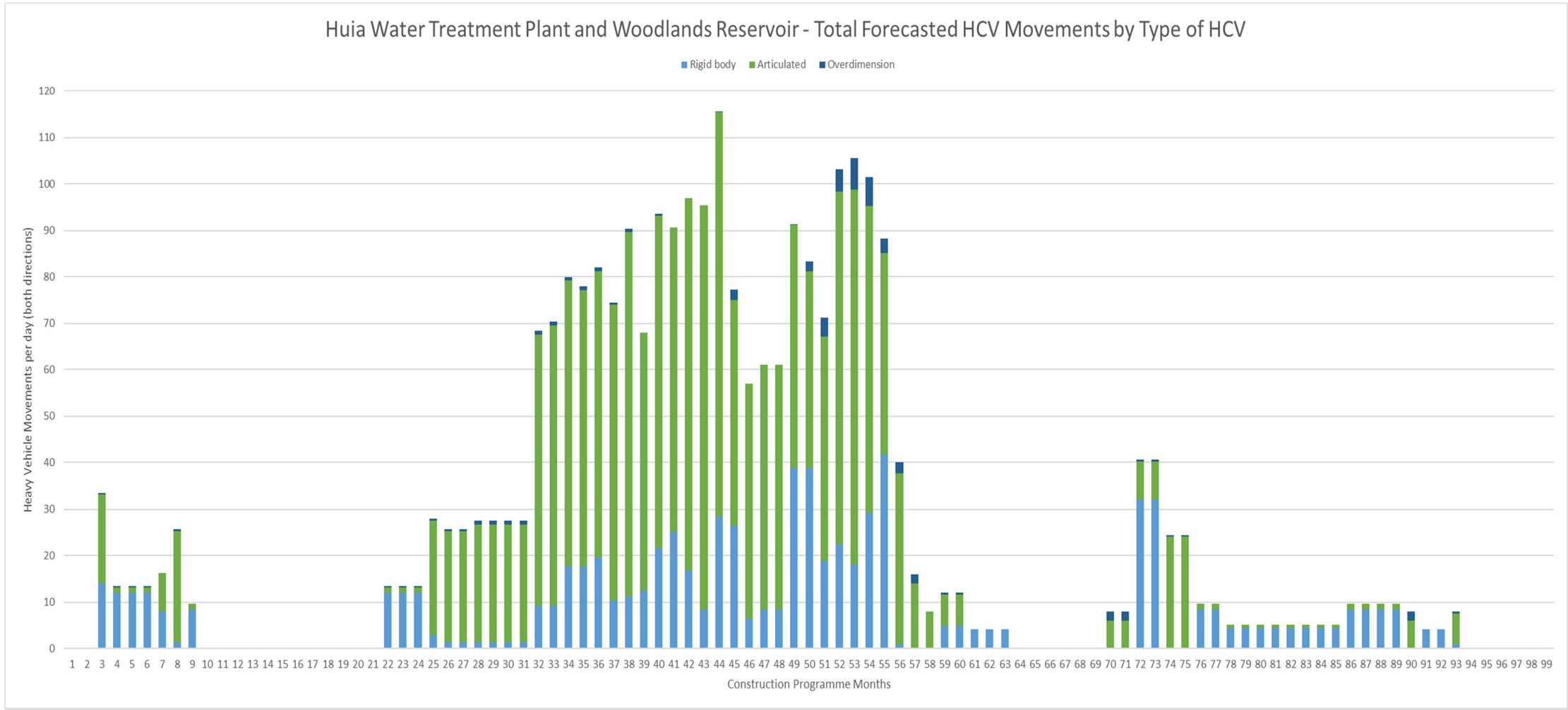


Figure 3-8: Summary of Anticipated Heavy Truck Movements by Heavy Truck Type across Programme

4 Assessment of Transport Effects

4.1 Construction Transport Effects

4.1.1 Heavy Vehicle Routing Review

To determine the potential suitability of routes for heavy vehicles, the existing transport environment and traffic volumes on the relevant local roads were assessed. As discussed in **Section 2**, the routes below provide connection via primarily arterial roads to the regional freight network identified in the Auckland RLTP.

Figure 4-1 shows a summary of the key transport environment and land use considerations. The route from the Project sites to the alternative Parau landfill (Mackies Rest) site is addressed separately in **Section 4.1.6**.

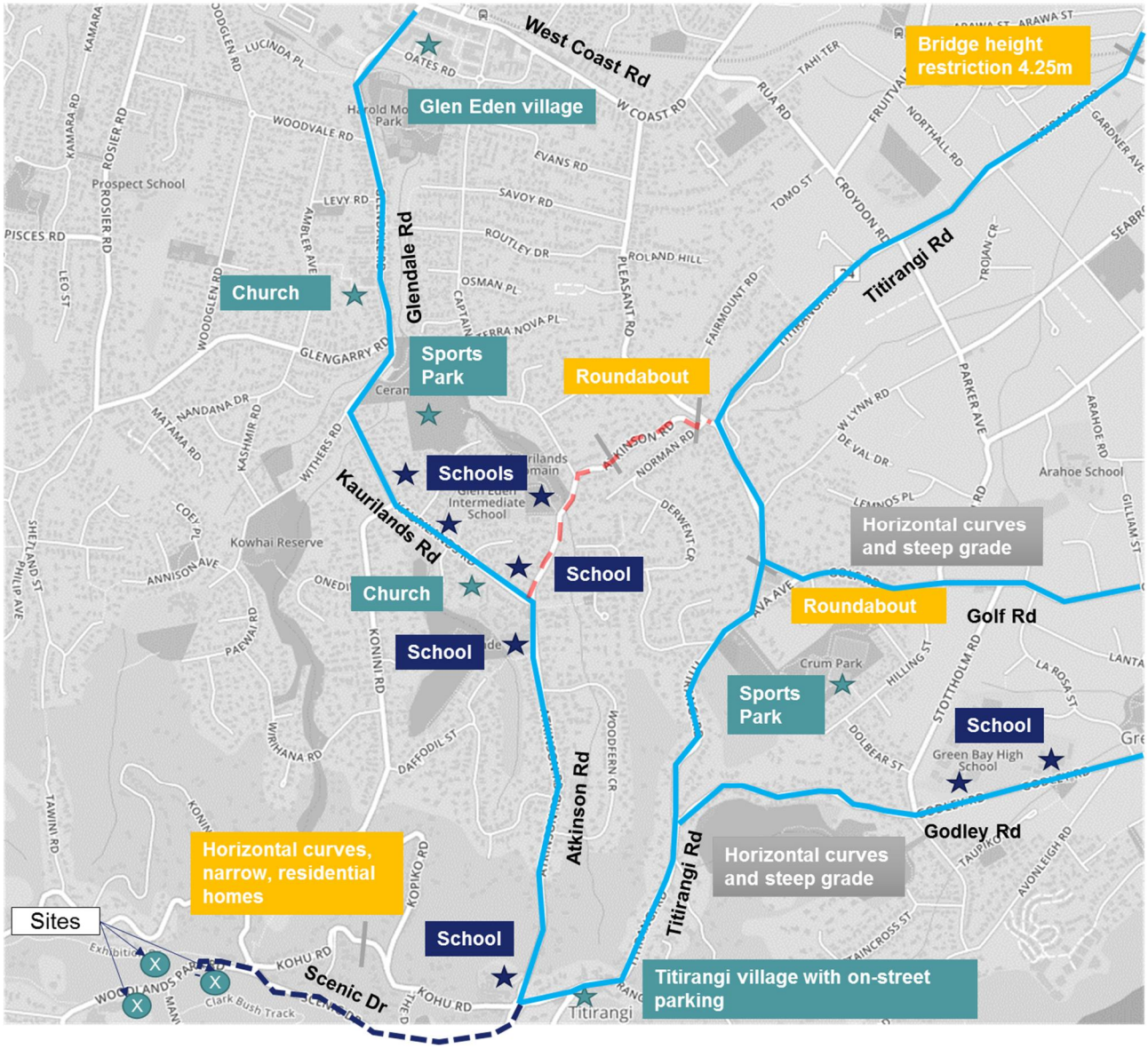


Figure 4-1: Potential Heavy Vehicle Routes and Key Constraints

The following key observations are made using the available data outlined in this report to assess the suitable heavy vehicle routes:

General observations:

- Current peak directional traffic tends to be to the north and east along the subject roads in the weekday AM peak, and vice versa weekday PM peak, which will be the opposite direction to the majority of construction staff travelling in these periods, as well as opposite to half of any heavy vehicle movements in these periods
- None of the routes assessed for heavy vehicles are overweight or over-dimensional routes, based on NZ Transport Agency maps (**Section 2.3**), other than short sections of Golf and Godley Roads approaching Portage Road. The over-dimensional vehicle network includes Great North Road and Rata Street in New Lynn, which are also part of the regional freight network
- It is therefore recommended that over-dimensional vehicles and other wide (or over size) loads are transported to and from the Project site between the hours of 10pm and 6am, whenever practicable, if they require more than the available lane width on the recommended heavy vehicle route/s. The movement of over-dimensional vehicles and other wide (or over size) loads being undertaken in accordance with the relevant standards and procedures.

Other routes considered:

- Scenic Drive (west of Woodlands Park Road) and Shore Road were initially considered as possible heavy truck routes to and from the Project sites. An initial high-level assessment of these routes identified that these routes will be too narrow and have poor horizontal and vertical alignment to accommodate the anticipated vehicles associated with the construction of the Project
- Kohu Road is a narrow residential road and has several out of context curves and several other constraints, which would not make it suitable for the anticipated number and type of heavy vehicles associated with the construction of the Project.

Atkinson Road (South)[1] and Titirangi Road routes:

- When comparing the AM peak weekday volumes for southbound traffic (non-peak direction for general traffic), Atkinson Road (South) and Titirangi Road (north of the village) both have sufficient residual capacity to accommodate the predicted Project traffic, albeit there is more residual capacity on Atkinson Road (South)
- Titirangi Road (north of the village) also has residual capacity in the AM peak hour in the northbound (peak direction) of approximately 22%. There is greater residual capacity in the peak direction on Atkinson Road (South) than Titirangi Road to accommodate the predicted Project traffic
- When comparing the weekday PM peak volumes for northbound traffic (non-peak direction), Atkinson Road (South) has slightly more capacity than Titirangi Road (north of the village), but both have more than sufficient residual capacity to accommodate the predicted Project traffic. Albeit, both having slightly less residual capacity than in the AM peak
- In the peak direction in the PM peak, Atkinson Road has great residual capacity to accommodate the predicted Project traffic than the AM peak direction. On Titirangi Road (north of the village), the peak direction residual capacity in the PM peak is slightly less than during the AM peak, albeit there is still residual capacity
- During the weekday midday period, northbound and southbound volumes are fairly similar on both roads. When comparing the average weekday midday volumes, Atkinson Road averages at approximately 200 vehicles per direction, while Titirangi Road averages at approximately 480 vehicles per direction. Both with more than sufficient residual capacity in both directions to accommodate the predicted Project traffic

[1] Atkinson Road (South) is between Titirangi Road and Kaurilands Road

- The Titirangi Road heavy vehicle route would travel through the Titirangi Village, which has on-street parking, and higher pedestrian volumes at this location. However, the Atkinson Road (South) route passes the Titirangi and Kaurilands Primary Schools, which are busy around the school pick-up and drop-off periods. In both cases, whilst there is residual mid-block capacity, the presence of the zebra and signalised pedestrian crossings reduces capacity, due to the frequency the crossings are used by pedestrians. On Atkinson Road (South), this is around the school pick-up/drop-off period, whilst in Titirangi village, this particularly occurs around the school pick-up/drop-off period and weekday commuter periods. In Titirangi village, this leads to a more congested environment at these times with the signalised pedestrian crossing resulting in queues developing northbound in the AM peak period and more notably, southbound in the PM peak period
- While there is a steeper grade on the southern section of Atkinson Road (South), approaching Titirangi, this section is still relatively straight and there is reasonable visibility to less frequent residential driveways, which are on the eastern side of the road
- The Titirangi Road route has a 4.25m height restriction due to an overbridge near the intersection of Margan Avenue. For the transport of some large equipment, such as cranes and other over-dimensional / oversize vehicles, this may be a constraint
- Based on the initial assessment, Titirangi Road has been identified as having higher traffic volumes throughout the day compared to the Atkinson Road (South) with queuing developing through the village at peak times. The higher traffic volumes mean less capacity to accommodate heavy vehicles making use of this route, at certain times of day. Albeit, while busy at these times, this is not considered to preclude any additional traffic demand associated with the anticipated construction vehicle movements. Moreover, further north and west, beyond Titirangi village, Titirangi Road has wider lane widths and the residual capacity that will better accommodate two-way heavy truck movements compared to Atkinson Road (South) route. On both routes, interaction of construction vehicles with adjacent land use activities will need to be managed.

Kaurilands Road / Glendale Road and Atkinson Road (North)[2] routes:

- At the Atkinson Road / Kaurilands Road intersection, alternatives to travel north via either Kaurilands Road or along Atkinson Road (North) have been considered
- When comparing the weekday AM peak volumes for southbound traffic (non-peak direction), Atkinson Road (North) and Kaurilands Road both have sufficient residual capacity to accommodate the predicted Project traffic, albeit there is more residual capacity on Atkinson Road (North)
- Atkinson Road (North) and Kaurilands Road both also have residual road capacity in the AM peak hour in the northbound (peak direction), but there is greater residual capacity in the peak direction on Atkinson Road (North) than Kaurilands Road to accommodate the predicted Project traffic
- When comparing the weekday PM weekday peak, there is a similar situation with both roads having residual capacity in the peak direction to accommodate the predicted Project traffic, but more capacity on Atkinson Road (North), and more than sufficient non-peak direction (northbound) capacity
- During the weekday midday period, northbound and southbound volumes are fairly similar on both roads. When comparing the average weekday midday volumes, Atkinson Road (North) averages approximately 200 vehicles per direction, while Kaurilands Road averages at approximately 480 vehicles per direction. Both with more than sufficient residual capacity in both directions to accommodate the predicted Project traffic
- On Kaurilands Road, whilst there is residual mid-block capacity, the presence of the zebra pedestrian crossing reduces capacity, due to the frequency the crossings are used by pedestrians. This is around the school pick-up/drop-off period and results in a more congested environment at these times
- However, Atkinson Road (North) has a much steeper grade than Kaurilands Road and Glendale Road, which is likely to result in very slow heavy vehicles speeds and likely to cause some delay to general traffic at times. In addition, the intersection layout at top of Atkinson Road (North), near

[2] Atkinson Road (North) is between Kaurilands Road and Norman Road / Pleasant Road

Pleasant Road, is not considered to be appropriate for heavy vehicles (particularly semi-articulated trucks) and these vehicles will have difficulty manoeuvring at the small roundabout
- This section of Atkinson Road (North) has the Kaurilands Community Kindergarten. However, this kindergarten has an internal parking lot and pick and up and drop off area for parents. Thus, the likelihood of heavy vehicles and children interaction is reduced
- Kaurilands Road and Glendale Road travel through past the Glen Eden Intermediate School and Kaurilands Primary, Titirangi Baptist Church, Learning Edge Montessori Preschool, Kidd-Inn Early Learning Centre, and Glen Eden Baptist Church. The church service times are between 9.30am to 12pm and they are both on Sundays, which is outside the indicative working hours
- Ceramco Park has sports and school sports events during the weekend. It has off-street parking, so many vehicles can be accommodated off-street, albeit some on street parking may be expected. The lane width on Glendale Road is wide enough to accommodate parking on street cars and still maintain traffic flow without having to cross the centreline in the instance of overflow in the off-street parking
- Taking the Kaurilands Road and Glendale Road route will require passing though the Glen Eden local centre on West Coast Road, however, the road width there is considered appropriate and has a flush median
- By assessing the traffic volumes and road constraints, the Kaurilands Road / Glendale Road route is the recommended route for heavy vehicles instead of east along Atkinson Road (North) to the north of the Kaurilands Road intersection.

Golf Road and Godley Road routes:

- Golf Road is generally considered an acceptable, albeit further detailed confirmation relating to the intersection layouts at Titirangi Road and Portage Road, which may require temporary changes to accommodate design vehicles. It is considered that this can be further addressed through further detailed confirmation as part of the CTMP, if this route is considered. This may limit the type of heavy vehicles that can use this route
- Golf Road has approximately 1,462 vehicles in the weekday AM peak and 1,469 in the weekday PM peak for both directions, resulting in an overall residual capacity of 26%. Godley Road has approximately 1,345 vehicles in the weekday AM peak and 1,781 in the weekday PM peak for both directions, resulting in less residual capacity of only 9%.[3]
- As such, both roads, particularly Godley Road, have potentially lower levels of residual capacity than Titirangi Road, albeit Golf Road (in particular) could potentially accommodate the predicted Project traffic
- Godley Road is similar to Kaurilands Road in that there are schools on the route, the Green Bay Primary and High Schools, as well as the presence of the shops and community facilities around the Green Bay local centre. There is also a relatively steep and windy section on Godley Road near to Titirangi Road, where there is a resulting reduction in visibility to relatively frequent residential driveways on both sides of the road
- In terms of comparison Golf Road is the more viable and appropriate route for heavy vehicles. However, for some heavy vehicles (rigid heavy vehicles, i.e. not semi-articulated trucks), Godley Road would still be a viable route provided truck movements were appropriately managed, particularly during the Green Bay Schools pick-up and drop-off periods.

Whilst there is a localised constraint through the Titirangi village section at certain times of day, due to increased activity, Titirangi Road is generally considered to be more appropriate overall in terms of its width and capacity to the north and east of the village centre. In particular, east of the village, Titirangi Road is more easily able to accommodate the regular two-way movement of heavy vehicles in comparison to Kaurilands Road, which has more challenges associated with some operational and safety constraints associated with the activities (particularly the kindergartens and schools) along that route, particularly for

[3] This accounts for the adjustment in volumes for these roads to growth traffic to a 2018 base year

semi-articulated heavy vehicles. Golf and Godley Roads have the potential as more secondary routes for heavy vehicles, which may be limited to certain types of heavy vehicles, if considered in the CTMP.

Based on the above assessment, the following options have been identified as appropriate routes for heavy vehicles, subject to appropriate mitigation and management through the implementation of the CTMP. Each of these routes includes two-way vehicle movements along Scenic Drive and Woodlands Park Road:

Routing option 1:

- Inbound and outbound movements along Titirangi Road only to and from Great North Road
  - This route would be limited by the current delays and queuing on Titirangi Road in Titirangi village in the weekday AM and PM peak directions, as well as around midday on Saturdays, given the pedestrian signalised crossing in the village
- An alternative for some of the inbound and/or outbound movements to use Golf Road or possibly Godley Road (rigid heavy vehicles only) instead of Titirangi Road.

Routing option 2 (**Figure 4-2** below)**:**

- One-way loop consisting of inbound (or outbound) only via West Coast Road, Glendale Road, Kaurilands Road and Atkinson Road, then outbound (or inbound) only via Titirangi Road (or Golf / Godley Roads) to Great North Road. Noting:
  - Southbound on an inbound route along Glendale Road, Kaurilands Road and Atkinson Road is with peak directional traffic in the weekday PM peak period. There is appropriate residual capacity in that peak direction through afternoon (outside of the school pick-up period) and there is less non-peak direction (northbound) conflicting traffic. There is also residual capacity throughout the rest of the day and on weekends
  - Northbound on an outbound route along Glendale Road, Kaurilands Road and Atkinson Road has appropriate residual capacity in that peak direction through afternoon (outside of the school pick-up period) and would avoid heavy vehicles having to travel uphill along Atkinson Road (South)
  - Northbound on an outbound route on Titirangi Road, results in travel through Titirangi Village in the less busy non-peak direction in the afternoon / PM peak. Whilst southbound on an inbound route, results in travel through Titirangi Village in the less busy non-peak direction in the morning peak. .

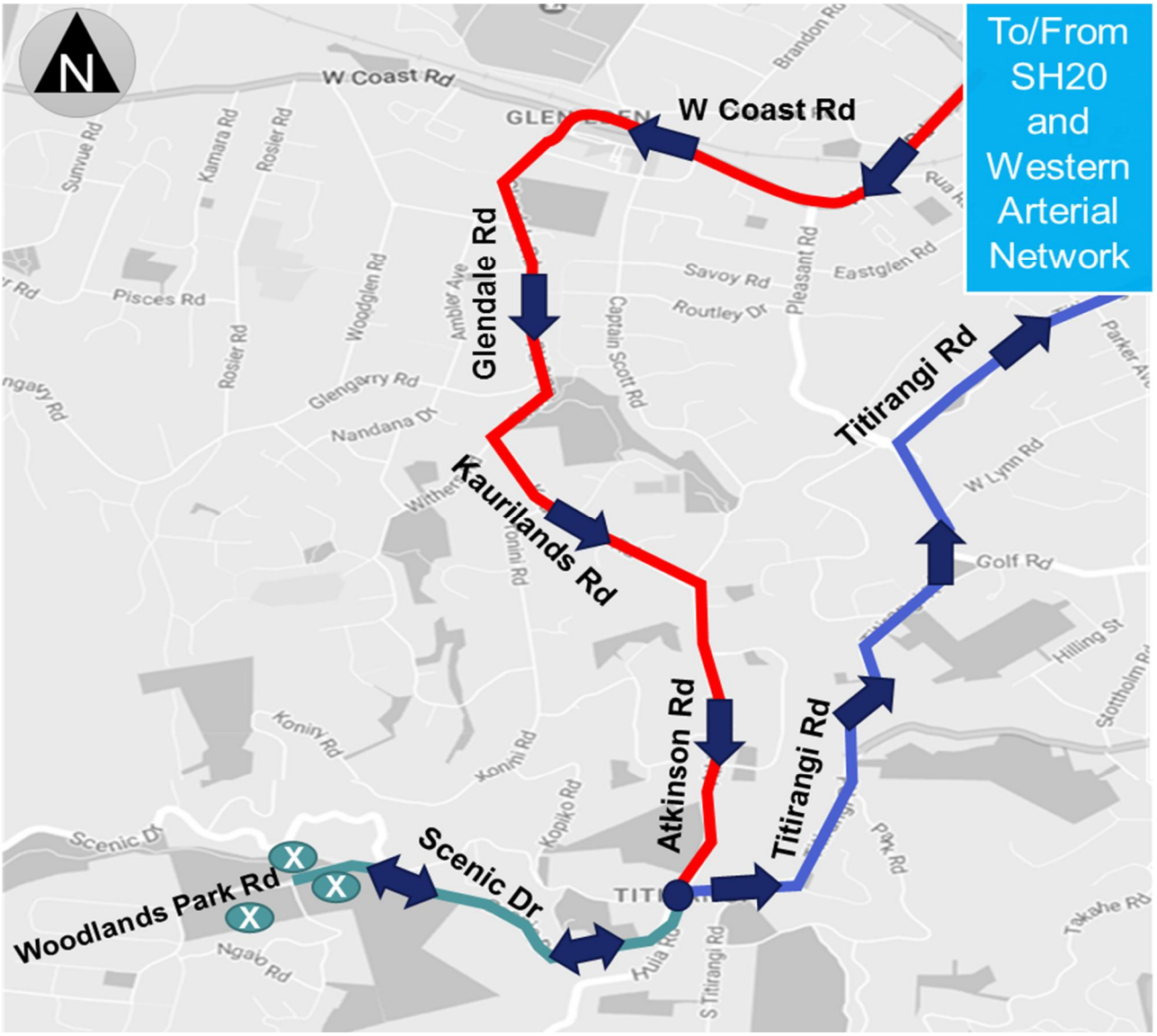


Figure 4-2: Proposed Heavy Vehicle Routing – Option 2

As such, it is considered there are options that are able to provide suitable heavy vehicle routes for access to and from the Project site. The routing will be further confirmed through the development of the CTMP, which will identify the appropriate management controls around the use of these routes. A draft CTMP is appended to this report, it will need to be updated, once the contractor is appointed, when the details of the construction methodology and programme will be confirmed. It will then be provided to Auckland Council for certification, as required by the draft conditions in the Assessment of Environmental Effects, prepared by Tonkin & Taylor.

Option 1 is generally considered a more appropriate route, given the road class and character as well as residual capacity during most operating times. In the case of Titirangi Road, from observations the road is currently used by heavy vehicles and the additional heavy vehicles on this route would not be unexpected, albeit the proportion of the larger semi-articulated heavy vehicles will be noticeable. The Titirangi Road route is therefore preferred over the Atkinson/Kaurilands/Glendale Road route, whereever possible.

Option 2 is also an appropriate option, as this could eliminate any opposing heavy vehicle movements associated with the proposed Project, other than along Scenic Drive and Woodlands Park Road, which

would assist in mitigating potential safety effects for all road users along the identified routes. Additionally, the option would distribute the heavy vehicles across the road network reducing the adverse effects and delays on both routes during the construction period. Accepting that the potential effects on particular adjacent land use activities, particularly the kindergartens and schools, will need to be managed. The use of this route at appropriate times of day, could therefore be considered in the busier construction periods.

[Placeholder – Heavy vehicle demonstration – discussion of outcomes for the key heavy vehicle routes]

4.1.2 Heavy Vehicle Scheduling

To consider whether the operating times of heavy vehicles would potentially have an adverse effect on the surrounding road network, consideration has been given to the identified construction hours and the impacts of heavy vehicles during those times and days. As with the construction routing, the assessment below will be used in form the further development of the draft CTMP (appended to this report) by the contractor (once appointed), in liaison with the Council and Auckland Transport.

a. Weekday

Figure 4-3 below shows an indicative heavy vehicle schedule. These existing transport activities and their subsequent operational periods have been highlighted to provide an understanding of the surrounding road environment and planning around the traffic generated by the proposed enabling and construction works. This assessment has provided an indicative period, where the adverse effects of the traffic generated by the proposed enabling and construction works would be minimised, where practicable.

<table>
<tr><th rowspan="2">Time Period Starting</th><th colspan="2">Route / Roads Affected</th></tr>
<tr><th>Kaurilands Rd, Scenic Drive, Woodlands Park Road</th><th>Titirangi Road, Scenic Drive, Woodlands Park Road</th></tr>
<tr><td>6:30 am</td><td></td><td></td></tr>
<tr><td>7:00 am</td><td></td><td></td></tr>
<tr><td>7:30 am</td><td></td><td></td></tr>
<tr><td>8:00 am</td><td colspan="2" rowspan="2">SCHOOL & GENERAL TRAFFIC</td></tr>
<tr><td>7:30 am</td></tr>
<tr><td>9:00 am</td><td></td><td></td></tr>
<tr><td>9:30 am</td><td></td><td></td></tr>
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<tr><td>2:00 pm</td><td></td><td></td></tr>
<tr><td>2:30 pm</td><td rowspan="2">SCHOOL TRAFFIC</td><td rowspan="3">SCHOOL TRAFFIC</td></tr>
<tr><td>3:00 pm</td></tr>
<tr><td>3:30 pm</td><td></td></tr>
<tr><td>4:00 pm</td><td></td><td></td></tr>
<tr><td>4:30 pm</td><td></td><td></td></tr>
<tr><td>5:00 pm</td><td rowspan="2">GENERAL TRAFFIC</td><td rowspan="2">GENERAL TRAFFIC</td></tr>
<tr><td>5:30 pm</td></tr>
<tr><td>6:00 pm</td><td></td><td></td></tr>
<tr><td>6:30 pm</td><td></td><td></td></tr>
</table>

Figure 4-3: Schedule of Activities along Heavy Truck Routes

The sections marked in blue (in **Figure 4-3**) have been discussed in **Section 2** of this report. They include:

- School traffic / people movement periods
  - Private vehicles for pick-up and drop-off
  - School bus traffic
- Busiest commuter movement periods
  - Weekday AM and PM peaks.

The following indicative periods of vehicle movements are identified from **Figure 4-3**, for the purposes of assessing the operational traffic effects, while the outcomes of the assessment in **Section 4.1.3** will inform the operational periods and associated mitigation measures:

- Where practicable, heavy vehicles should be limited and managed during the weekday AM and PM peak school and general traffic periods, particularly along Atkinson Road and Kauriland Road, where there is likely to be insufficient width for heavy vehicles at peak school pick-up and drop-off times
- In general, the predicted heavy vehicles are considered to operate satisfactorily between 9.00am and 2.30pm (providing at least a 5.5 hour operational period), outside the school and busiest commuter peak periods in the weekday AM and PM peaks
- Together, with limited and managed movements through the peak periods during the busiest periods of construction along Titirangi Road, additional periods have also been identified for heavy vehicle movements outside of those peak periods (potentially an additional 1.5 hours or more before/after these peak periods). This period is generally before 8am and after 3-3:30pm to 5pm (or in-between school and general PM peak traffic)
- As a result, excluding these periods, heavy vehicles would have at least an approximate 7 hour period (during the proposed working day) in which they could generally operate without significant conflict with existing traffic movements along the identified routes. Noting that the use of routing Option 2 and the CTMP will assist with management of movements throughout the day.

Based on the above, the general workday period occurs from 7am to 6pm and with the identified periods for trucks to be managed, this would mean an 'effective' truck operational period of 7 hours. In addition, it is possible that some trucks may arrive prior to 7am (opposite direction to peak direction traffic on the proposed inbound route), as whilst works will not necessarily have commenced on the site, staff will need to be present to receive and manage vehicles for the start of the day. Similarly, some vehicles may leave after 6pm, but would be travelling against peak direction traffic movements along Titirangi Road in that period.

In combination, limited movements in the peak periods and later in the evening could extend this 'window' and distribute vehicle demands. Albeit, for the purpose of this assessment, this has not been considered in determining the potential hourly vehicle movements.

b. Weekend

Workdays are scheduled for six days a week and the above-mentioned scheduling has dealt with the weekday period. Although the weekend period generally includes Saturday workdays for normal site activities during the enabling and construction works, occasional activities (such as delivery of equipment by over-dimensional vehicles or wide loads) may also be necessary on Sundays. The Saturday workday is generally scheduled for the whole day, similarly to weekdays, where feasible. For the purposes of this assessment, it is therefore anticipated that the same weekday hourly site traffic demands would also occur on a Saturday.

Traffic volumes on Titirangi Road (**Appendix A**) are observed to increase around midday, albeit the volumes are lower for the Saturday peak period compared to the weekday AM and PM peaks. Nonetheless, it is suggested that, if possible, heavy vehicle movements should be more limited during the busiest periods of

construction around this Saturday midday period to reduce any adverse effects in the village. This also considers the need to reduce the potential of heavy truck conflicts with periods of greater pedestrian activity in the village at weekends. As such, reducing trucks could include utilising the routing Option 2, which would only result in northbound heavy vehicles through the village.

4.1.3 Construction Traffic Effects

This section assesses the enabling and construction works for the replacement WTP and proposed reservoirs. The transport effects have been separated only to illustrate the differences of the replacement WTP and proposed reservoirs sites. As stated previously, activities will occur concurrently, and this assessment of the cumulative effects is then also provided below.

Based on the above, for the purposes of the operational traffic effects assessment, the subsequent sections will assume 'where practicable' a 7 hour period for heavy vehicle movements in the assessment. However, as discussed previously, there is potentially some flexibility to have an extended window, as well as limited movements in peak periods, that would reduce the hourly demands considered in this assessment.

From the construction programme, the replacement WTP and Woodlands Park Reservoir 1 generate the highest amount of heavy and light vehicles, for this reason the following section focus on the assessment of these two construction periods, as well as the peak combined construction period.

a. Replacement WTP construction works traffic movements

The replacement WTP enabling and construction works programme (excluding early works and Reservoir 1 works) will take place over an approximate 42 month period. **Figure 4-4** shows the expected heavy vehicle volumes per day.

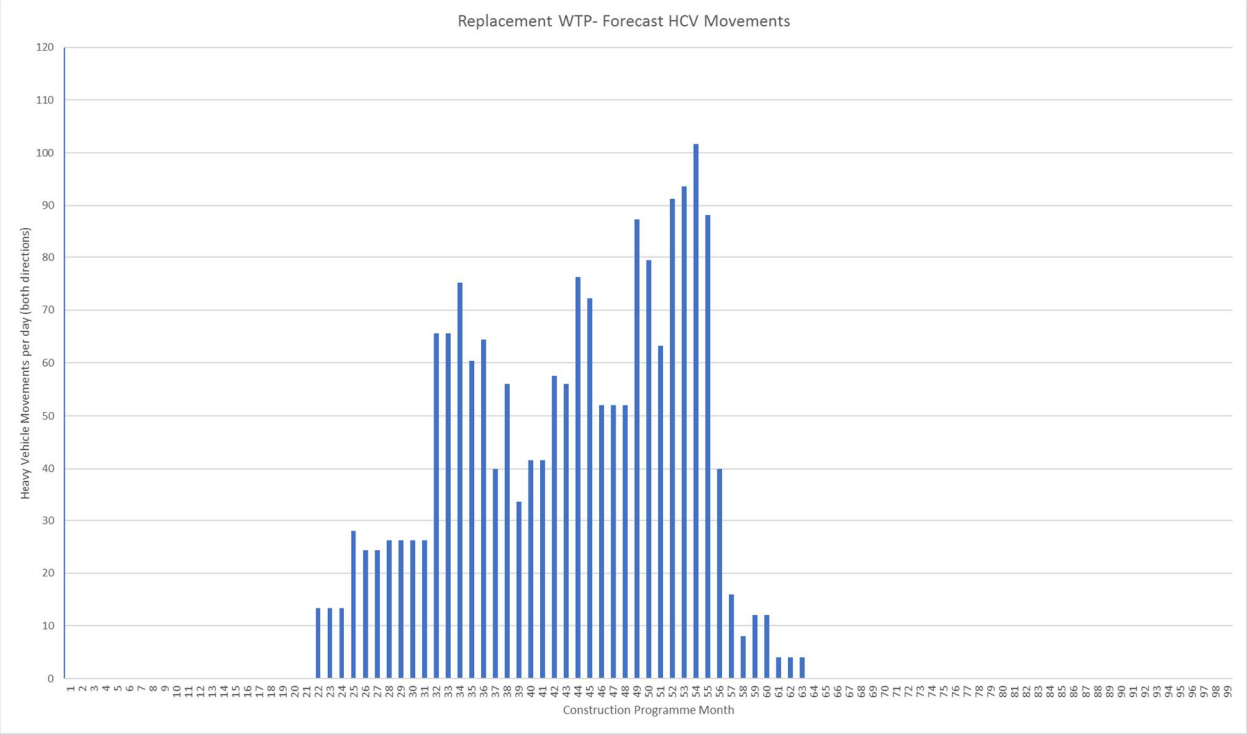


Figure 4-4: Expected WTP Heavy Vehicle Movements (both directions) – WTP Works

The expected busiest heavy vehicle movements per day would range from 64 to 112 during the busiest period (6 months). In addition, there would be an anticipated 105 staff movements (light vehicles) per day during this period.

This is approximately 24 to 30 vehicle movements (which includes the light vehicle movements) per hour and 12 to 15 vehicles per direction per hour. This assumes a 7 hour working day and that the arrival and departure demands for the proposed construction traffic is equal throughout a day.

To assess the impact on the road network due to the additional expected heavy vehicle and staff traffic volumes, the road capacity is used to check whether the existing capacity is able to accommodate the new traffic demand. **Table 4-1** shows the predicted busiest traffic demand with the combined heavy vehicle and staff traffic volumes for the busiest period of construction at the WTP site and compares it to the current traffic volumes and lane capacity. It is noted that, with the Option 2 (one-way) routing, there would only be heavy vehicles in one direction on Titirangi Road, Atkinson Road, Kaurilands Road, Glendale Road, Golf road or Godley Road.

Table 4-1:Traffic Demands with WTP Works – Heavy Vehicle and Staff Traffic Volumes

Road name	Existing Highest Peak Hour Volume (One Direction)	Proposed Heavy Vehicle and Staff Traffic		TOTAL Peak Hour Traffic (One Direction)	Road Capacity (veh/hour/ lane)	Residual Lane Capacity %
		Per Day	Per hour (One Direction)			
Woodlands Park Road (Collector)	314	168-207	12-15	329	900	63%
Titirangi Rd (Arterial)	933	168-207	12-15	948	1,200	21%
Atkinson Rd (Arterial)	469	168-207	12-15	484	900	46%
Scenic Drive (Arterial)	437	168-207	12-15	452	900	50%
Kaurilands Rd (Arterial)	608	168-207	12-15	623	900	31%
Glendale Rd (Arterial)	566	168-207	12-15	581	900	35%
Golf Road (Collector)	1,469** (both directions)	168-217	12-15	1,499 (both directions)	1,800 (2 lanes)	17%
Godley Road (Arterial)	1,630** (both directions)	168-217	12-15	1,660 (both directions)	1,800 (2 lanes)	8%

** Noting that through the village itself, there would be less capacity due to the friction of on-street parking and the existing signalised pedestrian crossing. Golf Road shows two-way volumes, rather than peak direction for other roads.*

*** Traffic volumes adjusted by 3% per annum to account for growth to 2018 base year.*

The total residual lane capacity with all the traffic (heavy vehicles and staff vehicles) generated as part of the enabling and construction works conservatively ranges from 8% to 63%. This demonstrates that the existing mid-block lane capacity for the roads recommended for heavy and staff vehicles are sufficient to cater for the additional vehicle movements during the WTP enabling and construction works, noting that Golf Road and Godley Road are less likely to be used by most vehicles given their identified physical limitations.

As discussed in **Section 4.1.1**, it is recognised that the signalised pedestrian crossing in Titirangi village reduces the capacity in this section of Titirangi Road. When this crossing is more frequently used, in combination with higher traffic demands around the school and commuter peak periods, this leads to queues forming in the peak directions through and approaching the village. However, whilst this is results in this section of Titirangi Road operating at or beyond capacity, this is not considered to preclude additional traffic movements during this period being acceptable, particularly those in a non-peak direction.

As such, given the relatively low number and proportion of predicted heavy vehicle movements (half of which will be in the non-peak direction) in comparison to existing traffic demands, it is considered that these could still be accommodated with acceptable effects through Titirangi village. However, it is considered appropriate to limit heavy vehicle movements at these times during the busiest periods of the construction programme to assist in managing these effects.

While these roads generally have enough capacity to cater for the heavy vehicle and staff traffic, it is considered appropriate to further consider the specific increases in heavy vehicles on these roads in relation to the potential impact on the safe operation of the transport network is further assessed in **Section 4.3.3**. The effects of these traffic volumes on the Titirangi roundabout have been modelled and the analysis presented in **Section 4.1.4**.

b. Proposed Reservoir 1 enabling, and construction works traffic movements

The proposed Reservoir 1 enabling, and construction works programme (excluding the early works, WTP and Reservoir 2 works) will take place over approximately a 21 month period. This begins approximately 12 months after the WTP enabling and construction works starts. **Figure 4-5** below shows the busiest expected heavy vehicle volumes per day.

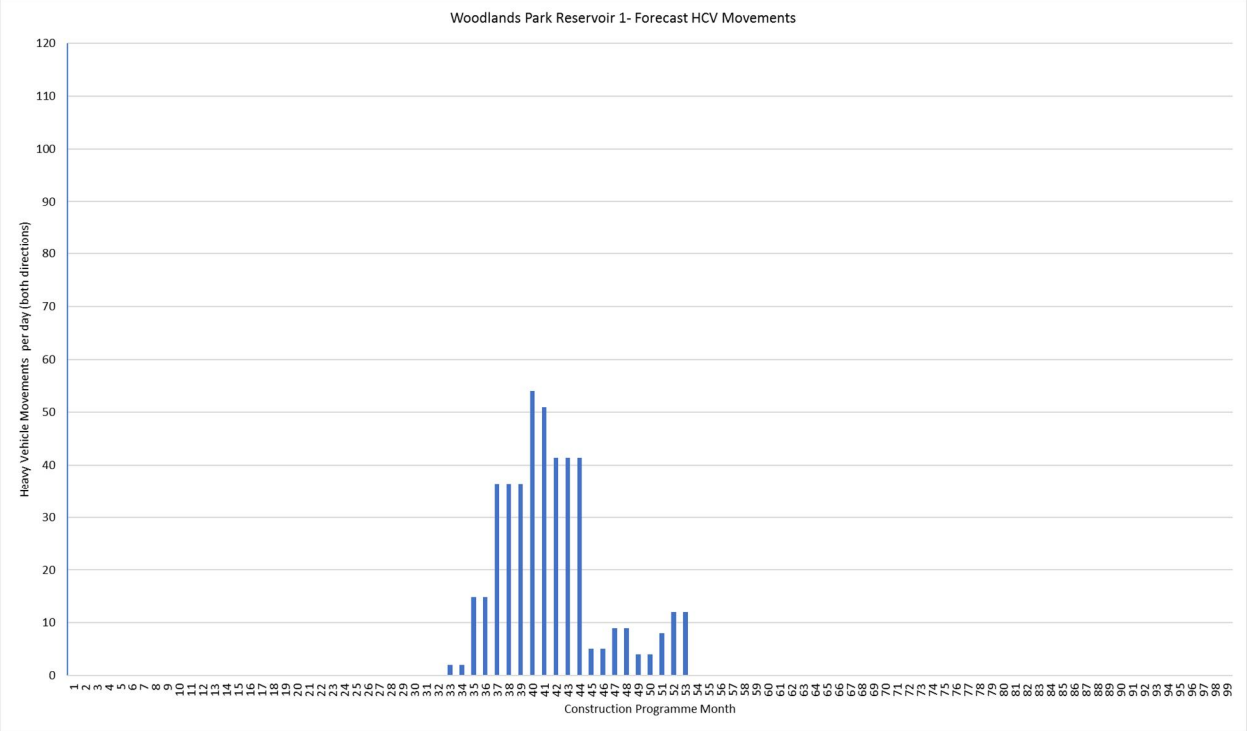


Figure 4-5: Expected Reservoir Heavy Vehicle Movements (both directions) – Reservoir 1 Works

The expected busiest heavy vehicle movements per day would range from 51 to 54 during the busiest period (2 months). In addition, there are anticipated to be 45 staff movements (light vehicles) per day during this period.

This is approximately 14 vehicle movements per hour (heavy vehicles and staff vehicles) and approximately 7 vehicles per direction per hour. Table 4-2 shows the predicted busiest traffic demand with the heavy vehicle and staff traffic volumes for the busiest period of construction at the reservoir site and compares it to the current traffic volumes and lane capacity.

Table 4-2:Traffic Demands with Reservoir Works – Heavy Vehicle and Staff Traffic Volumes

Road name	Existing Peak Hour Volume (One Direction)	Proposed Heavy Vehicle and Staff Traffic		TOTAL Peak Hour Traffic (One Direction)	Road Capacity (veh/hour/ lane)	Residual Lane Capacity %
		Per Day	Per hour (One Direction)			
Woodlands Park Road (Collector)	314	96-99	7	321	900	64%
Titirangi Rd (Arterial)	933	96-99	7	940	1,200*	22%
Atkinson Rd (Arterial)	469	96-99	7	476	900	47%
Scenic Drive (Arterial)	437	96-99	7	444	900	51%
Kaurilands Rd (Arterial)	556	96-99	7	563	900	37%
Glendale Rd (Arterial)	550	96-99	7	557	900	38%
Golf Road (Collector)	1,469** (both directions)	96-99	7	1,476 (both directions)	1,800 (2 lanes)	18%
Godley Road (Collector)	1,630** (both directions)	96-99	7	1,637 (both directions)	1,800 (2 lanes)	9%

** Noting that through the village itself, there would be less capacity due to the friction of on-street parking and the existing signalised pedestrian crossing. Golf Road shows two-way volumes, rather than peak direction for other roads.*

*** Traffic volumes adjusted by 3% per annum to account for growth to 2018 base year.*

The total residual lane capacity including all traffic generated as a result of the enabling and construction works conservatively ranges from 9% to 64%. This demonstrates that the existing mid-block lane capacity for the roads recommended for heavy vehicle traffic is sufficient to cater for the additional heavy vehicle and staff traffic during the proposed reservoirs enabling and construction works, noting that Golf Road and Godley Road are less likely to be used by most vehicles given their identified physical limitations. As discussed above, it is recognised that the signalised pedestrian crossing in Titirangi village reduces the capacity in this section of Titirangi Road.

However, while these roads generally have enough capacity to cater for the heavy vehicle and staff traffic, similarly to the replacement WTP works, it is considered appropriate to further consider the specific increases in heavy vehicles on these roads in relation to the potential impact on the safe operation of the transport network is further assessed in **Section 4.3.3**.

c. Assessment of combined busiest period

This section assesses the traffic effects when the enabling and construction works for the replacement WTP and proposed reservoirs occurring concurrently. From **Figure 4-6**, the other periods of the overall programme have notably lower daily traffic demands. The figure shows the expected heavy vehicle movements for the concurrent works. The busiest construction period will take place for an approximate 11 intermittent months, separated by some months of reduced demand, with the reservoirs bulk earthworks taking the majority of that time.

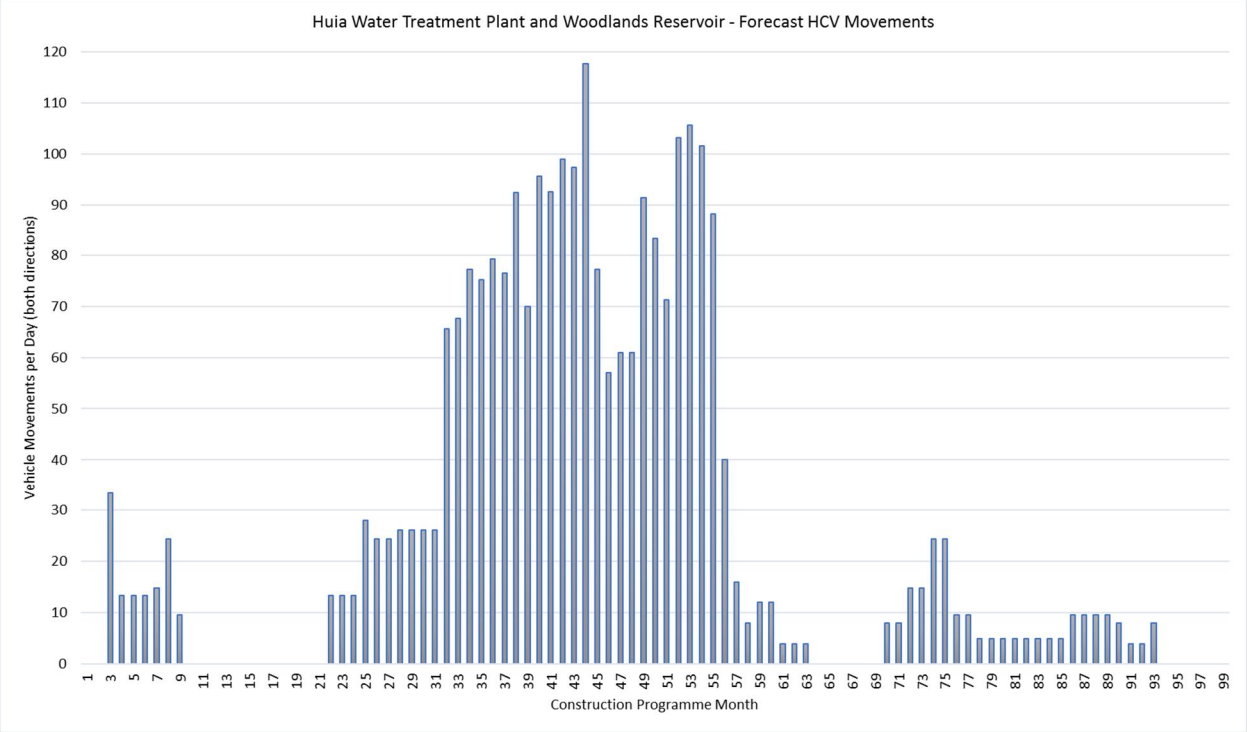


Figure 4-6: Combined WTP and Reservoirs Enabling and Construction Works – Heavy Vehicle Movements Programme

The busiest period of overall heavy vehicle movements for the combined sites of 11 intermittent months of the overall programme is only 11% of the full programme period. During the 11 month intensive period, several activities occur concurrently for the replacement WTP and proposed Reservoir 1 sites, **Table 4-3** shows the increase in the number and proportion of heavy vehicle movements on the local road network, based on the 7 hour working day.

Table 4-3: Predicted Increase in HCV on Recommended HCV Routes – With WTP and Reservoir Works

Road Name	Daily Traffic Volumes	Average Daily HCV Traffic (% HCV)	Max Generated HCV Traffic (% change)	New Total Daily Traffic Volumes	Existing HCV + Proposed HCV Traffic (% HCV)
Woodlands Park Rd	5,135	164 (3%)	118	5,254	282 (5%)
Scenic Drive	7,325	308 (4%)	118	7,444	426 (6%)
Titirangi Road	18,474	815 (5%)	118	18,593	933 (5%)
Atkinson Rd	7,954	398 (5%)	60	8,014	458 (6%)
Kaurilands Rd	8,229**	179 (2%)	60	8,289	239 (4%)
Glendale Rd	13,012**	368 (3%)	60	13,072	428 (4%)
Golf Rd	12,823**	578 (5%)	60	12,883	696 (5%)

**Daily traffic volumes based on 5-day ADT.*

*** ADT volumes adjusted by 3% per annum to account for growth to 2018 base year.*

The 5 day average heavy vehicle profiles for Titirangi Road northbound and southbound is shown in **Figure 4-7**and **Figure 4-8** below. The figures illustrate a small proportion of existing heavy vehicle volumes (shown in yellow) with a smaller band showing the additional Project heavy vehicles (shown in blue). Refer to **Appendix B** for the Titirangi Road, Atkinson Road and Scenic Drive 5 Day average and Saturday heavy vehicle profiles.

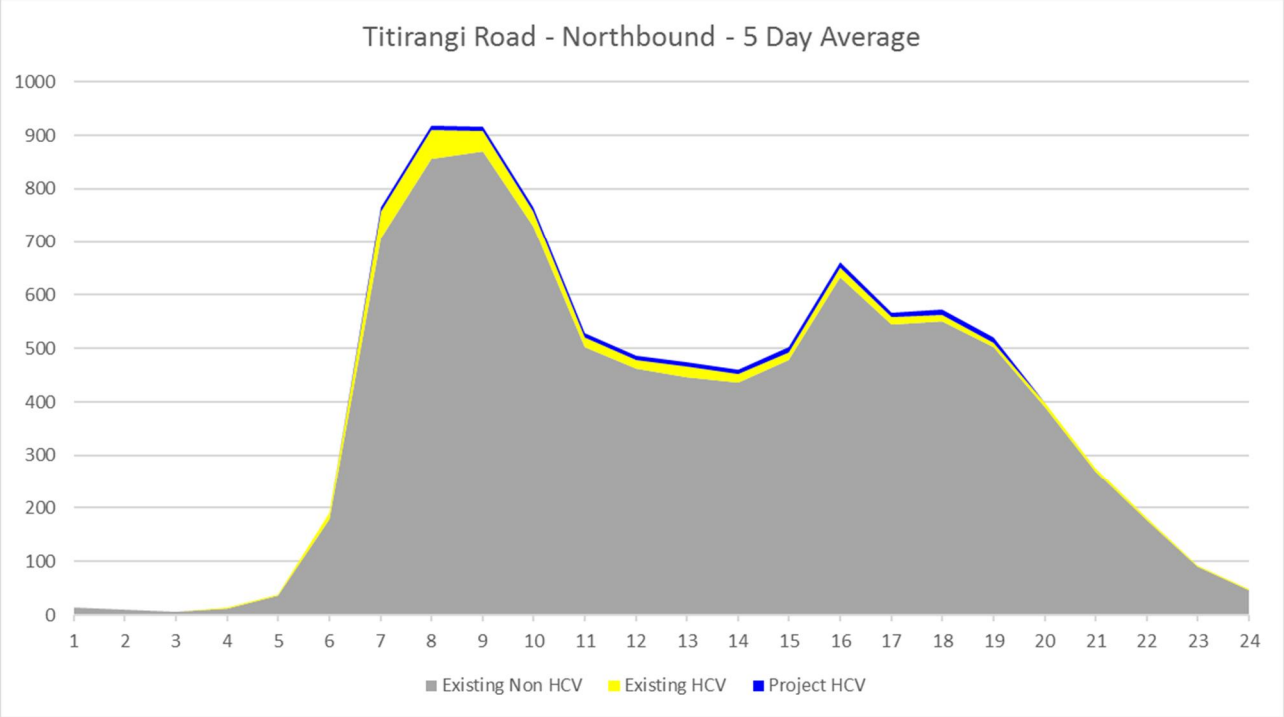


Figure 4-7: Titirangi Road Northbound – 5 Day Average Traffic Profile

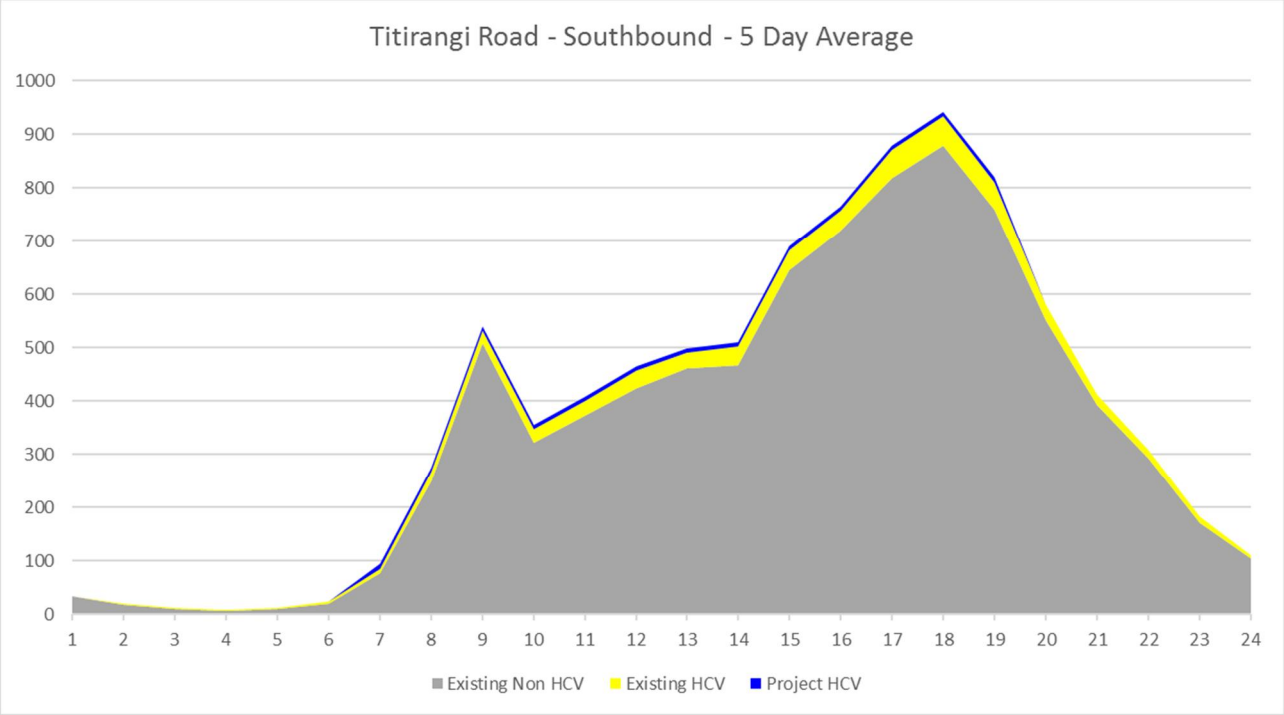


Figure 4-8: Titirangi Road Southbound – 5 Day Average Traffic Profile

All roads in **Table 4-3** above are expected to experience an increase of between 1 to 2% in average daily traffic volumes due to the proposed heavy vehicles of the Project during the busiest period of construction. In some cases, this results in a notable increase in the number of heavy vehicles using these roads across the day, when compared to current traffic demands. However, this is considered to be less of an operational

issue for these roads in terms of their operational capacity, and more a factor in terms of the safe operation of these roads in terms of potential conflicts with other road users.

In the case of Titirangi Road, it is noted that this is based on the 'worst case' scenario during the busiest period of the construction programme, with the proposed combined enabling and construction works for the replacement WTP and proposed reservoirs, and all traffic routed in both directions through the village, rather than using alternate construction routes.

By comparison, as shown in **Figure 4-6**, across the majority of the remaining months of the construction programme, the traffic demands on a daily and hourly basis will be lower than the traffic demands assessed here and the effects on the transport network will be less than considered above. The use of the busiest period volumes therefore provides a robust assessment of any adverse effects associated with construction works, particularly on Titirangi Road.

Table 4-4 shows the predicted busiest traffic demand with the heavy vehicle and staff traffic volumes for the busiest period of construction at the sites and compares it to the current traffic volumes and lane capacity. The total residual lane capacity including all traffic generated as a result of the enabling and construction works conservatively ranges from 7% to 63%. This demonstrates that the existing mid-block lane capacity for the roads recommended for heavy vehicle traffic is sufficient to cater for the additional heavy vehicle and staff traffic during the proposed combined enabling and construction works. Noting that Golf Road and Godley Road are less likely to be used by most vehicles given their identified physical limitations for larger trucks.

As above, it is acknowledged that the signalised pedestrian crossing in Titirangi village reduces the capacity in this section of Titirangi Road. However, whilst this is results in this section of Titirangi Road operating at or beyond capacity, this is not considered to preclude additional traffic movements during this period being acceptable, particularly those in a non-peak direction. It is therefore considered that the above movements could still be accommodated with acceptable effects through Titirangi village, albeit it is appropriate to limit heavy vehicle movements at these times during the busiest periods of the construction programme to assist in managing these effects.

Across the remaining less-intensive months of the programme, the traffic demands on a daily and hourly basis will be lower than the traffic demands assessed here and have less effects on the transport network. Reiterating that the most intensive or busiest period of the overall combined Project construction, relates to only 11% of the total programme.

Table 4-4: Predicted Traffic Demands with Combined Heavy Vehicle and Staff Traffic Volumes

Road name	Existing Peak Hour Volume (One Direction)	Proposed Heavy Vehicle and Staff Traffic		TOTAL Peak Hour Traffic (One Direction)	Road Capacity (veh/hour/ lane)	Residual Lane Capacity %
		Per Day	Per hour (One Direction)			
Woodlands Park Road (Collector)	229	218-248	16-18	247	900	63%
Titirangi Rd (Arterial)	749	218-248	16-18	767	1,200	21%
Atkinson Rd (Arterial)	415	218-248	16-18	433	900	46%
Scenic Drive (Arterial)	325	218-248	16-18	343	900	49%
Kaurilands Rd (Arterial)	608**	218-248	16-18	574	900	30%
Glendale Rd (Arterial)	566**	218-248	16-18	638	900	35%

Golf Road (Collector)	1,469 (both directions)	218-248	16-18	1,505 (both directions)	1,800 (2 lanes)	16%
Godley Road (Collector)	1,630 (both directions)	218-248	16-18	1,666 (both directions)	1,800 (2 lanes)	7%

** Noting that through the village itself, there would be less capacity due to on-street parking and the existing signalised pedestrian crossing. Golf Road shows two-way volumes, rather than peak direction for other roads.*

*** Volumes adjusted by 3% per annum to account for growth to 2018 base year.*

d. Surrounding Road Network Capacity

The surrounding road network capacity and effects are discussed further for each road below, in relation the predicted heavy truck during the busiest 11 months of the overall programme:

i. Woodlands Park Road

The road capacity of Woodlands Park Road in **Table 4-1** to **Table 4-4** shows that the road has sufficient capacity to cater for these heavy vehicle volumes and increase in expected daily traffic volumes. However, it is recognised that the increase in the heavy vehicle volumes on these roads, particularly around the site access, as a result of the enabling and construction works, will require specific management.

To minimise and manage any adverse effects this may have on the safety of road users on the surrounding road network the following mitigation measures are recommended for the CTMP:

- Site-Specific Temporary Traffic Management Plan/s (SSTMP) for Woodlands Park Road and the intersection with Scenic Drive, including signage and speed reduction along Woodlands Park Road
- Localised road widening and kerb / channel on the north side of Woodlands Park Road to assist in reducing potential conflict between oncoming vehicles with the additonal and more regular turning movements at the site accesses.

ii. Scenic Drive

The road capacity of Scenic Drive in **Table 4-1** to **Table 4-4** shows that the road has sufficient capacity to cater for these heavy vehicle volumes. With a low percentage increase in heavy vehicle volumes and low residential population and limited driveway access along Scenic Drive, the impact along the road is expected to be low, subject to managing heavy vehicle movements, via the measures included in the CTMP.

iii. Titirangi Road

The road capacity of Titirangi Road in **Table 4-1** to **Table 4-4** shows that the road has some residual mid-block capacity to cater for these heavy vehicle volumes. The function of Titirangi Road (Arterial), particularly in comparison to the other routing options means that Titirangi Road is generally considered to be the more appropriate route for heavy vehicle routing, subject to managing heavy vehicle movements through Titirangi village at certain times, via the measures included in the CTMP.

iv. Atkinson Road

The road capacity of Atkinson Road in **Table 4-1** to **Table 4-4** shows that the road has sufficient mid-block capacity to cater for these heavy vehicle volumes. Measures will be developed through the CTMP, to prevent, as far as practicable, heavy vehicles operating during the key pick-up and drop-off periods for the Atkinson Road schools, as discussed in relation to Kaurilands Road below. Whilst the zebra crossing on Atkinson Road near Woodlands Park School restricts capacity below the mid-block capacity in the school pick-up and drop-off periods, preventing heavy trucks at these times will in any event address that effect.

v. Kaurilands Road

The road capacity of Kaurilands Road in **Table 4-1** to **Table 4-4** shows that the road has sufficient mid-block capacity to cater for these heavy vehicle volumes. There are several schools and kindergartens on Atkinson and Kaurilands Route, heavy vehicle volumes are likely to impact on the safe operation and increase safety risks at these locations. In particular, it is noted that observations during the busiest times in the pick-up / drop-off periods indicate that there could be insufficient width for heavy vehicles to use this route due to the increased demand for on-street parking at these times, similarly to Atkinson Road (refer to **Figure 4-9** below). However, by managing the heavy vehicle scheduling (through the measures included in the CTMP), it is considered the adverse effects along Kaurilands and Atkinson Road can be appropriately addressed.

Figure 4-9: Kaurilands Road and Atkinson Road – School Drop-off Period

Outside school pick-up/drop-off and busiest commuter peak periods, observations have indicated that there would be a decreased demand for on-street parking, as well as low levels of on-street activity associated with the schools. The one-way routing option identified to be included in the CTMP will not only halve the number of predicted heavy vehicle movements on this route but would also reduce potential safety risks associated with opposing heavy vehicle movements.

vi. Glendale Road

The road capacity of Glendale Road in **Table 4-1** to **Table 4-4** shows that the road has more than sufficient capacity to cater for these heavy vehicle volumes. Similarly, to Atkinson and Kaurilands Road there are some school and recreational activities along on this route, and heavy vehicle volumes are likely to impact the traffic and increase safety risks at these locations.

Through the measures to be included in the CTMP to prevent, as far as practicable, heavy vehicle movements during peak school pick-up / drop-off and busiest commuter peak periods, it is considered that any adverse impacts on the road will be appropriately managed. As with Kaurilands Road, the one-way routing option identified to be included in the CTMP would reduce the safety risks associated with opposing heavy vehicle movements, as well as halve the amount of expected heavy vehicle traffic.

vii. Golf Road and Godley Road

The road capacity of Golf Road and Godley Road in **Table 4-1** to **Table 4-4** shows the roads have less residual capacity than other roads to cater for these heavy vehicle volumes. Noting also that, there potential physical restrictions of these routes, which would be confirmed through the CTMP development. This could mean that they would more likely only be utilised by some heavy rigid trucks, so only a smaller proportion of the total heavy vehicles per day. Measures will be developed through the CTMP, to prevent, as far as practicable, heavy vehicles operating during the key pick-up and drop-off periods for the Green Bay schools.

4.1.4 Titirangi Roundabout Assessment

SIDRA Intersection Software has been used to undertake detailed intersection modelling to assess the potential impact of the proposed enabling and construction works traffic for the combined replacement WTP and proposed reservoirs on the Titirangi Road roundabout. This assesses whether the roundabout will continue to operate with sufficient capacity or if mitigation measures are necessary.

From traffic surveys and on-site observations, the roundabout experiences delay and queuing not uncommon to the number of vehicles moving through the roundabout. The SIDRA analysis seeks to assess the additional effect that the proposed construction vehicles would have on the roundabout operation. It is also noted that the above assessment has identified that during the busiest periods of enabling and construction heavy vehicles will be limited during the weekday AM and PM peaks.

a. Assumptions and scenarios

Our assessment has made the following assumptions and includes the suggested scenarios:

Base Year (2018)

- Base year traffic volumes based on observed traffic turning count volumes
- In order to replicate observed queues along Huia Road and Atkinson Road, the following adjustments to the traffic models have been included and carried forward to the 'With Development' scenario:
  - Environment factors were adjusted on the Huia Road and Atkinson Road apporaches and the Huia Road exiting flow path in the AM peak period
  - On the Huia Road approach, the surveyed traffic demand was also increased to account for the 'suppressed' demand associated with the queuing on this approach.

Base Year + Development Traffic (2018)

AM Peak (8am-9am)

- Additional 52 light vehicles (80% of total light vehicles as per **Section 3.3.1**) coming 'In' via Titirangi Rd. heavy vehicles will not be operating during AM peak period.

Inter Peak (a one-hour peak between 9am and 2.30pm)

- With assumption of additional 17 heavy truck movements per hour (as per **Section 3.3.4**), with nine coming 'In' via Atkinson Road and nine heavy vehicles going 'Out' via Titirangi Road. Additional 30 light vehicle movements included during Inter-peak (15 In and 15 Out via Titirangi Road).

PM Peak (5pm-6pm)

- With assumption of additional 52 light vehicles (80% of total light vehicles as per **Section 3.3.1**) going 'Out' via Titirangi Rd. heavy vehicles will not be operating during PM peak.

b. Modelling results

The results for the SIDRA modelling for the Titirangi Roundabout are presented in **Table 4-5** below and the detailed outputs are attached in **Appendix C**.

The results in **Table 4-5** demonstrate that the change in delay experienced at the roundabout in the base year with busiest period of proposed enabling and construction works traffic has relatively little effect to the existing conditions. The additional vehicles have little to no change to the delay and queuing currently experienced and observed during the traffic surveys at the roundabout.

As such, it is considered the effects of the proposed works can be satisfactorily accommodated at the existing roundabout during these periods at the busiest part of the construction period, noting that this occurs across 11 months of the overall programme, and in other periods the effects will be less.

Table 4-5: SIDRA Intersection Modelling Results

Period	Approaching Movement	Base Year (2018)			Base Year (2018) with Development Traffic		
		Average Delay (s)	Queue (m)	LOS	Average Delay (s)	Queue (m)	LOS
AM Peak	Huia Road	23	87	C	28	103	C
	Titirangi Road	5	12	A	5	14	A
	Atkinson Road	18	41	B	18	41	B
	Koru Road	9	8	A	9	8	A
	Scenic Drive	11	22	B	11	22	B
	Overall Roundabout	**15**	**87**	**B**	**16**	**103**	**B**
Inter Peak	Huia Road	9	14	A	9	14	A
	Titirangi Road	4	9	A	4	10	A
	Atkinson Road	8	10	A	8	10	A
	Koru Road	7	3	A	7	4	A
	Scenic Drive	8	10	A	8	12	A
	Overall Roundabout	**7**	**14**	**A**	**7**	**14**	**A**
PM Peak	Huia Road	11	12	B	11	12	B
	Titirangi Road	7	64	A	7	64	A
	Atkinson Road	7	19	A	7	20	A
	Koru Road	6	2	A	6	2	A
	Scenic Drive	7	8	A	7	10	A
	Overall Roundabout	**7**	**64**	**A**	**8**	**65**	**A**

Note: Queue (m) - refers to 95% Back of Queue distance in meters for the worst lane.

4.1.5 Woodlands Park Rd / Scenic Drive intersection

As mentioned above, the road capacity of Woodlands Park Road shows that the road has sufficient capacity to cater for heavy vehicle volumes and increase in expected daily traffic volumes. The increase in heavy

vehicle and staff movements at the intersection of Woodlands Park and Scenic Drive would have limited impact, as the intersection (**Figure 4-10** below) has relatively low numbers of vehicles, especially on Scenic Drive (with 305 vehicles in the peak hour both directions on Scenic drive and 400 in the peak hour for Woodlands Park Road).

Figure 4-10: Woodlands Park Road / Scenic Drive Intersection

During construction, the intersection will form part of the Site-Specific Temporary Traffic Management Plan/s (SSTMPs), including signage and speed reduction along Woodlands Park Road. It is considered that this will satisfactorily address the management of the predicted heavy vehicles using this intersection during the construction period, as this would incoporate a temporarily lower speed limit through this area. The temporary reduced speed limits at the intersection would also assist in managing vehicle speeds and associated sightlines for vehicles existing Woodlands Park Road.

4.1.6 Alternative Landfill Site

A possible alternative landfill site for the disposal cut material has been identified as the Parau landfill (Mackies Rest) south west of the proposed WTP. The likely route towards the landfill is shown in **Figure 4-11**.

It is understood that the landfill site could potentially accommodate from approximately 66,000 m^3 and up to around 100,000m^3 of material. This means there is the potential for a large proportion, if not all, of the cut material to be transferred via heavy vehicles to this site, rather than along the routes that have been considered previously (**Sections 4.1.1** to **4.1.5**).

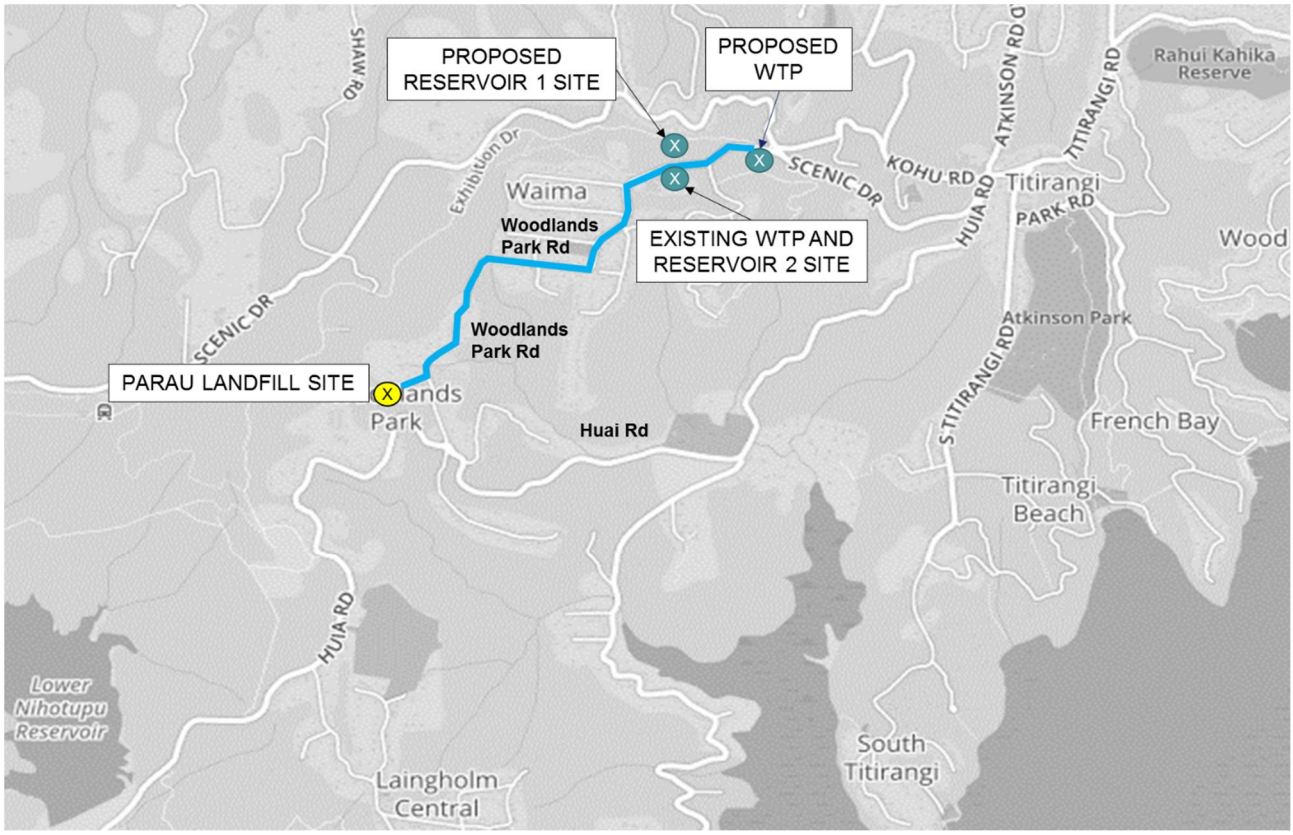


Figure 4-11: Alternative Landfill Site

a. Parau route overview

The route is along Woodlands Park Road through the Woodlands Park village and then along Huia Road. **Figure 4-12** to **Figure 4-19** show the current nature of the route that heavy vehicles would need to travel to access the Parau landfill site from the Project site. The route is characterised as mainly a residential collector route with regular residential driveway accesses along most of the route, albeit Huia Road is identified in the AUP as an Arterial road. Road widths are generally around 6.5m with a footpath along one side of the road on both Woodlands Park and Huia Roads.

The route along Woodlands Park Road passes through two small roundabouts with overrunable central islands at the intersections with Hollywood Road (**Figure 4-12**) and at Huia Road (**Figure 4-13**) with narrow entries on approaches that potentially limit the regular use by larger heavy vehicles. In Woodlands Park village, the route passes the Woodlands Park School, which is busy during the weekday school pick-up / drop-off periods, with cars manoeuvring to/from the road, including reversing to/from parking adjacent to the road (**Figure 4-14**). The route along Huia Road has several horizontal curves and is generally continuously uphill southbound at a reasonable gradient, as shown in **Figure 4-15**.

The entrance to the landfill is at an unformed driveway access off Huia Road, which also provides access to Exhibition Drive (**Figure 4-16** and **Figure 4-17**). Immediately to the north of the driveway off Huia Road, there is a curve on a slightly uphill section (southbound) that limits the sight line in this direction (**Figure 4-18**). Similarly, as Huia Road continues south, the sightline in that direction from the driveway is also limited (**Figure 4-19**). Immediately after turning into the driveway, the access road to Exhibition Drive and several residential properties is provided. The access is narrow and currently would not allow the two way movement of trucks and cars.

Figure 4-12: Woodlands Park Road / Hollywood Avenue Roundabout

Figure 4-13: Woodlands Park Road / Huia Road Roundabout

Figure 4-14: Woodlands Park Road outside Woodlands Park School - Weekday AM Drop-Off Period

Figure 4-15: Huia Road between Woodlands Park Roundabout and Site Access

Figure 4-16: Parau Site Access (gated entry) with Exhibition Drive access to the right

Figure 4-17: Parau Site Access off Huia Road

Figure 4-18 Parau Site Access – Northbound view of Huia Road

Figure 4-19: Parau Site Access – Southbound view of Huia Road

b. Parau route assessment

It is considered, given the route and transport environment (shown in **Figure 4-11**) and described above, that there would be limitations on the heavy truck types that could operate along this route to dispose of the cut material. The key considerations in this regard are:

- The small roundabouts at the Hollywood Avenue and Huia Road intersections
- The windy uphill section from the Huia Road / Woodlands Park Road roundabout to the site
- The regular residential driveways in this more rural environment, often located on curves
- The location and sightlines at the site access off Huia Road.

As such, it is considered that the heavy vehicle type should be restricted to a rigid truck only, rather than a truck and trailer combination vehicle. It is considered that these vehicles could operate along this route without adverse effects on the local transport environment, subject to the measures being implemented through the CTMP, as outlined below.

If a rigid heavy truck is used to remove cut material from the site, this has an impact on the anticipated heavy vehicle volumes for cut material, which were based on truck and trailer heavy vehicles. ALTA has provided an indication of the potential change in heavy vehicle volumes in this instance that relate to the anticipated period for intensive earthworks during the replacement WTP (11 months) and Reservoir 1 earthworks phase (lasting eight months), based on transporting up to 100,000m^3 of cut material:

- Intensive earthworks period – Truck and trailer volumes – 24 to 36 movements per day
- Intensive earthworks period – Rigid heavy vehicle volumes – 61 to 90 movements per day.

In this situation, if the Parau site were to be utilised for all spoil removal from the Project site, then this would result in 61 to 90 heavy rigid vehicles per day transporting the same amount of material, as could have been moved by 24 to 36 heavy truck and trailer vehicles along the routes discussed in **Sections 4.1.5**. The predicted heavy rigid truck movements along Woodlands Park Road and Huia Road to the Parau site equates to approximately 13 movements per hour or around one heavy vehicle every five minutes.

Data has been extracted from the Auckland Transport traffic counts database in order to understand the daily traffic volumes for this route. Woodlands Park Road near the school had a daily traffic volume (both directions) of 2,458 vehicle movements (402 in the AM peak), recorded in 2014. On Huia Road (near the Parau site access), the daily traffic volume (both directions) was recorded as 5,180 vehicle movements (490 in the AM peak hour) recorded in 2015. Comparing 2013 and 2015 traffic data for Huia Road in this location suggests the roads experience growth in traffic volumes of 3% per annum.

On this basis, not accounting for further growth in traffic, the predicted Project traffic demand of 90 heavy vehicle movements during the earthworks period represents approximately a 1% increase in ADT vehicle volumes. Both single lane roads would be considered to have a capacity of 500 to 700 vehicles per hour per lane (1,400 vehicles per hour in both directions). On the basis of the existing peak hour traffic demand, it is considered there is capacity to accommodate the predicted increase of 13 heavy vehicle movements per hour (both directions) from a road capacity perspective.

Whilst it is considered that the predicted heavy rigid vehicles can be accommodated on this route with appropriate mitigation, the effects could be further managed by continuing to operate some truck and trailer units for cut material on the Titirangi Road and Atkinson/Woodlands Park Roads route (as has already been assessed above). However, if the Parau site is used, it is considered that the adverse effects of using this route are overall balanced by the reduced adverse effects on the other routes.

Similarly, to Atkinson Road and Kaurilands Road, it is considered that, at certain times of day, there would be a need to limit (where practicable), trucks operating past the Woodlands Park School in the village during the busy weekday school pick-up and drop-off periods. It is considered that otherwise, heavy vehicle movements have the potential to impact on the safe operation of children and parents travelling to and from the school. It is considered that by managing the heavy vehicle scheduling (through the measures included in the CTMP), the adverse effects along Woodlands Park Road can be appropriately addressed. Outside school pick-up/drop-off, it has been anecdotally observed that there is generally a decreased demand for on-street parking in the village, as well as low on-street activity.

In addition, it is considered that measures would need to be implemented at the site access off Huia Road and on the approaches to provide for the safe movement of vehicles to and from the site access. This would be implemented through SSTMPs included in the CTMP that would provide for measures, such as, a reduced speed limit on this section of Huia Road, associated signage (including warning of turning trucks) and localised widening of the access for two way movement of trucks.

Based on this assessment, it is considered that the Parau site is potentially a feasible option for the removal of cut material during the earthworks, subject to implementation of the identified measures through the CTMP to manage the predicted effects. Furthermore, it is noted that the benefits of using this location for disposal of a large proportion, if not all, of the cut material, from a transport perspective are:

- Movements to the Parau site would mean that these movements did not need to occur along the Titirangi Road or Atkinson/ Kauriland Roads route, reducing the adverse traffic effects on those corridors, and distributing adverse effects over a wider network area
- Overall shorter trip distance (3.6km), less distance travelled by heavy vehicles on the public road network, when compared to the longer route via Titirangi Road to Great North Road or Atkinson/ Kauriland Roads to West Coast Road. Notwithstanding that the latter routes would also result in further travel distance to and from disposal sites, beyond the point of reaching Great North Road or West Coast Road
- Shorter trip durations, less time for heavy vehicles on roads, improving the turnaround for material disposal, and reliability of arrivals and departures from the site.

4.1.7 Trenching and Pipework

As shown in **Figure 4-20,** a pipeline is proposed to be constructed from Reservoir 2 to Reservoir 1 and the proposed WTP, which will exit the WTP at the site access point, follow Woodlands Park Road and enter the reservoir site access. There is likely to be other underground pipework located beneath the road in addition to that shown in **Figure 4-20**. These works are expected to be undertaken via trenchless construction to cross Woodlands Park Road and therefore not anticipated to result in works within the road reserve.

Smaller diameter pipes, ducting and chambers for electricity, lighting, communications and stormwater around site are to be trenched and installed during construction prior to civil finishing works. This will include incoming power and water and outgoing sewer. Construction of these utilities will require works within Woodlands Park Road at the proposed WTP site entrance and potentially along the southern berm between the replacement WTP and the existing WTP.

However, it is considered that appropriate traffic management controls can be established, and the standard Corridor Access Request Process followed to authorise such works. As such, as identified in the draft CTMP (in **Appendix E**), it is considered that the further development of such traffic management measures and associated processes can be easily dealt with through the further development of the CTMP.

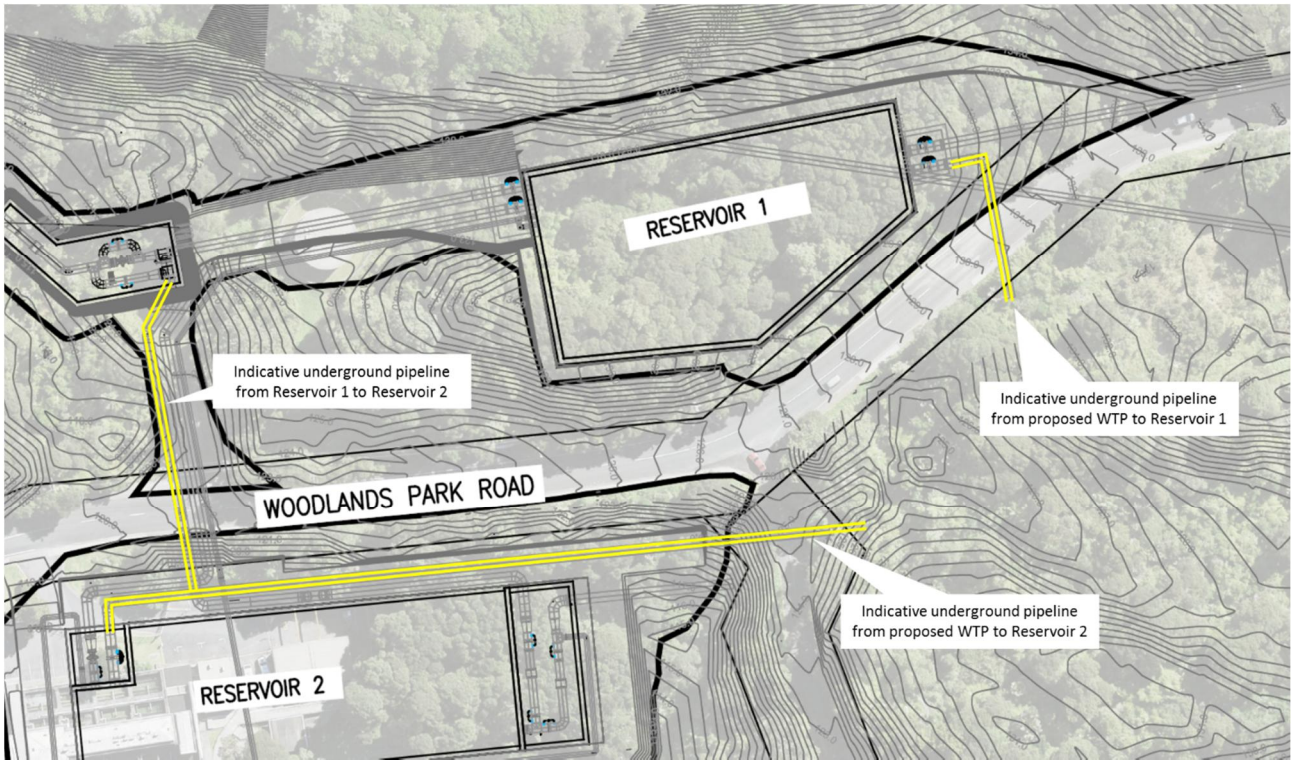


Figure 4-20: Indicative Water Pipeline Connection between the Replacement WTP and Reservoir Sites

4.1.8 Construction Staff Parking

Any parking along Woodlands Park Road is not considered to be safe and on-site construction staff parking and laydown areas will be required.

It is generally accepted that all construction related traffic would be accommodated on site and that no vehicles would be parked on-street. To mitigate the risk of staff and truck vehicles parking on the street, a parking management plan is to be included in the CTMP. As this is further developed, once the contractor is appointed, it will include further detail of the designated onsite parking locations for staff and heavy vehicle traffic. This will reduce the likelihood of staff parking their vehicles on outside nearby residential homes. The CTMP will also identify that on-street parking is prohibited along Woodlands Park Road.

As identified in the draft CTMP, construction staff will also be advised not to park in the car park at Exhibition Drive, as this area will be designated for recreational users (**Section 2.7.1**), as per the current arrangements. As per **Section 3.4.1**, the maximum on-site parking at any one time would include 50 carparks distributed between both sites:

- During bulk earthworks ample space to park on site will be available. Once the main level is constructed, there is a large enough area on-site where vehicles will be able to park
- When ancillary structures construction commences, parking will become more restrictive. Parking on-site in this period will need to be closely managed by the contractor. This will be further developed and identified in the CTMP.

As described in the draft CTMP, use of a shuttle bus to transport staff to the site and is included. The shuttle bus will assist in managing staff parking requirements by having staff park off-site, likely within the 'staging' site that is anticipated to be somewhere in the New Lynn area (to be confirmed, once contractor is appointed). As the CTMP is developed it will further identify the arrangements for the pickup/drop off location and details of the timing and use of the shuttle service as part of the staff transport plan for the sites.

4.1.9 Over Size Truck Movements

It is expected that throughout the enabling and construction works period over-dimensional and 'wide load' vehicles will be required to access the site, including to cart precast materials, structural steel, process plant components, etc. The route that these vehicles have to travel including potential hazards have been highlighted in **Section 4.1.1**. The Titirangi Road route also has a 4.25m height restriction due to an overhead bridge near the intersection of Margan Avenue. For the transport of large equipment, such as cranes, and over-dimensional vehicles this may be a constraint.

To mitigate any adverse effects on the road network, it is proposed that large over-dimensional and 'wide load' plant/equipment movements travel to and from the site overnight and under mobile traffic controls, which are identified in the draft CTMP and will be further developed by the contractor (once appointed) in liaison with Auckland Transport.

4.1.10 Bus Stops, Pedestrians and Cyclist Effects

As the existing bus stops are located to the east of the sites access for the new reservoirs, it is likely that pedestrians accessing those stops, particularly the stop on the north side of Woodlands Park Road, will come into conflict with the additional heavy vehicle movements.

To mitigate this effect, it is recommended that those two bus stops (as shown in **Figure 4-21**) are either relocated temporarily during the enabling and construction works or temporarily suspended. If these two stops were temporarily suspended, then passengers could use the other pair of bus stops further to the west on Woodlands Park Road. This should be discussed further with Auckland Transport and details of the relocation included in the CTMP.

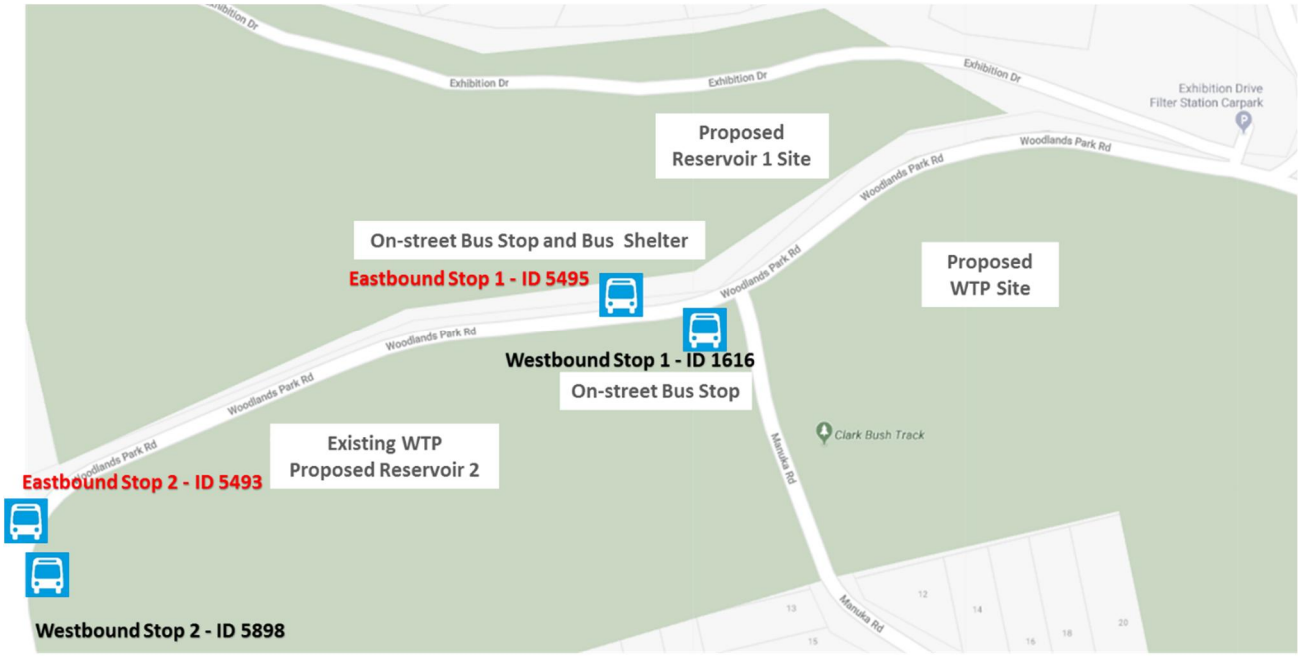


Figure 4-21: Bus Stops on Woodlands Park Road

As per **Section 2.8**, the AT HOP data showed the following demands for the public transport:

- Low usage of stops nearest sites, particularly the stop 5495 on the north side of Woodlands Park Road
- Stop 5495 is little used by school kids, children tend to alight at westbound stop in the afternoon, when returning home.

Recreational users (pedestrians and cyclists) were observed using the footpath along Woodlands Park Road. This is the only footpath on this road and it is located on the south side, adjacent the westbound traffic lane. There is no footpath adjacent the northern kerb and a narrow unpaved shoulder. As mentioned the site access will not comply with the Unitary Plan standards and due to operational requirements and needs to be wider to accommodate heavy vehicles accessing the site.

During the enabling and construction works, the CTMP needs to actively manage the pedestrian and cycle safety along the frontage of the replacement WTP construction site entrance accordingly. This is addressed within the draft CTMP.

4.2 Operational Transport Effects

This section assesses the overall operational effects of the replacement WTP and reservoirs, as well as the proposed site access locations for the Project sites. These access points will initially be established as part of the heavy vehicle and staff vehicle access for the enabling and construction works, then used during the operational phase. The operational activities at the replacement WTP are part of the Outline Plan of Works.

4.2.1 Operational Traffic Effects

Once the replacement WTP and reservoirs are operational the current WTP plant will scale down and ultimately stop operations on switch over. The replacement WTP site, once operational, would generally only generate low volumes of traffic similar to those currently generated by the existing WTP and also have similar timings of vehicle movements discussed in **Section 2.4.3**.

It is anticipated that the replacement WTP would generate a maximum of 10 staff (light vehicle) movements in the AM and PM peaks respectively. Heavy vehicle movements would include up to 1 to 2 heavy vehicle movements per day, which include activities such as sludge removal and chemical deliveries.

Reservoirs 1, 2 and 3 would generate negligible traffic once operational and would also require minimal maintenance and heavy vehicle movements. As such, these trips would have negligible effects on the transport network.

As mentioned, the WTP and Reservoirs operational traffic movements would replace the existing WTP traffic on the road network. Thus, the traffic volumes along the route and at the Woodlands Park Road / Scenic Drive intersection will be same as present and are negligible proportion of overall movements.

Therefore, as there is effectively no change in WTP and reservoir operational traffic effects, it is not considered upgrades are required in association with WTP and Reservoirs operational traffic. It is understood Watercare is separately exploring opportunities to improve the layout and safety of intersection with Auckland Transport.

4.2.2 Replacement WTP Site Access Assessment

The proposed primary site access for the WTP enabling and construction works is to be located on Woodlands Park Road east of the existing Huia WTP approximately 150m east of the Manuka Road intersection. All heavy vehicle and staff traffic are intended to use only this primary access for the proposed enabling and construction works.

The posted speed limit at the proposed site access is 50km/h along the entire length of Woodlands Park Road and Scenic Drive. The 85th percentile speed on Woodlands Park Road near the Scenic Drive intersection near the proposed access location was recorded at to be on average 55km/h and 56km/h for northbound and southbound traffic respectively. The operating speeds were recorded approximately 100m east of the proposed primary access site.

A site visit was undertaken in May 2018 to assess the sight lines from the proposed WTP access location. Based on the observations, the available sight distances are presented in **Figure 4-22** and the site photograph is shown in **Figure 4-23**.

Figure 4-23 shows the sightline when standing at the proposed sight access for the WTP facing east. The digaram shows that shrubs and possibly some trees impair the sight lines at the proposed site access location. It is recommended that the shrubs and possibly some trees be trimmed to achieve full available sight distances.

The *Austroads Guide to Road Design: Part 4A: Unsignalised and Signalised Intersections* was used to calculate the approach and safe sight distance requirements. The required approach sight distance (ASD) and safe stopping sight distance (SSD) requirements are assessed. The assessment has used the conservative deceleration coefficient for heavy vehicles in wet weather conditions to assess the absolute 'worst case' scenario. However, it is commonly accepted that the light vehicle deceleration coefficient is applicable for calculating appropriate sight distances.

Figure 4-22: Sight Line Distance for the Proposed WTP Site Access

Figure 4-23: Sightline Facing East for WTP on Woodlands Park Road

The following assumptions were made in determining the sight distance requirements:

- Design Speed on Woodlands Park Road (V)
  - 56km/h, 85th percentile speed from survey data
- Deceleration Coefficient (d) used was
  - 0.24 for heavy vehicles
  - 0.36 for light vehicles
- Observation Time
  - 3 seconds
- Reaction Time (Rt)
  - 2 seconds
- Grade (a)
  - 6% slope downhill
  - 7% slope uphill

Table 4-6 below shows the ASD/SSD required for both light and heavy vehicles and available sight distance of approximately 110m for westbound traffic and 80m for eastbound traffic.

Table 4-6: Approach Sight Distance and Safe Stopping Distance Requirements WTP Access

Criteria	Direction of Travel	Available Sight Distance	ASD/SSD Required	
			Light Vehicles	Heavy Vehicles
ASD/SSD	Westbound	110m	**72m**	**100m**
	Eastbound	80m	**60m**	**71m**

It is noted that the available sight distances meet the required approach sight distance and safe stopping based on Austroads requirements. The proposed WTP site access is not likely to significantly increase the risk of crashes. The distance to the nearest intersection at Manuka Road is approximately 150m from the WTP access location. Manuka Road is a very low volume road environment. Vehicle swept path analysis for the WTP access is included in **Appendix D**.

It is recommended that advanced signage for heavy vehicles crossing are implemented as part of the CTMP during the enabling and construction works, in combination with the temporary reduced speed limits, given the more frequent occurrence of those movements. During construction, there could also be some trimming of shrubs and trees, as necessary, to maintain sufficient sight lines from site accesses.

The WTP vehicle crossing design is based on vehicle tracking (**Appendix D**) and operational considerations, as advised by Watercare. This includes providing a crossing width that allows for operational heavy vehicles to enter and exit without conflict. However, It is recognised that the vehicle tracking indicates that there could be the potential to provide a pedestrian refuge (in accordance with ATCOP guidelines) between the entering and exiting vehicle swept paths. This would reduce the width pedestrians would need to cross in a single stage. The WTP access configuration will be refined in later stages of the project.

4.2.3 Reservoir 1 Site Access Assessment

The location of the site access shown on **Figure 4-24**, is intended to be the primary access for the proposed enabling and construction works for the Reservoir site and then used during the operational phase. The proposed Reservoir 1 site access is located on Woodlands Park Road east of the existing Huia WTP approximately 110m west of the Manuka Road intersection, refer to **Figure 4-24**.

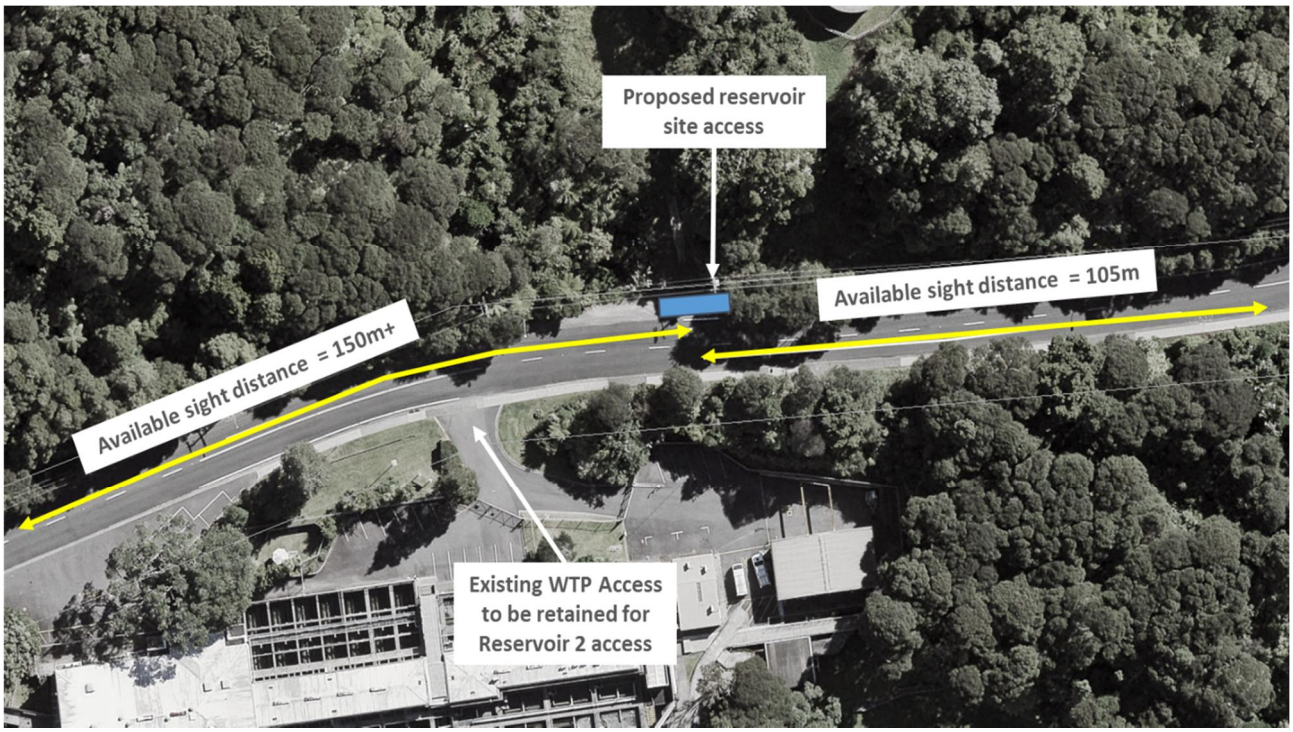


Figure 4-24: Site Access for Proposed Reservoir 1 and Reservoir 2 Site

As with the WTP site, the Reservoir 1 access is located on Woodlands Park Road. For the most part, the same assumptions apply to the ASD/SSD calculation except that the road gradient is flat, and no grade adjustment was used in the calculation.

Table 4-7 shows the ASD/SSD required for both light and heavy vehicles and available sight distance of approximately 83m for westbound traffic and 83m for eastbound traffic.

Table 4-7: Approach Sight Distance and Safe Stopping Distance Requirements Reservoir Access

Criteria	Direction of Travel	Available Sight Distance	ASD/SSD Required	
			Light Vehicles	Heavy Vehicles
ASD/SSD	Westbound	105m	**65m**	**83m**
	Eastbound	Over 150m	**65m**	**83m**

The available ASD/SSD meets the Austroads requirement of 65m for the proposed Reservoir site access. Therefore, the proposed location for the Reservoir site access meets the requirements as set out above. Vehicle swept path analysis for the reservoir access is included in **Appendix D**.

It is recommended that advanced signage for heavy vehicles crossing are implemented as part of the CTMP during the enabling and construction works, in combination with the temporary reduced speed limits, given the more frequent occurrence of those movements. Furthermore, the CTMP needs to consider 'stop and go' operations to allow heavy vehicles to make a right turn from Woodlands Park Road into the site.

4.2.4 Reservoir 2 Access (Existing WTP Site)

The existing WTP accesses will be used for all vehicles accessing Reservoir 2, once constructed. We do not expect any adverse effects from the adjacent access as the operational volumes would consist mainly of maintenance to the reservoirs, which would be infrequent and lower than the current access.

Construction will be finished on the adjacent Reservoir 1 site before the existing WTP decommissioning and Reservoir 2 access is used by construction vehicles. Hence no conflict with Reservoir 1 is expected.

4.2.5 Bus Stop, Pedestrian and Cyclist Effect

The existing bus stops are located to the east of the site access for the reservoirs site, once the sites become operational, it is proposed that the relocated bus stops will be restored to their current locations.

There is no footpath along the frontage of the reservoir site and no mitigation is required.

Recreational users (pedestrians and cyclists) were observed using the footpath along the southern side of Woodlands Park Road fronting the proposed replacement WTP site. As mentioned, the site access will not comply with the AUP provisions and due to operational requirements, needing to be wider to accommodate heavy vehicles entering and exiting the site. As such the impacts on pedestrians include crossing a wider accessway which could have some adverse effects on safety.

The adverse effects on pedestrians and cyclists using footpath are not expected to be more than minor, given the generally low number of pedestrians, as well as the low volumes of light and heavy vehicles accessing the replacement WTP, when operational (similar to current the current WTP traffic).

4.3 Unitary Plan Requirements

Appendix D provides a list of the assessment of the replacement WTP and proposed Reservoir 1 site against the relevant transport matters (Part E27. Transport) of the AUP. The specific matters are addressed in the table in **Appendix D**. It is noted that this assessment has been undertaken to inform the Outline Plan of Works, rather than the resource consent applications, as we understand that the AUP district plan land use requirements are not applicable to the regional resource consents for enabling earthworks currently being sought due to the designation.

In summary, the following items are addressed as follows:

- **Number of parking and loading spaces – Carparking and Accessible carparking**
  - The site will comply with the requirements as set out in E27.6.2. A formalised carpark will provide sufficient parking for staff during site operation hours. There will be relatively low amount of required staff on site and as a result parking provision would also be minimal.
  - The site will comply in accordance with the number, size and accessible routes for accessible parking under NZS:4121-2001.
- **Size and location of parking and loading spaces**
  - The site will comply with the standards in E27.6.3.1. (1), including the minimum dimensions for all carparks and loading spaces. Loading spaces will comply with Table E27.6.3.2.1.
- **Access and manoeuvring**
  - Vehicle tracking has been undertaken that demonstrates access and manoeuvring to/from the site can be satisfactorily achieved.
  - The proposed loading spaces near the rear of the site can be accessed satisfactorily and in accordance with operational requirements of the site.

- **Width and number of vehicle crossings**
  - The width of the access does not comply with the Unitary Plan Table E27.6.4.3.2 but has been designed according to operational requirements. Due to the operational requirements of the site, large heavy vehicles are needed to be able to pass one another at the access point. The vehicle tracking is shown in **Appendix D** and has demonstrated that two vehicles are able to pass at access point as required.
  - Any adverse effects on pedestrians and cyclists using footpath are not expected given the low number of pedestrians and light and heavy vehicles
  - The vehicle tracking indicates that there could be the potential to provide a pedestrian refuge (in accordance with ATCOP guidelines) between the entering and exiting vehicle swept paths. This would reduce the width pedestrians would need to cross in a single stage. It is considered that this can be addressed as part of the later design development through the Outline Plan of Works.
- **Gradient of vehicle access**
  - The gradient of the vehicle access and parking area will be in accordance with Table E27.6.4.4.1. Internal gradient has also been assessed and comply with the standards as set for (T158).

It is considered that any transport effects generated by the operation of the Project, when completed, will be generally similar to those of the existing WTP and largely not discernible. The width of the proposed WTP site access will have an adverse effect on pedestrians using the footpath on the southern side of Woodlands Park Road, which is considered to be less than minor and acceptable. As such, there is considered to be no mitigation required.

5 Recommended Transport Mitigation

5.1 Mitigation Measures

This section details the recommended mitigation measures following the assessment of traffic and transport effects on the surrounding network, as a result of the enabling and construction works for the replacement WTP and proposed reservoirs sites. These recommended mitigation measures are considered to enable any identified adverse effects experienced on the transport network, as a result of the enabling and construction activities for the Project to be managed and mitigated to an acceptable level.

The key recommendation for managing and mitigation the predicted adverse transport effects of the Project will be the preparation of a CTMP and a draft CTMP is included in **Appendix E**, guided by the objectives outlined in **Section 5.2** below. It will need to be updated, once the contractor is appointed, when the details of the construction methodology and programme will be confirmed. It will then be provided to Auckland Council for certification, as required by the draft conditions in the Assessment of Environmental Effects, prepared by Tonkin & Taylor.

A summary of the mitigation measures that are identified in the draft CTMP is provided in **Figure 5-1**. With the implementation of these measures through the CTMP, it is considered that the adverse transport effects will be able to be satisfactorily managed, so the resulting effects will be minor or less and acceptable.

Figure 5-1:Summary of Draft CTMP Measures

Identified Adverse Effect	Type of Effect – Without Mitigation	Measures included in Draft CTMP
Horizontal curves on Woodlands Park Road at site accesses with heavy vehicle movements **General traffic movements at Woodlands Park Road / Scenic Drive intersection** **Pedestrians and recreational users on Woodlands Park Road**	Moderate: Safety	Temporary speed limit and heavy vehicles crossing signage identified in the draft CTMP As identified in the draft CTMP, heavy vehicles accessing the site will be managed during the temporary construction works, as part of the SSTMP Appropriate facilities at site access points for pedestrians identified in draft CTMP
Heavy vehicle routing and timing of movements on existing road network, such as past schools and through local centres	Moderate: Traffic operations, Safety	Heavy vehicle routing and timing, as per the approach identified in the draft CTMP
Heavy vehicle turning movements around existing bus stops on Woodlands Park Road	Moderate: Traffic operations, Pedestrian safety	Relocation of bus stops on Woodlands Park Road, as identified in the draft CTMP
Limited carriageway width for on-street parking on Woodlands Park Road	Moderate: Traffic operations, Safety	Identification of an on-site parking plan for staff vehicles and heavy vehicles, as well as no parking on Woodlands Park Road or Manuka Road, as identified in the draft CTMP Identification of a shuttle bus service from the 'staging' site to Project sites for staff, reducing on-site parking and traffic demand. Location and operation of shuttle bus service to be confirmed further development of the CTMP
Over-dimensional plant/equipment movements and 'Wide Loads'	Moderate: Traffic operations, Safety	Large over-dimensional plant/equipment movements, as well as 'Wide Loads', to be managed under mobile traffic controls and required methods, as identified in the draft CTMP

Heavy vehicle movements to / from site for deliveries etc	Moderate: Traffic operations,	Provision for a 'staging' site, as identified in the draft CTMP (location to be confirmed) for storage of materials, provide staff parking / shuttle bus pickup and act as a partial assembly location

5.2 CTMP Objectives

In terms of the development of the draft CTMP, to provide for the mitigation identified above, it is considered appropriate that the specific measures and management procedures are guided by a series of objectives. It is recommended that the objectives outlined below are incorporated into the relevant conditions for the CTMP, should consent be approved, to guide its further development by the contractor (once appointed).

- Manage the number of construction traffic movements on the transport network
- Provide for the safety of everyone at all times
- Ensure of maintenance of access at all times to / from properties
- Minimise disruption from construction traffic on the travelling public and road users along the identified sections of the construction routes
- Seek to avoid full road closures and minimise any partial or managed closures
- Manage integration with other construction projects and Auckland Transport projects
- Provide for prior engagement with relevant stakeholders, when public access, particularly to properties, will be affected by construction traffic
- Provide a mechanism for addressing queries and responding to complaints (incl. through a Community Liaison Group (CLG) or similar).

6 Summary and Conclusion

6.1 Summary

This transport assessment has assessed the potential transport effects on the local transport network arising from the enabling and construction works and the operation of the Project.

The Project sites are accessed off Woodlands Park Road and the potential heavy vehicle routes used to access the Project during the enabling and construction works have been assessed with consideration to the transport and land use environment and conditions. The assessment of the transport conditions has considered the predicted traffic movements, together with land use and transport environments, to determine the potential effects and impacts of the enabling and construction works on the transport network.

This report addresses the transport effects relating to the regional consents for the Project (the replacement WTP and Reservoirs enabling works and bulk earthworks), as well as the Outline Plan of Works for the Project (construction and operation of the replacement WTP and Reservoirs).

The expected heavy truck and staff vehicles generated due to the proposed enabling works and construction activities has been assessed based on the indicative methodology and programme provided to Beca by ALTA. The effects of the generated heavy truck and staff vehicles during construction have been assessed by considering the combined impact of the total vehicle movements for both the replacement WTP and proposed reservoirs, as provided in the indicative ALTA programme. The development of that programme included consideration of methods to reduce the daily number of heavy vehicles and staff vehicles, whilst balancing this against the effects of a longer programme duration.

The predicted traffic demand assessed is considered to provide a robust assessment of the predicted effects, given it considers the traffic demands anticipated in the active period of the overall programme, which equates to 24% of the overall programme (with 42 to 118 movements per day). Of this period approximately 11% is seen as the busiest period with 85 to 118 movements per day. In the remaining months, predicted traffic demands will be lower (approximately 49% of the programme with less than 42 movements per day) and there are also many periods with little or no heavy vehicle movements (approximately 26%) of the overall programme. The expected highest heavy truck movements are as follows:

- The highest truck movements are generated during the busiest 11 months, with an anticipated total of 88 to 118 heavy vehicle movements per day for the combined Project sites, equating to a total of up to around 13 to 17 heavy vehicle movements per hour across the working day
- The average heavy truck movements across the periods of the programme when heavy truck movements occur is approximately 37 vehicle movements per day, which equates to around eight vehicle movements per hour
- Anticipated staff movements are expected to reach a maximum of 130 light vehicle movements (which includes shuttle bus) spread across the whole day with most occurring outside the weekday peak periods, due to the anticipated start and finish times on the Project sites.

The highest heavy vehicle movements considered in the assessment are likely to reduce further, as these movements are likely to be spread across a longer period than the more conservative 7 hour working day and with the flexibility of the 6 day working week.

An alternative site at the Parau landfill, which could accommodate the excavated earthwork volumes, has also been identified and assessed in this report. It is considered that the route would only be suitable for rigid heavy vehicles, rather than truck and trailer heavy vehicles. As a result, there would be an increase in the predicted number of heavy vehicle movements required to use this route, when compared with the number of vehicles required to remove this material along other potential heavy truck routes via Titirangi Road or Atkinson/ Kaurilands Roads. However, the use of this route would spread heavy vehicle movements across the potential routes, meaning there would be less heavy vehicle movements along the Titirangi Road and/or Atkinson/ Kaurilands Roads routes. It is considered the route to the alternative site can accommodate the increase of approximately 13 rigid heavy vehicle movements per hour during the busiest earthworks period. Whilst the effects on this route could be managed by continuing to operate some truck and trailer units for cut material on the Titirangi Road and Atkinson/Woodlands Park Roads route, if the Parau site is used, it is considered that the adverse effects of using this route are overall balanced by the reduced adverse effects on the other routes.

The traffic assessment identifies that the existing road network, including the Titirangi roundabout, will generally have sufficient capacity to cater for the proposed heavy and staff vehicle movements generated by the proposed construction and operational activities. However, there is the potential for adverse safety and efficiency impacts on the road network due to the increase in heavy vehicles at certain times (such as during the school pick-up/drop-off and in the busier traffic periods through Titirangi village) requiring mitigating measures in order to reduce these adverse effects.

The assessment has therefore identified the following mitigation to minimise the adverse impacts on nearby schools, local and town centres, public transport services, and recreational users that will be implemented through the provision of a CTMP, which will be a condition of the consent:

- In developing the construction methodology, balance the daily number of heavy truck movements and the implications on the extension of the programme, that will prolong the duration of the potential and actual adverse effects
- Preventing or limiting, where practicable, heavy truck movements on the adjacent road network during the busiest periods of construction in the weekday morning and afternoon peak periods around school pick-up/drop-off time and general commuter peak periods, as well as during the Saturday mid-day peak period
- Heavy truck routing via the identified haul route options using a combination of Woodlands Park Road and Scenic Drive, together with; Titirangi Road, Golf Road, Godley Road, Atkinson Road, Kaurilands Road and Glendale Road, which will address the operational and safety effects of the predicted hourly heavy truck movements on the identified truck routes at certain times of day or days of the week
- Heavy truck routing to the existing Parau landfill site via Woodlands Park Road and Huia Road for the disposal of a large proportion, if not all, of the cut material with associated mitigation, including managing truck movements around school pick-up/drop-off times
- Localised road widening along the northern side of Woodlands Park Road to provide new kerb and channel between Scenic Drive and the Project sites
- Site-specific traffic management, temporary speed limit reductions, temporary bus stop relocations and pedestrian management measures along Woodlands Park Road in the vicinity of the Project sites, up to and including the Scenic Drive intersection, as well as at the Parau landfill site access off Huia Road
- On-street staff parking restrictions, on-site parking / loading management, together with a staff travel management plan, including details of staff shuttle bus scheduling and identification of a suitable pickup/drop-off location at the ‘staging’ site
- Provision of a ‘staging’ site (location to be confirmed, likely in New Lynn area) to store materials, provide parking, bus/shuttle pickup and act as a partial assembly location to have greater flexibility and reliability of site truck and light vehicle movements

- For over-dimensional plant/equipment movements and 'Wide Loads' identification of appropriate scheduling of these movements, such as overnight or on weekends.

It is considered that any transport effects generated by the operation of the Project, when completed, will be generally similar to those of the existing WTP and largely not discernible. The width of the proposed WTP site access will have an adverse effect on pedestrians using the footpath on the southern side of Woodlands Park Road, which is considered to be less than minor and acceptable.

As such, there is considered to be no mitigation required. It is understood that Watercare is in separate discussions with Auckland Transport to explore the opportunity for improvements to the existing Woodlands Park Road / Scenic Drive intersection.

6.2 Conclusion

It is therefore considered that the CTMP will satisfactorily manage the potential adverse effects of the enabling and construction works for the replacement WTP and proposed reservoirs providing for the safe and efficient operation of the surrounding transport network.

The measures to be included in the CTMP are discussed in this report and identified in the draft CTMP that is provided with this report (**Appendix E**). The conditions of consent will provide for the further development and approval of the CTMP by the Council (including Auckland Transport) prior to the enabling works and construction commencing.

On this basis, it is therefore considered that the Project can be undertaken with temporary adverse effects on the safe operation of the transport network that are minor or less and are acceptable. As such, it is considered there are no transport related reasons to prevent the approval of the replacement WTP and proposed reservoirs consent applications.

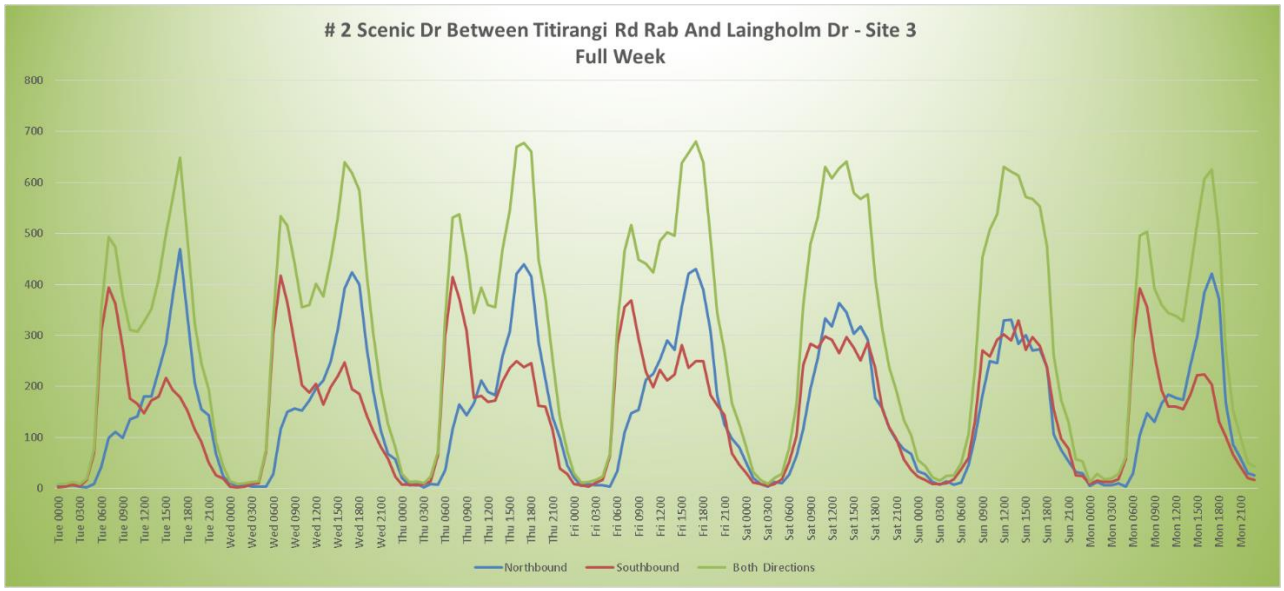
A

Appendix A – Traffic Volume Data

Traffic Volumes Data

Scenic Drive

Weekday data on turning counts were collected on 15 February 2018 and 17 February 2018.



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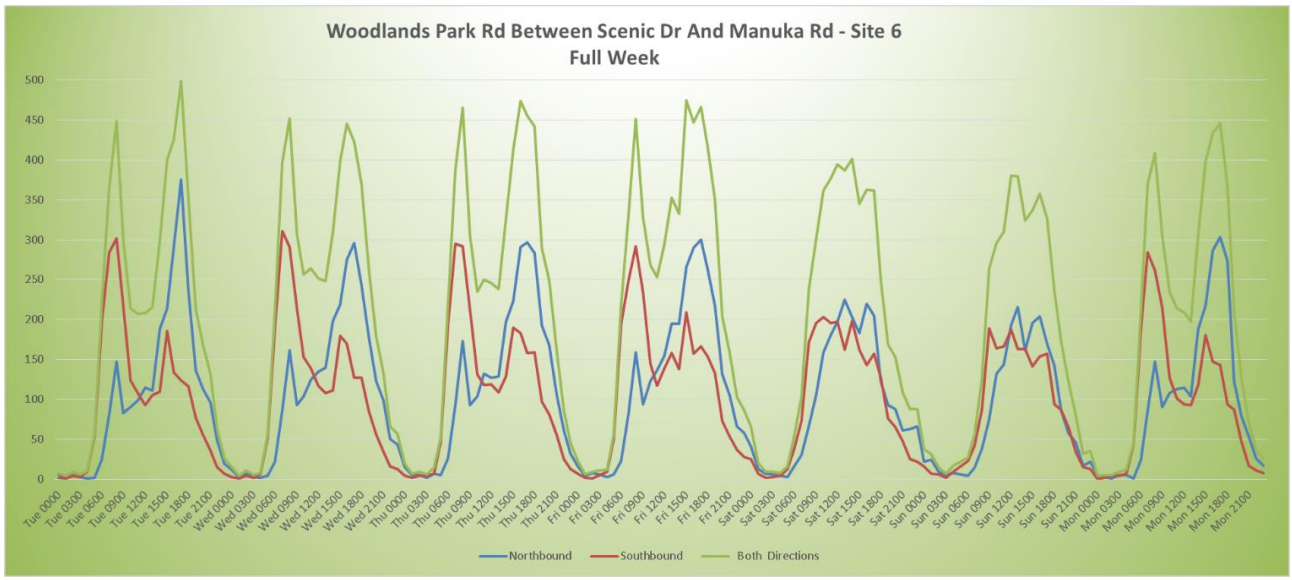
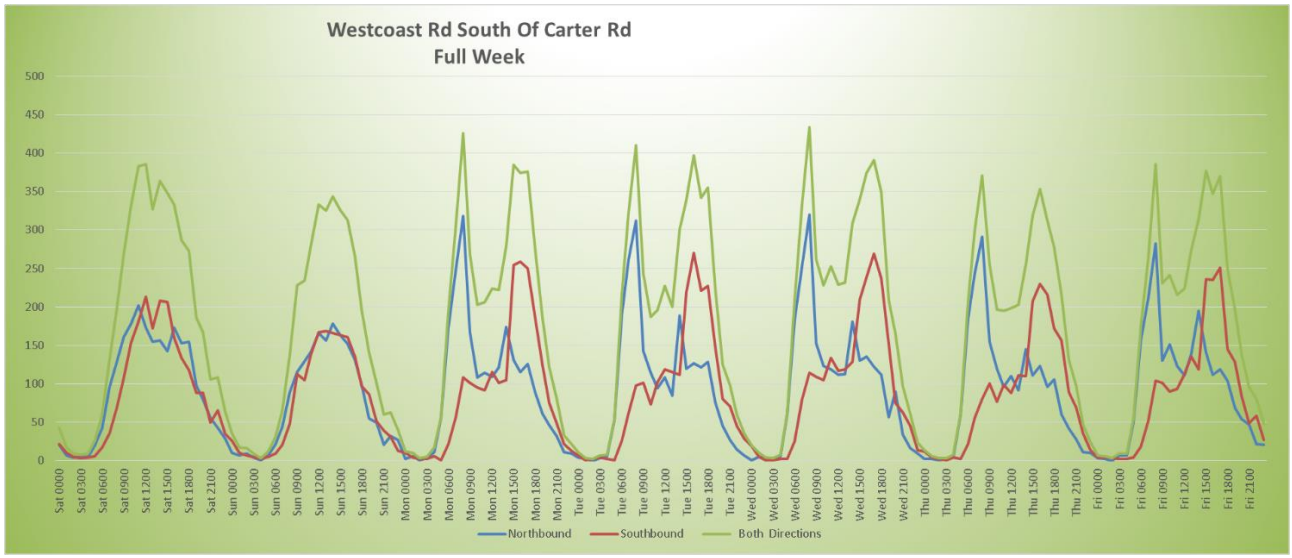
- Weekdays experience an AM and PM peak while the weekends experience one peak around midday. The PM peak volumes are higher than the AM peak volumes. The PM peaks are relatively similar to the midday weekend peak.
- Approximately 70% of vehicles from Scenic Drive travel onto Titirangi Rd in the AM peak and approximately 80% onto Titirangi Rd in the PM peak in weekday.
- The Saturday peak volumes increased from approximately 300 to 350 vehicles per hour. Volumes were below 50 vehicles per hour between midnight to 5am on all days surveyed.
- Vehicles travel southbound in the morning peak then travel northbound in the evening peak on weekdays. On weekends the southbound and northbound traffic are fairly similar and peak at the same time of the day.
- The traffic volumes between the AM and PM peak are approximately the same in each direction with northbound volumes increasing slightly and southbound volumes increasing slightly throughout the midday period.

Woodlands Park Road



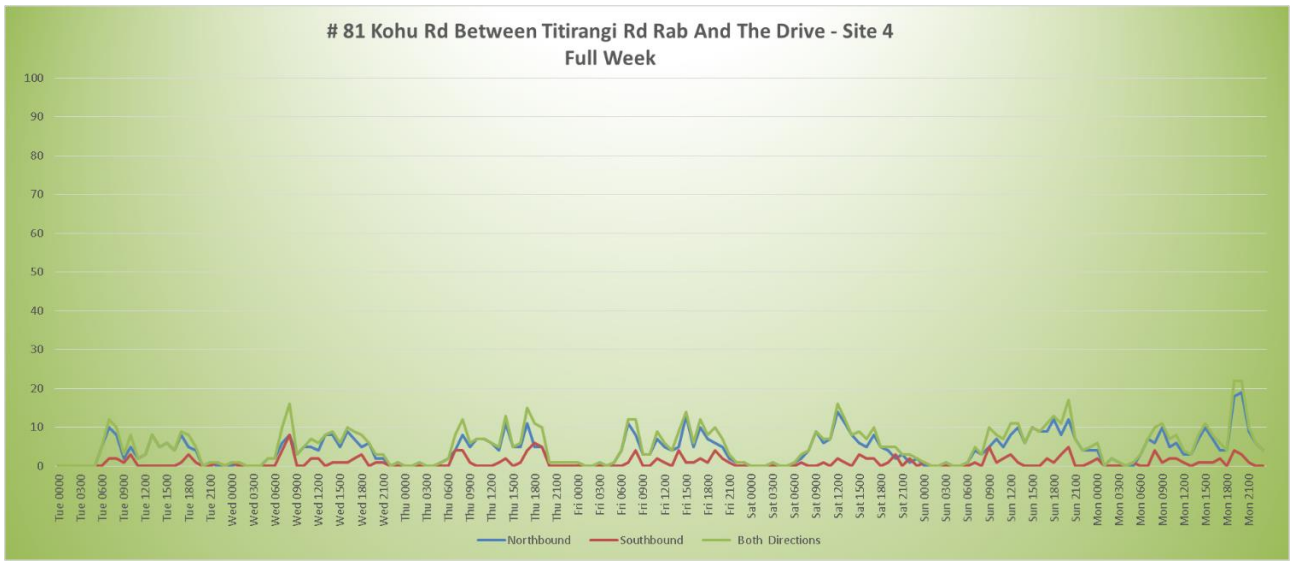
- Majority of vehicles travel southbound in the morning peak then travel northbound in the evening peak on weekdays. This trend for the direction of travel is similar on weekends with a slightly high volumes of traffic travelling south in the morning and slightly higher volumes if traffic travelling in the evening.
- Weekdays experience fairly similar AM and PM peak volumes. The weekends experience one peak around midday which is slightly lower by approximately 50 vehicles when compared to weekday peak volumes.

West Coast Road



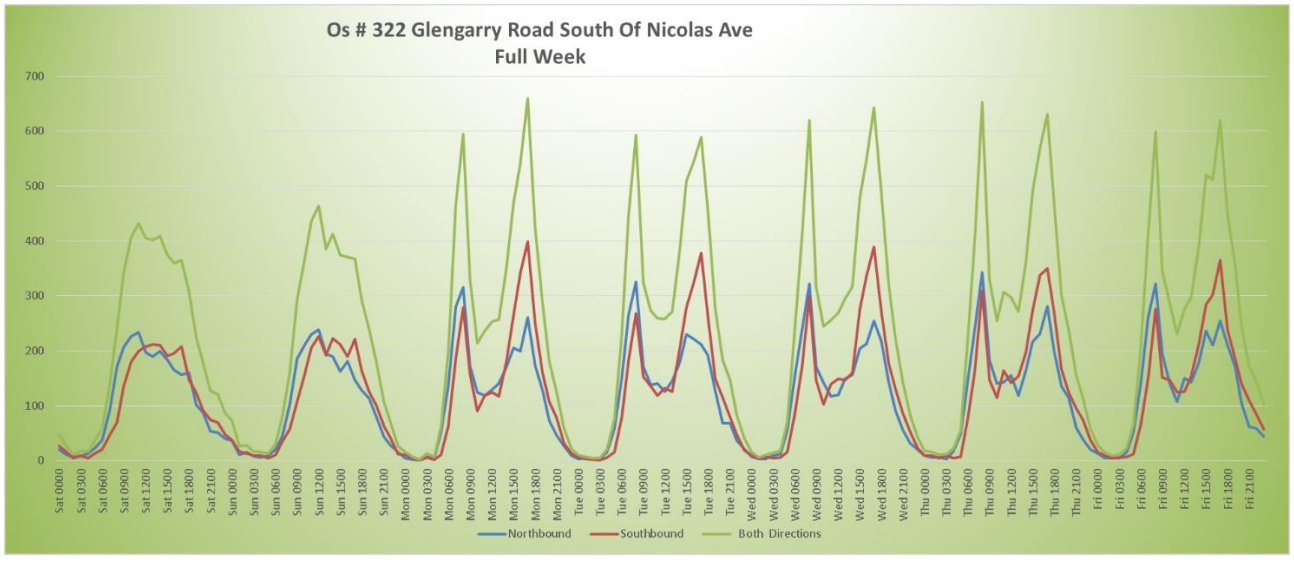
- Majority of vehicles travel northbound in the morning peak then travel southbound in the evening peak on weekdays.
- Weekdays experience fairly similar AM and PM peak volumes. The weekends experience one peak around midday which has a similar volumes to the weekday peak volumes.

Kohu Road



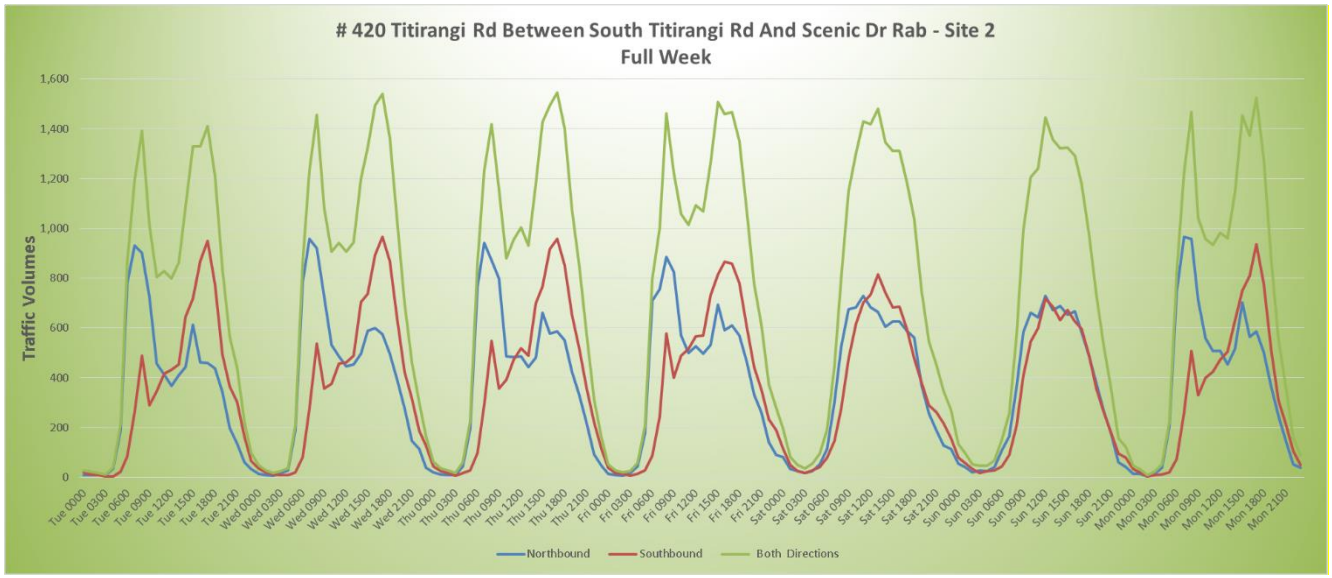
- Majority of vehicles travel northbound but don't seem to use Kohu Road to travel back southbound. This is unlikely due to rat running to avoid delays on Atkinson Road due to school traffic because it is consistently higher than the southbound vehicles all throughout the day not just at school opening and closing times. The reason for this traffic behaviour is unclear.
- The traffic volumes between the AM and PM peak are approximately the same in each direction

Glengarry Road



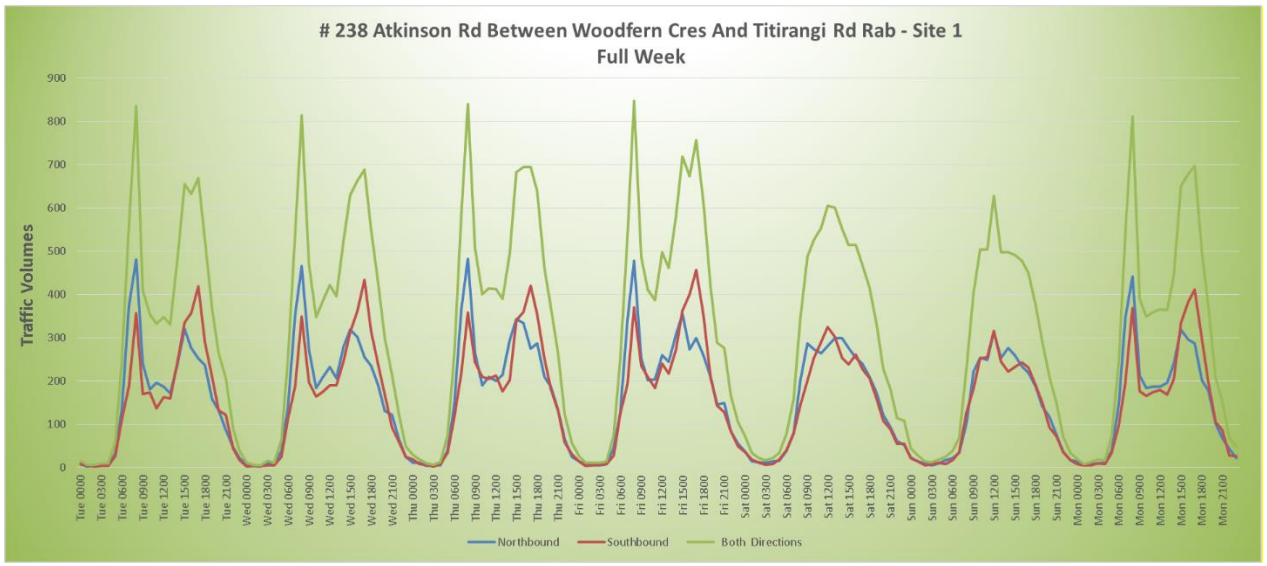
- Fairly equal volumes of vehicles travel both southbound and northbound in the morning peak on weekdays, while in the PM peak the southbound volumes are higher than the northbound volumes
- Weekends experience lower midday peak volumes of approximately 200 less vehicles when compared to the weekday AM and PM peak volumes.

Titirangi Road



- Majority of vehicles travel northbound in the morning peak then travel southbound in the evening peak on weekdays.
- The weekends experience one peak around midday which is slightly lower by approximately 100 vehicles when compared to weekday peak volumes.
- The traffic volumes between the AM and PM peak are approximately the same in each direction with the northbound volumes increasing slightly and southbound volumes increasing slightly throughout the midday period.

Atkinson Road



- Majority of vehicles travel northbound in the morning peak then travel southbound in the evening peak on weekdays. However the difference between the northbound and southbound volumes at peak periods is approximately 100 vehicles which is much less than that of Titirangi Road which had a difference of 400 vehicles.
- The weekends experience one peak around midday which is slightly lower by approximately 100 vehicles when compared to weekday peak volumes.
- In both directions the total volumes in the AM peak are higher by approximately 100 vehicles when compared to the PM peak volumes.

- The traffic volumes between the AM and PM peak are approximately the same in each direction with a northbound volumes increasing slightly and southbound volumes increasing slightly throughout the midday period.
- The traffic volumes between the AM and PM peak are approximately the same in each direction.

Kaurilands Road

No tube count data was collected for Kaurilands Road. AT Traffic Counts spreadsheet shows that in 2015 the recorded peak AM volumes at 8am was 1112, the midday peak volumes was 740 vehicles and the recorded peak PM volumes at 4.30pm was at 971 vehicles.

Phillip Avenue (south of the Glengarry Road intersection)

No traffic data was available for Phillip Avenue on the AT Traffic Counts Spreadsheet and no tube count or survey was conducted. Phillip Avenue is a cul-de-sac with residential homes. So based on the number of properties in the street the average daily traffic is approximately 140 vehicles per day. This is assuming a property has 1.5 vehicles and makes 2 trips a day.

Shetland Street (south of the Philip Avenue intersection)

No traffic data was available for Shetland Street on the AT Traffic Counts Spreadsheet and no tube count or survey was conducted. Shetland Street is a cul-de-sac with residential homes. So based on the number of properties in the street the average daily traffic is approximately 130 vehicles per day. This is assuming a property has 1.5 vehicles and makes 2 trips a day.

Pleasant Road

No tube count data was collected for Pleasant Road. The AT Traffic Counts spreadsheet shows that in 2016:

- 658 midday peak volumes
- 891 PM peak volumes
- 834 AM peak volumes

Glendale Road

No tube count data was collected for Glendale Road. The AT Traffic Counts spreadsheet shows that in 2016:

- 1067 AM peak volumes
- 1049 midday peak volumes
- 1240 PM peak volumes

B

Appendix B – Heavy Vehicle Movements across Programme

MONTH	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99
Commence Reservoir (early works)																																																																																																					
Reservoir Enabling Works & Bulk Earthworks																																																																																																			
Vegetation Removal, Ersed controls			13	13	13	13																																																																																													
Site Establishment			20																																																																																																	
Total HV movements	0	0	33	13	13	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NH2 Shaft and Tunneling																																																																																																			
NH2 Shaft																																																																																																			
Piling for 13m diameter shaft							15																																																																																											
Shaft Excavation								24																																																																																									
Base slab									10																																																																																								
Shaft fitout																																																																																																		
NH2 Tunnelling - (different consent)																																																																																																	
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Replacement WTP																																																																																																			
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Site Establishment																									20																																																																							
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Earthworks Cut																										24	24	24	24	24	24	24	24	24	24	24																																																													
Temporary Retention for Buried Structures																												2	2	2	2																																																																								
Place Imported Fill to Platform Level																																24	24	24	24	24	24	24																																																												
Retaining Wall Piles																																15	15	15																																																																				
Retaining Wall Construction (Backfill in EWKs)																																2	2	2	2	2	2	2																																																												
SW Detention/Treatment/Pond Link																																						8																																																													
Earthworks and Earth Retaining Structures Complete																																																																																																				
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BAC and Ozone Contact Tank																																																																																																			
Foundations and Slab																																		10	10	10	10																																																															
Walls/Suspended Floors																																				4	4	4	4	4	4	4	4	4																																																								
Backfill Underground Structure																																													20																																																								
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BAC and Ozone Dosing Complete																																																																																																				
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Chlorine Storage Facility																																										8	8	8	8	8	8	8	8																																																	
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Civils Conventional Structures																																																							8																																														
Civils Ancillary Area																																																											8	8																																														
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Woodlands Park Reservoir 1 Construction																																																																																																				
Retaining wall and Bulk Earthworks																																																																																																					
Commence woodlands park reservoir																																																																																																				
Site Establishment (reservoir)																																																																																																				
Retaining Wall Construction / Slope Stabilisation																																	2	2																																																																			
Piling works																																			15	15																																																																	
Bulk Earthworks																																					36	36	36	36	36	36	36	36																																																							
Reservoir Piping Pipework and Ducting																																																																																																					
Reservoir Under slab																																								8																																																												
Woodlands Park Reservoir																																																																																																					
Slab																																								10	10																																																										
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Reservoir Roof Structure																																															4	4	4	4																																																		
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Existing WTP Demolition and new Reservoir 2																																																																																																					
Site Establishment																																																																																																					
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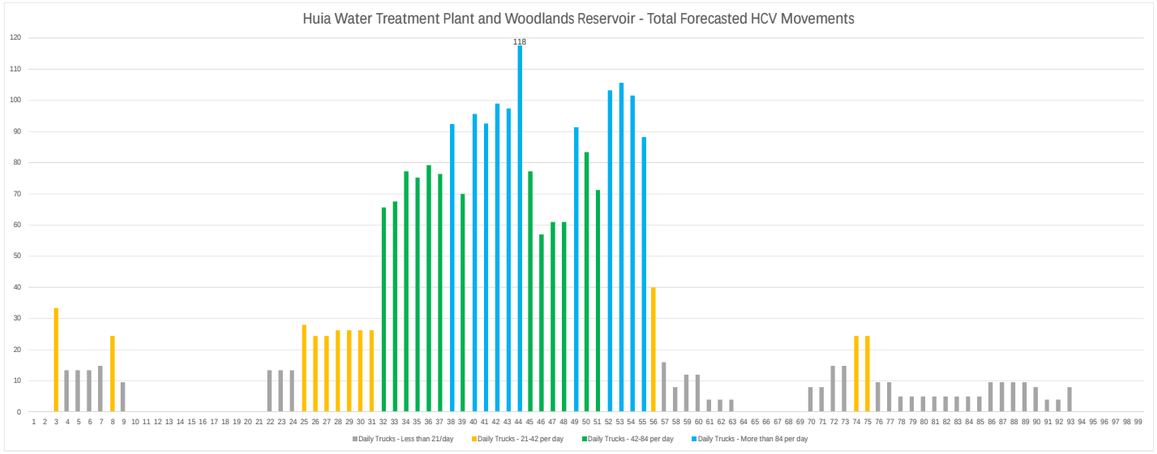
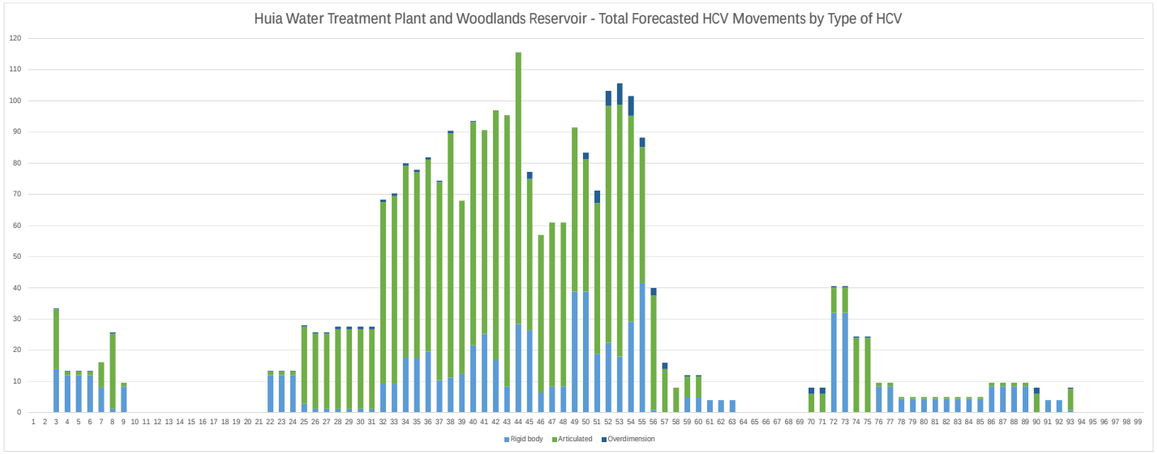
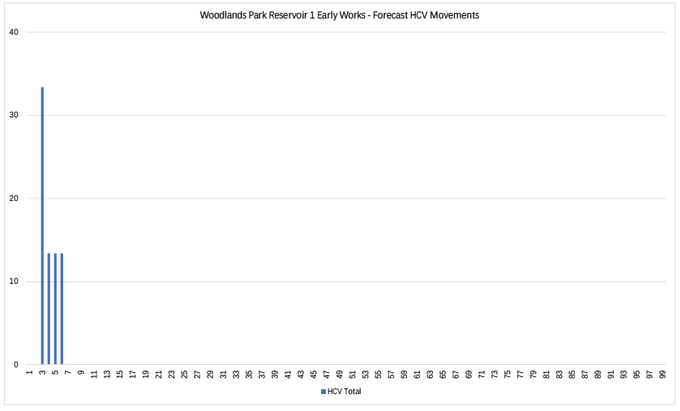
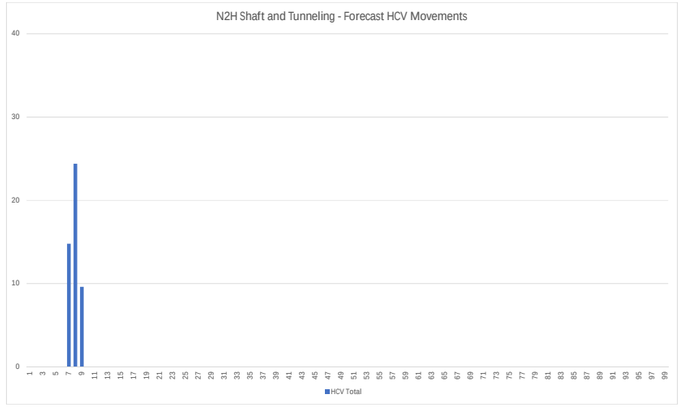
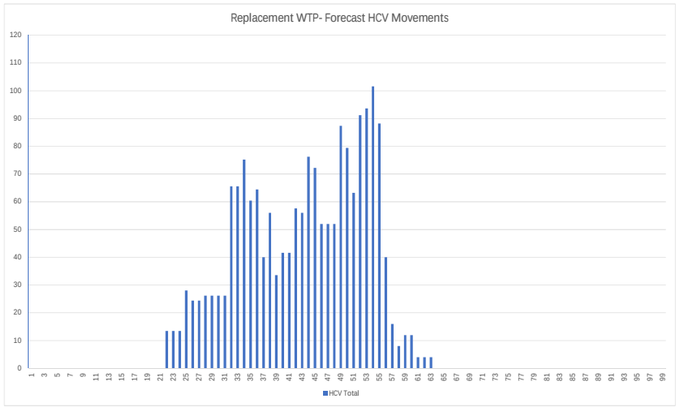
Demolition of Existing Structure																																																																																																					
Demolish existing structures on site to make way for reservoir																																																																																																					
Existing WTP Reservoir																																																																																																					
Ground improvements																																																																									15	15																											
Build 4m Pad for Reservoir																																																																											24	24																									
Slab																																																																													10	10																							
Reservoir Walls																																																																															5	5	5	5	5	5	5	5														
Reservoir Roof Structure																																																																																							10	10	10	10										
Existing WTP Reservoir Mechanical and Commissioning																																																																																																					
Electrical and Mechanical Fitout 2																																																																																												8									
Commissioning Reservoir 2																																																																																													4	4							
All Civil Works around Structures																																																																																															8						
Contingency																																																																																																					
Contingency																																																																																																				
Project Completion																																																																																																					
Total HCV movements	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	8	15	15	24	24	10	10	5	5	5	5	5	5	5	5	10	10	10	10	8	4	4	8	0	0	0	0	0	0
Total HCV movements	0	0	33	13	13	13	15	24	10	0	0	0	0	0	0	0	0	0	0	0	0	13	13	13	28	24	24	26	26	26	26	66	68	77	75	79	76	92	70	96	93	99	97	118	77	57	61	61	91	83	71	103	106	102	88	40	16	8	12	12	4	4	4	0	0	0	0	0	0	8	8	15	15	24	24	10	10	5	5	5	5	5	5	5	5	10	10	10	10	8	4	4	8	0	0	0	0	0	0

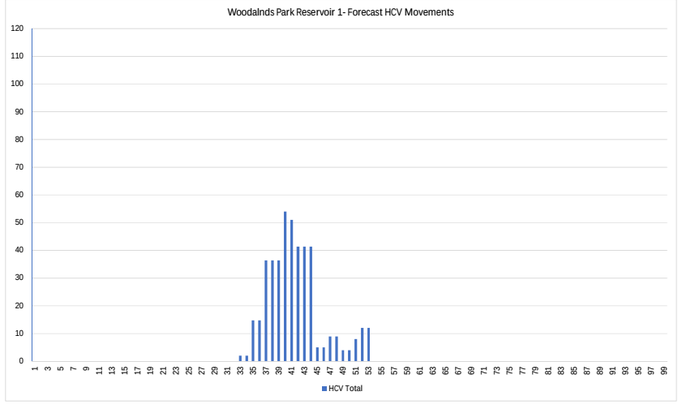

Huia Water Treatment Plant and Woodlands Reservoir - Total Forecasted HCV Movements
118
Daily Trucks - Less than 21/day
Daily Trucks - 21-42 per day
Daily Trucks - 42-84 per day
Daily Trucks - More than 84 per day

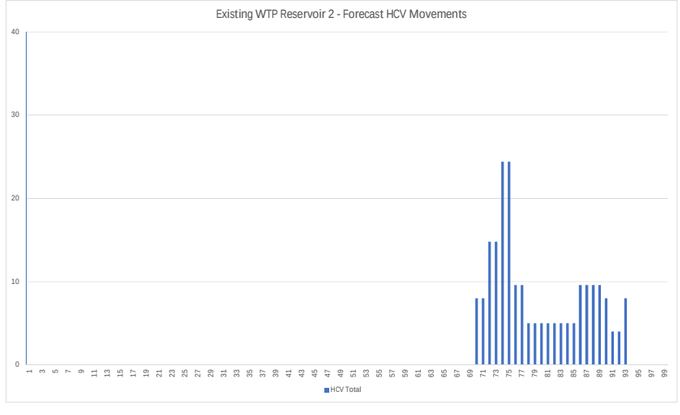

Huia Water Treatment Plant and Woodlands Reservoir - Total Forecasted HCV Movements by Type of HCV
Rigid body
Articulated
Overdimension


Woodlands Park Reservoir 1 Early Works - Forecast HCV Movements
HCV Total


N2H Shaft and Tunneling - Forecast HCV Movements
HCV Total


Replacement WTP- Forecast HCV Movements
HCV Total


Woodalnds Park Reservoir 1- Forecast HCV Movements
HCV Total


Existing WTP Reservoir 2 - Forecast HCV Movements
HCV Total

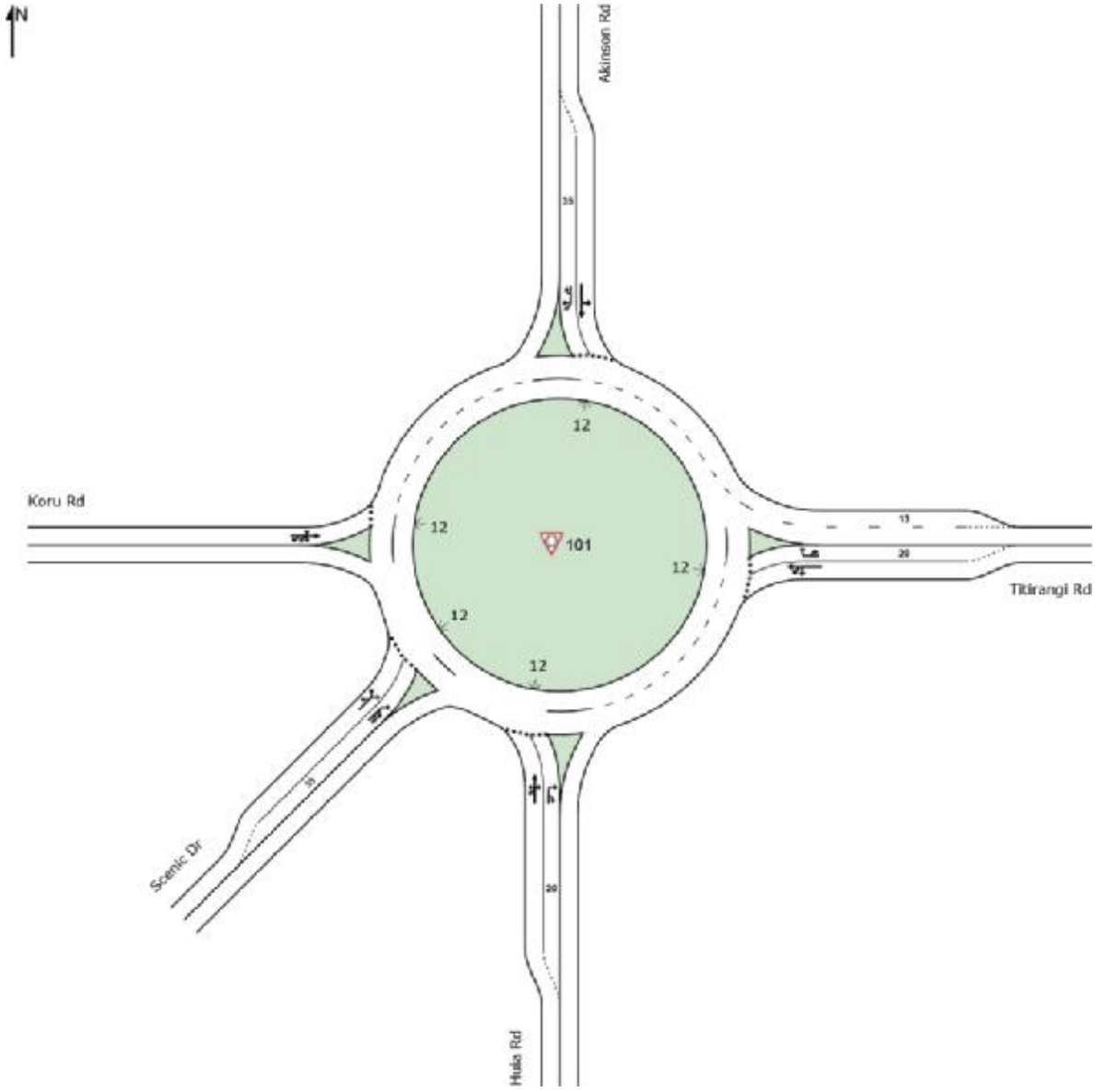
C

Appendix C – SIDRA Modelling Results

SITE LAYOUT

Site: 101 [2018 AM Peak]

New Site
Site Category: (None)
Roundabout



INTERSECTION SUMMARY

Site: 101 [2018 AM Peak]

New Site
Site Category: (None)
Roundabout

Intersection Performance - Hourly Values				
Performance Measure	**Vehicles**		**Persons**	
Travel Speed (Average)	35.2	km/h	35.2	km/h
Travel Distance (Total)	2211.2	veh-km/h	2653.4	pers-km/h
Travel Time (Total)	62.9	veh-h/h	75.5	pers-h/h
Demand Flows (Total)	2147	veh/h	2577	pers/h
Percent Heavy Vehicles (Demand)	2.4	%		
Degree of Saturation	0.877			
Practical Spare Capacity	-3.1	%		
Effective Intersection Capacity	2449	veh/h		
Control Delay (Total)	8.56	veh-h/h	10.27	pers-h/h
Control Delay (Average)	14.4	sec	14.4	sec
Control Delay (Worst Lane)	26.7	sec		
Control Delay (Worst Movement)	26.9	sec	26.9	sec
Geometric Delay (Average)	3.9	sec		
Stop-Line Delay (Average)	10.5	sec		
Idling Time (Average)	5.5	sec		
Intersection Level of Service (LOS)	LOS B			
95% Back of Queue - Vehicles (Worst Lane)	12.3	veh		
95% Back of Queue - Distance (Worst Lane)	87.0	m		
Queue Storage Ratio (Worst Lane)	0.03			
Total Effective Stops	2123	veh/h	2548	pers/h
Effective Stop Rate	0.99		0.99	
Proportion Queued	0.76		0.76	
Performance Index	124.9		124.9	
Cost (Total)	1704.24	$/h	1704.24	$/h
Fuel Consumption (Total)	227.6	L/h		
Carbon Dioxide (Total)	538.7	kg/h		
Hydrocarbons (Total)	0.046	kg/h		
Carbon Monoxide (Total)	0.370	kg/h		
NOx (Total)	0.636	kg/h		

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Intersection LOS value for Vehicles is based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Site Model Variability Index (Iterations 3 to N): 4.1 %
Number of Iterations: 7 (Maximum: 10)
Largest change in Lane Degrees of Saturation for the last three Flow-Capacity Iterations: 3.0% 1.6% 0.8%

Intersection Performance - Annual Values				
Performance Measure	**Vehicles**		**Persons**	
Demand Flows (Total)	1,030,737	veh/y	1,236,885	pers/y
Delay	4,109	veh-h/y	4,931	pers-h/y
Effective Stops	1,019,015	veh/y	1,222,818	pers/y
Travel Distance	1,061,362	veh-km/y	1,273,635	pers-km/y
Travel Time	30,183	veh-h/y	36,219	pers-h/y
Cost	818,035	$/y	818,035	$/y
Fuel Consumption	109,246	L/y		
Carbon Dioxide	258,572	kg/y		
Hydrocarbons	22	kg/y		
Carbon Monoxide	178	kg/y		
NOx	305	kg/y		

MOVEMENT SUMMARY

Site: 101 [2018 AM Peak]

New Site
Site Category: (None)
Roundabout

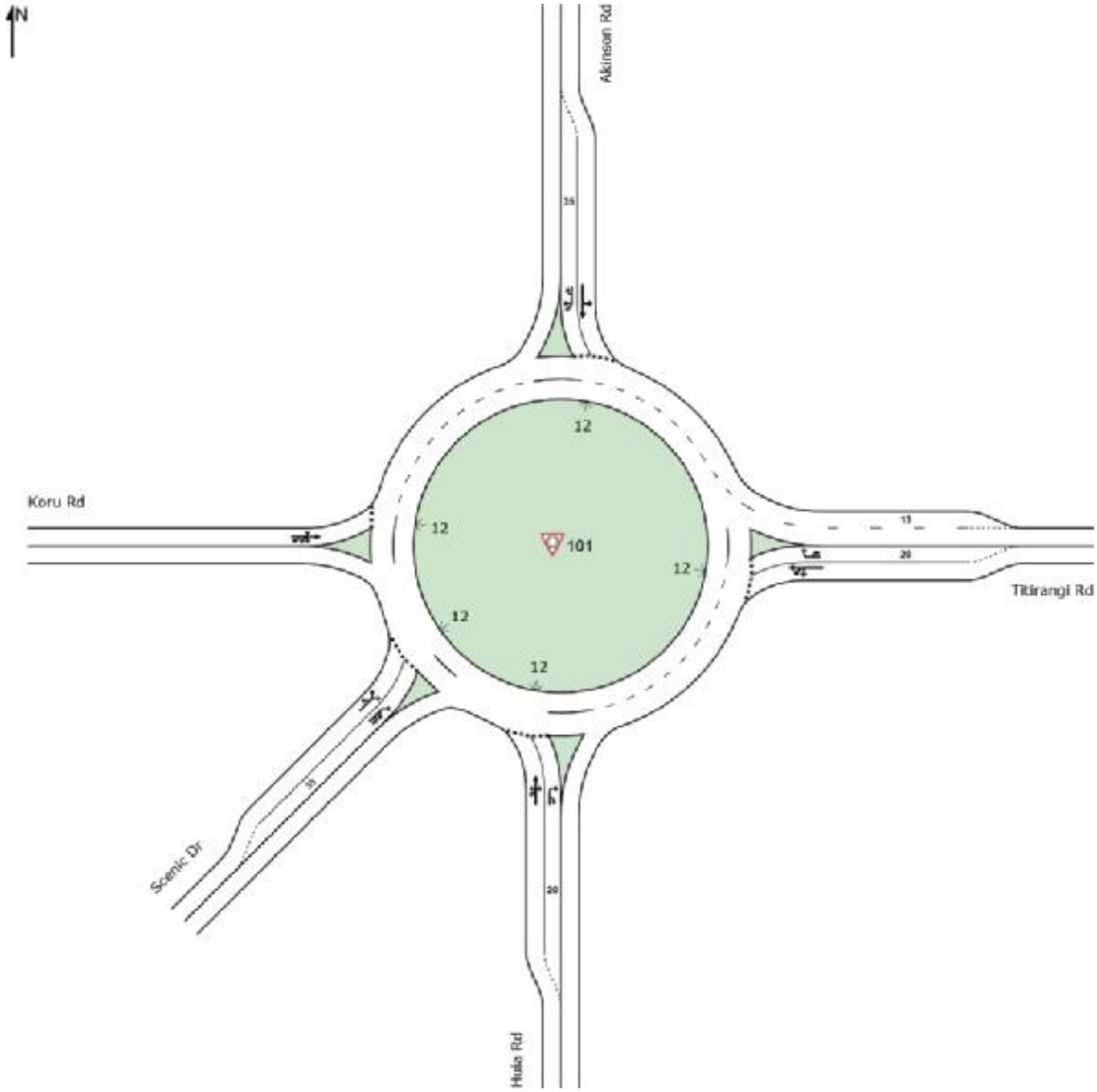
Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Huia Rd												
1b	L3	1	100.0	0.530	15.3	LOS B	3.2	22.8	0.79	0.96	1.04	34.6
1	L2	4	25.0	0.530	16.9	LOS B	3.2	22.8	0.79	0.96	1.04	34.9
2	T1	205	0.5	0.530	13.7	LOS B	3.2	22.8	0.79	0.96	1.04	35.6
3	R2	503	1.0	0.877	26.7	LOS C	12.3	87.0	0.98	1.51	2.03	31.8
3u	U	1	0.0	0.877	26.9	LOS C	12.3	87.0	0.98	1.51	2.03	32.1
Approach		715	1.2	0.877	22.9	LOS C	12.3	87.0	0.92	1.35	1.74	32.8
East: Titirangi Rd												
4	L2	155	3.4	0.255	3.3	LOS A	1.6	11.8	0.40	0.42	0.40	38.5
4a	L1	128	4.9	0.255	2.5	LOS A	1.6	11.8	0.40	0.42	0.40	39.0
5	T1	22	4.8	0.255	2.7	LOS A	1.6	11.8	0.40	0.42	0.40	39.3
6	R2	255	2.1	0.245	6.3	LOS A	1.5	10.9	0.40	0.58	0.40	38.0
6u	U	27	3.8	0.245	7.7	LOS A	1.5	10.9	0.40	0.58	0.40	38.6
Approach		587	3.2	0.255	4.6	LOS A	1.6	11.8	0.40	0.50	0.40	38.4
North: Akinson Rd												
7	L2	239	1.3	0.609	17.4	LOS B	5.8	40.9	0.98	1.18	1.36	33.7
8	T1	58	3.6	0.609	17.1	LOS B	5.8	40.9	0.98	1.18	1.36	34.3
9a	R1	39	8.1	0.288	20.4	LOS C	1.5	10.7	0.84	0.93	0.85	33.2
9	R2	4	0.0	0.288	20.0	LOS B	1.5	10.7	0.84	0.93	0.85	33.5
9u	U	25	0.0	0.288	21.4	LOS C	1.5	10.7	0.84	0.93	0.85	33.9
Approach		365	2.3	0.609	18.0	LOS B	5.8	40.9	0.95	1.14	1.27	33.8
West: Koru Rd												
10	L2	29	0.0	0.231	8.9	LOS A	1.1	7.6	0.78	0.86	0.78	36.6
11	T1	60	0.0	0.231	8.7	LOS A	1.1	7.6	0.78	0.86	0.78	37.2
12	R2	6	0.0	0.231	12.2	LOS B	1.1	7.6	0.78	0.86	0.78	37.3
12b	R3	3	0.0	0.231	12.9	LOS B	1.1	7.6	0.78	0.86	0.78	37.6
12u	U	2	0.0	0.231	13.6	LOS B	1.1	7.6	0.78	0.86	0.78	37.8
Approach		101	0.0	0.231	9.2	LOS A	1.1	7.6	0.78	0.86	0.78	37.1
SouthWest: Scenic Dr												
30b	L3	3	0.0	0.264	10.3	LOS B	1.3	9.6	0.79	0.85	0.79	36.1
30a	L1	98	6.5	0.264	9.8	LOS A	1.3	9.6	0.79	0.85	0.79	36.7
32a	R1	273	2.7	0.459	11.7	LOS B	3.1	22.1	0.86	1.01	1.00	36.1
32b	R3	4	25.0	0.459	14.3	LOS B	3.1	22.1	0.86	1.01	1.00	36.6
32u	U	1	0.0	0.459	13.6	LOS B	3.1	22.1	0.86	1.01	1.00	36.9
Approach		379	3.9	0.459	11.2	LOS B	3.1	22.1	0.84	0.96	0.95	36.3
All Vehicles		2147	2.4	0.877	14.4	LOS B	12.3	87.0	0.76	0.99	1.11	35.2

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SITE LAYOUT

Site: 101 [2018 Inter Peak]

New Site
Site Category: (None)
Roundabout



INTERSECTION SUMMARY

Site: 101 [2018 Inter Peak]

New Site
Site Category: (None)
Roundabout

Intersection Performance - Hourly Values				
Performance Measure	**Vehicles**		**Persons**	
Travel Speed (Average)	37.9	km/h	37.9	km/h
Travel Distance (Total)	1508.0	veh-km/h	1809.6	pers-km/h
Travel Time (Total)	39.8	veh-h/h	47.7	pers-h/h
Demand Flows (Total)	1465	veh/h	1758	pers/h
Percent Heavy Vehicles (Demand)	2.9	%		
Degree of Saturation	0.371			
Practical Spare Capacity	129.3	%		
Effective Intersection Capacity	3953	veh/h		
Control Delay (Total)	2.70	veh-h/h	3.25	pers-h/h
Control Delay (Average)	6.6	sec	6.6	sec
Control Delay (Worst Lane)	13.4	sec		
Control Delay (Worst Movement)	14.2	sec	14.2	sec
Geometric Delay (Average)	3.8	sec		
Stop-Line Delay (Average)	2.8	sec		
Idling Time (Average)	0.8	sec		
Intersection Level of Service (LOS)	LOS A			
95% Back of Queue - Vehicles (Worst Lane)	1.9	veh		
95% Back of Queue - Distance (Worst Lane)	13.8	m		
Queue Storage Ratio (Worst Lane)	0.01			
Total Effective Stops	946	veh/h	1136	pers/h
Effective Stop Rate	0.65		0.65	
Proportion Queued	0.52		0.52	
Performance Index	62.7		62.7	
Cost (Total)	1021.68	$/h	1021.68	$/h
Fuel Consumption (Total)	147.2	L/h		
Carbon Dioxide (Total)	349.1	kg/h		
Hydrocarbons (Total)	0.029	kg/h		
Carbon Monoxide (Total)	0.235	kg/h		
NOx (Total)	0.494	kg/h		

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Intersection LOS value for Vehicles is based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Site Model Variability Index (Iterations 3 to N): 1.9 %
Number of Iterations: 5 (Maximum: 10)
Largest change in Lane Degrees of Saturation for the last three Flow-Capacity Iterations: 3.1% 1.7% 0.9%

Intersection Performance - Annual Values				
Performance Measure	**Vehicles**		**Persons**	
Demand Flows (Total)	703,326	veh/y	843,992	pers/y
Delay	1,298	veh-h/y	1,558	pers-h/y
Effective Stops	454,214	veh/y	545,056	pers/y
Travel Distance	723,826	veh-km/y	868,592	pers-km/y
Travel Time	19,094	veh-h/y	22,913	pers-h/y
Cost	490,407	$/y	490,407	$/y
Fuel Consumption	70,648	L/y		
Carbon Dioxide	167,561	kg/y		
Hydrocarbons	14	kg/y		
Carbon Monoxide	113	kg/y		
NOx	237	kg/y		

MOVEMENT SUMMARY

Site: 101 [2018 PM Peak]

New Site
Site Category: (None)
Roundabout

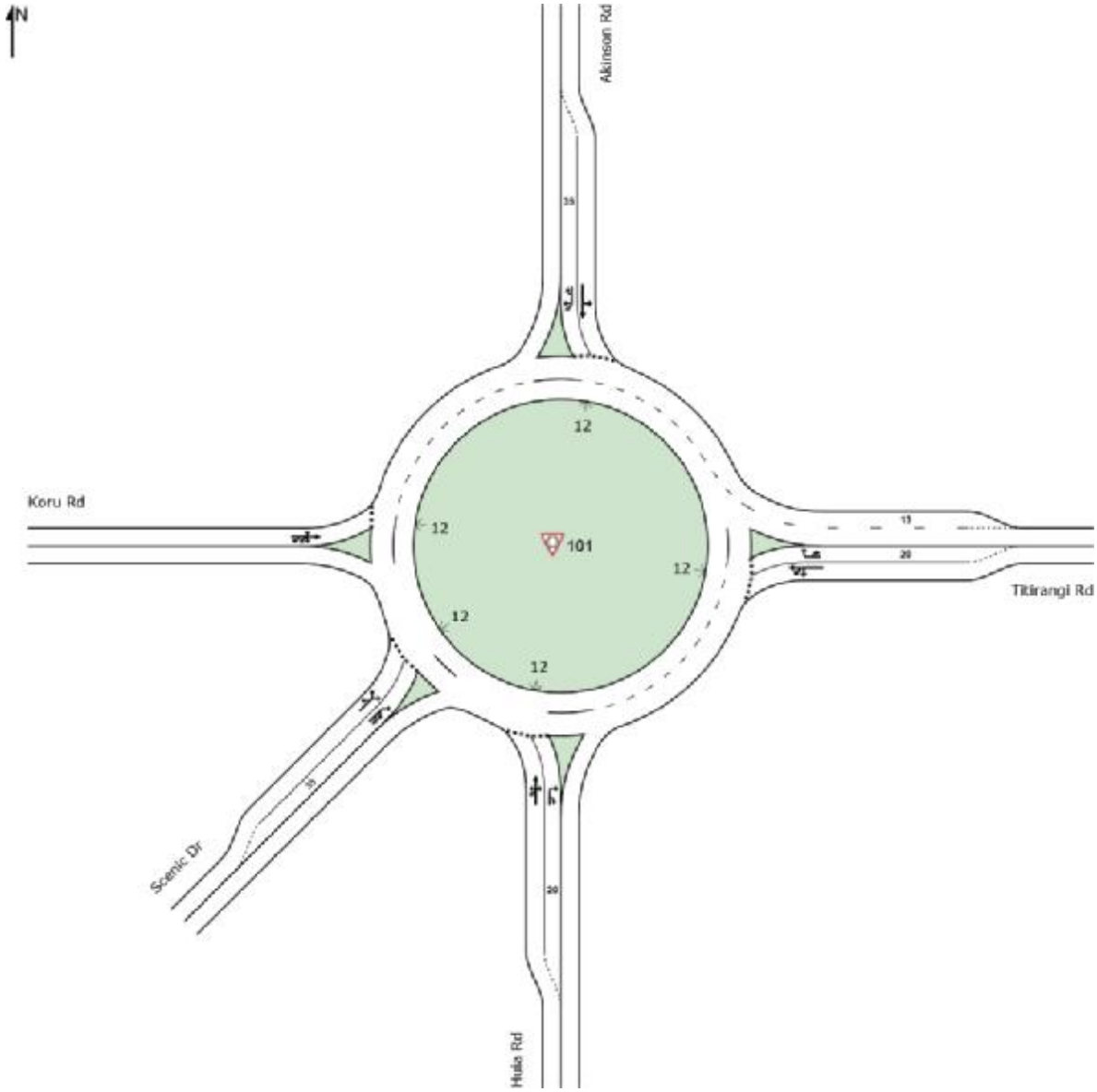
Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Huia Rd												
1b	L3	3	0.0	0.194	11.5	LOS B	0.9	6.1	0.72	0.80	0.72	35.8
1	L2	1	0.0	0.194	11.2	LOS B	0.9	6.1	0.72	0.80	0.72	35.9
2	T1	59	1.8	0.194	10.9	LOS B	0.9	6.1	0.72	0.80	0.72	36.6
3	R2	163	0.0	0.319	11.1	LOS B	1.6	11.5	0.74	0.89	0.74	36.6
3u	U	1	0.0	0.319	12.5	LOS B	1.6	11.5	0.74	0.89	0.74	37.1
Approach		227	0.5	0.319	11.0	LOS B	1.6	11.5	0.73	0.86	0.73	36.6
East: Titirangi Rd												
4	L2	423	0.7	0.738	6.7	LOS A	9.0	63.6	0.82	0.81	0.96	37.5
4a	L1	356	1.8	0.738	6.0	LOS A	9.0	63.6	0.82	0.81	0.96	38.0
5	T1	35	0.0	0.738	6.2	LOS A	9.0	63.6	0.82	0.81	0.96	38.3
6	R2	162	3.2	0.306	9.2	LOS A	1.7	11.9	0.61	0.76	0.61	37.3
6u	U	21	0.0	0.306	10.4	LOS B	1.7	11.9	0.61	0.76	0.61	37.8
Approach		997	1.5	0.738	6.9	LOS A	9.0	63.6	0.78	0.80	0.89	37.7
North: Akinson Rd												
7	L2	169	0.6	0.407	5.8	LOS A	2.6	18.5	0.67	0.68	0.67	37.8
8	T1	175	1.2	0.407	5.3	LOS A	2.6	18.5	0.67	0.68	0.67	38.6
9a	R1	94	1.1	0.205	9.9	LOS A	1.0	7.3	0.63	0.77	0.63	36.7
9	R2	7	0.0	0.205	10.6	LOS B	1.0	7.3	0.63	0.77	0.63	37.0
9u	U	5	0.0	0.205	12.0	LOS B	1.0	7.3	0.63	0.77	0.63	37.5
Approach		451	0.9	0.407	6.6	LOS A	2.6	18.5	0.66	0.70	0.66	37.8
West: Koru Rd												
10	L2	7	0.0	0.059	5.1	LOS A	0.2	1.8	0.57	0.62	0.57	37.9
11	T1	29	3.6	0.059	5.1	LOS A	0.2	1.8	0.57	0.62	0.57	38.6
12	R2	1	0.0	0.059	8.5	LOS A	0.2	1.8	0.57	0.62	0.57	38.7
12b	R3	3	0.0	0.059	9.2	LOS A	0.2	1.8	0.57	0.62	0.57	39.0
12u	U	1	0.0	0.059	9.9	LOS A	0.2	1.8	0.57	0.62	0.57	39.3
Approach		42	2.5	0.059	5.6	LOS A	0.2	1.8	0.57	0.62	0.57	38.5
SouthWest: Scenic Dr												
30b	L3	1	0.0	0.072	7.0	LOS A	0.3	2.3	0.58	0.60	0.58	37.5
30a	L1	37	2.9	0.072	6.1	LOS A	0.3	2.3	0.58	0.60	0.58	38.2
32a	R1	191	2.2	0.205	7.0	LOS A	1.1	7.6	0.56	0.69	0.56	37.8
32b	R3	3	0.0	0.205	8.3	LOS A	1.1	7.6	0.56	0.69	0.56	38.4
32u	U	1	0.0	0.205	9.0	LOS A	1.1	7.6	0.56	0.69	0.56	38.7
Approach		233	2.3	0.205	6.9	LOS A	1.1	7.6	0.56	0.68	0.56	37.9
All Vehicles		1949	1.3	0.738	7.3	LOS A	9.0	63.6	0.72	0.77	0.77	37.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SITE LAYOUT

Site: 101 [2018 PM Peak]

New Site
Site Category: (None)
Roundabout



INTERSECTION SUMMARY

Site: 101 [2018 PM Peak]

New Site
Site Category: (None)
Roundabout

Intersection Performance - Hourly Values				
Performance Measure	**Vehicles**		**Persons**	
Travel Speed (Average)	37.6	km/h	37.6	km/h
Travel Distance (Total)	1998.2	veh-km/h	2397.9	pers-km/h
Travel Time (Total)	53.1	veh-h/h	63.7	pers-h/h
Demand Flows (Total)	1949	veh/h	2339	pers/h
Percent Heavy Vehicles (Demand)	1.3	%		
Degree of Saturation	0.738			
Practical Spare Capacity	15.2	%		
Effective Intersection Capacity	2642	veh/h		
Control Delay (Total)	3.95	veh-h/h	4.74	pers-h/h
Control Delay (Average)	7.3	sec	7.3	sec
Control Delay (Worst Lane)	11.1	sec		
Control Delay (Worst Movement)	12.5	sec	12.5	sec
Geometric Delay (Average)	3.2	sec		
Stop-Line Delay (Average)	4.1	sec		
Idling Time (Average)	0.8	sec		
Intersection Level of Service (LOS)	LOS A			
95% Back of Queue - Vehicles (Worst Lane)	9.0	veh		
95% Back of Queue - Distance (Worst Lane)	63.6	m		
Queue Storage Ratio (Worst Lane)	0.05			
Total Effective Stops	1495	veh/h	1794	pers/h
Effective Stop Rate	0.77		0.77	
Proportion Queued	0.72		0.72	
Performance Index	93.6		93.6	
Cost (Total)	1316.61	$/h	1316.61	$/h
Fuel Consumption (Total)	166.8	L/h		
Carbon Dioxide (Total)	393.9	kg/h		
Hydrocarbons (Total)	0.033	kg/h		
Carbon Monoxide (Total)	0.252	kg/h		
NOx (Total)	0.348	kg/h		

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Intersection LOS value for Vehicles is based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Site Model Variability Index (Iterations 3 to N): 2.6 %
Number of Iterations: 6 (Maximum: 10)
Largest change in Lane Degrees of Saturation for the last three Flow-Capacity Iterations: 3.1% 1.6% 0.8%

Intersection Performance - Annual Values				
Performance Measure	**Vehicles**		**Persons**	
Demand Flows (Total)	935,747	veh/y	1,122,897	pers/y
Delay	1,896	veh-h/y	2,276	pers-h/y
Effective Stops	717,695	veh/y	861,233	pers/y
Travel Distance	959,148	veh-km/y	1,150,978	pers-km/y
Travel Time	25,487	veh-h/y	30,585	pers-h/y
Cost	631,973	$/y	631,973	$/y
Fuel Consumption	80,050	L/y		
Carbon Dioxide	189,093	kg/y		
Hydrocarbons	16	kg/y		
Carbon Monoxide	121	kg/y		
NOx	167	kg/y		

MOVEMENT SUMMARY

Site: 101 [2018 Inter Peak]

New Site
Site Category: (None)
Roundabout

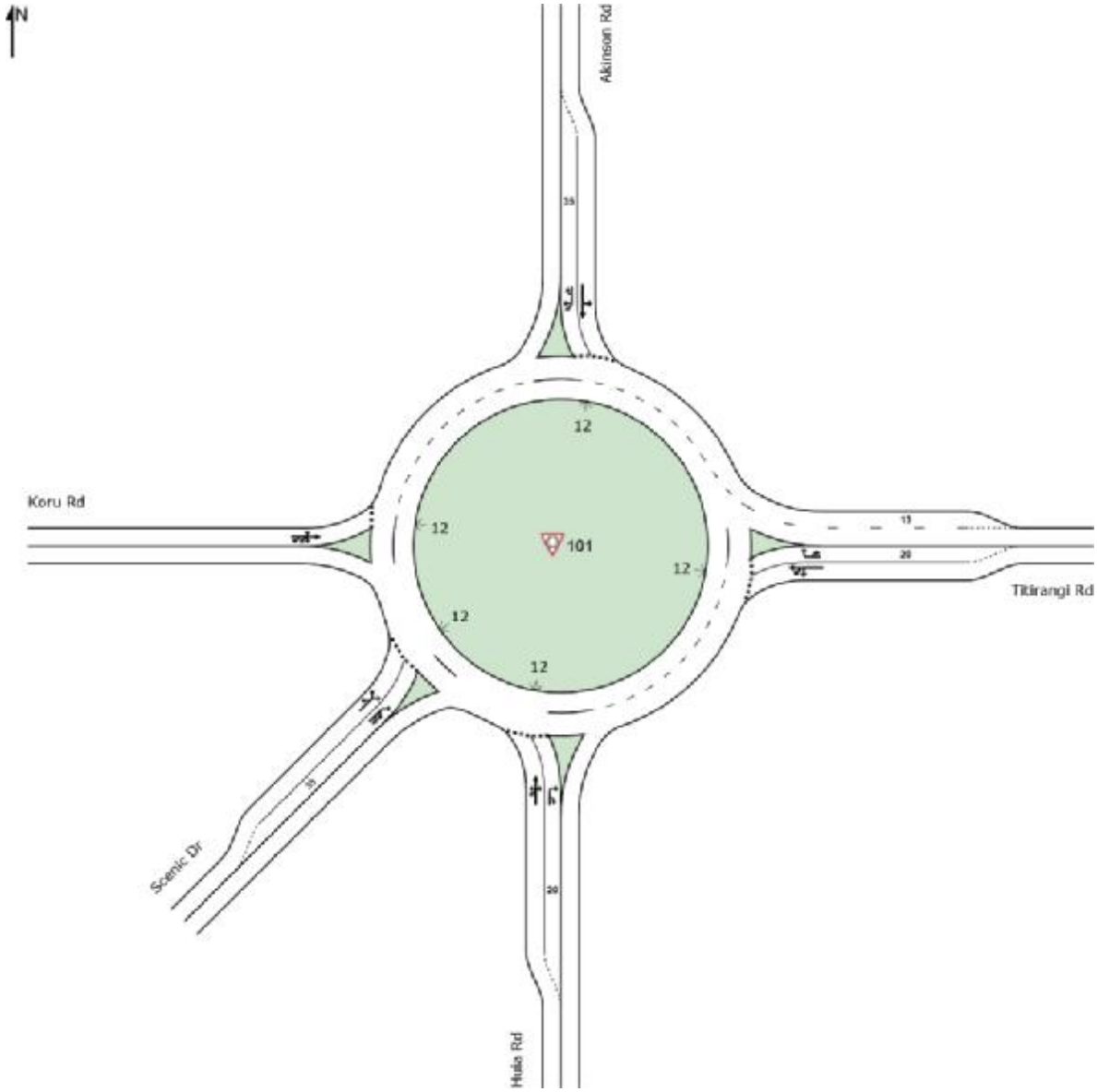
Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Huia Rd												
1b	L3	1	100.0	0.223	9.5	LOS A	1.0	7.3	0.62	0.70	0.62	36.8
1	L2	3	33.3	0.223	9.2	LOS A	1.0	7.3	0.62	0.70	0.62	37.2
2	T1	106	1.0	0.223	7.1	LOS A	1.0	7.3	0.62	0.70	0.62	38.0
3	R2	244	1.7	0.371	9.5	LOS A	1.9	13.8	0.65	0.82	0.65	37.2
3u	U	1	0.0	0.371	10.8	LOS B	1.9	13.8	0.65	0.82	0.65	37.7
Approach		356	2.1	0.371	8.8	LOS A	1.9	13.8	0.64	0.78	0.64	37.4
East: Titirangi Rd												
4	L2	140	3.8	0.210	2.9	LOS A	1.3	9.3	0.28	0.36	0.28	38.7
4a	L1	115	4.6	0.210	2.2	LOS A	1.3	9.3	0.28	0.36	0.28	39.2
5	T1	20	5.3	0.210	2.4	LOS A	1.3	9.3	0.28	0.36	0.28	39.5
6	R2	229	2.3	0.203	6.0	LOS A	1.2	8.7	0.29	0.55	0.29	38.2
6u	U	24	4.3	0.203	7.4	LOS A	1.2	8.7	0.29	0.55	0.29	38.8
Approach		528	3.4	0.210	4.3	LOS A	1.3	9.3	0.29	0.45	0.29	38.6
North: Akinson Rd												
7	L2	141	1.5	0.231	6.3	LOS A	1.3	9.5	0.66	0.69	0.66	37.6
8	T1	34	3.1	0.231	5.8	LOS A	1.3	9.5	0.66	0.69	0.66	38.4
9a	R1	23	9.1	0.105	12.9	LOS B	0.5	3.5	0.67	0.81	0.67	35.5
9	R2	2	0.0	0.105	12.9	LOS B	0.5	3.5	0.67	0.81	0.67	35.8
9u	U	15	0.0	0.105	14.2	LOS B	0.5	3.5	0.67	0.81	0.67	36.3
Approach		215	2.5	0.231	7.6	LOS A	1.3	9.5	0.66	0.72	0.66	37.4
West: Koru Rd												
10	L2	21	0.0	0.114	6.3	LOS A	0.5	3.4	0.64	0.74	0.64	37.5
11	T1	43	2.4	0.114	6.2	LOS A	0.5	3.4	0.64	0.74	0.64	38.2
12	R2	4	0.0	0.114	9.6	LOS A	0.5	3.4	0.64	0.74	0.64	38.3
12b	R3	1	0.0	0.114	10.3	LOS B	0.5	3.4	0.64	0.74	0.64	38.6
12u	U	1	0.0	0.114	11.0	LOS B	0.5	3.4	0.64	0.74	0.64	38.9
Approach		71	1.5	0.114	6.6	LOS A	0.5	3.4	0.64	0.74	0.64	38.0
SouthWest: Scenic Dr												
30b	L3	2	0.0	0.144	7.4	LOS A	0.7	4.9	0.65	0.70	0.65	37.3
30a	L1	77	6.8	0.144	6.7	LOS A	0.7	4.9	0.65	0.70	0.65	37.9
32a	R1	213	2.0	0.256	7.9	LOS A	1.4	9.8	0.65	0.78	0.65	37.5
32b	R3	3	33.3	0.256	10.6	LOS B	1.4	9.8	0.65	0.78	0.65	37.9
32u	U	1	0.0	0.256	10.0	LOS A	1.4	9.8	0.65	0.78	0.65	38.3
Approach		296	3.6	0.256	7.7	LOS A	1.4	9.8	0.65	0.76	0.65	37.6
All Vehicles		1465	2.9	0.371	6.6	LOS A	1.9	13.8	0.52	0.65	0.52	37.9

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SITE LAYOUT

Site: 101 [2018 AM Peak (+52LV via Titirangi)]

New Site
Site Category: (None)
Roundabout



INTERSECTION SUMMARY

Site: 101 [2018 AM Peak (+52LV via Titirangi)]

New Site
Site Category: (None)
Roundabout

Intersection Performance - Hourly Values				
Performance Measure	**Vehicles**		**Persons**	
Travel Speed (Average)	34.7	km/h	34.7	km/h
Travel Distance (Total)	2267.1	veh-km/h	2720.5	pers-km/h
Travel Time (Total)	65.3	veh-h/h	78.3	pers-h/h
Demand Flows (Total)	2202	veh/h	2643	pers/h
Percent Heavy Vehicles (Demand)	2.3	%		
Degree of Saturation	0.916			
Practical Spare Capacity	-7.2	%		
Effective Intersection Capacity	2405	veh/h		
Control Delay (Total)	9.57	veh-h/h	11.48	pers-h/h
Control Delay (Average)	15.6	sec	15.6	sec
Control Delay (Worst Lane)	32.9	sec		
Control Delay (Worst Movement)	33.1	sec	33.1	sec
Geometric Delay (Average)	3.8	sec		
Stop-Line Delay (Average)	11.8	sec		
Idling Time (Average)	6.4	sec		
Intersection Level of Service (LOS)	LOS B			
95% Back of Queue - Vehicles (Worst Lane)	14.5	veh		
95% Back of Queue - Distance (Worst Lane)	102.5	m		
Queue Storage Ratio (Worst Lane)	0.03			
Total Effective Stops	2246	veh/h	2695	pers/h
Effective Stop Rate	1.02		1.02	
Proportion Queued	0.76		0.76	
Performance Index	132.2		132.2	
Cost (Total)	1772.75	$/h	1772.75	$/h
Fuel Consumption (Total)	234.4	L/h		
Carbon Dioxide (Total)	554.6	kg/h		
Hydrocarbons (Total)	0.047	kg/h		
Carbon Monoxide (Total)	0.380	kg/h		
NOx (Total)	0.642	kg/h		

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Intersection LOS value for Vehicles is based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Site Model Variability Index (Iterations 3 to N): 4.1 %
Number of Iterations: 7 (Maximum: 10)
Largest change in Lane Degrees of Saturation for the last three Flow-Capacity Iterations: 3.1% 1.6% 0.8%

Intersection Performance - Annual Values				
Performance Measure	**Vehicles**		**Persons**	
Demand Flows (Total)	1,057,010	veh/y	1,268,413	pers/y
Delay	4,592	veh-h/y	5,510	pers-h/y
Effective Stops	1,078,183	veh/y	1,293,819	pers/y
Travel Distance	1,088,212	veh-km/y	1,305,854	pers-km/y
Travel Time	31,334	veh-h/y	37,601	pers-h/y
Cost	850,922	$/y	850,922	$/y
Fuel Consumption	112,503	L/y		
Carbon Dioxide	266,227	kg/y		
Hydrocarbons	23	kg/y		
Carbon Monoxide	183	kg/y		
NOx	308	kg/y		

MOVEMENT SUMMARY

Site: 101 [2018 AM Peak (+52LV via Titirangi)]

New Site
Site Category: (None)
Roundabout

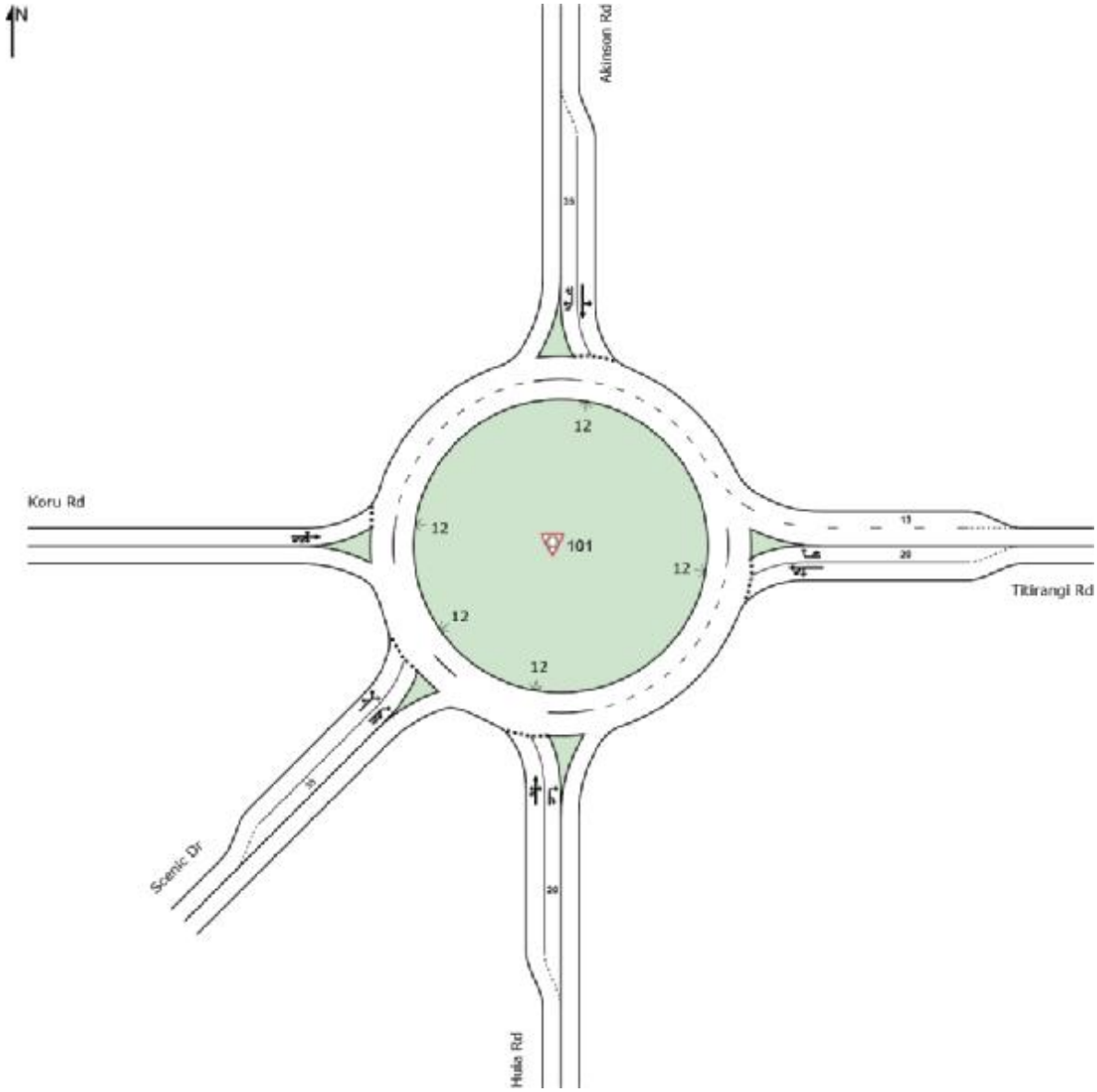
Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Huia Rd												
1b	L3	1	100.0	0.560	17.4	LOS B	3.4	24.2	0.80	0.99	1.10	34.1
1	L2	4	25.0	0.560	18.5	LOS B	3.4	24.2	0.80	0.99	1.10	34.4
2	T1	205	0.5	0.560	15.1	LOS B	3.4	24.2	0.80	0.99	1.10	35.1
3	R2	503	1.0	0.916	32.9	LOS C	14.5	102.5	1.00	1.70	2.44	30.2
3u	U	1	0.0	0.916	33.1	LOS C	14.5	102.5	1.00	1.70	2.44	30.5
Approach		715	1.2	0.916	27.7	LOS C	14.5	102.5	0.94	1.49	2.05	31.5
East: Titirangi Rd												
4	L2	155	3.4	0.297	3.3	LOS A	2.0	14.2	0.41	0.41	0.41	38.5
4a	L1	183	3.4	0.297	2.5	LOS A	2.0	14.2	0.41	0.41	0.41	39.0
5	T1	22	4.8	0.297	2.8	LOS A	2.0	14.2	0.41	0.41	0.41	39.3
6	R2	255	2.1	0.254	6.4	LOS A	1.6	11.4	0.41	0.58	0.41	38.0
6u	U	27	3.8	0.254	7.8	LOS A	1.6	11.4	0.41	0.58	0.41	38.6
Approach		642	3.0	0.297	4.5	LOS A	2.0	14.2	0.41	0.49	0.41	38.5
North: Akinson Rd												
7	L2	239	1.3	0.612	17.5	LOS B	5.8	41.2	0.98	1.19	1.37	33.7
8	T1	58	3.6	0.612	17.1	LOS B	5.8	41.2	0.98	1.19	1.37	34.3
9a	R1	39	8.1	0.289	20.4	LOS C	1.5	10.8	0.84	0.94	0.85	33.2
9	R2	4	0.0	0.289	20.0	LOS B	1.5	10.8	0.84	0.94	0.85	33.5
9u	U	25	0.0	0.289	21.4	LOS C	1.5	10.8	0.84	0.94	0.85	33.9
Approach		365	2.3	0.612	18.1	LOS B	5.8	41.2	0.95	1.14	1.27	33.8
West: Koru Rd												
10	L2	29	0.0	0.232	8.9	LOS A	1.1	7.6	0.78	0.86	0.78	36.6
11	T1	60	0.0	0.232	8.7	LOS A	1.1	7.6	0.78	0.86	0.78	37.2
12	R2	6	0.0	0.232	12.2	LOS B	1.1	7.6	0.78	0.86	0.78	37.3
12b	R3	3	0.0	0.232	12.9	LOS B	1.1	7.6	0.78	0.86	0.78	37.6
12u	U	2	0.0	0.232	13.6	LOS B	1.1	7.6	0.78	0.86	0.78	37.8
Approach		101	0.0	0.232	9.2	LOS A	1.1	7.6	0.78	0.86	0.78	37.1
SouthWest: Scenic Dr												
30b	L3	3	0.0	0.265	10.3	LOS B	1.3	9.6	0.79	0.85	0.79	36.1
30a	L1	98	6.5	0.265	9.8	LOS A	1.3	9.6	0.79	0.85	0.79	36.7
32a	R1	273	2.7	0.461	11.7	LOS B	3.1	22.3	0.86	1.01	1.01	36.1
32b	R3	4	25.0	0.461	14.4	LOS B	3.1	22.3	0.86	1.01	1.01	36.6
32u	U	1	0.0	0.461	13.6	LOS B	3.1	22.3	0.86	1.01	1.01	36.9
Approach		379	3.9	0.461	11.2	LOS B	3.1	22.3	0.84	0.97	0.95	36.3
All Vehicles		2202	2.3	0.916	15.6	LOS B	14.5	102.5	0.76	1.02	1.20	34.7

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SITE LAYOUT

Site: 101 [2018 Inter Peak (+9HV in Atk + 9HV out, 30LV Titirangi)]

New Site
Site Category: (None)
Roundabout



INTERSECTION SUMMARY

Site: 101 [2018 Inter Peak (+9HV in Atk + 9HV out, 30LV Titirangi)]

New Site
Site Category: (None)
Roundabout

Intersection Performance - Hourly Values				
Performance Measure	**Vehicles**		**Persons**	
Travel Speed (Average)	37.8	km/h	37.8	km/h
Travel Distance (Total)	1560.0	veh-km/h	1872.0	pers-km/h
Travel Time (Total)	41.3	veh-h/h	49.5	pers-h/h
Demand Flows (Total)	1516	veh/h	1819	pers/h
Percent Heavy Vehicles (Demand)	4.0	%		
Degree of Saturation	0.381			
Practical Spare Capacity	123.2	%		
Effective Intersection Capacity	3980	veh/h		
Control Delay (Total)	2.90	veh-h/h	3.49	pers-h/h
Control Delay (Average)	6.9	sec	6.9	sec
Control Delay (Worst Lane)	14.4	sec		
Control Delay (Worst Movement)	14.6	sec	14.6	sec
Geometric Delay (Average)	3.8	sec		
Stop-Line Delay (Average)	3.1	sec		
Idling Time (Average)	1.0	sec		
Intersection Level of Service (LOS)	LOS A			
95% Back of Queue - Vehicles (Worst Lane)	2.0	veh		
95% Back of Queue - Distance (Worst Lane)	14.3	m		
Queue Storage Ratio (Worst Lane)	0.01			
Total Effective Stops	1004	veh/h	1205	pers/h
Effective Stop Rate	0.66		0.66	
Proportion Queued	0.54		0.54	
Performance Index	65.9		65.9	
Cost (Total)	1067.91	$/h	1067.91	$/h
Fuel Consumption (Total)	158.3	L/h		
Carbon Dioxide (Total)	376.8	kg/h		
Hydrocarbons (Total)	0.031	kg/h		
Carbon Monoxide (Total)	0.261	kg/h		
NOx (Total)	0.656	kg/h		

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Intersection LOS value for Vehicles is based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Site Model Variability Index (Iterations 3 to N): 2.0 %
Number of Iterations: 5 (Maximum: 10)
Largest change in Lane Degrees of Saturation for the last three Flow-Capacity Iterations: 3.2% 1.8% 0.9%

Intersection Performance - Annual Values				
Performance Measure	**Vehicles**		**Persons**	
Demand Flows (Total)	727,579	veh/y	873,095	pers/y
Delay	1,394	veh-h/y	1,673	pers-h/y
Effective Stops	482,110	veh/y	578,532	pers/y
Travel Distance	748,814	veh-km/y	898,577	pers-km/y
Travel Time	19,810	veh-h/y	23,772	pers-h/y
Cost	512,596	$/y	512,596	$/y
Fuel Consumption	75,962	L/y		
Carbon Dioxide	180,851	kg/y		
Hydrocarbons	15	kg/y		
Carbon Monoxide	125	kg/y		
NOx	315	kg/y		

MOVEMENT SUMMARY

Site: 101 [2018 Inter Peak (+9HV in Atk + 9HV out, 30LV Titirangi)]

New Site
Site Category: (None)
Roundabout

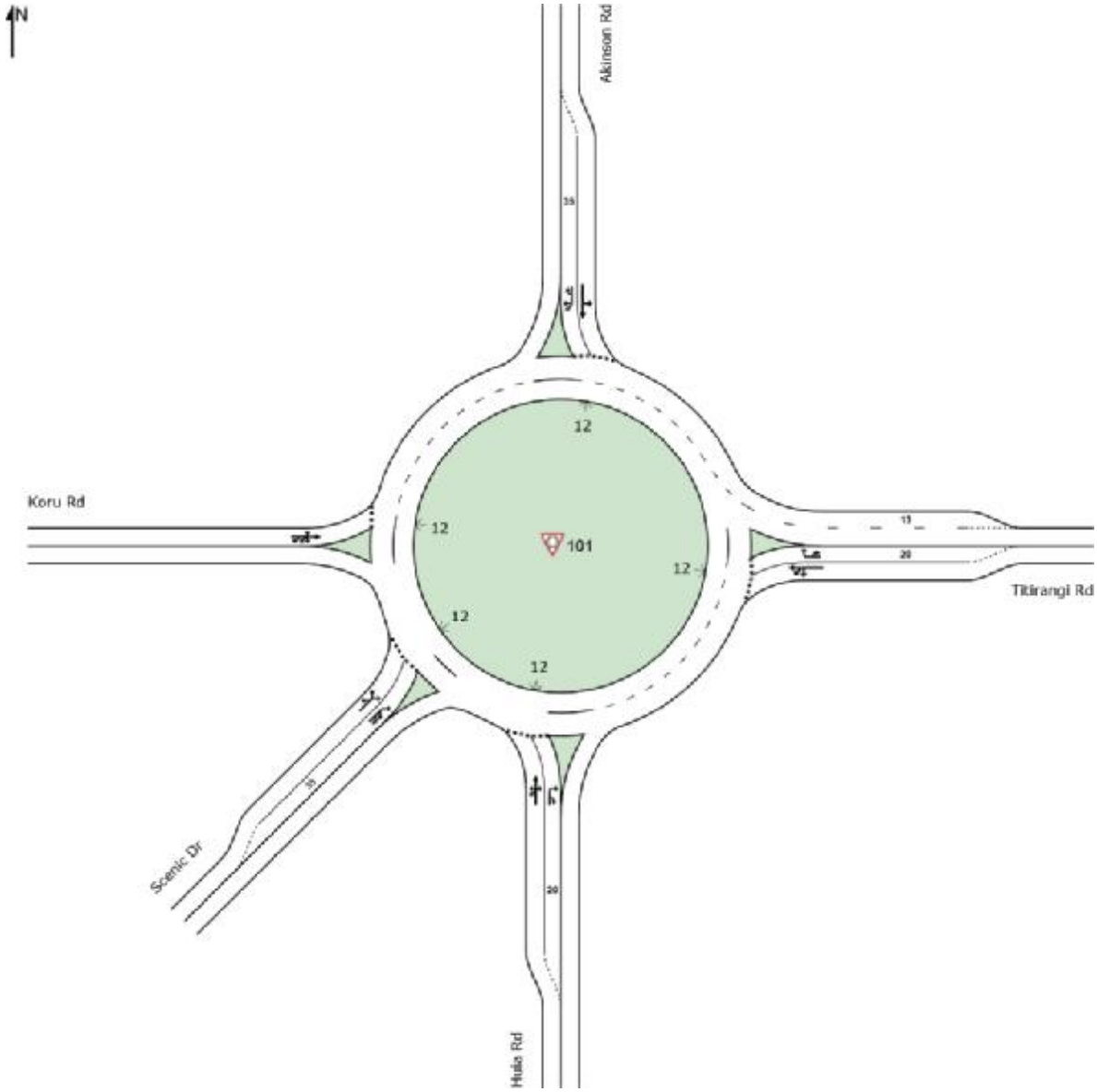
Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Huia Rd												
1b	L3	1	100.0	0.230	10.1	LOS B	1.0	7.5	0.63	0.72	0.63	36.7
1	L2	3	33.3	0.230	9.8	LOS A	1.0	7.5	0.63	0.72	0.63	37.1
2	T1	106	1.0	0.230	7.4	LOS A	1.0	7.5	0.63	0.72	0.63	37.9
3	R2	244	1.7	0.381	9.8	LOS A	2.0	14.3	0.66	0.84	0.68	37.1
3u	U	1	0.0	0.381	11.2	LOS B	2.0	14.3	0.66	0.84	0.68	37.6
Approach		356	2.1	0.381	9.1	LOS A	2.0	14.3	0.65	0.81	0.66	37.3
East: Titirangi Rd												
4	L2	140	3.8	0.227	3.0	LOS A	1.4	10.1	0.31	0.37	0.31	38.7
4a	L1	131	4.0	0.227	2.3	LOS A	1.4	10.1	0.31	0.37	0.31	39.2
5	T1	20	5.3	0.227	2.5	LOS A	1.4	10.1	0.31	0.37	0.31	39.5
6	R2	229	2.3	0.209	6.1	LOS A	1.3	9.0	0.31	0.55	0.31	38.2
6u	U	24	4.3	0.209	7.5	LOS A	1.3	9.0	0.31	0.55	0.31	38.7
Approach		544	3.3	0.227	4.3	LOS A	1.4	10.1	0.31	0.46	0.31	38.6
North: Akinson Rd												
7	L2	141	1.5	0.237	6.6	LOS A	1.4	9.8	0.68	0.71	0.68	37.5
8	T1	34	3.1	0.237	6.1	LOS A	1.4	9.8	0.68	0.71	0.68	38.2
9a	R1	33	35.5	0.140	14.6	LOS B	0.6	5.4	0.69	0.84	0.69	35.1
9	R2	2	0.0	0.140	12.6	LOS B	0.6	5.4	0.69	0.84	0.69	35.5
9u	U	15	0.0	0.140	14.0	LOS B	0.6	5.4	0.69	0.84	0.69	36.0
Approach		224	6.6	0.237	8.2	LOS A	1.4	9.8	0.68	0.74	0.68	37.1
West: Koru Rd												
10	L2	21	0.0	0.116	6.4	LOS A	0.5	3.5	0.65	0.75	0.65	37.5
11	T1	43	2.4	0.116	6.3	LOS A	0.5	3.5	0.65	0.75	0.65	38.2
12	R2	4	0.0	0.116	9.8	LOS A	0.5	3.5	0.65	0.75	0.65	38.2
12b	R3	1	0.0	0.116	10.5	LOS B	0.5	3.5	0.65	0.75	0.65	38.5
12u	U	1	0.0	0.116	11.2	LOS B	0.5	3.5	0.65	0.75	0.65	38.8
Approach		71	1.5	0.116	6.7	LOS A	0.5	3.5	0.65	0.75	0.65	38.0
SouthWest: Scenic Dr												
30b	L3	2	0.0	0.153	7.7	LOS A	0.7	5.2	0.66	0.72	0.66	37.1
30a	L1	77	6.8	0.153	7.1	LOS A	0.7	5.2	0.66	0.72	0.66	37.8
32a	R1	238	5.8	0.294	8.2	LOS A	1.6	11.8	0.67	0.80	0.67	37.4
32b	R3	3	33.3	0.294	10.7	LOS B	1.6	11.8	0.67	0.80	0.67	37.9
32u	U	1	0.0	0.294	10.0	LOS B	1.6	11.8	0.67	0.80	0.67	38.2
Approach		321	6.2	0.294	7.9	LOS A	1.6	11.8	0.66	0.78	0.66	37.5
All Vehicles		1516	4.0	0.381	6.9	LOS A	2.0	14.3	0.54	0.66	0.54	37.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SITE LAYOUT

Site: 101 [2018 PM Peak (+52LV out to Titirangi)]

New Site
Site Category: (None)
Roundabout



INTERSECTION SUMMARY

Site: 101 [2018 PM Peak (+52LV out to Titirangi)]

New Site
Site Category: (None)
Roundabout

Intersection Performance - Hourly Values				
Performance Measure	**Vehicles**		**Persons**	
Travel Speed (Average)	37.6	km/h	37.6	km/h
Travel Distance (Total)	2054.7	veh-km/h	2465.6	pers-km/h
Travel Time (Total)	54.7	veh-h/h	65.6	pers-h/h
Demand Flows (Total)	2004	veh/h	2405	pers/h
Percent Heavy Vehicles (Demand)	1.3	%		
Degree of Saturation	0.740			
Practical Spare Capacity	14.9	%		
Effective Intersection Capacity	2710	veh/h		
Control Delay (Total)	4.14	veh-h/h	4.97	pers-h/h
Control Delay (Average)	7.4	sec	7.4	sec
Control Delay (Worst Lane)	11.1	sec		
Control Delay (Worst Movement)	12.7	sec	12.7	sec
Geometric Delay (Average)	3.2	sec		
Stop-Line Delay (Average)	4.2	sec		
Idling Time (Average)	0.8	sec		
Intersection Level of Service (LOS)	LOS A			
95% Back of Queue - Vehicles (Worst Lane)	9.1	veh		
95% Back of Queue - Distance (Worst Lane)	64.3	m		
Queue Storage Ratio (Worst Lane)	0.05			
Total Effective Stops	1561	veh/h	1873	pers/h
Effective Stop Rate	0.78		0.78	
Proportion Queued	0.73		0.73	
Performance Index	96.7		96.7	
Cost (Total)	1356.96	$/h	1356.96	$/h
Fuel Consumption (Total)	170.7	L/h		
Carbon Dioxide (Total)	403.2	kg/h		
Hydrocarbons (Total)	0.034	kg/h		
Carbon Monoxide (Total)	0.257	kg/h		
NOx (Total)	0.350	kg/h		

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Intersection LOS value for Vehicles is based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Site Model Variability Index (Iterations 3 to N): 2.6 %
Number of Iterations: 6 (Maximum: 10)
Largest change in Lane Degrees of Saturation for the last three Flow-Capacity Iterations: 3.1% 1.7% 0.9%

Intersection Performance - Annual Values				
Performance Measure	**Vehicles**		**Persons**	
Demand Flows (Total)	962,021	veh/y	1,154,426	pers/y
Delay	1,989	veh-h/y	2,387	pers-h/y
Effective Stops	749,151	veh/y	898,981	pers/y
Travel Distance	986,247	veh-km/y	1,183,497	pers-km/y
Travel Time	26,238	veh-h/y	31,485	pers-h/y
Cost	651,340	$/y	651,340	$/y
Fuel Consumption	81,940	L/y		
Carbon Dioxide	193,534	kg/y		
Hydrocarbons	16	kg/y		
Carbon Monoxide	123	kg/y		
NOx	168	kg/y		

MOVEMENT SUMMARY

Site: 101 [2018 PM Peak (+52LV out to Titirangi)]

New Site
Site Category: (None)
Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Huia Rd												
1b	L3	3	0.0	0.195	11.5	LOS B	0.9	6.1	0.72	0.80	0.72	35.8
1	L2	1	0.0	0.195	11.2	LOS B	0.9	6.1	0.72	0.80	0.72	35.9
2	T1	59	1.8	0.195	10.9	LOS B	0.9	6.1	0.72	0.80	0.72	36.6
3	R2	163	0.0	0.319	11.1	LOS B	1.6	11.5	0.74	0.89	0.74	36.6
3u	U	1	0.0	0.319	12.5	LOS B	1.6	11.5	0.74	0.89	0.74	37.1
Approach		227	0.5	0.319	11.0	LOS B	1.6	11.5	0.73	0.86	0.73	36.6
East: Titirangi Rd												
4	L2	423	0.7	0.740	6.7	LOS A	9.1	64.3	0.83	0.82	0.96	37.5
4a	L1	356	1.8	0.740	6.0	LOS A	9.1	64.3	0.83	0.82	0.96	38.0
5	T1	35	0.0	0.740	6.2	LOS A	9.1	64.3	0.83	0.82	0.96	38.3
6	R2	162	3.2	0.306	9.2	LOS A	1.7	12.0	0.61	0.76	0.61	37.3
6u	U	21	0.0	0.306	10.4	LOS B	1.7	12.0	0.61	0.76	0.61	37.8
Approach		997	1.5	0.740	6.9	LOS A	9.1	64.3	0.79	0.80	0.90	37.7
North: Akinson Rd												
7	L2	169	0.6	0.427	6.3	LOS A	2.8	19.7	0.71	0.73	0.71	37.7
8	T1	175	1.2	0.427	5.8	LOS A	2.8	19.7	0.71	0.73	0.71	38.4
9a	R1	94	1.1	0.217	10.7	LOS B	1.1	7.7	0.66	0.80	0.66	36.4
9	R2	7	0.0	0.217	11.3	LOS B	1.1	7.7	0.66	0.80	0.66	36.7
9u	U	5	0.0	0.217	12.7	LOS B	1.1	7.7	0.66	0.80	0.66	37.2
Approach		451	0.9	0.427	7.2	LOS A	2.8	19.7	0.70	0.74	0.70	37.7
West: Koru Rd												
10	L2	7	0.0	0.061	5.4	LOS A	0.3	1.8	0.58	0.64	0.58	37.8
11	T1	29	3.6	0.061	5.3	LOS A	0.3	1.8	0.58	0.64	0.58	38.5
12	R2	1	0.0	0.061	8.7	LOS A	0.3	1.8	0.58	0.64	0.58	38.6
12b	R3	3	0.0	0.061	9.4	LOS A	0.3	1.8	0.58	0.64	0.58	38.9
12u	U	1	0.0	0.061	10.1	LOS B	0.3	1.8	0.58	0.64	0.58	39.2
Approach		42	2.5	0.061	5.8	LOS A	0.3	1.8	0.58	0.64	0.58	38.4
SouthWest: Scenic Dr												
30b	L3	1	0.0	0.072	7.0	LOS A	0.3	2.3	0.58	0.60	0.58	37.5
30a	L1	37	2.9	0.072	6.1	LOS A	0.3	2.3	0.58	0.60	0.58	38.2
32a	R1	245	1.7	0.262	7.1	LOS A	1.4	10.1	0.58	0.71	0.58	37.8
32b	R3	3	0.0	0.262	8.4	LOS A	1.4	10.1	0.58	0.71	0.58	38.3
32u	U	1	0.0	0.262	9.1	LOS A	1.4	10.1	0.58	0.71	0.58	38.6
Approach		287	1.8	0.262	7.0	LOS A	1.4	10.1	0.58	0.70	0.58	37.8
All Vehicles		2004	1.3	0.740	7.4	LOS A	9.1	64.3	0.73	0.78	0.78	37.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

D

Appendix D – Unitary Plan Assessment and Vehicle Swept Path Analysis

Unitary Plan Assessment

Table A provides a summary of the assessment of the proposed replacement WTP and reservoir sites against the relevant transport matters (Part E27. Transport) of the AUP. This assessment is undertaken against the current 'Operative in Part' version of the AUP.

AUP Assessment Table

Standard	Description	Compliance Assessment
E27.6.1. – Trip generation	The standard is not applicable.	N/A
E27.6.2. – Number of parking and loading spaces – Carparking	Table E27.6.2.4, All other industrial activities. 1 per 50m2 GFA or 0.7 per FTE (where the number of employees is known), whichever is the lower amount of onsite parking	To be determined Provision for 0.7 car parking spaces per FTE to be provided in accordance to Table E27.6.2.4.
E27.6.2.(10) – Number of parking and loading spaces – Accessible parking	Compliance with the number, size and accessible routes for accessible parking under NZS:4121-2001.	To be determined Site to comply with requirements as set out. In E27.6.2.7 Minimum Loading Space requirements and NZS:4121-2001 Accessible parking provision.
E27.6.3.1. – Size and location of parking spaces	Every parking space must be compliant with the standards in E27.6.3.1.(1), including the minimum dimensions.	To be determined Site to comply with requirements as set out in E27.6.3.1.1.
E27.6.3.2. – Size and location of loading spaces	Loading space must comply with Table E27.6.3.2.1	Complies. The loading space complies with the minimum dimensions specified in Table E27.6.3.2.1 as shown in **Appendix F**. The loading spaces are based on operational requirements.
E27.6.3.3. – Access and manoeuvring	(1) Parking access and manoeuvring areas must accommodate an 85th percentile car tracking curves (2) Loading access and manoeuvring areas must accommodate an appropriate truck for loading	Complies. As shown in **Appendix F**: (1) Vehicle tracking has been undertaken that demonstrates access and manoeuvring to/from the site can be satisfactorily achieved. Parking spaces to be assessed once finalised. (2) Loading space can be accessed satisfactorily.
E27.6.3.4. – Reverse manoeuvring	Sufficient space must be provided on site, so vehicles do not need to reverse off the site or onto or off the road from any site.	Complies. The vehicle tracking for the site is shown in **Appendix F** demonstrates manoeuvring to/from the site can be achieved without reversing onto the road from the site. The site layout accommodates a one-way loop to access the site and exit in a forward only movement.
E27.6.3.5. – Vertical clearance	A minimum clearance of 2.3m must be provided for access and parking of cars for 'all other activities'.	To be determined Site to comply with requirements as set out in E27.6.3.5.
E27.6.3.6. – Formation and gradient	(1) All parking and manoeuvring areas must be drained and provided with an all-weather surface (3) The gradient for spaces must not exceed 1 in 20 in any direction.	To be determined Site to comply with requirements as set out E27.6.3.6.

Standard	Description	Compliance Assessment
	(4) The gradient for manoeuvring must not exceed 1 in 8 in any direction.	
E27.6.3.7. – Lighting	Required where ten or more carparks will be used during the hours of darkness.	To be determined Site to comply with requirements as set out E27.6.3.7.
E27.6.4.1. – Vehicle Access Restrictions	N/A	Site will be restricted to permitted access only. No public access will be allowed.
E27.6.4.2. – Width and number of vehicle crossings	The number and separation of crossings must be in accordance with Table E27.6.4.2.1. (T146) Only one crossing per 25m of frontage or part thereof. Minimum separation from crossings serving adjacent sites – 2m. Minimum separation from crossings serving same site – 6m.	Complies.
E27.6.4.3. – Width of vehicle access and queuing requirements	Minimum formed access width must be in accordance with Table E27.6.4.3.2. (T155).	Does Not Comply. However, design provides for the operational requirements of the replacement WTP design vehicles. Due to the operational requirements of the site, large heavy vehicles are needed to be able to pass one another at the access point. The vehicle tracking is shown in **Appendix F** and has demonstrated that two vehicles are able to pass at access point as required.
E27.6.4.4. – Gradient of vehicle access	In accordance with standard E27.6.4.4. (1), the gradient of vehicle access must not be steeper than specified in Table E27.6.4.4.1. Transition ramps are required under standard E27.6.4.4.(2). In accordance with standard E27.6.4.4.(3), sufficient space must be provided on site for a platform as shown in Figure E27.6.4.4.4.	Complies. Access gradient in accordance with standards (T158). Parking gradient to be determined. Internal gradient have also been assessed and comply with the standards as set for (T158).
E27.6.4.5. – Sightlines for road/rail level crossings	The standard is not applicable.	N/A.
E27.6.5. – Design and location of off-road pedestrian and cycling facilities	(1) Ensure good connection to existing facilities (2) Width of path designed to accommodate anticipated number and type of users (3) Surface of path designed to safely provide for anticipated number and type of users	Complies. The existing footpath will be retained albeit the access width is not in accordance with the standards, the low amount of vehicular traffic would allow for safe crossing for pedestrians and cyclists.

Drawing Plotted: 21 May 2019 2:44 p.m.

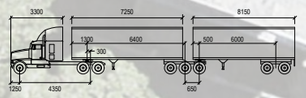
Notes:

1. All Travel led paths incorporate a 600mm envelope for heavy vehicles and 300mm envelopes for passenger vehicles as recommended by ATCOP.
2. All travelled paths have been analysed using a forward design speed of 10km/h

Design Vehicles

B85

	mm
Width	: 1870
Track	: 1770
Lock to Lock Time	: 6.0
Steering Angle	: 34.1



B-TRAIN

	mm		
Tractor Width	: 2500	Lock to Lock Time	: 6.0
Trailer Width	: 2500	Steering Angle	: 23.8
Tractor Track	: 2500	Articulating Angle	: 70.0
Trailer Track	: 2500		

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No.	Revision	By	Chk	Appd	Date
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Drawing Originator: Beca

Original Scale (A3)

Design			Approved For Construction*
Drawn	SF	21/05/2019	
Dsg Verifier			
Dwg Check			Date

* Refer to Revision 1 for Original Signature

Client: WATERCARE

Project: HUIA WTP AND RESERVOIRS

Title: HUIA WTP AND RESERVOIRS VEHICLE TRACKING

Discipline: TRANSPORTATION

Drawing No.: 01

Rev.: +

Document No. 21052019_LATEST ACCESS LAYOUT_VEHICLE TRACKING_V3.DWG

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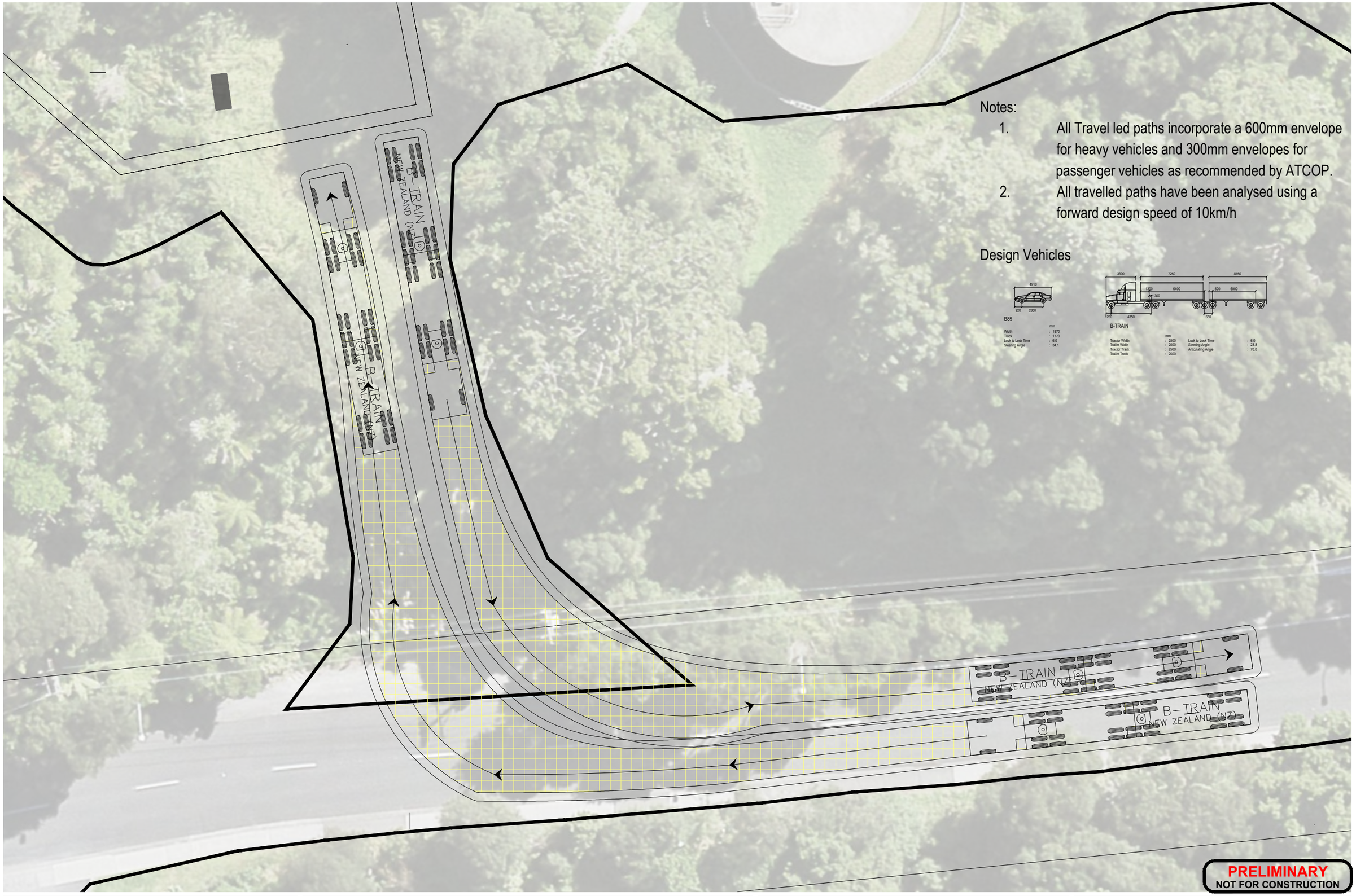

Notes:

1. All Travel led paths incorporate a 600mm envelope for heavy vehicles and 300mm envelopes for passenger vehicles as recommended by ATCOP.
2. All travelled paths have been analysed using a forward design speed of 10km/h

Design Vehicles

B85

	mm
Width	: 1870
Track	: 1770
Lock to Lock Time	: 6.0
Steering Angle	: 34.1

B-TRAIN

	mm		
Tractor Width	: 2500	Lock to Lock Time	: 6.0
Trailer Width	: 2500	Steering Angle	: 23.8
Tractor Track	: 2500	Articulating Angle	: 70.0
Trailer Track	: 2500		

PRELIMINARY
NOT FOR CONSTRUCTION

No.	Revision	By	Chk	Appd	Date
+	UNDER REVISION				

Drawing Originator: Beca

Original Scale (A3)

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Drawn	SF	21/05/2019	
Dsg Verifier			
Dwg Check			Date

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Client: WATERCARE

Project: HUIA WTP AND RESERVOIRS

Title: HUIA WTP AND RESERVOIRS VEHICLE TRACKING

Discipline: TRANSPORTATION

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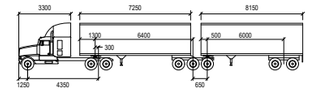
Notes:

1. All Travel led paths incorporate a 600mm envelope for heavy vehicles as recommended by ATCOP.
2. All travelled paths have been analysed using a forward design speed of 10km/h

Design Vehicles



B-TRAIN

mm

Tractor Width	: 2500	Lock to Lock Time	: 6.0
Trailer Width	: 2500	Steering Angle	: 23.8
Tractor Track	: 2500	Articulating Angle	: 70.0
Trailer Track	: 2500		

PRELIMINARY
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No.	Revision	By	Chk	Appd	Date
+	UNDER REVISION				

Drawing Originator: Beca

Original Scale (A3)

Design			Approved For Construction*
Drawn	SF	21/05/2019	
Dsg Verifier			
Dwg Check			Date

* Refer to Revision 1 for Original Signature

Client: WATERCARE

Project: HUIA WTP AND RESERVOIRS

Title: HUIA WTP AND RESERVOIRS VEHICLE TRACKING

Discipline: TRANSPORTATION

Drawing No.: 01

Rev.: +

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Notes:

1. All Travel led paths incorporate a 600mm envelope for heavy vehicles and 300mm envelopes for passenger vehicles as recommended by ATCOP.
2. All travelled paths have been analysed using a forward design speed of 10km/h

Design Vehicles

MEDIUM RIGID TRUCK

	mm
Width	: 2500
Track	: 2500
Lock to Lock Time	: 6.0
Steering Angle	: 37.3

PRELIMINARY
NOT FOR CONSTRUCTION

No.	Revision	By	Chk	Appd	Date
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Drawing Originator: Beca

Original Scale (A3)

Design			Approved For Construction*
Drawn	SF	21/05/2019	
Dsg Verifier			
Dwg Check			Date

* Refer to Revision 1 for Original Signature

Client: WATERCARE

Project: HUIA WTP AND RESERVOIRS

Title: HUIA WTP AND RESERVOIRS VEHICLE TRACKING

Discipline: TRANSPORTATION

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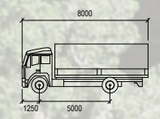
Notes:

1. All Travel led paths incorporate a 600mm envelope for heavy vehicles and 300mm envelopes for passenger vehicles as recommended by ATCOP.
2. All travelled paths have been analysed using a forward design speed of 10km/h

Design Vehicles



MEDIUM RIGID TRUCK

	mm
Width	: 2500
Track	: 2500
Lock to Lock Time	: 6.0
Steering Angle	: 37.3

PRELIMINARY
NOT FOR CONSTRUCTION

No.	Revision	By	Chk	Appd	Date
+	UNDER REVISION				

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Drawn	SF	21/05/2019	
Dsg Verifier			
Dwg Check			Date

* Refer to Revision 1 for Original Signature

Client: WATERCARE

Project: HUIA WTP AND RESERVOIRS

Title: HUIA WTP AND RESERVOIRS VEHICLE TRACKING

Discipline: TRANSPORTATION

Drawing No.: 01

Rev.: +

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E

Appendix E – Draft Construction Traffic Management Plan

Huia Replacement WTP

DRAFT Construction Traffic Management Plan

Prepared for Watercare Services Ltd
Prepared by CH2M Beca Ltd

11 July 2019

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everyday
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Creative people together transforming our world

Contents

Appendices

Revision History

Revision Nº	Prepared By	Description	Date
1.0	**Scheepers Fourie**	Draft for Watercare	13/02/2019
2.0	**Scheepers Fourie**	Final for Lodgement	21/05/2019
3.0	**Scheepers Fourie**	Post-lodgement revision	11/07/2019

Document Acceptance

Action	Name	Signed	Date
Prepared by	**Scheepers Fourie**		11/07/2019
Reviewed by	**Joe Phillips**		11/07/2019
Approved by	**Joe Phillips**		11/07/2019
on behalf of	CH2M Beca Ltd		

1 Introduction

1.1 Scope

Watercare Services Ltd (Watercare) plans to undertake enabling and construction works for the replacement Huia Water Treatment Plant (WTP) and the associated reservoirs (also referred to as 'the Project'). The proposed replacement WTP and reservoirs sites are located in Titirangi, off Woodlands Park Road.

This draft Construction Traffic Management Plan (CTMP) report has been prepared by CH2M Beca Ltd (Beca) to provide an outline of the measures to be implemented to manage the transport impacts of the enabling and construction works for the replacement WTP and proposed reservoirs.

This draft CTMP will be further developed following approval of the works and the appointment of a contractor by Watercare. This report is based on the current understanding of the indicative construction methodology and will be refined by the contractor (once appointed) to reflect changes in design, construction methods or to manage any unforeseen impacts. It is considered that this draft CTMP outlines appropriate mechanisms to manage the currently identified actual and potential adverse effects of the enabling and construction works.

[As noted above, this is a Draft CTMP, prepared to support the resource consent application, particularly the Transport Assessment prepared by Beca. It will need to be updated, once the contractor is appointed, when the details of the construction methodology and programme will be confirmed. It will then be provided to Auckland Council for certification, as required by the draft conditions in the Assessment of Environmental Effects, prepared by Tonkin & Taylor Ltd. In this regard, there are several sections of this 'draft' report highlighted in green, where details are not yet available.]

1.2 Purpose

The purpose of the draft CTMP is to provide an outline of the currently understanding of the enabling and construction activities for the Project and then outline the mechanisms that will enable the following outcomes in relation to the effective management of these activities:

- Limit and manage the number of construction traffic movements on the transport network
- Provide for the safety of everyone at all times
- Ensure of maintenance of access at all times to / from properties
- Minimise disruption from construction traffic on the travelling public and road users along the identified sections of the construction routes
- Seek to avoid full road closures and minimise any partial or managed closures
- Manage integration with other construction projects and Auckland Transport projects
- Provide for prior engagement with relevant stakeholders, when public access, particularly to properties, will be affected by construction traffic
- Provide a mechanism for addressing queries and responding to complaints (including through a Community Liaison Group (CLG) or similar).

1.3 Project Extent

1.3.1 Site Locations

Figure 1-1 below shows the location of the proposed replacement WTP and reservoirs sites, which are directly adjacent to the existing Huia WTP. The existing Huia WTP will be retained and remain operational throughout the enabling and construction works for the replacement WTP and Reservoir 1, then be de-commissioned prior to the construction of Reservoir 2.

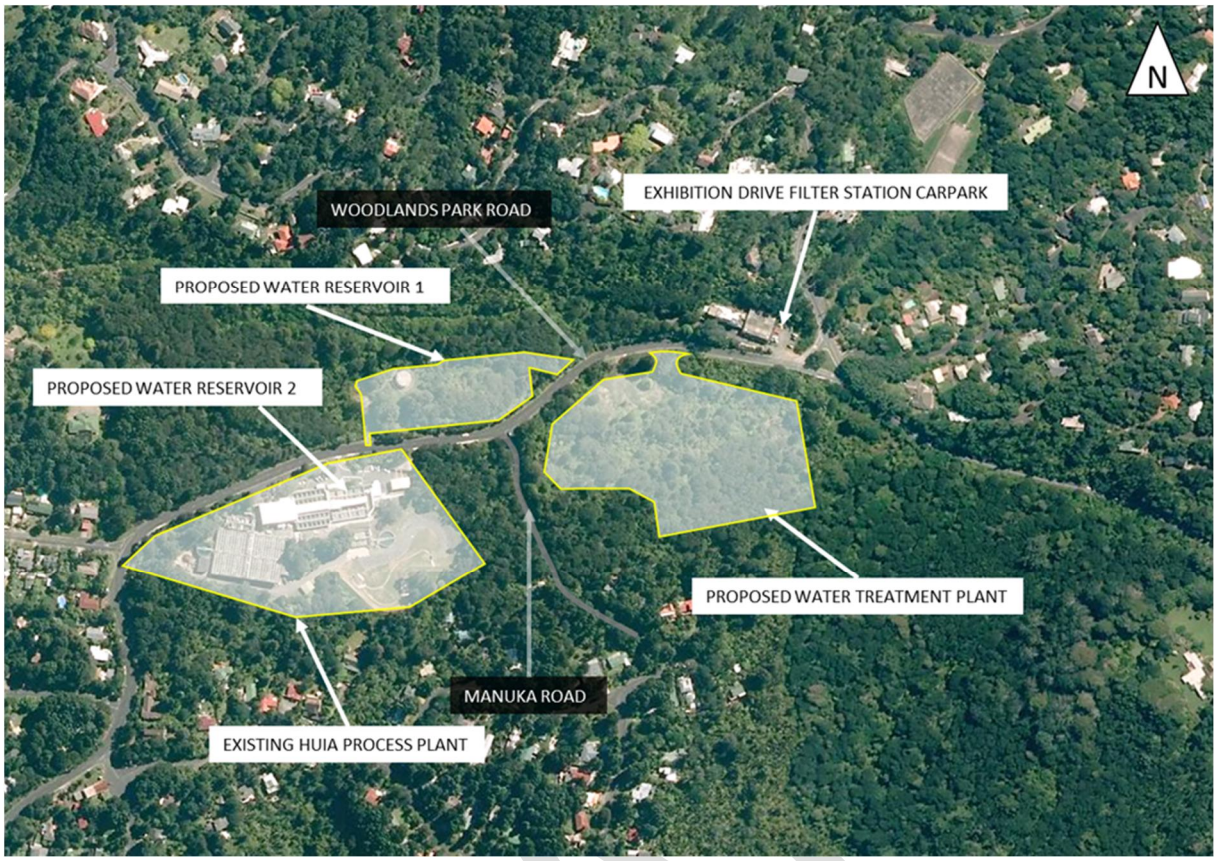

Figure 1-1: Site Locations

It is currently understood that entry and exit for Reservoir 1 site will be required during the works to provide for the necessary on-site circulation of construction vehicles, particularly truck and trailer vehicles (refer to **Section 4.3**). For the replacement WTP and Reservoir 2 sites only a single (entry/exit point) is likely to be required.

1.3.2 Truck Haul Routes

Based on the assessment of the transport effects of the Project, the following routes (**Figure 1-2** and **Figure 1-3** below**)** have currently been identified as options for construction vehicle haul routes to and from the Project. The identified haul routes provide options for the movement of trucks (particularly truck and trailer vehicles) between the Projects sites and the wider arterial and strategic transport network. More specifically, this includes via Great North Road and Clark Street to State Highway 16 (SH16) and State Highway 20 (SH20), as well as the route to an alternative landfill site near Parau.

Other than the alternative landfill site near Parau, the specific origin/ destination of trucks associated with the Project will need to be confirmed by the contractor (once appointed). However, the identified routes provide flexibility for access to both the Western, Northern and Southern Motorways. Further detail on the mechanisms to manage trucks using these routes are provided within to **Section 4**.

1.3.3 Staging Site

In addition to the Project sites, it is understood that a staging site would be provided at a location (to be determined) in the New Lynn area. The purpose of this site will be to provide storage of materials, pre-assembly of some components of construction prior to transfer to site, as well as provide for construction staff parking for bus transfers to/from site (refer to **Section 4.4**).

Figure 1-2: Identified Heavy Truck Haul Routes – Proposed WTP and Reservoirs

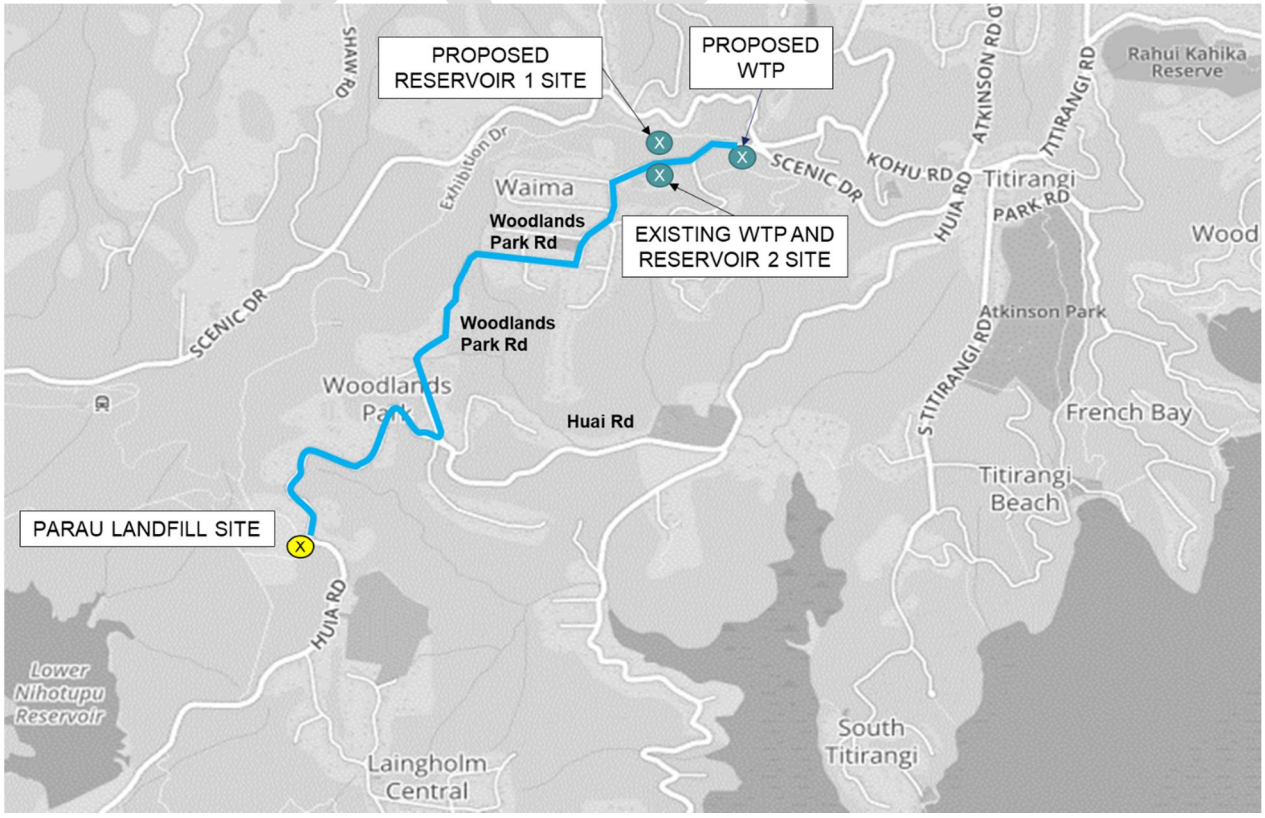

Figure 1-3: Identified Heavy Truck Haul Routes – Parau Site

1.4 Responsibilities

The contractor's Project Director will have overall responsibility for meeting the requirements of the CTMP.

The Project's Construction Manager in conjunction with the Project's Construction Traffic Manager will be responsible for implementation and monitoring of the CTMP.

1.5 Key Contacts

The contact details for the key Project staff as they relate to the CTMP, along with a Project hotline, for general queries and/or complaints will be provided, as per **Table 1-1**.

[Details to be provided, once contractor appointed]

Table 1-1: Key Contact Details

Role	Contact	Contact Number
Project Hotline		Xxx
Project Director	Xxx	Xxx
Construction Manager	Xxx	Xxx
Construction Traffic Manager	Xxx	Xxx
Stakeholder Manager	Xxx	Xxx
Health and Safety Manager	Xxx	Xxx

1.6 Heavy Truck Definitions

There will be a variety of construction vehicles accessing the Project sites, including heavy trucks. For the purposes of this document, the heavy trucks are categorised as follows:

- Rigid Trucks – Rigid vehicles with a gross vehicle mass exceeding 3.5 tonnes
- Articulated Trucks – Semi-trailers, truck and trailers and B-trains
- Oversize Trucks – Over-dimensional vehicles and other oversize / wide loads.

2 Project Works

2.1 Key Construction Works and Areas

The Project will require activities to be undertaken in two main work sites; Replacement WTP site and New Reservoirs site, as well as construction vehicles using the identified haul routes. **Table 2-1** and **Table 2-2** set out the broad features of the construction works in these areas.

Table 2-1: Features of Works at the Main Works Sites

Features	Replacement WTP Site	New Reservoirs Sites
Enabling and Construction Activities	• Enabling Works • Bulk Earthworks / Retaining Walls • In-situ and Pre-cast Structures • Ancillary Tanks • Civils Works • Commissioning	• Enabling Works • Bulk Earthworks / Retaining Walls • Pipework and Ducting • Reservoirs Construction • Civils Works • Commissioning
Space Limitations	Relatively large site. Although requires management of vehicle circulation and on-site parking during bulk earthworks.	Relatively constrained site requires management of vehicle circulation and on-site parking during bulk earthworks and reservoir construction.
Access	Interaction with various activities along a combination of arterial roads to be managed, as discussed in this draft CTMP, including specific access management on Woodlands Park Road.	Interaction with various activities along a combination of arterial roads to be managed, as discussed in this draft CTMP, including specific access management on Woodlands Park Road.
Vehicle Types	• General deliveries using range of rigid trucks • Truck and trailers for spoil removal and fill material etc • Flat-deck semi-trailer trucks for piling equipment, in-situ and pre-cast structural components etc • Concrete trucks • Over-dimensional and other oversize loads, comprising construction plant, mobile cranes etc	• General deliveries using range of rigid trucks • Truck and trailers for spoil removal and fill material etc • Flat-deck semi-trailer trucks for piling equipment, in-situ and pre-cast structural components etc • Concrete trucks • Over-dimensional and other oversize loads, comprising construction plant, mobile cranes etc

Table 2-2: Features of Works at the Alternative Parau Landfill Site

Features	Alternative Parau Landfill Site
Enabling and Construction Activities	• Bulk Earthworks – Spoil Disposal
Space Limitations	Large site. Although requires management of vehicle circulation and on-site parking.
Access	Interaction with various activities along arterial roads to be managed, as discussed in this draft CTMP, including specific access management on Huia Road.
Vehicle Types	• Staff and general deliveries • Rigid trucks for spoil delivery • Flat-deck semi-trailer trucks for earthworks plant etc

2.2 Traffic Flows

Table 2-3 shows the predicted typical daily heavy truck movements across the various months of the Project for the main work sites. During the busiest period (months 38 to 55), there will be 11 months with approximately 88 to 118 heavy truck movements per day, equating to around 13 to 17 movements per hour. However, either side of this period, there will generally be approximately 4 to 83 heavy truck movements per day, equating to around 12 or less movements per hour. There are also several extended periods with little or no anticipated heavy vehicle movements (26 months) and less than 42 heavy vehicle movements per day (49 months), that represent a total of approximately 75 months (76%) of the overall programme.

This is also based on the current indicative construction programme, which has sought to provide a balance between the resulting number of daily trucks anticipated and the length of the Project programme, where practicable, i.e. reducing daily trucks will result in extension to the duration of the activities.

Table 2-3: Predicted Typical Daily Truck Movements – Main Works Sites

Location	Daily Heavy Truck Movements (Sum of Inbound and Outbound)		
	Months 1 to 37	**Months 38 to 55**	**Months 56 to 99**
Replacement WTP Site	0 to 75	34 to 102	0 to 40
New Reservoirs Sites	0 to 36	4 to 54	0 to 24
Combined Sites*	**0 to 79**	**57 to 118**	**0 to 40**

** Noting that due to the offset of the peak period in the construction programmes at the WTP and two Reservoirs sites, the peak at each site does not equal the total for combined sites.*

In relation to the Parau Landfill site, as this site will only be accessed by rigid trucks for spoil disposal, it is predicted that this would result in around 61 to 90 daily truck movements. These would occur through busiest 11 months of the programme during the replacement WTP earthworks, plus during eight months of the Reservoir 1 earthworks. However, using this route will result in a reduction in the total number of daily truck movements using the other routes to/from the replacement WTP and Reservoir 1 sites, i.e. along Scenic Drive, Titirangi Road, Atkinson Road, Kaurilands Road, Glendale Road and West Coast Road.

2.3 Construction Traffic Management Philosophy

The overarching philosophy for the management of construction traffic during the Project is to:

- Ensure the safe and efficient operation of Woodlands Park Road and its intersection with Scenic Drive, as well as the Parau Landfill site access off Huia Road
- Minimise congestion on the surrounding road network and delays to the travelling public and road users
- Minimise disruption to private property access, both pedestrian and vehicle access
- Maximise the safety of the travelling public and site staff
- Maintain safety for pedestrians and cyclists
- Enable construction efficiencies
- Ensure appropriate access for emergency vehicles at all times
- Inform the public and directly affected stakeholders about potential impacts of Project construction traffic on the transport network.

This will broadly be achieved by:

- Preventing or limiting, where practicable, heavy truck routing and heavy truck movements at certain times of the day / week
- Appropriate design of access points and temporary traffic management
- Maintenance of roads, signs and work sites
- Planning construction traffic movement and management to reduce adverse effects
- Coordination with Auckland Transport in relation to other construction activity along the identified sections of the haul routes
- Communication internally within the Project team, with Auckland Transport, road users and key stakeholders that may be impacted by construction
- Educating construction staff on the needs of pedestrian and cyclists, as well as other key activities, near the Project area or along identified construction haul routes.

2.4 Roles and Responsibilities

General roles and responsibilities for the Project will be outlined separately by the contractor. Specific roles and responsibilities relating to the implementation of the CTMP are outlined in **Table 2-4**.

[Details to be confirmed, once contractor appointed]

Table 2-4: CTMP Roles and Responsibilities

Roles	Responsibilities
Project Director	• Overall responsibility for site management • Report any incidents or issues, as appropriate
Health and Safety Manager	• Oversight and advice on the safety of the interfaces with the public
Construction Manager	• Ensure the CTMP is implemented • Ensure staff are trained to the required level

	• Ensure Temporary Traffic Management (TTM) records / monitoring results are kept and TTM audits undertaken
Construction Traffic Manager	• Prepare and submit Traffic Management Plans (TMPs)
Stakeholder Manager	• Coordination with key stakeholders, including through the CLG
Site Traffic Management Supervisor (STMS)	• Implement TTM in accordance with approved TMPs • Maintain TTM records
Traffic Controller (TC)	• Fulfil manual traffic control roles on-site, as directed by the STMS
Auckland Transport	• Input to the preparation of the CTMP, including advising on relevant adjacent works on the public road network

3 Management Procedures

Several procedures will exist to identify and manage temporary traffic impacts during the Project, which are discussed further below.

3.1 Site Staff

The success of management measures developed is heavily dependent on the support of the Project workforce in implementing them. The Project construction team will make significant effort to build a culture where safety and strong relationships with Project neighbours are a key focus area.

All Project staff will need to attend a Project induction prior to the commencement of work on-site to ensure a common basis for approaching their work. The induction will include environmental, health and safety and hazard management in relation to the Project area, along with temporary traffic management control.

This is likely to reinforced through regular (perhaps weekly) briefings that will reinforce and educate staff around specific temporary traffic control issues and for site staff to raise issues identified.

This approach would involve the workforce in identifying and developing solutions to manage effects and can enable positive contributions to be recognised and rewarded, where appropriate.

3.2 Construction and Temporary Traffic Planning

3.2.1 Construction Planning

Construction of the Project will be divided into a number of work activities, with a Site Engineer responsible for managing a number of activities at any one time. As part of the construction planning process, the Site Engineers will develop a work package for each activity.

The work pack will then be reviewed and signed-off by the Construction Manager, Construction Environmental Manager, Design Manager and Health and Safety Manager (or their respective delegates) before those activities commence.

Temporary traffic management requirements associated with the work activities will be included in those works packs and will be subject to appropriate approvals.

3.2.2 Site Specific Traffic Management Plans

TMPs, also known as Site Specific Traffic Management Plans (SSTMPs), will be required (under the Local Government (Auckland Council) Act) for all work or physical controls within the 'live' road corridor, which will include along Woodlands Park Road and around the Parau Landfill site access.

The SSTMPs will be prepared for discrete stages of work within the road corridor and will follow the format set out in the Code of Practice for Temporary Traffic Management (CoPTTM). They will describe the measures to be implemented to manage the temporary traffic effects associated with the movement of construction traffic or the particular works.

SSTMPs will be submitted to and approved by Auckland Transport's Traffic Management Coordinator. SSTMPs will be assessed by the Traffic Management Coordinator for compliance with CoPTTM and the ability to avoid or mitigate adverse effects on the travelling public.

*[SSTMPs would be appended to the CTMP (**Appendix A** [placeholder]), as known at the Project outset, or subsequently developed for any works not initially anticipated. In each case approval from Auckland Transport will be required]*

3.2.3 Road Maintenance

The areas immediately adjacent to the Project sites that will be used by construction traffic will be inspected and photographed before construction begins. These areas will be monitored throughout construction and inspected at completion. Any damage directly attributable to the Project construction will be repaired.

There will also be a condition of consent for a Pavement Impact Assessment of the routes being used by heavy trucks, the scope and extent of which is to be agreed with Auckland Transport. Any damage directly attributable to the Project construction will be repaired.

It is also identified that an inspection of trees along the heavy truck routes, particularly along Scenic Drive, will need to be undertaken, such that any necessary trimming of trees can be undertaken in advance, particularly with regard to oversize trucks.

In addition to the provision of wash down or similar facilities, brooms will be in place at each site access point, so that gatemen (if required) can sweep up detritus. There will be monitoring and cleaning of any spillage from construction trucks onto roads adjacent to the sites, where this can be safely achieved.

3.2.4 Implementation

Each day's work will likely begin with a briefing for each crew, as which specific work being undertaken that day will be discussed and documented. This will include risks involved with the work to be undertaken and the mitigation measures to be implemented to avoid or mitigate the risks, such as temporary traffic control measures.

Any issues which cannot be solved by the crew will be escalated to the Construction Manager / Traffic Manager / Project Director, as appropriate. A process for escalation, including where necessary, beyond the Project Director, will be in place.

4 Mitigation Measures

4.1 Heavy Truck Access Routes

The routes to be used by heavy trucks to and from the Project sites are illustrated on **Figure 4-1**.

Figure 4-1: Identified Heavy Truck Haul Routes

The primary route for heavy trucks accessing the Project sites will be along Woodlands Park Road, Scenic Drive and Titirangi Road. This will generally be the preferred route for heavy trucks accessing the replacement WTP and new Reservoirs sites. However, to manage the predicted adverse effects of heavy trucks using this route, the following additional routes have been identified to distribute the predicted heavy truck demands across the transport network and provide flexibility in heavy truck routing, particularly during the busier periods of the construction programme:

- Atkinson Road (South), Kaurilands Road and Glendale Road
- Titirangi Road, Golf Road and Portage Road.

The route along Woodlands Park Road and Scenic Drive is common to all routing options. As discussed in **Section 4.3**, in the vicinity of the site, temporary traffic management will be implemented to safely manage the interaction between construction activities and the travelling public.

Along Scenic Drive, prior to the implementation of the CTMP, further detailed investigation of potential physical constraints will be undertaken to confirm any impacts for oversize trucks, such as overhanging tree branches within the road corridor (refer to **Section 3.2.3**). For the busier periods of heavy truck demand during construction, it may be necessary to consider temporary restricted speed limits and associated 'positive' temporary traffic management measures to manage the two-way movement of heavy trucks and other vehicles on Scenic Drive.

Due to the nature of the road and adjacent land use environment along the Atkinson Road (South), Kaurilands Road and Glendale Road route, it will be necessary to operate articulated and oversize trucks under a 'one way' arrangement on this route.

Golf Road is not classified as an Arterial Road and has potential physical constraints at the intersections of Golf Road with Titirangi Road and Portage Road. As such, this is potentially less well suited to provide a practical routing alternative for articulated or oversize trucks. However, it will be a practical two-way route for other heavy (rigid) trucks. Prior to approval of this document, and should the contractor seek to utilise this route, the ongoing review with Auckland Transport will consider the physical constraints of this route to identify the ability of articulated and oversize to operate on this route.

The routing for oversize trucks will be specifically discussed and agreed with Auckland Transport. Noting that the Titirangi Road route has a 4.25m height restriction where it passes under the Western rail line near the intersection of Margan Avenue.

In addition to the above routes, heavy trucks will also travel to and from the Project sites and the Parau Landfill site, as illustrated on **Figure 4-2** below.

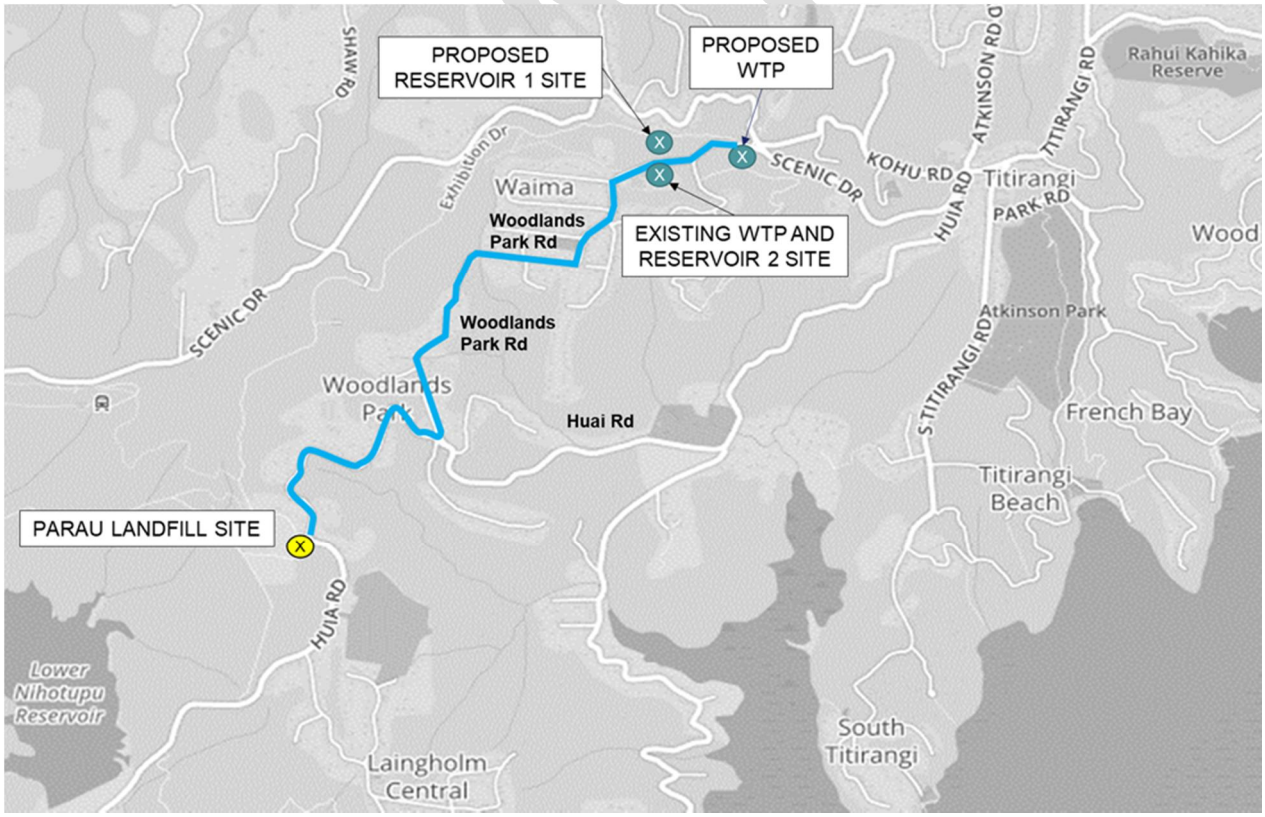

Figure 4-2: Heavy Truck Route – Parau Landfill Site

Due to the nature of this route, the transfer of spoil from the proposed replacement WTP and the reservoirs to the Parau Landfill site will need to be undertaken by rigid trucks, not articulated trucks.

These routes and other potential alternatives (such as Godley Road) will be reviewed regularly by the Construction Traffic Manager in consultation with Auckland Transport, so as to coordinate with other significant projects or temporary traffic management along these routes. The regular review will also provide for identification and implementation of changes to routing or additional mitigation measures (such as localised traffic management) should any unanticipated adverse effects be identified.

4.2 Access Times

Heavy trucks accessing the Project site will need to be minimised along certain routes at particular times of day or on certain days of the week. It is understood that normal construction activities will not require heavy trucks to operate on Sundays.

The restrictions will manage the potential adverse operational and safety impacts on certain activities (such as kindergartens, schools, local and town centres, and recreational activities) along these routes. These restrictions may not always be practicable due to the requirements of construction efficiencies, such as during concrete pours or due to construction vehicles being delayed on the wider transport network, when arriving at the sites.

For the Titirangi Road routes, this includes limiting heavy trucks in the following periods, where practicable, to address the potential adverse effects in Titirangi Village:

- During the weekday peak hours (07:30 to 08:30 and 17:00 to 18:00), excluding public holidays
- Around midday on Saturdays (12:00 to 14:00).

For the Atkinson Road (South), Kaurilands Road and Glendale Road route, as well as the Parau Landfill site route, this includes no heavy trucks, where practicable, in the following periods to address the potential adverse effects on kindergartens and schools on this route:

- During the weekday morning and evening pick-up / drop-off periods in school term times (08:00 to 09:00 and 14:30 to 15:30), excluding public holidays.

Oversize trucks will need to travel to and from the site overnight, or potentially at certain times on weekends, under normal mobile traffic controls, which will be further developed by the contractor (once appointed) in liaison with Auckland Transport.

4.3 Site Access Interfaces

4.3.1 Site Access

Access to both the replacement WTP and Reservoirs construction sites will be taken from Woodlands Park Road to the west of the intersection with Scenic Drive. Access to the Parau Landfill site will be off Huia Road, south of Woodlands Park village.

It is currently anticipated that separate entry and exit will be provided for the Reservoir 1 site in order to provide for satisfactory circulation arrangements within the sites for heavy trucks, including allowance for waiting areas. For the replacement WTP, Reservoir 2 and Parau Landfill sites, there will be a single point of entry/exit. The exit from the replacement WTP and Reservoir 1 sites will be provided in the proposed location of the permanent (operational) driveway access for those sites, where appropriate sightlines can be achieved in both directions along Woodlands Park Road. Where necessary, trimming of vegetation within the property boundary will be undertaken to enable sufficient sightlines during construction.

The location and temporary traffic management measures to be implemented for the construction site access will be confirmed through the process of approval of the SSTMPs for the construction works by Auckland Transport. It is expected that this will include temporary speed restrictions along Woodlands Park Road through the works area and up to and including the Woodlands Park Road / Scenic Drive intersection, as well as temporary speed restrictions around the Parau Landfill site access off Huia Road. This will

appropriately manage the movement of vehicles to and from the site accesses and at the Woodlands Park Road / Scenic Drive intersection, including achieving appropriate sightlines.

In addition to the temporary traffic management, it is expected that some localised widening will be provided within the road reserve along the section of Woodlands Park Road near the replacement WTP and Reservoir 1 sites to provide more appropriately for the two-way movement and manoeuvring of heavy trucks at the site access points. Some localised widening will also be required at the Parau Landfill site access off Huia Road to complement the required temporary traffic management. *[Further design of this localised widening and associated design approval by Auckland Transport, where required, is able to be satisfactorily completed as part of the further construction methodology development by the contractor (when appointed) and associated approval of the CTMP]*

4.3.2 On-Site Manoeuvring

As discussed above, the sites will be managed to enable heavy trucks and other vehicles to turn on the site, thereby avoiding the need during the normal operation of the construction for heavy trucks to reverse to or from Woodlands Park Road and Huia Road.

Should reversing to or from the sites off Woodlands Park Road be required very occasionally, such as during the transport of plant to/from the site by oversize trucks, this would be managed under appropriate traffic management supervision by an STMS with the necessary SSTMPs approved by Auckland Transport.

4.3.3 Pedestrians and Cyclists

The existing footpath along the southern side of Woodlands Park Road would normally remain open during the WTP construction site and appropriate measures to provide for the safe movement of pedestrians along the footpath will be included in the SSTMPs to be approved by Auckland Transport. Appropriate sightlines will be achieved between pedestrians, cyclists and construction vehicles. However, marshals will need to be provided at the site accesses to manage the interaction between pedestrians, cyclists and construction vehicles.

Measures to manage interaction of pedestrians, cyclists and construction vehicles will include:

- the provision of signage to warn pedestrians of the presence of construction traffic, particularly heavy vehicles, as well as alert construction vehicles to the presence of pedestrians
- appropriate sightlines between pedestrians, cyclists and construction vehicles
- marshals to manage the interaction between vehicles and pedestrians
- complementary training and the identified Project induction, that will alert construction staff to the presence of and the needs of pedestrians / cyclists using this footpath.

Similar measures, as appropriate, will be put in place in the vicinity of the carpark and pedestrian/cycle access to the Exhibition Drive recreational path, as part of the SSTMPs. This will provide for pedestrian and cycle safety, including at the southern end, where this is located adjacent to the Parau Landfill site access.

4.3.4 Staff Parking

As discussed in **Section 4.4**, a limited amount of on-site construction staff parking will be provided due to the physical constraints of the sites. Staff will be informed through the Project induction (refer to **Section 7.2**) that:

- there is limited on-site parking, which will be specifically allocated
- there is an alternative shuttle bus to/from a staging site
- parking on Woodlands Park Road, Manuka Road or at the Exhibition Drive car park is not be permitted.

[This will be specified in a parking plan that will be included in the Staff Travel Management Plan (STMP) attached to the CTMP. This would further specify the location of parking on the sites, where parking is not permitted and the staff/visitors who would be allocated with parking, as per Section 4.4 of the CTMP.]

4.3.5 Bus Stops

As heavy trucks will be operating along the section of Woodlands Park Road past the two existing bus stops immediately to the west of Manuka Road, refer to **Figure 4-3**, these bus stops will be relocated or removed during the period of the works. The current usage of these bus stops has been identified to be low, particularly for the eastbound bus stop on the northern side of Woodlands Park Road.

There two existing bus stops a short distance further to the west, just west of Waima Crescent, which can be used by bus passengers, if these bus stops are removed. Those bus stops are both accessible by footpaths on the north and south sides of Woodlands Park Road. Access to those bus stops, further to the west, will be maintained throughout the construction period. This will be agreed with and approved by Auckland Transport as part of the process for the SSTMPs *[To be appended to CTMP by contractor (when appointed) and completed]*.

Figure 4-3: Existing Bus Stop Locations

4.4 Staff Travel

A limited number of staff parking spaces will be provided on both Project sites. It is currently anticipated that this will not exceed a total of 50 spaces across both sites *[This will need to be confirmed as the construction methodology is developed by the contractor (once appointed)]*.

The parking spaces will likely be allocated to:

- Minor trades – assigned at the discretion of the Construction Manager, based on those needing to bring tools to the site for specialist activities etc
- Priority for car / van pooling
- Mobility impaired staff / visitors
- Staff working outside standard hours (in the event this is permitted).

Supporting the limited parking on the Project sites, is a Staff Travel Management Plan (STMP), a copy of which is included in **Appendix B** [placeholder], will be prepared. The STMP includes parking plan detailing the staff parking arrangements, including the provision of staff parking within a staging site, as well as the details relating to the provision for shuttle buses (including scheduling) for travel to and from the Project site at the beginning at end of the working day. In addition, the STMP outlines the alternatives for staff to access

the staging site by modes other than the private car. *[Further details, including the STMP document, will be provided once the contractor is appointed and the location of the staging site is known]*

4.5 Staging Site

The staging site is to be provided, which will provide several functions in relation to the management of construction traffic for the Project site. The location of the staging site is illustrated on **Figure 4-4**.

[Further details to be provided, when location confirmed by contractor (once appointed), likely to be somewhere in the New Lynn area]

[Insert map, once location confirmed]

Figure 4-4: Staging Site Location

The staging site will provide for the following functions:

- Staff parking and pick-up / drop-off for the shuttle bus services to the Project sites
- Storage of materials prior to delivery to the site, such as pre-cast units etc, enabling more efficient / consolidated delivery of materials
- Staging point for deliveries arriving from inland or sea ports, enabling greater control (flexibility and reliability) in the transport of these materials/equipment to the Project sites
- Partial assembly of materials/equipment away from the Project sites, potentially reducing the activities required to be undertaken at the Project sites.

5 Communication and Stakeholder Engagement

5.1 General Engagement

There will be a stakeholder engagement and engagement plan to identify how the stakeholders and the community will continue to be informed about the Project during the works. There will also be a stakeholder notification procedure and complaints response procedure to be implemented during the Project works.

In relation to the CTMP, communication will focus on provide information to the travelling public (road users and footpath users) and property owners / occupants of the construction activities around the Project sites. This would include the potential for activities to result in any temporary disruption to their travel plans, any congestion, or impacts on parking (such as at Exhibition Drive) or property access, enabling them to plan accordingly.

The Project stakeholder and communications team will be available for the duration of the Project to field queries and speak to affected property owners / occupants about work that may impact them. The Project stakeholder and communications team will serve as a central point of contact for involving other Project team members, such as the Traffic Manager, in discussion with property owners / occupiers, as required.

5.2 Specific Engagement

In addition, the Project will engage will engage with the following key stakeholders in relation to construction traffic management:

- Auckland Transport – in relation to other construction sites and street works in adjacent areas, including along haul routes, during the Project, as well as in relation to public transport (i.e. temporary bus stop relocations on Woodlands Park Road)
- CLG – in relation to any specific matters, both through regular meetings, and potentially day-to-day matters, as and when required, via the Stakeholder Manager
- Schools and other education facilities (such as child care centres / kindergartens) along the identified haul routes that may be directly impacted by construction traffic during the Project
- Businesses / business owners along the identified haul routes that may be directly impacted by construction traffic during the Project.

5.3 Traffic Management Coordination

The Construction Traffic Manager will regularly meet with relevant personnel at Auckland Transport to; inform Auckland Transport of any specific upcoming traffic management, as well as identify and resolve any conflicts arising in relation to the Project and any other separate works being undertaken.

5.4 Mechanisms for Queries / Complaints

The Stakeholder Manager will be responsible for implementing a process for receiving, addressing and monitoring any queries and complaints in relation to the Project construction works. This would address wider matters than traffic management, so will be further addressed in other documentation to be prepared by the contractor, once appointed.

6 Monitoring

Table 6-1 outlines the indicative responsibilities for the monitoring of temporary traffic planning that would be undertaken during the Project enabling and construction programme.

[Details to be confirmed, once contractor appointed]

Table 6-1: Indicative CTMP Monitoring Plan

Monitoring Activities	Frequency	Responsibility
Check method statements reflect requirements and requisite TMP has been approved	Prior to Work Packs being implemented	Construction Manager and Construction Traffic Manager
Inspect TTM layout	Two-hourly, when site is 'live'	STMS
Documented check of all TTM	Daily and, as layouts change	STMS
TTM Audit in accordance with CoPTTM	Monthly	Construction Traffic Manager
Review of communications log, incident register and workforce feedback	As issues arise, with quarterly review	Construction Manager
Road condition survey	Formal surveys pre-enabling works and at construction completion, and regular informal inspections	Construction Traffic Manager
Crash investigation	Report within 24 hours of an incident. Initial investigation within two working days with details provided to relevant Team Leader Compliance Monitoring at Auckland Council	Health and Safety Manager
Complaints	As issues arise with a quarterly review	Stakeholder Engagement Manager

7 Training

7.1 General

In addition to general Project training requirements, training in relation to temporary traffic management and the implementation of this CTMP is outlined in **Table 7-1**.

[Details to be confirmed, once contractor appointed]

Table 7-1: Indicative Training Activities

Qualification / Training	Description	Who
Project induction	Initial induction (refer **Section 7.2**)	All Project staff, including site staff, office staff and anyone who is approved to enter the site without an escort
Regular briefings	Meetings (likely weekly) to highlight key messages or issues and receive feedback	All site staff working on the Project at that time
STMS (Level 1)	NZQA Qualification to oversee site in 'live' road environment	Person responsible for setting out and monitoring traffic management
Traffic Controller	NZQA Qualification to assist with traffic management	All staff undertaking traffic management associated with the Project

7.2 Project Induction

The Project induction will address (but not be limited to) the following matters relevant to this CTMP:

- Information about the surrounding Project transport environment, including information relating to traffic management and safety of site staff and road users, as well as on haul routes (where relevant to specific staff, i.e. truck drivers)
- Roles and responsibilities of Project staff, including individual responsibilities around traffic management and safety
- Safety hazards – including pedestrians and cyclists, as well as manoeuvring plant, amongst others – particularly rules and processes to mitigate safety hazards
- Educating construction staff on the safety needs of pedestrians and cyclists adjacent to the Project sites, specifically along Woodlands Park Road, Scenic Drive, Exhibition Drive and Huia Road
- Key aspects of this CTMP, including interaction with existing transport users and land use activities along the identified haul routes
- Options for travel to and from the Project site/s
- Rules relating to parking at or in the vicinity of the Project site/s
- The emergency plan
- Looking after Project neighbours and the travelling public.

Appendix A – Site Specific Traffic Management Plans *[Placeholder]*

Appendix B – Staff Travel Management Plan *[Placeholder]*