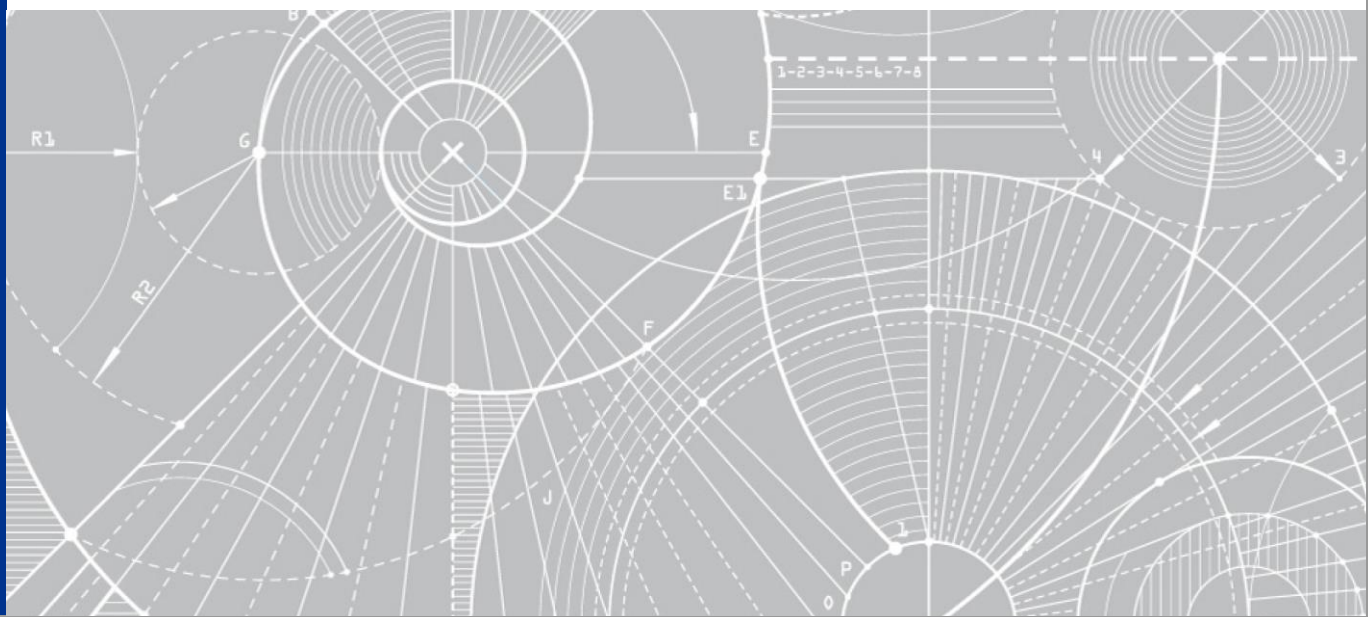
North Harbour 2 Watermain and Northern Interceptor Shared Corridor

WATERCARE SERVICES LIMITED

Technical Report E- Traffic Assessment

Final Report

26 April 2016



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Contents

Executive Summary

Jacobs has been commissioned by Watercare Services Limited (Watercare) to assess the potential traffic effects related to the construction, operation and maintenance of Watercare's proposed North Harbour 2 watermain (NH2) project between Titirangi and Albany and the land use effects associated with the construction, operation and maintenance of the Northern Interceptor (NI) project between Westgate and Hobsonville, where a shared corridor is proposed for both water and wastewater infrastructure. In general, the shared corridor which contains the NH2 and NI alignments is located outside of the road corridor and hence will have minimal impacts to the road network. All construction sites can be accessed safely from the roading network. There is no work within the live lanes of SH18. This traffic assessment focusses on the construction traffic effects of the project on the existing transport environment. Upon completion of the project the transport environment will be restored to the pre-construction condition i.e. there will be no lasting effect on the transport environment post construction and the effect of maintenance operations will be less than minor.

The majority of the NH2 watermain and NI pipeline in the shared corridor will be able to be installed whilst maintaining two traffic lanes through the worksite. Where this is possible, impacts to traffic are expected to be less than minor since the existing corridor is generally comprised of two lane roads. A lower speed limit will be implemented through the construction area which will slightly reduce the throughput of the road however the short distance over which this will be required means that this impact will be minimal.

Where only one lane is able to remain open, SIDRA modelling has been undertaken to assess the performance of an alternating two-way traffic control system. More than minor impacts such as increased delays and significant queuing from this traffic system may occur along:

- Parrs Cross Road – Between Seymour Avenue and Pine Avenue; and
- Don Buck Road – Between Swanson Road and Red Hills Road.

Mitigation measures such as strong communication prior to construction, advising of possible detours and construction during off peak hours could be implemented to help mitigate these impacts and reduce the effects to no more than minor.

Where the NH2 watermain and NI pipeline in the shared corridor alignment passes through roundabouts and other major intersections it is assumed construction will be staged to enable all movements to be maintained during construction. Manual traffic control will be required and SIDRA modelling has been undertaken to assess the performance of these manually controlled intersections. More than minor impacts such as increased delays and significant queuing may occur at:

- The West Coast Road / Parrs Cross Road roundabout will require manual traffic control whilst construction activities take place to ensure all movements can be safely accommodated. See Section 4.3
- Queues on Parrs Cross Road are expected to propagate back to the Seymour Road roundabout, causing delays at this intersection. Further detail is provided in Section 4.3.2
- Swanson Road at the Metcalfe Road and Universal Drive roundabouts. It is recommended that construction take place outside of the AM and PM peak periods. See Section 4.7;
- Ranui level crossing. Option 1 for this location would need to be undertaken during the weekend to minimise impacts to the rail network. See Section 4.6;
- William Pickering Drive / Douglas Alexander Parade roundabout. Recommended mitigation measures include banning right turns from William Pickering Drive during construction. See Section 6.3; and
- Brigham Creek Road / SH18 roundabout due to access requirements to microtunnel pits 10, 11 and 12. Recommended mitigation measures include the provision of advance warning signage. See Section 8.3.1.

Minor impacts are expected for pedestrian traffic as the construction area may be required to occupy footpaths. Adequate signage at safe crossings prior to construction areas will mitigate these effects.

Effects to cyclists are expected to be less than minor. The majority of the construction alignment does not contain dedicated cycle facilities however cycle lanes do exist on Don Buck Road and Rosedale Road and these will be able to be maintained during construction. On the rest of the corridor, the reduced speed of traffic through the construction site may in fact improve cycling conditions.

The expected volume of construction vehicle movements is less than 40 per day and will not have any adverse impacts on the surrounding road network. Parking for construction workers will need to be carefully planned so as to avoid adverse impacts on the road network. Site parking is subject to further investigation and will need to be arranged on a site by site basis.

Where on-street parking currently exists, parking restrictions will need to be implemented in order to provide sufficient space in the corridor for the work areas. These restrictions will need to be implemented in the evening prior to work starting and will be in place for one to two days. The amount of parking to be restricted will depend on the length of trench being dug at each particular location i.e. approximately 50m.

Access to properties will be maintained at all times along the route.

A project specific traffic management plan (TMP) will be required to be prepared by the appointed contractor prior to the commencement of construction works.

The effects on the transport environment are assessed as being no more than minor assuming that recommended mitigation measures are implemented.

1. Introduction

Jacobs has been commissioned by Watercare Services Limited (Watercare) to assess the potential traffic effects related to the construction, operation and maintenance of Watercare's proposed North Harbour 2 watermain (NH2) project between Titirangi and Albany and the land use effects associated with the construction, operation and maintenance of the Northern Interceptor (NI) project between Westgate and Hobsonville, where a shared corridor is proposed for both water and wastewater infrastructure.

The NH2 will convey potable water from storage reservoirs in Titirangi, via west Auckland and North Shore to storage reservoirs in Albany (a length of approximately 33km). Its purpose will be to increase capacity and resilience of the water supply network to western and northern Auckland.

The NH2 project incorporates:

- Pipeline installation, operation and maintenance of a new watermain of 1200 mm (west of Greenhithe Bridge) and 900mm (east of Greenhithe Bridge) nominal diameters (DN);
- Pipeline length of approximately 33km mostly within public road reserve; and
- Other features including valve chambers, scour valves, air valves, line valves, bulk supply points, pipe bridges, and associated works.

Most of the watermain will be constructed by open trenching, micro tunnelling or bored tunnel (the latter two referred to as "trenchless technology") within a typical construction corridor of approximately 12 – 22 metres width with additional areas required for erosion and sediment control devices, traffic management, construction yards and storage areas at intervals along the route for construction purposes.

The NI project comprises of a new wastewater pipeline and associated activities to convey flows from north-west Auckland to the Hobsonville Pump Station, and then to the Rosedale Wastewater Treatment Plant (WWTP).

The proposed NI project in the shared corridor begins in the vicinity of Hobsonville Road (West Harbour), near the intersection of the Upper Harbour and North Western Motorways (SH18 and SH16). From this location, the alignment follows the southern side of the SH18, continuing northeast to the Hobsonville Pump Station. Future phases of the NI project will also include new pipelines between the Hobsonville Pump Station and the SH18 causeway.

Within the shared corridor, the NI project incorporates the following:

- A new 5km wastewater pipeline of 2100mm DN;
- 16 pits / shafts for trenchless technology construction purposes. Five of these will be permanent manholes (MT Pits 2, 7, 11, 13 & 17) while the others (MT Pits 3, 4, 5, 6, 8, 9, 10, 12, 14, 15 and 16) will be temporary only until construction / testing is completed;
- MT Pit 7 will be a drop structure with permanent access, to allow for a future wastewater pipeline connection across SH18;
- A new 50m long wastewater pipeline and manholes connecting the 2100mm ND pipeline to the existing pump station;
- A new 1750 l/s Pump Station with future capacity across the site of 3,500l/s;
- Wastewater storage (within pipeline);
- Two 800m 1500mm DN rising mains (length to the causeway); and
- A 2100mm DN pipe installed by trenchless technology at SH18.

The proposed alignment of NH2 and the location of the NI project are shown in Figure 1 below.

A full description of the proposed works and construction methodology is included in in the North Harbour 2 Watermain and Northern Interceptor Shared Corridor Assessment of Effects on the Environment (the AEE report) prepared by AECOM Consulting Services (NZ) Ltd (AECOM) and Jacobs New Zealand Limited (Jacobs).

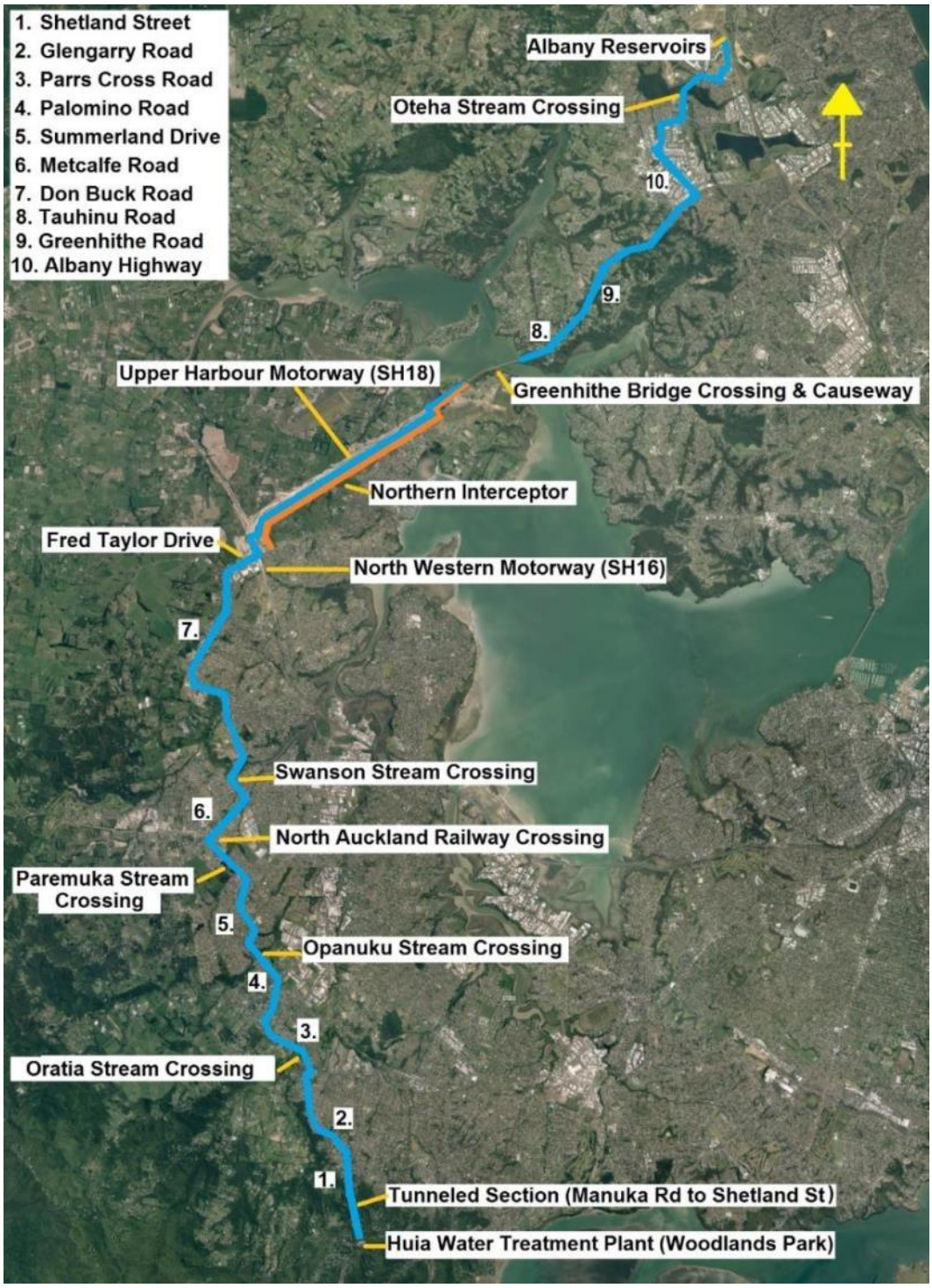


Figure 1 – Blue line is the proposed NH2 route and Orange line is NI section within shared corridor

Watercare is proposing to designate land for the NH2 project between Titirangi and Albany and the NI project between Westgate and Hobsonville, and will also be seeking various resource consents for NH2 under the Resource Management Act 1991 (RMA). This technical report provides specialist input for the AEE which supports the Notices of Requirement for designation (NOR) and the resource consent applications. The alignment drawings referred to in this report are contained within Volume 3 of the AEE. Resource consents required for works associated with the NI project will be sought by Watercare at a later date, nearer to the proposed date of construction.

This report provides the following:

- A description of the proposed works;
- A description of the existing transport environment;
- An assessment of the potential effects on the transport environment. This includes the identification of activities that could result in potential adverse effects and, in turn, identifying refinements or construction methodologies that could avoid, remedy or mitigate such effects; and
- Conclusions.

2. Transport assessment scope and methodology

This transport assessment focusses on the construction traffic effects of the project on the existing transport environment. Upon completion of the project, the transport environment will be restored to the pre-construction condition i.e. there will be no lasting effect on the transport environment post construction and the effect of maintenance operations will be less than minor.

The effects to the transport network are envisaged to arise from the construction activities taking place in the road corridor. In general, this will lead to a reduction in road capacity which may cause delays or disruptions to some road users.

This assessment has investigated the potential effects of the NH2 project and NI shared corridor during weekday AM and PM peak periods. These are the times at which delays and disruptions will be most significant. This assessment will however recommend locations where off-peak work may be required to mitigate traffic effects.

The construction methodology for the project states that the majority of the watermain will be installed using open trenching. It is understood that the required work area will be approximately 9m wide x 40m long in addition to approach areas for distance / setbacks required for any traffic management. There would be some flexibility in the working areas where constraints exist, particularly in terms of the length of working areas. In particular, trenching through major intersections will need to be staged in small sections to ensure all traffic movements can be maintained where practical.

The NZTA *Code of Practice for Temporary Traffic Management* (CoPTTM) states that the minimum width of a general traffic lane during temporary traffic management is 2.75m, assuming a speed limit of 40 km/h through the works area. Therefore it has been assumed that at least 5.5m is required to maintain two way traffic flow along the corridor during construction.

Some sections of the watermain are planned to be installed using trenchless technology. This will enable surface disruptions to be minimised and traffic effects constrained to only the areas containing the launching and receiving pits of the pipe sections.

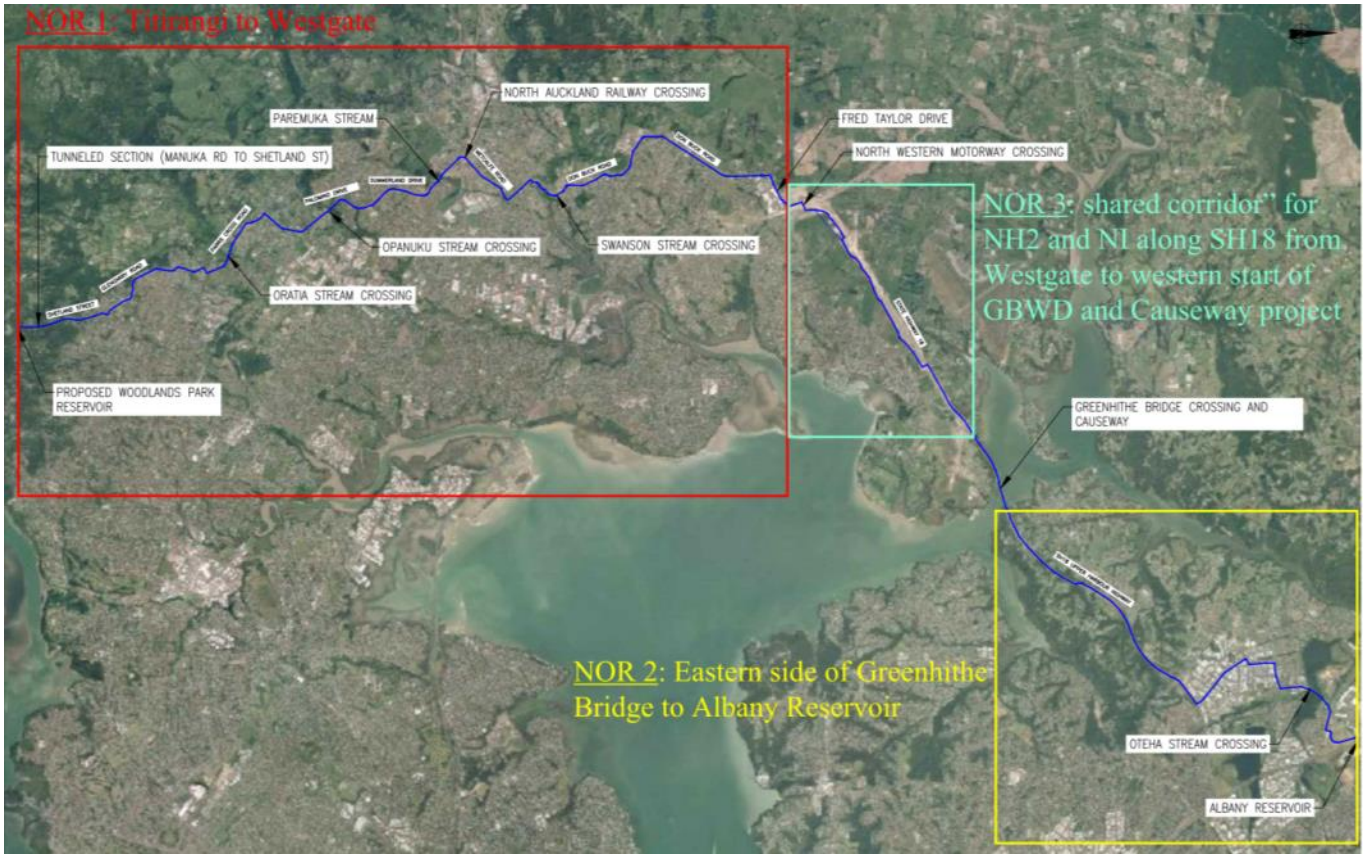
Traffic data used for SIDRA modelling has been obtained from Auckland Transport's Traffic Flow Counting Programme[1]. Traffic counts have been increased at a 1% per year linear growth rate in order to derive predicted volumes for 2018. This data is provided as bi-directional counts at midblock sections along the watermain alignment. It is noted that ongoing development in North-West Auckland which may result in traffic growth in excess of the 1% per year assumed in this analysis. It is recommended that traffic volumes are assessed again closer to the construction date. In the event of larger than expected traffic growth, mitigation measures such as construction during off-peak periods will be sufficient to provide acceptable outcomes.

The configuration of major intersections during construction will involve manual traffic control and it has been assumed that only one leg of the intersection is operating at any one time. Midblock counts are therefore sufficient to assess the performance of intersections using SIDRA, since the total volume on each leg is the constraining factor. The proportion of each turning movement can however have an impact on capacity and so these proportions have been estimated based on the volume of side roads at each intersection.

The assessment has been undertaken in three sections, to coincide with the three Notice of Requirements (NORs) being lodged. These three NORs are shown in Figure 2.1

[1] https://at.govt.nz/about-us/reports-publications/traffic-counts/

Figure 2.1 : Notice of Requirement corridors



3. NOR1 - Existing transport environment

NOR1 covers the area from the proposed Woodlands Park reservoir in the south to Fred Taylor Drive at Westgate.

3.1 Road network

A summary of the average traffic on roads along the proposed watermain route in the NOR1 corridor is shown in Table 3.1. Traffic data has been obtained from Auckland Transport's traffic flow counting programme. The year of collection varies from 2013 to 2015. All counts have been increased at a 1% per year linear growth rate in order to derive predicted volumes for 2018.

Table 3.1 : NOR1 Average traffic figures

Road	Average daily traffic (veh/day)	Heavy vehicle (%)	Average AM peak hour traffic (veh/hour)	Average PM peak hour traffic (veh/hour)
Glengarry Road	4,898	2.5%	531	611
Parrs Cross Road	26,836	3.1%	2,488	2,725
Palomino Drive / Border Road	12,311	4.3%	1,268	1,314
Summerland Drive	9,041	3.0%	884	1,005
Metcalfe Road	15,854	2.7%	1,445	1,444
Don Buck Road – south	17,414	3.1%	1,950	1,892
Don Buck Road - north	23,140	3.9%	2,261	2,591

3.2 Public transport

3.2.1 Bus

Auckland Transport is in the process of implementing the New Network. This is a new region-wide public transport network which involves significant changes to the existing bus routes and timetables. The New Network for West Auckland is to be implemented in late 2016 i.e. before construction begins on NH2. Bus routes in the New Network which will travel on roads along the proposed watermain route in the NOR1 corridor are shown in Table 3.2

Table 3.2 : Bus routes in project corridor

Corridor	Bus Routes
Glengarry Rd / Parrs Cross Rd	W23 (local), W25 (connector)
Forest Hill Road	W61 (connector)
Border Road / Summerland Drive / Munroe Road	W61 (connector)
Metcalfe Road	W61 (connector)
Swanson Road	W5 (connector)
Don Buck Road (south)	W5 (connector), W71 (weekday peak only)
Don Buck Road (north)	W5 (connector), W71 (weekday peak only), W3b (frequent)

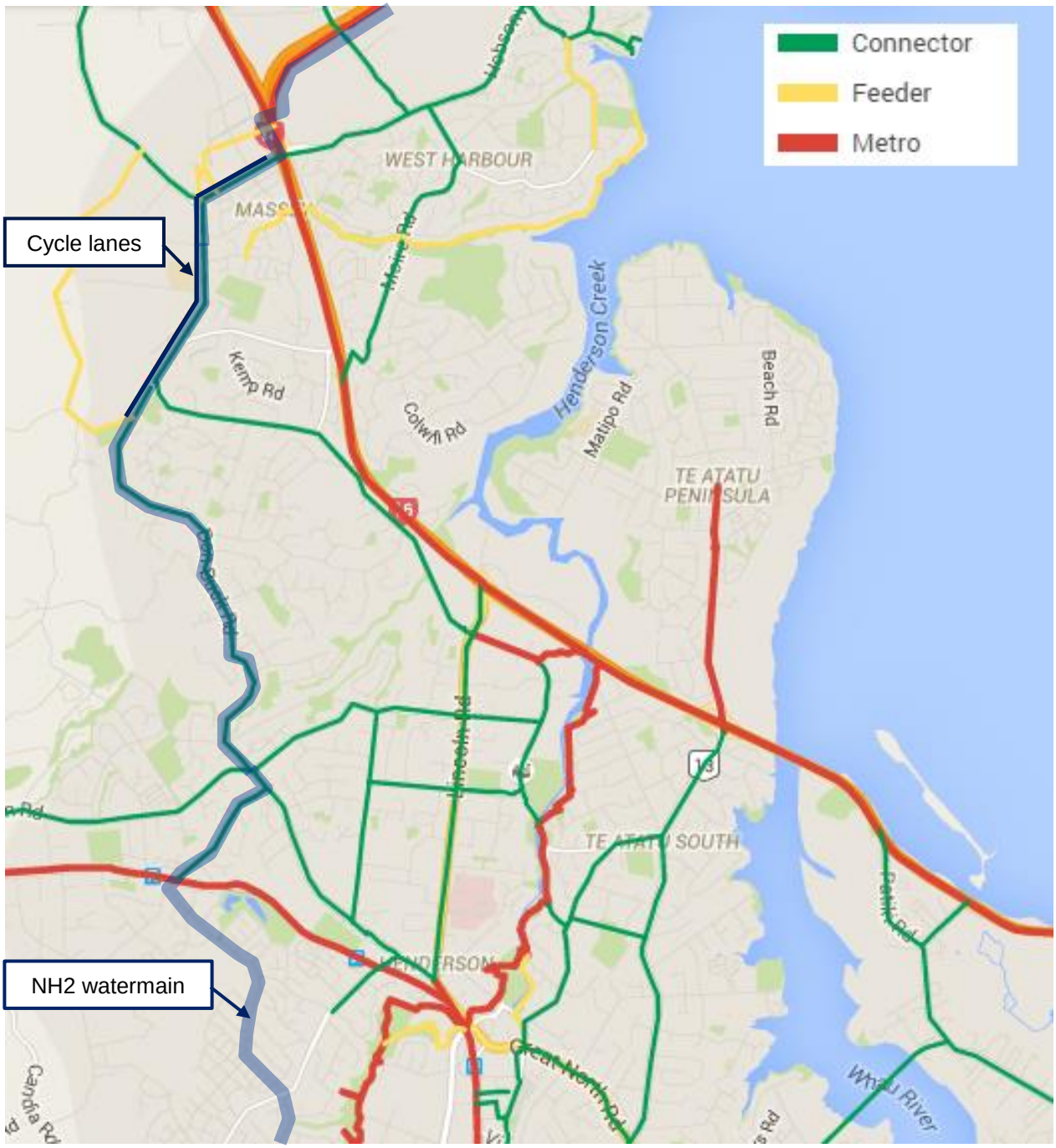
3.2.2 Rail

The watermain alignment runs through the level crossing of the Western rail line at Metcalfe Road. Ranui train station is located directly to the west of this level crossing. Trains on the Western line currently run at 15 minute frequencies in the peak periods and 30 minute frequencies off-peak. Auckland Transport is committed to providing peak services at 10 minute frequencies in the future however the timing of this change is not yet known.

3.3 Cycling

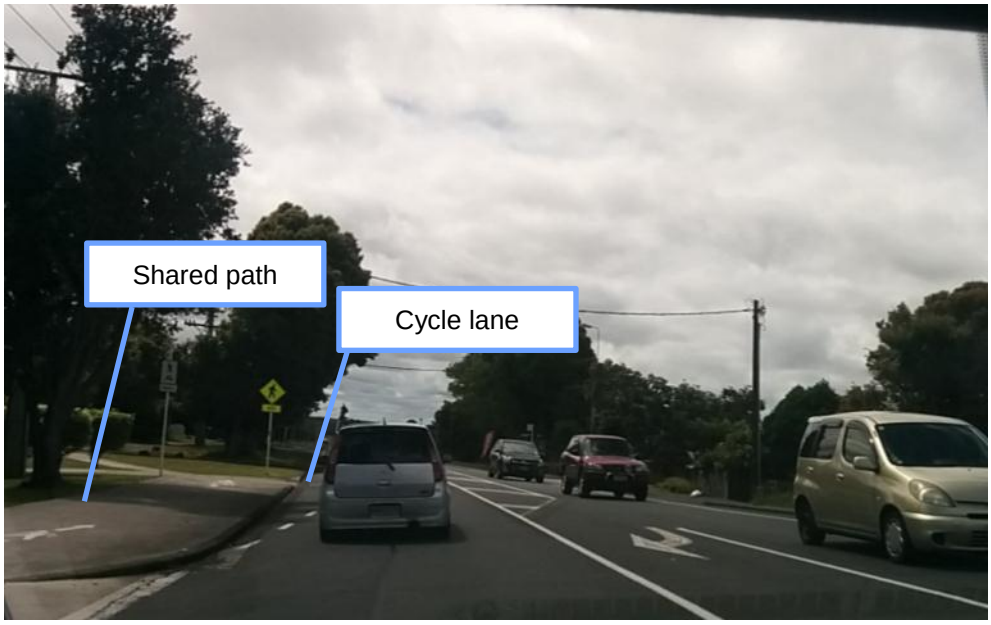
The Auckland strategic cycle network is shown in Figure 3.1. It is noted that the watermain alignment runs along the connector route on Don Buck Road, Swanson Road and Metcalfe Road.

Figure 3.1 : NOR1 - Auckland strategic cycle network



Dedicated cycle facilities are only provided on Don Buck Road north of Red Hills Road and along Fred Taylor Drive. Cycle lanes are not physically separated from traffic and are not continuous through intersections. A shared pedestrian and cycle path runs intermittently along Don Buck Road and allows cyclists to safely pass through intersections without needing to ride directly with general traffic. This shared path / cycle lane arrangement is shown in Figure 3.2.

Figure 3.2 : Don Buck Road shared paths and cycle lanes



The remainder of the watermain alignment in the NOR1 corridor does not contain any dedicated cycle facilities.

3.4 Walking

The majority of the corridor contains footpaths on at least one side of the road. According to 2013 census data, the active mode share (cycling, walking, jogging) for the Waitakere Ranges and Henderson-Massey local board areas was approximately 5%, indicating a low level of non-motorised transport use.

4. NOR1 – Traffic effects

4.1 General impacts

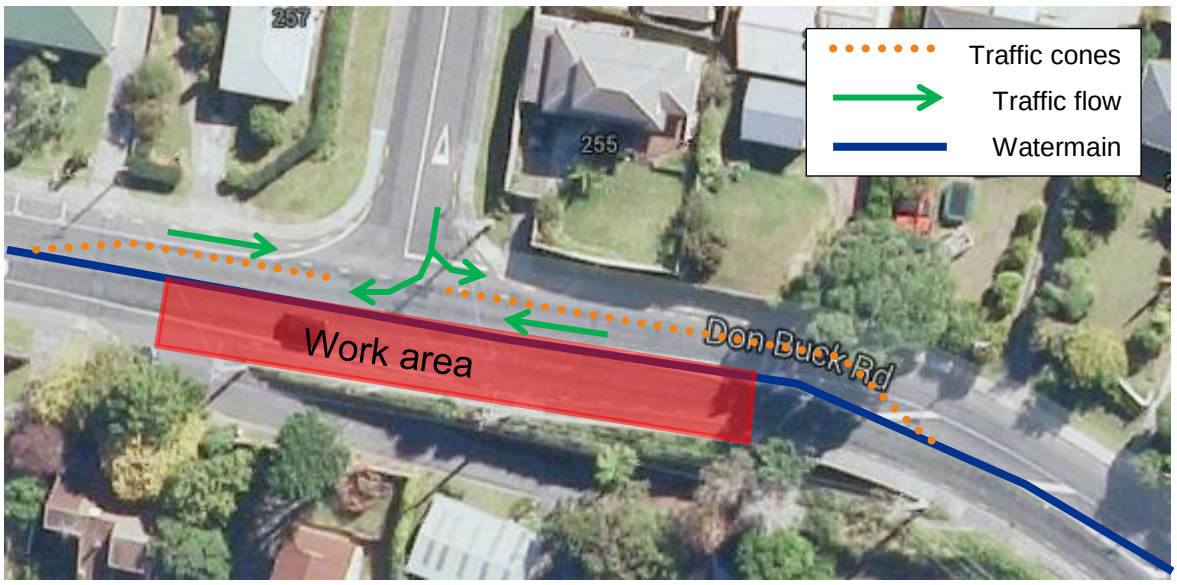
This section outlines typical traffic effects along the corridor. Specific effects relating to strategically important roads and intersections are presented in Section 4.2 onwards.

The majority of the watermain will be installed whilst maintaining two traffic lanes through the worksite. Where this is possible, impacts to traffic are expected to be less than minor since the existing corridor generally comprises of two lane roads. A lower speed limit will be implemented through the construction area which will slightly reduce the throughput of the road however the short distance over which this will be required means that this impact will be minimal.

4.1.1 Intersections

Where the alignment passes through intersections, it is assumed that access will be maintained for all traffic movements. For three-legged intersections, all effort should be made to setup the construction work area on the far side of the intersection as shown in Figure 4.1. This allows a full length of watermain to be constructed without the need for intersection staging. This configuration will lead to only minor impacts as a result of a reduction in lane widths and speed limits.

Figure 4.1 : Typical intersection layout



Four-legged intersections and all roundabouts will require staging of construction and manual traffic control in order to maintain all movements during construction. Detailed analysis of these intersections is presented in Section 4.2 onwards.

4.1.2 Pedestrian impacts

Pedestrian access may need to be restricted on one side of the corridor to allow sufficient space for construction. Advance warning signs located at safe and appropriate crossing points should be implemented to allow pedestrians to avoid the construction area. Detailed plans regarding pedestrian access will need to be prepared by the appointed contractor as part of a construction management plan. No more than minor impacts are expected.

4.1.3 Cycling impacts

Cycle facilities identified in Section 3.3 should be maintained during construction where possible. Provision for cycle access around the work area, on the opposite side to traffic, should be considered if cycle lanes are to be occupied by work areas. In areas where no cycle facilities currently exist, the nature of the construction works is such that traffic will be travelling at lower speeds which will provide a more favourable cycling environment. The narrow lane widths will however force cyclists to merge in with general traffic through the work area which may increase the risk to cyclists. The short length of the work areas however means that these risks and impacts are considered no more than minor.

4.1.4 Parking and property access impacts

Where on-street parking currently exists, parking restrictions will need to be implemented in order to provide sufficient space in the corridor for the work areas. These restrictions will need to be implemented the evening prior to work starting and will be in place for one to two days. The amount of parking to be restricted will depend on the length of trench being dug at each particular location i.e. approximately 80m (20-30m of trench plus transition / working areas at both ends of trench).

Access to properties is be maintained at all times along the route. Locations where access restriction may be required have been noted in the following sections.

4.1.5 Construction vehicles

Daily construction related vehicle movements have been estimated at approximately 40 (20 in each direction), but will depend on the length and complexity of each construction section. This includes construction vehicles for spoil removal and supply of plant and materials. This volume of vehicle movements is relatively small and will not have any adverse traffic impacts on the surrounding road network. Parking for construction workers will need to be carefully planned so as to avoid adverse impacts on the road network. Site parking is subject to further investigation and will need to be addressed in the TMP prepared by the appointed contractor.

4.2 Shetland Street / Phillip Avenue / Glengarry Road

4.2.1 Shetland Street

Shetland Street is relatively narrow so the working area required for pipe installation will take up the majority of the carriageway. Some properties on the western side of the street, at the southern end, will be able to use the small access road on this side of the carriageway however residents on the eastern side of the road will have their access restricted.

Residents should be given sufficient notice of the disruptions and all efforts will need to be made to minimise the severity and duration of the access restrictions.

Shetland Street is a dead end so does not carry any through traffic. Therefore the construction effects will only impact the local residents.

Pedestrian access should be maintained at all times.

The Shetland Street / Phillip Avenue intersection will require manual traffic control whilst construction activities take place to ensure all movements can be safely accommodated. The low traffic volumes at this intersection mean that construction activities will have only minor effects.

4.2.2 Phillip Avenue

The road reserve along Phillip Avenue is wide enough to maintain two lanes at least 2.75m wide during construction. Construction impacts will therefore be less than minor.

The Glengarry Road / Phillip Avenue intersection will require manual traffic control whilst construction activities take place to ensure all movements can be safely accommodated. The low traffic volumes at this intersection mean that construction activities will have only minor effects.

4.2.3 Glengarry Road

Between Phillip Street and Maywood Crescent and between Meynell Court and West Coast Road the road reserve is wide enough only to provide one lane during construction. Manual traffic control will therefore be required to allow alternating two-way traffic flow. SIDRA modelling has been undertaken to examine the impacts of such a traffic control scheme. Modelling has shown that delays will be minimal and queue lengths relatively short.

Table 4.1 : Glengarry Road - one lane system performance

Period	Direction	Delay (sec)	Average queue length (m)
AM peak	Northbound	11	31
	Southbound	13	20
PM peak	Northbound	13	25
	Southbound	12	38

The remaining sections of Glengarry Road are wide enough to maintain two lanes at least 2.75m wide during construction. Construction impacts will therefore be less than minor.

4.3 West Coast Road / Parrs Cross Road

4.3.1 West Coast Road

West Coast Road is wide enough to maintain two lanes at least 2.75m wide during construction. Construction impacts will therefore be less than minor.

The West Coast Road / Parrs Cross Road roundabout will require manual traffic control whilst construction activities take place to ensure all movements can be safely accommodated. The roundabout will effectively operate as a signalised intersection during construction due to the reduction in available road space through the roundabout. Works at this intersection are expected to take no more than five days.

SIDRA modelling has been undertaken to assess the impact of construction at this intersection.

Table 4.2 : Parrs Cross Road/West Coast Road intersection performance

Period	Approach	Existing			Construction		
		Delay (sec)	Average queue length (m)	Level of Service	Delay (sec)	Average queue length (m)	Level of Service
AM peak	Parrs Cross Rd - North	10	39	B	62	333	E
	W Coast Rd - West	12	13		47	90	
	W Coast Rd - East	11	15		83	159	
PM peak	Parrs Cross Rd - North	9	25	B	80	299	E
	W Coast Rd - West	13	11		60	64	
	W Coast Rd - East	13	43		58	277	

It is predicted that the manually controlled intersection will operate at Level of Service (LoS) E in both the AM and PM peaks. All approaches will experience some moderate delay and queuing. These effects are considered to be minor due to the very short construction duration.

4.3.2 Parrs Cross Road

Between West Coast Road and Bruce Mclaren Road, the road reserve along Parrs Cross Road is wide enough to maintain two lanes at least 2.75m wide during construction. Construction impacts along this corridor will therefore be less than minor.

Between Bruce Mclaren Road and Pine Avenue the road reserve is wide enough only to provide one lane during construction. Manual traffic control will therefore be required to allow alternating two-way traffic flow. SIDRA modelling has been undertaken to examine the impacts of such a traffic control scheme.

This section of Parrs Cross Road is 270m so construction is expected to take approximately four to five weeks, assuming 60m of trenching per week.

Table 4.3 : Parrs Cross Road - one lane system performance

Period	Direction	Delay (sec)	Average queue length (m)
AM peak	Northbound	75	393
	Southbound	57	561
PM peak	Northbound	93	750
	Southbound	109	503

The modelled delays of more than 60 seconds are considered more than minor since existing conditions are free flow with no delay. Vehicle volumes are relatively large with approximately 2,500 vehicles set to experience these delays in both the AM and PM peak hours. Similarly, no queues currently exist along Parrs Cross Road so the impact of the modelled queue lengths is considered to be more than minor. Northbound queues are expected to propagate back to the Seymour Road roundabout, causing delays at this intersection.

There is limited scope to provide detours through this area so it is unlikely that significant reductions in traffic could be achieved. A targeted campaign to inform drivers of expected impacts may provide some suppression during peak travel periods and demand may spread either side of the peak hours, reducing the impacts of the works.

It is therefore recommended that all efforts are made to reduce both the width and length of the work area at this location. Where possible, construction should be limited to off-peak times and / or school holidays. There may also be the possibility of temporarily using small sections of private properties to the south of Parrs Cross Road to limit the amount of road width required for construction. If construction can be avoided during regular AM and PM peak periods, the effects on this section would be considered no more than minor. It has been assumed that sufficient road width for two-lane flow can be re-instated after each day's work. Potential adverse traffic impacts could be mitigated by limiting the working hours to the inter-peak period (9am to 4pm).

Parrs Cross Road between Pine Avenue and Forest Hill Road will also require a one lane traffic management scheme with alternating two-way flow. No traffic count data is available for this section however the nature of the road and surrounding network indicates that volumes will be significantly less than the previous section, resulting in only minor impacts.

4.4 Forest Hill Road / Border Road

4.4.1 Forest Hill Road

The road reserve along Forrest Hill Road is wide enough to maintain two lanes at least 2.75m wide during construction. Construction impacts along this corridor will therefore be less than minor.

The Forrest Hill Road / Henderson Valley Road roundabout will require manual traffic control whilst construction activities take place to ensure all movements can be safely accommodated. The roundabout will effectively operate as a signalised intersection during construction due to the reduction in available road space through the roundabout. Only one approach leg would be able to flow at any one time. Works at this intersection are expected to take no more than five days.

SIDRA modelling has been undertaken to assess the impact of construction at this intersection.

Table 4.4 : Border Road/Henderson Valley Road/Forrest Hill Road intersection performance

Period	Approach	Existing			Construction		
		Delay (sec)	Average queue length (m)	Level of Service	Delay (sec)	Average queue length (m)	Level of Service
AM peak	Border Road – North	11	22	B	29	83	D
	Henderson Valley Road – East	11	16		51	108	
	Forrest Hill Road – South	12	19		40	99	
	Henderson Valley Road – West	13	19		48	75	
PM peak	Border Road – North	10	14	B	75	150	E
	Henderson Valley Road – East	12	33		67	272	
	Forrest Hill Road – South	24	96		65	267	
	Henderson Valley Road – West	20	27		74	94	

It is predicted that the manually controlled intersection will operate at LoS D in AM peak and LoS E in the PM peaks. All approaches will experience some moderate delay and queuing, particularly along Henderson Valley Road in the PM peak.

There is limited scope to provide detours through this area so it is unlikely that significant reductions in traffic could be achieved. A targeted campaign to inform drivers of expected impacts may provide some suppression during peak travel periods and demand may spread either side of the peak hours, reducing the impacts of the works.

Overall, these effects are considered to be minor due to the very short construction duration.

4.5 Border Road / Palomino Drive / Summerland Drive

4.5.1 Border Road / Palomino Drive

Border Road and Palomino Drive are both wide enough to maintain two lanes at least 2.75m wide during construction. Construction impacts along this corridor will therefore be less than minor.

The Sturges Road / Border Road / Summerland Drive roundabout will require manual traffic control whilst construction activities take place to ensure all movements can be safely accommodated. The roundabout will effectively operate as a signalised intersection during construction due to the reduction in available road space through the roundabout. Only one approach leg would be able to flow at any one time. Works at this intersection are expected to take no more than five days.

SIDRA modelling has been undertaken to assess the impact of construction at this intersection.

Table 4.5 : Summerland Drive/Sturges Road/Palomino Drive intersection performance

Period	Approach	Existing			Construction		
		Delay (sec)	Average queue length (m)	Level of Service	Delay (sec)	Average queue length (m)	Level of Service
AM peak	Summerland Drive – North	10	13	B	36	60	D
	Sturges Road – East	10	21		34	84	
	Palomino Drive – South	10	10		36	57	
	Sturges Road – West	11	15		37	74	
PM peak	Summerland Drive – North	9	9	B	64	64	D
	Sturges Road – East	12	40		51	184	
	Palomino Drive – South	18	44		37	103	
	Sturges Road – West	12	12		45	46	

It is predicted that the manually controlled intersection will operate at LoS D in both the AM and PM peaks. All approaches will experience some moderate delay and queuing. These effects are considered to be minor due to the very short construction duration.

4.5.2 Summerland Drive

Summerland Drive is wide enough to maintain two lanes at least 2.75m wide during construction. Construction impacts along this corridor will therefore be less than minor.

The Sturges Road / Border Road / Summerland Drive roundabout will require manual traffic control whilst construction activities take place to ensure all movements can be safely accommodated. The roundabout will effectively operate as a signalised intersection during construction due to the reduction in available road space through the roundabout. Only one approach leg would be able to flow at any one time. Works at this intersection are expected to take no more than five days.

SIDRA modelling has been undertaken to assess the impact of construction at this intersection.

Table 4.6 : Summerland Drive/Harvest Drive intersection performance

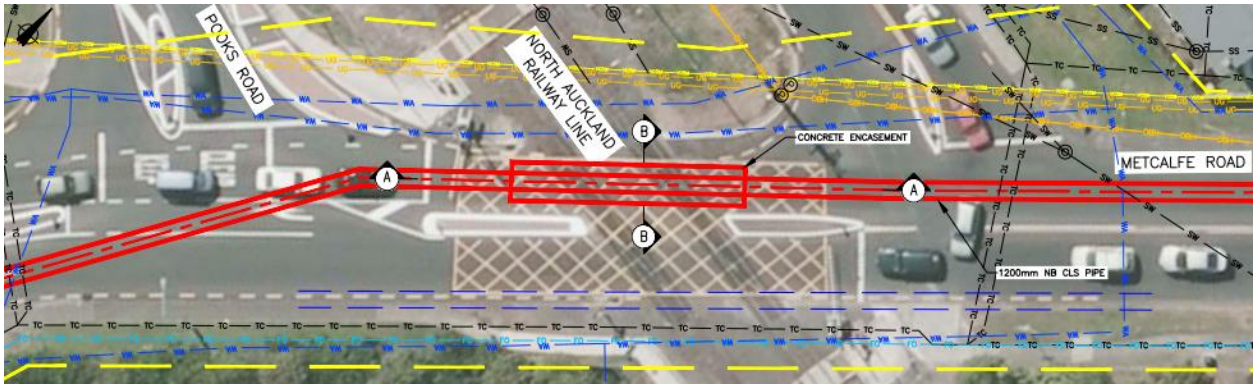
Period	Approach	Existing			Construction		
		Delay (sec)	Average queue length (m)	Level of Service	Delay (sec)	Average queue length (m)	Level of Service
AM peak	Summerland Drive – North	10	11	A	21	31	C
	Harvest Drive – East	10	4		30	10	
	Summerland Drive – South	8	12		21	37	

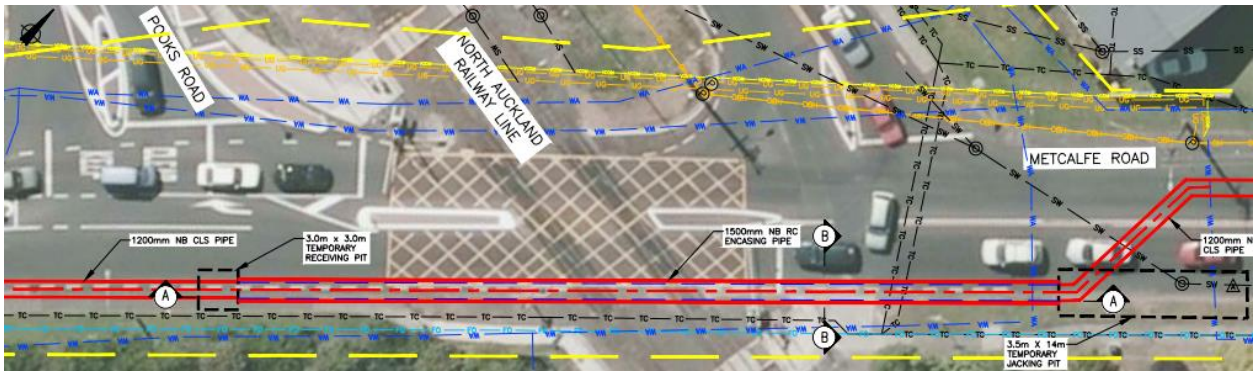
Period	Approach	Existing			Construction		
		Delay (sec)	Average queue length (m)	Level of Service	Delay (sec)	Average queue length (m)	Level of Service
PM peak	Summerland Drive – North	10	15	A	30	58	D
	Harvest Drive – East	11	9		28	28	
	Summerland Drive – South	9	29		24	85	

It is predicted that the manually controlled intersection will operate at LoS C in the AM and PM peaks. All approaches will experience some minor delay and moderate queuing. The scale of these effects is considered to be minor.

4.6 Ranui level crossing

There are two options being considered for construction of the watermain across the Ranui level crossing on Metcalfe Road. Option 1 involves using open trenching similar to that undertaken for most of the project. Option 2 utilises trenchless construction.





Option 1 would require a block-of-line to be implemented by KiwiRail to allow for the construction of the watermain section across the railway. The required block-of-line is expected to be required for approximately five days. This work would likely take place over the weekend in order to minimise impacts to the rail network.

Option 2 would allow construction to occur without impacting the railway line.

Both options would likely require closure of one lane on Metcalfe Road during the works. Manual traffic control will therefore be required to allow alternating two-way traffic flow. SIDRA modelling has been undertaken to examine the impacts of such a traffic control scheme.

Table 4.7 : Metcalfe Road - one lane system performance

Period	Direction	Delay (sec)	Average queue length (m)
AM peak	Eastbound	37	323
	Westbound	43	229
PM peak	Eastbound	40	198
	Westbound	35	300

Average delay is expected to be moderate in the AM and PM peaks and fairly significant queues may form. Alternative level crossings are available at Candia Road approximately 1.5km to the west and Sturges Road 1.6km to the east. Some traffic may find these alternative routes to be more efficient and hence some traffic reduction is possible on Metcalfe Road. These alternative routes should be communicated through the use of signage near the Pooks Road / Metcalfe Road intersection and the Swanson Road / Metcalfe Road intersection.

However, the effects to the rail network of Option 1 would lead to more than minor impacts. It is recommended that all efforts are made to minimise the duration of construction and undertake work during off-peak times if possible.

Option 2 would lead to less disruption to the overall transport network than Option 1 due to the ability to maintain train operations during construction. The overall impacts of Option 2 are therefore considered to be less than minor.

4.7 Metcalfe Road / Swanson Road

Metcalfe Road north of the level crossing is wide enough to maintain two lanes at least 2.75m wide during construction. Construction impacts along this corridor will therefore be less than minor.

The Metcalfe Road / Swanson Road roundabout will require manual traffic control whilst construction activities take place to ensure all movements can be safely accommodated. The roundabout will effectively operate as a signalised intersection during construction due to the reduction in available road space through the roundabout. Only one approach leg would be able to flow at any one time. Works at this intersection are expected to take no more than five days.

SIDRA modelling has been undertaken to assess the impact of construction at this intersection.

Table 4.8 : Swanson Road/Metcalfe Road intersection performance

Period	Approach	Existing			Construction		
		Delay (sec)	Average queue length (m)	Level of Service	Delay (sec)	Average queue length (m)	Level of Service
AM peak	Swanson Road - North	37	230	C	115	449	F
	Swanson Road - South	10	29		126	348	
	Metcalfe Road - West	15	39		137	303	
PM peak	Swanson Road - North	11	32	C	61	228	E
	Swanson Road - South	59	292		52	264	
	Metcalfe Road - West	13	18		97	136	

All approaches are predicted to experience some significant delay. The queue length on the northern Swanson Road approach leg may cause issues due to the nearby Swanson Road / Universal Drive roundabout. This

intersection is 135m to the north and modelling indicates queues on Swanson Road would propagate back and block this critical intersection. These impacts are likely to be unacceptable and consideration will need to be given to undertaking works during off-peak periods. A detailed methodology for mitigation of these effects will need to be confirmed in the TMP prepared by the appointed contractor.

Construction impacts at the nearby Swanson Road / Universal Road roundabout have also been assessed.

Table 4.9 : Don Buck Road/Universal Drive/Swanson Road intersection performance

Period	Approach	Existing			Construction		
		Delay (sec)	Average queue length (m)	Level of Service	Delay (sec)	Average queue length (m)	Level of Service
AM peak	Don Buck Road – North	68	212	C	92	270	F
	Universal Drive – East	18	33		125	168	
	Swanson Road – South	13	30		123	244	
	Swanson Road - West	18	36		71	122	
PM peak	Don Buck Road – North	17	58	C	192	440	F
	Universal Drive – East	26	79		226	453	
	Swanson Road – South	32	109		202	458	
	Swanson Road - West	14	21		136	177	

Significant additional delays and queuing is expected in both the AM and PM peaks which would cause major impacts to this intersection and the surrounding network. Approximately 4,000 vehicles use this intersection in the AM and PM peak hours so the overall impact of construction during these periods would be significant. Modelled queues would propagate back to the Metcalfe Road / Swanson Road intersection, also causing major delays at this location. This corridor is a key component of the road network in north-west Auckland and there are limited opportunities to provide detours or alternative routes.

These impacts are not considered acceptable. Works during peak periods will need to be avoided with construction taking place outside of these times. Weekend traffic data is not available however it is likely that traffic impacts at this time will still be significant. Consideration should be given to undertaking night works for this section of watermain construction. It has been assumed that the full intersection can be re-instated after each day's work. Potential adverse traffic impacts could be mitigated by limiting the working hours to the inter-peak period (9am to 4pm).

The significant queues anticipated during the AM and PM peaks at both the Metcalfe Road / Swanson Road and Swanson Road / Universal Road roundabout indicates that this entire section of watermain should not be constructed during peak hours.

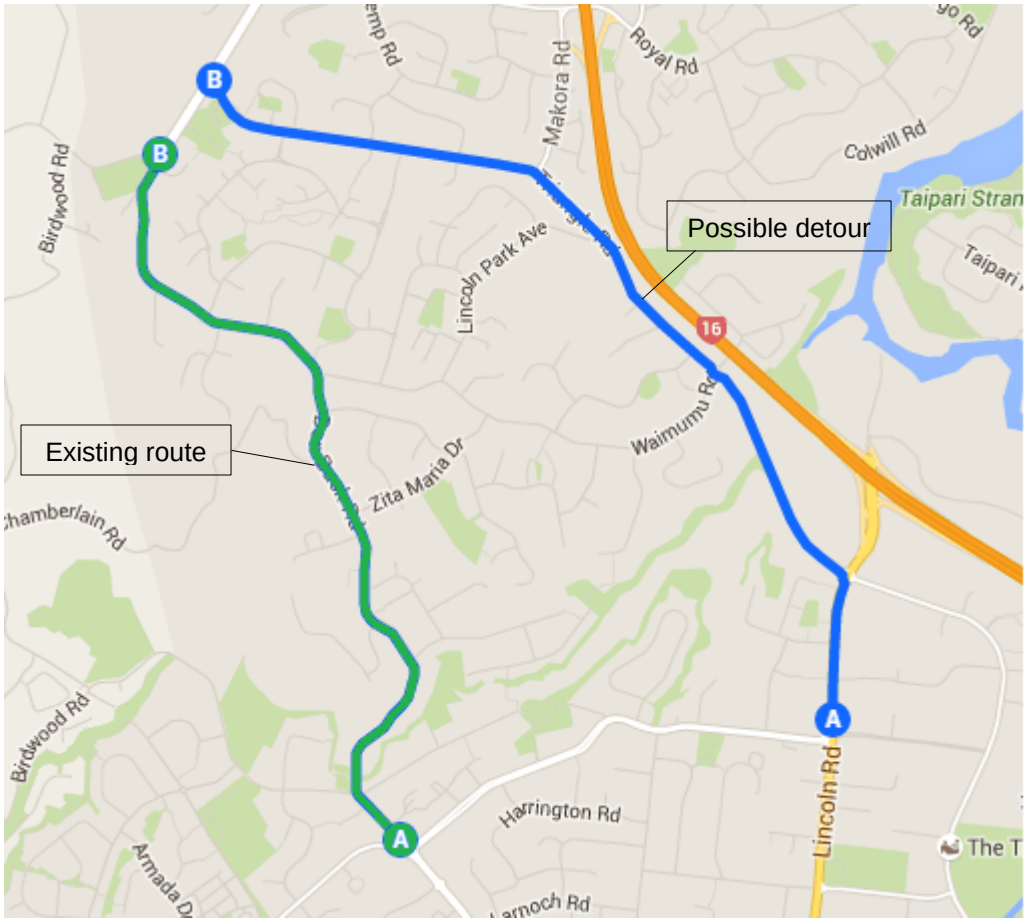
4.8 Don Buck Road

4.8.1 Don Buck Road – Universal Drive to Red Hills Road

Don Buck Road between Universal Drive and Red Hills Road is only wide enough to accommodate one lane of traffic during construction. Manual traffic control will therefore be required to allow alternating two-way traffic flow. SIDRA modelling has been undertaken to examine the impacts of such a traffic control scheme.

It is noted that there is scope for some traffic to re-route via Triangle Road in order to avoid the construction on Don Buck Road. The detour is shown in Figure 4.2.

Figure 4.2 : Possible Triangle Road detour



The SIDRA modelling has also been run with a 10% reduction in Don Buck Road demand, assuming this traffic is able to use Triangle Road as an alternative route. This is a conservative assumption and it is likely that greater demand shift could be achieved with a targeted communication campaign prior to construction.

Table 4.10 : Don Buck Road - one lane system performance

Period	Direction	Existing demand		10% detour	
		Delay (sec)	Average queue length (m)	Delay (sec)	Average queue length (m)
AM peak	Northbound	157	672	84	457
	Southbound	137	999	62	647
PM peak	Northbound	112	896	49	564
	Southbound	132	603	71	407

It is predicted that traffic impacts will be significant if 100% of existing demand continues to use Don Buck Road during construction. Delays of up to 2 minutes will be experienced with queues extending as far as 1km in the peak direction. The 10% reduction in Don Buck Road traffic would lead to significantly less traffic impacts with delay and queue length approximately halving in the peak direction. The performance of the alternating two-way traffic control system is clearly very sensitive to changes in vehicle demand. Therefore a targeted communication campaign including detour signage should be implemented prior to and during construction in order to induce as many vehicles as possible to avoid this section of Don Buck Road. Traffic effects are considered no more than minor assuming at least a 10% reduction in traffic can be achieved.

4.8.2 Don Buck Road – Red Hills Road to Fred Taylor Drive

Don Buck Road between Red Hills Road and Fred Taylor Drive is wide enough to maintain two lanes at least 2.75m wide during construction. Construction impacts along this corridor will therefore be less than minor assuming that pedestrian and side road access can be maintained.

The roundabouts at Triangle Road, Royal Road, Westgate Road and Fred Taylor Drive will require manual traffic control whilst construction activities take place to ensure all movements can be safely accommodated. The roundabouts will effectively operate as signalised intersections during construction due to the reduction in available road space through the roundabouts. Only one approach leg would be able to flow at any one time. Works at each intersection are expected to take no more than five days.

SIDRA modelling has been undertaken to assess the impact of construction at these intersections. Results are shown in Table 4.11 to Table 4.14.

Table 4.11 : Don Buck Road/Triangle Road intersection performance

Period	Approach	Existing			Construction		
		Delay (sec)	Average queue length (m)	Level of Service	Delay (sec)	Average queue length (m)	Level of Service
AM peak	Don Buck Road – North	9	7	B	84	391	E
	Triangle Road – East	14	19		60	104	
	Don Buck Road – South	15	15		69	328	
PM peak	Don Buck Road – North	8	35	B	85	358	E
	Triangle Road – East	19	37		53	77	
	Don Buck Road – South	12	72		73	337	

At the Don Buck Road / Triangle Road intersection, it is predicted that the manually controlled intersection will operate at LoS E in both the AM and PM peaks. All approaches will experience some moderate delay with significant queuing on Don Buck Road. These effects are considered to be minor due to the very short construction duration.

Table 4.12 : Don Buck Road/Royal Road intersection performance

Period	Approach	Existing			Construction		
		Delay (sec)	Average queue length (m)	Level of Service	Delay (sec)	Average queue length (m)	Level of Service
AM peak	Don Buck Road – North	9	40	A	76	355	E
	Royal Road – East	14	13		66	57	
	Don Buck Road – South	9	43		70	366	
PM peak	Don Buck Road – North	8	31	A	60	272	D
	Royal Road – East	14	11		57	66	
	Don Buck Road – South	9	44		47	282	

At the Don Buck Road / Royal Road intersection, it is predicted that the manually controlled intersection will operate at LoS E in the AM and LoS D in the PM peaks. All approaches will experience some moderate delay with significant queuing on Don Buck Road. These effects are considered to be minor due to the very short construction duration.

Table 4.13 : Don Buck Road/Westgate Drive intersection performance

Period	Approach	Existing			Construction		
		Delay (sec)	Average queue length (m)	Level of Service	Delay (sec)	Average queue length (m)	Level of Service
AM peak	Don Buck Road – North	10	46	A	86	361	E
	Westgate Drive – East	14	14		79	78	
	Don Buck Road – South	9	46		68	48	
PM peak	Don Buck Road – North	15	49	B	79	243	E
	Westgate Drive – East	12	11		32	32	
	Don Buck Road – South	10	39		80	413	

At the Don Buck Road / Westgate Drive intersection, it is predicted that the manually controlled intersection will operate at LoS E in the AM and PM peaks. All approaches will experience moderate delays and there may be significant queuing on Don Buck Road. These effects are considered to be minor due to the very short construction duration.

Table 4.14 : Rotu Drive/Fred Taylor Drive/Don Buck Road intersection performance

Period	Approach	Existing			Construction		
		Delay (sec)	Average queue length (m)	Level of Service	Delay (sec)	Average queue length (m)	Level of Service
AM peak	Rotu Drive - North	11	1	A	57	9	E
	Fred Taylor Drive - East	8	19		65	203	
	Don Buck Road – South	10	20		67	307	
	Fred Taylor Drive - West	11	21		81	199	
PM peak	Rotu Drive - North	11	2	A	35	5	F
	Fred Taylor Drive - East	9	15		96	216	
	Don Buck Road – South	10	29		68	300	
	Fred Taylor Drive - West	11	19		145	209	

At the Don Buck Road / Fred Taylor Drive intersection, it is predicted that the manually controlled intersection will operate at LoS E in the AM LoS F in the PM peaks. All approaches will experience some moderate delay and significant queuing may occur on the Don Buck Road and Fred Taylor Drive (east) approaches. Both of these approaches have upstream intersections located approximately 200m away which may be impacted by these queues. Vehicles traveling between Don Buck Road and Fred Taylor Drive (east) may find it more efficient to use Westgate Drive as an alternative route which will help to minimise the queues along the construction route. The availability of this alternative route, along with the relatively short construction timeframes means that traffic impacts at this intersection will be no more than minor.

5. NOR2 - Existing transport environment

NOR2 includes the corridor from Greenhithe Bridge to the Albany Reservoir.

5.1 Road network

A summary of the average traffic on roads along the proposed watermain route in the NOR2 corridor is shown in Table 5.1. Traffic data has been obtained from Auckland Transport's traffic flow counting programme. The year of collection varies from 2013 to 2015. All counts have been increased at a 1% per year linear growth rate in order to derive predicted volumes for 2018.

Table 5.1 : NOR2 average daily traffic

Road	Average daily traffic (veh/day)	Average AM peak hour traffic (veh/hour)	Average PM peak hour traffic (veh/hour)
William Pickering Drive	10,237	1,600	1,524
Douglas Alexander Parade	1,153	233	214
Rosedale Road	5,895	996	1,624
Bush Road	8,085	1,366	1,823
Corinthian Drive	1,532	182	300

5.2 Public transport

At the time of writing, the New Network in the North Shore is planned and has been consulted on but is not yet finalised. However, it is expected to be in place by 2017 i.e. before construction begins on NH2. Routes which are currently planned to travel along the proposed watermain route in the NOR2 corridor are shown in Table 5.2

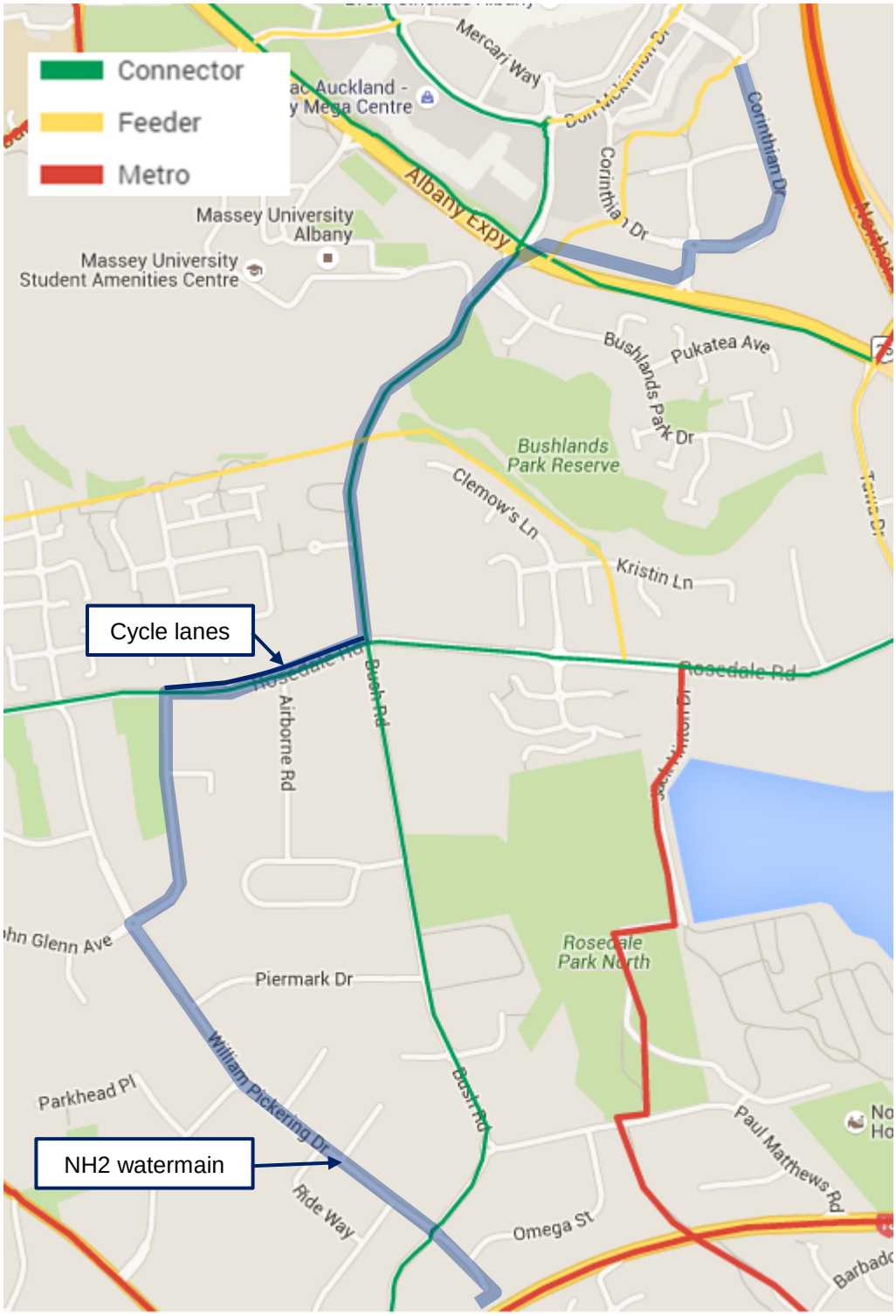
Table 5.2 : NOR2 bus routes

Corridor	Bus Routes
William Pickering Drive	N66 (local)
Rosedale Road	N65 (local)

5.3 Cycling

The Auckland strategic cycle network is shown in Figure 5.1. It is noted that the watermain alignment runs along the connector route on Rosedale Road and Bush Road. There are on-road cycle lanes along Rosedale Road whereas there are no dedicated cycle facilities on Bush Road.

Figure 5.1 : NOR2 - Auckland strategic cycle network



An example of the cycle lanes on Rosedale Road is shown in Figure 5.2. It is noted that the lanes are narrow at approximately 1.4m wide and provide no buffer between cyclists and general traffic.

Figure 5.2 : Rosedale Road cycle lanes

5.4 Walking

The majority of the corridor contains footpaths on at least one side of the road. According to 2013 census data, the active mode share (cycling, walking, jogging) for the Upper Harbour local board area was approximately 3%, indicating a low level of non-motorised transport use.

6. NOR2 – Traffic effects

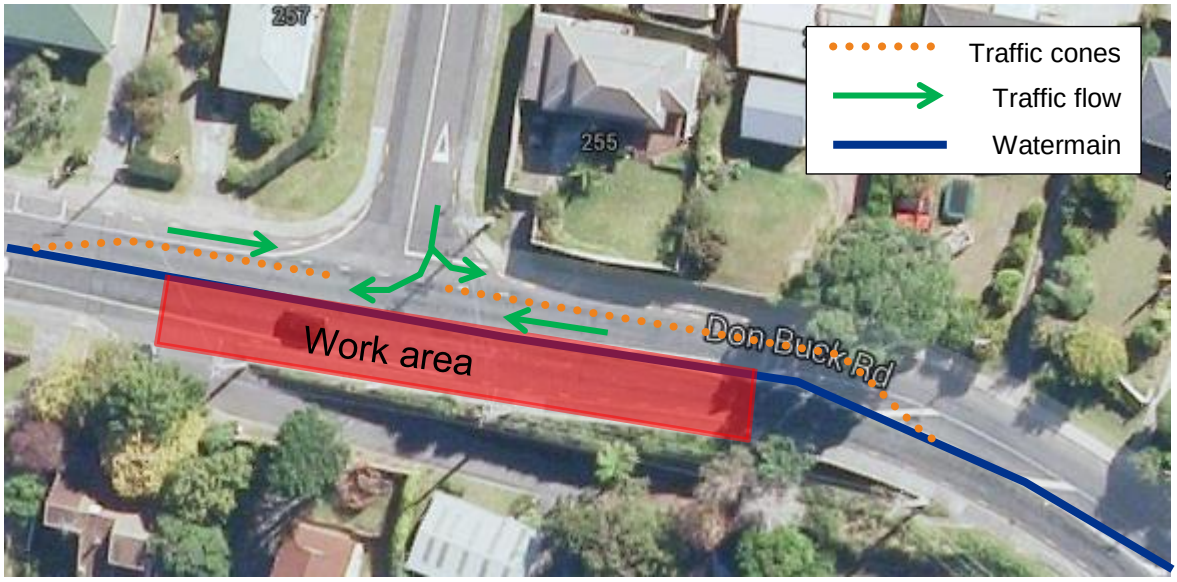
6.1 General impacts

Where on road construction is required, the majority of the watermain will be installed whilst maintaining two traffic lanes through the worksite. Where this is possible, impacts to traffic are expected to be less than minor since the existing corridor is generally comprised of two lane roads. A lower speed limit will be implemented through the construction area which will slightly reduce the throughput of the road however the short distance over which this will be required means that this impact will be minimal.

6.1.1 Intersections

Where the alignment passes through intersections, it is assumed that access will be maintained for all traffic movements. For three-legged intersections, all effort should be made to setup the construction work area on the far side of the intersection as shown in Figure 6.1. This allows a full length of watermain to be constructed without the need for intersection staging. This configuration will lead to only minor impacts as a result of a reduction in lane widths and speed limits.

Figure 6.1 : Typical intersection layout



Four-legged intersections and all roundabouts will require staging of construction and manual traffic control in order to maintain all movements during construction. Detailed analysis of these intersections is presented in Section 6.2 onwards.

6.1.2 Pedestrian impacts

Pedestrian access may need to be restricted on one side of the corridor to allow sufficient space for construction. Advance warning signs located at safe and appropriate crossing points should be implemented to allow pedestrians to avoid the construction area. Detailed plans regarding pedestrian access will need to be prepared by the appointed contractor as part of a construction management plan. No more than minor impacts are expected.

6.1.3 Cycling impacts

Cycle facilities identified in Section 5.3 should be maintained during construction where possible. Provision for cycle access around the work area, on the opposite side to traffic, should be considered if cycle lanes are to be occupied by work areas. In areas where no cycle facilities currently exist, the nature of the construction works is

such that traffic will be travelling at lower speeds which will provide a more favourable cycling environment. The narrow lane widths will however force cyclists to merge in with general traffic through the work area which may increase the risk to cyclists. The short length of the work areas however means that these risks and impacts are considered no more than minor.

6.1.4 Parking and property access impacts

Where on-street parking currently exists, parking restrictions will need to be implemented in order to provide sufficient space in the corridor for the work areas. These restrictions will need to be implemented the evening prior to work starting and will be in place for one to two days. The amount of parking to be restricted will depend on the length of trench being dug at each particular location i.e. approximately 50m.

Access to properties is to be maintained at all times along the route. Locations where access restriction may be required have been noted in the following sections.

6.1.5 Construction vehicles

Daily construction related vehicle movements have been estimated at approximately 40 (20 in each direction), but will depend on the length and complexity of each construction section. This includes construction vehicles for spoil removal and supply of plant and materials. This volume of vehicle movements is relatively small and will not have any adverse traffic impacts on the surrounding road network. Parking for construction workers will need to be carefully planned so as to avoid adverse impacts on the road network. Site parking is subject to further investigation and will need to be addressed in the TMP prepared by the appointed contractor.

6.2 SH18

The construction of the watermain will take place alongside the SH18 corridor from Greenhithe to William Pickering Drive with minimal impacts to traffic.

Trenchless construction will potentially be used at Tauhinu Road, Greenhithe Road and Albany Highway which will minimise traffic impacts. Launching and receiving construction areas will be located inside the SH18 corridor but will not directly impact the live traffic lanes. However access to these construction areas will, in some circumstances, be from the SH18 shoulder lanes.

6.3 William Pickering Drive to Corinthian Drive

6.3.1 William Pickering Drive

William Pickering Drive is wide enough to maintain two lanes at least 2.75m wide during construction. Construction impacts along this corridor will therefore be less than minor assuming that pedestrian and side road access can be maintained.

It is noted that the Albany Fire Station is located at 8 William Pickering Drive. Sufficient space will need to be made available to maintain fast and efficient access for fire station vehicles to exit onto William Pickering Drive. Consultation with the fire department prior to construction will be necessary.

Manual traffic control will be required during construction of the watermain through the William Pickering Drive / Douglas Alexander Parade / John Glenn Avenue roundabout. SIDRA modelling has been undertaken of the proposed construction traffic control configuration. Existing intersection results are shown in Table 6.1. Construction scenarios are shown in Table 6.2

Table 6.1 : William Pickering Drive/Douglas Alexander Parade existing intersection performance

Period	Approach	Delay (sec)	Average queue length (m)	Level of Service
AM peak	William Pickering Dr - North	8	25	A

Period	Approach	Delay (sec)	Average queue length (m)	Level of Service
	Douglas Alexander Pde – East	10	5	
	William Pickering Dr - South	8	73	
	John Glenn Ave– West	16	11	
PM peak	William Pickering Dr - North	6	29	A
	Douglas Alexander Pde – East	9	5	
	William Pickering Dr - South	7	52	
	John Glenn Ave– West	11	7	

Table 6.2 : William Pickering Drive/Douglas Alexander Parade construction scenarios

Period	Approach	Maintain all movements			No Right Turns from William Pickering Pde		
		Delay (sec)	Average queue length (m)	Level of Service	Delay (sec)	Average queue length (m)	Level of Service
AM peak	William Pickering Dr - North	147	428	F	17	146	C
	Douglas Alexander Pde – East	150	74		60	75	
	William Pickering Dr - South	117	800		23	321	
	John Glenn Ave– West	150	74		63	76	
PM peak	William Pickering Dr - North	133	700	F	17	124	C
	Douglas Alexander Pde – East	142	102		48	61	
	William Pickering Dr - South	131	504		22	247	
	John Glenn Ave– West	150	73		51	62	

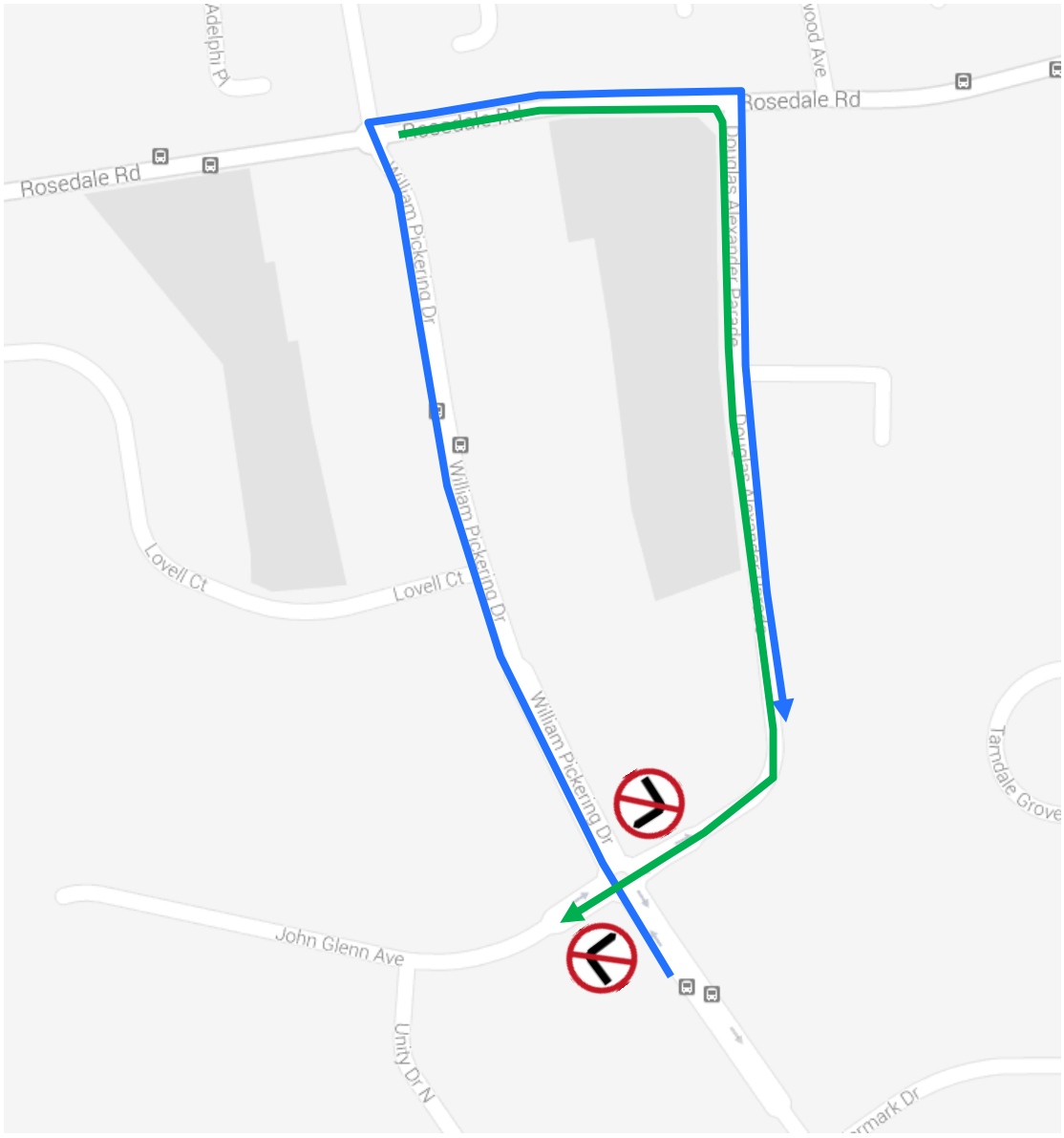
The significant delays under the ‘maintain all movements’ scenario has led to an investigation into options to reduce the impacts of construction at this intersection. If right turns from William Pickering Parade were banned this would allow both northbound and southbound traffic to operate simultaneously, significantly reducing the delay for all vehicles using the intersection. The intersection would perform at LoS C in both the AM and PM peaks with only moderate queues forming on William Pickering Drive.

Under the no right turns scenario, northbound vehicles could take a small detour via Rosedale Road in order to access Douglas Alexander Parade. Southbound vehicles could detour via Douglas Alexander Parade in order to access John Glenn Avenue. These detours are shown in Figure 6.2.

Detour signage would be required on Rosedale Road and Vanderbilt Parade to communicate the closure to vehicles who would normally travel southbound on William Pickering Drive to access John Glenn Avenue.

Both detours would add approximately 1.2km and 90 seconds of travel time compared to the normal journey. Approximately 100 vehicles would be required to make each of these detours in the AM and PM peak hours. The impacts of these detours are therefore considered to be minor.

Figure 6.2 : Detour routes during right turn bans at William Pickering Drive



6.3.2 Douglas Alexander Parade

The road reserve on Douglas Alexander Parade is only wide enough to provide one lane during construction. Manual traffic control will therefore be required to allow alternating two-way traffic flow. SIDRA modelling has been undertaken to examine the impacts of such a traffic control scheme. Modelling has shown that there will be very minor delay and very short queues. The impacts of construction on Douglas Alexander Parade are therefore anticipated to be minor.

Table 6.3 : Douglas Alexander Parade - one lane system performance

Period	Direction	Delay (sec)	Average queue length (m)
AM peak	Northbound	10	13
	Southbound	12	9
PM peak	Northbound	12	9
	Southbound	10	12

6.3.3 Rosedale Road

Rosedale Road is wide enough to maintain two lanes at least 2.75m wide during construction. Construction impacts along this corridor will therefore be less than minor assuming that pedestrian and side road access can be maintained.

The Rosedale Road / Bush Road intersection will be required to operate with a reduction in capacity during construction at this location. Existing performance is shown in Table 6.4

Table 6.4 : Bush Road/Rosedale Road existing performance

Period	Approach	Delay (sec)	Average queue length (m)	Level of Service
AM peak	Bush Road - North	40	128	C
	Rosedale Road – East	23	43	
	Bush Road - South	31	63	
	Rosedale Road– West	35	40	
PM peak	Bush Road - North	48	106	D
	Rosedale Road – East	24	40	
	Bush Road - South	33	244	
	Rosedale Road– West	53	174	

Construction will need to be staged and some lane closures implemented. It is assumed that each stage will take five days to complete. Possible staging options are shown in Figure 6.3 and Figure 6.4.

Figure 6.3 : Rosedale Road/Bush Road - Possible Stage 1 layout

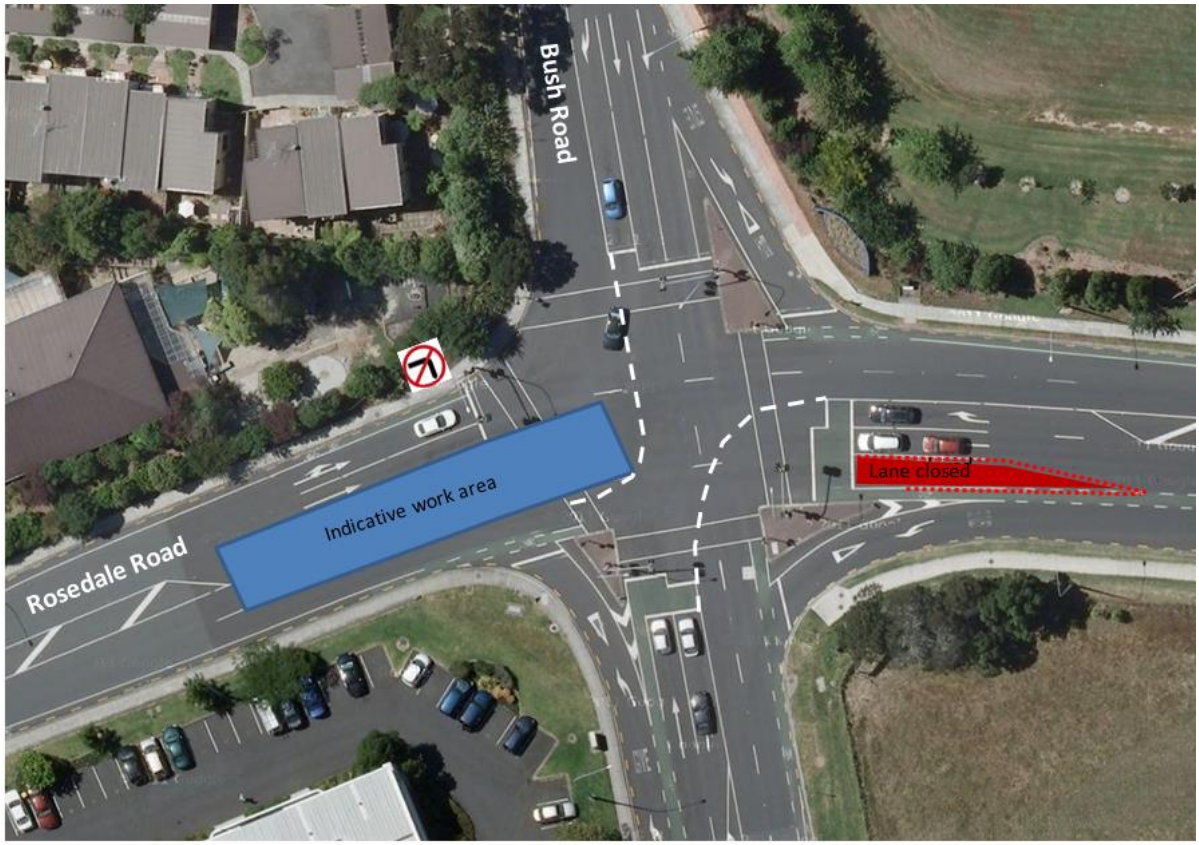
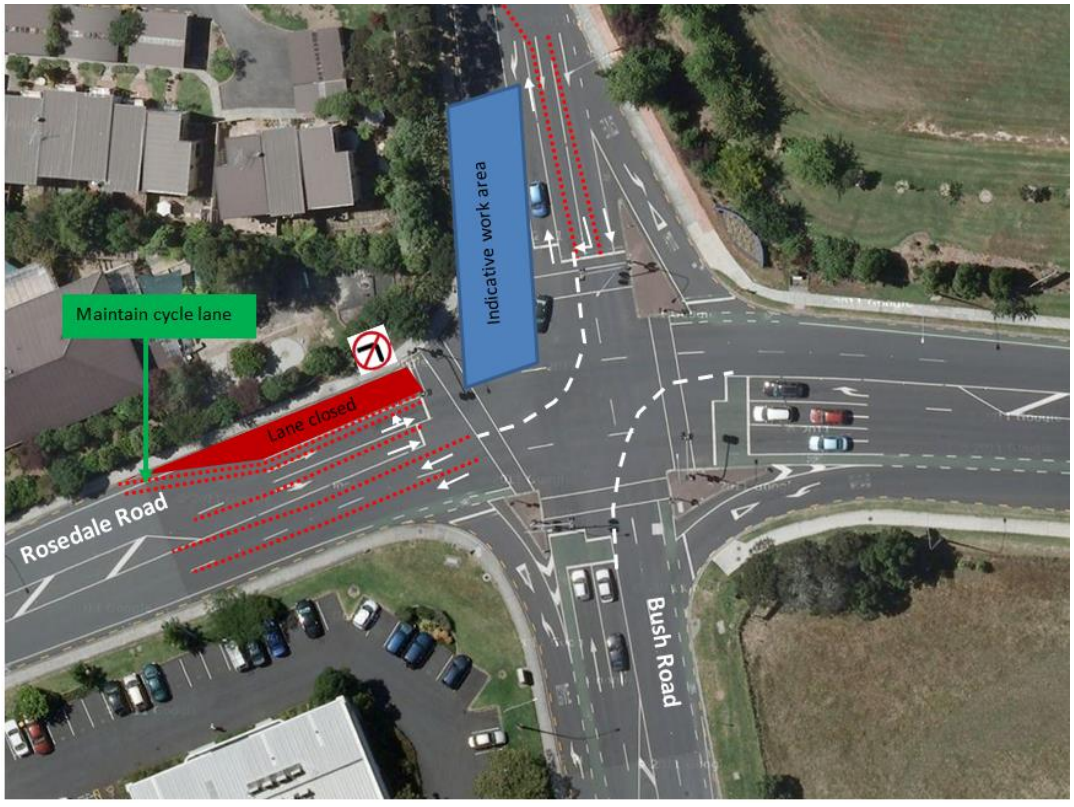


Figure 6.4 : Rosedale Road/Bush Road - Possible Stage 2 layout



It is recommended that the right turn from Rosedale Road into Bush Road southbound is banned during both stages of construction. Traffic count data shows that demand for this movement very low (approximately 60 vehicles in each of the AM and PM peak hours) and banning the turn would allow the intersection to operate satisfactorily during construction as shown by SIDRA modelling in Table 6.5.

Stage 1 has been modelled assuming that the right turn movements from Bush Road cannot be run in the same phase due to the geometric constraints of the work area.

Table 6.5 : Bush Road/Rosedale Road intersection performance

Period	Approach	Stage 1			Stage 2		
		Delay (sec)	Average queue length (m)	Level of Service	Delay (sec)	Average queue length (m)	Level of Service
AM peak	Bush Road - North	34	115	C	44	247	D
	Rosedale Road – East	21	78		28	65	
	Bush Road - South	36	62		34	62	
	Rosedale Road– West	37	47		52	70	
PM peak	Bush Road - North	48	106	D	49	151	E
	Rosedale Road – East	24	88		40	97	
	Bush Road - South	44	220		78	416	
	Rosedale Road– West	82	289		92	419	

The intersection operates satisfactory for both stages of construction in the AM peak. More delays and larger queue lengths are expected in the PM peak with the intersection operating at LoS E for both construction stages. It is noted that there will be some significant delays for the Bush Road (south) and Rosedale Road (west) approaches, however the short construction timeframes means that these impacts are considered to be no more than minor.

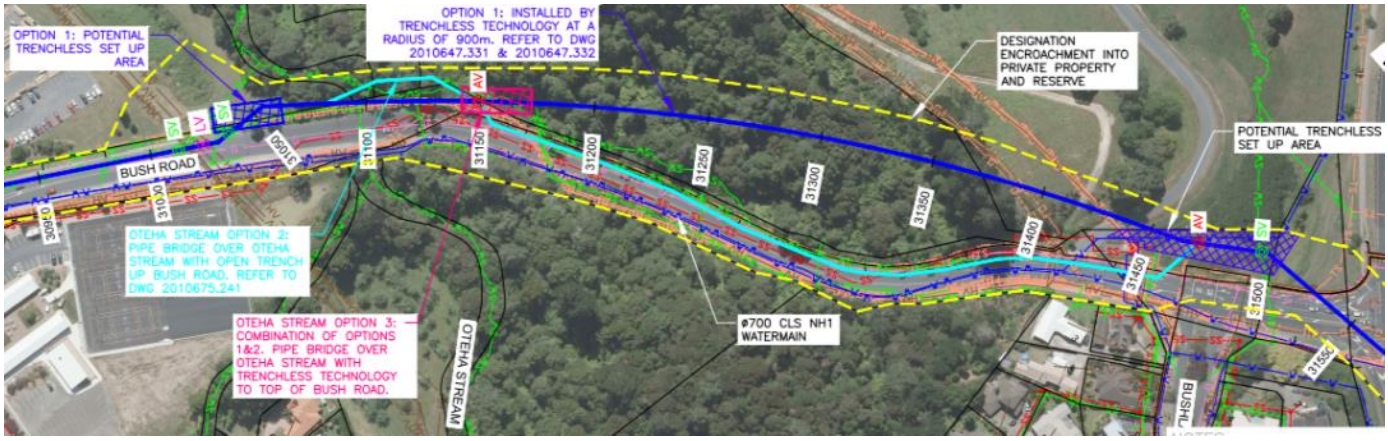
All efforts should be made to maintain the cycle lanes on Rosedale Road during all construction stages.

6.3.4 Bush Road

Bush Road is wide enough to maintain two lanes at least 2.75m wide during construction. Construction impacts along this corridor will therefore be less than minor assuming that pedestrian and side road access can be maintained.

There are several options for construction of the watermain across Oteha Stream as shown in Figure 6.5. Both the trenched and trenchless options will have minimal traffic impacts with sufficient room in the corridor to maintain two traffic lanes.

Figure 6.5 : Oteha Stream crossing options

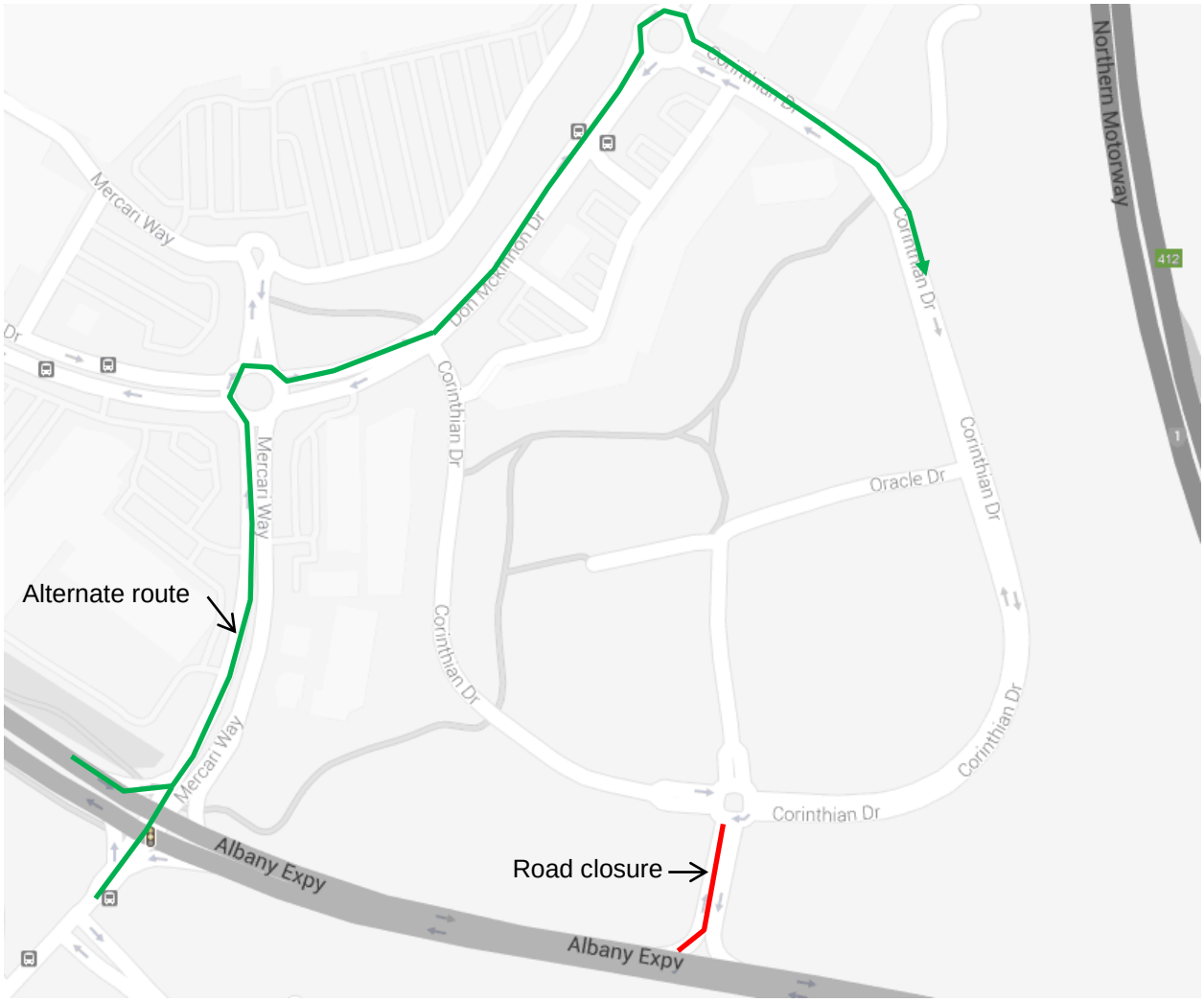


Trenchless construction will be used to cross the Albany Expressway / Bush Road intersection. Both the set-up and receiving areas will be outside of the road corridor which will result in less than minor impacts.

6.3.5 Corinthian Drive

The access road between Corinthian Drive and the Albany Expressway may be required to be closed during construction in this area. If closure is required, vehicles will be required to use an alternative route via Mercari Way and Don Mckinnon Drive as shown in Figure 6.6. This detour would add a maximum of 1km to the distance required to travel from the Bush Road / Albany Expressway intersection to Corinthian Drive. Detour signage would be required at the Bush Road / Albany Expressway intersection to advise drivers of the road closure and alternate route. Approximately 150 vehicles would be affected by this road closure in the AM peak, with less than 100 affected in the PM peak. These impacts are considered minor.

Figure 6.6 : Detour route during closure of Corinthian Drive access



Construction on Corinthian Drive will be able to take place whilst maintaining two traffic lanes at least 2.75m wide. Construction impacts along this corridor will therefore be less than minor assuming that pedestrian and side road access can be maintained.

7. NOR3 - Existing transport environment

NOR3 includes both the NH2 watermain and the NI Phase 2. In general, the shared corridor which contains the NH2 and NI alignments is located outside of the road corridor and hence will have minimal impacts to the road network.

7.1 Road network

In general, NOR3 is a corridor which runs alongside SH18 from Westgate to Hobsonville. The alignment also passes through the SH18 interchanges at Trig Road and Brigham Creek Road. The year of collection varies from 2013 to 2015. All counts have been increased at a 1% per year linear growth rate in order to derive predicted volumes for 2018.

Road	Average daily traffic (veh/day)	Average AM peak hour traffic (veh/hour)	Average PM peak hour traffic (veh/hour)
SH18	35,192	4,116	3,920
Trig Road	5,557	650	619
Brigham Creek Road	4,484	427	574

7.2 Public transport

The New Network is to be implemented in late 2016 i.e. before construction begins on NH2. The only bus route in the New Network which may be impacted by construction of the watermain in NOR3 is route W83. This is a local route which crosses SH18 at Brigham Creek Road.

7.3 Cycling and walking

The majority of the NOR3 corridor does not currently have any dedicated cycling facilities. Hobsonville Road just south of the motorway is a popular cycling route which links up with a shared path at Squadron Drive. The shared path continues beside SH18 and over the bridge towards Greenhithe.

The access roads will be used by Watercare for maintenance purposes and provision will be made for a cycleway.

8. NOR3 – Traffic effects

Between Fred Taylor Drive and the SH18-Squadron Drive interchange, the NH2 watermain and NI will be constructed outside of the road corridor. For NH2, trenchless methods will be used where crossing the motorway is required. This section of NH2 will therefore have minimal traffic impacts. Some disruption may occur at Trig Road and Brigham Creek Road. For NI, trenchless methods will be used for the entire alignment. There are 16 microtunnel pits along the shared corridor, with the potential for traffic impacts. This is discussed further in this section.

8.1 Construction vehicles

Daily construction related vehicle movements have been estimated at approximately 40 (20 in each direction), but will depend on the length and complexity of each construction section. This includes construction vehicles for spoil removal and supply of plant and materials. This volume of vehicle movements is relatively small and will not have any adverse traffic impacts on the surrounding road network. Parking for construction workers will need to be carefully planned so as to avoid adverse impacts on the road network. Site parking is subject to further investigation and will need to be addressed in the TMP prepared by the appointed contractor.

8.2 Trig Road

The NH2 watermain alignment crosses Trig Road just south of the SH18 off ramp. It is assumed that construction will be staged to allow one lane to remain open at all times. Manual traffic control will be required to allow alternating two-way traffic flow. SIDRA modelling has been undertaken to examine the impacts of such a traffic control scheme.

Table 8.1 : Trig Road - one lane system performance

Period	Direction	Delay (sec)	Average queue length (m)
AM peak	Northbound	14	29
	Southbound	14	46
PM peak	Northbound	13	42
	Southbound	14	27

It is clear that the impacts of the one lane traffic control scheme will be less than minor. Delay and queue lengths will be small in both the AM and PM peak periods.

8.3 Brigham Creek Road

The Brigham Creek Road / SH18 off ramp roundabout will require manual traffic control whilst construction activities take place to ensure all movements can be safely accommodated. The roundabouts will effectively operate as signalised intersections during construction due to the reduction in available road space through the roundabouts. Only one approach leg would be able to flow at any one time. Works at each intersection are expected to take no more than five days.

SIDRA modelling has been undertaken to assess the impact of construction at these intersections. Results are shown in Table 8.2.

Table 8.2 : SH18 off ramp/Brigham Creek Road intersection performance

Period	Approach	Delay (sec)	Average queue length (m)	Level of Service
AM peak	SH18 off ramp – North	22	271	C
	Brigham Creek Road – East	69	47	
	Brigham Creek Road – West	59	68	
PM peak	SH18 off ramp – North	19	154	C
	Brigham Creek Road – East	37	28	
	Brigham Creek Road – West	35	53	

It is predicted that the manually controlled intersection will operate at LoS C in both the AM and PM peaks. All approaches will experience some minor queuing and the Brigham Creek Road approaches will experience some significant delay in the AM peak. It will be possible to reduce these delays by allowing more time for these movements however this would adversely impact the SH18 off ramp queue length.

There is approximately 300m of queuing space on the SH18 off ramp so queues are not likely to extend back to the motorway. Manual traffic controllers should be instructed to observe these queues and allow more green time for this movement if the queues threaten to block the motorway. Furthermore, there is sufficient room in the shoulder of the motorway to provide extra temporary queuing space in the event of larger than expected queue lengths. Overall, these effects are considered to be minor due to the very short construction duration.

It is noted that ongoing development in the Hobsonville area may result in traffic growth in excess of the 1% per year assumed in this analysis. It is recommended that traffic volumes are assessed again closer to the construction date. In the event of larger than expected traffic growth, mitigation measures such as construction during off-peak periods will be sufficient to provide acceptable outcomes.

Traffic effects from Squadron Drive to Tauhunu Road have been assessed separately in the AEE for the *Greenhithe Bridge Watermain Duplication and Causeway.*

8.3.1 NI: Microtunnel pit access roads

There are 16 proposed microtunnel pits along the NI alignment between Fred Taylor Drive and Squadron Drive. Eight of these pits will be accessed from existing low volume roads, or cul-de-sacs where the traffic impacts will be negligible. The remaining nine pits will require access constructed from roads which may have traffic impacts during construction. These have been summarised below:

The access to microtunnel pit 2 is located on Hobsonville Road, west of the SH18 off-ramp. At this location there is currently provision for on-street parking, one wide through lane and one right turn lane into Oreil Avenue. Traffic impacts during construction in this location are expected to be less than minor as one narrow through lane and right turn bay can be retained.

The access to microtunnel pits 3 and 4 is accessed from Trig Road, just south of the SH18 overbridge. A new vehicle crossing has recently been constructed in this location so the only impact will be due to the additional construction vehicles. These vehicle movements are expected to be relatively small and hence effects will be less than minor.

The microtunnel pits 10, 11 and 12 are proposed to be accessed from the roundabout adjacent to the Brigham Creek on-ramp. During construction of this access road, the outside lane of the roundabout is likely to require closure for a period of time. This will not affect capacity of the on-ramp during peak times as it is controlled by ramp signals. However the on-ramp queues may affect roundabout capacity and delay vehicles exiting SH18 onto Brigham Creek Road. The effects could potentially be more than minor. To mitigate effects and reduce

impacts to less than minor, advance signage should be provided to inform drivers of the temporary roundabout configuration.

The microtunnel pits 13 and 14 are proposed to be accessed from Brigham Creek Road adjacent to the SH18 motorway off-ramp following the roundabout where two lanes merge into one. Traffic impacts during construction in this location are expected to be less than minor as one narrow through lane can be retained at all times.

8.3.2 Hobsonville Pump Station

The access to the Hobsonville Pump Station is from Buckley Avenue. There is an existing vehicle crossing in this location. Traffic impacts during construction in this location are expected to be less than minor. While Buckley Avenue is narrow and the road may be reduced to one lane for a period of time, Hobsonville Point Road provides an adequate detour.

9. Conclusion

Jacobs has been commissioned by Watercare to assess the potential traffic effects related to the construction, operation and maintenance of Watercare's proposed NH2 project and the land use effects of that part of the NI project that falls within the shared corridor along SH18 between Westgate in the west to the start of the Greenhithe Bridge causeway in the east.

Two traffic lanes will be able to remain open along the majority of the NH2 corridor. Where only one lane is able to remain open, SIDRA modelling has been undertaken to assess the performance of an alternating two-way traffic control system. For NI in the shared corridor, the pipeline is offline and any traffic effects resulting from microtunnel pit construction will be less than minor for the majority of pits. Access to microtunnelling pits 10, 11 and 12 have potential to cause more than minor impacts at the Brigham Road / SH18 roundabout.

Where the watermain alignment passes through roundabouts and other major intersections it is assumed construction will be staged to enable all movements to be maintained during construction. Manual traffic control will be required and SIDRA modelling has been undertaken to assess the performance of these manually controlled intersections.

A project specific traffic management plan (TMP) will be required to be prepared by the appointed contractor prior to the commencement of construction works.

General findings include:

- Minor impacts are expected for pedestrian traffic as the construction area may be required to occupy footpaths. Adequate signage at safe crossings prior to construction areas will mitigate these effects;
- Effects to cyclists are expected to be less than minor. Cycle lanes exist on Don Buck Road and Rosedale Road and these should be able to be maintained during construction;
- The expected volume of construction vehicle movements is relatively small and will not have any adverse impacts on the surrounding road network. Parking for construction workers will need to be carefully planned so as to avoid adverse impacts on the road network;
- Where on-street parking currently exists, parking restrictions will need to be implemented in order to provide sufficient space in the corridor for the work areas. The amount of parking to be restricted will depend on the length of trench being dug at each particular location i.e. approximately 80m (20-30m of trench plus transition / working areas at both ends of trench). These impacts are therefore expected to be minor; and
- Access to properties is be maintained at all times along the route.

NOR1:

More than minor impacts may occur:

- Along Parrs Cross Road between Bruce Mclaren Road and Pine Avenue due to the alternating two-way traffic control system. Strong communication prior to construction, advising of possible detours and construction during off peak hours should be implemented to help mitigate these impacts. See Section 4.3.2;
- On Swanson Road at the Metcalfe Road and Universal Drive roundabouts. It is recommended that construction take place outside of the AM and PM peak periods. See Section 4.7;
- On Don Buck Road between Universal Drive and Red Hills Road due to the alternating two-way traffic control system. Signposting the detour via Triangle Road is recommended and achieving a 10% reduction in Don Buck Road demand will help to mitigate these impacts. See Section 4.8.1;

NOR2:

More than minor impacts may occur at:

- William Pickering Drive / Douglas Alexander Parade roundabout. Recommended mitigation measures to reduce the scale of impacts to no more than minor include banning right turns from William Pickering Drive during construction. See Section 6.3; and
- Rosedale Road / Bush Road intersection. It is recommended that the right turn from Rosedale Road into Bush Road southbound be banned during construction in order to reduce the scale of impacts to no more than minor. See Section 6.3.

For NOR1 and NOR2 some assumptions have been made regarding the ability of the contractor to maintain two way traffic in all instances stipulated above. These assumptions have been tested on high traffic routes, rather than the smaller local roads (especially at the southern end of NOR1). Until detailed design is completed and the detailed construction methodology developed the full extent of carriageway limitations will not be known. To ensure that adequate traffic flow can be maintained the Traffic Management Plan (TMP) will be provided to Auckland Council for review and will form part of the Corridor Access Request process to Auckland Transport. The provision of the TMP has been offered by the Requiring Authority as a condition of designation on all three NORs.

NOR3:

All impacts are expected to be no more than minor.

Access to microtunelling pits 10, 11 and 12 have potential to cause more than minor impacts at the Brigham Road / SH18 roundabout. Advance warning signage will help to mitigate these potential impacts to be less than minor.

In conclusion, the effects on the transport environment are assessed as being no more than minor assuming that recommended mitigation measures are implemented.