



Watercare Northern Interceptor Project

Traffic Assessment for
Construction and Operation of
Northern Interceptor

NoR – Waitakere and North Shore
Prepared for Watercare

July 2016

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Quality Assurance Statement

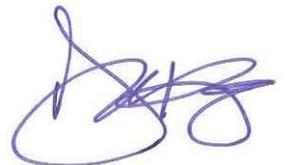
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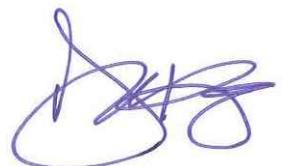
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Status: Final Report

Date: 19 July 2016



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Summary of Abbreviations

Abbreviation	Definition
AEE	Assessment of Effects on the Environment
AT	Auckland Transport
CAR	Corridor Access Request
CMA	Coastal Marine Area
CoPTTM	Code of Practice for Temporary Traffic Management
Council	Auckland Council
CTMP	Construction Traffic Management Plan
EED	Engineering Exception Decision
HDD	Horizontal Directional Drill
NH1	North Harbour 1 Watermain
NH2	North Harbour 2 Watermain
NoR	Notice of Requirement
NSGC	North Shore Golf Club
NSMP	North Shore Memorial Park
PS	Pump Station
PT	Public Transport
RMA	Resource Management Act
RAMM	Road Assessment and Maintenance Management
RTS6	Road and Traffic Standards Part 6: Guidelines to Visibility at Driveway
SH16	State Highway 16
SH18	State Highway 18
The Transport Agency	New Zealand Transport Agency
TBM	Tunnel Boring Machine
TMP	Traffic Management Plan
vpd	Vehicles per day
vph	Vehicles per hour
Watercare	Watercare Services Limited
WWTP	Wastewater Treatment Plant

Executive Summary

TDG has been commissioned by Watercare Services Limited (Watercare) to assess the potential traffic engineering and safety effects related to the future construction, operation and maintenance of new wastewater pipelines and associated infrastructure in the north-western and northern parts of Auckland.

Watercare is proposing to build new wastewater pipelines and associated infrastructure to convey wastewater from the north-western parts of Auckland to the Rosedale Wastewater Treatment Plant (WWTP) in Albany. This project is known as the “Northern Interceptor”. Construction of the Northern Interceptor (the Project) – is intended to be staged, with the timing of various stages dependant on the rate of population growth. In some cases, a phase of works may not be required for 15-20 years’ time. As such, the construction works assessed within this report have been forecast to commence in approximately 2035 (e.g. approximately 20 years from the present).

To secure the availability of the proposed route for construction at this later date, Watercare is seeking Notices of Requirement (NoR) to designate the proposed route as being required for this future use.

The Northern Interceptor comprises a new wastewater interceptor and associated infrastructure, from the existing storage tank located at The Concourse, Henderson to the Rosedale Wastewater Treatment Plant (WWTP). It will divert flows from three existing branch sewers (Swanson, Whenuapai and Massey) and connect flows originating from the North West Transformation Area (including Red Hills, Massey North, Kumeu, Riverhead, Huapai and Whenuapai). These flows will be transferred north to the Rosedale WWTP, rather than south to the Mangere WWTP

Two separate NoR are to be applied for to cover the separate working areas:

- NoR –NI (Waitakere) comprises of the proposed works between the existing Concourse Pump Station to Hobsonville Road. The works within NoR – NI (Waitakere) will transfer wastewater flows from the Concourse Storage Tank to Hobsonville Road, where it will connect with the pipeline that will be constructed as part of the NoR – NH2 (Waitakere, shared corridor);
- NoR – NI (North Shore) comprises of the proposed works in the area between Greenhithe and the Rosedale WWTP. The works within NoR – NI (North Shore) will transfer wastewater flows from an area adjacent to the eastern abutment of the Greenhithe Bridge to the Rosedale WWTP, and included the construction of pump stations, pipeline and associated structures.

TDG has assessed the traffic engineering effects of the Project in order that the scale of these effects can be considered as part of the NoR application process.

Construction will be by both open trenching and trenchless (sub-surface) construction methods. The traffic safety and traffic engineering implications of this construction work has been assessed.

The primary traffic effects are from:

- Works required in the road corridor, particularly for the sections of the pipeline to be constructed by trenched technologies; and
- The unloading and storage of construction materials, particularly for the sections of the pipeline to be constructed via trenchless methods where there will only be limited number of work sites as these sites will be in operation for months rather than days or weeks (as with trenched technologies).

These effects will require careful management. The effects from traffic associated with the transport of materials and staff to and from the sites are generally minor, except in some specific areas of the construction route. In these areas it is proposed to mitigate these effects via specific traffic controls. The traffic effects from the future operation of the pipeline and pump station network are considered to be negligible.

Section 5 of this report identifies both the general and specific traffic effects associated with the future works with Section 6 providing recommended mitigation measures for the general construction of the route and for specific construction areas. That said, the following general principles should apply throughout:

- The length or effect of an active construction zone should be controlled to ensure traffic delays of more than 5 minutes are avoided;
- When side roads or intersections must be crossed, construction should be staged to prevent their full closure, particularly where the affected road has only one connection to the road network; and
- The option of working outside of normal construction hours (i.e. night time) to take advantage of lower traffic volumes on the roads in business / industrial areas should be considered to mitigate the potential transportation impact on business and traffic operations.

The concepts and assumptions in this report are based on the information available at the time of writing regarding earthworks and construction methodology. Given the proposed timeframe until construction, TDG does not guarantee that the specific methodologies described here will be employed at the time of construction.

The construction works will involve the operation of heavy machinery, open excavations and the storage of plant and works materials in close proximity to the public road corridor or in some situations within public recreation areas. Appropriate measures, including fencing and barriers, should be employed to provide adequate and appropriate separation between members of the public and the work site.

An examination of the crash record for the route has not identified any specific road safety concerns. It is considered that subject to the use of appropriate mitigation and management measures in accordance with standard practises, existing levels of road safety can be maintained.

A Construction Traffic Management Plan (“CTMP”) for the project will be submitted to, Auckland Transport (“AT”) and the New Zealand Transport Agency (“the Transport Agency”), for approval, prior to the commencement of works, and this CTMP should incorporate any amendments to the construction methodology.

1. Introduction

1.1 Report Overview

The Project comprises a new wastewater pipeline that will divert flows from the existing Swanson, Whenuapai and Massey branch sewers at the existing storage tank located at The Concourse, Henderson to the Hobsonville Pump Station. Along its length the pipeline will connect flows originating from the North West Transformation Area (including Red Hills, Massey North, Kumeu, Riverhead, Huapai and Whenuapai). These flows are then transferred north, to the Rosedale Wastewater Treatment Plant (WWTP).

This technical report provides specialist input for the Northern Interceptor Assessment of Effects on the Environment (AEE), prepared by MWH New Zealand Limited which supports the NoR, these being NoR – NI (Waitakere) and NoR – NI (North Shore). Construction of the the Project is intended to be staged, with the timing of various stages dependent on the rate of population growth. In some cases, a phase of works may not be required for 15-20 years' time. As such, the construction works assessed within this report have been forecast to commence in approximately 2035 (e.g. approximately 20 years from the present).

Two separate NoR are to be applied for to cover the separate working areas:

- NoR –NI (Waitakere) comprising the proposed works between the existing Concourse Pump Station to Hobsonville Road;
- NoR – NI (North Shore) comprising the proposed works in the area between an area of land adjacent to the eastern abutment of Greenhithe Bridge and the Rosedale WWTP.

TDG has been commissioned by Watercare to assess the potential traffic engineering and safety effects related to the construction, operation and maintenance of NoR – NI (Waitakere) and NoR – NI (North Shore) in order that the scale of these effects can be considered as part of the NoR application process.

This report provides:

- A brief overview of the proposed works (Section 2);
- A description of the traffic environment on the roads surrounding the construction route that are potentially affected by the project (Section 3);
- A summary of investigations undertaken to assess the existing traffic environment and identify potential traffic effects (Section 4);
- A description of the potential traffic effects of the proposed construction (Section 5);
- An assessment of the potential effects on the transport environment during construction, considering temporary traffic management requirements, the specific location within the road network any other environmental factors considered relevant (Section 5); and
- Recommended mitigation measures (Sections 5 and 6).

The concepts and assumptions in this report are based on information available at the time of writing in respect of matters to do with earthworks and construction methodology. All figures for report are included in Appendix 1.

1.2 Note on the Standards used for Assessment

The assessments undertaken within this report have been performed against the framework of relevant current national and local standards.

These standards will be discussed in more detail during this report but include such documents as the New Zealand Transport Agency (NZTA) Code of Practice for Temporary Traffic Management (CoPTTM) and the Auckland Transport Code of Practice (ATCOP).

It is understood the construction works covered by this designation are not forecast to commence for approximately 15 years to 20 years.

In this timeframe, it is probable that modifications to the relevant engineering and safety standards used for this assessment may occur. Accordingly, it should be assumed that wherever there is reference in this report to the need to comply with a particular standard or guideline, and that standard has been subsequently updated, the updated standard should be used as the reference document.

1.3 General Note on Traffic Management During Construction

This report recommends that a detailed CTMP for the project be submitted to the relevant Road Controlling Authorities (AT and the Transport Agency), for approval, prior to the commencement of works, and this CTMP should incorporate any amendments to the construction methodology.

CoPTTM categorises roads by traffic volumes, speed limit and number of lanes to determine appropriate standards for temporary management equipment and the dimensions of safety areas. In principle, the greater the speed and traffic volume, the higher the safety requirements expected. These requirements can include such aspects of traffic management as larger signs, wider safety zones between the works and traffic flows, and greater signage spacing. Road categories range from Level LV (low-volume) to Level 3 (high-speed, multi-lane roads). **Table 1** below identifies the classification criteria for each level of road.

CoPTTM Road Level	Traffic Volume Criteria	Speed Criteria	Lane Criteria
Level LV	<500vpd	n/a	n/a
Level 1	<10,000vpd	n/a	n/a
Level 2	>10,000vpd	n/a	n/a
Level 3	>10,000vpd	>75km/h	Multi-lane

Table 1: CoPTTM Road Level Criteria

No roads within either the NoR – NI (Waitakere) or NoR – NI (North Shore) designations are Level 3 roads. Of all the roads within the designation corridor where it is proposed that there is a surface expression of the proposed works only three roads, Albany Highway, William Pickering Drive and Bush Road are Level 2 roads. All other roads are Level 1 roads.

2. Project Description

2.1 Proposed Works

TDG has been commissioned by Watercare to assess the potential traffic engineering and safety effects related to the construction, operation and maintenance of the Project.

The Project and a detailed construction methodology are described in detail in the Northern Interceptor Assessment of Effects on the Environment (“AEE”), prepared by MWH New Zealand Limited.

In summary, the Project works included within NoR – NI (Waitakere) and NoR – NI (North Shore) will comprise of the following elements:

- A new Pump Station at the Concourse Storage Tank site which will divert flow north away from the Western Interceptor;
- A new Booster Pump Station at Wainoni Park to accommodate additional flows from the Northwest Transformation Area;
- A new Intermediate Pump Station at Wainoni Park North to accommodate further growth in the Northwest Transformation Area, and the diverted flows from the Concourse (Swanson and Waitakere);
- Installation of a wastewater pipe from the Concourse Storage Tank to Hobsonville Road;
- Installation of a wastewater pipe from The Knoll, Greenhithe, to the Rosedale WWTP;
- Duplication of the rising main section of wastewater pipe from the Intermediate Pump Station at Wainoni Park North to the Rosedale WWTP;
- Associated structures at connection points, including access shafts, drop shafts, flow control structures, etc.; and
- Installation of a pipe bridge at Manutewhau Reserve, West Harbour.

3. Assessment Methodology

The effects and mitigation assessment undertaken in this report has been based on three key elements of research and investigation.

These elements were:

- An investigation of the complete designation route including the adjacent side roads and adjoining land use activity. This investigation allowed the existing traffic environment of the designation route to be identified, the location of key or susceptible pieces of transportation or social infrastructure to be clarified (e.g. schools or roads with only one connection to the wider road network), focused on recording key road dimensions and developed a general description of the current operating environment.
- Data Collation. Available background data was sourced on the current traffic environment. This data included traffic volumes, accident records and public transport routing information. Given the approximately 20 year timeframe until construction, further data was obtained on the proposed future zoning for land adjacent to the designation routes, future road hierarchy and potential upgrades to the road network within that timeframe.
- Projection of the future traffic environment. Based on the current traffic environment and the best information on the future development scope of the various sections of the designation route, an assessment of the future traffic environment along the designation route has been developed.

This future traffic environment was then used as the background environment against which to assess the potential effects of the construction activities proposed. The potential effects were broadly broken down into two aspects; the effects on the road network due to the presence of construction activities (e.g. construction using trenched technologies in a traffic lane), and the effects of the transport of materials to and from a work site (be that a fixed work site in the case of trenchless construction, or a moving work site for trenched technologies construction). The potential for, and scale of, effects were judged against the potential impact on pedestrians, public transport, nearby key or susceptible social infrastructure, residents and the wider road user group.

Reference has also been made to the traffic assessment reports undertaken for the consented Phase 1 of the Northern Interceptor and for the Northern Interceptor works within the shared corridor with North Harbour No. 2 Watermain to ensure that where relevant, assessment criteria and proposed mitigation measures have been applied consistently.

4. Traffic Environment of the Construction Corridor

4.1 Road Safety

The NZTA Crash Analysis System database was consulted to identify the location and cause of all injury and non-injury crashes along the route for the latest full five year period 2011-2015 inclusive. In general the full width of all roads and a 30m radius of any intersecting intersection were assessed. Roads where it is proposed that there is no surface expression of the works (e.g. open trenches or construction sites) were not assessed. The results of the accident search are summarised in **Table 2** below.

Area	Total Crashes	Injury Crashes	Predominant Crash Types	Heavy Vehicle Crashes	Crashes involving pedestrians	Comment
The Concourse to Selwood Road	2	1 (minor)	No Dominant Crash Type	0	0	
Selwood Road to Huruheru Road	2	0	No Dominant Crash Type	1	0	Heavy vehicle crash occurred when a parking truck failed to fully apply brakes /
Huruheru Road to Cedar Heights Avenue	1	1	Cyclist vs Car	0	0	Cyclist failed to give way to oncoming car.
Cedar Heights Avenue to Holmes Reserve	4	0	Loss of control (2)	0	0	Rain and alcohol were factors in one each of the loss of control accidents.
Holmes Reserve to Holmes Drive	2	0	No Dominant Crash Type	0	0	
Holmes Drive to Hobsonville Rd	1	0	Collision with a parked vehicle	0	0	Distraction was a factor in the sole reported crash
The Knoll to Collins Park	6	1 (minor)	No dominant crash type	0	1	Two crashes occurred in wet conditions.
Collins Park to Wainoni Park	2	2 (minor)	No dominant crash type	0	0	One of crashes involved a car vs cyclist collision
Wainoni Park to North Shore Memorial Park	2	1 (minor)	Collision with parked vehicle	0	0	Both crashes involved a collision with a parked vehicle
Schnapper Rock Road to North Shore Golf Course	2	0	Collision with parked vehicle	0	0	Both crashes involved a collision with a parked vehicle
Appleby Road to William Pickering Drive	9	2 (minor)	Rear-end Collision	0	1	See Section 7.8.3 for comments on clustering of rear-end collisions
William Pickering Drive to Bush Road	7	1(minor)	No dominant crash type	0	0	

Table 2: Reported Crashes Within NoR – NI Designation Route

This above crash record typology and frequency is considered to be typical of an urban environment and not indicative of any underlying traffic safety concern.

It is considered that there would not be any pressure on the road safety environment of the network due to the potential traffic growth within the designation timeframe.

4.2 Public Transport

4.2.1 Notice of Requirement: Northern Interceptor (Waitakere)

The Project route cuts across current public transport routes in only two locations, where it crosses Royal Road and where it crosses Hobsonville Road. At both of these locations the concept design proposes that the road crossing will occur via trenchless construction with no surface expression of the works. It is therefore considered that there will be no notable effect on the operation of the public transport network during the construction or operation of the pipeline.

4.2.2 Notice of Requirement: Northern Interceptor (North Shore)

The project route cuts across or follows the public transport (PT) network at a number of locations. A summary of the roads affected is provided in **Table 3** below:

Road	Routes	Services	Comment
Albany Highway	10	62	8 routes are school bus services. 2 routes are public bus services and account for 56 of the total bus services
Appleby Road	9	9	All bus services on Appleby Road are school related.
Greenhithe Road	6	60	4 routes are school bus services. 2 routes are public bus services and account for 52 of the total bus services
Schnapper Rock Road	2		All bus services on Schnapper Rock Road are school related
Tauhinu Road	6	60	4 routes are school bus services. 2 routes are public bus services and account for 52 of the total bus
William Pickering Drive	2	114	Services provide links to the Northern Busway

Table 3: Public Transport Services on Route Corridor

With the exceptions of Appleby Road and Schnapper Rock Road the affected roads listed above have high bus volumes.

The construction works have the potential to cause delay and disruption to the public transport network. The traffic management measures detailed in this report include measures to minimise these potential delays by the staged progression of the works, and the creation of traffic detours to maintain road network capacity and function. It is considered that with careful implementation of these measures effects on the public transport network can be minimised.

5. General Construction Methodology and Assessment of Effects

5.1 Overview

The Project primarily involves the installation of pipelines underground and the construction of above ground pump stations. It is anticipated pipelines will be installed by a combination of trenching and trenchless technologies.

It is understood these construction methods are routinely used for the installation of pipelines similar to those proposed for the Project, and are considered typical construction work which is carried out almost on a daily basis within Auckland. The types of methodologies described have been successfully mitigated and managed in many other construction projects.

Given the long timeframe to construction, there is a possibility that the construction techniques described may change as new technologies and methodologies become available in the future. Notwithstanding this, it is considered that a reasonable degree of confidence can be had with regards to where installation of pipelines will be either by trenched or trenchless technologies. This is demonstrated on the Project Drawings where anticipated trenchless and trenched construction methods are shown in different colours. It is considered that this establishes an effects envelope (i.e. trenched versus trenchless) with regards to the installation of pipelines.

Overall, it is considered that where construction techniques do change, they will remain within the envelope of effects assessed in this report.

The following section of this report provides details of the typical construction methodologies anticipated to be adopted for the Project.

5.2 Trenched Construction

Sections of the route will likely be constructed by open trench excavation. Construction by trenched technologies will involve excavation of a trench wider and deeper than the proposed pipeline, installation of the pipeline and reinstatement of the excavated area.

Trenched technology construction activities can typically aim to achieve 20m - 40m of progress per week. Specific details of this construction process are contained within the AEE.

5.2.1 Construction Effects and Traffic Operations

In addition to the trench width, a further working area on one or both sides of the trench will be required for machinery, personnel and materials. Safety zones will be needed between the edge of the working area (or trench if no working area exists on a particular side of the trench) and public areas such as footpaths or traffic lanes. Safety and taper zones will also be required at either end of the work site, which will increase the effective length of the construction area.

The dimensions of these safety zones should as a minimum conform to CoPTTM standards. It is noted that in particular locations, achieving this standard may be impractical or inadvisable due to site constraints which would cause out-of-scale effects on surrounding road network users or the environment. In such cases a deviation from CoPTTM should be sought via the Engineering Exception Decision process.

If the space available to other road users is less than 5.9m (this width allows for two 2.75m wide traffic lanes separated by 400mm wide traffic cones) a one lane alternating flow operation will be required.

On approximately one-third of the roads where trenched construction will occur, the dimensions of the work-site (including the safety zones) will require the implementation of a one-lane, alternating two-way flow traffic system around the work site. Traffic flows within the one lane area will be controlled by either Manual Traffic Control or temporary portable traffic signals.

CoPTTM suggests that 500 vehicles per hour (vph) is the typical threshold at which delays of more than five minutes may be expected when a lane closure is within 200m of an intersection. Beyond 200m, the threshold volume is considered to be 800-1000vph.

A key factor influencing the traffic flow volume needed to exceed an acceptable delay threshold is the length of the one-lane section. That means a balance must be struck between efficiency of construction and acceptable traffic capacity. When construction methodologies have been confirmed closer to the construction an analysis process to identify this balance should occur.

5.2.2 Traffic Generation

It is understood that the pipe lengths will be delivered 10 per truck on a semi-trailer unit. No more than two deliveries of pipe per week (i.e. four truck trips; two in, two back) are expected per operating section of excavation. The excavation operation itself is expected to generate around 24-36 truck movements per day, based on a daily excavation rate of 90-120m³ (6.5-7.5m³ per truck).

5.3 Trenchless Construction

Trenchless technology will be used in a number of locations for the Project. Microtunnelling and Horizontal Directional Drilling (“HDD”) are the most prevalent trenchless technologies at present, however within the next 20 years other technologies may become available.

It is understood that trenchless construction is a practical method to use when it is desired to locate a pipeline at depth, to minimise disruption that may otherwise result using standard trenching methods or where necessary to allow for the wastewater to flow by gravity.

Watercare prefer the microtunnelling trenchless technology method described in section 7.3. However HDD, may be considered by Watercare if that method is not viable.

Microtunneling is a trenchless technology that involves the use of a tunnel boring machine (“TBM”) to create a tunnel. The TBM is propelled by being ‘pushed’ through the hole by the pipes.

Microtunneling generally comprises the following construction activities:

- Construction of temporary jacking and receiving shafts to facilitate micro-tunnelling activities (may include piling and dewatering);
- Micro-tunnelling; removal of excavated material, jacking pipe supply;
- TBM recovery;
- Construction of permanent access and drop shafts, or backfill of the temporary construction shafts;
- Road, driveway and grass surface reinstatement; and
- Shaft construction (including piling and dewatering).

Microtunneling can typically achieve 5m - 10m progress per day.

HDD is a steerable trenchless method of installing underground pipes in a shallow arc along a prescribed bore path using a surface launched drilling rig. The HDD process involves drilling an electronically steered pilot bore from one end of a crossing to the other. A back ream, in effect a second larger drill bit, is connected to the pilot drill stem at the far end of a crossing and drawn back through the hole left by the pilot bore. Construction sites are thus required at both ends of the HDD alignment. This process continues until the hole is of a larger diameter than the pipe to be installed.

5.3.1 Construction Effects and Traffic Operations

The use of carriageway space for the purposes of construction will reduce the carriageway space available for traffic flows and hence reduce capacity. This will have an increased effect in the vicinity of intersections.

Given that the majority of intersections where site construction is intended have low to moderate traffic volumes; it is considered that any effects of the reduced capacity will be minimal and able to be appropriately mitigated

The use and extent of site fencing and hoardings will need to be selected and managed with care to prevent the creation of a potential road safety effect / hazard through the reduction in sight distance, particularly at the intersection sites.

Where construction sites are off-street, site access points should be designed to achieve acceptable sight distances and, unless impractical, allow for on-site manoeuvring such that both entry and exit movements can occur in a forwards direction. Reverse manoeuvres into or out of a site have the potential to create greater negative effects on the traffic environment though being less safe (particularly in higher vehicle or pedestrian traffic environments), and increased potential delay to through traffic due to such manoeuvres being more complex and less efficient, and potentially require through traffic to be stopped while the manoeuvre occurs.

While the volume of truck traffic generated on a daily basis will be significantly greater than the typical daily heavy vehicle volumes on the suburban roads which form the majority of the designation route, the expected number of truck movements per hour is relatively low and the overall effect will be minimal.

A greater effect will be experienced by those properties directly adjacent to the trenchless construction sites where trucks will be stopping, loading or unloading and departing on a regular basis for a longer period than with the trenched construction where although there would be the additional negative effect of an open trench, the overall construction train is likely to move past and out of the immediate area in a much shorter timeframe. Specific mitigation will be needed to address effects at properties in the immediate vicinity of a fixed construction site.

5.3.2 Traffic Generation: Microtunnelling

Excavated material will be typically hauled off-site in semi-trailer trucks (approximately 12.5m³ per load) with the number of trips dependant on the length of tunnel. A further 30-40 trips are expected for delivery of plant, pipes and other materials.

Truck volumes are expected to be less than 10 trips per day per site.

5.3.3 Traffic Generation: Horizontal Directional Drilling

The drilling operation is expected to generate about 20 truck movements a day (to remove spoil from the drill hole and deliver drilling mud). Additional truck movements will occur during the establishment and disestablishment of each drilling site. The traffic effects and potential mitigation of these movements are discussed in Sections 6 and 7.

5.4 Pump Stations

Pump stations will be constructed on sites at The Concourse Storage Tank, Wainoni Park South and Wainoni Park North.

Pump stations generally consist of below ground structures for pump station wells, storage tanks and chambers, above ground structures for switchroom, biofilter, chemical storage tanks, and dosing facility together with incoming and outgoing pipework and pipe overflow, paved vehicle access and stormwater drainage. Typical works associated with construction at pump station sites include:

- Site clearance, topsoil removal and excavation for below ground structures;
- Piling;
- Dewatering of excavations;
- Construction of concrete pump station wet well and dry well chambers and precast concrete storage tanks and chambers;
- Construction of above ground pump station and switchroom buildings;
- Trenching and laying of pipework; and
- Site reinstatement.

Typical drawings and site layouts are provided in Volume 3 of the AEE.

5.4.1 Construction Effects and Traffic Operations

Works for the pump stations will typically occur outside of the road corridor and traffic effects are confined to the vehicle trips into and out of the site. Management of the construction traffic can be achieved via the appropriate design and signage of site access locations, and guidance of CoPTTM.

Where works for the pump stations in the road corridor are required (e.g. for driveway construction or pipeline connection), the traffic effects should be assessed and managed with the CoPTTM framework.

5.4.2 Construction Traffic Generation

Typical traffic volumes will be about 20 to 30 truck trips and 12 other vehicle trips per day, and may peak at four to six truck trips and two light vehicle trips per hour per pump station site.

6. Specific Assessment – Notice of Requirement – Northern Interceptor (Waitakere)

6.1 The Concourse to Selwood Drive

6.1.1 Overview

As per the current concept design the pipeline will likely be constructed with the use of trenched technology construction from the Watercare-owned Concourse Storage Tank site onto The Concourse. It then follows The Concourse in a generally westwards direction to and through the intersection with Selwood Road.

6.1.2 Existing Traffic Environment

The Concourse is defined as a Local Road in the District Plan and has a typical kerb to kerb width of 12m.

Traffic volume data for The Concourse is not available from Auckland Transport. However reference to available RAMM¹ data indicates a daily traffic volume of approximately 1,500 vehicles per day (“vpd”). Based on patterns of traffic movement observed across the urban transport network, peak hour volumes represent approximately 10% of daily traffic volumes carried by urban roads; applying this ratio to the estimated daily traffic volumes would indicate peak hour traffic volumes in the region of 150 vehicles per hour (“vph”). A significant minority of the traffic on The Concourse is made up of heavy vehicles.

One traffic lane in each direction is provided, with the traffic lanes separated by a painted centreline. Kerbside parking is generally permitted on both sides of the road, although there are some no stopping and clearway restrictions in the vicinity of the intersection with Selwood Road.

The intersection of The Concourse and Selwood Road is a priority controlled T-intersection with Selwood Road forming the head of the T. Priority is afforded to the Selwood Road (south) and The Concourse legs with the Selwood Road (north) leg being stop-controlled.

Properties fronting The Concourse and Selwood Road are generally industrial in operation. Directly adjacent to the existing Watercare Pump Station is a refuse transfer station.

Photographs 1 and 2 show the general traffic environment of The Concourse and the Selwood Road / The Concourse intersection respectively.

¹ RAMM – Road Assessment and Maintenance Management



Photograph 1: The Concourse Looking South Towards the Transfer Station and Pump Station



Photograph 2: The Concourse / Selwood Road Intersection

Both The Concourse and Selwood Road have a 50km/h posted speed limit.

6.1.3 Future Environment

Under the Proposed Auckland Unitary Plan (“PAUP”) the land around The Concourse and Selwood Road is zoned as either Heavy or Light Industry. The surrounding land is heavily developed and any future development would consist primarily of brownfield development. The nature of any future development cannot be categorically assumed at this stage given the proposed industrial zoning. The current industrial character of the area is likely to dictate future developments in this location which would be expected to have

broadly similar traffic generation characteristics as the current development. Therefore it is not considered that there would be significant growth in traffic volumes.

6.1.4 Assessment of Effects

The construction route crosses the Selwood Road / The Concourse intersection which is in close proximity (approximately 50m) to the Lincoln Road interchange on the SH16 Northwestern Motorway. The restriction of traffic capacity at this intersection, particularly during the morning peak period when employees will be heading inbound to businesses on Selwood Road and The Concourse, could create the potential for vehicle queuing and congestion to extend back towards the interchange on-ramps and effect the safety and efficient operation of the interchange.

As the interchange directly connects to the Northwestern Motorway, effects on this interchange have the potential to create wider network effects extending beyond the immediate construction area.

Accordingly the extent of working areas and the capacity of the residual trafficable carriageway must be managed so as to prevent this occurrence.

Properties adjacent to The Concourse and Selwood Road are generally industrial in operation (and likely to remain so under the proposed future zoning), most will be regularly serviced by large heavy vehicles, and there are a number of vehicle crossings along The Concourse adjacent to the construction route. Interruption of vehicle access to these properties for loading and servicing purposes has the potential to have a significant impact on the affected business operations.

It is also noted that these large vehicles will have wider manoeuvring path requirements both along the road carriageway and to and from the adjacent properties than a standard private car.

Every practical effort should be undertaken to ensure continued access to the adjacent properties. Where access must be interrupted to achieve the project works such interruptions should be made as brief as practicable. Working areas should be designed with the vehicle composition of The Concourse traffic in mind to ensure ongoing efficient access and usage.

It is likely that most of the works on The Concourse will require a reduction in trafficable area to a single lane with managed alternating flow. Due to the larger vehicle sizes which will be present in the traffic flows on The Concourse, vehicles queues will have the potential to reach a greater length for the number of queue vehicles than is typical. The extent of working areas must be controlled so as to manage queue lengths.

6.1.5 Potential Specific Construction Mitigation Measures

- Kerbside Parking on The Concourse and Selwood Avenue should be temporarily restricted or banned where necessary to provide additional available carriageway width and maintain appropriate levels of traffic capacity.
- A survey of heavy vehicle movements including vehicle types along The Concourse should be undertaken prior to the commencement of construction works so that

works areas for the construction activity can be developed that maintain sufficient traffic lane width for the safe and efficient passage of the standard vehicle fleet using The Concourse.

- Access to The Concourse transfer station should be maintained at all times.

6.2 Selwood Drive to Huruhuru Road

6.2.1 Overview

As per the current concept design it is intended that west of the Selwood Road / The Concourse intersection the pipeline will cross what is currently vacant land before traversing an arm of the Henderson Creek. The pipeline will then cross an area of reserve land before re-entering the road corridor at the eastern end of Kopi Place and proceeding westwards along Kopi Place and through a private property to Huruhuru Road. This section of the route is approximately 600m long and construction on land will be by trenched technologies.

6.2.2 Existing Traffic Environment

Kopi Crescent is defined as a Local Road in the District Plan. It is a cul-de-sac with a single connection to the wider road network at an intersection with Taitapu Street. One traffic lane in each direction is provided, with no centreline marking. Kerbside parking is permitted on both sides of the road. Kopi Crescent is typically 8m wide from kerb to kerb, but widens at its cul-de-sac head.

Taitapu Street has a single connection to the road network at the intersection with Huruhuru Road. The intersection of Huruhuru Road and Taitapu Street is a “Y” shape priority intersection. Huruhuru Road forms the upper limbs of the “Y” and movements on Huruhuru Road have priority over those on Taitapu Street.

The traffic environment of Huruhuru Road will be detailed further in Section 6.3.2 of this report.

Traffic volume data for Kopi Crescent and Taitapu Street is not available from Auckland Transport. However observations from adjacent developments suggests daily traffic volumes for these roads would be in the region of 250, and 500 vpd respectively. Peak hour volumes are likely to be in the region of 25 and 50 vph respectively.

The area is residential with housing being predominantly of the single-unit dwelling house category.

Photographs 3 and **4** show the general traffic environment of Kopi Crescent and the Huruhuru Road / Taitapu Street intersection respectively.



Photograph 3: Kopi Place View to North.



Photograph 4: Huruuru Road / Taitapu Street Intersection View to South (the houses at the end of Kopi Place can be seen in the centre of the photograph).

Kopi Place and all surrounding roads have a speed limit of 50km/h.

6.2.3 Future Environment

Under the PAUP the land around Kopi Place is zoned Single House Zone. As the name suggest, sites within the Single House Zone are restricted to a single dwelling per site. All sites on Kopi Place have been developed as single residential dwellings and accordingly, based on the proposed future zoning, it is considered that there is limited additional development and hence traffic growth which would occur on this street.

6.2.4 Assessment of Effects

Only a relatively short section of road carriageway will be used for construction (approximately 70m) on Kopi Place. The first and second stages of this section of the route will require pipe installation across an area of currently vacant land and then across a tidal stream. There is no existing public road alongside this section of the route and it is assumed that servicing for construction will be via an access linking to the Selwood Road / The Concourse intersection.

The addition of this access to the intersection will create in effect a four-leg intersection which may potentially affect the operation of the intersection. However vehicle volumes using this access are anticipated to be low – in the region of a few trucks per hour. It is considered that the addition of these volumes would not have a noticeable effect on the overall intersection performance.

If all non-site traffic must regularly stop or manoeuvre out of its expected path to accommodate the manoeuvres of site traffic, there are potential safety and efficiency effects, noting the previously referred to proximity of this intersection to the Lincoln Road interchange.

Kopi Place has a kerb to kerb width of 8m. Given its relatively narrow width (apart from at its cul-de-sac head) there is the potential for the trenching works to temporarily cut vehicle access to the end of the road. This would result in a reduction in convenience and connectivity for the residents during the period of the works and have potential emergency servicing implications. If footpath and berm areas are used as part of the construction area, kerbside crossing facilities should be provided to allow pedestrians of all mobilities the ability to cross the road to avoid the work site otherwise pedestrians could be “stranded” or take the option of attempting to walk or otherwise move through the worksite with its attendant safety hazards.

Similarly, when the works move through the private property and walkway linking Kopi Place to Huruhuru Road there will be a localised temporary loss of amenity to affected residents, with the pedestrian detour adding approximately 300m to any walking trip. Construction duration for this section of the route is provisionally estimated at three to five weeks. Although the effect on local residents during this short time period will be noticeable, it is considered that the effect on the wider network will not be significant and the effect on local residents will be mitigated by the relatively short duration of the detour.

6.2.5 Potential Specific Construction Mitigation Measures

To provide access to the construction corridor it is intended that a site access would be constructed such that it connects to the road network in the vicinity of the Selwood Road / The Concourse.

- The access should be designed to efficiently and safely allow access for the typical heavy vehicles employed to service this site to prevent delays to non-site traffic at the intersection when site vehicles manoeuvre into or out of the site.

- The access design should also allow for, as a minimum, one heavy vehicle to enter, whilst another is contemporaneously waiting to exit, or on-site measures enacted to prevent such an occurrence to ensure that an entering site vehicle is not forced to wait on-street with consequential potential delays and congestion at the intersection before being able to enter.
- Emergency vehicle access should be maintained to all properties on Kopi Place.

6.3 Huhuhuru Road to Cedar Heights Avenue

6.3.1 Overview

As per the current concept design, the pipeline will likely be constructed predominantly by trenched technologies. From the Taitapu Street / Huhuhuru Road intersection the pipeline route will pass down the carriageway of Huhuhuru Road, cross the Lowtherhurst Reserve and travel under the carriageway of Redwood Drive to the Redwood Drive / Cedar Heights Avenue intersection. This section of route is approximately 500m long.

6.3.2 Existing Traffic Environment

Both Huhuhuru Road and Redwood Drive are defined as Local Roads in the District Plan.

Traffic volume data for Huhuhuru Road and the construction section of Redwood Drive (south of Cedar Heights Drive) is not available from Auckland Transport. However, based on observations of adjacent development and reference to available estimated traffic volume included in AT's asset management RAMM database, daily traffic volumes for these roads would be in the region of 800-1000vpd, and 80 vpd, respectively. Consequently, it is considered that peak hour traffic volumes would be 80-100vph and 10vph, respectively.

Huhuhuru Road is a cul-de-sac which connects to the wider road network at a roundabout intersection with Triangle and Waimumu Road immediately west of SH16. Huhuhuru Road crosses SH16 by way of an overbridge. East of SH16, Huhuhuru Road connects with Taitapu Street and Lowtherhurst Road, both of which are cul-de-sacs. As previously noted, Kopi Place gains access solely from Taitapu Street. Huhuhuru Road therefore provides the sole connection to the wider road network for all properties on four streets, Huhuhuru Road, Lowtherhurst Road, Taitapu Street and Kopi Place.

One traffic lane in each direction is provided on Huhuhuru Road, with centreline marking typically only provided in the vicinity of the intersections with side roads. Kerbside parking is permitted on both sides of the road north of the intersection with Taitapu Street. South and west of this intersection parking is prohibited on both sides of the road.

Within the proposed designation boundary, Huhuhuru Road is typically 7-8m wide from kerb to kerb. There is no widening for a turning head formation at the northern cul-de-sac end of Huhuhuru Road. **Photograph 5** shows the typical formation of Huhuhuru Road over which the construction will occur.

Lowtherhurst Reserve can be accessed from both Huruhuru Road and Redwood Drive. There is no vehicle access within the reserve, however a pedestrian trail and bridge provides walking access between Huruhuru Road and Redwood Drive.



Photograph 5: Huruhuru Road, View to North.

Redwood Drive has a total length of 520m, with the section to the south of Cedar Heights Drive where construction works will occur being 75m in length. One traffic lane is provided in each direction, with a centreline marking typically only provided in the vicinity of the intersections with intersecting side roads. There is a distinct gradient on Redwood Drive, sloping down towards the Lowtherhurst Reserve. This can be observed in **Photograph 6** below.



Photograph 6: Redwood Drive, View South from Intersection with Cedar Heights Avenue

Redwood Drive intersects with Cedar Heights Avenue at a priority controlled “T” intersection. Redwood Drive forms the head of the “T” and movements on Redwood Drive have priority.

All properties surrounding both Huruhuru Road and Redwood Drive are residential in nature and scale.

Huruhuru Road and all surrounding roads have a speed limit of 50km/h.

6.3.3 Future Environment

Under the PAUP, the land surrounding Huruhuru Road is zoned Mixed Housing Suburban.

Properties within the construction section of Redwood Drive are zoned as either Single House Zone or Mixed Housing Suburban Zone. Sites within a Mixed Housing Suburban Zone are permitted to be developed with up to three houses per site, or up to four dwellings per site as a restricted discretionary activity.

The properties accessed via Huruhuru Road in the Mixed Housing Suburban Zone have typically been developed with a single dwelling per property, so theoretically the permitted baseline would allow a tripling of dwelling numbers in this area and conceivably a pro-rata increase in daily and peak hour trip generation. However, to achieve this level of development would require the full redevelopment of the area and, as a future baseline, is considered unrealistic and therefore overly conservative. Within a twenty year timeframe a more likely development scenario would see a doubling of dwelling numbers. This would conservatively indicate a potential future peak hour traffic volume of 300-400 vehicles per hour.

A similar development scenario could be applied with regard to the properties accessing the construction of Redwood Drive, although only a total of six sites are so zoned. From a practical perspective it is considered that the increase in traffic generated by the potential redevelopment of six or less properties is negligible.

6.3.4 Assessment of Effects

Huruhuru Road, Lowerhurst Road, Taitapu Street and Kopi Place (which connects to Taitapu Street) only connect to the wider road network via the Huruhuru Road / Taitapu Street intersection. Full closure of this intersection would create a significant negative effect on local residents; therefore at least one lane through this intersection should remain open.

Construction works and vehicles in the Lowerhurst Reserve will temporarily reduce the accessibility of this public space, particularly if the through pedestrian connection is severed for a significant period during the works. As the reserve is an area likely to attract use by younger, vulnerable pedestrians, the potential effect of inadvertent access into the works areas by such pedestrians will need to be managed and mitigated to minimise the safety hazard.

6.3.5 Potential Specific Construction Mitigation Measures

One trafficable lane should remain open at all times at the Huruhuru Road / Taitapu Street intersection to ensure access for vehicles and to prevent the severance of vehicle access to this section of the road network. When works are in progress at Lowerhurst Reserve all working areas should be appropriately separated from public access by barriers and / or fencing.

6.4 Cedar Heights Avenue to Holmes Reserve

6.4.1 Overview

This section of the route will be approximately 1.1km in length and runs from the Redwood Drive / Cedar Heights Avenue intersection to the southern end of Holmes Reserve adjacent to Holmes Drive South. As per the current concept design, the pipeline will likely be constructed by both trenched and trenchless methods.

Between the Redwood Drive / Cedar Heights Avenue intersection to the Cedar Heights Avenue / Jarrah Place intersection it is proposed that trenched construction will be used. North of this point trenchless construction will be employed. Including the construction sites at the Cedar Heights Avenue / Jarrah Place intersection and within Holmes Reserve, it is forecast that six construction sites will be required. These six sites have been indicatively located at:

- Intersection of Cedar Heights Avenue / Jarrah Place intersection;
- Intersection of Cedar Heights Avenue / Benchmark Drive intersection;
- Outside 53 Cedar Heights Avenue;
- The southern corner of Makora Reserve;
- At 128 Royal Road; and
- The southern corner of Holmes Reserve.

6.4.2 Existing Traffic Environment

It is proposed that the majority of this section of the route will be undertaken by a trenchless method of construction. No trenched technology construction in the road carriageway will be required north of the Cedar Heights Avenue / Jarrah Place intersection. It is understood that three construction sites will be required along Cedar Heights Avenue (the fifth construction site will be in Holmes Reserve and is discussed separately below). Most of the proposed sites are to be located immediately adjacent to intersections.

Both the Cedar Heights Avenue / Jarrah Place and Cedar Heights Avenue / Benchmark Avenue are uncontrolled "T" intersections with Cedar Heights Avenue forming the head of the "T". Movements on Cedar Heights Avenue have priority of movement over the side road.

Table 4 below summarises the general physical characteristics of the roads which this section of the route will pass through or under.

Road	Proposed Pipeline Construction Method	District Plan Classification	Number of lanes	Kerbside Parking Permitted?	Average Annual Daily Traffic (vpd)	Data Date or Source ¹	CoPTTM Road Level
Royal Road	Underground no surface works	Collector Road	4	No	11,286	2015	2
Holmes Drive South	Underground no surface works	Local Road	2	Yes	600	Est.	1
Cedar Heights Avenue	Trenched technologies to int. with Jarrah Place	Local Road	2	Yes	500	RAMM	1
Jarrah Place	Construction Site location at intersection with Cedar Heights Ave	Local Road	2	Yes	100	Est.	LV
Benchmark Drive	Construction Site location at intersection with Cedar Heights Ave	Local Road	2	Yes	600	Est.	1

Table 4: Route Road Characteristics

For AT traffic count data – year of data collection noted, RAMM notes estimate from the RAMM database and Est. notes an estimate of traffic volumes made by TDG on the basis of site observations.

Photographs 7 to 9 show the general traffic environment of Cedar Heights Avenue and the proposed site works intersections between Redwood Drive and Holmes Reserve.



Photograph 7: Cedar Heights Avenue Looking South Towards Redwood Drive



Photograph 8: Cul-de-sac End of Cedar Heights Avenue



Photograph 9: Holmes Drive South, Holmes Reserve Can Be Seen Left of Centre in the Photo

It is not intended to have any works on Royal Road or Holmes Drive South, but vehicle access via these roads will be required.

Holmes Reserve is 4,500m² of public recreation area with its main road frontage to Holmes Drive South. There are no public vehicle access points to Holmes Reserve, but pedestrian access is possible via Holmes Drive South and pedestrian walkways from Glenbury Place, Luxor Place and a second pedestrian connection to Holmes Drive South. The northern end of Holmes Reserve backs onto properties fronting Berkshire Terrace. To gain access to the reserve for works purposes, a vehicle access point will need to be constructed connecting Holmes Reserve to Holmes Drive South. This accessway should be constructed in

accordance with the requirements of ATCOP, the standard engineering guidance for design and construction specifications for such works in the Auckland region.

On-site observations have confirmed that there is sufficient available sight distance available for any required manoeuvres into or out of a site entrance to be made safely.

With the exception of Royal Road, all roads have a predominantly residential development environment. Royal Road is a largely commercial environment in the vicinity of the designation corridor. On the southern side of Royal Road is a Badminton Centre and on the northern side a real estate office.

6.4.3 Future Traffic Environment

Under the PAUP the majority of land surrounding this section of the route is zoned Mixed Housing Urban.

As discussed under Section 6.3.3, while the PAUP zoning framework for this area would theoretically allow a tripling of dwelling numbers in this area and conceivably, a pro-rata increase in daily and peak hour trip generation, this is considered to be unrealistic within the 20 year timeframe. Applying the more probable development scenario, again as discussed in Section 6.3.3 would indicate a potential future daily traffic volume on the local roads in this vicinity of approximately 1,000 to 1,200 vpd and peak hour volumes in the region of 100-150vph.

As part of the SH16 Lincoln Road to Westgate Upgrading Project, scheduled to start in late 2016, it is proposed to replace the Royal Road overbridge.

6.4.4 Assessment of Effects

North of the Cedar Heights Avenue / Jarrah Place intersection it is intended that construction would be via trenchless technologies, for which the only surface expression would be the six works sites listed above. These work sites would require heavy vehicle access and, for the three sites in the road corridor, use of carriageway space for the working area. The forecast future traffic volumes are still at a level at which appropriately managed one lane alternating flow operations could occur on the designation route roads without undue traffic effects

6.4.5 Potential Specific Construction Mitigation Measures

The general mitigation measures discussed in Section 8.2.1 should be employed.

6.5 **Holmes Reserve to Holmes Drive**

6.5.1 Overview

Starting from the construction site in Holmes Reserve, the designation route heads in a northerly direction through the reserve and along the alignment of Berkshire Terrace

towards Ruze Vida Place. A small deviation to the east then occurs to allow the route to proceed along Jadewynn Drive to Manutewhau Reserve.

As per the current concept design between Holmes Reserve and Manutewhau Reserve the pipeline will likely be constructed by trenchless construction methods. From Manutewhau Reserve to Holmes Drive the concept design intends that construction would be via trenched technologies, although a small gully may be crossed via pipe-bridge in order to maintain the gradient profile of the pipeline.

Construction sites for the trenchless construction phase are expected to include:

- Holmes Reserve (discussed above);
- 15 Berkshire Terrace;
- Intersection of Ruze Vida Drive / Berkshire Terrace;
- Intersection of Ruze Vida Drive / Jadewynn Drive;
- Manutewhau Reserve; and
- Southern end of Holmes Drive (to be discussed in the following section of the report).

Additional working area may be required where the pipe-bridge is to be constructed.

6.5.1.1 Existing Traffic Environment

Table 5 below summarises the general physical characteristics of the roads which this section of the route will pass through or under.

Road	District Plan Classification	Number of lanes	Kerbside Parking Permitted?	Average Annual Daily Traffic	Data Date or Source	CoPTTM Road Level
Berkshire Terrace	Local Road	2	Yes	250	Est.	1
Ruze Vida Drive	Local Road	2	Yes	1390	RAMM	1
Jadewynn Drive	Local Road	2	Yes	1390	RAMM	1
Holmes Drive	Collector Road	2	Yes	1000	Est.	1

Table 5: Route Road Characteristics

South of Manutewhau Reserve it is proposed that works occur via trenchless construction and the only surface expression in the road corridor will be the construction sites at the intersection of Ruze Vida Drive / Berkshire Terrace and Ruze Vida Drive / Jadewynn Drive. These intersections are only separated by 50m and the road carriageway of all three roads is only 7-8m in width. As both of the construction sites will be operational simultaneously this will result in a concentration of effects which is discussed in Section 5.1.5 of this report.

Access to the construction sites in Holmes Reserve has been previously discussed and access to Manutewhau Reserve will occur from Ruze Vida Drive. There is no public vehicle access to Manutewhau Reserve and although there is an access for service vehicles, the dimensions and standard of its construction is not considered suitable for access by construction vehicles, therefore an upgrade or new access is recommended.

As with the other access points to be constructed during the works construction, this access route should be in accordance with ATCOP. It is considered that the available sight distance in this location is more than adequate for the proposed construction movements.

North of Manutewhau Reserve where the trenched technology construction works will occur, Ruze Vida Drive has a kerb to kerb carriageway width of approximately 8m. It is therefore probable that no through traffic on Ruze Vida Drive would be possible when these works are in progress, however the connectivity of Ruze Vida Drive and the adjoining roads will allow detour routes to be created, leaving only residents in the immediate work area to be accommodated.

Photographs 10 to 12 show the general characteristics of the roads on this section of the route with a particular emphasis on the locations adjacent to the proposed construction sites.



Photograph 10: Cul-de Sac end of Berkshire Terrace, The Designation Enters Though 15 Berkshire Terrace (the cream house left of centre in the photo)



Photograph 11: Jadewynn Drive / Ruze Vida Drive Intersection. The intersection of Ruze Vida Drive and Berkshire Terrace is at the Upper Right of the Photograph by the Red Car



Photograph 12: Jadewynn Drive and Mautewhau Reserve

All roads in the section of the designation route have a speed limit of 50km/h.

6.5.2 Future Traffic Environment

Under the PAUP the majority land surrounding this section of the route is zoned Mixed Housing Urban. As discussed under Section 6.3.3, while the PAUP zoning would theoretically allow a tripling of dwelling numbers in this area and conceivably, a pro-rata increase in daily and peak hour trip generation, this is considered to be unrealistic within the project's 20 year timeframe.

Applying the more probable development scenario, again as discussed in Section 6.3.3 would indicate a potential future daily traffic volume on the local roads in this general vicinity of approximately 2,500 vpd and peak hour volumes in the region of 250ph.

6.5.3 Assessment of Effects

As discussed in Section 5.3 although trenchless construction only requires surface area for the fixed work site locations, these work sites require heavy vehicle access and for the three sites in the road corridor, use of carriageway space itself as a part of the working area. The forecast future traffic volumes are still at a level at which appropriately managed one lane alternating flow operations could occur on the designation route roads without undue traffic effects

6.5.4 Potential Specific Construction Mitigation Measures

The general mitigation measures discussed in Section 8.2.1 should be employed.

6.6 **Holmes Drive to Hobsonville Road**

6.6.1 Overview

As per the current concept design, it is proposed that all but a 60m section of the construction works on this section would occur via trenchless construction. The 60m section of trenched technology construction would occur on Holmes Drive between the properties at 5 Holmes Drive and 75 Oriel Avenue.

The overall length of this section is approximately 1km and at its northern end will connect into the section of the Northern Interceptor constructed within the shared corridor with North Harbour No.2 Watermain.

Including construction sites at the southern end of Holmes Drive and in currently undeveloped land north of Hobsonville Road, it is forecast that some six construction sites will be required. These six sites have been indicatively located at:

- The southern end of Holmes Drive;
- Outside 5 Holmes Drive;
- Outside 75 Oriel Avenue;
- Within the southern section of St Margaret's Park;
- Within the northern section of St Margaret's Park; and
- North of Hobsonville Road (connection to NI Phase 2).

Access to the construction sites within St Margaret's Park would be via Truscott Place.

6.6.2 Existing Traffic Environment

Table 6 below summarises the general physical characteristics of the roads which this section of the route will pass through or under.

Road	District Plan Classification	Number of lanes	Kerbside Parking Permitted?	Average Annual Daily	Data Date or Source ¹	CoPTTM Road Level
Hobsonville Road	District Arterial	2 (plus flush median)	Yes	13,507	2015	2
Holmes Drive	Collector Road	2	Yes	1000	Est.	1
Oriel Avenue	Collector Road?	2	Yes		RAMM	1
Peterhouse Place	Local	2	Yes	150	Est.	1

Table 6: Route Road Characteristics

The section of Holmes Drive where construction by trenched technologies will occur has a kerb to kerb width of 11m.

Photograph 13 shows the general characteristics of Holmes Drive.



Photograph 13: Holmes Drive Looking North Towards Intersection with Oriel Avenue

Access to the construction sites in St Margaret’s Park will be via Truscott Place. Truscott Place is a short (approximately 130m long) cul-de-sac which connects to Fitzherbert Avenue. Fitzherbert Avenue is a Collector Road which runs between Oriel Avenue in the south and Hobsonville Road in the north. Both terminating intersections are priority controlled “T” intersections with the through road (Oriel Avenue and Hobsonville Road) having priority.

6.6.3 Future Traffic Environment

Under the PAUP the majority land surrounding this section of the route is zoned Mixed Housing Urban. As discussed under Section 6.3.3, while the PAUP zoning would theoretically allow a tripling of dwelling numbers in this area and conceivably, a pro-rata increase in daily and peak hour trip generation, this is considered to be unrealistic within the project's 20 year timeframe. Applying the more probable development scenario, again as discussed in Section 6.3.3 would see a doubling of dwelling numbers. This would indicate a potential future daily traffic volume on the local roads in this vicinity of approximately 1,000 to 1,200 vpd and peak hour volumes in the region of 100-150vph. It is however noted that it is intended to construction all bar a small part of this section using trenchless construction.

6.6.4 Assessment of Effects

Holmes Drive connects to the road network solely via Oriel Avenue, and there is a short cul-de-sac, Cecil Beatt Place, which connects to Holmes Drive. There is a short section of works (~60m in length) which it is proposed to construct by trenched technologies – within this section of work the pipeline is intended to cross from one side to the other of Holmes Drive. If this work were to occur in a single stage, access to properties on Holmes Drive south of the work site would be severed (including all properties on Cecil Beatt Place), with consequential effects on the local residents and their visitors. Such an effect should be avoided by employing a staged construction process.

There is no existing vehicle access lane into St Margaret's Reserve and such an access will need to be created for the works to proceed. Construction and operation of a new access point, particularly one which will be used predominantly by heavy vehicles, will increase heavy vehicle volumes (during the works period) on the access roads and reduce the available area within the reserve for pedestrian movement.

6.6.5 Potential Specific Construction Mitigation Measures

- Works within the proposed trenched construction area on Holmes Drive should be staged so as to maintain as a minimum a single lane and footpath of vehicle and pedestrian access to the southern end of Holmes Drive and Cecil Beatt Place.
- The St Margaret's Reserve site access points should be designed to achieve acceptable sight distances and (unless impractical) allow for on-site manoeuvring such that both entry and exit movements can occur in a forwards direction to minimise the potential for safety and efficiency effects on non-site traffic on the adjacent road network.
- Appropriate separation (e.g. fencing) should be installed to prevent pedestrian intrusion into the works areas in St Margaret's Reserve from those that remain open for public access.

7. Specific Assessment - Notice of Requirement: Northern Interceptor (North Shore)

7.1 The Knoll to Collins Park

7.1.1 Overview

The proposed construction methodology is to use trenchless construction. Including construction sites at The Knoll / Tauhinu Road intersection and within Collins Park, it is forecast that five construction sites will be required. These five sites have been indicatively located at:

- Intersection of The Knoll / Tauhinu Road;
- Intersection of Tauhinu Road / Pounamu Road;
- Intersection of Tauhinu Road / Manon Crescent;
- Approximately 80m north of the Tauhinu Road / Shiloh Way intersection; and
- The south-western corner of Collins Park.

The construction route will proceed northwards along Tauhinu Road to a point approximately 80m north of the western boundary of the Tauhinu Road / Shiloh Way intersection where it turn east and head underneath some residential properties to Collins Park.

7.1.2 Existing Traffic Environment

Tauhinu Road is defined in the District Plan as a Collector Road, all connecting side roads in this section of the works are local roads. **Table 7** below summarises the general physical characteristics of these roads.

Road	District Plan Classification	Number of lanes	Kerbside Parking Permitted?	Average Annual Daily Traffic (vpd)	Data Date	CoPTTM Road Level
Greenhithe Road	Collector Road	2	Yes	6,116	2014	1
Tauhinu Road	Collector Road	2	Yes	3,437	2012	1
Roland Road	Local Road	2	Yes	1,700	RAMM	1
The Knoll	Local Road	2	Yes	100	est	LV
Pounamu Avenue	Local Road	2	Yes	717	2013	1
Manon Crescent	Local Road	2	Yes	150	RAMM	LV

Table 7: Route Road Characteristics

All of the roads have a posted speed limit of 50km/h.

While it is intended that this section of the route will be undertaken by a trenchless method of construction and hence no open trenching in the road carriageway will be required, it is understood that some four construction sites will be required along Tauhinu Road (the fifth construction site will be in Collins Park and is discussed separately below). Most of the proposed sites are to be located immediately adjacent to intersections.

All of the construction site intersections are uncontrolled “T” intersections with Tauhinu Road forming the head of the “T”. Movements on Tauhinu Road have priority over movements from the side roads.

Greenhithe Road provides one lane in each direction and is categorised in the District Plan as a Collector Road. In the vicinity of Collins Park the carriageway is approximately 10.5m in width with one traffic lane in each direction divided by a painted centreline. Footpaths and grass berms are provided on both sides of the road and kerbside parking is generally permitted. At the northern end of Collins Park, Greenhithe Road intersects with Roland Road at a priority controlled “Y” intersection. Greenhithe Road forms the southern and eastern legs of the intersection and movements on this road have priority. Movements from Roland Road (the western leg of the intersection) are Give-Way controlled.

Photographs 14 and 15 show the general traffic environment of Tauhinu Road and the proposed site works intersections between The Knoll and the point at which the pipeline route is planned to leave the road corridor and head east to Collins Park.



Photograph 14: Tauhinu Road / the Knoll Intersection Looking Towards the SH18 Interchange



Photograph 15: Tauhinu Road / Marae Road / Shiloh Way Intersection Looking North, the Turn to the East Will Occur Approximately In the Mid-point of the Photograph

Properties fronting Tauhinu Road and the adjoining side streets are generally residential in nature, in keeping with the current Residential 1 zoning.

Collins Park is a recreational reserve which provides for a variety of passive and active recreational activities and includes a skate park and children's playground, both of which would attract younger pedestrians to the area. The park has frontage solely to Greenhithe Road, although its northern end (where it is proposed to provide heavy vehicle access during construction) is adjacent to the Greenhithe Road / Roland Road intersection. There is an existing vehicle access and off-street car park; however it is not proposed to use either as part of the construction works.

7.1.3 Future Traffic Environment

Under the PAUP the land around Tauhinu Road and Greenhithe Road is predominantly zoned for large lot residential. Comprehensive residential development has already occurred along Tauhinu Road and within the immediate side streets. With the proposed zoning there will be limited prospect for further residential growth and hence the potential for increases in traffic flow is considered to be minimal.

7.1.4 Assessment of Effects

The initial construction site on the eastern side of the Waitemata Harbour will be at the western end of The Knoll. Access to this construction site is proposed via either The Knoll road itself or along the Upper Harbour Cycleway.

The Upper Harbour Cycleway crosses the Upper Waitemata Harbour via the Upper Harbour Bridge and connects west Auckland with the North Shore. In advance of the Skypath (the proposed cycle path crossing the Auckland Harbour Bridge), it is one of the few cross harbour links in the Auckland Cycle network.

Even when the Skypath is in operation, there will still only be a limited number of cycle routes across or around the Waitemata Harbour. There would thus be a significant severance effect on the Auckland Cycle network were this link to be closed whilst construction activities occur and such an effect should be mitigated or avoided as discussed below.

The first construction site on Tauhinu Road is expected to be located between the connection of the Upper Harbour Cycleway to Tauhinu Road and the connection of the Tauhinu Road / SH18 eastbound off-ramp with Tauhinu Road. Additionally, Tauhinu Road bends to the north at this location.

Two of the currently proposed work site locations are at, or in the near vicinity of intersections where the side road is a cul-de-sac with only one road connection (Tauhinu Road / Pounamu Avenue and Tauhinu Road / Manon Crescent). Adequate allowance should therefore be made for movements into and out of these side roads so that the effects of construction on the properties in these side streets can be minimised.

Tauhinu Road and Greenhithe Road are public transport routes and the dimensions of work and loading areas should be designed with the need to maintain access by bus sized vehicles in order to maintain these public transport services which will minimise the effect on the local users and the public transport network.

Construction works and access by heavy vehicles into Collins Park may temporarily reduce the accessibility of this public space. As the park is an area likely to attract use by younger, vulnerable pedestrians the potential safety effect of inadvertent access into works areas by such pedestrians will need to be managed and mitigated to minimise the safety hazard.

It is noted that there is no existing vehicle access lane into or out of Collins Park and such an access will need to be created for the works to proceed. The access will connect to the road network on the southern side of the Greenhithe Road / Roland Road intersection. This is currently a Y-shaped intersection and the addition of the site access will effectively make a cross-roads intersection. The effect of the additional traffic volumes due to the construction traffic is considered to be minor, however, as previously discussed, off-street site access points should be designed to achieve acceptable and safe sight distances, and unless impractical, allow for on-site manoeuvring such that both entry and exit movements can occur in a forwards direction to minimise the potential for effects on non-site traffic on the adjacent road network.

7.1.5 Potential Specific Construction Mitigation Measures

- Works should be arranged so as to minimise disruption to the Upper Harbour Cycleway. If works or construction access on the cycleway does occur then an alternative path should be provided where practical.
- Contact should be made with Auckland Transport and Cycle Action Auckland prior to any works which disrupt the cycleway.
- Works areas in the road corridor of Tauhinu Road and Greenhithe Road should be established such that the remaining trafficable areas are suitable for used by bus services.

- Communication with the AT public transportation service disruption team should occur prior to any works on Tauhinu Road or Greenhithe Road and as required during the works process.
- If it is necessary to close any bus stops temporarily during the works then alternative temporary bus stop locations should be established.

7.2 Collins Park to Wainoni Park

7.2.1 Overview

From the south-western corner of Collins Park the pipeline route continues in broadly a westwards direction to the south-western end of Wainoni Park, an approximate distance of 550m. It is proposed that works would be undertaken via trenchless construction and that three construction sites will be required. These three sites have been indicatively located at:

- The south-western corner of Collins Park (discussed in Section 7.1);
- The north-western corner of Collins Park; and
- The south-western corner of Wainoni Park.

Access for the Collins Park sites would be off Greenhithe Road near the Greenhithe Road / Roland Road intersection, and for the Wainoni Park site from Greenhithe Road, approximately 130m east of the roundabout intersection with Churchouse Road.

Under the proposed construction methodology no works would be required in the road corridor on this section of the route.

7.2.2 Existing Traffic Environment

Greenhithe Road between Tauhinu Road and Roland Road has been previously described under Section 7.1. After exiting Collins Park the pipeline follows Greenhithe Road to Wainoni Park.

Greenhithe School is located adjacent to the Greenhithe Road / Churchouse Road / Isobel Road roundabout. This school is a primary school with students typically between 5 to 10 years old. There is a pedestrian zebra crossing of Greenhithe Road 50m south of the roundabout onto Churchouse Road. At either end of the school day this crossing is operated by a school crossing patrol.

Average weekday traffic volumes on Greenhithe Road are around 5,400 vpd near Tauhinu Road, rising to 6,100 vpd near Wainoni Park (see **Table 8** below).

Road	Traffic Count Date	Daily Traffic Volume (veh)	AM Peak Hour Volume (veh)	PM Peak Hour Volume (veh)
Greenhithe Road (north of Tauhinu Road)	2014	5,373	406(average) 465 (peak)	497 (average) 565 (peak)
Greenhithe Road (between Isobel Road and Sunnyview Road)	2014	6,116	537 (average) 561 (peak)	536 (645 peak)

Table 8: Traffic Flow Data: Greenhithe Road

Roland Road and Sunnyview Road are priority intersections with priority afforded to Greenhithe Road. Greenhithe Road and the surrounding road have a 50km/h posted speed limit.

Photograph 16 shows the roundabout intersection of Greenhithe Road with Churchouse Road and Isobel Road.



Photograph 16: Greenhithe Road / Churchouse Road / Isobel Road Intersection. View from Churchouse Road

Wainoni Park is an open recreational space of some 40 hectares which includes sports playing fields, playground and walking / recreation areas. The reserve is bounded by Churchouse Road on its western boundary and Greenhithe Road to the south. To the north and east Wainoni Park runs into the harbour. There are parking areas on both Churchouse Road and Greenhithe Road.

Vehicle access to Wainoni Park is provided via four driveways, three on Churchouse Road and one on Orwell Road. It is proposed to use the northernmost access on Churchouse Road as an access route to the construction areas within Wainoni Park.

Photograph 17 is a view of Wainoni Park from near Greenhithe Road.



Photograph 17: Wainoni Park from Greenhithe Road

Properties fronting Greenhithe Road and the adjoining side streets are generally residential in nature, in keeping with the current Residential 1 zoning.

7.2.3 Future Traffic Environment

Under the PAUP the land around Greenhithe Road and the surrounding side streets is predominantly zoned for large lot residential. Comprehensive residential development has already occurred along Tauhinu Road and within the immediate side streets. With the proposed zoning there will be limited prospect for further residential growth and hence the potential for increases in traffic flow is considered to be minimal.

Wainoni Park is zoned Open Space, Sport and Active Recreation within the PAUP, consistent with the current zoning and consequently, it is considered that the existing usage would remain. While much residential development has already occurred in the immediate surrounding area, due to the extent of sporting and recreation area offered by Wainoni Park, the potential catchment is larger, and would likely include areas where there is more scope for additional residential development. Accordingly, it is probable that within the 20 year timeframe there would be additional usage demands on the park, resulting in some increase in traffic volumes. These traffic demands are however likely to occur in the evenings and weekends, outside of standard working hours for the Project.

7.2.4 Assessment of Effects

There are no proposed works sites in the road corridor for this section of the route and hence the potential traffic effects will be confined to effects from the heavy vehicle volumes on the access routes, and localised minor effects in the immediate vicinity of the site access locations.

The potential effects and hazards of the construction access in Collins Park have been discussed in the preceding section of this report and can be appropriately managed.

Access to the Wainoni Park construction sites will occur off Greenhithe Road (a new access) and from Churchouse Avenue (via an existing access, discussed further in Section 7.4.4) and will require consideration of the site access factors previously discussed in order to minimise the effect of the additional construction traffic. The factors include the provision of acceptable and safe sight distances and, unless impractical, an allowance for on-site manoeuvring such that both entry and exit movements can occur in a forwards direction. This would then minimise the potential for effects on non-site traffic on the adjacent road network. In regard to sight distance, both Greenhithe Road and Churchouse Road in the vicinity of the proposed site access points, while undulating are straight, and clear lines of sight can be achieved readily.

It is noted that the heavy vehicle access route for this site will likely pass Greenhithe School, sited on the corner of Greenhithe Road and Isobel Road, adjacent to the Greenhithe Road / Isobel Road / Churchouse Avenue intersection. While the effects from the total heavy traffic volumes are considered minimal and manageable, heavy vehicle movements past the school should be managed in order to mitigate potential traffic and safety effects.

7.2.5 Potential Specific Construction Mitigation Measures

- All construction access driveways should be of an all-weather construction that minimises potential dust and debris tracking onto the road corridor.
- The width and corner radii of the construction access driveways (whether existing or newly constructed) should be built or upgraded so as to comfortably accommodate the movements by heavy vehicles of the expected dimensions.
- Truck movements should be reduced or halted during the school day start and end periods.

7.3 South Wainoni Park

7.3.1 Overview

As per the current concept design, it is intended to construct a new Pump Station in south-eastern corner of Wainoni Park. Construction and operational access to the Pump Station would be via Orwell Road.

7.3.2 Existing Traffic Environment

Orwell Road is classified as a local road in the Operative District Plan and connects to Greenhithe Road at its southern end. The northern end of Orwell Road terminates just north of the Orwell Road / Pitoitai Avenue / Huntingdon Park Drive intersection although there is a pedestrian link thorough to Kyle Road. Approximately 12 roads have access directly or indirectly onto Orwell Road. None of these roads have a separate connection to the main road network, the only connection is provided via Orwell Road.

Development on Orwell Road and the surrounding roads is predominantly residential.

Orwell Road is typically 10m wide between kerbs with and provides two traffic lanes separated by a painted centre line.

Kerbside parking is permitted on both sides of the road. Footpaths are provided on either side of the road and there is a driveway connection to the North Shore Dog Training Club which operates in Wainoni Park.

The general traffic environment at Wainoni Park has been previously discussed under Section 7.2.2.

7.3.3 Future Traffic Environment

Under the PAUP the non-park land around Orwell Road is predominantly zoned for large lot residential. Comprehensive residential development has already occurred along Orwell Road and within the immediate side streets. With the proposed zoning there will be limited prospect for further residential growth and hence the potential for increases in traffic flow is considered to be minimal.

The future traffic environment at Wainoni Park has been previously discussed under Section 7.2.3 of this report.

7.3.4 Assessment of Effects

Works for the Pump Station will typically occur outside of the road corridor and traffic effects are confined to the vehicle trips into and out of the site. Typical traffic volumes will be about 20-30 truck trips and 12 other vehicle trips per day, and may peak at between four to six truck trips and two light vehicle trips an hour.

The volume of these heavy vehicle trips, while likely to be notably higher than current heavy vehicle volumes on the access roads, are low in terms of the actual number of trips per hour. Management of the construction traffic can be achieved via the appropriate design and signage of site access locations, and guidance of CoPTTM.

The driveway connection to the Dog Training Club rises directly from Orwell Road and has limited width.

Overall, the traffic effects from the on-going operation of the Pump Station in South Wainoni Park are considered to be negligible.

7.3.5 Potential Specific Construction Mitigation Measures

It is recommended that the driveway access is upgraded to provide suitable all weather access for the expected heavy vehicle sizes.

7.4 North Wainoni Park to North Shore Memorial Park

7.4.1 Overview

Under the current concept design, pipeline construction is intended to be predominantly undertaken by trenchless construction methods as the pipeline passes under Te Wharau Creek to land at the North Shore Memorial Park (“NSMP”). In addition, a pump station will be constructed at the northern end of Wainoni Park.

7.4.2 Existing Traffic Environment

Vehicle access to the construction sites will be via Wainoni Park and Churchouse Road and via NSMP and Schnapper Rock Road.

Churchouse Road has narrow carriageway with a 6m width from kerb to kerb. There are traffic calming measures in the form of central islands and planting as shown in **Photograph 18** below.



Photograph 18: Churchouse Road, Typical Carriageway

The traffic environment at Wainoni Park has been previously discussed and the traffic environment of the North Shore Memorial Park will be discussed under Section 7.5.2.

7.4.3 Future Traffic Environment

Under the PAUP the non-park land around Churchouse Road is predominantly zoned for large lot residential. Comprehensive residential development has already occurred along Greenhithe Road, Churchouse Road and within the immediate side streets. With the proposed zoning there will be limited prospect for further residential growth and hence the potential for increases in traffic flow is considered to be minimal.

The future traffic environment at Wainoni Park has been previously discussed and the future traffic environment of the North Shore Memorial Park will be discussed under Section 7.5.3.

7.4.4 Assessment of Effects

Apart from a potential small section of trenched construction at the very northern end of Wainoni Park, it is intended that this section of the pipeline works will be undertaken by a trenchless method of construction and the majority of that construction will occur in the marine environment.

Construction works for the pump station have an estimated duration of between 18 and 24 months. Typical traffic volumes will be about 20-30 truck trips and 12 other vehicle trips per day, and may peak at four to six truck trips and two light vehicle trips per hour.

Vehicle access to the construction sites will be via Wainoni Park and Churchouse Road and via NSMP and Schnapper Rock Road, with all construction traffic for the pump station occurring from Churchouse Road. Both roads have some limitations from a heavy vehicle access perspective. Churchouse Road has a narrow carriageway while sections of Schnapper Rock Road have a winding alignment and steep gradients, however it is not considered that the extent of these limitations is such that they would noticeably affect site operations.

Traffic effects are thus considered to consist solely of the effects relating to the movement of construction vehicles and materials to and from the work sites. Effects relating to the construction site in NSMP will be discussed in the next section of this report and the focus here will be on the effects relating to construction at the Wainoni Park site.

It is intended to achieve access to Wainoni Park via an access lane off Churchouse Road. This (existing) access lane is immediately adjacent to houses in Birchwood Grove, and hence there will be a potential traffic-related effect on these properties due to the noise and potential dust from construction vehicles moving inwards and outwards along this lane. In addition construction traffic will add to the vehicle volumes on Churchouse Road. Churchouse Road is currently lightly trafficked, with a low proportion of heavy vehicles. There will thus be a significant relative increase in the number of heavy vehicles on this road, however as has been previously described, the actual number of heavy vehicle movements per hour is considered to be low and the effect on traffic operations within Churchouse Road are expected to be minor.

Greenhithe School is adjacent to the southern end of Churchouse Road. Greenhithe Road, Churchouse Road and Isobel Road which are the streets in the immediate vicinity of the school all experience peaks in traffic volume at the start and end of the school day. There are also increased pedestrian movements on the footpaths and pedestrians crossings around the school at these times. Added to this would potentially be the movement of heavy vehicles to and from the Wainoni Park construction sites. It is considered that the potential effects of this combination of movements should be mitigated.

7.4.5 Potential Specific Construction Mitigation Measures

- All construction access driveways should be of an all-weather construction that minimises potential dust and debris tracking onto the road corridor.

- The width and corner radii of the construction access driveways should be upgraded so as to comfortably accommodate the movements by heavy vehicles of the expected dimensions.
- Truck movements should be reduced or halted during the school day start and end periods.

7.5 North Shore Memorial Park to Schnapper Rock Road

7.5.1 Overview

North Shore Memorial Park (NSMP) is a Council owned and operated crematorium and cemetery. It has road access solely from Schnapper Rock Road.

The pipeline will come ashore at the north-western corner of NSMP and proceed eastward along the northern edge of the park before linking to the existing internal road network and continuing east to exit onto Schnapper Rock Road via the northern (secondary) park entrance.

This section of route is approximately 900m long with the proposed construction being principally open-trenching (some trenchless construction is proposed to occur where the pipeline lands after crossing Lucas Creek).

7.5.2 Existing Traffic Environment

Apart from where it connects to Schnapper Rock Road, this section of designation route occurs entirely outside of the public road network and is entirely within NSMP.

There is a limited road network within the NSMP consisting of lanes typically 4-5m in width.

NSMP connects to Schnapper Rock Road at two locations, a main driveway 260m north of the Schnapper Rock Road / Aberley Road (north) intersection and a secondary driveway 150m south of the Schnapper Rock Road / Aberley Road (south) intersection. It is proposed that the pipeline would enter Schnapper Rock Road via the secondary driveway.

Traffic volumes within NSMP are generally low, although some peaking volumes will occur before and after the start of services at the site. Particular mitigation measures to manage the impact of construction during these times are discussed below.

7.5.3 Future Traffic Environment

It is understood that the existing operation of NSMP will continue for the foreseeable future and it is not considered that there would be a significant change in the traffic patterns at this location.

7.5.4 Assessment of Effects

The proposed construction route will predominantly run along current and future access lanes within NSMP and is expected to exit NSMP onto Schnapper Rock Road via the southern (secondary) park entrance.

Traffic within NSMP is minimal and the effects of the construction on that traffic will therefore be minor. However, the access lanes within NSMP are generally of limited width and it is probable that the construction corridor will require all of the available lane width when works are in progress. Consequently, access for non-construction vehicles will not be possible. It is considered that the current and proposed internal lane has sufficient redundancy to allow appropriate detours to be established such that the effect of the closure of a particular lane or lanes during construction will be minor.

Additional truck traffic on Schnapper Rock Road due to the construction works is likely to be in the order of 20 heavy vehicle movements per day. An assessment of the NSMP traffic count data shows that traffic volumes on Schnapper Rock Road near NSMP are significantly less than those on the road nearer to Albany Highway. Both count locations report a typical heavy vehicle volume of approximately 4% of daily flows. This would be equivalent to 50-60 heavy vehicles a day near Memorial Park and nearly 300 heavy vehicles a day near Albany Highway. The proposed additional heavy vehicle volumes (20 truck movements per day) are thus equivalent to one-third of the current daily truck volumes near Memorial Park and 7% near Albany Highway. While the additional truck movements will be notable to other road users near NSMP, it is not considered that there will be an undue effect due to these heavy vehicle movements.

7.5.5 Potential Construction Mitigation Measures

- Where heavy vehicle access is required and there are no existing access lanes, an all-weather access built to a suitable construction standard for the expected vehicle traffic should be constructed to enable vehicle access to occur with the minimum of effect to the surrounding grounds.
- Given the sensitive nature of the NSMP, all reasonable efforts should be made to minimise construction noise at all times, and to liaise with NSMP management to ensure no disruption to services and events. Works may need to be temporarily suspended on occasion to avoid disruption to services.

7.6 Schnapper Rock Road to North Shore Golf Course

7.6.1 Overview

A trenchless construction method is proposed for the crossing of Lucas Creek and for approximately 250m within the North Shore Golf Course (NSGC), with the remainder of the section being constructed via trenched technology construction.

The construction route will proceed down the carriageway of Schnapper Rock Road to its northern end then through reserve land to a work site where construction operations for the works in the CMA will occur.

The pipeline will land on the southern boundary of the NSGC and proceed eastward through the golf course, including fairways via the chosen trenchless construction method before a switch to trenched technology construction occurs.

7.6.2 Existing Traffic Environment

Schnapper Rock Road, classified in the District Plan as a local road, runs for a distance of 2.7km from Albany Highway to Te Wharau Creek. Side roads provide access to adjacent residential subdivisions. In the vicinity of NSMP, Schnapper Rock Road has one traffic lane in each direction, divided by a painted centreline. The carriageway is typically 8m wide and kerbside parking is permitted only in sections. Photograph 19 shows the general arrangement of Schnapper Rock Road.

Auckland Transport traffic data for Schnapper Rock Road and from a 7-day machine traffic count near the NSMP entrance is summarised in **Table 9** below.

Road	Traffic Count Date	Daily Traffic Volume (veh)	AM Peak Hour Volume (veh)	PM Peak Hour Volume (veh)
Schnapper Rock Road (between Kyle Rd & Albany Hwy)	2014	7,486	631	669
Schnapper Rock Road (between Memorial Park & Aberley Road (S))	2014	1,399	111	128

Table 9: Traffic Flow Data: Schnapper Rock Road

These results show that traffic volumes on Schnapper Rock Road near the work site are significantly less than those on the road nearer to Albany Highway. Both count locations report a typical heavy vehicle volume of approximately 4% of daily flows. The increase in heavy vehicle volumes, both proportionally and in numerical terms is discussed below in Section 7.6.4 of this report.



Photograph 19: Schnapper Rock Road Facing North, the Entrance to the Memorial Park Can Be Seen In the Centre of the Photograph

7.6.3 Future Traffic Environment

The land between NSMP and the northern end of Schnapper Rock Road is zoned as “Single House Zone” under the PAUP. This area has already been largely developed as a residential subdivision with a single dwelling on each site, and only a few vacant sites remain. While it is probable that some redevelopment of individual sites will occur within the next twenty years, given the proposed zone, and the current level of development, it is unlikely that significant development would occur to markedly influence traffic volumes.

The NSGC is zoned as open space for public recreation. TDG is aware that a number of golf courses in the Auckland isthmus have been, or are in the process of being redeveloped for housing. For such a change to occur at the NSGC within the timeframe would require a rezoning and approval of the development under the resource consent process. TDG is not aware than any such process is planned or envisaged by the NSGC and for the purposes of this assessment it has been assumed that the golf course remains in operation.

Accordingly it is considered that there is limited scope for an increase in traffic volumes along the roads within this section of the route.

7.6.4 Assessment of Effects

Construction along Schnapper Rock Road will require the use of one full traffic lane, and potentially areas of the berm and / or the opposite carriageway. From a transport effects minimisation perspective, the goal should be to maintain at least one open traffic lane to provide for a managed, alternating two-way flow. Hence, any additional working space should be sought from the berm as opposed to the southbound carriageway.

With traffic volumes on this section of Schnapper Rock Road less than 1,400 vpd and hourly volumes in the region of 100-130 vph, it is not considered that operating a one-lane system in this area will create undue traffic delays, even with potential future traffic growth.

It is considered that peak hour traffic volumes would have to increase approximately four-fold before significant effects from the operation of a one-lane system would begin to occur.

Aberley Road which runs parallel to Schnapper Rock Road and connects with Schnapper Rock Road on either side of the works area would provide an appropriate detour route when works are progressing along Schnapper Rock Road. However, access to and from properties within the diversion area would need to be maintained. Additionally, there are properties (currently one, but potentially more at the time of construction) on Schnapper Rock Road north of the northern intersection with Aberley Road for which access would need to be maintained.

North of the northern end of Schnapper Rock Road a construction staging area is proposed as a base for potential trenching operation across Lucas Creek and into the NSGC. This stage of the works will not require any operations within the road corridor; however Schnapper Rock Road would continue to be used by heavy vehicles for access. Provided that the site access is appropriately designed and that sufficient manoeuvring spaces is available on-site for heavy vehicles to turn around before exiting (so that both entry and exit movements are made in a forward direction), it is considered that the effects of these works would be minimal.

The current proposal intends that the pipeline connects to Schnapper Rock Road at the northern driveway to the NSMP, which is approximately 450m north of the main entrance. If the connection to Schnapper Rock Road is made at the main entrance then the effects discussed above will be generally similar, however there will be a greater distance over which works in the road corridor will need to be managed and a greater number of properties potentially affected.

7.6.5 Potential Specific Construction Mitigation Measures

- At least one open traffic lane should be maintained on Schnapper Rock Road to provide managed, alternating two-way flow.
- Any additional working space should be sought from the berm as opposed to the southbound carriageway.
- Aberley Road can be utilised as a detour route if required for sections of Schnapper Rock Road.

7.7 North Shore Golf Club to Appleby Road

7.7.1 Overview

The NSGC is located on 41.5ha of land and offers 27 holes, a club house and attached restaurant. Sole road access is via a driveway which connects to Appleby Road.

As per the current concept design, it is proposed that the pipeline will be installed through the golf club site by trenched technologies, running through the golf club car park and then exiting along the route of the golf course driveway. This section of the route is approximately 750m in length.

7.7.2 Existing Traffic Environment

The NSGC has vehicle access via a single driveway to Appleby Road. This access road is in the region of 5-6m in width, and connects to the golf course car park with space for over 200 vehicles. This car park is the only parking facility on the NSGC.

Weekday traffic volumes for the golf course are low although it is noted that the restaurant on site does attract groups. Such groups may arrive individually or collectively in larger vehicles such as tour buses.

7.7.3 Future Traffic Environment

As discussed in Section 7.6.3 it is not considered that there will be change in the existing traffic environment within the timeframe of the designation.

7.7.4 Assessment of Effects

The pipeline will be installed through the NSGC by trenched technologies, running through the golf club car park and then exiting along the route of the golf course driveway (which connects to Appleby Road). The alignment through the NSGC property was reached through discussion with NSGC. The key traffic effects within the NSGC will occur when the pipeline proceeds across the carpark, and then along the access road.

The consented Northern Interceptor Phase 1 pipeline follows a similar alignment through the car-park and driveway section of the NSGC. The construction of Phase 1 in these locations is to be undertaken during the annual week-long maintenance shutdown of the course. If a similar policy is employed for the construction of this Project, particularly for the driveway section of construction, it is considered that the effect on the golf club operations due to the reduction or closure of car parking will be minimal.

Weekday traffic volumes for the golf course are low and it is considered that the addition of construction traffic to the volumes on the access road would not create significant adverse traffic delays, particularly if the main trenching works along the NSGC driveway are undertaken during the annual maintenance shutdown.

However, the driveway is the only vehicle access route to the golf club and has a relatively narrow carriageway (5-6m), hence, where possible, construction equipment operation and material storage should occur off the access road so that a minimum level of access for members can be maintained.

The effects of construction traffic on the operation of the NSGC would be more significant during the weekends when the golf course (if open) will be busiest, and hence construction traffic during these times should be minimised.

7.7.5 Potential Specific Construction Mitigation Measures

- If practicable, construction within the NSGC should occur during the annual maintenance shutdown.

- If works are required outside of the shutdown period then construction traffic during the weekends should be minimised.

7.8 Appleby Road to William Pickering Drive

7.8.1 Overview

The pipeline will proceed along Appleby Road, and then from Appleby Road to William Pickering Drive, a distance of approximately 850m via Albany Highway, across a private property, and along John Glenn Avenue to the intersection with William Pickering Drive. The current concept design proposes that construction works will be via trenched technologies.

7.8.2 Existing Traffic Environment

Appleby Road is a short cul-de-sac some 350 m long primarily providing access to the NSGC and Albany Junior High School. At its western end Appleby Road merges into a private driveway to the NSGC.

Two side roads, both cul-de-sacs, connect to Appleby Road: Fearnley Grove and St Andrews Way. Both of the side roads are defined as local roads. St Andrews Road is currently only lightly developed but will be further developed as a residential area, while Fearnley Grove is a fully developed residential area.

Photograph 20 shows the carriageway and surrounds of Appleby Road.



Photograph 20: Appleby Road, Looking Towards Albany Highway

In the District Plan Appleby Road is defined as a local road and has a typical carriageway width of 10m. This width provides for one traffic lane in each direction and kerbside parking on both sides of the road.

On the southern side of Appleby Road is the Albany Junior High School. Albany Junior High School is a middle school catering for approximately 1,000 students in Year 7 to 10

(typically 12-16 years in age). While the school has frontage to both Albany Highway and Appleby Road, vehicle access is via Appleby Road only.

Albany Highway is defined in the District Plan as a Primary (Regional) Arterial. In the pipeline construction section it currently has one through traffic lane in each direction, and a flush central median / right turn bay. However works are currently in progress to upgrade Albany Highway. When completed, this section of Albany Highway will include bus lanes, and an improved central median giving an increased overall carriageway width.

Photograph 21 shows the Appleby Road / Albany Highway intersection.



Photograph 21: Appleby Road / Albany Highway Intersection (from Appleby Road)

Between Albany Highway and John Glenn Avenue the pipeline will cross a private property and then re-enter the public road corridor to travel along John Glenn Avenue to William Pickering Drive. John Glenn Avenue is a local road with a single traffic lane in each direction and a typical carriageway width of 10.5m. Kerbside parking is generally permitted on both sides of the road. Photograph 22 shows this parking is heavily utilised during daytime working hours. Footpaths are provided on both sides of John Glenn Avenue.

Some land fronting John Glenn Avenue (including the property via which the pipeline will cross from Albany Highway) is currently undeveloped, but the developed land in the vicinity is generally occupied by warehousing and commercial activities.

John Glenn Avenue is a cul-de-sac, and only connects to the wider road network via its intersection with William Pickering Drive. One side road, Unity Drive North, leads off John Glenn Avenue, and is also a cul-de sac.

Photograph 22 shows the proposed pipeline route along John Glenn Avenue.



Photograph 22: John Glenn Avenue View towards No. 14 John Glenn Avenue

The intersection of William Pickering Drive, John Glenn Avenue and Douglas Alexander Parade is a four-leg roundabout. The roundabout has a single circulating lane and the central island has a diameter of 15m.

Photograph 23 shows this intersection.



Photograph 23: William Pickering Drive / John Glenn Avenue / Douglas Alexander Parade Intersection

Traffic volume data for Appleby Road was not available from Auckland Transport but based on peak hour flow data from surveys undertaken by TDG, it is estimated that daily traffic volumes on Appleby Road are in the region of 3,500 vpd.

Auckland Transport data for Albany Highway indicates a typical weekday traffic volume in the region of 18,000 vpd. It is thus a CoPTM Level 2 Road.

The intersection of John Glenn Avenue and Unity Drive North was surveyed on Wednesday 19 November 2014 and Saturday 22 November 2014 for the weekday morning, afternoon and Saturday lunchtime peak periods.

Table 10 summarises the traffic volume data.

Road	Traffic Count Date	Daily Traffic Volume (veh)	AM Peak Hour Volume (veh)	PM Peak Hour Volume (veh)
Appleby Road	2014	3,500	442	308
Albany Highway (between Schnapper Rock and Amcor)	2013	18,090	1,551	1,632
John Glenn Avenue	2014	1,100	105	115
Unity Drive North	2014	300	33	27

Table 10: Traffic Flow Data: Appleby Road, Albany Highway, Unity Drive North and John Glenn Avenue

For this section of the route the five-year accident search identified nine report crashes, two of which resulted in minor injuries.

One minor injury resulted from a rear-end crash at the Appleby Road / Albany Highway intersection, as one vehicle was following another too closely when stopping in a queue. Four other rear-end collisions occurred at the same location but with no injuries. A total of five rear-collisions were thus reported at this intersection within a five year period.

While the number of these collisions is not considered excessive given the traffic volumes which pass through this intersection, during construction appropriate steps should be taken to maintain an effective level capacity and safety at this intersection during the works. These matters are discussed more fully in section 7.8.4 and 7.8.5 of this report.

The other minor injury crash occurred on John Glen Avenue when a pedestrian ran out onto the road in front of an oncoming vehicle.

As it is not predicted that traffic volumes will increase significantly in this location, there should not be any pressure on the road safety of this part of the network due to traffic growth.

7.8.3 Future Traffic Environment

With the exception of the NSGC and the Albany Junior High School, the PAUP zones the land surrounding Appleby Road as Mixed Housing Suburban. Under this zoning sites are permitted to be developed with up to three houses per site, or up to four dwelling per site as a restricted discretionary activity.

The residential properties adjoining this section of the route have been / are being developed with a single dwelling per property so theoretically the PAUP zoning would allow a tripling of dwelling numbers in this area and conceivably a pro-rata increase in daily and peak hour trip generation. However residential development in this area is comparatively recent and a full-scale redevelopment to achieve this higher density within a twenty year time frame is regarded as unlikely.

The land between Albany Highway and William Pickering Drive is zoned as Light Industry in the PAUP. This zoning is similar to the current zoning and development. While the nature of any future development cannot be categorically assumed at this stage given the proposed industrial zoning, and the current industrial character of the area, it is probable that future redevelopments would have broadly similar traffic generation characteristics as the current developments and hence it is not considered that there would be significant growth in traffic volumes.

7.8.4 Assessment of Effects

The pipeline is anticipated to be installed via trenched technologies, and given the carriageway widths on Appleby Road and John Glenn Avenue, the installation would be expected to take approximately 50-70% of the total carriageway width.

To allow effective use of the carriageway by both the construction team and other road users, kerbside parking will need to be temporarily prohibited around the active construction area during construction. The loss of kerbside parking has the potential to affect the convenience currently enjoyed by the employees of businesses on John Glenn Avenue who are able to use these public kerbside spaces, although the area is well catered for by public transport and as such the effect of this temporary parking loss is one which can be considered minimal and acceptable.

Traffic on Appleby Road is largely related to the NSGC and the Albany Junior High School, although there are some residential properties on St Andrews Way (and the potential for further development on this road). Kerbside parking usage on Appleby Road is generally limited and if, as discussed later, works on Appleby Road occur during school holiday periods it is considered that the effects will be minor.

A one-lane operation around the active construction area on Appleby Road, likely to be ~100-150m in length including safety zones, will be required if the road space available to other road users is less than 5.9m (as previously discussed, the 5.9m road width allows for two 2.75m wide traffic lanes separated by 400mm wide traffic cones).

The surveys undertaken by TDG indicate that typical traffic volumes on Appleby Road should not reach levels at which one-lane operation becomes problematic, however traffic movements into and out of Appleby Road peak considerably at the start and end of the school day, and the traffic control measures would need to allow for this traffic pulse.

The ability to manage the school traffic “pulse” will be particularly important when the works approach Albany Highway as there is the potential for vehicles wishing to enter Appleby Road, but delayed by an outgoing traffic stream (in the event of one-way operations), to queue across Albany Highway increasing the traffic effects.

The crossing of St Andrews Way, a short cul-de-sac connecting to Appleby Road, will need to be staged so as not to restrict vehicle access to this road, and create more than minor effects on the residents of this road.

The crossing of Fearnley Grove, a short cul-de-sac connecting to Appleby Road, will need to be staged so as not to restrict vehicle access to this road, and create more than minor effects on the residents of this road.

The Albany Highway / Appleby Road intersection currently operates under priority control with a give-way control for movements on Appleby Road.

It is assumed that when works are at or in the immediate vicinity of the intersection, the requirement for lane space for excavation and working areas would necessitate the closure of some lanes and the reallocation of space within the remaining lanes. A reduction in capacity at this intersection particularly on the Albany Highway legs has the potential to create significant increases in queue lengths (in the order of hundreds of metres) and delays, particularly if right turn and through movements are sharing a single lane. Depending on the extent of these queues, flow-on effects could influence the efficiency and safety operation of adjacent intersections in the Rosedale area, specifically the Albany Highway / Rosedale Road and Albany Highway / Schnapper Rock Road intersections.

An alternative is to ban right turns from Albany Highway into Appleby Road, and detour this traffic so that it approaches the intersection from the south (for a left turn into Appleby Road). This allows northbound and southbound traffic on Albany Highway to flow simultaneously (except when or if movements out of Appleby Road are allowed to occur, and these might be given occasional priority under a managed temporary traffic control system imposed as part of construction).

In such a scenario, while there would likely be less delay-related effects at the Albany Highway / Appleby Road intersection, there would be modest increased travel time effects for the diverted traffic and increased traffic volumes through the diversion intersections.

Assuming that most of this traffic would approach from north of the Albany Highway / Rosedale Road intersection, it is suggested that the traffic can effectively and efficiently be detoured via Rosedale Road, William Pickering Drive, and Bush Roads and then into Albany Highway.

This detour is approximately 3.5km in length; at an average speed of 40km/h (taking the 50km/h speed limit and assuming some delays for stoppages at intersections) the full detour would add approximately 4 minutes travel time to the non-detour route between Albany Highway / Rosedale Road and Appleby Road. All of the turning movements required to achieve this detour occur at a roundabout or a signalised intersection. No uncontrolled right turns are required which will help to manage the effects of the detour. The works which require the operation of this detour have a forecast duration of one to two months.

The final decision on the implementation, routing and requirements for detours during the construction programme would be reached through discussion with Auckland Transport.

The pipeline section on Albany Highway between Appleby Road and a point approximately opposite John Glenn Avenue (about 120m) will occur within a section of busy arterial movement.

Albany Highway is a heavily-trafficked primary arterial road with current daily traffic volumes in the region of 18,000 vpd with forecast volumes greater than this expected in the future. Except for exceptional circumstances, construction processes which reduce Albany Highway to only one operating traffic lane during the daytime hours should not be employed as current vehicle volumes are 1,000vph or more (above the limit for effective stop / go control) between 7am and 7pm and are likely to increase in the future with the ongoing development of this area.

As the construction corridor runs down the centre of Albany Highway, the construction methodology and process may need to be adjusted (e.g. the construction corridor narrowed) so that a traffic lane can operate on either side of the construction area. This may require the temporary use of the bus lanes and / or road shoulder areas as traffic lane.

Current peak hour traffic volumes on John Glenn Avenue are around 130 vph (two-way). This is a sufficiently low volume as to allow daytime one lane traffic operations however when works in the immediate vicinity of the intersection with William Pickering Drive are undertaken, the potential for delays and congestion will be increased and this could potentially affect traffic flows on William Pickering Drive.

7.8.5 Potential Specific Construction Mitigation Measures

- Where the pipeline route crosses the Appleby Road / St Andrews Way and Appleby Road / Fearnley Grove intersection works should be staged to maintain one traffic lane of access to the side roads.
- Kerbside parking should be temporarily restricted or banned on Appleby Road and John Glenn Avenue to provide for additional available carriageway width as the construction process moves along these roads.
- To assist with the maintenance of traffic movements and minimise delays at the Albany Highway / Appleby Road intersection it is recommended that the works on Appleby Road should be timetabled to occur during a school holiday period if practicable.
- Right turn bans at the Albany Highway / Appleby Road intersection should be considered as part of the delay minimisation strategy during works at this intersection.

- When the crossing of Albany Highway is required (that is to reach the road centre from Appleby Road, and then to reach John Glenn Avenue from the road centre) and when or if the closure of all traffic lanes in one direction is required, then the option to undertake works at night (e.g. 8pm – 5am) or during holiday periods when traffic volumes are lower, may need to be investigated.
- Undertaking the works at night would allow for one or both traffic lanes to be closed and diversions established to redirect through traffic while the works are undertaken resulting in less disruption to the road network. It is considered that undertaking such works during the day time with normal traffic volumes would otherwise result in significant unacceptable delays and congestion through the Rosedale area.
- Overnight works are recommended at the John Glenn Avenue / William Pickering Drive intersection.

7.9 William Pickering Drive to Bush Road

7.9.1 Overview

The pipeline meets William Pickering Drive at the four-leg roundabout intersection of William Pickering Drive, John Glenn Avenue and Douglas Alexander Parade. The pipeline will then proceed north along William Pickering Drive to the intersection with Piermark Drive.

Piermark Drive is a link road connecting William Pickering Drive with Bush Road. The adjacent properties are largely commercial or light industrial. The road has steady traffic flows during business hours and is heavily parked on both sides.

The current concept design intends that all construction works on this section of the route would be undertaken via trenched technologies.

7.9.2 Existing Traffic Environment

William Pickering Drive has a carriageway width of 12.5m and provides one traffic lane in each direction separated by a painted flush median. Kerbside parking is not permitted in the vicinity of the intersection but is otherwise permitted on both sides of the road in marked parking lanes. In the District Plan William Pickering Drive is defined as a District Arterial Road.

Photograph 24 shows the typical carriageway of William Pickering Drive between John Glenn Avenue and Piermark Drive.



Photograph 24: William Pickering Drive (View North)

In the District Plan, William Pickering Drive is classified as a Secondary Arterial Road.

The intersection of William Pickering Drive and Piermark Drive is a priority “T” intersection with priority given to traffic on William Pickering Drive. At the intersection with Piermark Drive the flush median is used as a turning bay for vehicles making the right turn into Piermark Drive.

In the District Plan Piermark Drive is classified as a Collector Road. William Pickering Drive carries approximately 2.5 to 3 times the traffic volume of Piermark Drive.

Piermark Drive is approximately 11.5m wide between kerbs and has one lane of traffic in each direction. Kerbside parking is generally permitted on both sides of the road.

Both William Pickering Drive and Piermark Drive have footpaths and grass berms on each side of the road.

The intersection is shown in **Photograph 25** below.



Photograph 25: William Pickering Drive / Piermark Drive Intersection

Piermark Drive is approximately 500m long and has a typical carriageway width of 10.5m. One traffic lane in each direction is provided and kerbside parking is permitted along most of both sides of the road.

The intersection of Bush Road and Piermark Drive is a priority “T” intersection with priority given to traffic on Bush Road. The intersection is shown in **Photograph 26** below.



Photograph 26: Intersection of Piermark Drive / Bush Road

A traffic survey was undertaken at the intersections of William Pickering Drive / Piermark Drive and Piermark Drive / Bush Road on Wednesday 19 November 2014 and Saturday 22 November 2014 for the weekday morning, afternoon and Saturday lunchtime peak periods.

Traffic volume data for William Pickering Drive, Piermark Drive and Bush Road has been sourced from Auckland Council and is summarised in **Table 11** below.

Road	Traffic Count Date	Daily Traffic Volume (veh)	AM Peak Hour Volume (veh)	PM Peak Hour Volume (veh)
William Pickering Drive	2014	12,833	1,533	1,413
Piermark Drive	2014	3,535	418	325
Bush Road	2014	10,806	1,067	907

Table 11: Traffic Flow Data: William Pickering Drive, Piermark Drive and Bush Road

Approximately 90% of the traffic volume on Piermark Drive is recorded during the daytime period of 7am-7pm, suggesting that traffic volumes overnight are extremely low and night works may be the most effective working opportunity for construction in this area.

Similarly traffic volume data and observations for William Pickering Drive and John Glenn Avenue suggest that traffic volumes during the night-time hours are low.

Recent traffic count data provided by Auckland Transport indicates average weekday traffic on Piermark Drive of 3,535 vpd. In keeping with its commercial nature, heavy vehicles make up a relatively high proportion (~12%) of this volume. As previously noted, approximately 90% of the traffic volume on Piermark Drive is recorded during the daytime period of 7am-7pm; suggesting that traffic volumes overnight are extremely low and night works may be the most effective working opportunity for construction in this area.

The data indicates that William Pickering Drive and Bush Road are Level 2 Roads under the CoPTTM classification system.

7.9.3 Future Traffic Environment

The land between William Pickering Drive and Bush Road is zoned as Light Industry in the PAUP. This zoning is similar to the current zoning and development. While the nature of any future development cannot be categorically assumed at this stage given the proposed industrial zoning and the current industrial character of the area, it is probable that future redevelopments would have broadly similar traffic generation characteristics as the current developments. It is considered that while there is some scope for additional traffic growth there would not be significant growth in traffic volumes.

7.9.4 Assessment of Effects

Under the current concept plans it is proposed that all construction works in this section occur via trenched technologies.

Current daytime two-way traffic volumes on William Pickering Drive can be up to 1,500 vph and are consistently over 500 vph between 7am and 7pm. While development in this area of Rosedale is relatively mature, it is probable that over the time period before construction begins additional traffic growth will occur on a limited scale.

At these long-term traffic volumes (i.e over 500vph during the day), the operation of a one-lane traffic system (e.g. over the full course of a working day for a number of days) would not be sustainable.

Accordingly, for the assessment of effects which follows it has been assumed that careful staging and management of the works will allow two lane, two way flow at a reduced traffic speed on William Pickering Drive.

Additionally, at the intersection with John Glenn Avenue, the concept design proposes works in the northbound carriageway and it is assumed that the consequent reduction in overall carriageway space available for traffic movements will necessitate a change in intersection operational control from the current roundabout operation to another system of control, likely to be a managed form of control.

Even so, with the maintenance of two-way flow the proposed works will likely create delays and congestion effects larger than the pre-works operation. These delays could be reduced via the introduction of turn bans as discussed below.

The concept design proposes to install the pipeline along Piermark Drive, near the centreline, via trenched technologies. The installation corridor would take up approximately 50-70% of the total carriageway width of 10.5m. To accommodate this and other road users, and prevent significant traffic congestion effects, kerbside parking would need to be prohibited around the construction area. In the consideration of anticipated traffic effects which follows, the imposition of such a ban has been assumed as part of the baseline construction operation.

Current peak hour traffic volumes on Piermark Drive are around 500 vph (two-way) with typical daytime interpeak volumes around 300-350 vph. As with William Pickering Drive while development in this area of Rosedale is relatively mature, it is probable that over the time period before construction begins additional traffic growth will have occurred.

A traffic volume of 500vph is the threshold volume at which, according to CoPTTM, delays of more than 5 minutes can be expected if a lane closure is within 200m of an intersection. With a length of 500m, most of Piermark Drive is within 200m of an intersection. Some of the traffic volume (current and future) will be through traffic, which could be reduced by restricting access only to vehicles with business destinations or origins within Piermark Drive. However, enforcing this restriction would be difficult.

By contrast, current typical hourly traffic volumes between 7pm and 7am are substantially less than 100vph. Although ongoing growth in this area will likely increase these traffic volumes, it is not considered that the overnight volumes will increase significantly.

Some construction will also likely require the temporary closure of the footpaths on these roads. Although traffic speeds on these roads are not high, traffic volumes (particularly during the peak hours when pedestrians will be commuting to or from their places work) are high. There would thus be a potential effect on pedestrian safety if temporary traffic management measures require pedestrians to divert across a road without the installation of suitable temporary crossing facilities.

7.9.5 Potential Specific Construction Mitigation Measures

- Due to the traffic volumes on William Pickering Drive, the construction corridor should be established so that two-way flow can be maintained. Where it is impractical to maintain two lane, two way flow on William Pickering Drive, such works should not occur during peak times unless essential and serious consideration should be given to undertaking these works at night.
- The possibility of undertaking works in the evening or overnight should be considered as a means by which to minimise the effects of construction on these business operations. The properties along William Pickering Drive and Piermark Drive are primarily commercial and hence any disruption to residential property or residents would be minimal. It is therefore recommended that construction occur overnight.
- The potential for traffic delays on William Pickering Drive could be reduced via the introduction of right turn bans for some of the intersection legs. Current volumes undertaking the right turn into Douglas Alexander Parade from William Pickering Drive are low, so there would be limited benefit in removing the right turn option. However there would be advantages to limiting or restricting the right turn volumes out of John Glenn Avenue and Douglas Alexander Parade in order to allow the movements from these legs to occur simultaneously and reduce the overall delay to traffic movements on William Pickering Avenue.
- Staged kerbside parking restrictions should be employed on William Pickering Drive and Piermark Drive to provide for additional available carriageway width as the construction process moves along these roads.
- To avoid the creation of significant traffic congestion effects crossing the intersection of William Pickering Drive / Piermark Drive and Piermark Drive / Bush Road via trenched technology, construction will necessitate the staged closure of traffic lanes as works move across the road due to the intersection being heavily trafficked at peak times. Works should not occur at both intersections simultaneously to avoid compromising potential detour routes and exacerbating traffic effects. To allow these intersections to operate efficiently under temporary traffic control, it is recommended that right turns be prohibited during the works. Detours would be available via Bush Road or William Pickering Drive.
- As construction proceeds along Piermark Drive or William Pickering Drive, and to a lesser extent John Glenn Avenue, the construction activity will cut across access for the adjacent properties. While some sites may have two driveways, thus allowing construction to be staged so that only one is blocked at a time, many will have only one driveway. Additionally, most properties are serviced by medium to large commercial vehicles which require a wide turning space.

7.10 Bush Road to Rosedale Wastewater Treatment Plant

7.10.1 Overview

From Bush Road it is proposed that the pipeline will proceed along a private right-of-way (currently the driveway to Kea Campervans) via trenched technologies. At the eastern end of the Kea Campervans driveway (furthest end from Bush Road) a construction site will be established for the pipeline to proceed by trenchless construction across the Alexandra Stream and gully and into Rosedale Park. The pipeline will then continue to its terminus at the Rosedale Wastewater Treatment Plant by trenched technologies.

This final section of the pipeline will be approximately 750m in length.

7.10.2 Existing Traffic Environment

In the District Plan Bush Road is classified as a Secondary Arterial Road.

Bush Road has a carriageway width of 12.5m and provides one traffic lane in each direction separated by a painted flush median. At the intersection with Piermark Drive is a marked turn bay for southbound vehicles making the right turn into Piermark Drive. Kerbside parking is not permitted in the vicinity of the intersection with Piermark Drive but is otherwise generally permitted on both sides of Bush Road.

Footpaths and grass berms are provided on each side of Bush Road.

The Kea Campervans driveway is currently limited to left-turn exits only.

Rosedale Park is approximately 32 hectares in area and provides a variety of sports and public recreation facilities. Access is via Jack Hinton Drive, from Rosedale Road and a driveway from Paul Matthews Drive. Public car parking is provided within the park and the proposed designation route cuts through the southern end of the main car park and runs adjacent to the driveway from Paul Matthews Drive.

7.10.3 Future Traffic Environment

The land surrounding Bush Road is zoned as Light Industry in the PAUP. As previously discussed, for the land in this area of Albany current development is of a similar nature to this proposed zoning and large scale development has already occurred. Future development is likely to have broadly similar traffic generation characteristics as the current developments. It is considered that there while there is some scope for additional traffic growth there would not be significant growth in traffic volumes.

7.10.4 Assessment of Effects

Provided that adequate co-ordination with the tenants and owners of the properties that use the Kea Campervans driveway along which the designation corridor passes occurs before and during the construction process it is considered that the effects on these properties can be appropriately mitigated.

At the eastern end of the Kea Campervans driveway, it is likely that a construction staging area is established as a base for the proposed trenchless construction process into Rosedale Park. This stage of the works will not require any operations within the road corridor. Provided that the site access is appropriately designed and that sufficient manoeuvring spaces is available on-site for heavy vehicles to turn around before exit (so that both entry and exit movements are made in a forwards direction), the effects of these works would be minimal.

Traffic volumes within Rosedale Park are limited and the main traffic effect will be due to the reduction in parking caused by the establishment of a trenchless construction site within one of the car parking areas. Depending on the extent of construction operations at a particular time, up to 75% of the western car park may be closed to public use. The extensive parking areas around the hockey fields at the south end of the car park would remain open.

7.10.5 Potential Specific Construction Mitigation Measures

- The Kea Campervans driveway is currently limited to left-turn exits only, and it is recommended that construction vehicles adhere to this measure also.
- Given the proximity of the driveway to the Bush Road / Piermark Drive intersection, it is recommended that only left turn entry is permitted.
- Liaison should occur with Auckland Council, and other stakeholders at Rosedale Park prior to the works commencing to co-ordinate with respect to event scheduling so that where possible events which attract high parking demands do not occur during the 7 to 10 month period when works will be occurring in Rosedale Park.

8. Mitigation Summary

8.1 Assessment of General Effects

8.1.1 All Construction

Thanks to its progressive nature, the duration of effects on traffic from construction by trenched technologies are limited at a particular location (e.g. outside a specific property). However the use of the road carriageway as a construction corridor does have the potential to create significant effects on the adjacent road network when the works are in the area.

Conversely the trenchless works will typically have less direct effect on the road carriageway and general road corridor, as a smaller proportion of the total is used for construction activity, but a greater direct effect in the areas where work sites are located as these works sites will be active for a longer period of time (months vs weeks).

For both construction methods the following general principles should be observed:

- All temporary traffic management measures should meet or exceed the requirements in CoPTTM;
- Where the physical or operational constraints of a site area make compliance with CoPTTM impractical or inappropriate, and a solution outside of the standard scope is proposed, such solution should not reduce safety levels (for employees and road users). Moreover, any such solution shall be approved via an Engineering Exception Decision (EED) submitted with the relevant CTMP; and
- A detailed Construction Traffic Management Plan (CTMP) for the project should also be submitted to the local Road Controlling Authority (Auckland Transport) for approval prior to the commencement of works, and this CTMP should incorporate any amendments to the construction methodology.

Various mitigation measures to minimise the effects on the local road network of both the construction corridor and associated traffic are listed in the following sections of this report.

8.1.2 Long-Term Operation

Once the pipeline and pump stations are constructed and in operation it is considered that the traffic generation and effect of their operation will be negligible. During normal operations it is understood that there would be typically no requirement for maintenance vehicle or other vehicle trips to pipelines.

The pump stations will require regular inspection visits and servicing but the frequency of such visits will be low, e.g. two trips per week per pump station by a light vehicle (ute) and less frequent visits by a medium sized truck to deliver supplies and maintenance equipment. Such a low level of trip generation is not expected to have any noticeable effect on the road network.

8.2 Mitigation

8.2.1 General route-wide mitigation: NoR – NI (Waitakere) and NoR – NI (North Shore)

- Public notices and a publicity campaign should be prepared in advance of the works to advise businesses, the public and motorists of the works and the potential for the delay. The campaign could have the bonus of encouraging the diversion, delay or otherwise in order to reduce trip volumes during the works period which would assist with the management of traffic delay and congestion.
- All works areas should be appropriately secured from public access.
- All site access locations should achieve minimum sight distance standards. Where acceptable sight distances cannot be achieved, movements relating to the deficient sight distances should be banned and / or temporary speed limit measures imposed so as to reduce traffic operating speeds to a point at which acceptable sight distance is achieved.
- Where works sites for trenchless construction are located at or adjacent to intersections the work site shall be designed so as to ensure a minimum acceptable traffic capacity is maintained. Additionally the work site should be designed so as to maintain acceptable and safe sight distances for all movements as the intersection.
- Access to private properties should be maintained at all times, and vehicle access maintained where practical in order to minimise the effects on local residents and businesses. Where vehicle access must be temporarily interrupted (e.g. during trenching) alternative access methods such as steel plate ramps should be considered.
- Direct communication should occur with all property owners and occupiers of properties with street frontages which will be required as part of the site area for a trenchless construction site. These properties should be specifically advised of any periods when vehicle access to their property will not be practical. Pedestrian access should be maintained at all times. Efforts should be made to minimise the extent of this disruption.
- Where trenched technology construction works along a road or across an intersection have the potential to isolate sections of road or properties from access to the wider road network, works must be staged to prevent this occurring. In particular, staging must be used for works at these intersections: Selwood Road / The Concourse Access, Huruhuru Road / Taitapu Street, Jadewynn Place / Reyburn Place, Appleby Road / Albany Highway, John Glenn Avenue / Unity Drive North and John Glenn Avenue / William Pickering Drive.
- In general trenching works at intersections should be staged to maintain acceptable minimum traffic capacities; this should be determined by modelling prior to the commencement of construction works.
- Where footpaths are required to be closed as part of a work site alternative access around the work site should be provided. If this alternative access requires pedestrians to cross the road, kerb-ramps shall be provided to allow persons of all mobilities to cross.

Except in very limited circumstances (e.g. at the end of a cul-de-sac), a work site should not result in footpaths on both sides of a road being closed, or where there is only a single footpath on a road the closure of that footpath.

- Where pedestrian crossing points are to be closed by the works temporary alternatives or diversions should be provided.
- Where parks or public recreation areas are used for constructions sites or access lanes all such areas should be securely fenced off and where necessary actively managed to prevent non-works related access.
- Where bus-stops are to be temporarily closed during works alternative bus stop locations should be established. Liaison with AT will be required prior to this process.

8.3 Area or Site specific Mitigation Measures

- Access to The Concourse transfer station should be maintained at all times.
- A survey of heavy vehicle movements including vehicle types along The Concourse should be undertaken prior to the commencement of construction works so that works areas for the construction activity can be developed which maintain sufficient traffic lane width for the safe and efficient passage of the standard vehicle fleet using The Concourse.
- The duration of works within or the usage of the Upper Harbour Cycleway for heavy vehicle access should be minimised. If the complete closure of an existing section of the cycleway route is required for construction purposes, an alternative temporary cycle route should be created.
- Heavy vehicle movements on Greenhithe Road between Sunnyview Road and Wainoni Heights and on Churchouse Avenue should be avoided at the start and end of the school day during the school term. It is suggested that this blackout period commence thirty minutes prior to the start of the school day through to at least fifteen minutes after the school day start, and from fifteen minutes before the end of the school day to thirty minutes after the end of the school day.
- The access way from Churchouse Avenue into Wainoni Park should be sealed or otherwise constructed and maintained to minimise dust nuisance to the adjoining properties.
- Given that a high proportion of NSMP visitors may be unfamiliar with the general park layout and the road network within the NSMP, clear signage will be required on the internal road network of NSMP to direct visitors safely and efficiently around the working area. In addition to the signage, work staff should be on hand to direct and assist visitors as required. The ring road within the park should be used to effect these diversions and additional traffic control staff should be available to direct traffic if required.
- Given the sensitive nature of NSMP, all reasonable efforts should be made to minimise construction noise at all times, and to liaise with NSMP management to ensure no disruption to services and events held at the NSMP. Works may need to be temporarily suspended on occasion to avoid disruption to services.
- Works in the NSGC car park should be scheduled so as to coincide with annual maintenance shutdown.

- On Appleby Road, works should be conducted during school holiday periods to minimise the impact on the adjacent Albany Junior High School and, additionally, to take advantage of reduced traffic volumes on Appleby Road.
- The intersection of William Pickering Drive / John Glenn Avenue / Douglas Alexander Parade should be crossed in stages in order to keep one traffic lane in each direction on William Pickering open, and to maintain access to John Glenn Avenue. This may require temporary changes in the method of intersection control.
- Kerbside parking on John Glenn Avenue should be banned during the construction works to increase the available carriageway space.
- Kerbside parking on William Pickering Drive should be banned during the construction to increase the available carriageway space.
- Two-way traffic flow should be maintained on William Pickering Drive, potentially via the use of central flush median as a temporary traffic lane. If the maintenance of two-way flow is not possible, then works should occur overnight when traffic volumes are lower.
- Bus Services and accessibility along William Pickering Drive should be maintained. This may require the operation of temporary / relocated bus stops on occasion. Liaison with the Public Transport Operations team of Auckland Transport should occur to ensure that bus stop closures / relocations are suitably advertised and co-ordinated.
- Works at the Piermark Drive / Bush Road intersection will need to be staged to maintain traffic capacity through the intersection. Works at this intersection should not occur at the same times as works at the William Pickering Drive / Piermark Drive intersection.
- Communication should occur with all property owners and tenants along Piermark Drive prior to construction and their individual access requirements discussed.
- The option of night works in the Albany / Rosedale commercial area to minimise traffic and business disruption should be investigated.

8.4 Management

8.4.1 General Operating Principles for Access to Work Sites

It is proposed that the following principles are employed for all site access locations:

- Wherever practical, heavy vehicle movements to or from a live (non-closed) lane of the road network should only occur in a forward direction (i.e. limit reverse manoeuvring).
- Site areas are properly fenced or equipped with barriers to prevent unauthorised pedestrian access, and the worksite staffed and supervised so that pedestrians do not inadvertently enter the site.
- Signage (to CoPTTM specifications) is erected to alert both pedestrians and other road users and truck drivers of the presence of heavy vehicles and pedestrians.
- For heavy vehicle movements to and from individual sites, a traffic controller is on hand to co-ordinate all truck movements.

These measures will promote safe access to and from each site.

8.4.2 General Operating Principles for Operations around Private Properties / Dwellings and Community Facilities

- Property owners and tenants along the project route should receive initial contact from the project team at least one month prior to the commencement of works, with additional contacts at two weeks and one week in advance of works. Any delay or advancement of the work schedule should be communicated to affected property owners and tenants as soon as practical.
- Where works have the potential for a significant impact, (e.g. a trenchless construction worksite outside a property) more detailed and personal communication may be required.
- Access to private properties should be maintained at all times wherever practical. Where vehicle access must be temporarily interrupted (e.g. trenching across a driveway connection) the duration of such interruptions should be minimised.
- Working areas around schools and other community facilities e.g. parks should be securely fenced to prevent public access (particularly access by children).

8.4.3 Traffic Environmental Impact Considerations

The following operational and environmental measures are recommended:

- Equipment and facilities for truck cleaning prior to departure should be provided where there is exposed ground on the site that is traversed by site vehicles;
- All excavated material will be covered prior to being transported off- site to prevent aerial dispersal onto the road network; and
- Where appropriate, a bund should be installed around the site to prevent the run-off of exposed material and vehicle oil or fuel from the site roads and parking areas into the stormwater system.

8.4.4 Truck Waiting

Trucks waiting on surrounding roads should be minimised and avoided if practicable. Where waiting does occur, trucks will be expected to use a designated waiting area.

8.4.5 Road Signs

All traffic and warning signs to be erected should conform to the standards specified in CoPTTM. Signs associated with the works which are not required outside of working hours should be covered or removed at the end of each work day and reinstalled prior to the start of the next working day.

9. Conclusion

TDG has been commissioned by Watercare to assess the potential traffic engineering and safety effects related to the future construction, operation and maintenance of new wastewater pipelines and associated infrastructure in the north-western and northern parts of Auckland. This project is known as the Northern Interceptor. Construction of the Northern Interceptor is intended to be staged, with the timing of various stages dependent on the rate of population growth with some construction potentially not commencing until 2035.

To secure the availability of the proposed route for construction at this later date, Watercare is seeking NoR to designate the proposed route as being required for this future use. Two separate NoR are to be applied for to cover separate working areas and TDG has assessed the traffic engineering effects in these areas in order that the scale of these effects can be considered as part of the NoR application process.

Construction will be by both trenched and trenchless (sub-surface) construction methods. The traffic safety and traffic engineering implications of this construction work has been assessed.

The primary traffic effects are from:

- Works required in the road corridor, particularly for the sections of the pipeline to be constructed by trenched technologies; and
- The unloading and storage of construction materials, particularly for the sections of the pipeline to be constructed via trenchless methods where there will only be limited number of work sites, but these sites will be in operation for months rather than days or weeks (as with trenched technologies).

These effects will require careful management. The effects from traffic associated with the transport of materials and staff to and from the sites are generally minor, except in some specific areas of the construction route. In these areas it is proposed to mitigate these effects via specific traffic controls. The traffic effects from the future operation of the pipeline and pump station network are considered to be minor.

Sections of this report have identified the potential effects and possible mitigation measures for the proposed construction activities. That said, the following general principles should apply throughout:

- The length or effect of an active construction zone should be controlled to ensure traffic delays of no more than 5 minutes (due to the construction activities and exclusive of any other pre-existing delays which may be present on the road);
- When side roads or intersections must be crossed, construction should be staged to prevent their full closure, particularly where the affected road has only one connection to the road network; and
- The option of working outside of normal construction hours (i.e. night time) to take advantage of lower traffic volumes on the roads in business / industrial areas should be considered to mitigate the potential transportation impact on business and traffic operations.

The construction works will involve the operation of heavy machinery, open excavations and the storage of plant and works materials in close proximity to the public road corridor or in some situations within public recreation areas. Appropriate measures, including fencing and barriers, should be employed to provide adequate and appropriate separation between members of the public and the work site.

Once constructed it is considered that the day to day operations of the pipeline will have a negligible effect on the operation of the road network.

TDG