

Supporting Growth

Trig Road
Corridor
Upgrade

Preliminary
Site
Investigation

Version 1.0
August 2020



Preliminary Site Investigation

Document Status

Version no.	Responsibility	Name
1.0	Author	Zoe Lightfoot (2020)
	Reviewer	Emma Trembath (2020) Matthew Kerr-Ridge (2020)
	This report was authored in 2020 by Zoe Lightfoot and reviewed by Emma Trembath and Matthew Kerr Ridge. It has been assessed for issue in 2022 by Phillip Ware. Some aspects of the investigation require updating and additional content in line with the updated MFE Contaminated Land Guidelines. The matters requiring update are not considered to change the overall assessment of risk or approach to further investigation and management and can be addressed during the proposed Detailed Site Investigation.	
	Reviewer	Phillip Ware (2022)
	Approver	Bridget O'Leary (2022)

Revision Status

Version	Date	Reason for Issue
1.0	August 2020	Final

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Acronyms

Acronym/Term	Description
AT	Auckland Transport
AUP:OP	Auckland Unitary Plan Operative in Part 2016
DSI	Detailed Site Investigation (contaminated land)
HAIL	Hazardous Activities and Industries List
MfE	Ministry for the Environment
PSI	Preliminary Site Investigation (contaminated land)
SH18	State Highway 18

1 Introduction

1.1 Project Background

Auckland's population is growing rapidly; driven by both natural growth (more births than deaths) and migration from overseas and other parts of New Zealand. The Auckland Plan 2050 anticipates that this growth will generate demand for an additional 313,000 dwellings and require land for approximately 263,000 additional employment opportunities.

In response to this demand, the Auckland Unitary Plan Operative in Part (**AUP:OP**) identifies 15,000 hectares of predominantly rural land for future urbanisation. To enable the urban development of greenfield land, appropriate bulk infrastructure needs to be planned and delivered.

The Supporting Growth Programme is a collaboration between Auckland Transport (**AT**) and Waka Kotahi NZ Transport Agency to investigate, plan and deliver the transport network needed to support Auckland's future urban growth areas over the next 30 years.

1.2 Project Area

Trig Road, Whenuapai has been identified in the Supporting Growth Programme as a future arterial corridor which is needed to support the urban development of Whenuapai. AT is progressing a Notice of Requirement to provide route protection for the Trig Road Corridor Upgrade (hereinafter referred to as the Project or Project area).

The Project consists of the widening and upgrade of Trig Road between the State Highway 18 (**SH18**) off-ramps and Hobsonville Road. The Project area extends along the southern extent of Trig Road starting adjacent to the property located at 82 Trig Road down to the intersection with Hobsonville Road to the south. The Project area also extends along a section of Hobsonville Road between adjacent properties 60 and 78 Hobsonville Road and the northern extent of Luckens Road down to the adjacent property at 5 Luckens Road. Refer to Figure 1 for plan illustrating the extent of the Project area.

The Project is currently in preliminary phases and the final extent of land disturbance activities is yet to be defined. For the purposes of this Preliminary Site Investigation (**PSI**) we have assumed land disturbance to the extent as illustrated in black on Figure 1.



Figure 1: Project Area Plan

1.3 Purpose of this Report

The purpose of this PSI (contaminated land) is to:

- Provide a preliminary understanding of the nature and extent of historical and current landuse activities, and whether such activities may have adversely impacted soil contaminant conditions within the Project area.
- Provide recommendations with respect to any potential contaminated land issues or constraints.
- Provide an understanding of the contaminated land resource consents required to be sought in support of the Project.

1.4 Scope

In order to meet the purpose, the following scope has been undertaken:

- Review of available environmental and geotechnical records for the Project area.
- Completion of a Project area walkover.
- Review of historical aerial photographs for the period 1940 through to present day as made available through public information sources.

Property files, certificates of title, and review of Auckland Council groundwater records were not included in scope of the PSI. The exclusion of this information is not considered to materially impact upon the recommendations or conclusions of this report.

1.5 Terms of Reference

This PSI has been completed in general accordance with the following guidelines:

- Ministry for the Environment (**MfE**). Contaminated Land Management Guidelines No. 1: Reporting on Contaminated Site in New Zealand, revised 2011 (hereinafter referred to as MFE Guideline 1).
- Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011 (hereinafter referred to as the NES).

2 Environmental Setting

2.1 Topography

Topography across the study corridor is at its highest elevation along Hobsonville and Luckens Roads, decreasing in elevation towards the north-west along Trig Road. In summary:

- The section along Luckens Road has an elevation ranging between 76 and 78 m above sea level.
- The section along Hobsonville Road has an elevation ranging between 73 and 79 m above sea level.
- The section along Trig Road has an average elevation of 55 m above sea level, decreasing to approximately 50 m above sea level at the centre of the Trig Road.

2.2 Sensitive Ecological Receptors

A number of streams are located within a 1 kilometre radius of the Project area including, Pikau Stream and Waiarohia Stream to the north, Trig Stream and Rawiri Stream to the east, Waipateira Stream and an unknown tributary of Manutewhau Stream to the south and Totara Creek to the west. The nearest surface water body to the Project area is Trig Stream located on the eastern side of Trig Road.

2.3 Geology

The key geologic unit recorded within the study corridor is Tauranga Group material (GNS, 2001). The Tauranga Group deposits are noted on the map to form the majority of the study area and are part of the Puketoka Formation. This is described as pumiceous mud, sand and gravel interbedded with muddy peat and lignite, rhyolite pumice, including non-welded ignimbrite, tephra and alluvial pumice deposits.

There is a geological boundary at the southern end of the proposed arterial upgrade on Luckens Road. The key geologic unit at this location is Waitemata Group material comprising deposits from the East Coast Bays Formation. This is described as alternating sandstone and mudstone with variable volcanic content and interbedded volcanoclastic grit beds.

Geological borelogs for historical investigations completed within the Project area, as well as a map indicating the locations is included in Appendix A.

2.4 Hydrogeology

Boreholes advanced in the area have recorded groundwater between 3 and 4 m below ground level (refer Appendix A). Locally groundwater may flow north east towards areas of lower elevation and the Trig Stream located on the eastern side of Trig Road. Regional groundwater flow is likely south towards the Waitemata Harbour.

3 Summary of Current Landuse Activity

3.1 Current Aerial Photography

Table 1 presents a summary of landuse activity adjacent to the Project area as derived from the review of current aerial photographs (2019) provided in the Auckland Council GIS platform.

Table 1: Current Aerial Photograph Review

Direction	Summary of Observations
North	Pastoral landuse is visible to the north east and a mixture of horticultural and pastoral landuse is visible to the north west.
East	Trig Road section of the Project: Pastoral landuse is predominant with some residential properties.
South	Hobsonville Road beyond which is residential landuse.
West	Predominantly pastoral landuse with horticultural activities visible directly west of the northern extent of the Project area. A number of residential properties are visible adjacent to the south west section of Trig Road.

3.2 Walkover Observations

A walkover of the Project area was completed on 14 January 2020. A photographic log is included in Appendix B. A summary of key observations is as follows:

- Horticultural nurseries were observed at 62 and 82 Trig Road.
- An electrical substation was observed at 1 Trig Road.
- Electrical transformers were observed on the grass verges outside 12 and 40 Trig Road.
- A Watercare pump station for potable water is located at 74 Hobsonville Road.

3.3 Summary

The review of current landuse activity within the Project area has identified that activities classified on the MfE Hazardous Activities and Industries List (**HAIL**) are being undertaken i.e., horticultural nurseries, electrical substation, and electrical transformers. Refer to Appendix C for a copy of the HAIL.

4 Summary of Historical Aerial Photographs

4.1 Historical Aerial Photography

Table 2 presents a summary of observations derived from the review of historical aerial photographs made available by Retrolens and Auckland Council via their GIS platform. Copies of historical aeriels are provided in Appendix D.

Table 2: Historical Aerial Photograph Review

Year	Summary of Observations
1940	<p>The alignment of Trig, Hobsonville and Luckens Roads appear as they do at present day.</p> <p>Land surrounding the Project area is largely cleared and appears to have been used for pastoral activities. Hedgerows are present along the eastern side of Trig Road and both sides of Hobsonville and Luckens Road within the Project area. Several houses associated with farming activities are visible along Trig and Luckens Road.</p> <p>A water tank is visible on the corner of Trig and Hobsonville Roads.</p> <p>Properties on the eastern side of Luckens Road and western side of Trig Road appear subject to horticultural landuse (orchard or market gardening).</p>
1950	<p>The 1950 aerial photograph appears similar to the 1940 aerial photograph.</p> <p>Properties on the western side of Luckens Roads and the northern extent of Trig Road (western side) are now also subject to horticultural landuse (orchard or market gardening).</p>
1963	<p>A number of residential properties are visible along the south-western side of Trig Road, northern and southern sides of Hobsonville Road and southern end of Luckens Road.</p> <p>Horticultural landuse activities (orchard or market gardening) remain visible near the intersection of Luckens Road and Hobsonville Road.</p>
1972	<p>The 1972 aerial photograph appears similar to the 1963 aerial photograph.</p>
1988	<p>Residential landuse activity within the Project area has intensified since the 1972 aerial photograph.</p> <p>Two commercial nurseries including glasshouses (still present today refer Section 3) have been established on the western side of Trig Road (northern extent of Project area).</p> <p>An electrical substation (still present today refer Section 3) has been established on the corner of Trig and Hobsonville Roads.</p> <p>Horticultural activity (market gardening) appears to have been established on the northern side of Hobsonville Road.</p> <p>The horticultural activity formally observed at the corner of Luckens Road appears to have ceased.</p>
2000	<p>Residential landuse activity within the Project area has intensified since the 1988 aerial photograph. The former horticultural properties on the corner of Luckens Road have been redeveloped for residential landuse purposes.</p> <p>A commercial nursery including glasshouses has been established on the eastern side of Trig Road. Horticultural activity (orchard) is visible on the western side of Trig Road.</p>
2008	<p>The 2008 aerial photograph appears similar to the 2000 aerial photograph.</p> <p>The commercial nursery established on the eastern side of Trig Road appears to have ceased operation.</p> <p>The water tank formerly observed near the corner of Trig and Hobsonville Roads has been removed.</p> <p>The horticultural activity formally on the northern side of Hobsonville Road appears to have ceased.</p>

2010	The 2010 aerial photograph appears similar to the 2008 aerial photograph. SH18 is under construction.
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4.2 Summary

The review of historical landuse activity within the Project area has identified that activities classified on the MfE HAIL were historically undertaken i.e., horticulture and market gardening.

5 Summary of PSI Findings

The PSI has identified that activities classified on the MFE HAIL have historically been completed or are currently being undertaken on properties within the Project area. Refer to Table 3 for a summary of these key findings.

Table 3: Summary of PSI Findings

HAIL Activity	HAIL Classification	Contaminants of Concern associated with the HAIL Activity	HAIL Activity Inside or Outside of Project Area	Likely Extent of Soil Impact & Associated Risk
Horticultural Nursery Orchard Market Gardening	A10 Persistent pesticide bulk storage or use including sports turfs, market gardens, orchards, glass houses or spray sheds.	Heavy metals including arsenic, lead, copper, and mercury. Wide range of organic compounds including acidic herbicides, organophosphate and organochlorines. Asbestos containing materials (associated with building structures).	Inside. Former and current horticultural properties located on both Trig and Hobsonville Roads are within the current extent of the proposed road widening activities.	Direct application of hazardous substances to ground as part of operations. Impact likely restricted to shallow soil profile but may have been tilled to greater depth as part of crop preparation. Spray drift of chemicals across property boundaries as part of operations. Impact likely limited to surficial soils. The risk profile to human health and the environment is low, however this has not yet been assessed by way of soil sampling.
Electrical Substation	B4 Power stations, substations or switchyards.	Polychlorinated biphenyls. Hydrocarbons. Heavy metals including boron and arsenic. Asbestos containing materials (associated with building structures and other electrical equipment).	Inside. The front of the property is within the current extent of the proposed road widening activities.	Accidental discharge or leakage of hazardous substances to ground as part of operations. Impact likely limited to shallow soil profile. As only the front of the property is within the current extent of the proposed road widening activities it is unlikely that

Preliminary Site Investigation

				<p>soil impact will be encountered.</p> <p>The risk profile to human health and the environment is low, however this has not yet been assessed by way of soil sampling.</p>
<p>Electrical Transformers</p>	<p>B2 Electrical transformers including the manufacturing, repairing, or disposing of electrical transformers or other heavy electrical equipment.</p>	<p>Polychlorinated biphenyls. Hydrocarbons. Heavy metals including boron and arsenic. Asbestos containing materials (associated with building structures and other electrical equipment).</p>	<p>Inside. The electrical transformers may need to be relocated as they are within the proposed area of road widening.</p>	<p>Accidental discharge or leakage of hazardous substances to ground as part of operations. Impact likely limited to shallow soil profile.</p> <p>The risk profile to human health and the environment is low, however this has not yet been assessed by way of soil sampling.</p>

6 Recommendations

The PSI has identified that activities classified on the HAIL have historically been completed or are currently being undertaken on properties that are within the proposed road widening area of the Project. It is therefore recommended that a Detailed Site investigation (**DSI**) (contaminated land) be completed. Through the completion of a soil sampling exercise, the DSI would act to provide an understanding of actual soil contaminant conditions within the Project area. The results of the DSI would inform:

- Contaminated land resource consent requirements.
- Human health and environmental controls for implementation during land disturbance activities associated with the Project.
- Soil reuse and off-site disposal requirements i.e., classification status as cleanfill, managed fill or landfill.

7 Contaminated Land Regulatory Assessment

Based on the results of this PSI, and as soil samples have not been analysed which would indicate whether soil contaminant conditions (the DSI results, refer section 6) meet the Permitted Activity criteria of the AUP:OP or NES; Table 4 presents a current assessment of contaminated land regulatory requirements.

Table 4: Summary of Required Consents Relating to Contaminated Land

Regulation	Regulation / Rule	Activity	Status
Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011	11(1)	This regulation applies to an activity described in any regulation 5(2) to (6) on a piece of land described in regulations 5(7) or (8) that is not a permitted activity, controlled activity, or restricted discretionary activity.	Discretionary
	11(2)	This activity is a discretionary activity.	
Auckland Unitary Plan Operative in Part	E30.4.1(A7)	Discharges of Contaminants into air, or into water, or onto or into land not meeting controlled activity standard E30.6.2.1.	Discretionary

It is recommended that the above consents are applied for, and conditions imposed requiring a DSI to be undertaken and for a Contaminated Soil Management Plan to be prepared for the management and monitoring of any contaminated soil confirmed by the DSI.

8 Conclusions

Trig Road, Whenuapai has been identified in the Supporting Growth Programme as a future arterial corridor which is needed to support the urban development of Whenuapai. The Project consists of the widening and upgrade of Trig Road between the SH18 off-ramps and Hobsonville Road.

A PSI (contaminated land) was completed in support of the Project. As part of the PSI the following tasks were undertaken:

- Review of available environmental and geotechnical records for the Project area.
- Completion of a Project area walkover.
- Review of historical aerial photographs for the period 1940 through to present day as made available through public information sources.

The PSI identified that activities classified on the MFE HAIL have historically been completed or are currently being undertaken on properties within the proposed road widening area. These activities include:

1. Category A10: persistent pesticide bulk storage or use including sports turfs, market gardens, orchards, glass houses or spray sheds.
2. Category B2: electrical transformers including the manufacturing, repairing, or disposing of electrical transformers or other heavy electrical equipment.
3. Category B4: power stations, substations or switchyards.

Based on the findings of the PSI, the completion of a DSI (contaminated land) is recommended. Through the completion of a soil sampling exercise, the DSI would act to provide an understanding of actual soil contaminant conditions within the Project area. The results of the DSI would inform:

- Contaminated land resource consent requirements.
- Human health and environmental controls for implementation during land disturbance activities associated with the Project.
- Soil reuse and off-site disposal requirements i.e., classification status as cleanfill, managed fill or landfill.

Given the findings of the PSI and the fact that a DSI has not yet been undertaken for the Project, it is recommended that the following contaminated land resource consents are required to be sought in support of this Project:

- Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011: Discretionary Activity consent under Regulation 11(2).
- AUP:OP: Discretionary Activity consent under Rule E30.4.1(A7).

9 References

Auckland Council, 2016 (Updated 15 November 2019). The Auckland Unitary Plan Operative in Part.

Institute of Geological & Nuclear Sciences Limited, 2001. 1:250,000 Geological Map 3.

Ministry for the Environment, April 2012. National Environmental Standards for Assessing and Managing Contaminants in Soil to Protect Human Health.

Ministry for the Environment, 2004. Contaminated Land Management Guidelines No. 5: Site Investigation and Analysis of Soils. Revised 2011.

Ministry for the Environment, 2001. Contaminated Land Management Guidelines No. 1. Reporting on Contaminated Sites in New Zealand. Revised 2011.

Appendix 1. Geological Information



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BOREHOLE LOG

BOREHOLE No.:

BH-T56

SHEET: 2 OF 8

DRILLED BY: McMillan Drilling

LOGGED BY: PRMM

CHECKED: JWY

START DATE: 23/11/2015

FINISH DATE: 24/11/2015

CONTRACTOR: McMillan Drilling

PROJECT: NI - Phase 2-6
 JOB No.: 28773.213
 LOCATION: 52 Trig Road, Hobsonville

CO-ORDINATES: 5924976.76 N
 (NZTM) 1744441.61 E

DIRECTION: 0°
 ANGLE FROM HORIZ.: -90°

R.L. GROUND: 54.60m
 R.L. COLLAR: 54.60m
 DATUM: AUCKLAND 1946
 SURVEY: Handheld GPS

GEOLOGICAL UNIT	DESCRIPTION OF CORE		ROCK DEFECTS																
	SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation		Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Water Loss (%)	Water Level	Casing	Installation	Core Box
Tauranga Group	Clayey SILT, with trace coarse pumiceous sand; light grey streaked orange brown and red. Soft, moist, moderate plasticity.				SPT	100	0/0 1/1 1/1 N=4		49										
	Clayey SILT; grey. Firm to stiff, moist, high plasticity.				HQ3	100			6										
Weathered East Coast Bays Formation	Clayey SILT, with some fine sand; grey, streaked orange brown. Firm, moist, low plasticity.				PUSH TUBE	100													
	6-6.5m: Push Tube.																		
	Clayey SILT; grey streaked orange brown. Firm, moist, moderate plasticity.				SPT	100	0/0 1/1 1/1 N=4		48										
	Interbedded sandy SILT; grey. Stiff, moist, non-plastic; moderately thinly bedded with SILT, with minor clay; grey. Very stiff, moist, low plasticity. Thinly bedded.				HQ3	100			7										
	SILT, with minor clay; grey. Very stiff, moist, low plasticity. Thin sub-horizontally bedded.				SPT	100	1/1 1/2 2/2 N=7		47										
8.5-9m: CORE LOSS.				HQ3	52				46										
9.50m: SILT, with minor clay, grades moderately thinly bedded, sandy silt is thinly bedded with carbonaceous laminations throughout.				SPT	100	1/1 2/2 2/4 N=10		45											
9.50m: SILT, with minor clay, grades moderately thinly bedded, sandy silt is thinly bedded with carbonaceous laminations throughout.				HQ3	76														

COMMENTS: Standpipe piezometer installed with screened intervals at 4.5-5.5m and 32-34m below ground level. See standpipe piezometer record for further details

Hole Depth
35.3m

Scale 1:1

24/11/2015

Box 3, 5.5-8.2m

General Log - 31052016 5:24:10 p.m. - Produced with Core-GS by GeRoc



Tonkin+Taylor

BOREHOLE LOG

BOREHOLE No.:

BH-T56

SHEET: 3 OF 8

DRILLED BY: McMillan Drilling

LOGGED BY: PRMM

CHECKED: JWY

START DATE: 23/11/2015

FINISH DATE: 24/11/2015

CONTRACTOR: McMillan Drilling

PROJECT: NI - Phase 2-6
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DIRECTION: 0°
 ANGLE FROM HORIZ.: -90°

R.L. GROUND: 54.60m
 R.L. COLLAR: 54.60m
 DATUM: AUCKLAND 1946
 SURVEY: Handheld GPS

GEOLOGICAL UNIT	DESCRIPTION OF CORE		Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS			Water Loss (%)	Water Level	Casing	Installation	Core Box
	SOIL: Classification, colour, consistency / density, moisture, plasticity	ROCK: Weathering, colour, fabric, name, strength, cementation									Defect Log	Fracture Spacing (mm)	RQD (%)					
Weathered East Coast Bays Formation	Interbedded sandy SILT; grey. Stiff, moist, non-plastic; thinly bedded with carbonaceous laminations throughout. With moderately thinly bedded SILT, with minor clay; grey. Very stiff to moist, low plasticity.		UW	CU	HQ3	76												
	10.25-10.5m: CORE LOSS.																	
	Silty, fine SAND; grey. Medium dense, moist. Moderately thinly bedded with thin to moderately thin interbeds of grey hard SILT. Sub-horizontally bedded with carbonaceous laminations throughout.				SPT	100	2/2 2/3 4/4 N=13	44										
	12.00m: Silty, fine SAND, moderately thickly bedded.				SPT	100	2/2 4/4 4/5 N=17	12										
	12.50m: Silty, fine SAND and SILT, thinly bedded.				SPT	100	3/3 4/4 5/6 N=19	41										
	14.55m: Silty, fine SAND, moderately thinly bedded.				HQ3	100		40										

COMMENTS: Standpipe piezometer installed with screened intervals at 4.5-5.5m and 32-34m below ground level. See standpipe piezometer record for further details

Hole Depth 35.3m

Scale 1:1



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BOREHOLE LOG

BOREHOLE No.:

BH-T56

SHEET: 4 OF 8

DRILLED BY: McMillan Drilling

LOGGED BY: PRMM

CHECKED: JWY

START DATE: 23/11/2015

FINISH DATE: 24/11/2015

CONTRACTOR: McMillan Drilling

PROJECT: NI - Phase 2-6
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 R.L. COLLAR: 54.60m
 DATUM: AUCKLAND 1946
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GEOLOGICAL UNIT	DESCRIPTION OF CORE		Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS			Description & Additional Observations	Water Loss (%)	Water Level	Casing	Installation	Core Box
	SOIL: Classification, colour, consistency / density, moisture, plasticity	ROCK: Weathering, colour, fabric, name, strength, cementation									Defect Log	Fracture Spacing (mm)	RQD (%)						
Weathered East Coast Bays Formation	Silty, fine SAND; grey. Medium dense, moist. Moderately thinly bedded with thin to moderately thin interbeds of grey hard SILT. Sub-horizontally bedded with carbonaceous laminations throughout.				SPT	100	3/4 4/5 5/8 N=22												
	Silty, fine SAND; grey. Medium dense, moist.																		
	15.50 - 15.65m: high carbonaceous content.				HQ3	100			39										
	16.25 - 16.33m: high carbonaceous content.									16									
	16.88m: 20mm thick grey, very stiff SILT bed. Sub-horizontal.				SPT	100	2/4 4/4 5/5 N=18		38										
	17.00m: 20mm thick grey, hard SILT bed. Sub-horizontal.									17									
	18.30m: 40mm thick grey, hard, SILT bed. Sub-horizontal.				SPT	100	2/4 5/5 8/9 N=27												
19.25m: 10mm thick grey, hard SILT bed. Sub-horizontal.				HQ3	100				37										
19.50m: - grades dense.																			
19.75 - 19.77m: high carbonaceous content, very closely spaced laminations.				SPT	100	4/6 8/9 11/11 N=39													
									36										
									19										
									35										

COMMENTS: Standpipe piezometer installed with screened intervals at 4.5-5.5m and 32-34m below ground level. See standpipe piezometer record for further details

Hole Depth
35.3m

Scale 1:1

Box 6, 15.0-17.6m



Tonkin+Taylor

BOREHOLE LOG

BOREHOLE No.:

BH-T56

SHEET: 5 OF 8

DRILLED BY: McMillan Drilling

LOGGED BY: PRMM

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 DATUM: AUCKLAND 1946
 SURVEY: Handheld GPS

GEOLOGICAL UNIT	DESCRIPTION OF CORE		ROCK DEFECTS																
	SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation		Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Water Loss (%)	Water Level	Casing	Installation	Core Box
Weathered East Coast Bays Formation	20.05m: 20mm thick grey, hard SILT bed																		
	20.10 - 20.15m: high carbonaceous content.																		
	Moderately weathered, grey SANDSTONE. Extremely weak, dense, sub-horizontally bedded.				HQ3	100		34											
	20.55m: high carbonaceous content. 20.75m: 50mm thick SILTSTONE bed. Extremely weak to very weak.					SPT (SC)	100	6/9 11/11 11/11 N=44	21										
Weathered East Coast Bays Formation	21.85m: To 21.88m, high carbonaceous content.				HQ3	100		33											
	22.22m: 40mm thick SILTSTONE bed.							22				100							
								32											
East Coast Bays Formation Rock	24-24.35m: CORE LOSS.							31											
	Unweathered, grey streaked black silty fine grained SANDSTONE. Very weak, with black carbonaceous specks throughout. 24.70m: Extremely weak, uncemented, no carbonaceous content.				HQ3	65	7/18 25/22 3 -10mm N>=50	24						22.95 - 24.00m: , Drilling breaks 50mm apart filled with drilling mud.					
								30				65							

COMMENTS: Standpipe piezometer installed with screened intervals at 4.5-5.5m and 32-34m below ground level. See standpipe piezometer record for further details

Hole Depth 35.3m

Scale 1:1

General Log - 3/05/2016 5:24:10 p.m. - Produced with Core-GS by GeRoc

Box 7, 17.6-20.3m

Box 8, 20.3-24.0m



Tonkin+Taylor

BOREHOLE LOG

BOREHOLE No.:

BH-T56

SHEET: 6 OF 8

DRILLED BY: McMillan Drilling

LOGGED BY: PRMM

CHECKED: JWY

START DATE: 23/11/2015

FINISH DATE: 24/11/2015

CONTRACTOR: McMillan Drilling

PROJECT: NI - Phase 2-6
 JOB No.: 28773.213
 LOCATION: 52 Trig Road, Hobsonville

CO-ORDINATES: 5924976.76 N
 (NZTM) 1744441.61 E

DIRECTION: 0°
 ANGLE FROM HORIZ.: -90°

R.L. GROUND: 54.60m
 R.L. COLLAR: 54.60m
 DATUM: AUCKLAND 1946
 SURVEY: Handheld GPS

GEOLOGICAL UNIT	DESCRIPTION OF CORE		Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS			Description & Additional Observations	Water Loss (%)	Water Level	Casing	Installation	Core Box	
	SOIL: Classification, colour, consistency / density, moisture, plasticity	ROCK: Weathering, colour, fabric, name, strength, cementation									Defect Log	Fracture Spacing (mm)	RQD (%)							
East Coast Bays Formation Rock	25.05-25.5m: CORE LOSS.				HQ3	65														
	Unweathered, grey, silty, fine grained SANDSTONE. Very weak.				SPT (SC)	100	7/15 15/16 17/2 -5mm N>=50	29												
	25.95m: 10mm thick grey, very weak SILTSTONE bed. 26.00m: - grades extremely weak, uncemented, fine to medium SANDSTONE, with trace coarse grains.							26												
	26.55m: - grades very weak SANDSTONE.				HQ3	100		28												
	26.70m: - grades fine to medium SANDSTONE. 26.7 - 26.74m: high carbonaceous content.							27												
East Coast Bays Formation Rock	27.20m: 10mm thick grey, very weak SILTSTONE bed. 27.25m: - grades fine to medium SANDSTONE.				SPT (SC)	100	7/23 24/20 6 -20mm N>=50	27												
	27.40m: To 27.55m, convoluted siltstone beds and carbonaceous laminations.							27												
	27.8-28.5m: CORE LOSS.				HQ3	53		28												
East Coast Bays Formation Rock	Unweathered, silty, fine to medium grained SANDSTONE, with trace coarse sand grains. Very weak							26												
	Unweathered, grey, silty, fine grained SANDSTONE. Very weak, moderately thinly bedded, with thin interbeds of grey, very weak SILTSTONE. Sub-horizontally bedded.				HQ3	100		29												

COMMENTS: Standpipe piezometer installed with screened intervals at 4.5-5.5m and 32-34m below ground level. See standpipe piezometer record for further details

Hole Depth
35.3m

Scale 1:1

General Log - 30/5/2016 5:24:10 p.m. - Produced with Core-GS by GeRoc

Box 9, 24.0-27.5m



Tonkin+Taylor

BOREHOLE LOG

BOREHOLE No.:

BH-T56

SHEET: 7 OF 8

DRILLED BY: McMillan Drilling

LOGGED BY: PRMM

CHECKED: JWY

START DATE: 23/11/2015

FINISH DATE: 24/11/2015

CONTRACTOR: McMillan Drilling

PROJECT: NI - Phase 2-6
 JOB No.: 28773.213
 LOCATION: 52 Trig Road, Hobsonville

CO-ORDINATES: 5924976.76 N
 (NZTM) 1744441.61 E

DIRECTION: 0°
 ANGLE FROM HORIZ.: -90°

R.L. GROUND: 54.60m
 R.L. COLLAR: 54.60m
 DATUM: AUCKLAND 1946
 SURVEY: Handheld GPS

GEOLOGICAL UNIT	DESCRIPTION OF CORE		Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS				Water Loss (%)	Water Level	Casing	Installation	Core Box	
	SOIL: Classification, colour, consistency / density, moisture, plasticity	ROCK: Weathering, colour, fabric, name, strength, cementation									Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations						
East Coast Bays Formation Rock	Unweathered, medium to coarse grained SANDSTONE, trace fine gravel sized siltstone lithics. Very weak.		UW	US	HQ3	100		24	24		2000		60							
	30.70m: - grades silty, fine to medium SANDSTONE. 31.65m: fine to medium SANDSTONE, with trace coarse sand and fine gravel sized siltstone lithics.																			
	30.9-31.5m: CORE LOSS.																			
	Unweathered, grey, silty, fine to medium grained SANDSTONE. Extremely weak.		UW	US	HQ3	100		23	23											
	32.40m: UCS 0.23																			
	33.35m: - grades very weak.																			
	Unweathered, grey SILTSTONE. Very weak. Sub-horizontally bedded, with carbonaceous laminations, very closely spaced.		UW	US	HQ3	100		21	21											
	Unweathered, grey, silty, fine to medium grained SANDSTONE. Very weak.		UW	US	HQ3	100		20	20											
	34.10m: - grades medium to coarse grained SANDSTONE. 34.20m: - grades fine to medium grained SANDSTONE. Extremely weak, uncemented. 34.30m: - grades very weak. 34.55m: - grades extremely weak, uncemented.																			
	34.90m: - grades fine to medium SANDSTONE. Very weak.																			
34.10m: , Stopped run due to hard ground. Possibility of becoming core bound 34.30m: UCS 1.74 MPa																				

COMMENTS: Standpipe piezometer installed with screened intervals at 4.5-5.5m and 32-34m below ground level. See standpipe piezometer record for further details

Hole Depth
35.3m

Scale 1:1

General Log - 30/05/2016 5:24:11 p.m. - Produced with Core-GS by GeRoc

Box 10, 27.5-31.8m

Box 11, 31.8-34.3m



Tonkin+Taylor

BOREHOLE LOG

BOREHOLE No.:

BH-T56

SHEET: 8 OF 8

DRILLED BY: McMillan Drilling

LOGGED BY: PRMM

CHECKED: JWY

START DATE: 23/11/2015

FINISH DATE: 24/11/2015

CONTRACTOR: McMillan Drilling

PROJECT: NI - Phase 2-6
 JOB No.: 28773.213
 LOCATION: 52 Trig Road, Hobsonville

CO-ORDINATES: 5924976.76 N
 (NZTM) 1744441.61 E

DIRECTION: 0°
 ANGLE FROM HORIZ.: -90°

R.L. GROUND: 54.60m
 R.L. COLLAR: 54.60m
 DATUM: AUCKLAND 1946
 SURVEY: Handheld GPS

GEOLOGICAL UNIT	DESCRIPTION OF CORE		Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS				Water Loss (%)	Water Level	Casing	Installation	Core Box
	SOIL: Classification, colour, consistency / density, moisture, plasticity	ROCK: Weathering, colour, fabric, name, strength, cementation									Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations					
			UW MV MC CW US S LW EW	U5 S LW EW	HQ3	100					2000 600 600 600 200 20	100	25 50 75					Box 12, 34.3-35.3m	
	35.3m: END OF BOREHOLE							15	16	17	18	19	36	37	38	39			

COMMENTS: Standpipe piezometer installed with screened intervals at 4.5-5.5m and 32-34m below ground level. See standpipe piezometer record for further details

Hole Depth
35.3m

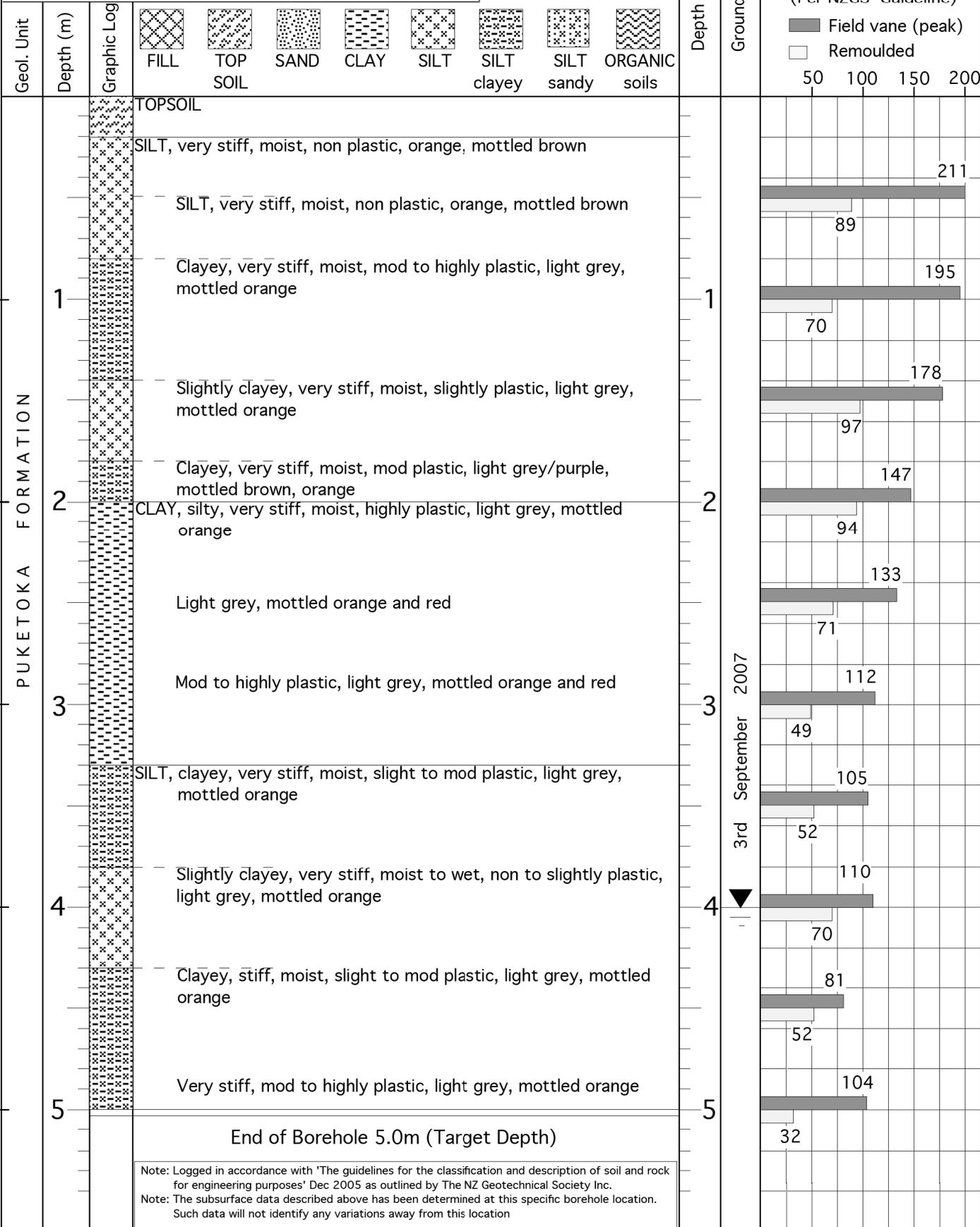
Scale 1:1

General Log - 30/05/2016 5:24:11 p.m. - Produced with Core-GS by GeRoc

Job No: 60025015
 Project: Upper Harbour Highway
 Borehole Location: see site plan
 Chainage: 11930 Offset: 130L
 Coordinates: 707571.57 N 287225.59 E RL: 45.48
 Surface Conditions: Gentle slope, Grass

HA CH 11930/130L_{MA0709}

Sheet 1 of 1



Note: Logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' Dec 2005 as outlined by The NZ Geotechnical Society Inc.
 Note: The subsurface data described above has been determined at this specific borehole location. Such data will not identify any variations away from this location

Drill Method: Hand Auger
 Date Drilled: 3 Sept 2007
 Drilled By: DTM
 Shear Vane No.: DR 4529

Observations
 Shearvane Correction Value for DR 4529 is 1. 623

Maunsell Ltd
 47 George St, Newmarket
 PO Box 4241 Auckland

NZGD ID	Type	Reference	Date	X (NZTM)	Y (NZTM)	RL	Vertical datum	Total depth	GW measured	GW depth	GW date
63712	Borehole	State Highway 16 & 18 - (AGD7506)	15/01/2000	1744375.7	5925051.1	55.4	Ellipsoidal (GPS)	22.5	No	-	-
65478	Borehole	Upper Harbor Cooridor - (AGD1891)	1/12/2001	1744434.7	5925010.8	55.6	Ellipsoidal (GPS)	19.5	No	-	-
65479	Borehole	Upper Harbor Cooridor - (AGD1892)	1/12/2001	1744408.7	5925042.8	55	Ellipsoidal (GPS)	20	No	-	-
67590	HandAuger	Waitakere #2 Upgrade - (AGD518)	21/07/2004	1744979.1	5924390.5	78	Auckland 1946 (MSL)	4	No	-	-
67591	HandAuger	Waitakere #2 upgrade - (AGD519)	9/07/2004	1744986.4	5924408.3	78	Auckland 1946 (MSL)	4	No	-	-
67592	HandAuger	Waitakere #2 Upgrade - (AGD520)	9/07/2004	1744988.8	5924415.3	78	Auckland 1946 (MSL)	1.2	No	-	-
67593	HandAuger	Waitakere #2 Upgrade - (AGD521)	9/07/2004	1744990.5	5924421.8	78	Auckland 1946 (MSL)	4	No	-	-
96780	CPT	A-CPT17	9/05/1999	1744431.4	5924972.9	0	Auckland 1946 (MSL)	15.3	No	-	-
96781	CPT	D-CPT16	26/07/2001	1744395.3	5925056.8	55.4	Auckland 1946 (MSL)	18	No	-	-
96785	CPT	F-CPT22	30/11/2005	1744406.4	5925079.9	54.88	Auckland 1946 (MSL)	16.5	No	-	-
96786	CPT	F-CPT23	30/11/2005	1744430.7	5925038.4	55.62	Auckland 1946 (MSL)	18.5	No	-	-
96787	CPT	F-CPT24	30/11/2005	1744457.6	5924992.5	55.11	Auckland 1946 (MSL)	23	No	-	-
96891	Borehole	A-BH4	14/04/1999	1744375.6	5925051.5	55.427	Auckland 1946 (MSL)	22.5	No	-	-
96892	Borehole	D-BH21	4/07/2001	1744433.8	5925010.6	56.26	Auckland 1946 (MSL)	19.5	No	-	-
96893	Borehole	D-BH22	26/06/2001	1744407.5	5925041	55.79	Auckland 1946 (MSL)	20	No	-	-
96897	Borehole	F-12120 50L	1/12/2005	1744441.4	5924985	55.01	Auckland 1946 (MSL)	18.44	No	-	-
96898	Borehole	F-12120 50R	29/11/2005	1744389.3	5925070.2	55.85	Auckland 1946 (MSL)	19.6	No	-	-
97058	HandAuger	H-11930 130L	2/09/2007	1744625.6	5925006.3	45.48	Auckland 1946 (MSL)	5	Yes	4	3/09/2007
100368	Borehole	BH-T56	24/11/2015	1744441.6	5924976.8	54.6	Auckland 1946 (MSL)	35.3	Yes	3	23/11/2015
110816	HandAuger	5122	10/07/2003	1745229	5924294		Not Available	5	No	-	-



Legend

-  Borehole
-  CPT
-  Hand Auger
-  Other

Appendix 2. Photographic Log

PHOTOGRAPHIC LOG

Client Name: Auckland Transport

Project: Trig Road PSI

Project No. 60558831

Photo No.
1

Date:
14/01/2020

Address:
82 Trig Road,
Whenuapai, Auckland
0618

Description:
Lyndale Nursery, facing
north-west.



Photo No.
2

Date:
14/01/2020

Address:
62 Trig Road,
Whenuapai, Auckland
0618

Description:
Touch of the Tropics
Nursery, facing south-
west.



PHOTOGRAPHIC LOG

Client Name: Auckland Transport

Project: Trig Road PSI

Project No. 60558831

Photo No.
3

Date:
14/01/2020

Address:
23-25 Trig Road,
Whenuapai, Auckland
0618

Description:
Highway equipment
laydown area adjacent to
the southern side of
SH18, facing north-east.



Photo No.
4

Date:
14/01/2020

Address:
19-21 Trig Road,
Whenuapai, Auckland
0618

Description:
Pond (potentially
associated with former
nursery), facing north-
east.



PHOTOGRAPHIC LOG

Client Name: Auckland Transport

Project: Trig Road PSI

Project No. 60558831

Photo No.
5

Date:
14/01/2020

Address:

Grass verge outside 40
Trig Road, Whenuapai,
Auckland 0618

Description:

Transformer, facing
south-east.



Photo No.
6

Date:
14/01/2020

Address:

Grass verge outside 12
Trig Road, Whenuapai,
Auckland 0618

Description:

Transformer, facing
south-east.



PHOTOGRAPHIC LOG

Client Name: Auckland Transport

Project: Trig Road PSI

Project No. 60558831

Photo No.
7

Date:
14/01/2020

Address:
Outside 12 Trig Road,
Whenuapai, Auckland
0618

Description:
Trig Road, facing north-
west.



Photo No.
8

Date:
14/01/2020

Address:
1 Trig Road, Whenuapai,
Auckland 0618

Description:
Hobsonville Substation,
facing east.



PHOTOGRAPHIC LOG

Client Name: Auckland Transport

Project: Trig Road PSI

Project No. 60558831

Photo No.
9

Date:
14/01/2020

Address:
74 Hobsonville Road,
West Harbour, Auckland
0618

Description:
Watercare pump station
(potable water).



Photo No.
10

Date:
14/01/2020

Address:
6 Luckens Road, West
Harbour, Auckland 0618

Description:
Dental Specialists
Limited, facing east.



PHOTOGRAPHIC LOG

Client Name: Auckland Transport

Project: Trig Road PSI

Project No. 60558831

Photo No.
11

Date:
14/01/2020

Address:

Outside 16 Luckens
Road, West Harbour,
Auckland 0618

Description:

Luckens Road, facing
north-west.



Appendix 3. Ministry for the Environment Hazardous Activities and Industries List and Summary of Likely Contaminants



Hazardous Activities and Industries List (HAIL)

October 2011

A Chemical manufacture, application and bulk storage

1. Agrichemicals including commercial premises used by spray contractors for filling, storing or washing out tanks for agrichemical application
2. Chemical manufacture, formulation or bulk storage
3. Commercial analytical laboratory sites
4. Corrosives including formulation or bulk storage
5. Dry-cleaning plants including dry-cleaning premises or the bulk storage of dry-cleaning solvents
6. Fertiliser manufacture or bulk storage
7. Gasworks including the manufacture of gas from coal or oil feedstocks
8. Livestock dip or spray race operations
9. Paint manufacture or formulation (excluding retail paint stores)
10. Persistent pesticide bulk storage or use including sport turfs, market gardens, orchards, glass houses or spray sheds
11. Pest control including the premises of commercial pest control operators or any authorities that carry out pest control where bulk storage or preparation of pesticide occurs, including preparation of poisoned baits or filling or washing of tanks for pesticide application
12. Pesticide manufacture (including animal poisons, insecticides, fungicides or herbicides) including the commercial manufacturing, blending, mixing or formulating of pesticides
13. Petroleum or petrochemical industries including a petroleum depot, terminal, blending plant or refinery, or facilities for recovery, reprocessing or recycling petroleum-based materials, or bulk storage of petroleum or petrochemicals above or below ground
14. Pharmaceutical manufacture including the commercial manufacture, blending, mixing or formulation of pharmaceuticals, including animal remedies or the manufacturing of illicit drugs with the potential for environmental discharges
15. Printing including commercial printing using metal type, inks, dyes, or solvents (excluding photocopy shops)
16. Skin or wool processing including a tannery or fellmongery, or any other commercial facility for hide curing, drying, scouring or finishing or storing wool or leather products
17. Storage tanks or drums for fuel, chemicals or liquid waste
18. Wood treatment or preservation including the commercial use of anti-sapstain chemicals during milling, or bulk storage of treated timber outside

B Electrical and electronic works, power generation and transmission

1. Batteries including the commercial assembling, disassembling, manufacturing or recycling of batteries (but excluding retail battery stores)

2. Electrical transformers including the manufacturing, repairing or disposing of electrical transformers or other heavy electrical equipment
3. Electronics including the commercial manufacturing, reconditioning or recycling of computers, televisions and other electronic devices
4. Power stations, substations or switchyards

C Explosives and ordinances production, storage and use

1. Explosive or ordinance production, maintenance, dismantling, disposal, bulk storage or re-packaging
2. Gun clubs or rifle ranges, including clay targets clubs that use lead munitions outdoors
3. Training areas set aside exclusively or primarily for the detonation of explosive ammunition

D Metal extraction, refining and reprocessing, storage and use

1. Abrasive blasting including abrasive blast cleaning (excluding cleaning carried out in fully enclosed booths) or the disposal of abrasive blasting material
2. Foundry operations including the commercial production of metal products by injecting or pouring molten metal into moulds
3. Metal treatment or coating including polishing, anodising, galvanising, pickling, electroplating, or heat treatment or finishing using cyanide compounds
4. Metalliferous ore processing including the chemical or physical extraction of metals, including smelting, refining, fusing or refining metals
5. Engineering workshops with metal fabrication

E Mineral extraction, refining and reprocessing, storage and use

1. Asbestos products manufacture or disposal including sites with buildings containing asbestos products known to be in a deteriorated condition
2. Asphalt or bitumen manufacture or bulk storage (excluding single-use sites used by a mobile asphalt plant)
3. Cement or lime manufacture using a kiln including the storage of wastes from the manufacturing process
4. Commercial concrete manufacture or commercial cement storage
5. Coal or coke yards
6. Hydrocarbon exploration or production including well sites or flare pits
7. Mining industries (excluding gravel extraction) including exposure of faces or release of groundwater containing hazardous contaminants, or the storage of hazardous wastes including waste dumps or dam tailings

F Vehicle refuelling, service and repair

1. Airports including fuel storage, workshops, washdown areas, or fire practice areas
2. Brake lining manufacturers, repairers or recyclers
3. Engine reconditioning workshops
4. Motor vehicle workshops
5. Port activities including dry docks or marine vessel maintenance facilities

6. Railway yards including goods-handling yards, workshops, refuelling facilities or maintenance areas
7. Service stations including retail or commercial refuelling facilities
8. Transport depots or yards including areas used for refuelling or the bulk storage of hazardous substances

G Cemeteries and waste recycling, treatment and disposal

1. Cemeteries
2. Drum or tank reconditioning or recycling
3. Landfill sites
4. Scrap yards including automotive dismantling, wrecking or scrap metal yards
5. Waste disposal to land (excluding where biosolids have been used as soil conditioners)
6. Waste recycling or waste or wastewater treatment

H Any land that has been subject to the migration of hazardous substances from adjacent land in sufficient quantity that it could be a risk to human health or the environment

I Any other land that has been subject to the intentional or accidental release of a hazardous substance in sufficient quantity that it could be a risk to human health or the environment



HAIL contaminants

The table below lists the kind of hazardous substances that are typically associated with each of the activities and industries listed on the HAIL (Hazardous Activities and Industries List).

The fact that an activity or industry is on the HAIL does not mean that hazardous substances were used or stored everywhere on that land, nor that any hazardous substances that were used or stored there have contaminated the land.

The hazardous substances listed in the table below for each activity or industry are provided as a guide only. The NES for assessing and managing contaminants in soil to protect human health requires a suitably qualified and experienced practitioner to decide which substances to check for in soil samples taken as part of a detailed site investigation.

Activity or industry on the HAIL	Hazardous substances likely to be associated with that activity or industry
Agrichemicals including commercial premises used by spray contractors for filling, storing or washing out tanks for agrichemical application	Arsenic, lead, copper; wide range of organic agrichemicals including organochlorine pesticides, organophosphate pesticides, herbicides, fungicides, carbamates, and synthetic pyrethroids; compounds may be mixed with diesel before spraying
Chemical manufacture, formulation or bulk storage	Wide range of organic and inorganic compounds
Commercial analytical laboratory sites	Wide range of organic and inorganic compounds including solvents, acids, metals, and mercury
Corrosives including formulation or bulk storage	Mercury, sulphuric, phosphoric, hydrochloric and nitric acids, sodium and calcium hydroxide, ammonia and ammonium hydroxide
Dry-cleaning plants including dry-cleaning premises or the bulk storage of dry-cleaning solvents	Volatile hydrocarbons including trichloroethylene 1,1,1-trichloroethane tetrachloroethene (also known as PCE), and carbon tetrachloride
Fertiliser manufacture or bulk storage	Calcium phosphate, calcium sulphate, copper chloride, sulphur, sulphuric and phosphoric acid, molybdenum, selenium, iron, cadmium, nitrates, and ammonia
Gasworks including the manufacture of gas from coal or oil feedstocks	Polycyclic aromatic hydrocarbons (PAHs), benzene, toluene, ethylbenzene and xylenes (BTEX), phenolics, metals (particularly arsenic, lead, copper, chromium), boron, cyanide compounds, sulphides and sulphates, thiocyanates, ammonia, nitrates, and coke
Livestock dip or spray race operations	Arsenic, organochlorines (eg, aldrin, dieldrin, DDT, lindane) and organophosphates, carbamates, and synthetic pyrethroids
Paint manufacture or formulation (excluding retail paint stores)	Solvents, resins, metals including arsenic, cadmium, copper, nickel, lead, zinc, and mercury
Persistent pesticide bulk storage or use including sport turfs, market gardens, orchards, glass houses or spray sheds	Arsenic, lead, copper, mercury; wide range of organic compounds including acidic herbicides, organophosphates, and organochlorines (eg, endosulfan on golf and bowling greens)
Pest control including the premises of commercial pest control operators or any authorities that carry out pest control where bulk storage or preparation of pesticide occurs, including preparation of poisoned baits or filling or washing of tanks for pesticide application	Arsenic, cyanide, strychnine, mercury, phosphorus, 1080, organochlorines and organophosphates, carbamates, synthetic pyrethroids, and other commercial preparations

Activity or industry on the HAIL	Hazardous substances likely to be associated with that activity or industry
Pesticide manufacture (including animal poisons, insecticides, fungicides or herbicides) including the commercial manufacturing, blending, mixing or formulating of pesticides	Wide range of insecticides, herbicides and fungicides, including arsenic, lead, mercury, copper, tin, chromium, organochlorines, organonitrogens, organophosphates, acid herbicides, and carbamates. Dioxin may be present as an impurity
Petroleum or petrochemical industries including a petroleum depot, terminal, blending plant or refinery, or facilities for recovery, reprocessing or recycling petroleum-based materials, or bulk storage of petroleum or petrochemicals above or below ground	Hydrocarbons including BTEX, PAHs, and solvents; lead and other metals, particularly if waste oil handled
Pharmaceutical manufacture including the commercial manufacture, blending, mixing or formulation of pharmaceuticals, including animal remedies or the manufacturing of illicit drugs with the potential for environmental discharges	Wide range of chemicals and solvents
Printing including commercial printing using metal type, inks, dyes, or solvents (excluding photocopy shops)	Solvents, acids, alkalis, and metals
Skin or wool processing including a tannery or fellmongery, or any other commercial facility for hide curing, drying, scouring or finishing or storing wool or leather products	Chromium (including hexavalent Cr), manganese, copper, ammonia, nitrite, sulphides, acids, sodium hydroxide, lime, formaldehyde, solvents, cyanide, detergents, pesticides, and bleaching agents (eg, hydrogen peroxide)
Storage tanks or drums for fuel, chemicals or liquid waste	Wide range of chemicals (organic and inorganic), and biological hazards
Wood treatment or preservation including the commercial use of anti-sapstain chemicals during milling, or bulk storage of treated timber outside	Pentachlorophenol (PCP), copper, arsenic, chromium, boron, PAHs, phenolics (creosote), antisapstain, organochlorine pesticides, fungicides, and tributyltin (TBT)
Batteries including the commercial assembling, disassembling, manufacturing or recycling of batteries (but excluding retail battery stores)	Metals (lead, mercury, zinc, cadmium, nickel, antimony, silver, and manganese), and sulphuric acid
Electrical transformers including the manufacturing, repairing or disposing of electrical transformers or other heavy electrical equipment	Polychlorinated biphenyls (PCBs), hydrocarbons, copper, tin, lead, and mercury
Electronics including the commercial manufacturing, reconditioning or recycling of computers, televisions and other electronic devices	Metals (eg, copper, tin, lead, mercury, cadmium, nickel, silver, zinc, and beryllium), solvents, and PCBs
Power stations, substations or switchyards	PCBs, asbestos, metals including boron, arsenic (in fly ash), water treatment chemicals (thermal stations), and hydrocarbons (eg, diesel in generators)
Explosive or ordinance production, maintenance, dismantling, disposal, bulk storage or re-packaging	Acetone, nitric and sulphuric acid, ammonium nitrate, PCP, nitroglycerine, lead, mercury, copper, aluminium, silver, sodium hydroxide, and explosives; fuel oils, solvents and metals (associated with workshops)
Gun clubs or rifle ranges, including clay targets clubs that use lead munitions outdoors	Metals (lead, antimony, copper, zinc, tin, and nickel)
Training areas set aside exclusively or primarily for the detonation of explosive ammunition	Explosives, lead, copper, arsenic, antimony (firing ranges), and hydrocarbon storage
Abrasive blasting including abrasive blast cleaning (excluding cleaning carried out in fully enclosed booths) or the disposal of abrasive blasting material.	Metals (iron, lead, chromium, aluminium, zinc). Dependent on material being removed and substrate
Foundry operations including the commercial production of metal products by injecting or pouring molten metal into moulds	Metals, particularly iron, aluminium, lead, zinc, copper, tin, nickel, chromium and oxides, chlorides, fluorides and sulphates of these, acids, coke, and fuel oils
Metal treatment or coating including polishing, anodising, galvanising, pickling, electroplating, or heat treatment or finishing using cyanide compounds	Metals (zinc, aluminium, cadmium, chromium, lead, copper, and tin), acids (sulphuric, nitric, hydrochloric, and phosphoric), cyanide; flourine and barium (from Al processing)
Metalliferous ore processing including the chemical or physical extraction of metals, including smelting, refining, fusing or refining metals	Metals and associated oxides, fluorides and chlorides; cyanide compounds
Engineering workshops with metal fabrication	Metals and oxides of iron, nickel, copper, chromium, magnesium and manganese; range of organic compounds used for cleaning including BTEX, solvents

Activity or industry on the HAIL	Hazardous substances likely to be associated with that activity or industry
Asbestos products manufacture or disposal including sites with buildings containing asbestos products known to be in a deteriorated condition	Asbestos
Asphalt or bitumen manufacture or bulk storage (excluding single-use sites used by a mobile asphalt plant)	Petroleum hydrocarbons and PAHs
Cement or lime manufacture using a kiln including the storage of wastes from the manufacturing process	Lime, calcium hydroxide, alkalis; boron and arsenic in fly ash
Commercial concrete manufacture or commercial cement storage	Cement, calcium hydroxide, alkalis, and ammonia
Coal or coke yards	Hydrocarbons (particularly PAHs), boron, and arsenic
Hydrocarbon exploration or production including well sites or flare pits	Hydrocarbons including PAHs, metals (barium, cadmium, zinc, mercury, lead), and vanadium
Mining industries (excluding gravel extraction) including exposure of faces or release of groundwater containing hazardous contaminants, or the storage of hazardous wastes including waste dumps or dam tailings	Arsenic, mercury, cyanides, sulphides, and metals and hydrocarbons associated with fuel storage
Airports including fuel storage, workshops, washdown areas, or fire practice areas	Petroleum hydrocarbons including lube oils; metals and PAHs in fire practice areas, potential for dioxins in fire practice areas
Brake lining manufacturers, repairers or recyclers	Asbestos and copper
Engine reconditioning workshops	Hydrocarbons including solvents, and metals contained in waste oil
Motor vehicle workshops	Hydrocarbons including PAHs, solvents, and metals contained in waste oil
Port activities including dry docks or marine vessel maintenance facilities	Metals, paint residues (tin, and lead), tributyltin (TBT), and hydrocarbons associated with fuel storage
Railway yards including goods-handling yards, workshops, refuelling facilities or maintenance areas	Hydrocarbons including PAHs, solvents, creosote/phenols, and metals
Service stations including retail or commercial refuelling facilities	Petroleum hydrocarbons (BTEX, PAHs) and lead
Transport depots or yards including areas used for refuelling or the bulk storage of hazardous substances	Wide variety of chemicals, dependent on products being transported
Cemeteries	Nitrates, lead, mercury, formaldehyde, and biological hazards
Drum or tank reconditioning or recycling	Wide range of chemicals from drums; hydrocarbons used to wash drums
Landfill sites	Dependent on original waste composition, wide range of hydrocarbons and metals, organic acids, landfill gas, and ammonia
Scrap yards including automotive dismantling, wrecking or scrap metal yards	Metals, petroleum hydrocarbons (particularly lube oils), solvents used for cleaning, and PCBs
Waste disposal to land (excluding where biosolids have been used as soil conditioners)	Depends on type of waste – biological hazards (bacteria, viruses), metals, PAHs, semi- volatile organic compounds, and solvents
Waste recycling or waste or wastewater treatment	Depends on type of waste – biological hazards (bacteria, viruses), metals, PAHs, semi- volatile organic compounds, and solvents.
Any land that has been subject to the migration of hazardous substances from adjacent land in sufficient quantity that it could be a risk to human health or the environment	Dependent on contaminants associated with adjacent property
Any other land that has been subject to the intentional or accidental release of a hazardous substance in sufficient quantity that it could be a risk to human health or the environment	Dependent on contaminants associated with spill

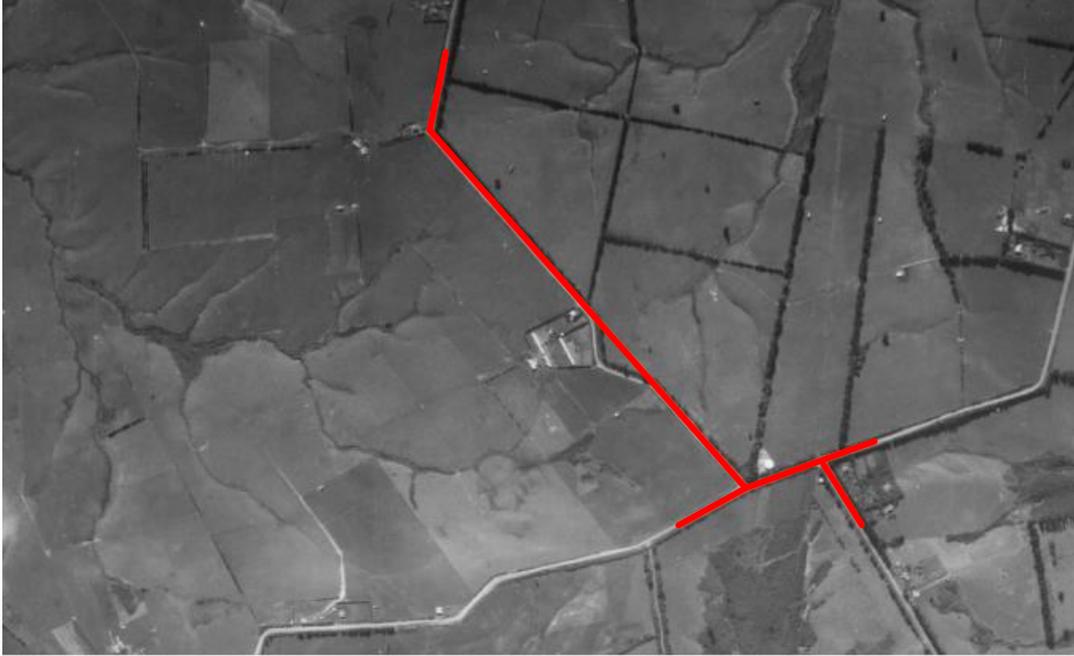
The New Zealand Institute of Chemistry (NZIC) has published a series of articles on many industries in New Zealand at http://www.nzic.org.nz/ChemProcesses/chem_processes.html. These articles provide a good chemical background for many of the industries listed on the HAIL.

Appendix 4. Historical Aerial Photographs

Historical Aerial Photograph Review

Year: 1940

Source: <http://retrolens.nz/Map/> - accessed 8 October 2019



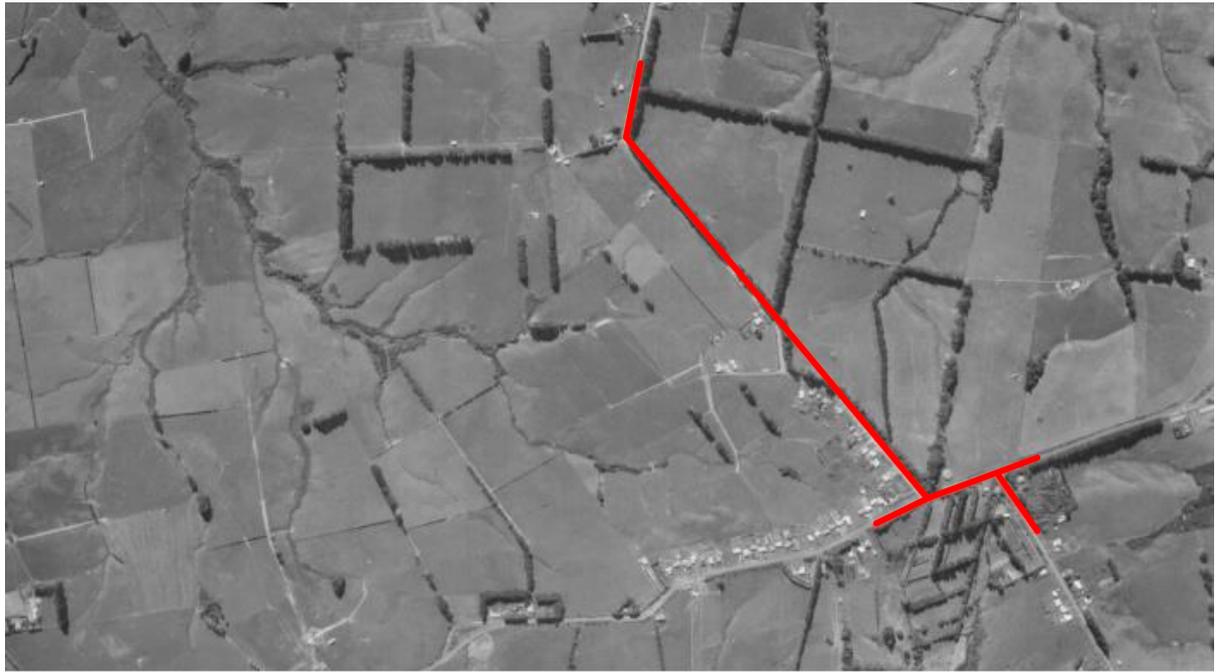
Year: 1950

Source: <http://retrolens.nz/Map/> - accessed 8 October 2019



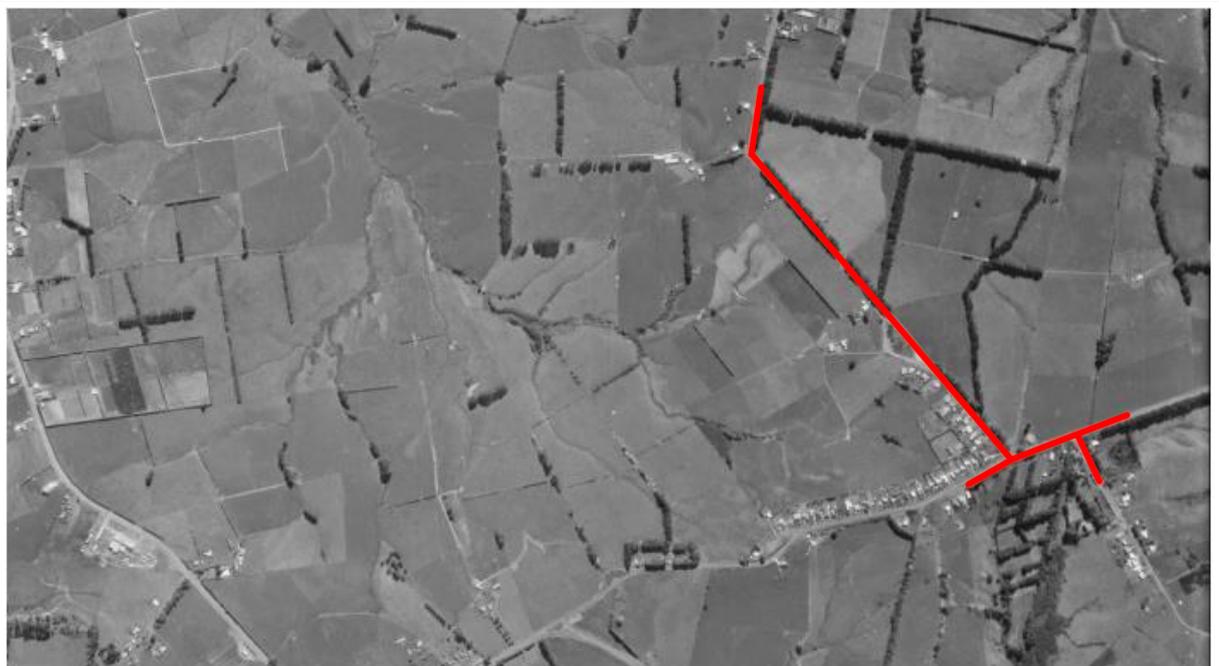
Year: 1963

Source: <http://retrolens.nz/Map/> - accessed 8 October 2019



Year: 1972

Source: <http://retrolens.nz/Map/> - accessed 8 October 2019



Year: 1988

Source: <http://retrolens.nz/Map/> - accessed 8 October 2019



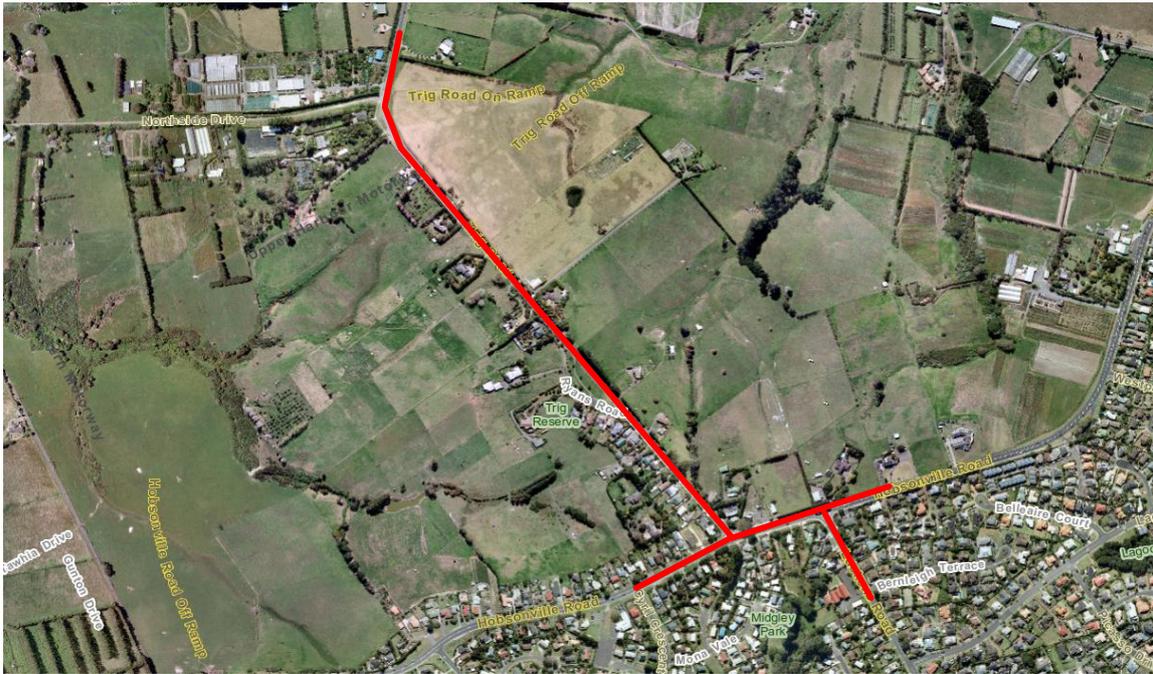
Year: 2000

Source: Auckland Council Geomaps – accessed 8 October 2019



Year: 2008

Source: Auckland Council Geomaps – accessed 8 October 2019



Year: 2010 / 2011

Source: Auckland Council Geomaps – accessed 8 October 2019



Year: 2017

Source: Auckland Council Geomaps – accessed 8 October 2019



Year: 2019

Source: Google Earth Pro– accessed 8 October 2019

